

Waterworld¹: The Heritage Dimensions of ‘Climate Change’ in the Pacific.

By

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Abstract:

The focus of this paper is particularly on low lying coral islands of the Pacific, such as the outer coral atolls and islands of Chuuk state, in the Federated States of Micronesia. The paper explores the relevance of heritage research to climate science. Questions posed include the following: How is the discourse of global warming being taken up at the local level? What are the experiences, understandings and responses of peoples who live at the ‘front line’ of sea level change? We consider the heritage dimensions of climate change in Chuuk in terms of the notion of ‘loss’ and what it is to feel that one is losing one’s world, as well as the distinction between tangible and intangible heritage. We argue that research on the ‘human dimensions’ of climate change must be expanded from its current socio-economic emphasis to include baseline local level ethnographic studies that enable understanding of non-market impacts and the complex transformative relationship between cosmologies of climate change and heritage values.

Introduction

This paper concerns how people, particularly in the low lying small island states of Micronesia, and the Pacific more generally, take up and respond to the contemporary scientific discourse on global warming. A wealth of ethnographic research has been conducted in the Pacific, providing excellent comparative material for understanding the relationship between different ‘cosmologies of climate change’ and how peoples

¹ We have taken the title to this paper from the 1995 Kevin Costner film *Waterworld*. However, it is not just because of its reference to the potential apocalyptic effects of global warming, that we chose this title, but also because the film concerns the conflict between different cosmologies, between those who *believe* and those who do not, in a mythical, imagined place called Dryland. In terms of the hegemonic cosmology of surviving humans the world was created in a deluge and any other idea is treated as blasphemy. Thus, because this paper alludes to different and competing ‘cosmologies’ of climate change not only scientific and non-scientific, but also among the climate scientists themselves, we thought the title particularly appropriate.

might deal *in practice* at the local level, with climate variability and the impact of extreme cataclysmic events, such as, most recently, the tsunami in the Solomon Islands, but also more gradual climatic changes.

In this paper we argue that research on the ‘human dimensions’ of climate change must be expanded from its current emphasis on socio-economic modelling to include baseline local level ethnographic studies that enable understanding of the relationship between climate change and heritage. We explore the heritage dimensions of climate change by considering the notion of ‘cultural loss’ and questioning the distinction between tangible and intangible heritage. We consider how heritage values are *produced* and the social and cultural resources that people *can* and *do* employ in the face of change.

Research Background

The paper draws on fieldwork conducted by William Jeffery in Chuuk as part of his doctoral project on heritage issues associated with the World War II Wrecks in the Chuuk Lagoon, as well as a short reconnaissance fieldtrip there by Rosita Henry in November 2006 to meet with Chuukese government officers so as to scope the potential for anthropological research on climate change in Chuuk State².

² There is an excellent historical ethnographic basis already for research on Micronesia as from 1947-1949 the US Navy started CIMA (Coordinated Investigation of Micronesian Anthropology) and sent 42 anthropologists to Micronesia. Among these were Ward Goodenough who did a study of Chuukese social organisation and land tenure.

Chuuk is part of the Federated States of Micronesia (FSM) consisting of 4 states – Yap, Chuuk, Pohnpei, and Kosrae. Chuuk state (population of 54,000)³ consists of a number of different island types. At its heart is a barrier reef embracing a number of small volcanic islands. This heart, which is known as Chuuk Lagoon is surrounded by several coral atolls and numerous ‘low’ coral islands.

Here we present some very preliminary ideas and arguments concerning the heritage dimensions of climate change in the Pacific (and elsewhere), but with particular ethnographic reference to Chuuk. Key research questions include:

- How is the discourse of global warming being taken up and interpreted at the local level, in places that are at the actual ‘seafloor’ of climate change?
- What might be the nature of the conjuncture between contemporary science-fed discourse predicting future climate change and indigenous cosmologies (that is, beliefs about the nature of the universe, including the postulates about the functioning of the natural and social world)?
- How does climate change discourse and its accompanying sense of imminent ‘loss’ contribute to the creation/constitution of heritage values?
- Moving beyond discourse, what are people’s empirical experiences at the local level, of climate variability and climate change?
- How do these practical experiences produce and/or impact upon heritage values?
- What forms of socio-cultural capital are available to Pacific Islanders in the face of climate change?

Responses to the Discourse of Global Warming: The Conjuncture between Scientific and Indigenous cosmologies

While the focus of this paper is specifically on Chuuk in the Federated States of Micronesia, much of what we discuss here applies to other small island states in the Pacific. Although there is still much debate among climate scientists, it has been predicted that atolls and indeed whole atoll states could become uninhabitable waterworlds within the next 50 years. Pittock (2005:274) lists in order of vulnerability

³ FSM Census 2000

Tokelau, the Maldives, Tuvalu⁴, the Marshall Islands and Kiribati. Together this represents a population of around 420,000. Surrounded as they are by vast expanses of ocean, it is clear that small island states are at the frontline of vulnerability in relation to the potential adverse effects of climate change, including sea-level rise, rise in sea-surface temperature and increased intensity and frequency of extreme weather events. Most vulnerable are the countries that are composed entirely of low-lying coral atolls (Barnett and Adger 2003). Many of the atoll islands of the Pacific rarely exceed 3-4m above present mean sea level; but even on the high islands human settlement is concentrated along the coast.

Yet, it must also be remembered that the geomorphology of these islands is highly dynamic, due to the impact of sea currents, volcanic events and shifting tectonic plates. The earthquake and consequent tsunami last year (2006) in the Solomon Islands provides a recent example of tectonic activity that has led to the appearance and disappearance of islands, irrespective of climate change. In terms of indigenous cosmologies too, there exists narrative knowledge of the dynamic nature of island formation in the past and local acceptance of the possibility of such environmental change – stories of islands disappearing into the sea, or being either thrown down ‘fished up’ by various ancestral beings or culture heroes (cf Lessa 1961).

Climate science predictions concerning global warming are well accepted in the Pacific and Pacific Island states have responded by developing a regional framework for action on climate change, climate variability and sea level rise (2000-2004), superseded recently by the *Pacific Islands Framework for Action on Climate Change 2006-2015*. Popular media representations of Pacific Island peoples as ‘tragic victims’

⁴ See documentary on Tuvalu, recently screened by the ABC (7th Feb 2007) entitled *Paradise Drowned: Tuvalu the Disappearing Nation*

of global warming and of some island states (cf Tuvalu) as being in imminent danger of disappearing altogether, have also been actively embraced. Yet, it is problematic to simply attribute all current locally observed environmental degradation and coastal transgression to sea level rise (as a catch-all cause). Connell (2003:104) points out that, while climate change does indeed pose threats in the future “that future has not arrived other than in the imaginations, dreams, fears and perhaps even the hopes of islanders and a variety of outside observers”. Connell fears that ‘doomsday’ predictions, and the acceptance of the inevitability of imminent disaster, may have negative consequences for the proactive address of more immediate, local factors in environmental degradation that are not necessarily connected with climate change, including anthropogenic causes. Similarly, Barnett and Adger (2003:329) argue that ‘the 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’. Importantly, as Farbotko (2005) argues, representations of Pacific Islanders as ‘tragic victims’ of global warming serve to erase any recognition of their agency, resourcefulness and resilience.

Chuuk and other small island states are faced with more immediate socioeconomic problems other than those predicted to occur as a consequence of climate change. Poverty, high unemployment, housing, education, and health care are all of major concern right now. Thus, it would be understandable if climate change issues were of low priority. Yet, our research indicates that this is not the case. In particular, government officers and representatives from the outer islands expressed deep concern regarding the impacts of climate change and we noted a sense of imminent “loss” particularly among Chuukese from the outer islands.

Doropio Marar, of the Chuuk Historic Preservation Office, who is from one of the outer islands (Moch Island in the Motlock group), introduced us to several men, who were able to tell us of their about conditions of life on the atoll islands. These men were all from the Mortlock Islands (approx. 300km south-east of Chuuk Lagoon) and all expressed a deep sense of “loss”, or at least expectation of inevitable looming “loss” of place, of the home islands that form the very core of their identities (perhaps more so because they live away from them).

According to a man from Oneop Island in the Lower Mortlocks:

I just came here [the capital of Chuuk - Weno] for work. My relatives and my family, we are all here. My second daughter is in Hawaii...But still we have some relatives and grandparents left [on Oneop]...I go back once a year...It's a low flat island...When I go back it looks like it's getting worse because some of the beach I saw before is gone and the island is getting smaller and smaller because the waves wash away the sand. It's not like before...Our main food is Taro and the waves come into the Taro patch and kill off the crops.

Here are the words of another Mortlock Islander:

I am from the Island of Kuttu in the Morlocks. During the 1970s there was a typhoon...the typhoon drew big waves on to the island and brought the saltwater into the taro and that was the saltwater that killed our taro and breadfruit...It cut off one forth of the island of Kuttu, now permanently under water...So all the islands of the Mortlocks we are suffering. I just call it “high tide”. We are depending on rice during this time. Little by little our shore is disappearing and coconut trees are standing in water. It's happening more and more over the years. We heard that pretty soon we'll be all underwater, the whole of the Mortlocks. They say this is the time of evacuation. They say this is the time to evacuate people to higher ground. Right now we are suffering erosion and we are suffering the high tide. In our language we call it *setupul*.

A report to the Governor, Chuuk Sate Government, summarises information obtained by the Disaster Coordinating office in the year 2000 regarding what in the report is referred to as ‘the continuing sea level rise’ and ‘unusual high tide’. It states that on Kuttu Island:

83 homes out of 104 got flooded. Beach and coastal washed-off by erosion. 80% Coconut trees got uprooted. Breadfruit and Banana trees got affected. 90% of Taro patches got severely affected by seepages or blowholes and all around. Well 100% salt water. Seawalls got major damages.

Kuttu is a small coral island (0.2 square miles) part of the Satawan Atoll. It has a population of about 350, but probably as many people reside away from their island, mostly in the Chuuk capitol of Weno (with a transient population of approximately 20,000)⁵.

While being part of states, small atoll islands are often beyond the reach of the tentacles of their state governments, which is unable to effectively respond to extreme climate events. The Disaster Coordination Office in Chuuk holds sketches and photos from the late 1990s, 2000 and 2001 documenting damage from flooding and erosion due to La Nina storm surges and the effects of ‘unusual’ high tides on homes and taro gardens and so on. One submission from the island of Uman within the lagoon, which included a sketch map of the area inundated by “high tide”, implored the state government to provide heavy duty equipment (back-hoes and cranes) to fill and elevate land. The submission complained of inequities on the part of the municipality with regard to distribution and allocation of these kinds of resources. When asked whether FEMA had any more-recent data, the Disaster Coordinator said that people had given up filing reports because the Agency had little capacity to respond.

Chuukese government officials and the Outer Island men interviewed all talked about possible means to mitigate the impact of sea level rise and storm surges. While one of the Mortlock Island men mentioned the need for the construction of protective sea walls and expressed concern about not enough funding to build such walls, Mr Ismael

⁵ Chuuk state has a total population of approximately 53, 500 (FSM Census at www.fsmgov.org/info/people.html accessed 28 April 2007).

Mikel, the Executive Director of the Environmental Protection Authority (EPA), noted that sea walls were not necessarily the answer. He said that in one case people had removed rocks and coral from the reef to build their own sea wall but this had caused worse erosion because of the alteration of the coastline and destruction of the protective reef. He noted that the EPA was trying to educate people about environmental protection in relation to climate change such as the necessity to maintain natural protection by replanting mangroves and protecting coral reefs.

The EPA Executive Director also commented on the problem of salinization on the outer islands due to changes in the water table as a result of sea-level rise. He noted that these effects were particularly noticeable in the region known as Nomun Witto where there was saltwater in the taro patches. While people had tried to build levy banks to protect their taro, it was not just that the high tide inundated the taro fields but that the saltwater was bubbling up out of the ground itself, due to changes in the water table. The EPA Director reported that because they could no longer grow taro, people on these islands were surviving mainly off morning glory vines which they would cook with coconut toddy.

Each of the outer islanders interviewed expressed concern about people having to abandon their atoll homes altogether and being evacuated to the high islands. Similarly, Chuukese government officers we approached to explain our research and to gauge the feasibility of our project (including Chuuk State Historic Preservation Officer, Mr Tracy Meter; the Disaster Coordinator, Federal Emergency Management Authority (FEMA), Mr Eric Paul; Mr Ismael Mikel, Executive Director, Environmental Protection Authority; Mr Joe Konno, past-director of the EPA and now a private consultant, and retired State Planner, Mr Suda) all expressed concern

about the capacity of the more vulnerable outer islands to maintain their current populations. They especially conveyed concern about and the limited capacity of Chuuk State to handle the socio-economic and political consequences of resettlement.

In Chuuk, as in most small island states, even on the high islands most of the settlement and infrastructure is concentrated on the narrow coastal plains. As increasing numbers of ‘outer islanders’ migrate to the capital of Weno, for socio-economic and educational purposes, competition for land has become acute. Thus, outer islanders become a category of landless squatters, second-class citizens dependent on the goodwill of their hosts. Their unenviable situation cannot be fully appreciated unless one understands the cultural significance of land to Chuukese. Of course, one can argue that land is important to people everywhere, but imagine its particular significance in this region of small islands where the reality of limited land is something they have always had to face, and where belief in the primacy of land (or the heritage value of land) is expressed in various cultural practices (eg in kinship and marriage rules, adoption practices, and so on)⁶. Island landscapes can also provide Chuukese with spiritual and physical identity. For example, one of the lagoon islands Tonoas, symbolises a man lying down, and people living in the district around the highest peak of the island, Mt Tononwan, which represents the head of the man, are said to have large heads through scheming and ‘planning evil deeds’ (Young et al. 1997: 16). As Hezel (2001:34-35) writes:

To have rights to land – understood as including the offshore flats and reef or fishing areas – was to be able to provide for all one’s basic needs: food, housing, transportation, and medicine. Land was as much a basic element of

⁶ In pre-colonial times most of the land was held by lineages that represented local segments of matrilineal clans. Marriage was matrilocal. Land was mostly inherited matrilineally. But land tenure was complex. Claims could arise from living on land, cultivating it, having ancestors born or buried on it etc. People could have interest in many plots or trees in different locations.

life as the food that was grown on it, and the two terms were used interchangeably on many islands...

If land was life for traditional Micronesians, then loss of land was a form of death; in Chuuk, according to one author [Parker 1985] it was lamented with the cry "I am no longer alive"...

Thus, Chuukese people value land not just for its economic use-value but also for the social status and political power that derives from land ownership and because the very concept of personhood, in fact what it means to be *fully* human, is tied to land ownership. Given these ideas, and in the context of population growth and increasing land shortage on the main island of Weno, it is not surprising that there is much reclamation activity to be observed. Land reclamation can be seen along much of the foreshore of Weno. Nevertheless, land creation and transformation of the seascape are not merely a recent response to population movement, as can be seen from WWII construction activities by the Japanese, which for example dramatically changed the whole shape of the island of Etten for construction of a seaplane base. Moreover, land creation practices should not be read as merely colonially induced. Rainbird (2004: 94, 171) presents archaeological evidence not only of dramatic human transformation of the seascape but of practices of protection and maintenance of these coastal areas. He writes that the first human settlers:

...altered the very nature of the landscape, by manipulating the vegetation so as to cause erosion and thereby lay the foundations for the subsistence systems...This approach to the landscape by the initial settlers would be responsible for creating conditions of high sediment transport and the progradation of the shoreline onto the reef flats...(2004:95)

Atoll islands were purposefully cultivated into rich dwelling places, as evidenced by the fact that on typical atoll islands there is a central taro patch that has been developed, mulched and cared for over centuries (Rainbird 2004:163).

Rainbird (2004:171-172) notes that in Chuuk Lagoon, coastal transgression in some areas is clearly a recent phenomenon. He suggests that, while sea level change due to global warming may be a factor, such transgression could also be due to the fact that, following adoption of a Western cash economy, 'coastal lowlands are not being maintained and consequently the sea is reclaiming the space it had enjoyed prior to human intervention' (2004:171). Of significance here is the archaeological evidence of past human resourcefulness in the face of life in a highly dynamic natural environment. Thus, while science-fed predictions and scenarios on climate change may have been taken up among Chuukese and reproduced in terms of a discourse of imminent 'loss', past practices (cultural heritage) demonstrate the possibility of socio-cultural resilience and resourcefulness in the face of such 'loss'. Similarly, while they argue that global warming means that the long-term sustainability of atoll countries are seriously at risk, Barnett and Adger (2003:333) conclude that, 'the challenge is to understand the adaptation strategies that have been adopted in the past and which may be relevant for the future in these societies'.

How does a sense of imminent 'loss' contribute to the creation/constitution of heritage values?

Heritage is not something fixed and given, but is actively produced in the face of change. In fact, the concept of heritage *requires* a notion of 'change'. Heritage is a construct that serves a human (not necessarily universal) impulse to 'fix' or hold on to something that is in reality continuously changing, whether due to natural forces such as the weather or to anthropogenic forces (including war, modernisation and economic development and so on). Thus, cultural practices and ideas, objects, places, land and seascapes become valued as heritage particularly in the face of their potential loss. However, the fact that something might physically disappear (as an island in the

Pacific) does not mean that it no longer exists in terms of heritage. Out of sight does not mean out of mind. Submerged places and invisible ‘ghost islands’ may still be part of the ‘sea of islands’, as Epeli Hau’ofa (1993) famously described it. For example, Bill Jeffrey was informed of an island (Sepin) in Yap state that is now totally submerged (c.30metres deep), being intentionally sunk by Yapese around the time the first Europeans (Spanish and Portuguese) entered this area in 1520s, so they would not have access to it. It is now an important part of the cosmology of Yap (and the Yap Historic Preservation Office wanted it surveyed, to see if there was any habitation remains).

In addition, *new* islands may appear and *new* objects might be deposited, to become part of this dynamically transforming cultural seascape and incorporated into everyday life. In Chuuk, these include the underwater WWII wrecks in the Lagoon as well as the terrestrial sites and structures associated with the Japanese military base. The wrecks are vital to the dive industry and attempts are being made to expand the tourist industry in the direction of the terrestrial sites, as for example on Weno and Tonoas where the Historical Preservation Office has funded a project to develop interpretive signs. However, much of the material remains of WWI have been integrated into the domestic living spaces of Chuukese landowners and have also become part of the play scapes of generations of Chuukese children, leading to a complex entanglement of heritage values.

Thus, heritage is better conceptualised as something that is always in the process of ‘becoming’. In other words, heritage values, while referring to the past, are actually future oriented. In the face of loss, cultural practices and places that were once taken-for-granted aspects of the seascape become valued as ‘heritage’. As a political tool

for governance, cultural heritage can provide a valuable means for coping with change.

Socio-cultural capital in the face of climate change: Resilience and Adaptation

The predominant approach among scientists (including social scientists) to understanding the impact of climate change is a systems-based one focusing on social-ecological systems⁷. Therefore, the Intergovernmental Panel on Climate Change (IPCC) reports and other literature on the human dimensions of climate change tend to focus on concepts of ‘vulnerability’, ‘adaptation’ and ‘resilience’. Adger and Hughes *et al* (2005:1036) argue that the concept of resilience marks ‘a profound shift in traditional perspectives, which attempt to control changes in systems that are assumed to be stable, to a more realistic viewpoint aimed at sustaining and enhancing capacity of social ecological systems to adapt to uncertainty and surprise’⁸.

Although systems-based approaches have generated useful global and regional models, from an anthropological point of view they are not adequately informed by essential baseline studies of actual social and cultural practices (which actually may not be all that systematic!). It is particularly problematic when indigenous knowledge and heritage practices are recorded taxonomically and in a piecemeal fashion and used to evidence the existence of adaptive *systems* of governance and traditional management. What is required is fine-grained ethnography at the local level. Local contexts are crucial, because, while climate change is a global phenomenon, there is

⁷ Systems theory basically is the thesis that variables, social and ecological, should not be analysed in isolation but in terms of their interrelation as part of a system.

⁸ “By resilience, we mean the capacity of linked social-ecological systems to absorb recurrent disturbances such as hurricanes or floods so as to retain essential structures, processes, and feedbacks. Resilience reflects the degree to which a complex adaptive system is capable of self-organisation (versus lack of organization or organization forced by external factors) and the degree to which the system can build capacity for learning and adaptation” (Adger et al 2005:1036)

great regional and local variability in terms of impact; and global modelling exercises cannot capture the complexities of people's real life experiences and responses. As noted in the Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report of Working group II:

Climate models are simplifications of very complex natural systems; they are severely limited in their ability to project changes at small spatial scales, although they are becoming increasingly reliable for identifying general trends. In the face of these concerns, therefore, it would seem that the needs of small island states can best be accommodated by a balanced approach that combines the outputs of downscaled models with analyses from empirical research and observation undertaken in these countries. (McCarthy et al 2001:870)

Local conditions vary widely on different island types and these factors may increase or decrease climate change impacts. However, it is not just because of the geographical variability of the impact of climate change itself, that local level research is required. How people deal with climate change is dependent on their own cosmologies as well as their take-up and interpretation of global discourses. It is also dependent on locally *experienced* historical, social, cultural and political contexts, including how people construct their relationships with others.

One of the strategies that people used in the past to deal with land shortages, due to whatever cause, and with extreme climatic events, was to turn to their kinship and exchange networks across the region. According to Rubenstein 2002:75) 'Micronesian island communities accommodated to climate extremes and natural disasters through the development of social and political linkages between the more vulnerable coral atolls and the neighbouring high islands'. In some parts these linkages became institutionalised in terms of formal ceremonial exchange systems (eg. *sawai* system in Yap). While, travel and/or migration away from their home

islands was common practice among Micronesians in the past, emigration from the Federated States of Micronesia became a significant social phenomenon after the implementation of the Compact of Free Association in 1986. Thousands of FSM citizens left for Guam, the Commonwealth of the Northern Mariana Islands, Hawaii and the mainland of the United States. According to Hezel and Lewin (1996) the explanation for this was primarily employment. They did not conceive of themselves as leaving their home islands permanently. They maintained close social bonds through exchange with their kin so that they could return home if, and whenever they wanted:

Goods flow back and forth between the home islands and the new communities as freely as people. A few years ago, Chuukese would send fish and pounded breadfruit to their relatives on Guam in ice chests that would be returned a few days later, filled with frozen chicken and other treats that could be bought cheaply on Guam. Chuukese on Guam would also send back cartons of secondhand clothes...Goods are exchanged between migrants and their relatives back home just as they would be if all were living on the same island. (Hezel 2001:153)

As one of the Mortlock Island men we interviewed commented:

Before I would like to live on my island, but right now I don't think I could survive out there. See it's a really sad situation. If they come in, the money that we have is not enough to share around. So they have to stay out there and we send them what we can.

Thus, the heritage practice of keeping exchange paths active might be considered an adaptive strategy in the face of climate change (cf Barrett 2001). Because kinship relations and exchange networks themselves provide a means of mitigating impacts of climate change, it is important to understand how these networks of connection operate and continue to flourish. There has been much recent anthropological research conducted on migration, transnationalism, diasporas and global flows of people and

goods, which is helpful in understanding the kinds of *social capital* that people can employ to cope with climate change. Such social flows are linked to heritage values of a cultural seascape constructed in terms movement, so that rather than a barrier, the sea is conceptualised as a ‘way’ or ‘pathway’ of connection. (Rainbird 2004:53; Hau’ofa 1993)

Conclusion

In conclusion, while there is an increasing amount of research being conducted on the ‘human dimensions’ of climate change, this research has mostly focused on trying to model global socio-economic and ecological impacts. But, how do such models relate to the micro-scale of everyday lives and to the production of heritage values? To understand this requires fine grained ethnographic research⁹.

In other words, we need an expanded notion of what is meant by ‘human dimensions’ that includes consideration of social practices at the micro-level and how people produce the heritage values that inform everyday practice and that demonstrate capacity to respond to change.

While much socio-economic research has been done to try and estimate and quantify the damages from climate change, non-market climate change impacts are not well understood. If we are trying to understand how people might respond to and mitigate adverse effects caused by climatic conditions, then we also need to understand non-market cultural losses and gains. In Chuuk (as elsewhere in Micronesia), as pointed out above, strong ties to land (understood to include sea) are a vital aspect of local cosmologies. Loss of one’s land (or its transformation — as by the Japanese and

⁹ According to Brown (1999) ‘...climate anthropologists appear to be making strides at relating global warming models to everyday lives’.

Americans during the war) is potential loss of something of one's identity, loss of something of one's sense of self. Yet, 'loss' is also a productive notion, creative of heritage values celebrating social practices (land tenure regimes, indigenous knowledge, economic and political institutions, exchange networks) that become key tools for resilience and adaptation.

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