

## SHORT COMMUNICATION

### A response to Flannery's reply

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Benson and Redpath (1997) was written as a critique of Ryan et al. (1995), a document that selectively quoted from historical references to support certain views about the pre-European structure of vegetation and fire frequency of Australia. We did not set out to review Tim Flannery's book *The Future Eaters*. However, because Ryan et al. quote from it to support their views, we commented on some of Flannery's hypotheses outlined in the book and the scientific paper (Flannery 1990) where his hypotheses were first published. His 1990 paper was criticised at the time (see the comments by eight scientists compiled as an adjunct to the paper) but Flannery does not mention this fact.

It is important to separate the various strands of *The Future Eaters* hypothesis before commenting on Flannery's reply. He is keen to defend his primary hypothesis that, after their arrival, the Aborigines rapidly hunted the megafauna to extinction. In our paper we canvassed the views of a range of experts who consider climate was the primary factor, particularly as the last ice age was more severe than previous ones. We do not claim to have refuted this aspect of his hypothesis. Flannery points out that this hypothesis is tenuous and may be refuted if evidence, such as the dating of material at Cuddie Springs, shows thousands of years of co-habitation. Recently, another line of inquiry, by Choquenot and Bowman (1998), has produced evidence based on predator-prey models that demonstrates the Aborigines did not have the capacity to eliminate the megafauna.

We are more concerned with the parts of the hypothesis that come after the megafauna became extinct. These deal with changes to the vegetation and fire regimes and are most crucial in the debate about land management today. Key points raised in Benson and Redpath (1997) were:

- that Flannery ignores the importance of insects, such as grasshoppers, and smaller mammals, such as wallabies, as herbivores and their likely role in keeping vegetation in check after the extinction of the megafauna. The role of termites in decomposition and herbivory is also overlooked. Fox and Clark (1972) found that 84% of eucalypts in the Darwin area of the Northern Territory were infested with termites;
- that the fossil and pollen record analyses indicate that Australia's sclerophyll flora evolved and became distributed across the continent over tens of millions of years;
- it is unlikely there was rapid replacement of fire-sensitive vegetation by sclerophyllous species after the extinction of the megafauna;
- based on pollen evidence it is also unlikely that rainforest covered vast areas of northern and eastern Australia 100 000 years ago;

- there is no scientific evidence that grasslands, and open woodlands containing well spaced trees, dominated all landscapes of south-eastern Australia at the time of European settlement.

We concluded that Flannery's views about the nature of pre-European vegetation and fire regimes do not hold up against a range of biological evidence and we cited references to support this. We substantiated from the literature, that the pre-European vegetation was much more heterogeneous than he suggests. It was not solely dominated by grassy open woodlands or grassland. For example, on page 380 of *The Future Eaters* Flannery suggests the vegetation around Sydney and Botany Bay was open and grassy. Yet, the explorer Peter Cunningham described heath in eastern Sydney. Also, evidence from herbarium specimens collected by Banks and Solander in 1770 from Botany Bay, along with studies of the population dynamics of plant species in relation to fire, prove that grassy vegetation did not dominate the Sydney sandstone landscape. We suspect that Flannery and Ryan et al. have extrapolated historical comments about the now mostly cleared grassy woodlands of the Cumberland Plain of western Sydney to other places.

Flannery's views on pre-European Aboriginal burning regimes are questionable. From what we know about many species' responses to fire, frequent burning (1–4 years) could not have been practised universally. Aborigines burnt different vegetation types differently depending on what resources they were extracting (Baker 1997). Some vegetation types were not, or infrequently burnt. We state on page 317 of our paper that Flannery's views about vegetation are 'mostly conjecture'. Flannery (1994a) himself states that his post-megafauna extinction vegetation hypothesis is based on guesses about how things might have been. We would argue that his hypothesis, that there was widespread, frequent Aboriginal burning to mitigate intense fires caused by extra vegetation growth caused by the extinction of large megafauna herbivores (his conflagration theory) is refuted by the type of evidence about vegetation and fire we cite in our paper. If this aspect of his hypothesis is refuted, then it effects the credibility of Flannery's explanation of the causes of the megafauna extinction.

Flannery claims we did not check the original source about his observations of forest change from open grassy understorey to rainforest at Bulli. On page 317 in our paper we refer to pages 218 and 219 of *The Future Eaters* where Bulli is discussed, so we do not only rely on the passages quoted in Ryan et al. On this issue, we repeat what we state in Benson and Redpath (1997) i.e. both dense and open grassy or *Lomandra*-dominated understoreys occur in the area. So how can Flannery assert he was looking at exactly the same spot that Cook observed in 1770? It is not a scientific approach to use a one off observation to support a hypothesis about vegetation change. Furthermore, on page 317 in our paper we quoted directly from page 224 of *The Future Eaters* concerning the claims that rainforest **blanketed** vast areas of northern and eastern Australia 100 000 years ago. We suggested that this is not supported by pollen or other evidence. There may have been more rainforest then than now, but the pollen evidence suggests it did not blanket the landscape.

The arrival date of the Aborigines to Australia is unknown — other than it was before 40 000 years ago. They came to a continent with much of its vegetation already adapted to fire. Australia's sclerophyllous vegetation and associated fauna is of great

antiquity. While Aboriginal burning may have extended the range of fire-adapted species, the complexity and distribution of the sclerophyll biota could not have evolved in response to Aboriginal burning over one glacial/interglacial cycle (Bowman 1998).

While Flannery suggests there has been substantial structural change to the vegetation since European settlement, we argued the vegetation today is more or less similar to what it was 200 years ago, particularly in the least disturbed areas. Our view is supported by comparative studies of the pre-European and current vegetation in the Bathurst region of NSW (Croft et al. 1997) and on the Darling Downs in Queensland (Fensham & Holman 1998).

In our paper we cited several studies on the habitat requirements of animals in order to show that frequent burning may eliminate habitat and therefore endanger some animal species. We agree with Flannery that not all medium-sized animals require hollow logs or dense ground cover, but many do. Frequent, regular fire will eliminate shrubby dense ground cover and will favour a structurally simple vegetation. For example, on the north coast of NSW frequent burning has led to a dominance of Bladey Grass *Imperata cylindrica* in coastal forests. This loss of dense understorey though frequent burning is detrimental to the survival of many small animals species which have specific food and cover requirements (see the review by Catling 1994). In light of the literature we find it difficult to understand Flannery's criticism of our statements about the habitat requirements for fauna.

Flannery understates the importance of predation by feral animals in *The Future Eaters*. In the third episode of the TV adaptation of *The Future Eaters*, their predation was emphasised as the primary cause for the loss of fauna in New Zealand. Yet, when Flannery discussed Australian fauna extinction he centred it on changed fire regimes, not on predation. We understand that the literature on mammal extinctions in Australia (for example, Dickman 1994), point to predation and altered vegetation structure due to clearing and grazing as the prime factors. This is supported by the fact that no species of small mammal has gone extinct in northern Australia even though fire regimes have changed there (D. Bowman pers. comm.). The likely explanation for this is that the habitats of northern Australia have been less affected by clearing and intense agriculture, and foxes are absent.

Flannery compares his hypothesis with that of Darwin's *On the Origin of Species by means of natural selection*. Darwin's theory was supported at the time by almost 30 years of meticulous documentation of a large amount of empirical data collected on numerous species from around the world. In comparison, Flannery's hypothesis is much narrower in its scope and is based on a limited amount of empirical data.

Flannery accuses us of being 'obsessed' with the success of the popularity of his work and that of Eric Rolls. We are simply concerned with the influence that poorly supported popular views have on public policy and nature conservation, not with the success or otherwise of the popular works. In our paper, we re-examined the historical accounts referred to by Ryan et al. and found that alternative interpretations could be made of them. We also summarised the scientific literature on native vegetation and fire ecology in south-eastern Australia. In doing this we have countered unsupported and simplistic notions about pre-European fire frequency and the composition and structure of vegetation. Such views were being

broadcast by the media at a time of critical decisions about vegetation management in NSW. Benson and Redpath (1997) cited an article from the Canberra Times that quoted Flannery and Rolls on issues relating to vegetation structure and numbers of trees. Flannery considers he was mis-quoted. We cannot prove or disprove this, but the damage was done.

If our analysis has conflicted with popular accounts, so be it. Our over-riding concern is to assist with the conservation and management of what remains of a fragmented landscape. Hundreds of species are threatened and natural ecological systems are breaking down due to over-clearing, competition with introduced species, pollution and other threats. If the views about fire frequency and vegetation structure of Ryan et al. and Flannery (1994) were to prevail, we consider that more species will become threatened or extinct due to inappropriate land management practices.

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