2 Conservation Issues for Metropolitan Adelaide

2.1 Habitat Loss/Fragmentation

In areas that have had much of the native vegetation cleared, the changes in distribution and abundance of particular plants or animals are not just a result of loss of habitat. Rather they are a result of habitat reduction, species invasion, fragmentation and changes in external processes affecting the dynamics of fragments (Hobbs *et al.* 1992, in Haila *et al.* 1993).

Vegetation decline in the Adelaide region was most rapid when many areas were cleared for agriculture and settlement. The rate of vegetation loss today is not as rapid as it was years ago. However, even now with only 12% of our native vegetation left and some of the strongest legislation in Australia prohibiting clearance of native vegetation, native habitats are still being lost. Areas of remnant vegetation are being whittled away at the edges: road widening exercises, clearing along fencelines, clearing for the erection of houses, collection of firewood and grazing by stock are just some of the ‘legitimate’ activities that result in the steady decline in the total area of remnant vegetation.

Extinction

Scientists agree that there are two types of extinction- driven and chance (Possingham 1996b). Driven extinctions occur when there are changes in processes that enable the persistence of a species. The death rate exceeds the birth rate throughout the range of the species (Possingham 1996b).

Chance extinctions occur when despite a positive population growth rate, a series of catastrophic events cause a species to become extinct. Typically, chance extinctions occur when the available habitat for a particular species has been severely reduced and fragmented (Possingham 1996b). For example, the habitat of a particular species may be fragmented into small remnant parcels, and a catastrophe such as a wildfire might destroy the whole population of one parcel. Conceivably, sequential catastrophes might destroy all existing populations.

Until only recently most extinctions in Australia have been ***driven extinctions***. That is, due to a combination of factors such as habitat loss, predation from introduced animals, disease, or many other threatening processes, the death rate has exceeded the birth rate. Chance extinctions are only just beginning to occur and will continue to occur for many centuries. Despite relatively strong vegetation clearance legislation that has drastically reduced the rate of clearance, we can still expect species to become extinct. Our past actions from habitat clearance have not yet been “paid-off,” this debt has been called the “extinction debt” (Possingham 1996b).

What this means for biodiversity conservation is that each native vegetation remnant cannot be managed in isolation from one another. Long-term strategies are required that manage remaining habitat in a regional context, underscoring the need for Regional Biodiversity Plans.

There is no clear opinion on what size remnant areas need to be in order to be capable of having self sustaining populations of plants and animals. What is clear however, is that some particular types of fauna require large tracts of native vegetation for foraging and breeding. Larger remnants have less chance of experiencing extinction of species than smaller remnants.

Island Biogeography

Island biogeography theory as developed by MacArthur & Wilson (1967) explains why small remnants are at risk of losing species over time.

While the island biogeographic concept was developed to explain why smaller and more isolated offshore islands have fewer species than larger and closer islands, it has been applied to remnant vegetation in urban and rural settings also. Remnant vegetation in cities and on farms can be seen as islands of remnants in a sea of suburbia and/or agriculture. Island biogeography helps to explain why small, isolated remnants are more likely to lose species to extinction than larger less-isolated remnant patches.

The work by MacArthur & Wilson (1967) explains that the number of species on islands increases with the increasing size of the island. Since larger islands contain more habitats and probably more variety of habitat, they are likely to contain more rare species. If a species becomes too rare, it is more likely to become extinct because there are no habitats from which to replenish numbers. The smaller the island, the more severe the effect.

MacArthur & Wilson (1967) also suggest that isolated islands have fewer species than islands of equal area that are not as isolated. This is because species have further to travel to colonise isolated islands.

The concept and application to terrestrial habitats of island biogeographic theory is limited by the fact that it considers the regions between the islands as being uniform. Therefore, the ability of particular species to move between islands is the same, regardless of the matrix between the islands. Urban areas are a particularly good example of this limitation. The “oceans” between the “islands” can be very different, ranging from parking lots and new residential areas at one extreme to open space areas such as parks with trees at the other.

Despite the above limitations, island biogeographic theory serves a useful purpose to underscore the fact that smaller, isolated patches of remnant vegetation generally have fewer species than larger, un-isolated patches.

Metapopulation Dynamics

A metapopulation is essentially a regional population that is comprised of several local populations- “a population of populations” (Hunter 1996). At the regional level, these sub-populations are separate from each other although movement of species between each population may still occur. Despite the balancing effect of immigration and emigration, sub-populations appear and disappear not unlike the winking on and off of small lights (Hunter 1996). Each appearance represents a colonisation event, such as the wind blowing in the seed of a particular species. Each disappearance represents a local extinction such as a sub-population being killed by wildfire (Hunter 1996).

Sub-populations that persist for relatively long periods are called “core populations.” Sub-populations that are more likely to wink on and off are called “satellite populations.” However, the difference between core and satellite populations is blurry. Indeed, one year a sub-population may be a core population and the next year it may be a satellite population (Hunter 1996).

In its application to conservation, the important concept to be gleaned from metapopulation dynamics is that while a particular patch of remnant vegetation may not contain a particular threatened species, it may contain it in the future.

Impacts on Biodiversity from Habitat Fragmentation

Two important issues are involved in habitat fragmentation. The first is reduction of habitat; the second is that remaining habitat is not one large patch but rather many often very small patches (Saunders 1993). It is important for managers to separate the effects of these two issues. The effects of habitat loss are fairly obvious, individual plants and animals are lost and the number of species able to inhabit an area declines. The effects of habitat fragmentation are not as obvious. Some of these effects of habitat fragmentation are discussed below.

Invasion by non-native species

Disturbed habitats are most susceptible to invasion because they are the areas that are likely to have under utilised resources (Fox & Adamson 1986).

Invasion of native vegetation by non-local species is a four-step process (Hobbs & Mooney 1993). First, propagules of a potential invader have to be available for dispersal. Invading species are introduced for a variety of reasons, primarily through human activities such as horticulture and agriculture. Second, if the propagules are available in an area they need to be dispersed into native vegetation. This may happen by wind or water dispersal or via human or animal activity.

Once a weed propagule has dispersed into a native vegetation site, the third required step for successful invasion is that it must germinate and establish successfully. Each species has different requirements for germination and establishment. Water and nutrient availability are important factors, as are presence of other species and the soil substrate on which the propagule is located. The fourth and final stage for successful invasion is for the established individual to grow to maturity and reproduce. Successful invaders often have particular biological attributes such as high fecundity, generalist habitat requirements and rapid growth rates (Fox & Adamson 1986). For example boneseed (*Chrysanthemoides monilifera* ssp. *monilifera*) is able to produce 50,000 seeds per plant, is dispersed through a variety of means including wind, water, vehicle movements, animals such as foxes and birds, produces seed two years following germination and is able to inhabit a variety of environments and ecological communities (Thomas 2000).

Disruption of ecosystem processes

Ecosystems are dependent on particular process for their long-term survival. Ecosystem processes might include fire regimes, pollination, seed dispersal, decomposition, water cycling and nutrient cycling. Fragmentation of habitats result in widespread changes to ecosystem processes.

Edge effects
One consequence of habitat fragmentation is an increase in the perimeter to area ratio. That is, as fragmentation makes patches of habitat smaller and smaller, the ratio of edge to interior increases disproportionately (Hunter 1996). This is important for two reasons. First, the physical environment near an edge is different to the interior environment. It is usually windier, drier, warmer in summer and cooler in the winter. The result is that some native species (especially plants) will not use this zone. Second, exotic species associated with disturbed habitat may penetrate the edge zone (eg weeds, cats, foxes, people).

2.2 Conservation Dilemmas

Removal of Weed Species

Within the context of biodiversity conservation, it is intended that the implementation of specific management actions will have specific desired outcomes. However, it is likely that any on-ground activities will have ***several*** outcomes, some of which are unforeseen and undesirable.

For example, blackberries (*Rubus fruticosis* L. agg.) are a weed of national significance, and one of the five most invasive weeds in the Adelaide region. They pose a significant threat to biodiversity through the smothering of native vegetation and inhibiting regeneration (section **Error! Reference source not found.**, p.**Error! Bookmark not defined.**).

The control of blackberries is imperative for the long-term survival of Adelaide's biodiversity. However, blackberries provide habitat for fauna such as the vulnerable (state) **Southern Brown Bandicoot** (*Isoodon obesulus*) and smaller birds of dense understorey such as wrens. While a threat to biodiversity, blackberries provide habitat for other native animals, and must be removed slowly and accompanied by adequate regeneration or revegetation.

A further example serves to illustrate the importance of looking at all outcomes for specific on ground actions.

Yellow-tailed Black-Cockatoos (*Calyptorhynchus funereus*) are a vulnerable species at the state level. Their natural habitat includes the more moist areas of the Mount Lofty Ranges. The native foods for these birds include the seeds of *Banksia* spp. and *Allocasuarina* spp. The distribution and abundance of the native food resources of this bird have declined considerably. However, this large bird has found an alternative food in the seeds of introduced pines (*Pinus* spp.). Indeed through their feeding behaviour, Yellow-tailed Black-Cockatoos have been implicated in the spread of pines.

Like blackberries, pines are a threat to biodiversity as they invade native bushland. Their removal is imperative for long-term biodiversity conservation. Consequently, the widespread removal of large pines in areas where Yellow-tailed Black-Cockatoos are known to live and feed is likely to have a negative impact on the population of this bird.

Increaser Species

While many plants and animals have declined markedly following European settlement, some native plants and animals have increased in distribution and abundance in this time. The significant amount of habitat alteration following European settlement has favoured some species over others.

For example, the **Noisy Miner** (*Manorina melanocephala*) has benefited from clearing of dense vegetation and from fragmentation of remnant vegetation (Stothers *et al.* 1999).

Common Brushtail Possums (*Trichosurus vulpecula*) have suffered from vegetation clearance as their food (fruit, leaves etc.) and shelter (hollows) have been destroyed. However, these animals have benefited from the construction of dwellings and the planting of fruit trees (nesting and food requirements). The result is that in built-up areas possums numbers have probably increased following European settlement, but in agricultural regions where vegetation has undergone broadscale clearance, numbers are comparatively very low.

However, some native animals are more easily 'noticed' by humans than other native animals. In particular animals that have a negative impact on humans are subject to scrutiny. For example, **Musk Lorikeets** (*Glossopsitta concinna*) are an attractive, medium sized bird that often includes the fruit from fruit trees in their diet. This sometimes results in significant losses to commercial fruit growers. The **Rainbow Lorikeet** (*Trichoglossus haematodus*) and **Adelaide Rosella** (*Platycercus elegans*) are also common visitors to local fruit orchards. The Common Brushtail Possums (*Trichosurus vulpecula*) and their nocturnal habits in suburban dwellings are also easily noticed by humans. The native animals mentioned here are often considered 'pests' to humans, as through their habits they negatively affect us and consequently are more likely to be noticed.

However, there are also native animals that can become locally abundant to the detriment of other native animals.

As discussed above, Noisy Miners (*Manorina melanocephala*) appear to be more common following European settlement. The success of this bird has been attributed to the fragmentation of vegetation and the clearing of dense understorey (Stothers *et al.* 1999). Their aggressive behaviour towards other nectarivorous/insectivorous birds excludes these more passive birds (Stothers *et al.* 1999). Indeed, studies have shown that in areas free of Noisy Miners, the abundance and diversity of other native bird species increases markedly (Stothers *et al.* 1999).

Furthermore, a Victorian study has shown that in native vegetation areas where Noisy Miners are common, eucalypts show signs of severe dieback caused by insect attack. This is due to the absence of small insectivorous birds in areas where Noisy Miners are common, allowing defoliating insects to increase unchecked (Stothers *et al.* 1999).

Clearly, the underlying cause of the problem is significant habitat alteration; the increase in abundance of this bird is simply an expression of this underlying cause.

Non-endemic Natives

A distinction needs to be made between plants and animals that are indigenous to the Adelaide region and those that have been translocated here or have colonised the region since European settlement. For example, Noisy Miners are indigenous to the Adelaide region (that is they were here at the time of European settlement) and have proliferated in number since then. However, the **Crested Pigeon** (*Ocyphaps lophotes*) was not present in the Adelaide region at the time of European settlement but has since colonised the Adelaide area.

Self-sustaining populations of the **Freshwater Catfish** (*Melanotaenia fluviatilis*) and **Koalas** (*Phascolarctos cinereus*) occur in the Adelaide region through translocation by humans from elsewhere in Australia.