

## Burning questions: shaping landscapes with aboriginal fire

Interview with Professor Marcia Langton

By DOUGLAS NAKASHIMA\*

*Nous avons souhaité nous entretenir avec Marcia Langton qui, se fondant sur des données historiques, écologiques, paléontologiques, anthropologiques, montre l'importance de la gestion aborigène par le feu avant la colonisation, les désastres écologiques entraînés par l'arrêt de ces pratiques, enfin leur réintégration aujourd'hui dans les Parcs nationaux et régionaux. Les recherches récentes battent en brèche les idées reçues sur la nature. Les paysages « naturels » ont été forgés par les hommes bien plus tôt et de façon beaucoup plus systématique qu'on ne le croyait. La gestion par le feu des sociétés traditionnelles avait, sur de nombreux continents, permis de créer des mosaïques d'écosystèmes favorisant une diversité biologique propice à l'exploitation. Marcia Langton en tire la conclusion que seul le maintien des aborigènes sur leurs terres et la réhabilitation de leurs savoir-faire permettra une gestion durable de ces régions.*

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**DN** – *As both a trained anthropologist and an aboriginal, you bring a very unique perspective to the issues that I would like to discuss with you today – the role of aboriginal peoples in managing ecological diversity in contemporary Australia. In your recent book *Burning Questions: emerging environmental issues for indigenous peoples in northern Australia* (Langton 1998), you accuse contemporary conservationists of perpetrating 'science fictions' by applying the term 'wilderness' to large tracts of aboriginal lands. In so doing, they deny the long and continuous presence of aboriginal peoples on the land, and ignore their profound role in shaping the landscape particularly through the traditional application of fire. You describe this as a form of ecological imperialism, a modern-day equivalent of the legal mythology of 'terra nullius' which the colonial powers used to their advantage by declaring Australia an 'empty land', devoid of human inhabitants, and therefore free for the taking. Today, the concept of 'wilderness' accomplishes a similar task, opening the way for the establishment of national parks and other protected areas. These are provocative ideas, underlining the persistence of colonial attitudes that change form but never seem to go away. With this in mind, perhaps you could begin by briefly describing how Australian landscapes have been transformed by the processes of colonisation that disrupted aboriginal societies and their traditional fire management regimes.*

**ML** – *Examining the history of contact, we can trace changes in the Australian landscape and the accompanying shifts in the perception of land by European colonists. Demographers, basing their work on the historical record, have recently calculated that in 1788 the aboriginal population of Australia would have been at least one million. This is substantially more than previous estimates of only three hundred thousand*

individuals put forward by some. Soon after contact, however, smallpox, influenza and measles epidemics took an enormous toll, followed by rampant frontier violence. In southern Australia, especially in the southeast, these frontier impacts led to the collapse of aboriginal societies and with that, the interruption of traditional fire management regimes. In the absence of aboriginal burning, the pastoral ideal – beautiful plains with sparse forests – encountered by early British colonists became, over the next two hundred years, dense forests.

With the birth of the conservationist movement in the twentieth century, people naively took these to be 'virgin' forests. Non-aboriginal families who have lived on the land for several generations know that this is not the case. They know that the contemporary landscape is quite different from that which their grandfathers and great-grandfathers first settled. There were not the dense forests that conservationists chain themselves to today, but open rolling hills with sparse clerical forests.

The interruption of aboriginal fire management also had another outcome. Since the nineteenth century, massive bush fires have occurred in Australia, some of which have been truly devastating. The image of settlers fleeing the notorious 'Black Thursday' fire that occurred in the 1800s has been immortalized in a renowned oil painting. Another iconic fire is the 'Ash Wednesday' fire. These bush fires were of regular occurrence. During Christmas of 1894, there were massive fires outside of New South Wales. The 1894 fires burned out almost the entire area of the present-day Royal National Park south of Sydney.

In all of the areas where the settler relationship with the environment has become supreme, all fire is

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Professor Langton has published widely on contemporary social issues in Aboriginal Affairs, including land, resource and social impact concerns, as well as reports to the Royal Commission into Aboriginal Deaths in Custody and to Aboriginal Land Councils. In 1993, Marcia Langton was awarded an AM (General Member of the Order of Australia) for services to anthropology and the advocacy of Aboriginal Rights.

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prohibited except for boundary burning, the making of fire breaks and the back burning by bush fire councils. The use of fire is largely centralised in bush fire councils or brigades, who are mainly volunteers, and property owners who are required to make fire breaks around their properties and along roadways. People

who see forested areas as an idyllic habitat, build their houses in forests with insufficient fire breaks because they think that this practice is environmentally damaging. Within a ten-year period they are sitting in the middle of a tinderbox. Inevitably, they will be the victims of a bush fire. These bush fires are pretty much uncontrollable. Bush fire brigades can go in and protect people and property to an extent. However, you basically have to wait for rain or for the wind to change direction or for the fire to burn out of its own accord. These fires can be atomic in proportion.

We have witnessed this same phenomenon in more recent decades in the desert. Here, aboriginal people have been moved off their ancestral lands and into settlements only since the 1950s. Without aboriginal people burning the desert, however, Spinifex – a low prickly bush that is full of highly flammable adhesive gum – spreads quickly, providing ample fuel for devastating fires. There have been at least two of which I know. In the 1970s, twenty years after the aboriginal peoples were removed, an atomic fire burned out hundreds of thousands of hectares in the central desert.

CSIRO (Commonwealth Scientific and Industrial Research Organization) has now begun to satellite-map the desert. They have begun to replicate traditional aboriginal burning patterns by using aerial fire bombing in order to create a fire-induced habitat mosaic. Also they are constantly monitoring the desert to ensure that there are no more Spinifex wild fires which basically destroy the pockets of non-spinifex areas that small mammal populations in the desert depend upon. There is still a lot more work and research to be done. The Uluru and Kakadu plans of management state very clearly that research on traditional burning is to be commissioned in that area. The emerging information on traditional practices are supplementing the CSIRO-designed fire plan and that is a project in progress.

In the wet-dry tropics, the monsoon areas, we know much more because of excellent research. It is the converging evidence from research by Russel-Smith (1996), a very interesting multi-disciplinary team including traditional owners, by David Bowman (forthcoming), Chaloupka (1993), Peter Whitehead and many others, including the commonwealth agency which manages the Kakadu National Park, that is now leading to the explicit recognition that aboriginal burning regimes are an essential part of the preservation of biodiversity. This growing recognition has resulted in very successful environmental management in certain areas, one example being Kakadu National Park.

*DN – So today, fire continues to be perceived by the majority of landowners and even conservationists, as a destructive force to be guarded against and suppressed whenever possible. Fire as a 'management tool' is a novel concept that is only beginning to emerge, and with this change in perspective also comes a growing willingness to recognise the conservation potential of aboriginal ways. In fact, I was very impressed to learn that in Kakadu National Park, it is now official policy to reconstitute customary aboriginal*

*burning practices. This is quite a change in perspective! According to Henry T. Lewis (1989), even in the early 1980s, the park was reluctant to accept such a radical departure from conventional conservation approaches. I would appreciate your insights on how ideas have shifted from an initial attitude that the indigenous population was a major part of the problem, to current policies that see aboriginal practice as a key biodiversity management tool.*

**ML** – I think that from the 1970s onwards, a number of scientists and even a lot of conservation land management staff in various agencies were familiar enough with the literature – the works of Sylvia Hallam (1975), Henry T. Lewis (1989), Bruce Jones, Richard Gould (1969) and others – to be aware that there were conservation intents and outcomes from customary aboriginal landscape burning. We have known that since about the 1970s but these were early anthropological discoveries and emerging understandings that required verification from other disciplinary work. That work started with the Kapalga Research Station, I am not sure when that was set up and it is now closed.

An interesting project was carried out by Russel-Smith (1996) that I have referred to, and that was published in *Human Ecology* in 1996 and is entitled 'aboriginal resource utilisation and fire management practices in Western Arnhem Land, monsoonal north Australia'. It provides a pretty comprehensive account, including the construction of an aboriginal calendar with its six seasons and the purposes of the fires, the winds and all the required kinds of information. Also Leslie Head (1996) has been doing work in western Australia and because of the Kapalga Institute, Russel-Smith's (1996) work and David Bowman's (forthcoming) work, we are now starting to find out more details and precisely what aboriginal people have been saying about their burning.

Early park managers were themselves very good researchers in various fields and took on board aboriginal culture and land management. The seeds for all of this were in early park plans in any case and the revised plans set out more detailed fire management strategies because of the coincidence of good research and well-trained Commonwealth Agency staff in the park. It is that coincidence that makes Kakadu outstanding. Uluru is similar but as I say, the research there is not at the same stage as in Kakadu, but it is ongoing. It is a similarly successful situation where research and aboriginal customary burning are two parallel parts of a new fire management regime. But with the exception of this handful of territory parks for which the land councils negotiated these arrangements, the other parks even in the Northern Territory and elsewhere in Australia do not have any explicit recognition of aboriginal landscape burning. They more or less say that it is irrelevant in the park plans, and their fire management policy states that the protection of park assets and the control of fire are the principal objectives.

**DN** – *But in the cases of Kakadu and Uluru National Parks, where aboriginal burning practice has been adopted as*

*official policy, who actually controls the burning regime? Do the park authorities alone determine how the land is burned? Or is it the local aboriginal population that is free to burn as it sees fit?*

**ML** – I think that it is a very interesting and wonderful example of co-operation. Basically the park management plan allows aboriginal traditional use of zoned areas, and aboriginal people carry out customary burning. At the same time, park staff carries out burning and I think that it is basically a case of people talking to each other, at least most of the time. The park rangers tell the traditional owners when they are burning. The fires are very obvious in any case. I think that it is truly a case of parallel fire management regimes. The park management scientifically based fire control regime alongside the aboriginal fire regime. There have been meetings where people discuss this in detail and it is an evolving system. I should also mention that aboriginal traditional owners are employed as rangers. They are actually a part of the park administration.

**DN** – *A majority of rangers are aboriginal?*

**ML** – I am not sure of that. There are certainly non-aboriginal park rangers trained in western institutions and there are aboriginal rangers. At the major station, the Jim Jim Ranger Station, it appears to me that aboriginal rangers are by far the majority. I am not familiar with all of the ranger stations. There is perhaps a majority of non-aboriginal staff but they are mostly in the upper echelons of the administration. The people who walk the country, drive the country, burn, pick up litter and clean the camping grounds are mostly aboriginal. I think that it is obvious that aboriginal people are now concerned about the escarpment as well as the lowlands. People seem to be continuing the burning to the extent of their presence on the land. I think that the park administration is documenting all of this. We are all waiting to find out the results of this experimentation.

**DN** – *How long ago did this experiment begin?*

**ML** – It is very recent, it is only a year or two old. I know about it because I have heard aboriginal people expressing their disagreement with the project people. I think what the park people are saying is that aboriginal people are lighting fires too late in the dry season, say in September, and these hunting fires are inappropriate. aboriginal people disagree.

**DN** – *Inappropriate from what point of view?*

**ML** – Because they are too hot. I think that the aboriginal people disagree with this argument that these late season hunting fires are too hot. Of course these differences of opinion are also related to the problem that the Asian buffalo created in Northern Australia. Buffalo were introduced into Northern Australia in the late 1800s and their populations increased until, in the 1970s, it became evident that the buffaloes were a

major environmental threat to wetlands and to the tropical savannahs. When it was discovered that they were carrying brucellosis and tuberculosis and were infecting the commercial cattle stock, a buffalo eradication campaign was launched. They were hunted from helicopter gun ships. The buffalo have not been completely eradicated, as it is impossible to do so, however their numbers have been radically diminished.

With the quasi-eradication of buffalo, there was an increase in vegetative growth and fuel load. Aboriginal people noticed this and started to burn more. Now the Kakadu National Park fire management plan involves the park staff working more closely with aboriginal people and they are running an experimental campaign of testing when to burn, at what season... because you have to change the fire regime after the eradication of buffalo. Aboriginal people are experimenting and the scientists are experimenting as well. There is a fair bit of contention such as the old ladies who are saying that the scientists are burning too late. The scientists tell the old women to not burn yet and the old women reply that they have to burn now. So there is some dispute...

**DN** – *What is interesting here is that perhaps there is not just disagreement over how and when to apply fire, but a more fundamental conflict between objectives. The park has the single objective of biodiversity conservation. But for Aborigines, fire is a multi-purpose thing. There are other reasons for burning besides conservation. And these applications may or may not coincide with the conservation goal. These differences in objective may also help explain why there is conflict.*

**ML** – Exactly. The park management plan does explicitly state that one of the objectives of the plan is to promote aboriginal culture and aboriginal customary burning. What happens, of course, is that non-aboriginal park rangers, who are trained in conservation methods, the 'Smokey the Bear'<sup>1</sup> tradition of putting out all fires, are not sufficiently aware of the very recent literature on aboriginal landscape burning to understand that they are dealing with a regime that has a number of goals. One goal is hunting, another is ritual and another is conservation. There are explicit conservation goals in aboriginal burning; this is documented in various places. The problem is that even though the plan is excellent, the park rangers are not sufficiently trained. Of course, with the non-aboriginal staff, there is a high staff turnover rate. That is a problem since non-aboriginal rangers do not stay long enough to become familiar with the seasonal nature of fire over several years.

On the other hand, it is also true that aboriginal people are adjusting to the post-buffalo eradication situation of fire fuel loads and therefore the scientists might very well be right in saying that the late dry season hunting fires are imposing a heavy impact on the environment. It is also the case that younger aboriginal people are not learning all the finer arts of burning. If they drive along in a truck and throw matches out of the window and think that they are

doing the right thing then they might be causing a problem. Dean Yibarbuk (1998) has written about that in his terrific account of traditional burning and he recognises that young people have to learn everything there is to know about burning because it is tremendously important that certain plant ecosystems such as the monsoonal rain forest pockets are not burned out.

People also have a self interest because this is where the flying foxes hang out. They were before, and still are an important part of the diet, an important medicine and they are eaten in very large numbers at a particular time of the year. People look forward to flying fox time as they look forward to magpie goose time and so on.

This is all in flux and we are waiting to see the results of some of the research. From my own point of view, if the old ladies are saying that 'that is not right', then I believe them because they are very observant. When people start this landscape burning they talk about the weather, the time of year, wind directions, how many people to place where on the country.

I think that it is really important to compare Kakadu to places in Arnhem Land. Even though you have a similar history of depopulation of the area and then people returning to it, in Arnhem Land, people were only taken to the administrative settlements on the coast in the late 1950s and they had already returned by the early 1970s. In other words, they were really only off their land for about fifteen years. This is a much shorter period of time than elsewhere, such as in Kakadu where they were removed from the early 1920s onwards. I think that a comparison with a control group in Arnhem Land is the next stage. If the park administration is unwittingly putting a conservation goal ahead of the preservation of aboriginal customary landscape burning then what we need is a control group in Arnhem Land to see what effect aboriginal customary burning has. There are some research projects that are starting up now that will provide that kind of comparative data ... however, it will take a while to find out.

**DN** – *Up until now you have underlined the scientific research that has led to this upheaval in attitudes towards fire and aboriginal uses of fire. But was research the only driving force? Are there not also specific political circumstances surrounding this exceptional integration of aboriginal practice in the management plan of Kakadu park?*

**ML** – Yes, indeed. The Aboriginal Land Rights (Northern Territory) Act – the only federal land rights act – was proclaimed in 1976 and began to operate in 1980. Aboriginal groups with the assistance of land councils which were established under the Act, placed claims over their traditional lands. With only fifteen to twenty years in the administrative assimilation settlements, there were still many old people who could make traditional claims to land. Kakadu and Uluru were among the first to be claimed, and these were, in the view of the aboriginal land commissioner who was a federal court judge, successful claims. The

<sup>1</sup> As part of a massive public awareness campaign on the dangers of forest fires, the US National Forest Service created in 1945 the emblematic figure of 'Smokey the Bear'. Through countless billboard advertisements, Smokey the Bear inscribed in the minds of millions of Americans the fundamental and unquestionable ethic of fire suppression.

commissioner had to recommend that the land be returned to traditional aboriginal people.

But the Act also provides for parties who wish to make detriment cases. They can make a submission to the land commissioner claiming detriment. Many groups of people, including the Northern Territory government, argued that there would be a public detriment if the land was returned to aboriginal people. The claims were outrageous. There was no evidence that if aboriginal people owned the land, then all of the bush walkers and tourists would be kept out of the parks.

**DN** – *Oh, so in this case, it was not so much a question of access to land for cattle grazing, as it was a question of access for wilderness tourism?*

**ML** – Well yes, it was over cattle as well. The cattlemen's association put up objections, as did conservation groups. They took the view that it was not a good idea for these areas to be returned to aboriginal peoples, although the Australian Conservation Foundation, at that time led by the late Nugget Coombs (1989), to whom my book is in some sense a memorial, gave evidence that aboriginal people were responsible in their land management. The land commissioner then made his recommendations. His report went to the Minister for Aboriginal Affairs whose responsibility was to resolve the detriment issues.

With the land councils pulling together a resolution of the detriment issues with government agencies, the outcome was that traditional owners would receive title to the land on the one hand and on the other hand, give to the federal government a ninety-nine year lease over these areas as national parks. So these parks – Kakadu, Uluru, Nitmiluk, and Gurig – became a compromise. They are aboriginal lands under the aboriginal Land Rights Act and are held by aboriginal land trusts in an inalienable freehold statutory title. At the same time, they are leased to the federal government for ninety-nine years as national parks under an agreement. In the case of Kakadu and Uluru, this provides for a majority of aboriginal people on the boards of management and various other provisions for aboriginal involvement, such as rental payments to traditional owners. Furthermore, there is explicit recognition in the management plans of these places as aboriginal homelands, where aboriginal culture, aboriginal occupation, use and enjoyment of land can continue.

It was through the resolution of these purported detriment issues that these jointly managed federal-aboriginal parks have evolved. Hence their very interesting development. Therefore, there is a dichotomy between these federally managed parks and a range of other parks where aboriginal involvement is not permitted.

**DN** – *I suppose that these other parks to which you refer were established according to the classical model of a national park. That is, in the lineage of Yellowstone and numerous other national parks established around the*

*world, according to the ideology whereby nature conservation and people do not mix. Each time a conservation area is established, the local populations must be moved out and local resource use stopped. I gather that in the parks that you are referring to, where aboriginal participation is not allowed, there is considerable conflict between the park and aboriginal peoples.*

**ML** – Very large conflicts and it is unfortunate but true that the people of the conservation movement have become the enemies of aboriginal people. The more extreme elements have basically locked aboriginal people out of national parks. What the state governments have done is to explicitly prevent aboriginal people from buying pastoral leases and returning to their traditional land. Instead they have converted areas, including pastoral leases, to national parks. There was a High Court case in 1982 where an aboriginal owner who received funding to buy a pastoral lease was refused transferral of the lease by the Queensland government. The High Court ruled that the Queensland government was being racially discriminatory. The issue was never resolved and today the area remains a national park.

In most national parks in Australia, aboriginal landscape burning is not permitted and there is a very stark contrast, which I call segregation, of conservation zones from surrounding areas. You have this situation where the few parks that I have spoken about that have parallel western and aboriginal land management regimes are oases of good management, and are segregated from surrounding impending catastrophes.

**DN** – *Turning back to your analyses of the conservationists' myths about wilderness as 'virgin forest', that must at all costs be conserved from fire... and also listening to your descriptions of changing attitudes towards fire in the Australian context, I could not help but be struck by the parallels with the North American experience. In particular, the case of Yellowstone National Park springs to mind and the recent soul-searching about 'what is natural' and 'what is wild' that was triggered by the immense fires that ravaged the park in 1988.*

*In North America, Yellowstone has always been a significant reference point for the concept of 'wilderness'. After all, it remains the world's first national park. Just like in Australia, the wilderness ideal was epitomised by so-called 'virgin' forest and, as a result, forest fires were presented as a deadly enemy. 'Smokey the Bear', as you mentioned earlier, struck into the heart of every citizen the incompatibility of nature conservation with fire. The fire suppression system that resulted was so efficient that after several decades of 'conserving' nature, the park had created instead a most un-natural situation – the understories of Yellowstone forests had become an explosive mixture of fallen trees, dead branches and dense underbrush. The park had been converted into a giant tinderbox. Finally in 1988, after an exceptional dry spell, fires ignited by lightning were whipped by stiff winds into an uncontrollable wildfire. To the horror of the public and scientists alike, more than half of Yellowstone, the jewel of the US conservation program, was reduced to smouldering ashes.*

*This event, which was first judged to be a total catastrophe, in fact forced people to reconsider a number of their cherished notions about fire, nature and wilderness. People were astonished, as well as relieved, by the park vegetation's rapid recovery, and they had to accept that the wildfire was fueled by the by-products of an overly successful fire suppression program. Because of these insights, people slowly began to accept fire as a natural part of the ecological system. This meant they also had to admit that park management policy in Yellowstone, far from conserving a natural system, was actually shaping nature to America's image of 'wilderness'. The parallels to the situations you describe in Australia are striking.*

**ML** – It is absolutely analogous to what has happened in Australia.

**DN** – *But the parallels do not end there. We must not forget that even before the park authorities' over-zealous exclusion of fire, they had already seen to the forcible removal of the Amerindians living within park boundaries. With their departure, anthropogenic fires that for millennia had transformed North American landscapes from the subarctic down through the prairies to the American south-west, were also removed from Yellowstone. This brings us to another of the key issues that you deal with in your book: the polemic over indigenous peoples as either original conservationists or environmental vandals. In fact, if I understand correctly, you wrote your book as a contribution to an on-going and very heated debate concerning the impact of aboriginal peoples on Australian ecosystems in the Pleistocene.*

**ML** – Yes this is true. Of course this particular debate has been around for a long time, and not being much interested in paleo-ecology and paleontology, I had not really taken much notice. The evidence just was not strong enough to say one thing or another. But then a particular biologist... his name is Tim Flannery (1994) made a bold assertion: that aborigines during the late Pleistocene were responsible for a blitzkrieg, single extinction event of the megafauna. Now I know a lot about aboriginal hunting and also something about fire, and I thought he has got to be wrong about this. I read his book 'The Future Eaters' which became a popular scientific best-seller in Australia (Flannery, 1994). He went on to make a three-part television series that was based on this book. He is now visiting professor at Harvard in microbiology.

In summary, this is what he argues. When humans in the Pleistocene colonised the continent, they perpetrated through their hunting an immediate blitzkrieg, single-event extinction of the megafauna. This is analogous to an extinction of African savannah megafauna such as giraffes, elephants and rhinoceros. The disappearance of the megafauna triggered a thickening of all the plant material that was formerly consumed by herbivores. This increased density of highly flammable plant material in a highly fire-prone environment became an enormous fire hazard. As a result, there was extensive burning.

With time, Pleistocene Australians, Flannery (1994) argues, learned to use fire with increasing skill until

their fire had the effect of replacing the marsupial giants that had become extinct. He argues that human control of fire had the effect of creating a habitat mosaic... we know that... which persisted until the arrival of the British. The collapse of aboriginal societies under the impact of colonisation, however, led to the cessation of anthropogenic burning. And once again the fire regime was changed from fire stick farming that created complex habitat mosaics, to catastrophic wildfires that rendered the landscape homogenous. The obliteration of the habitat mosaic led to the extinction of a number of small marsupials. That is his argument in a nutshell.

**DN** – *From your account, Flannery places Pleistocene aborigines in both negative and positive roles. First, they trigger the mass extinction of megafauna, then they use fire to re-constitute a habitat mosaic favourable to the survival of smaller marsupial species... at least up until the arrival of the British.*

**ML** – Well, that is not how it is seen by the propagandists for the pastoral industry. This is why Flannery's argument is so dangerous because it is taken up by people with a political ideology, and applied to contemporary conflicts over land use rights between the livestock industry and aboriginal peoples. I have heard the most appalling versions of Flannery's argument from cattle and sheep ranchers, and from journalists who work for pastoral journals. Their argument is that as Aborigines hunted and burned the megafauna to extinction, therefore they are environmental vandals. For this reason, Aborigines should not have anything to do with managing the landscape and all fires should be extinguished. Pastoralists, on the other hand, have done a really good job of looking after the environment and therefore everybody should get off their backs and let them run cattle in all of these 'marginal' areas.

**DN** – *I imagine that the concluding argument is that in fact cattle are replacing the herbivorous megafauna that were there before. Therefore today's true conservationists are pastoralists because through their herds of cattle, they are restoring Australia to its original pristine state, meaning before the presence of humans.*

**ML** – That is exactly what a pastoralist argued at a meeting that I attended in Sydney. When I heard his version of Flannery's argument, I thought, 'Oh dear... we have to do something about this. There has to be a response.' For sure, there were replies to Flannery's assertions in review articles by some social scientists. There were a few plant biologists who were making replies, again in refereed journals particularly, David Bowman's (forthcoming) Tansley review in *New Phytology*. But there was nothing that was easily accessible to the readership of Flannery's (1994) book, 'The Future Eaters', to demonstrate why he could not, as a scientist, get away with these bold assertions.

This is what motivated me to write my book. It was a very interesting exercise for me to review the existing literature on this issue and to make an assess-

ment of it. The literature is very interesting. There are palaeo-ecological studies of charcoal layers. This charcoal evidence goes right back to, some say 350 million years, some say 65 million years. It is obvious that fire becomes a major factor in plant evolution from 10 million years ago because of the continent moving into warmer latitudes, and the incidence of lightning strikes increasing. There is clear evidence of massive forest revolutions. There was a scleromorph revolution... that is *Eucalyptus* phylum taking over great areas of Australia about some seven and a half thousand years ago. The rain forests were reduced from larger areas to pockets.

We know that when humans colonised Australia, we think about 60 thousand years ago or perhaps even more, they arrived on a continent that was the most fire-prone continent on the planet. These human colonisers learned how to use fire to control fire. The predominant lightning-induced fires, natural wild fire that had already contributed to plant evolution and perhaps forest revolutions, were replaced by human-controlled fires. Rather than wild fires, very hot fires, over very large areas, we think that there were now more frequent fires, on a smaller geographical scale and with less intense heat.

**DN** – *So going back to Flannery's hypothesis, obviously there is an important distinction to be made between fires that are caused by humans, anthropogenic fire, and naturally occurring fires such as from lightning strikes. First he would have to distinguish between these two origins of fire and then be able to establish the consequences of fires set by humans and natural fires. I would be surprised if the record is fine-grained enough in order to do that.*

**ML** – The fossil record, the archaeological record, is very patchy and it does not provide a period of time in the Pleistocene, in one area, to say anything very much about the environmental impacts of aboriginal use of fire. One has to be very cautious interpreting from the fossil record. There are some very interesting points made by Bowman (forthcoming) and also by Head (1996). The palaeo-ecological record cannot resolve the problem of the impact of fire on the environment because you cannot control the necessary variables that would allow you to draw a conclusion.

In other words, one can speculate as to how these forest revolutions came about, and fire obviously was a factor. But to draw conclusions is impossible. One concrete reply to this public adoration of Flannery's arguments is being provided by a women paleontolo-

gist, who has located a site where there is a long period of human and megafauna co-existence. That straight away contradicts Flannery's hypothesised single extinction event. In the end, once I had gone through the research from the different disciplines: plant biology, palaeo-ecology, palaeontology, anthropology and archaeology ... I found that there was not enough evidence from any of these disciplines to uphold Flannery's arguments. Nevertheless, his work continues to nourish all kinds of wild speculation that intrude upon the debate on the role of Aborigines in contemporary biodiversity and landscape management.

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