SWIFFT meeting notes 29 January 2009

BIRD: linking the biodiversity community

Categories:

- SWIFFT
- SWIFFT meeting notes

SWIFFT meeting notes are a summary of the video conference and not intended to be a definitive record of presentations made and issues discussed.

The first video conference for 2009 was held on 29 January, with 33 participants connected across south-western Victoria and Melbourne. The theme was *Ecosystem Conservation* . Unfortunately due to high fire danger a considerable number of people were unable to attend and 2 locations were closed. Those attending included participants from; Deakin University – (Burwood Campus), Museum Victoria, Gordon Institute, Local Government (City of Greater Geelong, Warrnambool City), Western Coastal Board, Field Naturalist Clubs (Ballarat, Hamilton), Parks Victoria (Grampians & West Region), PIRSA (South Australia), Greening Australia, , DSE/DPI locations across south-west Victoria and Nicholson Street Melbourne. See Participants & Apologies SWIFFT 29 January 2008

Contents

Ecological and Evolutionary Processes in Large-scale Conservation Planning

Dr Janette A Norman, Senior Curator, Molecular Biology, Museum Victoria

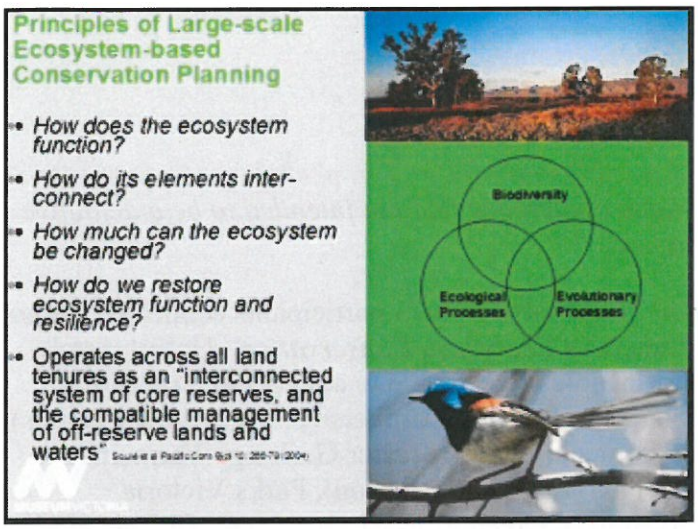
Large scale ecological and evolutionary processes in biodiversity conservation

Janette discussed how traditional approaches to biodiversity conservation are somewhat inadequate in maintaining healthy ecosystems particularly when global processes such as climate change are taken into account, for example;

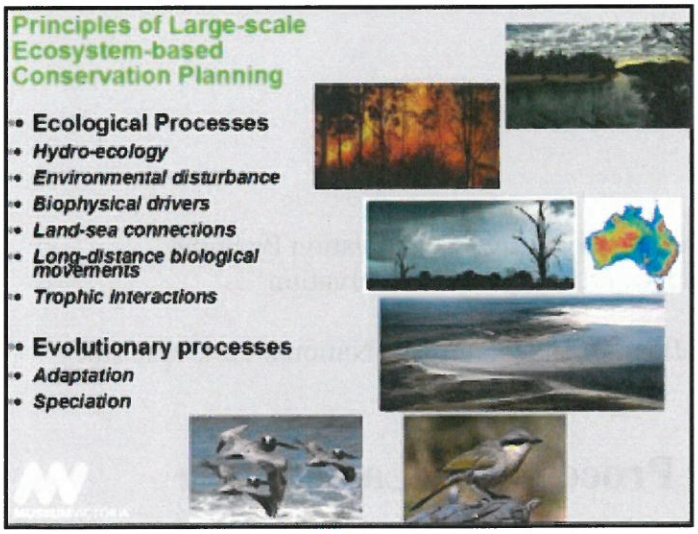
- *National Reserve System*: fragmented and disconnected habitats are insufficient for the maintenance of biodiversity and ensuring ecosystem health.
- *Rare and threatened species*: single-species conservation focussing on habitat specialists of small population size with high risk of extinction; does not account for the major component of biodiversity.

- *Biodiversity hotspots*: areas of high species richness and endemism associated with ecological specialisation; often (incorrectly) assumed to be a source of global biodiversity.

Principles of large scale ecosystem-based conservation planning



Principles of large scale ecosystem-based conservation planning



Janette discussed changing from a system of Natural Values (assets), to a system that looks at processes which maintain healthy ecosystems through large scale ecosystem-based conservation planning. She mentioned the need to manage biodiversity, ecological processes and evolutionary processes together, across all land tenures with interconnections between core reserves and have compatible management with non reserved land and waters. The connection between land and water also needs to be managed as one rather than separate units.

Janette outlined the principles of ecosystem-based planning which she said could be applied at a continental scale or local scale.

Ecological Processes

Hydro-ecology

- links between water, vegetation and animals

- catchment processes – rainfall, infiltration, evaporation and how vegetation cover impacts on these processes
- role of natural and artificial water sources at local, regional, continental scales
- impacts from interruptions to hydro-ecological processes at all scales and not only looking at the impact of an action on immediate environment but also on the broader environment and habitats of plants and animals

Environmental disturbance

- natural and anthropogenic disturbance – fire, dune movement, land clearing, weed invasion
- affect landscape structure and permeability – animal dispersal
- complex interactions between disturbance regimes which mean they cannot be looked at in isolation

Biophysical drivers

- climate and climate change impacts - seasonal, cyclical, episodic
- landforms and geological processes (erosion, earthquakes, volcanoes)
- changes in community structure (seasonal) and ecological processes in response to altered regimes
- there is a need to maintain habitat connectivity to enable species dispersal as an ecological response to climate change

Land-sea connections

- catchments and transport of water, nutrients and sediments from inland to coast
- disruption to natural flows impact on estuarine, coastal and reef communities as well as terrestrial communities and migratory species
- impacts of pollutants, sediments, nutrient loads, barriers (dams, bridges, jetties) and activities (aquaculture, boating) on upstream and downstream ecological processes

Long-distance biological movements

- accommodate migratory (seasonal) and nomadic (episodic) species
- species with life-stages in different habitats (aquatic – terrestrial)
- habitat loss, fragmentation and degradation are detrimental
- small habitat patches as 'stepping-stones' may be critical (water, food)
- protection of ecological refugia and dispersal corridors (riparian zone)

Trophic interactions

- top-down (predator) and bottom-up (seagrass beds) trophic interactions
- species that interact strongly with other species and whose removal is likely to have a dramatic effect on ecosystem structure or function
- predators (regulate prey density); pollinators (plant reproduction); frugivores, granivores (seed dispersal)
- indicator species of ecosystem health

Evolutionary Processes

Janette introduced the concept of integrating evolutionary processes into biodiversity conservation. Evolutionary processes are dynamic and can lead to changes in species diversity, distribution and community structure, which she stressed, is a normal process. Evolution enables changes in ecosystems from environmental pressures. Evolutionary changes can occur over short time frames but may take hundreds or thousands of years.

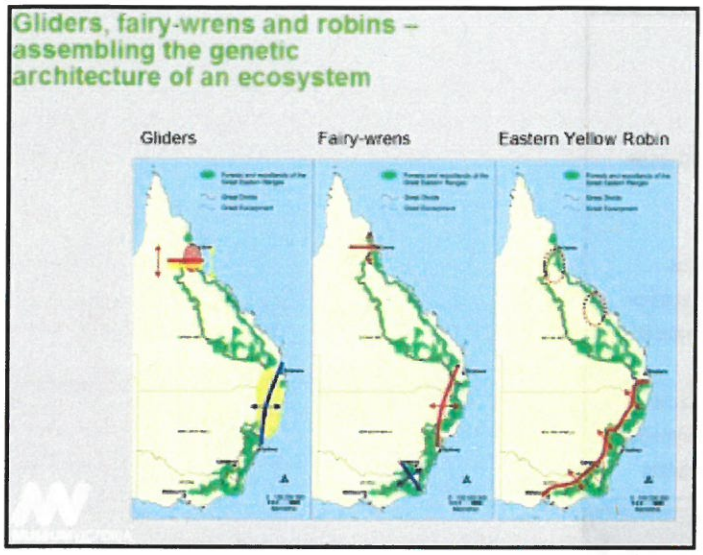
Janette spoke about the way species can evolve in response to changes to their environment through **Adaptation** (changes in traits, physiological adaptations), **Speciation** (species diversification-new species) and **Extinction** (creates new opportunities for niche evolution).

Great Eastern Ranges Initiative

Janette is currently working on the Great Eastern Ranges (GER) initiative, integrating evolutionary processes into large-scale conservation planning using birds and mammals of the GER as a Model to develop methods and understand how evolutionary processes operate across large scale ecosystems. This is an initiative of the Department of Environment, Conservation& Climate Change in New South Wales. The model incorporates continental scale conservation strategies which span State boundaries from Victoria, across New South Wales to Queensland.

Janette explained the linkage between and genetic variation and evolutionary potential. By studying genetic variation we can begin to look at evolutionary processes. Janette is examining what ecological processes and landscape features are important for the evolution of biodiversity in the GER. She is looking at;

- Features that promote local adaptation and divergence of populations or species (geographic barriers, temperature & rainfall, vegetation ecotones, breaks in genetic variation).
- Investigating genetic structure in multiple co-distributed species for birds and mammals (where genetic brakes occur, what landscape features or ecological processes involved).
- How species of the GER responded to past climate change and possibilities to predict future evolutionary responses.
- Signatures of a species' response to historical events that is evident in their genetic structure
- Paleoclimate reconstructions and molecular dating
- Bioclimatic modeling of locally adapted populations



Janette is looking at how indicator species (surrogates) may be used to monitor evolutionary processes in the GER. To-date she has looked at genetic variations in populations of Gliders, Fairy Wrens and Robins. This has meant genetic studies are able to contribute to the understanding of evolutionary processes in the GER.

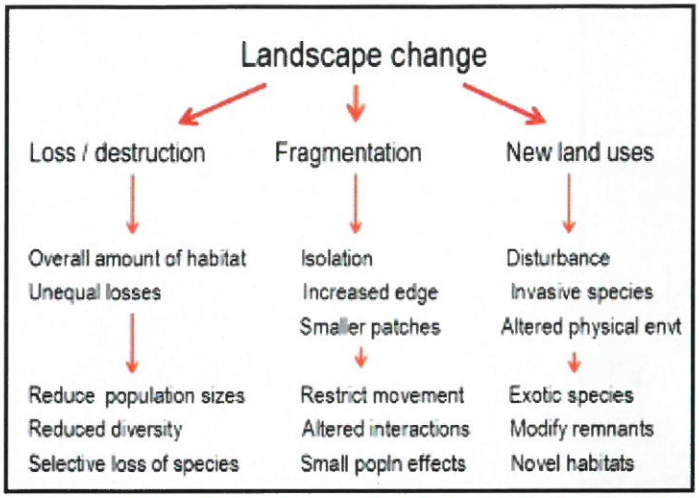
A question was asked why the study did not include the Great Divide west of Melbourne, as far as the Pyrenees or the Grampians. Janette said the decision was an arbitrary one which reflected the name Alps to Atherton, but the study does recognize extensions to the areas involved.

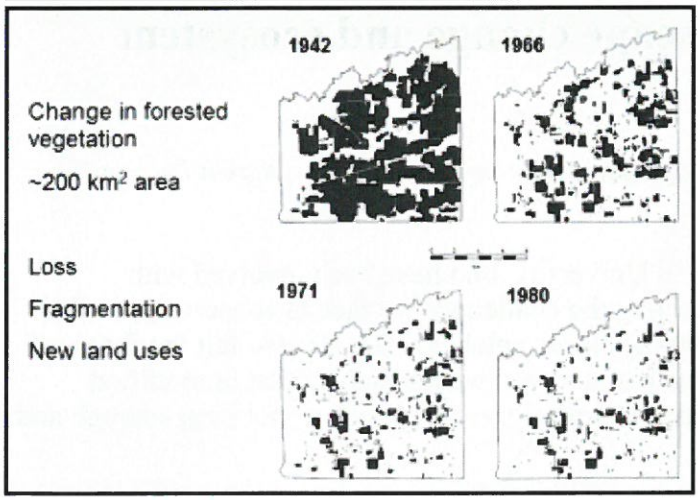
For more information contact: Dr Janette Norman, Museum Victoria

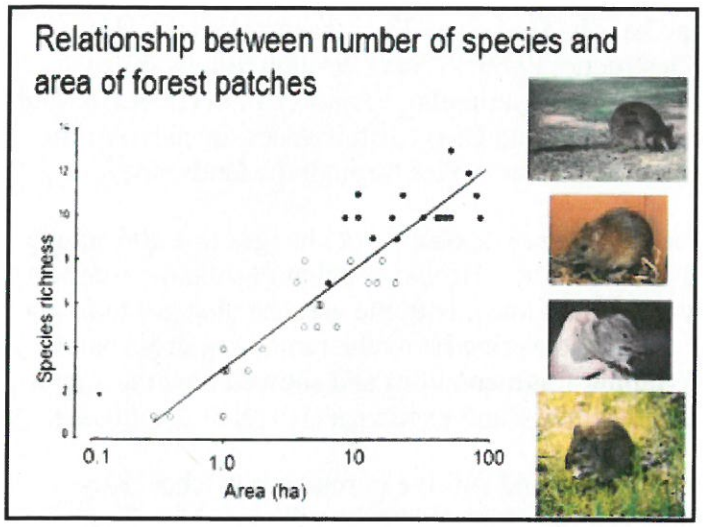
Habitat fragmentation, landscape change and ecosystem conservation

Professor, Andrew F. Bennett, School of Life and Environmental Sciences – Deakin University, Burwood Campus

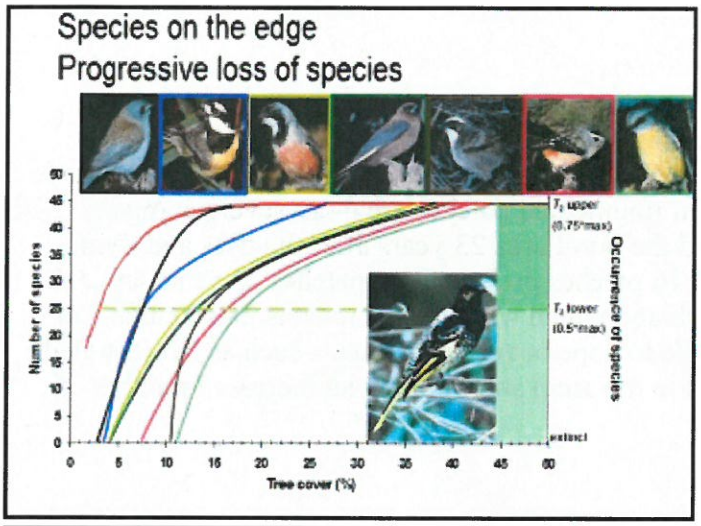
Andrew acknowledged his colleagues at Deakin University who have been involved with conducting case studies. He started by emphasising the challenges we face in conservation of the environment in landscapes greatly modified by people as a global issue. He also felt the future of many species of plants and animals will depend on how well we manage habitat in modified environments, particularly as many of the conservation reserves are too few, not large enough and often isolated.

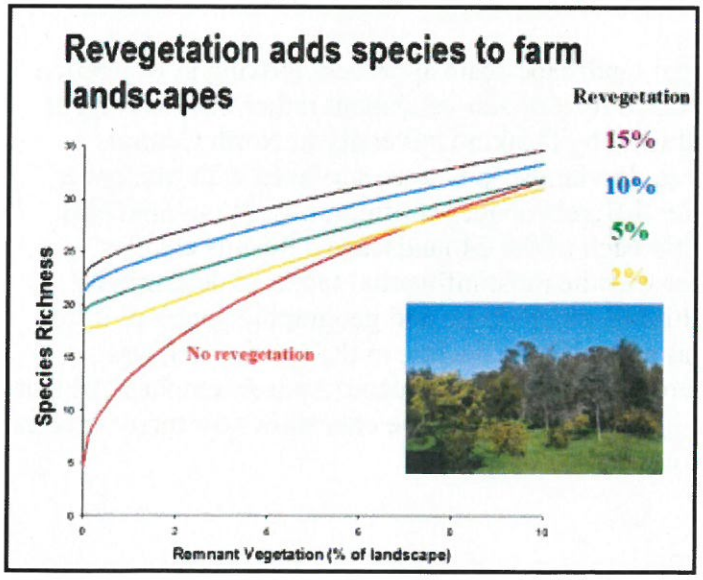

Landscape change
Loss / destruction
Fragmentation
New land uses
Overall amount of habitat
Unequal losses
Isolation
Increased edge
Smaller patches
Disturbance
Invasive species
Altered physical envt
Reduce population sizes
Reduced diversity
Selective loss of species
Restrict movement
Altered interactions
Small popln effects
Exotic species
Modify remnants
Novel habitats


Change in forested vegetation
~200 km² area
1942
1966
Loss
Fragmentation
New land uses
1971
1980



Note: Logarithmic scale on area of forest axis. Below 10 ha there is a marked decline in species richness





The benefits of adding revegetation to existing remnant vegetation for bird species diversity

Landscape change

Andrew spoke about how rapidly our landscape has changed since European settlement. He discussed landscape change in terms of Loss/Destruction (which flows through to how much habitat is remaining and the capacity to support plants and animals), Fragmentation (flows through to isolation and viability of habitat) and increased New Land Uses (disturbances, invasive/exotic species, changes to physical environment e.g. the way water moves through the landscape).

As an example of how landscape change can occur, Andrew spoke about changes to a 200 square kilometre area in the Nullawarre area of south-west Victoria. He showed that bushland cover has gone from about 50% cover to about 10% cover (Habitat loss), with the greatest changes to forest vegetation occurring post Second World War. He also described how the remaining areas have become broken up into smaller isolated units (Habitat fragmentation) and showed how the area is now mainly dairy farms with introduced grasses, fertilizers and exotic species (New Land Use).

Andrew previously studied how well native mammals could survive in remnant patches. Key outcomes from this and other studies is that there is a relationship between the number of native mammal species occurring in fragments and the size of fragment, i.e. larger patches can support more species diversity. Also some species such as the Long-nosed Potoroo require patches larger than 10 Ha, whereas a species such as the Bush Rat can cope in much smaller areas.

Species loss due to fragmentation

Andrew spoke about the reasons why populations of species in fragmented areas are more vulnerable to impacts than those in larger areas. He used the Ash Wednesday fires as an example and described how the consequences of fire on fragmented patches are more severe compared with a larger more continuous area. He re-surveyed the burnt area 23 years after the fires and found Long-nosed Potoroos went from occurring in 16 patches pre fire to 10 patches 23 years latter. It was lost from one of the larger patches of bushland which was also the most isolated patch and unable to be recolonised. Some species are able to cope better in fragments such as Brush-tailed Possum and the Koala (which was introduced to the area) and found in an increased number of patches.

Landscape approach & woodland birds

Andrew moved onto talking about a much larger landscape scale approach, looking at vegetation cover and arrangement of vegetation across a catchment or sub-catchment rather than looking at individual patches. He referred to studies conducted by Deakin University in North Central Victoria where a selection of twenty-four 100 sq. km landscapes were surveyed with tree cover ranging from 2% to 60% of the landscape under different spatial configuration. Woodland bird survey studies were carried out at 10 sites within each of the 24 landscapes. Results clearly pointed to the fact that the amount of tree cover was the most influential factor in determining species richness, to a much less extent were altitude, patch shape and geographic location. It was also found that below 10% tree cover there was a significant decline in the species richness. Below 10% tree cover a number of species were lost from the landscape. Andrew emphasised that less than 10% tree cover is where the greatest impact is found but the data shows for many species the decline actually begins to occur when tree cover is 25-30%.

Revegetation/landscape restoration

Andrew spoke about the value of revegetation or landscape restoration and referred to a Deakin University study in the Glenelg Hopkins CMA area in an area south of the Grampians which looked at the outcomes from revegetation in terms of bird populations. Forty-two landscapes each of 8 Hectares was studied which comprised a selection of; no revegetation, old revegetation,

remnant vegetation, remnant & revegetation and young revegetation. Over 2000 bird surveys were conducted. The results clearly show that revegetation has a positive outcome for bird species diversity as the percentage of wooded cover increases in a landscape.

Adding revegetation to remnant vegetation

Andrew highlighted that the greatest benefits were in landscapes that had some remnant vegetation combined with revegetation. Even landscapes with low percentages of remnant vegetation i.e. 2% remnant cover, had the greatest increase in bird species diversity when revegetation was added. While this is significant, Andrew felt that revegetation in landscapes with 10% remnant would give the greatest benefit because of the stabilising influence to habitats concerned. Scattered trees also play a role for some bird species and are an important component of the landscape. Andrew also pointed out that there is a substantial time lag for the full benefits of revegetation to become apparent as trees contribute to habitat diversification though canopy structure, trunk bark, hollows, logs etc.

Priorities for enhancing conservation in heavily modified landscapes

- Protect and expand the amount of habitat (incremental loss impacts at the landscape level)
- Enhance the quality of habitats
- Manage across entire landscapes
- Increase landscape connectivity
- Plan for the long term (and plan for change)
- Learn from conservation actions

Points of clarification from questions

Non native species of vegetation were not included in assessment of vegetation cover. Absence of species from surveys was noted with a reasonably high degree of confidence due to survey methodology. Problems with aggressive native birds such as Noisy Minor were seen as more of a problem in fragmented habitats in north-central Victoria than south-west.

For further information contact Andrew F Bennett, School of Life and Environmental Sciences – Deakin University, Burwood Campus, 03 92517609

Discussion Forum

There was some discussion about habitat quality, i.e. the grazing of understory in the Glenelg Hopkins bird study area. Andrew said the study focused more across a landscape scale and more detailed habitat patch analysis could follow. He also mentioned some work on butterflies which may indicate lack of certain understory species which are needed by butterflies as host plants.

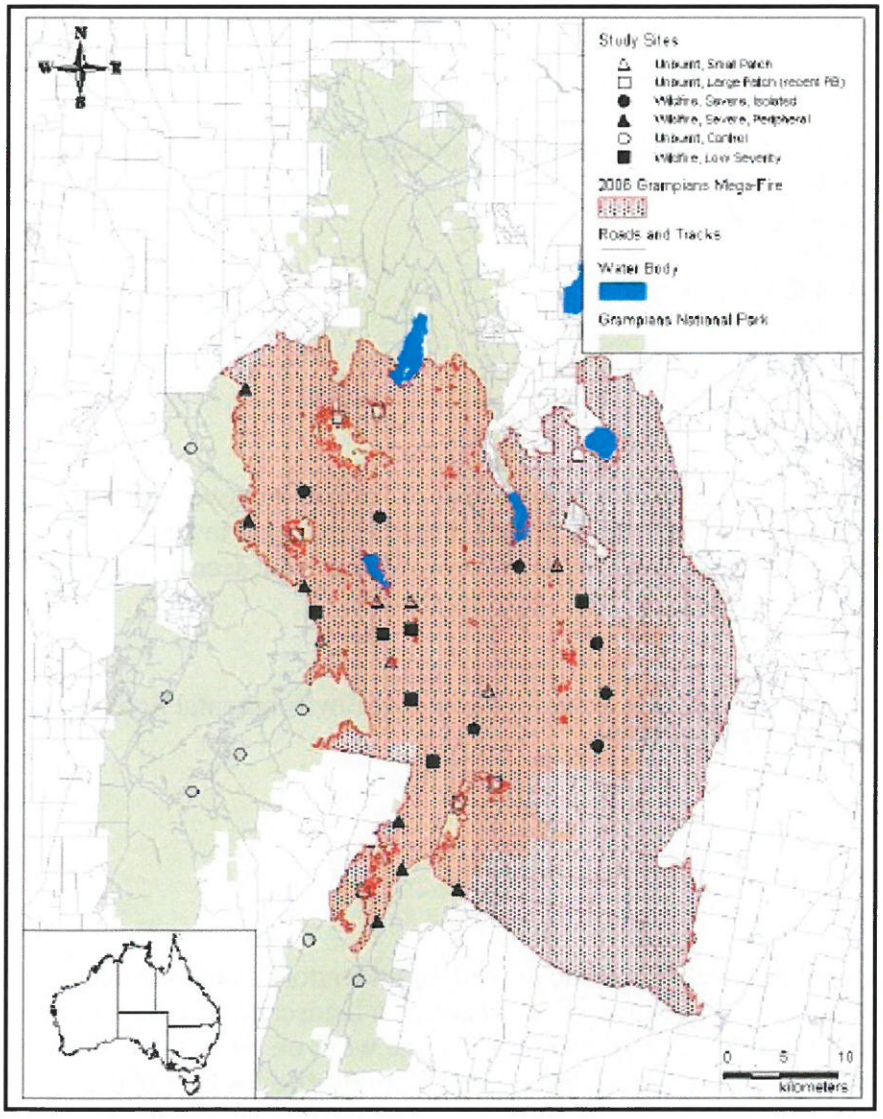
There was some discussion about genetic studies in relation to habitat corridors and fragments. Monash University is involved with a project in north-central Victoria, also the University of Adelaide Ark project is doing genetic work on small mammals in the South Australia/western Victoria area.

Reintroduction of some of the more common species which have been lost from isolated patches was discussed but it was felt that driving forces of loss may still be present therefore negating

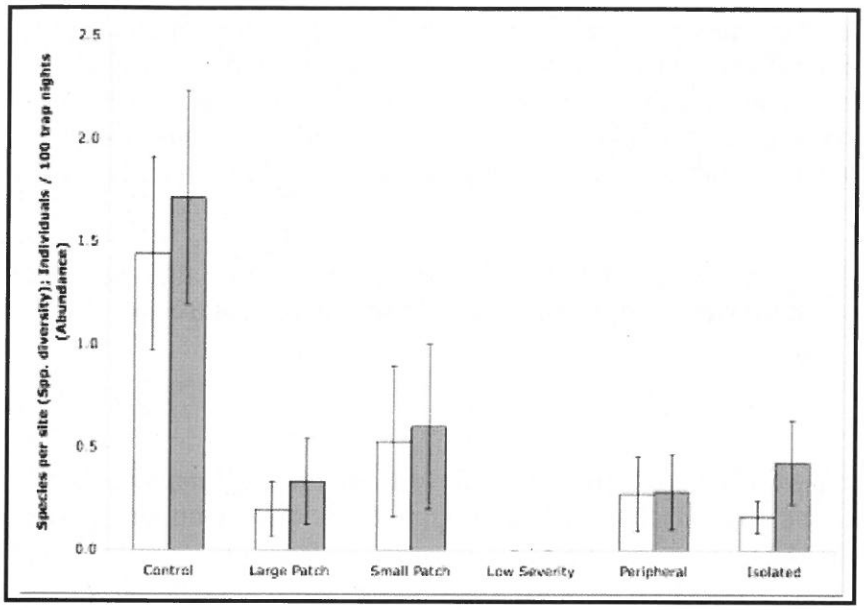
attempts to re-introduce. Re-introduction would better suit to large tracts of vegetation to avoid problems associated with small isolated populations. There are also questions regarding the genetic source of re-introduced animals and whether it is a positive or negative outcome in terms of genetics. Problems associated with re-introduction of Koalas were highlighted as a problem in the Lake Condah area.

The impact of severe wildfire on small mammals Grampians National Park case study

Mike Stevens – Grampians National Park



Extent of Grampians 2006 fire and sampling sites, *Source: Stevens (2008)*



Survey results: White bars – (Numbers caught), Grey bars – (Species diversity) *Source: Stevens (2008)*

Mike's project was conducted as part of a Research Partners Program through Deakin University two years after the 2006 Grampians fires. He introduced the topic by explaining that the threat of larger, hotter, catastrophic fires was increasing due to climate change The impact on fragmented habitats is likely to be greater as entire areas are severely burnt out. This will impact on small mammals as they are reliant on habitat at the ground layer.

Mike mentioned that many of the more recent studies of large fires have focused on the behavioural science of fire and some of the studies on biodiversity have been more related to prescribed burning. His study was specifically looking at the impact of 'mega fires' on small mammals diversity and abundance as well as habitat. The Grampians fires of 2006 were used as a study because almost half the park was severely burnt with only 3% unburnt within the fire area. A landscape scale study was used looking at burnt and unburnt areas using 38 study sites of varying sizes from 2 Ha to 100 Ha.

Within the burnt area sites were selected with a range of distances from the unburnt area. All sites were within the fox baiting area to rule out impacts from predation.

The small mammal survey was conducted in the autumn period with nearly 10,000 trap nights with the assistance of volunteers. Vegetation, habitat structure and floristic structure were also recorded.

Results confirm a significant impact on small mammals, two species of concern are Long-nosed Potoroo and Southern Brown Bandicoot which were not even recorded in the unburnt sites. For other species of small mammals unburnt control sites and unburnt patches had a higher species diversity and abundance than the burnt areas. Low severity burn sites yielded no native species, the reason for this is unknown.

Mike said there was evidence that the introduced House Mouse Mus musculus was recolonising sites 3 km form the unburnt areas which could be regarded as a positive sign that this species may be providing a temporary link in the food chain or a precursor to the colonisation of native species.

In summary, unburnt patches with a complex ground habitat up to 1 metre were the most important areas for refuge and a source from which recolonisation could take place. Mike said the consequences form large severe fires was to create a habitat vacancy where recolonization may

not take place unless there are species remaining to recolonise. Mike's studies will hopefully be considered in fire management of wildfires to keep patches of unburnt habitat and also in fuel reduction management to consider circumstances where populations of small mammals may be crucial for their capacity to recolonise post fire. Mike also mentioned the important questions of assessing when and how reintroductions from captive breeding are required if large scale species vacancy has taken place.

There were several questions on how the results could influence burning programs, although Mike stressed that this study was looking at impacts from large scale wildlfire and not prescribed burning.

Reference:

- Stevens, M. (2008). 'The impact of severe landscape-scale wildfire on small mammals: Grampians National Park case study'. Bachelor of Environmental Science, Honours thesis. (Deakin University: Melbourne.)

The next SWIFFT video conferences will be on Wednesday 23 April 2009 (Marine biodiversity conservation).

- SWIFFT meetings