

Climate Change Experiences in Northern Australia – Health, Adaptation, Fire Management and Global Relevance

Proceedings of the International Public Forum on Indigenous Peoples
and Climate Change: The Tropical Australian Experience

3 April 2008, Charles Darwin University, Darwin, Australia

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Hosts



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FOREWORD



This book contains the proceedings of an International Public Forum on Indigenous Peoples and Climate Change - a collaborative effort between Charles Darwin University (CDU), the United Nations University – Institute of Advanced Studies (UNU-IAS) Traditional Knowledge Initiative, and the North Australian Indigenous Land and Sea Management Alliance (NAILSMA), held at CDU on 3 April 2008.

The outcomes of the forum contributed to the International Expert Group Meeting on Indigenous Peoples and Climate Change which was held from 2 to 4 April 2008 in Darwin, Australia, which in turn was submitted to the seventh session of the United Nations Permanent Forum on Indigenous Issues held from 22 April to 2 May 2008 at the UN Headquarters in New York.

Speakers were invited to share case studies on practical experiences, particularly focussing on the impacts of climate change on indigenous peoples and adaptation, mitigation and opportunities for carbon projects. This was followed by a panel discussion featuring several international experts in order to relate the Australian experience with experiences worldwide.

The fascinating observations of the expert speakers have been reproduced here to benefit a wider audience. Jeremy Russell-Smith introduced the West Arnhem Land Fire Abatement Project and opportunities for Indigenous engagement and enterprise development across northern Australia in relation to fire matters and Dean Yibarbuk spoke of the cultural aspects and involvement of countrymen in this partnership. Wendy Brady provided many examples of the enormous capacity of Indigenous Australians for adaptation. Bart Currie spoke on the nexus between anthropogenic climate change, environmental health and human health, and Ngaire Brown provided perspectives on cultural determinants of health, and impacts of climate change on land management and Indigenous health in Australia.

The international panel comprised experts from the Arctic, Asia and the Pacific who provided commentary on the similarities of Indigenous experiences of climate change worldwide, and discussed the implications of a rapidly changing world on the application of traditional knowledge.

Indigenous peoples have contributed the least to world greenhouse gas emissions and have the smallest ecological footprints on Earth, yet they are suffering the worst impacts of climate change. As the effects of climate change continue to capture the attention of the international community, we hope that the discussions from this forum can help policy makers in their ongoing consideration of the impacts of a changing climate on Indigenous peoples, as the world considers how best to address these problems in ways that take into account not only the needs, but also the valuable contributions of Indigenous peoples in Australia and elsewhere.

Kirsty Galloway McLean

United Nations University – Institute of Advanced Studies
Traditional Knowledge Initiative

SESSION 1: FIRE MANAGEMENT

West Arnhem Land Fire Abatement Project

Jeremy Russell-Smith

Bushfires Council Northern Territory. Tropical Savannas Cooperative Research Centre

I am going to introduce the West Arnhem Land Fire Abatement Project (WALFA), related issues, and opportunities for Indigenous engagement and enterprise development across northern Australia in relation to fire matters. Dean will then look at the cultural aspects and involvement of countrymen in this partnership.

Figure 1 shows the distribution of fires in Australia – there are a lot of fires in the North relative to southern Australia – these are the big fires, the things that are bigger than a kilometre squared, and clearly they dominate in our region. In this area above which we'll call the tropical savannahs with monsoonal rainfall, it is very seasonal and every year in the Darwin region, parts of the Kimberley and Cape York, Arnhem Land is big mobs of fires. It is a big problem, but it also provides an opportunity.

Fire Frequency National Oceanic and Atmospheric Administration - Advanced Very High Resolution Radiometer 1997–2005

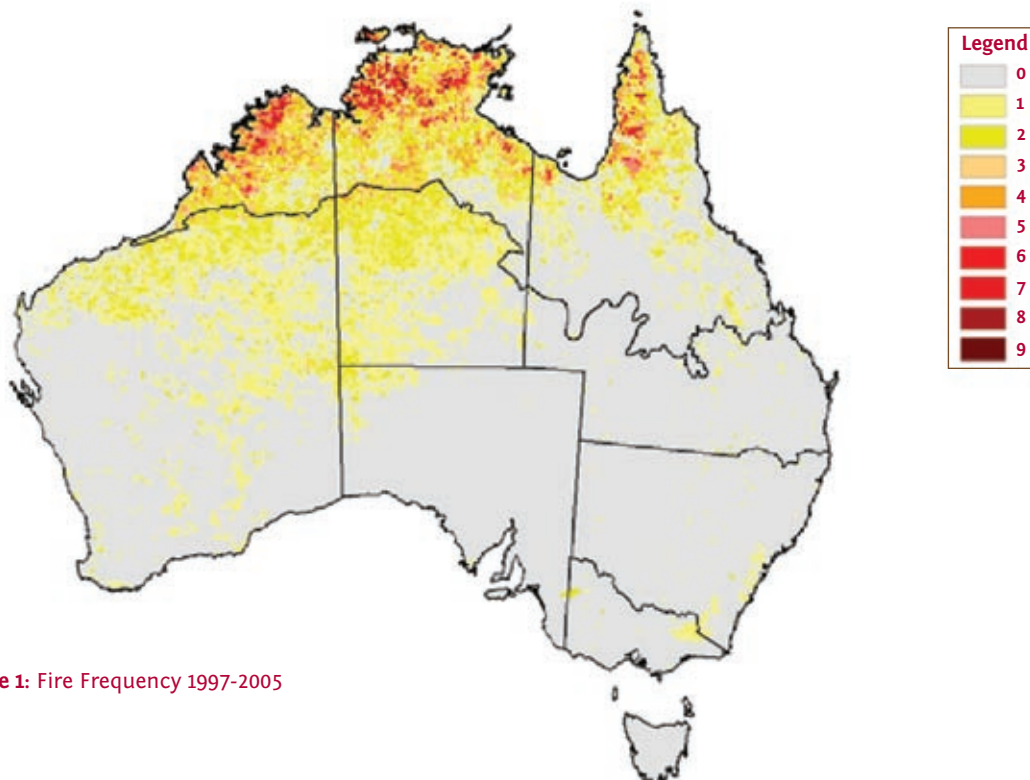


Figure 1: Fire Frequency 1997-2005

For those of you not familiar with the northern Australian landscape, it is predominantly an agricultural/pastoral landscape, with a few conservation reserves, a few aboriginal lands and Indigenously owned properties. And importantly we have this cadastre whereby we have lots of very big properties. To the East, in Queensland there are a lot of small properties, and

pretty arable Mitchell grasslands, black soil plains, lots of sheep production – whereas in the North it is a lot hungrier. There are some good places for growing cows, but mostly it is rocky and beautiful landscapes.

Even from space you can readily see fires (Figure 2) – and importantly this also illustrates that we can easily map fires. We can track them across the landscape on a daily basis and this is part of the technology that the Tropical Savannas CRC brings to bear as part of this partnership.



Figure 2: Mapping fires from space

As part of the background, prescribed burning of savannas is a listed accountable activity under the Kyoto Protocol in the agriculture sector. It provides thereby opportunities, not only for people in Northern Australian savannah landscapes, but also globally. It's a small part of the national inventory: 2-4% of Australia's greenhouse gas emissions. This includes all fire emissions from tropical savannas and temperate grasslands, and assumes all fires are anthropogenic (i.e. lit by people). We are only allowed to account for a couple of greenhouse gasses at the present time – carbon dioxide itself isn't allowed to be accounted for. If we could account for it, it would be about 40% of Australia's emissions.

This is an economic opportunity as you will see. It is not an issue similar to that in the forestry sector where you are talking about carbon being sequestered in trees, it is about an abatement activity, it is a management activity. You have to establish a pre-project base line, then you look at how effectively you can manage against that base line and bring down the amount of abatement. So it is fundamentally different to the forestry type of issues. It also means there is not a carbon ownership component to this – a very important point.

Northern Territory Greenhouse Gas Emissions 2005 by Sector

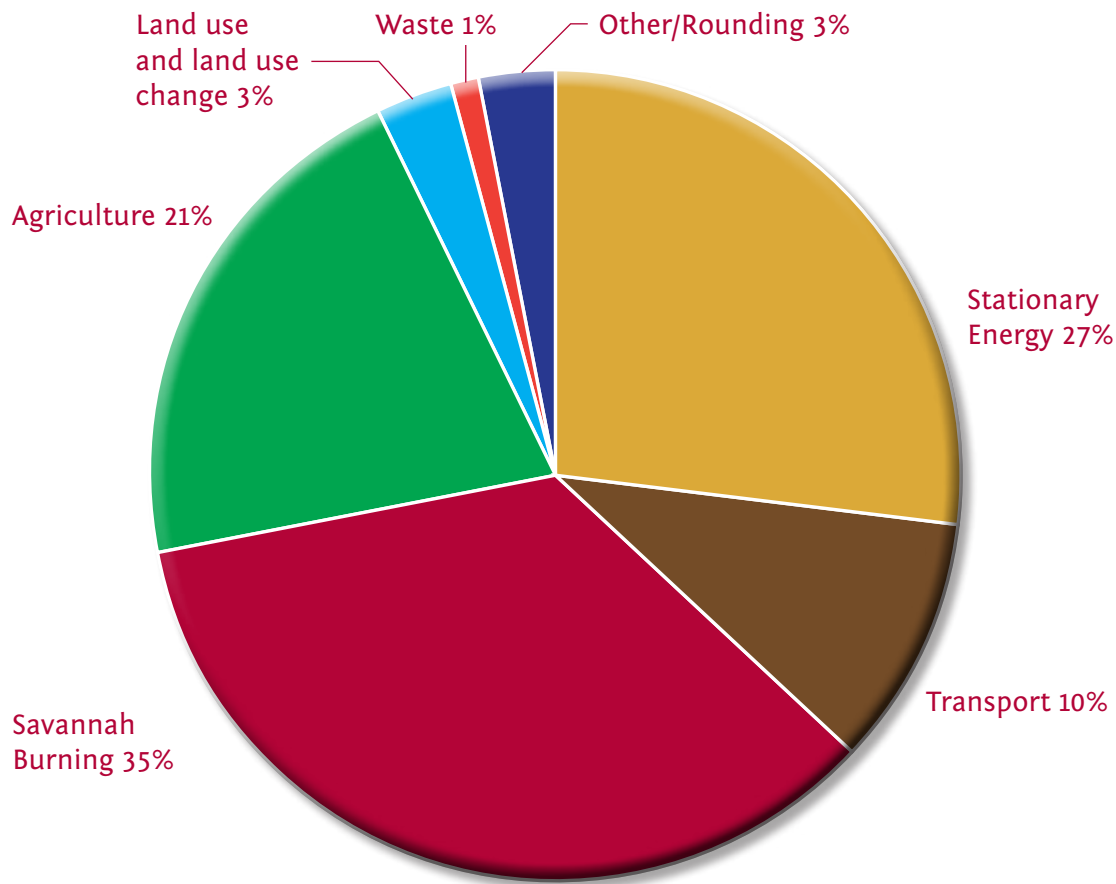


Figure 3: Northern Territory Greenhouse Gas Emissions

It is very important in the regional economy of Northern Australia: for example, it is 35% of the greenhouse gas emissions of the Northern Territory. It is generally between 4-6% of the emissions of Western Australia which many of you will appreciate is an industrial giant in this country, so they are a significant component of the economy. And we have taken advantage of that to look at how we might better manage and abate carbon emissions in that area there, called WAFMA (Western Arnhem Land Fire Management Agreement). It is a 28,000 km squared area, abutting Kakadu National Park (itself an area of 20,000 km squared). It is all Aboriginal land.

At the same time, we have ConocoPhillips, a trans-national energy organisation that's constructed a big liquified natural gas plant in Darwin Harbour. To get their licence to operate they needed to develop some sort of licence agreement with the Northern Territory Government. The company entered into a voluntary offset arrangement with a savanna burning emissions abatement project that was relevant to our region, relevant to the traditional owners of this landscape – though I must confess this is on Larrakia land, and the project itself is translocated to western Arnhem Land. As part of the ConocoPhillips offset, they had to deal with the fact that they had knocked down a lot of coastal jungle, that had to be part of the equation. In Western Arnhem Land there is a lot of endemic rainforest; part of the management regime that has been put in place is to assist there. Kakadu National Park is the little black delineated area and Figure 4 illustrates that on your left, endemic plant

species and on the right, terrestrial fauna are mightily concentrated in this Western Arnhem Land Kakadu region. So there are a whole lot of reasons we might want to be thinking about developing a project in that landscape.

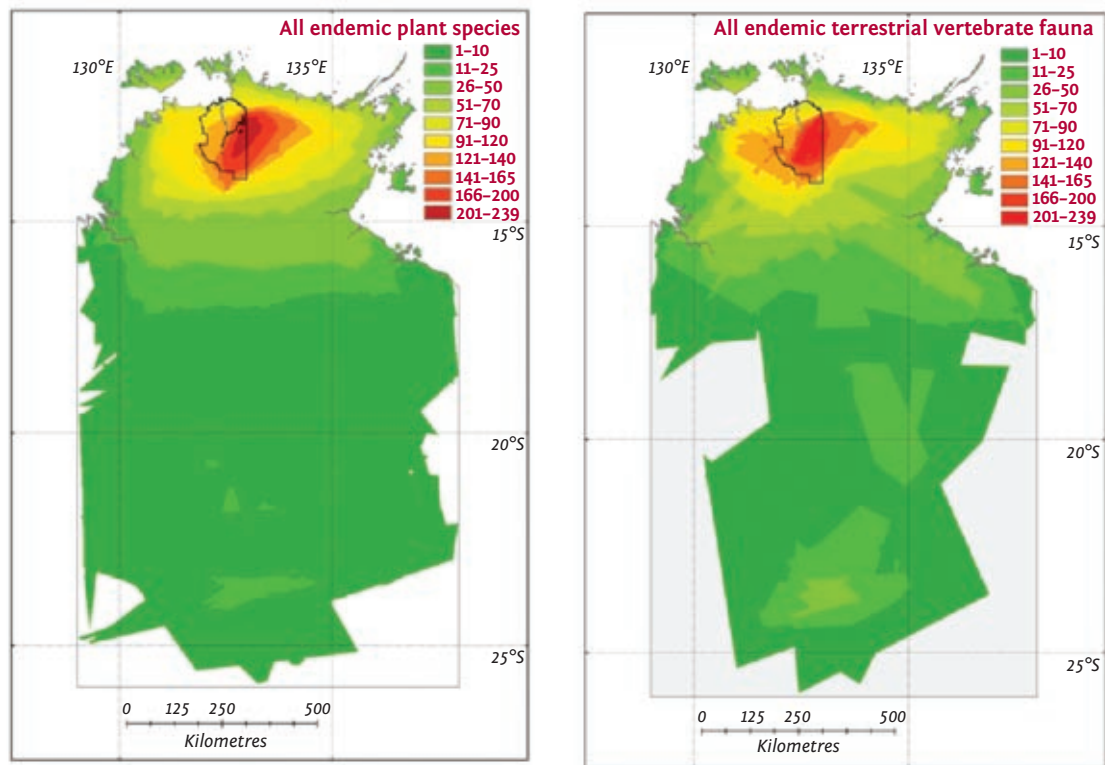


Figure 4: Co-occurrence of restricted range and endemic species

Figure 5 shows the Western Arnhem land project area, the fire frequency from 1990 – 2005 and in particular you will see the concentration of fires down here in the south east – most of the dry season in northern Australia got fires: winds coming from the south east and though these fires are carried up onto these rivers which provide natural breaks, you will see there are just a couple of tracks in this. Remember this is a 28,000 square kilometre area, access into it is very difficult, there are a few outstations located within the area, a couple of hundred people resident throughout the year, and not many economic opportunities for them. The baseline I talked about earlier, 1995 – 2004 is something we had to establish. Basically where it has been circled in red saying 8% of this area has been burnt earlier on in the year under low intensity, manageable fire regime conditions, and later in the year from about August onwards, over 30% of this landscape has been burnt on average each year.

Just put that into perspective, people in southern Australia think they have a fire problem, but less than 1% of that landscape burns on average each year. This is the type of burning that Dean will talk about that we would like to see undertaken through the landscape which would have been a lot more of under traditional management: slow creeping fires pull up easily on the one track which goes through the region. Conversely, later in the year you can get these types of infernos which have obviously a lot more impact at very large landscape scale and produce a lot of emissions.

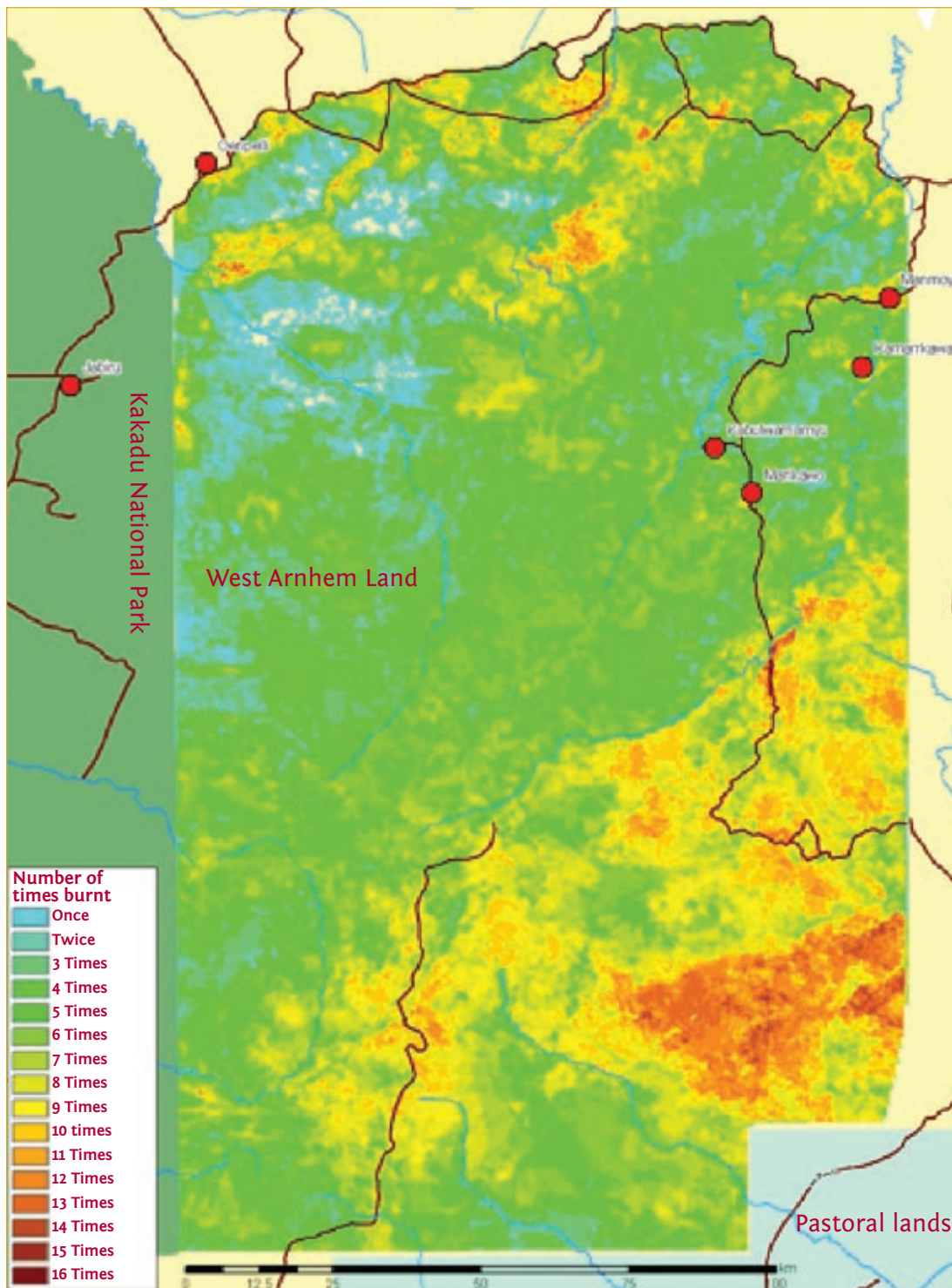


Figure 5: Fire Frequency 1990-2005 (Landsat imagery)

So over a ten year project period, we have developed a project which has involved lots of countrymen, talking about things, getting together, doing a lot of planning, and bringing the Northern Territory Government to the table to fund a fire management program in Arnhem land, the first Indigenous one in the Northern Territory, let alone Australia. There are lots of activities: on ground burning, trying to get around the country, a lot of aerial burning, using natural breaks like that river in the foreground of the rocky country, trying to protect a lot of the rocky country.

We have done a lot of science type establishment with plots looking at what the fuel and carbon composition is in the landscape. This is a typical open forest, savannah woodland from this area into the rocky bits, and the very rocky bits. And there we do post fire assessments, and I'm not going to bore you with the science or the details of it, but suffice to say that last year we were awarded the national, inaugural Eureka prize for innovative solutions to climate change. This is effectively the Australian environmental Oscars that we won, and again I would like to make the point that this was a partnership between two knowledge traditions that wouldn't have worked without either. And, the project is working. It is working fantastically well.

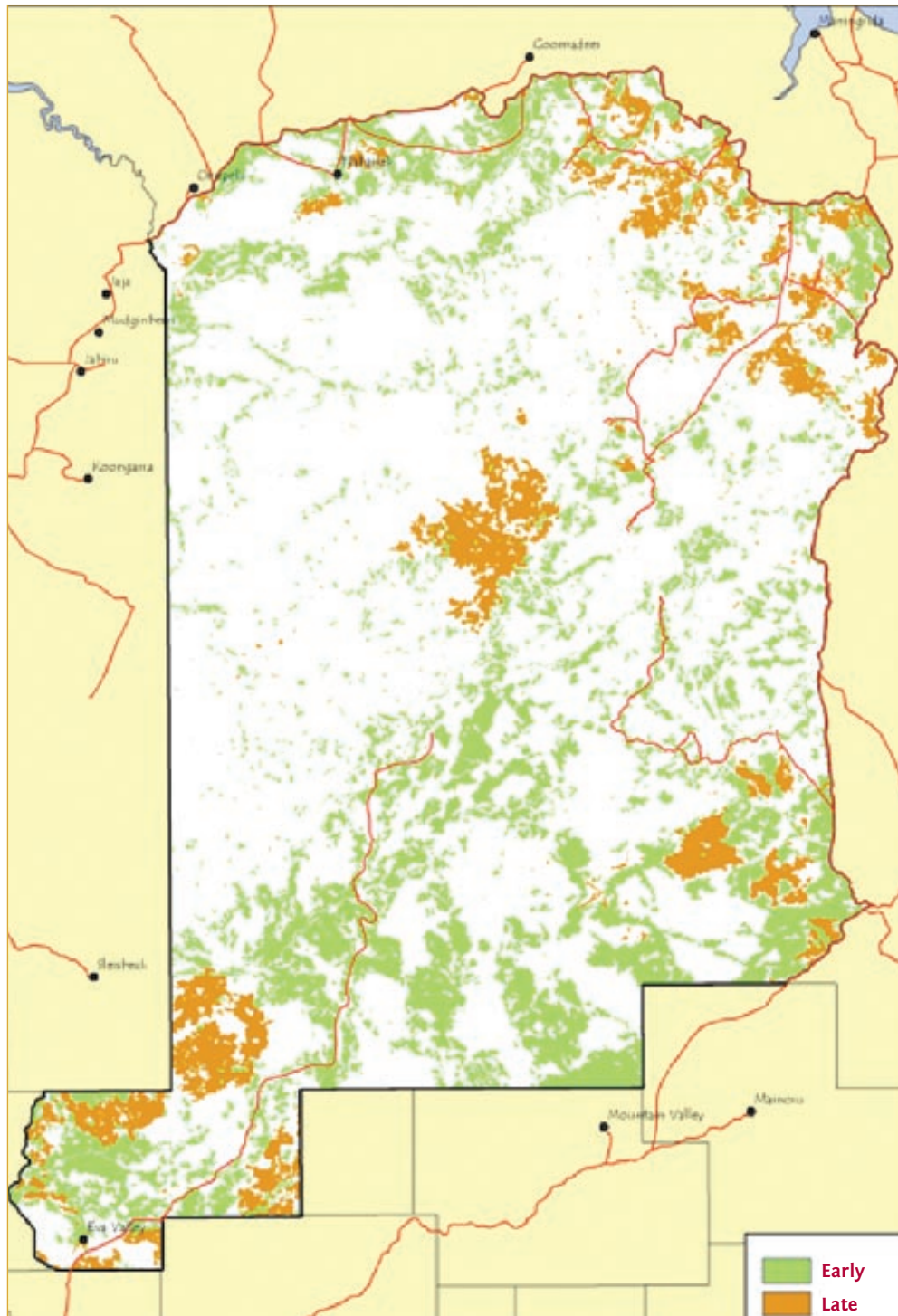


Figure 6: Fire Mapping for WALFA 2007

Figure 6 shows the fire mapping from 2007. The green colours basically show all of the prescribed burning that was put in earlier in the year, and the red parts were some of the wild fires we had later in the year, mostly lightning-lit. The result was – and if we were trying to abate 100,000 tons a year we got way over that – 180,000 tons. And basically in the last three years we are up about 500,000 tons against the abatement commitment we have made to ConocoPhillips. When you multiply that by \$20 - \$30 a ton, it starts to add up to a fair bit of money.

And the proof is in the pudding when you look at the stats. I gave you the 1995-2004 baseline, and last year you can see for the first time we really get fire happening a lot earlier in the year under a much more managed situation (Figure 7).

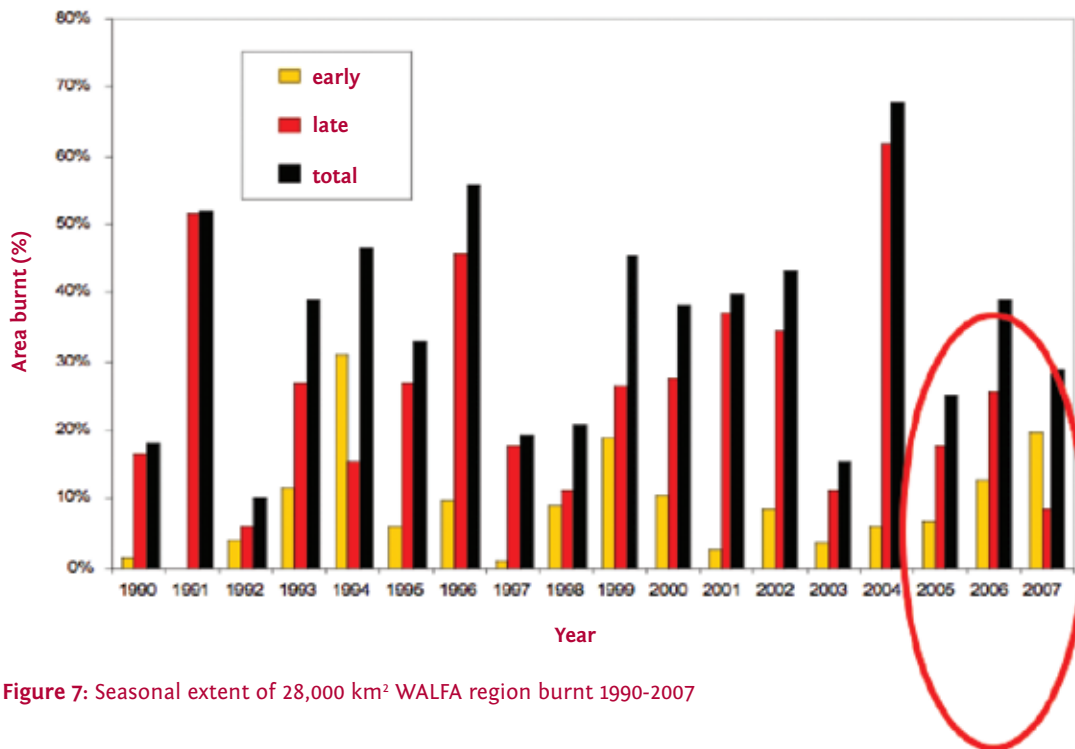


Figure 7: Seasonal extent of 28,000 km² WALFA region burnt 1990-2007

Fire management and the Effects of Climate Change on Indigenous lifestyles

Dean Yibarbuk

Fire ecologist and Demed Association Chairman (Kunbarllanjja Community, Arnhem Land)

Our understanding of the management of our country is very important. Traditional burning practices is an element impacting all aspects of country: not only the plants and animals, but for humans as well. Australia's indigenous people have played important roles for a decade without even thinking of the global support that we have given or been given.

In our belief – traditional belief, cultural belief – there is a spiritual element that holds between humans, plants and animals from when we are born in the beginning, to when we are adults, to when we get old. It includes the sacred species that we have been taught about through our childhood, and it has driven us from the beginning when we were born: we have to take care of the fires in this country.

However, in Australia today, many people don't understand how our country should be managed. A lot of the time we hear that down in the southern part of Australia people burn – but why? It is a big question mark to us, to our beliefs – and to our understanding of fire from the beginning of the history before the encounter of European settlement.

After settlement, the country here was almost gone. If we had not come back it would have been lost forever. You can't just abandon the land and expect it to survive. We have seen bushfires here with 200- to 300-kilometre fronts because the traditional burning stopped. But now we are living back on our lands as rangers, managing our country as we should, and managing the fires through our traditional practices

Of course, the country here is very unique, and our traditional lifestyle has been taught through the ceremonies. Our management practices begin with a ceremony. And although it's not about money to us, it's about caring for country. It's caring for country, land, people and nature as we have been brought up to do.

In many cases, we are seeing differences today: changes to our lifestyle and the way we are living. We need expertise, but who has the expertise? As a fire person I understood the landscape from where I was born. I have driven with my family group to a ceremony here and there. My academic skills belong to my people through my ceremonies. Of course, I appreciate scientific research needs to take place because of changes and differences of opinion around the world, which is really now why we are supporting this system.

We have been supporting our global system for thousands of years. What is a fire – happenings of small atmospheres up in the sky. Now, we have been told that there's different sorts of chemicals, different sorts of atmospheres going up into the air that is blocking the whole system, and that is what we are seeing right now. We have started to notice every scientist around the world. We didn't know. We've been pumping those small atmospheres for thousands and thousands of years. We keep on pumping those small atmospheres to support and understand our natural lifestyle.

We are working today with lots of scientists in different areas. We are pooling our valuable knowledge with their valuable knowledge about where vulnerable people will walk, hunt,

and gather for ceremonies. Here, we are all seeing a difference, what is happening to our systems? We are seeing a different pattern of the weather, and wondering why are we having this increased frequency of cyclones? Why are we having late weather happening? This is a concern of ours.

Our understanding of the weather patterns is supposed to be the beginning of September, October, November, December - we've got different cycles where our movements go. Many people in the north may have only two seasons, wet and dry. But we have six cycles, we move around with the cycles - we know what to hunt, we know what animals, we know where to go. The early wet season, the height of the wet season, and the late wet season are times without fire. Then when the early dry season begins with the south-easterly winds, we begin to clean the country with limited burning, using our pandanus or banksia firesticks. We are careful to protect the bush yams and fruit trees. The slow-burning fires encourage foods like the water chestnut to grow. By the middle of the dry season, the eucalypts flower and this is the peak of the burning season. Then as the dry season gets hotter, most burning stops except for hunting and on the plains where the fires can be controlled. Then the rains come and the cycle begins again. But at the moment we are frustrated because all the changes in the natural climate changes our understanding of the natural periods of our lives. We cannot go and find a specific resource that we used to gather and hunt before. Hunters and gatherers - senior people in our lifestyle - used to tell us "...that's the place you need to go to collect in a particular area for a certain time". But sometimes when we go to those places, we cannot find what we need any more - the plants and animals have gone - and we ask ourselves 'what is happening?'

Our knowledge comes from our people's beginning. It has been told to us: this area where you go, you collect food. Sometimes - a lot of the time - when our family groups go out there, when I go out there, we ask ourselves "where is the food? Where is the fish?" That's the big question my family group ask, and I tell them, "Look, things are changing." But why? Is it due to impacts from the people, the industry, the chemical companies? There is a big question mark, and we wonder, where are we going? What is the passage of information?

In our traditional beliefs, we need to have somebody in our community, our stable, our homeland, who can go and do the jobs. What jobs? Jobs like fire management - a very active, very important job.

Our people have been burning for thousands of years, to control the land. We burn just after the rains, and we make fire breaks to stop hot wild fires later in the year.

Before, we didn't have any materials, any machines. We didn't have any scientific understanding or knowledge. But we have always known what works. And we know our people are happier and healthier living back on our ancestral lands. Living on country, getting back to the bush, this is living the real life. This isn't just land to us - it is part of our spirit.

SESSION 2: ADAPTIVE CAPACITY

Adaptive capacity of Indigenous Peoples

Wendy Brady

Head of School of Australian Indigenous Knowledge Systems

In Australia, Indigenous people's capacity for adaptation to changing sea levels is recorded in the communal historical memory of Indigenous people, and in the evidence recorded by pre-historians. Sea level changes have spanned a rise of 130 metres from the last glacial maximum, 18,000 years ago, to the present level at 6,000 years ago. Indigenous people responded by relocation, altering their use of land and water and effecting social and cultural change. These adaptations were then recorded for future generations through patterns of environmental management as well as in the fabric of cultural maintenance.

The management of land and water has been the key to the ongoing capacity of Indigenous people to adapt to climate change. With colonisation and white settlement of Australia, the adaptive capacity of Indigenous people became critical in the management of land and the maintenance of culture, which stood alongside the social impact of enforced changes to Indigenous societies.

Because I come from southern parts of Australia there were forced movements and changes to occupation of land, containment and so forth. And in each level people adapted to changes in the best ways that they could. Here in my own country, at one time there were a number of Indigenous locations which were extremely popular food sources, and I was speaking to a colleague only the other day who was saying that my grandfather used to travel miles to get the Bogong moth. It's not to my taste, but that's because I've adapted to change. He adapted to that sort of change as well because he had to go further and go longer and that's when he learnt to ride a horse, so adaptation is very much a key to our survival.

In Australia the approach to climate change has been one of mitigation. However, now there is a realisation that the adaptive capacity of Indigenous people to meet the challenges of climate change have been recognised. One of the more obvious capacities of Indigenous people has been the management of land through fire referred to in earlier presentations. However, both historically and in the present Indigenous people have been able, and continue, to read country, and have for some considerable time been adapting to climatic and environmental changes. I know from myself when I lived in Darwin exactly 20 years ago and then came back most recently, that I have noticed a most distinct change in when the seasons start, and finish and the intensity of those changes.

Pollution, destruction of natural habitats, agriculture, mining, tourism, urbanisation, industry and marine enterprises have had a major impact on the adaptive capacity of Indigenous Australians. For example, figure 8 is a current indicator of the rainfall that happened between December 07 and 29 February 08. For many parts of Australia it was the highest on record. One of the things that did interest me is that when I was in Brisbane for some time, one of the people from the Brisbane area, an Indigenous woman, said to me "you know, we're going to get a lot of rain." I said how do you know and she said "I just know, I'm reading it." And of course there followed some of the heaviest downpours they have ever seen.

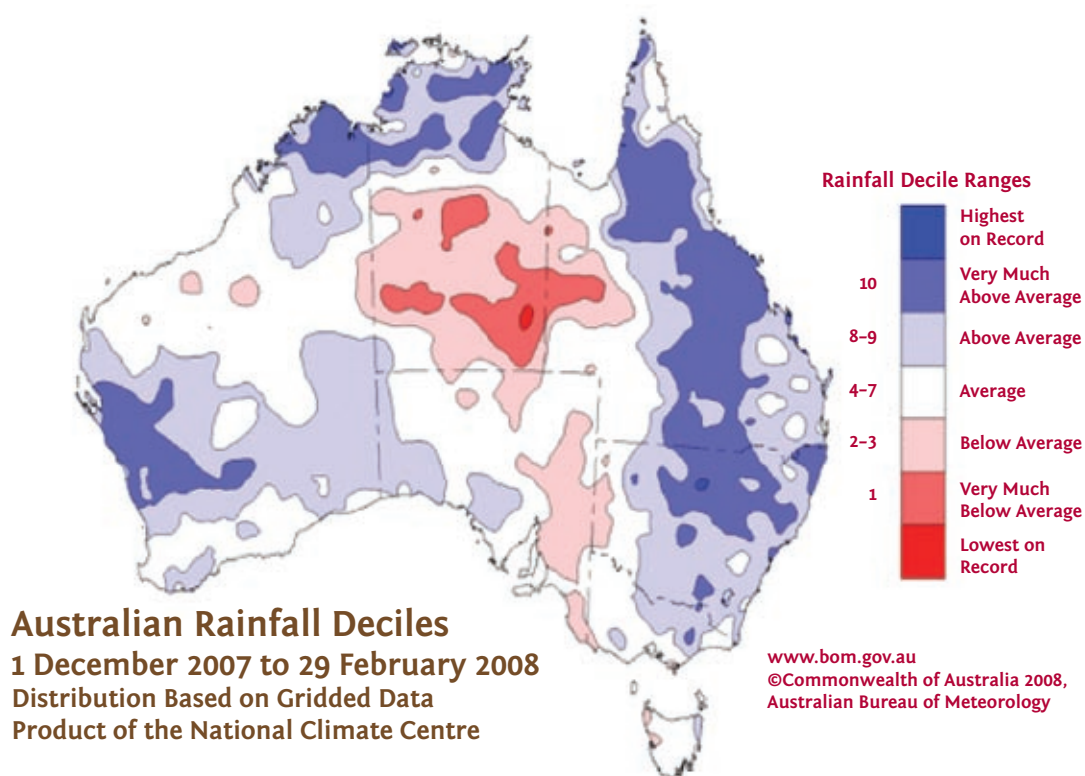


Figure 8: Australian Rainfall Deciles 1 December 2007 – 29 February 2008

These changes have major implications for Indigenous people and relationship to land and in terms of Indigenous enterprises. There is however a difference in adapting to climate change and being confronted with global warming, particularly in tropical zone communities. Increasing temperatures will require adaptation in Indigenous communities in the Northern Territory. These changes will affect the breeding seasons of particular animals and birds for example. I keep a close eye on the plovers that regularly nest on the lawn just out the front here and watch out for what time they are deciding to nest.

It will also affect the production of Indigenous enterprises related to agriculture of both introduced and native crops. Some Indigenous communities now raise beef cattle for live export and maintaining that community – this is a major Indigenous enterprise. It is an adaptation using country for something that has been introduced, and trying to maintain country in that situation.

Temperature changes, as the health experts have explained, have health risks. However, the changes in temperatures and in rainfall patterns will mean that Indigenous people will be at risk of other changes related to, for example, wind speeds and cyclones. We will have more interesting little creatures come to stay and remain to occupy different parts of our lands, and storm surges coupled with rising sea levels and changes in ocean currents will also affect our capacity. These changes also bring biosecurity risks to tropical Australia. The health of country, land, and water is inextricably linked by many Indigenous Australians to their personal and communal health and wellbeing.

The consequences of climate change have become obvious through loss and depletion of land and water as well as the wildlife and habitats. The connection between wellbeing and health of Indigenous people is accurate: the increase in temperatures will bring with it

increases in infectious diseases, bacteria and health risk, which will bring increased levels of illness, disease and death. However, one of the things I wanted to remind people of because I come from down south – when colonisation began, one of the major reasons for population decrease of people in the Sydney basin was smallpox and what could then be described as measles, cowpox and so forth (and for some people there is an ongoing debate about whether it was deliberately introduced, because the same method had been used in Canada). Some ten years after that massive impact on people, it was assumed that the people of the local Indigenous community in the Sydney harbour area had been completely exterminated. However, it was realised some ten years later that as soon as some of those people became sick, they had moved themselves out towards Parramatta to West of Sydney. And so those communities then became resistant to those diseases. So there is both a huge impact on health, but also in terms of what happens in then developing resistance.

Another thing that is not really understood and appreciated, is that weeds are often described by many people as ‘the plants you don’t want in your garden’. In fact the average household garden in Darwin for example can include plants that are devastating the native vegetation and fauna. I recently bought a unit and in the garden was some lovely mimosa and I immediately took the roundup to it, much to the disgust of my neighbour who thought it was just beautiful. There lives in these gardens the *Mimosa pigra* which is native to tropical America. The adaptability of Indigenous communities to deal with an invasive weed such as mimosa involves training in the control of such weeds. In this case the historical methods of caring for country are not able to deal with it because it’s such a massive invasion.

The eradication programs require extensive funds and for many communities weed eradication is not viable under their current economic conditions, before the mapping and eradication of mimosa can be undertaken. In 2004 it was estimated that Kakadu National Park was spending half a million dollars a year to control mimosa and to prevent new outbreaks. Now you know we talk about managing native species in Australia with biological control. The *Leuciris fimbriaria* mimosa moth is used as a biological controller of mimosa. But it requires ongoing monitoring to evaluate its success in depleting the weed. Weed control is a labour intensive activity, so therefore Indigenous people are trying to adapt but they need other support and infrastructure in to be able to exercise those controls.

Groote Eylandt is one example of how climate change could affect its communities and enterprises. It is the largest island in the gulf with an area of two and a half thousand square kilometres – 50 kilometres from east to west and 60 from north to south. It is a low lying island with an average height above sea level of only 15 metres. It’s a very beautiful place and the vegetation is typical of tropical savannah woodlands of northern Australia. A change in sea level and increasing levels of salt in the savannah woodlands would turn them into saline wastelands. In terms of trying to stall that invasion and so forth, you know in some places they are talking about putting up barriers and in other places they’re talking about using other methods to decrease the salination levels. So there are intensive examinations by Indigenous communities on the way to manage and adapt in terms of climate change.

Three years ago in Kakadu, one of the members of the local Gundjeihmi clan stated that in 20-30 years time the area around Wild Man River will be gone. It will be gone, and it will be mangrove. He also recorded that in 1980 a boundary fence was built near the Wild Man River mangroves. By 2005 the mangroves had moved a kilometre past the fence. Now in that instance, what we’re talking about is something that requires a great deal of capacity of Indigenous people in adapting to that massive growth and that massive invasion of land.

And, I will just revert to something a little political, to note that the scheme which employed Indigenous people on the sort of endeavours that we are talking about here was removed under the previous government. And what that has done, it has stalled some of the adaptation mechanisms to effect resistance to climate change and invasion by weeds and so forth.

Indigenous people have a huge capacity for adaptation. However, it is not endless. The capacity is not necessarily infinite. When adaptation is required in every sphere of society where they constantly undergo such massive changes as what has happened in the Northern Territory, it does take its toll and the capacity to adapt is diminished.

Indigenous people in tropical Australia have utilised country and culture to develop tourism enterprises. When sea levels rise and savannah grounds become saline wastelands, when the temperatures rise, when the biosecurity threats increase, tourism will be eroded. And this will endanger the cultural economies that Indigenous people have adapted to, to ensure cultural and social survival. There's always something lurking out there.

Tourists want to experience the abundant manifestations of Indigenous cultures. The tourists seek out the rock art galleries. They wish to engage in cultural demonstration ceremonies and events. They also want to see crocodiles from a safe distance most of the time, to feel the adrenalin rush of being up close and personal with the local wild life. They enjoy using their digital cameras to record the wetlands and its birdlife, they want to experience both the natural and cultural encounters of tropical Australia. They do not want to experience depleted savannah lands, biological health hazards, and communities that are forced from their lands by rising sea levels, denuded landscapes and a depleted or extinct natural world. Although I must say that in Tasmania, for those of you who have never been there, is one town where mining took place and the landscape was completely denuded and they use it as a tourist magnet now – I can't understand why...

Indigenous ranger groups are trained in conservation, land management and natural resource management, and I'm putting in a plug here because our school teaches rangers. They are utilising Indigenous knowledge and western sciences to combat the impact of climate and environmental change. They utilise their capacity to work towards preserving and sustaining country.

Climate change has also created some rather disturbing responses throughout Australia. In 2005 – and many still hold this to be true – there were calls to move the beef cattle industry to the Northern Territory. There were mistaken beliefs that rainfall increases would make the tropical north a prime water provider for the industry. Claims were made that in the northern savannah area stopping rates would potentially triple and holdings are expected to double in size. The competition for water in Australia is an ongoing debate. There was one grand scheme where they wanted to turn all the rivers around in Australia and make sure that the drought areas got water.

For many Australians the tropical north equates to the wetlands, lots of water, plentiful grasslands, and the potential to feed and water the whole nation. These beliefs, or myths, are born out of ignorance of understanding that climate change doesn't happen in only one part of Australia but the whole continent is subject to it. I'm reminded here of people always say how lucky I am to be living and working up here in northern Australia and how you can wash your car whereas in other states you are not allowed to. And I'm reminded again and again of the wisdom of Prof Bob Wasson when he said that the cyclone and monsoon seasons are

erratic, that you can never really measure what they're going to bring, and it's silly trying to make judgements on that and people should get back to looking at the whole continent.

These proposals to move the horticultural and beef industry to tropical Australia will again require Indigenous Australians to draw on their capacity for adaptation to both combat climate change and notions that others have of how climate change will affect them. And this may later be used as an excuse if they try and do this, and they will probably say we thought it was a good idea at the time. But by then will it be too late.

Indigenous Australians have a huge capacity for adaptation. They have been doing it since the ice age, and they will continue to do it. What we need in terms of adding to our capacity to adapt is infrastructure, funding, proper planning and also not to completely rely on the predictions that have been made in the past: for example, when the cyclonic conditions occurred in Queensland, one weather reporter said that we're using this on the models that we've had and those models aren't working any more - we're going to have to make some new models.

Indigenous people and our capacity for adapting to climate changes should surely be that model.

SESSION 3: HEALTH

Looking Beyond Climate Change: Implications for Health

Bart Currie

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Previous speakers have mentioned sickness linked to country, and one of the things I will be most trying to get across is that nexus between environmental health and human health, and putting global climate change in that context.

In my real job as a physician up at the hospital, the whole issue about environmental health and sickness and country is an important thing every day to the people that we are looking after that come into the hospital with various illnesses. Equally importantly over the last couple of years, some of the initiatives in caring for country have been happening, and are really some of the most exciting initiatives, certainly here in the tropical north and other parts of Australia. Those initiatives have really been showing the link between peoples' connection with the land and their general health, as well as the specific issues as they may present.

We hopefully all now accept that human-generated (anthropogenic) global warming is occurring. But one of the things people may not be well aware of, is that despite the reasonable and logical predictions of the impacts of global warming on health, clear associations of global warming with specific current health issues remain limited. On the other hand, we are all aware that human generated environmental change and particularly population pressures are major global issues. And there are clear associations of these with many different diseases and disadvantage. And of course the environmental destruction that is driving that, as well as overpopulation in many parts of the world, is continuing.



Figure 9: Impacts of deforestation on human health



So I am going to move on to some of the specifics of infectious diseases. As Figure 9 shows, in order to produce oil palm plantations for biofuel as an alternative to coal for instance, there has been massive deforestation in some parts of the world, leading to uncontrolled fires in countries to our north which have resulted in substantial impacts on human health. And this is just a picture of people living in Indonesia under massive smoke haze as a result of the burning off for production of oil palm and acacia plantations. So unfortunately this is the reality for many people living in some of the urban areas in large cities of Southeast Asia.

So what are some of the specific health issues that global climate change is responsible for? Well, I will put infectious diseases right down the bottom of the list, because despite all the talk about infectious diseases, there are other areas that there are much clearer associations with. There are many other drivers of infectious diseases that I will come to and which need to be addressed.

But first of all right up the top of the list is the sea level rise which is such a major issue for populations in the Pacific and everyone is aware of this. Australia and the Torres Strait Islands, some of the low lying islands – Mer, Saibai and Boigu – are all at great threat from sea level rise and there are clear health implications of that. Heat-related illness is something that we've heard about and is a major issue at times when these things happen. The excess number of deaths in the European heat wave of 2003 was said by some to be 35,000 excess deaths related to the heat stress that occurred – and this in very affluent countries, most of these deaths I believe occurred in France.

I guess people will be looking at what happened in Adelaide over the last couple of weeks where they had these very long periods of high temperatures, and there's been some fantastic research done by CSIRO scientists in Melbourne as part of the mitigation or adaptation and preparedness for this; i.e. development of early warning systems for heatwaves, so that people can adapt in their lifestyle over the next couple of days after a warning. They have calculated what are the actual thresholds for there being excess deaths. I won't go into that, but it does relate also to here in the tropical north; what is predicted for the future in that, for instance in central Australia, there will be a doubling of the number of days over 35 degrees Celsius by a little after 2050. And so clearly there is going to have to be some adaptation in relation to desert housing and lifestyle in general. So heat-related stress is a real entity and clearly global warming will have major impacts there.

The environmental stress for rural populations and for people on the land, farmers in particular, is of great concern. Issues about mental health with drought and difficulties with crops and production, for example. Direct trauma to people from severe weather events that are predicted to increase with global climate change include flooding, cyclones and bushfires. It is considered by various of the climate scientists that the places which will be particularly affected in the tropical north by the predicted increase in severe weather events such as cyclones will include Darwin – obviously we will be impacted because of our population – but also particularly Broome and for the coastal areas the Tiwi Islands. So that leads to opportunities for adaptation and preparation for that.

People may not be aware that there is a lot of work being done on air pollution and aero-allergens. Adverse respiratory health such as asthma is predicted to be increasing not just from atmospheric pollutants but also from increases in particular plant species and their pollens and also from organism spores.



Figure 10: Drivers for infection diseases

Then we come to infectious diseases. I'm actually an infectious disease physician, so I've sort of been making a summary of all the other issues from what I've read. But I feel a bit more confident about the rest of my presentation where I will be talking about infectious diseases, because that's what I do. Figure 10 shows the drivers for infectious diseases, and I'll spend a bit of time on this.

Infectious diseases have a lot of drivers, irrespective of whether the world is heating up or not. To begin with, we do have climatic variation and natural weather cycles – for those of you living up here in the top end of Australia, you know that in our wet season we have all sorts of nasty things happening in relation to infectious diseases. Melioidosis, an increase in mosquito viruses, things like that. These are the natural weather cycles that determine in many parts of the world the various infectious diseases. Temperature, rainfall, humidity and winds all impact on various types of infectious diseases.

Clearly sanitation and water supply are major issues that we have known about for a couple of centuries now. That relates very much to disadvantaged populations where there are difficulties with sanitation and water, resulting in an increase in water borne infections. And environmental damage and change will only make those sorts of things worse, and population density obviously impacts on all of that as well.

In times of flooding water borne diseases are a big issue, but then in times of drought there are diseases related to the lack of access to water.

Public health programs provide mitigation for many of these things, when you can try and bring resources to public health initiatives to address the issues.

Vector numbers and resistance talks about mainly mosquitos which transmit things and those mosquitos becoming resistant to insecticides. In addition the actual organisms, the infectious agents such as bacteria, viruses, parasites that affect us themselves, evolve over time to become resistant to the drugs we might use, such as antibiotics. Some of the infectious agents can evolve to become more virulent over time and some of them can evolve to emerge out of the animal or wildlife environment to be adapted to infect humans, which is what the concern is about potential pandemic flu arising from, for instance, avian influenza in the wild fowl and/or in the poultry.

And then of course, there is population movement. It has been well known throughout history that it is when there are times of famine and particularly war with associated massive population movement that many of the infectious diseases become rampant.

So, what about global warming? I haven't actually touched on what global warming does in theory, and of course in theory global warming can obviously impact on all of those specific things I have just discussed in ways that sort of just make sense. So global warming is likely to exacerbate many of the things that are already happening.

Jonathan Patz is one of the experts in the world on health aspects of global warming and I'd like to share this quote from the Proceedings of the National Academy of Sciences from the United States, one of the most prestigious scientific and medical journals.

"The nagging question remains as to whether or not there has been any documented change in human disease trends in response to long term climate change."

Jonathan Patz; PNAS 2002;99:12506

And then in the same editorial, Jonathan Patz says:

"This study likely represents the first piece of evidence that warming trends over the last century are affecting human disease."

Jonathan Patz; PNAS 2002;99:12506

Now, I want you to tell me what you think it was. What particular disease was, according to Patz, showing for the first time an objective change that was related to anthropogenic global warming?

So, what is it? Someone (from the audience) said malaria, which is the one people seem to talk about most. Dengue fever is another that people talk about a lot. Anything else? Influenza is something people have been talking about.

Well, it was, was actually cholera. Now cholera is a marine organism, it's a marine vibrio bacterium, and basically these marine vibrios thrive when sea surface temperature increases and salinity changes and they are also affected very much by environmental damage and river run-off. So that is where it may not just be the warming of the sea water but it may also be damage in relation to various activities or undertakings that lead to run-off into the sea. There are a number of marine vibrios apart from the cholera bacterium. They're all in the Vibrio genus.

But the main thing was that global warming clearly increases sea surface temperature and sea surface height, both of which had been predicted to increase marine vibrios. This study used very complicated mathematics which showed that the cholera cases in the Bay of Bengal were related to El Niño events via sea surface temperature rises. In summary, cholera cases dramatically increased when there were stronger El Niño events and these events were thought to be anthropogenically driven, in that they were stronger because of the global warming. This is in the Bay of Bengal, basically affecting Bangladesh in particular. And the point here is this impact is not a linear thing, but is a threshold phenomenon, and you're probably aware that climate scientists are talking a lot now about threshold phenomenon. Things go along and along and eventually you reach a threshold and things suddenly fall apart. And this was cholera cases dramatically increasing when there was a certain threshold of sea surface temperature which was reached. So that's just an example of cholera as an important indication of what may be the future with global warming.

So what about mosquito borne diseases? Which are the things like dengue and malaria that people are talking about in relation to global warming. Well, these have always been predicted to be "the most affected by climate variation and global warming". And this is because the mosquito geographic range will increase when things get warmer; the mosquitos which may be adapted to the tropics will go further north and south of the equator. They'll also go further up into altitude where in the past they hadn't been able to go because of temperature restrictions. The mosquitos live longer under some of these circumstances, provided they don't desiccate because of the dryness, so there has to be humidity as well as heating. The biting range changes – mosquitos in the hot weather bite a lot more and they reproduce much faster. And the various viruses and bacteria that replicate in these mosquitos, do that much more quickly under higher temperatures. So it all makes sense that mosquito borne diseases will be increasing with global warming.

However, the question is, are the current increases in dengue, and the current increases that are being seen in malaria, related to the global warming that has been happening up to date. The predictions are that as global warming increases these things will get worse. Fair enough, but what about the current situation? And the malaria story is very interesting because the malaria experts are saying that the current increases in malaria, particularly in Africa are not related to global warming as has happened up to now. They are not saying it won't get worse with global warming, but they're saying there are other explanations in relation to what's happening in the world for why malaria has got worse. And that is mainly related to socio-economic issues and equity issues. Diminished mosquito vector control measures are not surprising in what's happening in many parts of Africa at the moment. We have increasing drug resistance in the malaria parasite, and then decline in health service provision – which is probably the biggest thing. There is the population growth that's occurring in many of these countries where malaria is present, so there are increased people susceptible to malaria, and also the land use changes. Surprisingly in some parts of Africa, with land-use change it's actually becoming greener over the last decade and that's possibly also driven a little bit of the malaria change.

And dengue is a very similar story. The dengue explosion that's been happening in the last decade around the world has been almost entirely related to large urban populations living in disadvantage. It's in big cities where there are difficulties with water supplies and lots of open standing water in receptacles and old tyres etc that are ideal habitats for the peridomestic breeding dengue vector mosquito. You don't need global warming to explain the massive increases in dengue that have already occurred.

So this brings us back to these drivers of infectious diseases overall: international travel; people moving and carrying diseases around; mosquitos moving – for instance there is a well documented case of airport malaria in a mosquito that hopped off a plane in Cairns; imported animals – West Nile in the United States was related probably to imported birds that got into the US, or possibly to mosquitos coming off a plane. Melioidosis has been exported from our region of the world over to Europe on a number of occasions, in both animals and humans, and has in the past become established temporarily in parts of Europe.

As a local example, Japanese encephalitis has probably got into the Torres Strait Islands via infected mosquitos that were wind blown during severe weather events from the Gulf and Western Provinces of Papua New Guinea.

And then there is the phenomenon of dust clouds, and there have been bacteria that have moved from Africa to the Caribbean with dust clouds.

So this brings up the issue of population, and this is a concept that various people involved in global health are talking more about; biological pollution from human domination of the earth's ecosystem. The introduction of infectious diseases by humans into indigenous populations is human-mediated pathogen pollution, and a well-known term for this is "first contact depopulations".

A quote from Charles Darwin which I think is relevant, obviously because of the University that we are at: "Where the European has trod, death seems to pursue the Aboriginal... Most of the diseases have been introduced by ships and what renders this fact remarkable is that there might be no apparent appearance of the disease among the crew which convey this destructive importation because of the immunity in that population."

Charles Darwin was actually referring to the 15th and 16th centuries and the Conquistadors in South America. Fifty million people are estimated to have died from the introduced infectious diseases such as smallpox, measles, typhus. Three centuries later we know the history for indigenous Australians as well, with large depopulations, including from infectious diseases.

The second aspect of this biological pollution from human domination of the Earth's ecosystem is the biodiversity loss, which then impacts on human health, especially on islands, and the increasing global bio-geographical homogeneity with native species being replaced by introduced species; we know the feral pig story in northern Australia and the cane toad story as well.

So what about adaptation? There will be speakers after me who will be able to cover this in a much better way than I can, but I would just point out when you look at some of these issues of global warming, that adapting to environmental change is not new for indigenous populations. There have clearly been millennia over which there has been indigenous adaptation to an ever changing environment. 18,000 years ago was the last ice age and at that stage the temperature was 10-15 degrees Celsius less than it is now and the sea level was over 100 metres lower and the coast line was many hundreds of kilometres north of where it is here today. And of course the indigenous population in this part of the country had adapted to that, and remember that 18,000 years ago the indigenous population had already been adapting for over 20,000 years. Subsequent to that there have been periods of time when it has been hotter than it is now; although it's hotter now than it has been for 1,500 years, it is thought that in the days of the Romans the temperature in many parts of the

world was a little hotter than it is today. So this adaptation has clearly been happening with indigenous populations both here and elsewhere.

And it brings the whole point back to the nexus between human health and landscape health, and harnessing traditional knowledge underlying the complex understanding of the ecology of country. Not for me to really comment more on that except to say the thing that I've been very excited about, and in relation to my work as a physician, has been the initiatives that are happening in remote regions here, across northern Australia through the work of NAILSMA with the land and sea rangers. When I go out to communities to do my clinics, I'm seeing the young rangers, both indigenous men and women trained as sea and land rangers and how they are working basically on landscape health. Also I'm hoping that the link between landscape health and human health will be a thing that some of them, who may have some health-worker backgrounds, may want to get involved in as a career. I think that this has great potential for the future.

Health-Related Impacts of Climate Change

Ngiaire Brown

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I come from the south coast of NSW, and I am a doctor by trade. I will be providing some big picture perspectives around Indigenous health and some issues around land management and climate change here in Australia. (So big picture in fact, you can probably see them from space and will probably be well aware of them, but I have tried to condense them as much as is possible.) Some of those big picture perspectives are around the cultural determinants of health, some of the impacts of climate change on Indigenous peoples and health in Australia in particular, and also very briefly I will touch on a couple of issues for our later discussion.

I'm sure you are all well aware of the notions of social determinants of health and so issues of mastery and control, education, employment and income and how they influence people's health, their interaction, their ownership of their own destiny. And amongst the most famous of the researchers in this area are Marmot and his colleagues in the UK.

But what we often don't refer to, but in fact should, particularly for Indigenous peoples, are the cultural determinants of health. Whilst autonomy and self-determination are obviously universal, I think particularly land, language and cultural practice have significant impacts on Indigenous peoples – obviously within Australia, but also across the globe. And of course they are essential for Indigenous peoples' frameworks for decision making, for empowerment, but also for ownership of any initiative or work that is undertaken with them and for them. It is particularly important in health.

When we talk of Indigenous health and wellbeing it is not just the biomedical impacts that are important in terms of our health outcomes, and overcoming disparities that exist between Indigenous and non-Indigenous populations. But it is these determinants that are really difficult for western models to quantify and to qualify – so important to us obviously are emotional, spiritual and social wellbeing which are closely linked to issues of self esteem, resilience and cultural integrity and preservation and our identity.

Important too, are opportunities to participate in traditional land management practices, and other practices associated with lands and waterways, particularly here in the Northern Territory where I have been fortunate enough to work for about four years now. And also those practices that are linked to natural resources are hunting, bush food cultivation, and also traditional healing practices that are linked to the land and also to flora and which Aboriginal and Torres Strait Islander mob are leading in the Territory and across the country.

Some of those barriers to environmental practices are environmental degradation, encroachment by clearing for commercial purposes – particularly in the Tiwi Islands with clearing of timber but also for the introduction of crops and cattle, and of course real estate development, such as the economic development of the Tiwi Islands.

Bart has made reference for the potential for increase in cyclonic activity across the top end of Australia and the top end of Western Australia. For example, the recent cyclone that wiped out the top end of Alco Island flattened the forests and in fact has had significant impact on health and ceremonial practice there: they can't access bush bee native honey, like sugar bag, which is really important in terms of cultural education and ceremonial practice; the vines with yams have been wiped out; they found a pod of dolphins washed up on the beach,

which of course was quite traumatic for the community. And all the birds have moved on for the moment because there are no feeding options for them.

But I think that the importance of connectedness and traditional knowledge and wisdom, this is why the ranger programs are so important, and there are a multiplicity of benefits too for the Aboriginal and Torres Strait Islander mob. Individual benefits centre around income and self esteem and their contribution to their families; the community benefits are around economic development and sustainability; and of course there are benefits in terms of the acknowledgement of cultural wisdom and their remuneration for that wisdom and traditional practices. And it is interesting that our Australian government is playing catch-up with those notions of traditional knowledge and appropriate remuneration.

In reports such as overcoming Indigenous disadvantage, they know that the extent to which people's participation in the economy is closely related to their living standards and broad wellbeing: it influences how they interact at family and community levels. The overcoming Indigenous disadvantage reports and the associated indicators examine economic development through employment opportunities, influence over land resources, and aspects of training and education that are relevant to the goals of good governance and capacity to govern.

Now as a health professional, I would interpret that as the identification benchmarking and the development of indicators around traditional knowledge and cultural determinants.

I am sure we are all well aware that disconnectedness from cultural practice identity and issues such as land management for example, are significant contributors to psychological distress such as grief and loss and also psychiatric disorders, particularly around bipolar, psychotic disorders and depression and can be manifest as physiological and stress related ill health. And as you can well appreciate it increases – particularly for the Aboriginal and Torres Strait Islander mob – our risk profile for vascular disease, and therefore the risk for strokes, heart attacks, renal and metabolic disorders and particularly diabetes.

Some of the positive health aspects for which we are now able to determine and gather evidence – we have around 20 years worth of evidence from the homelands movement that with seasonal change and a change of campsite following food supply and availability for example – when the same families were able to undertake health checks, they found that there were improvements in a number of those physical measurements and indicators such as improved physical fitness as you would appreciate, also decreased risk profile such as lowered blood pressure, body weight, blood sugar levels, but their insulin resistance was also reduced. So the progression then to infarct or heart attack to the development of Type 2 diabetes to stroke and end stage renal disease was also significantly impacted.

Now my interactions beyond Aboriginal and Torres Strait Islander health in Australia is largely with the Pacific mob – the Pacific region Indigenous doctors, largely from Hawaii, New Zealand but also mainland US and Canada for example. What we're hoping to do is overcome some of the disarticulation of health from cultural practice because we feel it is an artificial distinction that proves a barrier in terms of health policy development and delivery and also service delivery.

And just to finish with we have noted that despite our geographical and cultural differences the same story comes from our elders around Indigenous peoples – connectedness to country and impacts on health, so that we in Australia are about 2000 generations worth

of cultural practice and wisdom – that we are the true custodians of mother earth. The reason that there are so many significant environmental upheavals and changes in weather patterns, and that our populations and the environment in chaos, is because Indigenous peoples the world over have been disrespected and dispossessed. And once the rest of the population realises that and comes back to Indigenous peoples and that knowledge, and restores them as rightful traditional custodians, then we will truly be able to seek and achieve balance.

Now I will leave it there. I know that I haven't been just specific to climate change, but hopefully I have given people some issues for consideration on the interface and integration between health and biomedical models, and traditional knowledge and cultural practice, that we find so hard to come to terms with.

SESSION 4: PANEL DISCUSSION

International Panel Members

Victoria Tauli-Corpuz, Philippines

Chair of the United Nations Permanent Forum on Indigenous Issues

Patricia Cochran, USA

Chair of the Inuit Circumpolar Council

Fiu Mata'ese Elisara, Samoa

Executive Director of the O Le Siosiomaga Society

Q. Panellists, please take a few minutes to compare or contrast your experiences in your region with the experiences here in northern Australia.

Patricia Cochran

I'm glad to be back and able to share a few of my thoughts with you again this afternoon. I think the thing that amazes me, no matter where I go whether it is in Africa or in Australia, or in the Andes, the stories from our people, the experiences we are sharing are the same. So we may not be all looking at our issues of climate change from the same perspective, but all of our issues, the things that we care most about, the survival of our people, our cultural identity, our values, our children – all of these things are important to every one of us. Not only as Indigenous People, but really as human beings.

So I think this is a message that translates across borders, across boundaries, across cultures, no matter where we come from. And I do really think one of the best things we can do is to share those stories with each other. Because the things we're seeing in the Arctic may be very different from what my brothers and sisters in Africa are seeing. But again, it all comes from the same place: especially as Indigenous people. So I am very interested in hearing all of the things that are happening here in Australia, I can tell you for sure that we are experiencing some of the same conditions, especially issues around fire which I was quite interested to hear about this afternoon, because in Alaska we've had huge, huge fires – fires that have burned in the last season, in the season before and the season before that: our fire seasons were two of the worst we've ever seen in our areas. That destroyed millions of acres of land within our state.

Now one of the things people don't realise is the geography of Alaska. In my area, which is the Arctic, we are mostly treeless. We are an area that really does not have anything but tundra: but one of the interesting things we're seeing even in our tundra areas, is the number of tundra fires that are now taking place within our own communities, that are severely impacting all of the animals that we depend upon. Because in some of our communities especially in the Arctic, up to 90% of what we eat comes from our natural supermarket, which is outside our door-front – that is where we go shopping. We still live very closely tied to the land. We expect that our animals will be there to offer themselves to us. And it is a very terrible thing to witness what is going on.

Again, in Alaska, we have many different kinds of areas from sort of tropical forest areas in the southeast of Alaska to the Arctic, which is ice and snow. So we're seeing all kinds of conditions. In the interior of Alaska last year they had a number of lightning strikes, creating many fires, and last year there were more than, I can't remember exactly, it was somewhere over two weeks, when the temperature in the interior of Alaska was over 100 degrees. Now for us, obviously, that's not the common thing. It's always been warmer in the interior but never the way we're seeing it now.

And again we're seeing so many of the same kinds of things, we're seeing new species that we've not seen before, new animals that are coming into our areas, we've actually started a whole new industry in Alaska around shark fishing. So now everybody wants to come shark fishing in Alaska – well that certainly isn't something we used to do before, but now again, these are just some of the experiences that we're having. So I guess what I'm trying to relate is that even though we're very far apart in our geography, I think that our issues are very common issues and ones that we all care about in our own unique ways. You can see the destruction that is really occurring in our front yard, where our villages are literally falling into the sea.

We're having loss of life of many people - there's hardly anyone in any of our communities who hasn't lost a family friend or member of their own family because of the problems that we have now in being able to travel safely within our own areas. The conditions of the ice that are very different now from what they used to be. The inability we have now to predict weather as we have in the past because things have changed so rapidly for us. So again, I can see many similarities that are happening here in this area, and one of the things that we're working on now is to try to bring together information from indigenous communities from across the globe, to begin to share our stories, to begin to share our concerns and to begin to find some common solutions that we can present as a united indigenous community, a worldwide community.

Fiu Mata'ese Elisara

When one of the Aboriginal leaders in Australia said that we had been here since long before the first sunrise, that rings very powerfully to me; an issue that is integral in terms of our own existence as indigenous peoples. And unfortunately it's something that we cannot defend, given the contemporary issues we are facing in our lives today.

They say that we should open our arms to change, but don't let go of our values. It's not very easy to juggle between change and retaining our values. And it's an ongoing challenge that we need to face.

I come from the Pacific and I made a presentation yesterday in terms of our issues as a liquid continent that we call ourselves. Many of our islands are actually two metres above sea level. And we've been also saying that the concept of sustainable development unfortunately has been in the main pushed very strongly only on economic pillar of sustainable development and we have failed miserably to give balance to the other pillars of sustainable development the world has agreed to. So we are obligated and we have the responsibility to remind the world that sustainable development is indeed a concept that is going to work if we are genuine about the whole pillars of sustainable development that being, economic, being only one of them. We've got to give consideration to the social aspects of our lives, the environmental concerns that we have, and indeed the cultural diversity that we need to embark on enriching ourselves with.

95% of the peoples in the Pacific are indigenous. What happened on 13th September last year, 2007, when ten or eleven of our countries refused to be in the room when the United Nations Declaration on the Rights of Indigenous Peoples was signed, was really something that is unacceptable and I've been known in the Pacific to be called a Samoan that is ashamed to be an indigenous Samoan. Why I've said that? It's because the interference of countries like Australia and New Zealand have caused our countries in the Pacific to not endorse that declaration. Which is in fact denying our peoples' rights to exist as indigenous peoples.

We've been talking in the last couple of days about some of the very issues on climate change with regards us as indigenous peoples. And we've been reminded all along by the fact that we've been taken over by trade concepts. Multilateral environment agreements are now taken over by WTO concepts, it's all about business now. It's all about money. Forget about us indigenous peoples, we don't matter any more in the current world issues.

This is from my perspective in the Pacific, this is the real fire that we are actually trying to put down. Fires of the contemporary issues that are challenging our very lives as we live in our world of today. The business world of today that do not give cognisance to ourselves as peoples, and we are basically commodities on the markets of today.

Climate change is indeed a challenge of our time that Ban Ki Moon has called is probably the biggest challenge of our times, and I think that we should take note of that. I think it is very right to say that we really need to try and violate our current situations to create our future because we are running like made to catch up with a tomorrow already made obsolete by the happenings of yesterday and today. And we really need to take it on ourselves these challenges because climate change is indeed a matter of life and death for many of our peoples. When you start to talk about some of our Pacific countries as environmental refugees, I ask you a question: Who has to be accountable? Somebody needs to be responsible. We are indeed southern countries of the world recognised under the charter of the United Nations, therefore nobody has any right to cause some of our countries, some of our peoples, to become environmental refugees.

In public forums like this, I refuse to address the issues of options for our peoples. It is indeed an inevitability that our people will end up being environmental refugees. But it is not my position to start sharing with you all that fact. It is a continued struggle and we need to continue to struggle with the very essence of our existence as peoples in our cultures, in our spiritual connectivity to our lands. And in Samoa where I come from, when the current government policy is talking about relocating some of our people under the name of climate change, I have a big problem with that.

When the current situation in our country has caused land reforms that have emanated from the white paper generated in Australia – and the Pacific 20/20 document of Australia, it's now right throughout the Pacific – and the current system is going to include 81% of our customary lands under those land reform policies of government, we have a problem. We have a problem because it really is the essence of our livelihoods as peoples in the Pacific. And if these changes are brought about because of the co-options of our own governments by some external forces then we are really answerable to the future generations of our time. They say in Greek, *Kyros*, it means now is the time. In the time of crisis, there has to be something, somebody, who would come out of those crises to make a difference. When they say in Africa *Obuntus*, they are calling us back to our roots, our fundamental principles of life to find the solutions to our problems.

The Bali convention of climate change last year have come up with very terrible flawed solutions to climate change. Bio fuel is one. Avoiding deforestation is one. We're being crucified by definitions. Concepts that are readily, you know, seemingly acceptable to us, but by gosh the devil in the detail and the hidden agendas behind those things will crucify us in the future, in terms of our concerns as indigenous peoples.

When Wendy Brady alluded to some of the failed models and the assessment of one of them saying that we have to go back to indigenous models, we have to say we've said it all along. And the scientific models have only gone back to prove that we've said it all along: that indigenous models continue to be relevant for us. We need to take some lessons from that.

I like telling stories. I'll end with a very short story which I've told to two of our colleagues here and they've said oh, you have to tell that story. It's the whole issue of equity – without the spirit it will never mean anything.

A dying father was on his death bed and he said to his two sons "I'm going to die, but I'm going to give you three gifts, that if you divide equally between the two of you, you will live happily ever after. And the three gifts are: first, a tree; the second one is a cow; the third one is a blanket." Then the father died. The elder son said "OK, younger brother, I'm going to divide this equally between you and me as advised us by our Dad. For the cow, you're going to have the front half, I'm going to have the back half. For the tree, you'll have the half down to the roots, I'll have the half up to the branches and leaves. And for the blanket, you can have it during the daytime while I have it at night-time." Of course, you are laughing because you know the story. The poor young brother keeps on feeding the cow, but when it's time to milk, only the older brother was benefiting out of it. The younger brother keeps on watering the tree, but when it comes to fruiting, only the elder brother was benefiting out of it. And for the blanket, he keeps on washing it and putting it out in the sun to dry and when it comes to the time when he really needs it at night, only his older brother was benefiting out of it.

Equity without spirit means nothing. We need to envelop that spirit and perhaps this is our call in terms of our plight. For Indigenous peoples on the issues of climate change that yes, we talk about equity, benefit sharing, fairness; but we really need to integrate that spirit into it to be meaningful to all of us and for our children in the future.

Victoria Tauli-Corpuz

Thank you very much. I'm going to speak as an indigenous person from my community – Kankana-ey Igorot from the Cordillera Region in the Philippines, and I come from a tropical forest in a high mountain area. Because the question was how similar or different our situation is from what was discussed earlier, well just to say I think that this whole issue of fire abatement is something that is very familiar with us because we are shifting cultivators, you know, we are rotational agriculturalists and fire plays a very key role in the kind of agriculture that we practice. And I remember that we, up to a certain time they looked at shifting cultivation as very backward, yet now it's shown that the shifting cultivation that we have practiced in our forests and in our lands have actually preserved these forests to what they are today. I come from a community which is one of the heavily forested regions in our region, and the reason for that is because of our own indigenous resource management practices, specifically our forest management practice which we call *Ba'Annan*, or it's really a collective practice of indigenous peoples, all being involved in the different phases of taking care of, and stages of taking care of the forest.

And this has not been recognised by the government for a long time, but with the realisation that in the areas where we practice this kind of forest management, these are the areas where there is still forest left in the Philippines. The Philippines is one of the most deforested countries in the world and when the government speaks, actually they speak only of the forest that we managed to conserve and that's because of our own practices and our own belief systems that's very much related to keeping this forest intact, so I think there's a lot needs to be learned by the dominant society from us.

But I'd like to say that actually climate change is the best proof that the whole economic development model adopted by the world, by the modern world, is really a failure. If we managed our world more sustainably we wouldn't have climate change as a problem and now all the scientists are saying it's caused by humans, it's a human induced climate change. The climate change that we went through the past hundreds of years or thousands of years ago is really more caused by, of course by humans, but also by natural consequences. But this kind of climate change that we face is really a proof, it's a living proof of the failures of all these things that are being said to us. Even what they call sustainable development – and because a few have said now that sustainable development means how to sustain all these businesses, these big businesses that are still there that are insisting to influence everything and not really to sustain the quality of the landscapes and ideas that have been used to sustain these kinds of landscapes.

But the second and more important point I wanted to say was about the role of youth. We heard some speakers this morning who are youths from the Navajo nation and from the indigenous peoples from the north in Russia, and this is really something that we need to take to heart, because truly, many of us are going to disappear in a few years time and it's the youth who are going to take on the responsibility to continue and to ensure the survival of our future generations. I think the biggest challenge for all of us is how do we bring the youth in to be more involved in all of these discussions and all these actions that we are taking, because they are the ones who are going to carry it forward. And maybe because this is a university, this is a big challenge for the university. How do you ensure that things you are teaching in the university are something that is really relevant for the indigenous youth who continue to carry on the responsibility not only for us, but also for the earth and for the whole of society. What are the challenges that the university like the CDU face in the light of that kind of challenge, that's a very, very serious question which we haven't had a good answer to yet so I leave that with all of us. What answers do we give to those kind of questions?

Q. How do we use traditional knowledge in a rapidly changing world?

Bob Wasson, *Charles Darwin University*

We've heard from Dean about traditional practices being used in fire abatement systems, but he's also told us that because of seasonal changes, changes to the type of rainfall etc. that the old indicators that our elders use no longer seem to work. One of the really interesting problems to my mind – and this is a Western science perspective – one of the interesting problems we face is that for the last thousand years we have not seen temperatures as high as we have now. The Roman period might dispute that, but that's 2000 years ago. So we haven't seen temperatures as high as now for the last 1000 years. In fact for most of the last 1000 years it's actually been colder across virtually the whole place, the tropics is different in itself. We haven't seen floods as big as now for the last 1000 years in most parts of the tropics. We haven't seen, well we don't know actually to be quite honest, we don't know if the big magnitude cyclones are actually increasing in

numbers, there's some evidence from some parts of the world where that's true, it's not clear that Australia. But let's say that it is true, that there has been an increase in large magnitude cyclones in the last few decades. That suggests, that in the last few decades, things are so different that traditional knowledge may be stretched that actually relates to what is going on now.

Oral traditions have been around to actually give us time depth, to perhaps 2000 years. Some of them may do that. I'm not trying to be negative, I'm simply saying that the world is so different now and will be even more different, how do we use traditional knowledge, except in particular instances such as the fire management example. Perhaps there are others around the world.

I think we need to understand that, we need to document it, so the universities can do what you're suggesting, but the community at large, and government agencies etc. can actually take note of traditional knowledge. Unfortunately, in the western tradition, unless it's documented, it's extremely hard to take note of. But I think this change of condition, this change of state, seems to me to present a particular challenge.

Patricia Cochran

Well, if I have three days to discuss that question - I'm not sure it's a question that can be answered but let me take a few points. First of all I guess what I would say is that people must realise that traditional knowledge is not static - traditional knowledge is dynamic. That what I know is very different from what my mother knew, from what my grandmother knew, from what my great-grandmother knew and will be carried on. So it is a compilation of centuries and I will tell you in my community, pretty intact. Centuries of experience.

Our experience though comes in different forms. And I think one of the problems that we have with your question is that we're still trying to fit traditional knowledge into a system that has no concept of traditional knowledge and how it works in a western paradigm.

And for me the question should be just the opposite - how does the western paradigm, the western educational system, how does that have to change in order for traditional knowledge to be accepted and to be utilised in ways that will indeed save our world. So I think that's the way we need to be facing this question. And I guess I'll start the conversation there, and let other people join in.

Wendy Brady

I think that one of the points I wanted to deal with first was when you were talking about western science if it's not documented it doesn't really have any weight. That's because western science has a poor memory. And western science uses these documentations to fight amongst each other most of the time about, you know, whether it was warm in Rome in 1500BC or it was cool in Rome in 1700 BC. But I wanted to respond to this because Dean raised a very clear indicator of the memory and the understanding of indigenous knowledge when he talked about how, when he goes fishing now, that the fish aren't there. When they go to find the particular plants, they're not there. And I think that the documentation should be not only what exists but what is gone and how people are managing in terms of that.

Indigenous knowledge as you said is on a foundation that has a relationship to working with the world, whereas western knowledge is about making use of the world and adapting it in order to be able to commodify its value. That is a clear separation in terms of understanding.

And I think that here is a crisis that is affecting all of us and it needs a shift in thinking in terms of western knowledge because as it's been said, you know, we're being seen as a source of information about ability to adapt and so forth but we're not actually seen as an authority on the management and it's being continually imposed on us about responses to climate change and it's all about mitigating. It's like you cut down a natural forest here, you put in a pine forest and then you know some carbon emission industry over here goes, we've saved the world. They're still emitting it, they've put in a pine forest, knocked down the natural forest, and you know the first bush fire comes along and the pine forest is little bits of ash and that's destroyed.

So I think that this whole thing in carbon trading is a furphy. It's like that thing where you put the coin under the card and you say where is it? And no-one ever wins with that sort of a game and I think carbon emissions is one of the biggest problems – I guess it's like buying a car that has no wheels. You'll still run the engine but you won't go anywhere.

Fiu Mata'ese Elisara

I'll start off my response with a little story. A scientist came to one of my communities and he deliberately pretended that he was sick, so that our traditional healer can come and apply her medicine on him. And through that process he learned what sort of plant the traditional healer was using. And through that process he learned how the methodology was applied. And we have been very respectful people, we didn't even dare to ask because we are very hospitable, we were very concerned that this person needs to get well again. Not knowing that our methodologies, that our understanding of those plants, were being stolen from us. Were being literally stolen from us. So be very careful about hospitality indigenous peoples.

Because that's basically the problem of today. Scientific knowledge in my view is indigenous knowledge. No matter how you want to package it, it's all about packaging. But much of it is indigenous peoples' knowledge. A case in point is the kava in the Pacific which you probably know a lot about. We've been drinking kava all our lives and it has strengthened us in our work out in the sun and enabled us to withstand the forces of the sun. And we've been exporting kava overseas and somehow the scientists have added an additive to our kava and they've gone in and say it's bad for your livers. Not because of the genuine pure kava, in the assessment of many scientists, but because they have literally added an additive that has caused it to be corrupted. And this has been said to us by some of the very prominent scientists that we have in the Pacific. And now in Germany we're having trouble trying to get them to get the export of kava going back, which is also causing a lot of poverty in many of our investments in kava.

What I'm saying is we really need to work together in terms of science and indigenous peoples' knowledge. New Zealand's National Institute Of Water & Atmospheric Research has said that on average the Pacific will have about 9 cyclones a year. So we have gone in in terms of our disaster preparedness and got back into the indigenous knowledge whereby we can keep the access fuelled, and the process where we would be able to survive for at least three months while we're waiting for assistance to come back in.

So that's another way we've gone back into using indigenous peoples' knowledge, in terms of our own survival and trying to revive what has happened in the past. Because that knowledge, as one of our colleagues was saying, the twilight years of many of our elders, they are unfortunately going down with that very important knowledge without us capturing it. So we are also trying very much now with some of our own projects to go round and try

and document some of these, because that was the problem with us, we never documented things, it was always handed down by word of mouth, and unfortunately we weren't able to document a lot of that, so we've also gone around and now documented some of that knowledge in some of the projects, to try and ensure that we have not lost this altogether. But as one of my friends always says "...be very careful about that. Once you start to document anything, you are actually giving it to the private sector and in a public forum that they will then turn around and patent it for their own good." And they will sell it back to us, the owners of the knowledge at astronomical prices that we can't even afford to buy them. And yet it originates from us and from our backyards. So I hope that's not too controversial.

John Scott, *Convention on Biological Diversity Secretariat*

I think it is important to recognise that traditional knowledge has never been under so much pressure as it has been under at this time – under attack as it were – and the inter-generational transfer of course has been weakened. 80% of the world depends on traditional knowledge for their primary health needs – we might forget that in Australia and the developed world.

Indigenous people have also never been so dispossessed and disassociated from our traditional lands and waters. At the same time we've never experienced such rapid climatic change. Strong healthy communities on-country using their traditional knowledge is what provides for resilience of traditional knowledge in face of change – including climate change. At the same time it is difficult for indigenous peoples to come to the table with indigenous knowledge not protected. It is often misappropriated and misused. And western science doesn't seem to be providing us with the answers to climate change. People have said traditional knowledge is becoming unreliable, perhaps irrelevant. Yet there is recently much interest in the exploitation of traditional knowledge, which until very recently was regarded as hearsay and myth. I think it is a very complex issue.

Victoria Tauli-Corpuz

Well the question was how do you address the fact that the changes have really had a lot of impact. The magnitude is such that the knowledge we have is not really able to cope with it, but I think that's really the beauty of the human being isn't it, the human being is able to adapt and really think about what to do whenever he is met with that kind of situation.

I remember, in my village, one time I was asking our women, the indigenous women who are the farmers of course, about the seeds we have – we have potato and rice, both sticky and unsticky varieties. I was asking them what are these crops that you're planting and when do we plant them? I don't know the whole range, and they showed to me the different crops they use when the soil becomes a little bit sandy, when there is drought and when there is too much water. They showed me all these crops and then just recently I had a conversation with the Consultative Group of International Agricultural Research (CGIAR), and of course we know the issue that many of the seeds that we have are kept in seed banks. And I think many of those crops we have developed are kept there, so one of the challenges I gave to them is "Are you going to allow indigenous peoples to go to your seed banks and get those crops that you took and which are storing there?" Of course here we are talking about the Agricultural Rice Research Institute, they said that in the International Centre for Tropical Agriculture (CIAT), actually they are now doing that because in CIAT they keep the beans, the forages, all these different kinds of seeds. They said that the Andean indigenous peoples, they went to CIAT because this is based in Colombia, they recovered all the seeds out there and now they are regenerating many of these. And I think that's really for the whole place now, because

if you're able to get those seeds that have been stored and of course let the people who are farming experiment for their own districts, it's them that will be able to develop those crops. I think that for the whole issue of food security and the knowledge around food crops and all that, a combination of modern, western science and traditional knowledge is really to be brought together, because it's not as if one has the monopoly on truth - because everything is there and we have to look at all those different combinations.

Q. What are some ways that traditional knowledge is informing people today?

Ngairé Brown

I heard a comment the other day on sighting of cricket birds being warnings for cyclones. That's exactly the same for us as well. I noticed in the last cyclone myself there were a lot more cricket birds in Darwin that I hadn't seen before.

During the Tsunami in Indonesia there's an island that thanks their ancestors for giving them a warning that the animals ran for the top of the hills and people noticed that and also went behind the animals and most of these people survived. Incidents like that abound: in the Internet site the green channel, because of the risk of floods in Brazil, people started noticing the animals doing something different, indicating an oncoming flood and potentially hundreds of peoples' lives were saved.

Q. What do you see as the role of international institutions?

Audience member

It seems to me the real issue is not so much the status of the different forms of knowledge, but how we really address the things driving the changes that continue to affect us. I'm interested in how what has been proposed as the method, the only real method that can be agreed upon, supposedly reducing the emissions, is carbon trading. I would suggest that traditional knowledge about nature is the right knowledge, but the extent to which economics, a distinct area of western knowledge, and carbon trading, what is the role of international institutes like WTO and especially the World Bank - both funds are increasing our output of fossil fuel energy, and also profit from carbon trading portfolios as the world's biggest broker. How would you see that role?

Victoria Tauli-Corpuz

Well first of all the world bank. Actually we raised that before the world bank, I said that "why suddenly is it that you are the main channel for climate investment funds for so called climate change mitigation and adaptation? And yet you are still funding a lot in terms of oil and fossil fuel extraction." You know, they didn't answer me.

The other question that I asked was "why is it that you are now suddenly engaged in attracting climate change investment funds and yet you are not involved in climate change negotiations?" They said because they are not a part of the negotiations. We have a situation where the World Bank is a very major player in all these things, yet it doesn't take part of course in the negotiations and that's really creating lots of problems, even for the countries who are negotiating under the climate change convention. For the negotiator, all the time the resources are with the bank, it's not with them, so that's one issue.

The second issue is of course with the WTO. The biggest problem that came out in Bali during the negotiations was the acknowledgement that technology transfer has not happened at all because it was the promise of the Kyoto protocol that the Annex I countries have the economically, environmentally sustainable technology that abates pollution, etc. etc. They're supposed to transfer those kinds of technologies to countries who have not managed to develop it because they're still in the stage of surviving, but in the end nothing's happened.

One of the things that kept that thing from happening is the intellectual property rights regime, because the WTO says that for transfer of technology you have to respect the intellectual property rights regimes of these countries who have developed this technology, so that's really an issue which needs to be dealt with. If you go in the WTO agreement, it says for public and moral purposes you have to be flexible in terms of using your intellectual property rights regimes and of course there is a public reason and a moral reason for you not to impose your regimes, but you know - unfortunately it is not happening. In fact there was a big meeting in Bali where many of the negotiators were there and that was one of the issues that they wanted to discuss.

Finally, even in the issue of environmental services, they're now looking at the issue of environmental services which relates to water, waste management etcetera, and the WTO is another body that's wanting to have a say over how environmental services is going to be managed. Especially in the developing countries and they would like the big environmental services companies to be allowed to go to the poor countries and manage the waste etc. I think that this is the kind of situation we're faced with where the big institutions still want to have control over the processes of addressing climate change, and in terms of decentralising energy systems, promoting small scale renewable energy systems, waste management systems etc. It's been difficult because of these big agreements.

Patricia Cochran

I'm not so sure that I'm going to have a popular opinion to state here, but I've been feeling this all day today in the discussions that we've had around carbon trading, carbon markets, everything related, I have to tell you this has left me on edge. And I will also tell you that I will leave it to other people who know more about this stuff to deal with it.

I have literally had to shake myself off of all of this stuff around us, because I think that we are becoming infected by all of the agendas of everybody else trying to influence our opinions and the way that we choose to do things in our world. And so I've had to literally just stop and say "That's it!" We have to go back to doing things the way that we know is the right way, regardless of other people's agendas. Because once we start buying into all of these ideas that are swirling around us every single day, and people trying to buy our votes, and taking our property, then we just become entrenched, mired, we get stuck ourselves. And so I honestly just literally have had to stop and say, I am not going to deal with that. I understand that these issues are going on, but I think the best thing that I can do for my people, for my community, is to be honest and true to who I am. And to the way I was raised, and to the beliefs and values that I come from. Because I think that is our strength. I think that is what is going to get us to where we need to be. And it's not all of these other systems that are around us. So that's where I stand, and I tell you now, that I'm not going to be one of these people leading this discussion.

Fiu Mata'ese Elisara

Very quickly, I think if you have the time to read my presentation in the meetings in the last couple of days you'll probably see some of the reasons that we, as indigenous peoples are quite concerned with the outcomes of Bali. But because you are mentioning world bank, I think it's an issue of liability here and also an issue of convenience. A lot of the donor countries that have put in to the carbon facility that Vicky was referring to, and this world bank project, it's between 5 and 40 million dollars per country into this facility, but the way we read it is that all of these countries do not want to be blamed for any failures out of those donor funds that are donated to world bank. It's easier to blame the world bank as an institution and make them liable, because it's only an institution, not a country, and therefore that's a concern for us. You know, the donations that some of these donor countries are giving into the world bank with regards that, we have a big concern about that, because countries can be liable under the UN, but under an institution like the world bank, it's easier to blame them rather than the source of the funds.

Wendy Brady

I agree with what Patricia says. It's very hard in the Northern Territory now for many communities to feel that level of independence, because there have been massive interventions and what started out to be a call in terms of child safety, turned into a blitzkrieg on indigenous rights, which is completely race based.

There have been good outcomes for some people, but as you know I'm not from the Territory, but I come from a family that grew up under the aborigines' welfare board and protection board from my parents and so forth, so we know that sense of having to do things out of sight, maintenance of language, maintenance of culture, and so forth. And to have it now in this situation and people trying to manage their lives in the face of such massive controls is a bit like, I think, the way that many people in the world feel when faced with something like climate change. Everyone's looking for a way to avoid being caught up in it, but it is having its effect and it could completely turn the world around and we might have to all start over again.

And I think those that are best placed do that. I had a neighbour that lived next door to me when I lived in Sydney who told me that he bought a piece of land in the mountains because when the sea level rises he'd be safe, and he had it cleared of most of the trees so that the fires wouldn't get him, and he built a stone house so that it was pretty solid and wouldn't burn down, and he was really serious, he said "I'm stockpiling food," and I said "What are you doing?" He said "I bought food, I filled up a whole side of one of the hills there and I've got it turned into a store room." I said "What are you putting in it?" and he said "cans." I said "cans of what?" "Everything." I was like, OK and he said "when climates change, I'm going to be ready." "Oh, good on ya mate," I said "don't forget to take a can opener will you? And always check the use by dates."

And I think for a lot of people they're just trying to work out the best way to avoid it. But indigenous people know that they don't have to stockpile cans and make sure they've got at least a dozen can openers, because we have that knowledge and we have to maintain that knowledge. When the big wet comes I don't care about western science, I care about the things that my community taught me and I've been trying to teach members of my community, about the way you go about surviving without electricity, without TV, without an iPod and with what is remaining in terms of country. And I think that's why it's important to us to maintain our caring for country in the face of all these other things, because if anything's left, we'll know how to use it.

Victoria Tauli-Corpuz

I just want to say something about solidarity, because I think that's really a value that indigenous peoples really are practising and that's what we all should be doing as indigenous peoples. I say this with all due respect, because I do respect and I practice that, as Patricia said, we really should just be defining our own agendas in that. Unfortunately, in the world today that is not the reality. For instance the United States who is the major voter on the decisions in the world bank, you know they are the ones who are making all these decisions, and for instance if our indigenous brothers and sisters in the United States are not involved at all in pressuring the United States government to stop from funding hydro electric power dams there will be problems – because now they have shown us that in 2005-2007 funding for hydro electric dams, big scale hydro electric dams have levels up to, levels that we cannot imagine how many dams are going to be built in the world. In India alone, north east India, 150 huge hydro electric dams are being built and all this is going to take place in the tribal lands of north east India.

You know, there is a complaint every day – you receive a letter from the tribes in north east India asking us to help stop this dam, that dam and also in Cambodia and Laos to stop Namtoong dam, etc. And you know, I was just thinking all of these dams are being built actually under the clean development mechanism because these are dams that are allotted to absorb the carbon emissions of the country are emitting the most carbon, so what do we do in that kind of situation where our own sisters in these poor countries where our governments are so corrupt there and interested only to get the money, investments from this bank, and they don't really care what's happening with the tribes. Where do we look for support, and I think that's the challenge for all of us indigenous peoples wherever we are found. That when we deal with decisions made that are going to affect the lives and the very survival of our peoples, especially in the poorest countries in the world, then I think we have to join hands together to really call this, to stop this kind of madness, because that is really what's happening now.

That's why I always stress the fact that all this mitigation processes are not really going to help us, I mean it might even mitigate very minimally the carbon dioxide emissions but it will cause the grabbing of our lands, especially the lands of indigenous peoples in the poorer countries and that is really the situation we are faced with. And I hope that the spirit of solidarity, we should be able to really harness that very well because I think that's where the whole place for many indigenous peoples who are looking to us to help them stop all these kind of developments in their own communities.

About the organisers

The United Nations University Institute of Advanced Studies (UNU-IAS) is a global think tank whose mission is “to advance knowledge and promote learning for policy-making to meet the challenges of sustainable development.” UNU-IAS undertakes research and postgraduate education to identify and address strategic issues of concern for all humankind, for governments, decision makers and, particularly, for developing countries. The Traditional Knowledge Initiative aims to promote and strengthen research on traditional knowledge (TK) of indigenous and local communities conducted from a global perspective, grounded in local experience. <http://www.ias.unu.edu>; <http://www.unutki.org>

Charles Darwin University (CDU) is founded on 50 years of delivering tertiary education in the Northern Territory (NT), Australia. The University is the largest tertiary institution in the NT, with campuses in the Darwin suburb of Casuarina, Palmerston, Alice Springs, Katherine and Nhulunbuy, and training centres in Jabiru, Tennant Creek and Yulara. The University aspires to be internationally recognised as a centre for excellence in Indigenous and cross-cultural knowledge, tropical knowledge and desert knowledge. <http://www.cdu.edu.au>

The North Australian Indigenous Land & Sea Management Alliance (NAILSMA) is an unincorporated bioregional forum for Indigenous land and sea managers across North Australia. It aims to support practical Indigenous land and sea management using strategic approaches to care for country with an emphasis on practical management by Traditional Owners across the whole of the North. NAILSMA is an alliance between Kimberley Land Council, Northern Land Council, Carpentaria Land Council Aboriginal Corporation and Balkanu Cape York Development Corporation. <http://www.nailsma.org.au>

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