

FOREWORD

In 1997/1998, Cooleman Ridge Park Care Group prepared a document about managing the Ridge. The Group submitted it to ACT Parks and Conservation Service, the then managing authority for Canberra Nature Park, in 1998. No copy of that submission is now in the Group's possession, as the records were destroyed by fire in 2003. However, an earlier electronic draft had been retained by one of the Group members, and this version has been created from it.

Many homes in the suburbs adjacent to Cooleman Ridge were destroyed in the 2003 Bushfires. The Group's submission has direct relevance to that story. For that reason, the Group decided to place a salvaged copy of the document in the Heritage Library at Woden. Any discrepancy between what was submitted to ACT Parks and Conservation Service and the present document is due to the circumstances described above.

**Arminel Ryan
President
Cooleman Ridge Park Care Group Inc**

September 2008

**DRAFT, OCTOBER 29, 1997 (additions 12/2/98)
TOWARDS A MANAGEMENT PLAN FOR COOLEMAN RIDGE
CANBERRA NATURE PARK**

Coolleman Ridge Park Care Group Inc.

The following text contains suggestions for the management of Coolleman Ridge Nature Reserve given the absence of an official plan. This text should under no circumstance be considered to be a management plan; Environment ACT is the management authority and management is their responsibility alone.

INTRODUCTION

Coolleman Ridge ("The Ridge") is both a physical and cultural divide. It forms part of the rim of the catchments of the Molonglo and Murrumbidgee Rivers and sits on the edge of suburban Canberra, ACT, thereby marking the boundary of city and country. The modest elevation of the Ridge and its location contribute to its appeal. To the northeast can be seen leafy suburbs leading to the city centre; to the southwest farms fill the foreground of the view to the forest-clad Brindabella mountains only about 13 km away. The Reserve is one of 26 that together comprise Canberra Nature Park (CNP). It is pleasantly wooded with mature trees of a number of *Eucalyptus* species.

This plan has been produced with the co-operation of members of the ACT Parks and Conservation Service, the managing authority of CNP. We do not claim this to be a professional document, nor can it be, but rather a contribution to the process of formulating detailed plans for the whole estate of CNP.

HISTORY

After thousands of years of Aboriginal occupation, white settlement began in the region about 1825. The local Ngunnawal tribe travelled to the mountains in summer to feed on aestivating Bogong moths (Flood 1980). Europeans sought land in the area for their domestic grazing animals once they had discovered a route through the Blue Mountains from their original settlement in Sydney.

Early maps nominated the vegetation of the area as "forest" or "open forest", even "thickly timbered" (Parish maps for Yarrowlumla 1879, 1880), but we know little of the detail of natural history of the area at the time of settlement. By 1899 the area was part of a large grazing property called *Yarralumla* which extended from what is now Canberra City to the suburbs of Belconnen and Weston Creek. A diary (Vest 1899) and maps reveal that European rabbits were present then and that thistles and briars were problems and had been since 1874 (L.Gillespie). Boxthorn hedges had been planted. In 1919 the value of the property was being assessed probably with a view to compensating the occupants as part of the process of establishing the National Capital of Australia following Federation of the States in 1901.

The Ridge at the turn of the century was part of *Yarralumla* Station. No doubt the Ridge had been disturbed in various ways but specifics are few. We do know that

thinning and ring-barking had taken place on the property as a whole. There were about 1.5 trees per acre on *Yarralumla* on average, about 4 trees per hectare.

Cooleman was a subdivision of *Yarralumla*. It was leased by the Champion family from 1937 to 1996 and run as a grazing enterprise. It comprised Blocks 18 and 22 and Stromlo – 2900 acres or 1 140 ha in all. Block 22 included Mt Taylor (Taylor's Hill then) which was resumed for housing and recreational use in the 1960s. The Champions operated their property from a house in what is now Doyle Terrace, Chapman but later moved to an area west of the Ridge. Their move may have resulted from resumption of land for the building of the suburb of Chapman from the late 1960s. In 1997, the lease on the property changed hands. Now (1997), it is run as an equestrian centre.

There was no clearing on *Cooleman* from 1937 onwards but there were aerial applications of superphosphate (13 cwt per acre per year, about 1.7 t/ha, from 1950 to 1969) and pasture seeds. *Phalaris aquatica* was established where ploughing was possible. Over the period of the Champion's lease, sheep-carrying capacity multiplied by 5 times with wool yield per sheep increasing by 3 times. However, with the establishment of suburbs nearby, domestic dogs took a toll of sheep. Up to 2000 sheep were lost overall, the maximum rate of loss being 70 on one night. By 1996, the reduced holding carried about 100 cattle and a similar number of horses, the latter mostly on agistment from individual owners. No cattle reside on the property now (1997).

As part of the development of Weston Creek two reservoirs were built on *Cooleman Ridge* (for Rivett and Chapman) and a major cut-off drain was dug in a line above the houses and unsealed service roads were established. A number of non-indigenous eucalypt species 2 or 3 rows wide were planted out in long strips, each strip terminated by a planting of *Acacia floribunda*. There are two farm dams on the reserve, the one near Kathner Street (at the far northwestern corner of the Ridge) excavated in 1993.

As occurs for the whole of the ACT, the Ridge is subject to the Territory Plan. Hills in the Canberra region, like the Ridge, form part of the backdrop to the city and are mostly managed under some category of "open space". This 187 ha area was originally set aside as a Reserve but was declared as part of CNP (Public land - Nature Reserve) only in October 1993. The new status of the area brought it under formal management.

ECOLOGY

Cooleman Ridge runs approximately 3.5 km northwest to south-east. It has a series of peaks above 700m elevation, the highest being Mt Arawang at 765m. The Ridge rises above the Canberra Plain, at about 600m, which, in turn is part of the Southern Tablelands Region of NSW and the ACT.

Lithologically the Ridge consists of an erosion-resistant igneous material, the Laidlaw volcanics (Abell 1991). The rocks have a fine-grained matrix in which large crystals are embedded; it is technically a rhyodacitic ignimbrite (Abell 1991). Ignimbrites are believed to have formed by the "eruption of dense clouds of

incandescent volcanic glass in a semi-molten or viscous state" (American Geological Institute 1976) condensing and fusing into solid rock at the earth's surface (after John Lindsay, personal communication to Cooleman Ridge Park Care Group). The soil derived from the rock is mostly a nutrient-poor coarse sandy clay which is quite erodible. As in many other hilly places in the region, there are some attractive rocky outcrops on the Ridge.

The climate could be described as being like a Mediterranean climate in that winters are cool with soils moist while summers are warm with soils dry. The relative dryness of the summer is not so much due to lack of rainfall as to high evaporation. The average monthly rainfall at Canberra airport (Bureau of Meteorology 1988) has a peak of 69 mm in October, a decreasing amount in each subsequent month (but with an out-of-sequence value of 51 mm in December) until it reaches a minimum in June of 37 mm. From July onwards the average monthly rainfalls again increase until October. The yearly average is 625 mm. Abell (1991) mapped the average rainfall of the Ridge as between 700 and 750 mm per year.

The eucalypt woodland that clothes the Ridge is dominated by *Eucalyptus polyanthemos* (Red Box), *E. melliodora* (Yellow Box), *E. blakelyi* (Red Gum) and *E. nortonii* (Mealy Bundy). The last of these is mainly found on rocky knolls while *E. melliodora* and *E. blakelyi* are found on deeper soils of small valleys or outwash areas from the hills. *E. polyanthemos* is typical of the shallow soils of the rocky hills but is supplemented by *E. rossii* on drier aspects and *E. dives* on moister aspects. *E. macrorhyncha*, now uncommon, may have been more abundant in the past. It was a preferred species for sawlogs. Small *Brachychiton populneus* (Kurrajong) are sometimes found beneath eucalypt crowns. *Allocasuarina verticillata* (Drooping she-oak) is a small tree forming thickets on drier aspects such as those on the north of Mt Arawang. Shrubberies of *Bursaria lasiophylla* are prominent on the suburban side of the Ridge in the northwest and also on Mt Arawang. The understoreys of the woodlands are grassy with exotics being the most prevalent. *Themeda triandra* (Kangaroo grass), *Poa* sp., *Bothriochloa macra* (Red-leg grass), *Austrostipa* sp. and *Austrodanthonia* sp. (Wallaby grass) are common in places, however. While there has been no formal survey, an interim list of the Cooleman Ridge Park Care Group records over 200 species of vascular plants, many of them exotics.

Despite the lack of formal study, there is anecdotal information on birds and other vertebrates as well as plants. There is a small mob of Eastern Grey Kangaroos (*Macropodus giganteus*) on the Ridge which usually frequents the Mt Arawang area. Other than these, non-avian native vertebrates are rarely seen. In one of the 'farm' dams Longnecked Tortoises (*Chelodina longicollis*) were common but are subject to disturbance by domestic dogs, horses and foxes. There are also Common Brown (*Pseudonaja textilis*) and Red-bellied Black (*Pseudechis porphyriacus*) Snakes.

Native birds are common on the Ridge. Raptors such as Black-shouldered Kites (*Elanus notatus*), Australian Kestrels (*Falco cenchroides*) and Wedge-tailed Eagles (*Aquila audax*) may be seen. Galahs (*Cacatua roseicapilla*), Crimson

Rosellas (*Platycercus elegans*), Eastern Rosellas (*Platycercus eximius*) and Sulphur-crested Cockatoos (*Cacatua galerita*) are quite common. Pied Currawongs (*Strepera graculina*) are numerous especially at cooler times of the year. Exotic birds include Common Mynas (*Acridotheres tristis*), Blackbirds (*Turdus merula*) and Common Starlings (*Sturnus vulgaris*).

Of considerable conservation significance is the Pink Tailed Legless Lizard (*Aprasia parapulchella*). This "nationally endangered" lizard lives under rocks set in native grassland where it feeds on eggs and larvae of a number of ant species (Jones 1996).

Ants feature in a number of ecological interactions of great interest. While not yet proven on the Ridge, it seems likely that ant-tended larvae of butterflies that feed on mistletoes and on Blackthorn (*Bursaria lasiophylla*), will be found. Another invertebrate of interest is the colourful leaf-rolling larva of the butterfly *Netrocoryne repanda* (Hesperiidae) which was seen to defoliate a small specimen of *Brachychiton populneus* (Kurrajong) in the spring of 1997.

Ecosystems on the Ridge have had a long history of disturbance from exotic herbivores, feral cats and dogs and foxes, and farming activities like tree cutting, sowing of pastures, fertilizing of pastures and ploughing. Fire regimes may have been altered. Large numbers of woody weeds (*Pyracantha*, *Cotoneaster* and *Rosa rubiginosa* particularly) were present in 1990 but reduced to small persistent populations by concentrated effort of the Cooleman Ridge Park Care Group by 1996. These species have probably been dispersed into the area by birds (native and introduced) and foxes from surrounding farms and gardens. Hatton (1989) demonstrated that Currawongs and horses distributed *Rosa* (Sweet Briar) seeds on the Southern Tablelands of NSW and in the ACT.

Herbaceous weeds, widespread on the Ridge, include *Phalaris aquatica*, Wild Oats (*Avena* sp.), Horehound (*Marrubium vulgare*), Paterson's Curse (*Echium plantagineum*) and St John's Wort (*Hypericum perforatum*). Thistles are thick in some places. It is likely that some or all of these species have been spread by cattle and sheep. "Camps" of these animals under trees have promoted dense populations of Horehound, Thistles and Paterson's Curse in places. *Phalaris* is a vigorous persistent perennial grass while Wild Oats is a dominant annual which suppresses some other species to the extent that they are confined to the soil seed pool until the oats are removed. Suppressed species include the weed *Lactuca serriola* (Wild Lettuce).

The study of the plants and animals of the Ridge has hardly begun. The interplays of suburb and farm with the Ridge ecosystems need to be understood in order to support good management. The study of the natural history of animal/plant associations would add to the intrinsic interest of the Ridge. Disturbance regimes that tip the balance of performance from exotic to native for both plants and animals need to be known. What roles are there for herbicides, fires, weeding, and controls on foxes, dogs and cats? Are nesting hollows of native species being colonized by introduced species?

AIMS AND OBJECTIVES

The Ridge is reserved as Public Land (Nature Reserve). Management objectives (ACT Parks and Conservation Service 1996) for the Ridge (and other similar tenures) are to:

- (i) conserve and enhance native plant and animal communities;
- (ii) conserve features of cultural, geological, geomorphological and landscape significance;
- (iii) maintain ecological processes;
- (iv) provide and promote appropriate recreation and tourism opportunities;
- (v) provide and promote a range of opportunities for raising awareness, appreciation and understanding of natural and cultural heritage;
- (vi) protect the area from the damaging effects of fire, erosion, pollution, pest plants and animals or other disturbances; and
- (vii) ensure appropriate practices by other agencies carrying out works in or adjacent to Canberra Nature Park.

PLANNING HORIZONS

The origins of the native species present on the Ridge go back millions of years. Climates, substrates, topography and species composition have changed many times. Thousands of years ago Aboriginal people colonized the area with unknown impact. Hundreds of years ago Europeans arrived in Australia with dramatic impact.

With conservation of native biota a major aim of management, what planning horizons are pertinent in our changed landscapes? Three time-scales are apposite currently while a fourth is relevant. These scales are yearly, decadal and centennial while millennial scales should not be discounted. At yearly scale is the annual works plan; at decadal scale are provisions for management and recreation including efficient roading, fencing and trails and a detailed management plan; and at centennial scale is the vision for the future of the Ridge. Without vision we wander in the darkness.

Over the next century we would hope to see the Ridge being managed by a highly professional team ably assisted by community groups. A series of walking tracks would be part of an integrated system of ACT-wide walkways. To the north would be a link to the Molonglo River Corridor; to the west would be a rural avenue to the Murrumbidgee River Corridor; to the south would be a link to Urambi Hills Reserve and to the east a link to Mt Taylor Reserve. The Ridge vegetation, while not pristine, would be to a large extent native and indigenous. Trees being planted now would be mature. Reservoirs and south-eastern suburbs would be screened. Vistas to the city and the mountains would be a drawcard. The National Horse Trail would be fenced by post and rail adjacent to a realigned south-western boundary at the northern end of the Ridge. The suburban boundary would include a 20m wide joint-management zone in which only approved indigenous native plants could be grown but in which fuel control by local residents would be encouraged. Low-impact recreation would be common; motorised recreation would be banned. Fuel control by management authorities

would be strategic and ecologically wise; it would be integrated with controls by neighbours, especially householders.

In the next ten years (to 2007) detailed long-term plans for the Ridge should be developed and implemented. The alignments of roads, tracks and trails, the locations and types of fencing, the control of erosion, the composition and location of indigenous plantings, the control of exotic plants and animals, the management of visitors, the place of fire regimes and the fate of non-indigenous plantations decided and acted upon. Inventory and survey, at least of vertebrate animals and vascular plants, is essential.

In the short term there needs to be a decision made on regulating the activities of pet and stray dogs (and their owners) and that of cats. Implementation of the policy should follow. There are provisions for fines but action is never taken despite the attacks by dogs on people, other dogs and wildlife (swimming in dams with tortoises, chasing kangaroos etc).

ISSUES

Exotic plants

With the repeal of the Noxious Weeds Act in 1996 emphases on weeds are now on case histories, not species. "Weeds" are seen, by this legislation, to be plants that threaten the value of a resource whether that be of value for conservation, farming or society in general. Action arises from complaint, not presence.

In the reserve there are 95 recorded examples of exotic species, the most prominent being Wild Oats, Phalaris and Paterson's Curse. Woody weeds like Cotoneaster, Pyracantha and Sweet Briar have been markedly reduced in number but are still present. *Verbascum thapsis* (Hairy Mullein) has also been reduced in population size by control measures instigated by the Park Care Group. Thistles and Horehound are prominent weeds also.

Exotic plantings

Plantations of non-indigenous eucalypts and acacias do not fall within the ambit of the aims of management. Blue gums (*E. bicostata*), one of the plantation species, are beginning to spread; they contribute large quantities of fuel and carry streamers of bark which, when alight, can start fires substantial distances from the main fire. In some places blue gums are competing with native indigenous trees. We suggest that a program of blue gum felling and removal begin immediately. This will have the effect of breaking up the strong linear impact of the plantations. Other species of these linear plantations should be phased out.

Exotic Grazing Animals

Since the reallocation of land from pastoral lease to management by Canberra Nature Park, intermittent grazing by cows and calves has been allowed with the intention of reducing fuel loads and thereby reducing potential fire intensities. Grazing has been concentrated in the north-

western and central parts of the Reserve while the areas immediately adjacent to Chapman, the fenced regeneration areas and Mt Arawang have been excluded. Grazing intensity has varied significantly from very light to complete removal of grasses and herbaceous material.

While the impact of grazing animals on fuel loads and fires will be discussed in the fire management section, it is noted that:

- (i) exotic animals represent the antithesis of the aim of attaining a state of native biodiversity in the Reserve and maintaining natural processes;
- (ii) cows and calves move from farms to the Reserve most likely carrying weeds on their hides and in their digestive systems;
- (iii) grazing often leads to an increase in weediness perhaps through selective choice of food;
- (iv) native plants may be disadvantaged over exotics by the presence of exotic herbivores; and
- (v) cattle deter recreational use of the area (Fenwick and Everall 1975).

Park Carers see cows browsing and bruising native shrubs as well as eating other native plants. The cattle disturb plants and animals in the artificial dams. They seem to add nothing yet do detract from the stated aims of management. Eucalypts appear to regenerate more easily when released from grazing pressure. Park Carers note the abundance of weeds and the lack of native species of herbs and grasses in old sheep or cattle camps and can spend long hours trying to rehabilitate them; they see no value in creating unnecessary work by perpetuating the practices which caused the problem.

As the presence of cattle on the Ridge is so contentious it seems worthwhile to briefly review literature pertaining to cattle and conservation. Borough and Cameron (1981) noted that sheep and cattle can cause serious damage to small eucalypts by "browsing leaves and growing tips, stripping bark, and by physical breakage of stems". The absence of eucalypt regeneration in tuart forest in Western Australia for a period of 50 years was entirely "due to grazing and fires" (Forests Department of Western Australia Annual Report 1921/22). In south-eastern Australia cattle may keep eucalypt regeneration dwarfed (Breckwoldt 1983). A condition of eucalypt regeneration is "low grazing levels" by domestic animals (or no grazing presumably) according to Venning (1985). Arnold (1977) considered that a "heavy grazing regime" promotes the "invasion of weed species" while Prober and Thiele (1995) found that "grazing encouraged weed invasion and reduced native species richness". In Tasmania, Fensham and Kirkpatrick (1989) considered that when grazing removed some of the grassy sward more native species may be apparent but exotics may be carried by "a variety of herbivores and machinery". Stuwe and Parsons (1977) found in Victorian grasslands that "in grazed sites, native plant species are often replaced by introduced species". Lunt (1991) concluded a review with "introduced stock ... will invariably diminish the conservation value of grassy ecosystems".

Dogs, cats, horses, foxes and rabbits

Dogs are legally permitted in the Reserve only when on a lead and under control. At present (1997) most dog owners do not keep their dogs on leads during their visits to the Reserve. While many keep their dogs under control yet not on a lead, this is illegal. Some owners take their dogs to swim in the dams, also an illegal act because of danger to native animals (tortoises). Numbers of people have been threatened, even attacked, by dogs on the Ridge. Enforcement of dog regulations is important for visitor safety and for wildlife. Free-ranging dogs have been seen in the Reserve, though this is relatively rare. It may be remembered that the previous lessee of the area was forced out of sheep-raising by the attacks of dogs on his animals.

Cats from Chapman often visit the Reserve. Their impact is unknown, but being exotic they contravene the aims of management of the Reserve.

Horses and riders use the marked National Horse Trail on the south-western border of the Reserve. Some riders take their mounts away from the Trail unlawfully. Away from the Trail the presence of such large animals intimidates visitors, has the potential to spread weeds (Hatton 1987) and creates soil compaction and facilitates erosion. Investigating the feasibility of fencing of the Horse Trail using materials commensurate with that use, allowing pedestrians to get through it easily, and allowing access to fire-fighting vehicles at regular (appropriately spaced) intervals is recommended.

Rabbits and/or hares are not common but do reside in the Park and are on the increase. Being at low densities, elimination is recommended. That they may reach high densities is evident from the experiences of Mr Ben Champion at *Coolman*. During the Second World War the rabbits became abundant. From 1950, Mr Champion embarked on an eradication campaign that took 4 years.

Foxes are common in the Reserve. It seems impractical to eliminate them but it is likely that they spread seeds of succulent-fruited weeds like *Cotoneaster*, *Pyracantha* and *Sweet Briar*. A study of their carriage of seeds is recommended.

Biological control agents for weeds, although exotic, have the potential to control serious weeds like *Paterson's Curse*, *St John's Wort*, *Skeleton Weed*, *Blackberries* and *Thistles*.

Having one long axis of the Ridge lined with houses means that exposure to suburban influences is maximized. One of these influences is the spread of exotics from gardens. Apart from human dispersal of plants through illegal practices like the dumping of garden waste and the planting of extended gardens, natural dispersers like the native *Currawongs* and the introduced *Blackbird* can, by analogy with *Buchanan's* (1989) study in

Sydney, carry a wide variety of fruit species into the reserve. A high density of seeds of the exotic tree *Prunus sp.* has been found in the reserve in several places.

Exotic birds

On the basis of the research of Pell and Tidemann (1997) in the Canberra area, Common Mynas and Starlings take over the hollows necessary for the nesting of native bird species like the Eastern and Crimson Rosellas and Galahs. Mynas are increasing in numbers and are already reducing the nesting success of the parrots.

Tree decline

The eucalypts of the Reserve form a native woodland. Like much rural land in Australia, regeneration has been sparse so far. Tree decline would markedly alter the character of the landscape to its detriment. "Rural tree decline" is a widespread problem probably due to many factors but here tree decline may be associated with christmas beetle defoliation of *E. blakelyi* and *E. polyanthemos* and psyllid damage to leaves of *E. blakelyi*. Lack of regeneration may be due to competition from grasses, poor seed supply, cattle grazing and exclusion of fire. Excluding cattle from some areas seems to have allowed a smattering of regeneration to develop in some areas while planting has proceeded apace. Only species indigenous to the area have been planted.

Tree planting

Tree planting has been a major activity of the Park Care Group in association with Canberra Nature Park (from 1993 to 1997 at least). Already there are four large fenced areas densely planted with trees. Much of the rest of the reserve is being planted with trees at various densities.

Priorities for planting need to be established. We suggest priority be given to areas:

- (i) heavily weed infested;
- (ii) adjacent to structures like the reservoirs;
- (iii) previously carrying trees, as shown by stumps; and
- (iv) suited to screening out distant suburbs.

Areas to be avoided include those:

- (i) adjacent to houses (fire problems);
- (ii) already adequately stocked with indigenous, self-established trees;
- (iii) having a large concentration of native indigenous species with few weeds; and
- (iv) scenic view points.

The plantings should consist of species which previously grew on the site. As a guide we suggest that for rocky knolls plant Mealy Bundy; for deeper, moister soils plant Yellow Box and Blakely's Red Gum; for south-eastern slopes plant Broad Leafed Peppermint and for slopes and ridges generally plant Red Box.

Tree Survey

A survey of mature trees was instigated by the Cooleman Ridge Park Care Group in 1997. The aim is to record positions, sizes and health characteristics for the 1000 - 2000 trees in the reserve. The information is being stored in a data base. Future repetitions will enable a study of the development of the tree cover in the area.

Road, Tracks and Trails

The roads, tracks and trails are shown on the map.

The main roads (packed soil) are those to the two reservoirs from Chapman, the road along the open ditch that mostly follows the edge of Chapman and continues round the base of Mt Arawang, and the road that is, in part, the Horse Trail but which continues beyond the south-eastern entrance along the boundary then goes uphill towards Chapman along the western edge of Mt Arawang. Tracks are numerous and vary from worn dirt paths, to the steps from Monkman St to Cooleman Trig, to the slashed, rock-cleared strips constructed each summer. Steps have been made southwest of Mt Arawang.

We suggest that three main pedestrian ways be promoted. The first would follow and be coincident with, the road from Kathner St to Namatjira Drive. The second would be the horse trail and its extension to Chapman near Mt Arawang. The third would be a ridge trail from the north-west, around the southern or south-western side of Cooleman Trig, almost meeting the ditch road at the saddle to the south-east of Cooleman Trig but then diverging from it in a southerly direction through the fenced plantations, across the weak saddle to the south of "Stonehenge Hill", downslope and thence to the north-eastern side of the "squarish" (large) reservoir, along the present track to the round (small) reservoir, temporarily joining the ditch road near Lincoln Place, crossing the ditch on the footbridge and joining the 3-part walking track on Mt Arawang.

The Cooleman Ridge Nature Trail in the north-western section of the Reserve has led to a sharp increase in visitor numbers. The use of steps next to the current steep eroding section of road near Kathner St should be considered. A second Nature trail is being planned for the use of Chapman Primary School. Considering the popularity of these trails it is hoped that more such trails will be established contributing to the enjoyment of the Ridge.

Erosion

Erosion is a problem on the road from Kathner St to the open ditch (cut-off drain) mentioned above. We suggest an examination of this area with a view to possible relocation of this section of road. Realignment from just inside the Kathner St entrance around the slope through the first saddle (just above the first steep eroding section), along the slope more or less parallel to the property alignment and rejoining the present road above Chauvel Circle, would be one option which would avoid both heavily eroded

areas. A second option would be to close the eroded sections of the road and upgrade the Horse Trail to carry heavy traffic near the Kathner St dam (even in wet weather).

Eroding sites near the Mt Arawang entrance also need attention amongst others.

Fencing

Fences divide, contain, channel and restrict people, vehicles and stock. In the absence of grazing by domestic stock, fences can be removed and general access can be facilitated for recreationalists and emergency vehicles, let alone Park staff. There are half-buried remnants of old fence lines that could be surveyed (simply) for historic reasons and then removed. The current fencing system should be reviewed and consideration be given to the suggestion for channelling equestrians to their designated corridor. Small realignments of the former alignment of the Horse Trail to avoid boggy patches may be needed if minimum fencing is given priority. (Originally the Horse Trail did not follow that section of the Cooleman Ridge Nature Trail but cut across the area to the south-west). A small excision of the pastoral lease (for inclusion in the reserve) to remove the sharp corner of the boundary should be considered.

Recreation

Recreation is encouraged. However, trail bikes are banned. There is an increasing use of the area by mountain bikes including that during competitive events. Horse riding is encouraged along the designated trail. Managers need to consider the ever increasing recreational use of the Ridge and how this may impact upon it.

FIRE MANAGEMENT

Introduction

Fire has an ambiguous image. On the one hand it is seen as a menace to life and property; it is seen to be frightening. On the other hand it is seen as integral part of nature being an ecological agent for the maintenance of biodiversity; it is seen to be necessary. In both cases, the properties of the fires are important as to how their impact can be assessed more accurately. For the persistence of the biota, not only the properties of the fires but also the intervals at which they occur and their seasons of occurrence can be important (Gill 1975).

[Fire type is neglected here because it lacks relevance in this context.]

Aborigines burned the landscape in this area (Flood 1980) but there are few details. Alan Cunningham was burning the vegetation at Tuggeranong in 1824 (Flood 1980) while Schumack (1967) refers to another bushfire in the early days of white settlement, in 1858. Today there are hundreds of fires per year in the region but most of them are small. McRae (1995) estimated that the number of fires per square km per year at the Park

interface with the suburbs was 0.8. For Cooleman Ridge this would suggest that there would be an average of 3 fires per year. In the period from July 1, 1977 to June 30 1994, 89 ha has been burnt, implying that, on average, the fire cycle (the time to burn an area equivalent to the whole Ridge) is about 36 years. Some parts of the Ridge seem not to have been burnt for at least 45 years because they were not burnt in the extensive Stromlo fires of 1952 (Ben Champion, personal communication to the Park Care Group) and have not been burnt since (e.g. the area to the south of the Kathner St entrance).

Aims of fire management

There are two main aims. The first is to protect life and property, a statutory responsibility. The other is to maintain the biota and ecological processes.

Fuels and fires

The main fuel on the Ridge is grass. How much grass there is per unit area affects the intensity of the fire and flame length but has little effect on the rate of spread. Once more than about 70% of grassy materials is dead, fires can spread.

Grasses of many species occur on the Ridge and the way they grow (and die) affects the way fire will behave. The most prolific fuel is produced by *Phalaris aquatica*, an exotic weed (and pasture grass) but substantial quantities of fuels can accumulate from native species also. In general, grasses are most green in spring when many of them flower. In November and December some grasses senesce so the chances of fire spread increase. The extent of growth in the summer and autumn depends on the amounts and distribution of rainfall and the occurrence of drying weather and winds. Frosts may kill grasses and growth is poor during the cold months of the year so there is the possibility of fire spread in dry grass in winter if the weather is suitable.

Litter fuels of dead leaves and twigs are found under woody plants. In mature plantations the fuel quantities are large beneath the Blue Gums particularly. Some woody plants have fuels present as streamers of decorticated bark or as dry fibrous stringybark. The crowns of woody plants can also burn. Burning pieces of bark may detach from their source and fall, still alight, some distance away. Burning debris can be a potent source for the ignition of structures (Ramsay *et al.* 1996).

Policies of fire management

Policies of fire management fall into three groups that may be summed up as:

- (i) keeping fire out of the landscape as much as possible;
- (ii) burning the landscape as the Aboriginal people did; and
- (iii) developing fire regimes that demonstrably address management aims.

The first of these policies seems to have been the aim on the Ridge. It is a policy that reacts to fire outbreaks by immediate suppression; it shuns prescribed burning; it does not consider fire impacts on the environment explicitly. If it could be demonstrated that non-fire options like slashing could achieve management aims within the constraints of the budget, then this policy could be relevant.

The second policy implies that the flora and fauna were adapted to Aboriginal burning regimes, that the years since this practice ceased have had no effect on the landscape, that the landscape is substantially unchanged, and that any Aboriginal policy or practice of management is still appropriate to today's conditions and needs. However, as we have no firm idea of what Aboriginal fire regimes were, such a policy for this area is void.

The third of these policy types seems to be the only rational one appropriate to today's needs. Even if such a policy was desirable in the past it was impracticable then because of the Air Pollution Control Ordinance of 1987 which effectively curtailed management fires near the city and suburbs. The challenge is to determine the effects of fire regimes, and alternate management actions, on the environment and on the protection of lives and property in order to help evaluate management options.

Options for the protection of life and property

There are two likely scenarios for the occurrence of fires on the Ridge. The first is the ignition of fires near the houses and the second is the ignition of fire to the west of the Murrumbidgee River and the development of a major fire which spreads rapidly in a wide front towards the Ridge area. There are many possibilities for fire scenarios of course.

Fires starting near the houses will have a tendency to burn uphill away from the suburb but the direction of spread may be strongly influenced by a northwesterly to southwesterly wind. In most cases this will create a fire front which will burn in a direction away from, or parallel to, the houses - but of course, the fire will spread out in all directions. Most fires are likely to be accidental although deliberate ignitions have been witnessed. Unless an arsonist sets a fire in a strategically bad position for the protection of life and property and on a day of extreme fire weather, most local fires are likely to be small and pose little - but not zero - threat to property. Response times of the Rural Fire Services or the Metropolitan Fire Brigade are likely to be of the order of 10 minutes.

The scenario in which a large intense fire approaches from the west or north-west could pose the greatest danger to life and property. Under such conditions - and particularly so if other fires were occurring at the same time - fire crews could be spread thinly. At one metre per second, the fire would spread 4 km in one hour. Faster rates of spread are possible. The substantial fuels and local slopes on the Ridge would raise the intensities of

the fire edges. The Metropolitan Brigade would be ready to protect the houses. Fire intensities would decline where the fire burned downhill toward the houses but could be substantial where slopes are relatively small and where there are saddles between hills.

If the wind was from the north-west the houses in most danger would probably be those at the north-western end of Percy Crescent and perhaps those between Chauvel Circle and the southwestern end of Ordell St. If the wind was from the west or south-west, the area near Darrell Place might be expected to be the most exposed. Houses on the uphill side of Percy Crescent might be exposed to the brunt of a fire burning with a westerly wind also.

Just what would happen is difficult to predict because of the swirling nature of winds in hilly terrain. Burning brands would likely be produced from the mature eucalypt plantations and isolated trees, especially indigenous (*E. macrorhyncha*) and non-indigenous (*E. cinerea*) stringybarks. The biggest fires would most likely occur in summer or early autumn when grassy fuels were cured (ie. dead) and high temperatures, low humidities and strong winds can occur.

Residents in areas considered more at risk than others should be offered the opportunity to take part in fire drills and on-the-spot instruction. Exposure to experimental, low-intensity, fires would be useful. Explanation of the value of staying with a property, if prepared and able, rather than leave the house, would be essential. The consequences of choosing various garden layouts and house characteristics, various degrees of garden maintenance, various shrubberies and surface mulches, and the siting and nature of garden sheds and fences etc. during a fire, should be explained. Consideration should be given to the idea of volunteer fire wardens. The use of the fire hydrants found at the backs of a number of houses in Chapman should be considered.

Reducing the fuel load reduces the potential fire intensity and makes suppression less difficult and more likely to succeed. There are a number of ways this can be done including grazing by exotic herbivores. Heavy grazing will reduce the fuel load but the ecological and social consequences may be undesirable (see above). It is arguable whether or not the effects of heavy grazing on parts of the Ridge would have a major effect on fire control in a big event because the rate of spread of the fire front would be little affected, fire control efforts would be concentrated near the houses or at farm boundaries (where there are bare-earth tracks) and the fuel-reduced area would be small relative to the size of the Ridge.

There are alternatives to grazing by exotic herbivores as a fuel amelioration measure. Firstly, the nature of the fuel can be changed. Eliminating the introduced *Phalaris*, a major problem species (see also Fenwick and Everall 1975), and replacing it with a sward of native grasses will reduce fuel loadings in many areas; this could be achieved by an incremental

program of herbiciding and sowing of native grass seeds (McDougall 1989) and by establishing indigenous trees. Plantations of trees change the fuel type from a grassy one to one dominated by twigs and leaves (litter) (see also Fenwick and Everall 1975); litter loads can be reduced by burning at a wide range of times during the year.

Secondly, the amount of fuel can be changed by slashing, mowing, cutting (shrubs) and by burning under safe conditions. It is recommended that a zone 10 m wide adjacent to the houses in the reserve be declared a "nature strip" (as at the kerbside of suburban properties); in this zone householders would be able, if they wished, to reduce fuels legally (cf present) by mowing or by removal of exotics (including non-indigenous natives) but be obliged to refrain from sowing or planting any non-indigenous species. Any planting would have to be under the authority of Canberra Nature Park. Managers would continue a program of slashing and seriously consider prescribed burning in selected areas adjacent to the suburban edge.

Thirdly, steps could be taken to inhibit or prevent the spread of fires onto the Ridge. This can be done by maintaining a selection of bare earth roads and reducing grass heights in a strip adjacent to them. By reducing grass height (and fuel load) the lengths of flames in a fire are reduced and the chances of fire crossing the bare-earth break are also reduced.

Finally, steps can be taken to reduce the ignition potential of the region, perhaps through education.

It is suggested that the Ridge be divided into two zones. One would be a priority zone for fuel minimization; the other would be a priority zone for environmental purposes. The former zone would be narrow and extend around the perimeter of the Ridge and possibly across the Ridge near its narrowest part (where the 'rectangular reservoir' is to be found).

It is apparent that when the fire management of particular areas is being considered that attention to detail is necessary and even to the point of knowing where individual problem trees may be. Thus a detailed fire management plan for the Ridge is needed. The suggestions made above should be taken into account. Suppression strategies have not been considered here but these should be explicit in the Plan.

Options for the maintenance of biodiversity and ecological processes

Because fire has been a component of ecological processes of the area for perhaps thousands of years, it is obvious that fire should be a part of management because one aim is that ecological processes are to be maintained (see "Aims and Objectives"). The question is to what extent this can be achieved. Which fire regimes are most appropriate? Which surrogates may be appropriate?

Research throughout southeastern Australia suggests that frequent burning is necessary for biodiversity conservation because it sets the cover of dominant grasses back and allows less competitive plants to flourish. Some of the 'less competitive' plants are rare. On the basalt plains to the west of Melbourne, Stuwe and Parsons (1977) concluded that regular firing (attempted every year along the railway) allowed the occurrence of a "suite" of less competitive native species to occur. If periodic reduction of the size of dominant grasses allows rarer species to persist then any means which achieves this should allow more species of natives to flourish. This seems to be what has happened with light grazing or slashing (Fensham and Kirkpatrick 1989, Stuwe 1994) as well as burning (Stuwe and Parsons 1977, McDougall 1989). The grazing or slashing regime (type, intensity and interval) will determine the responses of the vegetation - just as the fire regime does - but there has been little research to ascertain details of the benefits or negative effects of particular regimes.

Different 'disturbances' may have unique contributions to make to the control of exotics or the promotion of natives. James (1994) has discussed some aspects of the effects of mowing regimes in remnant bushland in western Sydney. The applicability of research outside the ACT to the ACT should be investigated by seeking out the results of local work in progress (NSW National Parks and Wildlife Service near Royalla and ACT Parks and Conservation Service in areas around Canberra) and comparing them with published work. However, there is no substitute for observations on the Ridge itself so investigation on the spot using simple methods is recommended.

Fires on Mt Taylor and near Cooleman Trig in 1994 were beneficial to native plant species.

There is an urgent need for experimental management to begin so that suitable fire and slashing regimes can be worked out. Experimental management can be very simple and consist of multiple clusters of small plots with simple initial treatments like burning in spring or autumn, no burning, and a herbicide treatment; slashing a buffer around the outside of the cluster could provide another treatment. As knowledge grows, larger areas could be treated. Particular fire regimes may have a role in the control of some exotics but no one fire regime, alone, is likely to control all weeds. Thus, supplementary methods of weed control will be necessary. Slashing at the right times may eliminate Wild Oats and allow other methods to be used subsequently that might favour Oats. The Park Care

Group has made a noticeable difference to the Ridge by the removal of weeds using herbicides, slashing and pulling. Tree plantations reduce weeds too.

Conclusion (to Fire Management Section)

The evidence so far is that for grasslands and grassy woodlands periodic, even frequent, burning is appropriate ecologically for the maintenance of plant species richness; fuel reduction will be achieved by such activities also. Further work is needed and this should begin immediately on the Ridge. Other, unreported, work by the NSW National Parks and Wildlife Service and of the ACT Parks and Conservation Service should be investigated for its relevance to the local area.

RECOMMENDATIONS

1. A formal survey of the biota as the basis for an inventory and a monitoring system is needed.
2. Experimental management should begin along with a suitable recording system for its results so that management will progressively improve.
3. Natural history projects should be encouraged.
4. A formal management plan for the Ridge incorporating a detailed fire management plan should be produced.
5. More effective links with Park Care Groups by the management authority should be developed to recognize the continuing contribution they make to the care of Canberra Nature Park.
6. Steps should be taken to improve the legal and social links between urban-edge residents and Ridge managers in relation to fire management.

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