Acquisition and Management of Conservation Reserves in Western Australia

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PREAMBLE

I have been involved with conservation for a long time, first with acquisition of reserves and later with their management. For this paper, I have chosen to give an overview of how and why my ideas developed.

INTRODUCTION

The raw material with which managers have to work — that is, the system of remnant vegetation — is largely an historical accident. This is because what is selected for reservation is merely a remnant of what was formerly more widespread. But, in addition to this happenstance, the success or otherwise of management will be affected by:

- the manager's assumptions about ecosystem processes;
- the initial state of the ecosystem, which is the result of past events;
- the operation of chance in the future.

HISTORY

Initially, selections were based on personal knowledge and what was available for reservation. Later, various committees selected areas for reservation following reviews of the knowledge available, or biological surveys of land in transition zones, or areas not yet represented in the conservation estate. This left the manager areas that had, in many cases, less than all the desirable characteristics. For example, areas were small, boundaries extensive and irregular, and so on.

CRITERIA FOR SELECTION

Early reserve selections were based on a desire to ensure that reservations were representative in some way, either of regions or of biotic assemblages, and management was expected to preserve these qualities. During this early period, habitat preservation was the vogue and minimal interference was the essence of good management. When ecosystems were considered at all, they were thought of as being static, and when disturbances did occur, it was assumed that over time succession would restore the biotic environment to its former state.

More recently, there has developed an international consensus that conservation effort should be devoted to retaining biodiversity, and this adds another dimension to management problems. Biodiversity is a diffuse concept which can be considered to include:

Genetic diversity: where conservation goals are to retain as much of the genetic variability as possible within any population that is being actively conserved. Genetic diversity can be lost by: inbreeding in very small populations; reductions of population size resulting from breeding failure; or catastrophic mortality resulting from disease, drought or fire.

Taxonomic diversity: this literally includes the five kingdoms of organisms but is usually taken as total species richness — for example, representation of species within groups such as eucalypts, banksias, forest birds, raptors, burrowing frogs, trapdoor spiders, or native bees. The range is endless and the management problems diverse.

Phylogenetic diversity: this includes the range of diversity within an evolutionary radiation — for example, within the marsupials, or a genus of lizards, or the trigger plants. Some of these organisms may be classified as rare or endangered, but also included are relicts such as cycads, echidnas, *Lepidogalaxias* (the mud minnow), peripatus, *Archaeochilus* (the granite rock chironomid) and the trapdoor spider *Moggridgia*. Such are to be considered particularly durable species.

Structural diversity: this category includes forest, woodland, shrubland, grassland and the structural stages in regeneration of vegetation following disturbances such as fires or storms. Restricted or relict habitats characteristic of former times fall into this category of diversity.

These basic kinds of biodiversity may be combined to describe more complex forms such as community, ecosystem or landscape diversity.

Such a wide-ranging focus suggests that management is concerned with nothing less than whole ecosystems considered as dynamic entities.

THEORY

Management based on empiricism cannot be expected to cope with the diverse requirements imposed by the foregoing concept. Some theoretical basis is needed. In this sense, theory merely means a schema or system which accounts for or explains a set of observations or phenomena. In terms of conservation management, we need to explain what is there, the sequence of events by which it has been derived, and the way the system is renewed or maintained. A comprehensive theory provides a framework within which the future may be predicted. Thus the consequences of both management practices and chance events can be foreseen or anticipated. Research should provide the knowledge and facts which form the basis of the theory, provide tests of current theory, or provide new knowledge which suggests that theory should be modified. Monitoring the consequences of management practices is a way of testing theory and gaining new knowledge.

But there are five classes of people involved with conservation: the public, administrators, those who write management plans, managers, and scientists. Not all of these consider the managed system as being dynamic; thus when their expectations are not met — for example, when the biota changes — there is a perception that preservation has not been achieved and management has failed. This is of importance in the event that the concept of accountability is extended to management of the conservation estate. Such a literal extension is inappropriate when ecosystems are dynamic, process driven, non-static entities. Furthermore, administrators sponsoring, for example, Cooperative Research Centres look to research to solve problems requiring complex and expensive technical expertise. On the other hand, perhaps in response to public perceptions, the Australian Nature Conservation Agency and World Wildlife Fund for Nature see the study of rare or endangered species as a priority. Not unexpectedly, administrators of management-oriented organisations see scientists as a skilled work force to be used in solving local problems as they arise. At all levels, little attention is given to adding knowledge that might be useful theoretically.

NATURAL SYSTEMS

There is a tendency to view natural systems as the analogue of agricultural, horticultural or forestry systems. In such systems, any reduction in productivity is disfavoured; consequently, diseases, pests, or any factor which reduces the productivity or the quality of the products is regarded as undesirable. However, in natural systems, diseases, pests and parasites reduce the vigour and may even lead to early death of their host. Such happenings make for less than optimal individual health, but conversely, when they affect the common or most vigorous species, they prevent the exclusion of less vigorous species from the community. Thus diseases, pests and parasites, along with predation and natural disasters, are the mechanisms by which dynamic ecosystems are maintained. They are intimately related to biodiversity but completely ignored in its study.

Characteristically, disturbance, of whatever origin, leads to the formation of gaps in the vegetation. It is in such places that the availability of space permits the germination of seeds and the initiation of population changes in the whole biota which sum to the successional stages that follow. But disturbance must not be thought of solely as being caused by physical environmental factors.

Gap creation, whether from branch fall or tree death, is also effective in initiating regeneration. Most often, such deaths are caused by disease induced by fungi or other pathogens. Such mortality is usually scattered through an ecosystem and is a potent source of minor habitat diversity by providing sites for other plants, animals, fungi, protists and bacteria. Managers should appreciate that this sort of habitat diversity can only be provided by natural events which vary in space and over time. They are the basis of patch creation and the dynamics of persistence. Population sizes and distributions are unlikely to be constant when such factors operate. Managers can only ensure that the likelihood of persistence is as high as possible.

The contrasts between static and deterministic versus dynamic and stochastic interpretations of systems maintenance are not merely a matter of academic disagreement. The general public and some biologists follow static, deterministic interpretations of nature — for example, as expressed in the phrases "balance of nature" or "stable population". To those with such beliefs, patch creation by mortality from disease or defoliation by insects is likely to be interpreted as failure of management rather than as a demonstration of the way that space, light and nutrients are made available to different species or another generation.

Recently, it has become a legislative requirement that the public be involved when management plans are being prepared. Legislation or regulation requires that the aims, goals and requirements are specific — for example, "preservation" may be a stated aim. This implies a static universe which can be preserved. Moreover, management plans require funds, and it follows that there is an expectation that those spending the money are accountable for achieving the legally specified goals. Yet, as indicated above, natural systems are hostage to chance events that are not readily accommodated in a legal system couched in terms of an ideal stable world. The potential difficulties should be anticipated by managers, who might sell their skills by emphasising that, even in a very fragmented, dynamic natural world, managers can retain the conservation values even if static preservation is not possible. Education to achieve a community awareness of what is biologically realistic is a prerequisite before sensible accountability can become a reality.

DISCUSSION

The foregoing sets out what might be included in the concept of biodiversity and so establishes an array of reasons for having reservations. It also sets out a theory of how the contained systems and communities may function and be maintained as dynamic entities. Naturally, I did not develop these ideas as a complete system at one time in a single paper. Initially, the size of reservations was a critical issue, and Main and Yadav (1971) justified arguments for larger reservations than had hitherto been considered adequate by land use planners. A general case for numerous reserves spanning a range of sizes and geographic locations was then developed (Main 1979). At this time, there was a public perception that reserves would preserve nature, especially rare and endangered species. An argument countering this was that rare species were thus because they were on the way to extinction, so it was a waste to reserve useful land for an unachievable purpose. These issues were addressed in Main (1982, 1984).

Allied to the foregoing was the question of reserve management, especially in terms of nutrients (Main 1981a, 1987), fire (Main 1981b), the effect of insect grazing on post-fire regeneration (Whelan and Main 1979), and the response to stress by vertebrates (Main 1986). Many of the problems associated with reserve management were reviewed, and possible solutions tabulated (Main 1987). As soon as it became clear that landscapes needed to be managed as whole entities and that management of nature conservation reserves should be integrated with other uses and landscape goals, it was appropriate to reiterate the basic similarities in the resources required by all living things (Main 1993a). The problems associated with the potential loss of biodiversity in reservations has been addressed by Main (1992a). Additionally, a possible approach to making management decisions when faced with uncertainty was presented (Main 1992b). The implications of climatic change for restoration ecology and management are dealt with in Main (1988, 1993b).

One would expect to see indications that the above interpretations were having an influence on reserve management, in management plans and field responses of managers, perhaps a decade after publication. In general, it is too soon to say whether the ideas developed are, or have been, of use to those involved in the practicalities of management, though I have had some verbal comments that the 1987 paper has been useful.

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