

GLOBAL WARMING AND THE SECURITY OF ATOLL-COUNTRIES

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It is now well established that the low-lying atoll-countries of Kiribati, Marshall Islands, Tokelau and Tuvalu are vulnerable to global warming. This article discusses the security implications of global warming for these countries and explores the political issues and policy responses at the global, regional, national and local levels of action. The atoll-countries have been very active in seeking to reduce global emissions of greenhouse gases through international fora. In conjunction with regional organisations, they have also been active in research and capacity building for adaptation to global warming. Despite remarkable progress, the atoll-countries are still unable to meet the challenges of climate change, largely due to outstanding shortfalls in research and policy implementation capacity.

Plus personne n'ignore maintenant que les atolls composant les Etats du Kiribati, des Iles Marshall, de Tokelau et de Tuvalu risquent d'être particulièrement affectés par les changements climatiques dus au réchauffement de la planète.

L'auteur analyse l'ensemble des implications que cela a entraîné pour ces Etats sur le plan de la sécurité civile et quelles ont été les solutions apportées tant au niveau local, national, régional et international.

Les petits Etats insulaires composés majoritairement d'atolls ont été extrêmement actifs auprès des organisations internationales pour tenter d'obtenir des Etats du reste du monde qu'ils réduisent leurs émissions de gaz carbonique à l'origine de la situation d'effet de serre que connaît la planète. Ces Etats insulaires du Pacifique ont aussi, avec l'aide des organisations internationales de la région, mis en place des programmes de recherches tendant à apporter des solutions concrètes aux conséquences liées au réchauffement de la planète. Il reste toutefois qu'en dépit de progrès non négligeables déjà obtenus que ces petits Etats insulaires, pour des raisons structurelles et de d'absence de vivier scientifique suffisamment étoffés, sont loin d'être en mesure de s'opposer de manière efficace aux conséquences des changements climatiques.

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I INTRODUCTION

It is now well established that low-lying atolls are particularly vulnerable to global warming. Global warming will herald changes in climate and rising sea-levels, and these will exacerbate existing environment and development problems in the Pacific atoll-countries of Kiribati, Marshall Islands, Tokelau and Tuvalu. Within 20 years there may be substantial declines in quality of life in these countries through reduced domestic food supply, increased prevalence of diseases, and increased damage from storms and flooding. In 50 to 100 years social pressures may intensify considerably as rising seas encroach on land and contaminate water resources, and as climate becomes more variable with more extreme events. These changes are likely to induce far greater demand for intra-country and international migration. If climate changes and sea-level rises are rapid and large, and if existing patterns of unsustainable development within the atolls continue, then ultimately atolls may become uninhabitable. Because sovereignty itself is at risk in this way, global warming is arguably the greatest of security risks to atoll-countries. Nevertheless, if the rate of changes are moderate, and with careful environment and development planning, the atoll-countries can most probably cope with global warming. Indeed, preparations are slowly under way. Importantly, the extent of the task depends on the extent to which worldwide emissions of greenhouse gases are reduced. To this end, the atoll-countries have played leading roles in the global politics of global warming. This chapter discusses the security implications of global warming for the Pacific atoll-countries. It introduces these countries, discusses the extent of their insecurity in the face of global warming, and works through the political issues and policy responses at the global, regional, national and local levels of action.

II THE ATOLL COUNTRIES

Atolls are rings of coral reefs which enclose a lagoon. Around the rim of the reef there are often low islets called *motu* which made of sediments washed up from the reef (Nunn 1994). Although marginal in terms of land-based food production, *motu* are able to sustain human life, largely due to the high productivity of the reefs. *Motu* are rarely more than four meters above mean sea-level, with an average height in the order of two meters. They are therefore prone to inundation due to short term rises in sea-levels such as spring tides, as well as from overtopping by large waves.

There are some 261 atolls among the South-west Pacific Ocean (Pernetta 1990). By country, the largest number of atolls (77) are found in French Polynesia, however this country also has 32 more elevated islands, lessening its overall vulnerability to global warming. The only Pacific Island Countries that do not contain atolls are the Commonwealth of the Northern Marianas, Guam, Vanuatu, Niue, Wallis and Futuna, Samoa, and Easter Island.

Four Pacific Island Countries — Kiribati, the Marshall Islands, Tokelau and Tuvalu — are comprised entirely of atolls. These are the only countries in Pernetta's "Category A" rating of susceptibility to damage from global warming, which he says may be "devastated" by global warming (Pernetta 1990: 23). There is general agreement among a wide range of scientists that these are the most vulnerable of all *countries* to climate change. Hoegh-Guldberg et al (2000) consider that of these four, Kiribati and Tuvalu are most vulnerable.

	Pop.	Population Density (people/km ²)	GDP (\$US)	GDP per capita	Human Development Index	Sovereignty Status
Kiribati	77,658 (1995)	112	59,000,000	702	0.515	Independent
Marshall Islands	58,000 (1997)	320	115,000,000	1882	0.563	Self governing (USA)
Tokelau	1,507 (1996)	154	—	—	—	Dependent territory (New Zealand)
Tuvalu	9,043 (1991)	381	12,700,000	1,157	0.583	Independent

Table 1: Selected information on the atoll-countries (after Kiribati Government 1999, RMI 2000, SPC 2000, UNCTAD 1999, UNDP 1999).

Although this paper focuses on these four atoll-countries, it is important to remember that what is being valued above all else in the statement — "*most vulnerable countries*" — is the potential damage, if not loss, to statehood. To be sure, this is serious and the concern for State integrity fits well within the ambit of traditional security discourse. However, to say that the loss of a country is in some way more significant than the loss of any particular atoll-based culture within any country is to make a moral judgement that States matter more than cultures, or that that national security is more important than human security. Nevertheless, there are good reasons why the focus is on the national-level in this way, notably because international action and discourses on global warming privilege States above all other actors, and will continue to do so for as long as global politics is dominated by nation-states.

Table 1 summarises key information on the four Pacific atoll-countries. It shows that there are substantial differences in their demography and development, as well as in their

political status. Indeed, the label "country" is inappropriate at least for Tokelau which is a dependent territory of New Zealand, but holds for the Marshall Islands, which is self-governing but in a Compact of Free Association with the United States. In as much as these are delineated political entities the label "country" is used in this chapter. Kiribati and Tuvalu are independent sovereign States. Kiribati, the Marshall Islands and Tuvalu are all members of the United Nations. As a dependent territory Tokelau is not eligible. The issue of association with metropolitan powers will become increasingly important as the effects of global warming increase, not least because it influences the opportunities of island people to migrate, but also because it may be influential in the provision of scientific, technical and financial assistance to help with adaptation to global warming.

Atoll-countries have very high population densities, although figures vary widely among sources and should be treated with caution. Densities can be as high as 32,000/km² as at Ebeye (Purdie 1999: 74). Population growth rates in all four countries are high and rural-urban migration is a common phenomenon, so the density of people living in the main centres is set to increase.

The gross domestic product of all four countries is low, and land-based agricultural production is restricted to a few crops. Kiribati and Tuvalu are official "Least Developed Countries" (LDC) in the United Nations system. Tokelau would certainly qualify for this category were it independent. The Marshall Islands is only slightly more "developed" than the most developed of the LDC's in GDP/capita terms, despite having a lower Human Development Index score than Tuvalu. This low level of economic wherewithal and associated low level of skills in modern engineering, planning and management means that atoll-countries have relatively little capacity to adapt to changes in climate and sea-level.

That these low-lying, relatively infertile and underdeveloped islands contain such dense populations explains why they are widely seen as very vulnerable to sea-level rise and increased climatic variability - the Malthusian spectre looms over all discussions of atoll societies (Connell 1993). As the following section explains this is true in many respects, but it is important to note that such a perception does not take account of the particular cultural and human-ecological context on atolls which differs substantially from continents and larger islands, not least because these populations are sustained from marine rather than terrestrial resources. Similarly, when assessed in terms of western capabilities, atoll-societies appear to have low adaptive capacity, yet there may be various indigenous institutions and skills which make the atolls less vulnerable than many commentators believe.

Atoll countries share a common set of environmental problems which, if unchecked, will render the islands more vulnerable to global warming (this discussion is based on Crawford 1992, Office of the Prime Minister of Tuvalu 1992, Toloa 1995, and Wilson 1994).

Two general forces drive these problems: rapid population growth and urbanisation; and development of natural resources to drive economic growth (Crawford 1992). Principal among these problems is the quantity and quality of freshwater. Water resources in atolls are restricted to a narrow lens of subterranean freshwater and rain storage tanks. Groundwater resources are susceptible to contamination from solid and human wastes including oil and insecticides, and from salt water. Freshwater lenses are rapidly depleted in times of low rainfall. Coastal erosion is also a problem as mining of beaches and coral for building materials, ad hoc construction of sea walls and poorly designed public infrastructure (such as causeways) affect changes in coastal systems. As populations are growing, becoming more urbanised and increasingly exposed to western lifestyles then problems of solid and biological waste disposal are becoming increasingly acute. There are no good places to dispose of wastes on highly populated atolls with porous soils and ecologically sensitive reefs. As well as contaminating freshwater resources, dumped wastes cause eutrophication and pollution of coastal waters, leading to reef deterioration and fish deaths. Finally, certain resources such as reef fisheries and soil are becoming increasingly depleted. In all the atoll-countries these problems are relatively unmanaged due to inadequate environmental planning, co-ordination, regulation and enforcement capabilities, which are in turn due to a lack of trained personnel and budgetary provision, and a low-level of environmental awareness among the general public.

III GLOBAL WARMING IN OCEANIA

The earth's climate is determined by the balance between incoming and outgoing solar radiation. The earth's surface absorbs much of the incoming solar energy, causing heating. This heat is re-emitted in the form of infrared radiation, some which goes back into space, but most of which is blocked by a blanket of *greenhouse gases* (IPCC 1996). This is known as the natural *greenhouse effect* which keeps the planet some 34°C warmer than it would otherwise be (Parry and Carter 1998). Since the industrial revolution around 200 years ago human activities such as the burning of fossil fuels (such as oil and coal), deforestation, agriculture and industrial production have increased the concentration of most greenhouse gases in the atmosphere. This thickens the greenhouse blanket so that more of the outgoing infrared radiation is trapped, thereby increasing warming of the earth's surface. This is known as *global warming*, the *enhanced greenhouse effect*, or simply *climate change*. As a consequence, the process of redistributing heat from the equator to the poles becomes more vigorous, leading to changes in atmospheric and oceanic circulation, weather patterns, and the hydrological cycle.

Carbon dioxide is responsible for approximately 64% of the enhanced greenhouse effect (Parry and Carter 1998). Most scenarios suggest that CO₂'s share of the enhanced greenhouse effect will increase in the future (IPCC 2001a). So, controlling emissions of CO₂ is the key to controlling climate change. Approximately 78% of CO₂ comes from burning

fossil fuels, particularly coal and oil, with deforestation and land use changes accounting for 22% (Jepma and Munasinge 1998). Carbon is taken up by the oceans, plants and soils, but the ability of these *sinks* to absorb all carbon is exceeded by the present rate of emissions, with the excess — about half of all emissions at present — accumulating in the atmosphere (IPCC 2001a).

Measurements of global average surface temperature show a warming of approximately 0.6°C in the last 100 years, with the 1990's most likely to have been the warmest decade — and 1998 the warmest year — on record (IPCC 2001a). Further, global sea levels rose by between 10 and 20cms over the past 100 years and this appears to be related to temperature increases (IPCC 2001a). Natural causes alone do not account for these changes, leading the Intergovernmental Panel on Climate Change to declare that "emissions of greenhouse gases and aerosols due to human activities continue to alter the atmosphere in ways that are expected to affect climate", and that "global average temperature and sea level are projected to rise" (IPCC 2001a: 3 and 8).

Climate scientists develop scenarios which describe possible future states. The most recent scenarios suggests mean sea-levels are likely to rise between 9 and 88cms by the year 2100, a rate at least twice as fast as that experienced over the past 100 years (IPCC 2001a). Although now reluctant to talk in such terms, the former IPCC "best estimate" of the rise in sea level by 2100 is 50 cm (IPCC 1996). An increase in global mean surface air temperature of between 1.4 and 5.8 °c by 2100 is also described by the scenarios (IPCC 2001a). The "best estimate" of temperature increase by 2100 is 3°C (reported in Burns 2000). To put this in perspective, even a 1°C rise would be larger than any century-time-scale rise over the past 10,000 years (UNEP 1999).

IV IMPACTS ON ATOLL COUNTRIES

The possible impacts of climate change are derived from complex general circulation models (GCMs) which make projections at the global scale. The spatial resolution of these GCMs is presently too coarse to make confident projections of the impacts of climate change on small spaces such as the islands. While there is substantial uncertainty, a general consensus about the possible impacts of climate change on the Pacific Islands is emerging (Barnett 2001a). The IPCC has consistently identified coral reefs and atolls as natural systems most at risk from climate change and sea-level rise (IPCC 1996, Nurse et al 1998, IPCC 2001b).

Average sea-level across the Pacific region has been rising at an average of 2mm per year for the last 50 years (Hay 2000: 272). It has been estimated that, given emissions of greenhouse gases up to 1995, a 5-12cm rise in sea-level by the year 2025 is inevitable, and a sea-level rise of 14-32cm by 2050 is very likely (Jones 1999). Even a 32cm rise in sea-level

has serious implications for the continued viability of ecological and social systems on low-lying coral atolls (Teuatabo in Pearce 2000).

Temperature records for the region show an increase in mean surface air temperature of between 0.3-0.8°C per decade this century (Nurse and Sem 2001). Scenarios for the region suggest that temperatures will increase at a rate less than the expected global trend, with an annual warming of some 2.1°C by 2050 being projected by climate models (Nurse and Sem 2001).

Model results suggest that there will be only small changes in *mean annual* rainfall across the region; however, the *intensity* of rainfall events is expected to increase by some 20-30% over tropical oceans (Jones et al 1999). There is therefore grounds to consider that flooding events will increase in frequency and intensity in the future, particularly when combined with rising sea levels and more intense storms and storm surges (IPCC 2001b). Indeed, Nicholls et al (1999) suggest that by 2080 the flood risk for people living on islands will be 200 times greater than in a situation where there was no global warming. Overall, it is expected that changes in precipitation patterns will place considerably greater stress on water resources in the region including more frequent droughts, and may enhance the spread of vector borne diseases such as malaria and dengue fever (Meehl 1996, Nurse and Sem 2001).

There is no conclusive evidence to suggest how global warming will influence the ENSO phenomenon. While not proven to be a function of climate change, it is noteworthy that there have been more frequent and intense El-Nino events since the 1970's (IPCC 2001a). There were five successive El Nino events between 1991 and 1995, and a severe El Nino again in 1997/8 with associated drought in the Marshall Islands. The effect of global warming on cyclone activity is also uncertain. Some research suggests that there is unlikely to be any change in the frequency of tropical cyclones, but they may be some 10-20% more intense, creating potentially catastrophic impacts from waves, storm surges and wind (Jones et al 1999).

Global warming may have negative impacts on agriculture and fisheries in atoll-countries. Agriculture is thought to be highly vulnerable due to increased heat stress, changes in precipitation and soil moisture, salt water incursion from rising sea-levels, and increased damage from extreme events. Growth gains from increased atmospheric CO₂ are negligible for most tropical plants, so crop yields in the tropics are likely to decrease overall (IPCC 2001b). Food security in the region is therefore likely to become less predictable, particularly if coastal zones are degraded and associated artisanal fisheries are depleted. It is now thought that changes in atmosphere-ocean regimes affect seasonal abundance and distribution of deep-water fisheries, further enhancing uncertainty about food availability in the future (IPCC 2001b). 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 region.

Coral reefs are crucial to the formation and maintenance of coastlines in most Pacific Islands and they are an essential resource for economic and subsistence activity. Coral reefs are highly sensitive to sudden changes in sea surface temperature, as indicated by large scale bleaching episodes during the intense 1997 El Nino event (Hoegh-Guldberg et al 2000). Expected higher levels of CO₂ in sea water may also suppress coral growth, which, in conjunction with anticipated increases in bleaching episodes and increased human-induced pressure on reefs, suggests that the region's coral reefs are highly endangered. Coastal mangrove communities are also vulnerable to climate change and sea-level rise, as are seagrasses and wetlands (Nurse et al 1998). If reefs fail to grow and sea-levels rise, coastal erosion on atolls will increase, flooding events will increase, freshwater reserves will become increasingly contaminated, and food from agriculture and artisanal fishing productivity will substantially decrease. Ultimately these factors may mean that some atolls are unable to sustain present numbers of people — if any people at all — raising the prospect of intra-country and international migration.

The effects of global warming will have substantial impacts on the economies of atoll-countries. The World Bank (2000) estimates that by 2050 Tarawa atoll in Kiribati could face an annual damages bill of US\$8-16 million (some 13-27% of current Kiribati GDP), with up to US\$430 million of capital at risk from inundation. Infrastructure damage is not just an economic problem but also a governance problem. In the Marshall Islands just one area — the Jaroj-Wulka-Telap area at Majuro — is both the commercial and government centre of the country, housing some 15,000 people, the government, water and power plants, two ports, a hospital and a community college; severe erosion or storm damage there would have massive repercussions for the country as a whole (Holthus et al 1992).

At present, sea level rise is considered to be a mid- to long-term problem for Pacific Island countries. The more immediate problems are likely to arise from enhanced climatic variability and extreme events, including: changes in rainfall regimes, winds, waves and soil moisture; short term variations in sea level; droughts; floods; and more intense cyclones (Burns 2000, IPCC 1998, Nurse and Sem 2001). These changes will be more damaging due to existing stresses caused by unsustainable development.

V ENVIRONMENTAL SECURITY

The word "security" comes from the Latin root meaning "lack of care" (Dower 1995). Security is: "1. the condition of being protected from or not exposed to danger; safety. 2. freedom from doubt..... 3. Freedom from care, anxiety or apprehension; a feeling of safety" (Little et al 1973: 1927). Security applies to different objects such as the nation, human beings, and finances. It also applies to different risks such as stock market crashes and

earthquakes, and different threats, such as rape or military invasion. Global warming is a national security threat to atoll-countries in so far as a worst-case scenario suggests that whole atolls and perhaps States may be substantially if not entirely depopulated (see Edwards 1996 and 1999). However, long before evacuation the socio-economic impacts of global warming may be "so profound that they dwarf any strategic issue currently confronting a major peacetime economy" (Hoegh-Guldberg et al 2000: 4).

A popular theme of the environmental security literature is the possibility that environmental change will induce violent conflicts within and among countries. For the most part this is a more theoretically than empirically driven subject motivated by Northern theoretical and strategic interests than the reality of environmental degradation (Barnett 2001b). Regardless, there is minimal likelihood of inter-island-state violent conflict as a consequence of global warming in the Pacific, not least because only Papua New Guinea and Fiji have armed forces and their offensive capabilities of these are extremely limited, but also because there are a substantial number of regional institutions through which regular and substantial dialogue on security matters takes place. However, it is theoretically possible that within the atoll-countries global warming may contribute to violence as increasing environmental pressures and migration may exacerbate existing sources of tension. Nevertheless, these additional factors do not in themselves justify predictions of violence as it takes more than a list of environmental pressures to explain an environmentally-induced conflict (Barnett 2000). Crocombe (2000) is probably correct to say that if reducing the likelihood of environmentally-induced violence is the highest priority, then tackling the underlying tensions and disparities will be the most effective strategy. In any event, focussing on the implications of global warming for violence is to totally miss the far more substantial problem of its impact on *human* security in the atolls.

Although there is merit in the idea that environmental degradation threatens national security – and nowhere is this more clear than in the case of climate change and atoll-countries – this article prefers to place a greater emphasis on people. Thus, environmental security is defined here as *the process of peacefully reducing human vulnerability to human-induced environmental degradation by addressing the root causes of environmental degradation and human insecurity*. So conceived, environmental security is as relevant to development policy as it is to security policy. What matters most, then, is the way global warming may degrade the quality of the lives of atoll-people.

The concept of environmental security has value as a means to elevate certain environmental problems beyond ordinary policy problems to become national security issues. This is intended to mobilise policy in a way commensurate with other security threats such as war. It therefore puts environmental problems into a distinctly political frame of reference. The problem with such a tactic is that all environmental problems can potentially be written as "security" problems, and so some criteria for distinguishing

among environmental problems as security problems is necessary. To this end there are six parameters for identifying an environmental problem as a security issue: the spatial scale of causes and effects; the magnitude of possible impacts; the temporal scale of possible impacts; the reversibility of impacts; the measurability of factors and processes; and the degree of complexity and connectivity (after Dovers 1995; see also Barnett and Dovers 2001). On this criteria, global warming registers as an environmental security issue: it is global in scope; its impacts are by most estimates likely to be very severe on all scales of social organisation; it is a long-term, potentially "runaway" issue which is not reversible except in the very long-term; and the degree to which it is connected to other problems is probably higher than with other contemporary issues, making it complex and difficult for political and economic systems to deal with.

Given that global warming is a security issue for atoll-countries, it is appropriate to see their actions to ensure that emissions of greenhouse gases are reduced, and to prepare to adapt to environmental changes, as in essence security policies. As a global problem with serious implications for atoll-people, the environmental security dynamic of global warming includes global, regional, national and sub-national levels of action. It is to these actions that the discussion now turns.

VI ATOLL STATES AND THE GLOBAL POLITICS OF CLIMATE CHANGE

Global warming is a problem for which atoll-countries bear little responsibility, but are at disproportionate risk. In terms of per capita emissions of CO₂, atoll people emit less than one quarter of the global average, yet they are particularly vulnerable to climate change and rising sea levels (Hay 1999). There is a strong element of injustice in that as the wealthy economies have developed they have and continue to emit large amounts of greenhouse gases, and this development simultaneously enhances their capacity to manage the effects of climate change. Conversely, the development of atoll-countries will be hindered by the climate change caused by these emissions. As a consequence of these differentials in responsibility and capacity, developed countries conceive of climate change as an *adaptation* problem, whereas atoll-countries conceive of it as a *security* problem.

Because global warming is a security issue for atoll-countries, the United Nations Framework Convention on Climate Change (UNFCCC) can be seen as a security treaty. Indeed, in so far as failure to achieve its goals potentially spells the extinction of several sovereign atoll-countries, the UNFCCC is arguably the most important environmental security treaty in the world. Adopted in May 1992, the UNFCCC entered into force on March 21 1994, and has now been ratified by 184 countries including Kiribati, the Marshall Islands and Tuvalu. Its ultimate objective is the "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" in a time frame "sufficient to allow ecosystems to

adapt naturally.. and to enable economic development to proceed in a sustainable manner" (Article 2).

Since the UNFCCC entered into force there have been six meetings of its supreme body — the Conference of Parties (COP). At the third Conference of Parties (COP-3) in 1997 the Kyoto Protocol was adopted. The Kyoto Protocol is a supplement to the UNFCCC. It sets legally binding targets for greenhouse gas emissions on 38 developed and 'economies-in-transition' countries. In aggregate these emissions reductions equal a 5% reduction of the main greenhouse gases below 1990 levels (but not for Australia — see below). While this reduction will do little but temporarily slow the growth of greenhouse gas concentrations, it is nevertheless a critical first step towards tackling climate change. The Kyoto Protocol has yet to enter into force. Kiribati, Tuvalu and Marshall Islands have signed the Protocol, and the first two have also ratified it (of a total of 31 ratifications overall). Articles 4.4 and 4.8 of the Convention and Articles 3 and 12 of the Kyoto Protocol all recognise the special vulnerability of small islands states with respect to climate change, conferring some leverage in negotiations.

Following the logic of seeing global warming as a security problem, the Alliance of Small Island States (AOSIS) can be viewed in effect as a security organisation. AOSIS has a membership of 43 States and observers, including Kiribati, Marshall Islands and Tuvalu, each of which is a particularly active member. It functions as a lobby and negotiating body operating within the United Nations system. AOSIS has been an effective voice for small island states, and without it the Framework Convention and Kyoto Protocol would undoubtedly have been weaker (Shibuya 1997). AOSIS is guided in its efforts on global warming by clearly stated principles, including the principle of preventative action, the precautionary principle, the polluter pays principle, the duty to co-operate and the principle of equity. AOSIS is seeking strong emission-reduction commitments, strong monitoring and compliance measures in the Convention, and assistance for adaptation to the adverse effects of climate change. Its efforts are hampered by other parties to the Convention, particularly the "JUSCANZ" countries (Japan, United States, Canada, Australia and New Zealand), who continue to obstruct progress towards implementation of the Kyoto Protocol. In this sense not only do these countries generate insecurity through their emissions, they actively impede the realisation of security for atoll-countries.

At all six of the conferences of parties to the UNFCCC, Kiribati, Marshall Islands and Tuvalu have had a disproportionate impact. They have experienced and skilled negotiators in Nakibae Teuatabo, Yumie Crisostomo and Seluka Seluka respectively, all of whom have detailed knowledge of the intricacies of the UNFCCC and are vocal in their defence of their country's interests. But perhaps more than any other Pacific Islander, former Tuvalu Prime Minister Bikenibeu Paeniu played a leading role in promoting the cause of Pacific atoll-

countries on the global stage with his high media profile and constant petitioning of G7 countries to reduce their greenhouse emissions (see Leggett 2000).

It is difficult to gauge the success of the lobbying and negotiating activities of the atoll-countries and AOSIS. At present the Kyoto Protocol is a long way from entering into force, and until such time emissions of greenhouse gases are likely to increase, and global warming will continue. However, that there *is* a UNFCCC and a Kyoto Protocol is in no small way testimony to the ability of the small island states to have their case heard and to present solutions. On the issue of assistance from the international community to help the small island states adapt to future climate variations and sea-level rises AOSIS has had partial success through the Global Environmental Facility, but a formal mechanism established in accordance with the UNFCCC has yet to be developed. The biggest obstruction here is from OPEC countries who seek payment of compensation for (hypothetical) lost oil revenues, and who will not accede to transfers of technology and financial assistance for small island states until developed countries agree to the principle of compensation. Until such time as arrangements to transfer technology and finance are made, the atoll-countries must make do largely with their own limited resources in conjunction with a few regional and bilateral initiatives.

VII ATOLL STATES AND THE REGIONAL RESPONSE

Pacific Island countries have a history of pooling their scarce resources to address common problems in a cost-effective manner. As a result, there are a substantial number of regional institutions through which regular and substantial dialogue on global warming can and does take place. In terms of security, the most important of these bodies is the Pacific Islands Forum, which meets every year. The Forum understands climate change as a potential security problem, but more in terms of threats to sovereignty rather than conflict potential. Its 2000 communiqué noted:

"the issues of climate change, climate variability, sea level rise and environment protection continue to be of major concern to the Forum region. Leaders further reiterated their deep concerns about the adverse impact of human-induced climate change, natural climate variability and sea level rise on all Pacific Islands, especially low-lying atolls. Leaders also recognized the importance of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol which provided a significant first step forward on the path of ensuring effective global action to combat climate change" (Pacific Islands Forum 2000).

Other organisations involved with global warming include the South Pacific Regional Environmental Programme (SPREP), the South Pacific Commission (SPC), the Forum Fisheries Agency (FFA), and the South Pacific Applied Geoscience Commission (SOPAC).

SPREP has been pivotal in nearly all global warming initiatives in the region. The most important initiative has been the ongoing Pacific Islands Climate Change Assistance Programme (PICCAP), administered by SPREP with support from the United Nations Development Program and the Global Environment Facility. PICCAP is a successful model of "capacity building", having implemented climate change country teams in ten Pacific Island Countries including Kiribati, Marshall Islands, and Tuvalu. Each country has submitted a National Communications to the UNFCCC. The country teams act as focal points for climate change activities and are comprised of representatives from an array of ministries and emergency management agencies. They serve as the primary locus of global warming policy-making and implementation. SPREP was also instrumental in the negotiation of the "Pacific Island Framework for Action on Climate Change, Climate Variability and Sea Level Rise", approved at the Pacific Islands Forum conference in 2000 (SPREP 2000). This meta-policy document will focus and guide all climate change-related science and policy in the region for the foreseeable future.

As global warming affects changes in the places where people live, it may induce intra-country and international migration. In the first instance, people may move to more developed atolls within their countries in search of wage labour as a substitute for increasingly difficult subsistence lifestyles on outer islands. Ultimately, more people, coastal erosion, flooding, contaminated water and decreasing food availability may mean that people wish to, or are forced by necessity to leave their countries. This presents substantial challenges to the region. A policy to minimise the cultural and psychological trauma associated with such migration would favour migration to other Micronesian (in the case of Kiribati and the Marshall Islands) or Polynesian (in the case of Tokelau and Tuvalu) countries — assuming, of course, that there is more cultural compatibility among these people than there is, say, amongst I-Kiribati and Australians (see O'Collins 1990). However, this might merely induce a further wave of ecological refugees as increased populations exacerbate environmental change in host islands. Instead, migration is likely to be to metropolitan countries with existing populations of Pacific Islanders, notably Australia, New Zealand and the United States. This will require some planning on the part of these countries. Understanding existing migration pathways is important (Bedford 2000).

The issue of relocation is extremely sensitive, but is regarded differently among the atoll-countries. The Marshall Islands publicly rejected the topic during interviews at the sixth conference of parties in 2000 (Fraser 2000), and Kiribati has consistently refused to consider it, with Teuatabo saying: "I think of emigration as being the stage where you know you're losing the battle. We're nowhere near that" (in Pearce 2000). However, Tuvalu is far more willing to discuss the issue, with then Prime Minister Ionatana Ionatana visiting New Zealand in June 2000 seeking a promise of greater access for his people should the

need arise. Indeed, as long ago as 1989 the issue of easing restrictions on the immigration of Tuvaluans to New Zealand was being discussed (Lewis 1989). The four atoll-countries differ in the access available to their citizens. People in Tokelau have easy access to New Zealand, and, through the Compact of Free Association, Marshall Islanders have some access to the U.S. (although restrictions have increased in recent years). By contrast, Tuvalu and Kiribati have no immediate metropolitan patron, although after Ionatana's visit in 2000 New Zealand has said it would welcome Tuvalu citizens should they be required to leave their homelands. It is the I-Kiribati, then, who remain most unprepared should the need for large scale emigration suddenly arise.

One of the few resources that atoll-countries have is a large Exclusive Economic Zone (EEZ). These extend from 200 nautical miles beyond a country's outermost islands and "drying reefs" (Article 47 of the United Nations Convention on the Law of the Sea — UNCLOS). An EEZ confers sovereign ownership over the fisheries and sea-bed mineral resources. Kiribati and Tuvalu, in particular, earn income from license fees paid by foreign fishing operations in their EEZs. There is also considerable potential for income derived from mining sea-bed manganese nodules. In a situation where sea-level rise may wholly or partially subsume outer islands and reefs, questions arise as to the status of an atoll-country's EEZ. Construction of artificial islands to maintain the criterion of "island" or "dry reef" is potentially not permitted under UNCLOS, as Article 60.8 states that "artificial islands, installations and structures do not possess the status of islands. They have no territorial sea of their own, and their presence does not affect the delimitation of the territorial sea, the exclusive economic zone..". There are thus substantial uncertainties about the way sea-level rise will affect atoll countries' EEZs. These need to be resolved as a matter of priority for atoll-countries.

There are acute tensions between the Pacific Islands and Australia on the subject of global warming. On a per capita basis Australia is one of the largest emitters of greenhouse gases in the world, while the atoll-countries are among the very lowest. With a large continental land mass and a highly developed and wealthy economy, Australia will be able to adapt to global warming with minimal suffering, whereas the atoll-countries and their cultures must contend with the risk of extinction. While Australia is very much responsible for the problem of global warming, it appears very able to cope with its effects, whereas the atoll-countries' responsibility is negligible yet they are highly vulnerable to the effects of global warming. Australia has consistently sought to avoid reducing its emissions of greenhouse gases by downplaying the severity of global warming, seeking loopholes and soft options in the Kyoto Protocol, and arguing that it will be particularly adversely effected by emission reductions measures. An integral part of Australia's strategy is to downplay the gravity of the problem of global warming, and this entails questioning the unique and pressing concerns of atoll-countries. Thus at a time when

regional leadership and support is required from Australia, the atoll-countries can scarcely gain recognition for their particular vulnerability. Australia's highly political agenda casts doubts over the integrity of government-funded research in the region, including the Ausaid-funded South Pacific Sea-Level and Climate Monitoring Project which has been more high-tech than capacity-based, has created confusion amongst certain islands, and whose Director has at times lacked diplomacy in dealing with certain countries (see *Pacific Islands Report*, February 22 and 25 2000).

These tensions surfaced at the 1997 South Pacific Forum meeting in Rarotonga which occurred in the lead-up to the negotiation of the Kyoto Protocol. Australian Prime Minister John Howard belligerently refused to support an intended Forum communiqué supporting binding uniform emission reductions as an outcome of the Kyoto meeting. Howard argued that Australia should be allowed to increase its emissions by 18% above 1990 levels, as opposed to the AOSIS proposal of a 20% reduction (Australia was to ultimately secure what its Ambassador for the Environment recently called a 108% "reduction" as its Kyoto target). John Howard's stance and demeanour at the 1997 Forum ruptured the meeting, with Tuvalu Prime Minister Bikenibeu Paeniu calling for more "respect" from Australia, and Nauru President Kinza Clodumar questioning Australia's right to belong in the Forum given its disregard for island issues (in Fry 1999, Hussein 1997). Since this time Australia has consistently pushed for various policies and measures to be included in the Protocol which would substantially reduce their commitments to reduce emissions. Among these policies, Australia is seeking a mechanism that would allow them to plant trees in other countries to absorb carbon, the credits for which would be deducted from Australia's own emissions budget. Australia has sought to induce the larger Melanesian countries into this scheme both to generate some legitimacy for its particular position, but also to break the solidarity of the Alliance of Small Island States. This struggle was most recently played out at the Pacific Islands Conference on Climate Change, Climate Variability and Sea-Level Rise in April 2000 (for a report see Barnett 2000c). Australia impedes finalisation of the policies and measures necessary to implement the Kyoto Protocol by insisting on such policies and measures despite their rejection by European countries and all developing countries. In these negotiations AOSIS, and in particular Tuvalu, are very active in exposing and countering Australia's position. Australia therefore not only continues to contribute to the greatest long-term security risk the atoll-countries face, it continues to obstruct progress on the treaty that would see emissions reduced and it seeks to undermine the capacity of its small island neighbours to act at the international level. In this respect Australia can be described as an agent of environmental *insecurity* in the region.

VIII NATIONAL POLICY AND POLITICS

It is the governments of atoll-countries that are most responsible for managing the environmental security risks of global warming. As a result of PICCAP and its implementation of national country teams, the atoll-countries (except Tokelau) are now substantially better positioned to manage the risks of climate change. Nevertheless, for all the research, policy advice and dialogue that comes from regional organisations, implementation of action must come from their member countries. To this extent, while PICCAP has established frameworks of action and built up national capacity, there has been almost no actual implementation of policies at the national level either to reduce emissions, but more importantly to facilitate adaptation to climate change and sea-level rise (Kiribati Government 1999, RMI 2000).

More than other policy problems, uncertainty confounds all planning for adaptation to global warming. Even for those impacts which are reasonably expected to occur, their precise magnitude, timing and location is uncertain. These basic uncertainties are compounded by limitations in knowledge about individual ecosystems, patterns of causality and interaction between ecosystems, and patterns of causality and interaction between social and ecological systems. Such substantial gaps in knowledge make predicting atoll systems' responses to global warming highly speculative. For the purposes of national policy, governments are faced with the prospect of investing scarce resources in expensive solutions to meet impacts which may not materialise and whose magnitude is uncertain (uncertainty of impact), even assuming that such solutions will be effective should the impact eventuate (uncertainty of effective solution). Moreover, in addition to uncertainty about what is reasonably expected to occur, atoll-countries must also prepare for unforeseen effects (surprises). Thus policies must be made to mitigate risks despite substantial uncertainties.

There is no "right" solution for the management of uncertain future possibilities and surprises. The traditional approach of policymakers is to anticipate problems and design responses; however, this always runs the risk of regret (Barnett 2001a). An alternative approach is to develop a society's general capacity to cope with any forms of change by building up its institutional structures and human resources, as these are the first and last requirements of a system able to absorb, learn from, and modify itself to changes (Barnett 2001a, Folke et al 1998). This is the essence of sustainability, especially as defined by Dovers as "the ability of a natural, human, or mixed system to withstand or adapt to, over an indefinite time scale, endogenous or exogenous changes" (Dovers 1997: 304). The importance of building up capacity and sustainability is reflected in the inclusion of a chapter on Sustainable Development and Equity in the IPCC Third Assessment Report (2001).

A further challenge for the atoll-countries is to keep up with their commitments to the UNFCCC. This is vitally important as the UNFCCC is the only mechanism whereby emissions can be reduced, the rate of climate change and sea-level rise slowed, and environmental security procured. Keeping faith with the UNFCCC is no easy task for the atoll-countries, and it is UNFCCC-related tasks, particularly the National Communications, that have occupied almost all of the PICCAP officers' time. Attending UNFCCC and IPCC meetings is expensive and time consuming. In most developed countries a team of full-time professionals is devoted solely to UNFCCC negotiations, with other teams conducting reporting and compliance functions, and with yet more people devoted solely to adaptation measures. In the atoll-countries all of these functions are the responsibility of one small team. As a result, adaptation issues are often put aside in favour of the more immediate tasks required to maintain faith with the UNFCCC. National teams are thus caught between their commitments "up" to the UNFCCC and "down" to local people. This is also true for SPREP. In practice this means that the needs of local people have yet to seriously enter national climate change planning. In short, despite their impressive efforts, the policy demands of securing against climate change are presently beyond most Pacific Island countries.

Global warming is likely to enhance rural to urban migration in the atoll-countries, placing added social and environmental stress on places which already have very high population densities. This has substantial implications for land tenure and raises the need for the difficult task of land tenure reform. There are lessons to be learned from similar episodes of migration in the atoll-countries, including the relocation of people from Bikini, Enewetak and parts of Kwajalein in the Marshall Islands due to U.S. weapons testing, and the relocation of the Banabans from Ocean island to Rabi island in Fiji (O'Collins 1990). Such intra-national migration is more likely in the first instance than international migration, and will probably for the most part be incremental in response to slow environmental changes. However, intra-national migration may also take the form of sudden moves, following extreme events which may heighten desires to migrate or which may require temporary evacuation of refugees who may then choose not to return to their home islands. As in the case of international migration such shifts will cause social and cultural disruptions, although perhaps less so than migration to larger Western countries.

The success of PICCAP proves that capacity to manage climate change can be successfully developed in the atoll-countries. However, much more work is necessary as outlined by SPREP (2000) and the national communications of Kiribati, the Marshall Islands and Tuvalu. The atoll-countries still lack the capacity to implement and monitor environmental policies. This is not a problem of designing good policies, but a problem of having sufficient numbers of trained personnel and adequate financial resources to make policies work. Also of importance is the need for further capacity to initiate and conduct

research to meet domestic policy needs. Thus far research has largely been *of* the atolls conducted *by* scientists from metropolitan countries, with varying but generally little involvement of indigenous people and researchers. This prevailing Western-led approach has been far removed from local experiences and expectations, leading to substantial failures to inform local policy (Teuatabo 1997). Such research also tends to see results and data concentrated in foreign institutions and it is often difficult for atoll-based researchers and policymakers to gain access to data concerning their own countries (Barnett 2000c). In the future it must be Pacific Islands themselves who control and conduct research. This changes the task for metropolitan donors, who must not so much set the terms for research but rather respond to the needs established by the region itself. This entails relaxing the implicit condition placed on aid. It should not be forgotten, though, that the most important task for these more developed countries is to reduce their own emissions of greenhouse gases.

IX THE LOCAL LACUNAE

The effect of global warming on atoll-countries will be the product of its impacts on local communities. It is at the local level where policymakers most need to understand the likely impacts of global warming and to plan for adaptation. However, little is known about the vulnerability of people at the local level, and there has been little planning in this regard.

Because it is the collective ability of local communities to sustain themselves that will ultimately determine the overall impact of global warming on the atoll-countries, the problem requires detailed consideration of local social systems. Thus far such consideration has been lacking (Barnett 2001a). Consistent with this need for more local level studies, there is also a need for more in-depth assessments over longer time periods. Improving these dimensions of climate research will require a substantial effort, but it is an exercise which, with a moderate level of assistance, local people can ideally undertake themselves.

It is now well established from cases from other developing countries that the most environmentally insecure are those who are already affected by poverty and are marginalised from resources, as these people have little to draw on in times of stress (Adger 2000, Blaikie et al 1994). Assessing local people's vulnerability in the first instance requires ascertaining their material wealth and access to resources in conjunction with their location (Adger 1999). For example, low-income people who have recently migrated to a drought-prone area are most probably more vulnerable to the impacts of climate change than wealthy people living on a water-rich motu. However, assessing human insecurity to climate change is more complex than this as a range of non-material factors also determine vulnerability, including: opportunities to relocate, the extent to which food and income sources are diversified, the quality of social networks and systems of

redistribution, the ability to learn, the ability to transmit knowledge across space and time, and the ability to collectively negotiate responses (see Blaikie et al 1994, Folke et al 1998).

While there is little doubt that atoll peoples are vulnerable to climate change, there may well be substantial intrinsic resilience as well. If it is acceptable to generalise across all atolls in this way, some general features of atoll life suggest resilience. First, there is a relatively high degree of reciprocity among people, communities, and neighbouring islands, especially in non-urban areas (Connell 1993). This facilitates the kinds of exchanges of materials and information that assists in coping with surprises. Second, atoll communities have a long history of exposure to short-term environmental perturbations, and have various strategies that enable learning and adjustment (see Hooper's 1980 account of cyclone impacts on Tokelau). Third, there is still some degree of traditional ecological knowledge and the prospects for building on traditional resource management institutions are good (Overton 1999). For environmental security, all of these potential strengths should be preserved, and it is of concern that general development trends appear to be undermining many of them (Seluka 2000). A comprehensive environmental security policy would seek to better understand these intrinsic strengths and implement programmes that build on them.

That there is some ground for considering that atoll societies can manage global warming raises particular problems with the widespread and unquestioned assumption that they are *vulnerable*. Continually describing atoll people as "vulnerable" and by implication "weak" and "powerless" runs the risk that the people themselves may believe this to be true (Campbell 1997). In a broader sense this can create a climate of no confidence, leading to a depreciation of the future and therefore more intense (less sustainable as the time-horizon shortens) resource extraction and no investment in long-term developments (see Edwards 1996 and 1999). There is little evidence of such problems thus far, but the emphasis on vulnerability is destroying confidence in the future of atoll-countries. In this regard, at least, the policy makers in the atoll-countries must take some of the blame themselves.

X CONCLUSIONS

Global warming poses substantial risks to atoll-countries and their peoples. The magnitude of possible loss is such that climate change can indeed be considered a "security" issue. The security challenge for the atoll-countries is large; however, the precise extent of the challenge depends critically on the degree to which global emissions of greenhouse gases are curtailed. A two-fold strategy is being pursued. First, atoll-countries have been very active in seeking to reduce global emissions of greenhouse gases through the Alliance of Small Island States and the United Nations Framework Convention on Climate Change. Failure to reduce greenhouse gases will result in substantial losses, including the potential loss of sovereignty. Second, atoll-countries in conjunction with

SPREP have been active in research and capacity building for adaptation to climate change. At present, despite remarkable progress, the atoll-countries are unable to meet the challenges of climate change, largely due to outstanding shortfalls in research and policy implementation capacity. Assistance from donors is required to address these needs, while remaining mindful that aid brings with it its own complications and inherent colonising tendencies. The challenge for donors is to facilitate and support research conducted by atoll people for people. It should never be forgotten, though, that the most important task for developed countries is to reduce their own emissions of greenhouse gases.

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