

## Introduction: climate change and indigenous peoples of the USA

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This special issue of *Climatic Change*, dedicated to the examination of impacts of climate change on indigenous peoples and their homelands, and proposed strategies of adaptation, constitutes a compelling and timely report on what is happening in Native homelands and communities. Indigenous peoples and marginalized populations are particularly exposed and sensitive to climate change impacts due to their resource-based livelihoods and the location of their homes in vulnerable environments. While these articles focus on indigenous peoples found within the borders of the USA, J. Maldonado et al. point out in their contribution, “The Impact of Climate Change on Tribal Communities in the U.S.: Displacement, Relocation, and Human Rights,” that indigenous communities around the world face similar issues and will likely find the contributions here valuable.

These articles confirm what those of us who have been paying attention to our homelands already know: the world we live in is changing, not the interior spaces and places where the majority of us situated in the midst of the modern industrial and postindustrial societies spend our days and nights, but the world of unbounded landscapes and seascapes that constitute what humankind denominates the natural world. Climate change, however, is only one of many drivers of change. Its effects cannot be isolated from the multiple social, political, economic, and environmental changes confronting present-day indigenous and marginalized communities. Indigenous peoples have long and multi-generational histories of interaction with their environments that include coping with environmental uncertainty, variability, and change. Collectively, these articles give us a glimpse of the day-to-day climate change reality those native people experience who still find their tribal identities and lifeways in practical activities situated in the symbiotic relationships of the nature–culture nexus.

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These articles highlight why awareness of climate change is so high among indigenous peoples of the USA when compared to most citizens of the USA. Unlike most citizens who form opinions about climate change based on cable news networks, internet sites, and even paper news publications, American Indian and Alaska Native awareness of climate change is the result of practical lifeway experiences and sensitivity to the rhythms of seasons that make them particularly knowledgeable about what is going on where they live. The recent UNESCO and UN publication of *Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation* (2012) by D.J. Nakashima et al. documents that indigenous peoples have been able to draw on a long multi-generational transmission of traditional ecological knowledges (TEKs) to demonstrate keen response and adaptation capabilities in the face of climate change.

Unlike the increasingly geographically mobile population of the USA, indigenous peoples draw on practical lifeway experiences—not one person’s experience—but that of entire nations and communities to share multi-generational “deep spatial” knowledges of empirical landscapes and seascapes. In scientific terms, these traditional knowledges (TKs) and/or TEKs are much akin to longitudinal case or field studies, with two exceptions: modern scientific studies are lucky to be designed and funded for a decade or two and they almost never have the rich experiential character of TKs. Also, to reiterate, indigenous peoples’ awareness of climate change effects and possible adaptation strategies to address those effects are born of practical lifeway exigencies and experiences accumulated over extremely long periods of time in particular places where home is identified with ecosystems and natural environments, not street addresses.

The useful knowledge of climate change and its challenges to Native people and native homelands offered here is far from exhaustive. The population of American Indians/Alaska Natives in the USA is approximately 5.2 million and Hawaiian Natives/Pacific Islanders number approximately 1.2 million. Few people realize that there are 566 federally recognized tribes and, at least, 34 state-recognized tribes across the USA situated in every type of environment found in the USA. This issue of *Climatic Change* deals with a good sample of those tribes and those willing to read every article presented here will glimpse the “big picture” of Native America too few Americans recognize: the history of this blue green planet—what many indigenous peoples throughout the Americas call Mother Earth—is essentially a story of intertwined ecological and cultural diversity.

This “big” history of people and places on the planet is now more important for the public to understand than any single national, biographical, or episodic-based history for a number of reasons, but one stands out. American Indian and Alaska Native cultural and lifeway diversity expressed through the symbiotic nature–culture nexus reminds all of us that our human responses to climate change will require diverse strategies that fit the people and places of the planet—in all of their diversity. There is no silver bullet or one-size-fits-all solution for addressing the impacts of climate change.

The contribution, “Indigenous Frameworks for Observing and Responding to Climate Change in Alaska,” by P. Cochran et al. is invaluable for emphasizing the importance of the inclusion indigenous peoples, their complex worldviews, and TKs in understanding climate change and adaptation strategies required to deal with climate change impacts. Cochran et al. document the complementary features of indigenous worldviews and the traditional knowledges they produce relative to Earth system science and persuasively argue for their necessary inclusion in climate change research, especially for the ethical framework they provide. Cochran et al. state, “From this knowledge emerges an indigenous sense of place, language, ceremonies, cultural identities, and ways of life that provide an ethical framework that guides responses to change.” An overarching theme that emerges throughout this

collection of articles is the necessity for respectful partnering and collaboration of indigenous peoples and their communities with non-indigenous governments and organizations if climate change impacts are to be successfully, i.e., sustainably, addressed. Cochran et al. make invaluable suggestions based on years of experience about what needs to be done to create the social and cultural “climate change,” required to establish what both K.P. Whyte and Hardison and Williams argue in their contribution to this issue *Climatic Change*, should be relationships based on justice.

K.P. Whyte’s article, “Justice Forward: Tribes, Climate Adaptation and Responsibility,” accurately suggests that one of the difficult challenges we must face in the USA is how to respond to climate change in ways that are just. Whyte’s analysis of institutional frameworks and mechanisms for realizing justice in our adaptations to climate change is timely and in itself challenging. In many respects, the physical features of climate change are much easier to understand and estimate than are the ways in which we can exercise human responses to those changes that embrace and realize justice. While the political, legal, and governmental situations of indigenous peoples vary widely across the planet, Whyte’s institutional analysis of justice can serve as a useful tool for other’s across the planet to ponder in addressing the difficult social dimensions of climate change.

Many of us see the indispensable value of incorporating traditional knowledges into adaptation strategies, but Hardison and Williams’s contribution, “Culture, Law, Risk and Governance: the Ecology of Traditional Knowledge in Climate Change Adaptation,” points out the potential downside indigenous peoples face when asked to share traditional knowledges. The potential for exploitation and misuse of traditional knowledges is real—as is the incompatibility between legal rational constructions of copyrights, contracts, and licensure tools to deal justly with indigenous knowledge(s). As the authors point out, “Once traditional knowledge is shared outside of a community, it enters alien social and legal contexts.” Consequently, it is not surprising, given the potential abuse and misuse of traditional knowledge, the cooperative partnerships many see as crucial to successful adaptation to climate change is seldom happening.

Hardison and Williams challenge all of us working at the intersection of Western law and science, and traditional knowledge to consider the development of a governance mechanism to guide the sharing of traditional knowledges. By arguing that indigenous traditional knowledge should be understood as “a sovereign property with its own rules and laws determined by its proper sovereign”, they affirm Article 31 of the United Nations Declaration on the Rights of Indigenous Peoples. They also suggest the guiding principle for sharing indigenous traditional knowledge “should be based on free, prior and informed consent and mutually agreed terms based on equal standing.” Moving beyond dialogues about how TK data can be integrated into existing resource management plans the authors remind us of the importance of carefully examining how TK experts are integrated in a just and meaningful resource management process.

J. Maldonado et al. point out in their article on climate change adaptation, displacement, relocation, and migration as fundamental human rights issues that considerable “heavy lifting” awaits our national and international governmental institutions. Their discussions of the situations facing the Alaska villages of Kivalina and Newtok, and the Isle de Jean Charles Band of Biloxi-Chitimacha-Choctaw Indians of Louisiana (a state—not federally—recognized tribe), highlight the governmental and institutional “no-man’s land” these indigenous communities experience in seeking ways to retain their unique cultural lifeways and governmental traditions in a sustainable manner. The problems these three indigenous communities face are complex and demanding: especially demanding of justice. The articles by Whyte, Hardison and Williams, and Maldonado et al. remind us that the effects of climate change are complicated and hardly an abstraction for many indigenous nations and communities in the USA.

At a basic level, climate change is all about water: some people and places will have a lot less of it than they had before the anthropogenic warming of the planet and others will have a lot more of it—often in places where they would prefer not to have it. Not surprisingly, 4 of the 12 articles here focus on water. Cozzetto et al. in, “Climate Change Impacts on the Water Resources of American Indians and Alaska Natives in the U.S.,” survey the impacts of climate change very broadly on water resources in six regions of the continental USA and make recommendations for water resource climate preparedness. In all cases, the impacts are complex given the range of other factors that can affect water quality and quantity, and the impacts vary from region to region. Like Cochran et al. and many contributors to this issue of *Climatic Change*, Cozzetto et al. call for the use of TEK in assessing impacts and developing mitigation/adaptation plans to deal with climate change. They too sound the most consistent theme running throughout this collection of articles—indigenous peoples will need to establish partnerships with non-tribal entities in order to sustainably address water resource climate preparedness.

M. Gautam, Chief, and Smith emphasize the same point in their article, “Climate Change in Arid Lands and Native American Vulnerability: The Case of the Pyramid Lake Paiute Tribe,” and make another crucial point: tribal vulnerabilities in the case of the Pyramid Lake Paiute (PLP) Tribe include threats to deep-rooted cultural beliefs, values, and practices that constitute the core of what it means to be Pyramid Lake Paiute. In the case of the PLP, the authors point out that the key tribal climate change vulnerability they face is to Pyramid Lake and the Cui-ui fish. Their analysis of PLP household survey’s and semi-structured interviews with tribal executives on values, beliefs, and perception regarding climate change demonstrates that the PLP know what is happening within the landscapes/seascapes of their homelands, including the intergovernmental environment and differing cultural values and worldviews they must navigate to maintain their unique identities as indigenous Peoples.

The articles focusing on climate impacts on rivers and salmon of the Northwest, “Changing Streamflow on Columbia Basin Tribal Lands—Climate Change and Salmon,” by Kyle Dittmer, and “The Effect of Climate Change on Glacier Ablation and Baseflow Support in the Nooksack River Basin and Implications on Pacific Salmon Species Protection and Recovery,” by O. Grah and J. Beaulieu illustrate the complexity of impacts and the need for cooperative concerted intergovernmental efforts to address climate change-induced threats. K. Dittmer et al. and Grah and Beaulieu find that the impacts of climate change on of the Columbia River Basin and the Nooksack Basin, respectively, will pose serious threats to the salmon and the cultural, religious and ceremonial, commercial, and subsistence activities of the Native peoples of these river basins. Citing the publication, “Salmon Culture”, by the Columbia River Inter-Tribal Fish Commission, consisting of representatives from the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, the Yakama Nation, and the Confederated Tribes of Warm Springs Reservation of Oregon, Dittmer states, “Salmon are more than just a major food source—it is an important part of tribal religion and culture.”

Using data collected from snow telemetry (SNOTEL) stations in the Nooksack watershed and published studies, Grah and Beaulieu find that the stream flow of the Nooksack has decreased in the summer, temperatures have warmed, and the peak runoff period occurs earlier. These findings, supported by aerial data, suggest that as glacial extent decreases among the glaciers feeding the Nooksack, reduced baseflows and higher water temperatures are likely to create more stressful conditions for salmonids, potentially pushing temperatures to lethal levels for fish that are central to Nooksack Indian Tribal culture and lifeways.

Dittmer analyzes GIS-based PRISM temperature and precipitation data, and USGS stream flow data, using linear trend analysis for the Columbia River and its tributaries to

assess climate change impacts on Columbia River Basin tribal reservations and historical tribal lands. Even factoring in the inter-annual climate variability effects of the El Niño-Southern Oscillation and Pacific Decadal Oscillation, they find warming air temperatures and the increase in 100-year November/December floods “could push enough runoff to scour the stream bed and disrupt or destroy redds (i.e., egg nest), which fall chinook, coho, and steelhead construct in September and October.”

No two river basins are the same, but the research by Dittmer and Grah and Beaulieu confirm what the tribal peoples on these Pacific Northwest rivers are experiencing right now—climate change that is negatively affecting the water flow levels, timing of peak flows, and temperatures to impact salmonids and peoples who found their indigenous identities and cultures in their relationships with rivers and salmon. Both articles illustrate that habitat restoration is an environmental justice issue that speaks directly to what few modern peoples directly experience today—our human stories of life on this planet are inseparable from the larger and diverse life-system stories of the planet.

Understanding the climate change threats to US rivers and lakes, it should come as no surprise that forests and their associated ecosystems do not fare much better. In “Cultural Impacts to Tribes from Climate Change Influences on Forests,” G. Voggeser et al. survey threats to forests, e.g., sudden oak death, emerald ash borer, invasive species, and wildfires, and find that changes in species composition in forests and other ecosystems will require “robust federal–tribal relationships” if negative impacts on “tribal subsistence, culture, and economy” are to be effectively addressed. They too affirm the importance of the inclusion of TEK when investigating adaptation strategies to deal with climate change impacts and note its holistic advantage—another theme running through many of the contributions to this issue of *Climatic Change*.

“Exploring Effects of Climate Change on Northern Plains American Indian Health,” by J. Doyl et al., provides a case study focused on health-related water quality and quantity issues for the Crow Tribe and a nice summary of existing reports and literature on the health effects of climate change on Alaska Natives. The authors examine meteorological data collected from NOAA weather station in Hardin, Montana located on the reservation’s northern border and US Geological Survey discharge data for the Little Bighorn River. They find dangerous levels of *Escherichia coli* are often found in the lower reaches of the Little Bighorn River. This finding and the recent appearance of lesions on catfish caught in the river are associated with warmer summers and possible increased sedimentation pollution resulting from the earlier spring runoff. These findings and two devastating floods in the last decade, Doyle, et al. point out, pose climate change-related health threats to those living on the Crow Reservation and in Big Horn County.

Doyle et al. emphasize that multiple dimensions of human health are affected by climate change. They point out that research is needed to understand and document the extent of the ecological and human health impacts of climate change. They conclude that a climate change health assessment is necessary for those living in Little Big Horn River basin to fully capture “the ecological effects of less snowfall, warmer temperatures, reduced stream flow and possibly increased flood frequency and fire severity currently experienced by Crow Tribal members and other residents of Big Horn County”. Like Doyle et al., contributors to this issue of *Climatic Change* understand that such an assessment would benefit by listening to what community members have observed in a landscape and river they know well. Decision-making processes for climate action are most effective if they are accountable and responsive to the populations that are affected, and provide support for full and effective participation and representation in climate governance.

Nowhere is the discussion of change so palpable as in the article by K. Lynn et al. “The Impacts of Climate Change on Tribal Traditional Foods.” They document the difficulty

indigenous peoples in the USA have maintaining traditional healthy diets in the world we now live in. They show how climate change is exacerbating the problems associated with traditional food-ways, e.g., the colonial political and legal restrictions placed on First Nations Peoples that make it difficult to harvest traditional plant and animal food sources and the larger dominant society's socioeconomic-driven popular food culture. The authors point out, like other contributors in this issue of *Climatic Change*, that climate change will only make the maintenance traditional foods and the required subsistence activities to provide such diets very challenging. In light of the threats the American Indian and Alaska Natives face, it is not surprising that more and more Native meetings are convened under the title of security—food, water, energy, cultural, etc.

J. Reo and A. Parker's contribution, "Re-thinking Colonialism to Prepare for the Impacts of Rapid Environmental Change," suggests that there could be useful results for tribes and policy makers in a comparison of the early colonial impacts on the coupled human and natural systems of New England and the current Climate change impacts presently experienced and forecasted for the near future. Their article successfully argues that both events are marked by dramatic changes for both peoples and places of New England and consequently a critical historical examination of the dramatic anthropogenic changes to the homelands of the first peoples of New England could be very useful for future planning. Like so many other Native contributions to this special issue of *Climatic Change*, they not only give a picture of the climate impacts now experienced and forecasted, they remind everyone the first peoples of this land understood something scientists and policy makers need to understand, now more than ever, if humankind is to sustainably address the incredible negative climate change impacts facing not only tribes but all of humankind on this Mother Earth—sustainability requires the recognition and restoration of reciprocal relationships between peoples and places.

The value of the scientific and scholarly analyses, research, and reports offered in this issue of *Climatic Change*, "Climate Change and Indigenous Peoples in the United States: Impacts, Experiences and Actions," taken as whole not only exists in the presentation of the difficult challenges climate change now poses for indigenous peoples of the USA, but in the clear message that climate change is not confined by human-made borders and boundaries. Successful, i.e., sustainable, climate change adaptation will require considerable "imagination," as N. Scott Momaday properly called it (see Reo and Parker), especially in the institution building (see Whyte) that will allow relationships of responsibility and respect to be created so American Indians and Alaska Natives can find some justice in climate mitigation and adaptation actions. This finds resonance with literature calling for "transformative" approaches to adaptation. The term "transformative" is being used to describe a range of endeavors that promise extraordinary outcomes.

That American Indian and Alaska Native scholars, community leaders, and scientists who have teamed with non-native scientists to produce this timely issue of *Climatic Change* is worth special note, too. For this collection of articles shows that respectful and responsible collaboration is possible between indigenous and non-indigenous people. Just as importantly, it illustrates that there is going to be plenty of work for everyone, indigenous and non-indigenous community members and leaders, physical and social scientists, policy makers, teachers, engineers, entrepreneurs, etc., if we are going to find diverse and sustainable responses to climate change.

Something else equally obvious, but possibly more provocative, strikes me after digesting these articles, the realization that indigenous Peoples or the First Nations of North America must not only assume the leadership roles in addressing climate change adaptation strategies on their present colonially determined reservations, but for their extensive ancestral and

traditional territorial lands. Why? We must do so, not because it is our right, but because in so many of our worldviews and the institutions that sustain our indigenous lifeways, we understand it is our responsibility to do so, in order to maintain good relationships with our “other-than-human” natural relatives.

Who better to lead during this time of dramatic climate change than peoples who know or can recollect in their indigenous traditions of TK and/or TEK practices of sustainability and indigenous ingenuity—*Indigenuity*? Can you imagine a world where nature is understood as full of relatives not resources, where inalienable rights are balanced with inalienable responsibilities and where wealth itself is measured not by resource ownership and control, but by the number of good relationships we maintain in the complex and diverse life-systems of this blue green planet? I can. Read the entirety of “Climate Change and Indigenous Peoples in the United States: Impacts, Experiences and Actions” and see if you can imagine—if you can, let’s get ready for some good hard work, together.