

Indigenous knowledge of a changing climate

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Anthropogenic climate change is perhaps the ultimate manifestation of humans' growing disconnect with the natural world, although not all societies share the same burden of responsibility for its creation. Compared to the dominant industrialised societies whose activities in the last 200 years or so have caused most of the climate impacts currently observed, Indigenous people living on their traditional lands bear little responsibility for current and future projected consequences of a changing climate. Despite this, they are likely to suffer the most from direct and indirect climate change due to their close connection to the natural world and their reduced social–ecological resilience—consequence of centuries of oppressive policies imposed on them by dominant non-Indigenous societies.

Much of the world's remaining diversity—biological, ecosystem, landscape, cultural and linguistic—resides in Indigenous territories. The main knowledge-holders of the site-specific holistic knowledge about various aspects of this diversity, Indigenous peoples, play a significant role in maintaining locally resilient social–ecological systems. Despite the recent adoption of the UN Declaration on the Rights of Indigenous Peoples (UNDRIP) in 2007, Indigenous people continue to be denied their rights and are subjected to climate injustice, remaining largely excluded from the official UN climate negotiations.

In a recent statement, World Bank Group President Robert Zoellick acknowledged that Indigenous people carry a 'disproportionate share of the burden of climate change effects' and must be included in international climate change discussions. Translating this largely theoretical recognition into practice remains a major challenge, in large part because of the perceived inferiority of local Indigenous knowledge compared to the conventional western scientific mode of inquiry. While

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this perception dominates public and policy discourse, the acknowledgement of the value of Indigenous peoples' observations of environmental, particularly weather and climate-related changes, is gradually increasing in the western scientific peer reviewed literature.

Since the case study chapter on 'Indigenous knowledge for adaptation to climate change' in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Parry et al. 2007), two journals have recently published special editions on related issues. They include a collection of papers on the theme of traditional peoples and climate change (Salick 2009), and a special issue on climate change impacts, adaptation and vulnerability in the Arctic (Ford and Furgal 2009). More recent non-peer reviewed material includes Bioversity International's report on the inextricable link between the maintenance and use of global agrobiodiversity and the ways in which Indigenous peoples and rural communities are adapting to climate change (Bioversity 2009).

This special edition of *Climatic Change* endeavours to further build the case for the integration of Indigenous peoples' knowledge and observations of environmental processes in developing collective responses to climate change. The journal's stated purpose of providing 'a means of exchange among those working in different disciplines on problems related to climatic variations,' provides a platform to bring the authors of papers in this special edition from a wide range of backgrounds and academic disciplines. Significantly, all of the papers demonstrate the salience of collaborative work between researchers and community members. This participatory research process is reinforced through co-authorship of papers in this edition by non-Indigenous researchers and community leaders, or by Indigenous researchers directly.

Several themes unite these papers. The value of integrating western science and Indigenous worldviews is clearly highlighted throughout, although in some cases, there is acknowledgement that these differing paradigms do not always straightforwardly concur (Gearheard et al. 2009). Despite this, the papers broadly reinforce the value for western scientists of engaging with Indigenous people to gain weather and environmental change observations for geographic regions with a paucity of scientific data. In a similar way, the large-scale climate projections developed by western scientists could likewise be of value for local Indigenous communities as they seek ways of adapting to and planning for environmental change.

The need to recognise the value of phenological knowledge held in Indigenous communities is discussed in Lefale (2009) and Green et al. (2010), specifically in relation to local seasonal weather calendars for small island communities in Samoa and Australia. Ifejika Speranza et al. (2009) stress the need to integrate Indigenous knowledge into education programmes in Kenya in order to maintain and strengthen culture. Ifejika Speranza et al. (2009) also note the need to recognise that the pre-existing stresses in many communities are a core reason in why otherwise resilient communities may have difficulties adapting to a climate changed world.

Overall, these papers demonstrate the parallels that can be drawn between Indigenous knowledge about environmental indicators and weather observations in a wide range of settings, from Nunavut in the Arctic and tropical islands in the Pacific to a semi-arid region of Kenya. Specific differences between these papers are briefly discussed below.

The first paper in the series, a collaboration between Orlove, Roncoli, Kabugo and Majugu (Orlove et al. 2009), examines the local knowledge around interannual variability in both the timing and seasonality of rainfall in southern Uganda. Four major components of their knowledge system are discussed: the longstanding familiarity with the seasonal patterns of precipitation and temperature, a set of local traditional climate indicators, observation of meteorological events and information about the progress of seasons elsewhere in the region. The paper examines these components and explores the connections between them as well as discussing the social context within which this knowledge is embedded.

The role of wind as a key environmental variable for Inuit at Clyde River, Nunavut is explored by Gearheard, Pocernich, Stewart, Sanguya and Huntington in the second paper (Gearheard et al. 2009). This paper explores how wind and other extreme weather conditions can constrain important hunting, travel and other activities for these communities. The paper documents how, through close observation, many Inuit throughout Nunavut have reported changes in wind patterns—including variability, speed and direction. These local observations are then compared to weather station data from Clyde River revealing limited agreement between the two sources of knowledge. The authors posit that this disagreement could be related to several factors: the weather station data may not be representative of the region, the Inuit observations or explanations may be inaccurate or the instrumental and Inuit observations may not be of the same phenomena.

Returning to the African continent, the third paper by Ifejika Speranza et al. (2009) focuses on the Indigenous knowledge held by the agro-pastoralists in the Makueni District, Kenya. Interviews conducted by the authors in several villages identified how these agro-pastoralists incorporate Indigenous knowledge and meteorological forecasts into their planning decisions and how they use it to monitor, mitigate and adapt to drought. The interviews discovered that only a few agro-pastoralists adapted their practices in response to Indigenous knowledge based forecasts. The authors conclude this limited use is partly due to conditioning and partly due to lack of resources. These authors stress the need for active intergenerational programmes to ensure the continued existence of Indigenous knowledge through its integration into education curricula and in formal climate change research programmes.

The final two papers discuss Indigenous knowledge on small islands in the Asia Pacific region. The paper by Lefale (2009) examines the local phenological observations of Samoans—as documented in their local seasonal calendar. Key indicators highlighted in this calendar include changes in behaviour of animals and plants which are still used as indicators for cultural and subsistence activities. Indigenous knowledge is currently drawn on for weather forecasts, and it is this knowledge which the author suggests is crucial to document for developing regional climate adaptation strategies.

The final paper by Green et al. (2010) draws together seasonal weather calendars for northern Australia, noting that for many Aboriginal communities this knowledge is beginning to be documented both in local languages and translated into English. The paper discusses how cultural activities on the mainland have adapted to past climate changes, and how Indigenous knowledge held in these communities today is still highly valued. The paper then discusses research carried out in the Torres

Strait to document seasonal weather observations and environmental indicators that are still in use. The paper concludes with the recommendation to develop a comprehensive programme to record this knowledge before it is lost. They suggest that such a programme would be of immeasurable value to the communities themselves to allow the intergenerational transfer of knowledge, and also potentially to contribute to a greater understanding of regional climate change for regions of Australia without long historic climate data observations.

Even if sweeping global climate change agreements are reached swiftly, the present global responses to climate change—either proposed or already implemented—will ultimately fail unless they are grounded in recognition of such basic human rights as the territorial, land, and resource rights of local custodians of global biocultural heritage—the backbone of strategies for adaptation and resilience. Such recognition is inseparable from creating an equitable and respectful space for knowledge co-creation that brings together local Indigenous and conventional scientific paradigms for the purpose of developing climate change mitigation and adaptation strategies and actions.

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