

CORRIDORS FOR HABITAT AND BIODIVERSITY CONSERVATION IN THE ACT WITH LINKS TO THE REGION.

A project funded by the Natural Heritage Trust (NHT) to assist the ACT develop and implement a comprehensive regional environmental strategy to provide the context for managing the ACT's environmental and natural resource assets and to provide the basis for strategic action in the ACT to meet the Territory's contribution to NHT goals.

1. Introduction

The *ACT Nature Conservation Strategy* sets out principal policies and strategies for nature conservation in the ACT and establishes a mechanism for setting priorities and directions, and for their integration into the overall planning and management process to ensure conservation of the ACT's biodiversity. Key elements of the strategy recognise the need for a regional approach to the conservation of natural assets and the identification of a network of linked habitat corridors, native vegetation remnants, concentrating on riverine systems and habitat currently poorly represented in reserves.

This network of habitat corridors is expected to provide the basis for many on-going actions in the ACT including re-vegetation and habitat rehabilitation projects funded under ACT and Commonwealth programs, identification of gaps in biodiversity and natural resource management effort in the ACT and planning for biodiversity conservation links with the surrounding region.

2. ACT Planning context

In the planning of Canberra and the ACT there has been a conscious effort to ensure that environmental protection and landscape conservation are significant components of land use and development proposals (*Territory Plan, National Capital Plan*). The object of the *National Capital Plan* is “to ensure that Canberra and the Territory are planned and developed in accordance with their national significance.” The object of the *Territory Plan* as set out in Section 7 of the *Land (Planning and Environment) Act 1991* is “to ensure, in a manner not inconsistent with the *National Capital Plan*, that the planning and development of the Territory provides the people of the Territory with an, attractive, safe and efficient environment in which to live, work and have their recreation”.

At the regional scale the *ACT Sub-regional Planning Strategy* continues this theme. In a section entitled *Strategies for managing natural and cultural resources* the Strategy gives “....a high priority to the establishment of a regional public and private land conservation system, linking existing corridors and significant areas in the region, to enable species and ecological communities threatened with extinction to survive and thrive in their natural habitats.....”. A preliminary map of environmental corridors at a regional scale is included in the *Strategy*.

As part of the ACT's statutory framework for planning draft *Flora and Fauna Guidelines* have been prepared to assist those responsible for assessment of planning

and development proposals. The draft *Flora and Fauna Guidelines* require consideration of wildlife movement corridors shown in a preliminary map covering the major stands of forest vegetation. Since this early draft was prepared there have been significant advances in conservation knowledge, including identification of threatened ecological communities and animal and plant species, and greater sophistication in planning for multiple land use and off-reserve conservation of biodiversity. The draft *Flora and Fauna Guidelines* acknowledge the practical constraints in establishing habitat corridors in an urban setting, although the National Capital Open Space System (defined in the *National Capital Plan*) contains many elements of a potential network of conservation corridors.

There is widespread recognition of the value of incorporating habitat corridors into plans for the management and conservation of wildlife, particularly the more mobile species (Bennett 1990, 1999, Smith & Hellmund 1993, Soule & Gilpin 1991). Community support in Canberra is also evident (TESAL 1993). It is generally accepted that corridors are beneficial to conservation and although not a panacea, they do facilitate the movement, interaction and dispersal of individuals between flora and fauna populations (Bennett 1990, 1999). Habitat corridors, regardless how effective they are can never replace reserve systems for the protection of species and their ecosystems (Soule & Gilpin 1991). The more the vegetation resembles the original vegetation the better the corridor will be from a conservation perspective (ACT Government 1997).

3. Definition (used in this project):

A habitat corridor is a linear two-dimensional landscape element that differs from the surrounding vegetation, in both vegetation structure and form, and connects two or more patches, of otherwise isolated, habitat that have been connected in historical time, this is meant to function as a conduit for both plants and animals (Soulé & Gilpin 1991, Wilson & Lindenmayer 1995)

4. Objectives of an ACT corridor system for habitat and wildlife conservation

- To reduce the ecological effects of habitat fragmentation caused by urban development, transport infrastructure and land uses inimical to wildlife;
- To link natural habitats and assist in conserving biodiversity across and between the urban and rural landscape;
- To facilitate natural dispersal and movement of animal wildlife in the “bush capital”;
- To provide for natural ecological processes to continue at the landscape scale; and
- To maintain ecological links to the region.

5. General Principles of Habitat Corridors

Habitat corridors:

- can be natural, remnant and cultural in origin (see Appendix 1 from Forman and Gordon 1986 in Bennett 1990);
- are not restricted by State or Territory boundaries;
- are for maintaining plants and animals and ecological processes;
- may provide habitat for resident populations and or individuals of plant and animal species but also, potentially, may enhance natural movement of some (but not necessarily all) wildlife;
- may facilitate the spread of weeds, pests, predators, diseases and maintain other threatening processes;
- must address planning and management issues such as:
 - connectivity
 - buffering
 - edge effects
 - impediments / effects of barriers / gaps
 - wider the better and easier to manage;
 - cost of establishment and maintenance;
- are a precautionary approach to biodiversity conservation; corridors have inherent value as habitat for plants and animals and therefore should be developed, protected, retained, enhance or restored (Wilson & Lindenmayer 1995);
- must take into account the surrounding land uses and be integrated with and include vegetation remnants outside nature reserves, in areas with a variety of land uses. For instance along drainage lines, road and railway easements as well as shelter belts, windbreaks and also as a educational resources;
- must be viewed as a component of a broader regional conservation system to ensure the maintenance of wildlife populations in fragmented off-reserve habitat within the rural landscape. Protection, maintenance and monitoring are essential components of a habitat corridor network. Research into function, effectiveness and management of habitat corridors needs to be encouraged to ensure habitat suitability is maintained in the long term. An adaptive management approach should be adopted to improve corridor design when new information is provided.

6. Method

Development of an ACT-wide habitat corridor system was undertaken by the Wildlife Research and Monitoring unit of Environment ACT using ArcView GIS. Additional ground truthing and air-photo interpretation was incorporated into the program as required.

In identifying an ACT-wide habitat corridor system the following action principles or sources were used to guide collation of information:

- existing remnants of natural habitats (core areas), including nature conservation reserves and significant off-reserve habitat areas containing known endangered ecological communities and/ or threatened species;
- Hills Ridges and Buffer areas, rural road vegetation and plantations which have existing or potential habitat value;
- other target species or groups including threatened species and ecological communities);
- major river and permanent streams and their associated riparian habitat;
- major urban open spaces which have existing and potential habitat value;
- areas to link unconnected habitat fragments; and
- other requirements such as buffers and planting / regeneration opportunities.

The above principles were followed in developing the corridor system. Utilising a variety of sources, remnant native vegetation was identified in core conservation reserves as well as in off-reserve areas including on rural land and in the Hills, Ridges and Buffer areas. Significant areas containing known endangered communities and/ or threatened species were also identified. These features were used to generate a vegetation habitat corridor system using proximity analysis. Natural stream corridors and those resulting from human activities in the landscape were also identified. From this information corridor boundaries were generated with the width being varied depending on the type of system.

6.1 Layers of data

The base data for the ACT was sourced by the ACT Land and Information Centre (ACTLIC) including:

- cadastral boundaries,
- road centre lines,
- water base (rivers, streams, lakes, ponds & dams)

The *ACT Sub-regional Planning Strategy* preliminary map of environmental corridors was incorporated into this project to ensure regional links were maintained. The data was supplied by the GIS System Division, NSW National Parks and Wildlife Service, Hurstville, NSW.

Additional data layers included:

ACT Forests: plantation timber, mostly softwood; managed for commercial purposes; some open space with native vegetation (Source: from the Territory Plan data set, ACT Land and Information Centre, Canberra, ACT);.

ACT & NSW nature conservation estate: ACT public land managed for nature conservation purposes (identified in the Public Land Map as wilderness zone, national park or nature reserve; Source: from the Public Land data set, ACT Land and Information Centre, Canberra, ACT); NSW, national parks and nature reserves (Source: GIS System Division, NSW National Parks and Wildlife Service, Hurstville, NSW).

ACT Urban Open Space: public land managed as open space for public use (Source: from the Territory Plan data set, ACT Land and Information Centre, Canberra, ACT);

Endangered ecological communities: remnant vegetation and associated fauna declared under the *Nature Conservation Act 1980* as being under threat of extinction; two communities are declared: Yellow Box/Red Gum Grassy Woodland and Natural Temperate Grassland. This category is a high priority conservation target with habitat linkages and floristic and structural diversity being important considerations; special measures required to protect and manage off-reserve occurrences (Source: Wildlife Research and Monitoring, Environment ACT);

Threatened species habitat: known habitat of the endangered Grassland Earless Dragon (*Tympanocryptis lineata pinguicolla*) and the vulnerable Striped Legless Lizard (*Delma impar*) (Source: Wildlife Research and Monitoring, Environment ACT);

Vegetation: remnant woody vegetation from open woodland through to closed forest, the classes were not differentiated for this exercise. It is assumed that all remnant woody vegetation has wildlife habitat value. (ACT source: Wildlife Research and Monitoring, Environment ACT), (NSW source: GIS System Division, NSW National Parks and Wildlife Service, Hurstville, NSW, this data layer also included native and disturbed grassland areas);

Major riparian network system: major rivers and streams outside the nature conservation estate;

Major road/rail network system: significant transport easements that may have landscape elements of nature conservation value, including remnant vegetation;

Disturbed vegetation network system: treeless or sparsely treed open space including secondary native and exotic grassland. In a sense it is all the areas within the corridor network that provide links to woody and or other remnant vegetation. The network was derived by ensuring all vegetation units were buffered by 50m and that the vegetation network corridors provide a zone of no less than 300m. (NSW ONLY source: GIS System Division, NSW National Parks and Wildlife Service, Hurstville, NSW, this data layer also included native and disturbed grassland areas). The ACT's disturbed vegetation network was derived by ensuring all vegetation units

greater than 10 ha were buffered by 50m and that the vegetation network corridors provide a zone of no less than 100m. (ACT ONLY source: Wildlife Research and Monitoring, Environment ACT)

Corridor systems:

The next stage in the process was to generate a series of corridor network overlays for the ACT, similar to those found in the *ACT Sub-regional Planning Strategy* preliminary map of environmental corridors. The overlays were produced by applying a proximity analysis to selected data sets: major rivers to produce a 800m zone of interest; perennial rivers to produce a 400 m zone of interest and the major road and rail network to produce a 100m zone of interest. **(N.B. the boundaries indicate an arbitrary zone of interest and the nature conservation and planning implications are not developed in this report)**. Actual zone boundaries would need to be refined on a case by case basis, including, for example, the riparian topography (an incised river channel could define the zone of interest to a more restricted area) and nature conservation values present, including potential for their enhancement and establishment of habitat links);

6.2 Map of a nature conservation/habitat corridor network for the ACT.

A series of maps were compiled (Appendix 3) using ArcView 3.0a GIS, the maps include:

- an A3 portrait of the ACT and Sub Region
- an A3 portrait of the ACT – habitat corridor detail
- an A3 portrait of the ACT – habitat corridor network system
- twelve A3 landscape inserts of the ACT at 1:125 000 scale.

These maps are the major output of this project.

7. Application of the habitat corridors to planning and land management projects in the ACT.

Habitat corridors represent an area of interest in ensuring habitat continuity and protection of movement opportunities for plants and animals. The corridors shown on the maps are not designed to indicate a new reserve system for the ACT. Rather it is envisaged that the map will be used to focus land planning and management resources and on-ground effort on reducing fragmentation, ameliorating threatening processes and enhancing habitat restoration and rehabilitation; in other words, achieving sympathetic integration of current and future uses and activities with habitat conservation objectives.

The habitat corridors therefore indicate an **area or zone of interest**, which may be an important input into other planning and management activities such as land use planning projects, site planning and development, tree-planting programs, Parkcare activities and other similar conservation management projects.

Of particular interest is the *Vegetation Investment Project* being carried out by Greening Australia with Natural Heritage Trust funding. This project is using a focal species approach to defining sites for revegetation projects in the ACT and

surrounding parts of NSW. The focal species approach identifies the species that are most sensitive to particular threatening processes such as habitat fragmentation, predation by feral animals, weed invasion and inappropriate fire regimes. In this application Greening Australia hopes to identify parameters for the minimum area needed for survival, connectivity requirements between remnants, the most appropriate vegetation structure, and therefore the priorities for the location and species choices for revegetation projects.

It is anticipated that the outcomes of the focal species approach will dovetail neatly with the habitat corridor work carried out in this project. The habitat corridor maps will provide the first approximation for locating revegetation projects. The focal species information will assist in choosing where revegetation is urgently required and whether or which existing remnants should be targeted as priority projects. Cross membership of Steering Committees for the projects has informed and enhanced the management of each of them and ensured coordination of outputs. This relationship between two Natural Heritage Trust projects illustrates the utility of the habitat corridor project in contributing to “*the basis for strategic action in the ACT to meet the Territory’s contribution to NHT goals*”(see opening paragraph).

Management Principles for an ACT-wide network of vegetation corridors

The following principles for management of land included in any of the habitat corridors have been prepared as an initial set of guidelines for projects seeking to respond to their location within an area defined as having habitat corridor values.

- Revegetation of habitat corridors must use native species from local provenance. Revegetation must take account of the original vegetation structure and species mix and any threatened ecological community and/ or species. To ensure greater planting success revegetate with plant species appropriate to the site, also taking into account up to date techniques and information.
- Natural revegetation of identified gaps may involve, fencing or removal of grazing (where appropriate) to allow natural regeneration.
- Minimising external influences (eg fertilisers and other farm chemicals) and encouraging lessees to protect and manage regenerating corridor vegetation.
- Habitat corridor requirements must be taken into consideration / account during planning, construction, on-going maintenance, and upgrading of urban infrastructure.
- Identify isolated animal and plant populations and establish appropriate management if possible.
- Importance of corridors in education and their great value towards conservation, as well as their landscape value, be used to raise the profile of conservation issues among the general public.

- Control land degradation, to minimise the loss of soil and impact of raising ground water.
- A need to minimise and manage for the disadvantages associated with corridors (see Appendix 2 from Wilson & Lindenmayer 1995).
- Need to develop management agreements with land-holders, on leased and agisted land, to maintain habitat corridors as a contribution to off-reserve biodiversity conservation.
- Need to establish management arrangements (including formal management agreements) for unleased land, ie road easements, institutional land, open space etc, outside the reserves system.
- Need to establish indicators to monitor changes in vegetation and management practices.
- Develop regionally consistent management approaches for the protection and management of selected conservation areas and corridors.

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Appendix A

Origins of corridors from Forman and Gordon 1986 in Bennett 1990

Appendix B

Disadvantages of Corridors from Wilson & Lindenmayer 1995

Appendix C

- an A3 portrait of the ACT and Sub Region
- an A3 portrait of the ACT – habitat corridor detail
- an A3 portrait of the ACT – habitat corridor network system
- twelve A3 landscape inserts of the ACT at 1:125 000 scale.

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The support and input from a Steering Committee comprising representatives from the ACT Rural Lessees Association, Greening Australia, Conservation Council of South-East Australia and Canberra, NSW National Parks and Wildlife Service (Southern Zone), ACT Government (Planning and Land Management, Canberra Urban Parks and Places, Parks and Conservation Service), is gratefully acknowledged.

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Origins of corridors

Habitat corridors may originate in a number of ways (Forman and Godron 1986). *Natural corridors, such as streams and* their associated riparian vegetation, usually follow topographic or environmental contours and are the result of natural environmental processes.

Remnant corridors, such as strips of eucalypt forest in pine plantations or along roadsides, result from clearing, alteration, or disturbance to the surrounding environment.

Regenerated corridors occur as the result of regrowth of a strip of vegetation that was formerly cleared or disturbed.

Planted corridors, such as farm plantations, windbreaks, and some urban greenbelts, have been established by humans.

Disturbance corridors, including railway reserves, roads, and cleared transmission lines, result from disturbance within the corridor strip.

Corridors are a typical element that is present both in natural landscapes and in landscapes severely altered by humans. However, there are some major differences between natural corridors and those resulting from human activities in the landscape. For example, streams and their associated riparian vegetation are typically meandering in their pathway, forming dendritic branching patterns as they join to form increasingly larger waterways. They follow the line of lowest topography in the landscape, they are relatively permanent in structure, and they are maintained by the natural distribution of environmental resources. In contrast, corridors of human origin frequently follow straight lines and cross environmental contours, they often form rectangular grids (e.g. road systems, farm plantations), and their maintenance requires continued management effort, either within the corridor or in the surrounding matrix. For example, a cleared transmission line corridor will regenerate with time if it is not deliberately maintained, and a corridor of mature forest in a clear-felled stand will gradually disappear as the surrounding forest regenerates and ages.

Disadvantages of Corridors

Summary of the Potential Disadvantages of Corridors.

Disadvantage	Comments
barrier or filter	• movement of some species may be impeded or prevented while others may benefit;
pathway for spread of pests	• may promote the spread of unwanted species, weeds and other pests and enhance the spread of fire and undesirable genes;
population sink	• there is the possibility of increased risk to individuals while moving through the corridor; also linkage of areas of unequal habitat suitability may cause a net loss of individuals from a local population; i.e. a source-sink effect
increased contact between gene pools	• corridors may link previously isolated populations and lead to hybridisation between species that normally occur in separate areas
spread of disease	• increased likelihood of disease transmission between animals may result from corridor establishment;
edge effects	• edge effects may significantly alter the quality and type of habitat available to animals and may not provide for species which require non-edge affected habitat for their long-term population persistence; cost of corridor establishment and maintenance
cost	• cost of corridor establishment and maintenance may prevent the consideration of other, possibly more appropriate, conservation management options.