ARCTIC RESOURCE COMPILATION

Cultural Aspects of Climate Change and Biological Variability

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Luis A. Rojas, Contractor
Research Analyst
Metro Professional Services

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Preface

This report creates a catalog of resources for use on the topic "Cultural Aspects of Climate Change and Biological Variability." This catalog of resources is in response to a request by the U.S. Air Force (USAF) Air University (AU) Academic Centers, USAF Culture and Language Center (AFCLC) at Maxwell Air Force Base (AFB), Alabama and is in support of the AFCLC mission.

The mission of the AFCLC is to serve as the USAF focal point for creating and executing programs that sustain career-long development of Linguistically, Regionally, and Culturally competent Total Force Airmen to meet the Service's global mission. In addition to providing subject matter expertise and support for Air Force Language, Regional Expertise, and Culture (LREC) governance, the AFCLC accomplishes this mission by designing, developing and delivering: 1) LREC familiarization education to AU officer, enlisted, and accessions programs; and 2) pre-deployment training and training products.

As a Research Analyst for Metro Professional Services, the researcher has identified open source material on Cultural Aspects of Climate Change and Biological Variability by using multiple sources during his research. This catalog includes academic journal articles, books and other legitimate peer-reviewed, academic resources. Sources are categorized by topic and broken down into relevant sub-topics based on the request of the AFCLC representative or on the discernment of the researcher. Catalog entries include Title, Author, Source, Date and Content Abstract, Summary or Overview that gives the end user a sense of what the author has to say about the selected topic and sub-topic. **The text used in this compilation is taken verbatim from the source, and none of this information is intended to be viewed as a product of AFCLC or Metro Professional Services. Incorporation in this compilation does not constitute endorsement of the source by AFCLC.**

CULTURAL ASPECTS OF CLIMATE CHANGE AND BIOLOGICAL VARIABILITY:

"Cultural Practices and Ecosystem Management," Pamela McElwee and Mina Hsu, International Union for Conservation of Nature, 2023 [1]
https://www.iucn.org/commissions/commission-ecosystem-management/our-work/cems-thematic-groups/cultural-practices-and-ecosystem-management

Abstract:

Provides expert knowledge and guidance on: the values and roles of culture and cultural practices to support Biological Variability conservation, ecosystem services, and ecosystem management.

Current & Relevant Information:

The perception of human societies of their environment is largely driven by their unique culture and cultural practices. Traditionally, modern ecosystem management has been driven via a scientific or conservation ethic. This has sometimes led to conflict between culture and conservation, but more recently there has been a strong recognition that effective ecosystem management can only be achieved through a better understanding and integration of the relationships between communities and nature. The stark reality is that most societies view and manage ecosystems through a prism dictated by long held cultural beliefs that have sustained their society, sometimes for millennia. The challenge for ecosystem management is that, in a changing global environment some of these long-held practices can lead to degradation of the ecosystem and others can play a very relevant role in promoting Biological Variability conservation but also in helping societies to address the impacts of climate change.

This is vitally important as humans now dominate the planet and consume or degrade a disproportionate proportion of ecosystem services from both the land and oceans. This explosion of the human population and use of the planets' natural resources have led many to describe the current period as the Anthropocene. In particular specific human actions and choices in industrial and industrializing societies have promoted a "culture of consumerism", favoring land use practices that undermine ecological resilience and are driving both global climate change and dramatic ecosystem changes.

Culture should be regarded as "a set of distinctive spiritual, material, intellectual and emotional features of society or a social group and that it encompasses in addition to art and literature, lifestyles, ways of living together, value systems, tradition and beliefs" (UNESCO, 2002). In addition, "Cultural systems of meaning shape the way that people interpret climate change, and provide an historical and sociocultural context within which impacts are experienced and responses are generated"

The following examples illustrate the potential uses and importance of cultural practices and ecosystem management in conservation and climate change adaptation:

1. Basic assessments of cultural conservation practices in different ecosystems of the world have highlighted the relevance of understanding and supporting local and traditional knowledge, when Biological Variability and cultural variability have never been more threatened than now.

2. The Commission on Ecosystem Management carried out a workshop in Doha in 2013 about "Spirituality and Ecosystem Management", and included as one of the main recommendations to establish a new thematic group that deals with those issues in a cultural context. As examples, formal and informal religions and spirituality can contribute to ecosystem management through mechanisms such as taboos, practices of care, and community motivations for conservation.

3. Real solutions to address the impacts of climate change and Biological Variability conservation require a knowledge and insight from the social sciences, specifically the role that culture plays. For example, culture influences consumption decisions that may impact species or contribute to greenhouse gas emissions, and culture influences how people support or oppose responses to mitigate Biological Variability loss or climate change.

"Climate Change and Biological Variability: Introduction," Convention On Biological Variability, 2024 [2] https://www.cbd.int/climate/intro.shtml

Overview:

There is ample evidence that climate change affects Biological Variability. Continued climate change is having predominantly adverse and often irreversible impacts on many ecosystems and their services, with significant negative social, cultural and economic consequences.

However, the links between Biological Variability and climate change flow both ways. Conserving natural terrestrial, freshwater and marine ecosystems and restoring degraded ecosystems (including their genetic and species variability) is essential for the overall goals of both the Convention on Biological Variability and the United Nations Framework Convention on Climate Change because ecosystems play a key role in the global carbon cycle and in adapting to climate change, while also providing a wide range of ecosystem services that are essential for human well-being and the achievement of the Sustainable Development Goals.

Current & Relevant Information:

Ecosystem-based approaches to climate change adaptation, which integrates the use of Biological Variability and ecosystem services into an overall adaptation strategy, can be cost-effective and generate social, economic and cultural co-benefits and contribute to the conservation of Biological Variability.

Examples of ecosystem-based adaptation activities include:

- Coastal defence through the maintenance and/or restoration of mangroves and other coastal wetlands to reduce coastal flooding and coastal erosion.
- Sustainable management of upland wetlands and floodplains for maintenance of water flow and quality.
- Conservation and restoration of forests to stabilize land slopes and regulate water flows.
- Establishment of varied agroforestry systems to cope with increased risk from changed climatic conditions.
- Conservation of Biological Variability to provide specific gene pools for crop and livestock adaptation to climate change.

In addition, sustainable land use management activities such as the protection of natural forest and peatland carbon stocks, the use of native assemblages of forest species in reforestation activities, restoration of degraded wetlands and sustainable agricultural practices, together with stringent reductions in greenhouse gas emissions from fossil fuel, are an important component of climate change mitigation.

“What is this thing called 'natural'? The nature-culture divide in climate change and Biological Variability policy,” Ylva Uggla, Journal of Political Ecology, 2010
[3] https://journals.uair.arizona.edu/index.php/JPE/article/view/21701

Abstract:

This paper treats two highly topical and interconnected environmental issues-climate change and Biological Variability-in which the nature-culture divide appears in policy and regulation. The aim is to analyze how "the natural" and concerns for Biological Variability and climate change are constructed in applicable regulatory frameworks, and to explore social and environmental consequences of these constructions. The analysis indicates that Biological Variability and climate change regulation help construct nature and culture as separate categories and give rise to the notion that the natural state is worth protecting from human intrusion. The notion of human agency, however, is ambiguous because humans are depicted as having the power and skill to protect and even recreate "natural nature". The paper concludes that, although nature and the natural are often used as politically and socially-neutral concepts, the definition of "natural nature" as a place devoid of humans has social as well as environmental consequences.

Current & Relevant Information:

The aim of the paper is to analyze how the natural and concerns for Biological Variability and climate change are constructed in applicable regulatory frameworks. Furthermore, the paper explores the social and environmental consequences of these constructions. Analysis of the explicit and implicit assumptions underlying these constructions tells us how human agency and the relationship between humans and nature are defined, and how and to whom responsibility for environmental protection is assigned.

This paper comprises six sections, starting with this introduction. Section two provides a brief overview of the modern nature-culture divide and some of its implications for environmental protection. Section three discusses how the concepts of nature and culture are negotiated in relation to each other. Section four analyzes motives and arguments for Biological Variability conservation and climate change mitigation. Section five analyzes how the "natural" is constructed in the regulatory framework and the social and environmental implications of this framing. Section 6 concludes that, although the "natural" is often used as a socially and politically neutral concept, the search for it remains a deeply value-laden activity that entails drawing boundaries and assigning priorities.

The modern understanding of the relationship between humans and nature is ambiguous, encompassing a wide range of emotions and rationales for its exploitation, domination and preservation. Out of a tangle of events and ideas, the conception of nature emerged, as an object of scientific inquiry and as a resource for economic progress (i.e., resourcism, conservation for the sake of benefits that humans derive from nature). This way of relating to the environment has its roots in Europe, where an "ideology of conquest and domination towards nature has evolved", an ideology that permeates globally today (Pattberg 2007: 1). In this process, modernism has transformed wilderness into a nature devoid of intrinsic value (Oelschlaeger 1991).

One important precursor of this change was the Judeo-Christian ethic. The material world was God's gift to humans for them to master, but it needed improvement, achievable only by human intelligence and physical labor. The Judeo-Christian recovery story is by no means one-sided, as it also alludes to the stewardship of nature and human responsibility for God's creation (Egri 1999: 67 ff.; Merchant 2003: 85 ff.). In this tradition we find the origins of the conception of humankind as both nature's conqueror and its keeper. Another important social and intellectual transition that led to the transformation of "wilderness" to "nature" was the Enlightenment, which ushered in the scientific and industrial revolutions, and the emergence of capitalism. The metaphor of nature as mechanism or machine was established, and nature and its varied resources (e.g., water, forests and minerals) became mere means to an end, that is, materials fueling consumption, progress and continuous economic growth (Oelschlaeger 1991: 93-95; cf. Merchant 2003: 83-84).

Modernism, however, has not unfolded without criticism and counter-argument, and nineteenth century romanticism represents one such counter-argument. One feature of romanticism, a varied movement, is that it took an aesthetic turn and embraced the idea of self-fulfillment through a personal relationship with wild and pristine nature. Urban life, the city and civilization were viewed as distortions, whereas wild nature was idealized and praised for its beauty and splendor (Faarlund 1993: 163; Hay 2002: 5 ff.).

Since the nineteenth century, nature lovers, conservationists and the environmental movement have frequently raised their voices in criticism of the environmental consequences of urbanization and industrialization. The movement has taken various guises, ranging from the conservation movement to ecofeminism. Despite the differences between these lines of thought, the representation of nature as inherently good is predominant in environmental thinking (Gandy 2002:13). Likewise, the presumption is shared that modern humans are at the root of environmental degradation.

There are several ideological currents-such as biocentrism, ecocentrism and streams of ecofeminism that question human supremacy over nature and notions of nature as "other" to human society and culture. There are also visions that aspire to transcend the nature-culture divide: the possibility of "a new synthesis" and the notion of "the human project as taking place within rather than outside nature" (Oelschlaeger 1991: 317). However, these lines of thought have been far from prominent in contemporary environmental discourse.

Accounts of the relationship between humans and nature, as they appear in the history of ideas, convey ambiguous messages that identify humankind as both destroyer and rescuer, and wilderness or "natural nature" as both threat and refuge. The current, more or less hegemonic discourse of sustainable development unites a number of such varied elements. Left out of this discourse, however, is a central element of the various guises of the "green critique", namely criticism of the notion of industrial progress itself (Hajer and Fischer 1999: 2). The discourse of sustainable development recognizes the structural character of environmental problems, but it also assumes that the institutions of modern society can deal with them. It promotes further, not less, modernization, responding to criticism of contemporary society with a modernistic answer involving research, technological innovation, market forces, and so on.

The discourse of sustainable development is based on the modern nature-culture divide and comprises an ambivalence towards nature and human agency that has been part of the relationship between humans and their environment for so long in the Western world. It is also within this discourse that the treaties of Biological Variability and climate change are negotiated.

“Biological Variability, cultural pathways, and human health: a framework,” Natalie E. Clark, et al., Trends in Ecology & Evolution, April 2014 [4]
https://www.sciencedirect.com/science/article/pii/S0169534714000238

Abstract:

Direct contact with Biological Variability is culturally important in a range of contexts. Many people even join conservation organizations to protect Biological Variability that they will never encounter first-hand. Despite this, we have little idea how Biological Variability affects people’s well-being and health through these cultural pathways. Human health is sensitive to apparently trivial psychological stimuli, negatively affected by the risk of environmental degradation, and positively affected by contact with natural spaces. This suggests that well-being and health should be affected by Biological Variability change, but few studies have begun to explore these relationships. Here, we develop a framework for linking Biological Variability change with human cultural values, well-being, and health. We argue that better understanding these relations might be profoundly important for Biological Variability conservation and public health.

Current & Relevant Information:

Humans have attached cultural importance to Biological Variability for thousands of years, over and above its utilitarian value as food, sources of material, or labor. Many plants and animals have enduring symbolic significance, appearing on national emblems, in folklore legends and religious documents. For example, lions feature on the crest of the British monarchy; peafowl are highly revered in several religions; and the resplendent quetzal is a bird of legend in Guatemala. Such cultural importance has been recognized through global and national ecosystem assessments, which argue that the cultural meanings facilitate a pathway through which Biological Variability is linked to human health. However, the significance of these processes has so far been underrepresented in ecosystem research and we have little idea about how human health could be affected by the presence of, exposure to, and loss of Biological Variability.

Today, the cultural value that we place on Biological Variability is evident in the amount of time and money that we spend to enable us to experience nature. Some will gain pleasure from remote, vicarious experiences, such as through nature documentaries, whereas others prefer more direct encounters. Membership of environmental groups worldwide is increasing, despite the economic downturn, and participation in global wildlife tourism continues to rise at a rate similar to that of international tourism. Public participation in biological recording through citizen science projects has also increased rapidly, implying that individuals value their local wildlife and want to contribute towards its conservation. For example, participation in the Great Backyard Bird Count, a joint project of the Audubon Society and the Cornell Lab of Ornithology, increased from 52 000 participants in 2005 to more than

136 000 in 2013 (http://www.birdsource.org/gbbc). The project has grown from solely recording birds in North America to a worldwide endeavor, with participants from 111 countries taking part in 2013.

Although the evidence suggests that humans care about and value Biological Variability, we currently have little understanding as to how this culturally mediated value will be affected by Biological Variability loss, and how this could then impact upon human well-being and health. Current estimates of Biological Variability loss place species extinction rates at 100–1000 times the natural rate, far higher than one would expect from background predictions. Here, we argue that there is sufficient circumstantial evidence that Biological Variability loss could affect the cultural values that we place upon Biological Variability so as to cause significant repercussions for human well-being by, for example, generating anxiety, frustration, and stress. However, few studies have begun to explore the relations along these cultural pathways and we have little idea of the resulting effects upon human well-being and subsequently health. Therefore, we offer a potential framework to help researchers explore these pathways and highlight their possible importance for Biological Variability conservation and public health.

"Linking Biological Variability Conservation and Climate Change Perspectives in Bio-Culturally Rich Transboundary Areas in the Kailash Sacred Landscape Region of China, India, and Nepal," Robert Zomer, et al., Research Gate, May 2010 [5] https://www.researchgate.net/profile/Joseph_Mungatu/publication/311393214_THE_SOLUTION_TO_GLOBAL_WARMING_COULD_BE_IN_THE_SOIL/links/584403f308aeda696816f7f6/THE-SOLUTION-TO-GLOBAL-WARMING-COULD-BE-IN-THE-SOIL.pdf#page=145

Overview:

The Kailash Sacred Landscape (KSL) Conservation Initiative, a collaborative effort of International Centre for Integrated Mountain Development (ICIMOD), the United Nations Environment Program (UNEP), and regional partners in China, India, and Nepal, was launched with an Inception Workshop and Regional Consultation held in Kathmandu in July 2009 (ICIMOD 2009). The KSL Conservation Initiative seeks to facilitate transboundary and ecosystem management approaches for Biological Variability conservation and sustainable development through regional cooperation. The proposed KSL includes an area of the remote southwestern portion of the Tibet Autonomous Region (TAR) of China, and adjacent parts of northwestern Nepal, and northern India, and encompasses the cultural geography of the greater Mt. Kailash area. This region, famous from ancient times, represents a sacred landscape significant to hundreds of millions of people in Asia, and around the globe. This region comprises the source for four of Asia's great rivers: the Indus, the Brahmaputra, the Karnali and the Sutlej, which are lifelines for large parts of Asia and the Indian sub-continent. These rivers provide essential ecosystem goods and services vitally important within the region, and beyond.

<u>Current & Relevant Information:</u>

The Kailash Sacred Landscape (KSL) contains a broad range of bioclimatic zones and landscapes, rich natural and cultural resources, and a wide variety of globally significant Biological Variability. The KSL provides an essential habitat for large numbers of endemic and endangered species, including large mammals like the snow leopard and the wild ass. This highly varied and environmentally fragile landscape is home to a range of endemic flora and fauna important in maintaining local livelihoods (see Figure 1).

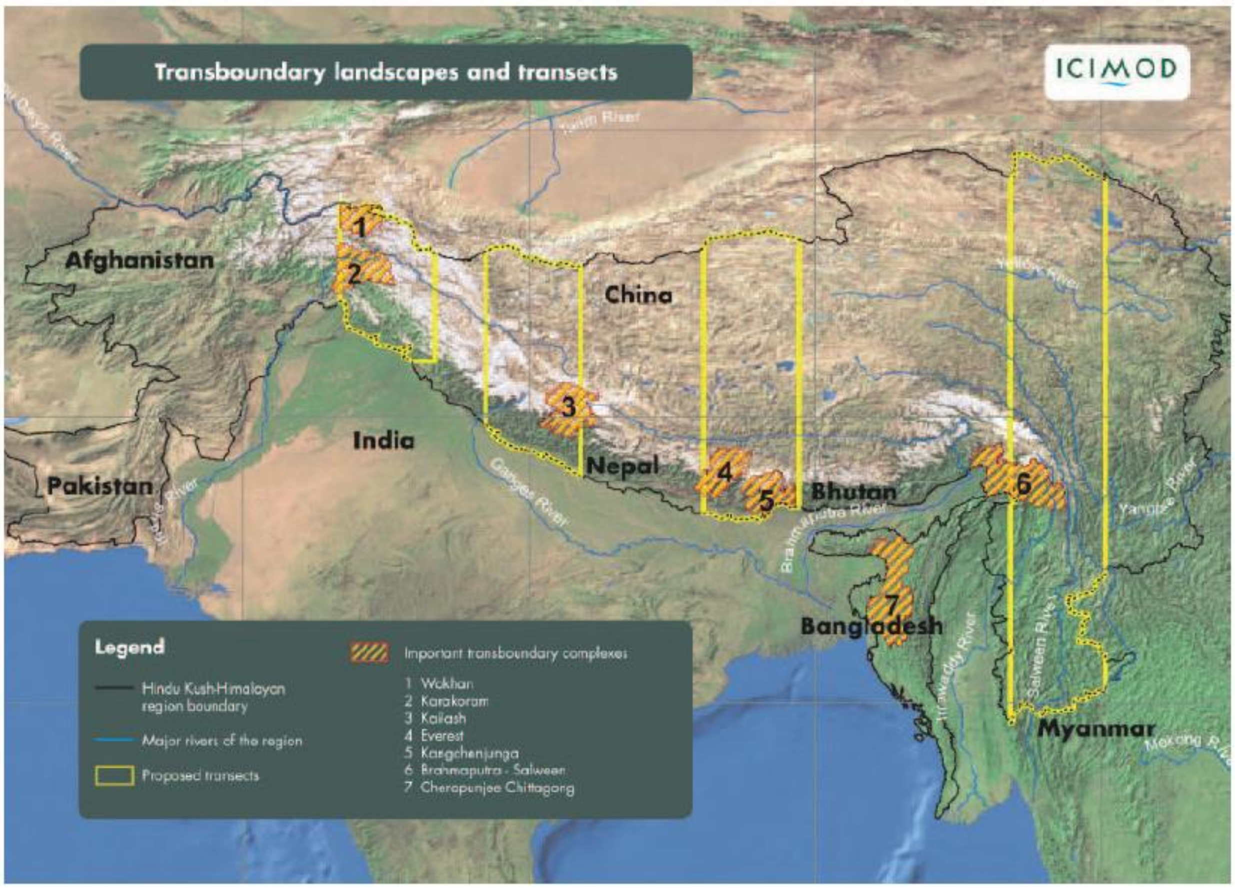

FIGURE 1: View of mountain Kailash with cultural monuments showing a glimpse of the high altitude part of the landscape.

The KSL is an extremely important cultural and religious transboundary landscape of significance to Hindu, Buddhist, Bon Po, Jain, Sikh, and other related traditions, which attracts thousands of pilgrims every year. Pilgrims from around the world journey to this sacred mountain to circumambulate at the foot of its 6,714-meter-high peak. Pilgrims from India and Nepal, as well as from the TAR, China, the central

Asian region, and other parts of the world, create a transboundary cultural landscape.

“Bio-cultural heritage and Biological Variability: emerging paradigms in conservation and planning,” Ian Rotherham, Sheffield Hallam University, 2015 [6] http://shura.shu.ac.uk/11073/1/rotherhambioculturalheritage.pdf

Abstract:

Long-term studies across Europe have clarified the eco-cultural nature of landscapes and their Biological Variability, and the importance of bio-cultural heritage. This raises issues of the nature of ‘Nature’ for example, and of how perceptions of ‘natural’ landscapes may be misleading. Indeed, the lack of understanding of how ecological systems and their Biological Variability relate to the cultural nature of landscapes is hugely problematic. Whilst wilder ‘futurescapes’ offer many benefits, the underlying concepts frequently confuse abandonment of ‘eco-cultural landscapes’ with ‘re-wilding’. The ending of traditional and customary uses and utilization of landscapes mistakenly seen as re-naturing or re-wilding, and inherently a beneficial change, may threaten the conservation of important bio-cultural heritage. The reality of landscape heritage is that much Biological Variability relates to long-term, predictable, sustainable, traditional uses. The ending of such traditions has now happened in many regions and taking place rapidly across much of Europe. Sudden, dramatic and often unexpected changes occur and massive declines of Biological Variability result.

With environments transformed by human activity, the eco-cultural landscapes in traditional or customary management hold much of the most significant wildlife resources. The ending of traditional and customary management, termed ‘cultural severance’ (Rotherham 2008), is probably the most serious threat for nature conservation in the twenty-first century, at least in the medium-term, the impacts exceeding those of climate change. The transformations now happening also have major implications for rural human communities and their economies.

Observational studies and cross-disciplinary research across Europe highlight the urgent need to recognize the eco-cultural nature of landscapes and to establish inventories and conservation programs for important bio-cultural heritage. This paper results from long-term historical research, scientific analysis of case studies, and international researcher collaborations to present ideas and paradigms relating to emerging concepts and visions.

Current & Relevant Information:

Introduction

A renewal of interest in new ways to address conservation problems through radical, novel approaches followed seminal texts by Adams (2003), Taylor (2005), and Vera (2000). “Wilding” and “wilder” landscapes, applied effectively and sensitively, offer huge, exciting benefits for Biological Variability, bio-cultural heritage, and amenity. However, there are significant pitfalls if implementation lacks a broad, multi-disciplinary approach, with careful planning and design. The “eco-cultural nature” of landscape (Rotherham 2014a), resulting from long-term, intimate interactions between people and ecologies is important. Often the interplay of humanity with nature creates the construct of “place” and of local distinctiveness (e.g. Westland (ed.) 1997). Across Europe in particular, twenty-first century depopulation means rural landscapes “abandoned” not “wilded,” with ecology, communities and economies potentially devastated. Alongside urbanization of rural landscapes, these socio-economic and demographic changes cause “cultural severance” (Rotherham 2008, 2013b), and this leads to long-term, often rapid, loss of Biological Variability and landscape quality. Furthermore, from urban to remote, rural areas, attitudes to, and perceptions of, “alien” invasive species challenge to attempts to “wild” the landscape. Feral species, exotic plants and animals, and invasive natives forming recombinant Biological Variability (Rotherham & Lambert 2001; Rotherham 2014a), but “re-wilding” discussions rarely mention feral and exotic. Current thinking may even place a positive spin on a future with invasive, alien species (e.g. Pearce 2015). Central to “futurescapes” and “re-wilding” are ideas and perceptions of “wild”, “wildness”, “wilderness”, “nature”, and “natural”, and importantly there is an imperative need to both learn from bio-cultural heritage and to seek to conserve and safeguard what remains. The implications and scale of human impacts on nature were raised by authors such as Rachel Carson in Silent Spring (1962), with a legacy as discussed by Jameson (2012), and then more recently by, for example, McKibben (1990), in The End of Nature. Yet, despite these major contributions to debates on nature and humanity, the eco-cultural landscape and its bio-cultural heritage often remain overlooked or misunderstood. McKibben (1995) presented ideas and suggested solutions to remediate adverse human impacts, and it is perhaps from some of these and other similar writings, that the ideas of “wild” have emerged. Fundamental drivers within these eco-cultural landscapes have frequently been misunderstood (e.g. Hardin 1968; Ostrom 1990; Apell 1993).

Conclusion

Bio-cultural heritage needs to be placed firmly at the forefront of conservation, as a link between people, history and Biological Variability. In Europe most coppice woods and associated ground flora, birds like nightingales, and woodland butterflies have gone. With ancient wood pastures abandoned, we lose 1,000-year-old oaks, unique saproxylic invertebrates, lichens, and fungi. Heartlands and grasslands like meadows and pastures, are essentially eco-cultural; severed from human tradition, they become rank, eutrophic communities of little ecological interest aside from catholic, competitive, opportunists. All this is widely known, and predicted in the plant strategy work of Grime et al. (2007 and Hodgson (1986), and by specialists like Webb (1986, 1990, 1998) and Chadwick (1982), considering European heathlands. With areas abandoned, landscapes become contested spaces; local, traditional peoples squeezed out by capital-intensive land-uses, absentee landowners, and leisure or recreation (Rotherham 2014a). Whilst traditional management transformed ecologies, local economic dependence fosters sustainable uses unless other factors tip the balance. Incomers may bring fresh ideas and fresh funds for environmental management and innovation, but across Europe, traditional landscapes morph into either abandonment or into leisurely landscapes detached from most ecosystem functions. With a few exceptions such as the work of the National Trust in Britain, little of the leisure and tourism economic activity feeds back into land management or conservation.

Following abandonment, biomass increase, eutrophication, and intensive recreational use or urbanization, many areas become vulnerable to rampant wildfires. From California, to Australia, from Greece, Spain, and Italy to France, and from Dorset heaths to Peak District moors, such fires are predictable results of cultural severance and abandonment. Traditional peoples often used regular fires to manage their landscapes, recycling and releasing precious nutrients, and providing essential grazing at the right time of year. When European imperialists populated the planet, they generally viewed native, indigenes as ignorant and primitive, and suppressed local fire management of landscapes. Today's catastrophic wildfires are direct consequences and descendants of past cultural severance (Rotherham 2008, 2013b, 2014b; Pyne 2001).

A major challenge now is to record local cultural knowledge and insight, to rebuild and celebrate local connectivity with nature, to value local traditions and uses, and to apply the knowledge in a meaningful way. Bio-cultural heritage is at the core of such ideas. It is neither possible nor desirable (socially and economically) to stop the clock, but we need to find long-term economically sustainable solutions to these problems. The approaches must be more ambitious and more radical than anything that we have achieved so far. Webb (1986, 1998) considered the issues and conservation management options for the European heartland component of this discussion, and his prognosis was less than positive.

With dynamic landscapes and fluid ecologies (Rotherham 2014a) replaced by fixed locations, habitat fragmentation, isolation, and soils and water altered by eutrophication, environmental conditions today are not "natural." Regular micro-disturbance, vital for many species, is replaced by unpredictable macro-disturbances. Domestic grazing herbivores or wild / wilded stock may be either beneficial or calamitous for conservation target species, depending on what, how, and when (Rotherham & Lambert 2011; Rotherham 2014b). Introducing large herbivores into small, isolated sites does not produce ecological benefits since they lack the dynamics of larger-scale ecosystems. Animal behavior is not "natural" without large carnivores influencing and directing herbivore feeding patterns and movement. Abandoned to attenuated ecology lacking keystone fauna or traditional management (Rotherham 2013a). Ecological successions are then predictable but no more “natural” than other options, and to intervene or not, a management decision for already highly modified landscapes. Informed by history, ecological visions must look forward to new futurescapes to conserve and enhance not only Biological Variability, but also bio-cultural heritage. The realities of such visions are beginning to be addressed by environmental writers such Marris (2011), but there is a genuine risk that bio-cultural heritage may simply be overlooked and lost.

“A systemic view of Biological Variability and its conservation: Processes, interrelationships, and human culture,” Eleanor J. Sterling, Andres Gomez and Ana L. Porzecanski, Bio-Essays Journal, 2010 [7]
https://www.researchgate.net/publication/47451406_A_systemic_view_of_Biological Variability_and_its_conservation_Processes_interrelationships_and_human_culture

Abstract:

Presentation of a systemic view of Biological Variability and its conservation that emphasizes complex interrelationships among subsystems and includes human culture.

Historically, views and measurements of Biological Variability have had a narrow focus, for instance, characterizing the attributes of observable patterns but affording less attention to processes. Here, we explore the question: how does a systems thinking view – one where the world is seen as elements and processes that connect and interact in dynamic ways to form a whole – affect the way we understand Biological Variability and practice conservation? We answer this question by illustrating the systemic properties of Biological Variability at multiple levels, and show that Biological Variability is a collection of dynamic systems linking seemingly disparate biological and cultural components and requiring an understanding of the system as a whole. We conclude that systems thinking calls traditional views of species, ecosystem function, and human relationships with the rest of Biological Variability into question. Finally, we suggest some of the ways in which this view can impact the science and practice of conservation, particularly through affecting our conservation targets and strategies.

Current & Relevant Information:

Introduction

The ongoing loss of Biological Variability associated with increasing human populations and unsustainable use of natural resources poses a major challenge in the world today. Conservation efforts are confounded by the fact that Biological Variability is complex and dynamic. While there are multiple definitions of Biological Variability, here we will define it as all life on earth across all levels (genes, population, and species – including humans, assemblages, ecosystems/landscapes, and the ecosphere) and the ecological, cultural, and evolutionary processes that sustain it. Biological Variability conservation requires an understanding of multiple issues including causes, effects, and unintended impacts. Yet despite, or perhaps because of, the complexity of the problem, proposed interventions frequently address only a subset of the issues and employ linear rather than systems level conceptualizations.

Systems based approaches, or ‘‘systems thinking’’, are derived from the larger discipline of systems theory, which identifies and analyzes linkages among system elements. Systems thinking emphasizes interrelationships, feedback loops, nonlinearities, and time delays, among other systems principles. Here we consider systems thinking to be an approach (with associated methods and tools) that promotes iterative analyses of a system's dynamic connections and interactions so as to better understand its components as well as the whole. Increasingly, systems thinking drives the search for solutions to societal problems. For example, systems thinking is being used to address complex issues such as environmental resource management and climate change among other biological phenomena.

In this essay we explore the question, how does a systems thinking view affect the way we understand Biological Variability and practice conservation? This issue has previously been addressed in a general manner, but here we present specific cases from three perspectives that highlight Biological Variability as a collection of dynamic systems. Such an approach seeks to understand and sustain both the parts and the structure of the Biological Variability system as well as the processes and linkages that determine system function: the ecological, evolutionary, functional, and cultural dimensions of Biological Variability. Finally, we discuss examples of the application of systems thinking in the practice of conservation biology.

Conclusion

We believe that a systemic view of Biological Variability can help us to better understand its individual components and their interrelationships. Scientists and conservation managers have made substantial progress in applying systems thinking to our understanding of Biological Variability and its conservation but we continue to face challenges, as systems viewpoints are by nature complex. For instance, as we have shown, systems thinking calls traditional views of species, ecosystem function, and human relationships with the rest of Biological Variability into question. All of these then affect our conservation targets and strategies. A systems view also requires a greater focus on the human element as it is an important determinant of ecological and evolutionary processes and has been shown to be a significant component in designing and managing successful conservation plans.

Successful Biological Variability conservation should aim to sustain ecological, evolutionary and cultural variability, and their underlying processes. This dual emphasis on dynamic process and the human dimension of Biological Variability highlights the importance of multi-disciplinarily in ecological and conservation research and practice. Not only do we require input from molecular biologists, geneticists, evolutionary biologists, community and ecosystem ecologists, and others, but social science also becomes a critical player in conserving Biological Variability. This increases the complexity of the science and practice of conservation biology, but we believe that it will result in concurrent increases in effectiveness and sustainability of conservation action. The implication for both research and practice is not that every subsystem, interaction, cultural attribute, or every possible stakeholder should be considered at all times. Rather, what a systems view suggests is that a broader understanding of the interacting biophysical and cultural systems at the core of biological variability can result in better conservation targets and more effective means by which to reach them.

"Climate and Culture: Anthropology in the Era of Contemporary Climate Change," Susan A. Crate, George Mason University, 2011 [8]
https://mason.gmu.edu/~scrate1/annurev.anthro.012809.104925.pdf

Abstract:

This review provides an overview of foundational climate and culture studies in anthropology; it then tracks developments in this area to date to include anthropological engagements with contemporary global climate change. Although early climate and culture studies were mainly founded in archaeology and environmental anthropology, with the advent of climate change, anthropology's roles have expanded to engage local to global contexts. Considering both the unprecedented urgency and the new level of reflexivity that climate change ushers in, anthropologists need to adopt cross-scale, multi-stakeholder, and interdisciplinary approaches in research and practice. I argue for one mode that anthropologists should pursue—the development of critical collaborative, multi-sited ethnography, which I term "climate ethnography."

Current & Relevant Information:

Introduction

The purpose of this review is to first provide some history of climate and culture studies in anthropology, which, to date, have been based largely in archaeology and environmental anthropology, and second, to discuss the contemporary context up to and including the rapidly emerging area of anthropology and climate change. This is no small task, which, owing to the limits of this review and the expansion of the field, is incomplete at least but necessary to bring some chronology to where we have come from to clarify where we are and what areas need more of our attention. To these ends, I argue that this emerging area introduces at least two nuances to the foundational climate and culture studies, namely an unprecedented sense of urgency and a new dimensional level of reflexivity. Both demand anthropological engagement that is cross scale, multi-stakeholder, and interdisciplinary in research and practice. They also demand nonanthropological engagement to realize truly transdisciplinary processes. I propose one approach to address these nuances is by developing what I term “climate ethnography.”

There is a growing body of literature on anthropological engagement with contemporary climate change (Brown 1999, Nelson & Finan 2000, Broad & Orlove 2007, Orlove 2005, Brondizio & Moran 2008, Strauss & Orlove 2003, Crate & Nuttall 2009), but the specific methods and praxis remain unclear. Early climate change researchers brought attention to anthropology’s unique offerings: for example, the agency of ethnographic and participatory methods to decipher the cognitive and cultural landscape in which farmers’ understanding of climate and climate information is grounded and the decision-making processes and environment which shape farmers’ adaptive strategies (Roncoli 2006). However, anthropological studies also revealed problems relating the specifics and multilayered complexities of local human experience to the generalities and abstractions of measurement in the global.

Additionally, interdisciplinary climate change research is often biased towards quantitative data and analysis, leaving social scientists expected to assume those tools of natural science, which do not accommodate sociocultural elements.

Foundational Climate Culture Studies

Both archaeology and environmental anthropology provide the needed theoretical basis for contemporary climate and culture research. On a deep time scale, archaeologists have a strong history of investigating climate change and its relationship with cultural dynamics—resilience and decline, florescence and social structure (Anderson et al. 2006, Cruikshank 2005, Rosen 2007, Redman 1999). Similarly, the well-established subfields of environmental anthropology, including cultural ecology, cultural materialism, political ecology, and human ecology, also have a history of such investigation (Steward 1955, Netting 1968, 1996, Orlove 1980, Moran 1982, Milton 1993, Crumley 1994, 2001, Richerson 1996, Smith & Wishnie 2000, Robbins 2004). Here Barth (1969) is also a major reference on culture and ecological boundary maintenance. Many of these earlier theoretical approaches were modeled on the natural science paradigms of rationality and objectivity. Some examples include the “culturology” of neo-evolutionist Leslie A. White (1959), who elaborated lineal stages of cultural development on the basis of quantifiable energy consumption; Roy Rappaport’s application of the biologically derived ecosystem, delineating human beings as competing against many nonhuman populations and performing religious rituals to maintain ecological balance (1968); Marvin Harris’s cultural materialism that posits culture to be the result of constantly optimizing human efforts of ecological adaptation (1979); and Julian Steward’s theory of cultural ecology, focused on the interdependence and interaction between nature and culture as an incitement for technical innovation and culture change (1955).

These early works by anthropologists, from both archaeology and environmental anthropology, of the multifaceted interrelationship between culture and ecology—how cultures attribute meaning and value to their interpretations of weather and climate and how people have achieved and continue their adaptation to local climate, temperature, flooding, and rainfall (or lack of it)—are the core to contemporary investigations of climate and culture. The main differences are that these early studies in cultural materialism and cultural ecology lacked an accommodation for the "global array of connections" that contemporary climate change invokes.

One Way Forward

Assessing the impacts of and the processes driving climate change within the broader context of social and cultural change for the range of local to global humans—from place-based peoples and local communities to transnational corporations to Western consumer society—demands the development of innovative inter and transdisciplinary methodologies between the natural and social sciences. It is a tall order and also our greatest opportunity. In short, anthropology's role(s) are critical.

"Incorporating Indigenous values with 'Western' conservation values in sustainable Biological Variability management," A.J.J. Lynch, D.G. Fell and S. McIntyre-Tamwoy, Australasian Journal of Environmental Management, December 2010 [9]
https://researchonline.jcu.edu.au/15119/1/AJEM_December_2010_Lynch_Fell_McIntyre-Tamwoy.pdf

Abstract:

Biological Variability management in Australia is underlain by legislative mechanisms such as the Environment Protection and Biological Variability Conservation Act 1999 (Cwlth) and policies such as the national Strategy for the Conservation of Australia's Biological Variability and the international Convention on Biological Variability. While these policy directives encompass a range of values and components of 'Biological Variability', on-ground planning and development assessments often focus only on threatened species and ecosystems as defined in state and national legislation. In regions such as northern Cape York Peninsula, which is managed by the resident Aboriginal and Torres Strait Islander communities as Deed of Grant in Trust (DOGIT), planning for Biological Variability management needs to acknowledge the high cultural values of such areas and to encompass Indigenous values and perspectives. A recent study assessed the significant species and habitats of the greater Lockerbie Scrub – the northernmost extent of rainforest in Australia and a region with high species and ecosystem variability. While it is acknowledged that research into the cultural values of the plant species is preliminary, the minimal overlap between lists of flora from Western (i.e. under

legislative mechanisms) and Traditional Owner perspectives suggests that cultural differences in values and perceptions may result in differing conservation management priorities. A more holistic, integrative approach to local and national Biological Variability management planning could accommodate multiple perspectives and enable greater environmental and socio-cultural sustainability.

Current & Relevant Information:

In this United Nation's declared Year of Biological Variability, it is important to take stock of and reassess commitments made at the 1992 Earth Summit in Rio and the subsequent ratification in 1993 of the Convention on Biological Variability (CBD). These events were benchmarks in formalizing the place of biological conservation globally and for instituting the term 'Biological Variability' in the public, governmental and scientific sectors, and in international attitudes to conservation, environmental management and sustainable development. The close and traditional dependence of many Indigenous communities on biological resources is also recognized in the CBD, along with the need to respect, preserve and maintain traditional knowledge (see SCBD 2005, pp. 5-8).

The Australian commitment as a signatory to the CBD was directly associated with the development of Biological Variability-related national policy (e.g. the Intergovernmental Agreement on the Environment 19921; the National Strategy for Ecologically Sustainable Development 19922; the National Forest Policy Statement (CoA 1992); the Strategy for the Conservation of Australia's Biological Variability (DEST 1996) and legislation (various Acts and regulations encompassing conservation of species, ecosystems, and national and cultural assets, which later were amalgamated under the Commonwealth's Environment Protection and Biological Variability Conservation Act 1999, EPBC Act). Similar policy and legislation mechanisms have been enacted internationally, such as the Endangered Species Act 1973 in the United States, the UK Biological Variability Action Plan, the Birds Directive of 1979 and Habitats Directive of 1992, which protect endangered species in European Union member states (McLean et al. 1999). Evaluation of threats to species underlies decisions globally about species conservation listing and prioritization, such as under the International Union for Conservation of Nature Red List categories of extinction risk (IUCN 2001).

The role of Indigenous communities in Australian environmental management has developed inconsistently between regions, but Indigenous land and sea management activities in northern Australia have proliferated since the mid-1980s (Hill et al. 2008). Indigenous Australian communities are involved in Biological Variability and cultural heritage management through formalized land and sea management programs, including the Indigenous Protected Area program. They have responsibility through land claims under the Native Title Act 1993 (Cwlth) for 12.1 per cent of the country (National Native Title Tribunal 2010)3, predominantly in remote areas (Altman et al. 2009) with limited alternatives for effective land management arrangements. It should be noted, however, that, for some IPAs, cultural heritage is considered a primary value with Biological Variability values as secondary (see DEWR 2007).

Nevertheless, and despite the acknowledgement of its importance in the CBD, Indigenous Traditional Ecological Knowledge (TEK) is frequently viewed as inferior to 'Western' scientific approaches – as being intuitive, informal, less reliable and less accessible – and its use remains elusive (Huntington 2000; Smallacombe et al. 2007). In contrast, scientific approaches to conservation have been criticized for being reductionist and relying on objectification and specificity, while ignoring social factors, long timescales and differing perspectives (Strang 1997, p. 266; Jackson 2005; Rotarangi & Russell 2009) – essentially hyper-focusing on some aspects while neglecting the broader interconnectedness and complexity of ecosystems and of the human – nature relationship.

However, there is an increasing call to recognize and integrate TEK and Western scientific knowledge into environmental management (Berkes et al. 2000; Huntington 2000; Ross & Pickering 2002). Western conservation management approaches and Indigenous environmental perspectives have been viewed as in conflict, but an alternative is to recognize the multiplicity of logics and practices underlying different knowledge systems and to reframe the debate as a science and traditional knowledge dialogue and partnership with coproduction of complementary knowledge for problem solving (Agrawal 1995; Berkes 2009). There are substantial heterogeneities among Indigenous knowledge systems and substantial similarities across the artificial Indigenous – Western knowledge divide (Agrawal 1995).

Both Indigenous and Western approaches to environmental management could be perceived as resource use frameworks but focused on different environmental aspects and timescales. Jackson (2005, p. 138) argued against this on the basis that Indigenous values are not purely utilitarian but related to broader humanitarian 'notions of sociality, sacredness, identity and life-giving'. However, Strang (1997) claimed that Aboriginal management was highly practical, well organized, and coupled regular resource use with management of the physical environment (including the use of spiritual increase rituals) to maximize and control resource availability and stability. Places were valued according to their resources, which is consistent with Western perspectives.

Further, both Indigenous and Western environmental management approaches have impacted on landscapes and biotic assemblages. Lewis (1989) argued that Aborigines and other foraging societies had varied and pronounced effects on most world environments, with Aboriginal setting of habitat fires as particularly ecologically significant in Australia. Russell-Smith et al. (1997) supported that many elements of traditional burning patterns – including its ordered, directed manner – were common to pre-contact Aboriginal groups in coastal northern Australia. Although describing the impact of Aboriginal burning on Biological Variability and on species extinctions and diversification as ‘complex’ and ‘contentious’, Bowman (1998) acknowledged that it must have influenced vegetation structure and species ranges, and may have caused the extinction of some species with fire-sensitive habitats, particularly during periods of climatic stress. Lack of burning by Europeans, however, may have caused severe declines in small-to-medium-sized mammal populations, vegetation changes, and range contractions in conifers and some monsoon rainforest trees (Bowman 1998; Russell Smith et al. 2004).

Since European settlement, land clearance has exceeded ecological limits across most of the intensive land-use zone of Australia, and significantly compromised broadscale landscape functions (Beeton & McGrath 2009). There are now over 2800 threatened ecosystems in Australia (Cork et al. 2006), many of Australia’s mammal species occur over less than 20 per cent of their original range, six per cent of marsupials and 14 per cent of rodents extant 200 years ago are extinct, while 76 plant species (1.5 per cent) are extinct and 1260 plant species (6.5 per cent) are threatened (Briggs & Leigh 1996; Johnson 2006; Chapman 2009).

Compounding these declines of biota and landscape functionality is the global threat of anthropogenic climate change. Climate change is expected to exacerbate existing stresses on environments, ecosystems and human population stability, by compounding threats such as increasing resource use intensity, poor farming or pastoral practices, invasive species and inappropriate fire regimes (Steffen et al. 2010). Apart from the climatic impacts, climate change is likely to enhance disturbance regimes (e.g. fire and invasive species), change local water availability and evapotranspiration regimes, and cause species migrations and assemblage shifts; the latter already evident in many regions (Easterling et al. 2000; McCarty 2001). The MEA (2005) has predicted massive extinctions for this century, with losses of about 1000 times greater than background levels.

“Bio-Cultural Refugia – Safeguarding Variability of Practices for Food Security and Biological Variability,” Stephan Barthel, Carole Crumley, and Uno Svedin, Swedish University of Agricultural Sciences, 2013 [10]
https://pub.epsilon.slu.se/11256/1/barthel_et_al_140813.pdf

Abstract:

Food security for a growing world population is high on the list of grand sustainability challenges, as is reducing the pace of Biological Variability loss in landscapes of food production. Here we shed new insights on areas that harbor place specific social memories related to food security and stewardship of Biological Variability. We call them Bio-cultural refugia. Our goals are to illuminate how bio-cultural refugia store, revive and transmit memory of agricultural Biological Variability and ecosystem services, and how such social memories are carried forward between people and across cohorts. We discuss the functions of such refugia for addressing the twin goals of food security and Biological Variability conservation in landscapes

of food production. The methodological approach is first of its kind in combining the discourses on food security, social memory and Biological Variability management. We find that the rich Biological Variability of many regionally distinct cultural landscapes has been maintained through a mosaic of management practices that have co-evolved in relation to local environmental fluctuations, and that such practices are carried forward by both biophysical and social features in bio-cultural refugia including; genotypes, artifacts, written accounts, as well as embodied rituals, art, oral traditions and self-organized systems of rules. Combined these structures a varied portfolio of practices that result in genetic reservoirs — source areas — for the wide array of species, which in interplay produce vital ecosystem services, needed for future food security related to environmental uncertainties, volatile financial markets and large-scale conflicts. In Europe, processes related to the large-scale industrialization of agriculture threaten such bio-cultural refugia. The paper highlights that the dual goals to reduce pressures from modern agriculture on Biological Variability, while maintaining food security, entails more extensive collaboration with farmers oriented toward ecologically sound practices.

<u>Current & Relevant Information:</u>

Introduction

In ecology, refugia are places where relict (formerly more widespread or abundant) species have found shelter during periods of stress, such as from forest fires or inclement climate. The term refers to areas where former conditions are maintained within broader geographical regions. In recent years the genetic material of a vast number of plants and other organisms has been collected and stored; one example is the large collection facility at Svalbard on the Norwegian island of Spitzbergen. Such collections are in response to concern of that industrial practices in landscapes of food-feed-fiber-fuel production could dangerously reduce genetic variability, affecting nearly half of all terrestrial species (Ferrier et al., 2004; Chappell and LaValle, 2009; Phalan et al., 2011). In this way a sort of collective biological memory has been created, with the capacity to restore cultivated species and habitats.

However, if the task is to safeguard global food security, it is not only the biological components of ecosystems that must be curated. Due to the varying historical and geographical conditions under which species have been (and are currently) cultivated, it is also important to safeguard knowledge of management practices that relate to these conditions. Using an interdisciplinary frame of analysis, we discuss areas where food continues to be produced in a context that links biological variability and social memory, and which carries place specific insights and experiences of stewardship (Nabhan, 2008). We call them bio-cultural refugia, meaning places that not only shelter species, but also carry knowledge and experiences about practical management of Biological Variability and ecosystem services. What is the role of bio-cultural refugia when dealing with the issues of food security and Biological Variability loss in agricultural landscapes and regions? This paper is not about a "museum collection" that would conserve the past; instead, it provides an intellectual perspective that can help safeguard a reservoir of practices that have been tested in a great variety of conditions and which can serve as living laboratories for innovations in landscapes of food production (Baleé, 2006; Crumley, 2007; Costanza, 2007; Dearing, 2008; Thurston, 2009; Guttman-Bond, 2010; Libby and Steffen, 2007; Paavola and Fraser, 2011). We argue here that this perspective has value in calling attention to the practical importance of varied agricultural contexts and management practices.

As at Svalbard but in a broader context, we examine how our stock of relevant knowledge and experience should be treated. This challenge can be compared to the contemporary effort to provide a complete map of the human genome. Surely the future capacity of humankind to safeguard its food requirements is of equal strategic importance. Of course, the two projects differ in a number of ways: while mapping the human genome is essentially a natural science activity, the effort to map and safeguard agricultural practice is inter- and trans-disciplinary, combining the natural and social sciences, technology, innovation, health and practical knowledge so that both general principles and practical insights can be derived and will be open to future modification and adaptation.

Since the agricultural revolution began around 10,000 years ago, small-holding farmers have experimented with the management of plants and animals important for their livelihood. Their solutions were “system-wide”: they thought about how vulnerability to shifting conditions could be reduced by maximizing useful connections between components of the broader landscape (e.g., fields, pastures, forests and woods, water resources, soils and external human settlements). In this sense, they practiced the central concept of permaculture (e.g., Graham 1992, 2004), a focus on relationships created among elements. We will discuss these place-specific insights for the future in the same way.

The goals of this paper are to illuminate how and where collective social memory of how to steward agricultural Biological Variability and ecosystem services can be carried forward between people and across cohorts. We discuss the functions of such bio-cultural refugia for addressing the twin goals of food security and Biological Variability conservation in landscapes of food production. Our methodological approach forges a conceptual framework that draws on four major research communities. 1) Studies in social or collective memory explore knowledge constructed through shared experience and transmitted across generations (Halbwachs 1952; Connerton, 1989). The study of social memory has its basis in sociology, anthropology, literary criticism, and psychology; its methods are thus ethnography (e.g., the open-ended interview), the study of material culture (e.g., memorials, museums), documentary evidence, and experimental settings in which individual and collective memory is examined. We are particularly interested in social memory as it pertains to the transmission of place-based environmental information.

2) Food security focuses on the production, distribution, availability and accessibility of food (Ingram et al., 2010). In recent years, food security has been recognized as vulnerable to climate change, loss of ecosystem services, conflict, long supply chains and other factors to which many of the systems that produce and distribute food are prone. Many methods, both qualitative and quantitative, are used to collect information that would allow assessment of vulnerability and offer ways to reduce risk. Our paper focuses on vulnerabilities that result from the loss of Biological Variability, the reduction in the variability of agricultural practice, and the loss of practical, place-based knowledge that ensures the durability of landscapes of agricultural production.

Here we are aided by the scholarship about 3) resilience, used here as the capacity of social-ecological systems to absorb shocks, utilize them, reorganize and continue to develop without losing fundamental functions (Holling, 1973; Gunderson and Holling 2002; Carpenter and Folke, 2006). This is all framed by insights about human-environmental relations that play out at wider temporal scales than are normally considered by agro-ecologists; this perspective is provided by 4) historical ecology, a holistic, practical perspective for the study of linked human activity and environmental change on time scales from decades to millennia. Historical ecology employs concepts, methods, and evidence taken from the biological and geophysical sciences, the social sciences, and the humanities. This fourth viewpoint provides critical conceptual tools to ‘cross-check over disciplinary boundaries,’ reveal new patterns of association, and raise new questions (Balee, 2006; Crumley 1994, 2007; Meyer and Crumley 2011). Our approach is thus interdisciplinary; the joining of these particular research fields appears to be the first of its kind. We searched for peer-reviewed journal papers relating these concepts, and found no previous studies using the approach of this paper. We used the search functions of Scopus-document search for journal publications until 2012, and the search fields (for abstract, key words and title), of each of the terms; *food security* OR *food production* OR *agriculture* AND *social memory* AND *Biological Variability*. We found only one publication, which dealt with urban community gardens. Since our previous research experience has been in Europe, this paper focuses on the European situation, but it holds insights for other regions with a long history of agriculture (Sahu, 2011).

Conclusion

The Convention on Biological Variability set targets for 2020: pressures from modern agriculture on Biological Variability are one key area that must be addressed (Perrings et al., 2010). At the same time, there is a need to maintain food security for a growing world population. These goals cannot be achieved in isolation (Godfray, 2011). We have addressed the need to meet these dual goals simultaneously by introducing a novel concept: bio-cultural refugia, the containers of agricultural

Biological Variability and which carry experiences of environmental variation extending into deep time.

The methodological approach behind the perspective is the first of its kind in combining the discourses on food security, social memory, historical ecology and resilience thinking, and it argues that the rich Biological Variability of many regionally distinct cultural landscapes has been maintained through a mosaic of management practices developed in relation to local environmental fluctuations and carried in collective social memories spanning millennia. We show here that the social memory of how to steward agricultural Biological Variability and ecosystem services is carried forward between people and across cohorts, both by biophysical elements including species, landscape features, written accounts and artifacts. These material and immaterial forms function as mnemonic devices that structure management practices. Many arts and practices such as ceremonies, songs, stories, and institutions function as memory carriers. Combined, they constitute a varied portfolio of practices for how to deal with environmental variation, and it is in bio-cultural refugia where such portfolios are found. Because they are not recognized as important, the Common Agricultural Policy threatens bio-cultural refugia in Europe (Mikulcak et al., 2013). An ongoing and accelerating generational amnesia of traditional practices and experiences in agricultural landscapes accelerates the erosion of Biological Variability and regulating ecosystem services.

The rate of Biological Variability loss due to agricultural practices associated with chemically intensive monocultures is alarming and threatens to erode the capacity of entire landscapes to produce regulating ecosystem services. Simplified landscapes of food production are increasingly subject to climate change, related disturbances, and other shocks of globalized society that challenge food security. Bio-cultural refugia protect vulnerable species and simultaneously produces food, and it is here that smallholders are still important. They can counteract such vulnerabilities and play an essential role in building resilience in landscapes of food production, along with reserves, national parks and other protected habitats in relation to ecosystem services and Biological Variability (Colding and Folke, 2001, Bengtsson et al., 2003, Tengö et al., 2007).

This contribution highlights the value of drawing on the rich fund of experience of Biological Variability and ecosystem functioning that is embedded in human societies, traditions and cultures, and the importance of nurturing hard-won ecological knowledge and understanding in social-ecological systems (Berkes and Folke, 1998). This is particularly true for a broad spectrum of issues related to the challenges of the Anthropocene era (Steffen et al., 2007; 2011; von Heland and Sörlin 2012). A key policy-message from this paper is the importance of safeguarding interlinked bio-cultural variability, a key facet of future stewardship strategies for our Planet.

“Impacts of Climate Change on Biological Variability, Ecosystems, and Ecosystem Services: Technical Input to the 2013 National Climate Assessment,” Michelle D. Staudinger, et al., Research Gate, July 2012 [11]
https://www.researchgate.net/profile/Virginia_Matzek/publication/267288330_Climate_change_ecosystems_Biological Variability_and_ecosystem_services/links/546944c20cf2397f782d6eb1.pdf

Summary:

Ecosystems, and the Biological Variability and services they support, are intrinsically dependent on climate. During the twentieth century, climate change has had documented impacts on ecological systems, and impacts are expected to increase as climate change continues and perhaps even accelerates. This technical input to the National Climate Assessment synthesizes our scientific understanding of the way climate change is affecting Biological Variability, ecosystems, ecosystem services, and what strategies might be employed to decrease current and future risks.

Building on past assessments of how climate change and other stressors are affecting ecosystems in the United States and around the world, we approach the subject from several different perspectives. First, we review the observed and projected impacts on Biological Variability, with a focus on genes, species, and assemblages of species. Next, we examine how climate change is affecting ecosystem structural elements—such as biomass, architecture, and heterogeneity—and functions—specifically, as related to the fluxes of energy and matter. People experience climate change impacts on Biological Variability and ecosystems as changes in ecosystem services; people depend on ecosystems for resources that are harvested, their role in regulating the movement of materials and disturbances, and their recreational, cultural, and aesthetic value. Thus, we review newly emerging research to determine how human activities and a changing climate are likely to alter the delivery of these ecosystem services.

This technical input also examines two cross-cutting topics. First, we recognize that climate change is happening against the backdrop of a wide range of other environmental and anthropogenic stressors, many of which have caused dramatic ecosystem degradation already. This broader range of stressors interacts with climate change, and complicates our abilities to predict and manage the impacts on Biological Variability, ecosystems, and the services they support. The second cross-cutting topic is the rapidly advancing field of climate adaptation, where there has been significant progress in developing the conceptual framework, planning approaches, and strategies for safeguarding Biological Variability and other ecological resources. At the same time, ecosystem-based adaptation is becoming more prominent as a way to utilize ecosystem services to help human systems adapt to climate change.

In this summary, we present key findings of the technical input, focusing on themes that can be found throughout the report. Thus, this summary takes a more integrated look at the question of how climate change is affecting our ecological resources, the implications for humans, and possible response strategies. This integrated approach better reflects the impacts of climate in the real world, where changes in ecosystem structure or function will alter the viability of different species and the efficacy of ecosystem services. Likewise, adaptation to climate change will simultaneously address a range of conservation goals. Case studies are used to illustrate this complete picture throughout the report; a snapshot of one case study, 2011 Las Conchas, New Mexico Fire, is included in this summary.

Key Findings:

Biological Variability and ecosystems are already more stressed than at any comparable period of human history. Climate change almost always exacerbates the problems caused by other environmental stressors including: land use change and the consequent habitat fragmentation and degradation; extraction of timber, fish, water, and other resources; biological disturbance such as the introduction of non-native invasive species, disease, and pests; and chemical, heavy metal, and nutrient pollution. As a corollary, one mechanism for reducing the negative impacts of climate change is a reduction in other stressors.

Climate change is causing many species to shift their geographical ranges, distributions, and phenologies at faster rates than previously thought. Changes in terrestrial plant and animal species ranges are shifting the location and extent of biomes, and altering ecosystem structure and functioning. These rates vary considerably among species. Terrestrial species are moving up in elevation at rates 2 to 3 times greater than initial estimates. Despite faster rates of warming in terrestrial systems compared to ocean environments, the velocity of range shifts for marine taxa exceeds those reported for terrestrial species. Species and populations that are unable to shift their geographic distributions or have narrow environmental tolerances are at an increased risk of extinction.

There is increasing evidence of population declines and localized extinctions that can be directly attributed to climate change. Ecological specialists and species that live at high altitudes and latitudes are particularly vulnerable to climate change. Overall, the impacts of climate change are projected to result in a net loss of global Biological Variability and major shifts in the provision of ecosystem services. For example, the range and abundance of economically important marine fish are already changing due to climate change and are projected to continue changing such that some local fisheries are very likely to cease to be viable, whereas others may become more valuable if the fishing community can adapt.

Range shifts will result in new community assemblages, new associations among species, and promote interactions among species that have not

existed in the past. Changes in the spatial distribution and seasonal timing of flora and fauna within marine, aquatic, and terrestrial environments can result in trophic mismatches and asynchronies. Novel species assemblages can also substantially alter ecosystem structure and function and the distribution of ecosystem services.

Changes in precipitation regimes and extreme events can cause ecosystem transitions, increase transport of nutrients and pollutants to downstream ecosystems, and overwhelm the ability of natural systems to mitigate harm to people from these events. Changes in extreme events affect systems differentially, because different thresholds are crossed. For example, more intense storms and increased drought coupled with warming can shift grasslands into shrublands, or facilitate domination by other grass types (for example, mixed grass to C-4 tallgrass). More heavy rainfall also increases movement of nutrients and pollutants to downstream ecosystems, restructuring processes, biota, and habitats. As a consequence, regulation of drinking water quality is very likely to be strained as high rainfall and river discharge lead to higher levels of nitrogen in rivers and greater risk of waterborne disease outbreaks.

Changes in winter have big and surprising effects on ecosystems and their services. Changes in soil freezing, snow cover, and air temperature have affected carbon sequestration, decomposition, and carbon export, which influence agricultural and forest production. Seasonally snow-covered regions are especially susceptible to climate change as small changes in temperature or precipitation may result in large changes in ecosystem structure and function. Longer growing seasons and warmer winters are enhancing pest outbreaks, leading to tree mortality and more intense and extensive fires. For winter sports and recreation, future economic losses are projected to be high because of decreased or unreliable snowfall.

The ecosystem services provided by coastal habitats are especially vulnerable to sea-level rise and more severe storms. The Atlantic and Gulf of Mexico coasts are most vulnerable to the loss of coastal protection services provided by wetlands and coral reefs. Along the Pacific coast long-term erosion of dunes due to increasing wave heights is projected to be an increasing problem for coastal communities. Beach recreation is also projected to suffer due to coastal erosion. Other forms of recreation are very likely to improve due to better weather, and the net effect is likely a redistribution of the industry and its economic impact, with visitors and tourism dollars shifting away from some communities in favor of others.

Climate adaptation has experienced a dramatic increase in attention since the last National Climate Assessment and become a major emphasis in Biological Variability conservation and natural resource policy and management. Federal and State agencies are planning for and integrating climate change research into resource management and actions to address impacts of climate change based on historical impacts, future vulnerabilities, and observations on the ground. Land managers have realized that static protected areas will not be sufficient to conserve Biological Variability in a changing climate, requiring an emphasis on landscape-scale conservation, connectivity among protected habitats, and sustaining ecological functioning of working lands and waters. Agile and adaptive management approaches are increasingly under development, including monitoring, experimentation, and a capacity to evaluate and modify management actions. Risk-based framing and stakeholder-driven scenario planning will be essential in enhancing our ability to respond to the impacts of climate change.

Climate change responses employed by other sectors (for example, energy, agriculture, transportation) are creating new ecosystem stresses, but also can incorporate ecosystem-based approaches to improve their efficacy. Ecosystem-based adaptation has emerged as a framework for understanding the role of ecosystem services in moderating climate impacts on people, although this concept is currently being used more on an international scale than within the United States.

Ecological monitoring efforts need to be improved and better coordinated among Federal and State agencies to ensure that the impacts of climate change are adequately observed as well as to support ecological research, management, assessment, and policy. As species and ecosystem boundaries shift to keep pace with climate change, improved and better-integrated research, monitoring, and assessment efforts will be needed at national and global scales. Existing monitoring networks in the United States are not well suited for detecting and attributing the impacts of climate change to the wide range of affected species at the appropriate spatio-temporal scales.

"Geography of Conservation Spending, Biological Variability, and Culture," T. R. McClanahan and P.S. Rankin, pubmed.ncbi.nlm.nih.gov, 2016 [12]
https://pubmed.ncbi.nlm.nih.gov/26991737/

Abstract:

We examined the associations between geography, Biological Variability, national spending on conservation, governance and cultural traits. Cultural traits and social metrics of modernization correlate positively with national spending on conservation. Further, we show the global distribution of this spending culture is poorly aligned with the distribution of Biological Variability. Specifically, Biological Variability increases towards the tropics where cultures tend to spend less on conservation, and have higher collectivism, formalized and hierarchical leadership, and weaker governance. Consequently, nations lacking social traits frequently associated with modernization, environmentalism, and conservation spending have the largest component of the Earth's Biological Variability. This has significant implications for setting policies and priorities for resource management given that biological variability is rapidly disappearing and cultural traits change slowly. Therefore, we suggest that natural resource management adapt to and utilize characteristics of existing social organization rather than wait for or promote social values associated with conservation spending. Supporting bio-cultural traditions, engaging leaders to increase conservation commitments, cross-national efforts that complement attributes of cultures, and avoiding interference with nature may work best to conserve nature in collective and hierarchical societies. Spending in modernized nations may be a symbolic response to a symptom of economic development and environmental degradation, and must therefore, be accountable for conservation impact.

Current & Relevant Information:

Introduction

The variability of plant and animal species, human cultures, and institutional traits, and capacity to conserve them are unequally distributed (Maffi 2005; Gavin et al. 2013). For example, species and human cultures are more varied towards the tropics, apparently due to similar drivers (Collard & Foley 2002; Burnside et al. 2012). However, social organization – potentially critical for providing a basis for human adaptation to future environmental change – has received less attention (Greenfield 2009; Hofstede et al. 2010). Conservation funding aimed at preventing losses of species and ecosystem service is also unequally distributed, both within and between countries, causing heterogeneous and targeted efforts with uncertain outcomes for broader-scale Biological Variability conservation (Miller et al. 2013; Waldron et al. 2013).

Global heterogeneity in the adaptive capacity of cultures, state of resources, and stresses to the environment creates a varied context to guide social-ecological adaptation (Boyd et al. 2011; McClanahan & Cinner 2012). As a normative science, conservation requires culture to acknowledge the importance of conserving species conservation and protecting ecological services. If, how, and why conservation values and actions are acknowledged is expected to differ with cultural history, human development, and associated personalities (Inglehart & Welzel 2005; McCrae & Terracciano 2005). Human development correlates with many psychological and cultural changes, and frequently emphasizes intrinsic rights to survival, individualism or self-sufficiency, and ideological support for species conservation (Inglehart & Welzel 2005; Greenfield 2009). Nevertheless, resource management responses are complicated as poor nations with strong materialistic or survival values may support conservation, and wealthy nations do not always effectively protect resources (Steinberg 2005; Dietz et al. 2012). Additionally, people's perceptions of their ability to adapt to their environment can differ substantially – often influenced by culture (Nisbett et al. 2001; McCright & Dunlap 2011). Consequently, problem framing and social institutions may influence resources management more than poverty or values that emphasize survival, economics and physical security (Wilshusen et al. 2002; Kahan 2012). These observations and studies indicate a complex interaction between cultural attitudes, personalities, and perceptions towards management options when natural resources decline.

Cultural Traits, Modernization Theory, and Governance

Funding for Biological Variability conservation has been explained by modernization theory. “New modernization theory” proponents argue that cultural values change from materialist to post-materialistic as economies develop from rural to urban, with societies adhering more to principles of human rights, democracy, good governance, and individualism, and less to survival values along a “human development sequence” (Inglehart & Welzel 2005). According to this theory, expansion of intrinsic rights often extends from people to the larger community of species, associating them with conservation values (Singer 2011). Further, economic development parallels psychological development, and increases individual innovation, specialization, education, and self-expression. Consequently, people organize less on necessity and more on cognitive and behavioral affinities, such as conservation concerns (Greenfield 2009).

New modernization theory states that once development passes into a post-materialist economy, survival and economic growth concerns become less important than protecting the rights of people, other species, and the environment (Pinker 2011). When realizing that human and technological power can threaten life, respect for life increases, with less reliance on traditional religions and collectivist affinities in favor of personal, nature conservation, and humanistic values (Inglehart & Welzel 2005). Risks and caution become more common cultural considerations and, as they emerge, post-material priorities lead to increased spending on conservation. Individualistic and self-expression values, while increasing recently, can reverse when economic development reverses but generally change slowly across generations (Greenfield 2013).

Though modernization may change values to support increased expressions of environmentalism and conservation, only rarely does it relate to objective metrics of energy efficiency or conservation that might reflect these values – at least at national levels (Dietz et al. 2012; Rodrigues et al. 2014). Additionally, individualism, private property, and national laws that support them can undermine the informal social institutions and collective behaviors that protect common property. Further, modernization theory may focus on some dominant trends while potentially oversimplify the complexity of cultures (Smith et al. 2002; Hofstede et al. 2010). Finally, values and associated symbolism, including spending money, can be responses to the symptoms of environmental degradation and not necessarily measures of effective action (York et al. 2010). Consequently, factors that help conserve natural resources are not always evident from cultural traits and conservation spending, but their associations provide social-ecological context for developing conservation strategies.

1. African Culture:

“Chapter 12: Conservation in a Biological Variability Hotspot: Insights from Cultural and Community Perspectives in Madagascar,” Nadine V.M. Fritz-Vietta, et al., Research Gate, August 2011 [13]
https://www.researchgate.net/publication/226894437_Conservation_in_a_Biological Variability_Hotspot_Insights_from_Cultural_and_Community_Perspectives_in_Madagascar

Abstract:

High levels of endemic Biological Variability, habitat loss and degradation have made Madagascar one of the planet’s Biological Variability hotspots. While protected areas are a sensible approach to preserving valuable ecosystems and their services, they are a conservation concept that often struggle to fully consider the local social and cultural characteristics of the areas where they are established. Protected areas are frequently inhabited by local people who directly depend on natural resources for their livelihoods, and whose beliefs and customary tenure systems have often become closely intertwined with the land over long periods. The conservation movement in Madagascar has made considerable efforts to develop viable models for conservation incorporating local communities, for example through community-based natural resource management models. However, a closer examination of the implementation of these models illustrates a cultural clash between the different ways of life, ambitions and world views of local recipients and external implementers. Increased consideration of local people’s values and cultural practices combined with integrative scientific understandings of conservation from both natural and social science could lead to an improvement of conservation policies and implementation in terms of both conservation effectiveness and socio-economic equity. We conclude by presenting suggestions for a basis from which actions can be taken to improve the coherence between forest conservation policies and culture. More participatory policy development and implementation processes, improved dialogue, recognition of customary tenure systems, and more comprehensive and timely livelihood solutions should lead to more balanced forest conservation strategies to ensure that ecosystem services can be sustainably provided to both the local and global community.

Current & Relevant Information:

Introduction

Conservation policies are designed with the primary objective of preserving Biological Variability and ecosystem services for human well-being. Conservation organizations and research agencies have played an important role in both the development and implementation of community forestry policies and in the establishment of new conceptual designs of protected areas that highlight the human dimension in conservation. However, there is no shortage of social critiques of the ethics, conception, design and implementation of forest conservation in Madagascar (some pertinent are: Corson 2008; Harper 2008; Henkels 2001; Horning 2004, 2005, 2006; Kaufmann 2006; Keller 2008, 2009; Muttenzer 2006; Pollini 2007; Simsik 2004; Walker 2001). While the studies behind these criticisms are often based on particular localities, organizations or processes, they also provide insights relevant across Madagascar's forest conservation policies. It is evident that anthropological perspectives on the human dimensions of forest conservation policy in Madagascar has only partially influenced the policy development process, as has been observed in other developing world regions where conservation has been studied (Peterson et al. 2010). Participation as it is promoted for a better involvement of people living in or nearby protected areas often remains more like a slogan than an effectively implemented approach, with placatory and consultative forms of participation typically dominating, rather than the more empowering and decentralizing forms which may be aspired to.

In this chapter we briefly introduce the context of conservation in Madagascar, which classifies the country as a Biological Variability hotspot; we then complement this with some insights from social and cultural perspectives with the aim of providing a more balanced portrayal of the conservation arena on the island. Next, we present the underlying ideas of nature conservation, showing how they are embedded within the ideology of the developed world; this is followed by an overview of conservation activities in Madagascar and analysis of the challenges of applying the concepts of protected areas and community-based natural resource management. The article closes with a discussion on the role of scientists in forming part of innovative conservation partnerships with practitioners and communities and concludes with recommendations to let local identities and aspirations move into the center of conservation initiatives.

Conclusion

A fundamental change of conservation ideology has to happen, if conservation is to support the people in Madagascar while saving their island's unique Biological Variability. This will only be possible, if scientific disciplines can move beyond their traditional research approaches and engage in more collaborative research processes, which combine insights from varied disciplines and forge deeper relationships between researchers, communities, practitioners and the policy makers, lobbyists and donors who are driving conservation. Just as the classical divide between nature and culture does not apply in Malagasy rural contexts (just as in fact it does not anywhere else in the world), and it can, therefore, not constitute the sole basis for design and delivery of conservation activities. So next to ecological values, equity, justice and autonomy should be fundamental drivers of conservation initiatives in Madagascar. We need to move beyond the simplified portrayals of conservation from the pure ecological and social dichotomy to a situation where we have the capacity to integrate "the social" into conservation from the identification of objectives to the design and delivery of strategies. New concepts have to replace the traditional way of classifying local phenomena, meaning that for example the category "people of marginal groups" implies in principle that people lack particular capacities and are at the edge of the society; instead it is more helpful to identify their strengths and the ways they adapt to their situation, assuming that everyone can develop power and means to handle peculiar living conditions while these provide them with particular opportunities for alternative livelihoods. And also, that conservationists should increasingly use unconventional means of understanding knowledge systems which are unfamiliar to them, this could include taking part and promoting more artistic and creative activities such as dance, songs, spiritual ceremonies and storytelling as well as more conventional mechanisms and approaches based on household economics, and agricultural and forestry systems.

So, it seems that conservation policy implementation will only succeed if community connectedness across all stakeholders is achieved and the new governance arrangements which are established are open, trusting, accommodating, flexible and sharing (O'Riordan 2002). Clear language, listening and the sharing of interpretations is a joint endeavor and has the potential to strengthen the sense of collective working and can harmonize knowledge exchange among the various parties. However, in order to build confidence, boundaries of familiarity need to be crossed through establishing new alliances stretching across academic disciplines, policy makers, practitioners and the local people concerned by conservation.

"The role of Indigenous Knowledge and Biological Variability in Livestock Disease Management under Climate Change," Elder Moonga and Harrison Chitambo, Research Gate, 20 August 2010 [14] https://www.researchgate.net/profile/Harrison_Chitambo/publication/267376128_The_role_of_Indigenous_Knowledge_and_Biological Variability_in_Livestock_Disease_Management_under_Climate_Change/links/5593f18308ae1e9cb42af495.pdf

Abstract:

Livestock productivity in the Sub Saharan African countries is severely constrained by the presence of a wide range of animal diseases that affect both production and productivity of livestock, especially in the poor rural farming communities that don't have the access to modern and/or conventional livestock management skills. The impact of climate change on livestock is likely to be, in certain cases, devastating among the African rural communities. Various disease epidemiology is likely to be altered due to vector development changes and vector habitat shifts. Local communities will have to adapt to climate change effects. One adaptation option described in this paper comprises the preservation and utilization of their inherent Indigenous Knowledge and livestock genetic variability because such knowledge has been shown, in certain cases, to be effective, sustainable, environmentally friendly and practical. Well adapted traditional livestock breeds will most likely, play a very significant role in the adaptation to climate risk. Traditional breeds have over many generations been reared under low management levels prevalent in the most traditional sectors. The most critical value of this adaptation is their survival instinct. There is need to enhance and exploit this indigenous knowledge base and genetic potential by building on the knowledge itself and blending it, where required, with appropriate technologies.

Current & Relevant Information:

Introduction

Indigenous knowledge has been shown to be of great utility in an increasing number of cases on the African continent. For example, in most sub-Saharan African countries, more than 80%of the population uses the services of traditional healthcare in combination with conventional healthcare systems (Soewu & Ayodele, 2009). The region is endowed with vast, readily available indigenous materials with proven efficacies and yet most of these materials are not well documented. In most cases, traditional healthcare systems are practiced concurrently with the conventional western medicine. The example that comprises the focus of this paper - indigenous livestock disease control and its knowledge base - is maintained mainly through oral tradition in families, thus posing a risk of its loss.

Livestock productivity in the Sub Saharan African countries is severely constrained by the presence of a wide range of animal diseases (McMillan & Meltzer, 1996) and is believed to be growing at half the rate required to make significant inroads in reducing poverty (ADB, 2002). These diseases not only affect production and productivity of livestock, but also seriously hamper any meaningful livestock trade. A number of zoonotic diseases are also a serious threat to human health. Potentially fatal diseases in cattle include wildebeest-derived malignant catarrhal fever (WD-MCF), East Coast Fever (ECF), Foot-and-Mouth Disease (FMD), Rift Valley Fever (RVF), Contagious Bovine Pleural Pneumonia (CBPP) and Trypanosomoses. These diseases are recognized to have been the major barriers which affected the early introduction of cattle-based economies in most of the affected countries (Gifford-Gonzalez, 2000). Ticks and tick-borne diseases as well as, tsetse and trypanosomoses, are two major parasitic vector borne disease complexes with very serious effects on livestock production and productivity in the sub Saharan Africa (Mattioli et al, 2000). For many years, these diseases have been causing serious problems in livestock production especially among the poor rural farming communities. This problem is exacerbated by the farmers' lack of access to the conventional livestock management skills and financial resources to afford vaccines and curative substances.

It is estimated that roughly 70% or 150 million of the rural poor in Sub Saharan Africa are at least partially dependent on livestock to sustain their livelihoods (LID, 1999). Poverty, food insecurity and the effects of livestock disease are thus intertwined. Infected animals cannot efficiently be used for draft power because of poor condition, while, sick animals may even die from most of these diseases. With time, surviving animals often tend to develop tolerance to some of these diseases and environmental challenges. In spite of these challenges, livestock production has been recognized as an essential contributing factor for improving the livelihoods of the poorest rural farming communities in Africa.

Some of the worst effects of climate change on human health and agriculture will be in sub-Saharan Africa, including impacts on livestock (Thornton, P.K. et al, 2008). If not checked, the effects of climate change will adversely contribute to poor living conditions of most rural communities. It has been estimated that by 2050, the effects of climate change in Africa will reduce crop yields by at least 10-20% (Jones & Thornton, in press).

Climate change is likely to pose new challenges in the livestock production sector, especially among the poor resource farmers in sub-Saharan Africa. The life cycles of disease pathogens and their epidemiology are likely to be altered drastically with the anticipated environmental changes caused by climate change. Such range alterations will influence changes in the development, habitats and distribution of disease vectors causing them either to be restricted or enhanced. This factor is supported by a prediction study which showed climatic change related range alterations and increased Theileriosis suitability in a number of Southern African countries (Olwoch et al, 2008).

Major livestock disease vectors which are likely to be altered by climatic change effects are ticks and tsetse flies. Some regions will need to double the efforts for strengthening climatic change adaptive capacities in the traditional livestock sector. Such regions, including East Africa and South Africa are currently considered the most vulnerable regions on the continent to climate-induced changes in tick distributions and tick-borne diseases (Olwoch et al, 2007). Tick borne diseases (TBDs) are responsible for substantial direct and indirect economic losses on cattle production in sub-Saharan countries. It has been estimated that direct costs resulting from the effects of TBDs is close to US$17.7 million. Theileriosis alone, which is a major TBD, accounts for 68% of this total loss (Brown, 1997). Both human and animal trypanosomoses have serious socio-economic implications making the disease a major obstacle to overall livestock development in the region (Taylor, 1998; Okomo-Assoumou et al., 1995). Close to 30 % of an estimated population of 147 million cattle and, a comparable number of small ruminants in 38 African countries, are believed to be at risk to trypanosomoses and causes an estimated annual loss of about US$5 billion (Murray and Gray, 1984). The potential benefits of improved trypanosomoses control, in terms of meat and milk productivity alone, is estimated at about US$700 million per year (Kristjanson et al, 1999).

As a matter of urgency, there will be need for more concerted efforts to develop adaptive capacities in traditional livestock management systems. To achieve this goal, new and innovative approaches for the management of vector borne livestock diseases especially in the traditional management systems need to be explored. One possible approach in this regard is the investigation of indigenous knowledge systems (IKS) and the exploitation of existing genetic variability in the region. Integration of conserved indigenous knowledge and existing rich animal variability with modern but relevant scientific knowledge should be considered. Examples considered in this paper include traditional livestock systems, healthcare and conservation of genetic variability.

Conclusions

The effects of climate change on the traditional livestock sector will be very devastating if adaptive capacities are not meaningfully strengthened. This sector already has a base upon which adaptive capacities can be anchored. Over generations, they have utilized the indigenous knowledge system and have maintained a pool of valuable genetic resources that have scientifically proved useful in several dimensions. Despite this advantage, this sector has remained vulnerable. In order to significantly reinforce the climate change adaptive capacities there is no alternative to seeking new, innovative and appropriate mechanisms that can easily be integrated with traditional practices and knowledge through appropriate technological transfers. The issues of regionally or internationally binding policies may need to be adopted in order to foster a more focused development in this regard.

"Factors Affecting the Success of Conserving Biological Variability in National Parks: A Review of Case Studies from Africa," Moses Muhumuza and Kevin Balkwill, International Journal of Biological Variability, 2013 [15]
http://downloads.hindawi.com/journals/Biological Variability/2013/798101.pdf

Abstract:

National Parks are a cornerstone for Biological Variability conservation in Africa. Two approaches are commonly used to sustain Biological Variability in National Parks. Past and current studies show that both approaches are generally ineffective in conserving Biological Variability in National Parks in Africa. However, there are a handful of cases where these approaches have been successful at conserving Biological Variability in National Parks. The question this paper attempts to answer is why in some cases these approaches have been successful and in other cases they have failed. A metadata analysis of 123 documents on case studies about conservation of Biological Variability in National Parks in Africa was conducted. A series of search engines were used to find papers for review. Results showed that all factors responsible for both the success and failure of conserving Biological Variability in National Parks in various contexts were socioeconomic and cultural in nature. The highest percentage in both successful case studies (66%) and unsuccessful cases studies (55%) was associated with the creation and

management of the park. These results suggest that future conservation approaches in National Parks in Africa should place more emphasis on the human dimension of Biological Variability conservation than purely scientific studies of species and habitats in National Parks.

Current & Relevant Information:

Introduction

National Parks are the most extensive type of protected areas in Africa and globally. They are classified under category II of the IUCN categories of protected areas. National Parks are created to (1) protect the ecological integrity of one or more ecosystem for present and future generations; (2) exclude exploitation or occupation detrimental to the purposes of designation of the area; and (3) provide a foundation for spiritual, scientific, educational, recreational, and visitor opportunities, all of which must be environmentally and culturally compatible. National Parks comprise the highest percentage (23%) of the total area covered by protected areas worldwide. For instance, according to estimates by Colchester, Africa has more than 1,812 National Parks covering a total 3,112,027 km2 of the continent. In Sub-Saharan Africa alone, over 1 million km2 of land out of 23 million km2 (constituting approximately 4%) has been set aside as National Parks.

Conservation of Biological Variability in National Parks is done through two main approaches: one approach is the preservation approach, which aims at setting aside National Parks to exclude human activities except for tourism. Through this approach, direct use of natural resources in the park for commercial or subsistence purposes is prohibited. This type of approach is often referred to as the "protectionism approach" or "the fines and fences" approach. For consistency, the term "preservation approach" is used in this paper. The preservation approach aims at excluding human activities considered inimical to the objectives of conserving Biological Variability in National Parks. The preservation approach was the most dominant approach until the 1980s, but in some National Parks, it has now been substituted by the second approach called the community-based conservation approach that allows people (especially those that neighbor National Parks) to benefit socially or economically from parks. The community-based conservation approach was proposed to address the problems associated with excluding human activities from the park. A detailed description of the development of the two approaches can be found elsewhere.

The community-based conservation approach involves initiatives aimed at conserving Biological Variability in the park but also letting local people benefit from the park. Some of the initiatives involved in the community-based conservation approach include signing of resource use agreements such as in the Rwenzori Mountains National Park which allow local people who neighbor National Parks to have access to specific resources from the park for subsistence use. In other cases, local people are given money for infrastructural development, such as in Integrated Conservation and Development Initiative in Korup National Park in Cameroon. And in other National Parks such as Pendjari National Park in Benin, local people are given a percentage of revenue generated from tourism activities in the park.

Despite the implementation of these approaches, the Global Outlook 3 which is a recent report by the Secretariat of the Convention on Biological Variability shows that Biological Variability loss from protected areas has persisted. The report revealed that the targets agreed upon by leaders of different countries in the world in 2002 to significantly reduce the rate of Biological Variability loss at global, regional, and national levels had not been met by 2010. Threats to Biological Variability such as habitat loss, climate change, pollution, unsustainable use of resources, and invasive alien species have intensified. According to Butchart et al., despite the many efforts taken around the world to conserve Biological Variability and use it sustainably, approaches and strategies so far have not been adequate to address the scale of Biological Variability loss or reduce the pressures.

Although none of the twenty-one sub targets accompanying the overall target of significantly reducing the rate of Biological Variability loss by 2010 was achieved globally, there are some that had been locally achieved. de Oliveira had earlier noted that for every profitable and successful protected area, there may be hundreds that are not successful.

There are a number of suggestions that have been made since the publication of the Global Outlook 3 by the Secretariat of the Convention of Biological Variability. For instance, Rands et al. suggested that beyond the year 2010, successful conservation approaches need to be reinforced and adequately financed. Rands et al. opine that a more radical change is required to recognize Biological Variability as a global public good and integrate Biological Variability conservation into policies and decision frameworks. However, before any suggestion about effective conservation of Biological Variability in National Parks is implemented, the current scenario necessitates an understanding of the underlying factors for success and failure of the existing Biological Variability conservation approaches.

Although many studies have been conducted on threats that protected areas face, there is a scarcity of literature that assesses why those threats have persisted. In addition, there is a scarcity of published literature that analyzes why some strategies aimed at preventing Biological Variability loss succeed in some instances and fail in other instances. In the absence of such literature, it becomes difficult to propose other strategies or to have a basis upon which new ones can be improved.

Although the Secretariat for the Convention on Biological Variability identified underlying causes to Biological Variability loss such as demographic change, economic activity, levels of international trade, per capita consumption patterns linked to individual wealth, cultural and religious factors, and scientific and technological change, these factors were not discussed in specific detail in the context of conserving Biological Variability in National Parks in Africa. In this paper, the aim is to identify and analyze factors that affect the success of conserving Biological Variability in National Parks in Africa.

Conclusion

The aim of this paper was to review the existing literature on conservation of Biological Variability in National Parks in Africa and identify factors that affect the success of Biological Variability conservation. The review has found that Biological Variability conservation in National Parks is affected by various factors associated with the creation and management of the park, the local community neighboring the park, the area where the park is located, the national policy governing the park, and the financial resource base of the park. These factors are socioeconomic and cultural in nature involving the management of local communities that neighbor National Parks as much as the resources in parks. This indicates that future strategies of conserving Biological Variability in parks should focus as much on the socio-economic human dimension of Biological Variability conservation as the scientific study of species and habitats in National Parks.

Limited attention to the socioeconomic and related aspects of culture had previously been blamed for failure of community-based conservation approaches. Studies on the social dimension of Biological Variability conservation and how various socio-economic and cultural factors affect park resource use and Biological Variability conservation in various contexts are recommended.

As this investigation has shown, factors that affect Biological Variability were not uniform across all successful or unsuccessful case studies. In each case study, there were specific underlying causes that influenced each of the identified factors. Future studies that investigate how and why local people neighboring National Parks interact with resources therein ought to be integrative in nature to include the psychological, socioeconomic, and cultural factors and not only emphasize the economic aspects as is often done in Integrated Conservation and Development Programs and Projects or the traditional ecological knowledge as is done in studies that link local people's culture and Biological Variability conservation.

This investigation has also revealed that Biological Variability in National Parks depends on the relations between local people and park staff. This necessitates training park staff in community social relations and development in addition to scientific managing of plant and animal species and their habitats.

"A Review of Climate Change Adaptation Initiatives within the Africa Biological Variability Collaborative Group Members," Anton Seimon, et al., Research Gate, September 2011 [16]
https://www.researchgate.net/publication/236335920_A_Review_of_Climate_Change_A

daptation_Initiatives_within_the_Africa_Biological Variability_Collaborative_Group_Members

Summary:

The Africa Biological Variability Collaborative Group (ABCG) comprises seven international conservation NGOs (African Wildlife Foundation, Conservation International and its affiliate Conservation South Africa, the Jane Goodall Institute, The Nature Conservancy, Wildlife Conservation Society, World Resources Institute, and World Wildlife Fund-US) who share the goal of working collaboratively, efficiently and effectively to further a sustainable future for the African continent. Across Africa, ABCG members are actively working to promote adaptation to climate change. However, until recently, there has been little communication among ABCG members to share approaches, early results and lessons learned.

To overcome this, ABCG members conducted a review of member organizations' principal climate change adaptation activities underway within the region. The review used a survey of ABCG members to compare approaches and tools for adaptation used in project work in Africa. The methodology was designed to be both iterative and adaptive, reflecting inputs and feedback received from ABCG members as the project developed. Preliminary findings of this work were presented at a Washington, DC workshop in July 2011 that brought together key climate change adaptation staff from each ABCG member organization, as well as representatives from other key organizations and donors. Feedback from the workshop has been incorporated into this report. This process has identified key lessons to be shared among the partners, and has generated recommendations for both ABCG members and the wider conservation and donor communities.

Comprehensive overviews of ABCG member programs presented in the report's appendix demonstrate that climate change adaptation has become a central component in conservation activities being conducted by ABCG members in Africa. The report examines ten of the most significant projects in the ABCG members' collective portfolio. These projects vary widely in scale, geographic and thematic focus, methodology and objectives. The summaries show adaptation programs in various stages of development that are serving as test cases for methodologies that may be applied in the future in other regions, by ABCG members and other organizations.

The results developed from the analyses presented in this report – representing the first such analysis of a set of projects in Africa with Biological Variability conservation as a primary focus – provide a comprehensive set of lessons learned that can be used to shape recommendations for future work on climate change adaptation in Africa. The survey reveals that project work largely follows adaptation-planning frameworks – if not always by design – but that most work falls short of implementation of on-the-ground actions to adapt conservation management to

accommodate climate change. Project work is strongly focused around themes of ecosystems, livelihoods and landscape/seascape conservation and, to a lesser degree on species, whereas disease and human population are largely not considered. Project objectives vary considerably, but demonstrate a fairly universal embrace of crosscutting, interdisciplinary approaches consistent with the broadening of NGO work on conservation in Africa from species- to people-based initiatives. Funding support provided for the highlighted projects suggest that donor attention to adaptation in Africa is increasing, but with five of the ten projects funded wholly or in part by a single donor (the John D. and Catherine T. MacArthur Foundation), there is much need for other donors to step forward in Africa. The tools and methods utilized in ABCG member projects show extensive use of applied modeling developed from projections of future climatic conditions generated by the global Intergovernmental Panel on Climate Change (IPCC) suite of models, but bring to light several key issues and challenges regarding its application.

Monitoring and evaluation (M&E) was examined in a special session at the Washington workshop, as it presents particular challenges within the context of the projects examined. M&E is particularly relevant given the uncertainties associated with the timeframe of climate change impacts and the added necessity of ensuring adaptive management for project implementation. On policy and outreach to decision-making bodies, the ABCG members all have activities across a range of scales from local communities to international conventions, though these generally complement on-the-ground conservation efforts rather than serve as objectives themselves.

Key recommendations derived from the analysis include:

On project design and execution:

- Utilize an adaptation framework to help conceptualize project design, tailored as needed to explicitly include the role of people in project activities when conducting adaptation work in Africa.
- Incorporate Ecosystem-based Adaptation (EbA) and Community-Based Adaptation (CBA) approaches into existing climate adaptation field projects where applicable, and conduct monitoring of such approaches in order to adaptively manage and refine them over time.
- Develop educational forums for local decision makers, donors and ABCG member organizations and their partners to identify strategies for designing actions that ensure effective implementation.

On data, analysis and modeling:

- Support the financing and installation of appropriately sited, research grade, automatic weather stations in protected areas and other sites of primary concern for Biological Variability conservation.

- Establish new monitoring sites in current data-void regions where climate monitoring is already ongoing but with inadequate systems.
- Centralize and share climatological data among national governments, conservation, development, climate monitoring and climate change communities – essential for filling in data voids.
- Use scenario building exercises with scientists, stakeholders and others as an alternative and/or complement to deterministic modeling to consider how outcomes may vary and what actions would be appropriate for different combinations of factors driving environmental responses to climate change.
- Critically assess all model projections developed for conservation planning purposes for plausibility by persons with relevant knowledge of the species or ecosystems under consideration.
- Take into account the diminished value of downscaling coarse resolution global climate models beyond recommended limits of the climate modeling community when project teams utilize modeling of climate change impacts on Biological Variability and environments at high spatial resolution.
- Hold forums to share lessons learned on models and modeling results that would help to improve their application in climate change adaptation initiatives.

On project monitoring and evaluation:

- Develop a set of guidance recommendations for conservation practitioners focusing on, among other aspects, how to integrate information from monitoring into a program for adaptive management.
- Develop specific recommendations for policymakers and donors on the support needed by partners to ensure that adaptation genuinely is a process of learning from actions, and develop improved but realistic data gathering and knowledge management.
- Collaboratively raise the issue of implementing and ensuring sustained funding for long-term monitoring beyond the duration of normal funding periods (< 5 years).

On working with donors:

- Utilize the findings of this report to inform key funders with programs in Africa of priorities through outreach activities such as workshops and consultations.
- Elevate the importance of climate change adaptation within the donor community. By working together and communicating our shared experiences, ABCG has the potential to increase its role in informing donors of on-the-ground needs and opportunities for adapting to climate change in Africa.

Other recommendations for ABCG and broader interests:

- Incorporate comprehensive consideration of the implications of population growth in current project activities on climate change adaptation in Africa.
- Increase research attention, funding and training on the critical issue of disease dynamics and epidemiology under a changing climate in Africa.

Finally, the report concludes by recommending that ABCG members continue joint efforts on climate change adaptation begun with this review by working collaboratively on a series of steps to develop an adaptation toolkit, and to share results and lessons learned with key constituencies in Africa and elsewhere.

<u>Current & Relevant Information:</u>

Climate change and Africa

The progress achieved by conservation efforts in Africa over the course of many decades is increasingly threatened by climatic changes forced by increasing greenhouse gas concentrations and land surface changes. According to the Intergovernmental Panel on Climate Change (IPCC, 2007), many parts of the African continent have high vulnerability to climate change-related stresses, and yet have a very low adaptive capacity. It is now widely recognized that climate change will exacerbate existing environmental degradation in Africa, threatening the rich variability of plant and animal species as well as the livelihoods of large populations of subsistence farmers, pastoralists, and even urban dwellers who rely on rural ecosystem-derived ecosystem services for their water, electricity, and sustenance.

As described in the IPCC Fourth Assessment Report (2007), global climate models based on a range of greenhouse gas emissions scenarios predict a 2-5-degree Celsius rise in temperature throughout tropical Africa over the next 50-100 years. The warming climate will be attended by changing rainfall patterns, changes in seasonality and an increase in the frequency of severe storm events, setting up further obstacles to the challenges of conserving Biological Variability and the ecosystem services that people depend upon. On the human side, failing rains, increased flooding, and shifting conditions for key subsistence crops (e.g., coffee and cocoa), natural resource species, and ecosystem services are expected to have profound impacts on many of Africa's people, with the poor and marginalized being particularly vulnerable (e.g. Ehrhart, 2009). The number of climate refugees will increase significantly over the next decade; this in turn is likely to exacerbate pressures on Biological Variability and accelerate environmental degradation (e.g. Warner et al., 2009).

The growing certainty over the seriousness of climate change threats to Africa has prompted responses across a spectrum of interests in conservation and development. These concerns both mitigation efforts to slow the rate of change through actions such as reducing greenhouse gas emitting practices like deforestation; and adaptation efforts to change existing practices and planning to produce more sustainable outcomes in the face of increasing climatic stress.

Conclusion

It has been less than a decade since the need for planning for climate change has been embraced as fundamental for Biological Variability conservation by the global conservation community. This survey of ABCG members finds that all members have active programs underway across a wide range of geographic and thematic contexts, with an equally broad range of targets and objectives. The full power of collaborative work within ABCG to achieve adaptation objectives for the long-term benefit of Africa's people and Biological Variability has yet to be realized. We therefore recommend initiating efforts to begin working together as a community, leveraging our respective institutional strengths and expertise, and developing a common voice to raise the profile of climate adaptation to decision-makers and the donor community. We hope that the findings of this report, and the recommendations generated, serve as a launching point for such collaborative work within our partnership for the future.

"Drowning Voices: The Climate Change Discourse in South Africa," Masego Madzwamuse, boell.de, 2010 [17]
https://www.boell.de/sites/default/files/assets/boell.de/images/download_de/2010-07-02_Drowning_Voices_The_Climate_Change_Discours_in_South_Africa.pdf

Overview:

Significant attention has been given to improving our understanding of the real and imminent impacts of climate change. It is accepted that rising temperatures, changes in rainfall patterns, extreme weather events, changes in sea levels and changes in Biological Variability will have significant consequences on the world economy, rural livelihoods and development in general. Africa in particular will be hardest hit by climate change yet its adaptive capacity remains low. The continent faces increasing water scarcity, a reduction in agricultural productivity, increased risks of floods and droughts and negative impacts on the health sector among others. Climate change is an additional stressor for a continent that is already struggling with food insecurity, high poverty levels, and a HIV/Aids pandemic. Climate change will have critical impacts on the economies of the region and threatens to reverse the gains of sustainable development in Africa.

Current & Relevant Information:

Climate Change Impacts and Vulnerability in South Africa

South Africa will be equally faced with adverse impacts of climate change. Climate change projections over the next 50 years show a warming of between 1°C and 3°C; a potential reduction of approximately 5 to 10% of current rainfall; increased daily maximum temperatures in summer and autumn in the western half of the country; increased incidents of flood and drought; and, enhanced temperature inversions, which are likely to exacerbate air pollution problems. These changes will have significant impacts on various sectors of the South African economy. The South African Country Studies Program identified the energy, mining, health, agriculture (particularly maize production), Biological Variability, water resources and rangelands as the most vulnerable sectors.

Impacts facing the agricultural sector include, a reduction in the amount of land suitable for both arable and pastoral agriculture; a shortening of the growing season and a decrease in yields particularly along the margins of semi-arid and arid areas. Climate change impacts will further reduce the sectors contribution to the GDP, which has already been declining over the years. In 1998 agriculture and forestry contributed 4.0% to GDP, which is significantly lower than in 1965 at 9.1%. The impacts on the agricultural sector thus not only have implications for the national and household food security but the economy as well. The predicted warming of the bio-climate and aridification are predicted to shrink the country's biomes by 38 -55% of their current coverage resulting in a displacement and loss of wildlife species and Biological Variability of significant global value. These changes have direct impacts on local livelihoods and the wildlife-based tourism sector.

While predicted shortages of water will have devastating effects on industry, the agricultural sector (which is by far the largest water user accounting for 62% of the national water allocation for irrigation) will be hardest hit. Water scarcity will be a major issue for South Africa as 98% of the national water resources are already overcommitted, while high levels of contamination from the mining industry and effluent from major cities continues to undermine the water quality. The country is thus faced with both a water shortage and a water quality problem that is likely to get worse due to climate change impacts.

A neglected area in the South African climate change vulnerability assessments is social vulnerability, particularly the question of poverty and socioeconomic vulnerability. Current climatic shocks and stresses already have a devastating impact on vulnerability of the poor. The poor generally have a limited number of coping strategies upon which to draw from in times of stress. This is particularly true for the poor in South Africa who have suffered a history of marginalization and dispossession. Poverty remains a daunting challenge in South Africa after more than 15 years of democratic rule 47% of the South African population still lives below the 'lower bound' poverty line proposed by Statistics South Africa in 2007. The majority of the poor are rural dwellers (59%). More than 85% of the land in rural areas is settled by commercial farmers while subsistence rural dwellers are overcrowded in highly degraded former homelands. These communities live in abject poverty isolated from economic opportunities. The majority of households facing these hardships are female headed with limited capacities to adapt to climate change impacts arising from social inequalities that manifest themselves in differences in property rights, access to information, lack of employment, low literacy levels and unequal access to resources.

Unlike other African countries South Africa is also a contributor of greenhouse gas (GHG) emissions, which at 10 tons per capita are about twice as high as in other developing countries. This is due to the fact that South Africa's economy is highly dependent on the use and export of fossil fuels such as coal. It should be noted that even though the average carbon footprint for South Africa is high due to coal dependence only 10% of the population (the affluent) is responsible for 90% of these emissions. With the above impacts of climate change and the associated economic, social and cultural costs climate change adaptation is no doubt an economic development issue for South Africa that requires urgent attention. The next section therefore looks at national efforts to address adaptation needs and why climate change adaptation is seemingly low on the national climate change agenda.

The drivers for the climate change adaptation agenda

Recognizing the direct and immediate impacts of climate change on the poor and their livelihoods, the United Nations Framework Convention on Climate Change (UNFCCC) is increasingly highlighting adaptation as a key response to climate change alongside mitigation measures. However, mitigation and carbon financing continue to dominate the climate change agenda. Little attention has been paid to adaptation even though this is where the focus of Africa and other developing countries ought to be, at least in terms of facilitating efforts towards meeting several Millennium Development Goals (MDG), reducing poverty and enhancing food security.

The slow response to climate change adaptation is also evident in South Africa. While the drivers for the adaptation agenda in South Africa may be similar to what is seen in other countries in the region, South Africa has a number of unique features that lead to the dominance of the mitigation discourse. Of particular importance is the high dependence of the economy on fossil fuels and the relevance of the mitigation agenda to maintaining national economic growth. As a major contributor to GHG emissions South Africa has to be seen to be on the forefront of this debate, particularly in response to pressure from its own private sector. A second feature is that the lack of civic engagement is not due to a weak civil society but rather to a lack of access to the right information and funding to support civil society led adaptation interventions.

"Inclusion of Local People and Their Cultural Practices in Biological Variability Conservation: Lessons from Successful Nations," Dickson Adom, American Journal of Environmental Protection, 2016 [18]
https://www.researchgate.net/profile/Dickson_Adom/publication/316914798_Inclusion_of_Local_People_and_Their_Cultural_Practices_in_Biological Variability_Conservation_Lessons_from_Successful_Nations/links/5917f15aa6fdcc963e856ac7/Inclusion-of-Local-People-and-Their-Cultural-Practices-in-Biological Variability-Conservation-Lessons-from-Successful-Nations.pdf

Abstract:

The inclusion of local people and their cultural practices impact positively on Biological Variability conservation. This is the underlying factors behind the success stories of countries with high numbers of biological variability resources. It is sad to reckon that most Biological Variability policies of developing countries like Ghana do not fully include the voices of the local people as well as their cultural practices. There was, therefore, the need to thoroughly review the national Biological Variability strategies and action plans of some countries that have effectively factored the local people and their cultural practices in their Biological Variability policies. This was to elucidate how and in what areas the views of the local people and their cultural practices can be effectively incorporated into Biological Variability conservation initiatives. The study utilized qualitative research approach with document analysis method. Related literature on the subject from peer-reviewed manuscripts, Biological Variability strategic reports and strategies of different countries were rigorously reviewed and analyzed using Interpretative Phenomenological Analysis (IPA). The study revealed that local people have time-tested conservation knowledge enfolded in their cultural practices like religious beliefs, taboos, etc. Legal backing was seen as the main driving force behind the utilization of the cultural practices of the local people in the Biological Variability strategies reviewed. Moreover, the local people were fully involved in the development of the Biological Variability strategies. This was seen in the areas of planning, management, and decision-making, recruitment of staff, as well as the dissemination and implementation of the Biological Variability strategy. The study concluded that effective Biological Variability policies must reflect the cultural practices and the views of local people since they are powerful instruments of conservation. Its tasks Biological Variability policy designers to fully incorporate local communities and their cultural practices in the development of Biological Variability strategies.

Current & Relevant Information:

National Biological Variability Strategies and Action Plans of Different Countries

This section of the paper delves into the national Biological Variability and action plans of some successful nations in Biological Variability conservation initiatives. These countries have effectively included the local people and their cultural practices in every aspect of their Biological Variability conservation initiatives and programs. These aspects include the planning, management, and decision-making processes as well as the implementation and recruitment of staff in spearheading conservation plans for Biological Variability. Also, the dissemination of conservation initiatives demonstrates the strong influence of local people and their cultural practices. In addition, the exact cultural practices of the local people that have played significant roles in Biological Variability conservation have been discussed.

These successful countries whose Biological Variability conservation strategies and action plans are reviewed are Kenya, Tanzania, and Angola.

National Biological Variability Strategy of Kenya

The Biological Variability strategy of the Kenyans also demonstrates a high impact of traditional conservation practices deeply rooted in the cultural practices of the local communities. They recognize the close and relevant link that their culture has with Biological Variability conservation. Owing to the great ethnic and cultural diversities in Kenya as well as the significant roles of their indigenous knowledge systems, the policy developers emphasized the revitalization of the roles of the local communities and their cultural practices.

One of the guiding principles in Kenya's national strategy is their assertion that 'conservation goals are best achieved through ecosystem approaches, particularly as managed by the local communities who have used traditional methods to sustainably manage ecosystems for generations'. This clearly shows that the Kenyans believe that the traditional conservation strategies enshrined in the cultural practices are playing quintessential roles in the conservation of the country's Biological Variability.

In addition, the policy designers ensured the full involvement of the local people and their traditional cultural practices. As expressed in the vision of the strategy, it was agreed by the team to adopt participatory management practices. They were convinced that this could boost the integration of the local people and their cultural practices. Moreover, the team placed in measures in assisting the environmentally friendly income generating projects in local communities. Also, to ensure fair representation of the local people and their cultural practices in the Biological Variability policy, the Kenyans supported the consultative processes of all stakeholders including the traditional authorities. Again, the team designed a legal structure that gives the local communities the right to implement their cultural practices in conservation programs for the Biological Variability in their jurisdiction.

National Biological Variability Strategy of Tanzania

The Biological Variability conservation strategy of Tanzania also emphasizes the full involvement and factorization of traditional cultural practices. The ninth guiding principle of the strategy states that 'the knowledge, innovations, and practices of indigenous and local communities should be respected, preserved, maintained and used with the approval and involvement of those who possess the knowledge'. This was not just paper documentation as some countries have done just to fulfill the requirement of the signed International Convention on Biological Variability. A critical look at one of the cross-sectoral objectives of the policy buttresses this assertion. It was the adoption of community participation approaches at all levels of the planning, development, management and decision-making processes of biological variability conservation programs. The document also hinted at the encouragement, revival and preservation of the indigenous knowledge that assisted in Biological Variability conservation like taboos, myths, religious beliefs and folklores. The high impacts of taboos and other cultural practices have been the backbone in ensuring the sustainable utilization of the Biological Variability resources in Tanzania, especially in the East Usambara district of the country. Steps were also taken by the Tanzanians to implement traditional conservation practices that were verified through a deep survey as sound and practicable for contemporary conditions.

The existing natural resources legislation in Tanzania was amended to empower the rural communities to devise means of conserving their Biological Variability. This resulted in an empowerment of the local governments, thus, the chiefs and their cabinet of elders. They were given the authority to inspect, prosecute and punish those who wantonly destroyed the Biological Variability resources in their jurisdiction. To do this, the local governmental authorities introduced management by-laws which were culled from the traditional cultural practices such as taboos, cosmological beliefs, myths, etc. Environmental tribunals and environmental committees have been established in every region or district in Tanzania to carry out the prosecution and punishments to defaulters of Biological Variability depletion.

Awareness campaigns were also launched through the mass media, folklores, seminars and extension services to stress the merits of the indigenous knowledge and practices in conservation. In addition, workshops and forums are organized by the environmental agencies to encourage the exchange of experiences among districts and regions in Tanzania.

National Biological Variability Strategy of Angola

The Angolan team that developed their national Biological Variability conservation strategy conducted a massive analytical procedure into the cultural practices of local communities in Angola to ascertain their contributions to the sustainable utilization of the nation's Biological Variability. This extensive and rigorous analysis of the existing cultural practices helped the team in knowing those that still have conservation worth for the contemporary Biological Variability situation in Angola. These positive cultural practices were incorporated into the national Biological Variability strategy and action plan.

Moreover, after the strategies were formulated from them in addition to the scientific models of conservation, the document was presented and debated at workshops and seminars in a public consultation process at rural communities and urban communities in Angola. This was to solicit for the views of the rural folks, traditional authorities, governmental institutions, educational institutions and the press. This campaign and sensitization procedures enabled the team to improve on the drawn Biological Variability conservation strategy before it was passed.

In the Biological Variability strategy document, one of the strategic areas focused on the Biological Variability management of the Protected Areas in Tanzania. The heinous challenge in the management of Protected Areas has always been when and how to incorporate the views and practices of the local communities. Usually, the personnel from the environmental protection agency are appointed to oversee the Protected Areas in local communities. This situation is worrying because the local people are those who are the custodians of the land mass. Thus, when the local people are neglected in the managerial process, when the Protected Area is abused, they act unconcerned. To prevent this situation from happening, the Angolan Biological Variability conservation team established a national integrated management system consisting of project managers and representatives from the local communities. This has promoted the interests of the local communities in conservation issues as well as in ecotourism in the country.

Another strategic area in their Biological Variability conservation is the sustainable use of Biological Variability components. In this area, the team encouraged the involvement and full participation and sharing of benefits to local communities. The team was convinced that this could serve as an incentive for the co-management, conservation and sustainable use of Biological Variability. They recognized that the local people are custodians of the Biological Variability resources of the environment and thus involved them in all decisions at all levels in the usage of land and natural resources.

As part of their action plans for accentuating and maximizing the role of local communities in Biological Variability management, the team suggested the implementation of awareness programs using the media, workshops, and seminars. Existing environmental framework laws were expanded to include consultation and approval of local communities before conservation projects were carried out by project managers. The team was also determined to bridge the gap and misunderstanding between the traditional knowledge of the cultural practices and scientific knowledge. Training sessions were organized to educate, sensitize and enlighten the traditional authorities about the conventional scientific conservation methods. On the other hand, conservationists like forest guards, forest rangers and project managers were equally instructed on the potentials of the cultural practices for the management of Biological Variability in the local communities. This resulted in mutual understanding and respect of both forms of knowledge which were complemented with each other to combat the Biological Variability decline.

Inclusion of Cultural Practices in Biological Variability Conservation Strategy

Cultural practices that are embedded with traditional conservation practices have been implemented by the successful nations in conserving their Biological Variability. Their examples illustrate in the truism that cultural practices are pivotal to the management and conservation of biological variability.

For instance, numerous sacred forests in Kenya among the Mijikenda local people have been conserved by means of taboos and other cultural institutions. Defaulters of Biological Variability depletion in local communities in Kenya face the sanctions imposed by the elders. The national legislation and other agencies aid in the implementation of the powers of the elders.

Belief in ancestors has also prevented the Tanzanians from exploiting the numerous sacred forests such as the Mungi, Mazimbo and others. This is due to the religious belief that those forests are housing the skeletal remains of their great ancestors and as such must not be abused.

It is because of the quintessential roles that cultural practices play in the conservation of the Biological Variability resources in these successful nations that explains why they have been given strong voices in national Biological Variability strategies. Almost every country, especially developing countries in Africa has a rich heritage of cultural practices that have equally played significant roles in Biological Variability conservation. For instance, proverbial sayings among the Asantes of Ghana have regulated the moral behaviors of the people against Biological Variability exploitation [3]. Also, cultural practices like taboos, totemic systems, and festivals have aided greatly in saving the Biological Variability resources in most local communities in Ghana [2,4]. Thus, cultural practices must be strongly highlighted in the national Biological Variability strategy because of their great services to Biological Variability as has been done by the successful nations under discussion.

"The Use of Traditional and Modern Tools for Monitoring Wetlands Biological Variability in Africa: Challenges and Opportunities," P.J. Stephenson, Yaa Ntiamoa-Baidu, and John P. Smimaika, Frontiers in Environmental Science, 2 June 2020 [19] https://www.frontiersin.org/articles/10.3389/fenvs.2020.00061/full

Abstract:

Biological Variability is being lost in wetlands at a faster rate than any other biome. Effective conservation and management of wetlands Biological Variability requires data on species status and threats to inform decision-making. However, there are key challenges in Africa around the availability, usability and quality of data, willingness to use data, and capacity. We review these challenges, using examples from Ramsar sites and other wetlands across the continent, and propose solutions to help information users access high quality data in the right format at the right time. We assess the relevance of traditional monitoring methods, as well as innovative new tools such as remote sensing and environmental DNA. We conclude by explaining how governments, civil society and the private sector can enhance data collection by applying common, policy-relevant indicators, scaling up the application of traditional and appropriate new tools and protocols, building capacity in key institutions, and using partnerships and credible science-policy interfaces. Only by sharing and upscaling the solutions to data collection and use will we be able to

mainstream Biological Variability into decision-making and ultimately stop Biological Variability loss across African wetlands.

Current & Relevant Information:

Introduction

The varied wetlands of Africa, which include some of the longest rivers and some of the largest freshwater bodies in the world, are of immense importance for Biological Variability and people (Thieme et al., 2005; Gardner et al., 2015; Okonkwo et al., 2015; IPBES, 2018; Ramsar Convention on Wetlands, 2018). Freshwater ecosystems cover <1% of the Earth yet they are home to more than 10% of known animals and about one-third of known vertebrate species (Balian et al., 2008; WWF, 2018). They also offer a range of ecosystem services, from water purification to hydrological buffering to coastal protection (Mitsch and Gosselink, 2000; Gardner et al., 2015). The importance of wetlands to people in Africa is further reflected by the fact the continent is second only to the Asia-Pacific region in total catch of inland fisheries (Thieme et al., 2005).

However, global wetland area may have declined by as much as 87% since 1700 (Davidson, 2014) and the downward trend for freshwater species is alarming (Vörösmarty et al., 2010). For example, in the last 35 years, the average abundance of freshwater vertebrate species populations declined by 83% (WWF, 2018), and freshwater fishes had the highest extinction rate worldwide among vertebrates in the twentieth century (Burkhead, 2012). Of the freshwater taxa in Africa that have been assessed, the most globally threatened are molluscs (41%), followed by amphibians (31%), crabs (28%), and fish (27%) (Darwall et al., 2011). These declines in aquatic ecosystems have been caused by a suite of threats, including habitat modification, fragmentation and destruction, overfishing, pollution, and climate change (Strayer and Dudgeon, 2010; WWF, 2018).

Effective conservation and management of wetlands Biological Variability require data on species status and threats to inform decision-making and adaptive management. However, there are key challenges in Africa around the availability, usability and quality of Biological Variability data, willingness to use data, and capacity (Stephenson et al., 2017a). As a result, many decision makers do not have access to the data they need.

We review the challenges of monitoring aquatic Biological Variability in Africa, using examples from Ramsar sites and other wetlands across the continent, and propose solutions to help information users access high quality data in the right format at the right time. We assess the relevance of traditional monitoring methods, as well as innovative new tools (Table 1).

Table 1

TABLE 1. Summary of responses needed to tackle the challenges with wetlands biodiversity monitoring in Africa.

Challenge	Response to challenge	Method to apply
Appropriate indicators are lacking.	Apply common, policy-relevant indicators.	Use common indicators that work at local and global scales (e.g., population indices like Living Planet Index, Dragonfly Biotic Index) when developing monitoring plans.
Indicators are not measured (inadequate collection, use, and sharing of data).	Scale up the application of traditional and appropriate new tools and protocols.	Use traditional methods such as bird counts, vegetation plots, and satellite-based remote sensing of habitats to monitor key ecosystems and species; Where appropriate to local needs and capacity, introduce, or scale up the use of, new technologies (e.g., camera traps, acoustic recording devices, drones, and environmental DNA monitoring), metrics (e.g., IUCN Green List of Species), and modeling (e.g., species distribution modeling to focus on key sites); Establish a series of pilots to test approaches for applying citizen science to wetland monitoring in Africa; disseminate lessons widely to ensure take up of successful options; Produce data products like maps and dashboards to facilitate data use and adaptive management; share data in national, regional, and global databases.
Lack of institutional capacity for monitoring and data sharing.	Build capacity in key institutions (see section Build Capacity in Key Institutions).	Governments, donors, and NGOs to make biodiversity monitoring a higher priority in conservation projects and budgets; wealthier countries to make data more accessible to high biodiversity countries; enhance the sharing of monitoring case studies.
	Use partnerships and credible science-policy interfaces (see section Use Partnerships and Credible Science-Policy Interfaces).	Academic institutions, local and international NGOs and international organizations need to support government agencies with biodiversity monitoring especially in high biodiversity countries; Scientists and decision makers from across sectors need to work together in credible science-policy interfaces that incentivize interactive dialogue and allow the joint and collaborative framing of research and policy.

In each case the response is relevant to all key stakeholders, including government departments, academic bodies, civil society organizations, and businesses.

Summary of Challenges

In spite of the importance of wetlands, monitoring of habitats and species is limited. If any monitoring occurs, it is usually in relation to the extent of wetlands or bird populations. These problems reflect a broader issue across Africa where challenges block access to, and use of, Biological Variability data.

Barriers to using Biological Variability information in decision-making in Africa include lack of availability of data, poor quality and usability of data, limited political will among key actors to collect and share data, a lack of capacity and limited resources for Biological Variability research (Stephenson et al., 2017a, in press). Only 10% of recent conservation science studies were carried out in Africa, reflecting the fact that research is poorly aligned with Biological Variability distribution and conservation priorities (Di Marco et al., 2017). As a result, many global data sets have taxonomic, temporal, and geographic gaps in coverage (Stephenson et al., 2015a; McRae et al., 2017). Monitoring of freshwater habitats is also hindered by resource and logistical implications and lack of data sharing (Turak et al., 2017; Hill et al., 2018). As a result, data sets on wetlands Biological Variability are rarely available and often inadequate, hindering conservation planning (Van Deventer et al., 2016). Many African countries regularly census wildlife populations, yet the survey data are rarely analyzed and presented in a format that could be of direct use to decision makers (Bubb et al., 2011). In some cases, data presentation and use are influenced by a donor placing conditions on sharing.

Capacity for biological research is particularly challenging in Africa (e.g., Yevide et al., 2016; Cresswell, 2017). Integrated approaches to water and wetlands management are key, since many water issues in Africa are linked to food and energy issues (Simpson et al., 2019). However, the implementation of integrated water resource management has been difficult in parts of Africa, mostly due to a lack of experience, capacity, and resources (Claassen, 2013). Limited capacity and expertise for data sharing and use are often compounded not only by more limited resources to pay for raw images and/or data processing, but by limited internet capacity (Roy et al., 2010; Stephenson et al., in press). Many of the recent assessments of African Biological Variability data have been led and conducted by scientists who are predominantly based outside the region (Beresford et al., 2013; Waeber et al., 2016). These trends reflect the fact that most of the global data sets, and most of the scientists with access and capacity to analyze them, are housed in Europe or North America. Many local communities use indigenous knowledge to make local decisions on farming and resource use (e.g., Mapfumo et al., 2016), yet this capacity is rarely tapped for more formal decision-making processes in Africa.

Solutions

In order to tackle the challenges with monitoring wetland Biological Variability in Africa, we propose that governments, civil society, the private sector, and wetland scientists should enhance data collection by applying common, policy-relevant indicators, scaling up the application of traditional and appropriate new tools and protocols, building capacity in key institutions, and using partnerships and credible science-policy interfaces.

Conclusions

Wetlands are vital for nature conservation and human well-being, yet our knowledge is limited on the state of Biological Variability and its threats. In order to enhance monitoring, governments, civil society, academia and the private sector can enhance data collection in several ways by: (a) applying common, policy-relevant indicators; (b) scaling up the application of traditional and appropriate new tools and protocols;

(c) building capacity in key institutions; and (d) using partnerships and credible science-policy interfaces.

Looking to the future, the SDGs should help stimulate an increasing number of governments to use monitoring data across sectors and encourage inter-disciplinary research and collaboration (Stephenson et al., in press). In African countries where Biological Variability goals have been closely aligned with governmental development priorities, such as in Namibia (especially around communal conservancies) and in South Africa, Biological Variability indicators have been used more widely and outcomes have often been positive (Tallis et al., 2008; Brown et al., 2014).

Building on successful examples of wetland Biological Variability monitoring across Africa will require a concerted, collaborative effort. Governments will need to be open to collaboration with other states, with NGOs and with academia, within strong, open and transparent partnerships and credible science-policy fora. Only by sharing and upscaling the solutions to data collection and use will we be able to mainstream Biological Variability into decision-making and ultimately minimize Biological Variability loss across African wetlands.

"Perceptions of Climate Change in Africa: Regional Agricultural Perspectives," E.P. Ejembi and G.B. Alfa, Research on Humanities and Social Sciences, 2012 [20]
https://core.ac.uk/download/pdf/234672955.pdf

Abstract:

Climate is the primary determinant of agricultural productivity. Poor livestock health, reduced crop yields and a range of other problems are attributed to climatic factors, especially wind. There were varied and mixed views about the causes and indicators of climate change across and within communities in Africa, despite the evidence of a general awareness. It was observed that impacts of climate variability among African communities are highly differentiated according to land tenure, traditional beliefs, resource availability and gender. Despite this, indigenous and other traditional people are only rarely considered in academic, policy and public discourses on climate change.

Current & Relevant Information:

Review of Perception of Adaptation to Climate Change

East Africa

A study to analyze determinants of farm-level climate adaptation measures in Africa using a multinomial choice model fitted to data from a cross-sectional survey of over 8000 farms from 11 African countries, indicate that specialized crop cultivation (mono-cropping) is the agricultural practice most vulnerable to climate change in Africa. Warming, especially in summer, poses the highest risk. It encourages irrigation, multiple cropping and integration of livestock. Increased precipitation reduces the probability of irrigation and will benefit most African farms, especially in drier areas. Better access to markets, extension and credit services, technology and farm assets (labor, land and capital) are critical for helping African farmers adapt to climate change (Rashid and Charles, 2008).

An analysis of perception and adaptation to climate change in the Nile basin of Ethiopia revealed that age of the household head; wealth, information on climate change, social capital and agro ecological settings have significant impact on the perception of farmers to climate change. Moreover, the analysis of factors affecting adaptation to climate change indicates that education of the head of the household, household size, gender of the head of the household being male, livestock ownership and extension on crop and livestock production, availability of credit and temperature have positive and significant impact on adaptation to climate change. Additionally, the main barriers to adaptation identified include lack of information on adaptation methods and financial constraints to using the methods (Temesgen, 2008).

Tanzania’s official report on climate change suggests that the areas that usually get two rainfalls in the year will probably get more and those that get only one rainy season will get far less. The net result is expected to be that 33% less maize—the country's staple crop—will be grown (Peter et al., 1999). An increase in the frequency of seasonal floods has led participating farmers in Tanzania to demand technical and institutional support so that they can begin producing rice. In dry years, a major source of vulnerability is the increase in transmission of cattle diseases due to the congregation of large numbers of cattle at water holes (Paul et al., 2008).

Southern Africa

Climate change phenomenon affects agriculture in a number of ways. For example, uncertainties in the onset of the farming season, due to changes in rainfall characteristics (early rains may not be sustained, and crops planted at their instance may become smothered by heat waves) can lead to an unusual sequence of crop planting and replanting which may result in food shortages due to harvest failure. Extreme weather events such as thunderstorms, heavy winds, and floods, devastate farmlands and can lead to crop failure. Pests and crop and diseases migrate in response to Climate Changes and variations (e.g. the tsetse fly has extended its range northward) and will potentially pose a threat to Agricultural activities in Africa.

A study published in science suggest that, due to climate change, "southern Africa could lose more than 30 percent of its main crop, maize, by 2030 and in South Asia, losses of many regional staples such as rice, millet and maize could top 10%" (Forest et al., 1999). In parts of central Mozambique, tradition does not allow for farmers to grow pearl millet (due to bird problems), despite its apparent superiority over maize in terms of drought tolerance. Selection and testing of drought-tolerant maize varieties was one of the key priorities to emerge, together with education of farmers and local leaders on the need for alternative crop types such as sorghum and millets. Farmers in Zimbabwe previously in maize-dominated high rainfall zones have begun experimenting with sorghum, millet and drought-tolerant maize. Early planting was identified as a major adaptive strategy, but some farmers, notably women-headed households, cannot meet this challenge due to other demands on their labor (Paul et al., 2008).

These adaptation strategies must not be used in isolation. For instance, the use of early maturing crop varieties must be accompanied by other crop management practices such as crop rotations or the use of cover crops. This, however, requires additional institutional support, such as credit, access to both input and output markets and information. This will enable farmers to increase and sustain their productivity and production in the wake of changing climatic conditions. Migrant farmers are more vulnerable to the adverse effects of climate change than native farmers, because the majority of them do not have secure access to land. Their adaptive capacity is also low, due to low levels of human, financial, institutional and technical capabilities as well as limited access to markets.

A research on farmers' perceptions and adaptations to climate change and variability in South Africa indicated that, indeed, the analysis of farmers' perceptions of climate change is in line with the climatic data records. However, only approximately half of the farmers have adjusted their farming practices to account for the impacts of climate change. Lack of access to credit was cited by respondents as the main factor inhibiting adaptation. The results highlighted that household size, farming experience, wealth, and access to credit, access to water, tenure rights, off-farm activities, and access to extension are the main factors that enhance adaptive capacity (Gbetibouo, 2009).

West Africa

West Africa is one of the most vulnerable to the vagaries of the climate, as the scope of the impacts of climate variability over the last three or four decades has shown (IPCC, 2007). It is estimated that by 2100, West African countries are likely to have agricultural losses of up to 4% of GDP due to climate change (Mendelsohn et al., 1998). A study of sixteen sites in five countries and 1,500 households in the Sudan-Sahel zone of West Africa on farmer and pastoralist perceptions of climate variability and change and the consequences thereof for natural resources in the communities surveyed indicates that, there is a clear trend that farmers and pastoralists capture the observed changes in climate well. They perceive the environmental change mainly as land degradation and poor soil fertility though recent in some areas intensification of agriculture counters this effect and has led to increased vegetation cover in marginal areas. They identified erratic climate, agricultural policies, insufficient food production and desire to increase income as the main drivers of change (Ole et al., 2009).

Farmers in the Sahel have always been facing climatic variability at intra- and inter-annual and decadal time scales. While coping and adaptation strategies have traditionally included crop diversification, mobility, livelihood diversification, and migration, singling out climate as a direct driver of changes is not so simple. An analyzes of the perceptions of climate change and the strategies for coping and adaptation by sedentary farmers in the savanna zone of central Senegal reports that, households are aware of climate variability and identify wind and occasional excess rainfall as the most destructive climate factors. Households attribute poor livestock health, reduced crop yields and a range of other problems to climate factors, especially wind. Households and groups assign economic, political, and social rather than climate factors as the main reasons for change. It is concluded that the communities studied have a high awareness of climate issues. Change in land use and livelihood strategies is driven by adaptation to a range of factors of which climate appears not to be the most important. Implications for policy-making on agricultural and economic development will be to focus on providing flexible options rather than specific solutions to uncertain climate (Mertz et al., 2010).

Climate change is expected to have serious environmental, economic, and social impacts on Ghana, particularly on rural farmers whose livelihoods depend largely on rainfall. The extent of these impacts depends largely on awareness and the level of adaptation in response to climate change and variability. A hundred and eighty farming household were interviewed in February and October 2009. Results showed that about 92 percent of the respondents perceived increases in temperature while 87 percent perceived decrease in precipitation over the years. The major adaptation strategies identified included crop diversification, planting of short season varieties, change in crops species, shift of planting date, reduction in farm size, among others. The results of analysis indicated that the level of education, gender, age, soil fertility, farm size, farming experience, land tenure, access to extension services and credit, all influence farmers perception and adaptation (Benedicta et al., 2010).

There are varied and mixed views about the causes and indicators of climate change across and within communities in Africa, despite the evidence of a general awareness. At a local level, a wide range of indicators for predicting wet and drought seasons were identified. For example, farmers believed that cold winters indicate a drought, while hot summers signify good rains. In addition, farmers identified specific environmental changes that they had observed. In Wenchi, Ghana, farmers listed the following observed changes (Paul et al., 2008): Reduction in soil fertility levels, reduction in yields of major staples such as yam and maize disappearance of cocoa as a major cash crop, disappearance of the forest and wildlife, changes in rainfall pattern, proliferation of disease and insect pests proliferation of obnoxious weeds, e.g. spear grass. Farmers' own responses to these changes included planting different (early maturing) crops, planting earlier and using more agro-chemicals (Paul, et al; 2008).

According to the research, the impacts of climate variability among African communities are highly differentiated according to land tenure, traditional beliefs, resource availability and gender. However, this provides opportunities for developing adaptation mechanisms directed at specific vulnerable groups (Paul, et al; 2008): in Wenchi district, Ghana, farming is dominated by immigrants who use their agricultural produce as payment for land leased from the landlords, who expect annual payment regardless of whether it has been a good growing season. Short-term climate variations then pose a major threat to the security of tenure for the immigrant farmers.

Recent food crises in countries such as Nigeria are reminders of the continuing vulnerability of the region to the vicissitudes of climatic conditions. This is in large measure due to weak institutional capacity, limited engagement in environmental and adaptation issues, and a lack of validation of local knowledge (SPORE, 2008; BNRCC, 2008; Royal Society, 2005). Accordingly, there is the need to gain as much information as possible, and learn the positions of rural farmers and their needs, about what they know about climate change, in order to offer adaptation practices that meet these needs.

The most devastating adverse impacts of climate change in Nigeria and other subtropical countries includes frequent drought, increased environmental damage, increased infestation of crop by pests and diseases, depletion of household assets, increased rural urban migration, increased Biological Variability loss, depletion of wildlife and other natural resource base, changes in the vegetation type, decline in forest resources, decline in soil conditions (soil moisture and nutrients), increased health risks and the spread of infectious diseases, changing livelihood systems, among others (Reilly, 1999; Abaje and Giwa, 2007).

Much of the Niger-delta wetlands areas of Nigeria are now endangered due to climate variability, as witnessed by the significant reduction of their size in recent years. The maximum flooded area of the inner Niger Delta, which is the second largest wetland area in Africa, has dropped from approximately 37,000 km^2 in the early 1950s to 15,000 km^2 in 1990, coupled with the environmental degradation of crude-oil exploration has done to Niger-delta wetlands areas (BNRCC, 2008).

Evidences in literature revealed the intrusion of salt water in the water table of coastal zones of Ayetoro Community in Ilaje LG of Ondo State, Nigeria, and thus, led to increased salinity in soils. Already, the encroaching water is making life very hard. It is “extremely difficult now for food crops to grow on the island”. Salt water sweeps through the land, making it impossible for food to grow (Apata et al, 2009). Residents lamented that “although they have always lived in harmony with the sea, they are now frightened and scared of living on these atolls”. The atolls are sinking and despite not knowing the sciences people can see with their naked eyes the impact of the rising sea levels (BNRCC, 2008). The community now have the feeling that the waves will just come one day and swept them over; the community is now feeling restiveness. This area and the people are victims of climate change and rising sea levels.

In addition, almost 68 percent of the land cover in Nigeria is prone to drought and desertification. Its water resources are under threat which will affect energy sources (like the Kainji and Shiroro dam). Moreover, rain-fed agriculture practiced and fishing activities from which 2/3 of the Nigerian population depend primarily on foods and livelihoods are also under serious threat besides the high population pressures of 140 million people surviving on the physical environment through various activities within an area of 923,000 KM2 (IPCC 2007; NEST 2004). Alongside other factors, regional climate change - in particular, reduced precipitation - is thought to have contributed to the conflict in Darfur (Judith, 1993). The combination of decades of drought, desertification and overpopulation are among the causes of the conflict, because the Baggara Arab nomads searching for water have to take their livestock further south, to land mainly occupied by farming peoples (Marty, 2006).

Conclusion

Perception of climate change in Africa is crucial to combating climate change and related problems. Against this background, this paper assesses the perceptions of climate change in Africa. Specifically, the study investigated the level of awareness and knowledge, effects, coping strategies and sources of information regarding causes and prevention of climate change. The analyses of the perception of farmers to climate change indicate that most of the farmers are aware of the fact that temperature is increasing and the level of precipitation is declining.

Very little is known about the way agriculturalists update their expectations with respect to climate. And even if they do perceive that the climate has changed, they may still, because of any number of market imperfections, be unable to respond in the way that they themselves or society at large would wish. There is a significant amount of evidence detailing the slow uptake of technological adaptations in agriculture during the green revolution, especially in Africa. Indigenous Peoples have very weak approach towards tackling climate change problems. Poverty and ignorance of various adaptation strategies are the major contributing factors to the impact felt by indigenous people. The knowledge and information gap concerning the effect of climate change, information dissemination, awareness programs and training programs calls for immediate action in order to relegate the impact of climate change in Africa.

The overall needs are to setup serious environmental conservation ethic among indigenous people. This can only be possible by first and famous educating the indigenous people on the implication of climate change, educate the indigenous people on the significance of conservation of the natural environment, support the most environmentally friendly people and groups towards achieving set goals and objectives in the study areas.

2. Baltic Culture:

"Wood production and Biological Variability conservation are rival forestry objectives in Europe's Baltic Sea Region," Per Angelstam, et. al., Ecosphere, 6 March 2018 [21] https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.2119

Abstract:

The policy term green infrastructure highlights the need to maintain functional ecosystems as a foundation for sustainable societies. Because forests are the main natural ecosystems in Europe, it is crucial to understand the extent to which forest landscape management delivers functional green infrastructures. We used the steep west–east gradient in forest landscape history, land ownership, and political culture within northern Europe's Baltic Sea Region to assess regional profiles of benefits delivered by forest landscapes. The aim was to support policy-makers and planners with evidence-based knowledge about the current conditions for effective wood production and Biological Variability conservation. We developed and modeled four regional-level indicators for sustained yield wood production and four for Biological Variability conservation using public spatial data. The western case study regions in Sweden and Latvia had high forest management intensity with balanced forest losses and gains which was spatially correlated, thus indicating an even stand age class distribution at the local scale and therefore long-term sustained yields. In contrast, the eastern case study regions in Belarus and Russia showed spatial segregation of areas with forest losses and gains. Regarding Biological Variability conservation indicators, the west–east gradient was reversed. In the Russian, Belarusian, and Latvian case study regions, tree species composition was more natural than in Sweden, and the size of contiguous areas without forest loss was larger. In all four case study regions, 54–85% of the total land base consisted of forest cover, which is above critical fragmentation thresholds for forest landscape fragmentation. The results show that green infrastructures for wood production and Biological Variability conservation are inversely related among the four case study regions, and thus rival. While restoration for Biological Variability conservation is needed in the west, intensified use of wood and biomass is possible in the east. However, a cautious approach should be applied because intensification of wood production threatens Biological Variability. We discuss the barriers and bridges for spatial planning in countries with different types of land ownership and political cultures and stress the need for a landscape approach based on evidence-based collaborative learning processes that include both different academic disciplines and stakeholders that represent different sectors and levels of governance.

Current & Relevant Information:

Introduction

Contemporary policy documents highlight the need to use a development approach that satisfies all sustainability dimensions based on material and immaterial values of landscapes and regions (e.g., European Commission 2009, 2013a). Ultimately, functional ecosystems form the supply base for human well-being and the development of sustainable societies (Burkhard et al. 2012). Ecological networks are a solution and have been subject to research, policy, and practice in Europe for decades (Jongman et al. 2011, Čivić and Jones-Walters 2014). The EU's green infrastructure policy (European Commission 2013a, b) retains this ambition and aims at a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of benefits, today often referred to as ecosystem services (e.g., de Groot et al. 2002, Lele et al. 2013). It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas, in both rural and urban settings. Development of green infrastructure is a key step toward the success of maintaining and enhancing Biological Variability according to the EU 2020 Biological Variability Strategy (**http://ec.europa.eu/environment/nature/ecosystems/strategy/index_en.htm**). The backbone of EU's green infrastructure policy is the Natura 2000 network of high conservation value areas (Salomaa et al. 2017). The EU's green infrastructure policy thus aims at ensuring that conservation, restoration, and management of green infrastructure will become parts of integrated spatial planning and territorial development. Implementing green infrastructure policy requires maintenance of sufficient amounts of patches of different representative vegetation types, which then form ecological networks. Note, however, that the term green infrastructure evolved more than a century ago along two paths, in the United Kingdom and the United States. The UK approach views green infrastructure as the linking of urban parks and other green space into functional networks to benefit people, while the US approach sees green infrastructure primarily as a Biological Variability conservation measure to counteract habitat degradation and fragmentation (e.g., Benedict and McMahon 2006, Allen 2014).

The increased pressure for higher biological production in terrestrial and aquatic systems under the heading of bio-economy (McCormick and Kautto 2013) and the expansion of the human footprint through housing, transport, communication, and energy infrastructures make the management and sustainability of green infrastructures a difficult balancing act (e.g., Popescu et al. 2014). Resolving competing interests through collaborative spatial planning is a key approach for reaching sustainability (e.g., Elbakidze et al. 2015), as well as a challenge for developing inclusive governance processes (Baker 2006) and active adaptive management (Walters 1986, 1997).

Therefore, to understand whether land covers representing a region's ecosystems actually form functional green infrastructures, it is crucial to assess the entire chain of actions from policy to practice, including evidence-based knowledge about the resulting state of sustainability in landscapes and regions. This requires both evaluation of the policy process and the outcomes of this process (Rauschmayer et al. 2009). Evaluation of the former involves assessment of what constitutes good governance (Currie-Alder 2005, Baker 2006), including elements such as more and improved information management and learning, a legitimate process, and the normative aims of transparency and participation. According to Rauschmayer et al. (2009), outcomes of the policy process can be divided into two parts: firstly, the outputs in terms of implementation of practices and rules to be applied by governors at multiple levels, including pronouncements of norms (e.g., Lammerts van Bueren and Blom 1997) such as strategic performance targets for short-term and long-term goals (e.g., Angelstam and Andersson 2001), as well as tactical planning and operational management approaches (e.g., Eriksson and Hammer 2006). Depending on the sector, management involves practices that imply both pressures and responses on sustainability (Butchart et al. 2010). Secondly, the consequences of the operational implementation of strategic and tactical plans by managers on the sustainability of landscapes and regions need to be assessed (e.g., Angelstam et al. 2011a, Elbakidze et al. 2011, 2015). This requires monitoring of indicators that measure the effectiveness of policy implementation tools on different aspects of sustainability, such as the functionality of green infrastructures. There are three approaches to monitoring: (1) implementation monitoring, (2) validation monitoring, and (3) effectiveness monitoring (Busch and Trexler 2003). The development of effectiveness monitoring based on evidence-based knowledge about the states of green infrastructures is a prerequisite for planning toward functional green infrastructures (Müller and Burkhard 2012). While policy-level indicators generally focus on national level reporting about policy implementation, spatially explicit data at the scale of local landscapes in regions are needed to provide knowledge about the state of green infrastructure for effective steering by spatial planning. Consequently, monitoring must also be undertaken at the scale where land management takes place, that is, in a local forest management unit or an administrative unit such as a municipality. A range of studies have proposed indicators and presented different frameworks for monitoring forest values, all of which need to be validated before being used (e.g., Stem et al. 2005).

Successful implementation of green infrastructure policy thus requires that stakeholders and actors coordinate and integrate their monitoring of land covers, landscapes, and regions. However, given that national and business policies, landscape histories and governance contexts among countries in Europe are very varied, Pan-European and EU policies linked to green infrastructures are likely to be comprehended and implemented differently. This is not made easier by national-, regional-, or local-level rhetoric that only stresses continued pressure on valuable natural systems, or only the responses made in terms of set-asides and management practices. The net effect of pressures and responses on the state of ecosystems is thus confounded to practitioners, policy-makers, and the public, unless comprehensive analyses are made (e.g., Elbakidze et al. 2016). Indicators of green infrastructure functionality need to address specific benefits and be robust and understandable.

The steep west–east gradient in landscape history, ownership, and political culture within Europe's Baltic Sea Region (BSR) provides excellent opportunities to explore the consequences for the profile of benefits delivered by landscapes' green infrastructures (e.g., Kern and Loffelsend 2004, Metzger and Schmitt 2012, Angelstam et al. 2013, 2017b). Following the enlargement of the European Union in 2004 by inclusion of the three Baltic States and Poland, the Baltic Sea has become close to an EU-internal sea. The BSR strategy (European Commission, 2009) aims at functional coordination and more efficient use of financial resources and existing cooperation schemes between Sweden, Finland, Estonia, Latvia, Lithuania, Poland, Germany, and Denmark. The European Commission (2014) noted that the involvement of stakeholders needs to be strengthened, including parliaments at different levels, regional governments, and civil society. Consistent with that, EU InterReg and other funding mechanisms for neighborhood collaboration have a broader geographical scope than the EU. Non-EU countries are also participating actively in work with the BSR Cooperation. These include Norway, Russia, and sometimes Iceland and Belarus (Swedish Agency for Economic and Regional Growth 2014). The BSR strategy emerged due to a suite of critical environmental problems as well as severe differences in infrastructural accessibility and economic development among regions (e.g., Bengtsson 2009). Being the first macro-regional cooperation of its kind in the EU, the BSR is a good test case. Thus, it is important to assess the extent to which this new model functions and whether this model may be applied in other macro-regions. This requires evidence-based knowledge about how different countries' governance and management affect environment, infrastructure, and development of natural resources.

With forests being the main natural ecosystems in the BSR, it is thus crucial to understand the extent to which forest landscape management satisfies the different dimensions of sustainable forest management policy by maintaining functional green infrastructure. Effective wood production and habitat for Biological Variability conservation are two key benefits received from forest landscapes, which are articulated in policy (e.g., Edwards and Kleinschmit 2013) and practice (e.g., Juutinen and Mönkkönen 2004). Integrative vs. segregative approaches to sustainable forest management are debated as solutions (Bollmann and Braunisch 2013). This dichotomy is analogous to land-sharing, which combines wood production with Biological Variability conservation across a landscape, and land-sparing, in which more intense forestry is combined with protected areas (Edwards et al. 2014). Maximum sustained yield wood production and Biological Variability conservation with policy ambitions about viable populations of specialized species and their habitats as well as ecological processes are rival in the same local forest area (e.g., Mönkkönen et al. 2014). Accommodating both production and Biological Variability conservation thus requires spatial planning that includes multiple sectors at the scales of landscapes and regions (e.g., Vierikko et al. 2008, Angelstam et al. 2011a, Elbakidze et al. 2015). This requires evidence-based knowledge about the state of these benefits in different contexts, such as in the BSR with its variability of contexts.

The aim of this study was to assess the relative state of sustained yield wood production as a means of delivering provisioning ecosystem services, and Biological Variability conservation to supply supporting (or habitat) services, as rival objectives in the west–east gradient of the BSR. Using public spatial databases with proxy data relevant to forest landscapes in different regions, we developed and modeled four effectiveness indicators (sensu Busch and Trexler 2003) of wood production and four indicators for Biological Variability conservation at the regional level in Sweden, Latvia, Belarus, and Russia. The resulting parameter values were then compared and the results discussed in the context of land-sharing or land-sparing.

“Adaptation to Climate Change in the Baltic States: A background paper,” Julia Peleikis, Matthias Grätz, and Jesko Hirschfeld, Baltic Environmental Forum Deutschland, November 2012 [22] https://research.fit.edu/media/site-specific/researchfitedu/coast-climate-adaptation-library/europe/baltic-states/Peleikis-et-al.--2012.--Baltic-CC-Adaptation-Background.pdf

Overview:

The climate is changing throughout the world. Irrespective of mitigation measures, i.e. measures aimed at reducing greenhouse gases, adaptation to the changes already caused by the emissions of greenhouse gases will be necessary to meet the consequences for the environment, economy and society anticipated by experts. Modern climate policy is therefore based on two pillars: reducing greenhouse gas emissions and adaptation to those consequences of climate change which are already unavoidable.

In 2009, the European Union (EU) outlined its approach to adaptation by publishing the White Paper Adapting to Climate Change: Towards a European Framework for Action (Commission of the European Communities 2009). The White Paper sets out a framework to reduce the EU’s vulnerability to the impacts of climate change. Due to the varying severity and nature of the impacts of climate change between different regions in Europe, the White Paper so far leaves adaptation decisions to individual countries.

In the Baltic States, climate change mitigation has been recognized as an important issue on a national level and the first set of measures have been adopted. However, the portfolio of adaptation measures in Estonia, Latvia and Lithuania is much more limited. This becomes particularly evident when comparing the action already taken on adaptation by the Baltic States to other countries within the Baltic Sea Region, such as Germany and Finland, which have developed national adaptation strategies and which are already actively implementing measures to adapt to climate change.

Addressing climate change adaptation is necessary, not only in order to be consistent with EU targets and visions, but in particular in view of the fact that some regions of the Baltic States are already experiencing first changes in the natural environment. Within the coastal zones, for instance, climate-related changes such as an acceleration of the rise of sea levels, a further rise in sea surface temperature and more extreme weather events can be expected to have a range of impacts (Policy Research Corporation 2009). The storm of January 2005, for example, affected all three Baltic States heavily (Bruneniece/ Klavins 2011: 492) and the vulnerability of Latvia, Lithuania and Estonia to coastal erosion and flooding will increase through climate change as the frequency and intensity of storms in the Eastern Baltic Sea region are predicted to rise (Policy Research Cooperation 20091).

This background paper briefly introduces adaptation as a policy issue and outlines developments at EU level. Followed by these general chapters, the paper will examine the situation in the Baltic States. These country-specific chapters are based on interviews conducted with representatives of the Environment Ministries of Estonia, Latvia and Lithuania as well as background research. The content of these chapters therefore reflects the views of the three ministries to a large extent.

<u>Current & Relevant Information:</u>

Estonia

Estonia has recognized climate change as an important policy field. At national level, the focus so far has been on greenhouse gas mitigation policy and crisis management, the latter being regulated by the 2009 Emergency Act and emergencies and crisis management plans under the regulation of the Emergency Act (Ministry of the Environment of the Republic of Estonia 2009: 146). The most relevant policy objectives in this context concern energy related questions and agricultural policy, according to the Estonian Ministry of the Environment.

Much less significance, however, has been attributed to adaptation to climate change than mitigation so far. When approved by the Estonian government in 2007, the Estonian Environmental Strategy 2030 and the National Environmental Action Plan of Estonia 2007-2013, serving as the implementation plan of the strategy, did not specify climate change adaptation as a goal or activity of the Estonian environmental policy (Ministry of the Environment of the Republic of Estonia 2007 and 2008). Some existing policy documents, however, do contain aspects regarding adaptation: the Estonian Forest Development Plan until 2020 mentions the changed composition of species and notes that this topic needs to be investigated more deeply; the Public Health Development Plan 2009-2020 and the HELCOM Baltic Sea Action Plan also includes adaptation aspects. Furthermore, the topic of adaptation has recently been added to the updated draft version of the National Environmental Action Plan of Estonia, the draft version of Development Plan for the

Ministry of the Environment 2012-2015, to the Nature Conservation Development Plan up to 2020, the as yet unpublished sectoral Climate Change Adaptation Strategy by the Ministry of Agriculture, as well as to the work plan of the Climate and Radiation Department of the Ministry of the Environment.

At local level, the strong storm of 2005 in particular resulted in the development of detailed adaptation on and action plans as to how local governments were to deal with storms and floods (Ministry of the Environment of the Republic of Estonia 2009: 26). The storm gave a clear indication that there is a need to improve the readiness of regions in case of emergencies, and the cities that were most influenced by the storm (Tallinn, Pärnu, Haapsalu) are also by far the most active in implementing adaptation measures (Ministry of the Environment of the Republic of Estonia 2009: 146). Apart from the above-mentioned preliminary approaches at national level, crisis management plans also provide guidelines on how municipalities should act in the case of floods and other emergency situations, and therefore often include adaptation aspects.

According to the Ministry of the Environment it is essential to conduct a thorough analysis of the impacts of climate change in order to develop a national adaptation strategy. As this has not been done so far, the Ministry finds it difficult at this time to name the most important objectives regarding adaptation, to make statements about policy objectives influenced or endangered by climate change as well as to suggest new policy goals. Goals mentioned in national documents are mostly of a very generic nature, often inspired by EU documents. In general, the ministry regards spatial and strategic planning as important objectives relevant to climate change adaptation in Estonia, highlighting in particular the importance of a long-term vision.

Latvia

Latvia does not yet have a national adaptation strategy, but has started the preparations for a related document. A systemic approach was begun in 2008 by the Latvian Government’s approval of the Report on Adaptation to Climate Change with the Latvian Government (Bruneniece/ Klavins 2011: 481). This advisory report cites the risks related to climate change (e.g. more frequent and more powerful storms, floods, droughts, human health problems, loss or movement of animals and plants etc.) as well as the advantages of climate change (e.g. a longer vegetation period and an increasing volume of precipitation which will allow higher and more stable power generation from own hydro power plants to be achieved). The report considers the costs and benefits arising from climate change impacts and policy response alternatives (Bruneniece/ Kalnins 2011: 495). Furthermore, it gives an overview on relevant research at international and national level and details the most important international policy initiatives related to adaptation. It describes adaptation needs and gives preliminary recommendations for future adaptation measures to be taken (Swart et al. 2009: 226).

The report serves as a basis for the development of Latvia's national strategy on climate change adaptation, which, however, will not be entitled 'National Adaptation Strategy' but 'National Adaptation Guidelines'. It was planned that within one year after the adoption of the European Commission's White Paper on Adaptation to Climate Change – i.e. until 1 April 2010 - the Latvian Ministry of the Environment would have developed a concept on adaptation to climate change (Ministry of the Environment of the Republic of Latvia 2009: 129). Until now, however, neither the format of the national adaptation guidelines nor that of the adaptation action plan has been agreed. According to the latest protocol of the Cabinet of Ministers, adopted on 29th May 2012, the Ministry of Environmental Protection and Regional Development has to prepare guidelines for adaptation by 1st December, including within changes of Environmental Policy guidelines for 2009-2015.

Nevertheless, some objectives concerning climate change and adaptation are already included in other documents, e.g. in the Strategy for Spatial Development of the Coastal Area 2011-2017, the Environmental Policy Guidelines 2009-2015 and the legislation documents regulating the use of funding from the Kyoto mechanisms, which is amongst others meant to be used for climate change adaptation activities. However, no projects have been implemented on adaptation activities. A few single sectors, e.g. forestry, have also evaluated climate change impacts already and have developed measures for their own sector. Other precautions, such as a compensation mechanism in agriculture and forestry, action in case of floods and construction regulations for coastal areas endangered by flooding and erosion are being envisaged according to the Ministry of Environmental Protection and Regional Development (MEPRD). According to the Ministry, however, they are not necessarily attributed to risks related to climate change.

In the opinion of the Spatial Planning Department of the Ministry of Environmental Protection and Regional Development, a policy objective in Latvia particularly relevant to climate change is the concept of land user and land owner responsibility. This was mentioned for the first time in the draft Law on Land Management and states that the land owner is responsible for the adaptation of his land to climate change. For this purpose, there are different instruments available, e.g. insurances. According to the Spatial Planning Department this aspect shall be mentioned in Latvia's national adaptation guidelines as currently people expect the government – therefore the department – to pay for such measures. Furthermore, the department regards it necessary to include in the guidelines information on how to integrate the topic of climate change in other sectors and documents.

According to the Climate Change Division of the Ministry, objectives that will be influenced by climate change include in particular those objectives which are related to regional development, e.g. the planning of business areas, infrastructure and settlements.

Lithuania

In January 2008, the Government of the Republic of Lithuania approved the National Strategy for the Implementation of the UNFCCC until 2012 (Ministry of the Environment of the Republic of Lithuania 2010: 105). Specific measures not only for mitigation but also for adaptation to climate change are described in the strategy. Measures to ensure relevant adaptation to climate change and to minimize the adverse impacts on human health and the environment are divided into the following groups:

- measures aimed at ensuring more effective monitoring of climate change,
- measures to ensure the assessment of the vulnerability of the landscape, ecosystems and biological variability, and the planning of adaptation options,
- measures to reduce the impact of the energy, industry, transport, agricultural and forestry sectors on the climate,
- measures to reduce the impact of climate change on human health, to develop research and to raise public awareness in combating climate change

The National Strategy for the Implementation of the UNFCCC until 2012 furthermore determines deadlines and responsible authorities, included in the annex on measures attached to the strategy (Ministry of the Environment of the Republic of Lithuania 2010: 14). The implementation of the strategy is organized and coordinated by the Ministry of the Environment with the Ministries of Energy, Finance, Transport and Communications, Health, Education and Science, Economy, Agriculture and other institutions involved depending on their competences (Ministry of the Environment of the Republic of Lithuania 2010: 12).

Lithuania’s second main document concerning climate change is the Law on Financial Instruments for Climate Change Management (Republic of Lithuania 2009). Passed in July 2009, it addresses the rights, duties and liabilities of the persons engaged in economic activities resulting in greenhouse gas emissions, the sphere of competence of state institutions and bodies, and the EU Emission Trading Scheme. It also lays down provisions for the National Strategy for Climate Change Management Policy (NSCCMP), which currently is in the process of development. In Lithuania there are no plans to develop a separate Climate Change Adaptation Strategy. Instead, the NSCCMP for the period 2013-2050 will cover both mitigation and adaptation.

The NSCCMP is being developed by a Lithuanian consultancy company, which has been charged with this task by the Ministry. The Ministry provided the company with data and strategic documents and they jointly agreed on the document structure, including the selection of the following sectors for the analysis of both mitigation and adaptation: water resources, landscape, ecosystems and Biological Variability, air pollution, waste, forestry, agriculture, energy, transport, industry, and public health. During the contracting phase, the company has maintained regular contact with the

Ministry and furthermore approached the Ministries of Transport, Economy, Energy, Agriculture and Education, as well as different universities. Data were also provided to the consultancy by the Industry Confederation, the Association of Municipalities and some municipalities. The contractor’s tasks included the analysis of climate change mitigation and adaptation options in the selected public management sectors, the suggestion of mitigation and adaptation goals and tasks on a national level as well as for the public management sectors, and the development of the NSCCMP draft strategy document and the implementation plan. A review or quality control of the NSCCMP is also included in the contract with the company.

The first draft of the NSCCMP was prepared in spring 2012. It provides climate change adaptation objectives, measures and tasks, and defines the format of the adaptation action plan. In June 2012 the draft version was sent to all related Ministries and was also made available for comments to the public. It is planned that the NSCCMP will be approved by the Seimas at the end of 2012 and that the strategy will come into force in 2013.

According to the Ministry of the Environment, the most relevant existing policy objectives in Lithuania related to climate change include the promotion of renewable energy sources and improvement of the energy efficiency, including the refurbishment of the housing stock. The main objectives concerning adaptation defined in the NSCCMP include the following:

- to mainstream adaptation objectives and measures in the policy documents, objectives and activities of the most important economy sectors, i.e. energy, industry, agriculture and transport;
- to promote the use of EU funds and the government’s budget for adaptation-related projects;
- to monitor and evaluate the impact of climate change in Lithuania and other countries;
- to coordinate and ensure a systematic gathering and dissemination of climate change information to various interest groups and the public;
- to promote research and innovation in the field of climate change, including adaptation measures, and ensure an efficient allocation of finances;
- to ensure the education and continuous skills development of climate change specialists;
- to create an effective insurance and compensation mechanism for damage caused by extreme weather events.

In the current draft of the NSCCMP, a need for adaptation measures is stated for the following sectors: Biological Variability and ecosystems, agriculture and soil, public health, energy, transport, industry, forest and water management. The Ministry of the Environment is of the opinion that it is good to analyze as many sectors as possible because currently there is still not sufficient information about many sectors.

“A framework for habitat monitoring and climate change modelling: construction and validation of the Environmental Stratification of Estonia,” Miguel Villoslada, et al., Regional Environmental Change, 2016 [23]
https://www.research.ed.ac.uk/portal/files/27476317/26531467._AAM..pdf

Abstract:

Environmental stratifications provide the framework for efficient surveillance and monitoring of Biological Variability and ecological resources, as well as modelling exercises. An obstacle for agricultural landscape monitoring in Estonia has been the lack of a framework for the objective selection of monitoring sites. This paper describes the construction and testing of the Environmental Stratification of Estonia (ESE). Principal components analysis (PCA) was used to select the variables that capture the most amount of variation. Seven climate variables and topography were selected and subsequently subjected to the ISODATA clustering routine in order to produce relatively homogeneous environmental strata. The ESE contains eight strata, which have been described in terms of soil, land cover and climatic parameters. In order to assess the reliability of the stratification procedure for the selection of monitoring sites, the ESE was compared with the previous map of Landscape Regions of Estonia and correlated with five environmental datasets. All correlations were significant. The stratification has therefore already been used to extend the current series of samples in agricultural landscapes into a more statistically robust series of monitoring sites. The potential for applying climate change scenarios to assess the shifts in the strata and associated ecological impacts is also examined.

Current & Relevant Information:

The present study was initiated in the frame of a multidisciplinary project within the Estonian University of Life Sciences concerning national ecotones and boundaries. A key module in the project is the assessment of the impact of climate change on vegetation and habitats. The aim of the present study is therefore to describe the construction and validation of the Environmental Stratification of Estonia (ESE), which will be used as a basis for the selection of representative sampling sites for recording data on habitats and vegetation. Moreover, the ESE will provide the statistical framework required to upgrade the current Agricultural Landscape Monitoring program in Estonia. The collected data will then be used in modelling the potential impacts of climate change on the stock and change of Biological Variability (Berry et al. 2003; Thuiller et al. 2008). Modelling exercises will also include determining the shifts in the distribution of the strata under different climate change scenarios. The ESE will also be used as a framework to determine the provision of ecosystem services throughout Estonia.

Conclusion

The Environmental Stratification of Estonia (ESE) was constructed using climate and geomorphological data and applying standard statistical procedures. The classification has been tested and correlated with environmental data sets, demonstrating that the strata are representative of the principal underlying environmental gradients. Because the strata are determined statistically and independently of personal judgement, the ESE provides the framework for optimizing the existing Agricultural Landscape Monitoring program in Estonia, in order to obtain statistically robust figures. Furthermore, the ESE will provide the background for modelling the effects of climate change on habitats, species distribution and the provision of ecosystem services.

“Preconditions of the Biological Variability Protection in the Context of Interaction Development between Urban and Rural Areas in Latvia,” Janis Vanags, et al., Economics and Culture, 2011 [24]
https://www.augstskola.lv/upload/augstskola/zinatne/2011_3.pdf#page=269

Abstract:

Latvia is famous for its forests and natural grasslands, the Baltic Sea coast and wetlands. In particular, it boasts with a beautiful country estate parks, household's decorative gardens and urban tree avenues. It provides to Latvia the special attraction. In Latvia the same as in the world the preservation of the natural wealth for present and future generations is recognized as one of the priorities in area of nature protection. Taking into account an actuality of the appreciation of the natural wealth of Latvia as well as its reasonable use in the context of sustainable development the following aim is defined to the scientific paper – to provide research in area of the interaction development between urban and rural areas in the context of preservation of the Latvian natural variability. The study is based on the following research methods – historical method, monographic and logically constructive method, analysis and synthesis method, research of the legislative acts and experts' opinion assessment. Consequently, the study of the preconditions of the conservation of the Latvian natural variability in the context of the interaction development between urban and rural areas is provided.

Current & Relevant Information:

Latvia has a long tradition of the nature conservation. In the opinion of historians, for the ancient inhabitants of Latvia nature has always been an object of worship. The ancient Latvians worshiped and adored not only Gods decision-makers, the Gods of fate and fertility but also deities of the nature and natural forces since they have a significant impact on the human life and well-being. This is shown by folk tales, folk songs and commonly found sacred springs, groves, trees, stones and other sacred places in Latvia. (Vide un ilgtspējīga attīstība 2010).

An attitude of the ancient Latvian citizens towards the environment is reflected in many Latvian folk songs preserved until nowadays. From ancient times people who inhabited Latvia considered themselves as a part of the nature next to animals, plants, water and land. Exploration of the fragile links between man and nature shows that respect for nature as well as its protection and conservation always has been one of the fundamental ethical principles of the Latvian society. (Kļaviņš, Nikodemus, Segliņš 2008) The ancient Latvians always have tried to live according to the laws of nature and to respect the existing natural rhythm and the order of things of the environment where they lived and conducted their business activities. An attitude of the previous generation of the Latvian society towards nature and natural processes reflects the foresight of the local population in development of the relationships with the environment. Our ancestors realized that their lifestyle, everyday business activities and values of life directly or indirectly refers to the development of the human settlements in the future. It is important to note that nowadays at the range of the issues addressed to the environment protection are both human and nature. Conservation and management of the natural treasures and resources, protection of the species and habitats, planning of the local development projects and landscapes' ecological planning is a part of them. (Īpaši aizsargājamās dabas teritorijas 2011).

Currently Latvia has a strong and stable system of the specially protected nature territories that provides state-level protection for 12,1% of the state territory. All specially protected nature territories in Latvia shall be marked on site with a special informative sign, the sample and the procedures for development and use of which are specified in Regulation of the No. 264 “General Regulations on Protection and Use of Specially Protected Nature Territories” adopted by the Cabinet of the Ministers of the Republic of Latvia on March 16, 2010. The special informative sign for marking of a specially protected nature territories is schematically shown in Figure 1.

Figure 1. The special informative sign for making of a specially protected nature territories (Īpaši aizsargājamo dabas teritoriju vispārējie aizsardzības un izmantošanas noteikumi 2010)

As shown in Figure 1, the special informative sign for marking of a protection territory shall be a green square field surrounded by a white frame with a stylized oak leaf pictogram. It was put into use to provide a common style of the representation of the specially protected nature territories throughout the Republic of Latvia. It is expected that a common style of the representation of the specially protected nature territories will promote identification of the Latvian specially protected nature territories around the world. The Nature Protection Board in co-operation with the relevant self-government shall develop (prepare) and place the signs.

"Cultural Variability Issues in Biological Variability Monitoring—Cases of Lithuania, Poland and Denmark," Deivida Vandzinskaite, et al., Variability, September 2010 [25]
https://www.researchgate.net/publication/46295141_Cultural_Variability_Issues_in_Biological Variability_Monitoring-Cases_of_Lithuania_Poland_and_Denmark

Abstract:

Public participation is a key element in nature conservation in Europe and a necessity for collecting broad scale data on Biological Variability and its dynamics. However, vast societal differences exist between eastern and western European countries, resulting in problems for public participation in post-communist states as compared to western countries. Here, we compare variability in monitoring practices and public participation in countries with different political histories. Drawing on in-depth ethnographic studies conducted in Lithuania and Poland, as well as a rapid assessment in Denmark, we have focused on the historical, cultural and social determinants of the volunteers' participation in Biological Variability monitoring. Our results indicate the reasons why volunteer involvement—as an expression of a

participatory approach—has a lower incidence in the post-communist countries, compared to voluntarism common in occidental democracies. We discuss our results in the context of the main social factors considered to be a legacy of the Soviet regime.

Current & Relevant Information:

The largest environmental organization in Lithuania was founded in 1984. LOD seeks to conserve all bird species in Lithuania by protecting their habitats and, through this, to work for the world's biological variability and the sustainability of human use of natural resources. It congregates above 200 members with a small ratio of volunteers.

Our ethnographic research showed that the level of public participation in Biological Variability monitoring within the three investigated countries was very varied. The main difference was observed between eastern (Lithuania, Poland) and western countries (Denmark), which possess different historical traditions and practices of civic participation. At a country level, there were differences regarding the level of volunteer involvement in Biological Variability monitoring, the volunteer recruitment and retaining practices, and in public attitudes toward volunteering as an unpaid activity as well as one of the forms of civic participation (decision-making process). Public participation is much more successful in western countries [20], as represented by Denmark in our present analysis. Denmark and other western countries have a long tradition of political and social democracy.

In summary, volunteer involvement appears to be both a matter of individual resources as well as cultural patterns, because culture plays an important role in determining one's participation in voluntary activity. Our ethnographic data also showed that elements of culture such as values, attitudes and shared perceptions strongly relate to the historical, political and socioeconomic context of the particular society. Forms of volunteering showed a large variability over Europe, with large differences between Eastern and Western European countries. Our study added that even though citizens of post-communist countries used to believe in the power of groups that can act on their behalf, after having experienced compulsory social labor in communist times, the majority of them are not eager to work freely even for the common good.

The lack of interest in almost all kinds of environmental issues in the Communist ideology resulted in a deficiency of adequate environmental legal regulations in the Eastern Block. Consequently, the instrumental way most people used to treat nature was generally accepted. Such a habit is very hard to change, given the fact that in the former communist countries, where —the obligatory voluntary work existed, the impact of past memories of the voluntary element still has a rather detrimental effect on the willingness of people to get involved. In addition, the natural environment in the Soviet Block has been declined gradually in some regions, so that by the end of the 1980s the Eastern and Central European countries were places characterized by very high pollution alongside undeveloped refuges of high Biological Variability. This situation was accompanied by a very low environmental awareness of the societies and pressure on economic development.

Although the communistic era is over, many people still have problems in altering their way of thinking about the natural environment. The attitude towards nature within the Communist ideology was highly negative right down to the level of the collective's goods, for which nobody felt personally responsible. Engagement in post-soviet countries seems to be a serious problem, even among the public, in terms of Biological Variability monitoring actions. Their lack of an appropriate attitude towards the environment may have negative consequences, as agreed by members of the Lithuanian and Polish NGOs.

Conclusions and Recommendations

The main issues on volunteer involvement rooted in post-communist culture seem to be a low interest in nature as a common good, a negative public attitude toward non-materialistic values reflected in the dependency on incomes and a discouraging working climate in the relationship between professionals and amateurs. The latter might be seen as a result of a low level of trust followed by competition instead of cooperation among NGOs and professionals and volunteers, and finally a lack of management and leadership skills within NGOs. As it was pointed out in the theory, a high level of social trust and active public participation is very much related to the traditions of volunteering and participation when members of a society learn to participate by participating. Therefore, building up new social habits in the post-communist societies requires a complex and continuous set of actions at both the macro/national and micro/organizational levels.

The success of volunteer recruitment in post-communistic countries is highly dependent on the success of the democratization process in general. A strengthening of civil consciousness through civic education is needed, which should help to replace the skepticism surrounding volunteering with a more positive attitude toward unpaid activities as a way to work for the common good. All the actions designed to improve the situation in the short term, rather than over a generation, must take into account the differences in the attitudes toward nature and volunteering traditions in post-communistic and non-communistic countries.

In this regard, human resource management could be strengthened through better organizational structure and performance, providing an environment where people with different levels of knowledge, skills and individual motives could be involved in NGOs activities. As long as the generally inadequate approach to nature and to volunteering exists in post-communistic societies, whilst implementing methods to increase public participation, create social bounds, strengthen feelings of belonging and solidarity within the NGO.

“Adaptation in Baltic Sea Region,” Climate ADAPT [26] https://climate-adapt.eea.europa.eu/countries-regions/transnational-regions/baltic-sea-region/adaptation/general

Overview:

The Baltic Sea Region (BSR) comprises eight EU Member States, the neighboring countries Norway and Belarus, and the north-west regions of Russia. The EU Member States – Denmark, Sweden, Finland, Estonia, Latvia, Lithuania, Poland and Germany – and Russia are all directly bordering the Baltic Sea. Parts of Norway and Belarus, both no riparian countries, are in the catchment area of the Baltic Sea.

The BSR countries share many different ties of cooperation such as within sustainable development and environmental protection, trade, education, culture and civil security. The geographical and political unity and a certain common cultural background, play an eminent role for establishing close ties. This has facilitated a wide range of integrative processes in the BSR. Various formal and informal cross-border organizations demonstrate the multi-dimensional scale of interaction and constitute regional strength.

Current & Relevant Information:

Threats to the environment of the Baltic Sea Region

Geographical, hydrological and biological features of the Baltic Sea and its river basins make them very sensitive to threats such as pollution and unsustainable use of natural resources. In the past, human activities have increasingly influenced the Baltic Sea and its ecology, in particular over the past two centuries during which the population has increased and agricultural and industrial activities have intensified. The impacts caused by climate change add to these threats and are projected to jeopardize the integrity of the ecosystem and increase risks caused by natural disasters. The BSR countries have to face the challenges of climate change and its regional and local impacts. Consequently, regional and local adaptation strategies are needed to cope with the inevitable consequences of climate change.

Climate change adaptation in the Baltic Sea Region

The EU developed the first macro-regional strategy in Europe: the EU Strategy for the Baltic Sea Region (EUSBSR). One of the EUSBSR's main actions is climate change adaptation.

Under the Horizontal Action "Sustainable Development" and its strategic Action "Climate Change Adaptation", the EUSBSR calls for a BSR-wide climate change adaptation strategy and action plan, focusing on the sea itself and its coastline. The EU-funded Baltadapt project, a CBSS-Baltic 21 Lighthouse and an EUSBSR Flagship project, developed a proposal for a BSR-wide Climate Change Adaptation Strategy and Action Plan. Both documents address climate change adaptation in an integrative manner for the entire region. They focus on the marine and coastal environment.

Within the Baltadapt project, also this transnational region's sub-section on Climate-ADAPT has been developed. It functions as an information portal compiling available information on climate change impacts and adaptation in the BSR. It is aimed at decision-makers in the region.

"Climate Change Adaptation Development Plan until 2030," Republic of Estonia Ministry of the Environment, 2018 [27] https://envir.ee/media/912/download

Overview:

Transition to a resource-efficient economy is directly linked to the mitigation of climate change (reduction of greenhouse gas emissions) and the adaptation to the effects of climate change. By adaptation to the effects of climate change, we refer to the mitigation of risks caused by climate change and a framework for action in order to increase the readiness of the society as well as of the ecosystems and their resistance to climate change.

Due to climate change, the temperature of both land and marine areas is increasing and the amount and distribution of precipitation is changing, resulting in an increase in the average sea level in the whole world, a risk of coastal erosion and more severe weather-related natural disasters. Changes in the level, temperature and flow of water influence the integrity of the ecosystem, which in turn affects all areas of life and activity, e.g. agriculture which is responsible for food supply and together with the increase in the average temperature, it affects the health of people and thus also healthcare, industry, transportation, etc. Climate change has considerable economic and social consequences which are especially severe in risk areas and risk sectors. Fast and unexpected changes endanger the cohesion of the society and sectors of the economy, which can quickly adapt to changing circumstances, gain a significant competitive advantage. The impact of climate change is also expected to be higher on certain groups of the society, e.g. the elderly, people with special needs or small social and economic capital. In order to reduce the impact of climate change, we shall, firstly, reduce greenhouse gas emissions (i.e. implement mitigation measures) and secondly, implement measures for adaptation to the effects of climate change (hereinafter adaptation measures) in order to cope with the unavoidable consequences of climate change.

Although climate change in Estonia is not as extreme as in many other countries of the world and the European Union (EU), based on forecasts, we can also expect the following changes during the 21st century:

- **rise in temperature**, which in the second half of the 20th century was faster in Estonia than in the world on average, and the related reduction in ice and snow cover; heatwaves and droughts; changes in vegetation; spread of alien species, including new plant pests and pathogenic agents; unfrozen and excessively moist forest land which limits the possibilities of logging; changes in seasonal energy consumption peaks; increase in the frequency of health problems of residents, etc.;

- **increase in the amount of precipitation**, especially in winter periods and the related floods, increase in the volume of maintenance of drainage ditches and systems, and dams; shore erosion of rivers and the related increase in the works related to the reinforcement of the shores; pressure for relocating residential buildings / civil engineering works; increase in the pumping volume of mines, etc.;
- **rise in sea level** and the related shore erosion, risk on coastal facilities, pressure for relocating buildings, etc.;
- **increase in the number of storms** and the related requirements for the durability of the infrastructure and the buildings as well as for the capability of eliminating the effects of the storm.

Several climate projects have been completed, several are underway and the impact of climate change has been handled in many scientific studies, however, the information between different sectors and institutions is fragmented. Considering that climate change affects the economy, the environment as well as the entire society, it is important to ensure that all relevant sectors and administrative levels are connected to the adaptation measures and to create a mutually agreed upon national strategic framework — a national development plan for adaptation to climate change which would assemble all the objectives and activities related to this area.

National strategies and action plans for adaptation to climate change have already been established or are under preparation in the majority of EU member states. The preparation of the Estonian development plan for climate change adaptation was started in 2013 and the draft plan together with the implementation plan was completed in spring 2016.

The development document “Development Plan for Climate Change Adaptation until 2030” presents a framework for action which serves as a basis for reducing the vulnerability of the state of Estonia in relation to climate change. The development plan was prepared based on comprehensive studies and analyses. These studies and analyses determined the impact of climate change on priority areas and the adaptation measures which need to be taken in the short term until 2030 and which are a part of a long-term vision until the year 2100. A detailed implementation plan has been prepared to achieve the objectives of the development plan.

The main objective of the development plan is to increase the readiness and capacity of the state, the regional and local level to adapt to the effects of climate change. The development plan sets eight subgoals based on the priority sectors of the economic and administrative structure in the Republic of Estonia (independently and partially also combined):

1. Health and rescue capability.

2. Land use and planning, including coastal areas, other areas with a risk of flooding, areas with a risk of landslides, land improvement, towns.

3. Natural environment, including Biological Variability, land ecosystems, freshwater ecosystems and environment, marine ecosystems and environment, ecosystem services.

4. Bioeconomy, including agriculture, forestry, fishing industry, hunting, tourism, peat production.

5. Economy, including insurance, banking, employment, entrepreneurship and industry.

6. Society, awareness and cooperation, including awareness, education and science, international relations and cooperation.

7. Infrastructure and buildings, including transport and infrastructure of transport, technical support systems, buildings;

8. Energy and security of supply, including energy independence, security, resources, efficiency, and heat and electricity production.

The area of adaptation to climate change is planned and managed comprehensively through one development plan which is also used to assemble and harmonize the approaches of adaptation to the effects of climate change used in different national development documents and accounts for the sectors that are most vulnerable to the effects of climate change. This ensures better coherence between the different sectors related to the adaptation to the effects of climate change.

Current & Relevant Information:

Society, awareness and cooperation

As according to the forecast, the climate in Estonia will continue to change relatively slowly compared to the changes in the society, there is no reason to believe that the Estonian society will face great challenges. The behavior of an individual is above all influenced by the society where they belong, the socio-economic structure around them and their own social relationships and economic situation. Together with the increasing number of extreme weather phenomena a need for the help of social workers is also increasing, especially when servicing vulnerable groups who are at a risk of social isolation. Also, there is an increasing need for cooperation between the institutions, organizations and individuals related to rescue work. Climate warming is expected to result in a decrease in the housing expenses of people but an increase in the occurrence frequency of extreme weather conditions may increase the unforeseeable proprietary damage. Hazards accompanying extreme weather conditions do not affect the groups of the society equally – the impacts vary locally (e.g. flood waters in coastal or lower areas) and by the members of the society (e.g. older people are more sensitive to extreme cold and heat). The less privileged people are most threatened by climate – people in a disadvantaged socio-economic situation and with smaller social capital who may not have the means and the network for buffering the immediate climate change they are exposed to or for mitigating climate risks. Health effects are primarily manifested in children, the elderly and people with chronic illnesses or those with several simultaneous health problems. Therefore, extreme weather conditions may deepen the inequality in the society.

Successful adaptation presupposes cross-sectoral cooperation at the level of central authority, regions as well as local governments but also between communities. It must be considered that even if a person feels concern and personal responsibility, it may not affect their behavior if favorable conditions have not been created for adaptation. On the one hand, the effectiveness of adaptation to the effects of climate change in the society depends on the activities of the state, the fragmentation of the decision-making structures and the political-administrative culture, on the other hand, however, it also depends on the activities of non-governmental stakeholders, including the scientific community, the pressure from the public and the non-governmental organizations (NGOs) and the interests of companies. It is the obligation of the state and the authorities to create favorable societal adaptation structures for groups and individuals: the legal framework, information and mentorship, technical support. The vulnerability of the society and its adaptation to climate change are also considerably changed by the level of research and education in the country, determining the preparedness for climate change and the accuracy of predicting the effects of climate change.

Although throughout history, all societies have had to adapt to the constantly changing climate, the implementation of active adaptation measures may also collide with the restrictions arising from the societal processes and patterns. For instance, information about the effects may be too frustrating for people, the amount of it may be too large (information overload occurs) or too small (unawareness). Generally, people have much more important problems than climate change in their own lives that they wish to solve. The central task is to translate the currently very abstract issue of climate change into as tangible solutions for people as possible. The awareness of the residents of Estonia about climate change, adaptation to the effects of climate change and the means of mitigating climate risks is relatively low because the officials and Estonian researchers have not yet contributed enough for sharing such information with the general public. Also, climate issues are not prioritized in the daily lives of people.

In international communication, the aspect of climate change to affect Estonia the most is the EU climate policy. Additionally, Estonia is one of the parties of the main international agreements and as a member of the EU and OECD, participates in the development cooperation directed to third countries. Globally, Estonia mainly grants aid and therefore, both global agreements as well as the issues agreed upon in the climate adaptation area within the EU mainly affect Estonia's development cooperation policy. It is also possible that the pressure of immigration from climate change will increase.

"Climate change and its consequences for cultural and language endangerment," Christopher P. Dunn, wpmucdn.com, 2017 [28] https://cpb-us-e1.wpmucdn.com/blogs.cornell.edu/dist/9/7784/files/2017/11/Dunn-Climate-change-languages-updated-1s1ia1q.pdf

Overview:

Endangerment is a concern in many disciplines, as it foreshadows loss of biological, cultural, or linguistic variability. The causes of endangerment are many and, in this age of globalization, it is tempting to ascribe similar forces as playing a role in endangerment (and ultimately extinction) across varied disciplines and areas of human experience.

Current & Relevant Information:

Introduction

In ecology, it is generally accepted that major threats to plants, birds, mammals, and other life forms include land use conversion (urbanization, natural resource extraction, agriculture, etc.), invasive species, and climate change. Although some will argue that there are no documented examples of any species going extinct as a direct consequence of any of these forces (but see Watson 2016), it is widely accepted that risk levels today are significantly higher than in past millennia, with current rates of extinction being about 1000 times the estimated long-term background rate (Pimm et al. 2014). This current human-mediated loss of biological variability is referred to by many as the "sixth mass extinction" (Leakey and Lewin 1995, Barnosky et al. 2011, Kolbert 2014, Ceballos et al. 2015), the other five mass extinctions having occurred over geological time as the result of one natural catastrophe or another.

Human cultures developed in an intimate association with the rich biological variability of their natural surroundings; some would say "co-evolved" with nature (Harmon 1996). Plants and animals are central to the identity and integrity of most cultures. Taro (Colocasia esculenta), for instance, is not only a staple food crop in much of the Pacific, but is central to the creation story in Vanua Lava and in other Pacific cultures (Caillon and Degeorges 2007). So, too, is the white pine tree (Pinus strobus) in the northeastern United States, which some Native American nations refer to as the “Tree of Peace” (Schroeder 1992, Lobo et al. 2010). The loss or endangerment of any such cultural keystone species (sensu Garibaldi and Turner 2004) would result in the associated peoples forever losing something of their identity, culture, and ultimately language. Thus, as biological variability is eroded, so too is the rich cultural and linguistic fabric of our species, suggesting a direct correspondence between biological and language endangerment.

However, the processes leading to endangerment in the natural world are not necessarily the proximal ones leading to endangerment of human cultures and languages. One recent and widely cited study suggests that extinction risks for languages exceed those for birds and mammals. Here, Sutherland (2003) used International Union for the Conservation of Nature (IUCN) criteria to determine that approximately 12% of birds, 25% of mammals, and 27% of languages of the world are of conservation concern (namely, the critically endangered, endangered, or vulnerable categories of IUCN); however, other studies (e.g., assessments by UNESCO) estimate an extinction risk for languages as high at 50%. Although similar factors help explain the broad variability of Biological Variability and languages globally (Sutherland 2003), those factors explaining extinction risk for birds and mammals (high altitude, high human densities, and insularity) do not necessarily apply to endangered languages.

Given that climate change can alter the integrity of biological and ecological systems, is it possible that that such an anthropogenic force can also directly or indirectly impact linguistic and cultural variability? This question has not been explored to any great extent despite the fact that many studies and essays on cultural and linguistic variability cite climate change as an operative factor. The correlation (though not necessarily causation) between biological and linguistic variability is supported by the linguistics literature (e.g., Harmon 1996, Nettle and Romaine 2000) and by more recent ecological studies (e.g., Loh and Harmon 2005, Gorenflo et al. 2012, Amano et al. 2014). Gorenflo et al. (2012), for instance, draw inferences regarding these biological and cultural relationships using mapping and statistical methods and suggest that this concordance is attributable in part to the “ecology” of human societies (including competition, or lack of, for resources), roles of human movements and dispersal in (and to) some areas of the world and not others, and topographic barriers. In an earlier comprehensive and ecologically based review, Harmon (1996) notes that of the 25 countries with the greatest number of endemic vertebrate species, 16 are also among the top 25 in endemic languages. This rate of 64% is true also for plants. Thus, Harmon suggests that there has been some co-evolution of cultural groups with their locally adapted biota. This is a reasonable hypothesis, as communities and peoples through time have differentially used and selected for or against plants and other resources in their habitat.

Amano et al. (2014) go a step further and consider a number of factors such as latitude, altitude, topographic variability, rainfall, and socioeconomic drivers such as

GDP and other markers of globalization, along with “risk components” (adapting those commonly used in ecology) such as geographic range size, speaker population size, and speaker population growth rate (which can be positive or negative). What they find are hotspots of threatened languages in areas marked by high rainfall, high topographic variability, and rapidly increasing human populations. Such areas, not surprisingly, are concentrated in the tropics, subtropics, Himalayas, northern Australia, eastern Eurasia, northern Russia and Scandinavia, and northwest North America.

In addition, Amano et al. (2014) identify areas that have suffered few documented language extinctions, yet support a disproportionately large number of threatened languages. Such areas (northwest Australia, New Guinea, desert regions of Africa and the Middle East, Brazil, among others) are thusly considered to be at a high threat level for future language extinctions. What they have in common is being marked by higher economic growth and greater seasonality and therefore would benefit from concerted efforts to mitigate risks and minimize threat levels to both biological and linguistic variability.

In many areas of the world, languages have already gone extinct and are currently dominated by large-range widely spoken languages. This echoes the situation with biological variability, where some regions of the world are incredibly varied and with significant extinction risks (Cape Floristic Region, for example), while others have considerably lower extinction risks (much of western Europe) not because the flora is particularly resilient, but because the ecological systems have been drastically altered and simplified by historic and current human activities (see Thomas et al. 2004).

It is one thing to search for underlying patterns, but another matter entirely to discern similar processes and unifying explanations for concordance in extinctions or extinction risk in ecological vs. language systems. However, it is essential to have an understanding of the dynamic relationship between biological and cultural/linguistic variability (Gadgil et al. 1993, Pretty et al. 2009) if we are to have some success in mitigating impacts as natural and cultural systems unravel, and as the sixth extinction leads us into what we might call “the seventh extinction,” namely of the world’s languages and cultures.

Conclusion

Threats to indigenous and local communities from climate change seem clear and have the potential to lead to cultural and language extinction. Many organizations and individuals are actively developing strong mitigation strategies (e.g., IPCC 2007, Salick and Byg 2007, IPCCA 2011, Nakashima et al. 2012). The IPCC (2007) provides extensive analyses, along with specific recommended strategies, for various parts of the world, ranging from integration of indigenous knowledge into management plans (see also Vinyeta and Lynn 2013), better water management policies and infrastructure, and improved climate models to better forecast and plan for biological and cultural impacts. These are echoed by Salick and Byg (2007) who also call for more meaningful international climate commitments, further ethnoecological research, and more interdisciplinary efforts. The IPCCA (2011), in its "toolkit," provides a number of detailed case studies and tangible ways by which indigenous communities can be better adapted to deal with and to anticipate the impacts of climate change.

Summarizing all possible mitigation strategies would require a separate volume. Suffice it to say that some key approaches should include (1) land management policies that integrate the local biocultural needs into forest reserves (e.g., "community reserve forests," Singh et al. 2011), (2) integration of TEK and western science into comprehensive land management policies and practices and educational programs (Agrawal 1995, Kimmerer 2002, Alexander et al. 2011, Hill et al. 2012, Ens et al. 2015, Linnell et al. 2015), (3) new binding international conventions that explicitly address the climate change refugee crisis (Myers 2002, Pourhashemi et al. 2012), (4) greater interdisciplinary conservation programs, particularly acknowledging the role of anthropology (Crate 2011), (5) a more active role of botanic gardens (as well as other natural history organizations), taking advantage of their horticultural, botanic, and educational expertise and global reach (Dunn 2008, 2012), and (6) a greater engagement of religious groups and faith communities. With respect to the latter, it is worth noting that both the encyclical issued by Pope Francis 1 (Francis 1 2015) and the Islamic Declaration on Global Climate Change (IFEES Sciences 2015) make direct reference to the link between climate change and erosion of human cultural variability.

With wider recognition of the links among environment, culture, and language, and an acknowledgement that the fabric of our human cultural variability is unravelling at a faster rate than global biological variability (thus the suggestion here of a seventh extinction), the imperative to engage with local and indigenous cultures in mitigating climate change and stemming the erosion of biological and linguistic variability has never been greater. Our survival depends on it. Our future will thank us for it.

3. Christian Culture:

"Biological Variability priority areas and religions—a global analysis of spatial overlap," Grzegorz Mikusinski, Hugh P. Possingham, and Malgorzata Blicharska, Fauna & Flora International, January 2013 [29]
https://www.researchgate.net/profile/Grzegorz_Mikusinski2/publication/228108445_Biological Variability_priority_areas_and_religions_-_A_global_analysis_of_spatial_overlap/links/02e7e53241137c6d87000000/Biological Variability-priority-areas-and-religions-A-global-analysis-of-spatial-overlap.pdf?origin=publication_detail

Abstract:

Numerous solutions have been proposed to slow the accelerating loss of Biological Variability. Thinking about Biological Variability conservation has not, however, been incorporated into the everyday activities of most individuals and nations. Conservation scientists need to refocus on strategies that reshape ethical attitudes to nature and encourage pro-environmental thinking and lifestyles. Religions are central to basic beliefs and ethics that influence people's behavior and should be considered more seriously in Biological Variability discourse. Using data from the World Religion Database we conducted an analysis of the spatial overlap between major global religions and seven templates for prioritizing Biological Variability action. Our analysis indicated that the majority of these focal areas are situated in countries dominated by Christianity, and particularly the Roman Catholic denomination. Moreover, the Roman Catholic and Orthodox Churches appear to have the greatest per capita opportunity to influence discourse on Biological Variability, notwithstanding the role of other religious communities in some key Biological Variability areas.

Current & Relevant Information:

Our analysis indicates that the majority of areas identified as the most important for global terrestrial Biological Variability are situated in countries that are to a large degree dominated by Christianity, and more specifically Catholicism and Orthodoxy. This pattern is the result of a multitude of factors that we did not study, including the unequal distribution of Biological Variability, the trajectory of the development of human societies in different parts of the world and their environmental footprint, and the way different religions have spread across the world. In addition, large countries dominated by Christianity have lower population densities and hence a generally greater fraction of any Biological Variability template per person. Note that we do not claim that there is any causal relationship between the presence of areas important for Biological Variability and particular religions.

We acknowledge that using data from the World Religion Database has its limitations. Firstly, the data provided on the country level are unable to take into account the issue of unequal spatial distribution of adherents of particular religions within a country. Secondly, some religious trends may not be apparent (e.g. people in Latin America turning towards apostolic and Pentecostal Christian denominations that are not institutionally organized and thus may not be reflected in the database). Other issues not included in our analysis include the different degrees of adherence, the power of various religions to influence the political process, and the role of religious leaders. Bearing in mind these limitations and also recognizing that our study indicates only a spatial relationship between different religions and the Biological Variability templates, we treat our findings as a crude measure of the per capita conservation opportunity for each major religion.

The spatial resolution of our analysis is coarse and unequal because countries differ in area and religious adherence varies within countries. For example, a few large countries with relatively sparse human populations holding large areas of high Biological Variability value (e.g. Canada, USA, Russia and Australia) weight results concerning some templates. Nevertheless, the governance of natural resources, including Biological Variability, is to a large degree affected by the attitudes of all citizens (Rauschmayer et al., 2009) and conservation policies are in most cases implemented nationally (Knill & Lenschow, 1998). Thus, we believe that our results may be useful to broaden the scope of the debate concerning the potential of religions to become involved in Biological Variability conservation.

The debate on the role of religions in conservation is not new (e.g. Posey, 2000) and many religions have already been involved in some conservation action (Bhagwat & Palmer, 2009; Mangunjaya, 2011). However, a greater involvement of religious communities in the conservation discourse, and a greater inclusion of conservation issues in religious ethics, could be beneficial for Biological Variability. The fact that stewardship and conservation are closely related concepts offers hope for mutual progress. This potential should not be overlooked by the scientific community and other stakeholders seeking new ways to engage societies in conservation.

Amongst the various religions the Roman Catholic and Orthodox Churches have the greatest potential to support Biological Variability conservation, as they are the dominant religions in areas important for global Biological Variability. In the case of the Roman Catholic Church this potential may be assisted by the fact that it is centralized and thus moral guidance from its leaders could influence many people. Other religions are also important in the Biological Variability conservation discourse, particularly within specific regions, such as Islam in Indonesia. A finer-scale analysis of the spatial distribution of religious adherents along with assessment of socio-ethical issues (e.g. the ability of a religion to influence political processes or the role of religious leaders in society) is needed to reveal the potential of religions in influencing pro-environment behavior in areas of priority for Biological Variability conservation. However, the practical issue is how to grasp the opportunity to involve religions in discourse about Biological Variability conservation. We believe that the conservation community, including researchers, should be more active in finding good arguments to engage religions in Biological Variability conservation. The results of our analysis may be one such argument.

"Adapting to climate change in shifting landscapes of belief," Conor Murphy, et al., Climate Change, 2016 [30]
http://mural.maynoothuniversity.ie/7873/1/BG_adapting%20climate%202015.pdf

Abstract:

Religious beliefs, an important element of culture, influence adaptation to climate change. Less understood is how changing beliefs shape the adaptive capacity of communities responding to climate change. In the last century sub-Saharan Africa has experienced a transformation in beliefs. Since 1900 Christians have increased

70-fold while in rural areas Traditional Beliefs and associated Traditional Ecological Knowledge (TEK) continue to influence the lived practices of vulnerable rural communities. Using two case studies of rural communities in Malawi (Bolero) and Zambia (Monze) we explore how Christianity and Traditional beliefs (and associated TEK) co-exist and assess if, and how, holding multiple belief systems affects climate-sensitive livelihood practices of food production. In Bolero we observed a lack of tensions between belief systems with Traditional leaders and elders noting the flexibility of adhering to both belief systems. In Monze however, basing livelihood decisions on the practice of rain-rituals resulted in strong tensions. In both communities' elders noted their concern of how changing beliefs affect adherence to TEK management practices. We find that culture and beliefs play an important role in adaptive capacity but are not static. In the context of changing beliefs, adaptive capacity will be influenced by how different belief systems co-exist and how epistemological and intergenerational frictions are negotiated. As climate services become the focus of research and government interventions in vulnerable regions, avoiding culturally and economically expensive mal-adaptation will require giving attention to the complexity and dynamism of changing religious landscapes.

<u>Current & Relevant Information:</u>

Discussion and conclusion

This research highlights how changing religious beliefs and practices, driven by non-climatic factors can affect adaptive capacity. Changing beliefs are associated with changes in the value and validity placed on different types of knowledge. In both communities' Traditional beliefs are closely coupled with TEK, while external knowledge in the form of western science is associated with Christian religions, specifically through the role of FBOs. Combining different types of knowledge for learning is a central aspect adaptive capacity (Folke, 2004). In Bolero, there is evidence that communities recognize the utility of pluralistic beliefs and practices in livelihood activities of food production, merging and blending beliefs and practices in different situations. In Monze, by contrast, changing religious beliefs have introduced tensions around the practice of TEK which are played out in how associated knowledge types are considered valid or not in agricultural decision making and practice, with direct implications for livelihood decisions.

Previous research in the field of medicine conducted with communities in sub-Saharan Africa has highlighted the important role of perceived causation in determining which types of knowledge are seen as valid in responding to crises. For crises seen as deriving from the human and mystical realm traditional knowledge is seen as more salient than scientific knowledge (Feierman and Janzen 2011). Here the association of failures of rain in Monze with the changing beliefs of the younger generation in particular may be playing a role in the tensions between knowledge types. From an intergenerational perspective older generation blame the youth for failure of rains through neglect of the social contract with ancestors (von Heland and

Folke 2014) due to a lack of adherence to moral codes, rituals and taboos. Thus, changing religious beliefs can create epistemological and intergenerational frictions. How beliefs, worldviews and associated knowledge system hierarchies are negotiated will determine social capital, opportunities and barriers to adaptation. Epistemologically western science is quantitative, formal and reductionist while TEK is experiential, informal, holistic and qualitative. Despite the tensions evident in Monze, future research could explore the complementarity of knowledge forms in forecasting rainfall (e.g. Kolawole et al. 2014), thus creating a space for bridging epistemologies. Wisner (2010a) highlights the potential (and pitfalls) of participatory action research methods in successfully bridging and co-producing hybrid knowledge.

The importance of TEK in building adaptive capacity is well established (Berkes et al. 2000). In both communities there is evidence that changing religious beliefs affect TEK practices of managing for resilience. Rituals play an important role in passing on institutional memory and supporting communal action. Tensions surrounding the Lwiindi ritual and the threat of stigmatization undermine this management function. In Bolero the smoother coexistence of belief systems and the recognition of the value of associated knowledge's and practices points to a greater adaptive capacity. However, even here concern was expressed (particularly by village elders) about the preservation of TEK management practices through the non-adherence to taboos and a weakening of collective action which is serving to lessen biological variability and decrease the coping range of communities during drought, thereby reducing their resilience.

We find that tensions are historically grounded. Our case study communities embody different experiences of colonialism. Following arrival of the Livingstonia mission, Tumbuka culture experienced a revival. On the other hand, tensions surrounding the Monze shrine surfaced shortly after arrival of the British South Africa Company and have been related to the resonance of the shrine in creating a Tongan identity (O'Brien and O'Brien, 1997) which stood as a barrier to transformation of institutional structures. In comparison with village focused rain rituals of the Tumbuka, the Lwiindi transcends local shrines drawing participants from throughout Southern Province. In tandem with colonialism, the Monze ritual assumed a complex political role alongside religious functions which have persisted (Colson 1977; O'Brien and O'Brien, 1997). These functions are impossible to unravel here but together with its continued wide appeal, may go some way to explaining the root cause of current tensions.

While we provide insights into tensions associated with changing beliefs in both communities, there are a number of limitations to this work and important aspects that require future research. The latter arise as unpacking tensions between belief systems was not the primary objective of our focus group discussions; their importance came to light during analysis; thus, our data is light in these respects.

Our research points to the importance of FBOs in both communities. While the potential and role of FBOs in adaptation has been recognized (e.g. Wisner 2010b) future research could trace their role in reconfiguring notions of knowledge and epistemology both in the everyday and historically. At the community level there is little information on actual rates of change in religious affiliation making it difficult to establish which churches tensions were associated. Anecdotal evidence suggests that disassociation with Traditional beliefs among the young is associated with charismatic Pentecostal churches in particular. In addition, future work will examine how TEK is evolving in the context of changing beliefs. Given the continued practice of Traditional beliefs through the colonial period to present, TEK is obviously resilient to changing socio-cultural dynamics.

In broader terms the overlap between areas of vulnerability to climate change and high importance of religion in everyday life points to the need to further unpack the importance of religion in determining adaptive capacity. Religion (broadly conceived) has important influences on attitudes and behavior and is an important social influence (Haluza-DeLay 2014). Studies have shown how religion can be positive for adaptive capacity in building social capital and institutional connections (e.g. Schipper 2010), while Reale (2013) highlights that churches have an institutional presence at local scales that governments often do not. Indeed, disaster research indicates that religion has increased importance when government capacity is low. However, religious landscapes are complex and dynamic. In situations where multiple beliefs are held research is needed to understand how individuals and communities coordinate beliefs and how such coordination can result in outcomes that enhance or undermine adaptive capacity. In particular further insights are required into how outcomes may be differentiated by gender and social standing. Tensions brought about by changing religious beliefs can affect social cohesion and trust thus undermining social capital. Evidence is emerging across different cultures and resource systems in the Global South of tensions wrought by changing religious beliefs that undermine adaptive capacity (e.g. Kuruppu 2009; Tang and Tang 2010; Davidson 2012; Watson and Kochore 2012; Paerregaard 2013).

Culture, here approached through the lens of religious beliefs and practices, plays an important role in adaptive capacity, but is not static. We find that in communities holding multiple belief systems adaptive capacity is largely determined by the manner in which belief systems co-exist. Religious beliefs have tangible influences on lived practices of individuals and communities, and vice-versa, and are an important determinant of adaptive capacity. In the context of changing religious beliefs, adaptive capacity will be determined by how epistemological and intergenerational frictions are negotiated by individuals and communities and ultimately how different knowledge forms are valued, accepted and integrated. As climate services become the focus of research and government interventions in vulnerable regions, avoiding culturally and economically expensive mal-adaptation will require giving attention to the complexity and dynamism of changing religious landscapes. Furthering insights will necessitate interdisciplinary research to understand how complex socio-cultural changes interact with changing environments (Castree et al. 2014) and will demand an increased agency of vulnerable communities in research and decision-making.

“Religious positions on climate change and climate policy in the United States,” Arjan (J.A.) Wardekker, Arthur C. Petersen, and Jeroen P. van der Sluijs, Communicating Climate Change: Discourses, Mediations and Perceptions Conference, 20 November 2007 [31]
https://dspace.library.uu.nl/bitstream/handle/1874/386014/Religious_positions.pdf?sequence=1

Abstract:

February 2006, a group of 86 evangelical leaders, under the auspices of the Evangelical Climate Initiative, challenged the Bush administration on global warming. Other religious groups and leaders in the USA, and other countries, have taken positions as well. As the US evangelical community seems to have a considerable influence on the views and policy of (Republican) national leaders, these developments are relevant for assessing US and international climate policy. Using argumentative discourse analysis, this paper analyzes the religious positions on climate change and climate policy in the United States, as evident in their communication in the media, opinion documents, and websites. Religious positions show a wide range of views, images, and discourses that deal with fundamental moral and ethical questions concerning climate change, stewardship and social justice. Our main conclusion is that both proponents and opponents of strict climate policy strongly value these concepts, but that they interpret them in different ways. A robust policy strategy (regarding support in the religious community) should pay careful attention to the effects of both climate change and climate policy on the poor in both developing nations and the USA itself.

Current & Relevant Information:

Introduction

February 2006, a group of 86 evangelical leaders, under the auspices of the Evangelical Climate Initiative (ECI), challenged the Bush administration on global warming with their ‘Evangelical Call to Action’ (ECI, 2006). Other religious groups and leaders in the USA and other countries have taken positions on this issue as well. The (religious-)ethical aspects of climate change are the central theme of their statements. The debate has attracted much attention in the media, and some attention in scientific forums as well (e.g. Kolmes and Butkus, 2007; Nisbet, 2006; Nisbet and Mooney, 2007). Simultaneously, climate change and climate policy have become more prominent in the US political debate as well, often with moral and religious-ethical connotations. For example, Al Gore notes in his ‘An Inconvenient Truth’ that it is ‘deeply unethical’ to allow the rise in CO_2 emissions to continue

(Gore, 2006). President Bush referred in the State of the Union in January 2007 for the first time to climate change as a serious societal issue, noting that technological breakthroughs would allow us to become 'better stewards of the environment' (Bush, 2007).

Climate change and climate policy raise many questions that have strong moral and ethical dimensions, which are important for policy formation and international negotiations (Brown, 2003; Brown et al., 2006; Gardiner, 2006). The issue is riddled with social dilemmas due to e.g. the spatial and temporal dispersion of causes and effects, diffusion of responsibility for the problem, and lack of institutions through which different countries and generations can effectively influence each other's behavior (Gardiner, 2006; Jamieson, 1992). One of the main ethical dimensions of climate change therefore is the issue of distributive justice. Climate policy deals with the question of how best to divide a scarce resource that no one owns, i.e. how to equitably (both interregional and intergenerational) distribute the costs (e.g. climate change impacts) and benefits (e.g. economic growth) of emissions and responsibility for policy action to mitigate and adapt to climate change (Brown et al., 2006; Gardiner, 2004, 2006; Grubb, 1995; Singer, 2006). See e.g. Gardiner (2004), Groenenberg and Van der Sluijs (2005), and Grubb (1995) for extensive discussion of the ethical aspects of various approaches to assigning emission reduction targets. Other specific ethical issues include procedural justice (who gets to participate in policymaking and how), how to deal with the many uncertainties (who should bear the burden of proof, and if, when and how to act under uncertainty), research approaches (e.g. economic approaches such as discounting and cost-benefit analysis), and some specific policy approaches (especially geoengineering) (Brown et al., 2006; Gardiner, 2007; Jamieson, 1996; Singer, 2006; Toman, 2006). Generally speaking, climate change is an ethical, as well as religious, issue because it poses questions on how we ought to live and how humans should value and relate to each other and non-human nature. In addition to insights from economics and natural science, moral and religious-ethical considerations form an important input for policymaking on complex and uncertain issues such as climate change (Hogue, 2007; Jamieson, 1992; Rolston, 2006).

Different religious views (or more generally, different philosophies of life) can lead to different approaches to environmental issues. One often-heard complaint, especially towards Judeo-Christian traditions, is that the classic 'dominion' argument (mankind transcends and has rightful mastery over nature) results in the abuse and destruction of nature (Greeley, 1993; Guth et al., 1995; ICT, 2006; Schultz et al., 2000; Trevors and Saier, 2006; White, 1967). One's view on the relationship between man and nature influences one's attitude towards ecology. A different, less anthropocentric, approach to nature and religion (also included within Judeo-Christianity) would prove less destructive (White, 1967). Others point to 'End Times thinking' (dispensationalism) as an additional barrier to support for environmental policy (Guth et al., 1995). Presenting religious beliefs as the sole source of antienvironmental attitudes, however, seems too simplistic. Greeley (1993) and Schultz et al. (2000) argue that, while studies have indeed found a negative relation between Judeo-Christian beliefs and pro-environmental attitudes, this relation is often small and may be due to political and moral conservatism rather than religion itself. Nonetheless, different religious views do seem to be related to what type of concerns people hold. For example, Schultz et al. (2000) found that respondents who expressed more literal beliefs in the Bible scored lower on ecocentrism environmental concerns, but higher on anthropocentric environmental concerns. No relation was found with self-reported pro-environmental behavior. These different bases for environmental concerns could however result in different views on both the nature of an environmental problem, as well as the desirability of various policy strategies to counter it.

Considering the large influence of religion on public life in the United States, the strong focus on the ethical aspects of climate change in the religious debate, and the important choices that will need to be made in the coming years concerning international climate policy, it is interesting to explore the perceptions among religious groups on this issue. This study aims to provide an overview of the religious societal debate that is taking place among the US Judeo-Christian communities. What are their positions on climate change, what measures should (or should not) be taken to deal with it, and what moral and religious-ethical arguments form the foundations of these positions? Following from that, this paper presents some possible implications and lessons for policymaking.

Discussion and conclusions

The issue of climate change is receiving an increasing amount of attention within religious communities in the United States and in the rest of the world. The Evangelical Climate Initiative's (ECI) 'Call to Action' and its follow-ups are recent examples, and have attracted considerable attention in the media. Calls to politics to take more notice of the issue originate from a multitude of religious convictions and movements. Some opposition to these initiatives exists as well. In the US, several Jewish-Christian groups have organized a counter-initiative to ECI, criticizing its views on climate change and climate policy.

The present study analyzed this debate by looking at published sources, focusing on Judeo-Christian groups in the United States. This limits the analysis mostly to the statements of religious leaders and figureheads on the topics of environment and climate change. An interesting question, however, would be to what extent these views are actually supported by their congregations. E.g. do the same perceptions of the issues of climate change and climate policy live in the religious community as a whole, how large is the group of religiously inspired proponents of strict policy, are there differences in perception between demographical groups (e.g. between urban and rural believers, the latter of whom may already have some type of land ethic), and how do they apply their beliefs in their daily lives? Surveys cited by several sources (e.g. EEN, 2005) show support for climate policy in the religious community, but these are fairly generic. Furthermore, do the awareness raising activities of churches (e.g. being an example, educational activities, etc.) actually result in behavioral changes, and to what extent has this religious debate permeated into entrepreneurial and policy communities? It would also be interesting to study perceptions in other countries and other religions. While no organized religiously inspired opposition to strict policy was found on the international level and a number of other countries that were briefly examined (and this finding was confirmed by other participants in the STT project), that does not mean that such opposition does not exist. Furthermore, how do religious communities in developing and newly industrialized countries, e.g. in Africa, Asia, or Latin America, perceive climate change and attempts to solve this issue (such as climate impacts, biofuel production/plantations, and development in these countries)? The perceptions on climate change among religions such as Islam (especially regarding its large influence in Asia and Africa, and increasing influence in Europe as well) and Hinduism (especially regarding its large influence in growing economies such as India) would be most interesting to study further as well. Harvard University's Forum on Religion and Ecology has performed similar studies on several religions regarding ecology in general in the past.

Religious groups in the United States frame the discussion on climate change and climate policy mainly as an ethical issue. Three specific ethical themes are at the forefront of the debate: the effects of anthropogenic climate change on nature (creation care, or environmental/climate stewardship), the implications for future generations (care for one's children; intergenerational equity), and the implications for the poor (environmental justice; interregional equity among other things). The implications of climate change – and climate policy – for the poor are the dominant theme. Proponents and opponents of strict policy employ the same concepts, images and motives in their discourses, but have very different interpretations of these things. Concerning the effects on nature, proponents state that God created the earth as 'good', and that mankind is part of nature and has the task to preserve this 'garden of God'. Climate change threatens creation and is therefore morally unacceptable. Opponents of strict policy place nature in a more serving position to mankind, who has the task to turn the earth into a 'garden'. Concerning implications for the poor, proponents of strict policy argue that the poor (particularly in developing countries) will face the most severe impacts of a problem that the rich have created, while they are the most vulnerable and least able to adapt. Developed nations have the moral duty to prevent this. They suggest various policy strategies, ranging from regulations to technology, adaptation and behavioral change. Recent initiatives favor cap-and-trade schemes in particular. Religious communities take an active role, by setting an example, educating their members and lobbying. Their critics however are concerned about possible negative effects of climate policy on the poor, both in developing nations and in the United States. They fear that the poor will have to bear the heaviest burden of such policies and press for increased resilience through economic (and technological) development instead. Proponents of strict policy share these concerns to some extent, and clearly place the responsibility for action with the developed world. A robust policy strategy (regarding support in the US religious community) would have to pay careful attention to the effects of both climate change and climate policy on the poor in developing countries and the United States itself.

While it remains to be seen what effects this religious debate will have on US climate policy, several aspects make it very interesting. Firstly, the recent initiatives are attracting attention in the media and among scientists, corporations, NGOs, et cetera; secondly, these initiatives do not stand alone; and thirdly, they are actively forming coalitions with these other parties. Calls for more strict policy emerge from many other sectors of society, ranging from politics to corporations, farmers, and ‘security hawks’ (The Economist, 2007a, b). Coalitions are formed, including between ‘unlikely’ partners (e.g. joint media campaigns by evangelicals, Fortune 500 companies, and environmental movement; Gunther, 2006). As such, the religious initiatives should not be seen in isolation, but as part as a larger societal debate on climate change, which could lead to greater pressure to participate in international climate policy. And fourthly, religious environmental initiatives seem to be making environmental care accessible to the conservative side of the political spectrum. Where the conventional environmental movement is highly distrusted among evangelicals/conservatives, these church-based initiatives seem to take upon themselves roles similar to environmental groups.

“Fighting Climate with Religion: A look into Judeo-Christian perspectives on climate change,” Rachel Brinks, University of Colorado, 2014 [32]
https://scholar.colorado.edu/concern/undergraduate_honors_theses/8049g544f

Abstract:

Previous studies have had mixed results in determining if Judeo-Christian faiths are positively or negatively correlated with pro-environmental behavior and thought. This study sought to investigate this phenomenon by doing a media analysis of climate change discussed in the context of religion in major United States newspapers over the last ten years. These results were compared to in-depth interviews from members of the Seventh-day Adventist Church in Boulder, Colorado. I found that the media analysis and the interviews emphasized the belief that climate change is happening or is a threat. The majority of the interviewees (70%) believed that their faith had some impact on their views on climate change. In regard to action on climate change, the articles tended to emphasis collective action, while the interviews tended to focus on individual action. The interviews focused largely on the moral dimensions of climate change (stewardship and the notion of sin), while the articles mentioned the moral and ethical dimensions of climate change, but emphasized the political or scientific dimensions as well. These findings indicate that faith-based climate change activism may be most successful if activists focus on concepts of stewardship and creation care, rather than on climate change directly.

These concepts could be used to encourage emissions-reducing behaviors without raising counterproductive conflicts over political beliefs or how prominent or harmful climate change may be.

Current & Relevant Information:

Introduction

Religion can be a powerful influence on the worldview, values, attitudes, decisions, and behavior of people and societies both positively and negatively (Sponsel, 2007). What one person regards as sacred or spiritual is more likely to be valued and protected. For decades, environmental advocates and educators have emphasized Buddhist, Native American, and Taoist teachings to inform Americans about human relations to the natural world. However, the Judeo-Christian religions have often been ignored as a potential ally for environmental efforts until recently (Hitzhusen, 2007). This is partially because multiple studies have suggested that Judeo-Christian faiths have been correlated with a lack of concern about climate change (Truelove & Joireman, 2009; Eckberg & Blocker, 1989; Greeley, 1993; Schultz, Zelezny & Dalrymple, 2000). Although these studies will be explored, they have oversimplified the issue and contributed to the belief that environmentalism and religion are fundamentally at odds. Religious groups may have even more of an incentive and a sense of responsibility to take care of the earth than other non-religious groups. However, beliefs about the environment are complex, nonuniform, and dynamic. They vary across different religions, congregations, and individuals.

Climate change acceptance in particular has been non-uniform among the religious community and across different denominations. Within the Judeo-Christian community different denominations seem to have a broad range of responses to the idea of climate change. Some church leaders have responded strongly to the need to address climate change and advocate for environmental stewardship or the responsibility humans have to protect the earth, while others virtually ignore environmental concerns. The majority of churches are found between these two extremes. In the United States, studies have found Evangelical Christians are most associated with being skeptical of climate research (Carr, Patterson, Yung & Spencer, 2012; Smith & Leiserowitz, 2013), while other sources have suggested that Evangelicals may be increasingly pushing for change (Banks, 2006; Mhlanga, 2000). The Seventh-day Adventists have been seen as increasingly concerned and proactive about climate change and environmental issues like it. The Adventists have released official statements on the dangers of climate change and have discussed ways to reduce the impact (“The Dangers of Climate Change”, 1995).

Although much research on the links between climate change acceptance and religious thought has been done with highly variable results, no study has focused on the Seventh-day Adventists. This study seeks to focus on the Adventists as a case study to explore: the general Judeo-Christian religious perspectives and suggested action on climate change, and how the Seventh-day Adventist congregation in Boulder compares to the general perspectives of Judeo-Christian faiths found in the United States' media.

The Adventists provide an instructive case study to investigate because stewardship is one of their twenty-eight fundamental beliefs and because of their promotion of a vegetarian diet. The congregation in Boulder is especially unique owing to its greater exposure to climate experts from the National Center for Atmospheric Research and their location in a predominantly environmentally aware and highly educated area. For the case study, twenty interviews were conducted with members of the Seventh-day Adventist Church in Boulder. This study also measured the amount and type of media attention on religious stewardship across five major news sources. Broadly, this research found that this coverage has been changing in recent years. The interviews and media analysis have been compared to highlight common themes and differences. This study is especially relevant due to the growing interest in initiatives in which religious leaders are forming alliances—either across religious divides or between religious and scientific associations—to halt the damage humans are doing to the natural world, including its climate (Hulme, 2009).

Conclusion

This study provides evidence about how the Seventh-day Adventist religious beliefs contribute to perceptions of climate change. I found that the majority of the interviewees (70%) believed that their faith had some impact on their views on climate change to varying degrees. This study shows that Judeo-Christian religions can indeed be correlated with environmental thought, agreeing with previous studies (Haluza-Delay, 2000; Hoffman & Sandelands, 2005; Kearns, 1996; Wallace, 2008; Beisner, 1997; Harper & Kennealy, 2009).

The general finding from the media analysis and the interviews is that Judeo-Christian ideology is correlated with environmental thought. Both the media analysis and the interviews emphasized the belief that climate change is happening or is a threat. The articles tended to emphasis collective action, while the interviews tended to focus on individual action. The interviews also focused more on the ethical dimensions of the issues (stewardship and the influence of sin). While the articles also brought up stewardship and the moral and ethical dimensions of climate change, they emphasized more of the political or scientific dimensions as well.

My hypothesis that there would be an increase in coverage of the topic of religious action on climate change after the United Nation’s Sponsored “Many Heavens, One Earth: Faith Commitments for a Living Planet” at Windsor Castle was inconclusive. While the topic seemed to peak around 2006, there were minor rises in media coverage in 2010 and 2013. The large peak around 2006 could be correlated with the release of Al Gore’s film, An Inconvenient Truth, which quickly became a box office hit (Marshall, 2009). The movie may have easily led to a media focus on the issue of climate change. The smaller peak in 2010 could be linked with the UN religious conference on climate change, but the amount of coverage found during this time period was not very significant. However, a study by Boykoff and Yulsman, which tracked the number of articles discussing climate change in North America, found a significant peak around 2009 and 2010. This study also found a major peak in 2006 (Boykoff & Yulsman, 2013). While the Boykoff and Yulsman study did not take into account religion, these trends could be extrapolated. This could suggest that my hypothesis may be accurate, but that not enough articles were analyzed in order to pick up on the increase in coverage after 2009.

Overwhelmingly, the interviewees believe that climate change was happening and believed that some sort of action should be taken. Even though that was the case, engaging Seventh-day Adventists in a discussion about supporting policies and actions that would address climate change would pose a significant challenge. This is due to the belief that the church should stay out of politics completely. The interviewees emphasized individual actions over collective ones. This included general attitudes about taking care and having respect for all living things, and by encouraging a vegetarian or vegan diet.

One way in which faith-based climate change action may be most successful is if activists focused on concepts of stewardship and creation care, rather than on climate change directly. Many of the interviewees had a basic understand of the concept of climate change but were fuzzy when it came to the specifics. Most were clearer in their understanding that generally human beings should take care of the planet and the way in which humans have been operating is destructive and unsustainable. Since the concepts of stewardship and creation care are prominent in Adventist thinking, these concepts could be used to encourage emissions-reducing behaviors without raising counterproductive conflicts over political beliefs or how prominent or harmful climate change may be.

It is worth noting that the majority of interviewees were willing and interested to discuss climate change, especially from a faith-based perspective. This may suggest that people in the Seventh-day Adventist congregation are interested and want to be engaged with this topic. However, it is important to remember that providing information and facilitating discussions does not guarantee transformed attitudes or new behavior within the church or at the individual level.

My results indicate that scientists, environmentalists, and others wishing to promote cooperation with the Seventh-day Adventists and other Judeo-Christian denominations on climate change mitigation need to be aware of the religious beliefs discussed above. While this study focused on general values and the links between religion and action on climate change, it did not fully investigate how ideas and values could translate into encouraging further action or awareness.

Although this study provides a good groundwork, future social-science research on the topic should focus on taking this study a step farther to investigate how to facilitate action on the subject. This could include focusing on what types of action may be most successful among religious audiences like the Seventh-day Adventists and what aspects of the climate change issue may be most beneficial to emphasize. This would further clarify barriers and opportunities for meaningful change. Future studies should also focus on expanding the number of interviews and including many different denominations for a more comprehensive understanding of the Judeo-Christian perspective on this topic. It would also be interesting and beneficial to expand outside of Judeo-Christianity and include the perspectives of other faiths.

“The New Green Christianity: Why the Church Is Vital to Saving the Planet,” Mark I. Wallace, Word & World, 2008 [33]
https://www.scribd.com/document/156970744/The-New-Green-Christianity-by-Mark-Wallace

Overview:

If the current scientific consensus about global warming is accurate, then we are now living in an objectively apocalyptic situation in which our planet is teetering on the edge of disaster. Jim Hansen, top climate specialist at NASA, claims we have just ten years to reduce greenhouse gases before global warming reaches an unstoppable tipping point and transforms our natural world into a “totally different planet.” Global warming—the trapping in earth’s atmosphere of greenhouse gases such as CO2 from car and power plant emissions—is causing air and ocean temperatures to rise.

Current & Relevant Information:

While science can analyze the record climate change since the industrial revolution, it cannot provide the necessary moral foundation for answering the existential question, What difference does it make whether our children or grandchildren survive the killer weather carbon dumping is destined to cause? While many scientists themselves are motivated by moral and even religious concerns, science as such is not amoral or religious enterprise. Science cannot say—as, for example, the religions of Abraham claim—that the natural world is God’s creation, lovingly designed for the sustenance and joy of all beings, and therefore humans are tasked with the responsibility to care for their planet home. In particular, science cannot assert, as religion can, that the earth is sacred and therefore deserving of our protection. My claim here is that without such an all-encompassing, hyper moral claim the prospects for saving the planet are slim indeed. Science is not enough. Like the chronic smoking behavior in a previous generation, we now know our carbon-intensive lifestyles are killing us and many other species, but we cannot stop our behavior. We are fall-down carbon drunks, fossil fuel addicts who cannot break our global addiction cycle. Only religion—or some alternative religion-like moral system—can save us now. Only religion has the symbolic potency and moral authority to break our collective carbon addiction cycle by motivating us to look beyond our private self-interest to the greater good of the planet itself.

While I will allude to different religions here, I want primarily to analyze how Christianity is awakening to its planetary responsibilities. No longer relegated to a long list of special interests, today care for creation has become a core moral issue for biblically centered Christians concerned about climate change and the loss of global Biological Variability. This newly embraced passion for the well-being of the natural world is provoking a seismic shift in values within American culture and politics. One of the reasons Republican candidates fared so badly in the 2006 mid-term elections is that the religious electorate was concerned about President Bush's failure, among other issues, to break America's dependence on fossil fuels by developing a sustainable energy policy that could blunt the impact of climate change. A recent cover article for the New York Times Magazine featured interviews of so called "green evangelicals" who now see a "biblical mandate for government action to stop global warming." Moving beyond polarizing social issues such as homosexuality, abortion, and stem cell research, churches on the left and the right are articulating a Christian response to global warming by promoting renewable energy, community-based agriculture, and conservation of natural resources. This article consists of both analysis of this change and advocacy for this change—a call to move beyond the impasse between red-state and blue-state politics by embracing the power of green religion to engender civic renewal and environmental health in our time.

"Religious motivation for mitigating human-forced climate change: Scientifically informed, politically astute, and collaborative," Jame Schaefer, International Journal of Climate Change Strategies and Management, 2014 [34]
https://www.researchgate.net/profile/Jame_Schaefer/publication/263043302_Religious_motivation_for_mitigating_human-forced_climate_change_Scientifically_informed_politically_astute_and_collaborative/links/570c025708aee0660351a9e3/Religious-motivation-for-mitigating-human-forced-climate-change-Scientifically-informed-politically-astute-and-collaborative.pdf

Abstract:

Purpose – Religious organizations are among the non-government groups in the USA that are addressing climate change phenomena from their various faith perspectives and, despite the differences in their traditions and practices, are collaborating with one another to achieve their mutual goal – the establishment of policies that will mitigate the real and anticipated perils scientists are forecasting. If sufficiently motivated by their faith, informed by climate science, and politically astute, these groups may be reliable allies for climate change decision-makers to tap as they strive to achieve their mutual goal. The paper aims to discuss these issues.

Design/methodology/approach – Focusing on the Coalition on Environment and Jewish Life, the Catholic Coalition on Climate Change, and Interfaith Power and Light, the author explores the varied religious faith-based motivations underpinning their efforts, the extent to which they remain cognizant of the latest climate science, the structures through which they share their particular faith perspectives and collaborate with one another, and their efforts to reach decision makers at various levels of governance.

Findings – Motivated by their religious faiths, these three organizations demonstrate that they are scientifically informed, politically astute, and collaborative with others in striving to achieve their mutual goal of mitigating the adverse effects of climate change locally to globally.

Research limitations/implications – The three groups on which the author focuses are based in the USA and collaborate with one another. In an earlier presentation prepared for an international conference, the author included two other groups outside the USA, but manuscript length precluded their inclusion in this submission. Perhaps the author's limited study will stimulate scholars to explore other groups in various parts of the world.

Practical implications – To assure and strengthen the momentum already underway, scholars of religions need to probe their foundations for responding to climate change, leaders of religious communities must heighten their efforts to educate their followers accordingly, adherents of religions must be open to embracing their motivating traditions, and religiously based groups must seek to collaborate with one another at various bioregional and political levels to demand actions that will advance a life-sustaining climate.

Originality/value – The author is unaware of studies exploring these three groups using the methodology the author employs for the purposes of describing and assessing the effectiveness of religious groups in addressing human-forced climate change.

<u>Current & Relevant Information:</u>

Crucial to resolving ecological problems are the underlying reasons why people pressure decision-makers to make and implement policies aimed at mitigating their adverse effects. Evidence that human activities are forcing changes in the global climate non-attributable to natural causes presents a particularly complex problem around which people individually and collectively are rallying at local to international levels of governance. Religious organizations are among the groups addressing climate change from their particular faith perspectives. Despite differences in their religious traditions, some organizations are collaborating with one another to achieve a mutual goal – the promotion of practices and establishment of policies that will mitigate the existing and projected perils that climate scientists have been forecasting.

Conclusion

Examination of two organizations grounded in a specific religious faith and one interfaith coalition of Jewish, Christian, and Islamic religious communities based in the USA attests to their efforts to be scientifically informed, politically astute, and collaborative with one another when addressing the climate crisis. The Coalition on the Environment and Jewish Life and the Catholic Coalition on Climate Change systematically ground their activities in their respective religious faiths informed by scientific findings, network with groups that share their faith, and advocate for changes in and establishment of pertinent government policies. Key to their efforts is the faith perspective from which each draws its motivation and actions. In their endeavors, these two organizations quote from, reflect upon, and find significance in key sources revered by their religious traditions, and they apply their faith perspectives to mitigating the adverse effects of human-forced changes in the global climate.

Religious faith also motivates the activities of Interfaith Power and Light to address a plethora of energy issues relate to human-forced climate change. Grounded in a basic shared faith in God as the purposeful creator and sustainer of the world but recognizing and respecting the nuances of Judaism, Christianity, and Islam, Interfaith works with affiliates in 39 states and their religious communities to stimulate their clergy and members to act on the basis of their faith in all aspect of their domestic, social, cultural, economic, and political life. Their shared goal is to mitigate the adverse effects of human-forced climate change. Throughout, Interfaith underscores the obligation to care for God’s creation and to be especially attentive to the materially poor and vulnerable people who are most adversely affected in the present and those who are projected to be most adversely affected in the future. Like the Jewish and Catholic coalitions, intra-and inter-generational justice looms large in Inter-faith’s concerns.

Because religious faith motivates the groups and their members, scholars of the Abrahamic and other world religions can help by researching their traditions, reflecting carefully on them for their fruitfulness in addressing climate change and other ecological problems, assuring they are sufficiently informed by our current scientific understanding of the world, and making their conclusions available to these groups. Scholars have produced many books, anthologies, and journal articles pertaining to religious foundations for addressing ecological concerns over the past 30 years (Dolgin, 2013; Foltz, 2013; FORE, 2013). However, much more has yet to be accomplished and shared effectively with religious communities and organizations so their members can be deeply motivated to act within their various social, economic, and political contexts. Even more may be accomplished when religious groups collaborate with one another and with secular advocacy groups for their mutual good – a life-sustaining Earth.

"Talking Climate Faith: Katharine Hayhoe and Christian Rhetoric(s) of Climate Change," Megan Von Bergen and Bethany Mannon, enculturation, 10 November 2020 [35] https://www.enculturation.net/Talking%20Climate%20Faith

Overview:

Evangelicals' intransigence towards climate change is a paradox. As early as the 1970s, groups such as the National Association of Evangelicals committed to "solv[ing] critical environmental problems" (qtd. in Wilkinson 16). Some evangelicals subsequently maintained a limited commitment to environmental advocacy and employed religious terminology such as "creation care." However, Barna Group and Pew Research Center polls find that climate change remains a low priority for evangelicals,[2] who are less likely than other practicing Christians or the general public to assert that "humans absolutely caused climate change" ("Are Humans Responsible?"). The pervasive "culture of scientific skepticism" among evangelicals poses one obstacle; a theology based in individual salvation rather than social engagement poses another (Wilkinson 95). Especially as climate impacts worsen, this gulf between evangelical and scientific communities calls for deft rhetoric that reconciles evangelical ways of being with substantive, sustained climate action.

Katharine Hayhoe, a climate scientist and an evangelical Christian, speaks into this exigence. An atmospheric scientist by training, Hayhoe directs the Texas Tech University Climate Center. Her faculty bio lists more than 125 published, peer-reviewed papers and her public rhetoric includes a TED talk, podcast interviews, and the Global Weirding YouTube series that answers common questions such as "What's the Big Deal with a Few Degrees?" Hayhoe uses Twitter to amplify climate research and call her 147,000 followers to action.

Hayhoe is also a practicing Christian known for addressing fellow evangelicals, as in the Global Weirding video "The Bible Doesn't Talk about Climate Change, Right?" Distilling the fraught history of the term "evangelical," Hayhoe offers a simple definition: "people who take the Bible seriously" and see their Bible reading as a foundation for engaging the world. In that video she argues that Bible verses about God's care for creation and Jesus's teachings to act in "love for others, particularly those less fortunate than ourselves" motivate evangelical climate action. Even as she locates herself within this evangelical ethic of care, she distinguishes between Christians who are "religiously evangelical" and those who object to climate science because of their "politically evangelical" affiliation ("The Bible"). Although the growing influence of political evangelicalism interferes with Hayhoe's rhetorical appeals, the distinction opens space for her to draw on shared religious landscapes in her climate advocacy.

In this paper, we explore the intersections between Katharine Hayhoe's religious commitments and her climate rhetoric. We argue that Hayhoe cultivates an evangelical ethos and an invitational rhetoric that asks resistant publics to recognize climate action as belonging to the landscape of their faith. Situating our argument within rhetorical feminism, we first analyze how Hayhoe uses Twitter to publicly establish her ethos as a Christian climate scientist. We then examine how her invitational rhetoric in lectures at two Christian universities enacts that ethos, “renovating” both climate rhetoric and evangelical ways of being (Vander Lei). In this way, she offers a model for rhetorical work that addresses resistant publics from within their own discursive landscapes.

Current & Relevant Information:

CONCLUSION

Hayhoe demonstrates that religious rhetoric can speak across the ideological divides that inhibit meaningful change. The invitational rhetoric we analyze in this essay locates climate action and evangelical belief as adjoining landscapes, connected through fused horizons of a commitment to truth and a care for the global poor. This work recasts climate change rhetoric in hopeful terms, countering the fear Hayhoe sees at the root of skepticism. As Cheryl Glenn reminds us, hope is not optimism; hope is better understood as actively working towards alternative ways of being. Hayhoe’s work holds out hope for evangelicals to reimagine their faith as motivating climate action, particularly among younger evangelicals who see themselves in a global coalition committed to justice and service.

This religious rhetoric holds significance for the field of rhetorical studies as it contends with fluid conceptions of fact and considers how to engage resistant publics amidst deteriorating public discourse. Hayhoe’s work demonstrates the value in an expanded understanding of invitational rhetoric that acknowledges the importance of a rhetor’s whole standpoint, including her expertise and religious (or other) commitments. Hayhoe’s knowledge of climate science research is core to her renovation of evangelical climate rhetoric, but such expertise gains persuasive power when she presents it as integrated with her faith. To shift dominant evangelical climate discourses, Hayhoe asks her audience to join her in a landscape that includes (sometimes in productive tension) both scientific literacy and Christian faith and values. Even if some listeners do not accept Hayhoe’s invitation, her work creates possibility, envisioning alternative, hopeful models of faith expansive enough to include climate change—models that may, eventually, take root. Hayhoe’s approach, inhabiting familiar landscapes of faith but widening their horizons, offers a model for other contexts where rhetors might successfully connect with resistant publics using invitational approaches that recognize the relevance of their standpoint and expertise.

“Faith, environmental values and understanding: a case study involving Church of England ordinands,” Elizabeth A. C. Rushton and Martin J. Hodson, John Ray Initiative Briefing Papers, 2012 [36]
https://kclpure.kcl.ac.uk/portal/files/109802736/Rushton_Hodson_JRI_briefing_25.pdf

Abstract:

This study examines whether there is a link between faith and environmental values and understanding in Church of England ordinands. Using a questionnaire survey ordinands were asked to respond to the New Environmental Paradigm (NEP). In addition, they responded to statements about the importance of environmental issues and ecology within their faith and to biblically based interpretations of environmental issues. The questionnaire also collected data from a sample of environmentally aware Christians who were associated with the distance learning course Christian Rural and Environmental Studies (CRES).

The ordinands were generally moderate in their theological positions and data analysis revealed that churchmanship was the only variable that varied significantly within the sample. The evangelical ordinands gave some responses that might suggest less interest in environmental concerns. The CRES sample was generally more sympathetic to environmental issues than the ordinands.

It is suggested that the provision of environmental theological education is poor within the colleges surveyed, and that this situation needs to be changed if the Church is to have a leadership role in reversing the human-induced causes of the environmental crisis.

Current & Relevant Information:

Introduction

This study seeks to examine whether there is a link between faith and environmental values and understanding in the particular case of Church of England ordinands. There are four main environmental crises that face humanity; climate change, availability and access to freshwater, loss of Biological Variability and human population growth. Governmental and intergovernmental reports in the last few years have highlighted the increasing agreement between the world's leading scientists that global warming is human-induced and very serious. These include the Intergovernmental Panel on Climate Change (IPCC) fourth assessment report in 2007. Atkinson highlights the wide-ranging impacts of an average global temperature rise of 2-4°C rise this century as including: flooding affecting millions of people; the loss of wetlands; the death of coral reefs; and an increase in methane emissions into the atmosphere as permafrost melts. Houghton links future freshwater shortages to an increase in global temperature. The rate of climate change, both over the last one hundred years and projected over the 21st century has and will cause a serious detrimental impact on Biological Variability. This is due to the inability of ecosystems to adapt to increasing temperatures, habitat loss due to agriculture, mining and expansion of human settlements and pollution. Finally, the global population increase is perhaps the most significant crisis as an increase in the human population increases greenhouse gas emissions, thereby increasing all the aforementioned impacts of climate change. The United Nations predicts the global population will reach 9.1 billion by 2050.

In recent years there has been increased interest in environmental theology and what the Christian faith has to say on environmental issues. Recent books include those by Bookless, Deane-Drummond, Atkinson, and Bauckham. There have also been numerous journal articles, with the journal Theology devoting an entire issue in 2009 to environmental concerns. The Church of England continues to have an important presence as the established church in England and the largest denomination or faith group in Britain. Almost half of the population of England regard themselves as members of the Church of England and 70% regard themselves as Christian. The continued high involvement of many of the population indicates that the Church of England, its priests and leaders have a significant opportunity to reach a large number of people with a faith-based message about climate change and other environmental issues. Therefore, the environmental attitudes and values of the clergy are of crucial importance, and those that are currently training are likely to have more time to think about and reflect on the environmental issues facing the Church.

Little research has been done on the provision of environmental theology in theological colleges. M.J. Hodson surveyed and then codified the place of environmental theology in syllabi across European courses. There has however, been no research as yet on the opinions and theology of those undergoing training.

In summary, it is hoped that this study will meet the following aims:

- To discern whether those training for ordained ministry in the Church of England (ordinands) have a significantly different response to environmental values and theology than other groups.

- To discover which, (if any) variables influence ordinands' responses to environmental values and theology.

- To understand reasons behind any differences in response.

- To highlight areas of current Christian thinking that may be especially helpful or unhelpful in the understanding of the Christian response to the environmental crisis.

- To assess the current provision of environmental theology within the training of ordinands.

Conclusion

We have conducted the first survey of the environmental opinions of Church of England ordinands. We are well aware that there is much more work to do in this area. In particular, at present there are few data sets available with which to compare our work. Hulme, considering the topic of climate change, includes a whole chapter on “The things we believe”, looking at faith responses, but he does not cite any quantitative work. We hope that the present work will stimulate others to improve our knowledge in this area.

In general, this study found that Church of England ordinands were moderate in their theological positions with respect to the environment. The only variable that showed significant difference between the ordinands surveyed was churchmanship. The evangelical ordinands differed from the other groups in their responses to four of the 27 questions set. These responses could be interpreted as indicating less interest in environmental concerns among evangelical ordinands, but it is far from clear that this is always the case with evangelicals. The CRES respondents were generally more sympathetic to environmental issues than the ordinands, suggesting that education is important in improving environmental awareness. At the moment rather little environmental theology is taught in ordination colleges, and it is recommended that this situation needs to be changed if the Church is to play its part in meeting the environmental challenges of this century.

4. Confucian Culture:

“Functional Links Between Biological Variability, Livelihoods, and Culture in a Hani Swidden Landscape in Southwest China,” Jianchu Xu, Louis Lebel, and Janet Sturgeon, Ecology and Society, 2009 [37]
https://ecologyandsociety.org/vol14/iss2/art20/main.html

Abstract:

The landscape of Mengsong, southwest China, was biologically varied until recently due to historical biogeographical processes overlain by the swidden-cultivation practices of the Hani who migrated there several centuries ago. Our research sought to understand how the Hani adjusted their livelihoods to new policies, markets, and technologies, and the consequences for Biological Variability conservation. We combined landscape, plot, and household surveys, interviews, and reviews of secondary documents, to reconstruct the major changes and responses to challenges in the social–ecological system over previous decades. Significant changes from closed to open canopy of secondary-forest vegetation took place between 1965–1993 and from open-canopy to closed-canopy forest between 1993–2006, mostly explainable by changes in state land-use policies and the market economy. Most remaining swidden-fallow succession had been converted into tea or rubber plantations. Swidden-fallow fields used to contain significant levels of biological variability. Until 2000, Biological Variability served several important ecological and social functions in the Hani livelihood system. Indigenous institutions were often functional, for example, linked to fire control, soil management, and watershed protection. For centuries, the Hani had detailed knowledge of the landscape, helping them to adjust rapidly to ecological disturbances and changes in production demands. The Hani understood succession processes that enabled them

to carry out long-term land-management strategies. Recent government policies and market dynamics have simplified livelihoods and landscapes, seriously reducing Biological Variability, but greatly increasing the area of closed-canopy forest (including plantations) and undermining the usefulness of Hani knowledge and land-use institutions. Meeting both conservation and development objectives in this landscape will require new functional links between sustainable livelihoods, culture, and Biological Variability, rather than seeking to recreate the past.

Current & Relevant Information:

Introduction

Swidden-farming systems have emerged repeatedly in tropical landscapes, transforming them, and often sustaining them in particular configurations for long periods (Conklin 1957, Spencer 1966). The landscape mosaics they create are often high in agroBiological Variability and, over time, can create complex functional links between livelihoods, Biological Variability, and culture that can be highly resilient (Brookfield et al. 2003, Rerksasem et al. 2009). However, in most places around the world, these systems are being transformed by conservation and development policies and the emergence of new markets for cash crops (Sturgeon and Menzies 2008). In many cases, these rapid changes have disrupted crucial links that helped make these systems resilient, and they have not yet been replaced by new links in the new configurations of landscapes and livelihoods.

The Hani (known to themselves and in Thailand as the Akha) were originally from Hong He in the Red River region of central Yunnan and probably moved into Xishuangbanna around the middle of the 18th century. Mengsong lies on the border of Myanmar in Jinghong County in southern Xishuangbanna, in the southwest of China. River valleys in the warm subtropical zone were occupied by Dai and other ethnic groups from whom the Hani learned to practice swidden cultivation in the vacant temperate uplands. The Hani maintained complex social networks with the lowland Dai, the Bulang in the middle hills, and the highland Lahu, receiving ecological services from upland ecosystems and local livelihoods through product exchange.

Changes over previous decades led to a series of challenges to Hani livelihoods. The varied landscapes of Mengsong and culture of the Hani were factors in their capacity to respond to these challenges (Xu et al. 2005a). Although the Hani have a tradition of managing nature (Pei and Luo 2000, Xu and Melick 2007), their efforts are not recognized by the government (Xu et al. 1999, Xu 2006a).

This study was undertaken to describe and explain how recent government reforms in forest and agricultural land policies and market integration have reconfigured landscapes and functional links between livelihoods, Biological Variability, and culture in Mengsong. We synthesize and expand on past studies by presenting new empirical data and analyses based on our research between 1989–2007. Evidence from social, ecological, and policy studies indicates that it was the reciprocal, functional links between Biological Variability, culture, and livelihoods that provided long-term resilience and incentives for conservation (Folke et al. 2003, Berkes 2006). These were the links that less nuanced paradigms of conservation and development have severed, threatening both livelihoods and Biological Variability in Mengsong.

Conclusion

The variability of livelihoods and ecosystems in Mengsong is under threat. Livelihood uncertainties make predictions about future Biological Variability difficult. The state's past efforts at sedentarization took hold through conservation policies and market-based incentives for intensification. Sedentarization of agriculture changed the structure of the landscape, almost eliminating the variability of successional stages.

Ways of building new functional links among sustainable livelihoods, culture, and Biological Variability are needed, rather than seeking to recreate old links. Efforts at realignment and reconciliation to save species and environments without displacing people or their economic activities are now being made (Rosenzweig 2003) and less restrictive state policies are creating opportunities for self-organization and innovation.

"Inclusion of Local People and Their Cultural Practices in Biological Variability Conservation: Lessons from Successful Nations," Dickson Adom, American Journal of Environmental Protection, 2016 [38]
https://www.researchgate.net/profile/Dickson_Adom/publication/316914798_Inclusion_of_Local_People_and_Their_Cultural_Practices_in_Biological Variability_Conservation_Lessons_from_Successful_Nations/links/5917f15aa6fdcc963e856ac7/Inclusion-of-Local-People-and-Their-Cultural-Practices-in-Biological Variability-Conservation-Lessons-from-Successful-Nations.pdf

Abstract:

The inclusion of local people and their cultural practices impact positively on Biological Variability conservation. This is the underlying factors behind the success stories of countries with high numbers of biological variability resources. It is sad to reckon that most Biological Variability policies of developing countries like Ghana do not fully include the voices of the local people as well as their cultural practices. There was, therefore, the need to thoroughly review the national Biological Variability strategies and action plans of some countries that have effectively factored the local people and their cultural practices in their Biological Variability policies. This was to elucidate how and in what areas the views of the local people and their cultural practices can be effectively incorporated into Biological Variability conservation initiatives. The study utilized qualitative research approach with document analysis method. Related literature on the subject from peer-reviewed manuscripts, Biological Variability strategic reports and strategies of different

countries were rigorously reviewed and analyzed using Interpretative Phenomenological Analysis (IPA). The study revealed that local people have time-tested conservation knowledge enfolded in their cultural practices like religious beliefs, taboos, etc. Legal backing was seen as the main driving force behind the utilization of the cultural practices of the local people in the Biological Variability strategies reviewed. Moreover, the local people were fully involved in the development of the Biological Variability strategies. This was seen in the areas of planning, management, and decision-making, recruitment of staff, as well as the dissemination and implementation of the Biological Variability strategy. The study concluded that effective Biological Variability policies must reflect the cultural practices and the views of local people since they are powerful instruments of conservation. It tasks Biological Variability policy designers to fully incorporate local communities and their cultural practices in the development of Biological Variability strategies.

Current & Relevant Information:

National Biological Variability Strategies and Action Plans of Different Countries

This section of the paper delves into the national Biological Variability and action plans of some successful nations in Biological Variability conservation initiatives. These countries have effectively included the local people and their cultural practices in every aspect of their Biological Variability conservation initiatives and programs. These aspects include the planning, management, and decision-making processes as well as the implementation and recruitment of staff in spearheading conservation plans for Biological Variability. Also, the dissemination of conservation initiatives demonstrates the strong influence of local people and their cultural practices. In addition, the exact cultural practices of the local people that have played significant roles in Biological Variability conservation have been discussed. These successful countries whose Biological Variability conservation strategies and action plans are reviewed are China and Japan.

National Biological Variability Strategy of China

Global conservation and nature protection usually takes place at the official level in China. This is due to the fact that the country houses a pool of sacred sites with rare and endemic species of Biological Variability. It is interesting to know that most of these areas are traditionally conserved through the implementation of cultural practices such as religious beliefs, taboos, folklores and others. This commendable example of China was highlighted in the fourth world wood day. This event was organized by the International Union for the Conservation of Nature (IUCN) held on the 21st of March 2016 themed ‘Nature and Culture.’ The event was aimed at exploring the interrelationship between nature and culture. China was applauded because of the precedence she has set in looking into the books of culture for solutions to halt the degradation of Biological Variability. Policy designers in China aver that the Chinese cultural practices, together with its religious values and ideals can contribute immensely to the sustainability and conservation of nature. They again liaised with the Chinese indigenous traditional religion, Daoism, popularly labeled as the ‘green religion. This was due to the religion’s strong advocacy for environmental sustainability and conservation. The ideals and values propagated in this indigenous religion as well as other cultural practices play archetypal roles in Biological Variability conservation.

As a result of this, education and communication are used as mediums for encouraging the wider participation of local communities and their cultural practices. Aside from the sensitization campaigns, the team embarked on an astronomical improvement in the documentation of all forms of traditional knowledge related to Biological Variability conservation. This documentation was aimed at preserving the conservation values in the traditional practices for future generations.

Furthermore, the document highlighted on the establishment and enhancement of Biological Variability management and coordinating bodies at the local level. This was to heighten their capacities to handle challenging Biological Variability situations at the local communities. Biological Variability partnerships between these local communities, urban centers, and NGO’s were established to ensure that the effective traditional cultural practices used by some local communities could be equally implemented in other areas of the country.

In addition, the Biological Variability-related laws and regulations in the country are very effective. This is because the law enforcing systems, both at the local and national levels were given that mandate by parliament. This gave the local authorities the legal right to administer punishments to the defaulters of the established Biological Variability-related laws and regulation. In making sure that the implementation processes become very effective, the implementation powers were vested in the hands of the local governments in every jurisdiction in China. The reason for that action is that the rich Biological Variability resources are located in various communities and towns. Thus, supervision and implementation will be effectively carried out at the local level better than at the national level.

However, at the national level, measures were taken to regulate the general execution of the international Biological Variability agreements and treaties. How did the Chinese monitor the duties of the local governments? The monitoring power was vested in the hands of the Ministry of Environmental Protection in China. They were tasked to inspect, supervise and review the roles of the implementation bodies while presenting regular reports to the state council. To assist the local governments in performing their duties successfully, the Ministry instituted administrative training programs, workshops, and seminars to groom and update the implementing agencies on their expected roles. This robust legal, implementation and monitoring mechanisms put in place by China ensured the continual attainment of the vision, objectives and action plans of their national Biological Variability strategy.

National Biological Variability Strategy of Japan

Japan, like her oriental neighbors, seriously considers the inclusion of the local people and their local communities. Recognizing the import of traditional knowledge, a meticulous assessment of the existing traditional conservation knowledge for Biological Variability resource usage that characterizes the local regions in Japan was carried out. Since decision making, planning and management are at the core of conservation programs, the policy developers included the coordination between the national and local governments in the Biological Variability strategy. This served as the platform where the local people and experts shared ideas on Biological Variability conservation issues. This ensured that formulated policies reflected the culture and traditions of the local communities.

To increase the involvement of the local people and their communities, the government intensified capacity building workshops and seminars with the local residents who are well versed in local conservation methods of Biological Variability.

Local people were hired by the government to oversee forest and wildlife conservation activities in the local communities. This is a step in the right direction because the local people usually know much about the Biological Variability resources in their environment. Sensitization and awareness programs are carried out using modern technological approaches like the internet and other online media. Also, printed media of the conservation initiatives were distributed to various people in both the rural and urban centers.

“Education for Sustainability Meets Confucianism in Science Education,” Baoyu Li, et. al., Science & Education, 3 June 2022 [39]
https://link.springer.com/article/10.1007/s11191-022-00349-9

Abstract:

Confucianism provides a specific view on the world held by many people living in several Asian societies. It offers views on humans and nature that generally differ from other traditional or Western modern views. The paper presents a systematic analysis of the literature in education with a focus on science education about the connection of Confucianism with education for sustainability. It suggests a framework for how education for sustainability can be operated in the foreground of Confucian societies taking concepts from the international literature into consideration. This critical review provides justification for a stronger reflection about how to include ideas from Confucianism into education for sustainability in the teaching and learning of science. It suggests that Confucian thinking offers a rich and authentic context for science learning in Confucian societies and and also provides a chance to reflect on views of humans, nature, and science in science

education in other societies, potentially contributing to the development of more balanced and holistic worldviews.

Current & Relevant Information:

Introduction

As technological development brings modern societies to the global community, global development is accompanied by many human made challenges, such as climate change, global pollution problems, gradually decreasing natural resources, or Biological Variability loss (United Nations Environment Program [UNEP], 2012). Because humans became the most influential factor to the world, geologists suggested calling our epoch now as the Anthropocene (Caro et al., 2012). The Anthropocene concept suggests that humankind needs to take responsibility for the world; change in behaviors is suggested to reduce negative human impacts on the Earth (Jeong et al., 2021; Ogden et al., 2013). To fend these challenges, the United Nations (UN, 1987) made the concept of sustainable development a regulatory idea of international policy: “Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs” (UN, 1987, para.1). In other words, the current generation is asked to re-think their lifestyles for the sake of the rights and needs of future generations. Sustainability, or sustainable development, emphasizes maintaining sustainable living conditions. Although the concept of sustainability has been under constant debate for many years (Hopwood et al., 2005), most of them refer to a balanced development under ecological, economic, and societal sustainability (Burmeister et al., 2012; UN, 1987).

To further promote sustainable development around the world, the United Nations (UN) coined the term Education for Sustainable Development (ESD) in the Agenda 21. ESD means to educate people to be able to make informed decisions and take responsible action in line with the sustainability ideas of ecological integrity, economic feasibility, and societal justice (United Nations Conference on Environment and Development [UNCED], 1992). ESD proposes a continuously updated education for sustainability to promote current and future generations having abilities to live sustainable lives. ESD suggests learning and acquiring related skills about sustainability in schooling and higher education and also in informal, nonformal, and lifelong learning (UN, 2015; UNCED, 1992; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2005a, 2016). The political vision of ESD, and related concepts with slightly differing visions (Öhman & Östman, 2019), led to an exponential growth of related scientific research articles in the last 30 years in general and in science or chemistry education in particular (e.g., Burmeister et al., 2012; Herranen et al., 2021; Jegstad & Sinnes, 2015; Juntunen & Aksela, 2014).

Education for sustainability (or ESD, sustainability education, etc.) is more than environmental or moral education. It is the fruit of evolution of environmental education and the leading approach for environmental protection now, for its stressing social contribution to deal with major contemporary ecological issues, rather than mainly relying on the study of science for environmental protection (Castellanos & Queiruga-Dios, 2021; McBeath et al., 2014). It concerns the ethical values of individuals concerning individual life, society, economy, and environment in a systems thinking approach (Mahaffy et al., 2018). Its implementation should consider students' and society's ethical and cultural values about local and global sustainability and promote appraisal of the rights and chances of others (e.g., Feng & Newton, 2012; Li et al., 2016b; UNESCO, 2005b).

In school education, science education plays an important role for ESD. Science education is teaching and learning of and about science, including scientific knowledge itself, and the development and utilization of it (Herron, 1969). Scientific theories and knowledge highly relate to and directly reflect the development of industry and technology and their impacts on the natural environment, society, and the economy. Science knowledge is essential for modern citizens' lives, and science is part of the culture in any society, being in Western or Eastern industrialized societies, countries of the Global South, or indigenous living peoples (Zidny et al., 2020). Science education also plays an important role in preparing future scientific literate citizens, scientists, and related experts. Science education is traditionally implemented as one core field of school education in most educational systems, and both teaching science knowledge and teaching about science are highly recommended, such as about the nature of science and its societal ramifications (e.g., Hansson & Yacoubian, 2020; Hofstein et al., 2011; Holbrook & Rannikmae, 2007; Park et al., 2020; Taber, 2017).

Science education for sustainability (or science education in ESD, science education for ESD, etc.) is used here as a term with the understanding of education to promote sustainability knowledge and skills through or in science education. It can be defined in different ways. One way is to see it as the research field where science education meets environmental/sustainability education (e.g., Dillon, 2014; Herranen et al. 2021). Another related way is to see it as science education driven by a sustainability vision (e.g., Colucci-Gray et al., 2013; Sjöström, 2018; Zidny et al., 2020). The latter is based on a view of science that goes beyond reductionist Western modernization. It is characterized by, e.g., complexity, uncertainty, epistemological reflections, and trans-disciplinarity. Such an approach emphasizes "the interplay between facts and values and the way in which we build and make use of new knowledge" (Colucci-Gray et al., 2013, p. 138).

The above-mentioned, negative side effects of Western modern societies' development are particularly also shown in present mainland China caused by its rapid economic growth during the past few decades in connection with its big territory and the world’s largest population. Education for sustainability is urgently needed in mainland China. Moreover, mainland Chinese students have drawn lots of attention from international education scholars, due to their frequently excellent science performance in the international science assessments, such as the Trends in International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA) during these years (Cheng & Wan, 2016; Grosseck et al., 2019). However, literature about how ESD is implemented in school science education in mainland China is still limited (Li & Eilks, 2021).

Culture deeply influences not only individuals’ ways of living and thinking, but also learning or teachers’ teaching approaches. It forms certain patterns of education in a society, due to the differences of history, values, philosophy, beliefs, and behaviors (e.g., Chuang, 2012; Gorry, 2011; Gündüz & Özcan, 2010). Culture is also a direct factor for how people are thinking and knowing about the physical world (e.g., Cobern, 1993; Gao, 1998). This is of importance if a new paradigm of education, like ESD, is to be implemented in general and in science education in particular. Mainland China has one large people of Han with the largest population in the world and 55 ethnic minorities. Han Chinese also take the largest part of Chinese communities in Asia and other parts of the world. They have highly been influenced and maintained by Confucianism, generation by generation (Cheng & Wan, 2016). According to Ogawa (1989), Western modern science, as part of the imported culture from Western civilization, should be taught by concerning local traditional and scientific ways of understanding and observing nature in non-Western countries.

As Chinese scholars look back to Chinese traditional culture, they find that Confucian wisdom about friendly living in nature has potential value to deal with modern ecological problems by leading action towards a sustainable future (Chen, 2019; Chen & Bu, 2019; Cheng, 2013). Confucian ecological ethics, as a cosmological metaphysics, emphasizes that humans and nature are one dynamic, holistic, and organic body, where humans harmoniously and sustainably live together with all the things in nature (Chen & Bu, 2019; Li et al., 2012; Tu, 1998, 2001, Tucker, 1991). Confucianism suggests that humans should love all things in nature and carefully, mildly, and prudently use natural resources (Chen & Bu, 2019; Li et al., 2012; McBeath et al., 2014). This can be understood as a contribution to sustainability. Confucianism is a moral code with the core Confucian spirit of benevolence, highlighting self-cultivation of moral ethics, which is also related to the intended outcomes of modern ESD (Tu, 2001). Even though China has adopted environmental education and ESD since 1992, Confucian ecological ethics is still not paid enough attention to in ESD in China until now in general and science education in particular (Li & Eilks, 2021; McBeath et al., 2014). Therefore, based on a systematic analysis of the literature, this paper tries to identify the features of and explore a potential model for ESD in science education in the context of Confucianism.

Conclusion

The United Nations (UN) suggest by 2030

> [ensuring] all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural variability and of culture's contribution to sustainable development. (see Goal 4.7: UN, 2015, p. 17)

This overarching political goal should influence educational practices in all countries, among them those having a background in Confucian culture and tradition. It is, however, necessary to note that the international discourse on education for sustainability in science education is basically dominated by Western modern views, at least when it comes to questions of science, technology, and the environment. More recent discussions nevertheless emphasize the importance of respecting non-Western worldviews on science more thoroughly in science education (Zidny et al., 2020).

Science education in China has been localized with disadvantages and/or advantages of Confucianism accompanying the development of Chinese industrialization in recent decades. As the awareness of the side effects is increased, the traditional anthropocosmic view of nature and humans (tian ren he yi) including Confucian values is being withdrawn. Tian ren he yi might be considered an important contribution for the global education community to enrich education for sustainability (Tu, 2001). Many (Neo-)Confucian values and ideas are in line with the philosophies of education for sustainability or ESD. Since most industrialized societies are built upon scientific knowledge and technology based on a Western modern scientific way of thinking, comparison, tensions, and connections of Western and Eastern cultures should be concerned in science education, including the fissions that potentially exist (Ogawa, 1986, 1989).

This paper provides an analysis of the research literature on science education for sustainability in Confucian culture with reference to the international discourse on education for sustainability. The discussion in this paper shows many parallels between Confucian thoughts and values and Western educational theories, e.g., in the concept of Bildung, when it comes to sustainability issues. Many connections were identified between Confucianism, education for sustainability, and selected concepts from Western education. Respect for nature and more holistic thinking in systems are essential components of both Confucianism and contemporary concepts of sustainability. These parallels provide a chance to enrich science education in Confucian societies by reflecting on developments in science and technology from both the political agenda for sustainable development and the values of Confucianism. From this comparison, the view of nature and humans can be considered a good link for Chinese science education to foster skills by education for sustainability. It is, however, important that curriculum development and research are needed in science education on how to better operate the combination of learning science with ESD in mainland China and other Asian societies, and Confucian views are related to both of them. To support this endeavor, a framework is suggested that aims to guide this process.

“Sustainability from a Chinese cultural perspective: the implications of harmonious development in environmental management,” Ying Li, et al., Environment, Development and Sustainability, 2016 [40]
https://link.springer.com/article/10.1007/s10668-015-9671-9

Abstract:

Sustainable development has broad consensus in environmental science and policy discourse, but its implications differ in specific cultural contexts. This article articulates sustainable development from a Chinese cultural perspective by tracing ideas from Chinese traditional culture and exploring China’s concept of harmonious development with emphasis on environmental management. Ideas that resemble sustainable development are not new to Chinese culture, but have roots in ancient Chinese thoughts, which in turn influence current governance and policies. Notably, Chinese traditional philosophies such as Confucianism, Taoism, Legalism, and Yin–Yang contain philosophies fundamental to sustainable development. As a distinct local discourse, such concepts were well interpreted and understood in the ancient meaning of harmony, giving China unique sustainability perspectives with institutional implications for policies of harmonious development and environmental management. Currently, China is driven to create a new national identity of harmonious development that involves Chinese traditional philosophies and values in its modern administration. The slogans “harmonious society” and “Chinese dream” reflect this new way of responding to the world with the aspiration to achieve cleaner growth, personal prosperity, and social stability. The Chinese and Western roots of sustainable development are conceptually, ideologically, and historically different, and this paper articulates how the convergence of the two underlies contemporary international debates.

Current & Relevant Information:

Cultural influences are significant in effecting collective action in individuals (Nye 2004). This is a fundamental determinant of human’s relationship with nature. At one extreme is the desire to fully manipulate the natural systems, with disastrous consequences (Diamond 1997; Layzer 2012), and at the other end is a mediated and harmonious relationship of humans with nature.

Chinese culture has been evolving for thousands of years, and has not been impervious to outside influences demonstrating internal integration and external adaptation (Triandis 1996; Pan et al. 2012). There is no brand-new culture or institution in Chinese civilization. Consistent with this, the main theme of management philosophy in New China has been a mix of traditional Chinese culture as the core with modern Western management (Fan 1998; Zhang 2010). The widespread adoption of traditional cultural values and philosophies which has been inherent in the ancient Chinese state is now redeployed as part of the communist political project in various forms (Yang 2012). Most recently, this has taken the form of “soft power” (Nye 2004), in contrast to what has been a more militant and domineering “hard” approach (Zhang 2010). Soft power has been considered as a core concept in the Chinese cultural development framework. This concept was captured by the intellectuals and converted into “a new way to conceptualize and exercise power” (Wang and Lu 2008). Former President Hu (2007) stressed the importance of stimulating cultural innovation as part of the country’s “soft power”. The cultural development dimension in the current Chinese administration is a manifestation of “soft power”, which could be regarded as part of China’s comprehensive national power (Zhang 2010).

Soft power in China is interpreted as “using power softly” (Zhang 2010). In Chinese philosophy, there is a strong relationship between soft power and a harmonious world. Confucianism, the dominant Chinese ideology for over 2000 years, advocates leading by moral authority rather than force (Denecke 2010). Cultural power forms Chinese values and the way of living with the natural world. On the other hand, “hard power” is the legalistic tradition, exemplified by the first Emperor of Qin (259 BC–210 BC), which is also a recurring theme especially around dynastic changes when power was being consolidated (Peerenboom 2002).

Soft power is important in the context of the Chinese Government and Communist Party of China (CPC)’s approach to environmental problems as it provides a culturally acceptable adjunct to regulation and places it in an acceptable Chinese cultural context.

“Theology, Ecology and Economics from an East Asian Confucian Perspective,” Kok-Weng Chiang, Madang, June 2013 [41]
https://www.academia.edu/38645434/Theology_Ecology_and_Economics_from_an_East_Asian_Confucian_Perspective

Abstract:

This paper posits the development of an indigenous East Asian environmental ethics to address the environmental problem in East Asia for sustainable economic growth. It proposes a contextualized environmental ethics based on an integration of theology, ecology, economics and East Asian Confucian tradition. This can be done through three dimensions.

The first dimension is to understand the intricate interdependence and interconnectedness of society, environment and economy in the formulation of a

viable environmental ethics. Theological reflection and Herman Daly's concept of steady state economy will form the basis for understanding these relationships.

The second dimension is to establish how the three domains of society, environment and economy are related to each other. To these end the East Asian Confucian concepts of Heaven-Earth-Human, Social Harmony and Intergenerational Equity will be used to establish these relationships.

The third and final dimension is to identify the driving or motivation force that can operationalize this proposed environmental ethics. A transcendent-immanent Eco-Spirituality for effecting change (metanoia) in society will be proposed here.

Current & Relevant Information:

Introduction

In recent years, there is growing interest and recognition of the East Asian economies and their cultural contexts because of the phenomenal growth of their economies. 1) They are also being sought after as dialogue partners, because their traditions and religious ideas can inform and inspire new ecological theology, environmental ethics and grassroots activism. 2) East Asian religious cosmologies, with their originations from and relationships to the natural world, provide rich resources for encouraging spiritual and ethical discussion on the issues of God, man and creation. 3) Within East Asia's many religious cosmologies, the Confucian tradition is a good dialogue partner for reviewing the role of man in creation. 4) Confucianism's practical concern with social and ethical orders, can contribute to the construction of a workable environmental ethics, where economic development and growth must be both sustainable ecologically and responsible socially. 5) Confucianism with its emphases on interconnectedness with nature, intergenerational indebtedness to past generations and obligations to future generations, and communal responsibility towards the common good, provide an ethical framework for developing an environmental ethics that embraces sustainable development and restrained consumption.

This paper proposes an environmental ethic model involving theology, ecology, economics and East Asian Confucian tradition in three parts. The first part will be a theological reflection and critique on the current approach to society, environment and economy. The second part will be an exploration of the Confucian perspectives to society, environment and economy and economics with the view of developing a viable environmental ethics that is relevant to the East Asian context. The final part will be the operationalization of the proposed environmental ethics through a transcendent-immanent Eco-Spirituality for effecting change (metanoia) in human attitudes and actions.

Conclusion

The goal of the economy is to sustainably improve human well-being and quality of life. We have to remember that material consumption and GDP are merely means to that end, not ends in themselves. We have to recognize, as both ancient wisdom and new psychological research tell us, that material consumption beyond real need can actually reduce well-being. We have to better understand what can really contribute to sustainable human well-being, and recognize the substantial contributions of natural and social capital, which are now the limiting factors in many countries. We must acknowledge the importance of ecological sustainability. Ecological sustainability implies recognizing that natural and social capital are not infinitely substitutable, and that real biophysical limits exist to the expansion of the market economy.

The long-term solution to the ecological crisis is therefore to move beyond the growth at all costs economic model to a model that recognizes the real costs and benefits of growth. We need to break the addiction to over-consumption, and create a more sustainable economic model that focuses on quality of life rather than merely quantity of consumption. It will not be easy; it will require a new vision, new measures, and new institutions. It will require a redesign of society s worldview. Clearly, environmental ethic is about changing hearts and not merely better economic theory or improved technological. As such, we need to look at economy and ecology from a spiritual metanoia perspective, that is a transformation of hearts and minds. In this regard, our study of East Asian Confucianism shows that its inherent transcendent-immanent spirituality provides an inroad for this metanoia to take place. The next challenge is to construct a framework and formulate the approaches to bring about this transformation. This will be the subject of further studies.

"Environmental Education in China: Provisional Results and Characteristics," Jerry McBeath, cuny.edu, 12 October 2014 [42]
https://aacs.ccny.cuny.edu/2014conference/Papers/Jerry%20McBeath.pdf

Overview:

China's monumental environmental crises are no longer news, as for two decades they have stimulated headlines in the world press, hundreds of scientific studies and reports, attention of global governmental and non-governmental organizations (NGOs), and delicate diplomatic negotiations with global powers. Much less reported on are the attempts within the Chinese state system to learn from the mistakes of the past and to deal with the environmentally polluted present, through a formal and non-formal educational process.

Although the term "environmental education" (EE) had been used in the United Kingdom in the mid-1960s, the first definition of the concept was the product of the "International Working Meeting on Environmental Education in the School Curriculum" held in Nevada, USA in 1970. The co-sponsors of the event were

UNESCO and the International Union for the Conservation of Nature (IUCN). The definition, still in use in 2014 (but amended as education for sustainable development (ESD) and climate change education (CCE) were added in the evolution of the field), was adopted by the meeting participants:

> Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among man, his culture, and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behavior about issues concerning environmental quality.

In this paper we describe and analyze China's three-decade effort in environmental education. Initially, we titled it "failures and successes," but decided that was inappropriate—because ours is an exploratory survey and insufficient research has been done to establish final outcomes. Instead, we consider "provisional results" in both formal and informal domains of education.

Beginning with a brief discussion of the philosophical background to environmental education, we then treat the formal components of the system: the compulsory 1-9 public education system, post-secondary education and the "green university" concept, and the training of teachers. Following this we turn to the media and non-state actors (both business firms and non-governmental organizations [NGOs]), and the role they have played in environmental education. Then we point out two important variations of EE: 1) first, the ways in which China's geographic, ethnic, and income variability affect transmission of EE, and 2) second, variations evident across greater China. A brief penultimate section examines how difficulties of measurement complicate assessment of EE outcomes.

In the final section of the paper we ask, based on a survey of experts in the field, whether there are "Chinese characteristics" of environmental education.

Current & Relevant Information:

Confucianism is both a philosophical system and a social ethic. It envisions humans at the center of a universal system of values, and it most prizes relationships humans have with other humans and institutions created by them. Yet Confucianism is an exceptionally rich philosophical system, and has regularly been reinterpreted to meet changing exigencies of the times. Thus, although the Confucian ethic appears to be solidly anthropocentric, it also can accommodate higher-order animals and ecosystems.

Some may object to our use of Western models to analyze China's major philosophical tradition. We do this because not only did environmental education (EE) and education for sustainable development (ESD) develop in the West, but also in affluent Western nations there is a high degree of awareness of environmental problems and established research into the ideological and philosophical roots of environmental degradation. Conducting a brief and preliminary analysis of the Confucian canon, we can identify elements that could be considered anthropocentric, sentientist, and eco-centric in orientation. Overall and unlike many of the dominant historical environmental paradigms in the West, Confucianism appears to be at least a "weak" anthropocentric environmental ethic. Recent additions to the canon and authors in the neo-Confucian tradition have cosmic dimensions; the tianrenheyi concept of Confucianism may add to an emerging global environmental ethic that emphasizes sustainability.

The revival of Confucianism in China leads some observers to think (wishfully) that it will have a decisive impact on popular attitudes toward environmental change and direct people toward pro-environmental behavior. This would be in error because the gap between thought and action is broad and deep. Nevertheless, Confucianism is a rich and complex philosophical and ethical system; over the centuries it has adapted well to social, economic and political changes. China may become more pluralistic in the future, which would open up avenues for Confucian influences. Of the five different analytical strains of Confucianism developed by Rozman, the "reform" version has great promise in stimulating the transformative nature of Confucianism to address the large environmental problems that China confronts.

"Towards an Ecological Civilization: Perspectives from Daoism," L. Allen Doyle, IV, Journal of Daoist Studies, 2020 [43]
https://www.academia.edu/43429192/Towards_an_Ecological_Civilization_Perspectives_from_Daoism?auto=download

Abstract:

The concept of "Ecological Civilization" (shengtai wenming 生态文明) provides a vision of the future that promotes a human flourishing that is fundamentally intertwined with the well-being of the earth and its systems. Although this phraseology has a global reach, it has gained the most traction in China. Its rapid ascent as a dominant philosophical and political paradigm in China is contextual both to China's ideological heritage and current needs.

A major task of both scholars and party-members has been framing the Ecological Civilization agenda in the context of Classical Chinese thought. However, most efforts deploy a syncretic vision of Chinese traditions, avoiding any close readings of texts or traditions. This paper response to this void in the literature, reading the Daoist canon through the lens of Ecological Civilization.

Current & Relevant Information:

What is Ecological Civilization

A brief discourse on Ecological Civilization is necessary before diving into the Daoist literature. The phrase first appeared in 1985 when a Chinese journal translated and published a Russian environmental article (Goron 2018, 41). The following two decades saw only sporadic use of the phrase, but these usages lack any unified voice. It was not until 2007 at the 17th Communist Party Congress (CPC) that the term was galvanized as a specific ideological concept (Shuai 2018, 1-2). This idea quickly gained political momentum, and in 2012 it was adopted into the Chinese Communist Party's constitution (Gare 2017, 136); by 2018 the phrase Ecological Civilization was ratified in the Constitution of People's Republic of China (Goron 2018, 41).

As significant as this idea has become in China, however, Mette Hansen notes that the concept of Ecological Civilization "may still sound obscure to readers unfamiliar with Chinese political discourse and civilization campaigns" (Hansen, et. al, 2018, 195). But as Goron notes, "the concept has received increasing attention, especially since the Trump administration pulled the United States out of global environmental governance" (Goron 2018, 39). Therefore, as Ecological Civilization becomes a dominate paradigm of sustainable development globally, it is invaluable to know what is meant by the phrase – as well as its political and philosophical baggage.

Two-legged philosophical stool

The notion of Ecological Civilization in China emerged from two distinct needs (Douglas 2008). Firstly, China was facing an unprecedented ecological crisis. Industrial environmental degradation had created a public health crisis that was threatening the legitimacy of the CPC (Hansen & Liu, 2017). It was necessary to mitigate the negative impacts of unfettered industrialization. Thus, a radical transformation of development models and governance was needed. The CPC realized it needed to shift away from their former rubrics of success (primarily GDP) towards a new assessment tool, one that incorporates environmental integrity (Rapoza 2013). Beginning in 2008, the PRC implemented robust environmental legislation, facilitated a vibrant environmental NGO community, opened an eco-centric judiciary, and began a propaganda campaign to promote this new environmental focus. The terminology chosen to describe this new agenda was, of course, Ecological Civilization.

Secondly, and in tandem with the ecological crisis mentioned above, the CPC needed a new socio-technical imaginary to replace an ideology of exponential growth and consumerism (Hansen et. al, 2018, 202). Ecological Civilization provided this new imaginary. However, as with all Chinese political ideologies, these ideologies need be presented as uniquely Chinese. This is often done by attaching the phrase "with Chinese characteristics" to an extant political idea. In many ways, Ecological Civilization could be considered Sustainable Development with Chinese Characteristics.

The task then becomes delineating Ecological Civilization from other models of sustainability. The tactic most commonly deployed in this posturing is to draw off of the longevity of Chinese Civilization in general, its rich philosophical/religious heritage in particular. By rooting Ecological Civilization in this ancientness, it gains legitimacy. Whereas sustainable development is presented as a new phenomenon, Ecological Civilization highlights the ancient wisdoms of China – wisdoms that had been largely ignored since the Cultural Revolution. Thus, Ecological Civilization has simultaneously depended on classical Chinese thought and been a paramount agent in its revival.

Comparative analyses between Ecological Civilization and traditional Chinese thought proliferate. However, this scholarship is largely uncritical – syncretizing seven Chinese traditions that have strong resonances with constructive postmodernism. In his article, "The Greening of China" Jay McDaniel notes the particularities of each – articulating the idiosyncrasies of the I Jing, Confucianism, Philosophical Daoism, Chinese Buddhism in the Hua Yen tradition, Chinese Buddhism in the Ch'an tradition, and Traditional Chinese medicine (McDaniel 2008, 282-83). Of these 7 however, proponents of Ecological Civilization have drawn on Confucianism and Daoism the most.

Coraline Goron argues that the majority of the philosophical rhetoric surrounding Ecological Civilization is Confucian, focused on the values of "harmony between man and nature" (Goron 2018, 42). She then goes on to claim that "other traditional concepts of nature-society relations such as the more eco-centered Daoist concepts… were never given equivalent discursive space" (Goron 2018, 42),

Although Confucian rhetoric might be preferenced, one should not discount the influence of Daoism in constructing the Ecological Civilization narrative. Arran Gare goes so far as to say that "proponents of ecological civilization are encouraging also a revival of the more radical Daoist traditions" (Gare 2017, 137). These advocates of Daoism are not just tertiary political players, however, but include President Xi Jinping himself, who in a 2014 speech described Daoism as "natural, stated that Daoism deeply affects the lives of Chinese people, and appealed to Laozi" (Schönfeld & Chen 2019, 11).

At another talk in 2015, President Xi, when discussing water quality, "quoted verbatim from the Daodejing" (Schönfeld & Chen 2019, 11). Xi Jinping, and the CPC by extension, believe that Daoism in particular "is a resource for constructing an Ecological Civilization" (Schönfeld & Chen 2019, 11). The value of Daoism in the Ecological Civilization project is not only limited to China however, for "the revival of Daoic thought generally is important not only for China but for the world" (Gare 2017, 136). Both Gare and Schönfeld believe that Daoism's utility in the Ecological Civilization movement is far greater than a propaganda technique, or attempts to co-opt legitimacy from China's philosophical genealogy. Instead, they both submit that Daoist thought is ideally postured to facilitate the paradigm shifts necessary to prevent our imminent ecological crisis. If this claim is true, then it is vital to engage the Daoist canon more directly. In doing so, I submit that critical insights for the longevity of life on Earth will emerge.

Perspectives from Daoism

As noted earlier, Daoism is often considered the “greenest” philosophical traditions (Schönfeld & Chen 2019, 1). Of course, this ecological orientation is critical in understanding the relevance of Daoism in Ecological Civilization construction. However, it is important to delineate a Daoist reverence of earth-systems from “environmentalism” as understood in the West. Thus, more recent scholarship has attempted to reframe and decolonize the Daoist ecological ethos (Mille 2017, xxii). In doing so, Miller and Scönfeild both submit that a Doaist cosmology - with its lack of cartesian dualism and “soft-anthropocentrism” - posture Daoism as the ideal mechanism for implementing the Ecological Civilization agenda.

Although the ecological currents throughout Daoism are quite apparent, its position on Civilization construction is much more complex. This is in part due to erroneous attempts to describe Daoism as anarchic (Graham 2001, 170). Although Daoist visions of civilization are much more critical than other Chinese traditions, both the Zhuangzi and the Laozi maintain the necessity of the state. This is particularly evident in the Daodejing, which many sinologists believe was written as leadership strategy guide for statesmen (Graham 2001, 170). Although the Zhuangzi is written with a more reclusive tenor, it too includes Utopic visions of civilization (Graham 2001, 170-71). These visions are simultaneously aspirational and nostalgic, deploying ancient Chinese persons and practices to promote its contemporary vision. These myriad appeals, although quite distinct in presentation, share two common themes. Firstly, they draw off a sentimentality for the eras predating the Warring States. Secondly, there is an assertion that these ‘better times’ were in fact because Chinese civilization (particularly its leadership) was once more in tune and cooperative with natural processes.

Because the primary imaginary for a Daoist civilization is contextualized to the Warring States era, it is valuable to better understand the brutality of this era. Roger Ames spoke to this in the introduction to his translation of Daodejing, noting that “as time passed, internecine warfare raged with escalating ferocity among the contenting states of the central plain… For generation after generation, death became a way of life” (Ames & Hall 2004, 1). This horrific scene is this context in which both the Laozi, and then later the Zhuangzi emerged. These Daoist writings were but a small percentage of the attempts to bring stability and peace to the Chinese countryside through philosophical discourse. The myriad ideologies that emerged during this era are collectively known as the Hundred Schools of Thought. Although each presented a distinct cosmology and ethic, their objectives were unified.

Confucianism, in constructing its socio-political imaginary, appealed to the Zhou Kings – a mythical trio of sages who had ruled a unified China centuries earlier. Confucius submitted that a reclamation of a Zhou era value system could facilitate the radical paradigm shift necessary to bring an end to the violence (Ames & Rosemont 1999, 2-3). However, the Daoist authors looked elsewhere for their imaginary, appealing to hermit-sages who governed non-coercively in alignment with natural processes and circumstances.

This Daoist vision of governance, although quite distinct from the contemporary realities of the Chinese Communist Party, strongly resonates with the articulated socio-political imaginary of Ecological Civilization. Additionally, there is a commonality between the unique contexts in which Daoism and Ecological Civilization emerged. In both circumstances, Chinese persons were faced with an existential threat to the longevity of Chinese civilization. In the Warring States era, this threat was sectarian violence; in modernity, this threat is environmental degradation and climate change. Likewise, both provide an aspirational imaginary, a pragmatic assessment of modernity, and an appeal to ancient Chinese thought.

Conclusion

Beyond mere affinity, Daoism has a lot to offer the project of Ecological Civilization. This is because of its historicity of efficaciousness. The original project of Daoism emerged from and responded to existential threats; likewise, contemporary Daoists are already concentrating their efforts on confronting our ecological crisis (Lemche & Miller 2019, 580). For persons in this Daoic continuum, no paradigm shift is needed (Schönfeld & Chen). However, for those of us outside of a Daoist sphere of influence, the shift towards Ecological Civilization requires more effort. The necessity of this paradigm shift is exasperated by the fact that “the environmental movement in the West has by and large been a failure” (Miller 2017). Thus we must look elsewhere, and the ecosmology of Daoism is aptly suited for such work. James Miller concludes his book with the hope that this form of Daoist-ecological “discourse can play a role in shaping China’s conception of an ‘ecological civilization’ in a way that has relevance not just for China but for the global environmental movement” (Miller 2017). And that through this reintegration of nature and culture, we will see transfiguration of life on Earth in an unceasing process of transformation and flourishing” (Miller 2017). This reintegration of nature and culture is the root of a Daoic vision for Civilization construction. And this Daoic vision is synonymous with the present Ecological Civilization imaginary. If there is to be any hope for the construction of an Ecological Civilization, it must rest firmly upon the foundations of Daoist thought.

“China’s Eco-Civilization: From History to Policy,” R. James Ferguson, Bond University, 1 March 2019 [44]
https://pure.bond.edu.au/ws/files/32010659/AM_China_s_Eco_Civilization_chapter_from_A_Discourse_on_Economic_Development.pdf

Abstract:

The modern Chinese public has demonstrated a growing ecological awareness, driven in part by the impact of rapid industrialization and related pollution trends that have directly undermined societal health and well-being. The PRC government recognizes the real costs of environmental degradation in the face of rising energy needs and societal expectations unleased through the “China Dream” of recent years. The linking of large segments of economic, energy, developmental, social and foreign-relations policy under an integrated rubric had already emerged via earlier “harmonious society” and “harmonious world” doctrines. This approach has gained extended government endorsement under Xi Jinping through 2013–2018. The construction of an Ecological Civilization, first formally taken up from 2007, has now been given the status of a National Development Strategy and has been further embedded in the 13th Five-Year Plan for 2016-2020 and gained extra endorsement in major meetings of the CPC (Chinese Communist Party) and the NPC (National People’s Congress) in early 2018. Behind this debate stands the long-term engagement of Chinese civilization with its environmental and productive base. Renowned as pioneers in irrigation and agricultural expansion, early Chinese states developed philosophies directly supportive of agriculture as the “root” on which the other branches of the society and state were established. The difficulty of maintaining a large peasant (farming) population on the land without excessive human and environmental exploitation, however, became a major dilemma for all imperial dynasties. This tension has found expression today in the challenge of providing food security and rural livelihoods during periods of intensified industrialization and urbanization. This will remain one of the major challenges for a truly Ecological Civilization in the 21st century, whether in China or elsewhere.

Current & Relevant Information:

Although efforts have been made to link current ecological needs with traditional notions of harmony between humans and nature, as found in Confucianism and Taoism, this link is somewhat indirect. The logic of Confucianism argues that humans were enmeshed within a Heaven-Human-Earth triad and that the creative collaboration of these three forces indicated the conditions of good governance (Ferguson amd Dellios 2017a). This suggests that governance had to concern itself with cosmological factors that shaped the wider human environment, while for neo-Confucian thinkers such as Zhang Zai (1020-1077), the Earth was seen as the “mother,” and humans should have a concern for all creatures and things as companions (Li 2003). These connections have since been revived by thinkers such as Tu Weiming, seeking to build bridges between contemporary Confucian ethics and new models of human development (Tu 2004; Dellios 2018). However, the Heaven-Human-Earth triad is more a cosmological conception than an ecological one, with limited understanding of underlying biological processes. Likewise, government promotion of a Beautiful China (UNEP 2016) is as much based on aesthetic and marketing grounds as on environmental ones (Yao 2014). Building a positive eco-civilization needs to go beyond these general orientations. It requires a complex understanding of dynamic interactions amid changing ecological conditions, evolving human developmental needs, and the complex web of political interactions that constitute national resilience and global governance.

For traditional Chinese political thought agriculture rather than industry or trade always remained the first branch or root of the wealth of a kingdom, views put forward by Confucius and thinkers such as Jia Yi of the second century BCE. This would influence Han and later imperial institutions, with agronomy the foundation (ben) as a science of state and the basis of legitimate rule (Bray 2008; Shouyi 1982). Likewise, various strands of Taoist thought saw in the small village the prototype of the largest natural human community, and thinkers such as Xu Xing (Hsü Hsing), a contemporary of Mencius, promoted the idea of communism and agricultural socialism (Mei 1934). The Mohists, too, argued for agriculture as the basis of society and for frugal, utilitarian government that would not waste human lives or effort (Watson 1958). A direct recognition of the fundamental role of agriculture and need to maintain a stable government and farming population is found in the Analects of Confucius (12.11) where Duke Jing of Qi asks about proper government. Confucius replies: "Let the ruler be a ruler, the subject a subject, the father a father, the son a son." In other words, the ruler and ruled should take on the necessary roles and responsibilities for a functioning society. The questioner, the Duke of Jing, then replies to Confucius: "Splendid! Truly, if the ruler be not a ruler, the subject not a subject, the father not a father, the son not a son, then even if there be grain, would I get to eat it?" (Confucius 2012). This principle, known as the "rectification of names," implies that a failure to live up to social roles would result in political and economic chaos. Failures in planting, harvesting and distribution of staples for any reason, including droughts, floods and wars, were a disaster for any dynasty (Dellios and Ferguson 2013).

5. European Culture:

"The cultural politics of climate change discourse in UK tabloids," Maxwell T. Boykoff, ResearchGate, June 2008 [45]
https://www.researchgate.net/publication/222515098_The_Cultural_Politics_of_Climate_Change_Discourse_in_UK_Tabloids

Abstract:

In the United Kingdom (UK), daily circulation figures for tabloid newspapers are as much as ten times higher than broadsheet sources. Nonetheless, studies of media representations of climate change in the UK to date have focused on broadsheet newspapers. Moreover, readership patterns correlate with socio-economic status; the majority of readers of tabloids are in 'working class' demographics. With a growing need to engage wider constituencies in awareness and potential behavioral

change, it is important to examine how these influential sources represent climate change for a heretofore understudied segment of citizenry. This paper links political geographies with cultural issues of identity and discourse, through claims and frames on climate change in four daily ‘working class’ tabloid newspapers in UK e The Sun (and News of the World), Daily Mail (and Mail on Sunday), the Daily Express (and Sunday Express), and the Mirror (and Sunday Mirror). Through triangulated Critical Discourse Analysis, investigations of framing and semi-structured interviews, this project examines representations of climate change in these newspapers from 2000 through 2006. Data show that news articles on climate change were predominantly framed through weather events, charismatic megafauna and the movements of political actors and rhetoric, while few stories focused on climate justice and risk. In addition, headlines with tones of fear, misery and doom were most prevalent. These analyses then enable discussions of how these representations may influence ongoing climate science and governance interactions as well as political geographies, and (re)-shape the contemporary cultural politics of climate change discourse.

<u>Current & Relevant Information:</u>

Discussion

The framing of news content as well as tone of headlines analyzed here combine with previously mentioned elements of tenor, breadth and depth to provide insights into how features media representations can influence potential engagement with the issue of climate change. These dynamic and interacting factors can be illustrated through three representative cases: (1) an illustrative moment, (2) an influential actor, and (3) a guiding theme. The first example draws on synchronic analyses while the other two focus on diachronic explorations. First, in a 6 December 2000 issue of the Daily Mail, Julian Champkin (2000) wrote an article that began, ‘‘Whatever happened to desert Britain; Three years ago, experts were queuing up to tell us our climate was becoming ever hotter. How could they have got it so wrong?’’ The piece continued:

> Yet it was only four years ago that experts were queuing up to forecast that temperatures would consistently rise and lead to dustbowl droughts. They had pointed to evidence that greenhouse gases (from car exhausts and factories) would change the world’s atmosphere by trapping the sun’s heat in an invisible blanket around the Earth. At the same time, harmful gases, such as CFCs given off by fridges and aerosols, were blamed for thinning the ozone layer and increasing the intensity of the sun’s rays. So, what has happened to those desperate predictions? The truth is that those who believe in global warming claim that the storms we have been experiencing are all part of the same pattern: the world is heating up, which creates a mixture of droughts, devastating spring floods and violent winter storms. They warn that these will be regular features of Britain’s weather over the next 100 years. On the other hand, those experts who

> disagree with global warming believe that the unpredictable weather is because the Earth is going through a phase of cooling linked to a scarcity of sunspot activity. So, what for the future? The Met Office will not commit itself. So, look at these ‘then’ and ‘now’ pictures, marvel at our changeable climate - and treat with due skepticism the claims of all those so-called experts who pretend to know what is really happening (p. 10).

Through a combination of opinion-driven reporting with satirical tones, sensationalized villains (the Met Office as ‘so-called experts’), and skeptical claims and frames, the piece casts doubt on the legitimacy of scientific assertions, and specifically the veracity of claims regarding anthropogenic contributions.

A second illustration can be drawn from some representative quotes from frequent Daily Mail journalist and columnist Michael Hanlon. Hanlon wrote on 8 April 2003 ‘‘it is still too early to say for certain whether we are looking forward to a greenhouse hell - or whether the story of global warming is no more than a load of hot air’’ (Hanlon, 2003: p. 17). In a 15 September 2004 commentary entitled ‘Global warming? No, just hot air from politicians’, he wrote, ‘‘the threat from climate change is still largely unproven. For all their posturing over their green policies, Tony Blair and Michael Howard may find they have declared war on an enemy that doesn’t exist and instead of weapons of mass destruction, we now have weather of mass deception’’ (2004: p. 12). Throughout the seven-year period of study, Hanlon espoused consistently contrarian views on climate change. As another example, on 15 January 2005 he wrote an article called ‘The Great Climate Conspiracy’ on Michael Crichton’s novel ‘State of Fear’, and stated:

> It takes a brave man to challenge this consensus; to point out that, despite the cries from the environmentalists, there is actually very little scientific agreement about whether any of these extreme weather events can be blamed on anything other than normal and natural variation. Step forward Michael Crichton, (his) new work, which essentially says that the global warming panic is no more than a modern myth, has not made him many friends. Yet what is happening is pernicious and sinister. Climate change has now become a global industry, with a multibillion-pound budget, and hundreds, if not thousands, of scientists whose careers are predicated upon their agreement with the central thesis: ‘Climate change is real, Man is causing it; it’s going to get worse and we are going to have to do something about it otherwise there will be hell to pay.’ This is why you hear little from those who don’t believe e or at least are skeptical about e this theory. It is difficult to get hard and fast statistics, for instance, in just how far sea levels have risen in the past century (2005: p. 48).

Hanlon is among a handful of journalists in these UK tabloid newspapers who has written most on this issue. Consequently, his voice e though often counter to widespread views in the climate scientific community e is influential.

A third example draws attention to guiding frames that bound and shape perceptions, and places this in a wider context of narratives through reference-dependent perceptions (Kahneman & Tversky, 1973). It interacts with themes of ‘non-problematicity’ in sociology literature (Freudenburg, 2000), and Festinger’s (1957) notion of cognitive dissonance in psychology in that tension arises when there are inconsistencies between beliefs and behaviors. Instead of modifying discourses or actions to mesh with beliefs, in fact beliefs are adjusted to cohere with behaviors or articulations. In this case, considering regional warming as a welcome change becomes an adaptive strategy where the adaptation action is inaction. To illustrate, Zoe Nauman (2001) wrote a 2001 piece for the Express entitled, ‘On balance, the weather’s going to be wonderful’ (p. 17). As another example, Clare McKeon (2001) commented in the Sunday Mirror:

> The consequences of global warming are supposed to be dire for everyone on the planet. Mediterranean regions will become like central Africa, and will be too hot to visit. Water temperatures will rise and the Gulf Stream will alter its course. Well, October has been the warmest one on record, and it’s been wonderful. Long balmy days with wonderful mild weather and sunshine. I planted tomatoes late this year and all the know-alls told me ‘‘They’ll never ripen.’’ Guess what, they did, and this week and last, I have had an abundance of sweet organic tomatoes. Global warming can’t be all that bad (p. 27).

This particular news frame focuses on meteorological frames that consistently dominated coverage across time and newspapers, where reporting focuses on how warmer weather would be considered welcome in the UK context. Comments such as these, noted through illustrations also provided above, are consistently evidenced in the UK tabloids in the period of analysis.

The UK context is one where class remains a significant part of identity and culture, as captured somewhat by aforementioned NRS readership figures. An October 2007 Guardian/ICM poll showed that, ‘‘Britain remains a nation dominated by class division, with a huge majority certain that their social standing determines the way they are judged’’ (Glover, 2007: p. 1). Among the findings, class identity remained an important facet of UK society, as 53% of respondents considered themselves working class and 89% of people felt that people are still judged by class. Amid great nuance and complexity regarding class position and associated perspectives on a range of political, economic, cultural, societal and environmental issues, thinking through class in relation to media representations of climate change issues is useful. Specifically considering class issues and UK tabloid news coverage, Mirror journalist and interviewee Mike Swan said, ‘‘We are very conscious of our readers’ lives…something like [carbon] taxes on flights are going to hit our readers a lot harder than broadsheet readers’’.

The cultural politics of climate change are dynamic and contested spaces battled out by various actors. Through various frames and claims, non-nation state actors - from mass media to celebrities to NGOs and businesses - influence ongoing climate science, governance and public understanding. In this new millennium, climate-related discourse has increasingly pervaded the lexicon. For instance, the New Oxford American Dictionary word of the year for 2006 was ‘carbon neutral’. Editor-in-chief Erin McKean said, ‘‘The increasing use of the word carbon neutral reflects not just the greening of our culture, but the greening of our language. When you see first graders trying to make their classrooms carbon neutral, you know the word has become mainstream’’ (Oxford University Press, 2007). Competing with, and perhaps complementing the discursive traction of ‘carbon neutral’, Merriam-Webster named ‘truthiness’ their 2006 word of the year (Gorlick, 2006). ‘Truthiness’ - a term coined by US-based satirist Stephen Colbert e signifies contested spaces where ‘the truth’ is defined and maintained, thereby shaking one’s belief in ‘objectivity’. Through the cultural resonance of this term, Colbert has tapped into an increasingly recognized space of claims-makers and their claims about truth. Together, these decorated terms mark the visible interactions taking place in this high stakes and dynamic arena of carbon-based industry and society. Key actors within climate science, policy and the public e often via the mass media e have waged pitched battles over varying meanings relating to humane environment interactions. Scientific findings on climate change are not ‘the truth’ translated, but rather offerings of legitimized ‘truthiness’ for critical inputs into multiple scale climate governance.

Conclusions

Through this case-study of UK tabloid press coverage of climate change, this paper unpacks and interrogates frames and practices that shape conceptions of this ‘truthiness’ in context. It has evaluated frames and tropes that pervade daily print media coverage in the four working-class UK newspapers - The Sun (and News of the World), Daily Mail (and Mail on Sunday), the Daily Express (and Sunday Express), and the Mirror (and Sunday Mirror) - in order to assess how these representations may influence the contemporary cultural politics of climate change discourse. Through these analyses, the paper has sought to both outline the articulations as well as the silences that contribute to particular ways of knowing through time. Climate change science, policy and public activities clearly continue to shape media reporting; however, journalism - specifically UK tabloid press coverage - in turn shapes ongoing discourses on climate change.

UK tabloids have played important roles in other science, technology and environment issues: along with the aforementioned examples is the 2008 ‘banish the (plastic) bags’ campaign by the Daily Mail (Humphrys, 2008). Therefore, these findings are relevant to ongoing examinations of how media representational practices may contribute - in non-linear and dynamic ways - individual to community- and international-level perceptions of climate science and governance as well as pressure for climate mitigation or adaptation actions. Particularly, this case of UK tabloid portrayals of climate change is vital, given high circulation of these sources and their primarily working-class readership.

Embedded in these analyses is recognition of the need for ongoing work that links political geographies with cultural issues of identity and discourses (Marston, 2004). In a study of climate change and conflict, Norda's and Gleditsch (2007) called for further work to disaggregate and map more subtle factors that contribute to differentiated vulnerability through climate change. Moreover, these analyses complement associated work in political geography across other socio-economic contexts and environmental issues, such as Miller's (1997) investigation into defense investments in Massachusetts, Harrison's (2006) analysis of pesticide regulations in California agriculture, and Kurtz's (2003) work in citing a polyvinylchloride production facility in rural Louisiana. This endeavor can be further situated within discursive and material interrogations: while political and spatial contexts shape imaginaries and discourses, media representations and translations (re)constitute and maintain material conditions over time (Bialasiewicz et al., 2007; Cox, 1998).

Ultimately, this project seeks to contribute to more-textured investigations of media coverage of climate change, and thus, explorations of the cultural politics of climate change discourse. This paper has examined various contributions - from articulations to silences - that (re)shape and (re)configure discourses. It works in accordance with Dalby (2007), who has written about the importance of examining framing processes and their effects of marginalizing some discourses while contributing to the entrenchment of others. This work has engaged with questions that then relate to what the emergent media representations mean for ongoing climate science-policy - public interactions as well as political geographies. Re-configuring (or re-organizing) discourse can open up new possibilities for climate change action (Swyngedouw, 1992). Media translations and interpretations here are not viewed as reified markers of culture, but rather windows into the processes that contribute dynamically to the formation and maintenance of cultural identity as well as the cumulative characteristics of society (Maleuvre, 2004). While working-class segments of the population have been of secondary importance in science-policy analyses, examinations such as these need to take on a more central role: these citizens are differentially impacted by 'modern global climate change', and are potentially critical contributors to calls for improved climate policy governance.

"Guiding principles for adaptation to climate change in Europe," Andrea Prutsch, et al., European Topic Centre on Air and Climate Change, November 2010 [46]
https://www.eionet.europa.eu/etcs/etc-cca/products/etc-cca-reports/etcacc_tp_2010_6_guid_princ_cc_adapt-1/@@download/file/ETCACC_TP_2010_6_guiding_principles_cc_adaptation.pdf

Abstract:

This report is the result of the work done in Task 2.1.3.2 of the Implementation Plan 2010 of the European Topic Center on Air and Climate Change (ETC/ACC): 'Guiding principles on adaptation'. This study was led by the Environment Agency Austria (UBA-V) in cooperation with the Potsdam Institute for Climate Impact Research (PIK) and the Environment Agency Germany (UBA-D) within the ETC/ACC. The work was coordinated by André Jol and Stéphane Isoard from the EEA.

The aim of the study is to provide a starting point for further work by EEA and/or other organizations on identifying success factors and case studies on how good adaptation could work in practice at various governance levels and in different sectors. In order to achieve this, the paper presents a set of guiding principles for good adaptation in Europe and therein identifies specific elements that support its successful implementation. Furthermore, it illustrates a few practical examples that are meant to highlight how certain aspects presented in the guiding principles can be put into practice.

The guiding principles presented in this paper build on a comprehensive literature review, a comparison of national adaptation strategies, expert judgements and good practice examples.

<u>Current & Relevant Information:</u>

Since several years, the EU and its Member States have undertaken proactive adaptation actions by developing strategies based on future climate change projections. A number of EU Member States have adopted national adaptation strategies or are in the process of doing so. In addition, the European Commission published a White Paper on adaptation to climate change (EC, 2009a/b). It sets out a two-phase strategy that complements actions taken by Member States through an integrated and coordinated approach. In the first phase (until 2012) mainstreaming of climate change in key EU policies will start and by 2013 an EU climate change adaptation strategy will be developed.

Even though adaptation is still a relatively new concept, some methodological approaches for designing and implementing adaptation actions have been published (Willows & Connell 2003; Lim et al. 2004, Kropp & Scholze 2009; ICLEI 2008; UNECE Water 2009). The European Commission prepared guidelines on how to include climate change into river basin management plans (European Communities, 2009c) and performed a study for possible guidelines on developing regional adaptation strategies (Ribeiro et al. 2009). The European Centre for Disease Prevention and Control prepared guidance on climate change and communicable diseases (ECDC, 2010).

Nevertheless, for most countries in Europe and also at the EU level widely acknowledged guiding principles for all levels of decision making are still lacking. It should be noted however that some of the existing national adaptation plans (e.g. Germany) and regional/local plans (e.g. city of London) include principles of good practice in adaptation. In addition, the UK, as a frontrunner in adaptation, has published Defra´s Climate Change Plan 2010, including key principles, that Central government as well as organizations in the wider public and private sectors shall take account of (HM Government, 2010):

• Any adaptation needs to be sustainable. This means that our responses should not add to climate change, or limit the ability of other parts of the natural environment, society or business to carry out adaptation elsewhere. Our responses must avoid any detrimental impacts on other parts of society, the economy or the natural environment.

• Actions should be flexible. Although there is still uncertainty over the future climate, we should consider options now and make decisions that maximize future flexibility – in many cases it is failure to take decisions that locks us into inflexible pathways.

• Action needs to be evidence-based – making full use of the latest research, data and practical experience so that decision-making is well-supported and informed.

• Our response to climate impacts should be prioritized – for example, by focusing more attention on policies, programs and activities that are most affected by the weather and climate, those which have long-term lifetimes or implications, where significant investment is involved or high values are at stake, or where support for critical national infrastructure is involved.

• Adaptation measures need to be effective (reducing the risks from climate change without introducing perverse effects), efficient (the long-term benefits of adaptation actions should outweigh the costs), and equitable (the effects of the activity on different groups and where the costs should fall should be taken into account).

These general aspects from the Defra´s Climate Change Plan 2010 can be taken as an overall framework in which any good/successful adaptation should take place.

Yet, there is no commonly agreed definition of “good” or “successful” adaptation. In the broadest term, one can speak of good/successful adaptation when the objectives of adaptation are reached without negative impacts for others (Adger et al. 2005). This definition clearly focuses on the outcome of adaptation activities. Most of other definitions for good/successful adaptation rather highlight key success factors for the adaptation process (Frankhauser et al. 1999, Smith & Lenhart 1996, Lemmen et al. 2008). One can expect though that taking these factors into account and tailor them to site-specific conditions will enhance the chance of reaching good adaptation outcomes.

“Assessment of the potential of ecosystem-based approaches to climate change adaptation and mitigation in Europe,” Sandra Naumann, et al., Environmental

Change Institute, 23 November 2011 [47]
https://www.researchgate.net/profile/Sandra_Naumann/publication/272352073_Ecosystem-based_Approaches_for_Climate_Change_Adaptation_and_Mitigation/links/54e24c360cf2edaea092b1cc.pdf

Summary:

Addressing the effects of climate change via adaptation measures and the implementation of mitigation measures is central to ensuring continued ecosystem functioning, human health and socio-economic security. Ecosystem-based approaches have emerged as a key instrument to confront these concerns across sectors of business and society, offering multiple benefits in a potentially cost-effective manner.

The concept of an 'ecosystem-based approach' builds on the Convention on Biological Variability's (CBD) definition, stating that: "the ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way" and which aspires to maintain the natural structure and functioning of ecosystems. Ecosystem-based approaches address the crucial links between climate change, Biological Variability, ecosystem services and sustainable resource management and thus have the potential to simultaneously contribute to the avoidance and reduction of greenhouse gas emissions and the enhancement of sinks - inter alia - through increased carbon sequestration. These approaches also maintain existing carbon stocks, regulate water flow and storage, maintain and increase resilience, reduce vulnerability of ecosystems and people, help to adapt to climate change impacts, improve Biological Variability conservation and livelihood opportunities and provide health and recreational benefits.

Applying this definition, this study aimed to address current knowledge gaps regarding the uptake and implementation of ecosystem-based approaches and thereby gain a better understanding of their role and potential in climate change adaptation and mitigation in Europe. A database of 161 applicable projects, five in-depth case studies, targeted interviews with European Commission officials and a literature review served as the basis for this assessment. Using these sources, this study sought to illuminate the success factors leading to and obstacles hindering the implementation of ecosystem-based approaches in climate change programs at local, regional, national and transnational levels and provide appropriate recommendations for overcoming existing obstacles. Furthermore, evidence on the costs and benefits of ecosystem-based approaches has been collected and compared to the costs and benefits of traditional engineered approaches for addressing climate change and its impacts.

The breadth of projects identified for the database, which employ ecosystem-based approaches, enabled several overarching observations to be drawn. The frequent cross-sectoral nature of such approaches, for example, place these projects in a position to potentially contribute to a range of EU, national and regional policies within the area of climate change adaptation and mitigation. However, little specific mention of ecosystem-based actions or evidence of ecosystem-based adaptation and mitigation actions was found in EU level documents, although there was recognition that ecosystem-based actions often provide multiple benefits including mitigation. The most frequently mentioned ecosystem-based actions within the country and sector documents were creating or maintaining protected areas and ecological connectivity and using ecosystems as carbon stores. At a national level, evidence of concrete adaptation actions was found in just less than half of the country level reports and evidence of mitigation action was given in the majority of cases in which measures were discussed. Ultimately, the review shows that many good examples of ecosystem-based approaches to adaptation and mitigation exist and their implementation needs to be promoted, such that there is a move from theory to practice and potential synergies are exploited.

The research has also identified a number of factors leading to and obstacles hindering the successful implementation of ecosystem-based approaches in climate change programs. Given the relatively small knowledge basis regarding these approaches, a host of challenges are created relating to the technical task of designing and implementing effective strategies, capacity issues regarding institutional, financial or technical resources, organizational challenges related to the need to bring together a wide variety of practitioners and stakeholders, behavioral issues arising from the power of habitual modes of practices and political and socio-economic barriers. In order to overcome these challenges, several factors were identified, including: project management experience amongst the staff, clear delineation of roles and transparent communication among project partners; stakeholder consultation and participation processes from the planning phase onwards; awareness raising about the current threats posed by climate change and Biological Variability loss and the employed ecosystem-based approaches to address these threats. Highlighting the multiple benefits of the proposed project, which are linked to ecosystem-based approaches is key within this context.

Regarding costs and benefits, the lack of quantitative data made it difficult to fully assess these aspects in association with ecosystem-based approaches. While data on the financial costs related to the projects are generally available, the benefits are largely expressed in qualitative terms (e.g. habitat protection, recreational opportunities etc.). This indicates the need to commission detailed valuation studies at the project level. However, the available evidence indicates that the majority of projects using ecosystem-based approaches can be considered as beneficial from an economic point of view if one takes account of their long-term social and ecological benefits. In this respect, ecosystem-based approaches are likely to be more cost-effective than traditional engineered approaches, but further evidence is needed.

In addition to the above findings, this study has produced lessons and recommendations for implementing ecosystem-based approaches in Europe and for integrating such approaches in policies and strategies relevant for climate change at different spatial levels as well as for supporting the EU 2020 Biological Variability Policy and work on the planned EU Green Infrastructure Strategy.

Currently, there is a need to raise awareness about ecosystem-based approaches and the underlying concept, as well as the multiple functions and benefits offered towards climate change mitigation and adaptation. While quantitative evidence of how effective activities have been in terms of mitigation (e.g. how much carbon is sequestered) or adaptation (e.g. how much flooding damage has been avoided) is often still lacking, the multiple benefits aspects can be a powerful tool for advocating the use of such approaches. Providing examples of relevant ecosystem-based measures that can be undertaken in the different sectors (such as agriculture, forestry, water etc.) can also help to increase the understanding of these approaches.

Alongside the need for increased knowledge opportunities for potential financing are also to be made available to strengthen the integration of such approaches. The current financial crises provide real opportunities to promote and pursue ecosystem-based approaches as they have the potential to be more cost-effective (particularly in the long-run), enable a sense of responsibility to be cultivated, allow for increased engagement of different stakeholders and can deliver multiple benefits as compared to traditional engineered solutions. Therefore, evidence on the cost-effectiveness of such approaches should be provided where available and further research (e.g. in the form of cost and benefits analyses for selected projects) should be undertaken where knowledge gaps exist. Further knowledge could also support financing by the private sector via, for example, public-private partnerships (PPPs), carbon markets, corporate social responsibility and regulative instruments.

In order to increase the uptake of ecosystem-based approaches and to make use of all potential benefits, increased cross-sectoral integration is needed. The analysis of the EU sector strategies revealed that the lack of integration is an obstacle for coherent and efficient implementation from the local to transnational levels. Furthermore, alongside coordinating knowledge transfer, promoting research and encouraging the uptake of best-practice practices, there is a need to i) clearly outline the ecosystem-based adaptation and ecosystem-based mitigation actions to be undertaken in the different policy sectors and pertinent programs, strategies and action plans and ii) report on the implementation of these actions.

At a national and regional level, given the importance of technical capacity highlighted in the explored case studies, an increased knowledge and understanding of specific design characteristics for projects using ecosystem-based approaches and their implications should further be supported. Both positive experiences as well as barriers were encountered during implementation. These can serve as a useful knowledge basis for increasing the success and efficiency of emerging projects. Further, such information could help to create successful management frameworks and a more appropriate selection of measures. Systems of institutional learning can enhance these efforts, ensuring that knowledge can be transferred to a wider audience and that the utilization of lessons learned is maximized. Finally, increased stakeholder involvement and a higher level of awareness amongst policy makers and the general public are necessary. Governments can be seen as serving a central, guiding role here in acting as a motivating actor and providing impetus to action at the local level.

Current & Relevant Information:

Concluding Remarks

It has been shown that the traditional estimation of costs and benefits of projects using ecosystem-based approaches is subject to a number of limitations. First, the amount and quality of evidence available varies considerably among the selected case studies. While data on the financial costs related to the projects are generally available, there is a clear knowledge gap with regard to possible opportunity costs and to (quantifiable) ecological and socio-economic benefits. Within most projects, no proper cost-benefit assessment has been commissioned; therefore, the available information is often based on the estimation of the projects' managers. As a result, opportunity costs and benefits are often only expressed in qualitative terms.

The comparability of costs and benefits among the selected case studies is also difficult. The use of different cost accounting systems was a major issue in this context. For instance, it was not always possible to clearly distinguish between one-off and recurrent costs or to define the timeframe over which the costs occur. On the benefits side, the lack of quantitative data forced the project team to draw rather rough comparisons. In general, the lack of monetary values for opportunity costs and ecological and socio-economic benefits prevented the project team from a comprehensive assessment of costs and benefits.

However, the available evidence indicated that the majority of projects using ecosystem-based approaches can be considered beneficial from an economic point of view if one takes account of the long-term social and ecological benefits that are associated with the projects. In the long run, benefits arising from the sequestration of $CO2$ and the prevention of natural disasters are likely to outweigh the financial and opportunity costs associated with a project, thus making those projects using ecosystem-based approaches potentially more cost-effective than traditional engineered approaches. The available literature (e.g. Doswald and Osti, 2011) supports this view.

In order to come to a comprehensive EU-wide assessment of the costs and benefits associated with projects using ecosystem-based approaches, there is a need for detailed assessments at the local scale. In particular, the monetary assessment of the associated benefits will require environmental valuation studies to be commissioned. In this context, the use of shared protocols and guidelines is highly recommended in order to allow for a subsequent scaling-up of the results. The cost and benefit typology presented in 6.1 and applied in the case studies could provide a relevant basis for such assessments.

"Beyond Biological Variability Conservation: Land Sharing Constitutes Sustainable Agriculture in European Cultural Landscapes," Jacqueline Loos and Henrik Von Wehrden, Multidisciplinary Digital Publishing Institute, 2 May 2018 [48]
https://www.mdpi.com/2071-1050/10/5/1395

Abstract:

While the academic land sharing–land sparing debate peaked in the recognition that neither strategy alone may offer the best solution to integrate commodity production with Biological Variability conservation, the lack of integrating the local realities of people and their cultural landscapes beyond mere Biological Variability conservation is hampering the knowledge transfer from our scientific discourse to the policy agenda. Here, we focus on European cultural landscapes, which represent prime examples for the success but also the fragility of social-ecological agricultural systems that benefit from land sharing. In contrast, we challenge the effectiveness of land sparing for sustainable agriculture. Moreover, we question whether and how either sparing or sharing can actually be implemented on the ground. We conclude that creating and maintaining sharing systems nowadays is a normative choice that society can take. Based on this, we caution against the ongoing prioritization of optimizing the economic benefits perceived from such systems. We highlight the limitations of economic instruments to safeguard the multifunctionality of sharing landscapes. Taken together, we suggest that deliberations on the sparing–sharing discussion ought to be moved from a limited perspective on Biological Variability towards a holistic consideration of landscapes as spaces that are shaped by and satisfy manifold aspects of human well-being, ranging from cultural to materialistic needs.

Current & Relevant Information:

Introduction

Triggered by an exponential human population growth since the industrial revolution and a simultaneous increase of resource use, anthropogenic land transformations increasingly degrade ecosystems. To date, human activities have affected 75% of the Earth's terrestrial surface, and more than a third of inhabitable land is used for the production of food, fuel, and fiber. At the same time, improved livelihoods and profligate ways of living further challenge the currently widely unequally distributed resource use, such as for instance through shifting dietary patterns toward more animal-based proteins and increased demands for other commodities. Consequently, an accelerated demand for agricultural products fosters agricultural intensification, which takes place either through the conversion of natural ecosystems or through the increase in yield output per hectare. While increased production is considered necessary to satisfy the needs of a growing human population, agricultural intensification is one of the main drivers of our current environmental problems. For example, land conversion for agriculture causes the loss of natural vegetation, such as primary rainforests in tropical areas. Increases in yield output through the use of agrochemicals as well as heavy machinery alter agroecosystems and adjacent vegetation. Especially in highly industrialized agriculture, these intensification measures lead to ecological homogenization. Thus, increased agricultural productivity often happens at the expense of Biological Variability, ecosystems, and their functions and usable services. The urgency to integrate societal and environmental needs sparked discussions about how to embed conservation into agriculture as a means of maintaining Biological Variability and navigating the trade-offs between various ecosystem functions and services, which is pivotal to safeguarding human well-being. Thus, the need to efficiently produce commodities without harming the environment is a vital attribute of sustainable agriculture today.

After more than a decade of debates around how to harmonize agriculture with the environment, land sparing and land sharing still represent extreme endpoints of a continuum to allocate land either for commodity production or for nature conservation. Land sparing intends to set aside large areas for nature conservation, such as for example in form of protected areas, and at the same time increase agricultural output on farmland. In contrast, land sharing promotes extensive land use at regeneration rates to protect natural resources. While some species may well survive in extensively used agroecosystems, other species may only occur in intact and continuous natural vegetation. Thus, neither concept alone provides an ultimate solution for best conservation outcomes in all contexts. Notably, the current scientific literature predominantly focuses on the link between agriculture and Biological Variability, while more holistic views on agricultural land as platforms for people–nature interactions are underrepresented. However, agriculture affects wider scales, including ecological aspects of our environment, from local to landscape scales, economic topics such as yield, and many social facets, ranging from local identity, traditions, and aesthetic values of the people living in a landscape up to higher governance levels. In turn, agricultural practices derive from complex system interactions between the choices of farmers, market demands, environmental as well as agricultural policies, and international agendas. Thus, we recall that discussions on integrating nature conservation and agriculture need to entail social and economic aspects of commodity production rather than just focus on ecological effectiveness in order to feed into sustainable agriculture. In this paper, we argue that the land-sharing concept offers such an integrative perspective for viable future farming, especially in cultural landscapes in Europe.

"To integrate or to segregate: balancing commodity production and Biological Variability conservation in European forests," Kurt Bollmann and Veronika Braunisch, In Focus: Managing Forest in Europe, 2013 [49]
https://www.researchgate.net/profile/Veronika_Braunisch/publication/258688959_To_integrate_or_to_segregate_balancing_commodity_production_and_Biological Variability_conservation_in_European_forests/links/00463528ceac81ea2f000000/To-integrate-or-to-segregate-balancing-commodity-production-and-Biological Variability-conservation-in-European-forests.pdf

Overview:

Worldwide, there is an obvious dominance of forestry systems that aim at integrating Biological Variability conservation into commodity production. In total, only 11 % of forests are under different protection status. While there is an ongoing debate on the pros and cons of integrative versus segregative approaches for nature preservation, a comprehensive framework for Biological Variability conservation in forest ecosystems will rely on both types of instruments and their effective and appropriate use at different spatial scales. In this paper we aim to (1) present segregative and integrative instruments for forest Biological Variability conservation, (2) discuss their potential and limitations, and (3) propose a conceptual framework for supporting the comprehensive preservation of autochthonous forest Biological Variability in a system of multi-purpose forestry. With a focus on Europe, we do not define overall goals for forest Biological Variability conservation but present the underlying ecological principles and discuss the different conservation instruments in this context. We highlight the generality of the presented concept, which offers practitioners and decision makers the opportunity to assess the trade-offs between different conservation instruments and their implications for other forest functions and to adapt their choice to the specific environmental and socio-economic situations found in Europe.

Current & Relevant Information:

Forest ecosystems cover approximately 30% of the world's and 32% of Europe's land surface (FAO 2010; FOREST EUROPE 2011). These ecosystems provide a multitude of services, such as timber production, the protection of soil and water resources, climate regulation, and the provisioning of habitat for forest species. The vast majority of forestland is designated for multi-purpose use and is outside formally protected areas. Forest reserves of different protection regimes account for only about 11% of the global forest area; the respective proportion for Europe is 10% (Parviainen and Schuck 2011), and human intervention is totally banned in only 0.7% (Bücking 2007). Thus, concepts and instruments that integrate the habitat requirements of forest biota into the management and production of other forest goods and services are mandatory for sustainable forestry that balances human commodity needs with the management of natural resources and ecosystem services (Thompson et al. 2011). Often criticized aspects of current forest management are the uniformity of forest structure and composition, the lack of late seral stages caused by regular harvesting and management for stand stability and productivity in general (Puettmann et al. 2009), and the consequential loss of suitable habitat, e.g. old-growth stands and large and decaying trees, for forest organisms in particular (Lindenmayer et al. 2006).

In recent decades, public perception of the functions of European forests has changed, which is reflected in the progressive request of integrating Biological Variability conservation with timber production and other functions in multi-purpose forestry. Yet, an exclusively integrative approach is not suitable to provide the large variety of ecological niches and processes needed to preserve a representative forest Biological Variability in Europe. Although close-to-nature forestry provides a minimum habitat quality for the majority of generalist species, an area-wide integrative approach does not comprise niches for many habitat specialists, particularly species that depend on extended habitat tradition (e.g. lichens, fungi, insects), the accumulation of limiting resources (e.g. deadwood; sapro-xylobiont insects, fungi, and birds), natural dynamics and disturbances (e.g. fire-dependent plant and insect species), or particular forms of forest use and their habitat features (thermo- and photophilic species). Thus, there is an obvious need to develop an integrative multi-functional forestry with complementary segregative elements that are effective enough to preserve species richness in forests of high conservation value. A dual strategy that flexibly combines integrative and segregative conservation instruments could serve most Biological Variability conservation goals in European forests. Beyond that, managing forest Biological Variability by focusing on the underlying conservation principles and applying a dual strategy that combines the advantages of various instruments will enable silviculturalists to adapt the prevailing conservation concepts to their current environmental conditions, previous harvesting types, and future developments.

"Coppice Forestry in South-Eastern Europe: Problems and Future Prospects," Tzvetan Zlatanov and Manfred J. Lexer, Silva Balcanica, 2009 [50]
https://www.researchgate.net/profile/Tzvetan_Zlatanov/publication/293058117_Coppice_forestry_in_South-Eastern_Europe_Problems_and_future_prospects/links/56dd5c9008ae73b58b381eca.pdf

Overview:

Coppice forestry in general, including all its variants, is a silvicultural system that is still widespread over many European countries where it covers an area of about 23 million hectares (UN/ECE-FAO, 2000). While in Central and Northern Europe coppice forests comprise just a small share of total forest area (e.g. 70.000 ha in

Austria, 2% of the total forest area), in Mediterranean (e.g., 6 822 000 ha in France, 3 397 000 ha in Italy, 1 640 000 ha in Greece) and South-Eastern Europe (SEE) coppice forests make up major parts of the forest resource and comprise between 22% and 58% of forest area (Albania 405 000 ha of coppice forests; Bulgaria 1 750 000 ha; Croatia 512 000 ha; Macedonia 557 000 ha; Montenegro 298 000 ha; Romania 369 000 ha; Serbia 1 456 000 ha). In addition, high variability of site conditions and vegetation patterns accompanied by the different socio-cultural country specific background has produced a wealth of varied coppice stands and a variety of management practices.

Current & Relevant Information:

While 10-20 years ago interest in coppice forest management was low, recently coppice forestry has attracted much attention which is mainly due to the increasing demand for biomass for energy production. This development was triggered by climate change mitigation policies in the wake of Kyoto Protocol (IPCC, 2007; Commission of the European Communities, 2005). With increasing revenues from fuelwood ('biomass for energy') coppice forest owners may be able to invest in improved management. However, this may be detrimental with regard to the maintenance of Biological Variability and traditional management schemes. Substantial portions of current coppice forests in SEE do not fully utilize the site production potential. Among others, major reasons are (i) degraded stands (stump age, species shift), and (ii) lack of appropriate management concepts unifying traditional management practices and up-to-date scientific knowledge. For instance, despite the long tradition of coppice forestry, the potential of coppice with standards systems to provide both, fuelwood and valuable timber are not yet fully explored (Hochbichler, 2009).

The SEE−ERA.NET project 'Multi-functional management of coppice forests in South-Eastern Europe: contributions to rural development; maintenance of Biological Variability; and climate change mitigation and adaptation in natural resource management' (http://cforsee.boku.ac.at/) brought together forest research institutions from five countries with substantial shares of coppice forests and intensive research experience in coppice forest management. Those were: University of Natural Resources and Applied Life Sciences, Vienna (Austria); Forest Research Institute, Sofia (Bulgaria); Forest Research Institute, Zagreb (Croatia); Belgrade University (Serbia); St. St. Cyril and Methodius University, Skopje (Macedonia).

The overall objective of CForSEE was to gather and synthesize available knowledge about coppice forests and forestry in SEE. Specific issues which are covered by this Special Issue are to identify major forest types (EEA, 2006) within coppice forests in SEE (Dekanic et al., this issue), to synthesize past and current coppice management practices in SEE countries (Stajic et al., this issue), to discuss stakeholder interests in coppice forests in SEE (Wolfslehner et al., this issue), to estimate the biomass potential for energy production from coppice forests in SEE countries (Nestorovski et al., this issue) and to discuss the role of coppice forests for maintenance of Biological Variability and nature conservation (Vacik et al., this issue).

“Local Biological Variability Action Planning for Southeastern Europe,” Aysegul Cil, et al., Research Gate, January 2011 [51]
https://www.researchgate.net/publication/283455353_Local_Biological Variability_Action_Planning_for_Southeastern_Europe

Abstract:

Biological Variability is life on earth, the variability of living beings, places that they inhabit and the interaction between them. According to the most widely accepted definition, Biological Variability is the totality of genes, species, ecosystems and landscapes on Earth. The Convention on Biological Variability defines this term as the variety and variability of living organisms, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes variability within species, between species and ecosystems. Biological Variability is integral to sustainable development by providing vital goods and services which are currently being degraded at an alarming rate both in Europe and globally. Biological Variability loss is one of the world’s most pressing crises. Causes for Biological Variability loss are complex, and solutions require the involvement of multiple groups, from international bodies to governments and local authorities to civil society. There is now high interest in and recognition of the value of the richness of Biological Variability in the Western Balkans. The region harbors an exceptional wealth of plants and animals, and a great number of species, especially in the remote mountain areas, are found nowhere else. Many of these species are of global or European conservation importance. The vast majority of the area is covered by the Dinaric mountain range and a small part of the area in the north-east belongs to the Carpathian mountain range. Lowlands are to be found only in the far north of the area in the Danube, Sava and Tisa river valleys and in the Morava river valley in the central part of the area. Tara National Park consists of a group of mountain peaks with deep gorges between them; the Tara river gorge is more than 80 kilometers long and is 1,300 meters at its deepest, making it one of the deepest river canyons in Europe. Other examples include Šar National Park, between Macedonia and Kosovo, and Durmitor National Park, which is the refuge of many glacial species from the Great Ice Age. The Western Balkans region belongs to the water catchment basins of three seas: the Adriatic, Black and Aegean. Other important features of the area are the three big lakes shared by neighboring countries: Ohrid Lake (Albania and Macedonia), Prespa Lake (Albania, Greece and Macedonia) and Shkodra Lake (Albania and Montenegro).

Current & Relevant Information:

“We can no longer see the continued loss of Biological Variability as an issue separate from the core concerns of society: to tackle poverty, to improve the health, prosperity and security of present and future generations, and to deal with climate change. Each of those objectives is undermined by current trends in the state of our ecosystems, and each will be greatly strengthened if we finally give Biological Variability the priority it deserves.” (Global Biological Variability Outlook 3, Secretariat of the Convention on Biological Variability.)

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There is now high interest in and recognition of the value of the richness of Biological Variability in the Western Balkans. The region harbors an exceptional wealth of plants and animals, and a great number of species, especially in the remote mountain areas, are found nowhere else. Many of these species are of global or European conservation importance. The vast majority of the area is covered by the Dinaric mountain range and a small part of the area in the north-east belongs to the Carpathian mountain range. Lowlands are to be found only in the far north of the area in the Danube, Sava and Tisa river valleys and in the Morava river valley in the central part of the area. Tara National Park consists of a group of mountain peaks with deep gorges between them; the Tara river gorge is more than 80 kilometers long and is 1,300 meters at its deepest, making it one of the deepest river canyons in Europe. Other examples include Šar National Park, between Macedonia and Kosovo, and Durmitor National Park, which is the refuge of many glacial species from the Great Ice Age. The Western Balkans region belongs to the water catchment basins of three seas: the Adriatic, Black and Aegean. Other important features of the area are the three big lakes shared by neighboring countries: Ohrid Lake (Albania and Macedonia), Prespa Lake (Albania, Greece and Macedonia) and Shkodra Lake (Albania and Montenegro).

The importance of Biological Variability conservation should be primarily recognized in the fact that the territory of the Balkans is characterized by high genetic, species and ecosystem variability, which have appeared in response to the geological, climatic, hydrological and orographic variability of the Balkans, and the historical background. Today the high-mountain and mountain massifs of the Balkan Peninsula represent one of six centers of European Biological Variability. The Balkan Peninsula is the most varied part of Europe.

Countries in the Balkans have initiated the restructuring of strategic, legal, institutional and economic frameworks related to Biological Variability. Current activities are largely dictated by the EU stabilization and accession processes in all countries. Thus, priorities reflect real needs related to the resolution of long-term and ever-growing problems in this area in order to transpose relevant provisions from various international agreements in the field of nature and Biological Variability, including the Convention on Biological Variability (CBD), and the relevant EU legislation.

The strategic framework of the Balkans countries in relation to Biological Variability conservation is defined through international Biological Variability-related conventions, in particular the CBD, strategic documents and the determination of governments to join the EU, through the National Biological Variability Strategies and Action Plans of all countries and numerous sectoral strategies (agriculture, forestry, etc.) as well as in improved environmental legislation adopted in recent years.

The local level is where action plans can be developed that reflect national (and international) policy priorities that seek to reconcile the need to conserve biological variability and healthy ecosystems with the need to ensure the well-being of the local populations in terms of health, employment and education. Without the active participation and ownership of local communities and local governments, aided by their strategic partners (such as NGOs and businesses), it is impossible to achieve the delivery of these policy objectives in the fields of poverty reduction, sustainable development and the conservation of Biological Variability.

ECNC-European Centre for Nature Conservation and REC Regional Environmental Center and its country offices have carried out a three-year project (end of 2008 – end of 2011) in ten municipalities in Southeastern Europe which aims to integrate Biological Variability and ecosystem services into local sustainable development policy and actions. The project – also known as the SEE-BAP project - owes its success to the Finnish Ministry for Foreign Affairs, which is committed to contributing to the alleviation of poverty, sustainable development and capacity building in the region.

The project focuses on selected rural municipalities and key local stakeholders in the target countries of the Finnish regional environmental development cooperation in the Western Balkans:

The project has provided a participatory process for better communication of the direct benefits of Biological Variability and ecosystem services, how they provide means to create local employment and to fight poverty in rural areas, and thus to contribute to a more harmonious and stable development of the Balkans. It is crucial to know what kind of tools and approaches could actually help in reaching Biological Variability conservation goals.

"Ecosystem-based approaches to adaptation and mitigation – good practice examples and lessons learned in Europe," Nathalie Doswald and Matea Osti, BFN-Skripten, 2011 [52]
https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=07731d645cd26b5a940f4991e177d5ef0786260e

Summary:

This report documents and analyses good practice examples of ecosystem-based approaches to climate change mitigation and adaptation in Europe. Ecosystem-based approaches to mitigation (EBM) are defined as the use of ecosystems for their carbon storage and sequestration service to aid climate change mitigation. Ecosystem-based approaches to adaptation (EBA) are defined as the use of Biological Variability and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change; these approaches may include sustainable management, conservation and restoration of ecosystems, as part of an overall adaptation strategy that takes into account the multiple social, economic and cultural co-benefits for local communities.

Compilations of case studies relating to EBM and EBA are found in the literature, though these mainly focus on activities undertaken in developing countries. However, mitigation and adaptation activities are being undertaken in Europe. This study aims to show what is being and can be done to help people in Europe mitigate and adapt to climate change using ecosystem-based approaches.

European case studies of EBM and EBA were sought along with examples of adaptation in nature conservation, which are sometimes indistinguishable from EBA case studies and can also inform the undertaking of future EBA projects. Case studies were gathered through sending questionnaires to experts and through literature searches. This study compiled 101 case studies: 13 are EBM, 49 are EBA and 39 are from adaptation in nature conservation (nine of which were used to inform EBA), covering over 17 European countries (some projects were regional). The majority of case studies came from the United Kingdom, followed by Germany and The Netherlands.

Case studies on ecosystem-based approaches to mitigation involved peatland restoration or conservation (11 projects) and forest conservation, restoration and reforestation (2 projects). The main additional benefits from these approaches were nature conservation of important ecosystems, as well as adaptation benefits through the areas providing water regulation.

Case studies on ecosystem-based approaches to adaptation were divided into inland waters (28 projects), coastal zone (10 projects), agriculture and forestry (11 projects) and cities (9 projects).

Inland waters case studies addressed freshwater flooding through river restoration or watershed management. The majority of these project addressed both adaptation and mitigation to climate change through their implementation and the main additional benefits were new space created for recreation.

Coastal zone case studies addressed sea level rise and storm surges through managed realignment and management of beaches (sand nourishment, dune restoration and creation of hanging beaches). Managed realignment has been undertaken in many areas in Europe, mainly as compensation for lost wetland habitats but more recently as part of an integrated adaptation scheme which also includes technical or structural adaptation measures (e.g. sea walls).

Adaptation to climate change for both the forestry and agricultural sector encompasses a broad range of techniques (e.g. sustainable management techniques for crops and soil, use of different species suitable for new conditions, etc.). There were 6 agricultural/farming projects including 2 aquaculture projects, and 3 forest management projects. These were varied in their adaptation approach. These studies showed that ecosystem-based approaches provided extensive interlinked benefits.

Ecosystem-based approaches to adaptation in cities involved the creation of green and blue space, which aids urban cooling and reduces freshwater flooding. Some of these projects started out as urban environment improvement and nature conservation projects, which overtime realized the adaptation benefits these projects provide.

Many of the case studies found were not labelled as EBA or EBM, or were only labelled as such at a later stage (their original purpose being for nature conservation). This indicates that many countries are and have undertaken projects relating to EBA and EBM, and that therefore there may be more examples to find.

The review of all the projects showed that ecosystem-based approaches to adaptation and mitigation bring a number of environmental, social and economic benefits in addition to adaptation or mitigation. Many of the EBA approaches also contribute to EBM and vice versa. Despite these benefits, the studies showed that there are a number of barriers to adopting EBA and EBM approaches. The three main barriers are: the need for considerable land, opposition from communities and lack of funding.

The lessons learned from the case studies indicated two key elements of success: Stakeholder engagement and communication, and monitoring and adaptive management. Stakeholders need to be informed of all aspects of the project and consulted to minimize conflict and gain their buy-in. Furthermore, involving stakeholder participation in the project can be beneficial for the sustainability of the project. Monitoring and adaptive management are project components that often do not take place, usually due to a lack of funding or poor project design. Nevertheless, these are essential components of good practice and several of the projects indicated their importance. Furthermore, from a climate change perspective where uncertainty of changes is high, adaptive management is the only way to ensure success.

Current & Relevant Information:

Introduction

This report provides an overview of different projects that are being undertaken in Europe to mitigate and help people and ecosystems adapt to climate change using ecosystem-based approaches. Through the case studies, the report shows what is being and can be done, and provides an assessment of good practice, barriers and lessons learned in Europe.

The climate has changed over the last 100 years, with a global increase in temperature of 0.74 °C, changes to precipitation patterns and an increase in extreme weather events (Solomon et al. 2007). According to the European Environment Agency's global and European temperature indicator, the average temperature for the European land area for the last decade (2001 -2010) was 1.2 °C above the 1850 -1899 average, which is higher than the global mean (EEA 2011). Projected global future climate change of between 1.1-6.4 °C, as well significant changes to precipitation and weather events over the next 100 years (Solomon et al. 2007), signifies the need to not only mitigate as far as possible but also to adapt to new conditions. In Europe, projected changes for the period 2080 -2100 compared with the 1961 -1990 indicate average temperature increases of 2.5-7 °C, with higher increases in Southern Europe in the summer and higher increases in Northern Europe in the winter; average projected summer precipitation ranges from -60 % in Southern Europe to +20 % in Northern Europe and average projected winter precipitation ranges from -20 % in Southern Europe to +50 % in Northern Europe (van der Linden & Mitchell 2009).

The uncertainty and variability surrounding projected changes is high. Nevertheless, the need to continue efforts to mitigate further changes in climate and prepare for change – to adapt – has been recognized by governments through the United Nations Framework Convention on Climate Change (UNFCCC), which aims to stabilize atmospheric greenhouse gas concentrations to prevent dangerous interference with the climate system. Climate change mitigation refers to activities that reduce and remove greenhouse gas emissions. These can involve the use of more efficient cleaner or greener energy and reducing emissions from land use, land use change and forestry. European mitigation activities undertaken are currently regulated and reported under the Kyoto Protocol, which ends in 2012; at the same time many European countries have or are starting to prepare their national adaptation plans and strategies, given that some degree of climatic change is now inevitable.

Ecosystems are a vital part of the climate system as they help regulate the climate, including through sequestering greenhouse gases (mitigation through emission removals), and regulating water flow, which can aid adaptation to flooding and drought; and therefore, ecosystems should be an important part of strategies relating to climate change. In 2009, the European Commission adopted a White Paper on Adapting to climate change: Towards a European framework for action, which indicates the importance of Biological Variability and ecosystems and lays out a broad framework for action along four pillars: 1) increasing knowledge; 2) integrating adaptation into policy; 3) policy instruments; and 4) international cooperation (COM 2009). European countries vary widely with respect to the state of their national adaptation strategies (NAS). An analysis published in 2009 noted that seven European countries had adopted a NAS and a further six were in preparation (Swart et al. 2009). The current status of NAS can be found on the European Environment Agency's website, which indicates that twelve European countries have adopted a NAS.

The European Environment: State and Outlook 2010 on Adapting to climate change (EEA 2010b) describes European vulnerabilities to climate change under seven headings: 1) Inland waters (glaciers and headwaters; river floods; drought and agriculture; water scarcity); 2) Coastal zones (sea level rise; coastal flooding due to extreme events); 3) Terrestrial Biological Variability and ecosystems (wildlife and nature conservation); 4) Economic sectors (agriculture and forestry; energy; tourism and recreation); 5) Cities and the built environment (situation and urban design); 6) Human health (heat stress; disease spread); 7) Damage costs (economic losses from weather and climate related events).

The NAS vary with regard to the extent and emphasis that they place on the above vulnerabilities and associated climate change impacts. For example, water stress is a greater concern in Southern European countries, and flood risk more a concern of many central and northern European countries (Swart et al. 2009).

Adaptation to climate change refers to adjustments in natural and human systems in response to actual or expected climate change impacts, which moderate harm or exploit beneficial opportunities (Solomon et al. 2007). The European Environment State and Outlook 2010 (EEA 2010a) describes adaptation measures as including "technological solutions ('grey' measures); ecosystem-based adaptation options ('green' measures); and behavioral, managerial and policy approaches ('soft' measures)".

Ecosystem-based adaptation and mitigation

The role of Biological Variability and ecosystem services in both climate change adaptation and mitigation has been acknowledged in both the Convention on Biological Variability (CBD) and, albeit more obliquely, in the UNFCCC. They are “natural solutions” to help society adapt to and mitigate against climate change; and measures involving these have been labelled as ecosystem-based approaches for adaptation and mitigation (EBA and EBM). They involve the use of environmental or natural resource management for carbon sequestration and storage, climate regulation, for climate change adaptation. In so doing, they improve the resilience of ecosystems, maintain, enhance and restore ecosystem services and ultimately sustain people’s livelihoods and wellbeing in a changing climate (CBD 2009). Using these ‘green’ measures for adaptation can be beneficial for mitigation and vice-versa, and hence, synergies are clear. They can also be used in conjunction with ‘grey’ measures to provide integrated climate change mitigation and adaptation approaches. EBA and EBM can also be supported by efforts of adaptation in nature conservation. Furthermore, adaptation in nature conservation can also in some instances be an example of EBA (e.g. river restoration to conserve Biological Variability, which also reduces flooding) or provides climate change mitigation benefits.

Studies and reviews of these ecosystem-based measures to climate change indicate that these also provide communities with benefits in addition to climate change adaptation and mitigation and are often more cost-effective and viable in the long-term than technical solutions (Campbell et al. 2009). EBM options are a relatively well developed and agreed climate protection measure. Indeed, the evolution of REDD+ (Reducing emissions from deforestation and forest degradation in developing countries, including sustainable management of forests, conservation and enhancement of forest carbon stocks) is a sign of this; although the role of other ecosystems in mitigation is still largely ignored in global policy. EBA on the other hand is an emerging concept, but one that has backing from many NGOs (e.g. IUCN, TNC, Bird Life International, ELAN) and IGOs (e.g. UNEP, UNDP).

Since the concepts of EBA and EBM were developed, a number of case-studies and good practice examples have emerged across the world, though some of these have been retrospectively called EBA and EBM. Most of these documented case studies come from outside Europe, though interest in compiling European case studies is growing. European countries are engaging in adaptation and mitigation projects, some of which are ecosystem based. Some of these projects are government-led but many are NGO-led. Compiling and analyzing these examples enables knowledge transfer in this new subject field and the drawing out of some of the key lessons learned to allow good adaptation and mitigation practice.

Conclusions

This study compiled 101 case studies of ecosystem-based approaches to mitigation (EBM) and adaptation (EBA) including adaptation for nature conservation projects.

The review showed that many of these projects did not start out as mitigation or adaptation projects. For example, introducing urban blue and green space can contribute to adaptation, but was originally focused on improving the urban environment; similarly, many peat restorations projects have been undertaken for the sake of Biological Variability conservation. The analysis has also shown that of the considerable number of EBA projects being undertaken in Europe, many have not adopted the climate change discourse, being labelled instead as disaster risk reduction or landscape management initiatives. This is particularly true of projects related to water management (e.g. floodplain restoration and watershed management) or crops (change in planting dates, diversifying, etc.). The possibility exists, therefore, that EBA and EBM approaches are being undertaken more frequently than thought. However, what the dedicated adaptation projects show, is that future climate change is explicitly being considered by the projects through the use of climate change projections. Taking future climate change into account will be necessary to ensure the long-term viability and usefulness of these projects.

When describing project results, most of the case studies do not provide any evidence of how effective the activities have been in terms of mitigation (e.g. how much emissions reductions and removals have been made) or adaptation (e.g. how much flooding damage has been avoided). Such information would be a powerful tool for advocating the use of ecosystem-based approaches. However, the qualitative evidence and the associated benefits, including the livelihood and business potential and the overall positive impact on quality of life, which are part an evaluation of adaptation (Adger et al. 2005), provide a good case for ecosystem-based approaches. Further in connection with some of the case studies, information was found that hinted at or demonstrated the efficacy of ecosystem-based approaches. For example, there has been good research on the role of urban green space in cooling, and reducing surface runoff (Gill et al. 2007), the benefits of using mixed species in forestry (Ammer et al. 2008; Matthes & Ammer 2000), and on the role of vegetation in protecting the shoreline (Möller et al. 2009; Gedan et al. 2011) and against landslides (ProAct Network 2008).

The current lack of measures of effectiveness in EBA/EBM projects is likely to be due in part to the fact that many of these projects were originally set up to improve the environment and Biological Variability of the area, only latterly being adopted as an adaptation measure. There is a need therefore for these and future EBA/EBM projects to measure and monitor effectiveness.

One clear observation from the compiled case studies is that ecosystem-based approaches to adaptation and mitigation bring a number of environmental, social and economic benefits in addition to adaptation or mitigation. Many of the EBA approaches also contribute to EBM and vice-versa. These approaches, for the most part, also contribute to Biological Variability conservation. Moreover, they provide areas where recreation activities can take place, which can also provide income to local people; and can be a source of food and other materials for people. Finally, some of the studies suggest that these options can be more cost-effective than traditional adaptation or mitigation options.

Despite these benefits, there are a number of barriers to adopting EBA and EBM approaches, which were highlighted in many of the case studies. The three main barriers are: the need for considerable land, opposition from communities and lack of funding. EBA and EBM approaches are often land hungry approaches. For example, managed realignment and many river restoration schemes require land to be 'lost' as flood storage areas, though these can also be used for other functions, such as recreation. Some of the case studies made use of arable lands as flood storage areas. This does not necessarily have to mean loss of all the land if their drainage system is adapted. In so doing, it would also increase water conservation and directly benefit farmers in periods of drought. In terms of land use, making use of farmland in ecosystem-based approaches to adaptation is going to be necessary (and beneficial) given that approximately 70 % of Europe is farmland.

Nevertheless, in many of the case studies, areas of land had to be purchased, or people had to be given compensation for lost land. This problem, as well as skepticism of the effectiveness of these approaches in protecting people and property, often results in fierce opposition from the local community and other relevant stakeholders. For this reason, outreach and participatory decision-making are important tools to increase the acceptance and the engagement of the people concerned.

Finally, securing adequate funding is a common problem for many projects. Some of the case studies had funding for project set up or implementation, but no future funding for upkeep and management, which is highly problematic as it decreases the sustainability of the projects. However, investment in ecosystem-based approaches may reduce costs in the long-term and contributes to a resource efficient green economy.

Lessons learned from the case studies point to two key elements of success: Stakeholder engagement and communication, and monitoring and adaptive management. Involving stakeholders, getting their buy-in and maintaining communication and outreach are essential if a project is to be successful. Involving volunteers and the local community in project implementation is a great (though potentially unreliable) way to minimize project costs and engage in outreach. Many of the projects found that although community engagement can be a long and difficult process, the gain in terms of results is large.

Monitoring and adaptive management are project components which often do not take place; usually due to a lack of funding or poor project design. Nevertheless, these are essential components of good practice (see CMP 2007) and several of the projects indicated their importance. Long-term monitoring is necessary to indicate a) the responses of the ecosystem to changes (environmental/anthropogenic), b) the response to the ecosystem to any management in place and c) the success of the implementation. The results of the monitoring can then be used to adapt management plans and adaptation strategies (the essence of adaptive management). Furthermore, from a climate change perspective, where uncertainty of changes is high, adaptive management is the only way to ensure success.

Structural and other 'grey' measures also require long-term upkeep, which can be more costly than the management of 'green' measures (Campbell et al. 2009). Therefore, adaptation projects, including ecosystem-based ones, will contribute to long-term climate change adaptation if monitoring, management and maintenance is incorporated in the project design.

This study showed that numerous EBM and EBA projects are taking place in Europe, and highlighted elements of good practice, challenges and lessons learned. It is by no means a complete compilation of all the case studies that have or are taking place. The compilation process indicated that there may be more examples throughout Europe. For example, we found that there are a number of databases already in existence, e.g. APBmer, GRaBs, and ECRR, which provide further examples of EBM and EBA projects in Europe. Some of these databases record not only basic components of projects, but also identify the processes which have led to their successful implementation/failure. Such databases, including the database compiled for this study, will serve as valuable resources for practitioners wishing to learn from existing projects.

6. Islamic Culture:

"Muslims and ecology: fostering Islamic environmental ethics," Arthur Saniotis, Contemporary Islam, 2012 [53]
https://www.researchgate.net/profile/Arthur_Saniotis/publication/257695114_Muslims_and_ecology_Fostering_Islamic_environmental_ethics/links/59897ddf0f7e9b6c8542f415/Muslims-and-ecology-Fostering-Islamic-environmental-ethics.pdf

Abstract:

Recent scholarly interest in religions and ecology reaffirm the importance of religious models in understanding humanity's place in nature. While Islam provides detailed ethical principles on the environment, the majority of Muslim majority countries show an apparent indifference to environmental issues. Due to the complexities in Muslim majority countries in relation to environmental issues, this paper contends that there is a need for an examination of the different aspects of Muslim environmentalism, and to what extent environmental practices are influenced by Islamic environmental ethics. Therefore, this paper develops a multipronged approach whereby both environmental and non-environmental practices by Muslims are discussed, giving an overview of Islamic attitudes towards ecology and environmental practices and suggesting reasons for Muslim non-concern for the environment. Moreover, the

paper illustrates how Muslims in western and Muslim majority countries implement Islamic environmental ethics. Finally, western and eastern Muslim thinkers who have written on Islam and the environment are explored.

Current & Relevant Information:

Islam and the environment: religious attitudes towards nature

Islam is the third of the Abrahamic religions, sharing its religious heritage with Judaism and Christianity. What is relevant here is the environmental context of early Islam. Islam arose amongst the Arab Bedouin, who were desert nomads and herders. Since prehistory, the Arab Bedouin were acutely aware of their environment and venerated the forces of nature. The stark environment of the Arabian desert fostered an attitude of submission among the Arab Bedouin. The prophet Muhammad (570–631) began to preach Islam among his Bedouin kinsmen from this environment. Early Islam was characterized by its simplicity and reverence for nature. As Islam spread into Africa, Asia and Europe in the seventh century, it maintained its naturalistic attitude. A key feature of early Islam, which has informed Muslims for 14 centuries, is its emphasis on nature.

The Qur'an and the prophetic traditions are the main sources of Islamic environmental ethos that have been integrated within Islamic jurisprudence. Both Muslim lay people and scholars often read these two sources when making deliberations on the environment (Wersal 1995: 453). The three founding ideas of Islam's ecological ethics are tawhid (Divine unity), khilafah (trusteeship), and akhirah (the hereafter). The cornerstone of tawhid is that Allah created the universe and that all existence reflects unity in plurality (Chittick 1986; Dutton 1996; Saniotis 2004; Foltz et al. 2003).

According to Muslim scholars, the universe is governed and regulated by the principles of unity, balance, and harmony that characterize the interactive unifying principle—tawhid. The Qur'an (14:19–20; 46:3; 15:85–86) repeatedly quotes that the universe is characterized by proportion, harmony, and beauty, which are the hallmarks of Divine craftsmanship (Saniotis 2004: 101; Wersal 1995: 453; Ozdemir 2003; Nasif 1987). Scholars have argued that, in Islam, the universe is maintained in balance, and is regulated by the interdependency of ecological systems (Wersal 1995: 453; Faruqi 1980: 24–31). Consequently, nature provides a source of inspiration and guidance for understanding Divine action in creation. In human terms, tawhid is the basis of human action and thought, penetrating every dimension of subjective and social life (Sardar 1985: 225; Shariati 1979).

The second concept of Islamic environmental ethics is stewardship (khilafah) (Idris 1990; Khalid and O'Brien 1992). The Qur'an declares that human beings are stewards of Allah's creation "Behold, the Lord said to the angels: "I will create a vicegerent on earth" (Qur'an 2:30). Furthermore, human beings need to refrain from mischief (actions leading to the corruption of the environment).

> “Do no mischief on the earth after it hath been set in order, but call on him with fear and longing in your hearts: for the Mercy of God is always near to those who do good” (Qur’an 7:56).

The importance of ecology in Islam is affirmed by the fact that one-eighth of the Qur’an exhorts Muslims to meditate on nature. The sociologist Ali Shariati contends that the notion of stewardship should include its spiritual dimensions (Sonn 1995). Similarly, Khalid (1996: 20), notes that included in the concept of stewardship is the notion that humans are friends of the earth, not its masters.

The third concept of Islamic environmental ethics is akhirah (the hereafter). This indicates that humankind is not only obligated as Allah’s steward on the earth, but will also be held accountable in the hereafter if there is any straying. Zaidi notes that intimated in the hereafter is that humans undergo a test of their stewardship (Zaidi 1981: 41). For Manzoor (1984) and Faruqi (1980: 30), and (Weeramantry 1988: 61), this means that each generation of humans is obliged to improve the condition in which preceding generations have left the earth. No generation has a right to pollute the earth in a manner that depletes its resources and degrades its biological systems (Weeramantry 1988: 61).

In addition, the level of environmental maintenance is open to Divine judgement at the Day of Reckoning. Some ahadith (accounts of the Prophet Muhammad’s teachings), note that cruelty to animals and wanton defacement of nature is forbidden and warrants Divine punishment. Alternately, kindness shown to animals bestows God’s reward (Ibn Kadamah 1992; Wescoat 1995). The following two prophetic accounts are mentioned to this effect: Ibn 'Umar, a companion of the Prophet (narrated by Al-Bukhari) reported that the Prophet said: “A woman who tied a cat will go to Hellfire; she neither fed it, nor allowed it to find food on its own.” Another companion of the Prophet called Al-Sharid (narrated by Ahmad) reported that he had heard the Prophet say: “If you kill a sparrow wantonly it will hasten to God on the Day of Judgement saying: O Lord! So, and So killed me for play and not for use!”

Scholars like Zaidi (1981: 35), Faruqi (1980: 30–31), and Ateshin (1989: 179) (see also Wersal 1995) maintain that humans have the rights and privileges of living from the earth in a sustainable manner, or usufruct. Of course, what humans define as sustainable will differ from culture to culture, and indeed, between individuals. From this viewpoint, then, both the Qur’an and the prophetic traditions unequivocally prescribe a criterion for responsible human trusteeship of the earth. Wersal (1995: 454) suggests that usufruct pertains to all creatures, and not just humans, a view that is supported in the works of Al-Hafiz Masri and Gulzar Haider (Timm 1993: 50).

“Islamic perspectives on environmental protection,” O.M. Ashtankar, International Journal of Applied Research, 2016 [54] http://ijtihadnet.com/wp-content/uploads/2-1-57.pdf

Abstract:

There is a growing concern about the threats posed by environmental issues throughout the World. Global warming, freshwater depletion, Biological Variability reduction, hole in the ozone layer - are all examples of such threats. How serious is it really? And what is to be done to change the direction? Many researchers have begun to look into underlying philosophical causes for man's rapacious attitude towards his environment. Part of this search involves a look at root philosophies affecting the human outlook and interaction with the world and the responsibility religion shares in creating the attitudes and philosophies that have led to the desecration of nature. Environment protection is an important aspect of Islam. Protection of the environment is essential to Islamic beliefs and mankind has the responsibility to ensure safe custody of the environment. This paper is an attempt to briefly present some aspects of the Islamic perspective on environment protection in the light of Quranic verses and Islamic narrations (hadiths).

Current & Relevant Information:

Islam & Environment Protection:

The Islamic perspective on the environment rests on the belief that Allah is the Creator & Sustainer of the universe. The whole universe along with all of its factors has been created with perfect wisdom (hikmah). The number, quantity, and quality of these factors is precisely determined by the divine plan. Each factor plays its ordained role. Everything created by Allah has a just purpose which must be fulfilled. The Holy Quran, shedding light on this point, says:

> “We created not the heavens and the earth and all between them but for just ends, and for a term appointed: but those who reject Faith turn away from that whereof they are warned.” (Quran: 46:3)

For the sustenance of His creation, Allah has placed a measured quantity of the environmental resources which matches the total demand of the resources in the universe. This implies the existence of environmental balance in the natural ecosystem. Hence, Islam looks at the environment from the standpoint of balance. The Quran describes the notion of environmental balance in various terms like ‘adl’, ‘qadar’ and ‘mouzoon’. ‘adl’ literally means acting justly, rightly, or equitably. ‘qadar’ is a specified measure or amount either of quantities or qualities. This term corroborates the notion of balance in the following ayah:

> “Verily all things We have created in proportion and measure.” (Quran: 54:59)

The above ayah makes a general statement about the existence of equilibrium in everything. The process of creation & growth of all things follows the principle of balance. The term ‘mouzoon’ which occurs in the first of the following ayahs:

> "And the earth We have spread out, set therein mountains firm and immovable and produced therein all kinds of things in due balance. And We have provided therein means of sustenance for you and for those whose sustenance you are not responsible." (Quran, 15: 19-20)

According to above ayahs, all kinds of provisions have been made for the sustenance of human and the non-human beings in a way that the quantity demanded of these provisions equals their supply. There is no question of relative shortage or surplus in the divine plan regulating these provisions.

"A Review of Good Adaptation Practices on Climate Change in Bangladesh," L.C. Sutradhar, et al., International Conference on Water & Flood Management, 2015
[55] https://research.fit.edu/media/site-specific/researchfitedu/coast-climate-adaptation-library/asia-amp-indian-ocean/bangladesh/Sutradhar-et-al.--2015.--A-REVIEW-OF-GOOD-ADAPTATION-PRACTICES.pdf

Abstract:

This paper discusses good adaptation practices for adapting to climate change in Bangladesh to reduce vulnerability of expected climate change. The analysis is based on national reviews of climate change adaptation practices, especially in Bangladesh. This review shows that Bangladeshi different communities and stakeholders are already using adaption practices related with climate risks. Good adaptation practices adopted by national and international NGOs in Bangladesh found quite fit for our environment. Tidal River Management (TRM), Green Afforestation Belt, Community Based Adaptation (CBA), floating agriculture, homestead vegetable gardening, caged-fish culture, raised flood-proof houses, elevated tube wells and latrines, diversified salt and flood tolerant crop varieties, etc. are some examples of good adaptation practices in Bangladesh.

Current & Relevant Information:

Introduction

Bangladesh is a deltaic country situated between the Himalayan Mountains in the north and the Bay of Bengal in the South. Because of its geographical position, there is little doubt that Bangladesh is likely to be one of the worst affected nations in the face of climate change (Harmeling, 2014). The country annually and inter-annually experience floods, cyclones, droughts, river bank erosions, salinity intrusions, tornados and other natural calamities that have adverse effect on agriculture, fishery, infrastructure, water and health (ADPC & BCAS, 2008).The country has been facing prolonged and repeated floods in the northern and central regions, severe cyclones, salinity increase in coastal areas, erratic rainfall and drought in northwest region (BCAS, 2008).The country has faced devastating Sidr in November 2007, Aila in April 2009, series of flood of 2004, 2007 and 2009, Nargis in 2010 and Mahasen in May 2013 (Ahmed , 2010 ; MOEF, 2009).

Among the least developed countries (LDC) in 2002; Care Bangladesh implemented Reducing Vulnerability to Climate Change (RVCC) project. RVCC project was the first climate change community adaptation project in the Southwest region of Bangladesh. The project piloted several options in context of salinity, flood, water logging and drought. Bangladesh was amongst the first LDCs to produce National Adaptation Program for Action (NAPA) in 2005 under United Nations Framework Convention on Climate Change (UNFCCC) (MoEF-UNDP, 2005). NAPA suggested a range of adaptation practices for Bangladesh which was subsequently revised in 2009 (MoEF-UNDP, 2005). Technology Needs Assessment Report and National Capacity Self– Assessment (NCSA) was planned in 2009 (IUCN, 2009). In 2008-2009, the country has formulated the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) as a foundation of all activities regarding climate change including Climate Change Adaptation (CCA) (MOEF, 2009). There were several community-based adaptation projects undertaken in Bangladesh by Practical Action Aid, Area Development Organization, Bangladesh Center for Advance Studies, Comprehensive Disaster Management Program, Food and Agriculture Organization of the United Nations in Bangladesh (FAO), International Union for Conservation of Nature (IUCN), Prodipan, Nabolok, RDRS Bangladesh and some other NGOs.

Conclusion

Several good adaptation practices have been identified that can be tailored to the future changing climate in context of Bangladesh and can help in finding out future pathways on integration of best adaptation practices in ongoing as well as in future Climate Change Adaptation (CCA). Tidal River Management (TRM), Green Afforestation Belt, Community Based Adaptation (CBA), floating agriculture, homestead vegetable gardening, caged-fish culture, raised flood-proof houses, elevated tube wells and latrines, diversified salt and flood tolerant crop varieties, etc. are some examples of good adaptation practices in Bangladesh. The lessons learned so far could be replicated with modifications to be found from innovative research and applications in real field life.

"Sustainability and climate change in major religions with a focus on Islam," Vegard Skirbekk and Konrad Pędziwiatr, Humanitarian Academy for Development Research Paper, December 2018 [56]
https://www.researchgate.net/publication/329656310_Sustainability_and_climate_change_in_major_religions_with_a_focus_on_Islam

Abstract:

Background

Climate change mitigates adaptation and requires not only technical solutions, but also better insights in the understanding of relevant belief and identity systems, in which religion plays an important role. Human attitudes, convictions and ultimately our consumption patterns will play an important role in climate adaptation and mitigation. Religion is a key determinant of individual convictions and a central marker of behavior and community belonging.

The report presents findings from the world's second largest religion, Islam, on attitudes and behaviors to climate change in countries around the world. Climate change preparedness in several Muslim dominated countries is relatively low in spite of the fact that some of the countries that will be most affected by climate change are Muslim majority.

This report is based on a new survey on Muslim leaders and our assessment of population level datasets around the world focused on attitudes towards climate change.

Data

Muslim leader's survey: The research team has designed a carried out its own survey in English, French, Russian, Arabic and Turkish among the Muslim leaders whom it identified as a key influencer within larger Muslim populations. The data was collected for slightly over 3 months from the beginning of July 2018 till mid-October 2018. We have invited numerous Muslim leaders worldwide to fill in the questionnaire on paper or electronically and asked various Muslim organization (e.g. Muslim Council of Britain, Turkish Diyanet, Egyptian Dar al-Ifta and Al- Azhar, as well as Tunisian Ministry of Religious Affairs – to name a few) to help us reaching Muslim leaders and invite them to the survey. Our sample consists of 150 respondents from countries of Global South and North.

Background study: The report paints a broader picture of the views and attitudes of Muslim populations around the world towards the environment and climate change. Our assessment of background data using existing data on ecological views among Muslim populations in countries around the world builds on data from World Values Survey (WVS), Pew Research Center's Global Attitudes Survey, European Bank for Reconstruction and Development's Living in Transition Survey (LiT) and Afrobarometer Survey that are well known and widely used in the scientific community.

Findings

There is wide variation in Muslims' views on climate change according to nation. One example of our finding is that the proportion who considers climate change a serious problem ranges from below a third in countries such as Pakistan to more than two thirds in Uganda and India.

Turning to the findings from the Muslim leader survey, we find that a vast majority (around four fifths) perceive humans to be partially or mainly responsible for ongoing climate change. Moreover, we find that almost half of the Muslim leaders think climate change harm individuals now. Among the respondents, 53% of the surveyed

Muslim leaders believe that the effects of the climate change will probably or very likely lead to the end of the human existence on Earth.

More than four fifths think that the Muslim religious leaders should be more active in actions related to climate change and above two thirds of the Muslim religious leaders think they should promote that individuals should consume less and switch to environmentally friendly consumption patterns.

In terms of stabilizing or decreasing demographic growth to reduce climate change, Muslim religious leaders are split and on average much more negative than when it comes to consumption. While 33% of the religious leaders believe they should promote less population growth to curb climate change, 42% disagree with this and 26% are indifferent or need more information to decide.

Understanding the knowledge and views of Muslim populations and Muslim leaders about climate change and various dimensions of the problem seems especially important as the world becomes more religious and Muslims register some of the most rapid levels of growth.

In summary, majorities in Muslim communities tend to be well aware of the issues of climate change and ready even to slow down their economic growth to minimize its effects. A significant number of them are for example in favor of raising taxes for those who are most heavily polluting the environment. Many Muslims see their religion as a powerful source of tools to help preserving the Earth and address the problems of climate change.

Current & Relevant Information:

Conclusions and Recommendations

The influential German scholar of Islam Annemarie Schimmel wrote in her “Deciphering the Signs of God" that green color in Islam has always been connected with paradise and positive spiritual things, and angels and saints are frequently clad in green clothing (1994: 16). According to the Islamic tradition green was the favorite color of the Prophet Muhammad and the Quran points out that while entering the paradise “Upon the inhabitants will be green garments of fine silk and brocade” (76:21). But how “green” are the minds of today’s followers of Islam and the leaders of the Muslim communities around the world? Are they aware of the climate change and its main causes and effects? What are they ready to do in order to address them? These are only some of the questions that have been sought to answer with this research.

One of the Hadiths says “The world is green and beautiful, and God has appointed you its administrators. See how you get your job done” (Hadith in: Masri, 1992: 12). The inhabitants of the Earth have perhaps not been very good administrators or custodians of the planet (Khalifah) and through their actions or mismanagement caused significant environmental degradation that is endangering the delicate balance of nature (Mizan). As discussed above, the followers of Islam are one of the religious groups that is already or will be affected by climate change in the near future. Addressing these issues will require concerted efforts of not only all countries but also every major religion in the world. This is because the problems of climate change have global dimensions. A recent UN report suggests that there was maximum 12 years left to limit scale of the climate change catastrophe (Watts 2018).

As the report has shown above some Muslim communities are well aware of the issues of climate change and are ready to slow down their economic growth to minimize its effects. However, whereas others that might already be more affected by it, they are less aware of its seriousness, and take limited actions to minimize its effects, in spite of the fact that several Muslim majority nations are or will be severely affected by climate change.

Faith-based conflicts and consequences of climate change are among the top major threats as suggested by population level surveys across different countries (Carle, 2015; Levy et al., 2015; Pascual-Ramsay, 2015). Yet, religions have significantly contributed to numerous human rights struggles around the world in recent decades ending slavery, promoting racial equality, resisting dictatorship and supporting the rights of the poor. It can be crucial that they use more effectively some of their mobilizatory potential to address the climate change issues and raise awareness of them as well come up with innovative methods of reducing human impact on environment. Not only Islam but also other religions need to more dynamically engage in what Ulrich Beck calls the “greening of modernity” or a process of reconciliation between nature and humankind (2010: 254).

Within the ummah or the global Muslim community, a particular responsibility of addressing the issues of climate change lies on the shoulders of the Muslim leaders. For these reasons the report has focused on this group of people. Our empirical research has shown that the Muslim leaders are quite well aware of the existence of climate change and the problem is not new to them. Almost half of them indicate that the climate change is substantially harming people already and that some of the most worrying consequences include weather anomalies and rise of temperatures. For the majority of respondents, climate change is largely a man-made phenomenon with natural processes playing only a small role in it.

The majority of the surveyed Muslim leaders believe that the effects of the climate change may eventually lead to the end of the human existence on the Earth. They are in favor of radical steps being taken in order to address at least some of the issues linked with climate change. A significant number of respondents are in favor of raising taxes on heavy polluters. They clearly see a role to be played in the fight with causes and consequences of the climate change not only by international organization and state governments, but also by every person on the Earth.

A particularly important role, according to respondents, can be played by Islam. They see their religion as a powerful source of solutions to help preserving the Earth and address the problems of climate change. At the same time almost one-third of respondents think that Muslim leaders do not adequately address the issues related to climate change in communication with their congregations. The vast majority thinks that the Muslim leadership should be more involved in activities related to climate change mitigation. Particularly powerful Muslim organizations and Ministries of Religious Affairs in Muslim majority countries (e.g. Egyptian Al-Azhar or Turkish Diyanet) could consider developing policies to educate their leaders about the climate change and encourage them to address these issues in their preaching and teaching.

Enhancing the knowledge of the leaders about the climate change and empowering them in addressing various dimensions of the problem could be especially important as the world becomes more religious and Muslim communities register some of the most rapid levels of growth (Stonawski et al., 2015). A more religious planet will be more environmentally friendly only if people fully comprehend their role of "custodians of the Earth" and see the signs of God in nature and ecological balance.

"Climate Change Rhetoric in Bangladesh: A Curse or A Blessing?" A. Hossain and D. Marinova, Rajshahi University journal of environmental science, December 2011 [57]
https://www.researchgate.net/profile/Dora_Marinova/publication/267780023_CLIMATE_CHANGE_RHETORIC_IN_BANGLADESH_A_CURSE_OR_A_BLESSING/links/54b7d9600cf28faced608e51/CLIMATE-CHANGE-RHETORIC-IN-BANGLADESH-A-CURSE-OR-A-BLESSING.pdf

Abstract:

The rhetoric about climate change in Bangladesh is varied. First, there is the scientific evidence by the IPCC Fourth Assessment foreshadowing bleak scenarios, including the significant rise of sea level and sinking of coastal areas; others refute it with alternative views. Second, many see India's unilateral withdrawal of the Ganges water in the summer as increasing the desertification in the western half of the country and accuse the morally bankrupt government for its incapacity to address the water-sharing problem. Third, religious and spiritual people perceive climate change as a result of human transgression of nature's limits. The fourth view maintained by innate naturalists, such as Baul mystics, acknowledges all-natural phenomena as the act of Nature/Creator.

Bangladeshi people recognize climate change as neither a curse nor a blessing. A sustainability assessment requires examination of the positive and the negative sides. The paper analyses the positive perceptions in light of the interpretation they bring towards understanding the changes and human behavior within a framework of spiritual values. It concludes that despite the varied rhetoric, people in Bangladesh

should continue to address climate change within a sustainability framework and without attempting to technologically dominate nature.

Current & Relevant Information:

Introduction

For Bangladesh, whatever you think, the opposite is equally true and, on the surface, it appears that the country is full of contradictions. Back in 1998, Bangladesh was the world's poorest and happiest country but by 2005 the net happiness had slipped to number 212 with only a marginal improvement in the country's GDP per capita (from $325 to $394 but still truly among the poorest countries in the world). Despite population density in rural and urban areas being among the highest in the world, the ecological footprint of its consumption is very light and stands at only 0.6 ha per capita (compared to 2.7 for the world and 1.8 for Asia; in fact, only Timor Leste has a smaller footprint at 0.4 ha). There is also the view that Bangladesh is underdeveloped because adult literacy rate stands at only 55% and in rural areas some 95% of its folks lack primary education. Novak, however, observes: "When you visit Bangladesh, by all means view the people as they are. But for your sake and theirs, remember that you are dealing with people who know what development is" (1993: 86). Maloney (1988, 1991) supports these contradictory views asserting that "the capacity of Bangladesh to support a huge population for many centuries appears uniquely bright and there is probably no other society in the world in which such a heavy population can subsist on the land without destroying the resource base" (1988: 2).

The varied rhetoric about climate change is another striking example of the contradictory views about Bangladesh and its prospects. There are geo-environmental reasons for such variability, but there are also different attitudes and assessments as to how climate change is perceived. Based on analysis of secondary data sources, literature review and personal observations, the structure of the paper is as follows. We firstly examine the geographical conditions of Bangladesh which make the country quite unique in the way it is affected by climate change as well as in its positioning to cope with it. After this, we analyze the various assessments of the changes projected to be triggered by climate change – from the work of the Intergovernmental Panel for Climate Change (IPCC) to the political and cultural environment of the country. The existing and newly developing coping strategies are then discussed before concluding that irrespective as to what your attitude to climate change is, it is important to address its implications from a sustainability framework without attempting to find technical fixes and technologically dominate nature.

Conclusion

The rhetoric about the impacts of climate change on Bangladesh's rural living is varied. Bangladeshi people resent India's selfish unilateral imposition of climate change over the western half of Bangladesh by withholding water from the Ganges, but are more tolerant of human induced global changes despite all blame and responsibility for the latter resting with the developed countries. The people of Bangladesh tend to see the impacts of climate change as neither a curse nor a blessing. It has both positive and negative sides. The positive aspects that most people count are the evidence of increasing bumper agricultural yields. Thus, climate change is a blessing for the Bangladesh agricultural sector. This is in line with the IPCC's Second Assessment Report, which concluded that global agricultural production appears sustainable in the face of predicted climate change (Lemons et al. 1998: 297). Munasinhe et al. (2005: 210) also refer to studies showing that a temperature increase of a few degrees would lead to an increase in temperate crop yields. Hence climate change is still perceived positively by many notwithstanding its mostly short-term negative impacts, such as sufferings due to flash floods, untimely draughts and rains. It may also be the case that for Bangladesh the positive impacts of climate change eventually outweigh its negative impacts, particularly if they are valued with broader metrics than the limited economic measures (Adger et al. 2009).

Within the nation's limited resources, the Bangladeshi government, non-government organizations (NGOs), concerned members of civil societies and intellectuals are all actively or passively addressing the consequences from the fast-occurring climate change. This is happening following untimely floods and draughts within the varying realities of the varied local geographical, socio-economic and political conditions across the country. The science of climate change in many ways informs their policies and actions, but the most powerful reality and sustainability tools for the future lay within the spiritual strength and resilience of the people.

Is climate change a curse or a blessing? The implications from this analysis show that this rhetoric is likely to continue. However instead of depicting bleak scenarios for the future, it enriches Bangladeshi people's perception by way of hope and inspiration.

"Significance of Forests in Islam," Mumtaz Hussain, World Environment Day, 16 June 2011 [58]
https://www.pecongress.org.pk/images/upload/books/(7)%20Significance%20of%20Forest%20In%20Islam%20by%20Engr.%20Mumtaz%20Hussain.pdf

Abstract:

Human beings have been familiar with the plants existing in the natural environment since the pre-civilization era. They have been utilizing the services of trees as a source of food, shade, sports gear and weaponry. The inextricable relationship between the man and trees has since grown manifold. Their respective perpetuation is mutually interdependent. Yet the man has exhibited cruelty to the silent trees by

embarking on damaging practices for meeting the selfish ends of the so-called development.

Islam is the moderate divine religion. It believes in the golden principle of live and let live. Man is the best creation of Almighty Allah. The Nature has appointed him as His caliph on the Planet Earth. Human beings have been empowered to make use of the natural resources for fulfilling their needs of course, not at cost of extinction of the Biological Variability. Man is required to maintain congenial environment for survival of wide range of Biological Variability. Whenever and wherever the humanity had deviated from showing soft corner for the plants and animals it had to face His severe wrath. Human history is replete with such examples.

Current & Relevant Information:

Trees in Divine Books

The trees have been discussed in detail in the Divine Books. Likewise, these have been mentioned on many occasions in The Holy Quran and golden sayings of The Holy Prophet (PBUH). Islam has given the examples of good and bad trees. Good Muslims will be rewarded by free access to fruit and other trees in the life hereafter. On the contrary the sinners will be forced to eat cactus like plants to control their hunger.

Conclusion

Islam is the complete code of life. Biological Variability is of immense significance in the Islamic teachings. The Creator has appointed man as His vicegerent on the Earth for looking after the plants and animals. Man has been advised to preserve the trees even during adverse environment of war.

"The Future of Water Resource Management in the Muslim World," Syeda Mariya Absar, Journal of Futures Studies, March 2013 [59]
https://www.researchgate.net/profile/Mariya_Absar/publication/290538687_The_future_of_water_resource_management_in_the_muslim_world/links/579645c008aec89db7b85578/The-future-of-water-resource-management-in-the-muslim-world.pdf

Abstract:

This article provides an insight into water availability and usage in the Muslim world, based on the global data on water consumption and availability with respect to specific geographical regions and an extensive literature review to categorize the regions with similar socio-economic and hydro-geological make up into distinct water zones. Causal Layered Analysis futures technique is used to examine the way water has been valued and managed, and the systems and worldviews that have influenced the current human-water relationships in the Muslim world. The zones and their inherent water paradigms are then contrasted with emerging international perspectives and trends that might herald a change in the way water is managed in

the Muslim world. Finally, Muslim religious philosophy and the importance of water is revisited as a potential linchpin that could influence future policies and begin to answer some of the water demand challenges these nations face in the 21st century.

Current & Relevant Information:

Introduction

This paper looks at the future of fresh water availability and usage in the Muslim world and aims to identify factors that determine and may change the way water is currently accessed and consumed. Water has immense spiritual importance to Muslims as water is a symbol of purity and cleanliness, which is the essence of Islam. Water concerns in the Muslim world vary from being negligible to severe, spatially contained to nationwide and at times transcending boundaries, including concerns over quality and quantity. Countries in this region typically confront a combination of these problems.

This paper focuses on the current and emerging trends in water availability and management in the Muslim world because water is of profound importance to Muslims. The Quran, the holy book of Muslims, mentions water in sixty-three different verses. In one verse Allah says, ‘And we created from water every living thing’ and in another verse he says that the most precious creation after humans is water. The Quran describes Allah’s throne as floating on water and there is clear reference to streams flowing underneath the gardens of paradise. The life-giving properties of water is reflected in the verse, ‘And Allah has sent down water from the sky and therewith gives life to the earth after its death’ (Faruqui et al., 2001).

All humans rely on water for sustenance and health but Muslims have a special relationship with water. One of the five pillars of Islam is praying five times a day and each prayer is preceded with wudu or ablution which is a ritual cleansing of hands, feet and face with water. Without this ritual a prayer stands void. Prophet Muhammad (peace be upon him) compared the five prayers to the cleansing property of water in the following saying; ‘the similitude of five prayers is like an overflowing river passing by the gate of one of you in which he washes five times daily’ (Faruqui et al., 2001).

Muslims also observe certain hygiene practices that set them apart from other cultures. As an Islamic tradition, all Muslims wash with water after urination or defecation and toilet paper is used merely as a drying agent. This signifies the importance of water and the need for accessing clean water in toilets. There are special sanitary fixtures attached to the plumbing that supply water in the toilet such as hand showers or water spouts fitted into the toilet bowls or bidets. The need to wash prior to the five prayers daily and to wash every time the toilet is used, increases the per capita water demand and consumption of all Muslims. As per the Pacific Institute’s data on water resources, approximately 75% of Muslims have access to clean drinking water and 60% have access to sanitation (Gleick et al., 2009).

According to the Islamic principles, humans may consume and utilize natural resources, but should not manipulate nature in a way that irreversibly degrades the environment. Islamic doctrine asserts that the ecosystem belongs to Allah, who entrusts humankind to pass it on, relatively unharmed, to their succeeding generations. This is consistent with the notion of sustainable development and inter-generational equity. People ought to share in the abundance as well as in the scarcity of all resources because they are finite and people as inheritors are accountable to Allah for their actions on earth (Ameri, 2001).

The Muslim world experiences varying environmental, economic, and political challenges, but it is united by its common religious and ethical guidelines, which can form the bases of water management policies. Globally, there is a greater recognition of resource management and policy influenced by traditions and knowledge of indigenous people, however the potential role of religion as the basis for policy making is underestimated. In countries where the majority of people are practicing Muslims, a water management policy that is grounded in the tenets of Islam has greater potential for being effective. (Ameri, 2001).

Conclusion

The Muslim world cannot afford to waste a single drop of water. Governments should urgently implement sustainable water management policies which rationalize demand to ensure more efficient use. This can be achieved by attaching an economic value to water, measured by the value of the end product from each drop. Governments should implement water efficiency measures, shift from irrigation by flooding to more efficient irrigation systems including drip irrigation, introduction of crop varieties that are resilient to salinity and aridity, recycle, treat and reuse wastewater, and develop affordable technologies for water desalination.

Islamic principles stress women’s rights, especially their equal rights to education and inheritance. According to a saying of Prophet Muhammad, “Acquisition of knowledge is binding on all Muslims (both men and women without any discrimination)”. Providing equal educational and inheritance opportunities would empower women with wealth and education, enabling them to become valuable members of the labor force and the economy. Taking women away from solely domestic roles has many long-term benefits such as economic development, a lower fertility rate and prevention of water borne diseases thus improving public health and reducing stresses on water and food production.

Given the importance of water in Islam, a management instrument that broadens traditional economic water management approaches to include nontraditional cultural and spiritual approaches is more likely to succeed in the Islamic world. This would involve looking for solutions beyond the litany level and changing the world view and metaphor around water management by incorporating the Islamic principles into water management policies or public awareness campaigns. These grassroots, bottom-up, culture and religion-based approach to water conservation and protection may help the Muslim world look beyond the neoliberal globalization of water, where water is just a commodity.

“Muslims and climate change: How Islam, Muslim organizations, and religious leaders influence climate change perceptions and mitigation activities,” Jens Koehrsen, Wiley Interdisciplinary Reviews Climate Change, 24 February 2021 [60] https://wires.onlinelibrary.wiley.com/doi/full/10.1002/wcc.702

Abstract:

A growing body of research stresses the importance of religion in understanding and addressing climate change. However, so far, little is known about the relationship between Muslim communities and climate change. Globally, Muslims constitute the second largest faith group, and there is a strong concentration of Muslims in regions that are particularly affected by global warming. This review synthesizes existing research about climate change and Muslim communities. It addresses (a) Islamic environmentalism, (b) Muslim perceptions of climate change, and (c) mitigation strategies of Muslim communities. The analysis shows that there is no uniform interpretation of climate change among Muslims. Based on their interpretations of Islam, Muslims have generated different approaches to climate change. A small section of Muslim environmentalists engages in public campaigning to raise greater concern about climate change, seeks to reduce carbon emissions through socio-technological transition efforts, and disseminates pro-environmental interpretations of Islam. However, it remains unclear to what extent these activities generate broader changes in the daily activities of Muslim communities and organizations. Contributions to this research field are often theoretical and stress theological and normative aspects of Islam. Empirical studies have particularly addressed Indonesia and the United Kingdom, whereas knowledge about Muslim climate activism in other world regions is fragmented. Against this backdrop, there is a need for comparative studies that consider regional and religious differences among Muslims and address the role of Muslim environmentalism in climate change mitigation and adaptation at the international, national, and local scales.

Current & Relevant Information:

INTRODUCTION

In recent years, there has been a rising consideration of religion in the field of climate change research (e.g., Allison, 2015; Clingerman & O'Brien, 2017; Edenhofer et al., 2015; Haluza-DeLay, 2014; Hulme, 2017; Jenkins et al., 2018; Kilburn, 2014; Murphy et al., 2016; Smith & Leiserowitz, 2013). The increasing focus on culture, values, and worldviews in research on climate change appears to have encouraged directing attention to religion (Abson et al., 2017; Adger et al., 2013;

Christie et al., 2019; Ives et al., 2020; Ives & Kidwell, 2019; O'Brien, 2018; Otto et al., 2020). Scholars have therefore argued that there is a fundamental need to understand the role of religion in order to fully grasp the cultural dynamics of climate change (Hulme, 2016; Jenkins et al., 2018).

At the same time, by stressing the specific capacities of religions, scholars from the field of religious studies have made strong claims about the potentials of religion in addressing human-induced environmental degradation (Bergmann, 2009; Gardner, 2003, 2006; R. Gottlieb, 2008; Hitzhusen & Tucker, 2013; Holmes, 2006; Posas, 2007; Rolston III, 2006; Tucker, 2006). Religions shape the worldviews and moral attitudes of their adherents and how they approach nature (Jenkins, 2009; Watson & Kochore, 2012). Moreover, religious leaders and organizations often enjoy high credibility. They have an important voice in public debates and can influence political decision-making through their different networks (Casanova, 1994; Reder, 2012; Schaefer, 2016; Wardekker et al., 2009). In addition, some religious institutions have massive financial and organizational resources (e.g., media networks, local schools) that they can mobilize to promote transformations toward more environmentally sustainable societies (Gardner, 2002; Mangunjaya et al., 2015; Palmer, 2013). Finally, several scholars have discussed – some with more scepticism than others as, e.g., in the case of Taylor et al. (2016) – an ongoing “greening” process of religions, meaning that religious traditions over time become more environmentally aware and engaged (Bergmann, 2009; Chaplin, 2016; Kanagy & Willits, 1993; Koehrsen, 2018; Koehrsen, Becci, et al., 2020; Reuter, 2015; Shibley & Wiggins, 1997) [Correction added on 21 April 2021 after first online publication: This statement was updated to clarify the positions of the articles that were cited.]. Apart from “green” reinterpretations of the given faith traditions, religious communities have started to undertake environmental activities, such as public statements, consultations with national and regional governments, recycling or tree-planting projects, and environmental education (Amri, 2014; DeHanas, 2009; Mohamad et al., 2012; Shibley & Wiggins, 1997). For these reasons, scholars have stressed the transformational potentials of religions to facilitate transitions toward more environmentally sustainable societies and to address climate change (Bergmann, 2009; R. Gottlieb, 2008; Holmes, 2006; Palmer, 2013).

The extent to which religions are becoming “greener” and contribute to climate change mitigation still remains an open question. Up to now, most research about religious environmentalism has focused on Christianity in the Global North (Haluza-DeLay, 2014, p. 269; Hulme, 2016, pp. 245–246; Jenkins et al., 2018, pp. 93–94). However, less is known about the world's second largest religion, Islam. Despite the fact that many of the regions where most Muslims live are highly vulnerable to climate change and that Islam often assumes a great societal relevancy in these regions, only few social science studies have addressed the relationship between Islam and climate change (Hancock, 2018, p. 3). This review aims to bring the existing but scattered knowledge together. Thus, it provides insights into the potentials of Muslim communities to facilitate (or block) climate change mitigation in different world regions. The review distinguishes between "Islam" as an abstract religious knowledge system and "Muslims" as individual and collective actors (e.g., organizations) who identify with Islam. These actors may interpret the religious knowledge system in different ways. As this review shows, there is no uniform interpretation of climate change among Muslims. Based on their interpretations of Islam, Muslims have generated different approaches to climate change.

The review starts with a brief introduction to Islam and the rising field of Islamic environmentalism. Drawing on surveys and qualitative case studies, the second section addresses how Muslims in different world regions perceive and interpret climate change. The third section outlines the potentials of Muslim organizations and leaders to contribute to climate change mitigation, naming different fields of activity and examples of existing initiatives. While there is surprisingly little research on the Middle East, existing studies have mostly addressed initiatives in Indonesia and the United Kingdom. Therefore, the fourth section undertakes case studies of Muslim mitigation activities in these two countries. A comparison of the activities in the two countries shows the potentials and limitations of Muslim mitigation efforts and illustrates how these relate to the broader country context. The final section summarizes the main results, stresses the need for further research, and outlines potential directions of future studies.

CONCLUSION

Most literature on Islam, the environment, and climate change is theoretical and focuses on Islamic environmental ethics. While it indicates a growing ecological thought, it is unclear to what extent this "greening" affects broader sections of the global Muslim community. Research suggests that Islamic environmentalism is still a minority phenomenon among Muslims. Future studies may explore different channels through which the "greening" of Islam is expanding in various world regions. In particular, Muslim leadership on national and local scales may have an important impact on the presence of environmentalism among local communities. In addition, pioneering benchmark projects (e.g., "green" Mosques) may also help to create greater awareness.

This review has shown that there is no univocal perspective on climate change among Muslims. Muslims interpret climate change in different ways, regarding it as caused by (a) humans, (b) God, or (c) neglecting its existence. Moreover, research indicates that specific perceptions of climate change are prominent in particular regions. Regional traditions of Islam are likely to inform the interpretations of phenomena related to global warming. Therefore, there is a need for more empirical research on regional differences that considers the Islamic interpretations of Muslims living in the given areas. For instance, future quantitative research could study how specific understandings of Islam interact with other variables (e.g., regional climate change vulnerability) to inform Muslims' perceptions of climate change.

Scholars have pointed toward different potentials of Muslim organizations and leaders to facilitate climate change mitigation. Accordingly, these actors can campaign in the public sphere and toward political decision-makers for mitigation measures, disseminate pro-environmental Islamic ethics among their followers, or materialize low-carbon transformations within their organizations. In general, there is little social science research on such activities. Nevertheless, some studies have addressed Indonesia and the United Kingdom. While Muslim grassroots initiatives in the United Kingdom mostly focus on “converting” other Muslims to Islamic environmentalism at the grassroots level, in Indonesia, powerful Muslim organizations are undertaking transformation activities at different levels. The two cases show that the institutional context influences the form and the potentials of Muslim mitigation activities. Future research may study whether the activities in these two countries have led to a broadening of climate change concern and to lifestyle changes among Muslims. In addition, there is a need for research on Muslim mitigation activities in other regions. Such research could address, for instance, how powerful religious organizations and leaders approach climate change in the Middle East and North Africa.

Interestingly, so far, research on Muslim environmentalism has not addressed climate change adaptation. However, beyond raising concern about global warming among Muslims and encouraging mitigation efforts, Muslim environmentalism has strong potential to advance ethical questions about climate change adaptation (e.g., climate justice).

In particular, in Muslim-majority countries, Muslim environmentalism can play an imminent role. Apart from the already mentioned directions of research, future studies might address the political dimensions of Muslim climate change activism at different levels. For instance, how are Muslim initiatives interacting with actors from other faith backgrounds to campaign for climate justice in international settings such as the United Nations Framework Convention on Climate Change (Glaab, 2017)? In addition, research could explore their linkages with national and local political administrations and what strategies they use to influence the agendas of these actors. The political dimensions also include political Islamism and its relationship to Islamic environmentalism: Are political Islamists increasingly addressing climate change, or are they rather assuming a similar role to that of some evangelical actors in the United States by challenging religious environmentalism and mitigation policies (Chaplin, 2016)? In what way are they influencing the climate policies of countries such as Pakistan, Saudi Arabia, or Turkey?

Finally, studies could also empirically explore the role of Islamic environmental ethics and their impacts on the business sector, as Abdelzaher and Abdelzaher (2017) suggest. Are Islamic environmental ethics living up to their expectations and being brought to use in small- and medium-size businesses in the Middle East and North Africa? Apart from Muslim-majority countries, Islamic environmentalism has proven to also evolve in the diaspora as the case of the United Kingdom illustrates. However, it is, so far, unclear how it is evolving in other Global North countries with important Muslim communities, such as in France and Germany, and in what way it creates a broader dialog between different religious communities to jointly campaign for climate change mitigation and adaptation (Dohe, 2021).

7. Latin American Culture:

"Social preferences for ecosystem services in a Biological Variability hotspot in South America," Iñigo Bidegain, et al., PLOS ONE, 22 April 2019 [61]
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0215715

Abstract:

Identifying which ecosystem services are relevant to different stakeholders and understanding stakeholders' perceptions of such services is useful for making informed decisions, especially in regions of the world where the achievement of Biological Variability conservation goals is threatened by economically productive activities. In this article, we assess social preferences for ecosystem services in a Biological Variability hotspot in central Chile. We use a consultative case study to ask local stakeholders (n = 70) from the Campana Peñuelas Biosphere Reserve to identify the most important ecosystem services the area provides for them and inquire about the perceived vulnerability of the services to changes in the future. We also explore the association between the perceived importance of ecosystem services and the sociodemographic and cultural characteristics of the respondents, which allows us to identify contrasting stakeholder perceptions of different ecosystem services. The most important services for local actors were the drinking water, fresh air and climate change control, genetic pool of plant communities in central Chile, and educational value. From the perspective of local actors, the services that could be threatened by negative changes in the future in terms of their provision included the possibilities of developing conservation activities focused on iconic threatened animal and plant species, water regulation, food from agriculture, and drinking water. Contrasting perceptions about the importance of ecosystem services emerged among stakeholders. While small farmers and members of local organizations attributed higher importance values to provisioning services, scientists and rangers and administrators of protected areas as well as teachers, NGO members and local government employees attributed more importance to the regulating and cultural services associated with threatened species. Our results can serve as a source of information for the planning and decision-making processes related to the search for socially and ecologically sustainable solutions for land use management.

Current & Relevant Information:

Introduction

In recent decades, the concept of ecosystem services (ES) has had important impacts in both scientific and political forums. ES can be defined as the aspects of ecosystems that are used (either actively or passively) to maintain human well-being. This definition considers ecosystem organization, processes and functions utilized by humanity. Policy initiatives, such as the Aichi Targets and the Intergovernmental Platform on Biological Variability and Ecosystem Services (IPBES) that explicitly recognize the importance of the ecosystem services approach to ecosystem management have stimulated assessments and valuations of ecosystem services in different regions of the world. Although these policy platforms have explicitly recognized the importance of understanding the social dimensions of ecosystem services (e.g., assessing societal preferences for and perceptions of ecosystem services using non-economic approaches, uncovering divergent interests regarding ecosystem services from different local actors, or understanding how people respond to the management of such services, the assessment of these social dimensions of ecosystem services is still lacking. Much work has been done to conduct ecological assessments and economic valuations of ecosystem services. The ecosystem services approach recognizes that healthy ecosystems depend not only on the ecological properties of ecosystems but also on their capacities to fulfil social needs. In addition, the economic valuation of ecosystem services (i.e., the process of valuing the contributions of the ecosystem services and Biological Variability at the level of the life and well-being of social actors, conceived in terms of individual utility does not capture the full range of benefits people obtain from ecosystems. If only ecological and economic criteria are considered in the assessments of ecosystem services, it can lead to conflicts in ecosystem management when social contexts are not appropriately recognized. In this regard, identifying which services are relevant to different stakeholders and understanding stakeholders' perceptions of such services is relevant to making informed decisions, especially in regions of the world where the achievement of conservation goals is threatened by economically productive activities. On the one hand, ecosystem management is largely about regulating human actions towards ecosystem services. Human actions are conditioned by the perceived benefits that people get from ecosystems and consequently such perceptions of benefits affect engagements or not in behaviors that ensure the continuous flow of desired ecosystem services. On the other hand, different stakeholders can have different relationships with the same ecosystem. For example, scientists and administrators of protected areas may value a natural area because they want to safeguard threatened species and they recognize the scientific and educational value of the ecosystem. Local farmers can value the same area because their lifestyles are based on agricultural and farming activities; additionally, they may be guided by traditional ecological knowledge. Furthermore, tourists and urban-dwellers may value the area because they can appreciate its scenic beauty, but they do not have a close link or a long-standing connection to the ecosystem. Divergent social interests may lead to conflicts over the use of territory, which threatens the achievement of conservation goals, and these conflicts can lead to the development of policies that result in very different outcomes and involve different beneficiaries. Including a priori analyses of the social dimension of ecosystem services as part of ecosystem management may contribute to improving the provision of ecosystem services for all stakeholders, thus reducing conflict.

In this article, we assess social preferences for ecosystem services in one of the most important regions of the planet regarding the conservation of Biological Variability, i.e., central Chile. We use a consultative case study and ask local stakeholders from the Campana Peñuelas Biosphere Reserve about their preferences for different ecosystem services that flow in the area. Local stakeholders are the local government, enterprise managers/owners, small farmers, representatives of local organizations, and tourism workers. We also included educators from schools and colleges and scientists working on conservation and environmental topics in the area.

Specifically, we a) analyze the relative importance and the perceived vulnerability that the different stakeholders attribute to different ecosystem services, and b) explore the association between the perceived importance of ecosystem services with the sociodemographic and cultural characteristics of the respondents to identify contrasting perceptions of stakeholders regarding different ecosystem services.

Our study is framed by the need to strengthen the evidence of the links between natural systems and local communities in the context of biosphere reserve management in Chile. For example, the current methodology for management planning in the Chilean System of Protected Areas of the State, which encompasses several protected areas that are part of biosphere reserves, involves not only ecological criteria but also human-well-being. Such a demand requires a process for implementing different approaches to garner local participation, where the assessment of preferences for ecosystem services can represent the beginning of a comprehensive understanding of the complex relationships between humans and natural systems. Understanding how people use and value ecosystems is fundamental to achieving effective and equitable conservation, and the type of valuation presented here can help provide this information.

Given the scarce information on different local stakeholder preferences for ecosystem services in the study area, our research study has a consultative participatory characteristic and adopts a semi-structured interview approach. According to Pretty et al., the consultative participation approach is considered very appropriate when social actors respond to questions about their perceptions and knowledge on a topic, such as in our case. In addition, a semi-structured approach can be useful when the objective is to characterize social actors according to their perceptions of ecosystem services and use this information to provide initial images of diverging interests among stakeholders for ecosystem services. The information generated with our approach can contribute to the future design and implementation of stronger participative methods, such as in-depth interviews or deliberative participation, that benefit from questionnaire results on the perceptions of ecosystem services.

At a global scale, with our study, we contribute to the existing literature on the social dimension of ecosystem services by providing a new assessment of social preferences for ecosystem services in a globally relevant biosphere reserve in South America. South America has been recognized as a region that urgently requires more research on how to effectively conserve ecosystems while incorporating human needs and values. Furthermore, our study has local relevance. Given the distinctive characteristics of the relationships between humans and ecosystems, many regions of the world are attempting to implement policies that require data on particular ecosystems. Societies and ecosystems around the world differ; thus, local studies of ecosystem services are necessary if we want to achieve the objectives of biosphere reserves and find sustainable solutions that balance social and economic development with Biological Variability conservation.

Conclusion

The biosphere reserve model explicitly recognizes the necessity of integrating different actors into the design and implementation of effective mechanisms of Biological Variability conservation at local, regional, national, and global scales. Accounting for social preferences for ecosystem services enables the multiple ways by which people benefit from nature to be visualized. In countries such as Chile where economic criteria are often given more weight than other ecological and socio-cultural criteria in territorial management, ignoring information generated from social approaches can hide the complex socio-ecological webs that are not necessarily visualized through existing legal regulations or policies. However, understanding these webs is key to advancing towards sustainability. This fact has important policy implications as it forces scientists and decision makers to recognize the legitimacy of the interests of local communities in nature, thus favoring a more transparent decision-making process. In this regard, our approach contributes to a better understanding of how the different social actors of a biosphere reserve in a Biological Variability hotspot in South America perceive ecosystems from the perspective of the provision of different benefits through the following specific findings: a) divergent perceptions of ecosystem services emerged from different stakeholders; b) there was an urban-rural dichotomy in terms of preferences for ecosystem services; c) local ecological knowledge (e.g., that of small farmers) emphasized provisioning ecosystem services (e.g., beekeeping, food from agriculture, and drinking water) as well as cultural services associated with plants, while more expert knowledge (i.e., that of scientists or environmental professionals) leads to the favoring of regulating services (e.g., fresh air and climate change regulation) and cultural services (e.g., possibilities of developing conservation activities focused on threatened animals and plants). Thus, locals are guided by subsistence logic—the reproduction of their lives and their way of life—that is mainly linked to provisioning services, while scientists and environmental professionals perceive the benefits of natural systems on a more global scale by focusing on regulating services.

At the local level, we found that ecosystem services associated with water supply and agriculture (e.g., traditional activities such as beekeeping) and cultural services associated with symbolic plants seemed to be embedded in the perspective of local actors. Thus, this bundle of ecosystem services seemed to be critical for local communities, where the provision of water was a key factor in the manifestation of such services. In central Chile, there is concern about the future water supply, which may be affected by the increasing human population and frequency of drought associated with climate change. In this regard, ecosystem-based approaches to water management can be integrated into agricultural development as well as Biological Variability conservation.

In Chile, the inclusion of social perspectives in land management is still limited, although discourse on environmental sustainability is increasing. To advance towards sustainability, the needs and perspectives of all beneficiaries must be taken seriously to legitimize processes, avoid conflicts and design socially informed conservation policies. Our results may also contribute to the implementation of the planning model for protected areas based on open standards, which consider human well-being and ecosystem services. Because local planning processes are in full swing, our analysis provides timely information that can be used by local and regional stakeholders and decision makers to design stronger participative approaches; additionally, our results can be considered as base knowledge on local preferences towards ecosystem services.

Our study highlights the necessity of exploring social perceptions of ecosystem services to uncover the interests of different stakeholders in complex management scenarios, such as biosphere reserves, that must consider both natural and social issues.

"Inclusion of Local People and Their Cultural Practices in Biological Variability Conservation: Lessons from Successful Nations," Dickson Adom, American Journal of Environmental Protection, 2016 [62]
https://www.researchgate.net/profile/Dickson_Adom/publication/316914798_Inclusion_of_Local_People_and_Their_Cultural_Practices_in_Biological Variability_Conservation_Lessons_from_Successful_Nations/links/5917f15aa6fdcc963e856ac7/Inclusion-of-Local-People-and-Their-Cultural-Practices-in-Biological Variability-Conservation-Lessons-from-Successful-Nations.pdf

Abstract:

The inclusion of local people and their cultural practices impact positively on Biological Variability conservation. This is the underlying factors behind the success stories of countries with high numbers of biological variability resources. It is sad to reckon that most Biological Variability policies of developing countries like Ghana do not fully include the voices of the local people as well as their cultural practices. There was, therefore, the need to thoroughly review the national Biological Variability strategies and action plans of some countries that have effectively factored the local people and their cultural practices in their Biological Variability policies. This was to elucidate how and in what areas the views of the local people and their cultural practices can be effectively incorporated into Biological Variability conservation initiatives. The study utilized qualitative research approach with document analysis method. Related literature on the subject from peer-reviewed manuscripts, Biological Variability strategic reports and strategies of different countries were rigorously reviewed and analyzed using Interpretative Phenomenological Analysis (IPA). The study revealed that local people have time-tested conservation knowledge enfolded in their cultural practices like religious beliefs, taboos, etc. Legal backing was seen as the main driving force behind the utilization of the cultural practices of the local people in the Biological Variability strategies reviewed. Moreover, the local people were fully involved in the development of the Biological Variability strategies. This was seen in the areas of planning, management, and decision-making, recruitment of staff, as well as the dissemination and implementation of the Biological Variability strategy. The study concluded that effective Biological Variability policies must reflect the cultural practices and the views of local people since they are powerful instruments of conservation. It tasks Biological Variability policy designers to fully incorporate local communities and their cultural practices in the development of Biological Variability strategies.

Current & Relevant Information:

This section of the paper delves into the national Biological Variability and action plans of some successful nations in Biological Variability conservation initiatives. These countries have effectively included the local people and their cultural practices in every aspect of their Biological Variability conservation initiatives and programs. These aspects include the planning, management, and decision-making processes as well as the implementation and recruitment of staff in spearheading conservation plans for Biological Variability. Also, the dissemination of conservation initiatives demonstrates the strong influence of local people and their cultural practices. In addition, the exact cultural practices of the local people that have played significant roles in Biological Variability conservation have been discussed. These successful countries whose Biological Variability conservation strategies and action plans are reviewed are ***Brazil***, China, Japan, India, Tanzania, Kenya, and Angola.

Brazil happens to be one of the world's countries that have a high peak of Biological Variability resources. A critical analysis of their national Biological Variability strategy and action plan shows the high factorization of cultural practices. This is laudable because of the different indigenous people and communities numbering over 230 in Brazil. Poised in implementing the rudiments in the Convention on Biological Variability, Brazil, as it has been their culture, revamped the incorporation of the local people and their cultural practices that have effective conservation values. The national target 18 in the national Biological Variability strategy and action plan captured in their fifth national report to the Convention on Biological Variability, 2015, was aimed at respecting the traditional knowledge and innovations of the local communities. This included formulating legislation for the factorization of their traditional cultural practices while granting them full participation in the decision-making and management processes at all relevant levels in their nation's Biological Variability conservation and sustainable usage. This was not just abiding by an international obligation because the Brazilians have a historical record of how the cultural traditions of the people have helped in the preservation of their forests and wildlife resources. Thus, the NBSAP of Brazil aimed at developing effective means of protecting, valuing and promoting the outstanding and successful experiences of the traditional conservation initiatives. It was also aimed at assisting in the dissemination of the conservation ethos in the traditional cultural practices to the younger and unborn generations.

Moreover, in raising the awareness of the worth of the traditional cultural practices in Biological Variability conservation, the Ministry of Culture in the country constantly supported and funded annual events geared to the promotion and preservation of the cultural heritage of the indigenous communities. A typical example is the funding of the 2013 meeting of the traditional cultures of some states in Brazil. As part of the event observance, workshops regarding the national policy on traditional knowledge linked to Biological Variability were organized. The various educational institutions in the country also aided in the dissemination of the traditional knowledge in the cultural practices. The Ministry of Culture and the Ministry of Education liaised with the educational institutions to incorporate traditional knowledge into formal education. Modules on traditional knowledge and cultural practices with lessons on traditional beliefs, mythology, folklores and their relation to nature are relayed by instructors as has been done by the University of Brasilia since 2010.

According to, despite the massive developmental roles, traditional societies and their splendid cultural practices have played in varied areas of life, such as Biological Variability conservation, it is difficult to understand why their voices are conspicuously missing in national decision-making forums. These forums, register either minimal or nil representation of their voices. This situation is very true in most countries and it is very distressing to know. This situation does not exist in developed countries like Brazil. The strategic objective E of the NBSAP of Brazil stressed on the enhancement of the implementation processes of the policy through participatory management. This partnership is forged between the governmental ministries and the set-up community-specific protocols who act as the representative voices of the local communities. This participatory management seeks to solicit the opinions of the local residents in every household in the local communities through workshops with community stakeholders. Their views are then debated and carefully scrutinized for a possible factorization into national policy documents related to Biological Variability conservation. This co-management approach helps project managers in seeking the consent of the local people who are part of the decision-making team before projects that are agreeable to the customary laws and cultural practices of the local people are undertaken.

The strategic coordination and partnership between the Ministry of Environment, the Ministry of Education and the Ministry of Culture has successfully assisted in the promotion, dissemination, and integration of the wisdom of the traditional cultural practices of the various ethnic societies into the Biological Variability policy in Brazil. This has ensured cultural variability among the numerous ethnic societies.

"Climate change, Biological Variability conservation for Synergies and Interactions, Deforestation and its Policy Responses in Bolivia Under the Current Political Context: What Scope?," Bernardo Peredo-Videa, UPEI, October 2008 [63]
https://projects.upei.ca/climate/files/2012/10/Book-7_Paper-16.pdf

Abstract:

Biological Variability conservation is an economic, environmental and social process. It is also a political and cultural process in developing nations, characterized by being the richest regions in Biological Variability but also the poorest economically. Paradoxically, while Biological Variability and forest management provide substantial socio-economic and environmental benefits, local people have not often received benefits resulting from these processes. Thus ecosystem degradation and deforestation has increased. This would be the case of Bolivia, considered among the richest countries in Biological Variability, especially within the Tropical Andes Hotspot, recognized as the global epicenter of Biological Variability. However, the country is one of the poorest nations in Latin America with indigenous communities among the most vulnerable groups. Despite some progress and advances during the last decade in Biological Variability conservation and climate change, these efforts have been mainly promoted by the international cooperation. Therefore, political arguments and economic policies are asking new questions on the effectiveness of these initiatives for conservation and sustainable development, including climate change and the discussion of emerging trade-offs as part of new development approaches to reduce poverty. Furthermore, new threats arise to the sustainability of these processes related to increasing deforestation rates. Hence, the current national agenda is recognizing the need for improved roles and synergies in the management and ownership of renewable natural resources, including recent legal and policy frameworks that are integrated into national development plans.

Current & Relevant Information:

Introduction

Evidence produced in several studies since the early 1990s suggests that large-scale conversion of tropical forests into pastures or annual crops could lead to changes in the climate. Thus, it has been documented that land-use change impacts regional and global climate through the surface-energy budget as well as through the carbon cycle. As well as influencing local long-term weather conditions, regional-scale land-cover change can impact on the global climate system besides energy emissions of greenhouse gases (GHGs). These aspects of human influence on climate were not accounted for under the Kyoto Protocol. The neglect of land use effects lead to inaccurate quantification of contributions to climate change.

The role of tropical forests may be significant in this process. Apart from their role as reservoirs, sinks and sources of carbon, tropical forests provide numerous additional ecosystem services. Many of the ecosystem services directly or indirectly influence climate, including the maintenance of elevated soil moisture and surface air humidity, reduced sunlight penetration, weaker near-surface winds and the inhibition of anaerobic soil conditions. Such an environment maintains the productivity of tropical ecosystems.

Deforestation in Amazonia is progressing rapidly, with estimations by several authors suggesting that if deforestation were to continue at the present rate, a significant reduction of Amazonian tropical forests would occur in less than 100 years. Such rapid deforestation is clearly contributing to regional CO_2 emissions. Although, it is considered that deforestation and tropical forests fires contribute globally to about 20 per cent of total CO_2 emissions, the major impact is related to the rapid loss of forest ecosystems and Biological Variability.

Academic and policy literature has directly linked deforestation rates with structural adjustment programs (SAP) implemented in many South American countries, which promoted the expansion of timber and soy exports. In the case of Bolivia, deforestation has increased dramatically since the mid-1990s, particularly because Bolivia was amongst the first Latin American countries to initiate a far reaching and relatively orthodox SAP, which greatly contributes to forest clearing for soybean exports and to higher timber exports.

Summary of results

Only the expansion of protected areas between 2002 and 2008 will allow for a 272±180,000 km2 reduction of deforestation that could be expected for 2050, which is, in other words, equivalent to a reduction of 3.3±1.1 billion tons of carbon emissions. Twelve percent of this global reduction can be attributed to the ARPA Program, which supported the creation of 13 protected areas during this time period. Moreover, the expansion of 210,000 km2 planned by the ARPA Program for 2008 and 2009 could increase this reduction to 350±170,000 km2, equivalent to 4,3±1.2 billion tons of carbon. Should all the protected areas be 100 per cent impervious to future deforestation, these reductions would reach 324±152,000 km2 and 409±137,000 km2 respectively, number that is equivalent to a reduction in carbon emissions of 3.9±1.3 to 4.9±1.5 billion tons of carbon.

Final assessment and recommendations

Nearly 50 per cent of remaining Amazon forests is under some type of protected area designation. Of this total, 16.8 per cent are supported by the ARPA Program. Historically, protected areas have played a fundamental role in deforestation reduction and are, consequently, a barrier to the advancing agricultural frontier that, when uncontrolled, illegally and predatorily destroys the Amazon forest.

Our empirical analysis has shown that protected areas not only inhibit deforestation within their lands, but also show an inhibitory effect on reducing deforestation in their surroundings. Notably, this inhibitory effect has been augmenting over time, as shown by the analysis of the effectiveness of protected areas in impeding deforestation, especially is the case of sustainable use areas supported by the ARPA Program.

Mosaics, corridors or networks of protected areas play a fundamental role in conserving biological variability, protecting habitats, maintaining hydrological regimes, as well as in the stability of regional climate. Today, the protected areas of the Brazilian Amazon hold nearly 50 per cent of the remaining forest carbon stocks. The areas supported by the ARPA Program alone can reduce potential emissions from deforestation by 2050 of nearly 1.1 billion tons of carbon. Nevertheless, the consolidation of this extensive protected area network represents a great challenge to the Brazilian nation, especially in areas located along the active deforestation front, where numerous land conflicts and other illegal activities threatens the social and natural environment. This challenge is likely to grow in the near future due to increasing demands for agricultural commodities. Thus, those areas located along the deforestation front face greater threats and present the greatest potential for carbon emissions. On the other hands, if efficiently implemented, these same areas also represent the greatest potential for the reduction of carbon emissions. For these reasons they deserve special attention from conservation investments, even though they do not fit the traditional conservation approaches that prioritize protection according to their high biological variability and low levels of threat.

In our view, the best way forward consists in encompassing both strategies. In other words, it is necessary to give priority in protecting key areas against the advance of the deforestation frontier, as well as targeting the highly representative Biological Variability samples of the Amazon as a whole. In addition to continuing to expand the Amazon protected network, a substantial allocation of resources is vital to the success of this innovative conservation strategy that aims for the creation and consolidation of protected areas along regions of extreme land use dynamics.

Quantifying reductions of deforestation and associated carbon emissions through the implementation and consolidation of protected areas is an important contribution to the international debate. In the scope of the United Nations Framework Convention on Climate Change, this work brings major contribution to the decisions made by the Conference of the Parties, held in December of 2007 in Bali. The Bali Action Plan (Decision UNFCCC 1/ COP13), which addresses measures and proposals with the objective of increasing the implementation of national and international mitigation, specifically refers to the development of policy approaches and positive incentives on issues relating to reducing emissions from deforestation in developing countries. In a specific decision concerning deforestation (Decision UNFCCC 2/CP 13), it is noted that sustainable reductions of emissions resulting from deforestation in developing countries require stable and predictable resources. It is also acknowledged that reducing emissions from deforestation in developing countries can foster multiple benefits and complement the objectives of other relevant conventions.

The estimate of the reduction of emissions resulting from deforestation under various scenarios allow us to conclude that the strategy for the implementation and consolidation of protected areas, especially the ARPA Program, can be classified as a demonstration activity for reducing emissions from deforestation in Brazil. As highlighted by the COP, this huge effort towards conservation and reduction of deforestation emissions requires stable and predictable availability of resources. It is imperative that the efforts made until the present moment be ensured and continued. The ARPA Program is ready to become integrated with future formal and/or volunteer mechanism of positive incentives towards reducing emissions from deforestation.

"Chapter 2: Adaptive Management for Biological Variability Conservation under Climate Change – a Tropical Andean Perspective," David G. Hole, et al., Climate Change and Biological Variability in the Tropical Andes, 2011 [64]
http://www.keneamazon.net/Documents/Publications/Virtual-Library/Impacto/86.pdf

Overview:

The tropical Andes are a globally significant region for Biological Variability (Mittermeier et al. 2004). Dramatic environmental heterogeneity across the region including steep gradients in elevation and humidity, and complex mosaics of bedrocks and soils, together with the wide range of historical variability in Andean climates, have helped shape this remarkable biological variability (e.g., Trenel et al. 2008; Antonelli et al. 2009; Guarnizo et al. 2009). These same processes have also shaped the human context and provided natural resources that now sustain the wellbeing of millions of people, including lands for farming and grazing, water for households, irrigation and industries, and space for settlements. The region is one of the key places in the world for the development of early human societies, from organized settlements, to irrigated agriculture and the domestication of plant and animal species (Denevan 2001). Hence, it now contains large expanses of human dominated landscapes, from highly urbanized centers to more rural areas, where native forests have been replaced by agriculture and non-native tree plantations. Even the dry environments and high elevation sites are often used for extensive grazing of livestock. This leaves relatively few areas without a human presence, principal exceptions being the cool, moist cloud forests and the very humid paramos on the high mountains of the northern Andes. As a result of these historical and contemporary land-use patterns, there have long been tensions among the needs for conservation and protection of natural Biological Variability, versus those for economic development and the reduction of social inequalities (Terborgh 1999). These tensions substantially increase the complexities of conservation planning in the region.

Historically, the rate of change in the land cover of tropical landscapes is unlikely to have occurred as rapidly as it has in the last 50 years (Young 2007). Deforestation and conversion of land has led to an unprecedented loss of natural habitats in recent decades, with profound ramifications for the continued functioning of entire ecosystems (MEA 2005). Ongoing and projected climate change adds a substantial new component to this mix. Dramatic changes to both biotic and abiotic systems and processes are already being seen across the tropical Andes, with glacial ice diminishing and upward biotic range extensions occurring even into high alpine areas (Seimon et al. 2007), with local people already altering their land uses in response (Postigo et al. 2008; Young 2008). Such changes are having profound impacts on species' phenologies, distributions and abundance (Parmesan 2006) that will increase in magnitude in the future. Of particular conservation concern are the likely changes in representation and abundance of species within existing protected areas and across networks (Araujo et al. 2004; Hole et al. 2009), as well as the high likelihood of profound changes in the location and continued functioning of many Andean ecosystems. Indeed, such changes are likely to result in the formation of 'no-analog' communities (i.e. species assemblages for which there are no present-day examples) (Williams and Jackson 2007). Given the projected pace and likely consequences of climate change, magnified as they are in regions such as the high Andes (Bradley et al. 2006; IPCC 2007), it is critical that we adapt conservation management strategies in an effort to maintain their effectiveness under climate change. Without such effort, the region risks losing substantial components of its Biological Variability, loss of key ecological processes and disruption of its ecosystems and consequent reduction or loss of the services they provide.

In this chapter, we will focus on the conservation spotlight on adaptive management. It is not intended to be exhaustive in its coverage - the topics included are broad and need consideration in greater detail. Instead, we begin the process of identifying the range of risks and opportunities for Biological Variability conservation and adaptive management presented by climate change within the unique context of the tropical Andean region. We highlight some of the principal tools available for assessing the vulnerability of Biological Variability and ecosystems, and describe a range of conservation and management options that might be selected, based on the degree of manipulation and use required in order to maintain human wellbeing. In some cases, strict protection of very fragile ecosystems and endangered wild species is likely to be needed. In other cases, a mix of conservation through protected area systems and integrated planning for sustainable land use will likely be more appropriate. We then look briefly at options for monitoring climate change impacts and the effectiveness of management actions, before highlighting the opportunities (however limited) that climate change may bring for conservation. Finally, we identify critical institutional capacity needs within the region that are urgently required in order to effectively, efficiently, and equitably enable adaptation to the profound challenges posed by climate change.

Current & Relevant Information:

Current Status of Andean Biological Variability Conservation

Protected areas are the single most important tool for Biological Variability conservation in the tropical Andes region and have seen a substantial increase in number and area covered over the past 15 years. Currently, around 15% of the four Andean nations' land area is under national protected area status. While designation of protected areas has generally been based on Biological Variability targets, it has not necessarily resulted in the representation of the most biologically pristine or valuable areas within priority ecosystems. More recently, protected areas have in many cases been created simply on the basis of sociopolitical opportunity.

Even though robust assessments of the representativeness of the different protected area systems have not been carried out in a systematic manner, around 70-80% of species are likely to be represented within national protected areas (excluding municipal and departmental level protected areas, indigenous and community conservation areas, and indigenous communal lands). However, representation is biased towards lowlands and foothills, and little attention has been paid to ecological processes, especially in western regions.

Capacity and data limitations mean that potential gaps in the network under climate change are largely unknown. However, there is now a push to integrate the large number of additional conservation areas managed at local and regional levels, into the National Protected Area Systems (Hoffmann 2009), in some cases led by municipal governments, and in others by native peoples, which could play a vital role in adapting national Biological Variability conservation efforts to the challenges of climate change. There are also efforts under way to define national and regional conservation corridors that serve to link protected areas (e.g., Vilcanota-Amboró

Corridor in Bolivia and Peru; three altitudinal corridors on the Eastern slopes in Colombia). Only in Colombia, however, has climate change recently been incorporated as an explicit component of the conservation planning process behind these efforts. Hence, substantial basic research, including gathering of baseline data, as well as modelling of potential future shifts in species distributions and consequent changes in the provision of ecosystem services, is a critical priority for the tropical Andes region.

Conclusions

Given the global importance of the tropical Andes for Biological Variability, and the considerable risks posed by climate change, it is critical that both a regional and an international response be oriented to provide the necessary information and resources at the appropriate regional, national, and local scales, in order to inform robust adaptive management responses. Given current social inequalities which will likely be further exacerbated by climate change, the implementation of strategies that incorporate the use of economic, policy, and legal instruments for Biological Variability conservation across the tropical Andean region will need to consider equity, fairness and distributional issues. How are these policies impacting stakeholders? Are they imposing burdens on the poorest sectors? These and other similar questions must be considered when designing and implementing integrated conservation and development policies. We highlight nine critical needs:

- Convene a region-wide systematic conservation planning process, that explicitly incorporates the impacts of climate change, and that reconvenes every five years, in order to coincide with the availability of new knowledge from the IPCC and other assessments.

- Continue to develop a comprehensive understanding of Andean climatology of the present and recent past to provide a baseline for detecting change and for assessing species and ecosystem capacities for resilience to climate stresses.

- Implement standardized monitoring protocols to provide baseline evaluations of species distributions, population status, and ecosystem integrity, drawing from taxonomy, field ecology, and remote sensing. It is critical that data transparency and sharing is widely promoted.

- Continue to develop and test the next generation of SDMs for projecting species and ecosystem (or proxy) spatial responses to climate change, since these provide the only way of assessing potential synergies and conflicts with people in an uncertain future.

- Improve the understanding of the indirect impacts of climate change, resulting from planned and unplanned human adaptation and mitigation responses, on Biological Variability and the provision of ecosystem services.

• Demonstrate the direct and indirect benefits of ecosystem-based adaptation as a key tool for making lives and livelihoods more resilient to climate change.

• Build institutional capacity to design and implement robust adaptive management strategies, at regional, national and local scales, including all stakeholders.

• Incorporate consideration of Biological Variability into local, national and regional development planning, across all economic and societal sectors. Biological Variability and the ecosystem service it underpins must be front and center with economic and other considerations.

"Chapter 11: Forgotten Social Issues for Achieving Long-Term Conservation in Protected Areas," Daniel Torres-Orozco Jiménez, Benito Vázquez-Quesada, and Cecilia L. Jiménez-Sierra, Mexican Natural Resources Management and Biological Variability Conservation: Recent Case Studies, 2018 [65]
https://www.researchgate.net/profile/Daniel_Torres_Orozco_Jimenez/publication/326528759_Forgotten_Social_Issues_for_Achieving_Long-Term_Conservation_in_Protected_Areas_Recent_Case_Studies/links/5c0b23f94585157ac1b05168/Forgotten-Social-Issues-for-Achieving-Long-Term-Conservation-in-Protected-Areas-Recent-Case-Studies.pdf

Abstract:

Protected areas (PAs) are probably the most important conservation instrument in Mexico. Historically, their planning and implementation have focused on ecological data ignoring values, attitudes, behaviors, and institutions of the people living in the PA, thus inhibiting its long-term effectiveness. Here, we review three social disciplines that might enhance the understanding of the social sphere around PAs: conservation psychology (CP), social-ecological system framework (SESF), and conservation marketing (CM). CP is crucial to understand human behavior toward nature or conservation. We present different tools for evaluating values, attitudes, and behaviors that are relevant for understanding conservation outcomes. SESF allows to systematically map and diagnose the pattern of interactions of relevant variables in search of factors that can be promoted or restricted to enable the involvement of local people in the planning and implementation of conservation programs and instruments. Finally, CM allows us to modulate and design conservation programs with specific end-state behaviors and target audiences to improve the success of the conservation actions. We proposed that using these disciplines in the design, implementation, and evaluation of the conservation programs, we will enable effective long-term conservation inside Mexican PAs.

Current & Relevant Information:

Introduction

Protected areas (PAs) are one of the most common tools for the conservation of Biological Variability worldwide. Historically, PAs were created based on biological or ecological criteria (Halfter 2005), and human settlements within or adjacent to them were viewed as threats to their natural preservation (Redford and Sanderson 2000; Sarkar 1999). In this sense, the paradigm of early PAs was preservation of the environment, even if that meant removing the local communities from the area (Adams and Hutton 2007; Agrawal and Redford 2006). Following this preservation paradigm, policymakers aimed to create PAs in pristine habitats (Sarkar 1999), ignoring the social and economic impacts of their creation and management (Adams and Hutton 2007; Halfter 2005).

Protected Areas in Mexico

Mexico has a long history of protecting Biological Variability. Currently, there are seven legal methods to protect Biological Variability: environmental impact assessment (MIA), wildlife management unit (UMA), national forestry program (PRONAFOR, PSA), fishing refuge area (ARP), voluntary scheme for forest certification (SCEFORMEX), program of ecological general panning of the territory (POEGT), and protected areas (PAs). Of the seven, PAs have the longest tradition of use in Mexico and are probably the most important, as the other six methods can be implemented within PAs.

Mexican federal PAs are still designated by decree mainly following the current conservation paradigm, without an understanding of the cultural and ecological context. Mexico has more than 180 PAs, and their management depends on the National Protected Areas Commission (SEMARNAT and CONANP 2017). A specific management plan (PM) and an annual operative program are the principle guidelines for the management of the Mexican PAs. The National Commission of Natural Protected Areas (CONANP) directs the human and economic resources to monitor, patrol, manage, and promote sustainable development in each PA (Pisanty et al. 2016).

Conclusions

The problems of conservation are complex. They involve different actors, interests, and scales; consequently, their solution must recognize this multiple level interaction to achieve long-term goals (Ostrom 1990, 2007). The use of social disciplines and theories, as conservation psychology, environmental governance, and conservation marketing, in the design, implementation, and evaluation of PAs would improve its management (Bennett et al. 2017). Up to now, tools have not been fully involved in helping to address conservation threats (Clayton and Myers 2009). However, we believe that conservation managers could reinforce their strategies by applying them to ensure effective long-term conservation.

Social ineffectiveness found in Mexican PAs could be related to the form the conservation programs are designed. Mexican conservation programs were created in a top-down scheme aiming to solve the conservation problem or to reduce the threat as fast as possible. This report provides a summary of the potential tools to investigate how human relates to their environment. We believe this information would be crucial to design target-specific programs. For example, to stop habitat loss and fragmentation, the PROCODES program gives subsidies to the landowners as payment for the ecosystem services provided by the conservation status of their habitat. This program searches to stop habitat loss in the short term, because, despite ending the threat and provoking a conservation outcome, the program does not consider the long-term biological effects and the social feasibility (e.g., founding). This type of reactive conservation strategies needs to be perpetually applied to have an impact; in such cases, even if the species' extinction risk may be reduced (e.g., by increasing its survival and/or reproduction) in few generations, the program's associated costs may render it financially unsustainable, and ultimately the species would return to its endangered status after management actions are terminated (Cardador et al. 2015; Torres-Orozco et al. 2016). As PROCODES, most of the conservation programs in Mexico depend on subsidies, which are inefficient for achieving long-term conservation benefits and do not advocate to change people values, attitudes, and behaviors after the program has stopped. Therefore, we suggest that conservation programs in PAs might be conservation traps instead of conservation solutions.

To avoid funding possible conservation traps, conservation strategies should advocate changing the values, attitudes, and behaviors of the population that live inside or in the surroundings of PA and of the society in regional and national scales. We believe that Mexican conservation managers in PAs are doing exceptional work and that the inclusion of social disciplines and tools as presented in this chapter would allow reaching to long-term conservation.

"Urban Green Infrastructure in Latin America and the Caribbean: the case of San Salvador," Borja Castro Lancharro and Ophélie Chevalier, iadb.org, 26 May 2022
[66] https://blogs.iadb.org/ciudades-sostenibles/en/urban-green-infrastructure-in-latin-america-and-the-caribbean-the-case-of-san-salvador/

Overview:

The cities of our region are called to play a key role in the fight against climate change and achieve the Paris Agreements and COP26 goals. As we mentioned in the first blog of this series, the **Urban Green Infrastructure** (UGI) is one of the best **tools through which the municipalities of Latin America and the Caribbean** (LAC) can adapt and mitigate the climate crisis in line with the objectives of Vision 2025 of the Inter-American Development Bank (IDB).

In today's blog we share the experience of several municipalities in our region, the **Metropolitan Area of San Salvador** (AMSS), applying UGI solutions with the aim of providing ecological, economic, and social benefits to its inhabitants. We hope that their example can serve as an inspiration for many cities in LAC.

Current & Relevant Information:

Why is this type of tool necessary in the cities of the region?

The cities of our region are increasingly exposed to climatic disasters such as floods, heat waves, droughts, or storms. The UGI can complement climate change policies carried out by LAC cities by improving risk management and resilience, promoting sustainable urbanization, and restoring degraded ecosystems with all that this entails.

"Chapter 8: Forest Governance in Latin America: Strategies for Implementing REDD," Mariel Aguilar-Støen, Fabiano Toni and Cecilie Hirsch, Environmental Governance in Latin America, 2016 [67]
https://library.oapen.org/bitstream/handle/20.500.12657/27908/1002091.pdf?sequence=1#page=214

Overview:

Global interest in and attention to forests have grown as concerns about global warming and climate change have taken a heightened position in international policy debates. Forests have been repositioned in international arenas as repositories of global value for their contribution to carbon sequestration and climate mitigation (Fairhead and Leach, 2003; Peet, Robbins and Watts, 2011). In this context, Latin American forests are seen as globally important in fighting climate change.

Carbon emissions in developing countries, particularly in Latin America, are related mostly to land-use and land-cover change. In Latin America, energy accounts for only 28% of regional emissions, whereas land use, land-use change and forestry (LULUCF) accounts for 67% (Barcena et al., 2010). Forests cover about 11.1 million km2 and savannahs 3.3 million km2, comprising several different types of vegetation. The region as a whole has the world's greatest forest loss (Pacheco et al., 2010). Most of the forest conversion in Latin America occurs in the Amazon basin. Some countries are already being pressed to reduce emissions related to land-cover change, particularly deforestation. Political pressure comes from the international arena in many forms and is exerted by several actors: sovereign states, international organizations, media, civil society networks and others.

Several Latin American governments have turned to climate policies as an opportunity to improve environmental governance. Current discussions focus on a set of policies known as REDD in developing countries plus carbon-sequestering forest activities. REDD was originally designed as a payment for environmental services – that is, a voluntary transaction where a well-defined service (or a land-use system likely to secure that service) is being "bought by a buyer from a provider, if and only if the provider secures the service provision" (Wunder, 2005). REDD is based on the idea that it is possible to reduce deforestation by offering economic compensation to forest users for not changing the use of forestlands. It is seen as a win–win approach that would potentially address the trade-offs between forest conservation and economic development. Some analysts claim that REDD projects have the potential to generate enough money to end deforestation in tropical countries (Nepstad et al., 2009).

Although originally presented as an “apolitical” technological fix (cf. Li, 2007), REDD has encountered much criticism, and early proposals faced fierce political resistance. The neoliberal idea of the commodification of nature seemed repellent to individuals and even to countries, which fear that developed countries would use their economic power to increase or leave unaddressed their carbon emissions at the expense of developing countries. There were also fears that REDD would benefit actors who have historically been responsible for deforestation, such as ranchers and large-scale farmers, while excluding the less privileged forest-dwellers, who cannot bear the transaction costs of carbon markets and do not even have the title to their lands (Boyd, Gutierrez and Chang, 2007; Blom, Sunderland and Murdiyarso, 2010).

REDD proved to be much more complex than a simple carbon-market arrangement. Since it is a project “in the making”, it necessarily leaves room for bargaining and negotiations as to how forest and climate policies will take shape in specific contexts. As a result, REDD quickly moved from strictly carbon storage to having multiple objectives, including Biological Variability conservation and the enhancement of local livelihoods (Angelsen and McNeill, 2012). This even more complex mechanism is not yet settled. There are important struggles at international, national and local levels to define how REDD should be implemented.

REDD can be seen as a multilevel project of environmental governance. By environmental governance we mean “a set of mechanisms, formal and informal institutions and practices by way of which social order is produced through controlling that which is related to the environment and natural resources” (Bull and Aguilar-Støen, 2015: 5). Some decisions regarding REDD are taken at the global level, other decisions are taken at the national level and finally actions, projects and initiatives are implemented at the local level. This complexity might result in the hybridization of REDD, and, as the idea is appropriated by different actors, such hybridization might also result in subtle or open power struggles among actors at the different levels.

REDD emerged as a global initiative from the climate negotiations, but it is going to be implemented in countries with very different approaches to combating deforestation, technical capacity, institutional and political settings, levels of decentralization of forest governance, budgets and so forth. Therefore, it is possible to expect REDD to unfold in quite different ways across the region. To understand and analyze the variability in which REDD is evolving in Latin America, in this chapter our analytical focus will move across different scales and will make use of some paradigmatic examples, with special emphasis on the countries representing such cases. Our analysis will show that despite their initial opposition, some groups of actors support REDD and are taking advantage of the new opportunities that the scheme offers. REDD initiatives, for example, have become an economic opportunity for both state and national governments as well as for international and regional environmental NGOs.

This chapter is organized as follows. After this introduction, we present our main analytical argument. The following section examines the phased approach to implement REDD in Latin America. In the third section, we present what we have identified as three general strategies to implement and shape REDD across the region. In the next section, we discuss some examples of how pilot projects are taking off in the region. Finally, we present our conclusions.

<u>Current & Relevant Information:</u>

Conclusion

In this chapter we have looked at different strategies employed by Latin American countries and actors in their meeting with the global forest and climate initiative, REDD, from resistance to accommodating to assertive strategies. Brazil has been one of the major actors in the initiative after it changed its strategy from resistance to a more offensive approach and managed to align REDD with its own domestic interests. A strong actor such as Brazil has the resources, knowledge and power to shape REDD in its interests, and with the focus on results-based payments, the country is in a privileged position. It has also succeeded in sovereignty issues in international negotiations, such as those related to monitoring, reporting and verification/national forest monitoring systems.

The experiences of the countries that have followed the accommodating strategy show how the history of environmental governance in each country affects the implementation of the REDD initiative. Colombia has, to a large extent, left the initiative in the hands of private actors and local authorities, while Costa Rica has applied a model of “hybrid” governance and a centralized REDD program. Bolivia has stood out in Latin America as one of the fiercest opponents of carbon markets, something that has affected its possibilities and willingness to take part in the initiative. Bolivia’s commitment to the inclusion of civil society demands in environmental governance and the anti-commodification rhetoric has formed its responses to the global initiative. However, there are divergent opinions, especially among the indigenous organizations, about the right path to follow. Indigenous organizations with recognized titles to their land believe that REDD can bring new opportunities. However, although Bolivia’s position has been similar to that of Brazil to a large extent, with national sovereignty and opposition to offsets as focal points, Bolivia has instead been seen as the “activist state” that is trying to fragment REDD.

It was not until 2013 that Bolivia won support for its alternative mechanism to forest and climate efforts.

These three strategies illustrate how the “black-boxing” of REDD has allowed for the emergence of quite different hybrid models of negotiating environmental governance at the international level.

Our research reveals that there is a constellation of actors shaping the direction of REDD+ in Latin America. That constellation varies from country to country and includes among others, donors, BINGOs and national NGOs, research institutions, and in some cases different levels of government. Through their engagements in networks that promote and advance a narrative in which markets and monetary compensations offer the solution to deforestation, these actors are in a privileged position to participate in the co-production of knowledge and policy, and to advance their agendas.

For some governments, engaging in REDD – at least at the discursive level – does not conflict with their priorities in other sectors, such as oil exploitation, soy expansion, the expansion of large-scale cattle-ranching, and mining and infrastructure development, which all represent threats to the forests and further deforestation. REDD is seen as an alternative that will allow for the ending of trade-offs between forest conservation, poverty alleviation and economic development. A good example of how this change is unfolding can be found in the partnership between Norway and Brazil. Thanks to REDD, Brazil became the largest receiver of Norwegian development cooperation aid, which is an enormous paradox given that Brazil is one of the fastest growing economies in the world. At the same time, but not necessarily as a consequence of such collaboration, Brazil has drastically decreased deforestation in the Amazon.

NGOs have the technical and rhetorical expertise to participate in negotiations in national and international arenas. They also have connections with farmers, indigenous and traditional populations, government officials and bureaucrats. That makes them a privileged set of boundary organizations (Guston, 2001) that can help to break resistance against REDD and to open channels for the implementation of pilot projects. They have been particularly strengthened by REDD due to this role. They are becoming knowledge-providers to governments, donors and local organizations, which has opened the doors for them to policymaking forums. Environmental NGOs are now in a better position to offer business alternatives to corporations and other private actors. Aside from their role as boundary organizations, they are also brokers in REDD implementation and have a direct stake in the negotiations.

The black-boxing of REDD has allowed for the construction of a large and varied network that supports the initiative. The widespread questioning of the market premises of REDD has led to a broadening of the concept to accommodate disparate interests, ideologies and representations of what forests are and why they should be conserved. That is why countries that have been vocal against REDD, such as Brazil until the mid-2000s, are engaging in REDD preparedness. Accordingly, some groups that initially opposed the mechanism, such as indigenous populations, have pilot projects in their lands as REDD might offer an alternative to strengthen their land rights. However, many indigenous organizations remain critical of carbon markets.

The way in which REDD is going to be financed is still an open question. Although it was born as a market mechanism to trade carbon, political mobilization from different actors has resulted in discussions that challenge the market orientation of REDD, and many actors in the Latin American region advocate for a global public fund to finance the initiative. The political opposition of several actors in Latin America has also resulted in a broadening of the focus of REDD to multiple aspects of forests and their related environmental services. In some countries, at the domestic level, it is increasingly assuming the format of a public policy, whereas in the global arena it resembles what Angelsen (2013) has called a "performance-based aid" mechanism. This means that development cooperation funds are used to finance REDD on the condition that countries demonstrate that they achieve certain levels of performance in terms of reduced deforestation.

"Global impacts of future cropland expansion and intensification on agricultural markets and Biological Variability," Florian Zabel, et. al., Nature Communications, 28 June 2019 [68] https://www.nature.com/articles/s41467-019-10775-z

Abstract:

With rising demand for biomass, cropland expansion and intensification represent the main strategies to boost agricultural production, but are also major drivers of Biological Variability decline. We investigate the consequences of attaining equal global production gains by 2030, either by cropland expansion or intensification, and analyze their impacts on agricultural markets and Biological Variability. We find that both scenarios lead to lower crop prices across the world, even in regions where production decreases. Cropland expansion mostly affects Biological Variability hotspots in Central and South America, while cropland intensification threatens Biological Variability especially in Sub-Saharan Africa, India and China. Our results suggest that production gains will occur at the costs of Biological Variability predominantly in developing tropical regions, while Europe and North America benefit from lower world market prices without putting their own Biological Variability at risk. By identifying hotspots of potential future conflicts, we demonstrate where conservation prioritization is needed to balance agricultural production with conservation goals.

Current & Relevant Information:

Introduction

For thousands of years, humans have cultivated the planet to satisfy their needs for food, fiber and energy. Today, farmlands dominate 38% of the global land surface and almost 30% of global net primary production is appropriated for human use. The pace of farmland production growth is unlikely to continue, but the demand for agricultural commodities is projected to increase inexorably (70–100% by 2050). Since the focus on agricultural production is motivated also by income generation and economic growth, high pressure on farming systems will continue in the next decades.

As a result, agriculture is likely to remain the primary driver of global Biological Variability loss, because both strategies to increase production, namely cropland expansion and intensification, pose major threats to many common as well as IUCN red-listed species. While cropland expansion into uncultivated areas threatens Biological Variability mainly through the loss and fragmentation of natural habitat, the negative effects of cropland intensification may be less pronounced. There is clear evidence, however, that land-use intensification threatens multiple taxa of primarily farmland species due to habitat homogenization, irrigation and high inputs of agro-chemicals, such as fertilizers and pesticides. Therefore, meeting future biomass demands while, at the same time, safeguarding remaining ecosystems and Biological Variability is a critical challenge we face in the 21st century (Sustainable Development Goals 2, 12 and 15).

Recent advances in data availability and spatially explicit modelling of land systems improved our ability to assess future agricultural impacts. General solutions to cope with the increasing demand for agricultural resources have been proposed but the spatial relationship between different farming strategies and Biological Variability patterns have been understudied. Although cropland expansion and intensification often occur simultaneously, recent studies evaluated only one aspect separately or did not separate intensification from expansion processes. Often a limited set of production metrics was used (e.g. yields) or biophysical constraints of farmland production were considered but socio–economic drivers were ignored or vice versa. Changes in agricultural productivity are addressed in some scenario studies feeding yield changes into partial or general equilibrium models, but feedbacks from the economic model to biophysical models are neglected. Thus, emerging trade-offs have not yet been addressed using comparable scenarios that integrate biophysical and socio–economic drivers of crop production. Therefore, integrated approaches are required that

(i) utilise comparable scenarios of both cropland expansion and intensification,

(ii) account for spatial information on biophysical constraints as well as socio–economic drivers of agricultural production,

(iii) capture repercussions of changes in supply and demand on regional and global markets, and

(iv) estimate how different farming strategies and their impacts on Biological Variability play out across space.

This is crucial to assess the feasibility of achieving desired agricultural pathways and minimize their impact on areas with the highest conservation value.

Here we capture feedbacks between biophysical and socio–economic drivers of land-use change as well as interactions with Biological Variability. We examine global trade-offs between agricultural markets and global Biological Variability that future farmland production may impose. First, we combine two established approaches from previous work of the authors, which integrate both biophysical and socio–economic conditions to create maps of future cropland expansion and intensification potentials simulated for 17 major agricultural crops at 30 arc-sec spatial resolution. These crops represent 73% of global cropland area and crop production and cover the most important staple and energy crops, to also capture trends in political support of biofuels.

These integrated potentials of cropland expansion and intensification account for the interplay of biophysical constraints at the local scale, such as water availability, soil quality and climate change, and regional socio–economic drivers, such as population growth and dynamics in consumption patterns. Second, we examine the impact of cropland expansion and intensification on agricultural markets. To do so, we apply a computable general equilibrium (CGE) model of the world economy that accounts for interlinkages between economic sectors to two comparable scenarios of cropland expansion and intensification until 2030. These are compared to a reference scenario that carries forward current trends in population growth, gross domestic product and trade policies. The cropland expansion scenario allows additional 7.3 million km2 of land to be available for crop production in areas with the highest 10% of global expansion potential. Comparably, the cropland intensification scenario allows closing yield gaps on 10% of land with the highest global intensification potential, up to the level that both scenarios leads to equivalent global production gains. Finally, we use global range maps for 19,978 vertebrate species to examine the spatial concordance between patterns of global Biological Variability and potentials for near-future cropland expansion and intensification. Our goal is to (1) quantify the relative differences in the impact of alternative global farming strategies (cropland expansion vs. intensification) on crop yields, prices, trade and consumption, and to (2) identify hotspots of potential future conflicts between cropland expansion, intensification and Biological Variability.

8. North American Culture:

"Human Impact on Biological Variability, Overview," Leslie E. Sponsel, Encyclopedia of Biological Variability, 2013 [69]
https://www.researchgate.net/profile/Harasit_Paul4/post/What_is_biological_variability_and_its_connection_to_humans/attachment/5ef0544acf1f7a00018f8241/AS%3A905118698450945%401592808522475/download/sponsel2001.pdf.

Abstract:

Throughout human prehistory and history, human impacts on Biological Variability have reached progressively higher thresholds. Most likely the net impact of humanity has been to reduce Biological Variability. However, at the population level, the types and magnitudes of human impacts on Biological Variability vary tremendously through time and space, depending on the specifics of the particular context. Many societies have decreased local Biological Variability, whereas many have sustained or even increased it. Nevertheless, because of the widespread direct and indirect impacts of humans on Biological Variability, any consideration of Biological Variability must also assess the possibilities of human influence.

Current & Relevant Information:

Not all humans are equal in their impacts on Biological Variability. While it is widely recognized that there is tremendous variability in nature, there is also considerable variability in humanity. Nearly 7000 distinctive cultures exist today and there were many times more in the past, probably on the order of at least tens of thousands over some four million years of human existence. Accordingly, there is tremendous variability in human relationships with and impacts on Biological Variability. In examining human impacts, it is imperative to consider the variability of humans through time (prehistory through history) and space (cultures and regions).

Environmental variability is another variable in determining the human impact on Biological Variability. Some environments are simply much more fragile and vulnerable than others, especially those that are relatively simpler, such as the arctic and deserts, and those that are isolated with a high proportion of endemic species, such as oceanic islands. Also, some regions are simply much less accessible or hospitable to humans than others, including the poles, mountain heights, deserts, and deep oceans. In these cases, the label ''wilderness'' may still apply—pristine nature that is largely unaffected by humans.

Furthermore, given the dynamism of ecosystems and ecological processes, together with the widespread impact of humans on them, it is misleading to consider most environments as pristine, virgin, primeval, or wilderness. The condition of any ecosystem is the cumulative product of previous conditions, usually including human impacts. The more important question is not whether or not a human society had or has any environmental impact, but its particular forms and magnitude, and if negative then the extent to which it is reversible and allows natural regeneration within a normal period of time.

In studying human impact, it cannot be assumed that the previous environment was in a state of equilibrium or climax stage in ecological succession. Furthermore, even when humans are a factor in environmental change, it cannot be assumed that other agencies, such as natural alterations in climate or weather and natural fires, are not also contributing to change.

In any case, it is unrealistic to consider Biological Variability anywhere without also considering the possibilities of human influence. Human impact is inevitable because, ultimately, Biological Variability is the primary or raw natural resource that all societies rely on for their subsistence and economy. Also, Biological Variability is the biotic component of ecosystems and ecological processes on which human survival, adaptation, and welfare ultimately depend.

Conclusions

Globally the net impact of the human species has most likely decreased Biological Variability. However, not all humans are equal in their impact on Biological Variability because of the tremendous variability in humankind throughout its temporal and spatial distribution including cultural variability. At the population level, clearly some societies may sustain or even enhance Biological Variability. In particular, many indigenous societies, especially those who retain some core traditions despite superficial changes, have special potential in their environmental knowledge, worldviews, and other attributes to contribute to developing systems for the sustainable use, management, and conservation of Biological Variability. The cumulative and collective impact of humans on Biological Variability across the world is sufficient to make it imperative that anyone concerned with the Biological Variability of any area must consider the possibilities of human influence. Accordingly, research on cultural ecology and historical ecology is indispensable.

Current anthropogenic extinction rates are estimated at 1000 to 10,000 times higher than normal background rates. Furthermore, these recent anthropogenic extinctions also involve plants, whereas prehistoric extinctions mainly affected animals. This is an alarming fact, among other reasons, considering how fundamental plants are to other life as primary producers in capturing solar energy through photosynthesis. Another distinction of the present extinction spasm is that increasingly humans are becoming aware of what they are doing and could change their behavior to reduce their negative impacts. After all, destroying Biological Variability and ecosystems is ultimately ecocide for humanity since they are our life-support systems.

Biological Variability is unlikely to be adequately conserved only by preservationist—by isolating nature from human ‘‘disturbance’’ in a few areas of supposed wilderness. Much more effort needs to be directed to adequately recognizing and better managing human impacts from the local to the global levels and over the long-term. One problem is that decisions and actions that seem reasonable in the short-term may have negative consequences in the long-term. Thus, adequate environmental and resource management requires, among other things, much better-informed politicians and policy-makers at all levels (local to international) who have the political will and morality to consider no less than the integral relationship between humanity and Biological Variability for many generations to come. Of course, so far, such leadership is grossly inadequate, but not unprecedented. For instance, the Iroquois in North America acted with the seventh generation into the future in mind. Perhaps the Convention on Biological Variability from the 1992 Rio Summit is a hopeful change.

Biological Variability conservation also depends on a much more informed, concerned, and involved public that understands the nature and consequences of human impact on Biological Variability. Considering the gravity and urgency of this subject, environmental and Biological Variability education must be advanced at all levels and include mass media. In the process, environmental ethics must be first and foremost. One of the best places to begin is by exploring Aldo Leopold's (1949: 262) land ethic: ''A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise.'' (However, today the term ''resilience'' is more appropriate than ''stability.'') Every individual decision potentially has some impact on Biological Variability, however small or indirect; and those of humanity collectively can be synergetic and life threatening. (For teaching, especially useful videos are: ''World Population,'' ''Biological Variability,'' ''Web of Life,'' the series ''Living Planet,'' ''Can the Tropical Rainforests Be Saved?,'' ''An Ecology of Mind'' from the Millennium series, and ''Spirit and Nature.'').

Finally, because the human impact on Biological Variability both locally and regionally is mixed with positive as well as negative influences, there is reason for hope as well as despair for the future. However, with the current magnitude of Biological Variability loss and other environmental problems, there is no doubt that the very viability, resilience, and habitability of too many of the world's ecosystems, and thereby the biosphere as a whole, are at risk, as are the very futures of organic and human evolution on this planet. Globally the net impact of Homo sapiens in reducing Biological Variability is a dangerous reversal of the megatrends that held throughout the last 3.75 billion years of organic evolution on earth—namely, increasing variability, complexity, and adaptability. Furthermore, recovery from this extinction spasm may require many millions of years. Because of the gravity and urgency of the negative impact of humans on the earth's life, this impact is perhaps the single greatest challenge facing humankind and Biological Variability studies for the twenty-first century.

"Possible future trade-offs between agriculture, energy production, and Biological Variability conservation in North Dakota," Michael J. Hill and Rhonda

Olson, Regional Environmental Change, 2013 [70]
https://www.stevenphipps.com/publications/hill2013.pdf

Abstract:

In this study, we describe a spatially explicit scenario analysis of global change effects on the potential future trade-offs and conflicts between agriculture, energy generation, and grassland and wetland conservation in North Dakota (ND), USA. Integrated scenarios combining global policy, oil security, and climate change were applied to North Dakota using a spatial multi-criteria analysis shell. Spatial data describing climate changes and grassland, wetland, cropland, and energy distributions were used to characterize the geographical environment. The final multicriteria framework examined the potential trade-offs between climate change, agricultural expansion, and energy generation resulting from global change scenarios on one hand, and the current footprint of wetlands and grasslands for six regions of ND that capture the major climate gradients and differences in land use. The results suggest that the tension between regional climate changes that may limit agricultural expansion, and global changes in food and energy security and commodity prices that favor agricultural expansion, may focus a zone of potential pressure on grasslands and wetland conversion in central ND and the Prairie Pothole Region. The balance between conservation programs, commodity prices, and land parcel productivity may determine grassland conversion, while wetland outcomes may almost totally depend upon regional climate change.

Current & Relevant Information:

Introduction

North Dakota (ND) sits in the middle of one of the great granaries of the world. It is a significant producer of wheat, corn, soybeans, canola, sugar beet, potatoes, and sunflowers. In addition, it is the center of a major oil and gas boom made possible by rising oil prices and advances in technology that enable deep shales containing oil and gas to be fractured and mined, with multiple shafts emanating from one drill site (Sorenson 2008). It also has significant potential for the development of renewable energy (Boyer et al. 2008; Knoll and Klink 2009; Aravindhakshan and Koo 2011).However, it contains one of the largest areas of National Grasslands in the USA (Hurt 1985), and the Prairie Pothole Region (PPR) contains wetlands that are the breeding grounds for millions of ducks and other water birds (Niemuth et al. 2010). As such, ND represents a microcosm of the trade-offs faced globally in many of the major grassland biomes-turned-granaries between resource exploitation and food production on one hand, and maintenance of ecosystem function and services on the other (e.g., Euliss et al. 2010; Aravindhakshan and Koo 2011; Gascoigne et al. 2011). This confluence of attributes and pressures provides an opportunity to explore trade-offs under a plausible set of future global change scenarios.

The IPCC Fourth Assessment Report (AR4) indicates that the Northern Great Plains region of the USA (contained within the Central North America (CNA) land region) is likely to experience annual warming that exceeds the global mean, with warming from as low as between 2 and 5°C under the B1 scenario to warming as high as 3–8°C under the A2 scenario (Christensen et al. 2007). It is likely that precipitation will increase in winter and spring, but decline in summer, although uncertainties are higher for precipitation than for warming. The line of zero change moves north from winter to summer. These changes may be critically important for wetlands, in particular, since more spring rain will increase storage in Prairie Potholes, but drier summers may reduce wetland area and water volume (e.g., Johnson et al. 2005, 2010) and encourage drainage and conversion to agriculture.

Scenarios are a useful approach to exploration of potential futures for complex systems such as the global coupled human–environment system subject to changes in climate and land use. The exploration of global change scenarios has expanded from the landmark Intergovernmental Panel on Climate Change Special Report on Emission Scenarios (IPCC SRES; Nakic´enovic´ et al. 2000) to include global development scenarios (UNEP/RIVM 2003; Rosen et al. 2010), environmental impact scenarios (Carpenter et al. 2005), and oil security scenarios (Johnston 2010). Future land use in Europe has been a focus for some of the most comprehensive analysis (Abildtrup et al. 2006; Audsley et al. 2006; Berry et al. 2006; Rounsevell et al. 2005, 2006). Significant attention has also been paid to the effects of climate change on global food production and food security (Parry et al. 2004a, b; Schade and Pimental 2010; Scherr et al. 2010; Godfray et al. 2010).

Downscaling is a significant issue for regional assessment of global scenarios (Carpenter et al. 2005). For a State like ND, or smaller regional entity, the economic and natural resource status is easier to define than for larger more varied regions or entities, and it can largely be directly linked to national and international markets and regulations. For example, a recent analysis of the economics of grassland conversion to cropland (Rashford et al. 2010) found that agricultural commodity prices were a major potential driver of conversion, but that probability of conversion was spatially heterogeneous depending upon the soil quality and yield potential of parcels. In addition, it seems likely that only a global revolution in terms of energy preference, which reduced oil consumption to a degree that resulted in a major fall in prices, could have a major negative effect on the ND oil exploration given the current reserve estimates of 3.0–4.3 billion barrels (Pollastro et al. 2008)—now considered to be a very conservative estimate. On a national scale, federal programs provide cash incentives for grassland and wetland conservation through land retirement mechanisms that are highly significant in ND. These fall under several headings including the Conservation Reserve Program (CRP), the Conservation Security Program (CSP), the Farm and Ranch Land Protection Program (FPP), the Grasslands Reserve Program (GRP), the Wildlife Habitat Incentives Program

(WHIP), and the Environmental Quality Incentives Program (EQIP) (Wiebe and Gollehon 2006).

In this study, we undertake a spatially explicit assessment of the potential effects of a range of scenarios derived from combining global scenario frameworks emphasizing development, climate change, environmental conservation, and oil security, on the trade-offs between agriculture and energy on one hand, and grassland and wetland conservation on the other in the US state of North Dakota. The study aims to identify the geographical areas of greatest tension between energy and agricultural enterprises, and key natural ecosystems.

Conclusion

All future global change scenarios focus more potential pressure on central ND and the PPR, since all current SRES climate change outcomes predict a tension between better thermal and poorer moisture growing conditions, with a tipping point for benefits lying around central ND and the middle of the PPR. The scenarios with the greatest climate change, population increase, and oil consumption will magnify food and bioenergy demand, and hence may result in commodity price rises that substantially drive conversion of grassland to cropland (Rashford et al. 2010). However, these scenarios also result in the greatest reductions in precipitation during summer and hence the greatest restriction on the westward expansion of cropping. As a result, food and energy imperatives might demand that grassland with moderate or even relatively low crop yield potential currently in CRP or under grazing be converted for food or biofuel production in the humanitarian and national security interests. Such conversion may be facilitated by shrinking of PPR wetlands due to dryer summers (Johnson et al. 2005, 2010), removal of ‘‘conservation’’ limits (reduced federal programs), and increased resumption of private wetland for cropping. The land area rendered idle has historically shown a tendency to vary inversely with net farm income (Wiebe and Gollehon 2006). The primacy of private land management rights in ND means that Federal incentives for conservation such as CRP, WRP, and other Farm Bill programs would be very important factors in retaining residual perennial wetland, and remnant native grassland on private land and maintaining Biological Variability and ecosystem function (e.g., Gleason et al. 2011). Conservation programs in the Dakotas are estimated to provide a net benefit to society of $1 billion over a 20-year time period with largest benefits from carbon sequestration and waterfowl production (Gascoigne et al. 2011).

Projection of federal conservation programs out to the 2070–2100 period in a scenario context could be regarded as highly problematic; however, land retirement programs have been in existence since the 1930s (Claassen et al. 2011), so it is not unreasonable to suggest that similar mechanisms may be active or even more prominent in 60 years from now. Assessments of some of these programs (CRP, CSP, and EQIP) indicate variable levels of success, concerns with effectiveness, and some reservations about CRP as a default means of conserving/maintaining grassland in the landscape (SWCS/EDF 2008). Recent assessment of ecosystem services in the PPR that focused on native prairie grasslands, CRP/WRP, and cropland found that CRP/WRP does not compensate for loss of native prairie grassland (Gascoigne et al. 2011).

Analysis of long-term oil and gas leases in grasslands of Saskatchewan indicates that impacts extend beyond the direct footprint of the physical infrastructure, with litter and herbaceous cover increasing and bare soil and compaction decreasing with distance from the well head (Nasen et al. 2011). In addition, range health and desirable species variability was lower, and abundance and variability of undesirable species were higher on lease sites. Given that energy demand and security issues likely mean that western ND will have a high intensity of oil and gas extraction for as long as reserves hold out, similar impacts to those described for Saskatchewan may be expected on native prairie grasslands associated with oil and gas leases in ND. Recent discoveries and advances in extraction technology, and a full appreciation of the potential variability of fuel resources from shale oil, gas, coal conversion, and electrification may have cast doubt on the peak oil hypothesis (Helm 2011). ‘‘Peak oil’’ assumes that limited supply and expanding demand result in increased prices and shortages (e.g., Sorrell et al. 2010). However, the oil security scenarios used here still represent an appropriate framework for this analysis, since United States consumption is so much greater than current national stocks, and gas substitution for oil does not change potential impacts in western North Dakota.

The outcome of this analysis is highly dependent upon the regional climate change projections associated with the SRES scenarios. North Dakota is at a critical location in relation to the line of zero change in summer precipitation for North America: the line lies further to the north for SRES scenarios with greater greenhouse gas emissions (IPCC 2007). However, the uncertainty around precipitation projections is high and a shift in this line further to the south could reduce negative climate effects on agriculture, and agricultural expansion in response to food demand and commodity prices, and longer growing seasons, could be more intensive and extensive in central and western ND. In addition, the SRES scenarios are somewhat confining due to the linear consequential framework. A more flexible framework (Moss et al. 2010) that operates in parallel and facilitates information flow between physical, biological, and social sciences could provide more variety in outcomes.

Finally, there is an element of personal judgment in any scenario analysis (Metzger et al. 2010). This is particularly so where rankings are adjusted for different energy combinations among the global scenarios in order to adjust energy pressure on grasslands. However, for the most part, the data in terms of climate change patterns and the distribution of grasslands, wetlands, and croplands form an objective, but qualitative basis for the results.

“Climate Change, Culture and Cultural Rights,” Justine Marrion Massey, ohcr, 15 May 2020 [71] https://www.ohchr.org/sites/default/files/Documents/Issues/CulturalRights/Call_ClimateChange/JMassey.pdf

Overview:

Cultural patterns can shift over time and are not locked into one monolithic definition but rather are lived, reaffirmed and edited by the people who form the culture by participating in it. Drastic change, however, can present deep challenges to otherwise generally cohesive narratives or patterns of behavior, disrupting traditional activities ranging from subsistence to recreation. Individual participation in cultural life can be severely limited by physical changes to the local environment including perturbed seasonality and increased competition over resources. Variations in responses to these challenges can fracture cultural groups as individuals make choices about how to seek stability and prosperity in new contexts. Previously existing divisions may be exacerbated, or new conflicts may arise as each as each person responds to their threatened interests. Even groups of individuals that largely agree on how to respond will face pressing challenges to successfully adapt to the changes resulting from a rise in global average temperature. Specific changes to local conditions are difficult to predict due to the complexity of the natural systems involved and their relationships to one another. This chaotic disruption to balance threatens the very concept of tradition.

At the same time, all humans now find ourselves within a critical time period of roughly the next 10 years (until 2030) in which collective actions of the global population can actually change the trajectory to prevent catastrophic climate change. Even as it is imperiled, culture remains an important key to successful climate adaptation. Traditional knowledge about how to interact with and care for natural systems is indispensable. Indigenous understanding in particular will be pivotal to stabilizing the climate. Contradictory on the surface but often complementary in practice, a rising culture of change pushes for local and global responses that prioritize climate mitigation and adaptation through changed consumptive behaviors, new green infrastructure, and a just distribution of access to resources. Implementing these preemptive changes will be critically important for effectively preserving the climate as humans have known it throughout the history of the species. Culture has a critical role to play in humanity's reaction to climate change. In this time of forced editing of cultural practices, individuals and their values will be put to the test. What will be preserved? What will be sacrificed? What people decide to prioritize individually, locally, regionally and internationally will determine what change will look like.

Current & Relevant Information:

Introduction to Subject Matter

“Climate adaptation refers to the actions taken to manage impacts of climate change by reducing vulnerability and exposure to its harmful effects and exploiting any potential benefits. Adaptation takes place at international, national and local levels. Subnational jurisdictions and entities, including urban and rural municipalities, are key to developing and reinforcing measures for reducing weather- and climate-related risks. Adaptation implementation faces several barriers including lack of up-to-date and locally relevant information, lack of finance and technology, social values and attitudes, and institutional constraints (high confidence). (IPCC, 2018, p. 51) The global transformation that would be needed to limit warming to 1.5°C requires enabling conditions that reflect the links, synergies and trade-offs between mitigation, adaptation and sustainable development. These enabling conditions are assessed across many dimensions of feasibility – geophysical, environmental-ecological, technological, economic, socio-cultural and institutional – that may be considered through the unifying lens of the Anthropocene, acknowledging profound, differential but increasingly geologically significant human influences on the Earth system as a whole. This framing also emphasizes the global interconnectivity of past, present and future human– environment relations, highlighting the need and opportunities for integrated responses to achieve the goals of the Paris Agreement." (IPCC, 2018, p. 52)

Summary of Report, importance of addressing the nexus of climate, culture and human rights "Society's response to every dimension of global climate change is mediated by culture. … [C]limate change threatens cultural dimensions of lives and livelihoods that include the material and lived aspects of culture, identity, community cohesion and sense of place. … [T]here are important cultural dimensions to how societies respond and adapt to climate-related risks. … [C]ulture mediates changes in the environment and changes in societies." (Adger, W. Neil; Barnett, Jon; Brown, Katrina; Marshall, Nadine; O'Brien, Karen, 2013, p. 112) "Culture is important for understanding both mitigation of and adaptation to climate change, and of course plays its part in framing climate change as a phenomenon of concern to society. Culture is embedded in the dominant modes of production, consumption, lifestyles and social organization that give rise to emissions of greenhouse gases. The consequences of these emissions—climate change impacts—are given meaning through cultural interpretations of science and risk. Culture is no less central to understanding and implementing adaptation: the identification of risks, decisions about responses, and means of implementation are all mediated by culture. Cultures are dynamic and reflexive and so are in turn shaped by the idea of climate change. Hence culture, and its analysis, is central to understanding the causes and meaning of, and human responses to climate change." (Id.) "Culture is a common good that broadens everyone's capacity to shape his or her own future. All individuals are vehicles of culture, as well as participants in its development. Culture itself is a process that allows us to understand, interpret, and transform reality." (UCLG-United Cities and Local Governments, 2015, p. 11 ¶2) "The New Urban Agenda acknowledges that culture and cultural variability are sources of enrichment for humankind and provide an important contribution to the sustainable development of cities, human settlements and citizens, empowering them to play an active and unique role in development initiatives. The New Urban Agenda further recognizes that culture should be taken into account in the promotion and implementation of new sustainable consumption and production patterns that contribute to the responsible use of resources and address the adverse impact of climate change." (New Urban Agenda, 2017, p. 4 ¶10)

"Psychology and Global Climate Change: Addressing a Multi-faceted Phenomenon and Set of Challenges," Janet Swim, et al., American Psychological Association, 2009 [72] https://www.apa.org/science/about/publications/climate-change.pdf

Abstract:

Addressing climate change is arguably one of the most pressing issues facing our planet and its inhabitants. In bio and geophysical terms, climate change is defined as changes over time in the averages and variability of surface temperature, precipitation, and wind as well as associated changes in Earth's atmosphere, oceans and natural water supplies, snow and ice, land surface, ecosystems, and living organisms (Intergovernmental Panel on Climate Change [IPCC], 2007b). What is unique about current global climate change, relative to historical changes, is the causal role of human activity (also called anthropogenic forcing) and the current and projected dramatic changes in climate across the globe.

Our primary aim in our report is to engage members of the psychology community (teachers, researchers, those in practice, and students) in the issue of climate change. To this end, this American Psychological Association (APA) task force report describes the contributions of psychological research to an understanding of psychological dimensions of global climate change, provides research recommendations, and proposes policies for APA to assist psychologists' engagement with this issue.

Current & Relevant Information:

Introduction

Climate change is more than changes in weather. Climate Change is defined by the Intergovernmental Panel on climate change (Intergovernmental Panel on Climate Change [IPCC], 2007b) as "any change in climate over time, whether due to natural variability or as a result of human activity." Changes in climate refer to changes in means and variability of, for instance, temperature, precipitation, and wind over the course of months to millions of years. More broadly, climate refers to changes in atmosphere (gaseous envelope surrounding the earth), hydrosphere (water on the surface of the earth), cryosphere (snow, ice, and permafrost on and beneath the surface of the earth and ocean), land surface, and biosphere (ecosystems and organisms living in the atmosphere, land, and oceans). Global climate change is fundamentally a biophysical phenomenon. However, the recent and accelerating warming of the earth's climate is largely attributable to human activity, and its impacts are mediated by psychological and social processes and can be limited primarily by human activity.

This American Psychological Association (APA) task force report describes how psychology can help better understand the causes and consequences of climate change and can contribute to humanity's response to the continuing process of global climate change. Psychologists as members of an intellectual and practice community have relevant skills for understanding why and how humans act in ways that contribute to climate change; the psychosocial impacts of climate change; and ways to assist society in responding to current and anticipated impacts of climate change via both adaptation strategies to lessen impacts and actions to reduce greenhouse gas emissions. To effectively contribute, psychologists need to communicate with other disciplines in the social and natural sciences and develop more widely shared understandings of relevant human phenomena associated with climate change that can be integrated with understandings and frameworks of other disciplines.

The most recent major international scientific consensus evaluation concluded that human activities are changing the climate at a planetary level, that many geophysical and biophysical impacts are already evident, and that further such effects are inevitable (IPCC, 2007c). The present report, following the lead of other climate change summaries (e.g., Confalonieri et al., 2007; Gilman, Randall, & Schwartz, 2007) works from the findings of the Intergovernmental Panel on Climate change (IPCC) Working Group II's conclusions about the high probability (67 to 95 percent likelihood) that climate change will result in the following:

- Higher maximum temperatures leading to increased heat related deaths and illnesses and heat-related impacts on livestock, wildlife, and agriculture.
- Higher minimum temperatures contributing to an extended range of some pest and disease vectors.
- More intense precipitation events leading to increased floods, land and mudslides, and soil erosion.
- Increased summer drying and drought associated with decreases in crop yields and in water resource quality and quantity and increased risk of forest fire.
- Increase in tropical cyclone wind and precipitation intensities leading to increased risk to human health, risk of infectious disease epidemics, coastal erosion and damage to coastal infrastructure, and damage to coastal ecosystems.

The projections for effects of climate change typically are through 2050 or 2100. It is important to note, though that some believe climate change impacts are already occurring and the impacts will last for next millennium and beyond. Yet, continued research is needed to be able to identify the time course of various impacts. The precise timing and intensity of these events are unknown because, for instance, they are dependent upon how people respond, there are likely unpredictable impacts due to interdependence of biophysical phenomena, and there are likely different time courses for different events.

Although other environmental concerns are also pressing, climate change deserves concerted attention because irreversible changes in earth systems due to climate change (on a 1000 year time frame) will require profound adaptation (IPCC, 2001, 2007c; Solomon, Plattner, Knutti, & Friedlingstein, 2009) and because preventing even more severe changes will require significant alterations in individual and collective behavior.

Some have argued that the impacts of climate change will not be universally negative; there will be both “winners” and “losers”; some regions may benefit by, for instance, being able to increase agricultural production, having access to oil reserves in previously inaccessible areas (such as Siberia), supporting human inhabitants in areas (such as Northern Canada) that were previously inhospitable to humans, and greater good to all with increase in wealth due to the above changes and distribution of positive consequences of wealth to others (Easterbrook, 2007). Yet, this implies that the presence of winners negates concern about “losers.” It neglects the interdependency among people and assumes that the misfortunes of some will have little or no negative impact on those who have benefitted. Further, it does not take into account the full range of predictions about climate change and the potential for feedback loops. The greater the increase in temperatures, the fewer “winners” there will be and ironically, if “winners” contribute to climate change with high levels of emissions perhaps due to their improved life circumstances, many may become losers as the magnitude of changes increases. Further, attending to the adverse impacts of climate change is consistent with psychological ethical principle of avoiding harm and ensuring human welfare and psychologists work with marginalized groups who are most apt to experience negative impacts. For reasons such as these, we focus on the risks and negative impacts of climate change.

This report considers psychology’s contribution to understanding and responding to climate change by focusing on psychological dimensions of climate change. We do this by reviewing what psychological research can tell us about perceptions and conceptions of global climate change, human activities that drive climate change, the psycho-social impacts of climate change, barriers to responding to climate change, and human responses to climate change via adaptation and mitigation. After a review of the literature, we recommend ways that the APA can: 1) Encourage psychologists to become involved in understanding human and psychological dimensions of global climate change; 2) Create effective outreach programs that assist the public in understanding of climate change, mitigating its human causes, and adapting to climate change impacts, and facilitate international, cross-disciplinary, trans-disciplinary collaborations that address a climate change; and 3) Address the organization’s environmental impacts that contribute to global climate change.

Summary and Discussion

Psychology has important contributions to make toward understanding, limiting, and coping with climate change. These contributions can be developed from knowledge and concepts in many subfields of psychology and enhanced by collaborations with psychologists worldwide and with a number of potential stakeholders, including community members, policy-makers and colleagues from other fields, including the natural and social sciences. This report summarizes some characteristics associated with psychology and the research that has been conducted that are useful for progress to be made on climate change, discuss the importance of attending to cross-cultural issues and other forms of human variability, and discuss ways that psychologists can maximize their ability to meet the challenge of climate change.

“U.S. Natural Resources and Climate Change: Concepts and Approaches for Management Adaptation,” Jordan M. West, et al., Environmental Management, 2009 [73] https://link.springer.com/content/pdf/10.1007/s00267-009-9345-1.pdf

Abstract:

Public lands and waters in the United States traditionally have been managed using frameworks and objectives that were established under an implicit assumption of stable climatic conditions. However, projected climatic changes render this assumption invalid. Here, we summarize general principles for management adaptations that have emerged from a major literature review. These general principles cover many topics including: (1) how to assess climate impacts to ecosystem processes that are key to management goals; (2) using management practices to support ecosystem resilience; (3) converting barriers that may inhibit management responses into opportunities for successful implementation; and (4) promoting flexible decision making that takes into account challenges of scale and thresholds. To date, the literature on management adaptations to climate change has mostly focused on strategies for bolstering the resilience of ecosystems to persist in their current states. Yet in the longer term, it is anticipated that climate change will push certain ecosystems and species beyond their capacity to recover. When managing to support resilience becomes infeasible, adaptation may require more than simply changing management practices—it may require changing management goals and managing transitions to new ecosystem states. After transitions have occurred, management will again support resilience—this time for a new ecosystem state. Thus, successful management of natural resources in the context of climate change will require recognition on the part of managers and decisions makers of the need to cycle between ‘‘managing for resilience’’ and ‘‘managing for change.’’

Current & Relevant Information:

Introduction

Natural resource management practices in the United States were developed under relatively stable climatic conditions in the last century, and based on the presumption that ecological systems tend toward a natural equilibrium state for which one could manage (Dixon 2003; US-GAO 2007; Heller and Zavaleta 2009). However, it is now understood that widespread ecological sensitivities to climate variability and change necessitate a re-examination of management practices in the context of a dynamic climate system (Adger and others 2007). A recent report commissioned by the United States Climate Change Science Program (CCSP 2008) reviewed management practices for reducing the impact of climate change on sensitive ecosystems and natural resources. The report, which examined selected management systems for protected lands and waters within the United States (i.e., National Forests, National Parks, National Wildlife Refuges, Wild and Scenic Rivers, National Estuaries, and Marine Protected Areas), was written by a team of 61 scientists and managers and represents the largest review to date of management adaptations. This article examines concepts and approaches distilled from across the management systems reviewed in the report and concludes that only through a transformation of management and goal-setting approaches—from a static equilibrium view of the natural world to a highly dynamic and variable approach—will it be possible to make major advances in adaptation to climate change.

Adaptation to climate change refers to adjustments in natural or human systems in response to climate change or impacts (IPCC 2001). In biological disciplines, adaptation refers to the process of genetic change within a population due to natural selection, whereby the average state of a character becomes better suited to some feature of the environment (Groom and others 2006). This type of adaptation, also referred to as autonomous adaptation (IPCC 2001), is a reactive biological response to climate stimuli and does not involve intervention by society. Planned adaptation (i.e., management adaptation), on the other hand, refers to strategies adopted by society to manage systems based on an awareness that conditions are about to change or have changed, such that action is required to meet management goals (modified from IPCC 2001). This article focuses on this latter form of adaptation.

Thus far, the literature has focused largely on management adaptations that increase the resilience of ecological systems to climate change (Scheffer and others 2001; Turner II and others 2003; Tompkins and Adger 2004; Hansen and others 2003; Grimsditch and Salm 2006; Walker and Salt 2006; Heller and Zavelata 2009). Here, resilience refers to the amount of change or disturbance that a system can absorb before it undergoes a fundamental shift to a different set of processes and structures (Holling 1973; Gunderson 2000; Bennett and others 2005). Thus, the adaptation approaches discussed in the first part of this review consist of strategies for supporting the ability of ecosystems to persist at local or regional scales. Only more recently has the science and management community begun to grapple with what constitutes adaptation when resilience can no longer be maintained (Millar and others 2007); a discussion of this emergent topic takes place in a later section.

This article begins with an overview of the prerequisite for any adaptation effort: an assessment of likely current and future climate change impacts on ecosystem processes associated with management goals. This is followed by a review of management adaptation strategies currently available from the literature (resilience approaches). A subsequent section discusses real or perceived barriers to implementation in terms of how they may be converted into opportunities for success. Final sections discuss management under conditions in which thresholds are exceeded and goals become unattainable, as well as observations about the steps necessary to advance the management community's capability to adapt.

Conclusion

To date, most of the literature on adaptation to climate change has focused on strategies for ‘‘managing for resilience’’; indeed, resilience approaches represent the bulk of what managers have in their adaptation toolkit today. This focus makes sense given that the current goals of natural resource management in the United States revolve around the preservation of species, Biological Variability, ecosystems, and ecosystem services and the avoidance of major losses and ecosystem shifts. Given these existing mandates, understanding and testing resilience strategies, as well as finding ways to overcome barriers to their implementation, is an important endeavor because it may be possible to continue managing some systems for decades or more in the face of climate change by bolstering their resilience. The degree to which this will be possible (i.e., for how long, for which systems, and using which strategies for greatest effectiveness) remains to be seen and is an important area for research and testing. Yet it is clear that adjustments will have to be made in current management practices in terms of timing, placement, scaling, and coordination in order to support ecosystem resilience in the context of a rapidly changing climate.

At the same time, it is also clear that some ecosystems will soon be—or in some cases already are—going through major transitions as climate change causes tolerance thresholds to be exceeded. This reality necessitates that managers begin an additional focus on ‘‘managing for change’’, which involves planning for the management of unavoidable ecosystem shifts and for the use of a triage approach to priority-setting. The aim should be to prioritize cases where management can influence the trajectory of ecosystem shifts toward new ‘‘stable states’’ that provide valued ecosystem services. This will be a challenging proposition since it is difficult to anticipate threshold changes and because the array of potential states into which a system may change is highly uncertain; thus, concentrated research to understand the characteristics and indicators of threshold responses will be essential. Impact assessment, which is such an important tool for managing for resilience, may become even more important for investigating the nature of thresholds that trigger managing for change.

While there is an immediate need to address managing for change, this does not mean that managing for resilience will no longer be a useful concept. Resilience strategies can be used to forestall losses and slow the approach to thresholds, thereby buying time for managers to plan how best to manage upcoming transitions. Furthermore, after a given ecosystem shift has occurred, the goal for management of the new system state will again be resilience (in order to prevent losses of valued services due to direct anthropogenic impacts). Thus, successful resource management under climate change will require flexibility on the part of managers and decision makers in cycling between ‘‘managing for resilience’’ and ‘‘managing for change’’.

This conceptual flexibility must be accompanied by concomitant practical flexibility in social structures. Such flexibility will be essential for supporting and encouraging management at larger spatial scales, promoting and enabling partnerships across agencies and organizations, and making logical adjustments to policies, goals, and plans for meeting the challenges posed by climate change. Without a doubt, the degree of flexibility and creativity that will be needed to address the ever-increasing challenges of climate change is unprecedented. Only with a transformation of management and goal-setting, from the traditional static view to a highly dynamic and variable approach, will it be possible to make significant advances in adapting to climate change.

“Tribal Nations,” US Climate Resilience Toolkit, 7 April 2024 [74]
https://toolkit.climate.gov/topics/tribal-nations

Overview:

Climate change continues to negatively affect the livelihoods, health, and cultural practices of Indigenous Peoples, as well as the ecological resilience of their territories. Self-determination is key to implementing effective resilience strategies that meet the needs of Indigenous communities. Indigenous Peoples are leading climate adaptation and mitigation actions guided by Indigenous Knowledge and values.

Current & Relevant Information:

Key points:

- Indigenous Peoples Face Risks to Well-Being and Livelihoods from Climate Change and Barriers to Energy Sovereignty
- Self-Determination Is Key to Indigenous Peoples’ Resilience to Climate Change
- Indigenous Leadership Guides Climate Change Response

Introduction:

Indigenous Peoples in the United States represent more than 700 communities and Tribal Nations. They are culturally and politically unique and self-determining societies in North America, Hawaiʻi, American Sāmoa, Guam, the Northern Mariana Islands, Puerto Rico, and the US Virgin Islands, encompassing varied ecosystems. They differ in their relationships with federal, state, territorial, and local governments but have similarly endured genocide and land dispossession. Indigenous Peoples' origins begin millennia ago, long before the United States. Many Indigenous persons are scientists of the environment, holding holistic understandings of the interconnected drivers of climate change and evidence of climate-related changes and strategies for adaptation. For generations, Indigenous Peoples have centered their knowledge of climate change in their cultures, political organizations, and arts. Many Indigenous persons closely track natural cycles and assemblages of plants and animals, making them keenly aware of environmental disruptions.

Indigenous Peoples Face Risks to Well-Being and Livelihoods from Climate Change and Barriers to Energy Sovereignty:

Climate change continues to cause negative effects on critical aspects of Indigenous Peoples' well-being, including their livelihoods, health, nutrition, and cultural practices, as well as the ecological resilience of their territories. Indigenous Peoples are responding in varied ways, including through energy sovereignty.

Self-Determination Is Key to Indigenous Peoples' Resilience to Climate Change:

By exercising their right to self-determination, Indigenous Peoples can respond to climate change in ways that meet the needs and aspirations of their communities. However, their ability to exercise this right is often undermined by institutions and policies shaped by the impacts of settler colonialism. Expanded support from federal and state governments has the potential to uphold Indigenous rights to self-determination for guiding climate resilience.

Indigenous Leadership Guides Climate Change Response:

Indigenous Peoples lead numerous actions that respond to climate change. Indigenous-led organizations, initiatives, and movements have demonstrated varied strategies for climate adaptation and mitigation that are guided by Indigenous Knowledges and values and by the pursuit of Indigenous rights.

"Enhancing Parks and Protected Area Management in North America in an Era of Rapid Climate Change through Integrated Social Science," Ryan L. Sharp, et al., Journal of Park and Recreation Administration, 2014 [75]
https://www.researchgate.net/profile/Edwin_Gomez6/publication/270952346_Attitudes_about_urban_nature_parks_A_case_study_of_users_and_nonusers_in_Portland_Oregon/links/5d51722ea6fdcc370a8f95c8/Attitudes-about-urban-nature-parks-A-case-study-of-users-and-nonusers-in-Portland-Oregon.pdf#page=9

Summary:

The contributions of the social sciences to the advancement of protected areas and climate change adaptation discourses and deliberations have remained relatively marginal and under-recognized. Given the slow response by protected area agencies in terms of the development and implementation of adaption strategies and site-level management actions, it is becoming increasingly clear that solutions to the complex challenges posed by rapid climate change will require an integrated approach—one that extends beyond the biological realm to one that acknowledges the inextricable links between biological and social systems. This paper illustrates how some of the significant advances in the social sciences are improving the cultivation of knowledge of climate change impacts, and reframing protected areas policy and practice. First, we discuss the ways in which social science work has already improved conservation knowledge and practice related to climate change. We argue that social science's critique of conservation ideas and management norms has improved both knowledge and understanding of climate change, understanding the management implications thereof, and has contributed to the development of a range of insightful tools and methods in support of adaptation efforts. We then proceed to outline ways in which the social sciences can be used to communicate uncertain climate risks to policy- and decision-makers, and an increasingly concerned public. Next, we look at emerging governance paradigms relevant to protected area management, including adaptive co-management, which may encourage dialogue amongst stakeholders working in complex, multi-jurisdictional land use planning contexts and enhance management flexibility in an uncertain future. We conclude by emphasizing that the ability of the conservation community to better understand and effectively adapt to climate change will require a more substantive effort to integrate natural and social science perspectives in research, policy and practice. Such adaptations will not be easy and imply a major paradigm shift in current parks and protected areas policy and planning, and the practice of climate change research.

Current & Relevant Information:

Introduction

Climate change in anticipated to have significant consequences for global Biological Variability and the conservation thereof. Parks and other forms of protected areas (PPAs) are designed to protect specific natural features, species, and ecological communities and processes in-situ, and have not taken into account potential shifts in ecosystem composition, structure, and function that are anticipated to occur as a result of global climate change. Indeed, studies by Parmesan (2006) and others more recently (Quintero & Wiens, 2013) have indicated that a number of species are already responding to climate change occurring over the 20th and early 21st centuries. Empirical analyses of species response to climate change over the remainder of the 21st century consistently project large species turnover and the potential for widespread species extinctions (IPCC, 2013; Araújo, Alagador, Cabeza, Nogues-Bravo & Thuiller, 2011; Lawler et al., 2009; Thomas et al., 2004). In response to increasing awareness of such implications, the International Union for the Conservation of Nature's (IUCN) World Commission on Protected Areas (WCPA) declared climate change as the "greatest threat to Earth's Biological Variability and human livelihoods." (IUCNWCPA, 2011, n.p.)

Climate Change and Social Science

Adaptation to climate change involves thinking, decisions, and actions to mitigate damage, or take advantage of new opportunities (IPCC, 2013). Fortunately for PPA practitioners, a varied range of adaptation options that would enhance the resiliency of protected areas and their Biological Variability to the impacts of climate change have been reinforced in the scientific literature for nearly 25 years; examples include developing a suite of in-situ conservation-oriented measures to enhance the resilience of PPAs to direct and indirect climate change impacts, including the establishment of systems of large and well-connected protected areas, and minimizing external stressors such as habitat loss, fragmentation, and invasive alien species (see Heller & Zavalleta, 2009 for a useful review).

Despite the emerging consensus over this conservation biology-rooted resilience enhancing measures within the conservation community, there continues to be a relatively slow response by PPA agencies both in terms of the development and implementation of relevant policy and on-the-ground management actions. North American PPA agencies currently face a host of socio-economic and political barriers and challenges in their climate change adaptation efforts (Archie, Dilling, Milford & Pampel, 2012; Jantarasami, Lawler, &Thomas, 2009; Lemieux & Scott, 2011; Lemieux, Beechey, Scott & Gray, 2011; Lemieux, Thompson, Dawson & Schuster, 2013; Lemieux et al., 2014), making it increasingly clear that the implementation of effective and efficient solutions will require a more integrated approach–one that acknowledges the inextricable links between biological and social systems.

In light of the above management challenges, this synthesis article aims to provide insights on three key questions:

1. In what ways has social science improved knowledge of climate change and response capacity with respect to parks and protected areas?

2. How can the social sciences be used to communicate uncertain climate risks to policy and decision-makers, and an increasingly concerned public?

3. How can emerging governance paradigms improve PPA management to better address the challenges of climate change and how can these paradigms be informed by social science?

To address these questions, we proceed with a list of the ways in which we think social science work has improved knowledge of climate change, with respect to impacts, policy and management implications, and response capacity within PPA agencies. We then frame ways in which the social sciences can be used to communicate uncertain climate risks to policy- and decision-makers, and an increasingly concerned public, including visitors to PPAs. We also outline ways in which integrated social science can continue to contribute to the study of climate change policy, practically address management problems, and provide effective and timely solutions. We conclude by discussing the relevance of new governance paradigms within the context of PPAs and integrated resource management. While the review primarily focuses on North American knowledge and experiences, insights are also drawn from management experiences from other parts of the world. In particular, we incorporate different ideas and methods for enhancing communication and promoting collaboration between stakeholders in an effort to foster more robust social-ecological systems.

Conclusion

A growing body of research indicates that PA is directly related to the built environment (Ding & Gebel, 2012; Gomez et al., 2010; Gordon-Larsen et al., 2006; Kaczynski & Henderson, 2007), and as part of the built environment, public parks should be considered viable and modifiable opportunity to increase PA among low-active populations. In the current study, there were clear differences in the use and rates of PA within specific target areas. Determining how specific area types and their characteristics affect the use of public parks is important so that park planners and developers can plan for and maintain facilities that provide opportunities for MVPA. This is particularly important in low-income and urban neighborhoods where public parks are a main source of leisure time PA opportunities (Bedimo-Rung et al., 2005). Future studies could incorporate qualitative methods to study intentions for use of local community parks to further examine the relationship between park facilities and PA among varied demographic groups and settings, and especially within low-active communities.

"Farming for System Change: The Politics of Food Sovereignty and Climate Change in Canada," Bryan Dale, Research Gate, March 2019 [76] https://www.researchgate.net/profile/Bryan_Dale/publication/337745334_Farming_for_System_Change_The_Politics_of_Food_Sovereignty_and_Climate_Change_in_Canada/links/5de8171392851c8364628a35/Farming-for-System-Change-The-Politics-of-Food-Sovereignty-and-Climate-Change-in-Canada.pdf?origin=publication_detail

Abstract:

In this dissertation, I explore the overlap between climate change and food production, focusing on the concept of food sovereignty and the potential for ecological farming to help mitigate greenhouse gas emissions. I unveil how the

concepts of food sovereignty and agroecology are (and are not) being taken up by Canadian farmers, farmers' organizations and others who have a stake in climate change debates. Based on two years of scholar-activist-oriented research, including interviews with farmers and ethnographic engagements on farms and at events focused on agricultural politics and practices, I describe the opportunities and constraints for agroecological approaches to contribute to mitigating climate change, as well as the significant political, geographical and socio-cultural challenges that are generally inhibiting the actualization of food sovereignty in Canada. Focusing on the work of La Vía Campesina's two member organizations in this country, the National Farmers Union (NFU) and Union Paysanne, I am concerned with the basic problem of how tensions between systemic and pragmatic changes are articulated through agroecology initiatives and food sovereignty advocacy. My essential claim is that a broad counterhegemonic movement will be required in order for there to be a significant shift in climate and food politics in Canada. Food sovereignty and agroecology have the potential to be incorporated into a system change agenda, I argue, but any serious effort to move them forward, and tackle climate change, will require confronting capitalism itself. I do not suggest that this will necessarily require overt anti-capitalist campaigns, but rather that farmers and other food sovereignty proponents will do well to grapple with the structural constraints within capitalism, while finding ways to talk about and pursue radical change through ostensibly more prosaic initiatives. As part of the counterhegemonic shift I am pointing to, I also argue that farmers' organizations will need to prioritize both strategic alliances building with various groups, as well as political education activities that can help both farmers and non-farmers make progress on these fronts, disrupting apolitical approaches to climate and food issues.

<u>Current & Relevant Information:</u>

There are clearly practical and political reasons why ecological agriculture is marginal in the Canadian context—and yet this is a sector that has the potential to contribute significantly to the fight against climate change. While pipeline politics, energy systems and fossil fuel extractive industries tend to take center stage in climate change discourses, it is often overlooked that the global food system is responsible for 19 to 29 percent of greenhouse gas emissions (Vermeulen et al. 2012). Of these emissions, 80 to 86 percent are directly or indirectly tied to food production itself (ibid.). It therefore behooves academics and activists to try to understand agriculture better—and to investigate how ecological farming can help mitigate climate change. Developing a thorough understanding of agriculture may seem like a daunting task given that 83 percent of Canadians live in cities and more than 99 percent are not farmers (Statistics Canada 2017a, 2017b). Indeed, the majority of urbanites (and many rural people) are likely to experience food procurement through the process of visiting a grocery store or restaurant, with relatively little awareness of the power relations, dense and spatially extensive commodity supply networks, and socio-ecological processes that go into making that food available for purchase. To be sure, many Canadians are increasingly demonstrating that they are interested in eating local or organic foods (COTA 2017a), likely because have some awareness of relevant issues, yet labels such as these tell us surprisingly little about the politics of our food and agricultural systems (Getz and Shreck 2006; Johnston et al. 2009).

An additional tension concerns the fact that climate change requires an urgent response, yet the fossil-fuel-intensive food system that dominates in Canada was developed over the span of decades, and as a result of very deliberate processes and policies. How, therefore, are key activists within the movement for food sovereignty to bring about changes in the food and agricultural system expeditiously, particularly if that system is so enmeshed in the broader functioning of the capitalist economy? The challenge this question raises is not only economic in nature. It is also cultural. Does capitalist hegemony not shape and constrain the scope of imagined alternatives in the agricultural sector and in the food system more generally? The above-mentioned notion that responsible consumption practices and individual behaviors can adequately change the food system suggests that these sensibilities are indeed prevalent within the existing hegemony (see Guthman 2007). It is worth contemplating then, exactly how social groups in Canada set about to "globalize the struggle, [and] globalize the hope," as per La Vía Campesina's rallying cry, as they strive to advance a politics of food sovereignty and agroecology.

I argue, but any serious effort to move them forward, and tackle climate change, will require confronting capitalism itself. I do not suggest that this will necessarily require overt anti-capitalist campaigns, but rather that farmers and other food sovereignty proponents will do well to grapple with the structural constraints within capitalism, while finding ways to talk about and pursue radical change through ostensibly more prosaic initiatives. As part of the counterhegemonic shift I am pointing to, I also argue that farmers' organizations will need to prioritize both strategic alliance-building with various groups, as well as political education activities that can help both farmers and non-farmers make progress on these fronts, disrupting apolitical approaches to climate and food issues.

9. Post-Soviet Culture:

"The interrelationship of socio-variability and Biological Variability: Experiences from a Post-Soviet Siberian village," Leo Granberg, Research Gate, March 2019
[77]
https://www.researchgate.net/publication/331602563_The_interrelationship_of_sociodiverity_and_Biological Variability_-_Experiences_from_a_Post-Soviet_Siberian_vilage

Abstract:

This paper investigates the extent and means by which Yakutian Cattle survived in three Siberian villages during the Russian transition from socialism to capitalism. The system of farming in these villages is a unique mixture of old traditions, Soviet

remnants, and modern features. The production structure is widely varied. An investigation of the process of privatization and structural changes in animal production led to the finding that socio-variability facilitated the preservation of this single cattle breed and the recovery of animal production after the crises. Analysis of the interrelationship between variability in society and variability of domesticated animals suggests that socio-variability is an important facilitator for Biological Variability, even in a more general sense. Furthermore, to understand the connection of socio-variability and Biological Variability as a conceptual couple, one needs intermediary concepts, such as "ecosystem services."

Current & Relevant Information:

Introduction

The Evenyo-Bytantay district is located in a mountainous region in Siberia, in the northern part of Sakha (Yakutia), a republic of the Russian Federation. Even though the region is one of the coldest populated places on Earth, there is much cultural variability. Moreover, the ecosystem sustains a wide variability of domesticated animals, among which are the Yakutian Cattle, a rare breed found only in this distant region. Because the Russian transition from socialism to capitalism brought great difficulties to the region, the survival of the Yakutian Cattle was somewhat in doubt. Our research, however, indicated that in this area socio-variability facilitated the preservation of this unusual cattle breed. This paper is an attempt to understand the interrelationship between socio-variability and Biological Variability and to open way to further research on a wider scale.

Our research project, which included several teams, was truly multidisciplinary. Members were drawn from animal genetics and agricultural engineering, anthropology and arts, cultural geography, history and sociology, among others. Each of the researchers was able to contribute important information from the perspective of a specific scientific context. However, such an approach, as interesting and useful as it was, raised many questions: for example, how to prepare better for a joint project, how to process collected data, and how to interpret information produced by one scientific discipline from the premises of another discipline.

Such deliberations led us to reflect on the interrelationship between variability in society and the variability of domesticated animals. The concept of Biological Variability refers to the variety of plants, animals and micro-organisms; the concept socio-variability, to the variability of social, cultural and economic features of a social system.

Socio-variability

Nowadays an increasing amount of research is devoted to examination of the relations between society and the environment. One of the first researchers to acknowledge socio-variability was Brazilian scientist Walter Neves, who studied relationships between forms of social organization and eco-variability on the basis of Amazonian empirics. He describes social evolution in the Amazon region as co-evolution between natural environments and human societies, involving structural adjustments on both sides (Neves 1995, 108). Neves attributes this connection to the pioneering works of Conklin (1954, 1967; see Neves 1995) and Frake (1962; see Neves 1995), and to the work since the 1960s in such disciplines as applied anthropology, archaeology, ethno-biology, and ethno-ecology.

Studying society and ecology as systems is an integral branch of mainstream sociology, developed by Talcott Parsons and continued by Niklas Luhmann. Luhmann brought ecology explicitly into his system theory (Luhman 1990). Today, attempts are made to integrate the social system and ecological system in scientific models, not least because of environmental impact assessments, which are becoming a kind of scientific industry (see Millennium Ecosystem Assessment 2005).

One of the early contributors to the issue of a conceptual pair was Sabine U. O'Hara. In response to work done by E. O. Wilson on Biological Variability, O'Hara promoted the role of socio-variability: "'Biological Variability is our most valuable but least appreciated resource,' writes Wilson (1988, 1992, 281). The same can be said for socio-variability" (O'Hara 1995, 44).

O'Hara utilized the concept of socio-variability to criticize mainstream neoclassical economics for its inability to take into consideration links between economic and ecological systems. The reason for the shortcoming in neoclassical economics, according to O'Hara, was that "market activity forms only a small portion of economic activity (namely those activities which find expression in the market's price system), this in turn is only a small portion of human activity within the larger context of human ecosystems' activity" (O'Hara 1995, 32).

O'Hara suggests expanding economic theory with five categories: context, participation, place, limits, and temporality. Her interesting and relevant rationale points up serious weaknesses in economics in the study of many acute societal and socioecological problems and developments. However, the question is whether economics is able to study these problems with its own conceptual arsenal. Perhaps the link between economic and ecological systems must be constructed in another way. Recognizing and accepting certain limitations in economic theory is a first step to join economics with other disciplines to solve scientific challenges of a socio-ecological nature. If socio-variability is not an integral part of economics but a puzzle located in the boundary area of different disciplines, it is a subject for multidisciplinary research.

Conclusion

In summary, an interrelationship exists between socio-variability, a concept from social sciences, and Biological Variability, a concept from natural sciences that describes characteristics of ecosystem. An intermediating concept between these systems is ecosystem services, which means producing and supplying goods for society, regulating the living environment of humans, and offering services for various cultural needs.

This is one example of transdisciplinary conceptual connections. The methodological reason for this consideration is that finding a link between such concepts might open new opportunities for multidisciplinary research work. The main argument in this paper is that socio-variability is an important precondition to sustain Biological Variability, that is, to maintain ecological sustainability.

An ecological system supplies services to any social system, and different social systems have different capacities to receive these services. This capacity depends on the way a society is organized; in other words, it depends on the socio-variability of the particular society. A social system not only receives but also processes ecosystem services and produce outputs, which move, in turn, from the social to the ecological system. Through these outputs each social system has an impact on Biological Variability. The quality and intensity of the impact depends on the quality of socio-variability in the social system. Finally, changing Biological Variability also has consequences and will in the long run change the capacity of the ecosystem to produce services for the social system.

Co-evolution in the Amazon (by Neves), Finland's modern plant production system (by Heinonen et.al), as well as the case of Siberian Cattle support the argument that socio-variability has consequences for Biological Variability. A higher level of socio-variability can keep Biological Variability richer than a lower level of socio-variability, e.g., monocultural. Naturally, this data is too restricted for any final conclusions. An additional difficulty is that the effects of socio-variability on Biological Variability can only be studied indirectly because Biological Variability is connected to a certain spatially organized ecosystem and socio-variability is connected to a certain, often non-spatial social system. They only partly overlap. However, socio-variability in farming appears to offer better promise for supporting and promoting Biological Variability than exclusionary small-scale farming, as seen in the Russian rural transition, or than modern family farming, as seen in the Finnish agricultural system. In short, large-scale farming is efficient and small-scale farming is beautiful, but socio-variability offers such flexibility and multi-faceted benefits to the social system that no other solution can offer.

"Climate Change and the Transition Movement in Eastern Europe: The Case of Czech Permaculture," Marta Kolarova, Czech Sociological Review, March 2020
[78]
https://www.soc.cas.cz/sites/default/files/publikace/climate_transition_kolarova_0.pdf

Abstract:

This paper focuses on a grassroots community movement addressing climate change: the transnational Transition (Towns) movement. While this movement has mainly spread to Anglophone countries, it is almost entirely absent in Eastern Europe, and Czechia in particular. The aim of this paper is to explain why the Transition movement—a grassroots community initiative—has not been successfully adopted in post-socialist Czechia, and why the issue of climate change has not become an important frame for the local permaculture movement which introduced the idea of Transition to the country. The paper presents an analysis of ideological frames and framing processes of the local movement. Among the reasons identified for the absence of the movement in Czechia are the fact that it was largely overshadowed by the broader post-socialist transformation in Eastern Europe, that there was little public awareness of climate change and no real culture of community organizing in the post-socialist period, and a strong climate skepticism was promoted by Czech political elites. Other reasons relate to the ideological frames of the local permaculture movement, which is centered more on prognostic and mobilizing frames, combined with a positive agenda and an emphasis on practical activities, and also revolves around individualized strategies and frames in which permaculture and a nature religion (Anastasian spirituality) are linked to the concept of a 'family homestead'. The research draws on in-depth interviews with permaculture practitioners, media analysis, the study of documents, and participant observation.

Current & Relevant Information:

Introduction

Scholars and politicians have been discussing climate change as a serious environmental and social problem since the late 1980s. The academic consensus is that global climate change is a fact given the evidence the increasing temperature of the atmosphere and oceans, the widespread melting of ice, and rising sea levels. Global warming is mostly caused by greenhouse gases being released in increasing volumes into the atmosphere as a result of the burning of fossil fuels. According to climate scientists, there is a clear evidence of the human impact on the climate. Some of the consequences of global climate change include an extreme rise in temperatures and drought accompanied by flooding, which in some regions has caused malnutrition, starvation, death, migration, and poverty [IPCC 2018]. According to the Intergovernmental Panel on Climate Change (IPCC), it is necessary to limit warming to 1.5°C and reduce greenhouse gas emissions. Carbon dioxide emissions have nevertheless continued to increase year on year [IPCC 2018].

Although IPCC scholars, state politicians, corporations, and transnational organizations are the main players in negotiating climate change, various social movements have also become involved in this issue and since 2006 have come to form a new transnational movement focused on climate change [Dietz and Garrells 2014]. The climate movement has never been a homogeneous one, with a single collective identity to unite behind and a shared ideology or strategy [Caniglia, Brulle, Szasz 2015: 243]. There have always been multiple streams within the movement: First, there is the moderate branch of the movement, which sees the solution to global warming as lying within the existing social order, and second, there is the radical wing, whose approach to climate change is part of a systemic critique of capitalism and neoliberalism [Dietz and Garrells 2014; Cassegard, Soneryd, Thorn and Wettegren 2017]. There is also a wing made up of non-protest movements that focus on practical changes that emerge from the bottom up, such as grassroots community initiatives and lifestyle movements, the most visible example being the Transition (Towns) movement.

Climate change and the related activism has become a topical issue in the Czech media, especially since the extremely hot summer of 2018, the publication of the IPCC report, and the climate protest initiated by Swedish teen activist Greta Thunberg. However, there is a lack of research on climate activism in Czech scholarship. When this paper was begun in autumn 2018, there were not many movements yet dealing with climate change; but by the time the text was being revised in spring 2019, numerous initiatives, groups, and protest organizations had emerged. These processes, however, have not yet been addressed in academic research.

Work has been done on the radical environmental movement in general [Novák 2017], on the climate-sceptic countermovement [Vidomus 2018], on various aspects of environmental movements, mostly from the perspective of social-movement organizations (such as Greenpeace, the Green Party, Nesehnutí, etc.), and on protest events and tactics [Binka 2010; Císař 2011; Fagan 2004; Maslowski 2009]. Novák [2017] is currently working on research concerning the climate justice movement led by the Czech group Limity jsme my (Limits Are Us), which organizes climate camps and protests against coal-mining companies. But there has been no work on non-protest climate movements. This paper focuses on the Transition movement in Czechia.

A look at the Transition Network map showing Transition initiatives and hubs in countries around the world reveals that there are many in Western Europe, but in the East the map is almost empty and there are only a few scattered initiatives. The majority of initiatives were active in anglophone countries at the beginning of the movement [Bailey, Hopkins and Wilson 2010], and nowadays four Western European countries (Italy, France, Great Britain, and Germany) are home to about forty-eight percent of all the initiatives within the Transition network [Feola and Him 2016].

Why have there been so few Eastern European Transition initiatives? And why has no community movement focused on climate change emerged in Czechia?

This paper describes the Transition movement internationally and its spread into Czechia through the permaculture movement. It outlines theoretical approaches to the study of non-protest social movements—i.e. grassroots community initiatives and lifestyle movements—and then turns to the view of climate change and community-organizing in post-socialist countries and Czechia in particular. The core of the paper involves an analysis of the ideological frames and framing processes of the local permaculture movement and an explanation of which frames are successful in mobilizing people.

This paper seeks to explain: (1) why the Transition movement which is based on grassroots community initiatives has not been successful in Czechia, and (2) why the climate change issue has not become an important frame for the local permaculture movement.

Conclusion

There are several reasons why the concept of a grassroots community movement tackling climate change and peak oil—Transition—has not taken hold in Czechia. While there are some reasons that apply more generally to Eastern Europe as a whole, others are specifically Czech, and others are inherent to Czech permaculture.

The overall situation in Eastern Europe, with its grand transformation from socialism to capitalism and democracy, has overshadowed the new concept of a Transition to a sustainable future, which was developed in the Western countries. In the transformation years Eastern Europeans also had little awareness of climate change issues. The absence of a culture of community organizing and the low level of non-electoral political participation in this region had a further impact on the local level, which, in the case of Czechia, and in the environmental sphere these activities were then further stunted by the strong climate skepticism on the part of its political elites, led by the former president Václav Klaus.

There are also other reasons that are more inherent to the permaculture movement. The frame analysis here showed that the movement is oriented towards practical change, and that they incentivize action rather than complicated theoretical frames, such as climate change. A critique of the system or particular institutions is missing to some degree; permaculture proposes solutions and practical guidelines for everyday life. The framing is usually positive with efforts to motivate people in a good way and not frighten them with negative messages. Prognostic and motivational framing dominate over diagnostical, and it has resonated in Czechia because of a local culture of DIY activities and self-provisioning.

The permaculture movement has used frames of sustainability, self-reliance, and spirituality as the main values and ideas guiding their activities. The frame most successful in in having a mobilization effect—in terms of adherent numbers—has been the ‘family homestead’ frame related to individualism and natural spirituality, using positive and transcendental vocabulary and attracting people with ideas of freedom, abundance, joy, and love. This frame has refused voluntary modesty and rather promoted pursuing self-interests. It was aimed at individuals and resulted in individual action in private settings, not in collective efforts and building communities. The other branch of permaculture, women-led and organizational in form, supports community projects (eco-communities, community gardens, and community supported agriculture), but it would be an exaggeration to speak of a larger community movement or community activism in Czechia. The eco-communities are of small importance and are not very numerous; the number of community gardens and CSA is growing, but these are communities oriented around interests in leisure or consumption, and they are not for the most part political or civic initiatives aimed at contributing to public debates on climate change and sustainability. So, in general, I would prefer to call Czech permaculture a lifestyle movement focused on individual practices and lifestyles instead of a community movement. Czech perm-culturalists fulfil their environmental citizenship in the private sphere, and much less so in the public sphere by engaging in organizing activities with others.

The conclusions of this paper might contribute to the ongoing debate on how to communicate about climate change with the public and how to mobilize people into action. The away to attract members of the Czech population seems to rest on the use of positive vocabulary and not frightening them with catastrophic scenarios. Moreover, a stress on practical activities resonates among Czechs; therefore, a focus on adaptation strategies (for example, how to retain water, fertilize the soil, or support local farmers) might be successful. A resonance with local values and experiences is important. Voluntary simplicity, even though it is crucial to reducing the carbon footprint, is not a term with a mobilizing force; thus, I assume that mobilization on climate change mitigation will be more difficult, as people do not want to limit their consumption. It seems that the value of modesty needs to be communicated by means of other terms, be it minimalism, energy descent, health, self-reliance, or the future of our children.

"Revitalization of (post-)Soviet neighbourhood with Nature-based solutions: Jubilejny district, Mogilev, Belarus," Madhu Bharti, et al., erda-rte.eu, 26 August 2018 [79] http://erda-rte.eu/sites/default/files/Group%205%20-%20Jubilejny%20district.pdf

Summary:

The neighborhoods in the former Soviet Union were after the second World War often planned according to the self-consistent microrayon concept similar to Clarence Perry's neighborhood unit. Each residential district was based on the walkable community center in the middle whereas the area itself was surrounded by arterial streets as the main transport routes with basic services. However, the recent situation of many of those neighborhoods is rather dim - the bad condition of housing, faded public spaces and unorganized greenery systems are between the most crucial issues.

The results of the research made on the case study of the Jubilejny district in the city of Mogilev, Belarus show that population aging is the main threat of these areas. Residents are dissatisfied with uncertain housing situation besides inappropriate parking options and lack of opportunities to spend a leisure time outside. Therefore, our proposal to the future development of the Jubilejny district includes short term improvements such as leisure activities within the public spaces or regeneration of green spaces as well as long-term designs regarding a community garden and other Nature-based solutions.

Current & Relevant Information:

Introduction

After the World War II, Mogilev became a major center for the chemical and machinery industries. As a result, the population of Mogilev has grown fast since 1950. As a need for housing for the industrial workers grew, the former state of USSR responded by building industrial and prefabricated housing units. The so-called Khrushchyevkas consist of concrete-paneled or brick three- to five-storied apartment building built from the late 1950s to the early 1980s, mainly because of their low construction cost. Originally, Khrushchyevkas were planned as temporary solutions and to be replaced by more comfortable houses later (Bohn 2008).

The residential neighborhoods that consist of Khrushchyevkas were often planned according to the Soviet's microrayon concept, influenced by Clarence Perry's neighborhood unit (Perry 1929). The latter concept, originally developed from Howard's Garden City model (Howard 1898; Choguill 2008), was Clarence Perry's vision of a self-contained neighborhood as a reaction to an increasing motorized transport in the metropolitan areas of capitalist cities (Perry 1929; Maxim 2009). The idea of the neighborhood unit comprises a residential area for up to 6,000 – 10,000 inhabitants surrounded by arterial streets with retail and services (Perry 1929). In its walkable center with the restricted movement of cars, an elementary school with other community buildings or open spaces such as a church, clubhouses, a local library, playgrounds or green parks are located (Perry 1929; Choguill 2008). Nevertheless, the majority of the residents are obliged to commute to their work or seldomly used services outside the neighborhood (Perry 1929).

The microrayon concept might be thus perceived as a Soviet type of the neighborhood unit sharing the same basic principles (Perry 1929; Maxim 2009). The microrayon was also planned as the "residential ensemble [that] constitutes an organic unity, aimed at connecting its inhabitants through the everyday use of shared social and cultural institutions" (Maxim 2009, p. 9). The unique features of the microrayon, in the concurrence of the Soviet planning principles, contain the maximum walking distance to the nearest public transportation stop (i.e. 500 meters) or an appreciation of architectural variability within the neighborhood (Maxim 2009).

A number of new neighborhoods within the Soviet Union were originally planned in the microrayon concept (Bohn 2008).

As the time went by, Khrushchyevkas were demolished or renovated in many parts of the former Soviet Union. However, in Mogilev, they are still in place and subject to a gradual degradation, both physically and socio-economically. On one hand, the buildings are in poor condition due to the low-quality construction works and materials which were used in the 1950s and the 1960s, and the lack of an insulation. On the other hand, these Khrushchyevka districts are facing problems of social exclusion and cohesion, even though they were planned to support integration and socialization. As a result, public spaces which make up a big part of the neighborhood are not used and lie fallow (Wisniewska, M., interview).

In addition, Belarus might be affected by climate changes in the near future. Heat waves and other extreme events (e.g. floods or droughts) are expected to increase, putting urban areas at high risk (Kabisch et al. 2016). In particular, elderly people, whose physiological capacity for thermoregulation has diminished, could be particularly affected by the increase in temperature (McMichael et al. 2006). The Belarusian economy will be impacted mostly in three sectors - agriculture, forestry and water management (Communication 2015). For that reason, the adaptation to climate changes is extremely important for the country, especially because 41 % of GDP in Belarus is produced in sectors dependent on the weather conditions (Communication 2015).

The Republic of Belarus has already set up different policy programs and strategies for climate mitigation and adaptation: “The National Program of Measures to Mitigate the Effects of Climate Change for the Period of 2008–2012 years” (Program 2008), “The Strategy for Reducing Emissions and Enhancing Removals of Greenhouse Gases by Sinks in the Republic of Belarus for the period of 2007–2012” (Strategy 2006) and “The National Strategy for Introduction of Integrated Environmental Permits for the period of 2009–2020” (Strategy 2009) aiming to reduce and absorb greenhouse gas emissions and develop the program of synergic measures for various sectors of the national economy (Zenchanka 2016).

According to Choguill (2008), the concepts of garden cities or neighborhood units were, albeit unconsciously, based on sustainable solutions. In fact, they give an important set of criteria to plan sustainable neighborhoods (Howard 1898; Perry 1929). Therefore, our suggestion is to re-establish these concepts and adapt them to the new challenges. Sustainable neighborhoods include economic, social, technical, environmental dimensions (Choguill 2008). The most important feature of a sustainable neighborhood is that the structure encourages community interaction and mutual exchange. Neighborhoods have to be limited to an accessible and walkable area. Local shops, markets and coffee shops can be used to expand social opportunities. The number of streets and cars in the neighborhoods should be reduced to ensure safety for children and older members of the society. In addition, parks and other green and open spaces play an important role in common meeting places.

Sustainable neighborhoods include economic, social, technical, environmental dimensions (Choguill 2008). The most important feature of a sustainable neighborhood is that the structure encourages community interaction and exchange. Neighborhoods have to be limited to an accessible and walkable area. Local shops, markets and coffee shops can be used to expand social opportunities. The number of streets and cars in the neighborhoods should be reduced to ensure safety for children and older members of the society. In addition, parks and other green and open spaces play an important role in common meeting places (Choguill 2008).

Nonetheless, the development of urban green spaces is a complex process due to the involvement of long-term natural processes including growth and maturation of living elements. Moreover, these green spaces represent public values and have an important role in the well-being and health of inhabitants (Górniak and Costa 2008). Likewise, in other places in Europe, the degradation of urban green spaces has been observed in Mogilev. However, without sufficient political and financial support from national or local authorities, funding agencies or private investors, their further development is not possible (Górniak and Costa 2008). The main reason for the deterioration of these green spaces is due to the fact that the governing body may neglect to understand the compound mechanism that acts upon the green spaces, social economy and environmental subsystems (Li et al. 2016).

Conclusion

The Jubilejny district in the city of Mogilev, formerly built in concordance with the microrayon concept in the 1960s, is recently many years after its planned longevity. Nowadays, a number of inhabited apartment buildings, including famous Khruschyevkas, are in almost deteriorated condition with faded public spaces between them. Fortunately, according to the research, the concept of microrayon and its inner structure persists as the residents have a good access to basic services and a public transport, and the district center comprises car-free zone with kindergartens and schools.

However, there are several threats besides an uncertain future of Khrushyevkas which might further contribute to a decay of the Jubilejny district. Firstly, the locality is bounded by population aging since predominantly younger generations have intentions to move out. Therefore, in our proposal, we considered better leisure infrastructures mainly for youths such as the renovation of sports grounds or other outside activities as well as brand new implementations for adult and older people like an amphitheater or a community garden that may support the active way of life inside the neighborhood.

Secondly, even though the center of the Jubilejny district is almost without cars and walking belongs to the most used type of transport therein, the residents perceive the parking as one the main problems of the whole area. Thirdly, the locality enjoys the abundance of greenery, however, trees often consist of monotonous and invasive species and several green spaces are unkempt. Thus, our proposal mainly comprises nature-based solutions which enriching the Biological Variability and better utilization of the empty green areas. Overall, the Jubilejny district needs to be handled with immediate solutions as well as the long-term visions that consider also potential solutions for apartment buildings and their future development.

"Land Use/Cover Change in Russia within the Context of Global Challenges," Elena Milanova, Romania Journal of Geography, 2012 [80]
http://www.rjgeo.ro/issues/revue%20roumaine%2056_2/e.%20milanova.pdf

Abstract:

The paper presents the results of a research project on Land Use/Cover Change (LUCC) in Russia in relations with global problems (climate change, environment and Biological Variability degradation). The research was carried out at the Faculty of Geography, Moscow State University on the basis of the combination of remote sensing and in-field data of different spatial and temporal resolution. The original methodology of present-day landscape interpretation for land cover change study has been used. In Russia the major driver of land use/land cover change is agriculture. About twenty years ago the reforms of Russian agriculture were started. Agricultural lands in many regions were dramatically impacted by changed management practices, resulted in accelerated erosion and reduced Biological Variability. Between the natural factors that shape agriculture in Russia, climate is the most important one. The study of long-term and short-term LUCC dynamics permits the analysis of the present status and trends of evolution of natural and anthropogenic landscapes. A feasibility study had been undertaken for scale-dependent landscapes applications and study of land cover dynamics under ongoing changes in Russia.

Current & Relevant Information:

Land use structure in Russia

The structure of lands in Russia (total area 1,720.8 mill. ha) has a significant geographical variability: most of the country is located in the forest and tundra zones and considered at high-risk for agricultural development (permafrost, insufficient growing degree days and much moisture).

The forests occupy about half (46%) of the country territory. The large areas of the original forests are located in the northern part of European Russia, the south of the boreal zone in Siberia, and in the southern part of the Russian Far East (RFE). Conifers represent the dominant forest type (larch, pine and spruce). The current state of the forests is characterized by the decreasing of the share of coniferous species and relative increase of less valuable small-leaved species. A considerable area is covered by oligotrophic marshes that are absolutely dominant in the northern regions. Water bodies (4.2% of the country) include lakes, rivers, streams and man-made reservoirs. Reindeer pastures are located mostly in East Siberia and RFE (30% of all reindeer pastures in Russia are concentrated in the Sakha Republic, Yakutia). A considerable part of reindeer pastures continues to deteriorate, mainly through overgrazing, fires and technogenic contamination. Built-up lands have maximum expansion in the Central European region (4.8%). The lands damaged by human activity are that under mining work, geological prospecting, etc. The largest such areas are situated in the Ural region, Western Siberia and in the Far East. Agricultural lands occupy 13% of total country area.

Conclusion

Russia is a country with a transitional economy, which includes both elements of the free market and an administrative economy, inherited from socialism times. Despite the low level of agricultural specialization, a distinct difference between agriculture in forest and steppe zones is still preserved at national scale. This difference has increased during the past 15 years, when many marginal lands within the forest zone were abandoned. On the other hand, the agriculture of the steppe and forest steppe zones in the European part of Russia received a boost from investments, including those made by the big, wealthy oil, energy, and mining companies. Aside from the political and economic reforms, bringing new investments into the regions, suitable for large-scale agriculture, climate change is likely to redefine these regions, producing large-scale land use and land cover change. The effect of climate change and global warming will be fairly deep-going, so the country can reasonably expect temperature rise and moisture deficit that will significantly affect the agricultural sector. GCM scenarios simulations show an increase in potential yield in the central and northern regions and a fall in yields, in the currently most productive southern European region of Russia due to ever more frequent droughts. It is likely that the most productive regions will have to cope with increasing crop failure by shifting their strategy from producing crops for export to local consumption. Adaptation to the new climate conditions by shifting agriculture further north will be limited by the shortage of fertile soils. Another adaptation strategy is a major increase in the irrigated area, which, however, will be limited by seasonal water shortage. Any research of climate change impacts in agriculture should include the elaboration of adaptive mechanisms: widening the drought-resistant crop area, development of water-saving technologies and irrigation (according to water resource changes).

The methodology of land use/ land cover classification based on remote sensing data, as well as collection, generalization and analyses of all currently existing data (local and regional maps, satellite imagery, detailed field observations) have allowed to produce an up-to-date land characteristics database and to study land cover/ land use structure and trends of change. The present-day landscape concept could enrich the assessment of land use/cover change and avoid the unfavorable consequences of land degradation. Different spatial levels of the LUCC study help providing an understandable presentation of the geographical distribution of areas with different LUCC trends and degree of land cover transformation.

The results of research have direct relevance to land management and nature conservation, and can help to elaborate recommendations for a rational land-use strategy in Russia. The mapping, monitoring and modelling of land cover / land use in such a vast territory as Russia could also contribute to the study of global environmental change.

"Large greenhouse gas savings due to changes in the post-Soviet food systems," Florian Schierhorn, et al., Environmental Research Letters, 2019 [81]
https://core.ac.uk/download/pdf/269321992.pdf

Abstract:

As the global food system contributes significantly to global greenhouse gas (GHG) emissions, understanding the sources of GHG emissions embodied in different components of food systems is important. The collapse of the Soviet Union triggered a massive restructuring of the domestic food systems, namely declining consumption of animal products, cropland abandonment, and a major restructuring of agricultural trade. However, how these complex changes have affected global GHG emissions is uncertain. Here, we quantified the net GHG emissions associated with changes in the former Soviet Union's food systems. Changes in food production, consumption, and trade together resulted in a net emissions reduction of 7.61 Gt carbon dioxide equivalents from 1992 to 2011. For comparison, this corresponds to one quarter of the CO2 emissions from deforestation in Latin America from 1991 to 2011. The key drivers of the emissions reductions were the decreasing beef consumption in the 1990s, increasing beef imports after 2000, mainly from South America, and carbon sequestration in soils on abandoned cropland. Ongoing transformations of the food systems in the former Soviet Union, however, suggest emissions will likely rebound. The results highlight the importance of considering agricultural production, land-use change, trade, and consumption when assessing countries emissions portfolios. Moreover, we demonstrated how emissions reductions that originate from a reduction in the extent and intensity of agricultural production can be compromised by increasing emissions embodied in rising imports of agricultural commodities.

Current & Relevant Information:

With approximately a quarter of total anthropogenic greenhouse gas (GHG) emissions, the global food system is a key driver of climate change (Smith et al 2014). Estimating the sources of GHG emissions embodied in major components of food systems is therefore important when developing strategies to mitigate climate change, but this is challenging for several reasons. First, global food systems are highly complex as they encompass all processes from agricultural production to processing and distribution, are spatially very heterogeneous, include a large variety of food products, and distinct supply chains (Garnett 2011). Second, relating GHG emissions from agricultural land-use change to individual food products is difficult because both direct and indirect land use changes are not fully understood (Arima et al 2011, Lambin and Meyfroidt 2011). Third, food systems change over time, for example due to political and economic restructuring, which often have drastic effects on food production, per capita consumption, and food trade (Müller et al 2014, Distefano et al 2018).

As a striking case in point, the breakdown of socialism in 1991 across the former Soviet Union (FSU) and transitioning from planned to market economy had drastic consequences for the region's agricultural sector and food system (Lerman and Shagaida 2007). On the demand side, higher consumer prices and lower purchasing power substantially reduced per capita consumption of livestock products (Schierhorn et al 2016). Lower demand combined with market liberalization and diminishing state support for agriculture resulted in 51% and 52% reductions in cattle and pig numbers, respectively, across the 15 FSU countries between 1992 and 2011 (Schierhorn et al 2016, FAOSTAT 2017). The collapse of the livestock sector also contributed to widespread agricultural abandonment, defined as the cessation of agricultural land use, especially in Russia and Kazakhstan in the 1990s (Alcantara et al 2013, Schierhorn et al 2013, Kraemer et al 2015, Lesiv et al 2018). Patchy and inconsistent data have thus far prevented a consistent quantification of the effects of the collapse of the Soviet Union on GHG emissions resulting from changes in the food systems. In particular, soil organic carbon sequestered on abandoned cropland, largely due to succession of secondary vegetation (Kalinina et al 2011), has been severely underestimated in most global GHG emission accounts so far, mainly because of the lack of reliable land-use data (Schierhorn et al 2013, Houghton and Nassikas 2017).

Assessing the net impact of the collapse of the FSU on GHG emissions as well as understanding future emissions trajectories requires quantifying the effects of the massive restructuring of international trade after 1991. This is challenging as production-based national emissions inventories fail to capture the substantial GHG emissions embodied in traded agricultural commodities. Domestic food demand in the FSU countries started to rebound in the late 1990s, once economies had stabilized. Consumption of beef, the most GHG-intensive food, increased by 15% between 2000 and 2008, although beef production in the FSU stagnated. The region thereby became the second largest importer of beef globally (after the US), with approximately 80% of these imports sourced from South America between 2005 and 2010 (FAOSTAT 2017). Beef exports from South America embody high GHG emissions due to deforestation and inefficient production systems (Berndt and Tomkins 2013, Karstensen et al 2013, Opio et al 2013). Conversely, the Soviet Union had to import large amounts of grain until the late 1980s to feed its livestock, but rebounding domestic grain production turned the region into a leading exporter of grains after 2000 (Liefert et al 2010). To date, accounting for global GHG emissions has failed to capture how changes in trade patterns affect regional GHG emission balances (Peters et al 2012).

Our main objective was to quantify the combined net GHG effect from 1992 to 2011 of (i) changes in livestock production inside the FSU, (ii) cropland abandonment inside the FSU, and (iii) feed and food trade between the FSU and other world regions. We used a new, consistent database on land-use change and associated changes in soil organic carbon stocks to quantify the emission intensities of agricultural production (emissions measured in carbon dioxide equivalents, CO2e, per unit of agricultural output), including livestock, and the emissions embodied in the trade of agricultural commodities. Based on an index decomposition approach, we identified the most important socio-economic drivers contributing to changing GHG emissions embodied in food consumption inside the FSU after 1991.

"Can Russia Afford Climate Change?" Vladimir Otrachshenko and Olga Popova, Russian Analytical Digest, December 2019 [82] https://www.research-collection.ethz.ch/bitstream/handle/20.500.11850/385448/3/RAD243.pdf

Abstract:

Given its resource richness, large territory, and population, Russia is a key partner in global efforts on mitigating the adverse impacts of climate change. The majority of Russians agree that the Earth's climate has become unpredictable and global warming will have a negative impact on Russia. Extreme temperature events lead to social, economic, and health consequences. These consequences might be partially mitigated through encouraging low carbon development and energy-efficient production, improving regional economic conditions, and providing job opportunities. However, it remains an open question whether the Russian population and the Russian economy can adapt to the steadily increasing influence of global warming.

Current & Relevant Information:

On 21 September 2019, Russia approved the 2015 Paris Climate Agreement. This agreement sets a long-term goal of limiting the global temperature increase to 2°C until 2030 and fosters low carbon technological development. Each country that formally joined the Agreement commits to individually set, fulfill, and regularly report greenhouse gas emissions targets to keep them below the pre-industrial level by 2030. Russia's self-specified target is about 25–30% below the emissions level in 1990. Russia's approval of the Paris Climate Agreement provides an important contribution to the global efforts on mitigating the adverse impacts of global warming, since the country is currently the fourth largest emitter of greenhouse gases globally and the largest emitter that has not formally adopted the Agreement until now.

Beyond physical changes in the environment, it is important to consider the socioeconomic consequences of global warming and extreme temperatures. In the economics literature, mean daily temperatures above 25°C (i.e. in Russia, outdoor temperatures may vary significantly during the course of a day, for instance, from 15°C at night to 35°C during the afternoon) are considered extremely hot, since they induce physiological adjustments in the human body and influence daily activities, labor productivity, and the health condition of individuals. Extremely cold temperatures also affect human health, but the definition of extreme cold may vary from place to place. In the case of Russia, mean daily temperatures below -23°C are considered extremely cold, since according to the data from the Russian Federal Service for Hydrometeorology and Environmental Monitoring, they constitute no more than 5% of all temperature observations. Yet, such temperatures are experienced in all regions of Russia.

One way to obtain the economic cost estimates due to extremely hot and cold days is to measure the foregone earnings of individuals based on statistics measuring average wages in a region and average years left before retirement for a person of a given age group. Such estimates for Russia show that a single day with an average temperature above 25°C may lead to more than a 10 mln. USD loss (in 2014 prices). This is a substantial cost that constitutes about 0.28% of daily GDP in Russia and is incurred because persons who could have worked for an average wage until retirement forego those earnings due to premature death before retirement. This is an average estimate of economic costs that may increase depending on the average impact of a single hot day on mortality in different age groups, the number of such days, average regional wages, and the retirement age.

"Post-Soviet food system changes led to greenhouse gas reductions," Simon Davies, physicsworld, 21 June 2019 [83] https://physicsworld.com/a/post-soviet-food-system-changes-led-to-greenhouse-gas-reductions/

Overview:

Changes in agriculture, trade, food production and consumption after the collapse of the Soviet Union led to a large reduction in greenhouse gas emissions, a new study has found.

From 1991 to 2011, there was a net emissions reduction of 7.61 gigatons (Gt) of carbon dioxide equivalents – the same as one quarter of the CO_2 emissions from deforestation in Latin America in the same period.

However, the team behind the research cautioned that ongoing changes in food systems in former Soviet Union countries suggest the reduced emissions will ultimately rebound.

They published their results today in *Environmental Research Letters*.

Dr Florian Schierhorn, from the Leibniz Institute of Agricultural Development in Transition Economies, Germany, is the study's lead author. He said: "The global food system contributes significantly to greenhouse gas emissions, so understanding the source of greenhouse gas emissions from the different components of food systems is important. A key aspect of this is assessing how changes in international trade patterns affect regional greenhouse gas emission balances.

Current & Relevant Information:

"When the former Soviet Union collapsed, the transition from a planned to a market economy had drastic consequences for the region's agricultural sector and food systems. Higher prices and lower purchasing power reduced the consumption of meat, particularly beef.

"This fall in demand, coupled with a reduction in state support for agriculture, led to a halving in pig and cattle numbers. This collapse in the livestock sector led to widespread agricultural abandonment."

To assess the impact this had on greenhouse gas emissions, the researchers used a database of land-use change and the associated changes in soil organic carbon stocks to quantify the emissions from agricultural production, including livestock and the emissions from the trade of agricultural goods.

They then estimated the net cumulative change in greenhouse gas emissions of all years from 1991 to 2011, minus the average emissions by the end of the Soviet Union.

Dr Schierhorn said: "The post-Soviet changes in greenhouse gas emissions from food production, food trade, and cropland led to a cumulative net reduction of 7.61 Gt CO_2e from 1992 to 2011, compared to a scenario where emissions stayed at the late Soviet level.

"The most important reasons for this reduction were the decline in domestic livestock production, and soil organic carbon sequestration on abandoned cropland, particularly in Russia and Kazakhstan."

However, the researchers noted that the ongoing carbon balance remains unresolved. Their analysis suggests several further developments, including the potential for abandoned cropland to sequester additional significant carbon until mid-century, but with these gains likely being mitigated by an increase in agricultural development.

In addition, importing agricultural commodities such as beef may compromise these gains through embodied carbon emissions.

Dr Schierhorn said: "Once economies in the former Soviet Union had stabilised in the late 1990s, domestic food demand in the region started to rebound. The consumption of beef, for example, increased by 15 per cent between 2000 and 2008.

"However, beef production in the region had stagnated, and shows no signs of recovering. The demand meant it became the second largest importer of beef globally, with 80 per cent coming from South America. This is significant, because South American beef exports embody high greenhouse gas emissions, due to deforestation and inefficient production systems.

"This relationship shows how negative emissions due to agricultural land abandonment can be compromised by increasing emissions from rising agricultural imports. This situation is likely similar in many industrialized and emerging regions where agricultural land use has been contracting in the recent past."

"Biological Variability on the waves of history: Conservation in a changing social and institutional environment in Hungary, a post-soviet EU member state," Barbara Mihók, et al., Biological Conservation, July 2017 [84]
https://www.sciencedirect.com/science/article/abs/pii/S0006320717307875

Abstract:

Changes of the social-political system in the last twenty-five years heavily affected Biological Variability conservation in the post-soviet Central and Eastern European (CEE) countries. We used a framework to present the effect of the two fundamental social, political and economic changes on the Biological Variability and ecosystems of Hungary from 1989 until recently. First, following the democratic transformation in 1989 social, political, economic and institutional drivers led to the increase in farmland Biological Variability, improvement of water quality due to less chemical use and decrease of habitat loss within protected areas. At the same time, land privatization and uncertain ownership led to habitat degradation, abandonment and fragmentation. These changes were coupled with the spread of alien species and re-ploughing. The second change was joining the European Union in 2004. This resulted in the establishment of the Natura 2000 network, the application of the relevant EU policies, and access to conservation related EU funds, which contributed to successful habitat restorations increasing of some charismatic species' populations. Meanwhile, however, disappearance of extensive farming practices, agricultural intensification and infrastructural developments driven by some increasing EU funds led to a net habitat loss, degradation and decline in Biological Variability, with more than half of the species of European importance having unfavorable conservation status. Increased support for conservation institutions, adaptive and extended agri-environment schemes and further research and monitoring to establish, refine and supervise sustainable management practices, including water management, are needed to prevent further Biological Variability loss in the coming years.

Current & Relevant Information:

Introduction

Effective conservation of biological variability can be achieved only if viewed in a coupled socio-ecological system (Berkes and Folke, 1998, Díaz et al., 2015). Understanding the links between society and nature, however, requires specific knowledge, gained particularly from regions where rapid social transformations have high stakes regarding Biological Variability conservation. In Central and Eastern European (CEE) countries political, legal and regulatory systems changed dramatically in a relatively short period making a substantial impact on Biological Variability conservation (Liira et al., 2008, Berkes, 2016). Despite of forced intensification trends (Peterson, 1993, Jepsen et al., 2015), extensive farming practices and extended semi-natural and natural habitats survived in Hungary during socialism (Báldi and Batáry, 2011), similarly to other CEE countries (Stoate et al., 2009, Tryjanowski et al., 2011). These habitats contributed substantially to the increase of Biological Variability-rich areas of the European Union (EU) when these countries joined (Henle et al., 2008, Young et al., 2007, Stoate et al., 2009, Sutcliffe et al., 2015). The deconstruction of the socialist legislation, the establishment of new institutions, new progressive conservation laws and later the EU accession introduced new regulation and management tools for Biological Variability conservation in the new member states, including the establishment of the Natura 2000 network and the related agricultural incentives (Hochkirch et al., 2013, Kati et al., 2014). The EU Common Agricultural Policy (CAP) has a much broader and debatable influence on the ecosystems: in addition to resource allocation to the conservation of high nature value areas (HNVA-s) and sustainable agriculture and forestry practices, CAP is driving agricultural intensification accelerating the decrease of farmland Biological Variability (Tryjanowski et al., 2011, Pe'er et al., 2014). While impacts of socio-economic changes on species, habitats and land-use are thus manifold (e.g. Kuemmerle et al., 2008, Pullin et al., 2009), Biological Variability governance and conservation institutions have also gone through substantial transformation in these countries (Kluvánková-Oravská et al., 2013), resulting in an ever-so changing socio-political landscape of conservation advocacy.

Particular case studies contributed to the overall picture of conservation in the CEE region on e.g. protected areas (Iojă et al., 2010, Knorn et al., 2012, Lepšová and Pouska, 2014), conservation policy (Ioras, 2003), and pollinators (Kovács-Hostyánszki et al., 2016) in Romania, farmland birds population trends in Poland and Hungary (Sanderson et al., 2009, Szép et al., 2012), wood pastures (Hartel et al., 2013, Varga et al., 2015) and steppe habitats (Wesche et al., 2016) in Eastern Europe. Information compiled from the EU Member States' reports and further assessments under the EU Directives provides a review on the status of habitats and species in the European Union (EEA, 2015). There is an increasing need, however, to understand the wider picture of this dynamic era (see e.g. Hanspach et al., 2014), but no report is available at the most important and operative administrative level, the state, to scrutinize the relationship between Biological

Variability, governance and legislation in a socio-economic context. Thus, information from the CEE region, that applies an integrative approach and provides the wider context are key for a better understanding and documentation of how substantial changes in socio-political context influence Biological Variability conservation. Considering the recent rapid political changes, such case study will provide essential information. Hungary has been the subject of these radical changes while substantial knowledge has been also accumulated enabling us to assess the effects of changes on Biological Variability. Exploring these changes and their impacts on Biological Variability conservation is strongly needed, as it provides further basic insights into the links between society and nature. This is all the more needed, as Biological Variability conservation faces particular challenges more than twenty-five years after the transition from communism to democracy and a decade after the EU accession (e.g. Knorn et al., 2012, Baumann et al., 2011, Báldi and Vackar, 2016).

A conceptual framework is needed for this exploration as it can provide a simple view of the key components and relationships in a complex socio-ecological system. Such a framework is particularly useful for interdisciplinary approaches, namely to highlight relationships across disciplines, science and policy (Ostrom, 2009, Díaz et al., 2015). For this paper, we use a conceptual framework (CF) based on the IPBES (Intergovernment Science-Policy Platform on Biological Variability and Ecosystem Services) framework (Díaz et al., 2015). The central tenet of the concept is that society makes an impact on the ecosystems through indirect and direct drivers. These drivers affect nature, Biological Variability and ecosystems and lead to different impacts in terms of ecosystem services and human well-being. These impacts lead to various actions in society (e.g. institutional re-structuring) initiating changes in indirect and direct drivers. The IPBES CF furthermore incorporates “anthropogenic assets” in the framework as the accumulation of physical, intellectual or cultural achievements (Díaz et al., 2015).

Our framework follows the above approach in a simplified way by exploring the basic elements of IPBES CFs: Indirect drivers, Direct drivers, and Biological Variability and ecosystems (Fig. 1) from 1989 up until recently. Under Indirect drivers (Section 3) we discuss the country-scale institutional, legal and financial changes affecting nature in Hungary in this period. While a comprehensive review of all indirect drivers (e.g. economic, technological and cultural, Díaz et al., 2015) would be much beyond the scope of this paper, we include some substantial aspect of cultural and economic changes in the discussion which we see as fundamental, including ‘anthropogenic assets’ such as knowledge accumulation. Direct drivers (Section 4) cover those anthropogenic factors influenced by the indirect drivers, that induce changes in ecosystems directly, including habitat conversions, shifts in land-use, deforestation and afforestations, habitat restoration, exploitation, species introduction and pollution (Díaz et al., 2015). The consequences of these direct effects on the species and habitats in Hungary are reviewed under Biological Variability and ecosystems (Section 5).

By applying this framework, we aim to show the Biological Variability gains due to the strengthening conservation instruments after the transition and the EU accession, and to highlight the threat of Biological Variability losses imposed by recent institutional changes, development and agricultural pressures following the EU enlargement. Finally we discuss a number of responses that are most needed to address these threats in order to maintain Biological Variability in Hungary in the longer term.

10. South Asian Culture:

"Inclusion of Local People and Their Cultural Practices in Biological Variability Conservation: Lessons from Successful Nations," Dickson Adom, American Journal of Environmental Protection, 2016 [85]
https://www.researchgate.net/profile/Dickson_Adom/publication/316914798_Inclusion_of_Local_People_and_Their_Cultural_Practices_in_Biological Variability_Conservation_Lessons_from_Successful_Nations/links/5917f15aa6fdcc963e856ac7/Inclusion-of-Local-People-and-Their-Cultural-Practices-in-Biological Variability-Conservation-Lessons-from-Successful-Nations.pdf

Abstract:

The inclusion of local people and their cultural practices impact positively on Biological Variability conservation. This is the underlying factors behind the success stories of countries with high numbers of biological variability resources. It is sad to reckon that most Biological Variability policies of developing countries like Ghana do not fully include the voices of the local people as well as their cultural practices. There was, therefore, the need to thoroughly review the national Biological Variability strategies and action plans of some countries that have effectively factored the local people and their cultural practices in their Biological Variability policies. This was to elucidate how and in what areas the views of the local people and their cultural practices can be effectively incorporated into Biological Variability conservation initiatives. The study utilized qualitative research approach with document analysis method. Related literature on the subject from peer-reviewed manuscripts, Biological Variability strategic reports and strategies of different countries were rigorously reviewed and analyzed using Interpretative Phenomenological Analysis (IPA). The study revealed that local people have time-tested conservation knowledge enfolded in their cultural practices like religious beliefs, taboos, etc. Legal backing was seen as the main driving force behind the utilization of the cultural practices of the local people in the Biological Variability strategies reviewed. Moreover, the local people were fully involved in the development of the Biological Variability strategies. This was seen in the areas of planning, management, and decision-making, recruitment of staff, as well as the

dissemination and implementation of the Biological Variability strategy. The study concluded that effective Biological Variability policies must reflect the cultural practices and the views of local people since they are powerful instruments of conservation. It tasks Biological Variability policy designers to fully incorporate local communities and their cultural practices in the development of Biological Variability strategies.

Current & Relevant Information:

This section of the paper delves into the national Biological Variability and action plans of some successful nations in Biological Variability conservation initiatives. These countries have effectively included the local people and their cultural practices in every aspect of their Biological Variability conservation initiatives and programs. These aspects include the planning, management, and decision-making processes as well as the implementation and recruitment of staff in spearheading conservation plans for Biological Variability. Also, the dissemination of conservation initiatives demonstrates the strong influence of local people and their cultural practices. In addition, the exact cultural practices of the local people that have played significant roles in Biological Variability conservation have been discussed. These successful countries whose Biological Variability conservation strategies and action plans are reviewed are Brazil, China, Japan, ***India***, Tanzania, Kenya, and Angola.

National Biological Variability Strategy of India

India is one of the top countries that have high Biological Variability resources. The secret behind the successes in their Biological Variability is with the incorporation of the traditional conservation practices of the local communities. The policy designers recognize that the local people are direct stakeholders in the protection and conservation of nature's Biological Variability. Thus, their cultural practices such as taboos, myths, and cosmological beliefs played powerful roles in the sustainable usage and conservation of the bio-resources. It is reported that various taboos and religious beliefs have helped in conserving the numerous sacred groves in the Meghalaya, Karnataka, and Kodagu districts in India.

The policy designers ultimately aimed at preserving as well as strengthening the traditional, religious, ritualistic, ethical and cultural methods of conservation. They were convinced that the traditional cultural practices are best practices that must be revived and revitalized. This need was as a result of the massive shift to the scientific conservation models which the team realized was overshadowing the traditional cultural practices. However, the team tried to bridge the science-based strategy with the sustainable traditional cultural practices that are applicable today.

Moreover, to intensify the involvement of the local people and their communities in the decision-making process governing Biological Variability conservation, the team encouraged capacity building at the grass root levels. This participatory approach in the decision-making process factored the voices of the local people in the policy. This co-management approach between the local communities, project officers and foresters has been discovered as the best means of enhancing the implementation processes of Biological Variability conservation strategy.

Indigenous knowledge and its valuable imports evident in the cultural practices are not very popular in contemporary Biological Variability schemes due to the influx of foreign conservation models. Owing to this, the team decided to enhance public awareness campaigns on the conservation values of the traditional cultural practices via audio, visual and print media. Furthermore, to assist in the preservation of the traditional knowledge in these cultural practices of the local people, the team that developed the national Biological Variability strategy adopted the sui generis system of intellectual property rights. This was in consonance with the advice of the International Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore, Second session's report on December 14, 2001, paragraph 17. This action was undertaken by the Biological Variability conservation strategy developers to preserve these traditional cultural knowledge systems of the various ethnic cultures and communities in India.

"Vegetation Dynamics in the Western Himalayas, Variability Indices and Climate Change," Shujaul M. Khan, et al., Science, Technology and Development, December 2012 [86]
https://www.researchgate.net/profile/Arvind_Singh56/post/What_are_the_different_methods_of_calculating_Important_Value_Index_in_Tropical_Forests/attachment/59d64a6f79197b80779a4b9a/AS%3A475322941480963%401490337228745/download/Vegetation+dynamics+in+the+Western+Himalayas%2C+Variability+Indices+and+Climate+Change.pdf

Abstract:

Vegetation provides the first tropic trophic level in mountain ecosystems and hence requires proper documentation and quantification in relation to abiotic environmental variables both at individual and aggregate levels. The complex and dynamic Himalayas with their varying climate and topography exhibit varied vegetation that provides a range of ecosystem services. The Biological Variability of these mountains is also under the influence of varied human cultures and land uses. The present paper is not only first of its kind but also quite unique because of the use of modern statistical techniques for the quantification of Variability Indices of plant species and communities. The vegetation was sampled in three categories, i.e., trees, shrubs and herbs, as follows: a height of ≥ 5m were classified in the tree layer, shrubs were all woody species of height 1m and 5m and, finally, the herb layer comprised all herbaceous species less than 1m in height. The presence/absence of all vascular plants was recorded on pre-prepared data sheets (1, 0 data). For the tree layer, the diameter of trees at breast height was measured using diameter tape. Coverage of herbaceous vegetation was visually estimated according to

Daubenmire and Braun Blanquet methods. It gives overall abundance of vascular plants on one hand and composition of these species on the other. Data was analyzed in Canonical Community Coordination Package (CANOCO) to measure variability indices of plant communities and habitat types. Results for five plant communities/habitat types indicated that plant Biological Variability decreased along the altitude. Shannon Variability Index values range between 3.3 and 4. N2 index and Index of Sample Variance were also designed. All of these Variability Indices showed the highest values for the communities/habitats of north facing slopes at middle altitudes. Higher plant variability at these slopes and altitudes can be associated to the period of snow cover which is longer and a relatively denser tree cover as compared to the southern slopes and hence the soil has high moisture which supports high Biological Variability in return. Global warming causes desertification in number of fragile mountain ecosystem around the globe. These findings suggest that species variability decreases along the measured ecological gradient under the influence of deforestation coupled with global climatic change.

Current & Relevant Information:

Mountains are the most remarkable land forms on earth surface with prominent vegetation zones based mainly on altitudinal and climatic variations. Variations in aspects also enhance habitat heterogeneity and bring micro-environmental variation in vegetation pattern (Clapham, 1973; Khan et al., 2011b). In north-western Pakistan, three of the world's highest mountain ranges, i.e., the Himalayan, Hindu Kush and Karakoram, come together, ensuring high floral variability and phytogeographic interest. Plant Biological Variability survives at the edge of life at these high mountains where climatic changes are more visible and species extinction very rapid. Studies on mountainous vegetation around the globe show that ecological amplitude of alpine species shifted to even higher elevations over the recent decades. Species preferred temperatures in higher altitudinal zones. Therefore, many alpine species are under the risk of extinction due to their requirements for germination and reproduction (Grabherr et al., 1994; Holzinger et al., 2008). Unlike the eastern Himalayas, where monsoon-driven vegetation predominates under higher rainfall and humidity (Chawla et al., 2008; Dutta and Agrawal, 2005; Anthwal et al., 2010; Behera et al., 2005; Roy and Behera, 2005), the vegetation in the western Himalayas in general (Chawla et al., 2008; Kukshal et al., 2009; Shaheen et al., 2011; Ahmad et al., 2009; Dickoré and Nüsser, 2000; Shaheen et al., 2012) and in the Naran Valley (Khan et al., 2011b) in particular have closer affinities with that of the Hindukush mountains, which have a drier and cooler climate (Ali and Qaiser, 2009; Wazir et al., 2008; Noroozi et al., 2008). A recent study showed that with the passage of time, homogeneity takes place in the vegetation of a region due to continuous dominance of certain resistant and vigorous species. This phenomenon is further enhanced by selective utilization of species by human intervention (Del Moral et al., 2010). Similarly, the tree-line vegetation and indicator species shift upwards due to climate change.

Mountainous vegetation has manifold functions, not only within the system where it exists regionally in the lowland ecosystem by regulating floods and flow in streams and globally in combating the climate change and greenhouse effects. Regionally, shrubby vegetation of high altitude regulates avalanche movements and protects soil but in majority of places, it is threatened due to human and climatic influences (Hester and Brooker, 2007). Plant Biological Variability is necessary for regulation of overall system in the mountain, e.g., the Himalayas is the birth place for 10 largest rivers in the Asia and a big and important carbon sink. Ecological changes in the Himalayas affect global climate by bringing changes in temperature and precipitation patterns of the world. Himalayan Vegetation is varied and range from tropical evergreen species in the south east to thorn steppe and alpine species in the north western parts (Behera and Kushwaha, 2007). Melting of its snow in a regular fashion is related to its vegetation cover. Irregular loss of its ice might have dangerous rise in world sea-levels (Xu et al., 2009). These mountains are extremely sensitive to global climatic change. Such hazardous glimpses have already been observed in the form of flood in Pakistan, India, China and Thailand in the last three years.

The Naran Valley is located at the far west of the Western Himalayas on the border with the Hindu Kush range which lie to the west and near to the Karakorum Range to the north. Due to this transitional location the valley host representative vegetation types from all three mountain ranges. Monsoon winds are main source of precipitation and also a primary force of controlling erosion and climatology over millions years of time and thus modify its climate, topography and vegetation of Himalayas but in the western Himalaya, especially in Naran Valley, high mountains situated at the opening of the valley act as barriers to the incoming summer monsoon from the south and limit its saturation into upper northern parts. Thus, summers remain cool and relatively dry and make most of the valley as a dry temperate-type of habitat. There are clear seasonal variations. Total average annual precipitation is low at only 900-1000mm but there is heavy snowfall in winter which may occur any time from November to April (average annual snowfall 3m). The range reflects a sharp increase in depth of snow with increasing altitude. There is a distinct wet season in January-April whilst the driest months of the year are June-November. As far as temperature of the area is concerned, most of the year, it remains below 10°C. December, January, February and March are the coldest months of the year in which temperature remains around the freezing point or even below most of the times. June to August is the main season for growth, with average daytime temperatures in the range 15-20°C. Geologically, the valley is located where the Eurasian and Indian tectonic plates meet and where the arid climate of the western Eurasian mountains gives way to the moister monsoon climate of the Sino-Japanese region (Qaiser and Abid, 2005; Takhtadzhian and Cronquist, 1986; Kuhle, 2007). The valley thus occupies a unique transitional position in the region. In remote mountainous valleys like the Naran, the complexity of ecosystems, their inaccessibility and the cost and time factors make it extremely difficult to observe each and every aspect of vegetation features. Perhaps those were the reasons that in spite of its high phytogeographic importance, there have been no previous quantitative studies of the vegetation in this valley. The present study is not only the first of its kind but also quite unique because of the use of modern statistical techniques for the quantification of plant species and communities along geo-climatic environmental gradients that has limited comparator studies in this region (Wazir et al., 2008; Saima et al., 2009; Dasti et al., 2007). The Naran Valley, which is floristically located in the Western Himalayan province of the Irano-Turanian region, forms a botanical transitional zone between the moist temperate (from the South East) and dry temperate (from the North West) vegetation zones of the Hindu Kush and Himalayan mountain ranges, respectively. A phyto-climatic gradient of vegetation based on life forms further emphasizes the nature of the area and makes apparent the transitional position of the region, though predominated by alpine species (Khan et al., 2011b & c).

The quantitative approaches to vegetation description and analyses deployed in this study not only fill methodological deficiencies (Khan, 2012) and gaps in the literature, i.e., evaluation of variability indices but also provide a firm basis for extending this approach to the adjacent mountain systems that are in need of up to date vegetation mapping (Fosaa, 2004; Mucina, 1997). In addition, the present study documents and provides suggestions for the conservation of mountain plant Biological Variability under a scenario of continuous human exploitation and climate change. It is necessary to maintain ecosystem services in general and food security in particular, not only within mountain system but also for the people and ecosystems of the lowlands that depend on those mountains (Rasul, 2010; Manandhar and Rasul, 2009; Sharma et al., 2010; Khan et al., 2011a).

"Climate Change in South Asia: A Framework of Sustainable Development and Human Security," Chanchal Kumar, Journal of Environment Pollution and Human Health, 25 November 2014 [87]
https://www.researchgate.net/profile/Chanchal_Kumar5/publication/333531617_Climate_Change_in_South_Asia_A_Framework_of_Sustainable_Development_and_Human_Security/links/5cf212f2299bf1fb184e8ef5/Climate-Change-in-South-Asia-A-Framework-of-Sustainable-Development-and-Human-Security.pdf

Abstract:

Climate change is increasingly been called a 'human security' problem, and there has been speculation that climate change may increase the risk of violent conflict. The broad contours of a research program to guide empirical investigations into the risk's climate change poses to human security and peace. It is now increasingly realized that even with the currently agreed regime of emissions control, concentrations of greenhouse gases (GHG) are likely to rise over the next few decades and over the millennia. Climate change is likely to threaten all life forms on earth with the extent of vulnerability varying across regions and populations within regions. Changes in temperature and precipitation patterns and numerous other

factors will impact both natural and human systems. Climate sensitive sectors like agriculture, forestry, water resources and coastal regions, and, human systems including human health, human settlements, industry and energy sectors will be drastically affected. The South Asian experience can contribute to the larger literature on environment and security and, more particularly, to the literature on human security and sustainable development. It argues that chronic and structural impoverishment—rather than resource scarcity alone— forges the connection between environmental degradation and conflict. It also suggests that poverty and weak institutions of governance are the more immediate triggers of environmental insecurity.

Current & Relevant Information:

Introduction

Climate change has attracted unprecedented attention in recent years. It has been referred to as the defining human development issue of our generation. While climate change originated as an environmental problem, it now impinges on every aspect of human life including international peace and security. South Asia provides an interesting case study to discuss climate change as the challenges facing these countries are wide and varied yet they share similar cultural and socio-economic backgrounds. Issues relevant to India which is fast industrializing will be different from the Maldives, which is threatened by submergence due to rising sea levels giving rise to “climate refugees.” Problems facing Sri Lanka, an island nation, will be different from Nepal and Bhutan which are landlocked states. At the same time, these countries are plagued by conflict, poverty and malnutrition. The effects of global warming on the Indian subcontinent vary from the submergence of low-lying islands and coastal lands to the melting of glaciers in the Indian Himalayas, threatening the volumetric flow rate of many of the most important rivers of India and South Asia. (Penny Christopher: 2007).

The South Asian region is one of the most densely populated and at the same time most exposed regions in terms of the threats of climate change. A considerable section of the South Asian population is dependent on agriculture for their livelihood and they have to bear the brunt of the vagaries of the changing climate. It is estimated that by 2050, the population of South Asia will increase to reach 2.2 billion from the current figure of 1.5 billion. With an estimated 600 million South Asians subsisting on less than $ 1.25 a day, even relatively small climate shocks can cause irreversible damage and push a large number of people into destitution. Over the years the South Asian region has experienced significantly longer summers and, in some cases, severe heat waves. In many parts of South Asia, the frequency of more intense rainfall has increased-leading to severe floods, landslides and debris flow. At the same time, the total amount of precipitation has declined. (worldbank.org).

Sustainable Development in South Asia

South Asian countries while sharing similar geographical and cultural features, are also very varied: the region has the country with the second largest population in the world (India), a small island state (Maldives), an island nation (Sri Lanka), land-locked countries (Nepal and Bhutan), two nuclear power states (India and Pakistan), and a country located on a river delta (Bangladesh). They are very rich in biological variability as the region is home to many tropical rainforests and world heritage sites. South Asia is home to well over one fifth of the world's population and is one of the most densely populated areas of the world. Most countries in the region are prone to conflict and political instability and are also plagued by poverty and corruption. Sri Lanka enjoys the highest GDP per capita and the highest literacy rate in the region while India alone accounts for 5.6 million child deaths per year. According to the World Hunger Index, the region also has the highest child malnutrition rate in the world.

The south Asian region accounts for five per cent of the world's land but houses 20 per cent of the global population. The population density is the highest with 260 people per sq. km. in contrast to the global average of 44 people per sq. km. Also, poverty is widely prevalent with one third of the population living under one dollar a day. To add to this, the effects of climate change have been on the rise in this part of the globe. The erratic weather patterns, retreating Himalayan glaciers causing frequent floods and droughts coupled with the varied ethnic beliefs and internal conflicts further complicate adaptation measures and pose significant threat to national and human security. South Asia is a zone of instability with unstable governments and inter and intra state conflicts. It is also home to some of the poorest countries in the world. In addition to the existing conflicts, climate change throws up new challenges in the form of water scarcity and resultant water disputes and also other national security issues along the unsettled boundaries. On the other hand, India is fast industrializing, and has made tremendous strides in the field of science and technology – it even made its mark on the moon recently. Bangladesh and Nepal are among the poorest countries in the world while the Maldives, consisting of atolls barely above the sea level, is a tourist haven. While Sri Lanka was the first country in the region to liberalize its economy its development efforts have been undermined by the 25-year-old civil war that ravaged the country. Tensions have always been high between the two nuclear powers – India and Pakistan. India, by far the largest and the most populous country in the region, has naturally been its dominant political power.

In South Asia there are at least forty-seven million people living in highly vulnerable Low Elevation Coastal Zones in Bangladesh, India and Pakistan. These zones include one of the most populous delta regions of the world—and megacities such as Mumbai, Kolkata, Dhaka and Chennai—where some areas are only 2–10 meters above the current sea level. As flooding and drought increase in frequency, this will have devastating impacts on livelihoods, and slow economic growth within the countries of South Asia, thereby increasing the number of people living in poverty and the number of triggers for displacement and forced migration. Small farmers living in the coastal zone are particularly vulnerable to storm surges, salt water ingress, and flooding which damages crops and creates conditions for seasonal attacks by insects and rats. Rural wage laborers are even more vulnerable to climate changes as their opportunities for employment will be reduced and as they will have fewer assets to sustain their households during times of disasters. In urban areas, poor households are particularly vulnerable as their members are forced to live in 'high risk areas' due to a lack of affordable housing and to a lack resources needed for adaptation to changing climatic conditions. Effective responses to climate-related displacement need to be informed by a robust research base, with a strong and dynamic social science approach bringing together local, regional and international knowledge and experience.

"Major Environmental Issues and Problems of South Asia, Particularly Bangladesh," Tanjina Hasnat, Alamgir Kabir, and Akhter Hossain, Handbook of Environmental Materials Management, 2018 [88]
https://www.researchgate.net/profile/G_N_Hasnat/publication/323264078_Major_Environmental_Issues_and_Problems_of_South_Asia_Particularly_Bangladesh/links/5e7c678fa6fdcc139c04692f/Major-Environmental-Issues-and-Problems-of-South-Asia-Particularly-Bangladesh.pdf

Abstract:

South Asia covers diversified climatic zones and experiences an array of climate change impacts. Human pressures together with changing hydrology and land resources have distinct impact on the production of food grain and resilience of ecosystems. The most threatened areas are grasslands and mountain forest ecosystems of the Himalayas and ecosystems of the Sundarbans. Forests of South Asia having most biologically varied ecosystems on the planet are destroyed due to rapid deforestation and urbanization. Moreover, the South Asia partake the worst air pollution in the world, and it is maximum in India. Thar Desert is extending at a rate of 100 ha per year which may cause damage to approximately 13,000 ha of cultivated lands and pastures in India and Pakistan. Availability of freshwater is highly seasonal in this region, and water supplies become more threatened by higher temperatures, changes in river regimes, and greater incidence of coastal flooding. This article discusses major environmental issues faced by the South Asian people particularly Bangladesh and the resultant problems encountered by majority of people. Major environmental issues discussed here are climate change, geophysical setting, ecosystem changes, overgrazing, import of hazardous wastes, deforestation, desertification, pollution, population pressure, collapse and pollution of land resources, water resources and lack of potable water, Biological Variability loss, food security risks, depletion of energy resources, and degradation of river and marine resources. Different problems created by mentioned environmental issues like Biological Variability loss, impacts to the marine environment, atmospheric pollution, deficient urban structure, water scarcity and degradation, soil erosion and land degradation, natural disaster, pests, and diseases have been depicted in this chapter. Some recommendations have also been provided on the basis of major environmental issues identified and resultant problems.

Current & Relevant Information:

Introduction

South Asia is the large unique landmass representing the southern region of the Asian continent. The South Asia comprises of eight countries – Bangladesh, India, Nepal, Pakistan, Bhutan, Maldives, Sri Lanka, and Afghanistan (Sivakumar and Stefanski 2010). The total area of South Asia covers almost 5.1 million km2 (1.9 million mi2), and this is 11.51% of the Asian continent. The land mass of this region gives a ground for near 1.749 billion people that covers about one fourth of the world's population (SACEP 2016). South Asia is not only the most populated region in the world but also densely populated (South Asia Regional Overview 2008).

The physiography of South Asia region ranges from the northern mountains to southern plateaus. The landforms distributed from the world's highest magnificent Himalayas with nearly two dozen peaks rising to 24,000 ft or above of Bhutan and Nepal to the lowest, the Bay of Bengal, the Indian Ocean, and the Arabian Sea beaches. The physical landscape of this region is also demonstrated with the fertile delta of Bangladesh, peninsula of India, and jewel-like islands of Sri Lanka and Maldives in the Indian Ocean.

The South Asia is ecologically more valuable area in the world because of its diversified natural resources and ecosystems. The total forest area of South Asia covers 2.73% of world's forests and provides a shelter for approximately 15.5% flora and 12% fauna of the world. The floral variability comprises 39,875 species of flowering plants, 66 conifers and cycads, and 764 ferns. Faunal variability is wide-ranging with 933 species of mammals, 4494 birds, 923 reptiles, 332 amphibians, and 342 freshwater fishes. Only the Hindu Kush Himalayan belt was embracing a home to a number of 25,000 major plant species that covers 10% of the world's total flora. In addition, India contains extensive savannah and forest habitats that provide spaces for many endemic species having international importance. Sri Lanka is also one of the most biologically diversified countries in the world. South Asia is the home of around 14% of the world's mangrove habitat. Moreover, highest percentage of threatened wetlands are in here, 82 of which are in Bangladesh.

The climate types of South Asia are quite difficult to understand and describe. About half of the climatic zones that exist on the earth can be found in South Asia. Though the climatic condition is quite different and varies considerably from area to area as of tropical monsoon in the south to temperate in the north, several distinct zones appeared here quite clearly. The total area is broadly separated into six main climate zones. The highland zone has the coldest climate. This area covers the Himalayas and other northern mountains. Snow exists here in all the year-round. Another one is the humid subtropical zone, much warmer than the highland zone. This zone includes the lower elevations and encompasses the deluxe slopes and valleys of Nepal, Bhutan, and northern India and the Indo-Gangetic Plain.

The semiarid zone is a region of high temperatures and light rainfall. This type of region is generally found at the western end of the Plain and in parts of the Deccan Plateau. The other zone is the desert zone, and it covers much of the lower Indus Valley in the borderlands of Western India and Southern Pakistan. The Thar Desert is located in this region and is the driest part of this area with an average 10 in. annual rainfall. The tropical wet zone is found along the western and eastern coasts of India and in Bangladesh. Temperatures are comparatively high, and rainfall is heavy in this zone and has recorded a world's record of 366 in. in a month. The sixth one is tropical wet and dry zone. In Sri Lanka the southern part has a tropical wet climate, while the northern part reveals a tropical wet and dry climatic zone.

The variety in climatic conditions of South Asia mainly is influenced by three bases – the altitude, vicinity to the seacoast, and the seasonal impact of the monsoons. Literary monsoon means seasonal winds that bring alternating periods of wet and dry weather. During summer season winds blow from the sea and bring moisture, called wet monsoon period. But, in the winter season winds blow out from the center of the region toward the sea and bear much less moisture. This period is dry monsoon period. The climate of South Asia is influenced by the monsoon patterns. The southern parts are near to the seacoast, so it's mostly hot in summer and receive rain during monsoon periods. The northern belt of Indo-Gangetic Plains gets both the seasonal warm air from the seacoast and the cold air of Himalayas. The mountainous north is colder and receives snowfall at higher altitudes of Himalayan ranges.

Although monsoons are crucial for South Asia, it causes severe suffering for millions of people, especially in the lowlands of Bangladesh and India. Monsoons are highly unpredictable, and recent years abnormal monsoon patterns generate more frequent and intensive natural disasters as well as climate change.

Conclusion and Recommendations

Urbanization, industrialization, and burning of fossil fuel along with many other factors are responsible for raising the CO2 level in the atmosphere and producing other greenhouse gases in many ways (Khwaja et al. 2012). Raised CO2 and other greenhouse gases are the major contributor to the global climate change and resultant effects (IUSS 2002). To combat with climate change, site appropriate mitigation and adaptation measure can be taken. For reducing greenhouse gases emission to safer level, renewable energy sources like solar energy can be used in industries, vehicles, brickkilns, and for cooking. Non-degraded forests and nonpolluted soil and water can consume huge amount of CO2 from the atmosphere.

Human pressure is the rooted problem for rapid urbanization and industrialization, increased number of vehicles and fossil fuel burning, pressurized land-use changes, and rapid climatic changes with its adverse impacts (Bremner et al. 2010; Vanclay 1993; Wibowo and Byron 1999). Developing the existing population into human capital along with measures for controlling the future population size to desired level by reducing growth rate could be proper solutions for mitigating all adverse environmental issues.

"Climate change in the South Asian context with a special focus on India: a review," Joyashree Roy, American Enterprise Institute, 3 April 2007 [89]
https://www.researchgate.net/profile/Joyashree_Roy2/publication/265076037_Climate_change_in_the_South_Asian_context_with_a_special_focus_on_India_a_review_1/links/5618d16b08ae044edbae7247.pdf

Overview:

South Asia includes the Indian subcontinent (India, Pakistan, Bangladesh, and Nepal) as well as Sri Lanka, Maldives, and Bhutan. It is argued that this region is particularly vulnerable to predicted climate change impacts because of its population load, low adaptive capacity, several unique and valuable ecosystems (coral reef, large deltaic region with rich Biological Variability), and vast low-altitude agricultural activities. Although the region comprises 3% of the world's land area, it is home to more than 20% of the global population. India alone accounts for almost 75% of the landmass.

Proactive response and action in the context of climate change in the South Asia region is limited by the availability of information on the net benefit of damage reduction. There are no conscious efforts to internalize climate variability in the investment decisions of today. The real challenge is to integrate climate concerns in fast growing economies into their development agenda. For the developing countries, the top priority is development, both economically and politically.

The purpose of this article is first, to understand the status of the available information on climate variability and impacts. The second objective is to make an assessment based on reactive adaptation that communities or stakeholders have followed in the past in case of extreme climatic events. This can help us understand the possible range of adaptation costs and justification for proactive actions for mainstreaming climate policy. Thirdly, we intend to identify the research and knowledge gaps in the South Asia region in order to make an assessment of the economic benefits of reduction of damage associated with predicted climate variability.

Inputs for the current assessment have been collated from two sets of literature. First, the review of the model has been based on climate variability predictions and associated impact assessments in the context of countries in South Asia with special reference to India. Secondly, past reports/studies related to natural calamities and disasters in the South Asian context have been studied, which are expected to reflect the possible range of damages from predicted extreme events.

Current & Relevant Information:

Despite the absence of very systematic estimates of past and predicted damage costs caused by variability in temperature, rainfall, sea-level rise, and extreme events, the findings summarized above provide enough justification to ponder over development priorities of these countries and introduction of appropriate regulations. The total outlay for natural disaster relief has been about 0.3% of the country's GDP in India. GDP loss of 1%–5% in Bangladesh, Nepal, and Pakistan due to flood and drought can be avoided by prudent choice of actions. While the recovery period from natural disasters ranges from 2 years to 4 years if the return period also coincides with this time scale, which is very likely and has also been observed in the recent past, intensification of adaptation activities calls for immediate attention. The challenge is to endogenize the adaptation measures to reduce the cost of reactive adaptation. Capacity building, when developed around traditional welfare issues such as poverty, low levels of economic activity, starvation, and health risks, can generate participation. The capacity to adapt to climate change calls for the reorganization of priorities in the development planning agenda. A climate-friendly development agenda, with a short-term agenda consistent with political realities, may be divided into two groups—technical and institutional.

"Disaster Risk Reduction Including Climate Change Adaptation Over South Asia: Challenges and Ways Forward," Rajesh K. Mall, et al., International Journal of Disaster Risk Science, 20 December 2018 [90]
https://link.springer.com/content/pdf/10.1007/s13753-018-0210-9.pdf

Abstract:

South Asia is vulnerable to a variety of hydrometeorological hazards, which are often cross boundary in nature. Climate change is expected to influence many of these hazards. Thus, climate-related risks over South Asia make disaster risk reduction (DRR) and climate change adaptation (CCA) key policy goals. Recently there is an increasing consensus that DRR including CCA should be embedded in development planning. Disaster risk reduction including CCA has progressively gained importance in global governance. Across South Asia, however, such integration is only in a preliminary stage. This review was to assess the existing status and scope of DRR including CCA in development projects across South Asia, so that an effective and achievable deliberation may be made to regional policymakers. A total of 371 projects relevant to CCA and DRR were reviewed. The project inventory was varied in nature with respect to location, scale, sectoral focus, and strategic importance. Bangladesh, India, and Bhutan were observed to be proactive in implementing DRR- and CCA-related projects. Meta-analysis of the project inventory suggests an urgent

need for an individual and collaborative convergence of processes for DRR and CCA through policies, plans, strategies, and programs.

Current & Relevant Information:

Introduction

Climate-related disasters in the South Asian region are becoming more frequent, destructive, and costlier in terms of both economic and social impacts (UNISDR 2011; Bhatt et al. 2015). From 1900 to 2015, there has been a continuous increase in the number of climate-related disasters, peaking from 2000 to 2015 (EM-DAT 2016). Interestingly, the rate of mortality associated with such disasters has been considerably reduced in the current era, even though the number of people reportedly affected has been increased enormously. Entire South Asia is frequently exposed to severe climate-related disasters, a situation that has been further complicated by unprecedented population growth, reaching a massive 1.8 billion in 2018 and predicted to increase by another 800 million people by 2050. The entire population is vulnerable to change in climate and extreme events because of the low level of institutional capabilities, economic vulnerability, and great dependence on climate sensitive resources (SAARC 2008; MHA 2011; Mall and Srivastava 2012). Climate-related vulnerabilities are exacerbated by low population resilience; most people survive on less than USD 1 a day (UNDP 2013). The extent of this stress is, however, highly uncertain because the magnitude of climate-related disasters is so variable. In addition, the rural population across South Asia still survives on agriculture, which is regarded as the principal employment opportunity of more than 60% of its population. More than half of the South Asian countries, particularly Afghanistan, Bangladesh, Bhutan, and Nepal, are classified as least developed countries as of March 2018 (United Nations 2018) and are grappling with various socioeconomic issues such as poverty, health, and education. Therefore, climate related environmental hazards and their impacts potentially have serious consequences over the entire region and should be addressed with specific considerations of unique regional geomorphology, culture, and socioeconomic structures.

Disaster risk reduction means reducing disaster-related risks through a systematic effort. Improved preparedness, reduction in individual exposure, reduced damage to property, proper management of land, and enhanced population resilience are the core objectives of DRR (UNISDR 2011). Climate change adaptation only refers to the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, including regulating damages and exploiting possible beneficial opportunities (UNFCCC 2008; IPCC 2013). Both DRR and CCA have several similarities and represent similar policy goals, DRR is concerned with a widely known problem in the field of all environmental hazards and CCA with only emerging issues related to climate change-instigated environmental hazards. While these concerns have different origins, DRR deals with all environmental hazards including CCA, which by definition is about change in climate and largely through the common factors of weather and climate and through tools used to monitor, analyze, and address adverse consequences (Kelman et al. 2017). In addition to CCA, many states have been making efforts to institutionalize several practices relating to DRR to reduce regional vulnerability. In tune with this paradigm shift in disaster management, the focus has shifted to other components of DRR, such as preparedness, prevention, and mitigation. However, many DRR measures, particularly those related to hydrometeorological events such as drought-proofing, flood protection, cyclone warning and shelters, malaria eradication, resistant agriculture, mangrove conservation, saline embankment, and alternative livelihood development, have similarities to CCA measures in terms of their application.

Various researchers, practitioners, policymakers, and organizations focused on the similarities and differences between CCA and DRR, and on the process for integration (Kelman and Gaillard 2008; Alexander et al. 2013; Hasan et al. 2013; Mercer et al. 2014; Banwell et al. 2018; Brewer et al. 2018; Dias et al. 2018; Raza 2018; Vij et al. 2018; Xu et al. 2018; Zuccaro and Leone 2018). Suggestions of increases in the frequency, intensity, and severity of climate-related disasters call for better integration of DRR and CCA in order to reduce vulnerability and increase population resilience, especially over the South Asian region (Seidler et al. 2018). However, the integration of CCA and DRR policies is extremely challenging and therefore requires a proper framework to avoid duplication and to derive optimal benefits from scarce resources (Mall et al. 2006, 2011a). Recently there have been emphases on including CCA within DRR to make it a single comprehensive mechanism with multiple approaches (Kelman et al. 2009, 2017). Kelman and Gaillard (2008) also emphasized that by embedding CCA within DRR, it ensures a long-term perspective to achieve development goals, neither by distracting through politics of climate change nor by emphasizing a hazard-focused approach. Kelman et al. (2017) concluded that CCA sits as a subset within DRR.

To develop and promote regional peace, stability, integrity, economic prosperity, and increased cooperation in terms of economic, social, and technical issues, in 1985 all the South Asian countries (Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka) established an organization known as the South Asian Association for Regional Cooperation (SAARC). The entire region is vastly varied both in term of geographical and cultural features, with almost 1.8 billion people (39% of the Asian and 23% of the world's population). Throughout this article, climate- and disaster-related issues and DRR including CCA issues are discussed against the backdrop of SAARC countries. While it is recognized that South Asia is frequently associated with disasters, information regarding the proper governmental framework for implementation of CCA and DRR is extremely scarce. This article specifically discusses institutional developments among the SAARC member states and their policies and programs for DRR and CCA. Attempts have been made to identify the areas for prospective regional collaboration in DRR including CCA in terms of analogous geological and hydrometeorological conditions. In conclusion, a list of suggestions and recommendations has been included especially for the SAARC member states, to improve institutional mechanisms for different facets of preparedness, response, improving resilience, and mitigation.

Conclusion

In view of the evidences on existing status and scope of integrating disaster risk reduction including climate change adaptation in various development projects, policies, and planning across South Asia, it has been learned that there are some fundamental and implemental constrains that necessitate priority attentions. We therefore conclude few priorities that require agreement and development within the South Asia partner states, governmental and international agencies, and disaster/climate experts, and offer some practical means to achieve these.

To address the DRR including CCA over South Asia, top priorities should be to establish institutional linkages at both the national and regional levels by removing structural barriers. Emphasis should be given to establishing integration among various institutions both horizontally and vertically. A mechanism for convergence of policies, planning, and programs should also be prioritized. The SAARC member states should put in place a framework for ensuring complete integration of policies, plans, and programs undertaken for DRR including CCA within individual countries and for the entire region. There is also a need to establish a platform for knowledge sharing, like a climate change knowledge management center parallel to the SAARC Disaster Management Centre (SDMC) or a division within the SDMC to facilitate sharing knowledge and information, conducting regional research, and replicating good practices among SAARC member states. To leverage the capacity of member states, a regional response facility should be created under the SDMC to facilitate quick mobilization and deployment of critical resources.

A precise and efficient mechanism for monitoring and evaluating implemented projects is also required. Such mechanism is necessary for maintaining standard among all the implemented projects. Guidance notes on compliance, quality control, and evaluation criteria on different scales may also be developed to assist both policymakers and practitioners. Additionally, a non-lapsable SAARC fund should be constituted with development of new tools and techniques to support the DRR including CCA by the member states. A regional coordination mechanism for various agencies in relevant sectors such as agriculture, water resources, and health is necessary for member states to manage common resources.

We also felt the necessity to set up a roster of regional and international disaster/climate experts within the South Asian member states. Various SAARC member states have developed considerable expertise (for example, scientific, technical, administrative, and search and rescue) in various aspects of DRR and CCA. Such expertise may well be utilized and shared for the common good across the region. The SAARC Secretariat should create and maintain a panel of experts from the member states that may be utilized as and when needed by individual member states. We also strongly advocate for constituting a platform for corporate engagement by means of engaging chambers of industry and commerce for all member states to facilitate partnerships in efficient implementation of DRR including CCA.

"Climate change and agriculture in South Asia: adaptation options in smallholder production systems," Jeetendra Prakash Aryal, et al., Environmental Development and Sustainability, 2020 [91]
https://link.springer.com/content/pdf/10.1007/s10668-019-00414-4.pdf

Abstract:

Agriculture in South Asia is vulnerable to climate change. Therefore, adaptation measures are required to sustain agricultural productivity, to reduce vulnerability, and to enhance the resilience of the agricultural system to climate change. There are many adaptation practices in the production systems that have been proposed and tested for minimizing the effects of climate change. Some socioeconomic and political setup contributes to adaptation, while others may inhibit it. This paper presents a systematic review of the impacts of climate change on crop production and also the major options in the agricultural sector that are available for adaptation to climate change. One of the key conclusions is that agricultural practices that help climate change adaptation in agriculture are available, while the institutional setup to implement and disseminate those technical solutions is yet to be strengthened. Thus, it is important to examine how to bring the required institutional change, generate fund to invest on these changes, and design dynamic policies for long-term climate change adaptation in agriculture rather than a mere focus on agricultural technology. This is one of the areas where South Asian climate policies require reconsidering to avoid possible maladaptation in the long run.

Current & Relevant Information:

Introduction

Climatic variability explains almost 60% of yield variability and thus a crucial factor influencing food production and farmers' income (Osborne and Wheeler 2013; Ray et al. 2015; Matiu et al. 2017). Climate change influences the start and length of growing seasons (Fiwa et al. 2014; Zhao et al. 2015; Lemma et al. 2016) and the duration and magnitude of heat and water stress in agricultural production systems (Lobell et al. 2015; Saadi et al. 2015; Schauberger et al. 2017). Growth acceleration due to higher average temperature results in less radiation interception and less biomass production (Rosenzweig and Hillel 2015). Besides, above-optimal temperatures directly harm crop physiological processes. A recent analysis demonstrates the effect of climate change in the production and yield of four major crops globally, i.e., maize, rice, wheat, and soybean (Wang et al. 2018). Crop yield studies focusing on India have found that global warming has reduced wheat yield by 5.2% from 1981 to 2009, despite adaptation (Gupta et al. 2017). It is projected that climate change would reduce rain-fed maize yield by an average of 3.3–6.4% in 2030 and 5.2–12.2% in 2050 and irrigated yield by 3–8% in 2030 and 5–14% in 2050 if current varieties were grown (Tesfaye et al. 2017). Despite variability in input use and crop management, there is a negative effect of both season-long and terminal heat stress on rice and wheat, though wheat is considerably more sensitive than rice (Arshad et al. 2017).

Besides its impact on crop yields and production, climate change also affects the natural resources, primarily land and water that are fundamental to agricultural production. Water availability is expected to decline due to climate change, while agricultural water consumption is predicted to increase by 19% in 2050 (UN-Water 2013). For instance, growing reliance of Indian farmers on groundwater to cope with climate-induced drought has led to a rapid decline in the groundwater table, and it may worsen further due to increased climatic variability in future (Fishman 2018). In South Asia (SA), it is predicted that the annual average maximum temperature may increase by 1.4–1.8 °C in 2030 and 2.1–2.6 °C in 2050, and thus, heat-stressed areas in the region could increase by 12% in 2030 and 21% in 2050 (Tesfaye et al. 2017). Projections claim that almost half of the Indo-Gangetic Plains (IGP), the major food basket of the South Asian region, may become inappropriate for wheat production by 2050 as a result of heat stress (Ortiz et al. 2008). Even a relatively modest warming of 1.5–2 °C in SA can severely impact the availability and stability of water resources due to increased monsoon variability and glacial meltwater, thereby threatening the future agricultural productions (Vinke et al. 2017). With its impact on agricultural production and natural resources, climate change will bring greater fluctuation in crop production, food supplies, and market prices and will aggravate the situation of food insecurity and poverty in South Asian countries, which adversely affects the livelihoods of millions of people in the region (Schmidhuber and Tubiello 2007; Bandara and Cai 2014; Shankar et al. 2015; Wang et al. 2017; Aryal et al. 2019b). It is projected that food price changes between 2000 and 2050 are 2.5 times higher for major food crops (e.g., rice, wheat, maize, and soybean) and 1.5 times for livestock products (i.e., beef, pork, lamb, and poultry) with climate change (Nelson et al. 2009). Therefore, in the absence of adaptation measures to climate change, South Asia could lose an equivalent of 1.8% of its annual gross domestic product (GDP) by 2050 and 8.8% by 2100 (Ahmed and Suphachalasai 2014). The average total economic losses are projected to be 9.4% for Bangladesh, 6.6% for Bhutan, 8.7% for India, 12.6% for the Maldives, 9.9% for Nepal, and 6.5% for Sri Lanka. Since agriculture provides livelihood to over 70% of the people, employs almost 60% of the labor force, and contributes 22% of the regional gross domestic product (GDP) in SA (Wang et al. 2017), these losses of GDP will have major consequences in agriculture-dependent communities in the region (Ahmed and Suphachalasai 2014). Therefore, improved understanding of impacts of climate change in agriculture and the adaptation practices to cope with these impacts are essential to enhance the sustainability of agriculture and to design the policies that reduce poor farmers' vulnerability to climate change in SA.

Adaptation to climate change involves any activity designed to reduce vulnerability and enhance the resilience of the system (Adger 2006; Vogel and Meyer 2018), and therefore, the actual impacts of climate change largely depend on the adaptive capacity (Vermeulen et al. 2012). Adaptation is particularly fundamental to South Asian agriculture for the following reasons: (1) agriculture is a primary source of livelihood; (2) largely rain-fed which makes it vulnerable to extreme climate; (3) fragmented and small land size—less than a hectare—reducing farmers' capacity to adapt to climate change; (4) increased population and high economic growth has further exacerbated the adverse impacts of climate change due to increased demand for land and water from other sectors of the economy mainly driven by search for alternative farm practices; (5) lack of better institutions and policies to address climate risks in agriculture; (6) less developed risk and insurance market to promote adaptation to climate change; and (7) to sustain local food security, especially of the poor and small farmers against the high food price fluctuation under extreme climatic variability.

Farmers in SA use a wide range of resources to adapt to climate change, and thus, households with better access to multiple resources and varied livelihood portfolios are more likely to better cope with climate risks (Ojha et al. 2014; Bhatta et al. 2017; Brown et al. 2018; Thornton et al. 2018). Given the site-specific nature of climate change impacts on agricultural production together with wide variation in agro-ecosystems and socioeconomic conditions, adaptation strategies must acknowledge environmental and cultural contexts at the regional and local levels.

On this backdrop, this study examines the prospects of the smallholder production system in SA to adapt to climatic variability to minimize the negative impacts of climate change on food systems. We also discuss why farmers use few adaptation measures, if any, despite the prevalence of several measures in light of the existing barriers and policy setup. For this study, SA includes Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka.

The rest of the paper is organized as follows. Section two documents the impact of climate change on agriculture in SA. Section three presents multiple adaptation measures applied in the agricultural sector. In section four, we discuss the climate change adaptation policies and future prospects of agriculture in SA with a due focus on existing barriers, and the last section concludes the study.

Conclusion

Climate change adaptation is essential for agricultural sustainability. Building adaptation in the agricultural system requires simultaneous attention to increasing production by adopting varieties of technologies, adopting sustainable land management practices, building on and use of local knowledge/culture, and formulating enabling policy and institutional setups. Though several adaptations options are available in agriculture, not all of them can be applied to all location, as they are mostly location-specific. All countries in SA have devised national-level policies to climate change adaptation. However, their financing and proper implementations remain critical as most of them are financed through international institutions, and thus, any change in donor priorities can constrain their sustainability. Therefore, institutions at the international and national levels need to work in cooperation to deal with the challenge of climate change.

Alternative adaptation measures in agriculture are continuously being developed. For instance, there are several researches on new varieties that can tolerate climatic stresses. Similarly, policies and institutions in SA are increasingly becoming responsive to climatic risks. Insurance mechanisms and other community-based approaches are also evolving and improved continuously to address the challenges. Although all South Asian countries have come up with national, state, and local policies to address climate challenges, they are not at the same level. Still, there is a need to enhance coordination at different levels of institutions implementing climate change adaptation policies.

Despite the availability of options for climate change adaptation in agriculture, inefficient institution and financing might hinder South Asian agriculture to tackle climate challenges in the future. Several technical measures along with the local knowledge contribute to adapting agriculture to climatic variability. However, the researches related to the magnitude of impacts of climate change on specific crops vary over ecological zones, and this largely depends on the resources that are available to the farmers for adapting to climate change. As a result, generalizing the impact of climate change and its severity in agriculture is very difficult and seems impractical. Of the impact studies, the assessment of the impact of other climate variables except for temperature on crop yield is limited and thus an area for future research.

"Chapter 11: Climate Change and India: Impacts on Biological Variability," Subodh K. Sharma and Lokesh Chandra Dube, Research Gate, 16 March 2017 [92]
https://www.researchgate.net/profile/Lokesh_Dube/publication/336347027_Climate_Change_and_India_Impacts_on_Biological Variability/links/5d9cb5dd299bf1c36301e815/Climate-Change-and-India-Impacts-on-Biological Variability.pdf

Abstract:

Climate change has emerged as the most-significant global environmental issue. It is both, a threat and a challenge. The projected climatic changes are likely to adversely affect the key economic sectors and sustainable development. Various scientific assessments and special reports brought out by the Intergovernmental Panel on Climate Change (IPCC) reveal that there is discernible human impact on

the climate system. The impact of climate change is projected to be more severe in developing countries across all sectors. Biological Variability is one such sector that is likely to be severely impacted. Changes to the present climate system in India may affect the different ecosystems with corresponding impacts on key sectors, such as water resources, agriculture, natural ecosystems including forestry, health and industrial sectors. This chapter reviews the status of knowledge on Biological Variability and climate change; the latest understanding on the observed changes in climate, its impact on the Biological Variability at global, regional and national scale in context of India; the projections of climate change at the same spatial scales and consequent impacts. It further discusses summarily the actions that have been taken in the global and national context that will mainstream climate change concerns vis-à-vis Biological Variability and also the immediate research needs for a meaningful planning for sustaining Biological Variability in the future. This chapter underscores the development of adaptation plans as a suitable strategy in the longer-term perspective to mitigate the challenges posed by likely climatic changes and recommends setting up of long-term ecological observatory networks across all vulnerable Biological Variability hotspots.

Current & Relevant Information:

Introduction

Climate change has emerged as the most-significant global environmental issue. It has engaged the attention of scientists, planners, governments and politicians alike worldwide. It is both a threat and a challenge. The projected climatic changes are likely to adversely affect the key economic sectors and sustainable development. The impacts of climate change in developing countries would be more severe. The various scientific assessment and special reports brought out by the Intergovernmental Panel on Climate Change (IPCC) reveal that there is discernible human impact on climate and there is unequivocal evidence that human activities impact the climate system. There is evidence to show that there have been changes in climate over the last century as well as the current decade manifest in the physical and biological systems in different continents and in regions. Climate change would also impact the Biological Variability – the very basis of existence of mankind.

Before addressing the other aspects of impact of climate change and Biological Variability, let us familiarize ourselves with the definitions and scope of terminology used in the context of climate change and Biological Variability.

The United Nations Framework Convention on Climate Change (UNFCCC) under its Article 3 on definitions, states – Climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. Whereas the Intergovernmental Panel on Climate Change (IPCC) refers to climate change as a change in the state of the climate that can be identified (using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing, or to the persistent anthropogenic changes in the composition of atmosphere or in land use.

It would be noted that the usage by the climate change convention recognizes climate change as a change of climate which is attributed directly or indirectly to human activity and which is in addition to natural climate variability as opposed to climate variability that is attributable to natural causes.

Biological Variability, according to Convention on Biological Variability, means (for the purposes of the convention) the variability among the living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes variability within species, between species and of ecosystems.

Biological Variability provides to human kind enormous direct economic benefits, an array of indirect essential services through natural ecosystems, and plays a prominent role in modulating ecosystem function and stability. Biological Variability is the basis of human survival and economic well-being, encompasses all life forms, ecosystems and ecological processes. The total estimated number of species on earth is of the order of 13 million, of which, about 1.76 million species have yet been described indicating that our both understanding and documentation of Biological Variability is remarkably incomplete (Singh, 2002).

Climatologically, India occupies an important position in south-east Asian region. Changes to the present climate system may affect the different ecosystems with corresponding impacts on key sectors, such as, water resources, agriculture, natural ecosystems including forestry, health and industrial sectors.

The prediction and assessment of impacts of climate change is still an emerging field and is a complex area of research. Scientists in India are working in varied areas through enhanced knowledge and understanding of climate change impacts. However, more research is needed to understand the possible magnitude and potential consequences of projected climate change and its impact including impacts on Biological Variability.

Keeping these concerns in view, this chapter aims to review the state of knowledge on the Biological Variability and climate change globally as well as in India, by exploring and examining inter-linkages between climate and Biological Variability; reviewing the latest understanding on the observed changes in climate, its impact on the Biological Variability at global, regional and national scale; reviewing the projections of climate change at the same spatial scales and consequent impacts. The chapter also briefly provides the actions that have been taken in the global and national context that will mainstream climate change concerns vis a vis Biological Variability.

Biological Variability and Climate Change in India

India is endowed with rich biological variability owing to its physical setting. The varied edaphic, climatic and topographic conditions and years of geological stability have resulted in a wide range of ecosystems and habitats, such as, forests, grasslands, deserts and coastal and varying ecosystems. So far, over 91,200 species of animals and 45,500 species of plants in its stem biogeographic regions have been documented. India ranks among the top ten species-rich nations showing high endemism with four global Biological Variability hotspots. It is recognized as one of the eight centers of origin and variability of crop plants having more than 300 wild ancestors and close relatives of cultivated plants. Besides the Indian region is recognized for its vast traditional knowledge associated with biological resources (MoEF, 2009).

Adaptation to Climate Change – The Path Ahead

Although ecosystems have adapted to changing conditions in the past, current changes are occurring at rates not seen historically. Faster the climate changes, greater will be the impact on people and ecosystems. Reductions in greenhouse gas emissions can lessen these pressures, giving these systems more time to adapt. However, there is a need to develop climate change adaptation plans as in addition to climate change climate change, activities that lead to the land (such as deforestation and overgrazing) and water degradation, can exacerbate the consequences of climate change. In many countries, more people, particularly those at lower income levels, are now forced to live in exposed and marginal areas (i.e. floodplains, exposed hillsides, arid or semiarid lands), putting them at risk to the negative impacts of climate change. For these people, even minor changes in climate can have a disastrous impact on lives and livelihoods. The same can be said of many species, which are adapted to very specific climatic conditions. A small change in these conditions could mean that we lose these species forever. While there is still more to understand about climate change, enough is known about the range of impacts, the magnitude of risks, and the potential for adaptation to act now.

Conservation, preservation and creation of buffer zones have been the traditional adaptation mechanisms to combat the impacts on Biological Variability due to environmental degradation. However, climate change would require additional steps to combat the impacts of climate change such as the changes in distribution, increased extinction rates, changes in reproduction timings, and changes in length of growing seasons for plants.

11. Indigenous People:

“Cultural values and indigenous knowledge of climate change and disaster prediction in Rajasthan, India,” Aparna Pareek and PC Trivedi, Indian Journal of Traditional Knowledge, January 2011 [93]
https://www.researchgate.net/publication/229047146_Cultural_values_and_indigenous_knowledge_of_climate_change_and_disaster_prediction_in_Rajasthan_India

Abstract:

This Paper provides a case study in which Indigenous knowledge and traditional stories relating to cloud formation, lightning, wind direction, rains, drought, disaster prediction, response, mitigation, and effects of weather on crops are applied in a contemporary context by the tribal peoples of Rajasthan, India. The state of Rajasthan falls in an area of high climate sensitivity, maximum vulnerability and low adaptive capacity. The study documents how individuals in these tribal communities (including Bhil, Meena, Banjara, Kathodi, Rabaris, Sansi and Kanjar) perceive and manage natural disasters and extreme weather events, including their strategies for early detection of coming events and for coping with these events, as well as their perceptions of their short and long term impacts on Biological Variability.

Current & Relevant Information:

Scientific evidence of climate variability of events such as droughts and floods suggest that climatic oscillations have occurred in the past and may in future, potentially with large impacts on human society and economy and on the ecosystems of which they depend.

There is evidence to show that slow and gradual climate changes over the earth’s history have been interspersed with abrupt climate changes such as rapid cooling, warming, wetting and drying due to the forcing of earth systems across thresholds.

Over the course of history and up to this day traditional local communities have continued to rely heavily on their own indigenous knowledge systems in observing the environment and dealing with natural disasters. These communities, particularly those in hazard prone areas, have collectively generated a vast body of knowledge on disaster prevention and mitigation, early warning, preparedness and response and post disaster recovery. This knowledge is acquired through observation and study, and is often based on cumulative experience handed down from generation to generation.

Such traditional environmental knowledge systems are important tools today in environmental conservation and natural disaster management.

Indigenous knowledge is now much sought after in the present context of globalization. However, while the varied knowledge systems of the third world are claimed as heritage that belongs to all humanity, the knowledge about how to apply this variability is often exclusive to the domain of the people who have developed it.

Ecological problems coupled with unequal access to resources results in human ill-being and threats to the livelihood security of the world's poorest peoples. Humanity faces the exceptional challenge of eroding natural resources and declining ecosystems services due to a magnitude of threats created by unprecedented growth and consumerism. Also, imperiled are the Biological Variability and sustainability of the essential ecological processes and life support systems.

The present paper is an attempt to integrate the collective wisdom of humanity for the conservation of Biological Variability, embodied both in formal science as well as local systems of knowledge, providing the best possible means of developing sustainability. It is aimed to build awareness of the immense value indigenous knowledge holds in helping to reduce risks presented by different types of hazards in varied environmental and cultural settings throughout the state of Rajasthan, India.

Conclusion

The relationship between indigenous knowledge and natural disasters has received greater interest in recent years. New discussions around indigenous knowledge highlight its potential to improve disaster risk reduction policies through integration of particular knowledge and insights into disaster education and early warning systems, both of which play a crucial role in disaster risk reduction. Various studies have revealed that a proper communication system coupled with traditional knowledge can actually mitigate the effects of disasters and can be helpful in risk reduction. It is concluded that a shift in paradigm from "top down" strategy to a "bottom up" participatory approach will be most effective and that designing a policy framework comprising both scientific and indigenous knowledge is vital to facilitate disaster risk reduction.

Since Indigenous knowledge is mainly based on relative experience and local experience, lack of benchmark makes it difficult to be harmonized and integrated into conventional forecasting system. Systematic documentation, quantification and subsequent integration of indigenous knowledge into conventional weather forecasting system is therefore recommended as one of the strategies that would help to improve the accuracy and reliability of seasonal forecasting information under a changing climate.

India has increasingly adopted holistic multidisciplinary methods for management of disasters. However, there are still a number of challenges ahead. Global Climate change is causing phenomenal challenges of its species. Although disasters are a natural phenomenon, their increasing frequency, magnitude and intensity of damage are attributed to human activities, and must be controlled at least in part through social mechanisms. This is where application of Indigenous and local knowledge and practices can be particularly effective.

"The Holistic Effects of Climate Change on the Culture, Well-Being, and Health of the Saami, the Only Indigenous People in the European Union," Jouni J. K.

Jaakkola, Suvi Juntunen, and Klemetti Näkkäläjärvi, Current Environmental Health Reports, 2018 [94] https://link.springer.com/content/pdf/10.1007/s40572-018-0211-2.pdf

Abstract:

Purpose of Review - (1) To develop a framework for understanding the holistic effects of climate change on the Saami people; (2) to summarize the scientific evidence about the primary, secondary, and tertiary effects of climate change on Saami culture and Sápmi region; and (3) to identify gaps in the knowledge of the effects of climate change on health and well-being of the Saami.

Recent Findings - The Saami health is on average similar, or slightly better compared to the health of other populations in the same area. Warming climate has already influenced Saami reindeer culture. Mental health and suicide risk partly linked to changing physical and social environments are major concerns.

Summary - The lifestyle, diet, and morbidity of the Saami are changing to resemble the majority populations posing threats for the health of the Saami and making them more vulnerable to the adverse effects of climate change. Climate change is a threat for the cultural way of life of Saami. Possibilities for Saami to adapt to climate change are limited.

Current & Relevant Information:

Introduction

From the global perspective, the indigenous people in the Artic constitute potentially the most vulnerable population to the effects of climate change for two reasons. They live in close interaction with the natural environment and the climate change and its effects to environmental conditions including temperature are most impactful in the Arctic. Therefore, indigenous people could be regarded as the first population indicators of the effects of harmful environmental condition and change. From the perspective of the indigenous people, climate change has been regarded as one of the most extensive threats to health and well-being. In addition to climate change, environmental change related to natural and human-based reasons, continued regional economic development, and prolific utilization of natural resources constitute similar threats to health, well-being as well as to the entire culture.

The average temperature in the Arctic has already risen from the preindustrial period. The effects of climate change in the Polar Regions are expected to be globally the most pronounced. Conditions in the Sápmi region have changed during postindustrial period, including the timing of snowmelt and the length of thermal seasons.

Around 40 indigenous peoples inhabit the Arctic Region forming 10% of the total population in this region. The present article focusses on the Saami (in North Saami:

Sámi), the indigenous people living in the northern parts of Norway, Sweden, Finland, and Kola Peninsula in Russia. Many of the phenomena related to the Saami are likely to be generalizable to the other indigenous populations. On the basis of a priori knowledge, we hypothesized that the effects of climate change are likely to be holistic, influencing not just health and well-being, but the entire culture. Our overall objective was to elaborate the holistic effects of climate change on the Saami.

The specific objectives of the study were (1) to develop a framework for understanding the holistic effects of climate change on the Saami people and Arctic indigenous people in general; (2) to summarize the scientific evidence about the primary, secondary, and tertiary effects of climate change to Saami culture and to Sápmi region; and (3) to identify gaps in the knowledge of the effects of climate change on health and well-being of the Saami.

Conclusion

The multidisciplinary methodology presented here to theorize and understand how climate change effects all aspect of Saami life is central for monitoring the effects and finding ways for culturally sustainable adaptation. Cultural well-being in the Saami context depends on social community and kinship structure, environmental relationship, and traditional livelihoods, and ultimately, possibility to maintain Saami ethnicity and language. Loss of language, culture, and living in urban areas expose Saami to lifestyle changes that can have negative implications for mental and physical health.

Saami have been a study object for centuries in different disciplines, nonetheless holistic analysis is missing on the status and capacities of Saami people to survive and adapt in changing climate. The warming climate and new insight call for a new, comprehensive assessment of the effects of climate change to Sápmi and Saami culture and projected outlook for the future. However, climate change has already influenced Saami culture substantially. Outmigration can in future change to climigration and have a profound effect on the Saami culture and viability of traditional Saami home region. Saami population is small and number of Saami that speak Saami as native language is even smaller. Societal changes and assimilation policies have contributed the loss of language and cultural knowledge and made Saami people even more vulnerable to the negative and cumulative effects of climate change.

A crucial challenge for the future of Saami people and vulnerability among the Saami is the small population size, dispersed settlement, and urbanization that limits the possibilities for cultural adaptation in the changing climate.

"Climate Change and Human Mobility in Indigenous Communities of the Russian North," Susan A. Crate, Brookings-LSE: Project on Internal Displacement, 30 January 2013 [95] https://www.refworld.org/pdfid/510a3ca52.pdf

Summary:

This paper explores the effects of climate change on human mobility (displacement, migration, and planned relocations) in the Russian part of northern Eurasia, with a particular emphasis on indigenous communities. The paper is based on almost twenty years of longitudinal research with Viliui Sakha, one indigenous group of northeastern Siberia with a specific focus on local perceptions and responses to the effects of global climate change. In-depth examination of the effects of climate change on the Viliui Sakha, followed by a survey of responses to climate change and relocation within the Sakha Republic, is supplemented by three 'mini-case studies' of other indigenous groups in the Russian North: the Nenets, the Dolgan and Nganasan of the Taimyr Peninsula and the Chukotka- Chukchi and Siberian Yupik. The study then turns to the response of indigenous peoples and the Russian government to these changes and concludes with recommendations for indigenous groups, the government and other groups.

The historical context

Prior to mid-seventeenth century Russian colonization, mobility was key to the livelihoods for the varied reindeer-herding, hunting/gathering, and pastoralist peoples inhabiting northern Eurasia. Russian colonization of these areas began to change that essential adaptive strategy. But the historical period that had by far the most dramatic effect on northern Russia's indigenous peoples' mobility and livelihoods and that introduced massive migrations and relocations was the Soviet period. With the 1917 October Revolution, and the 1922 establishment of the U.S.S.R., the feudal Russian system was transformed into a distinctive socialist one. The process was long, marked by five-year plans for collectivization and industrialization of both rural and urban life (Forsyth 1992: 283). Forced collectivization policies entailed relocations and resettlements into increasingly compact agro-industrial production centers. This meant the gradual transformation of the economy from decentralized production, involving subsistence activities that necessitated movement across the land, to centralized production based on concentrating breeding and growing operations in place. In accord with the resettlement and relocation for collectivization, non-Slavic peoples were categorized to designate them areas for inhabitance and production. In the 1920s the government divided the indigenous groups of the Russian North into two categories based on the size of their populations: 1) minority or 'small numbered' peoples, for those groups with less than 50,000 persons, and 2) 'big-numbered' or titular nations, for all non-Slavic peoples above that number.

As a result, the sparse pre-Soviet settlement pattern of the Russian North changed immensely. Settlement policies forced nomadic and semi-nomadic subsistence peoples to stay in one place in order to school their children and have their production accounted for. Collectivization policies led to the concentration of populations into larger and larger food production units. Additionally, the relocation of ‘specialists’ from western Russia to serve as technological experts in the Soviet modernization plan altered the demographics of communities in the Russian North.

The coercive Soviet resettlement of indigenous peoples from small settlements into larger villages had a profound effect on indigenous communities, destroying the foundational ecological and social relationships that underpinned subsistence livelihoods. Furthermore, resettlement often meant that families were divided as children were sent to state boarding schools. Inhabitants were separated from their birth lands to work in mass production in centralized locations, leaving them little time, if any, to engage in historically-based subsistence practices.

It was during the Soviet era that the government designated 16 regions as parts of the ‘Far North’ (Kraynyy Sever) (Rosstat 2006). Of the 16 regions, 11 were homelands of non-Russian ethnic groups, most of whom were in residence long before seventeenth century Russian colonization. Reflecting the ecological sparseness of the extreme northern ecosystems, human population densities in the Far North are typically low. For example, although the Russian North makes up 53 percent of the country’s territory, in the post-Soviet era it is home to a mere 5.6 percent of the Russian Federation’s population (Heleniak 2009b:33). Even so, in comparison with other circumpolar regions, the region’s population is relatively dense. If compared to the 2001 population of northern Canada in 2001, northern Russia at the time had 46 people per square kilometer in comparison with 3.

Up until the collapse of the Soviet Union in 1991, many inhabitants of northern Russia were ‘temporary,’ lured to the north mostly from western areas of the Soviet Union by a combination of Soviet planned economic incentives and state-regulated migration. Since then, many of the temporary population, (mostly Russians, Ukrainians and Belorussians) have left the region to return to their homelands. By 2009 one of every six people (17 percent of the population) had migrated out of the Russian North (Heleniak 2009a:129). In the post-Soviet context, the indigenous peoples of northern Russia number approximately 250,000 individuals belonging to forty-one different peoples, comprising less than 0.2 percent of the entire northern Russian population (Nuttall 2005).

Physical science

Russia is the largest country on earth, embracing 11 time zones, and home to a wide variability of ecosystems stretching from the Arctic tundra to the pre-Caspian deserts. It claims most of the continuous Arctic shoreline. With the fall of the Soviet Union and reorganization of the former 15 republics into independent countries, Russia was rendered a majority northern country, based on latitude.

For reasons of both ecology and history, Russia is more vulnerable to the effects of global climate change than most other world areas. The effects of global warming in the Russian North include permafrost degradation, increasing ambient air temperatures, precipitation, and frequency of extreme events, and an overall softening of the extreme climate, all triggering changed seasonal timings (phenology) and ranges of animals and plants (ACIA 2005; IPCC 2007; Roshydromet 2008; Perelet et al. 2008). As one example of the impacts of climate change, northern Russia, home to 50 percent of the world's boreal forest, is losing that forest as temperatures warm and deciduous forests move north. Global climate models predict that Russia could lose up to 50 percent of its vast boreal forest reserves in the near future (Krankina et al. 1997).

Like most of its circumpolar neighbors, much of its land area consists of permafrost, but unlike its neighbors, Russia is home to the most southerly permafrost areas on earth

> Russia – the world's biggest country by geographical area - is already warming at one and a half times the rate of other parts of the world. If global temperatures do go up by the 4°C many scientists fear, the impact on Russia would be disastrous. Much of Russia's northern region would be turned into impenetrable swamp. Houses in several Arctic towns are already badly subsiding (Harding 2009).

Not only are Russia's vast permafrost areas predicted to turn into swamp but northern Russia's, and particularly Siberia's vast permafrost area sits on top of large methane deposits that will further exacerbate global climate change if and when they are released due to permafrost degradation.

In addition to being ecologically more susceptible to climate change, Russia is also more vulnerable to its effects due to its history. The Soviet period held back Russia and its 14 neighboring former Republics in comparison to other developed countries in leaving three major areas underdeveloped: 1) the physical infrastructure and civil awareness necessary for environmental protection; 2) a stable economy that was competitive in the world market; and 3) a democratic political system capable of delegating responsibility and power across a vast landscape.

Close-up case study: Illustrating the changes affecting livelihoods and teasing out climate effects

Local peoples and ecosystems are affected and respond in different ways to climate change. Not only is the Russian North warming more than other parts of the world, within Russia, the greatest warming is occurring in the Sakha area. In-country scientists report an unprecedented increase in this region in both average annual precipitation rates and air temperature in the last decade (Fedorov and Svinoboev, 2000; Skachkov, 2005). Both are attributed to global climate change (Roshydromet, 2008).

Taking a close-up view of Sakha to understand mobility, resettlement and relocation in the face of contemporary climate change is particularly poignant given the fact that Sakha already had had a long history of mobility before climate change became an issue. While most northern peoples practice hunting and gathering and/or reindeer pastoralism for subsistence, the one exception to this are the horse and cattle-breeding Sakha.

Sakha adapted a subsistence livelihood originally developed in the south by their Turkic ancestors to the extreme northern climate. Their main adaptive strategy to maintain their horse and cattle breeding livelihood in the northern climate was to keep their cows in barns for nine months of the year and to work intensely during the brief summer to harvest enough fodder for that period.

But the forced collectivization and settlement of the Soviet period led to transformative changes in Sakha's livelihood activities. From the late 1920s through the late 1950s Viliui Sakha were gradually consolidated into larger and larger collective operations which culminated in extensive agro-industrial state farms. Not only did agricultural developments of the Soviet period affect Viliui Sakha livelihoods, but industrial development, particularly diamond mining, also led to changes. The local costs of the diamond mining were quite high, including the contamination of water and air by heavy metals and major changes in the Viliui River due to the massive Viliui hydro-dam built to power the diamond processing (Crate 2002). Additionally, the Soviet government performed eleven underground nuclear tests, two of which had substantial nuclear fallout (Crate 2002). With the 1991 fall of the Soviet Union, an event that entailed the overnight dissolution of village-level agro-industrial state farm operations where most inhabitants worked and where most meat and milk was produced, Viliui Sakha adapted by developing household-level food production based on keeping cows and strengthening dependence on kin households, a strategy termed 'cows and kin' by the author (Crate 2006b).

The impact on other indigenous communities in the region was substantial. Forced settlement and industrialization policies of the Soviet period extinguished the last two Viliui reindeer herding, hunting, fishing and foraging communities, the Shologinskii (Tugolukov, 1985:188) and Sadinski (Crate 2003). The government relocated the Sholonginskii to the far North in 1952 to make way for what soon became industrial areas, the Udachnyi and the Aikhal diamond mines. The Sadinskii, inhabiting the rugged mountainous regions of the Chona River, were forced to abandon their homelands in order for the area to be flooded and to create a reservoir to generate hydro-power for diamonds.

Analysis of Viliui Sakha communities demonstrates that Soviet policies and the post-Soviet aftermath to date have had a much greater impact on indigenous peoples' livelihoods than climate change. However, climate change is affecting the livelihoods of the indigenous communities in the region. Over the course of anthropological interdisciplinary research with Viliui Sakha on environmental change, a majority of inhabitants reported observing nine main changes, including 1) warm winters; 2) cool summers; 3) lots of rain and at the wrong times; 4) land remaining under water; 5) lots of snow; 6) more floods; 7) extreme temperature changes; 8) seasons arriving late; and 9) fewer birds and animals (Crate 2008, 2011b). All of these, impact the livelihoods of the community.

However, other factors interact with the effects of climate change and also impact livelihoods, including: 1) the departure of young people from rural settlements for urban areas, depleting rural areas of the next generation cow-keeping cadre; and 2) the economic context which has improved access to consumer goods in village stores, helped to render cow keeping passé and motivated individuals to increase horse breeding activities often at the expense of cattle. In fact, although inhabitants were outspoken about their concern for changing seasonal and weather patterns in 2006 these other entangled changes now seem to be a higher priority.

Viliui Sakha are not yet in need of relocating due to the effects of climate change although given current trends of permafrost degradation, increasing precipitation and overall climatic softening, they may need to move in the future if they intend to maintain their cow and horse breeding practices. When inhabitants were asked if they would move if conditions changed to the extent that they could no longer breed cows and horses, only 15 percent said they would. Participants' responses were overwhelmingly in favor of remaining in their homeland even if it meant changing their mode of subsistence.

Other cases within the Sakha Republic

Although there are no other specific research projects focusing on inhabitants' perceptions of and responses to climate change in the Sakha Republic, there are other sources of information to help ascertain the overall issue of climate change and relocation.

In the Sakha Republic, 92 villages (14.9 percent of the total) are in the direct path of flood incidents. Those 92 villages are home to 136,000 or 7 percent of the total population of the Republic. During 1998 and 2001, (two of the ten hottest years on record), there were catastrophic floods in the Republic. In 2002 the Sakha government passed a resolution to 'relocate the most affected flooded villages.' Relocation work began in Kyllakh in 2005 with plans to move the village from the island to a non-flooding terrace on the right bank of the Lena River. Despite the state's efforts to relocate the community and the continued annual flooding, the population of Kyllakh has slightly increased, from 1,055 in 2001 to 1,181 in 2010. The main issues keeping the residents on the island despite continued and increasing flooding are the huge expense, commitment of energy and the many difficulties involved in moving as well as the problem of psycho-social adaptation to a new place.

Another way the Sakha government is responding to unprecedented change is by handling an increasing number of emergency situations through the Republic's Rescue Service. As they have acquired more experience in dealing with emergencies, specialists in this service have developed a system of making prognoses in order to have early warning and be able to evacuate areas that have an impending catastrophe. Because of the early warning system, the rescue service experts are able to claim that not a single person has died in floods since 2007. The unprecedented flooding of the Lena River in spring 2009 put 33 villages underwater in a few hours. While 1,000 cows died, all residents were saved thanks to the operation of the early warning system.

Other indigenous peoples within the Sakha republic (Even, Evenk, Yukagir, Chukchi) are migrating and, as in the case of the Sakha, they are moving for many reasons, including climate change. For example, climate change is transforming the infrastructure, to the extent that roads and transportation lines cannot function as they used to due to early thawing and late freezing. Also, similar to the Viliui Sakha case, many inhabitants are discontinuing their historically-based subsistence activities, in these cases of reindeer herding, hunting, fishing and foraging, due to the interaction of various factors, including globalization, social transformation, and environmental change.

In comparison with the Sakha, these reindeer-herding/hunting/fishing/gathering populations have both advantages and limitations in respect to mobility and adaptation to climate and other change. Because their subsistence mode is based on mobility—either moving with their herds to access new pastures or moving with the animals and plants for forage, they have a greater flexibility to move in the face of calamity and thereby maintain their subsistence. However, the changes in climate and seasonal patterns do have an overall negative effect on the wild resources supporting reindeer-herding and/or hunter/gathering livelihoods.

In sum, these three cases from within the Sakha Republic drive home important lessons for understanding mobility in the face of climate change. First, if a community such as Kyllakh decides or is told it must be relocated because their present living area is becoming uninhabitable, sufficient research, ideally in collaborative consultation with the affected communities, must inform an appropriate resettlement site where inhabitants can continue their livelihood practices. Secondly, with increasing emergency situations, early warning systems are needed to enable evacuation of settlements in a timely fashion. Lastly, livelihood type is a critical consideration in understanding a people's need to move or stay and their capacity to adapt to change. The following section compares the Sakha cases with the experiences of other northern Russia peoples.

Comparisons and Contrasts with other Northern Russian peoples – forces of change affecting livelihoods

> Since the beginning of the 1930s, coastal villages [of Chukotka] predominantly inhabited by native Chukchi and Siberian Yupik were officially deemed unprofitable, subsequently closed and their inhabitants relocated to newly founded settlement centers. These state-enforced relocations of native

> communities, which peaked during the 1950s and 1960s, led to a creeping depopulation of a coastline, whose intricate settlement history traces back for thousands of years (Holzlehner 2011: 1958).

This account, although specific to the Soviet reality of two of northern Russia's indigenous peoples, is a common refrain across the former Soviet Union. This section illustrates through three mini-cases – the Nenets, the Dolgan and Nganasan of the Taimyr Peninsula and the Chukchi and Siberian Yupik of Chukotka – the varied ways in which climate change affects mobility. These groups all face the impact of climate change within the context of a common post-Soviet legacy that limits their mobility options and adaptation to climate change. They, like Viliui Sakha, are affected by many environment and socio-economic factors, including climate change. In contrast to indigenous peoples of the rest of the circumpolar north, the specific historical legacy of the Soviet period plays a pivotal role in that mix. The full report examines both the commonalities and the variability among northern Russia's indigenous peoples facing intersecting change factors with an emphasis is placed on how perceptions shape peoples' understandings and responses.

To mention here in brief, the cases in Russia illustrate to some extent the interaction of various factors of change—be it the oil and gas development of the Yamal peninsula affecting Nenets' livelihoods, the restraints on hunters' mobility and access to wild resources of the Dolgan and Nganasan, or the relocation from optimal sea-mammal hunting camps and pastoral access of the Chukchi and Siberian Yupik. They each also highlight the effects of climate in that mix and how perceptions are based in local understandings of the world.

The indigenous response

One major development for Russia's indigenous peoples has been the establishment of the Russian Association of Indigenous Peoples of the North, Siberia and the Far East (RAIPON). Begun as a loosely knit congress of peoples in 1990, today this organization works specifically to protect the human rights of indigenous peoples of the North. In 2002, RAIPON's President, Sergei Haruchi, was quoted as saying, "Their (the 'small-numbered peoples') political representatives are engaged at the highest international levels" (Haruchi, 2002). But while RAIPON has made impressive progress and while joining forces with international colleagues is important, the key to on-the-ground change for Russia's affected peoples is policy development and implementation which, as detailed in the full text, is challenging.

Other successes in indigenous response include collaboration between local communities and researchers. For example, researchers worked with Yamal-Nenets communities and indigenous activists to help pass three federal laws that (at least theoretically) protect indigenous economic activity in the North from the effects of industrial development.

Additionally, to facilitate indigenous response, a great deal needs to be done in raising awareness among local communities about the impact of climate change. For example, research with Viliui Sakha found that while inhabitants observed changes in their environment and understood its effects on their livelihoods, they attributed most of the cause of the changes to sources other than climate change.

In terms of recommendations, communities need first to be able to understand how the effects of climate change on their present and future livelihoods are at play in daily life. They also need to be able to discern how climate change interacts with the other change factors in their lives. This understanding should then serve as a base for communities to become more assertive with their local, regional and federal representatives about the effects of climate change and in, particular, the likelihood that they might in the future have to relocate as a result of a loss of livelihoods.

The government response

It would be too extreme to say that Russia's federal government is in climate denial, considering how far official policies have come in establishing climate change as a federal policy problem.2 While there are still murmurs in federal boardrooms of 'scientific uncertainties' and still many skeptical voices in Russia's media, the policy discourse has shifted from discussing causes of climate change to debating its economic and political costs and benefits. One example of this change in federal mindset and climate change's place on the policy agenda is Russia's 2009 Climate doctrine and 2011 action plan. The doctrine focuses on questions of adaptation and preparedness with much less attention to mitigation and international relations (Wilson Rowe 2011).

Another hurdle in Russia is effective implementation of federal policies. However, as in the case of other countries where federal bodies are less active on climate change issues, Russian governmental bodies at the regional level have been more responsive.

At both the federal and regional governmental levels, there is a great need for sharing experiences with international counterparts, particularly in the areas of: 1) how to govern and redesign policy that accommodates indigenous livelihoods in the face of climate change, including implications for relocations and resettlements; 2) how to develop and sustain interdisciplinary research collaborations that bring together in-country and international natural and social science scholars for community-based projects to address issues of climate change and displacement;3 3) how to further promote collective action/advocacy by Arctic indigenous peoples; and 4) how to create an 'enabling environment' (Stammler and Wilson, 2006), not only on the local level, but also inclusive of research and policy communities to promote understanding and thereby a greater capacity for action.

Recommendations for other bodies

This research suggests that anthropology plays unique roles in the policy debate on climate change, particularly with respect to indigenous peoples and their livelihoods. (Crate & Nuttall 2009) Further there is a need for transdisciplinary research which draws on the strengths of many academic disciplines. Thirdly, influential think tanks, like the Brookings Institution, should continue this new focus on the effects of global climate change on circumpolar indigenous peoples' mobility, with particular attention to the effects of climate change on livelihoods.

Conclusions

This paper documents how northern Russia's indigenous peoples' livelihoods, like those of other place-based peoples of the world, are increasingly challenged by environmental changes due to the pervasive effects of global climate change interacting with other change factors. This analysis has further shown that Russia's northern inhabitants share a common historical legacy of Russian colonization, Sovietization and de-sovietization, and that these processes worked both to hamper their adaptive flexibility founded on mobility and also to remove them from the resources and land rights they needed to pursue their livelihoods. They also share a common plight of being 'entangled' in other changes including the industrial contamination of their homelands, resulting in the loss of land and resources; the implications of internal economic transformations from a feudal to a command to a market system; the effects of globalization and modernity on rural livelihoods; and the alienation of the next generation from their ancestral homelands and livelihood practice.

"Indigenous and Traditional Peoples and Climate Change," Mirjam Macchi, et al., IUCN, March 2008 [96] https://portals.iucn.org/library/efiles/documents/Rep-2008-011.pdf

Summary:

The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report published in early 2007 confirmed that global climate change is already happening. The report found that communities who live in marginal lands and whose livelihoods are highly dependent on natural resources are among the most vulnerable to climate change. Many indigenous and traditional peoples who have been pushed to the least fertile and most fragile lands as a consequence of historical, social, political and economic exclusion are among those who are at greatest risk.

On the other hand, people living in marginal lands have long been exposed to many kinds of environmental changes and have developed strategies for coping with these phenomena. They have valuable knowledge about adapting to climate change, but the magnitude of future hazards may exceed their adaptive capacity, especially given their current conditions of marginalization.

The potential impacts of climate change on the livelihoods and cultures of indigenous and traditional communities remain poorly known. The goals of the IUCN report on Indigenous Peoples and Climate Change are:

- to improve understanding of the potential impacts of climate change on vulnerable communities and cultures and their associated ecosystems;
- to identify further research required to reduce the risks of climate change; and
- to develop appropriate adaptation and mitigation measures, particularly in areas with high risk of socio-cultural impacts.

Through this report, IUCN offers some elements that will facilitate integration of socio-cultural considerations in programs and actions to address climate change impacts.

The first chapter critically analyses the treatment of traditional and indigenous people in climate change policy documents, including the United Nations Framework Convention on Climate Change (UNFCCC) (1992), the Kyoto Protocol and the Clean Development Mechanism (1998), the Stern Review (2006) and the Fourth IPCC Report (2007). Even though these documents agree that the costs of climate change are going to fall inequitably on the world's poorest and most disadvantaged communities including traditional and indigenous peoples, the communities discussed almost exclusively live in developed countries, i.e. in North America, Europe, Australia and New Zealand and the Polar Regions. The majority of traditional and indigenous peoples who live in the tropical developing world get very little or no consideration. Furthermore, while all the analyzed documents put their emphasis on monetary, knowledge and technology transfer from developed to developing countries, traditional and indigenous peoples' own coping and adaptive strategies are hardly recognized.

Chapter two identifies the determining factors of social and biophysical vulnerability of indigenous and traditional peoples. Even though no single conceptual framework of vulnerability has been agreed, many recent publications agree that vulnerability is a multidimensional concept which involves exposure, sensitivity and resilience. Assessing vulnerability of a system to climate change is based on the exposure of a system to a potential biophysical hazard level at a global, regional or local scale, the sensitivity of vulnerable groups and ecosystems to climate change impacts, and their adaptive capacity. The capacity of a social group to adapt to environmental hazards depends on their physical location, entitlements of the use of certain resources and land, and access to knowledge, technology, power, decision making, education, health care and food.

Chapter three provides maps that superimpose the location of indigenous and traditional peoples (ethno-linguistic groups) over climate change projections on temperature, precipitation and sea level change from the IPCC (2007). The resulting maps show areas of high concentration of indigenous and traditional peoples and areas of greatest predicted climatic change. Predicting changes at a regional or local level to pinpoint specific groups that are at risk remains challenging, because of the limited resolution of regional climate change models. Still, it is possible to identify broad regions which are likely to experience certain types of climate change. These include the Arctic region, the Caribbean and the Mediterranean region, the south of Latin America and the Amazon, southern Africa, the Arabian Peninsula and large parts of Australia. Concerning sea level rise, areas at greatest risk include islands in general but especially small islands, the Arctic region, and low-lying Asian coastal areas.

Chapter four describes the projected impacts of climate change on coastal areas; islands; tropical forests; and drylands. It provides case studies showing that climate change is already having serious implications on traditional and indigenous peoples' livelihoods. These communities have adapted to a wide variety of hazards and these adaptation practices have the potential to alleviate adverse impacts and to capitalize on new opportunities brought about by climate change. Examples of such traditional and innovative adaptation practices include:

- shoreline reinforcement,
- improved building technologies,
- rainwater harvesting,
- supplementary irrigation,
- traditional farming techniques to protect watersheds,
- changing hunting and gathering periods and habits,
- crop and livelihood diversification,
- use of new materials, and
- community-based disaster risk reduction.

However, the adaptability and the degree of vulnerability can be unevenly distributed between different tribes and can even be asymmetrically distributed within a community. Women are particularly affected by climate change as a result of their disproportionate involvement in reproduction work, insecure property rights, limited access to resources, and reduced mobility.

In conclusion, climate change is already having serious implications on the livelihoods and cultures of traditional and indigenous peoples. Even though these peoples have developed important strategies to adapt to these changes, the magnitude of future hazards may limit their capacity to adapt. IUCN and its member and partner organizations therefore will further explore culturally appropriate ways to enhance the resilience of traditional and indigenous peoples and to reduce factors which are hindering adaptation. Recommendations include:

- formulating policies which actively involve indigenous and traditional communities in the international, regional and local climate change discourse and which secure their entitlements to self-determination, land, natural resources, information, education, health services, and food;
- recognizing and actively promoting indigenous adaptation strategies;
- building awareness of traditional adaptation and mitigation strategies;
- promoting technology transfer which is culturally appropriate;
- improving the social and physical infrastructure;
- supporting or enhancing livelihood diversification;
- ensuring the conservation of natural resources and biological variability;
- supporting further research on impacts of climate change on vulnerable cultures and their associated ecosystems;
- collecting and analyzing information on past and current practical adaptation actions and measures;
- combining scientific and indigenous knowledge;
- promoting collaborative research and action between indigenous peoples and scientists; and
- monitoring the implications of mitigation efforts including the Clean Development Mechanism (CDM) and Reduced Emissions from Deforestation in Developing countries (REDD) on indigenous and traditional peoples.

"Indigenous people's perception on climate change and adaptation strategies in Jema'a local government area of Kaduna State, Nigeria," S. Ishaya and I.B. Abaje, Journal of Geography and Regional Planning, November 2008 [97]
https://www.researchgate.net/profile/IB_Abaje/publication/236248674_Indigenous_People's_Perception_on_Climate_Change_and_Adaptation_Strategies_in_Jema'a_Local_Government_Area_of_Kaduna_State_Nigeria/links/0c96051760cf4e84ba000000.pdf

Abstract:

This study examines the way indigenous people in Jema'a Local Government Area of Kaduna State perceive climate change and their adaptation strategies to climate change. The paper also asks indigenous people of the impacts of climate change on their various activities and any perceive hindrance to its adaptation. A total of 225 questionnaires were administered in five settlements within the study area, although only 200 of these questionnaires were used for the purpose of analysis. Findings

revealed that indigenous people in the study area perceived that the environment, climate in particular, has been changing over the years due to varied human activities. Findings also revealed that the threat of climate change is more on health, food supply, Biological Variability lost and fuelwood availability than on businesses and instigating of disaster; and it is the poor, who depend heavily on the natural resources that are mostly affected by incidence of climate change. In adapting to climate change indigenous people cultivate different/varieties of crops which are tolerant to climate change and shortening of growing season as adaptation strategies. Result further revealed that lack of improve seeds, lack of assess to water for irrigation, lack of current knowledge of modern adaptation strategies, lack of capital, lack of awareness and knowledge of climate change scenarios are the hindering factors to the adoption of modern techniques of combating climate changes in the area.

Current & Relevant Information:

Introduction

Climate change is an environmental, social and economic challenge on a global scale (Scholze et al., 2006; Mendelsohn et al., 2006). Climate change can be exacerbated by human induced actions such as: the widespread use of land, the broad scale deforestation, the major technological and socioeconomic shifts with reduced reliance on organic fuel, and the accelerated uptake of fossil fuels (Millennium Ecosystem Assessment, 2005).

The most devastating adverse impacts of climate change in Nigeria and other subtropical countries includes frequent drought, increased environmental damage, increased infestation of crop by pests and diseases, depletion of household assets, increased rural urban migration, increased Biological Variability loss, depletion of wildlife and other natural resource base, changes in the vegetation type, decline in forest resources, decline in soil conditions (soil moisture and nutrients), increased health risks and the spread of infectious diseases, changing livelihood systems, etc. (Reilly, 1999; Abaje and Giwa, 2007).

Indigenous Peoples who are vital and active parts of many ecosystems may help to enhance the resilience of these ecosystems. Their livelihoods depend on natural resources that are directly affected by climate change, and they often inhabit economically and politically marginal areas in varied, but fragile ecosystems. In addition, they interpret and react to climate change impacts in creative ways, drawing on traditional knowledge as well as new technologies to find solutions, which may help society at large to cope with the impending changes (Jan and Anja, 2007).

In Nigeria, just as in many developing countries in the Subtropical region the agricultural sector is more vulnerable to climate change landless farmers, livestock keepers, people in poor health, those who are undernourished, people with low economic power, women and children including women headed households, those with low level of education, and those with low technological know-how are more exposed to the risk of climate change (Barber, 2003).

Doss and Morris (2001) opine that the perspectives of the indigenous people, the way they think and behave in relation to climate change, as well as their values and aspirations have a significant role to play in addressing climate change. Despite this, Indigenous and other Traditional Peoples are only rarely considered in academic, policy and public discourses on climate change, despite the fact that they are greatly impacted by impending changes of climate (Berkes and Jolly, 2001).

Climate models paint the bigger picture of climate change and provide estimates for the likely consequences of different future scenarios of human development; they are not very good at providing information about changes at the local level. In recent years, there has been an increasing realization that indigenous groups are a valuable source of this information. Indigenous Peoples are not only keen observers of climate changes but are also actively trying to adapt to the changing conditions. In some instances, people can draw on already existing mechanisms for coping with short-term adverse climatic conditions. Some of these responses may be traditionally included in their normal subsistence activities, while others may be acute responses, used only in case of critical weather conditions (Stott and Kettleborough, 2002).

Most research on people perception of climate changes were carried out in the developed countries of the world which dominate the uppermost northern region of the earth where the relationship between Scientists and Indigenous Peoples is high (Jan and Anja, 2007). Though the hope in this devastating scenario of climate change lies with the indigenous peoples themselves, who are very successful at preventing deforestation and managing natural environment, those in the developing countries are rarely considered (Jan and Anja, 2007).

Despite the fact that efforts have been made towards fighting climate change from scientific views, research and policies directed towards indigenous knowledge and perception are highly needed. It is, therefore, important to understand indigenous perceptions of climate change and their preferences of strategies towards adaptation. The specific drive of this study is to assess the perceptions of Indigenous People’s in selected villages/wards in Jama’a Local Government Area of Kaduna State on climate change issues, and adaptation/coping measures, identify indigenous response options for information and knowledge that will help in policy making that may have positive impact on the life of the local and marginalized poor people who are directly affected by climate change.

Conclusion

The change in climate patterns (rainfall, temperature, precipitation, etc.), and the destruction of the natural resource base leads to the unpredictable and erratic rainfall pattern, warmer temperature, increased evapotranspiration, increased deforestation and ecosystem fragmentation, diminishing pasture and water availability, frequency of drought, changes in the livelihood patterns of communities, increased social conflicts between communities, loosening of social cohesions, increased incidence of diseases and epidemics, increased rural urban migration and increased community displacement from fragile environment.

The findings of this study show that the threat of climate change is more on health, food supply, Biological Variability quality and fuelwood availability than on businesses, instigating of disaster. Indigenous adapting to climate change strategies in the study area include, planting different varieties of crops, cultivating different crops, shortening growing season, changing the extend of land put into crop production, changing to irrigation/fadama farming, the use of chemical fertilizer, improve in water maximization and mulching. More of the adaptation strategies are more on planting different varieties of crops, cultivating different crops and shortening of growing season Factors hindering the use of quality seed are found to be the non-availability of the desired variety seeds and higher price of quality seeds.

The analysis has revealed to a great extent that the indigenous people in the study areas take the issues of climate change seriously. The perceived hindrances to adoption of modern technique as adaptation strategies of climate change include lack of improved seeds, lack of assess to water for irrigation farming, lack of current knowledge on adaptation methods, lack of information on weather incidence and lack of money to acquired modern techniques all influences the drive towards adapting to climate change.

Indigenous Peoples in the study area have very weak approach towards tackling climate change problems. Poverty and ignorance of various adaptation strategies are the major contributing factors to the impact felt by indigenous people. The knowledge and information gap concerning the effect of climate change, information dissemination, awareness programs and training programs calls for immediate action in order to relegate the impact of climate change in the study areas. The role of public administration in the study area must also change from implementing to specific climate conservation and adaptation programs serving as facilitators, promoters, encouragers, guardians and makers of more possible larger participation of indigenous people in developing and applying more sustainable forms land uses in the study areas.

The overall needs are to setup serious environmental conservation ethic among indigenous people. This can only be possible by first and famous educating the indigenous people on the implication of climate change, educate the indigenous people on the significance of conservation of the natural environment, support the most environmentally friendly people and groups towards achieving set goals and objectives in the study areas.

“Climate Change and Indigenous People,” Tenzing Ingty and K.S. Bawa, Research Gate, 2012 [98]
https://www.researchgate.net/publication/304825026_Climate_change_and_indigenous_peoples

Abstract:

Climate change may be the biggest threat of the 21st century. Studies in the Himalayas a global Biological Variability hotspot indicate that climatic changes have significantly impacted Biological Variability and the people of the region and have shown that indigenous communities have already been adapting to the induced effects of climate change. Yet there is very little literature on the impacts or the response of the communities. At the same time there is a wealth of information in the form of local knowledge of the indigenous communities based on their observations, perceptions and experiences over the years. We conducted a series of household surveys in 2010 and 2011 in Lachen valley, North Sikkim to assess local perceptions and adaptation to climate change. The perceptions on the impacts of climate change were very detailed and provided numerous insights on local concerns. The data clearly suggested that the local people of the region have been experiencing changes in climatic conditions and natural surroundings including their grazing pastures and agriculture. The response of the people to adversities resulting from changing climatic conditions and their adaptation strategies particularly with the help of their local institution, the Dzumsa were documented. The study suggests that indigenous peoples have much to offer on the discourse on and actions countering climate change. To effectively tackle climate change, the local perceptions, adaptations, responses and solutions must be kept in mind while being inclusive of the traditional institutions like the Dzumsa to effectively develop and implement adaptation and mitigation strategies.

Current & Relevant Information:

Climate change is an all-encompassing global problem that is likely to have catastrophic effects on natural and human systems. The IPCC Fourth Assessment Report (2007) has predicted extreme weather conditions and erratic rainfall patterns in various part of the world along with further cascading effects on Biological Variability. Projected global mean temperature rise for the end of the century has been revised upwards from 1.8-4.0°C (IPCC 2007) to 2-7oC, with an increase of over 5oC seeming most likely given current emission trajectories (Sokolov et al. 2009).

Climate change has severe impacts on Biological Variability resulting in altered phenology, (Penuelas and Filella 2001; Parmesan and Yohe 2003; Amano et al. 2010; Yu et al. 2010; Visser 2010) and shifts in distribution of species and biomes, (IPCC Techincal Paper V 2002; Bahn and Körner 2003; Parmesan 2005; Chen et al. 2011).

Extinctions are also likely to increase considering that many species would not be able to adapt to the rapid rate of warming (Pounds et al. 1999; Thomas et al. 2005; Harley 2011). Many studies have shown that climate change causes advances in spring phases of many plant species (Primack et al. 2004; Menzel et al. 2006; Primack and Miller-Rushing 2011). However, Yu et al. (2010) showed that strong warming in winter could slow the fulfilment of chilling requirements, which may delay spring phenology in certain plants. Evidence for range shifts comes from many studies. Kullman (2004) showed that among the 29 vascular plants he sampled, most showed an increase in the altitudinal limits by about 165±20 m over the last 50 years. A recent meta-analysis by Chen et al. (2011) estimated that the distributions of species have recently shifted to higher elevations at a median rate of 11.0 meters per decade, and to higher latitudes at a median rate of 16.9 kilometers per decade. These rates are approximately two to three times faster than a previous meta-analysis by Parmesan and Yohe (2003). Changes in species distributions resulting in altered interspecific interactions, community structure and variability have led to local and possible global extinctions (Harley 2011).

Agricultural systems and food production too would be severely impacted by climate change due to an increase in carbon di oxide ($CO2$) levels in the atmosphere, higher temperatures and erratic rainfall coupled with modified weeds, pests and pathogen outbreaks (IPCC 2007; Schmidhuber and Tubiello 2007; Iglesias 2011; Müllera 2011). Changes in crop phenology have already started to provide evidence of the response to recent regional climatic changes. Low-latitude areas are at most risk of having decreased crop yields (IPCC 2007). Similarly, “subsistence” or “smallholder” farmers are most vulnerable given that they are predominantly located in the tropics and various socio-economic and policy trends limit their adaptive capacity (Morton 2007).

Climate change has had wide ranging effects on human health leading to high mortality and morbidity (IPCC 2007; McMichael and Lindgren 2011). These include non-infectious health effects such as deaths due to heat waves and droughts resulting in increased malnutrition and infectious effects such as increase in vector borne diseases such as dengue fever, malaria as well as diarrhea (Patz et al. 2005). A study by the World health Organization (WHO) indicates that the climatic changes may already have been causing over 150,000 deaths since the mid-1970s (McMichael 2004).

In this chapter, we first outline the extent and magnitude of climate change in the Himalayas. We primarily focus on the perceptions of indigenous people, as our work is concentrated on local communities of the Lachen Valley of North Sikkim. We then discuss how pastoralists in Lachen Valley are coping with climatic change, particularly with the help of their local institution, the Dzumsa. We conclude with comments on the role of institutions in helping local communities adapt to climate change.

Conclusion

Climate change may be one of the biggest threats of the 21st century. Both mitigation and adaptation measures should be pursued to tackle the problems of climate change. However, during academic and policy debates in the past, more attention has been devoted to mitigation than to adaptation. While the significance of mitigation strategies cannot be underestimated, climate change impacts such as an increase in global temperatures, sea levels rise and extreme climate events (Raper et al. 1996; White and Etkin 1997; Wigley 1999) are likely to continue even if emissions are appreciably reduced (Solomon et al. 2009). Thus, adaptation strategies remain important. Indeed, sensitivity to the issue of adaptation has grown over the recent past after the Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report was issued. Now, the development of planned adaptation strategies is regarded as a necessary complement to mitigation actions (Burton 1996; Smith et al. 1996; Parry et al. 1998).

The ability to adapt to the effects of climate change will vary among countries, regions and socioeconomic groups, as well as over a temporal scale. “Given that the natural resource-dependent poor are also the most vulnerable, reducing vulnerability may require a flexibility and people-centric dimension that only highly decentralized, democratic and environment-friendly system of governance can ensure” (Gadgil and Lele 2009).

We need to acknowledge the obvious links between indigenous knowledge and climate change adaptation. Indigenous communities that have been adapting to various stresses for centuries and more recently to climate change impacts, as has been shown in previous sections of this chapter, have the ability to adapt or help themselves (Salick and Ross 2009). Perception studies of indigenous people on changing climatic conditions in various parts of the world have demonstrated that traditional knowledge, local observations and experiences are important sources of information for climate sciences (Berkes et al. 2001; Reidlinger and Berkes 2001; Nicolas et al. 2002; Bridges and McClatchey 2009; Byg and Salick 2009; Turner 2009; Chaudhary and Bawa 2011). In a region like the Eastern Himalayas with limited literature available on the impacts of climate change, the indigenous communities and their wealth of traditional ecological knowledge could be used as an important tool in complementing scientific studies.

Apart from traditional knowledge, local institutions will have an important role to play in countering climate change. The Dzumsa of Lachen as a local institution has proved to be very sagacious while overcoming the adversities brought in by climate change. Local institutions empower communities to rapidly respond to environmental change that threatens their traditional livelihoods, economies, practices and lifestyles. Thus, to effectively tackle climate change, local perceptions, adaptations and institutions must constitute an integral component of national polices and action plans.

“Indigenous peoples, local communities and climate change mitigation,” Ameyali Ramos-Castillo, Edwin J. Castellanos, and Kirsty Galloway McLean, Climatic Change, 2017 [99] https://link.springer.com/content/pdf/10.1007/s10584-016-1873-0.pdf

Abstract:

This special issue of Climatic Change collects recent findings on the relationship between climate change mitigation and local communities/Indigenous peoples in a single issue. Specifically, this issue seeks to address the question of what policy measures have proven effective and in what context for advancing both the goals of indigenous sovereignty and climate change mitigation. The journal aims to provide a means of exchange among those working in different disciplines on problems related to climatic variations and to provide a platform to reflect on the wide and varied range of perspectives and experiences concerning Indigenous peoples and local communities and climate change mitigation responses. Although many papers are available regarding the contributions and impacts of climate change adaptation and Indigenous peoples, significantly less material is available regarding their relationship and contributions to climate change mitigation. The papers in this special issue address some of the most pertinent cross-disciplinary topics facing policy-makers today, including links between mitigation initiatives, livelihoods, and resilience, and how these impact local, regional and international levels.

Current & Relevant Information:

Indigenous peoples and their traditional knowledge have an important role to play in responding to climate change. Indigenous peoples form approximately 5% of the world’s population, manage 11% of the world’s forest lands and customarily own, occupy or use somewhere between 22 and 65% of the world’s land surface (UNDP 2011; RRI 2015). It has been estimated that indigenous lands and other protected areas created to safeguard land rights, indigenous livelihoods, Biological Variability and other values contain more than 312 billion tons of carbon (Campbell et al. 2008). Recent analyses reveal that indigenous territories in the Amazon Basin, the Mesoamerican region, the Democratic Republic of Congo and Indonesia alone contain more than 20% of the carbon stored aboveground across the whole planet (AMPB et al. 2015).

Despite having contributed the least to global warming by traditionally leading ‘low carbon’ ways of life, Indigenous peoples and local communities are disproportionately vulnerable to climate change because: 1. They often live in ecosystems particularly prone to the effects of climate change (polar regions, small islands, mountain regions, humid tropics, coastal regions, deserts); 2. They are heavily dependent on lands and resources for basic needs and livelihoods (food, medicine, shelter, fuel, etc.); and 3. They are among the poorest and most marginalized people globally. Compounding these vulnerabilities, programs being implemented by non-indigenous people to mitigate and adapt to climate change also have the potential to adversely affect the livelihoods of IP as well as undermine their customary rights to lands and natural resources if not properly designed and implemented (Nilsson 2008). Examples of such a situation are the complaints about appropriation of indigenous lands in various regions in Latin America to establish oil palm plantations for biofuel production. The Mapuche people in Chile, for example, have repeatedly complained against the establishment of forestry companies in their lands claiming that the forest plantations dry their lands and pollute their waters with chemicals (Reinao 2008).

However, Indigenous peoples are not simply victims of climate change: they have an important contribution to make to address climate change. Due to their close relationship with their environment they are repositories of learning and knowledge on successfully coping with local-level climate variability and effectively responding to major environmental changes such as natural disasters. Indigenous peoples play a fundamental role in the conservation of biological variability and the protection of forests and other natural resources; their traditional knowledge on climate variability can also enrich substantively scientific knowledge and adaptation activities of others. The detailed knowledge of Inuit and Sami of snow and ice regimes and the knowledge of Pacific Islanders of ocean currents, winds and tides in relation to anticipating extreme weather are just two well-documented examples of traditional knowledge applied to weather forecasting. Case studies in varied locations such as China, Kenya and the Bolivian Andes show that the use and knowledge of traditional crop varieties is essential for adaptation to unpredictable weather (Nakashima et al. 2012).

"Impact of Climate Change on Life and Livelihood of Indigenous People of Higher Himalaya in Uttarakhand, India," Piyoosh Rautela and Bhavna Karki, American Journal of Environmental Protection, 2015 [100]
https://pubs.sciepub.com/env/3/4/2/

Abstract:

Increase in average temperatures and abrupt changes in the precipitation regime are perceived to take place in the region by most people. Duration, amount and form of atmospheric precipitation is reported to have changed significantly. Even during winters, the people of the region are increasingly getting overwhelmed with liquid precipitation rather than solid precipitation that was traditionally received in the form of snow. This is perceived to be responsible for reduced duration of snow in the region. This is held responsible for reduced water availability in the region and people have already started to face scarcity of water. Most people of the region at the same time agree that there are changes in the timing of flowering and fruiting of plants. Productivity of the agricultural fields is also reported to have decreased. Increased incidences of pest infestations and animal attacks are also reported from the region. These have forced the inhabitants to introduce many changes in their

traditional life support pursuits. Of these some are identified as being part of the coping strategy of the people of the region that is witnessing climate induced changes at an alarming rate. These are required to be studied, documented, researched and improvised with appropriate inputs from formal science and technology so as to make these viable and acceptable to the masses.

Current & Relevant Information:

Introduction

Mountain ecosystems play an important role in ecological sustainability, economic development and livelihood security of people at local as well as global level. Mountains are however amongst the most fragile environments on earth. These are at the same time identified as being repositories of Biological Variability and water and providers of ecosystem goods and services on which downstream communities rely on both regional and global level. The mountain ecosystems help in stabilizing atmospheric circulation by creating barriers to free movement of winds. In the Indian subcontinent these have played an important role in stabilizing the summer monsoon and shielding the region from the westerlies during winters.

Scientific evidence for global warming is now considered irrevocable and climate change impacts are lately being held responsible for instability in the monsoons resulting in spells of intense precipitation and unusually long dry spells. These at the same time are understood as being superimposed on a variety of other environmental and social stresses, of which many are recognized as being severe. Climate change is perceived to threaten livelihoods of the people, particularly where they are dependent upon natural resources that are particularly vulnerable to changes in climatic conditions. Declining natural resource availability and uncertainty introduced by climatic variability are understood as posing threat to the sustainability of agriculture and allied sectors in the face of already declining natural resource base.

Influenced by climate change, people living in the mountain ecosystems are experiencing wide ranging effects on their environment, Biological Variability and socioeconomic conditions. Study and documentation of coping mechanisms of the indigenous people thus becomes important and this is a must for developing long term adaptation strategies for reducing vulnerability related to climate change.

Adaptation is widely recognized as a vital component of human response that helps in coping better with changed ground realities; particularly so with regard to ones introduced by climate change. Without adaptation, climate change is generally understood to be detrimental but with adaptation, vulnerability could largely be reduced.

This study is an attempt to record impact of these changes as perceived by the masses and understand the impact of these on the life and livelihood of local people.

In the process attempt is also made to document efforts of masses to overcome the hardships so being introduced.

Conclusion

The study shows that the area is witnessing changes in temperature and precipitation regime. Both duration and amount of rainfall having changed significantly, most precipitation is received as rain rather than as snow. Besides changes in hydrological regime and agricultural productivity, phenological changes in wild and cultivated crops are common observation. Changes in floral and faunal population and type together with changed animal behavior are also observed.

Changing climatic conditions are resulting in loss of livelihood capital, changing agro-livestock conditions and emergence of invasive species. The biggest impact is perceived to be on the agricultural sector that accommodates highest proportion of the workforce of the state. Though fast pace of migration from the region is held responsible for this, climate change is sure to have adverse impact on the livelihoods based on forestry, agriculture, livestock husbandry, Non-Timber Forest Products and medicinal plants. Communities are observed to react positively to changed situation and taking advantage of the niche of their area and improvising on their traditional knowledge they have started to grow commodities that are better suited to the changed scenario and has ready market. They are also taking advantage of reduced duration and harshness of winters for growing new crops. Organic farming that is observed to gain ground in the area is perceived to stabilize the population of the pollinators and also control infestation of weeds.

The efforts of the people are certainly short of what is really required for coping up successfully. The impacts have therefore to be studied in detail so as to devise adaptation strategy that improvises upon traditional practices of the people by dovetailing elements of modern science and technology in the same.

"Submission to the Review of the National Biological Variability Strategy: Indigenous people's involvement in conserving Australia's Biological Variability," Jon Altman, et al., The Australian National University, 2009 [101]
https://openresearch-
https://www.researchgate.net/publication/237432370_Submission_to_the_Review_of_the_National_Biological
Variability_Strategy_Indigenous_people's_involvement_in_conserving_Australia's_Biological
Variability/download?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6Il9kaXJlY3QiLCJwYWdlIjoiX2RpcmVjdCJ9fQ

Overview:

This submission addresses 'Australia's Biological Variability Conservation Strategy 2010-2020 Consultation Draft' (hereafter 'the Consultation Draft') with a focus on

‘Priority for change 5: Involving Indigenous peoples’. In particular, it addresses the question ‘Do you think the Consultation Draft adequately covers the roles of Indigenous peoples in Biological Variability management?’

In short, we answer this question in the negative: The Consultation Draft does not adequately cover the roles of Indigenous peoples in Biological Variability management.

The consultation draft does not adequately cover the roles of Indigenous peoples in Biological Variability management as it fails to recognize the enormous effort Indigenous Australians make towards Biological Variability management through their formalized Indigenous land and sea management programs that now operate across numerous regions of Australia, including many areas of extremely high Biological Variability value.

In section 1.1 of the Consultation Draft (1.1 Building on current work) there is no mention of the large network of Indigenous land and sea management programs that operate across many regions of remote Australia. Although, many of these programs are small, their combined effort ensures many hundreds of thousands of square kilometers are now under some form of formalized land and sea management. The growth of these Indigenous land and sea management programs over the last 15 years represents one of the most significant developments in the conservation history of Australia.

The Consultation Draft sets out Australian governments’ vision for the next 10 years without fully recognizing past and on-going Indigenous efforts outside of the Indigenous Protected Area (IPA) program. In failing to do so, it understates Indigenous contributions to the national Biological Variability management effort, of which the IPA program represents only a small portion.

This submission provides comments and recommendations in support of our central argument that:

> the Indigenous estate, Indigenous people on country and Indigenous land and sea management are essential to the effective long-term conservation of Australia’s Biological Variability.

We strongly support the Consultation Draft’s recognition of the fundamental importance of Indigenous peoples, their knowledge, and their lands in conserving Australia’s Biological Variability. In particular, we welcome the Consultation Draft’s recognition of ‘Indigenous peoples’ access to, and presence on, country and their use of the Biological Variability resources of country … as essential elements of the management of country’ (National Biological Variability Strategy Review Task Group (NBSRTG) 2009: 75). However, we do question why this and other strong, evidence-based findings are contained in Appendix 8 of the document rather than forming central elements of the strategy.

CAEPR research, including the current People on Country, Healthy Landscapes and Indigenous Economic Futures Project, has highlighted the importance of Indigenous Australians living on, and caring for, their country in addressing key threats to Australia's Biological Variability including climate change; invasive species; loss, fragmentation and degradation of habitat; unsustainable use of natural resources; changes to the aquatic environment and water flows; and inappropriate fire regimes (see, for example, Altman, Buchanan & Larsen 2007).

While supportive of the Consultation Draft's increased emphasis on Indigenous involvement as a priority for change, we have identified some key areas where the strategy needs to recognize existing Indigenous efforts and better support current activities and future involvement. In the following we outline the need for greater support for Indigenous people on country in conserving Australia's Biological Variability; key comments on the Consultation Draft's effectiveness in addressing this need; and recommendations for better addressing these needs in the final version of Australia's Biological Variability Conservation Strategy for 2010-2020.

<u>Current & Relevant Information:</u>

The Indigenous estate, people on country and Indigenous land and sea management are essential for the effective conservation of Australia's Biological Variability. It has been estimated that over the past 30 years over 20 per cent of the Australian land mass has been returned to Indigenous Australians via land claims, native title and land acquisitions, predominantly in remote and very remote Australia. The Indigenous estate is still growing—incorporating both marine and terrestrial environments—along with the role that Indigenous people play in conserving Biological Variability and maintaining essential ecological systems and processes in the national interest. The Indigenous estate includes some of the most biovaried and ecologically intact parts of Australia. However, this estate, its Biological Variability and Indigenous livelihoods it supports face major threats from climate change, invasive species, changed fire regimes, pollution, overgrazing, and erosion. In view of this, there is a vital need for further strategic, legislative, policy and program innovation in support of Indigenous traditional owners living on country and for Indigenous community-based land and sea management programs.

Over the past 30 years a great deal of the management of Biological Variability on the Indigenous estate and in related sea country has been conducted by traditional owners living on country supported by outstation resource agencies, land councils and Community Development and Employment Projects (CDEP) organizations. These Indigenous organizations and management efforts have historically been poorly supported and remunerated as a result of underinvestment by both the state and the private sector. More recently, the IPA and Working on Country (WoC) programs have delivered significant symbolic and practical breakthroughs in support for Indigenous land and sea management on the Indigenous estate. Initiatives like the West Arnhem Land Fire Abatement (WALFA) program has similarly highlighted the potential for greater public and private investment in Indigenous land and sea management as new markets emerge (particularly in carbon and water). However, there remains a need—in terms of closing gaps in both Biological Variability conservation and Indigenous socioeconomic outcomes—for more holistic and whole-of-government support; for greater support of Indigenous people's sustainable customary and commercial use of Biological Variability; and for greater public and private investment in Indigenous land and sea management on the Indigenous estate. The new national Biological Variability conservation strategy must play a key role in addressing these needs.

"Climate Change, Biological Variability and Livelihoods in Indian Himalaya: The Elements of Uncertainty and Varied Perceptions," K.G. Saxena and K.S. Rao, Proceedings Of National Seminar On Climate Change: Data Requirement and Availability, 17 April 2009 [102]
https://www.researchgate.net/profile/Rakesh_Maikhuri/publication/324562713_Climate_change_impact_on_rural_landscape_of_Alaknanda_catchment_in_central_Himalaya_Mitigation_and_adaptation_strategies/links/5ad5dbb4aca272fdaf7c9032/Climate-change-impact-on-rural-landscape-of-Alaknanda-catchment-in-central-Himalaya-Mitigation-and-adaptation-strategies.pdf#page=115

Abstract:

Conservation of Biological Variability and avoidance of negative impacts of climate change are the perhaps most critical challenges faced by all sections of the society. The patterns and processes related to climate change and Biological Variability are so complex that corrective measures are often taken with an imperfect scientific knowledge base. This article draws on the scope of indigenous knowledge in mitigation and adaptation to climate change, with special reference to central region of Indian Himalaya.

Current & Relevant Information:

With adoption of Convention on Biological Variability and United Nations Framework Convention on Climate Change, global warming and Biological Variability depletion figure as the most as the critical challenges for sustainable development worldwide. As the current phase of climate change has been progressing parallelly with a whole range of ecological-socioeconomic-cultural-technological changes, with significant interactions between them, it is difficult to precisely segregate the effects of climate change on ecosystem structure and function and livelihoods. This article deals with some dimensions of climate change Biological Variability-livelihoods relationships in the central region of Indian Himalaya, a region distinguished globally for its rich Biological Variability and far-reaching climatic and hydrological immense environmental services.

Cropping patterns in the Himalaya are built around two seasons: the monsoon/rainy season and the winter season. With a belief of occurrence of absolute crop failure due to bad climate only in one cropping season in a year, farmers tend to stock staple food required for a period of 6 months. Over the last 50 years, farmers could recall complete failure of both crops only in 1966-67 in a few high elevation villages. People coped such a situation by consuming wild staple food like dried fruits of Pyrus pashia and Aesculus indica and by selling non-timber forest products and by earning wages in far off places. However, policy of supplying a quota of staple food at subsidized price since 1970s have drawn farmers' attention away from local production-based food security system (Semwal et al., 2004; Singh et al., 2008). Even though sowing of winter crops has been delayed by about a month due to late winter precipitation in recent years, harvesting time seem to be unchanged possibly because of warming.

"Depleting Biological Variability and Indigenous People: Case Study of Jharkhand," Smita Pandey, American International Journal of Research in Formal, Applied & Natural Sciences, February 2019 [103]
https://www.academia.edu/39262692/Depleting_Biological Variability_and_Indigenous_People_Case_Study_of_Jharkhand

Abstract:

Rio Earth summit gave birth to Convention on Bio Variability and UNFCCC and the world met in Paris in the year 2015 to talk about the climate change and took unanimous decision to join hands and fight against the climate change. The nature creates a very intrinsically designed, interdependent system of which even if one component is disturbed it is bound to disturb everything else. Bio-variability, ecosystem, climate change each of these components are a part of each other and in some way or the other control each other. This paper looks into the importance of Biological Variability generally and specially to indigenous people. The paper brings forth the issues faced by the indigenous people of Jharkhand when the bio-variability of the area is disturbed. The disturbance has been caused due to several reasons like social, economic and political but the paper concentrated on the economical reason alone through the Bi lateral treaties with foreign MNC for the purpose of investment. The paper also looks into the international convention like United Nations Declaration on the Rights of Indigenous People,2006 International Labor Organization (ILO) Convention concerning Indigenous and Tribal Peoples, 1989 and ILO Convention concerning the Protection and Integration of Indigenous and Other Tribal and Semi-Tribal Populations in Independent Countries, 1957.The implementation and ratification of these Conventions is also looked into in India especially Jharkhand and its Tribal People. The paper tries to suggest the solution to the problem of depleting Bio-variability and its implications on Indigenous people of the Jharkhand.

Current & Relevant Information:

Importance of Bio-variability for Indigenous People

Decolonization as a process was largely initiated by the UN Charter which has ultimately reflected upon the rights of indigenous people. The acceptance of decolonization has been evident in international hard and soft-law instruments and institutions at the global and regional levels including: Agenda 21, the Convention on Biological Variability ("CBD"), the 1995 FAO Code of Conduct for Responsible Fisheries, the Arctic Council, the Convention to Combat Desertification and the Forest Principles; lending practices of development banks such as the World Bank; and more generally, in the UN system. The indigenous people are very important on local, national as well as international level. They have been assigned certain rights which will help them to sustain their living style as well as culture. From Environment perspective also they are very important. The cultures and living style of them eventually help the bio-variability of any region from being depleted. Putting the environment under spotlight, the paper has concentrated on Agenda 21, the World Summit on Sustainable Development ("WSSD"), the Barbados Program of Action for the Sustainable Development of Small Island Developing States ("Barbados Program of Action" or "BPoA"), the CBD, the World Bank, the Permanent Forum on Indigenous Issues, and the Arctic Council.

The Rio Declaration under its Article 22 of Declaration states "indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development." Likewise, Agenda 21 of Rio Earth Summit calls for the empowerment of "indigenous people and their communities" through, among other means, "recognition of their values, traditional knowledge and resource management practices" as well as "traditional and direct dependence on renewable resources and ecosystems;" capacity building; strengthening their active participation in the national formulation of policies and laws; and involving them in "resource management and conservation strategies." Agenda 21 also notes that states "could" adopt or strengthen "indigenous intellectual and cultural property" protections and measures to "preserve customary and administrative systems and practices."

Indigenous People

The international community is coming together for "indigenous peoples". They are recognized by different names world over, for e.g., "aborigines" "tribal" peoples and "First Peoples"' as well. International organizations and conventions have named them beneficiaries. Many countries have individually named them differently. America calls them "Native Americans/Indians" and Canada has termed them "First nations"

The different names for indigenous people have created a void of the definition of them. Jose Martinez-Cobo was one of the earlier sociologists to define the parameters of this term in his seminal Study of the Problem of Discrimination against

Indigenous Populations. According to him, 'Indigenous communities, peoples and nations are those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of the societies now prevailing in those territories, or parts of them. They form at present non-dominant sectors of society and are determined to preserve, develop and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions and legal systems.' The definition given by Martinez-Cobo in some parts emphasizes the element of distinctiveness (cultural and otherwise), which could be characteristic of "tribal" as well as "indigenous" peoples, and in others the element of invasion or colonialism," which international law and international law scholars use in part to distinguish "tribal" from "indigenous" peoples. Not only these elements define indigenous people but other traits like historical continuity, non-dominance, traditional lands, and self-identification function as important determinants as well. With no clear definition of both kinds of people, in recent times, Individuals or cultures described as "indigenous" can be put side by side against communities as "local" or "traditional." The most important aspect of Local or traditional communities is that they have a connection with particular land which is a remarkably similar trait as indigenous people. Their use of those lands and their lifestyles are integrally tied to their cultural traditions, which distinguish them from the dominant societies within their states. The terms "local" and "traditional," like "indigenous," are not defined in international law even though their use as term has been increasing exponentially. Examples of their use in international environmental law include the Convention to Combat Desertification, the Proposed American Declaration on the Rights of Indigenous Peoples, and the Convention on Biological Variability.

In the Asian context, Benedict Kingsbury tilts his liking in favor of "local" communities against "indigenous" or "tribal" concepts. His contention lies in the fact that the latter cannot be defined in true sense and its "implicit emphasis on social structure does not mesh well with the dynamic societies, cultures, and political forms of many of the groups in the internationally active indigenous peoples' movement. Inclusion of "local" communities with "indigenous" within the ambit of international environmental law is not without controversy in some contexts. For example, some whaling preservation advocates have expressed concerns over the resumption of whaling by the Makah Indian tribe in the United States because they feared the implications of a precedent in favor of Makah whaling on Japan's advocacy for small-type coastal whaling.

"The Role of Indigenous People Knowledge in the Biological Variability Conservation in Gursumwoerda, Eastern Hararghe Ethiopia," Yeneayehu Fenetahun Mihertu, Annals of Ecology and Environmental Science, 2018 [104]
https://www.researchgate.net/profile/Yeneayehu_Mihertu/publication/324476468_The_Role_of_Indigenous_People_Knowledge_in_the_Biological

Variability_Conservation_in_Gursumwoerda_Easternhararghe_Ethiopia/links/5acf5818a6fdcc87840fd7e7/The-Role-of-Indigenous-People-Knowledge-in-the-Biological Variability-Conservation-in-Gursumwoerda-Easternhararghe-Ethiopia.pdf

Abstract:

The term Biological Variability refers the number and variability of living organisms. It also incorporates human and cultural variability. The Gursum indigenous people and their knowledge on the Biological Variability conservation represent one of the oldest traditionally valuable systems in Ethiopia. Indigenous peoples and their socio-cultural relationship with biological systems have largely been contributing to sustainable conservation of Biological Variability. Lack of awareness and knowledge on the part of the people about Biological Variability is one of the major factors that contribute for loss of biological resources. The main objective of this study was to analyze the role of indigenous peoples and their knowledge on Biological Variability conservation. For this research key informant interview, filed visit and informal discussion were carried out to generate primary data. The collected data was analyzed using descriptive statistics such as percentage. Mainly indigenous Biological Variability conservation method dominantly owned by Gursum community was home garden/traditional agro forestry practice. And the methods are its own advantage to mitigate environmental problems such as loss of Biological Variability and high concentration of atmospheric carbon dioxide. Lack of prioritization for indigenous people due to neglect, decay, as well as destruction of socio-cultural values and their knowledge on the Biological Variability conservation were the reasons for the degradation of Biological Variability. Therefore, we concluded that evidence of culture; spiritual, social and ethical norms possessed by indigenous peoples have often been determining factors for sustainable use and conservation of Biological Variability.

Current & Relevant Information:

Introduction

Ethiopia has reach in community indigenous knowledge in a wide range of fields like soil and water conservation, seed selection and preservation, advancement of traditional farm implements, development of appropriate farming systems, and adaptation of effective coping mechanisms withstanding food insecurities through time (Tizita E.E, 2016).It has well appreciated indigenous technologies that have been devised by the community, using their own indigenous knowledge to cope up harsh time and be able to sustain the livelihoods. For instance, In Eastern Hararghe, remnants of the Harla civilization could be observed (near Dire Dawa) where improved soil and water conservation practices are still traceable (Norbert et al., 2002). Advanced soil and water conservation in Konso is a well-known living example of strategy to cope up with moisture-deficient soils and is still sustaining the livelihoods of the ever-increasing population (Besha, 2003).Farmers in

KindoKoishaworeda (southern Ethiopia) mitigate the problem of declining soil fertility through organic manuring, a succession of specific crops and short fallow at the lowland (Elias, 2002). Farmers in Tikurso catchments (northern Ethiopia) rank the qualities of their land by using slope, soil depth, soil fertility (quality), agro climatic zones and water logging as criteria (Bekele, 1997).The Borana pastoral community practiced regulated water use through local leaders to conserve water for livestock and human use during the dry period. In general, different part of Ethiopian community has its own traditional knowledge system to conserve Biological Variability and climate condition.

Most of the Gursum people are one of the Oromifa language speaking groups of Eastern haraghe Ethiopia. The Gursum indigenous peoples perform their cultural practice in their daily life a significant role in the conservation and maintenance of Biological Variability. According to Desalegn Desissa, a plant ecologist (2007) who has studied the area, the Gursum's "traditional activities depend on a friendly relationship with the local environment, which frequently contributes to minimizing environmental disruption and thereby maintaining an overall ecological equilibrium." Since most of the Gursum communities are pastoral and agro-pastoral they have buffer areas that are off limits to grazing and cultivation. Besides this the community use organic and terraced cultivation and composting practice, which has greatly controlled soil erosion and water pollution and allowed them to cultivate most of their total land area. Careful use of manure as fertilizer is a key to soil fertility throughout the region. According to Desissa (2007), the communities are lead elders and they are a paternal symbol, a protector of communities against misfortunes." And most study indicated that in range land area the abundance of Biological Variability is high as compared to other cultivated areas. In each of the community the elders are responsible for leading community ceremonies and are also considered the "father" or traditional custodian for the rangeland. In this system, knowledge is transmitted to younger generations from stewards of the spiritual life, who hold the community responsible for the protection and well-being of the lands and waters. However, the issues of indigenous peoples, their socio-cultural values and knowledge on the Biological Variability conservation are not give emphasis on the government and documented yet not only in the Gursum area but also most part of Ethiopia. Therefore, the main objective of this study was to assess the current situation and analyze the role of indigenous peoples and their knowledge in Biological Variability conservation.

Conclusion

Indigenous peoples and their socio-cultural relationship with biological systems have largely been contributing to sustainable conservation of Biological Variability. Field-based studies or interview were identified that the indigenous knowledge dominantly practiced to conserve Biological Variability were the practice of home-garden in small scope traditional agro ecosystem having varied plant species was carried out in the area of Gursum. The indigenous farmers have well founded ingenious knowledge to conserve home garden and manage each components of the system. One major endeavor is the maintenance of varied taxa of plant species in the home-gardens that are grown for food and others. This practice has a significant role on the Biological Variability conservation and climate change mitigation and adaptation of the peoples. The major causes for Biological Variability degradation are neglecting of local Biological Variability relationship through belittling of local knowledge, beliefs and practices and policy failure. Based on this, it is possible to conclude that indigenous people and their knowledge are playing a significant role in the protection of environments well as Biological Variability.

"Climate change and REDD+: property as a prism for conceiving Indigenous peoples' engagement," Kathleen Birrell, Lee Godden and Maureen Tehan, Journal of Human Rights and the Environment, September 2012 [105]
https://www.researchgate.net/publication/272872911_Climate_change_and_REDD_property_as_a_prism_for_conceiving_Indigenous_peoples'_engagement

Abstract:

The rapid emergence of carbon markets internationally, and rising concerns about the impact of such schemes on Indigenous and local community interests, rights and traditional knowledge, present a strong need to examine legal regulation, protection and promotion of equitable outcomes for the effective engagement of Indigenous peoples and local forest subsistence communities in climate change mitigation. This is particularly so in the context of Reducing Emissions from Deforestation and Degradation (REDD and REDD+ as it later became known) – a scheme that will significantly affect the 'property' rights and interests of such communities. The pace and enthusiasm for investment in, and implementation of, this scheme necessitate scrutiny of the foreseeable consequences at a local level, including the potential of this global project to act as a form of neo-colonialism, co-opting Indigenous and local community interests where the value of the carbon 'offset' may not accrue to local inhabitants of the forested areas. Accordingly, this paper seeks to present a series of fundamental questions raised by the program, particularly in respect of differing conceptions of property, as it uniquely relates to and impacts upon Indigenous peoples.

Current & Relevant Information:

The challenges posed by climate change, which in some quarters is regarded as 'a global problem which requires a coordinated global response', present particular difficulties and opportunities for Indigenous peoples and forest subsistence communities. The challenges are exacerbated where the environmental and economic impacts of climate change are 'inextricably linked to … cultural heritage and identity'. The rapid emergence of carbon markets, internationally and in Australia, and rising concerns about the impact of such schemes on Indigenous and local community interests, rights and traditional knowledge, present a strong need to examine legal regulation, protection and promotion of equitable outcomes for the effective engagement of Indigenous peoples and local forest subsistence communities in climate change mitigation – socially, culturally and economically. This is particularly so in the context of Reducing Emissions from Deforestation and Degradation (REDD) – a scheme that will significantly affect the 'property' rights and interests of such communities. Since its initial formulation, the concept of REDD has been extended beyond the reduction of deforestation, to include conservation, sustainable management of forests and enhancement of forest carbon stocks, and is now known as REDD+. The pace and enthusiasm for investment in and implementation of this scheme necessitate scrutiny of the foreseeable consequences at a local level, including the potential of this global project to act as a form of neocolonialism, coopting Indigenous and local community interests where the value of the carbon 'offset' may not accrue to local inhabitants of the forested areas. In particular, a failure to appreciate fundamental ontological differences between Indigenous and non-Indigenous conceptions of property, including systems of formal and informal tenure, in assessment of the proposed benefits of the program to Indigenous communities, may simply embed Western models of value assignment and extraction that are subsumed under designations of property. In this context, this paper presents a series of fundamental questions raised by REDD+ activities, as it uniquely relates to and impacts upon Indigenous peoples and their property rights. We situate these rights within a relational property model, as opposed to the conventionally conceptualist and instrumentalist models of Western liberal jurisprudence, where adherence to the latter has been described as 'a full-scale eradication of [the] culturally specific ontological grounds' of Indigenous social relations, as mediated in specific ways through customary property forms. Conceived more expansively, Indigenous notions of property are frequently localized, imbued with rich social and cultural meanings; in short, these conceptions are derivative of a 'sociality in and with places.'

To date, sustained analysis of the intersections between international, national and localized approaches to climate change mitigation, and Indigenous peoples' involvement in such endeavors, has been limited. There is growing recognition, however, that insufficient attention has been given to the likely impacts of REDD+ on Indigenous and customary communal land tenure, title and resource holding systems, cultural heritage protection and traditional knowledge. In this paper, we examine legal and regulatory frameworks, commencing with the UN Framework Convention on Climate Change (UNFCCC) and associated climate change mitigation measures – specifically, REDD+, as well as a range of bilateral and voluntary measures – to identify their ramifications for the rights and interests of Indigenous peoples and local forest communities. Critically, this analysis will be focused upon the manifest differences between Indigenous and non-Indigenous conceptions of property, the perpetuation of the latter in current international and domestic laws, and the need to recognize and accommodate ontological differences in the localized implementation of REDD+.

The proliferation of forest mitigation programs also raises an enduring question for law – that of the interaction between legal regimes, and the overlapping or fragmented patterns of rights and entitlements that may ensue. In the context of an expanding climate change regime, this question is particularly pertinent in terms of its points of intersection with domestic and international environmental regulation and, for our purposes, with the opportunities and difficulties presented for Indigenous peoples in having to navigate across regimes to ensure protection secured in one area is not undermined by developments in intersecting legal frameworks. Thus, detailed consideration of how the implementation of REDD+ measures will coexist with other legal regimes, as well as the potential practical effects at the local level, needs further examination. Accordingly, we raise questions concerning the interaction between REDD+ and existing regimes, including frameworks governing world heritage, Biological Variability conservation and international human rights and Indigenous rights frameworks. Some REDD+ objectives may be mutually supportive of, and supported by, these other international legal regimes, such as Biological Variability protection. In other situations, there may be potential conflicts between realizing the proposed co-benefits to Indigenous and local communities, such as retention of communal systems of land tenure, while giving effect to carbon market integrity standards.

Conclusion

To explore how such overlapping and conflicting mandates might be resolved is a complex and multifaceted legal question of critical practical import for Indigenous and local communities, in the face of the projected rapid expansion of climate change mitigation efforts around bio-sequestration. It involves the examination of local impacts on broadly framed Indigenous ‘ontologies’ of property of REDD+ scheme implementation and as further mediated through the matrix of the international climate law and financial transfer regime, and its intersections with other international legal frameworks governing, for example, Biological Variability protection and human rights, as well as national laws and customary law, including native title. Moreover, where the precise process and legal parameters for REDD+ implementation are in a state of flux, the potential for inequitable outcomes for Indigenous peoples and local communities is exacerbated. In this context, it is essential that appropriate and, indeed, more innovative legal mechanisms be identified, by which Indigenous peoples’ knowledge of, and capacity to contribute to, climate change mitigation might provide tangible benefits to Indigenous communities. These frameworks must comprehend the full spectrum in terms of economic return, continuation of cultural practices, protection of cultural heritage and the capacity for peoples to remain on or return to traditional forest lands. Where reduced deforestation simultaneously provides for carbon sequestration, protection of sustainable ecosystems and expanded opportunities for Indigenous peoples, REDD+ activities present potential opportunities for a more integrated approach to climate change mitigation, Biological Variability conservation and the maintenance of living Indigenous cultures and heritage. In the realization of such an approach, comprehensive examination and analysis of an appropriate conceptual and legal framework, at international, national and sub-national levels, remains vital to the provision of a more inclusive platform, and to ensuring that REDD+ is not merely the latest wave in a continuing tide of 'deep' colonization of the life spaces of Indigenous peoples.

"Asante Indigenous Knowledge Systems: Repositories of Conservation Ethics for Ghana's Biological Variability," Dickson Adom, Research Gate, 4 August 2016
[106]
https://www.researchgate.net/profile/Dickson_Adom/publication/309413378_ASANTE_INDIGENOUS_KNOWLEDGE_SYSTEMS_REPOSITORIES_OF_CONSERVATION_ETHICS_FOR_GHANA'S_BIOLOGICAL VARIABILITY/links/580f437b08aea04bbcba3254/ASANTE-INDIGENOUS-KNOWLEDGE-SYSTEMS-REPOSITORIES-OF-CONSERVATION-ETHICS-FOR-GHANAS-BIOLOGICAL VARIABILITY.pdf

Abstract:

The indigenous knowledge systems of the Asantes handed down to them by their past but active forebears carries a lot of weight in Biological Variability conservation discussions. This is promulgated by the numerous conservation ethics hidden in the cultural and artistic practices of the people. Using the Asante Bekwai Traditional Area and its Protected Areas as a case study, the researcher accentuates the enormous conservation ethics in the Asante indigenous knowledge particularly cosmological beliefs, taboos and totems. Data analysis spiral was implemented for the interpretation of the data accrued via focus group interviews and non- participant observations. The study revealed that the Asante indigenous knowledge systems were and is still instrumental in conserving the Biological Variability resources by regulating the residents' behaviors towards the Biological Variability resources in the environment. The research contends that the conservation ethics of Asante indigenous knowledge transcends time and must be utilized in contemporary conservation strategies for Biological Variability. The study advocates for a renaissance and factorization of Asante indigenous knowledge in various developmental projects in Ghana. It tasks developers of conservation strategies and projects in Ghana to tactfully synergize the Asante indigenous knowledge with the Western scientific knowledge to aid in conserving and arresting the deficiencies in Ghana's Biological Variability.

Current & Relevant Information:

Introduction

Biological Variability is a valuable asset that sustains life on earth (Cho, 2011). It offers indispensable provisional services to man such as food, clothing, shelter, medicine etc. (Bradley, Emmet & Gonzalez, 2012). This makes it imperative that humans conserve the Biological Variability resources in the environment. Thus, nature's resources must be used judiciously so as to keep them in constant supply to the present generation and the future progeny. However, it is sad to gleam from various reports that the numbers of Biological Variability resources globally are reducing at a very alarming rate with most species at the threshold of extinction. Vaughan (2015) recently reported that there has been an unprecedented rate in the earth's Biological Variability species loss which is hundred times higher than its normal rate since the 4.5 billion years of the planet's existence. These great extinctions and decline in the Biological Variability species are to the peril of humans and at an ascending cost. For instance, it is estimated that Ghana's economy loses over GH¢ 42 million annually as a result of her Biological Variability depletion (Ghana News Agency, 2012). There are high concerns by international and local bodies for pragmatic solutions to salvage this high deteriorating rate of the Biological Variability resources in the environment.

A critical analysis and comparison of the Biological Variability numbers of the past human forebears, the deteriorating rates and strategies that were implemented to regulate the usage of the Biological Variability resources with the modern Biological Variability numbers, deteriorating rates and conservation strategies shows significant margins. What caused this huge gap? Some scholars attribute it to the advancement in human population and industrialization (Shah, 2014). This may be true to a certain degree since humans keeps increasing in population and thus puts great pressure on the Biological Variability resources in the environment. This notwithstanding, others like Diawuo and Issifu (2015) as well as Adu Gyamfi (2011) and Bonye (2008) associate the rapid loss of Ghana's Biological Variability to the relegation and/or abandonment of the indigenous knowledge enshrined in the cultural practices of the people such as taboos, totems, cosmological belief systems, myths, proverbs, folklores, festivals and the like. These repositories of indigenous knowledge systems proved resilient in monitoring the judicious usage of Ghana's Biological Variability resources (Awedora, 2002). The indigenous knowledge of the Asantes appealed to the moral of the Asantes and helped in shunning negative behavioral patterns that caused massive wrecks to the Biological Variability resources in the environment. Appiah-Opoku and Hyma (1999) contends that the cosmological belief systems of the Asantes instilled discipline among the Asante people while cautioning them not to abuse the Biological Variability resources in the environment so as not to incur the wrath of the gods and ancestors. The indigenous knowledge systems of the Asantes were the sole traditional institutions that helped in averting the depletion of the Biological Variability resources in the environment. It is however sad that today most of these indigenous knowledge systems have been totally abandoned for the Western scientific knowledge in modern Biological Variability conservation discussions, projects and strategies (Ngara & Mangzivo, 2013). This worrying situation exists in Ghana, a nation colored in numerous time-tested and proactive indigenous knowledge systems. The full swing to the Western scientific knowledge by conservation bodies and agencies has been the sole cause of the Biological Variability depletion in Ashanti and Ghana as a whole. Golo and Yaro (2013) argue that these Western scientific models of conservation used singlehandedly have significantly failed because they do not give room for the Ghanaian indigenous knowledge.

Owing to the huge impact of Asante indigenous knowledge systems in Biological Variability conservation in the past, several scholars have advocated for a renaissance as well as the factorization of the conservation ethics that underpins the indigenous knowledge of the Asantes in the light of proverbs, totems, cosmological beliefs, taboos etc. in the modern Biological Variability conservation strategies (Soini & Dessein, 2016; Gadzekpo, 2013). The researcher believes that a synergy of the two forms of knowledge thus the Asante indigenous knowledge with the Western scientific knowledge can pave a pragmatic journey in our quest to salvage the remnant of the Biological Variability resources in Ghana. This study highlights the significant conservation ethics in the Asante indigenous knowledge and how these valuable repositories of conservation values can be utilized in conserving Ghana's Biological Variability which is now in wanton depletion. The proceeds of the paper would be a powerful tool to conservationists and developers of conservation strategies in Ghana and other sub-Saharan African states in coming out with the sure antidote to halt the abysmal retrogression of the Biological Variability resources in nature. It will aid in beefing up the sensitization of the wealth of ecological wisdom in the indigenous knowledge systems of the Asantes. This action will greatly ensure the preservation, transmission and propagation of the Asante indigenous knowledge systems which are now under constant threat of eradication. More importantly, it will help regulate the moral attitudes of Ghanaians and change the decadency in their attitudes towards the Biological Variability resources in the environment which to this researcher has been the cardinal cause of Ghana's Biological Variability depletion.

Summary and Conclusion

The fulcrum of the research was to accentuate the high conservation ethics in the Asante indigenous knowledge systems in the areas of cosmological beliefs, taboos and totemic systems and how they have promoted and conserved the Biological Variability resources in Ghana. The research used the states of two forest reserves and the surrounding towns in the Asante Bekwai traditional area to highlight the essence of upholding and implementing the time-tested wisdom in the Asante indigenous knowledge and the repercussions of not heeding to them. The findings from the study clearly reveals that the Asante indigenous knowledge systems have high conservation ethics values which when blended with the modern methods of conservation can help save the Biological Variability resources in the environment. These Asante indigenous knowledge systems should not be brushed off as superstitious nonsense but must be part and parcel of modern conservation policies and strategies to make it easy for the local indigenes to implement them. After all, it will show that these technical experts highly respect their cultural heritage, a pride of every Asante. These indigenous knowledge systems have preserved most of the Biological Variability resources as have been seen in the two cardinal examples in this research. This makes it imperative for their factorization in modern conservation policies and strategies for Biological Variability conservation in Ghana. These recommendations have been put forward by the researcher to help in saving the rich Biological Variability resources in the forest reserves used for the study as well as showing how indigenous knowledge can be relayed and factored in Ghana's Biological Variability conservation policies and strategies.

1. Conservation bodies and technical experts must factorize the viable Asante indigenous knowledge in the modern Biological Variability conservation policies and strategies that they develop. Cultural experts must be included in the team that draws the conservation policies so that they would advise on which forms of the Asante indigenous knowledge systems are viable for contemporary settings in Ghana and show how the synergy of the Western scientific knowledge and Asante indigenous knowledge can be effectively carried out.

2. The chiefs and elders in the traditional area must institute communal meeting days where Asante indigenous knowledge will be relayed and instructed the youth seem not to know much about the taboos and cosmological beliefs governing the Biological Variability resources in the environment. They must be enlightened on the need to protect and promote the Biological Variability resources in nature especially those in the forest reserves that have been the sole source of revenue for the surrounding villages and towns in Ghana.

3. Orientation sessions must be organized for visitors to alert them on the dos and don'ts at the forest reserves that are used for ecotourism. Strict sanctions must be imposed to punish offenders of the taboos and cosmological beliefs protecting the reserves. These traditional institutions must be backed by the modern legislation so as to punish any person, local resident or visitor who defiles the premises.

4. Recreational sites must not be constructed closer to the banks and thresholds of the forest reserves since this causes the abuse of the Biological Variability resources in the environment. The recreational sites already constructed very close in proximity to the forest reserves must be desolated with immediate effect.

5. Tree planting exercise must be carried out to replace the cut or logged trees in forest reserves such as the Bosumtwe forest reserve and other similar forest reserves in Ghana. This would help in averting disasters like flooding, hurricanes, bush fires and the like.

6. Well trained personnel must be employed to take care of the forest reserves and tourist attraction sites. Refuse bins must be available and situated at vantage pints

around the reserve so that tourists would put all waste substances in them. Cleaning and tidying up of the premises should be done by trained persons. Local communities must revamp the cleaning exercises carried out on agreed days in the month to help save the Biological Variability resources in Ghana.

“A compendium of case studies: Advance Guard: Climate Change Impacts, Adaptation, Mitigation and Indigenous Peoples,” Kirsty Galloway McLean, United Nations University Institute of Advanced Studies, January 2010 [107] https://www.researchgate.net/profile/Kirsty_Galloway_McLean/publication/259609189_Advance_Guard_Climate_Change_Impacts_Adaptation_Mitigation_and_Indigenous_Peoples-A_Compendium_of_Case_Studies/links/545bee5c0cf249070a7a83c8/Advance-Guard-Climate-Change-Impacts-Adaptation-Mitigation-and-Indigenous-Peoples-A-Compendium-of-Case-Studies.pdf

Summary:

This compendium presents a wide-ranging overview of more than 400 projects, case studies and research activities specifically related to climate change and Indigenous Peoples. It provides a sketch of the climate and environmental changes, local observations and impacts being felt by communities in different regions, and outlines various adaptation and mitigation strategies that are currently being implemented by Indigenous Peoples – the world’s “advance guard” of climate change – as they use their traditional knowledge and survival skills to trial adaptive responses to change.

Effective adaptation planning relies on the best available knowledge base, and the urgent need to respond to the pressures of climate change has put a premium on the generation, interpretation and use of information in this regard. In recent years, there has been an increasing realization that the observations and assessments of indigenous groups provide valuable local level information, offer local verification of global models, and are currently providing the basis for local community-driven adaptation strategies that are way past the planning stage and are already being implemented and tested.

Local observations of direct effects of climate change by Indigenous Peoples corroborate scientific predictions, and include temperature and precipitation changes; coastal erosion; permafrost degradation; changes in wildlife, pest and vector-borne disease distribution; sea-level rise; increasing soil erosion, avalanches and landslides; more frequent extreme weather events, such as intense storms; changing weather patterns, including increasing aridity and drought, fire and flood patterns; and increased melting of sea-ice and ice-capped mountains.

Specific vulnerabilities and early effects being reported by Indigenous Peoples include cultural and spiritual impacts; demographic changes, including displacement from their traditional lands and territories; economic impacts and loss of livelihoods; land and natural resource degradation; impacts on food security and food sovereignty; health issues; water shortages; and loss of traditional knowledge.

Impacts are felt across all sectors, including agriculture and food security; Biological Variability and natural ecosystems; animal husbandry (particularly pastoralist lifestyles); housing, infrastructure and human settlements; forests and natural resource management; transport; energy consumption and production; and human rights.

In spite of these impacts, Indigenous Peoples also have a variety of successful adaptive and mitigation strategies to share. The majority of these are planned adaptive responses that are based in some way on their traditional ecological knowledge, whether they involve modifying existing practices or restructuring their relationships with the environment. Indigenous strategies include application and modification of traditional knowledge; shifting resource bases; altering land use and settlement patterns; blending of traditional knowledge and modern technologies; fire management practices; changes in hunting and gathering periods and crop diversification; management of ecosystem services; awareness raising and education, including an increasing use of multimedia and social networks; and policy, planning and strategy development.

This report incorporates material from different disciplines and covers a variability of approaches to data collection and project reporting drawn from the literature. Whilst the compendium of projects and case studies does not claim to provide an exhaustive list of ongoing activities related to climate change and Indigenous Peoples, it does contain a representative and illustrative survey of current effects and adaptive responses. It is hoped that this review provides an insight into the ecological and cultural complexity of sustainable development issues surrounding climate change and Indigenous Peoples, and highlights instances that may be useful in providing guidance for future policy development.

<u>Current & Relevant Information:</u>

Human activities, particularly fossil fuel-based energy production and use, have led to increases in the atmospheric concentration of greenhouse gases (GHG), mainly carbon dioxide, methane and nitrous oxides. The primary direct impacts of such emissions on the environment include increases in the Earth's surface temperature, altered rainfall patterns, sea level rise, and increased frequency and severity of storm surges, floods, droughts and heat waves. These changes in turn have follow-on impacts that adversely affect many communities, for example through agricultural-related economic losses, reduced access to clean water, loss of livelihoods and increased incidences of vector and water-borne diseases.

There is now a strong consensus that climate change presents an urgent challenge to the well-being of all countries, particularly the poorest people living in them. Even if efforts to reduce GHG emissions are successful, it is no longer possible to avoid some degree of global warming and climate change. The poorest countries and communities of the world are likely to suffer the most because of their geographical location, low incomes, and low institutional capacity, as well as their greater reliance on climate-sensitive sectors like agriculture. Adaptation to climate risks and change therefore is increasingly important and countries are undertaking significant efforts to adjust to ongoing and potential effects of climate change.

Indigenous Peoples from all regions of the world have an identity and culture that depends upon the natural environment. Their rich and detailed traditional knowledge reflects and embodies a cultural and spiritual relationship with the land, ocean and wildlife. However, as human activity is changing the world's climate, it is altering the natural environment to which Indigenous Peoples are so closely attached and on which they so heavily rely.

Reflecting their role as environmental stewards of the environment and drawing upon their traditional knowledge, Indigenous Peoples are at the vanguard of climate change. They have been among the first communities to actively engage with the impacts of climate change – through recording their observations of changes in the climate and its effect on the natural environment, through implementing their own activities to adjust to ongoing and potential effects of climate change ('adaptation'), and through reaction to actions being taken by other countries to reduce greenhouse gas emissions ('mitigation').

Indigenous Peoples form approximately 5% of the world's population (between 250 to 300 million people). They manage 11% of the world's forest lands and customarily own, occupy or use 22% of the world's land surface. It has been estimated that within their lands and territories, they maintain an overwhelming 80% of the planet's Biological Variability and are located in or adjacent to 85% of the world's protected areas. It has been estimated that Indigenous lands and other protected areas created to safeguard land rights, indigenous livelihoods, Biological Variability, and other values contain more than 312 billion tons of carbon. Ironically however, despite having contributed the least to global warming by traditionally leading 'low carbon' ways of life, they are disproportionately adversely affected by climate change because they usually live in ecosystems particularly prone to the effects of climate change (polar regions, small islands, high altitudes, humid tropics, coastal regions, deserts), because they are heavily dependent on lands and resources for basic needs and livelihoods (food, medicine, shelter, fuel, etc.), and because they are amongst the poorest people globally. Compounding these vulnerabilities, programs being implemented by non-indigenous people to mitigate and adapt to climate change also have the potential to adversely affect Indigenous Peoples' livelihoods' as well as undermine their customary rights to lands and natural resources if not properly designed and implemented.

Climate change therefore poses a significant threat to the survival of Indigenous Peoples' communities. But at the same time, because of their close traditional relationship with the environment, Indigenous Peoples are uniquely positioned to adapt to climate change. Through their culture of intergenerational transmission of knowledge over thousands of years, Indigenous Peoples are unique repositories of learning and knowledge on successfully coping with local-level climate change and effectively responding to major environmental changes such as natural disasters. Historically and currently, Indigenous Peoples play a fundamental role in the conservation of biological variability, protection of forests and other natural resources, and their traditional knowledge on climate change can also substantively enrich scientific knowledge and adaptation activities of others.

In a very real sense, therefore, Indigenous Peoples are the advance guard of climate change. They are the first communities to observe climate and environmental changes first-hand, and are already using their traditional knowledge and survival skills – the heart of their cultural resilience – to trial adaptive responses to these changes as they occur today. Moreover, they are doing this at a time when their cultures and livelihoods are already undergoing significant stresses due not only to the environmental changes from climate change, but influenced also by the accelerated development of natural resources from their traditional territories that has been stimulated by trade liberalization and globalization.

There is a significant amount of literature on projected, possible and likely impacts of climate change, and adaptive strategies that are being developed to combat these eventualities. However, this publication does not deal with theoretical assessments of potential responses, nor conjectures about how such measures might reduce climate damages under hypothetical scenarios of climate change. With an explicit focus on real-world behavior, the attached compendium includes hundreds of examples of climate impacts already being observed by indigenous communities, and adaptive practices currently being implemented by Indigenous Peoples, in the hope that the global community can also learn from these invaluable experiences as we plan for our collective future.

The compendium includes projects and case studies that identify and conserve Biological Variability; implement land, water and soil management practices that are based on traditional Indigenous knowledge; help increase the resilience of Indigenous Peoples to climate threats; and innovative adaptation plans and communication strategies based on Indigenous systems that are designed to accelerate learning and knowledge sharing on climate change adaptation. There is still much to study and understand about climate change and its effects on the biospheres and ecosystems that are important to Indigenous Peoples and other communities throughout the world. To this end, this compendium makes the experiences of many people's available to their brother and sister communities in the hope that the lessons learned by one community can be shared with many, and work to benefit all.

The majority of projects that address Indigenous Peoples and climate change are small in scale and sample size, and are often reported only through specialized channels, or in non-professional and grey literature. This meta-analysis has therefore been undertaken to capture generalizations across case studies, and to ground individual community experiences in a more global context. The resulting information affirms and supports the observations and activities being reported at community level and, it is hoped, provides an impetus to enable future action.

"Adaptation and Indigenous Peoples in the United Nations Framework Convention on Climate Change," J.D. Ford, et al., Climate Change, December 2016 [108] https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/56537/IDL-56537.pdf?sequence=2&isAllowed=y

Abstract:

Indigenous peoples are uniquely sensitive to climate change impacts yet have been overlooked in climate policy, including within the United Nations Framework Convention on Climate Change (UNFCCC). We identify and characterize the discourse around adaptation in the UNFCCC, examining implications for Indigenous peoples based on a critical discourse analysis of the original Convention and decision texts from subsequent Conference of the Parties (CP). CP16 in Cancun (2010) was a critical juncture after which adaptation emerged as a central component of climate policy in the Convention, with a shift from a purely scientific approach to adaptation to one where local, Indigenous, and traditional knowledge are also valued. Since CP16, the discursive space for incorporating the voices, needs, and priorities of Indigenous peoples around adaptation has expanded, reflected in decision texts and engagement with Indigenous issues in the work streams of relevant bodies. We outline opportunities for greater engagement of Indigenous issues in the UNFCCC post-Paris Agreement, noting the underlying State-centric nature of the Convention limits what can ultimately be achieved.

Current & Relevant Information:

Introduction

Concern over climate change first emerged as an issue of public and policy interest in the 1960s and 70s, culminating with the negotiation of the United Nations Framework Convention on Climate Change (UNFCCC or 'the Convention') at the UN Conference on the Environment and Development (UNCED) in 1992. Ratified by 195 countries (known as Parties to the Convention), the UNFCCCs role in international climate governance has been described as part of a regime complex, characterized by a system of overlapping international institutions (or regimes) that relate to climate change, and characterized by a loose network of linkages between them (Betsill et al 2015, Keohane and Victor 2011). While various international regimes and organizations deal with different aspects of climate change, the UNFCCC forms the central component of global climate governance, in which the rules, norms, institutions, networks and decision-making procedures established have facilitated cooperative action, affected behavior through customary and binding forms of law, and have facilitated action through the establishment of funds for climate action (Ayers et al. 2010, Gehring and Faude 2013; Gupta 2010a).

Scholarship on the UNFCCC is varied, and has characterized the nature of the Convention and its evolution over time (Khan & Roberts 2013), examined whether the UNFCCC is the most appropriate mechanism for addressing climate change (Jordan et al. In press), proposed ways to strengthen the international climate regime (Eckersley 2012), and evaluated how certain components of climate policy—primarily mitigation—have been tackled (Gampfer et al. 2014). Where adaptation has been examined in this work, the focus has been on evaluating funding trends or examining interest in adaptation (Schipper 2006, Khan & Roberts 2013). Few studies have examined the discourse around adaptation in the UNFCCC or how this discourse frames certain countries, populations, or groups, contrasting to work on mitigation (Brugnach et al in press). This gap in understanding is significant given that international organizations, and the discourses and cultures that they create and perpetuate, help define the problems to be governed, shape the perceptions and behaviors of actors, and help to regulate new norms, interests, and shared social tasks (Barnett 2004; Smith and Sharp, 2012).

This paper catalogues the emergence of adaptation within the UNFCCC by reviewing decision texts from the Conference of the Parties (CP) to the UNFCCC from 1992 until CP20 in 2014 (Lima). Using critical discourse analysis, we then examine how Indigenous rights, practices, and knowledge have figured in the emerging adaptation discourse as embodied in decision texts, and outline the implications of discursive trends around adaptation for Indigenous peoples. The focus on the UNFCCC reflects its catalytic role in establishing and reinforcing norms, principles, and priorities for adaptation; legitimizing the importance of adaptation to state and non-state actors; exerting pressure on national governments to make commitments on adaptation; and, distributing resources for addressing climate change impacts (Karlsson-Vinkhuyzen & McGee 2013, Betsill et al. 2015). While we acknowledge critiques of the UNFCCC, the Convention continues to exert significant influence on climate policy, including in determining its main stakeholders and beneficiaries—a process that is particularly important for the powerless and marginalized (Betsill et al. 2015, Cole 2015).

Discussion

This paper identifies and characterizes the discourse around adaptation in the UNFCCC, examining implications for Indigenous peoples based on a critical discourse analysis of the original Convention text and decision texts from subsequent Conference of the Parties (CP). The discursive space for engaging Indigenous issues in adaptation in the UNFCCC has expanded over the last decade, especially after CP16 in Cancun, advancing considerably from the original Convention text where there is no acknowledgment of Indigenous peoples, despite their being sections where one would assume that reference would be made (e.g.

Article 4 on differentiated impacts by social groups) (Smith and Sharp 2012). This is concomitant with developments around the framing of acceptable or appropriate forms of knowledge to guide adaptation evident in the gradual shift from a reliance on scientific and technocratic processes to approaches sensitive and open to traditional and Indigenous knowledge and practices, paralleling developments in the broader scientific community (Smith and Sharp 2012, Schipper et al. 2014, Maldonado et al., 2016). For example, the fifth assessment report (AR5) of the Intergovernmental Panel on Climate Change (IPCC) calls for the explicit need to include traditional knowledge in adaptation; the US Third National Climate Assessment had a specific chapter on Indigenous peoples, involving collaboration to solicit, collect and synthesize traditional knowledge; and a number of guidelines have been developed in recent years for the engagement of traditional knowledge in climate initiatives (e.g. CTKW 2014, UNFCCC 2014). It also occurs in the context of actions by Indigenous Peoples Organizations (IPOs) and Indigenous thought leaders who have been increasingly vocal over the threats posed by climate change and concerns that climate policy may further undermine Indigenous rights.

While the recognition of Indigenous issues in the UNFCCC remains limited and recent, the expanding discursive space nevertheless represents an important development as Indigenous knowledge systems have often been dismissed as ‘unscientific’ or ‘anecdotal’, and overlooked in national planning as representing ‘backward’ forms of development (Ford 2012, Singh et al. 2013, Smit and Sharp 2012; Brugnach et al in press). As such, institutional processes that engage constituents whose needs and interests may otherwise be silenced in national negotiation discourses, and which endorse new norms and best practices, are believed to influence State behavior through their constitutive and regulative effects (Barnett 2004). In the case of the UNFCCC, this would occur by setting international expectations about future decision pathways for adaptation and by encouraging countries to report on these issues in National Communications, NAPAs, and NAPs.

Greater engagement with Indigenous issues is already being reflected in the work streams of relevant bodies within the Convention. For example, in 2014 an expert workshop on best practices and available tools for the use of Indigenous and traditional knowledge and practices for adaptation was convened by the Adaptation Committee and Nairobi WP (UNFCCC 2014), attended by IPOs, Indigenous thought leaders, researchers, and UN staff. Recommendations from the workshop focused on, among other priorities: (1) considering and integrating local, Indigenous and traditional knowledge and practices into national adaptation planning; (2) the recognition of Indigenous and traditional knowledge in a manner commensurate with science; and (3) the need for the UNFCCC to provide guidance to adaptation funding mechanisms on how to integrate local, Indigenous and traditional knowledge and practices into adaptation programing. In turn, these recommendations have influenced decision making processes and actions taken through the Convention. At CP20 in Lima, for instance, Decision 4 directly mentions recommendations made at the workshop, and there are further indirect references in both Decision 3 and Decision 4.

The establishment of the legitimacy of Indigenous knowledge and practices among Parties documented from CP11 to CP20 provides a grounding for greater engagement of, and focus on, Indigenous issues in the Convention post-CP21, particularly in light of the Paris Agreement (PA), with the rights of Indigenous peoples acknowledged in the decision text preamble along with the need for stronger and more ambitious climate change action for Indigenous peoples. This is a major development as in the original UNFCCC text and Kyoto Protocol Indigenous peoples are construed as standardized 'stakeholders' (Smith and Sharp 2012).

The extent to which the PA will affect priorities, rules, and work streams within the UNFCCC will depend on whether it is first ratified by enough States, and then how its Articles are interpreted in the context of the Convention. In turn this will be influenced by the ability of IPOs to meaningfully participate in the Convention process. Discursive practices in the UNFCCC, however, focus almost solely on the nation-state, with the Convention's original mandate being to provide a forum primarily for negotiating climate change mitigation agreements between States. This State-centric structure frames the responsibility for climate action of sub-national populations as being in the jurisdiction of national governments. Participation by IPOs in the formal negotiations (outside of being non-state observers) depends on being included in official delegations by respective national governments. Given the marginalization and lack of recognition given to Indigenous populations in some nations, these opportunities may be limited and dependent on political factors (Maillet & Ford 2013; Brugnach et al in press). Although there are channels through which IPOs can submit statements, recommendations and proposals to the Parties, there is currently no mechanism through which to ensure that Indigenous rights are respected, or that the special needs of Indigenous people are incorporated in decision texts.

The role of Indigenous peoples in the UNFCCC contrasts to the UN Convention on Biological Variability (UNCBD). Here, Indigenous peoples were recognized as having a stake in negotiations from the beginning, with the UNCBD text containing several references to Indigenous peoples, including calls on states to "respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities …" (Article 8(j)). This builds upon an earlier recognition by the scientific community of the relevance of Indigenous knowledge to Biological Variability conservation. The UNCBD also allows Indigenous groups to comment on, to draft text in negotiations, and to participate in contact group meetings at the discretion of the Chair when issues relating to them a discussed (Schroeder 2010). In contrast, no explicit link was made between Indigenous peoples and climate change until the mid-2000s in the UNFCCC, and there are as yet no formal mechanisms for IPOs to influence the process beyond lobbying delegates (Schroeder 2010).

IPOs and thought leaders have argued for the creation of Indigenous-specific adaptation funds (e.g. similar to the Voluntary Fund for Indigenous and Local Communities in the UNCBD), reflecting sensitivity of Indigenous peoples to climate change, special needs in a changing climate, and marginalization, which it is believed will limit their ability to access nationally controlled adaptation funds. There is limited discursive space, however, for the development of such stand-alone funding mechanisms given the State-centric nature of the Convention. Further, some have argued that adaptation funding through the Convention should target Indigenous peoples regardless of geographical location, reflecting similarities in drivers of vulnerability and absence of support mechanisms in varied contexts (Ford 2009). Yet the guiding principles of the Convention make the creation of such Indigenous-specific funding streams appear unlikely; all funding flows through the Convention are unidirectional, from high income nations to low and middle income (non-Annex 1), and while the scope of responses for the facilitation of adaptation has expanded to include all countries (e.g. through Adaptation Committee), financial assistance remains firmly directed towards developing countries.

In-light of these limits, we recognize the importance of promoting Indigenous needs and rights in a rapidly changing climate through alternative venues which have potential to create or inform the development of targeted Indigenous focused work-streams, including relevant UN Conventions (e.g. UNCBD, Sendai Framework), international financial institutions (World Bank), the UN Permanent Forum on Indigenous Issues, regional bodies (e.g. EU, OECD), and national governments. Greater engagement of the IPCC with Indigenous issues is also important, with IPCC assessment reports influential in informing the UNFCCC and other international bodies (Ford et al. 2012, 2016; Smit and Sharp, 2012). There are also opportunities within the UNFCCC to formally enhance the engagement of Indigenous issues, including:

- The rules of fund board composition and membership, and Convention committees and work programs (e.g. Decision 2, paragraph 101, CP17/2011), could be amended to include additional seats, such as an Indigenous representative from an Annex-I Party and another from a non-Annex I Party. Given that there is no disclaimer of precedent in the decisions examined that would explicitly restrict this kind of amendment, it can be assumed that this could be done, should the Parties to the Convention agree to do so.
- IPOs could be invited by Working Groups to co-chair meetings and intervene in debates that cover topics relating to traditional and Indigenous knowledge, and hence contribute to making formal recommendations to the Parties (e.g. LDC WG, WG on Loss & Damage, AC). Such an approach has been advocated in the UNCBD, and was followed by the UNFCCC at its 2014 meeting on Indigenous knowledge for adaptation (UNFCCC 2014).
- There is a need for greater participation by IPOs in the UNFCCC. Betzold and Flesken (2014), for example, document that on average only 6 participating

IPOs attend UNFCCC CPs as accredited NGO observers, compared to over 50 in average UNCBD CPs, attributing this to a number of factors, including perceptions among IPOs that Biological Variability issues are more relevant and important to them. Greater engagement of IPOs in the UNCBD, from an earlier stage and with a greater sense of cohesion, has also led to formal mechanisms being established, including the formation of the International Indigenous Forum on Biological Variability (IIFB) in 1996, with the aim of providing advice to Party Delegations and influence the interpretation of government obligations within the UNCBD (Schroeder 2010, Betzold & Flesken 2014). The IIFB, in turn, was officially recognized as an advisory body to the UNCBD in 2000, and receives logistical support from the UNCBD Secretariat, and has served to establish clear rules for the participation of IPOs in the negotiations. Indeed, after its recognition, the time allocated to IPO contributions increased and the social dimensions of Biological Variability, including the role of Indigenous peoples as resource managers, received greater attention (Schroeder 2010). More broadly, the establishment of official advisory bodies has been identified as important in increasing issue legitimacy in the eyes of the Parties to the Convention (Haas 2002, Biermann & Gupta 2011). We recommend similar institutional mechanisms to be created as part of the UNFCCC framework.

Climate change is a major overarching challenge facing Indigenous peoples, acting as an impact multiplier to many underlying stresses, yet it may also be an opportunity to catalyze action, seek redress, and challenge violations of rights. Greater engagement and co-ordination among IPOs involved in the UNFCCC process, ultimately including the establishment of an Indigenous advisory body / forum, would serve to advance Indigenous issues among Parties. The opening up of discursive space for engagement with Indigenous issues in the Convention documented here over the last decade, combined with the text of the Paris Agreement, indicates growing awareness and significant potential for change at the global level.

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