

# ACT State of the Environment Report 2011

## THEME: Biodiversity

### Indicator cluster: Threatening processes

The indicators for this cluster are:

- Weed status (C) - extent and distribution of weeds;
- Pest status (C) - extent and distribution of pests;
- Ecosystems and climate change (P) - impacts of climate change on ecosystems;
- Fire and fire regimes (P) - type, area, distribution and extent of fire (including ecological impacts of prescribed burning);
- Firewood gathering (P) - extent and distribution of firewood gathering;
- Road kill (P) - vehicle collision impacts on native species;
- Weed impacts (I) - nature of weed impacts on native species;
- Pest impacts (I) - nature of pest and overabundant native species impacts on native species;
- Ecological degradation (I) - broad measure of effects of urban and other development on ecological communities and species including urban expansion;
- Weed management (R) - effectiveness of weed management responses;
- Pest management (R) - effectiveness of pest and overabundant native species management.
- Fire management and ecology (R) - effectiveness of fire management responses in terms of ecology and native species and communities.

**Condition indicators (C)** present data on the state of the environment at any particular time.

**Pressure indicators (P)** present data about the main human activities that could potentially adversely affect the condition of the environment.

**Impact indicators (I)** present data on the effects of environmental changes on environmental or human health.

**Response indicators (R)** present data about the main things we are doing to alleviate pressures, or to improve the condition of the environment.

## Summary

The ACT has large areas of green space around and within the city. Changes at the local scale (such as human population increase and associated pressures) and at

# ACT State of the Environment Report 2011

global scale (such as global warming and climate change) are placing the ecosystems of the ACT under increasing pressure.

Processes that threaten or could threaten the survival of native species and populations or ecological communities in the ACT include: climate change impacts; changed fire regimes; pest and weed impacts; and development impacts such as urbanisation. There is a lack of ongoing monitoring, and therefore knowledge about specific impacts and the status of many threatening processes is very limited in the ACT. More information is required to guide effective management.

## Introduction

Processes such as invasion by weeds and pest species, urban development, and climate change are placing ecosystems under increasing pressure. Much of Australia's flora and fauna has evolved alongside threatening processes such as fire and may rely on those processes for continued survival. However, changes to the processes (for example, fires of high or low intensity that are either too frequent or insufficiently frequent), or new processes such as loss of habitat through urban or infrastructure development, can lead to loss of native species and ecological communities. This paper reports on management responses to threatening processes in the ACT, and, where possible, the outcomes of these management responses during the reporting period. The paper also reports on identified potential factors resulting from threatening processes, which influence loss of biodiversity.

## Condition indicators

The ACT the *Nature Conservation Act 1980* (ACT Government 2011a) defines a threatening process in relation to a species or ecological community, as:

*... a process that threatens, or may threaten, the survival, abundance or evolution of the species or community and includes the spreading of a pest animal or pest plant.*

Threats to the threatened species declared under the Nature Conservation Act (e.g. loss, fragmentation or alternation of habitat, and overgrazing) are identified in the Action Plans prepared for those species. (See also the Annex to the *Native species - fauna* indicator cluster paper for a summary of the major threats to each threatened fauna species listed under the Act.)

There are currently no threatening processes declared under the Act (ACT Government 2011a). The Flora and Fauna Committee has integrated threatening processes into Action Plans 27, 28 and 29 (TAMS 2006). It is important to assess

# ACT State of the Environment Report 2011

whether that integration puts enough focus on the individual threatening processes, and provides enough impetus to act on them.

Under the ACT *Pest Plants and Animals Act 2005* (ACT Government 2011b) a pest animal or plant can be declared a notifiable pest (i.e. its presence must be notified to the Director-General, previously the Chief Executive) or a prohibited pest (i.e. the supply or keeping of the pest animal is prohibited). Once a pest has been declared, the minister may prepare a plan for the management of that pest plant or animal.

## **Weed status**

Weeds can be found across most of the ACT, including in remote areas of Namadgi National Park. Transported livestock and fodder, contaminated crop and pasture seeds, deliberate introductions of new species, and the movement of contaminated machinery including cars can spread weeds through agricultural areas and beyond. Once weeds establish in native plant communities they can change the structure and species composition of the original plant community by out-competing native plants, leading to flow-on effects to native animal species. Weeds such as Paterson's Curse (*Echium plantagineum*) and Capeweed (*Arctotheca calendula*) successfully spread and establish in new areas because of their capacity to quickly respond to changes in the landscape. Losses of native plant cover through fire and drought, and bare ground in introduced pasture or after harvest, give these and other weed species suitable opportunities to invade. Weeds such as Chilean Needle Grass (*Nassella neesiana*) and African Lovegrass (*Eragrostis curvula*) are also spreading in areas where land has been disturbed, particularly along fire trails, utility easements and adjacent to urban areas (ACT NRMC 2009). Between 2007 and 2009 the number of declared weeds included in the *Pest Plants and Animals (Pest Plants) Declaration 2009* increased from 76 to 78 (ACT Government 2011b). The two new pest plants declared are Mexican Feather Grass (*Nassella tenuissima*) and African Fountain Grass (*Pennisetum setaceum*) (Table 1).

# ACT State of the Environment Report 2011

Table 1. New pest plant inclusions in the ACT

Species	Condition	Pressure	Status
Mexican Feather Grass ( <i>Nassella tenuissima</i> )	Planted in gardens across ACT. Identified plants have been seized, and there is an ongoing search for remaining plants. Small infestations near Bendora Dam and the Namadgi Visitor's Information Centre have been identified and contained. Monitoring for seedlings is ongoing.	Has the potential to invade pastures and native grasslands in the ACT. If uncontrolled, it could spread to other states of Australia. Importation into Australia is prohibited.	A notifiable and prohibited pest plant. Ongoing monitoring and education are necessary. Capable of dominating disturbed and undisturbed areas due to its extreme rates of spread, smothering a wide range of native plants and/or pasture. Even small infestations are difficult to contain. Mono-cultures form rapidly.
African Fountain Grass ( <i>Pennisetum setaceum</i> )	Has been found growing in the ACT. No locational information on this species has been provided.	An invasive weed, capable of dominating disturbed and undisturbed areas with very high rates of spread, smothering a wide range of native plants and/or pasture. The species can form mono-cultures.	A notifiable and prohibited pest plant. Ongoing monitoring and education are necessary.

Source: TAMS 2008, 2009

There are currently 20 species recognised as Weeds of National Significance (WoNS) in the ACT, of which 9 (listed below) have been declared as pest plants under the provisions of the ACT Pest Plants and Animals Act.

Weeds of National Significance that are established in the ACT are:

- Blackberry (*Rubus fruticosus* agg.);
- Chilean Needle Grass (*Nassella neesiana*);
- Gorse (*Ulex europaeus*);
- Serrated Tussock (*Nassella trichotoma*);
- Willow (*Salix* spp.);

# ACT State of the Environment Report 2011

- Alligator Weed (*Alternanthera philoxeroides*).

Weeds of National Significance with the potential to establish in the ACT are:

- Bridal Creeper (*Asparagus asparagoides*);
- Cabomba (*Cabomba caroliniana*);
- Salvinia (*Salvinia molesta*).

The 2019 ACT target for weeds management is to eradicate a few species entirely (including Mexican Feather Grass and Madagascan Fireweed, *Senecio madagascariensis*), and either reduce the percent cover or reduce the infestations to occasional and localised for most other species and locations (see Table A1 in the Annex). A few species are targeted for occasional and widespread or common and localised cover on specific sites.

The ACT Government's weeds management team described 7 sites as having a 'common to dominant' coverage of targeted weeds in 2008-09 (PCL 2010a), indicating significant difficulties in achieving the targets of reduced weed coverage in well-established areas. In contrast, at 5 of the 7 sites that were reported as having 'common to uncommon' coverage the team successfully reduced the weed presence, in line with the 2019 ACT Weed Strategy targets for the weed species (PCL 2010b). At all sites described as having 'rare' species coverage, either the weed species was eradicated or it was contained (PCL 2010b).

It is noted that weed cover has also increased in 8 of the 26 ACT locations (PCL 2010b). Further information is provided in Table A1 in the Annex.

## Pest status

Pest species, including insects, birds, mammals and fish, are found throughout the ACT and surrounding region. Of these, 10 species are declared pests under the Pest Plants and Animals Act:

- Wild Rabbit (*Oryctolagus cuniculus* (wild));
- Wild Dingo/Wild Dog (*Canis lupus* (wild));
- Wild Deer species (*Cervus* spp. and *Dama* spp. (Wild));
- Wild Pig (*Sus scrofa* (wild));
- Wild Goat (*Capra hircus* (wild));
- European Red Fox (*Vulpes vulpes*);

# ACT State of the Environment Report 2011

- European Wasp (*Vespula germanica*);
- Weatherloach (*Misgurnus anguillicaudatus*);
- Carp (*Cyprinus carpio*);
- Gambusia (*Gambusia spp.*).

Data on the status of pest species, in terms of ACT-wide population trends, are not collected. Particular species are monitored at key sites. Data on the status of pest species monitored in the ACT are contained in Table 2.

Table 2. Current status and impact of selected pest species in the ACT

Pest	Current status in the ACT
European Red Fox	<ul style="list-style-type: none"> <li>• Foxes are considered ubiquitous in the ACT.</li> <li>• In areas where targeted dog baiting occurs, fox numbers are likely to be greatly reduced because the foxes take the 1080 dog baits. Sand plot monitoring in southern Namadgi National Park confirms this assumption (0% plots showed fox prints).</li> <li>• Fox numbers are reported as being at medium levels in both Googong Nature Reserve and Rob Roy/Gigerline Nature Reserves (20% of sand plots showed fox prints) where monthly baiting occurs (winter and autumn baiting only in Gigerline).</li> <li>• Foxes have been eradicated from the Mulligans Flat Sanctuary using predator-proof fencing and trapping and shooting.</li> </ul>
Carp	<ul style="list-style-type: none"> <li>• Despite the good biodiversity of native fish species, European Carp (<i>Cyprinus carpio</i>) continue to make up 80-90% of fish biomass in the Murrumbidgee River within the ACT.</li> </ul>
Wild Rabbit	<ul style="list-style-type: none"> <li>• Rabbit numbers have been increasing in the ACT and in all other Australian jurisdictions over the last five years, probably because of a failure to use conventional methods of rabbit control to capitalise on low rabbit numbers following introduction of Rabbit Haemorrhagic Disease (Rabbit Calicivirus Disease) in 1995.</li> <li>• Results of regular spotlight monitoring within Namadgi National Park show a significant increase in numbers across all sites monitored.</li> </ul>
Wild Pig	<ul style="list-style-type: none"> <li>• Feral Pigs are widely distributed throughout the ACT in non-urban parks and reserves.</li> <li>• Former long-term performance monitoring in Namadgi National Park found a dramatic drop in signs of pigs (dung and rooting) following the initiation of a park-wide pig baiting program in the mid 1980s. The annual baiting program maintained pig signs at this level until the end of the study in 2000.</li> <li>• No more recent data are available.</li> </ul>

# ACT State of the Environment Report 2011

Pest	Current status in the ACT
Feral Horse	<ul style="list-style-type: none"> <li>Feral Horses were eradicated from Namadgi National Park in 1987. By 2006, 18 horses had recolonised the park. Subsequent control has reduced the numbers of horses in Namadgi National Park to 4 animals.</li> </ul>
Wild Deer Species	<ul style="list-style-type: none"> <li>Feral Deer sightings appear to have been increasing over the last 10 years. Herds of Fallow Deer are present along the Murrumbidgee, Naas, Paddy's and Molonglo rivers. Red Deer are present in the Naas Valley and adjoining areas of Namadgi National Park. Sambar Deer have recently been reported in the Brindabellas and upper Cotter catchment.</li> <li>In response to the increased reports of incidental sightings a deer sightings register was established in 2008-09 for reports from staff of ACT Parks and Conservation Service, landholders and the public. In 2009-10 there were a total of 26 deer sightings reported, including 15 Fallow Deer sightings, 6 Red Deer sightings, 2 Sambar Deer sightings and 3 unidentified sightings. In 2009-10, 6 deer (4 Red Deer and 2 Fallow Deer) were reported shot by ACT Parks and Conservation Service.</li> </ul>
Goat	<ul style="list-style-type: none"> <li>During 2009-10, 7 goats were shot at Googong Nature Reserve and 10 from Gigerline Nature Reserve and the lower Molonglo valley. About 60 goats were mustered from the Molonglo River corridor near Coppins Crossing to protect the nearby National Arboretum.</li> </ul>

Source: DECCEW 2010, PCL 2010a

## Pressure indicators

### Ecosystems and climate change

In the coming decades impacts from climate change are likely to become increasingly prevalent in the ACT. The most likely future climate scenario for the ACT includes (Webb 2011):

- the strong likelihood of mean temperatures continuing to increase, along with more frequent and severe heatwaves for the ACT and region; and
- a high probability of changes in the pattern of rainfall from that observed during the period of instrumental records, with some risk of a decline in long-term average rainfall; and in addition, the likelihood of an increase in rainfall intensity with more extreme rainfall events.

Climate change is likely to affect ecosystems in the region by altering their structure, composition and function. The distributions of individual species may change, as may invertebrate populations. Climate change may cause high-altitude ecosystems to contract (NSW Government 2010). Change is expected to be driven by bushfire frequency and intensity, reduced primary productivity in plants, interaction with existing pressures, changes in rainfall patterns involving more intense seasonality,

# ACT State of the Environment Report 2011

increased grazing pressure from native herbivores and increased weed incursion (NSW Government 2010). The potential rate, scale and geographic extent predicted as possible under climate change make it potentially even more significant than other threats (Webb 2011).

Organisms are responding individually to climate change and will not move as complete ecological communities (Peters 1990). This may result in the formation of novel ecosystems with new species compositions and relative abundances (Hobbs et al. 2006, Lindenmayer 2008).

## Impacts on native species

Climate change is predicted to affect species directly through: heat stress and changes to growth and water use in plants; concentration of nutrients and toxins in leaves; timing of seed germination and flowering in plants; and egg laying and hatching in birds, reptiles and insects (Webb 2011). Some sensitive species are expected to be lost while invasive species are expected to persist and spread. Species at most risk from climate change include those with limited ability to move, those with limited habitat range, and those with specialised habitats or dependent on other species (DECCW 2010).

Some of these potential impacts have already begun to occur, as indicated by a number of extinctions, functional extinctions and threatened species; and changes in relative abundance, diversity, distribution and range of species (Webb 2011). Globally, observed changes in biodiversity have predominantly been at the species level, with the clearest evidence coming from changes in life-cycle events and shifts in geographic ranges (Hughes et al. 2010).

Observed changes include reductions in communities of freshwater invertebrates that prefer cool fast-flowing water bodies (Chessman 2009), and fauna such as Kookaburras colonising sites at higher altitudes than normal, such as alpine ecosystems in the Australian Alps where they are preying on alpine skinks that do not recognise them as predators (Green 2003, Pickering et al. 2004, Low 2007, DECCW 2010). Climate change now affects bird species' behaviour, ranges and population dynamics. Birds are highly sensitive to weather and are the 'canaries in the coal mine' in relation to climate change (Wormworth and Mallon 2006).

## Ecological communities and biomes

Impacts of climate change on grassy woodlands in the ACT could include death of trees from moisture stress, altered shrub-grass balance potentially in favour of shrubs, and changes in groundcover composition, with consequent impacts on fauna. Potentially higher stress is predicted for reptiles, snails and plants, and relatively



# ACT State of the Environment Report 2011

lower stress for mammals, birds and frogs. However, species such as the Northern Corroboree Frog, which lives in high-altitude habitats, are likely to experience greater pressure. Fauna impacts may be very complex and involve 'cascading changes' affecting invertebrate dynamics, species-species interdependencies and disease patterns (Prober et al. 2010). Grassy woodlands are no longer as well buffered against the impacts of change as they would have been when they had naturally high species-richness and environmental heterogeneity, were widely distributed and well connected (Webb 2011).

Natural Temperate Grassland and Snow Gum-Candlebark Tableland Woodland are dependent on low temperature conditions for their distribution; higher temperatures could result in invasion by other species.

In freshwater ecosystems, reduced water availability will affect fish migration and spawning, other aquatic vertebrates, macroinvertebrates (such as insect larvae and crayfish), water plants and adjacent riparian systems, and it will make sites more vulnerable to weed invasions (Sharp et al. 2008).

Increased concentrations of atmospheric carbon dioxide have been shown to increase plant productivity and water use efficiency, but soils beneath Australian forests are typically poor in nutrients and that may restrict this benefit (Medlyn et al. 2010). Reduced water availability and more frequent droughts may threaten forest functioning. However, the limited evidence available suggests that flowering and reproduction in Australian forests are relatively robust under climatic variability. Also, the overall impacts of pathogens and invasive weeds as stressors on native forests are unlikely to worsen with the projected changes in climate (Medlyn et al. 2010).

## **Invasive species**

Climate change is likely to aggravate Australia's invasive species problems. Native plant communities can be displaced by weeds because weeds tend to have greater capacity to adapt to changing climatic conditions (Low 2008). Predicted extreme events, such as floods, droughts and fires, will facilitate invasions by introduced species (Low, 2008), with weed species such as short-lived annuals quickly colonising grassy woodland areas following the breaking of drought (Sharp 2011). Invasion by weeds can weaken ecosystems in advance of direct impacts from climate change, making weed control and improvement of ecosystem resilience important lines of defence against both these threatening processes (Low 2008).

Pest animal problems may be exacerbated by climate change. For example, feral pigs may stay in high-altitude areas for longer if winters become warmer, rather than retreating to lower altitudes. That could result in more rooting damage to subalpine

# ACT State of the Environment Report 2011

areas during the colder months. It could also affect pig control in Namadgi National Park where rangers conduct effective baiting programs in winter when pigs congregate there.

Climate change may also result in native species from around the ACT expanding their geographic ranges and threatening local native species. For example the Broad Tooth Rat (*Mastacomys fuscus*), which is found in the ACT but is listed as threatened in NSW, may suffer increased competition from the Native Swamp Rat (*Rattus lutreolus*) (Low 2008).

## Landscape function

Some Canberra reserves already have reduced or severely reduced landscape function (Sharp 2011). In addition to direct effects of climate change on species, there is a significant risk that climate change will affect natural ecosystem function and processes through increased erosion, drier soils, reduced vegetation growth and renewal, and effects on biological or nutrient processes (Webb 2011).

Drought and drier conditions in general reduce landscape function because they restrict soil moisture, vegetative growth and the maintenance of biological processes. On the other hand, extreme rainfall events result in excessive run off and erosion. More frequent fires and prescribed burning may decrease landscape function by removing natural litter layers and destroying the soil crust (Webb 2011).

## Fire and fire regimes

A fire regime is defined as the history of fire events at a point in the landscape. The region is prone to bushfires, because although the ACT is in a zone of seasonally uniform rainfall (BoM 2011) the summers can be relatively dry, periodically there are droughts, and the native vegetation is flammable. While natural ecosystems of the ACT are adapted to fire, changes in the fire regimes - whether from suppression of fires or from more frequent fire - can have serious consequences for species that have evolved to survive different fire frequencies and intensities. Changed fire regimes can have ecosystem-scale impacts that may take years to disappear or that permanently change vegetation communities. Changes in vegetation communities can in turn affect the fire regime because fuel loads are influenced by vegetation type.

Even prescribed burns can have an ecological impact. The ACT Strategic Bushfire Management Plan (ACT Government 2009) does not focus on potential ecological impacts, but it acknowledges there may be a difference between the planned fire regimes and the natural fire regime resulting in changes to natural ecosystems.

# ACT State of the Environment Report 2011

Climate change will also affect fire regimes through impacts on both fire weather and fuel availability. Modelling for a 2°C increase in mean annual temperature suggests an increase in the landscape measure of fire intensity by 25%, increasing the area burnt and reducing intervals between fires (Cary 2002). More research is needed to clarify the net impact of climate and fire regime change on ecosystems in the region (Webb 2011). For more information on the impacts of climate change on fire see the *Climate vulnerability* and *Natural hazards* indicator clusters.

The 2007-08 *State of the Environment Report* proposed “improving the scientific knowledge of managers and custodians of the ACT nature conservation estate about fire fuel management through research, monitoring and evaluation”. Currently only around 10% of prescribed burns are monitored for ecological effects, and only for a 5-year period (OCSE 2011). Considering the complexities of ecosystems, the knowledge gaps about the responses of threatened species to different fire regimes, and the risks that modified fire regimes pose for natural ecosystems, monitoring of fire management activities should be a high priority.

## Fuel reduction

Balancing the protection of life and infrastructure against the maintenance of biologically appropriate fire regimes is a challenge in the ACT. The Canberra Nature Park reserve system comprises 33 areas located within or adjacent to the suburbs of Canberra. The nearness of houses to the Canberra Nature Park system means that fuel loads within the reserves need to be kept relatively small in order to protect property. If the fuel loads are controlled by relatively frequent prescribed burning, there is a risk of loss of the parks’ native species that need relatively infrequent fires to survive. For more information on fire management and fuel reduction practices, see the *Natural hazards* indicator cluster.

Areas where fuel reduction activities are proposed, and the methods to be used, are identified in the ACT Government’s Regional Fire Management Plans and annual Bushfire Operational Plan. Activities to reduce fuel loads can include prescribed burning, slashing, grazing and physical or chemical removal of vegetation. These activities all have the potential to cause environmental damage and associated loss of biodiversity if applied inappropriately.

At the time of reporting, no data were available on the locations or numbers of prescribed burns or other fuel reduction operations during the reporting period. The 2010-11 Bushfire Operational Plan for the ACT lists a total of 49 prescribed burns planned for the financial year. Of these, 9 were planned for ecological reasons.

# ACT State of the Environment Report 2011

## Firewood gathering

Collection of firewood for commercial purposes is not permitted in the ACT. Firewood sales in the ACT are regulated, and firewood merchants must be licensed and are required to report annual sales.

Dead trees and fallen timber in nature reserves, local forests, woodland occurring on private property or roadsides may look like potential pieces of firewood but should not be collected because they offer essential habitat for native fauna for nesting, roosting and foraging.

There is currently no provision to issue an infringement notice for the offence of removing fallen native timber under section 52(3) of the ACT Nature Conservation Act 1980 (ACT Government 2011a). If a ranger observes somebody collecting fallen timber for firewood the ranger's only option is to issue a warning of prosecution or undertake prosecution (DECCEW 2010).

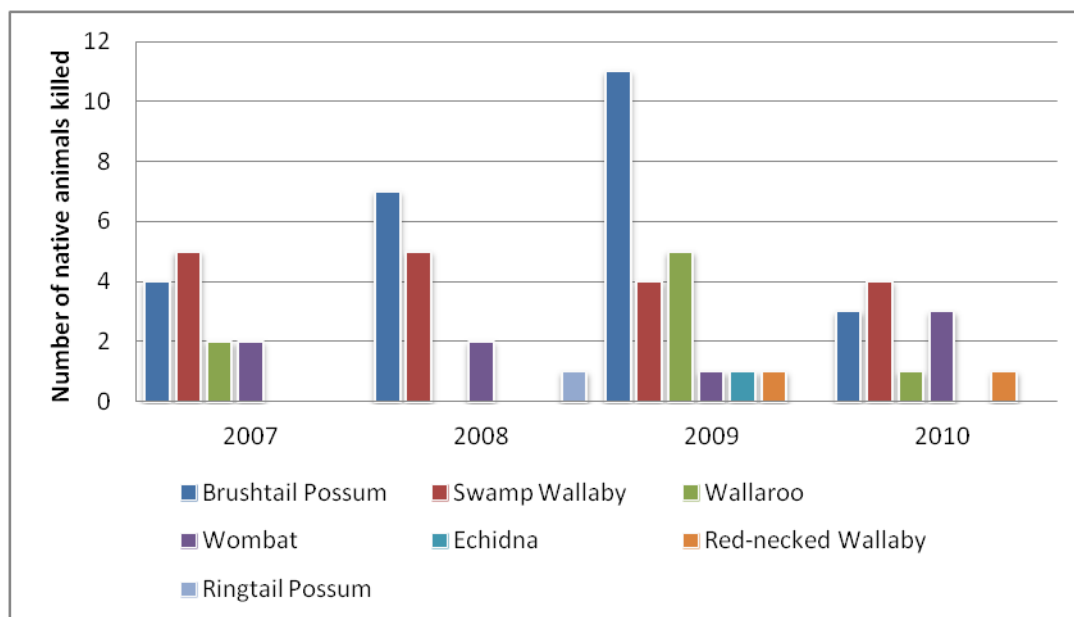
## Road deaths

Vehicle collisions with wildlife are of significant concern, both for human safety and for conservation reasons. Roads fragment areas of native habitat, and pose hazards to native fauna crossing the roads. These add to other existing pressures on biodiversity, such as from habitat loss and degradation and invasions by pests and weeds. The gains to fauna conservation from reserving land in an urban setting can be eroded through native species' road fatalities within and adjacent to these patches of land.

There are known collision 'hot spot' locations for large wildlife species in the ACT (TAMS 2010a). During the reporting period, 15 native species have been killed on ACT roads (Figure 1), with brushtail possums the most numerous apart from kangaroos, followed by swamp wallabies and then wombats and wallaroos. However, not all road deaths are reported to TAMS and the data should be considered to show only minimum numbers. Many smaller native species killed in vehicle collisions cannot be identified.

# ACT State of the Environment Report 2011

Figure 1. Native fauna reported killed on ACT roads, 2007-2011 (excluding kangaroos)



Source: TAMS

Kangaroos are by far the most commonly reported victims of collisions on roads, because of their large population within the urban area, the intersection of their natural movement corridors with roads, and the combined pressures of drought and abundant roadside vegetation. Over the reporting period more than 200 kangaroos were killed annually, except in 2010 when approximately 140 kangaroo road-deaths were recorded.

## Impact indicators

### Weed impacts

Weeds reduce natural diversity by smothering native plants or preventing their seedlings from establishing. Weeds also reduce the productivity of agricultural lands, and some weeds are toxic to stock. For information on the status of weeds in the ACT in 2009, see Table A1 in the Annex.

The impacts of weeds on native species and agriculture in the ACT are not comprehensively understood. The ACT lacks standardised procedures and databases for collecting and maintaining consistent information on weeds, and that limits the capacity to identify priorities and manage the impacts of weed species on biodiversity and agriculture at the Territory level. Work has begun to map species and density of weeds in priority areas, including locations of rare or threatened plant species that may be at threat from weed invasion. This will help with setting priorities for control work.

# ACT State of the Environment Report 2011

There need to be quantitative studies on the impact of the 78 declared pest plant species on native species in the ACT. The studies need to identify the native species that are most at risk from weed invasions, and also the capacity of native species and ecosystems to tolerate each relevant weed species. Weeds are also having broader impacts, at the landscape level, in relation to soil degradation, habitat disturbance and water quality. These need to be understood to help in effective management of weed impacts.

## **Pest impacts**

Pest animals have negative impacts on native biodiversity through habitat competition and degradation, predation, and by harbouring parasites and diseases. Pest animals can also damage crops, pastures and agricultural assets, and reduce the safety and aesthetic value of urban open spaces.

Rabbits are a major cause of degradation in the Canberra Nature Park. Besides the obvious impacts of their warrens there are more subtle impacts, such as interactions with grazing by other herbivores and the stringencies resulting from drought and burning and sustaining populations of predatory foxes and cats. The long-term outcome is loss of perennial vegetation, trees and shrubs, native species and their ecosystem services, loss of nutrients, denudation and erosion of soil, and increase in weedy annual forbs and grasses (Williams 2011).

Some examples of pests listed in the ACT Vertebrate Pest Management Strategy (2002) and their impacts are shown in Table 3.

# ACT State of the Environment Report 2011

Table 3. Current impacts of selected pest species in the ACT

Pest	Potential impacts	Monitored impacts
European Red Fox	<ul style="list-style-type: none"> <li>Reduced abundance of medium-size native mammals, especially wallabies and possums, and likely impacts on invertebrates, small mammals and reptiles.</li> <li>Possible impacts on bird populations and some threatened species.</li> <li>Occasional urban nuisance.</li> <li>Potential reservoir for rabies.</li> <li>Agent for the spread of weed seeds.</li> </ul>	No performance monitoring reported.
Wild Rabbit	<ul style="list-style-type: none"> <li>Reduced seedling recruitment by browsing.</li> <li>Warrens promote soil erosion and weed invasion.</li> <li>Grazing competition with native herbivores.</li> <li>Overgrazing can lead to habitat degradation, affecting fauna species that rely on groundcover plants for food and shelter.</li> <li>Food source for populations of feral cats and foxes that in turn can pose a threat to native species of concern.</li> </ul>	No performance monitoring reported. Rabbit abundance from spotlight counts is used as a guide to the likely level of damage caused by rabbits.
Wild Pig	<ul style="list-style-type: none"> <li>'Ploughing' of treeless flats and bogs in sub-alpine areas, with presumed impacts on wetland hydrology and abundance of plants and animals, including threatened species.</li> <li>Reduced distribution of favoured tuberous native plants.</li> <li>Pig-ripped ground and sightings of mobs of pigs impact negatively on experience of park visitors.</li> <li>Degradation of water quality in catchments and wetlands.</li> </ul>	Long-term monitoring of 700 plots in Namadgi National Park shows pig rooting has been recorded on 5-10% of plots since the 1980s, down from 30% of plots pre-control. (Data since 2000 were not available at the time of reporting.)
Feral Horse	<ul style="list-style-type: none"> <li>Alteration of subalpine habitat and other non-treed vegetation.</li> <li>Restructuring of habitat critical to sub-alpine species of very limited distribution, particularly wetlands.</li> </ul>	No performance monitoring reported.
Wild Deer	<ul style="list-style-type: none"> <li>Some evidence of tracking and browsing; significance of impact unknown.</li> <li>Reservoir for diseases of livestock.</li> </ul>	No performance monitoring reported.
Goat	<ul style="list-style-type: none"> <li>Vegetation structure altered by selective browsing of native shrubs, with implications for dependent species that are of conservation concern.</li> </ul>	No performance monitoring reported.

Source: Environment ACT 2002, PCL 2010b

# ACT State of the Environment Report 2011

## Ecological degradation

Ecological degradation is defined as any change or disturbance to the environment perceived to be deleterious or undesirable.

In addition to the impacts of climate change, weed and pest invasion, and changes in fire regimes discussed above, the most significant threat of ecological degradation in the ACT comes from the growing human population of the Territory and associated urban expansion. Urban developments can potentially have significant negative impact on the habitats of some key native species. However, developers are also financing targeted ecological research to be done as part of the impact assessment process. The findings of these studies are often equally applicable to the species or community of interest at other locations in the ACT.

## Urban development

Urban development and expansion can lead to loss, fragmentation and alteration of habitats and ecosystems. Of the lowland area of the ACT, 60% has been cleared for agricultural and urban land use, and further urban expansion is planned.

Yellow Box-Red Gum Grassy Woodland and Natural Temperate Grasslands occur on the lowlands and are at increasing risk from the continued urban expansion. Key remnants of these ecosystems are conserved in the Canberra Nature Park reserve system, but less than 15% of the former lowland vegetation is protected and the fragmented nature of the reserves makes maintaining connectivity particularly important. This connectivity is likely to become even more important for maintaining biodiversity as the effects of climate change increase.

Future urban development in the Gungahlin area in North Canberra could potentially affect the Superb Parrot (*Polytelis swainsonii*) a nationally and locally vulnerable species that has been recorded in increasing numbers in north-west Canberra by the Canberra Ornithologists Group (COG) over recent years (see Table A1, Annex, *Native species - fauna* indicator cluster). A recent survey has confirmed breeding attempts and mapped potential habitat (Davey 2010). Currently 40 nesting trees used by the Superb Parrot have been identified in the ACT, and of these 22 are located in the proposed future suburb of Throsby.

Urban expansion into the Molonglo Valley in Canberra's south-west will have an impact on areas of habitat used by the Pink-tailed Worm Lizard, *Aprasia parapulchella*, a species listed as vulnerable in the ACT and nationally (see Table A4, Annex, *Native species - fauna* indicator cluster). Detailed habitat mapping and surveys have been undertaken as part of the urban development process in this valley. These studies have confirmed that nationally significant populations of Pink-tailed Worm



# ACT State of the Environment Report 2011

Lizards still exist along the Molonglo River. The maps have enabled the areas of habitat supporting key populations to be incorporated into the design of a large river park that is proposed as part of an offset strategy for the development. An additional conservation area, protecting habitat containing the largest and highest-density population of the species, to the west of the proposed urban development, is also proposed as part of the offset strategy.

One of the impacts commonly associated with urban development is an increase in domestic pets. Cats in particular can have a devastating impact on native wildlife. In recognition of this the ACT Government has required cats in new suburbs, for example Forde and Bonner in the Gungahlin area, to be contained within property boundaries at all times. These measures protect threatened native species in nearby nature reserves such as Mulligans Flat and Gorooyarroo as well as the cats themselves. A recent survey on the public perception of cat containment conducted on behalf of the ACT Government showed strong community support for cat containment in the ACT. An education campaign about the benefits of cat containment, both for the cats and for native wildlife, could build on this support and help increase cat containment in the ACT.

## Other developments

The Enlarged Cotter Dam is a major project currently being undertaken by ACTEW Corporation and partners, to secure the future water supply of the growing ACT population. The project involves the construction of a new dam wall that will increase the area of Cotter Reservoir by 232 ha. The Cotter River is home to 5 threatened native aquatic species listed under the Nature Conservation Act 1980 (see Tables A2 and A3, Annex, *Native species - fauna* indicator cluster):

- Macquarie Perch (*Macquaria australasica*);
- Trout Cod (*Maccullochella macquariensis*);
- Silver Perch (*Bidyanus bidyanus*);
- Two-spined Blackfish (*Gadopsis bispinosus*); and
- Murray River Crayfish (*Euastacus armatus*).

The proposed works have the potential to affect some or all of these species through changes to breeding, shelter and foraging habitat. Research, via 9 separate projects, has provided information to guide mitigation that should minimise impacts to the threatened species through the construction and operation of the Enlarged Cotter Dam. The results of the studies should help in managing the species in the rest of

# ACT State of the Environment Report 2011

their range and therefore have conservation implications beyond the direct impact areas of the development.

## Overgrazing

The remaining native grassy ecosystems of the ACT are of high conservation value for ecological communities because large areas of these lowland ecosystems elsewhere in the region have been cleared for agriculture and urban development. Overgrazing by rabbits, kangaroos and livestock are key threatening processes to the Territory's lowland native grassland sites (OCSE 2009). Kangaroos are a natural part of the native grassy ecosystems, but with the removal of natural controls such as dingoes and the provision of new areas of habitat through clearing, numbers of kangaroos have risen to a point where their grazing pressure puts other native species at risk (TAMS 2010b).

## Response indicators

The *Nature Conservation Act 1980* (ACT Government 2011a) establishes the ACT Flora and Fauna Committee, and assigns it responsibility for assessing the conservation status of the native flora and fauna of the ACT and the ecological significance of potentially threatening processes. As previously stated, there are currently no threatening processes declared under the Act.

If a threatening process were to be declared under the Nature Conservation Act, then an Action Plan would be developed to minimise the effect of that process threatening any species or ecological community. Identification and subsequent nomination of the most significant threatening processes in the ACT might therefore help the formation of strategic approaches to address them.

Threatening processes have been declared under both Commonwealth and NSW legislation. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (Australian Government 2011) lists 19 key threatening processes of which 9 have been identified as threats within Action Plans for threatened species in the ACT (Table 4). The NSW *Threatened Species Conservation Act 1995* (NSW Government 2011) lists 36 key threatening processes, 19 of which are relevant to the biodiversity of the ACT. It may be appropriate for such threatening processes to be examined for nomination under the ACT Nature Conservation Act.

# ACT State of the Environment Report 2011

Table 4. EPBC Act threatening processes identified in ACT Action Plans

Key Threatening Processes declared under the EPBC Act
<ul style="list-style-type: none"><li>• Competition and land degradation by rabbits</li><li>• Infection of amphibians with chytrid fungus resulting in chytridiomycosis</li><li>• Land clearance</li><li>• Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.</li><li>• Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases</li><li>• Predation by European Red Fox</li><li>• Predation by feral cats</li><li>• Predation, habitat degradation, competition and disease transmission by feral pigs</li><li>• Psittacine circoviral (beak and feather) disease affecting endangered psittacine species</li></ul>

Source: DSEWPaC 2009

## Climate change and biodiversity

In 2009, the Office of the Commissioner for Sustainability and the Environment commissioned a report on the implications of climate variability and change for the Canberra nature reserves (Webb 2011). The report recommends a series of response strategies including:

- maintaining and enhancing ecosystems processes and services;
- enhancing ecosystem resilience through diversity, refugia and connectivity;
- facilitating ecosystems and species development (including 'novel ecosystems');
- land use planning;
- fire management;
- integrated governance; and
- adaptive management.

A study examining landscape function in the ACT's reserve system (Sharp 2011) has also made findings and recommendations that should be considered in future planning for Nature Park management.

# ACT State of the Environment Report 2011

In 2010 a workshop titled ACT Climate Change Vulnerability and Adaptation - Knowledge Needs for Natural Resource Management, was held<sup>1</sup> to identify knowledge gaps and priorities for improving natural resources management during climate change. The workshop developed options for knowledge management, and also fostered relations between the institutions. Outcomes of this workshop should be integrated into adaptive management for natural resources in the ACT.

## Connectivity

The ACT Government commissioned the report *Ecological Connectivity for Climate Change in the ACT and Surrounding Region* (Manning et al. 2010), which provides a series of recommendations for enhancing connectivity in the ACT region. Specific locations in the ACT and region are identified where high priority should be given to maintaining or improving connectivity, and the report stresses the need to adopt whole-of-landscape connectivity as part of the planning process, irrespective of the tenure or use of the land. Other recommendations include the protection of scattered trees, anticipatory establishment or restoration of habitat, and assisted translocation in some cases. For more information see the *Ecological communities* indicator cluster paper.

Connectivity modelling is currently being conducted by researchers at the ANU for a range of planning purposes, including identifying connectivity corridors that could be included in the Canberra Spatial Plan, and conservation planning generally. Further work will contribute to woodland restoration in the ACT, and the location of restoration activity will be guided by the connectivity study. For more information on connectivity see the *Ecological communities* indicator cluster paper.

As discussed above, roads cut through the habitats of some native species and individuals are killed while crossing between habitat patches (TAMS 2010a). Mitigation measures such as the installation of underpasses with wing fences designed to funnel animals may help maintain connectivity and reduce the risk of native wildlife road deaths. Globally, this approach has been incorporated into many road systems, but the effectiveness of underpasses in the Australian context is yet to be proved (Rowden et al. 2008).

Underpasses and overpasses have been built into several new ACT road developments such as the Gungahlin Drive Extension and Majura Parkway. A

---

<sup>1</sup> co-hosted by the ACT Natural Resource Management Council (ACT NRM), the Australian National University (ANU) Climate Change Institute, and the ACT Government Department of the Environment, Climate Change, Energy and Water (DECCEW)

# ACT State of the Environment Report 2011

drawback associated with better connectivity is that it can also facilitate pest and weed dispersal, but the potential benefits to native species would appear to outweigh the potential costs: most pest and weed species in the ACT are already widespread.

## Firewood collection management

The *ACT Firewood Strategy 1999* promotes the use of fuelwood from mixed sources. Ideally, fuelwood should come from both hardwood plantations and softwood plantations, rather than native woodland outside ACT (collection within ACT not being permitted). Use of local plantation softwood and establishment of some fuelwood plantations could be part of a management strategy for woodland remnants, both in the ACT and in the region (ACT Government 1999). Potential air pollution and adverse health impacts from burning firewood should continue to be managed. See also the *Local air quality* indicator cluster paper.

Research into the location and characteristics of firewood source areas would improve understanding of the impacts of this process on both public and private lands. This research could be used to inform the community about the impacts of firewood collection on biodiversity, as well as the development of management strategies by government.

In addition it may be appropriate to decide whether on-the-spot fines should be issued for collecting fallen timber for use as firewood. The recent investigation into the ACT Government's tree management practices and the renewal of Canberra's urban forest (OCSE 2011) recommended developing a policy for sustainable reuse of timber, based on principles that include re-use of material from local urban trees, including for management and community purposes. Such a policy may help improve understanding of the use and management of wood collection in the ACT.

## Weed management

Key policies and legislation relating to weed management in the ACT are:

- the *Planning and Development Act 2007* (ACT Government 2011c), which provides for agreements between the Government and rural lessees;
- the *Pest Plants and Animals Act 2005* (ACT Government 2011b), which provides for the declaration of pest plants, the preparation of pest plant management plans, the notification of a notifiable pest plant, and the creation of offences for the propagation of prohibited pest plants; and
- the *ACT Weeds Strategy 2009-2019* (DECCEW 2009), which, together with its annual implementation plans, provides a coordinated approach to weed management across rural leases and land managed by the ACT Government.

# ACT State of the Environment Report 2011

Weed control targets specific weeds in specific locations via the Annual Weed Program. A class of plants may be declared to be pest plants, either generally or in a specified area. Once declared a pest, a plan for control of the propagation of the plants must be prepared.

The release and implementation of the *ACT Weeds Strategy 2009-2019* (DECCEW 2009) addresses one of the key recommendations of the *2007-08 ACT State of the Environment Report*. The Weeds Strategy gives priority to Weeds of National Significance (WoNS), and is guided both by the WoNS guidelines and the list of species declared under the ACT Pest Plants and Animals Act. Operational plans are currently being developed and updated.

Responsibility for managing pest plants in the ACT has been shared between ACT Parks and Conservation Service, Parks and City Services, ACT Planning and Land Authority and the Land Development Agency, with the Australian Government's National Capital Authority responsible for weeds on National Land. However, the recent restructure of the ACT management agencies into directorates under a single department may integrate the various ACT weeds management groups.

Effective implementation of weed control programs requires adequate support, coordination of action and ongoing resources. In recognition of this, the 2009-2019 strategy provided for the establishment of an ACT Land Managers Weeds Working Group (LMWWG) that is focused primarily on coordinating and implementing weed control programs across land management boundaries. To work with the LMWWG, a technical reference group has been established, which will give the LMWWG strategic direction and expert advice on weed matters.

Weed control programs are monitored using GPS-referenced photo points and mapping. The monitoring has shown a reduced cover of the priority weed species in targeted high conservation value areas. However, many other areas have shown an increase in weed cover (PCL 2009, 2010b). There has been some success in containing Mexican Feather Grass and African Fountain Grass. In high priority areas, the species and density of weeds since 2009 has been mapped and work is ongoing and expected to be included in future ACT Environmental Weed Control Operations Plans.

## **Pest management**

The *ACT Vertebrate Pest Management Strategy* (Environment ACT 2002) is the principal planning and management tool for the management of fauna pest species. This document incorporates national developments in a strategic approach to pest management, based on reduction of damage caused rather than a reduction in pest numbers as an end in itself.

# ACT State of the Environment Report 2011

A review of the pest management strategy is currently underway: the *Draft Pest Animal Management Strategy 2011-2021* (ESDD 2011) identifies production of Pest Animal Management Plans, consistent with national threat abatement plans, as a key strategic action. Pest Animal Management Plans are most likely to be beneficial where a coordinated pest management response is required from multiple stakeholders across one or more land uses, and they are essential where management practices need to be enforced (ESDD 2011). The *2011-12 Vertebrate Pest Management Plan* is being developed.

In line with recommendations of the *2007-08 ACT State of the Environment Report*, the ACT Government has continued existing programs to manage known pest animals and is undertaking work to monitor and control emerging pests such as European wasps and deer.

Rabbits remain a challenge, as identified in a recent report, *Managing Rabbits in Canberra Nature Park* (Williams 2011). They are a prime cause of degradation of Canberra Nature Park, but strategic rabbit control has been implemented on only 6 of the Canberra Nature Parks because of inadequate resourcing that has also generated managerial and operational problems (Williams 2011). The report recommends focusing on resourcing, management, knowledge and research as well as operational issues in managing rabbit impacts.

Feral pig control used to be assessed annually in Namadgi National Park by performance monitoring to examine the relationship between pig rooting and reduced plant species richness. That work concluded in 2000, but ACT Parks and Conservation Service plans to establish follow-on monitoring to assess the effectiveness of the new 1080 baiting program (ESDD 2011).

Indian Myna birds are being successfully reduced in number in the ACT, largely through the efforts of the community-based Canberra Indian Myna Action Group (CIMAG). The group, operating in the ACT since 2006, aims to reduce the impact of the highly invasive Indian Myna through increasing public awareness of the problems caused by this species and by a humane trapping program. More than 37,000 Indian Mynas have been removed since the program started in 2006, and data indicate the species has dropped from the third (in 2005-06) to the thirteenth most commonly recorded species in 2010. CIMAG has inspired the formation of other groups in NSW, Victoria and Queensland, and the Canberra group provides support for these interstate Myna control activities. The group has assisted ANU research into the impacts of Mynas on native species.

Further information on current control of pest species in the ACT and the management outlook is in Table A2 in the Annex.

# ACT State of the Environment Report 2011

As was recommended in the *2007-08 ACT State of the Environment Report*, the effectiveness of pest animal and weed control programs should be evaluated on their success in achieving biodiversity and catchment-management aims. Best practice pest management assesses the response of the protected ecosystem or species, rather than the number of pests. Such performance or outcome monitoring is not generally undertaken in the ACT; for example, indices of rabbit abundance use spotlight transects or counts of active entrances to warrens. It is recognised that the ACT has relatively large conservation areas and limited resources. Therefore, a plan of robust performance monitoring should be developed for pest control programs (Clayton and Cowan 2010, Reddiex et al. 2006), which would allow management efforts and limited resources to be strategically focused.

## Overabundant native species

Canberra is unusual in having large populations of free-ranging kangaroos in its urban areas. In the absence of natural predators such as dingoes, and with large areas of grazing habitat available because of land clearing for urbanisation and agriculture, kangaroo populations in some areas of the ACT have grown very large and caused ecological damage through overgrazing. Management needs to reduce the sizes of these populations and the impacts that overgrazing causes to the lowland native grasslands and grassy woodlands.

In response to community and scientific concern about the overabundance of kangaroos and associated ecological, social and economic impacts the ACT Government prepared the *ACT Kangaroo Management Plan* which was released in 2010 (TAMS 2010a). The plan represents a significant advance in kangaroo management in the ACT. Its completion fulfils a recommendation of the *2007-08 ACT State of the Environment Report*.

The plan sets out the approach to be adopted in maintaining wild populations of eastern grey kangaroos in the ACT while managing their various impacts and ensuring their welfare. Particular consideration is given to managing kangaroo grazing pressure on native grassy ecosystems in the context of grazing pressure from all herbivores.

The stated goals of kangaroo management in the ACT are to:

- maintain populations of kangaroos as a significant part of the fauna of the 'bush capital' and a component of the grassy ecosystems of the Territory; and
- manage and minimise the environmental, economic and social impacts of those kangaroo populations on other biota, grassy ecosystems, ACT residents and visitors.



# ACT State of the Environment Report 2011

It is important that monitoring is undertaken on the grassy ecosystems to determine the effect of managing kangaroo grazing. See the *Native species - fauna* indicator cluster paper for more information.

## Fire management and ecology

### Strategic planning

In 2009 a second version of the *Strategic Bushfire Management Plan for the ACT* was produced by the ACT Emergency Services Authority and ACT Territory and Municipal Services (ACT Government 2009). The plan provides a framework and lists actions to address the bushfire risk in the ACT, with this goal:

*Through Government and the community working together, suppress bushfires and reduce their consequences on human life, property and the environment.*

Bushfires are strategically managed or prevented in the ACT via bushfire management zoning. ACT-wide zoning maps are included in the Strategic Bushfire Management Plan, for all tenures. The plan allocates areas of land to particular zones with measurable treatment standards.

This approach makes it possible to clearly identify areas where the primary aim of fire management is to satisfy ecological requirements, so appropriate management strategies can be applied. Appropriate fire frequencies are determined using ecological thresholds.

Details of prescriptions and specific actions to be undertaken for particular areas of the ACT are contained in Regional Fire Management Plans developed by the ACT Government in consultation with the community. These plans are reviewed annually and identify target inter-fire intervals for ecological protection of different vegetation types following the initial planned burn. They also identify fire exclusion areas.

### Monitoring

Annual surveys, which record potential changes in vegetation composition and structure as a consequence of prescribed burning, inform future management decisions and monitor biodiversity impacts of prescribed burns in the ACT. The ACT Government has been operating this program of surveys since 2005. In 2010, the team monitored 7 sites: 4 were prescribed burn sites where new survey sites were established, 2 were ongoing monitoring sites, and 1 was a long-term monitoring project.

# ACT State of the Environment Report 2011

Monitoring methods include Landscape Function Analysis and a rapid assessment survey. Landscape Function Analysis is a relatively new technique that focuses on soil characteristics. The rapid assessment includes photo monitoring sites.

A long-term monitoring project known as the Piccadilly Fire Ecology Project is looking at the interactions between fire and Snow Gum Woodland communities. The project spans 36 years and includes data from planned and unplanned fires. Results from the first 20 years of data indicate that the community is very resilient to repeated low intensity fires. Since 2008, monitoring undertaken by the ACT Government has collected data on the impacts of the devastating high-intensity fire of 2003. Trends emerging include some evidence of a decline in plant cover abundance under frequent fire regimes. The study indicates that this community may still decline under the 8-10 year fire frequency thought to be suitable for its recovery.

The impacts of other forms of hazard reduction in ecosystems, such as slashing or mowing, are not currently monitored to assess ecological outcomes and enable adaptive management, in the same way as prescribed burns are. Slashing and grazing are more likely to introduce or spread weeds than prescribed burns. Inappropriate mowing regimes have been identified as a key threatening process affecting lowland native grassland sites in the ACT (OCSE 2009). Information on the impacts of all forms of fuel reduction on the ecosystems of the ACT is required, to enable adaptive management and to develop appropriate annual site-operation plans for key sites such as lowland native grasslands. An ability to manage hazard-reduction activities in an ecologically sensitive manner is of increasing significance because of the predicted increase in fire frequency and intensity as a result of climate change.

## **Minimising risks to biodiversity**

To minimise the risk of ecosystem impacts from fuel reduction activities, ecological guidelines have been prepared for the conduct of prescribed burns in the ACT. The guidelines include additional requirements to protect threatened and sensitive species (Table 5).

# ACT State of the Environment Report 2011

Table 5. Specified fuel reduction activities in the ACT

Flora/Vegetation		Fauna	
Species	Requirements	Species	Requirements
Black Cypress Pine ( <i>Callitris endlicheri</i> )	As far as possible, this species must not be burnt.	Northern Corroboree Frog ( <i>Pseudophryne pengeilleyi</i> )	Every practical measure is to be taken to protect this species and its habitat from burning.
Baeuerlen's Gentian ( <i>Gentiana baeuerlenii</i> )	This species must not be burnt.	Smoky Mouse ( <i>Pseudomys fumeus</i> )	Every practical measure is to be taken to protect this species and its habitat from burning.
Button Wrinklewort ( <i>Rutidosis leptorrhynchoides</i> )	Restrict fires to December to March.	Grassland lizards (Grassland Earless Dragon <i>Tympanocryptis pinguicolla</i> , Striped Legless Lizard <i>Delmar impar</i> , Pink-tailed Worm Lizard <i>Aprasia parapulchella</i> )	Slashing is to be preferred to burning. Where burns are undertaken, they must be low-intensity and patchy. Preferably they should be undertaken in September-October (to avoid breeding season in summer) or March-April (to preserve winter vegetation cover).
Canberra Spider Orchid ( <i>Arachnorchis actensis</i> )	As far as possible, burning of this species must be avoided.	Golden Sun Moth ( <i>Synemon plana</i> )	Every practical measure is to be taken to protect mapped Golden Sun Moth areas. Surrounding areas must not be burnt between November and February.
Tarengo Leek Orchid ( <i>Prasophyllum petilum</i> )	Every practical measure is to be taken to protect this species from burning.	Nesting birds	Areas with significant numbers of trees and/or shrubs must not be burnt during September-November.
Tuggeranong Lignum ( <i>Muehlenbeckia tuggeranong</i> )	Every practical measure is to be taken to protect this species from burning.		
Showy Parrot-pea ( <i>Dillwynia sericea</i> )	Burn with high-intensity fire to encourage seed germination. Minimise low-intensity prescribed burning.		

# ACT State of the Environment Report 2011

Flora/Vegetation		Fauna	
Riparian management zones (as defined in the Code of Forest Practice)	<p>Every practical measure is to be taken to prevent burning. If burning occurs, fire retardant or fire fighting foam must not enter any stream and must not be used within 50 m of any stream containing threatened fish.</p> <p>Sediment and erosion controls should be assessed following burning to protect riparian areas. Where required, these should be in accordance with Environment Protection guidelines.</p>		

Source: 2009-10 Burning Operational Plan - Ecological Guidelines Specified Conservation Actions

## Post fire recovery

In partnership with NSW, a Burned Area Assessment Team (BAAT) has been developed by TAMS in line with global best practice. This post-fire recovery team, including specialists in flora, fauna, flooding and erosion, assets and cultural heritage, was deployed during the 2010-11 fire season as a pilot project. The BAAT should facilitate rapid and strategic remediation activities following wildfires. There have been no significant fires since the establishment of the BAAT team.

Rapid response to a wildfire in southern Namadgi National Park in 2007-08 reduced the extent of the burn to 5 ha but the use of a bulldozer containment line created the need for post-fire rehabilitation work. Full track rehabilitation used a systematic approach, applied rapidly after the wildfire had been suppressed. In 2009, ACT Government staff revisited the site to assess the success of the rehabilitation works. The key findings were that the site was stable with very little evidence of soil loss and that vegetation of a similar composition to the original vegetation was re-establishing on the track. The recovery work is considered effective and the technique has been subsequently used to rehabilitate a post-fire site on Blundell's Road in Namadgi National Park.

## Species recovery

Fire can be an important tool in the recovery of threatened species. In the *2010-11 Burning Operational Plan* a burn is planned at the site of a threatened annual herb Baeuerlen's Gentian (*Gentiana baeuerlenii*). Despite monitoring the population of this plant since 1991, it has not been seen for over 12 years. If specimens are not detected

# ACT State of the Environment Report 2011

during the 2011 survey season a prescribed burn will take place with the objective of triggering germination of any seed that may persist at the site.

Prescribed burning is a proposed management action for the Small Purple Pea (*Swainsona recta*), listed as a threatened species in the ACT. Monitoring has failed to detect any recruitment of this species at one of the 5 sites that support this species in the ACT. A prescribed burn is thought likely to promote seedling recruitment, and may be undertaken in the future.

## Glossary

**Biodiversity:** Biodiversity is the variability among living organisms from all sources (including terrestrial, aquatic, marine and other ecosystems and the ecological complexes of which they are part), at all levels of organisation, including genetic diversity, species diversity and ecosystem diversity

**Ecological community:** Ecological communities are naturally occurring groups of plants and animals. Their species composition can be determined by factors such as soil type, position in the landscape, climate and water availability.

**Ecosystem:** An ecosystem is a dynamic combination of plant, animal and micro-organism communities and their non-living environment (e.g. soil, water and the climatic regime) interacting as a functional unit. Examples of types of ecosystems include forests, wetlands, grasslands and tundra.

**Environmental weed:** Plant species not native to Australia and horticultural species that have escaped from cultivation

**Habitat fragmentation:** The result of removal (usually by clearing) of large parts of a natural area, resulting in the retention of only small parts (fragments or remnants) of habitat

**Performance monitoring:** Monitoring changes in pest or native animal impacts, or in their abundance or distribution, with the aim of evaluating management program success against established performance criteria and criteria for failure

**Pest animal:** an animal that causes more damage than good to a valued resource

**Species:** A level of biological classification comprising one or more populations of individuals capable of interbreeding to produce fertile offspring

**Threatening Process:** In relation to a species or ecological community, a process that threatens, or may threaten, the survival, abundance or evolution of the species or community and includes the spreading of a pest animal or pest plant

# ACT State of the Environment Report 2011

**Weed:** A terrestrial or aquatic species of non-native or native plant that is harmful to the natural environment (ecosystems/biodiversity), agriculture and other industries, or public amenity and health ACT

## References

- ACT Government 1999. *Yellow Box/Red Gum Grassy Woodland: An Endangered Ecological Community - Action Plan No. 10*. Environment ACT. ACT Government. Canberra  
[http://www.environment.act.gov.au/\\_\\_data/assets/pdf\\_file/0003/234480/actionplans10.pdf](http://www.environment.act.gov.au/__data/assets/pdf_file/0003/234480/actionplans10.pdf) (accessed 11/12/11)
- ACT Government 2009. *Strategic Bushfire Management Plan for the ACT: Version 2*. Territory and Municipal Services. ACT Government. Canberra.  
<http://www.esa.act.gov.au/wp-content/uploads/2011/08/act-sbmp-version-two.pdf> (accessed 1/12/11)
- ACT Government 2011a. *ACT Nature Conservation Act 1980*. Canberra.  
<http://www.legislation.act.gov.au/a/1980-20/current/pdf/1980-20.pdf> (accessed 28/5/11)
- ACT Government 2011b. *Pest Plants and Animals (Pest plants) Declaration 2009 (No 1)*. Canberra. <http://www.legislation.act.gov.au/di/2009-67/default.asp> (accessed 16/5/11)
- ACT Government 2011c. *Planning and Development ACT 2007*. Effective 21 September 2011. Canberra. <http://www.legislation.act.gov.au/a/2007-24/current/pdf/2007-24.pdf> (accessed 1/12/11)
- ACT NRM Council 2009. *Bush Capital Legacy: ACT Natural Resource Management Plan*. ACT Natural Resource Management Council. Canberra.  
<http://actnrmcouncil.org.au/files/NRMplan.pdf> (accessed 1/12/11)
- Australian Government 2011. *Environment Protection and Biodiversity Conservation Act 1999*. Effective 21 September 2011. Canberra.  
<http://www.comlaw.gov.au/Details/C2011C00751/5b28cad4-483a-4028-ada3-196a4fc7230a> (accessed 1/12/11)
- BoM 2011. *Climate Classification Maps: Seasonal Rainfall, Major Zones*. Bureau of Meteorology. Australian Government. Canberra.  
[http://www.bom.gov.au/jsp/ncc/climate\\_averages/climate-classifications/index.jsp?mctype=seasgrpb](http://www.bom.gov.au/jsp/ncc/climate_averages/climate-classifications/index.jsp?mctype=seasgrpb) (accessed 11/12/11)
- Cary, G. 2002. Importance of a Changing Climate for Fire Regimes in Australia. In: R. A. Bradstock, Williams, J.E. and Gill, M.E. Cambridge (eds). *Flammable Australia: the Fire Regimes and Biodiversity of a Continent*. Cambridge University Press
- Chessman, B. 2009. Climatic Changes and 13 Year Trends in Stream Macroinvertebrate Assemblages in New South Wales, Australia. *Global Change Biology*. 15(11):2791–2802
- Clayton, R. and Cowan, P. 2010. Management of Animal and Plant Pests in New Zealand – Patterns of Control and Monitoring By Regional Agencies. *Wildlife Research* 37:360–371

# ACT State of the Environment Report 2011

- Davey, C. 2010. The Distribution, Abundance and Breeding Status of the Superb Parrot *Polytelis swainsonii* During The 2009-10 Breeding Season. *Canberra Bird Notes* 35(3), December 2010. Gungahlin. ACT. <http://cbn.canberrabirds.org.au/> (accessed 11/11/11)
- DECCEW 2009. *ACT Weeds Strategy 2009-2019 – Policy: Natural Environment*. Department of the Environment, Climate Change, Energy and Water. ACT Government. Canberra [http://www.environment.act.gov.au/\\_\\_data/assets/pdf\\_file/0003/157026/WEED\\_STRATEGY\\_web\\_version.pdf](http://www.environment.act.gov.au/__data/assets/pdf_file/0003/157026/WEED_STRATEGY_web_version.pdf) (accessed 1/12/11)
- DECCEW 2010. *Review of the Nature Conservation Act 1980, Enhancing Nature Conservation in the Australian Capital Territory*. Department of Environment, Climate Change, Energy and Water. ACT Government. Canberra. [http://www.environment.act.gov.au/\\_\\_data/assets/pdf\\_file/0005/209984/Review\\_of\\_the\\_Nature\\_Conservation\\_Act\\_Discussion\\_Paper\\_WEB.pdf](http://www.environment.act.gov.au/__data/assets/pdf_file/0005/209984/Review_of_the_Nature_Conservation_Act_Discussion_Paper_WEB.pdf) (accessed 2/8/11)
- DECCW 2010. *Priorities for Biodiversity Adaptation to Climate Change Statement of Intent in Response to the Listing of Anthropogenic Climate Change as a Key Threatening Process Under the NSW Threatened Species Conservation Act 1995*. Department of Environment, Climate Change and Water. NSW Government. Sydney. <http://www.environment.nsw.gov.au/resources/biodiversity/10771prioritiesbioadaptc.pdf> (accessed 1/12/11)
- DSEWPaC 2009. *Listed Key Threatening Processes*. Biodiversity. Department of Sustainability, Environment, Water, Population and Communities. Australian Government. <http://www.environment.gov.au/cgi-bin/sprat/public/publicgetkeythreats.pl> (accessed 12/3/11)
- Environment ACT 2002. *ACT Vertebrate Pest Management Strategy*. Department of Urban Services. ACT Government. Canberra [http://www.tams.act.gov.au/\\_\\_data/assets/pdf\\_file/0015/13425/vertpestmgmtstrategy.pdf](http://www.tams.act.gov.au/__data/assets/pdf_file/0015/13425/vertpestmgmtstrategy.pdf) (accessed 1/12/11)
- ESDD 2011. *Draft ACT Pest Animal Management Strategy 2011–2021*. Environment and Sustainable Development Directorate. ACT Government. Canberra [http://www.environment.act.gov.au/\\_\\_data/assets/pdf\\_file/0010/229879/PAMS\\_2011-12\\_WEB.pdf](http://www.environment.act.gov.au/__data/assets/pdf_file/0010/229879/PAMS_2011-12_WEB.pdf) (accessed 5/9/11)
- Green, K. 2003. *Impacts of Global Warming on the Snowy Mountains*. In Howden, M., Hughes, L., Dunlop, M., Zethoven, I., Hilbert, D. and Chilcott, C. (eds.). *Climate Change Impacts on Biodiversity in Australia*. Australian Government. Canberra
- Hobbs, R.J., et al. 2006. Novel ecosystems: Theoretical and Management Aspects of the New Ecological World Order. *Global Ecology and Biogeography*. 15 : 1-7
- Hughes, L., Hobbs, R., Hopkins, A., McDonald, J., Stafford Smith, M., Steffen, W., Williams, S. E., and Stadler, F. 2010. *National Climate Change Adaptation Research Plan: Terrestrial Biodiversity*. National Climate Change Adaptation Research Facility. Gold Coast. [http://www.nccarf.edu.au/sites/default/files/NCCARF%20terrestrial%20biodiversity%20OC\(1\).pdf](http://www.nccarf.edu.au/sites/default/files/NCCARF%20terrestrial%20biodiversity%20OC(1).pdf) (accessed 1/12/11)
- Lindenmayer, D.B. 2008. Temporal Changes in Vertebrates During Landscape Transformation: A Large-scale "Natural experiment". *Ecological Monographs*. 78 pp. 567-590
- Low, T. 2007. The State of Australia's Birds 2007: Birds in a Changing Climate. *Wingspan*. 14. 4:18-22

# ACT State of the Environment Report 2011

- Low, T. 2008. *Climate Change and Invasive Species: A Review of Interactions*. Workshop Report. Biological Diversity Advisory Committee. Department of Sustainability, Environment, Water, Population and Communities. Australian Government. Canberra. <http://www.environment.gov.au/biodiversity/publications/pubs/interactions-cc-invasive.pdf> (accessed 1/12/11)
- Manning, A.D., Shorthouse, D.J., Stein, J.L. and Stein, J.A. 2010. *Technical Report 21: Ecological Connectivity for Climate Change in the ACT and Surrounding Region*. Fenner School of Environment and Society. Australian National University. Canberra
- Medlyn, B., Zeppel, M., Brouwers, N., Howard, K., O’Gara, E., Hardy, G., Lyons, T., Li, L. and Evans, B. 2010. *An Assessment of the Vulnerability of Australian Forests to the Impacts of Climate Change*. National Climate Change Adaptation Research Facility. Gold Coast
- NRMCC 2010. Australian Government Natural Resources Management Ministerial Council. [http://www.mincos.gov.au/about\\_nrmmc](http://www.mincos.gov.au/about_nrmmc) (accessed 11/8/11)
- NSW Government 2010. *NSW Climate Impact Profile*. Department of Environment, Climate Change and Water. Sydney <http://www.environment.nsw.gov.au/resources/climatechange/10171climateimpactprofile.pdf> (accessed 1/12/11)
- NSW Government 2011. *Threatened Species Conservation Act 1995*. Current for 25 November 2011. Sydney. <http://www.legislation.nsw.gov.au/viewtop/inforce/act+101+1995+FIRST+0+N> (accessed 1/12/11)
- OCSE 2009. *Report on ACT Lowland Native Grassland Investigation*. Office of the Commissioner for Sustainability and the Environment. Canberra [http://www.envcomm.act.gov.au/\\_\\_data/assets/pdf\\_file/0011/169256/ocse\\_actgrasslandreport\\_0309\\_noappendices.pdf](http://www.envcomm.act.gov.au/__data/assets/pdf_file/0011/169256/ocse_actgrasslandreport_0309_noappendices.pdf) (accessed 1/12/11)
- OCSE 2011. *Report on the Investigation into the Government’s Tree Management Practices and the Renewal of Canberra’s Urban Forest*. Office of the Commissioner of Sustainability and the Environment. Canberra [http://www.envcomm.act.gov.au/\\_\\_data/assets/pdf\\_file/0006/219354/OCSE\\_TreeInvestigation\\_Part1\\_ReportV5\\_28February2011.pdf](http://www.envcomm.act.gov.au/__data/assets/pdf_file/0006/219354/OCSE_TreeInvestigation_Part1_ReportV5_28February2011.pdf) (accessed 13/12/11)
- PCL 2009. *ACT Environmental Weed Control Operations Plan*. Parks, Conservation and Lands. Territory and Municipal Services. ACT Government. Canberra.
- PCL 2010a. *Weeds & Invertebrate Pest Management Guidelines*, Parks, Conservation and Lands. Department of Territory and Municipal Services. ACT Government. Canberra. [http://www.tams.act.gov.au/\\_\\_data/assets/pdf\\_file/0017/219050/eWeed\\_Management\\_Guidelines.pdf](http://www.tams.act.gov.au/__data/assets/pdf_file/0017/219050/eWeed_Management_Guidelines.pdf) (accessed 1/12/11)
- PCL 2010b. *Environmental Weed Annual Report 2009-10*. Parks, Conservation and Lands. Department of Territory and Municipal Services. ACT Government. Canberra.
- Peters, R.L. 1990. Effects of Global Warming on Forests. *Forest Ecology & Management*. 35: 13-33
- Pickering, C.M., Good, R.A. and Green K. 2004. *The Ecological Impacts of Global Warming: Potential Effects of Global Warming on the Biota of the Australian Alps*. Australian Greenhouse Office. Department of the Environment, Water, Heritage and the Arts. Australian Government. Canberra



# ACT State of the Environment Report 2011

- Prober, S.M., Hilbert, D., Ferrier, S. and Dunlop, M. 2010. *The Implications of Climate Change for Biodiversity, Conservation and the National Reserve System: Temperate Grasslands and Grassy Woodlands*. Report by CSIRO Climate Adaptation Flagship for the Commonwealth Department of Environment, Water, Heritage and the Arts. Canberra.
- Reddiex, B., Forsyth, D.M., McDonald-Madden, E., Einoder, L.D., Griffioen, P.A., Chick, R.R., and Robley, A.J. 2006. Control of Pest Mammals for Biodiversity Protection in Australia - Patterns of Control and Monitoring. *Wildlife Research*. 33:691–709.
- Rowden P., Steinhardt D. and Sheehan M. 2008. Road Crashes Involving Animals in Australia. *Accident Analysis and Prevention*. 40:1865–1871.
- Sharp, S., Evans, L., Evans, M. and Kitchin, M. 2008. Climate Change and Biodiversity: What Are the Challenges for the ACT. In McCue, K. and Lenz, S. (eds). *Corridors for Survival in A Changing World*. Proceedings of the NPA ACT Symposium. May 2008. National Parks Association ACT. Canberra
- Sharp, S. 2011. *Landscape Function in Canberra Nature Park and Impacts of Threatening Processes on Landscape Function*. Report for the ACT Office of the Commissioner for Sustainability and the Environment. Canberra
- TAMS 2006. *Action Plans: Action Plans for Protecting Threatened Species and Ecological Communities in the ACT*. Territory and Municipal Services. ACT Government. Canberra. [http://www.tams.act.gov.au/play/pcl/conservation\\_and\\_ecological\\_communities/threatened\\_species\\_action\\_plans](http://www.tams.act.gov.au/play/pcl/conservation_and_ecological_communities/threatened_species_action_plans) (accessed 11/12/11)
- TAMS 2008. *Annual Report 2007-08*. Territory and Municipal Services. ACT Government. Canberra. [https://secure.ausport.gov.au/\\_\\_data/assets/pdf\\_file/0009/382149/ACT\\_TAMS\\_AR\\_2007-2008.pdf](https://secure.ausport.gov.au/__data/assets/pdf_file/0009/382149/ACT_TAMS_AR_2007-2008.pdf) (accessed 14/4/11)
- TAMS 2009. *Annual Report 2008-09*. Territory and Municipal Services. ACT Government. Canberra. [https://secure.ausport.gov.au/\\_\\_data/assets/pdf\\_file/0020/382151/ACT\\_TAMS\\_AR\\_2008-2009.pdf](https://secure.ausport.gov.au/__data/assets/pdf_file/0020/382151/ACT_TAMS_AR_2008-2009.pdf) (accessed 14/4/11)
- TAMS 2010a. *ACT Lowland Woodland Conservation Strategy – Action Plan 27 Implementation Report*. Territory and Municipal Services. ACT Government. Canberra
- TAMS 2010b. *ACT Kangaroo Management Plan*. Department of Territory and Municipal Services. ACT Government. Canberra [http://www.tams.act.gov.au/\\_\\_data/assets/pdf\\_file/0006/186378/Kangaroo\\_Management\\_Plan\\_complete\\_for\\_web.pdf](http://www.tams.act.gov.au/__data/assets/pdf_file/0006/186378/Kangaroo_Management_Plan_complete_for_web.pdf) (accessed 1/12/11)
- Webb, B. 2011. *Impacts of Climate on the Canberra Nature Park: Risks and Responses*. Report for the ACT Office of the Commissioner for Sustainability and the Environment. Canberra [http://www.envcomm.act.gov.au/\\_\\_data/assets/pdf\\_file/0004/220477/OCSE\\_ANU\\_per\\_climate\\_CNP.pdf](http://www.envcomm.act.gov.au/__data/assets/pdf_file/0004/220477/OCSE_ANU_per_climate_CNP.pdf) (accessed 1/12/11)
- Williams, K., 2011. *Managing Rabbits in Canberra Nature Park*. A Report to the Office of the Commissioner for Sustainability and the Environment. Canberra [http://www.environmentcommissioner.act.gov.au/\\_\\_data/assets/pdf\\_file/0005/220478/OCSE\\_managing\\_rabbits\\_CNP.pdf](http://www.environmentcommissioner.act.gov.au/__data/assets/pdf_file/0005/220478/OCSE_managing_rabbits_CNP.pdf) (accessed 1/12/11)

# ACT State of the Environment Report 2011

Wormworth, J. and Mallon, K. 2006. *Bird Species and Climate Change*. Climate Risk Pty Ltd.  
<http://www.worldwildlife.org/climate/Publications/WWFBinaryitem7659.pdf> (accessed 1/12/11)

## Other data sources

In addition to these published reports, data for this paper were also sourced from:

ACT Department of Territory and Municipal Services (TAMS) - -now Territory and Municipal Services Directorate (TAMSD)

ACT Natural Resource Management Council (ACT NRMC)

ACT Parks, Conservation and Land (PCL) - now part of the Environment and Sustainable Development Directorate (ESDD)

Australian Government Natural Resources Management Ministerial Council (NRMMC)

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC)

Greening Australia

NSW Department of Energy, Climate Change and Water (DECCW)

# ACT State of the Environment Report 2011

## Annex

Table A1. Summary of ACT Parks weed management moving towards the 2019 targets

Environmental weed species and 2019 target	Location	Snapshot of 2009 cover	2009-10 status or change since 2008-09	Comments
Mexican Feather Grass Target: Eradicate	Bendora Dam	Rare	Contained	
Spotted Knapweed, Madagascan Fireweed Target: Eradicate	Cotter Rd, Sulwood Dr	Rare	Eradicated	
Giant Willowherb Target: Eradicate	Gungahlin Pond	Uncommon	Contained	
Artichoke Thistle Target: Eradicate	Greenhills	Rare	Contained	
Madagascan Fireweed Target: Eradicate	Commonwealth Park	Rare	Eradicated	
Serrated Tussock, St John's Wort, African Lovegrass, Chilean Needlegrass Target: Reduce to isolated infestations	Canberra Nature Park, Namadgi National Park, Googong Foreshores, Tidbinbilla Nature Reserve	Uncommon	Reduced % cover	Exceptions: At Mt Pleasant Nature Reserve, Serrated Tussock and Chilean Needlegrass % cover have increased. African Lovegrass cover has increased at Tuggeranong Hill, Mt Taylor, Oakey Hill and Urambi Hills nature reserves.
Serrated Tussock, St John's Wort, African Lovegrass, Chilean Needlegrass Target: Reduce to isolated infestations	Agistments: Mugga-Mugga, Canberra Ave, Amtech, Molonglo-Coppins, Abattoir Holding Paddocks, Gungahlin 1 & 2 and One Tree Hill	Uncommon to Sub-dominant	Mixed results	Mixed results: % cover has increased at some agistments. For example African Lovegrass is sub-dominant at the Abattoir Holding Paddocks.

# ACT State of the Environment Report 2011

Environmental weed species and 2019 target	Location	Snapshot of 2009 cover	2009-10 status or change since 2008-09	Comments
Serrated Tussock, African Lovegrass, Chilean Needlegrass Target: Reduce to isolated infestations	Urban Open Space	Common to Dominant	Increased % cover	An example is the Watson powerlines corridor near Watson Woodlands and Mt Majura Nature Reserve.
Serrated Tussock, St John's Wort, African Lovegrass, Chilean Needlegrass: Target: Reduce to isolated infestations	Targeted rural roadsides	Uncommon to Sub-dominant	Reduced % cover	An exception is African Lovegrass. Its rapid rate of spread has been favoured by roadside mowing. Lack of resources for urban roadsides has allowed % cover to increase.
African Lovegrass, Chilean Needlegrass Target: Reduce % cover	Lower Molonglo River, Urban Waterways	Common to Dominant	Increased % cover	A very large increase in resources would be needed to contain the spread.
Alligator Weed Target: Reduce % cover	Yerabi Pond, Lake Ginninderra	Uncommon	Reduced % cover	
Serrated Tussock, St John's Wort, African Lovegrass, Chilean Needlegrass Target: Reduce % cover	Umbagog Districk Park, Non-reserve Priority 1-2 Urban Grasslands, Mt Rogers, Kowen Forest	Common	Reduced % cover	Kowen Forest will need an increase in control work in harvested areas - the loss of forest canopy leads to a increased % cover of Serrated Tussock.
Chilean Needlegrass, Serrated Tussock, African Lovegrass Target: Reduce % cover	Urban parks and open space	Common to Dominant	Increased % cover	

# ACT State of the Environment Report 2011

Environmental weed species and 2019 target	Location	Snapshot of 2009 cover	2009-10 status or change since 2008-09	Comments
Blackberry, Sweet Briar, Broom, Potentilla, Other Woody Weeds Target: Reduce % cover	Canberra Nature Park, Namadgi National Park, Tidbinbilla, Swamp Creek, Woodstock, Stony Creek, Bullen Range and Gigerline nature reserves, Lower Cotter Catchment	Rare to Common	Reduced % cover	Common in Canberra Nature Parks - Mt Pleasant and some former grazing properties on reserved land.
Sweet Briar, Bathurst Burr, Blackberry, Hawthorn, Crack Willow and Boxthorn Target: Reduce % cover	Agistments: Mugga-Mugga, Canberra Ave, Amtech, Molonglo-Coppins, Abattoir Holding Paddocks, Gungahlin 1 & 2 and One Tree Hill	Rare to Common	Reduced % cover	
Cotoneaster, Firethorn Target: Reduce % cover	Numerous urban parks, e.g. RSL Park Campbell	Uncommon to Common	Increased % cover	
Blackberry, Sweet Briar Target: Reduce % cover	Targeted rural roads	Uncommon to Common	Reduced % cover	
Blackberry, Cootamundra Wattle Target: Reduce % cover	Urban arterial rural roads	Common to Dominant	Increased % cover	Exception: Cootamundra Wattle spread on some urban arterial roadsides corridors is being contained by the Bushfire Operation Plan works program.

# ACT State of the Environment Report 2011

Environmental weed species and 2019 target	Location	Snapshot of 2009 cover	2009-10 status or change since 2008-09	Comments
Black Willow, Black Alder, Crack Willow, Blackberry Target: Reduce % cover	Molonglo Gorge Forest Reserve, Lower Molonglo Nature Reserve, Molonglo Reach, Westbourne Woods, Riparian sections of Swamp Creek, Woodstock, Stony Creek, Bullen Range and Gigerline nature reserves	Common to Dominant	Reduced % cover	Exceptions include the following sections of the Molonglo River: Oaks estate to Fyshwick, Pialligo, Scrivener Dam to Greenhills and Jerrabomberra Wetlands Nature Reserve (work will be done in 2010-11).
Blackberry, Broom, Cootamundra Wattle, Cotoneaster, Firethorn, Hawthorn Target: Reduce % cover	Urban open space areas, Pierces Creek Forest, Kowen Forest	Common to Dominant	Increased % cover	Blackberry control will need to increase in Pierces Creek and Kowen forests to keep up with the rapid rate of spread. Exceptions are where the Bushfire Operations Plan has targeted woody weeds in high fire risk areas. At these sites cover has been reduced.
Nodding Thistle, Paterson's Curse, Viper's Bugloss, Verbascum Target: Reduce % cover	Namadgi NP, Tidbinbilla Nature Reserve, Canberra Nature Park	Uncommon to Common	Mixed results	These broadleaf weeds have large fluctuations in % cover with seasonal conditions. Common on the former grazing properties in reserved land, and along disturbed areas such as roadsides and fire trails.

# ACT State of the Environment Report 2011

Environmental weed species and 2019 target	Location	Snapshot of 2009 cover	2009-10 status or change since 2008-09	Comments
Paterson's Curse, Thistles Target: Reduce % cover	Agistments: Mugga-Mugga, Canberra Ave, Amtech, Molonglo-Coppins, Abattoir Holding Paddocks, Gungahlin 1 & 2 and One Tree Hill	Uncommon to Common	Mixed results	
Caltrop, Khaki Weed Target: Reduce % cover	Open Space Areas eg. From Tuggeranong Open Space to Point Hut Crossing Car park	Uncommon to Dominant	Increased % cover	Exceptions are where City Parks - La-Trobe Depot staff have contained the spread of Caltrop.
Broadleaf weed species Target: Reduce % cover	Urban Arterial roadsides	Common to Dominant	Increased % cover	Highly disturbed sites - which favours spread of broadleaf weeds, eg. Thistles, Paterson's Curse, Capeweed, Caltrop.
Nodding Thistle, Viper's Bugloss Target: Reduce % cover	Boboyan Rd	Uncommon to Common	Reduced % cover	
Broadleaf weed species Target: Reduce % cover	Riparian areas	Common to Dominant	Mixed results	Thistles and Verbascum increase and decrease with seasonal flows and are not usually targeted for control work in these environments.

Source: ACT PCL 2010b

# ACT State of the Environment Report 2011

Table A2. Current pest control actions in the ACT

Species	Current management and monitoring practices	Outlook
European Rabbit	<ul style="list-style-type: none"> <li>• Management programs are conducted at the landscape scale, involving all adjoining land managers.</li> <li>• Pre and post-management monitoring conducted to assess effectiveness of control programs.</li> <li>• Long-term spotlight monitoring of populations conducted in Namadgi National Park (Namadgi National Park), Tidbinbilla Nature Reserve (Tidbinbilla) and Googong Foreshores.</li> <li>• Cooperative, targeted community involvement in mapping and/or monitoring of rabbit populations.</li> <li>• Where terrain limits physical control actions the objective will be to reduce abundance to the 'low equilibrium range' where predators will tend to keep rabbit numbers low.</li> </ul>	<ul style="list-style-type: none"> <li>• Continuing participation in the national Rabbit Haemorrhagic Disease (RHD) program by supply of RHD-infected carcasses and testing of new RHD strains as they are developed.</li> <li>• Maintain community participation in mapping/monitoring of rabbit populations.</li> <li>• Stay aware of new and emerging technologies, e.g. carbon monoxide pressure fumigator being developed by the Invasive Animals CRC.</li> </ul>
European Red Fox	<ul style="list-style-type: none"> <li>• 1080 baiting programs undertaken in high-conservation, non-urban parks and reserves to reduce impacts on native species and neighbouring sheep-breeding enterprises.</li> <li>• Mulligans Flat Sanctuary maintained as fox-free area.</li> </ul>	<ul style="list-style-type: none"> <li>• Participate in site-based research programs on fox biology or new control methods.</li> <li>• Improved coordination of control programs across differing land tenures.</li> <li>• Implications for Brush-tailed Rock Wallabies need to be evaluated if their re-introduction is contemplated.</li> </ul>
Dingo/Wild Dog	<ul style="list-style-type: none"> <li>• 1080 baiting, 1080 ejectors and trapping occur in a control area of several kilometres between sheep-growing areas and parks and reserves.</li> <li>• Cooperative cross-border dog/fox management plans undertaken with NSW.</li> <li>• Sand-pad monitoring is used to assess effectiveness of management in buffer zone areas in southern Namadgi National Park.</li> <li>• Information signs about wild dog biology and behaviour erected at locations where park visitors are most likely to encounter wild</li> </ul>	<ul style="list-style-type: none"> <li>• Wider use of 1080 ejectors to improve cost effectiveness of baiting.</li> <li>• Seek further opportunities for collaborative research on movement patterns, the dingo's role in ecosystems, genetic integrity and control techniques.</li> <li>• Improve effectiveness of wild dog management by seeking further landholder participation in cooperative</li> </ul>



# ACT State of the Environment Report 2011

Species	Current management and monitoring practices	Outlook
	<p>dogs.</p> <ul style="list-style-type: none"> <li>• Australian Alps wild dog fact sheet available at visitor centres and on display boards at camp sites/toilets.</li> <li>• Promotion and education that wild dogs are performing function of top order predator in protected area landscapes.</li> </ul>	<p>wild dog management programs and on-farm stock protection via fencing and guardian animals.</p> <ul style="list-style-type: none"> <li>• Investigate use of remote cameras for monitoring of wild dogs</li> <li>• Interpretive pamphlets explaining presence and function of wild dogs in protected areas.</li> </ul>
Feral Pig	<ul style="list-style-type: none"> <li>• 1080 poisoned baiting has now replaced warfarin for the annual control program in southern parks and reserves, to keep impact to acceptable levels.</li> <li>• Targeted trapping is used to remove pigs that cause damage to specific sensitive or public areas, or where poisoned baiting is not possible.</li> <li>• Exploring options for alternative monitoring protocols following cessation of monitoring of pig abundance plots in Namadgi National Park.</li> <li>• Baiting of ACT parks and reserves is coordinated with parallel programs in neighbouring NSW parks. Free poisoned bait offered to rural landholders who participate in cooperative baiting programs.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue to participate in trials of new feral pig toxins.</li> <li>• Continue to test new delivery systems for pig bait, particularly those suitable for use in remote areas.</li> <li>• Important to maintain some form of monitoring of feral pig abundance and impacts in Namadgi National Park to assess effectiveness of the annual program, new baiting regimes and toxins.</li> </ul>
Feral Goat	<ul style="list-style-type: none"> <li>• Populations currently at acceptable levels following aerial shooting and 2003 fires.</li> <li>• Continued monitoring of mob locations and size.</li> <li>• Ground-based shooting where practicable.</li> <li>• Mustering of goat mobs in collaboration with rural landholders.</li> <li>• Trial trapping on reserves, and rural land in collaboration with rural landholders.</li> </ul>	<ul style="list-style-type: none"> <li>• Joint control programs with NSW for border areas.</li> <li>• Re-visit radio-collaring 'Judas' goat technique when necessary.</li> </ul>
Feral Horse	<ul style="list-style-type: none"> <li>• Feral horses in remote areas of the Bimberi Range in Namadgi National Park managed by trapping, sedation and euthanasia.</li> <li>• Namadgi National Park Feral Horse Management Plan also allows for aerial</li> </ul>	<ul style="list-style-type: none"> <li>• Continual re-infestation likely from Kosciuszko National Park, requiring continuation of regional collaboration to facilitate cross-border control</li> </ul>

# ACT State of the Environment Report 2011

Species	Current management and monitoring practices	Outlook
	<p>shooting of trap-shy animals.</p> <ul style="list-style-type: none"> <li>• Photo-point monitoring of sub-alpine bogs impacted by feral horses.</li> </ul>	<p>programs.</p> <ul style="list-style-type: none"> <li>• Continue partnership with Australian Alps National Parks agencies to support feral horse research in the region.</li> </ul>
<p>Fallow Deer Red Deer Sambar Deer</p>	<ul style="list-style-type: none"> <li>• General monitoring of occurrence via a sightings database.</li> <li>• Rural lessees advised to shoot any deer that occur on rural land. Trials of attractants to improve the efficiency of ground shooting.</li> <li>• Education on deer impact and seasonal behaviour.</li> </ul>	<ul style="list-style-type: none"> <li>• Maintain regional liaison and surveillance.</li> <li>• Participate in research projects on deer ecology and management.</li> <li>• Management implications of further escapes/releases of animals from deer farms in the ACT region.</li> </ul>
Feral Cat	<ul style="list-style-type: none"> <li>• Targeted, intensive programs using trapping and shooting for sites of significance.</li> <li>• Continuing control and fence maintenance in sites of significance.</li> <li>• Cat containment requirement in new suburbs adjacent to high-value conservation areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Maintenance of a watching brief on new management developments.</li> <li>• Participation in research on ecological significance of cat predation on native species.</li> </ul>
Brown Hare	<ul style="list-style-type: none"> <li>• Fencing, tree guards, chemical deterrents or shooting in response to damage.</li> </ul>	<ul style="list-style-type: none"> <li>• Likely to be continuation of current practices.</li> </ul>
Indian Myna	<ul style="list-style-type: none"> <li>• No cost-effective control method available for use on public land.</li> <li>• Protective measures undertaken on an individual basis by producers.</li> <li>• Public referred to Canberra Indian Myna Action Group for advice on trapping in backyard situations.</li> </ul>	<ul style="list-style-type: none"> <li>• Continue to support research on new control techniques and on quantification of impacts of Indian Mynas.</li> <li>• Community Indian Myna control has effectively reduced numbers in the ACT.</li> </ul>
Common Starling	<ul style="list-style-type: none"> <li>• No cost-effective control method available for use on public land.</li> <li>• Protective measures undertaken on an individual basis by producers.</li> </ul>	<ul style="list-style-type: none"> <li>• Continuing industry investigation of cost-effective and environmentally benign control measures.</li> </ul>
Feral Pigeon (Rock Dove)	<ul style="list-style-type: none"> <li>• No cost-effective method available for use on public land.</li> <li>• Licensed pest controllers may be authorised to use poisoned bait for specific, small-scale situations.</li> </ul>	<ul style="list-style-type: none"> <li>• Maintenance of a watching brief on new management developments.</li> </ul>
Non-local aviary	<ul style="list-style-type: none"> <li>• Maintenance of licensing system to reduce risk of escape of problem species.</li> </ul>	<ul style="list-style-type: none"> <li>• Community education regarding species of concern</li> </ul>

# ACT State of the Environment Report 2011

Species	Current management and monitoring practices	Outlook
escapees		and responsible bird keeping.
Carp	<ul style="list-style-type: none"> <li>• Participation in the Murray-Darling Basin Authority ACT Regional Carp Control Plan.</li> <li>• Programmed fish monitoring program.</li> <li>• Angler education.</li> <li>• Eradication of farm dam populations in otherwise un-infested catchments.</li> </ul>	<ul style="list-style-type: none"> <li>• Maintenance of a watching brief on emerging management and control measures.</li> <li>• Opportunistic continuing eradication of new farm dam populations.</li> <li>• Community education.</li> </ul>
Feral Goldfish	<ul style="list-style-type: none"> <li>• Programmed fish monitoring program.</li> <li>• Angler education.</li> </ul>	<ul style="list-style-type: none"> <li>• Community education.</li> <li>• Continuation of fish monitoring program.</li> </ul>
Redfin Perch	<ul style="list-style-type: none"> <li>• Programmed fish monitoring program.</li> <li>• Angler education.</li> </ul>	<ul style="list-style-type: none"> <li>• Community education.</li> <li>• Continuation of fish monitoring program.</li> </ul>
Oriental Weather-loach	<ul style="list-style-type: none"> <li>• Programmed fish monitoring program.</li> <li>• Angler education.</li> </ul>	<ul style="list-style-type: none"> <li>• Community education.</li> <li>• Continuation of fish monitoring program.</li> <li>• Maintenance of a watching brief on research to determine ecological impact of the species.</li> </ul>
Brown Trout Rainbow Trout	<ul style="list-style-type: none"> <li>• Programmed fish monitoring program.</li> <li>• Stocking of selected impoundments, i.e. at Googong.</li> <li>• Ban on stocking streams.</li> </ul>	<ul style="list-style-type: none"> <li>• Improved angler appreciation of issues involved.</li> <li>• Increased alignment with regional fish stocking policies.</li> </ul>
Eastern Gambusia Fish	<ul style="list-style-type: none"> <li>• Angler education.</li> </ul>	<ul style="list-style-type: none"> <li>• Community education.</li> <li>• Continuation of fish monitoring program.</li> <li>• Maintenance of a watching brief on research for impact and control of the species.</li> </ul>
Discarded aquarium fish	<ul style="list-style-type: none"> <li>• Education of aquarium keepers.</li> <li>• Participation in National Ornamental Fish Management Implementation Group (OFMIG).</li> </ul>	<ul style="list-style-type: none"> <li>• Community education.</li> <li>• Continuation of fish monitoring program.</li> <li>• Implementation of OFMIG pest lists.</li> <li>• Increase control on importation of pest species.</li> </ul>
Over-	<ul style="list-style-type: none"> <li>• Procedure in place for kangaroo culling on</li> </ul>	<ul style="list-style-type: none"> <li>• Continuing investigation of</li> </ul>

# ACT State of the Environment Report 2011

Species	Current management and monitoring practices	Outlook
abundance of native species e.g. Eastern Grey Kangaroo	<p>rural properties.</p> <ul style="list-style-type: none"> <li>• Response to other issues on a case-by-case basis.</li> <li>• 'Living with nature' ethos promoted.</li> </ul>	<p>management options in response to issues arising.</p> <ul style="list-style-type: none"> <li>• Community education regarding management alternatives.</li> <li>• Improved monitoring of population and distribution trends with support for related research.</li> </ul>
Non-local crustaceans (Marron etc.)	<ul style="list-style-type: none"> <li>• Surveillance of potential sources of introduction.</li> <li>• Education of aquarium keepers.</li> </ul>	<ul style="list-style-type: none"> <li>• Community education.</li> <li>• Continuation of fish monitoring program.</li> <li>• Compliance with National Policy for the Translocation of Live Aquatic Organisms.</li> </ul>
European Wasp	<ul style="list-style-type: none"> <li>• A contract consultant will provide an identification service and advice to the ACT community on European Wasps.</li> <li>• European Wasp Hotline.</li> <li>• All confirmed nests on Territory land will be treated within 24 hours.</li> <li>• In high-use barbecue/picnic areas where a nest cannot be located, a baiting program will be implemented during the breeding season when wasps are particularly aggressive.</li> </ul>	<ul style="list-style-type: none"> <li>• Adequate stocks of European Wasp brochures are to be available at Visitor Information Centres.</li> <li>• It is critical that media coverage is provided to remind residents to be aware of European Wasps and to encourage people to report nests.</li> </ul>
Honey Bee	<ul style="list-style-type: none"> <li>• Will only treat bee swarms if they pose a high risk to the public, e.g. a swarm in a high-use shopping centre or adjacent to a child-care centre or school.</li> </ul>	<ul style="list-style-type: none"> <li>• Will only treat bee swarms for nature conservation purposes if increasing numbers of bee swarms setting up in tree hollows become a key threatening process.</li> </ul>
Termite	<ul style="list-style-type: none"> <li>• Nests within 60 m of structures under attack must be destroyed within 14 days of Parks and Conservation being notified in writing by the pest control firm.</li> </ul>	<ul style="list-style-type: none"> <li>• Where a termite nest is not located, private leaseholders may consider the installation of a chemical soil barrier to prevent possible future termite attack of their residence from the soil.</li> </ul>
Meat Ant and Sugar Ant	<ul style="list-style-type: none"> <li>• Only treat Meat Ant nests if they occur at bus stops, barbecue areas or playgrounds</li> <li>• In exceptional circumstances, where ants are</li> </ul>	<ul style="list-style-type: none"> <li>• Residents are strongly urged to consider alternative ant control methods if ants are foraging in</li> </ul>

# ACT State of the Environment Report 2011

Species	Current management and monitoring practices	Outlook
	genuinely invading a private property and making it uninhabitable to residents, i.e. residents or children are being bitten by ants.	backyards, e.g. removal of food sources which may attract ants.

Source: TAMS