

Climate Dangers and Atoll Countries

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Introduction

Climate change induced sea-level rise and increased frequency and intensity of extreme weather events puts the long-term ability of humans to inhabit atolls at risk, according to the latest findings of the Intergovernmental Panel on Climate Change (McCarthy *et al.* 2001). We argue that this risk constitutes a dangerous level of climatic change to atoll countries by potentially undermining their national sovereignty. We outline the novel challenges this presents to both climate change research and policy. For research, the challenge is to identify the critical thresholds of change beyond which atoll social-ecological systems may collapse. For the international policy process, centred on the UN Framework Convention on Climate Change (UNFCCC), the possible extinguishing of atoll-countries radically challenges international norms of justice, sovereignty, and human and national security.

Climate Impacts on Atoll Countries

Atolls are rings of coral reefs which enclose a lagoon. Around the rim of the reef there are islets called *motu* with a mean height above sea-level of approximately two meters. There are five countries comprised entirely of low-lying atolls: Kiribati (population 78,000), the Maldives (population 269,000), the Marshall Islands (population 58,000), Tokelau (population 2,000), and Tuvalu (population 9,000). With the exception of Tokelau (a dependent territory of New Zealand), these are all sovereign states. Kiribati, the Maldives and Tuvalu are official 'Least Developed Countries' (LDC) in the United Nations system.

Atolls have common environmental problems that render them particularly vulnerable to climate change. They have very high population densities (897 people/km² in the Maldives). Water reserves are restricted to a narrow subterranean freshwater lens easily contaminated by salt water and human and industrial wastes. Freshwater lenses become depleted in times of low rainfall. Atoll islands typically face coastal erosion as a result of mining of beaches, while construction of sea walls and infrastructure, and waste dumping on reefs and mangroves undermine the ecological functions on which these island systems depend (Moberg and Folke 1999). Coastal developments and pollution has also lead to depletion of artisanal fisheries.

Overall, their small size, isolation, physical infrastructure and low levels of income make atoll countries apparently vulnerable to global economic forces as well as to climatic changes. The atoll countries are relatively more vulnerable in terms of economic structure and, on average more food insecure than other small island developing states as demonstrated in Figure 1. These parameters of underlying economic vulnerability can, however, be questioned for subsistence economies which are often more resilient to weather extremes and climatic change than suggested by economic structure (Smith and Wishnie 2000). This underlying vulnerability, when combined with sensitivity to climatic changes, nevertheless raises the necessity for large-scale adaptation for the atoll countries.

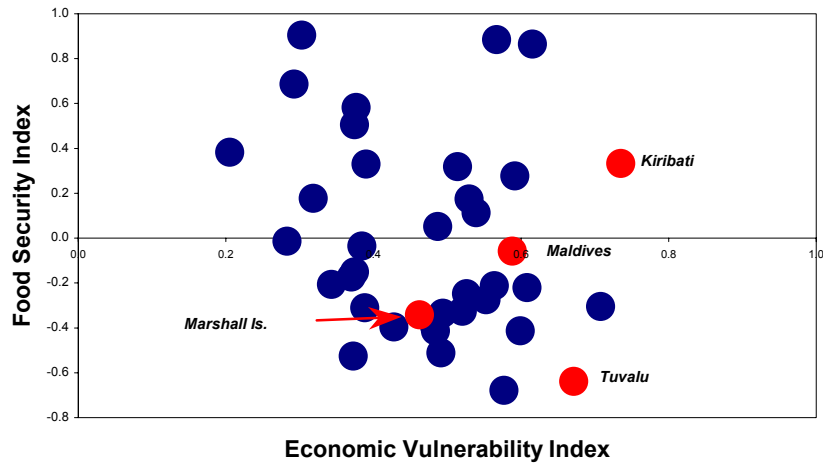


Figure 1. Economic vulnerability and food insecurity of small-island states and atoll nations.

Food security is a normalised weighted index comprising national food shortage (food availability per capita); household food poverty (GNP per capita); individual food deprivation (based on FAO data) following Downing (1992). The data are from FAO sources and include national food production and import per capita, GNP per capita, and calorific intake per capita. Economic vulnerability is an index constructed to comprise economic openness, the costs of remoteness and level of diversity in the economy. It is estimated in a normalised weighted index procedure of nine variables representing openness, remoteness and diversity, including export concentration and intensity, freight and insurance costs as a percentage of imports, proportion of net energy imports and dependence on overseas development assistance. Data are from UNCTAD and World Bank sources and the index follows the economic vulnerability index for small islands developed by the Caribbean Development Bank (Crowards 1999). Data not available for Tokelau.

The ‘commitment’ to climate change caused by greenhouse gases already present in the atmosphere means that sea-levels will rise by 5-12 cm by the year 2025, and a rise of 14-32 cm by 2050 is projected with a high level of certainty (Jones 1999). Their high ratio of coastline to land area, high population densities, and low level of adaptive capacity renders atoll countries the most physically vulnerable of all small island states to sea-level rise (Figure 2). It is not sea-level rise *per se*, but rather projected increases in sea-surface temperature that poses the greatest risk to atoll morphology. Raised sea surface temperature events cause coral bleaching and the death of reef and motu building corals. Without coral bleaching reefs would most probably be able to grow at a pace with rising sea-levels (Brown *et al.* 2000).

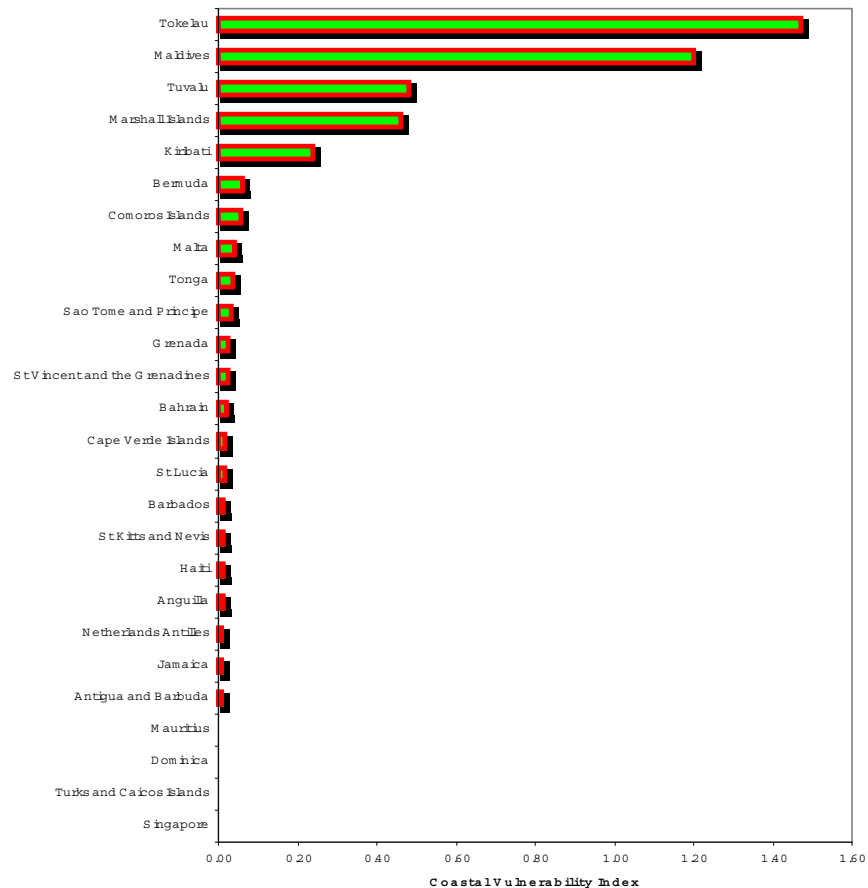


Figure 2. Vulnerability to sea-level rise of small-island states including atoll nations.

The index is comprised of coastline length divided by land area multiplied by population density to deliver a coastal vulnerability index (Gommes *et al.* 1998), GDP/capita is taken as an indicator of adaptive capacity and divided by the coastal vulnerability index to deliver the overall sea-level rise vulnerability index.

Sea-level rise and coral bleaching are mid- to long-term problems for atoll-countries. The more immediate problems are likely to arise from enhanced climatic variability and extreme weather events (McCarthy *et al.* 2001). The damages from these changes will be enhanced due to existing stresses caused by unsustainable development.

Water resources are likely to be increasingly stressed in the future through a shift to more intense rainfall events and possibly more intense droughts. In 2080 flood risk is expected to be in the order of 200 times greater than at present for Pacific atoll countries (Nicholls *et al.* 1999). Cyclones are likely to be more intense if not more frequent. Climatic variability is linked to El Niño Southern Oscillation (ENSO) events, and these may be becoming more frequent and intense as a function of climate change (Jones *et al.* 1999).

Artisanal fisheries are likely to decline as episodes of coral bleaching increase, and the availability of deep water fish may become increasingly variable as there is reasonable confidence that this is linked to ENSO events (McLean and Tsyban 2001). Agriculture is highly vulnerable due to increased heat stress on plants, changes in precipitation and soil moisture, salt water incursion from rising sea-levels, and increased damage from extreme weather events. In conjunction with the likely increased spread of

vector borne diseases and more frequent and severe extreme events, this greater food insecurity is likely to degrade human health in the Pacific region. Climate change will have substantial impacts on the economies of atoll-countries. The World Bank estimates that by 2050 Tarawa atoll in Kiribati could face an annual damages bill equivalent to 13-27% of current Kiribati GDP (World Bank 2000).

Ultimately, atoll environments may be unable to sustain human habitation, a possibility with even a moderate amount of climate change over the next century. Should low-probability yet high-impact changes occur, then this would almost certainly result in atolls becoming uninhabitable (McCarthy *et al.* 2001). Thus, IPCC Chair Robert Watson has said that low-lying small island states face “the possible loss of whole cultures” through the impacts of climate change (Watson 2000).

Dangerous Climate Change and Sustainable Adaptive Capacity

The potential impacts of climate change therefore suggest that the physical basis of national sovereignty – the right to self determination – is at risk. This represents a particular, political form of ‘dangerous’ change in terms of the ultimate objective of the UNFCCC to stabilise greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system. It is also a very clear case of environmental insecurity (Barnett 2001a).

The risk to atoll countries challenges the ability of science to predict and prevent dangerous thresholds of climate change (Jones 2000). The threshold of penultimate concern is that point at which atolls will no longer be able to sustain human habitation. Thus there is a need to engage in impact assessments that consider the full range of biophysical, social, and biophysical-social interactions at all relevant scales to understand the nature of thresholds, and to link these thresholds to levels of concentration of greenhouse gases. Methods designed for global and regional assessment such as general circulation models and integrated assessment models fail to capture the most important elements of impact and adaptation strategies on atolls. There is a need to explore empirically the effects of climate change at the local level, as well as to incorporate the culturally-specific adaptive capacity of diverse and potentially resilient societies (Kaluwin and Smith 1997).

The thresholds of dangerous climate change are, we argue, manifest in behaviour and risk as well as in physical parameters. So, for example, rates of international migration from atoll countries threatened with climate change may pass a critical threshold that constitutes danger for a society. This may arise through increasing dependency ratios, or social and cultural impacts of migration. Historical migration patterns from atoll countries in the Pacific and from other small island nations have been shown to contribute to the resilience of these societies when faced with stresses such as hurricane impacts (Paulson and Rogers 1997). Such migration also contributes to maintaining a sustainable resource base and social structure (Connel and Conway 2000). But ultimately a threshold may be reached which pushes the social system from sustainable international migration into complete abandonment due to resource scarcity on the islands, cultural unsustainability, or increased adverse effects from droughts or storm surges.

Atoll societies are faced with challenges to adapt to this risk. Many small island societies have proved resilient in the past to social and environmental upheaval (Bayliss-Smith *et al.* 1988). The key parameters of this resilience include: traditional knowledge, institutions and technologies; opportunities for migration and subsequent remittances; land tenure regimes; the subsistence economy; and linkages between formal state and customary decision-making processes (Barnett 2001b). But atoll

countries of the Pacific and small island states in general are increasingly integrated into the world economy primarily through commercial exploitation of their extensive Exclusive Economic Zones and through international tourism. Forces of globalisation, regional integration and national policy changes can interact with and effect adaptive capacity in important ways (O'Brien and Leichenko 2000).

The confidence of foreign investors, aid agencies and atolls people themselves in the ability of atolls to sustain future human occupation is important, and represents an important critical threshold. The threat of future serious climate impacts can undermine present sustainable resource use in three ways.

First, given the prospect of ultimate abandonment due to climate change, the optimal exploitation rate for renewable and non-renewable resources is to deplete to extinction. This unsustainable resource use creates a feedback that undermines ecological and social capacity to adapt to climate change. Second, should foreign investors and aid agencies believe that atolls will cease to be able to sustain human populations in the future, then investment and aid may cease to flow into atoll countries. The government of Tuvalu, for example, may well have undermined investor confidence by negotiating migration rights to New Zealand for up to half of that country's population in the event of serious climate change impacts. A decline in foreign investment and aid is likely to undermine sustainable development and capacity to adapt to climate change. A precursor of this possibility is the increasing withdrawal of insurance coverage for climatic extremes (Edwards 1999). Third, the institutions for collective action in resource management have been shown to break down when there are expectations of future resource degradation (Adger 2001a). This has been evident in tourism development in the Maldives where the tourism sector adopts a frontier resource use strategy, opening new atolls to tourism as the tourism life cycle seeks pristine beaches and waters. Such development is in effect the open access use of scarce resources and has been shown to lead to the deterioration of water quality as well as breaches in cultural carrying capacity (Brown *et al.* 1997).

Through these three processes, the end result of lost confidence in atoll-futures may be the end of the habitability of atolls brought about less by the physical impacts of climate change *per se*, and more by a common expectation of serious climate impacts leading to changes in domestic resource use and decreased assistance from abroad.

There are two implications of this issue of confidence thresholds for climate change research. First, the prevailing emphasis of research on vulnerability is conducive to a loss of confidence as it focuses on weaknesses and shortcomings rather than inherent strengths and opportunities (Campbell 1997). This can be avoided by framing research in terms of resilience rather than vulnerability. Second, the highest standards of uncertainty management are necessary. Estimates of serious change need to be subjected to a higher level of certainty given their potential effects on confidence, and extant uncertainties need to be clearly and forcefully stated. Shifting the emphasis of impact assessment to risk assessment with explicit quantification of uncertainties is therefore desirable.

Justice in Global Climate Policy

In climate policy research, debates over justice predominantly concern the equitable distribution of costs of climate impacts and emissions reduction measures. These are determined largely in economic terms informed by the assumption that there can be an optimisation of competing values. However, the risk of the loss of atoll-countries is incommensurable with economic optimisation in that there is no common measure by which to compare the value of atoll sovereignty and cultures with the monetary costs of climate change. To compare values to a common standard for the purposes of seeking an optimal solution implies all items of value are ultimately substitutable and losses can be compensated

(O'Neill 1993). Although technically possible, we argue that atoll-countries and cultures can never be satisfactorily compensated for the loss of their physical bases. The difficulties of sufficient compensation for loss of land and the cultural and economic impacts that ensue is evident in ongoing tensions over land rights and self-determination in post-colonial countries such as Australia and New Zealand, countries which are themselves likely hosts to any climate refugees from the Pacific atoll-countries.

The incommensurability of loss of rights within economic optimisation renders decision-making approaches problematic. Cost-benefit analysis applies more for micro-level decisions and requires standard metrics of value which are unavailable as the comparability between values cannot be sustained in this instance. To reduce the problem of lost atoll-countries into any such decision-making framework would be to fit philosophically incomparable values into inappropriately technical procedures (O'Neill 1993).

This is not to say the decision-analysis of the problem must be 'irrational', nor that choice is impossible. It is the latent recognition by some countries of the potential severity of impacts on atoll-countries that has given the small island states considerable leverage in negotiations over the UNFCCC. However, decisions on global climate policy must be made according to a higher formal conception of justice than the equitable distribution of costs. Various international treaties offer such a formal benchmark of justice.

There are both legal and philosophical pointers to what this justice entails. The Universal Declaration of Human Rights states simply that "everyone has the right to a nationality" (Article 15.1), and that "no one shall be arbitrarily deprived of his [sic] property" (Article 17.2). The United Nations Covenant on Civil and Political Rights states that "in no case may a people be deprived of its own means of subsistence" (Article 1.2). In the case of climate change's effects on atoll-countries, these basic rights are at risk, reinforcing the 'danger' that climate change poses to atoll-countries and cultures.

Theories of justice are implicit in such international laws and norms. For international decision-making on climate change, consideration of just actions depends on these existing laws and norms. Under theories of justice such as those proposed by Rawls, the explicit international rule would be that global decision making on climate change by nation states would adhere to the maximin principle – just actions minimise the impacts of climate change to the most vulnerable state (Rawls 1971, Adger 2001b). For sovereign states the possibility of extinction would constitute the greatest threat, and this is likely for perhaps five of the 181 states which are Parties to the UNFCCC. Even without this maximin principle, a radically different and just outcome would be arrived at if states negotiated under a 'veil of ignorance' whereby the 181 states in the UNFCCC would decide on 'dangerous climate change' on the basis of not knowing *a priori* which of the five out of 181 states would cease to exist. This would result in greater action than exhibited at present in the Kyoto Protocol negotiations. These philosophical underpinnings for climate justice are implicit in the negotiating position of the Association of Small Island States and carry some moral weight, though clearly not outweighing national self-interest which, as the 'veil of ignorance' exercise shows, obscures proper recognition of justice.

The constitutive principle of international relations – sovereignty – is itself problematised by the possibility of climate change extinguishing atoll-countries. Sovereignty is the right of political entities to be free from outside interference. It is an intersubjective construction, meaningful only because it is mutually recognised that states should not act in ways that interfere with other states. It is a founding principle of the Charter of the United Nations (Article 2.1), and is the core value underlying national

security practices. For all states to do less than everything possible to prevent the loss of a sovereign entity is to undermine this most essential and powerful norm of international law and politics.

Conclusions

Climate change puts the long-term ability of humans to inhabit atolls at risk. The potential abandonment of sovereign atoll-countries can be used as the benchmark of 'dangerous' change which the UNFCCC seeks to avoid, not least because such an outcome would be contrary to international standards of justice and human rights. The challenge for research is to identify the thresholds of change beyond which atoll social-ecological systems collapse and how likely these thresholds are to be breached. Existing techniques for assessing optimum climate policy responses are incapable of dealing with the risks posed to atoll-countries and cultures. This is, in effect, a call for sustainability science which seeks to promote social learning for just solutions to the consequences of climate change on diverse cultures and societies (Kates *et al.* 2001). The possible extinguishing of atoll-countries has yet to be sufficiently incorporated into UNFCCC negotiations. It calls for a higher conception of justice than simply a focus on the equitable distribution of economic costs of mitigation.

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