THE WHY AND HOW OF MANAGING BIOLOGICAL RESOURCES

ANDREW BURBIDGE
Department of Conservation and Land Management,
Western Australian Wildlife Research Centre, P.O. Box 51, Wanneroo, W.A. 6065.

WHY MANAGE BIOLOGICAL RESOURCES

This question is basic to the allocation of public finance by society, and becomes even more important in times of economic difficulty when people's and especially politicians' thinking tends to become even more concerned with short-term goals.

The question can be reduced to its most basic parts.

1.Are endangered species worth saving, especially if they are of no economic benefit to humans?

2.Why manage for sustainable utilization when we can produce more in the short-term and leave the solution of problems to later generations who may have more knowledge and better technology?

3.Can management produce cost-effective results?

Endangered Species. Extinction is a natural evolutionary process. Charles Darwin (1859) in his "Origin of Species" said "...as new forms are continually and slowly being produced, unless we believe that the number of specific forms goes on perpetually and almost indefinitely increasing, numbers must inevitably become extinct."

Before Darwin, extinction was a shocking thought to people who believed that species had been created once and for all. Now we have almost come a full circle with some people using Darwin's name to justify man-caused extinctions. These people argue that rare species are headed for extinction anyway, and, therefore, it is a waste of money to try and save them.

The most obvious difference between natural evolutionary extinctions and those induced by humans is the rate. Australia unfortunately provides too many striking examples of this increased rate of extinction since the arrival of Europeans.

In Western Australia, in only 150 years, 17 (12.4%) of the 137 species of terrestrial mammals have become extinct on the mainland and a further 24 species (17.5%) have declined to a small fraction of their former abundance and range. A further 8 species of Australian mainland mammals that did not occur in W.A. at the time of European settlement, plus the Thylacine, are extinct and a further 8 have declined. Fortunately, eight of the 25 species that are extinct on the mainland still occur on continental islands, meaning that 18 species or 7% of Australian mammals are extinct.

Similarly, 104 species (about 1.4%) of plants are presumed extinct in W.A., the overwhelming majority having occurred in areas cleared for cereal growing in the south west of the State (S. Patrick & S.D. Hopper pers. comm.). The exact number will never be known, since it is more than likely that many species were wiped out before they came to the attention of botanists. The W.A. figure of ca 1.4% of the total flora compares unfavourably with only 27 extinct plant species in the whole of Europe (ca 0.2% of the total flora), 39 in southern Africa (0.2%) and 74 in all continental U.S.A. (0.4%) (Leigh et al. 1982).

There are four main arguments for the preservation of species (see Main 1982, Ehrlich & Ehrlich 1983 for a detailed discussion of this topic).

The first is that simple compassion demands their preservation. Compassion develops from a view that other products of evolution also have a right to exist; the needs and desires of humans are not the only basis for ethical decisions. It is fairly easy for most of us to feel compassion for the beautiful and large living things around us (so long as they are not dangerous!) but few feel com-

passion for invertebrates or micro-organisms, even though vertebrate animals and vascular plants cannot exist without them.

The second argument is based on aesthetics: other species should be preserved because of their beauty, symbolic value or intrinsic interest. Kangaroos, numbats, wildflowers of striking beauty and butterflies of iridescent hue seem automatically to appeal to most members of our society, and we feel a loss if they are not around. However, most of the vital links in the food webs of ecosystems are not obvious to most people and even if they are drawn to people's attention they do not appeal because they are small and insignificant.

The third argument is based on economics: the unique Australian fauna and flora attracts tourists; plants and animals provide all our food; plants, animals and micro-organisms provide medicines and drugs; plants provide perpetually renewable sources of fuel, wood for building and many other products. Any examination of the history of human utilization of wild animals and plants will show that so far we have utilized a minute proportion of the potential that exists in nature. Many biological resources may assume a value in the future. Sometimes something that has been considered "useless" suddenly becomes "useful", e.g. timber from marri (*Eucalyptus calophylla*). Clearly, extinctions reduce our future options. Unfortunately, such arguments often seem to hold little value when weighed up against the often short-term economic benefits of a major development project.

Another difficulty with economic arguments is that they are often impossible to quantify to economists who usually view 10 years as being the maximum period for economic planning.

The final argument, probably the most important, is also the most difficult to sell to the general public because it involves indirect benefits to mankind; it is that other species are vital components of ecosystems that provide humanity with indispensable free services: the life-support systems of our planet. Life-support services provided include the oxygen we breathe, the maintenance of the quality of the atmosphere, the control and amelioration of climate, the regulation of freshwater supplies, the generation and maintenance of soils, the disposal of wastes and cycling of nutrients, the control of pests and diseases, the pollination of crop plants, the direct supply of food and the maintenance of a genetic store from which we can benefit in the future.

Do the rarer components of ecosystems make a significant contribution to the provision of life-support systems? Rarity is a function of species diversity. The usual situation is that, at a given locality, a few species are common and most species are rare. The few common species that perform most of the ecosystem functions are often termed "keystone species". Some biologists argue that conservation action should be aimed at keystone species rather than at rare species; however, rare species may play important ecosystem roles too, which are difficult to detect until a species disappears (e.g. pollination).

A review of whether rare species are worth conserving from a life-support services - ecosystem function point of view needs to examine why some species are rare (Main 1982). Rarity is caused by a variety of "limiting factors" - physical factors like climate, soil or nutrient availability or biological factors like predation, parasitism, food availability, fecundity, etc. What if limiting factors change? Clearly, relative abundance of species in an ecosystem may change also and other limiting factors then become important. A local example of this is provided by the studies of fox predation on rock-wallabies by Kinnear et al. (1988). When predation pressure was removed rock-wallaby populations increased rapidly until other limiting factors such as food availability controlled overall population numbers.

In time, limiting factors affecting species abundance in ecosystems change, either naturally or because of human interference. If ecosystems are to adapt and evolve then rare species must be protected since some of them may be the keystone species of the future. Change in the near future may be rapid because of the climatic changes that will probably result from increasing levels of carbon dioxide and other pollutants in the atmosphere.

Managing for Sustainable Utilization. The concept of sustainable yield is easy to understand when applied to species of considerable economic value, whether they be jarrah or karri trees for timber, tuna or western rock-lobsters for food or ducks for hunters. It simply means harvesting the species at a rate that is sustainable, rather than allowing overharvesting with a resultant loss of the resource.

Sustainable utilization is a concept that applies to ecosystems and the biosphere as a whole. The

principle is the same but the control of over-utilization is more difficult; many different sectors of society impact on ecosystems and the biosphere. There is also the problem of knowing how much disturbance ecosystems or the biosphere will absorb before they change irrepairably. Managing for sustainable utilization requires the cooperation of whole societies and, ultimately, the whole world.

Arguing that future generations will be able to fix our mistakes is akin to the proverbial ostrich with its head in the sand. (They actually flatten their long necks on the ground when nesting to try and avoid detection by predators; evolution is not that silly!) Attempts today to rehabilitate degraded environments have a low success rate and are very costly. There is no reason why attempts in the future should be any different and future societies will have even greater problems than ours, partly because of our mistakes, e.g. climatic change and rising sea levels due to atmospheric CO_2 buildup, and partly because of a greater human population.

The effectiveness of management. There are many cases where research into and management of biological resources have proved effective. One of the best known local examples of an endangered species being saved by the application of research results is the Noisy Scrub-bird (*Atrichornis clamosus*), which has increased from one population of around 100 when the species was rediscovered in 1961 to four populations totalling over 450 today (Burbidge et al. 1986). There are many similar examples that could be quoted. As to whether these success stories are cost-effective depends on what value is placed on endangered species.

Endangered species programs often get the limelight, but programs that prevent ecosystems getting out of balance and species becoming endangered are just as, if not more, important and are usually much cheaper in the long run. A good local example is West Australian Petroleum's achievement in preventing exotic animals establishing on Barrow Island during the operation of their oil field (Butler 1987). Barrow Island is the largest land mass in the world that is free from exotic rodents. Its nature conservation values are very high and the environmental costs resulting from establishment of exotics would also be high. The economic costs of eradication of exotics once they became established are likely to be enormous.

HOW DO WE MANAGE BIOLOGICAL RESOURCES?

Although some of us may appear to spend much of our time managing paper and people, our profession actually is the management of biological systems. How good are we at managing? What can science provide to help us?

The Complexity of Biological Systems. It has been estimated that there are about 30 million species in the world, of which only 1.7 million are named. I do not know of any estimate of the number of species in Western Australia, but there are likely to be several hundreds of thousands. These multitudinous species exist in complex interacting ecosystems about which we understand some general principles but know little of the detail. Any analysis of our current knowledge must conclude that we often can not comprehend the whole system we are trying to manage and we usually can not predict the changes that will take place after perturbations. The current state of our science allows us to look only at parts of a system.

Humans have tended to regard the environment as limitless and for 99% of our history that view was correct. Today, however, we can assault the environment in ways that it cannot sustain. Technology has captured our imagination to the extent that many are coming to believe in the "hi-tech solution" - a belief that it does not matter how big a mess we make, someone will invent something that will solve the problem. This almost religious belief overlooks two facts; that new technology is creating environmental problems much faster than it is solving them and that there is no such thing as a foolproof technology, as Chernobyl and Challenger testify.

Clearly, we are grappling with complex problems at a superficial level. The best approach is to understand and remember that fact and act accordingly - we should be conservative as well as conservationist in our approach. We should monitor for and seek any unexpected effects of our actions and modify our procedures accordingly.

General Principles. One set of guidelines we can follow is contained in the three conservation strategies: The World Conservation Strategy (WCS) of 1980, the National Conservation Strategy for Australia (NCSA) of 1983 and the

State Conservation Strategy for Western Australia (SCSWA) of 1987.

The objectives of the WCS are:

1.To maintain essential ecological processes and life-support systems

2. To preserve genetic diversity

3.To ensure the sustainable utilization of species and ecosystems

Within the SCSWA are several key Strategy Directions that are particularly relevant to our workshop. These are presented below in the same order as listed in the Strategy with some comments about our role as researchers and managers.

1.IMPROVING THE CAPACITY TO MANAGE

"Foster an environmental ethic throughout all sectors of the community."

"*This is the most important aspect of the State Strategy... Inherent in achieving this ethic is to develop*:

(i)"a sense of stewardship for our environment and natural resources as a whole, not just those within conservation areas;... and

(ii)a wider exposure to and understanding of the concept of sustainability;..."

Clearly we must be able to demonstrate that we apply these principles to our own work if we are to influence others. We should commit a proportion of our resources to fostering an environmental ethic in the public and ensure that all our educational and interpretative material promotes development of an environmental ethic. For example, we should ensure that our Departmental journal "Landscope" promotes the development of an environmental ethic, and presents nothing that promotes the opposite view. Our commitment to public participation in planning and other facets of our work, such as setting research priorities, will also help foster the development of an environmental ethic. This does not mean we should react to every pressure group, but it does mean that we should react to broad public views as much as possible. We should also be involved in shaping public views through education.

"Emphasize the contribution of the environment to our way of life"

We should commit a proportion of our time to educating people about the dangers of extinction and environmental degradation, particularly in relation to the role of living things in providing life-support systems. Many environmental scientists and managers are committing themselves to the principle of an "ecological tithe", i.e. committing at least 10% of their time to environmental education. Educating people about the plants, animals and environments in Parks, Reserves and State Forests is an important first step to helping them gain an understanding of wider environmental problems. In my view, recreational guides like "Beating About the Bush" should present more educational material. We should also emphasize the contributions reserved lands make to our way of life, e.g. the water catchment functions of State Forest.

"Develop a conserver approach in the use of resources"

Here, too, the best approach is to set an example and promote relevant education in order to convince others. Management Plans are an important method of promoting a conserver approach.

"Recognize the affinity of the Aboriginal culture with the natural environment"

We have made a start to developing cooperative management programs for land that has both nature conservation and Aboriginal significance. Much more needs to be done. Such programs will be of enormous benefit if we are to manage most of our remote reserves.

"Plan to meet the consequences of changes to climate"

"*Continued rises in levels of atmospheric carbon dioxide and other gases which trap heat are predicted to begin affecting our climate increasingly over the next few decades. Early planning, especially for the coastal zone as sea level rises, will mitigate the economic and environmental costs*."

As far as biological resources are concerned the predicted rise in sea level is far less important than the possible climatic effects, which are predicted to include increasing aridity in the south west. One possible way of planning to mitigate climatic effects on flora and fauna is to define those areas that are likely to be refugia and ensure that they are reserved and managed.

"Integrate land use management and monitoring on a regional basis"

Monitoring of ecosystems, both in relation to natural fluctuations in abundance and in relation to the effects of management practices, is in its infancy in W.A. CALM is developing a strategy and will work out ways of implementing it in the near future.

"Develop and regularly update inventories of natural resources and processes, required for regional planning and management"

Natural resource inventories and knowledge about environmental processes are of value for things other than regional planning and management, having considerable local value as well. Preparing inventories and studying processes are a major function of research in both CALM and CSIRO. The challenge is to commit a sufficient proportion of our resources to it and to set priorities correctly.

2.MANAGING FOR SUSTAINABLE YIELD WHILE PROTECTING LIFE SUPPORT SYSTEMS

"Prevent further decline in species and genetic diversity in Western Australia

"In view of our commitment under the WCS and NSCA to preserve genetic diversity, the continuing decline of species and genetic diversity in Western Australia is of great concern.... Even an expansion of well-managed National Parks and Nature Reserves will not prevent further loss of species and genetic diversity."

This strategy is a major function of CALM. While a continued expansion of National Parks and Nature Reserves will not prevent a further loss of genetic diversity it will certainly reduce the loss enormously and we should continue to press for further reserves even if we cannot manage them at this time. Do we commit enough resources to documenting and managing genetic diversity? I submit we do not. Can we formulate better ways of conserving habitats and species on lands and waters outside conservation reserves? Not an easy task, but its importance indicates that it should continue to have a high priority in research programs.

"Adequately protect and manage representative areas"

In Western Australia we have already done more than some other states and/or countries to reserve areas of nature conservation significance. However, it is clear that many more areas should be reserved and that more needs to be done to adequately protect conservation reserves from interference and degradation. Too few of our existing conservation reserves are Class A and mining remains a threat to the protection of some areas and the reservation of others. As we all know, many conservation reserves receive no management at present, so it is a long way from "adequate".

"Implement a conserver approach in the use of resources"

"As part of a conserver approach, consideration should be given to:

- lowering per capita consumption by reducing waste;
- substituting alternative resources where applicable;
- maximizing yield per unit of resource;
- production of higher value goods, thus achieving the same economic benefit while conserving the rate of resource use; and
- further attention to recycling/re-use."

We, above all other sectors of society, should maintain and improve a conserver approach to the use of resources entrusted to our Department and we are doing a lot in this regard. No doubt, there is still much room for improvement.

"Modify inappropriate management practices to conserve natural resources"

Some people in society believe that some CALM management practices are inappropriate. We know we do not monitor the results of our management practices sufficiently; perhaps much of the heat would be removed from some of these arguments if we did.

"Rehabilitate degraded lands, waters and ecosystems"

While we have made major commitments to rehabilitate some lands under our control, other land, such as the rabbit-degraded areas of Nullarbor Plain reserves and cattle-degraded parts of Kimberley reserves, have received no attention.

"Avoid disturbing sensitive environmental areas where viable alternatives are available

"Development options in biologically productive areas, such as wetlands and islands, should be subject to detailed environmental impact assessment."

This strategy sounds too much like a meaningless compromise to me. CALM manages the majority of W.A.'s islands and many of its wetlands, as well as other biologically productive areas. We should argue against degradation of these environments under any circumstance.

"Review regularly the state of the environment in W.A. and progress toward the objectives of the Strategy

"Agencies responsible for managing sections of the Western Australian environment should report regularly on the condition of each facet. These reports should be integrated by a lead agency and the findings reported to the community."

Clearly, this strategy relates to CALM and associated research agencies. We need to work out

an efficient way of reporting the state of that part of the environment entrusted to our care.

THE FUTURE

The group of people at this workshop represents a cross-section of the scientists and managers associated with the natural biological resources of Western Australia. I believe that the challenge for us is to ensure that we and our colleagues develop and maintain a strong biological background and a commitment to nature conservation. Otherwise, the management of biological resources will be superficial, concerning itself too much with people-issues like hazard reduction for the protection of adjacent property, rather than dealing with important but complex issues like the management of ecosystems. Protection of adjacent lands is important, since conservation is unlikely to succeed if there is local opposition to it; the challenge is to convince local communities that they benefit from biological resource management and to develop joint arrangements that protect all interests.

Perhaps one way of measuring the state of the environment in relation to our capacity to manage biological resources is to work out what proportion of CALM's resources are actually spent on effective research and biological management and then see if the proportion increases with time.

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