

What Revolution?

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ABSTRACT

Suggestions that Australia can advance the conservation of native fauna by encouraging people to keep native animals as pets and have pastoralists replace sheep and cattle with kangaroos are not revolutionary. As with the preoccupation of environmentalists with endangered species, national parks and wilderness, these are limited options which will achieve little in the way of conserving Australia's flora and fauna. It is far more important to end land clearing and habitat fragmentation in terrestrial environments and to cease building dams, diverting rivers and trawling for fish in aquatic environments. Even these suggestions are far from revolutionary. A real revolution in nature conservation requires a change in national priorities from ones of increasing economic growth, resource consumption and population growth to becoming an ecologically sustainable society. Achieving ecological sustainability means that Australia needs to adopt population policies which will ultimately reduce the size of the population by half. Population reduction needs to be accompanied by reductions in energy and resource consumption. Landcare needs to return a minimum of 30% of existing cleared land to native vegetation with an additional 20 to 40% placed under deep-rooted perennials with a primary objective of providing other species with the resources they require to achieve their evolutionary potential. Only by a revolution of this magnitude can Australians meet their responsibilities to the other species with which we share the continent and begin to meet the requirements of ecological sustainability. Only by caring for other organisms can Australians say they are worthy of sharing Australia with other species. Eating jump steak and keeping native animals as pets are steps in that direction, but only small ones.

Introduction

Listening to proposals that we let Nature save herself by eating jump steak, putting breasts on Koalas to titillate the tourists, and replacing Lassie with Tassie, the reconstructed marsupial dog, I am encouraged by the words penned recently by two students in their review of *Nature's Services: Societal Dependence on Natural Ecosystems* edited by Gretchen Daily from the Center for Conservation Biology at Stanford University (Daily 1997). The students concluded their review with these words:

"Although societal values were considered, Nature's Services focuses heavily on economic issues. It is a sad indictment of society when the people most aware of the need to preserve ecosystems feel they can most effectively argue their case through economics.

Natural things and places have intrinsic values that cannot be bought or sold. Have people forgotten this? We hope not." (Loomes & O'Neill 2000)

This is the judgement of the next generation and we would be foolish to ignore their words.

Gretchen Daily and the other contributors to *Nature's Services* are among the world's most prominent conservation scientists. They are among the few who seek to ensure that the world's governments protect global ecosystems and biodiversity. The world's most powerful leaders seek their advice on environmental issues. Daily and her colleagues are aware of the intrinsic values of nature. Like most of us concerned about the well-being of Earth, they promote conservation not only because of the benefits to human society

and future generations, but because they identify strongly with natural places and wild things. It is because they feel so strongly about the natural world that they turn increasingly to economic arguments to justify nature conservation; monetary value is one thing all people seem to understand and the accumulation of material wealth is a universal aspiration.

Economics and conservation

Conservationists have not succeeded in stemming the tide of extinction. While helpful and important, the conservation initiatives that conservationists have managed to put in place are inadequate by themselves for protecting even the residuals of nature from expanding human populations and rising demands for resources. Because of this, it is not surprising that economic arguments for nature conservation are increasingly common. By demonstrating the dependence of human economic and social systems on global ecosystems and the services they provide, such as removing greenhouse gases from the atmosphere, as well as by documenting the economic returns from the exploitation of biodiversity for tourism, the pet trade, drugs, and food, proponents of nature conservation seek to exploit the dominant paradigm of human society. Humanity venerates unending economic expansion, with prestige and accolades, as well as wealth and power, to whomever can control the world's resources and people. By using economic arguments, conservation becomes part of the human economic system and the need for a revolution - that is, changing the paradigm and the values on which the system is based - is avoided.

I can almost feel the desperation as conservation scientists set aside ethics, their sense of identity with nature, and submerge their awe of life and compassion for other species as they search for some way to change human attitudes towards other species. The sense of frustration is overpowering as year by year humanity mindlessly eats its way across the planet and consumes the future until evolution itself is damned into oblivion and relegated to the test tube, to the gene jockeys and to the stock exchange.

Even the alliance between the Australian Conservation Foundation and the National Farmers Federation to tackle issues of water and land degradation is derived from the economic costs of degradation and the financial benefits of halting the spread of salt and soil erosion.

Planting trees is at the core of the alliance, as it was when the Commonwealth designated the 1990s as the decade of Landcare (State of Environment Advisory Committee [SEAC] 1996), but nature conservation is only a by-product, not a primary goal. This may be the only way that conservation organisations can appeal to government, but, so long as this is the dominant theme, there is the risk that the realisation of an economic benefit will remain the only stimulus on which governments will act to resolve environmental problems and conservation will continue to be reactive, not proactive.

Propositions or revolution

Traditional approaches to conservation have not succeeded in preventing extensive and debilitating land and water degradation throughout Australia's agricultural regions (see SEAC, 1996; Yencken and Wilkinson 2000 for details). Accompanying the development of agriculture and pastoralism, there was been a wave of extinction across the continent (see Burbidge and McKenzie 1989; Recher and Lim, 1990; Saunders *et al.* 1990; SEAC 1996; Recher 1999). As land and water degradation intensifies, the rate of extinction increases with evidence that entire ecosystems and their accompanying biota are now threatened with extinction (SEAC 1996; Recher 1999). No part of the Australian continent has escaped the impact of European settlement and it is not surprising that scientists propose new ways of conserving the continent's biota (see Bradstock *et al.* 1995; Grigg *et al.* 1995; Hale and Lamb 1997; Yencken and Wilkinson 2000 for examples).

Among many options, some conservation scientists propose that Australians:

- use native flora and fauna to replace current agriculture, at least in part;
- use native animals as pets, both to replace the environmentally damaging dog and cat, and to kindle an identity with and a sense of caring for native animals;

Still other scientists and conservationists:

- use the fear of death and illness to promote biodiversity and the conservation of invertebrates and lesser plants as sources of miracle cures and big profits;
- use the myth of wild things and wild places, as fountains of spiritual fulfilment, romance and

adventure, to cocoon bits of nature in conservation reserves safe only from the sensitive tread of intrepid nature lovers and Japanese tourists;

- use the beauty and novelty of natural areas to educate and change the minds of people through tourism, while ensuring they are entertained and their wallets are open for conservation; and,
- use the new technology of DNA cloning to restore life, not so much to usurp the role of evolution and God, as to demonstrate the mastery of science in the face of all odds and the importance of museums among the great cathedrals of human knowledge.

Others have put parallel propositions (e.g. Chisholm *et al.* 1993, p.169), but express a different philosophy from traditional conservationists, one that is part of the dominant paradigm. Their philosophy is based on private property rights and the right of individuals to own natural resources, including wildlife, and to use their land as they choose. According to this philosophy, market values will dictate whether the land and its resources are used in ways compatible with nature conservation or not (for a discussion of these issues, see Goulder and Kennedy 1997). Among the propositions put by those holding these views are the following:

- privatise wild animal stocks and natural areas as the best way to manage and conserve them for maximum social and economic advantage;
- patent evolution, including the human genome, because it is the right thing to do in a commercial society;
- compensate land owners for protecting biodiversity;
- introduce tradeable biodiversity and resource credits and,
- share ownership of wildlife and wild places among the people who really care by listing on the Stock Exchange.

While the proponents of these ideas may have different motives from 'true nature lovers' and real 'conservationists', there is not much to distinguish their propositions from the ones promoted by the environmental advocacy industry and many conservation scientists. The question is, 'Are any of the propositions revolutionary?' Will any conserve biodiversity, protect wild areas, and create an ecologically sustainable human system?

Revolution

Regrettably, none of the options advocated by either philosophy are revolutionary, nor are they likely to be effective as conservation measures in the long-term. Long-term conservation requires a real revolution in the dominant economic paradigm and dramatic changes in human social systems. The propositions in front of us, regardless of source, are just more of the same. If people really want to protect wild things and wild places, there are many more fundamental things society as a whole should do. For example, it is necessary to change:

- the assumption that having children is a right, as distinct from a privilege;
- the belief that women are inferior to men;
- the attitude that the accumulation of material wealth and private property are praiseworthy achievements;
- the presumption that land owners (and governments) have special rights in how they use and manage the land; and,
- the prevailing ignorance of our interdependence with world ecosystems.

These changes need to be made so that not only is the rate of growth of the world's human population slowed, but human populations are, as rapidly as humanely possible, reduced to ecologically sustainable levels consistent with whatever levels of resource consumption people decide to endorse. For 20% of the world population and 90% of Australians, the immediate ecological need is to reduce energy and resource consumption precipitously while moving to a 50% reduction in the population.

We can only achieve these goals and protect nature on a global scale by wealth redistribution and education: anything else will fail. I won't comment further other than to point out that, given present political and social systems, none of them are achievable in the time left to us to save global and continental biodiversity. Recall that it was in 1990 that David Suzuki told us we had 10 years, a decade, in which to act and change our ways. We have not changed and the decade is finished; we must now wait to see if Suzuki was right.

To make up the time we have lost, a revolutionary change in political and social direction is required. But a revolution in political systems and social thinking is unlikely in Australia. A succession of state and

Commonwealth governments of all political persuasions have already failed to halt land clearing despite the blindingly obvious land and water degradation that inevitably follows. Nor have any of these governments responded meaningfully to the widening gap between rich and poor; a gap that widens daily because of resource competition arising from overpopulation and the use of inappropriate technologies on farm and in factory alike. I cannot find anything in the policies of any of Australia's political parties, including the Greens and Australian Democrats, which suggests that the ecologically necessary change in direction is likely. I acknowledge that an increasingly large number of people, of all ages and persuasions, understand the environmental challenges facing Australia and are prepared to work for change to produce an ecologically sustainable human society, but these are a minority even within green politics and the environmental movement.

Nor is there any evidence of support from the community for change in environmental, social and economic policies. Consider that in 2001, the voting intention of a very large proportion of Australians is influenced more by the price of petrol, an environmentally damaging commodity, than by the degradation of the Murray-Darling Basin, Australia's food bowl, and the failure of governments to end the land clearing which continues to degrade the Basin's land and water. For the damage done to the environment (e.g. urban smog, greenhouse gas emissions), petrol is not too expensive, it is too cheap. For its importance to Australia, the state of the Murray-Darling should be a primary concern to any Australian concerned about the nation's future. Until these attitudes are reversed, there will be no real change in environmental management in Australia.

An ecologist's opinion

From an ecologist's point-of-view, where is Australia in respect to the protection and conservation of biodiversity?

It is obvious from the lack of national action on issues such as land clearing, greenhouse gas emissions, inadequate public transport, and poor urban planning that Australians have no commitment to environmental management, much less to the conservation of continental

biodiversity. Australia's conservation efforts are under-resourced and rank low in national priorities relative to economic development, sport, health, and defence. There is little or no understanding of the dependence of human society on biological resources or of the interactions between human welfare and health and the state of the environment.

The human ecosystem relies totally on other organisms, either through the activities of living organisms or through past activities (e.g. as in the formation of coal and oil), for virtually all our energy, food, water, shelter and housing. Hardly any product we use is free of a biological past. Yet, our dependence on biodiversity is not understood, nor does society appreciate the consequences for its own welfare in the loss of biodiversity. Australia is already far down the path of North Africa to where the degradation of natural ecosystems affects regional climates, threatens water supplies and jeopardises our capacity to feed ourselves. The most obvious examples of Australia following North Africa into environmental oblivion are the degradation of the Murray-Darling River System and the rising water tables and increasing salinisation and acidification of agricultural land in eastern and southwestern Australia, but there are many others. Anyone who doubts these words or who would like more examples of Australia's declining environmental viability can read the 1996 Australian State of Environment Report (SEAC 1996) (see also Cocks 1992, 1996; Flannery 1994; Kirkpatrick 1994; O'Connor 1998; White 1994).

The failure of governments to halt land clearing and impose sustainable grazing regimes on the pastoral zone in the face of measurable economic and health costs are evidence of our failure, if not inability, to appreciate the consequences of environmental degradation. According to the Australian Conservation Foundation and the National Farmers Federation, the annual cost in lost agricultural production alone [greatly] exceeds \$1 billion. Even this is conservative, as the estimate does not take into account the cost of environmental degradation to human health and infrastructure, much less accounting for the opportunity costs of the burgeoning extinction debt being incurred.

Instead, nature conservation is reactive and dominated by politics.

Problems with nature conservation policies

Apart from regulations controlling the take of native species, the emphasis in nature conservation policy is on threatened species and the allocation of land to conservation reserves. Neither addresses the most serious issue of biodiversity loss which is the loss of entire ecosystems and their attendant organisms, and the ensuing loss of the life support services previously provided by these ecosystems and organisms.

Endangered species

It could be argued that the protection and recovery of threatened species provides an umbrella for all the other organisms in the habitat required by the focal species, but it rarely works that way. Even if it were true, resources are only made available by governments to assist a few tens of high profile species (SEAC 1996, Table 4.19). This is several orders of magnitude below what is required for a focal species approach to work effectively at a continental scale of biodiversity conservation. More than 20% of Australia's terrestrial vertebrates are threatened (Recher and Lim 1990; Recher 1999). This alone is more than 300 species and does not include the hundreds of threatened plants and non-vertebrates which form the vast bulk of biodiversity and the vast majority of threatened species (see Ponder and Lunney 1999).

Threatened species management can never solve the problems of the loss of biodiversity. In response, one referee of this paper commented "...that the current focus on endangered species exists because this appears to be the crisis point on which governments are prepared to take action. It is of necessity, for political reasons only, that endangered species receive the primary focus. Most conservationists would recognize this is the case." I am less certain that this is the reason endangered species conservation dominates conservation efforts. In my opinion, many conservationists feel good about saving a species (many even feel good about saving an individual) almost regardless of the numbers not saved. Governments exploit this teary-eyed compassion because it is cheap, easy and politically popular, not because threatened species are seen as a 'crisis point' where action can no longer be avoided. Actual benefits to nature conservation are irrelevant. To repeat myself, if governments and conservationists were committed to nature conservation and

understood the most cost-effective way to slow and then reverse the tide of extinction enveloping Australia (Recher 1999), all land clearing would immediately be halted, environmental water flows would immediately be restored to all drainage systems, and most (if not all) the pastoral zone would be immediately de-stocked. Similar actions would be taken to protect the marine and estuarine environments of Australia (see Hutchings 2000).

I have two particular concerns arising from the emphasis on threatened species. First, and possibly the most important, the emphasis on species marginalise the need to both protect populations, on the one hand, and ecosystems, on the other. Second, conservation efforts are always attempting to recover taxa *after* numbers have declined to near extinction instead of anticipating problems and working to protect species *before* a crisis point is reached. In other words, threatened species management is reactive, too late and does not address the underlying causes of biodiversity decline which are primarily related to the loss and degradation of habitats by humans who are both too numerous and too greedy in their consumption of the world's resources.

Politically, it may only be possible to achieve action by governments on threatened species, but this does not mean that either conservationists or conservation scientists need to accept the situation. Unfortunately, the situation is accepted and even encouraged by the willingness of conservation organisations and scientists to undertake and foster research on threatened species because there is money available to do so. I do not hear protests or many ideas about how things could be done differently as the cheques are cashed. Unlike the anonymous referee, I do not think that conservationists recognize the limitations inherent in threatened species research or in encouraging governments and industry to focus their conservation initiatives on threatened species. I think they actually believe they are achieving important conservation goals.

Conservation reserves

The allocation of land to conservation reserves, as currently practised, while important for conservation, is an equally limited solution to the problems of biodiversity conservation. At best, conservation reserves provide a temporary refuge for biodiversity. As such, they could be important

in restoring degraded landscapes, if and when there is a revolution in social attitudes. However, by themselves they are inadequate and need to be supplemented by intensive off-reserve conservation management. It has been said before, but the national conservation reserve system is unplanned and unrepresentative of continental diversity (e.g. Recher 1978; Frawley 1988; Pressey 1994). Entire ecosystems are either not represented or are only poorly represented in the system. This is particularly true of ecosystems within Australia's agricultural and pastoral regions - in other words, most of the continent is inadequately conserved or sampled.

Reserves are too small, have poor boundaries, and the system is inflexible. Almost none has been established for the express purpose of biodiversity conservation following a well-designed and comprehensive biological survey. When this was attempted, as in the Northeast Regional Forest Agreement process in New South Wales, the results were discarded in deference to a political imperative to retain a rural electorate by a government with a tenuous majority in the lower house (Recher ms). However, this did not stop the State government from justifying its decisions by referring to the considerable scientific research that had been done, even if the advice was ignored. Similar comments were made about the Western Australian RFA by government ministers (Recher ms).

The role of reserves in biodiversity conservation and management and the need for a scientific approach is not understood by most Australians. Conservation is forever and needs to be planned on ecological time scales - that is, the reserve system has to be able to accommodate climatic change over the next 100 to 100,000 years. The inflexibility of the present system and the reliance on allocating land to particular uses (e.g. conservation reserve or logging area) largely prevent this from happening. The inflexibility of the reserve system is a political response to what should be an ecologically designed and evolutionary driven program.

On one side, the environmental lobby is rabid in its refusal to modify reserve boundaries. On the other, developers and land owners demand resource security and significantly constrain the design of a system of reserves or conservation programs that might actually protect continental biodiversity.

Wilderness: the soft option

When it comes to environmental conflicts and competing forces, politicians fall between the cracks of least resistance.

Nowhere is this more evident than in New South Wales with its wilderness reserve classification (Recher 1998). Very large areas of New South Wales have now been dedicated as wilderness, but when the benefits of wilderness classifications for conserving biodiversity are assessed critically, they are found to be minimal. Consider that virtually all wilderness designations involve a change in land use *within* the existing conservation system on Crown Land: either State Forest, Vacant Crown Land, National Park or Nature Reserve is redesignated as Wilderness. There is little or no addition to the conservation estate and the emphasis on forests and wild rivers has meant little attention to critically endangered New South Wales' ecosystems west of the Dividing Range, or to biodiverse and important, but disturbed, ecosystems, such as bush remnants within metropolitan areas. The emphasis on purported wilderness and a lack of disturbance means even the forest reserve system is unbalanced.

New South Wales is not the only State where conservationists promote wilderness over biodiversity conservation. One referee drew my attention to the recent deal between the Greens and the Tasmanian government whereby large areas of land were added to already large and well-sampled wilderness areas, in exchange for allowing continued logging in forests in eastern Tasmania which are poorly represented in Tasmania's reserve system.

My point is not that wilderness areas have no conservation value, most are useful for conservation, but that a wilderness designation is not necessary to protect an area's biodiversity. This is especially so when an area is already protected as a national park or nature reserve. For example, designating the Nadgee Nature Reserve in southeastern New South Wales as a wilderness has done nothing to enhance its conservation value. To the contrary, the dedication has had significant costs for long-term nature conservation. The reserve's importance as a research site has been substantially diminished and several globally significant long-term ecological studies on fire and climate effects can no longer be continued due to limits on access. In the current research climate, it is unlikely these studies will ever be repeated elsewhere and the

long-term value of more than 30 years research effort has been lost. Additionally, the difficulty of access brought about by road closures has led to a significant increase in uncontrolled camping with the greatest threat being the increased risk of accidental fires and increased fire frequency. The long-term research at Nadgee has shown that increased fire frequency is a major threatening factor for many of the birds and mammals which the reserve was created to protect. The lack of access also makes it difficult to control weeds and exotic animals, such as the European Fox *Vulpes vulpes*, an animal which is my opinion is already adversely affecting Nadgee's native wildlife.

Apart from some people, hardly part of an endangered species population, no plant or animal on Earth, much less in Australia, requires wilderness for its survival. Many species do require large areas, just as many more species need strategically located habitats across a wide longitudinal range (e.g. migratory birds and bats, many marine fish - see Hutchings 2000) and many species benefit from being undisturbed by people and their commensals. None requires wilderness.

Wilderness is not a conservation initiative for biodiversity conservation. Wilderness is pandering to a small group of misanthropes at the expense of effective biodiversity conservation. As with threatened species conservation, for politicians, wilderness designation is a low cost, high profile policy which not only placates a vocal minority, but presents an image of caring for nature.

Resurrection technology

An interesting and controversial proposal for dealing with the world's extinction crisis is to use genetic material (DNA) from preserved (mostly museum) specimens of extinct species to clone new individuals, literally bringing the species 'back to life'. This is very different from the cryogenic (deep freeze) storage of gametes, seeds and tissues which can be used to propagate individuals for re-stocking depleted populations or restoring extinct species to the wild. Cryogenic techniques are already widely used in agriculture and horticulture and play an important role in propagating some wild plants which have been depleted in the wild. They are also useful in protecting genetic variety among animals (particularly large ones) in captivity where there is insufficient space to house enough individuals to always be certain of a genetically viable population. For example, storing sperm from a

genetically unique individual helps ensure that the genotype is retained within the population even though the individual may die without breeding or when only a few progeny at a time can be produced and cared for, as with rhinoceros. Unfortunately, recovering extinct species from DNA obtained from museum specimens is not yet feasible. This does not mean that the technique should not be investigated and hope held that it will eventually become feasible. It would be fantastic to restore the Pig-footed Bandicoot *Chaeropus ecaudatus*, a species Europeans brought to extinction in Australia.

The value of cryogenic storage and the hope of genetic restoration of extinct species does not mean Australia can become 'blase' about the extinction of species in the wild. Cryogenics and DNA cloning are 'last resorts' to be used only when all else has failed, or, as with the bandicoot, extinction is an event in the past. Conservation of nature in Australia must always place a priority on retaining and enhancing extant species and ensuring their habitats are protected on all lands irrespective of land use and tenure. Also, there is little gain in recovering an extinct species from DNA extracted from a museum specimen unless there is a suitable habitat where it can be released back into the wild. In this sense, it is exactly like *ex situ* conservation where plant and animal species are kept alive through breeding programs in botanic gardens and zoos in the hope that one day they can be returned to the wild.

While not yet feasible, the recovery of extinct organisms using modern DNA recovery and cloning techniques merits thought and long-term planning. For one thing, the idea of bringing long-extinct species to life has great publicity value. It may actually work and could be the only way that humanity can save species, such as the large cats and bears, which are culturally important. The space and cost of preserving genetic material until habitats have been restored is small relative to the value of such species in human culture.

Conservation scientists might also like to consider the potential importance of well-crafted documentaries of natural landscapes and wild plant and animal populations. Obviously a documentary can no more substitute for conserving ecosystems and life in the wild than storing DNA, but if humanity is forced to restore ecosystems in the absence of living examples, a documentary serving as a visual model might help people who may never have the opportunity to see or walk in the real thing.

With 50% or more the planet's surface already affected by agriculture and urbanization, in quick time, television documentaries, bits of DNA, sound recordings and a few frozen eggs and sperm may be all that is left of nature. The proponents of DNA cloning should no more be ridiculed because they may be ahead of their time than Copernicus when he argued the Earth revolves around the Sun, and not the Sun around the Earth.

Native animals as pets

The concept of encouraging the use of native animals as pets is excellent, but primarily because it could be effective at raising the need for biodiversity conservation with the media. The conservation scientists who make these proposals, however, need to ensure that media reports present and understand the conservation issues and do not just treat the issue as one of 'human interest'.

There is an important distinction between keeping an animal as a 'pet', and keeping one as a companion. If native animals are unlikely to be good companions, they may still make good pets provided they can be appropriately housed and fed. With that caveat, I support the idea that people should have better access to keeping native fauna in captivity. For a small number of people, the experience of having wildlife at home engenders a sense of caring for wild things and is an important learning experience. Many, possibly all, of the biologists I know kept wild animals as 'pets', collected butterflies and bird's nests, or had a plant collection. The cause and effect cannot easily be unravelled, but we should not dissuade the young Paul Ehrlich from having a butterfly collection or the young Harry Recher from catching tadpoles.

In my view, existing wildlife regulations are too bureaucratic and of doubtful benefit when compared to the wholesale destruction of wildlife that accompanies land clearing, clear felling and the use of private automobiles. I do caution, however, that we should not expect too much for nature conservation from liberalising the laws regulating the keeping of native fauna. Given the countless Australians who have had the odd budgie or native finch or two, keeping native fauna does not guarantee a sense of responsibility or caring for wild animals. I also wonder whether a neighbourhood replete with wandering quolls would be any less damaging to the local fauna than a neighbourhood of cats.

Replacement of one set of animals with another also ignores the wider problems associated with keeping domestic animals in urban and semi-urban environments: domestic animals are significant sources of nutrients through their wastes to urban water pollution (see Recher 1972). There is also an ethical issue of feeding high quality protein to pets when large numbers of children have inadequate diets affecting their ability to achieve their potential as human beings and when more land is being cleared to produce more food.

The better and more ecological answer to the environmental damage caused by dogs and cats would be to prohibit ownership except for 'working animals' (e.g. seeing eye dogs).

In keeping native animals as pets, it is necessary to guard against the transmission of disease and parasites from novel pets to their keepers, or from captive animals to wild populations. While breeding native animals for the pet trade could be a way to enlarge the populations of endangered species, captive breeding is fraught with genetic problems and there is the important risk of animals or genetic varieties of animals being translocated within Australia outside their natural distribution. Viggers and Lindenmayer (2002) clearly identify the range of problems that can accompany keeping native fauna.

An integrated pastoral industry

A pastoral industry that relies less on sheep, goats and cattle and more on kangaroos and other native herbivores may not be much more effective in furthering the conservation of biodiversity than liberalising the trade in native animals as pets. The real problems with the pastoral industry are not so much the animals being husbanded as the way in which it is done. A great part of the damage from domestic stock in arid and semi-arid Australia occurred more than 100 years ago when sheep and cattle were first introduced to Australia's rangelands. The early settlers grossly overstocked and overgrazed with the consequent destruction of the capital resource. In my opinion, recovery of Australia's rangelands will not be achieved without significant reductions in grazing intensity (already forced to low levels by habitat degradation in many areas) by all herbivores, not just exotic species. Far better to close watering points and destock than fiddle the mix of species. There are also problems with changed fire regimes and water flows that are not addressed simply by replacing sheep with a native species.

When you consider that there are fewer than 400 pastoral properties occupying the pastoral zone of the western half of the continent and that many of these claim hardship, and virtually all are significantly degraded and have large populations of feral herbivores, something more radical than promoting 'jump steak' is needed. A good place to begin might be to amalgamate properties along ecological boundaries, while ensuring each property is large enough to be economically viable and ecologically sustainable. The surplus rural population that results can then be retrained or pensioned off as happens in any industry that is no longer viable.

Do not misunderstand me, we should be making better use of native wildlife as alternative sources of income to land owners. I support the development of a kangaroo-based industry provided it is really ecologically sustainable as distinct from being a sustainable harvest. Like keeping quolls in place of cats, the idea has merit in raising the profile of conservation issues, but it also avoids the core environmental problems. One of these problems is that any sort of pastoral industry is probably ecologically unsustainable over most of the continent given present levels of degradation and the abundance of feral animals. My own view is that closing down pastoralism may be the best short to medium-term strategy for restoring economic and ecological viability to Australia's rangelands.

In proposing the use of wildlife for commercial purposes as a means of supporting better conservation of biodiversity, I am surprised that conservation scientists in Australia are not more vocal in opposing the closing down of hunting of native birds. Among the few examples of using wildlife for the betterment of *all* species is the willingness of hunters and fishers in North America, Africa and Europe to put hard cash up front for habitat acquisition and management. These habitats can then support a tourist industry which can be even more profitable for local communities than hunting (Van Oosterzee 2000).

By rejecting the use of wildlife for sport, we deny access to considerable amounts of conservation dollars. Similarly, there is no convincing ecological or management reason not to auction Koalas to overseas zoos or to sell cockatoos on the international pet trade. Given the plague numbers of some parrots, such as the Galah *Cacatua roseicapilla* and Port Lincoln Parrot

Platycercus zonarius, and the negative impact on other species, it is puzzling that the conservation industry opposes a trade in these species which has the potential to generate money for conservation. The same argument holds for Koalas when numbers exceed the carrying capacity of their environment, as has happened on Kangaroo Island.

In theory, if not always in practice, harvesting of wildlife is a manageable and ecologically sustainable industry. I can see little difference between a well-managed fishery, such as the Western Australian rock lobster fishery, and the harvesting of other wildlife. What is needed is the assurance that the fees, taxes and royalties raised are returned to conservation coupled with the necessary management science to ensure the take is sustainable.

I understand that individual animals do die as a result of such activities. However, my primary concern is with the survival of populations and species, and not the rights attributed to individual animals by some people. It would be nice to have both, but animal rights and welfare activists who oppose killing animals need to understand that their actions to protect individuals may, and are, condemning whole species to extinction.

Tourism and prospecting

The same arguments apply to biodiversity prospecting and the use of wild genetic material for the food, horticulture and pharmaceutical industries, and for eco-tourism. I see no evidence that the tourism industry, much less the drug companies and horticultural firms, return any money to conservation. At best, a tiny fraction of tourists acquire a sense of sharing and caring that translates into political and economic action on their return home.

The tourist industry in Australia lacks any policy in these areas and seems oblivious to its dependence on natural, not to say wild, landscapes and wildlife (van Oosterzee 2000). On balance, the developments associated with tourism are negative and I question the conservation benefits from using sexual dimorphism (e.g. Western Australia's tourism campaigns using high profile female models) and adventure to promote tourism. In my view, this sends the wrong message about the wrong places for the wrong reasons and achieves little for biodiversity conservation.

Hands on, research based eco-tourism does provide special opportunities for a select group of wealthy, educated people who are already committed to nature conservation. Fostering their ethic is beneficial and programs such as Earthwatch merit better recognition for their achievements. We could do worse than extend programs such as Earthwatch to the school level always making sure they are carried through to secondary school and university. Australia has been particularly deficient in this area and is decades behind North America in providing field based nature education to young people (however, see Fisher and Campbell 1998).

An almost real revolution

All of the above may sound negative and it may appear that I have donned the traditional sack cloth and ashes. But there are actions to take which will achieve many of the goals of biodiversity conservation that conservationists see as desirable and necessary. Therefore, let me conclude with some almost revolutionary proposals:

- first and most important, there must be an immediate cessation of land clearing for agriculture, forestry and urban expansion. I am almost tired of saying this, but I take comfort in the knowledge that I am supported in this conclusion by almost every conservation scientist in Australia, as well as by the Ecological Society of Australia and the National Biodiversity Council.

Continued land clearing in Queensland, New South Wales, the Northern Territory, Tasmania, Victoria, South Australia and Western Australia constitutes the single greatest threat to continental biodiversity. It is pathetic that we hear the Australian Conservation Foundation and the National Farmers Federation call for a multi-billion dollar program to plant 50 billion trees and stem the spread of land degradation when native vegetation is being cleared faster than we could ever hope to replant it and government environment ministers wash their hands of responsibility. Landcare activities are important, but they involve only a small part of the farming community and they do not necessarily involve the land owners doing the most significant damage. Landcare is what we do after we failed to care for the land in the first place.

- As the second most important and urgent action to take in protecting continental biodiversity, I suggest that it is necessary to place a minimum of 30% of all existing cleared land back under native vegetation. To ensure correction of land and water degradation problems, it is necessary to put an additional 20 to 40% of existing cleared land under deep-rooted perennial vegetation, which need not be native. This needs to be done uniformly across the landscape and it must be designed. One of the more conspicuous failures of the decade of Landcare was the failure to design and implement revegetation programs according to ecological principles.

- a third initiative requires action from the conservation scientists in Australia. They have to become more involved publicly with environmental and biodiversity issues. Science should take a leading role in the design of reserves and reserve systems and in the political processes required to end land clearing and the revegetation of degraded lands. Scientists must become much better communicators (Ehrlich 1993; Recher 1992, 1998; and Wills and Hobbs 1998). Scientists can begin by introducing communication and media skills into their university and school classes (Dorfman and Taylor 1998). Let me quote Paul Ehrlich:

“When we were students, we were taught that a piece of scientific research was not completed until it had been published. Research was not just a matter of personal discovery, it was a part of a larger scientific enterprise – an effort to understand how the world worked. But since then, it has become clear that science must be viewed as part of a larger social picture. Especially in ecology and conservation biology, research cannot now be considered complete until its significance has been explained to the general public.” (in Recher and Ehrlich 1999).

Australian conservation scientists, with some notable exceptions, do little of this. Further, those who do speak up are more often attacked and penalized than rewarded as should be the case.

- thus, as a fourth and final initiative, we need an education program in ethics and the ecological sciences for scientists, politicians and journalists. Universities and professional societies need to teach communication and lobby skills to scientists and train them to distinguish between what is important and what is publicity.

It is important to grab the headlines, but it is more important to grab the headlines with meaningful proposals, even if they are revolutionary. We may elect to be pragmatic and emphasise the economically based and more

socially acceptable proposals discussed in these proceedings, but we must also promote and publicise revolutionary ideas of real social, economic and environmental change.

Acknowledgments

I want to acknowledge that this paper is incompletely referenced. I have shamelessly used or referred to other people's ideas and data, but always from the public domain. This is simply the nature of this paper which was used to conclude a day of papers and discussion touching on all the things I write about. This is what people do with my ideas and writings and I don't mind, so I hope others won't mind either. After all, the debate and discussion is what is important not who had the idea first (or last). For those who want more, there are several textbooks on conservation biology which go into detail on the issues discussed and provide abundant references to the scientific literature.

In the same way, there are published and exhaustively referenced symposia proceedings on such issues as 'off-reserve conservation', 'ex situ' conservation, and the responsibilities of scientists in public communication. Some of these are in the references. Use the library. For the anonymous referees who were concerned my ideas might be used to justify government inaction on nature conservation or by developers to validate their destruction of the land and species, I can only say that their anonymity and timidity are reasons contributing to the lack of respect of science in Australia and cause science and scientists to be ignored when it comes to environmental destruction.

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QUESTIONS & ANSWERS

DAN LUNNEY: Thank you, indeed, Harry.

ELIZABETH USHER: I hope to be a vocal young scientist.

I'd like to respond to the issue of feeding our pets instead of those starving millions overseas. During the height of the Ethiopian famine, the Ethiopian government was still exporting grain to feed overseas livestock. Perhaps anyone interested in the environment should consider vegetarianism. There are certainly plenty of delicious meals, which have less impact on our environment, and indeed on our health, than steak tartare.

Also, we've been presented with some major paradigm shifts that are necessary but, unfortunately, unlikely. I would like to suggest one further major reversal of a social attitude and challenge the assumption that animals exist for us to own. In the words of a campaign by In Defence of Animals, they are not our property; we are not their owners.

HARRY RECHER: I agree with that last point. As far as the first point goes, I have a postgraduate student who is a vegan, he drives me mad on field trips, but I've learned to take a bale of hay along with me. However, I am not sure that we can solve all the world's problems by turning to vegetarianism. It could help. If you are committed to more people, then, by shortening the food chain and going straight to the grass, we can increase the number of people that we can feed on the planet. It is a lifestyle choice.

What I'd like to see is a system evolved where people continue to retain a choice in what they eat. We're being forced into a situation where there's not going to be enough for anybody, not just the people in Africa. The situation in Africa where a nation with starving children continues to export grain is ridiculous, we all know that. It is also ridiculous that this country continues to feed high quality protein to dogs and cats, particularly when most of that protein winds up as nutrients in our urban waterways and is responsible for a significant amount of urban water pollution.

There is a range of reasons, including animal welfare, why keeping any animal as a pet - owning any animal - is anathema to me. We should not allow the ownership of any animal. It would solve some pollution problems, and we would have a better society; it would certainly be quieter at night-time.

HALINA THOMPSON: Thank you very much, it made sense, all of it, and, of course, the best comes at the end. We all know that the world, and therefore Australia, is going to hell in a handcart. Why is it therefore that you're not prepared to take that personal stand and turn to vegetarianism?

Now, the other thing is you complained that scientists have to grovel for research dollars. What's your attitude to the proposed spending of millions to clone the thylacine? Isn't that a bit like eating kangaroos, and keeping wildlife for pets, a so-called conservation issue, which is like whistling in the dark. It makes you feel better but stops you from actually looking for a way towards the light?

HARRY RECHER: The answer to spending \$60-80 million on cloning the thylacine is complex; it is like the space program. You can look at the space program and say we spent billions of dollars that could have been spent on better things. On the other hand, the spin-offs have been significant and I suspect that the spin-offs from a cloning program of an extinct species would also be significant. It does raise the profile of conservation among people like Bob Carr. You have no idea how difficult it is to get a conservation message across to politicians. We need more money for research, but I wouldn't begrudge the money spent on a thylacine program. The trade-off may be worth it.

As far as giving up being a carnivore, I admit to being an improbable carnivore. I try to be a carnivore that feeds only on other carnivores. Since energy is lost with each transfer up the food chain, this means I am out on a very tenuous limb. My favourite foods are marine carnivores, marine fish AND shellfish. IT IS unsustainable, and I recognise it.

JIM SHIELDS: I had the opportunity once to ask Jack Ward Thomas, just before he was going to become the director of Forest Services for the US, when ecologists were going to take the same action that Einstein did. In 1938 Einstein and his colleagues wrote a letter to Roosevelt and to Churchill and said that, "There's a terrible weapon about to be delivered unto the earth. We think a nuclear bomb could be developed. We think Hitler is in the process of developing it. If you don't do something about it, to stop it, we're all for it."

I said, "When are ecologists going to take the same step for the current ecological problems and inform the politicians?" Jack Ward Thomas is a good old boy from Texas and he said, "Well, Jim, I'll quote Voltaire, they had one thing that we don't. Voltaire said, 'Nothing sharpens the mind like execution in the morning'.

Do you see any way that we can truly focus politicians' attention in a similar manner; and can you think of any process that we can make them really see that there's going to be something in the future that they need to deal with?

HARRY RECHER: The letters have been written and sent to the world's governments by the world's leading scientists identifying human population growth and the loss of biodiversity as the two significant issues facing the survival of human society on the planet.

The message has been delivered. To the question, "How do you get politicians to respond?" the answer is that a societal change is needed. The implication of a revolution is rapid change, but we are not going to change societal attitudes rapidly. We can only do it through education, and I argue we're not doing a very good job about educating politicians or anybody else in our society as to our dependence on biodiversity.

As long as you can continue to walk into a Woolworths or a Coles and be confronted with more food and greater variety, including meat, than you could possibly consume in a day, a week, a month or a year of your life, people in Australia and the western world, who are the big consumers, are not going to see any problems. There will not be a response until you walk into Woolworths and there is nothing on the shelves. Then there will be action.

MIKE ARCHER: Boy, do I second that, Harry. Having talked to Bob Carr, I know that he is actually genuinely concerned about conservation; he is one of Paul Erhlich's greatest fans, he listens. The problem is, he has advisers who tell him to think other things. I was very disappointed to see that while he was trying to be a visionary politician, out there thinking about the ways in which politics could drive these things in the right direction, he was being told, as I read in Sydney newspapers, to get back in the kitchen and mind the pots.

It is not just the politicians, it is the media and their attempt to reflect public opinion that tends to influence politicians.

But one little squeak, if I could just have a little kick in there about this vegan business. The thought that if we all converted to eating plant material we would save these problems we've been talking about, you'd have to ask: what happens to all that habitat that has to be cleared to grow all of that extra monoculture wheat in order to feed all those extra vegans?

Most of the meat animals that we eat are out there grazing native vegetation, where they shouldn't be, and that's another important matter.

HARRY RECHER: The last time I spoke in this particular auditorium was just after Bob Carr had been elected, and the room was filled with lawyers, it was the National Labor Lawyers Conference. I made the observation that, although Bob Carr spoke an environmental message and no doubt had a commitment to the environment, time would tell whether he would be allowed, by the party machinery, to implement any of those ideas. He has not really been allowed to do it, and that's because there's not enough support from the community for those changes.

The minute the politicians can count the votes, they'll change. We changed the Regional Forest Agreement decision in Western Australia when people in suits and ties and using mobile phones confronted the politicians and blocked Parliament House. Then they realised it was serious. That's what we need to do on a continental and global scale.

DAN LUNNEY: Harry Recher, thanks.