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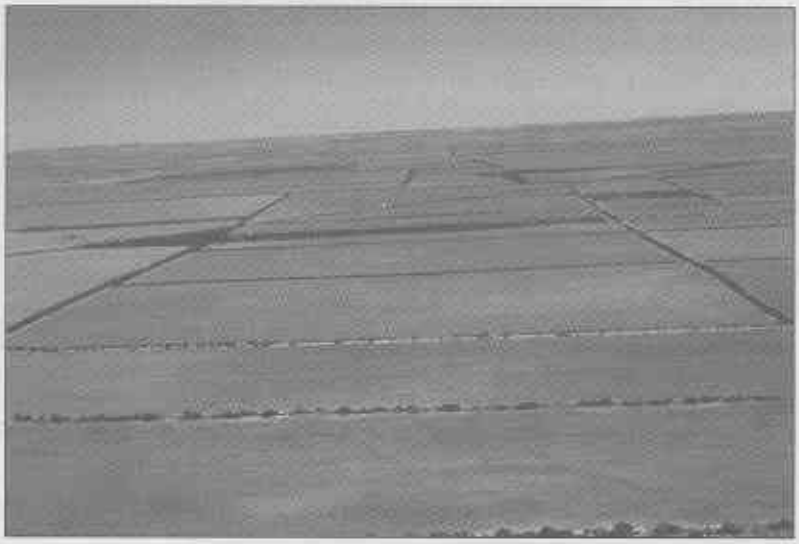
# THE ECOLOGICAL IMPERATIVES FOR CONSERVATION AND MANAGEMENT OF NATIVE VEGETATION

*Denis A Saunders*

WE are told that over most of the extensively cleared areas of Australia, clearing has ceased. Unfortunately this statement is not true; clearing is still going on, but it is clearing by ecological processes and these must be managed. It is not sufficient to put a fence around remnant vegetation and say we are protecting it. We will need to manage actively because the ecological imperatives are leading to the degradation of remnant patches with detrimental feedback to ecological processes.



*"When you fly ... you quickly realise that nature grows in straight lines ... "*

## Ecological consequences of clearing and fragmentation of native vegetation

The removal of native vegetation on a broad scale is a non-random process that leads to a collection of fragmented vegetation patches in a matrix of different vegetation and/or land uses. The result is a series of fragments or remnants located in different positions in the landscape, on different soil types, possessing different vegetation types and associated fauna, and varying in size, shape, isolation and type of ownership. What are the ecological consequences of this reduction and fragmentation of native vegetation?

As soon as a patch is created so is an edge. Over most of the country subject to large scale clearing, remnant vegetation is mainly edge and in many cases these are fairly linear. When you fly over these regions you quickly realise that nature grows in straight lines and that is the way we manage these landscapes. We are starting to think about fencing to soil type but the compartmentalisation of our landscapes is still a major problem for management. If we look at the trees, shrubs and grasses along an edge of a patch of remnant vegetation we can see how they are now exposed to a whole series of forces they were not exposed to before that land was cleared. This is simply illustrated by thinking about standing outside on a very cold, windy day. Much more protection is afforded by standing in the middle of a group of people as it is a damn sight colder on the edge than the middle.

Removal of native vegetation results in changes in radiation fluxes with increases in solar radiation leading to higher temperatures during the day. There are also increases in re-radiation at night resulting in lower night temperatures. Surface and soil temperatures increase in range and may be very much greater by day and lower at night than before clearing took place. There also may be an edge-effect in relation to solar radiation depending on the angle of the sun; the higher the latitude, the more it penetrates the edge of the remnant. The implications of these factors alone are significant. Changes in microclimate may result in changes in the species composition at the edges of remnants and may have major impacts on the soil biota with potential effects on ecological processes such as nutrient cycling. In addition, species present before clearing may not be able to be re-established because the changed microclimate may not

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provide a suitable environment for them. These effects will be exacerbated by grazing.

Clearing native vegetation also results in changes to the pattern of wind flow across the landscape, with less resistance and protection. Species that established themselves when the vegetative cover was continuous were relatively well-protected from the effects of wind. Increased exposure often results in increasing rates of wind throw and wind pruning of dominant plant species. This creates gaps in cover with increased chances for invasive species to establish. Increased exposure to wind can lead to increases in evapo-transpiration, reduced humidity and increasing dessication rates. Increased wind may also lead to increases in fall of litter with potential for changes in the litter fauna and changes in nutrient cycling. In addition, there may be increasing movement of dust and seed into patches from the outside, further increasing the chances of invasion by species from outside the remnant.

One of the interesting things about native vegetation is that it is resistant to weed invasion until two things happen: disturbance and enrichment. With the combination of forces now operating, patches are often subjected to both. There are some interesting examples of this. It is possible in some patches to see where farmers have thrown dead sheep, and in doing so, they have created a disturbance and as the carcass rots nutrient enrichment follows. There is usually a tremendous seed source in the wool and it is easy to see these foci of weed invasion with the invaders radiating from them. The same phenomenon can be seen in a patch with an active wedge-tail eagle's nest. The adults bring parts of sheep carcasses back to that nest, tear them apart, drop the wool, often containing seed, onto the ground and void their faeces over the edge of the nest. Scavengers, like foxes, scrape around and again there is disturbance, enrichment, and a seed source. These might sound like small ecological processes within small patches, however, over time they may become major degrading impacts.

Major changes in the hydrological cycle result from the removal or thinning of native vegetation. Problems with changes in the water table, including waterlogging and increased salinity, will be familiar to all West Australians, but clearing can also lead to more soil erosion, larger flood events, and redistribution of nutrients from farmland into remnants. Dryland salinity is now a major problem in many parts of Australia. In addition, saline waters flow into watercourses leading to destruction of freshwater ecosystems and loss of potable water. It is ironic that in the driest continent after Antarctica, some of our major environmental problems stem from too much water in the landscape.

Loss of native vegetation and its fragmentation have a number of biotic consequences that can be moderated by a number of factors. For example, time since isolation or creation of the remnant is a major modifying factor. The Theory of Island Biogeography states that at the time of isolation the island (in this case remnant patch) is carrying more species than it is capable of carrying over time and so species will be lost. This is the process of 'species relaxation'. Comparing the species component of Tasmania with mainland Australia illustrates the truth of this theory. Tasmania is poorer in species. This is a function of area. The longer a remnant has been isolated the more species it will lose. The extensively cleared areas throughout Australia have already lost much of the native vegetation dependent fauna. That has been a fairly rapid response but the flora is following the same path, although the loss of plant species will to take much longer. The dominant tree species may take hundreds of years before they disappear from regions, but unless we bear this in mind and work to counteract those losses we are going to see that ecological clearing continue. The point to note is that remnants will lose species over time and this will pose major management problems.

The number of species lost will also be modified by the distribution of native vegetation and the dispersal mechanisms of the plants and animals of the remnant. The shorter the distance between remnants and the greater the number of species with the ability to cross that distance, the greater will be the chances of the species remaining. Some species, which require other species to help them move around the landscape, are doomed if their transport is lost from the area, eg some species of the genus *Santalum* when the emu is lost from an area.

*Quandong seeds in an emu plop (photo: F. Falconer)*

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The debate about the value of landscape linkages (bush corridors) in nature conservation has been one of the most heated in academic conservation circles. Corridors may aid movement of species dependent on native vegetation; provide extra habitat; provide samples of former vegetation associations; and increase landscape aesthetic appeal. Linear strips of vegetation also have some disadvantages in their potential to aid the spread of pathogens, disease and pests and the high costs of maintenance due to the long length of edge compared to the area of the vegetation.

Remnants now occur in a matrix of human-dominated landuses. Every one is likely to be affected by what is happening in the surrounding land. Nutrients and seeds being deposited in the remnant have been mentioned earlier. Species that depend on the surrounding land can also have an effect. Domestic stock are obvious examples but there are other more subtle ones; like the galah that has expanded its range because of human activities and competes with remnant-dependent species for nest hollows, damages and kills trees, and introduces the seed of invasive species via its droppings.

There are a number of characteristics of remnants that help to modify some of the degrading processes. Remnant size is an obvious one. The larger the remnant the longer it will be able to resist some of the degrading processes. Unfortunately we have no general information on how large remnants should be; that will be determined on a case by case basis, depending on position on the landscape, etc. However, the non-random nature of clearing of native vegetation will almost always ensure that the larger privately owned remnants are usually on the poorer soils and are not representative of the original vegetation associations.

The shape of the remnant will also help modify the effects of degrading processes, as will the position of the remnant in the landscape. Larger remnants have less edge compared with their area than smaller remnants and are therefore subject to fewer edge effects. Those remnants lower in the landscape can be exposed to more of the impacts from the surrounding matrix.

'Paddock trees ... the quintessential Australian landscape'

The first rule of management of fragmented landscapes is that all the native systems left should be preserved, because they are going to be the skeletons on which we rebuild these landscapes.

## What of the ultimate remnants?

These are the stately old paddock trees isolated from other elements of native flora by 'parkland clearing'. These contribute to what many regard as the quintessential Australian landscapes painted so evocatively by Hans Heyen. These sort of rural landscapes epitomise the way many urban Australians think about Australia. In 50 years time, most of these landscapes will have changed dramatically. How many single paddock trees are being considered in revegetation programs? There are billions of these trees - many of which are dying rapidly. I believe our rural landscapes are going to be looking considerably poorer and people are losing something of great cultural importance.

In addition, these single paddock trees have important ecological functions. They are very important to bats and many other animal groups for food, shelter and movement. We need to bear the capacity of the biota to move around the landscape in mind. I have had farmers say to me, "I'm interested in all you say, but why should we worry about a single species?" The answer is that we really don't know the functional significance of most of our biota. However, let us express the significance in terms of what we need to survive in this landscape. If we need our native vegetation surviving, most of it is pollinated by animals. We have lost many of the invertebrates which served this purpose and we are now losing many of the honeyeaters which are important in pollination. If we lose the honeyeater community, plants may have lost the ability to move round the landscape. Once that happens, we are going to have to take over that function for them or we will have patches which consist of the 'living dead'.

## What follows from the ecological imperatives?

The era of broadscale clearing has finished; if only because most of the land suitable for agricultural,



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horticultural, etc (but not for urban development) purposes has been cleared. However there is still the danger of whittling away at the remainder; the supposed 'death of a thousand cuts'. There is no doubt that both education and legislation are required to halt this process. Legislation needs to put all applications for clearing into a perspective that shows transparently that the planned clearing will not result in the loss of a remnant of high conservation value or of high ecological value, or lead to further degradation of ecosystem processes. That means identifying and weighing its value as part of the ecological function of the area; in its water use, moderation of erosion, etc. Individual trees also require this type of protection.

*With no regeneration, this patch of woodland could be termed the "living dead".*

At present we hear talk of 'net gain' of vegetation. Unfortunately, unless there is considerably more action and very much greater expertise in landscape design, anybody talking about a net gain of vegetation is deluding themself. In Australia at the moment - and despite all the rhetoric in terms of revegetation - we face a massive net loss. We hear of off-set programs where one patch could be cleared subject to creation of an equivalent patch. Creation involves all strata, from dominant trees through understorey, including grasses. It also involves establishing fungal-plant associations and other ecologically functional elements. We do not yet have the ability to restore to the same functional level of that which we destroy.

The critical need of native vegetation is management. Most remnants are degrading. Management of internal dynamics of remnants is necessary in order to halt the process. With larger remnants it may be necessary to manipulate disturbance regimes like fire as well as the population dynamics of key organisms. In addition it will be necessary to examine external influences and see if they can be moderated. On smaller remnants it will be necessary to concentrate on the external influences. This means integrated landscape management on an ecological basis with knowledge of what each remnant contributes to the ecological whole.

We need to value remnant vegetation better in an economic context. At present, remnant vegetation on agricultural land is valued on the basis of the economic value of the land on which it occurs, if put into agricultural production, or on the contribution it adds aesthetically to the resale price of the property. This valuation system is fundamentally flawed because it takes no account of the contribution the remnant vegetation makes by providing a range of ecosystem services from local to regional scales.

In conclusion I would like to say that Australians are currently standing at an ecological cross-road. There is no way we can go back to the landscapes of pre-1750. Where do we want to go? We can continue down our present path; this will see an estimated 15 million hectares of agricultural land affected by salinity, many rivers further degraded and further loss of native plants and animals. Or do we wish to deal with the environmental problems in order to limit further loss of biodiversity and other environmental degradation? This means setting priorities for action and reaching thresholds of intervention to effect change. These are the decisions we, as a society, need to make.

I will finish with a conundrum that interests me greatly. Anybody who has been to a financial planner or who reads the business section of their newspaper will know that a prime rule in ensuring a viable financial future is not to put all our financial eggs in one basket. Why are we doing the opposite with biodiversity, our greatest resource?

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