

DETAILED MANAGEMENT PLAN FOR THE BEMBOKA RIVER RESERVE



The banks of Colombo Creek on the western edge of the Reserve. Small trees from the 2008 planting can be seen in the distance. The foreground area was planted in November 2012. There is scope for more plantings along the creek.

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EXECUTIVE SUMMARY

The Bemboka River Reserve is of very high conservation value, being a relatively large (18 hectare) remnant of the Endangered Ecological Community Lowland Grassy Woodland, in good condition. This vegetation community has been largely cleared on the NSW south coast, and remnants are frequently severely degraded by grazing, poor tree health and weed invasion. It has been used as Crown Leasehold grazing land, with a history of intermittent grazing, and the light grazing history has probably helped to maintain a grassy groundcover of better than average diversity (although not as good as the adjacent ungrazed cemetery). Grazing stopped in about 2004 and Reserve management was transferred to Bega Valley Shire Council. The Bemboka Landcare Group received funding to prepare a management plan for the reserve in 2012, and this document is the outcome of that process. In addition guides to identification of native understorey species and weeds on the Reserve have been produced to assist the Landcare Group with their management efforts. A number of working bees were held during 2012 to familiarise group members with the reserve and its vegetation, and to undertake some weeding.

Key management recommendations

1. While it is desirable to have community ownership of and interest in the Reserve, over-development should be avoided. Construction activities (for example, gravelled paths) and too much foot or vehicular traffic has the potential to degrade the Reserve, mainly by weed introduction. Improvements to public access should be kept to low impact developments with the aim of fostering passive recreation activities and increased environmental stewardship.
2. Vehicular access to the Reserve should be discouraged except for essential uses such as power pole maintenance, and there should be liaison with bodies such as Essential Energy that need to enter the Reserve, to ensure that they are aware of its conservation significance.
3. Interpretive signage should be developed and placed at access points to the Reserve from Colombo Park and the cemetery, when such access points are formalised. Signage on the gate from the adjacent Travelling Stock Reserve, the only vehicle access route, should explain the need to keep vehicles out of the Reserve as far as possible.
4. Existing weeds urgently require control, particularly those listed as noxious in Bega Valley Shire; African lovegrass, St John's wort and blackberry are the most well-established of the noxious weeds. Thorough control work on all these using Crown Lands funding was undertaken in late 2012. Rigorous follow-up will be needed to prevent African lovegrass and St John's wort from rapidly regaining lost ground, and professional weed control may be required for at least another five years, after which infestations may be reduced to the point where volunteers could handle them. Crown Lands funding is likely to dry up and alternative sources such as the Council's Environment Levy will need to be explored.
5. If not controlled weeds have the potential to greatly reduce the conservation value of the Reserve. In addition to noxious weeds there are a large number of environmental weeds, most being only sparsely established. Some of these such as woody weeds (cotoneaster, hawthorn, African boxthorn etc) are relatively easy to control and should be removed as thoroughly as possible. Considerable work has already been done on this. Other weeds should be monitored for impact on native vegetation and could be the subject of control efforts if they are seen to be spreading or having a damaging

effect. Weeds which are not yet well established and which can be controlled by hand removal could be the subject of regular working bees by the Landcare Group.

6. In addition to controlling weeds on the reserve, infestations on surrounding public land also need to be controlled, since they will spread into the Reserve. African lovegrass and St John's wort are the key species in this regard. Removal of woody weeds from surrounding lands is less feasible, and as most woody weeds are readily removed by hand pulling of young seedlings within the Reserve, is also less important. Regular control of bindyi on the Colombo Park oval and surrounds is important to avoid having this weed introduced on shoes into the Reserve.
7. More indirect methods of weed control should be explored. These include the use of topdressing weedy areas with sugar to draw down plant nutrients and starve weeds and the use of fire to discourage spring annuals and improve access to weeds for spraying or hand removal of the more difficult perennial weeds. Fire is also likely to be beneficial for the diversity of the grassy groundcover, which in the absence of occasional grazing, can come to be dominated by a handful of vigorous grasses. A fuel reduction certificate was obtained in 2012, though too late to actually undertake a burn. A routine of regular mosaic burning of parts of the Reserve should be implemented as soon as conditions permit, though burns should not be attempted when conditions are too wet or very dry, or predicted to be very dry in the coming summer.
8. Six 50 metre long monitoring transects and photopoints marked by steel posts at both ends have been installed by Jackie Miles with a view to monitoring the impacts of fire and any changes in boundaries between weedy and native-dominated areas. These should be re-done after every fire or in the absence of fires, every three years, to monitor vegetation condition. This may help to identify where changes in management techniques are needed.
9. Two plantings of local native trees and shrubs have so far been undertaken on the east bank of Colombo Creek in a relatively weedy area. More such plantings could be used to engage locals in management of the Reserve, but should use appropriate local native plants, and should not extend beyond the weed-dominated areas of the creek bank and adjacent lower slope. The re-establishment of tree cover in this area is the easiest way to reduce weed infestations in the long term, besides improving habitat values for wildlife.

Introduction

The Bemboka River Reserve lying north from the Bemboka cemetery at the confluence of Colombo Creek and the Bemboka River is 18 hectares in area, and carries Lowland Grassy Woodland, which is listed as an Endangered Ecological Community (EEC) in NSW under the *Threatened Species Conservation Act* and has been nominated for listing as a Critically Endangered Community nationally under the *Environment Protection and Biodiversity Conservation Act*.

Lowland Grassy Woodland was originally described as two separate vegetation types, Candelo Dry Grass Forest and Bega Dry Grass Forest. Although there are some distinguishing features of the two communities, they are also very similar, so they have now been combined into a single EEC. Lowland Grassy Woodland occurs in coastal valleys south from Batemans Bay, such as around Moruya, Bega and Towamba. It is mostly found on soils of moderate fertility derived from granite, and has borne the brunt of the agricultural activity on the south coast. As the clearing phase has finished in the farming areas of the Bega Valley, and trees are regrowing on much of the more marginal farming land, the main on-going threat is weed invasion. Many of the better remnants have been severely degraded by weed invasion in recent years. Many existing remnants have the groundcover biodiversity greatly reduced due to grazing and weeds, and the trees are often suffering dieback as a result of high levels of insect attack on the foliage.

The main features of Lowland Grassy Woodland are an open tree cover usually dominated by forest red gum (*Eucalyptus tereticornis*) and rough-barked apple (*Angophora floribunda*), a low density of shrubs and small trees like wattles and a more or less continuous groundcover of grasses and forbs (non-woody, non-grass plants: “herbs” or “wildflowers”). Variations on this include dominance by different trees, such as the yellow box (*E. melliodora*) on the Bemboka River Reserve, greater density of shrubs in areas protected from fire or grazing such as steep rocky slopes and river banks and less dense groundcover in areas with thin, dry soils or localised erosion such as gully sides.

The reserve is one of the most, if not the most, intact Lowland Grassy Woodland remnants in the region. It was formerly Crown Leasehold land which was grazed irregularly. It has obviously been cleared of trees in the past as most of the trees are relatively small, but there are one or two very large old trees on the old highway route between the reserve and the adjacent cemetery, which give an indication of the original woodland stature. The trees on the reserve are generally in better health than those seen in most privately owned remnants in the region, although their health goes up and down in response to rainfall and levels of insect attack on the leaves.

The practice of leasing the land for grazing ceased in about 2003, and since then a shrub layer and small tree layer of wattles has been developing, particularly close to the Bemboka River bank, where a seed source for these species was present in the more intact vegetation of the river bank. The old highway also still carries some understorey vegetation. All of the Reserve carries a grassy groundcover, and in most parts of the site it is of a relatively low species diversity, although still better than that of regularly grazed remnants. Kangaroo grass is dominant on some parts of the site. Other native grasses such as microlaena, paddock lovegrass, plume grass and poa tussock are all common, along with a number of exotic grasses. A considerable number of native forbs are present, though most of them apparently only in low numbers. Some of these are regionally significant species, in that they were originally found mostly in the grassy woodlands of the farmed parts of the Bega Valley, and are now quite rare in the district. The cemetery carries higher numbers of such species than the reserve, since it has never been grazed. However, given that the cemetery will eventually fill up with graves, it is desirable to encourage the spread of as many of these plants as possible into the reserve, to make them more secure in the long term.

A plant species list for the reserve is appended. Regionally significant species are marked in bold. In addition a guide to the smaller native plants of the reserve has been produced, which discusses the conservation significance of the various species. It includes some species which are not on the reserve but could be established there in future through planting or relocation of seed from the cemetery or other remnant vegetation patches in the Bemboka area.

There are basically two types of native vegetation present on the reserve, though both fall within the definition of Lowland Grassy Woodland. Around the perimeter of the reserve, except for the Colombo Creek frontage, there is a heavily treed area which has a groundcover of shade-tolerant grasses such as microlaena. The internal area has fewer trees, although there are occasional old trees surrounded by copses of younger regrowth, and the dominant grass in these more open areas is kangaroo grass, which prefers full sun. The wattle and shrub layer is mostly confined to the perimeter area, and other native grasses and forbs also appear at this time to be mostly located in this area. However, this may be because the dense growth of grass in the treeless areas is concealing populations, and could change if a fire temporarily reduced the dominance of kangaroo grass. This is discussed in more detail below.

The reserve is no doubt also significant for native fauna, though there has been little survey effort to find out which species might use it. The Far South Coast Birdwatchers occasionally visit the reserve and Colombo Park, and a list compiled by them for the two areas, with some additions by Jackie Miles, has also been appended. It would be of interest to undertake some night time surveys to see what mammals such as possums might be present. The reserve is moderately well connected to large tracts of forest around the valley rim by remnant riparian vegetation along the Bemboka River. This would increase the likelihood that a range of animals use it. For example, the Swamp Wallaby, usually an inhabitant of forests, has been seen in the reserve. The presence of some large old trees and dead trees which probably contain hollows would also increase its value for native fauna, since quite a lot of birds and mammals, and even reptiles (such as the Lace Monitor or Goanna) and tree frogs, use hollows for shelter or breeding. Some animals which are listed as threatened in NSW have been recorded on the reserve (the birds Varied Sittella, Diamond Firetail, Scarlet Robin and Gang-gang Cockatoo) and it is quite likely that more would be detected with greater survey effort, particularly small insectivorous bats.

The reserve is not currently much used by the local community or travellers, although the facilities in the adjacent Colombo Park are frequently used by campers or travellers stopping for a rest and a meal. Once access problems across Colombo Creek are resolved the reserve will be more accessible and is likely to come in for greater usage for passive recreation. This may bring with it some risks to the ecological integrity (for example by weed introduction) but it will also provide opportunities to educate and engage both locals and travellers.

Other parcels of public land occur around the reserve, a Travelling Stock Reserve, a portion of the Bemboka Common (these two located on either side of the cemetery), the old highway road reserve and the Bemboka River and Colombo Creek banks. These really need to be brought under conservation management along with the reserve, as otherwise they will act as a reservoir of weeds and threaten the integrity of the reserve.

Threats to the reserve, and management issues

There are a number of threats to the ecological integrity of the reserve, the greatest of which is weed invasion. Weeds have the capacity to greatly alter the species composition and appearance of the reserve, and can do this over quite short time frames. The weed situation

on the reserve has deteriorated substantially in the decade since its value was first noticed, despite the cessation of grazing.

Other potential threats are erosion, tree dieback, damage by the public if the reserve becomes a more popular recreational destination and damage by livestock if fences are breached.

Management actions to address these threats are suggested below.

1. Weeds

The situation in 2012

The Reserve has a substantial, though sparse, infestation of St John's wort and African lovegrass as well as small numbers of woody weeds including blackberry, sweet briar and various garden escapees like cotoneaster and hawthorn. In November 2012 a single plant of serrated tussock was found.

In a draft management plan produced in 2003 I stated that there was no African lovegrass in the reserve though it was sparsely present on the old highway. Searches of the entire reserve in July 2012 located it in 37 different locations, an impressive rate of spread in ten years. As African lovegrass generally arrives in new areas on vehicles, livestock or people rather than as windblown seed, it seems likely most of it penetrated the reserve on vehicles. The tree planting on Colombo Creek banks in 2008 was probably responsible for another introduction, since it is abundant within this planting. It probably arrived on machinery used to prepare the site for the planting. The main vehicle access to the reserve is probably for weed spraying by contractors and it is desirable to reduce this and conduct most weed control on foot. There is a powerline easement through the south-western corner of the reserve and this receives occasional maintenance from Essential Energy or their contractors.

St John's wort may have initially arrived on or in the gut of cattle grazing the reserve, as it was present prior to the cessation of grazing in around 2003. It has been gradually increasing since then, despite regular annual control attempts by Bega Valley Shire Council staff or weed contractors.

Serrated tussock is a highly invasive grass which has wind-dispersed seed. There are scattered infestations in the Bega and Towamba valleys especially at Candelo and Brogo, and occasional plants could appear anywhere. A watch will need to be kept for this weed on the reserve now that it has appeared. The single plant found was located at the high point of the reserve, close to the eastern one of two steel posts which indicate the location of a monitoring transect.

Blackberry is also scattered throughout the Reserve, particularly on the lower banks of Colombo Creek, as small plants. Fireweed is gradually invading the reserve, arriving as wind-blown seed from surrounding lands where it is not adequately controlled. These five weeds are listed as noxious in Bega Valley Shire and land managers are legally required to control them. Numerous other weeds which are not listed as noxious are also present.

Woody weeds include briar rose and African boxthorn, which are present in low numbers. Cotoneaster and hawthorn which would have spread by bird-distributed seed from the nearby village of Bemboka are scattered under trees and are likely to continue to appear as new seedlings. The Bemboka River banks had an infestation of tree of heaven in 2003, but this and some other woody weeds on or near the river bank were dealt with at the time that the reserve fencing was replaced in about 2004.

Weed control work was undertaken on the reserve in June 2012 by Brighter Day Landscapes, a local bush regeneration team, with assistance in locating weeds by Jackie Miles. This included spot-spraying of all African lovegrass and some isolated patches of other grass weeds such as kikuyu and foxtail grass with glyphosate and removal of seed heads for disposal off site, spraying of occasional St John's wort plants (but only a small proportion of the total infestation as it is not very active at this time of year) and cut-and-paint or stem injection of some of the woody weeds, including feral pines, hawthorn, sweet briar and African boxthorn, as encountered during lovegrass spraying. No attempt was made to search the entire reserve for woody weeds at this time, as the primary target was African lovegrass. Spot spraying of African lovegrass with glyphosate was done in December 2012. There was not a great deal of regrowth of this weed found, suggesting that removal of seed heads was an effective strategy. However, there was enough regrowth for populations to have re-established if there had not been effective follow-up spraying.

Spraying of St John's wort by Brighter Day Landscapes and Jackie Miles was undertaken in December 2012, with three visits being required to spray all the younger plants which appeared subsequent to the earliest visit. Plants are very widely scattered over the reserve with two areas of dense infestation, in a valley north-east of the main track which runs from the gate to the north-west corner and to the west of this track close to the gate. St John's wort is also abundant on the western bank of Colombo Creek.

Blackberry and thistles were also sprayed during these three visits. At least one more day of follow-up work will be needed to complete the initial knock-down of St John's wort and blackberry. St John's wort is also present close to the fence in the cemetery, on the edges of Colombo Park, in the section of the common adjacent to the cemetery and is abundant in the TSR, along with African lovegrass. Control work in December 2012 included spraying of most of these areas. The TSR was slashed to improve access in December, and only the unslashed areas of St John's wort around the gully edges were sprayed in 2012. The remainder will be sprayed after it has recovered from slashing.

A number of Landcare Group working bees were held through the winter of 2012, which concentrated on hand removal of some of the less well-established weeds on the reserve, such as stinking roger, spear thistle, mullein and fireweed. Removal of weeds before they build up to large populations is the most efficient method of weed control and a lot of this can be achieved with timely hand weeding by volunteers. The larger weed issues will require input from professionals.

On-going control of weeds will be required, but the amount of effort should not be great after the initial knock-down of the existing infestations, which have developed over a long period.

It is important to reduce as much as possible the introduction of new weeds to the reserve, since it is a lot easier to keep weeds out than to control them once they are in.

There are a lot of other exotic forbs and grasses present on the reserve, some only in low numbers and some quite abundant. Some of these, such as the stinking roger and mullein mentioned above, are worth trying to control, and are sparse enough that they could be controlled by volunteers. Others are too well established for control to be feasible without a great deal of effort and would require the attentions of a dedicated weeding team over several growing seasons. There needs to be more assessment of the effect these weeds (for example, panic veldt grass which is common in shady areas, and veined verbena which is patchy throughout) are having on the reserve and whether they are spreading or more or less stable. If they appear to be spreading and potentially quite damaging, then their control could be the subject of further grant applications.

Funding for weed control has come mostly from the Lands Department/ Department of Primary Industries to date, but with the loss of the Senior Natural Resource Management Officer position from Bega (Noel Whitem), this funding source may dry up after the current summer season. Alternative sources will need to be found, so on-going grant applications or long-term commitment from another body such as Council or the Catchment Management Authority will be needed, at least for the next five years or so until existing infestations can be brought under control.

As well as being a threat in their own right to native vegetation weeds also introduce the threat of herbicide use onto the reserve. Since the herbicides likely to be used may be toxic to a wide range of plants, their careless use can cause considerable damage to native vegetation and ultimately make the weed problem worse by creating bare ground. There is an example of this already present, in a number of almost bare "scalds" scattered around the reserve. It is likely that these were created by over-enthusiastic use of the herbicides Frenock, Kenock or Taskforce to control African lovegrass. These are selective grass herbicides when used at the recommended application rate, but if mixed too concentrated or sprayed on too heavily they can suppress all plant growth for a number of years. Use of herbicides needs to be judicious, tightly targeted and done only by people with a careful and respectful approach to native vegetation.

Recommendations

1. Minimise the arrival of new weeds by limiting vehicle access to the reserve. Actions to implement this could include:

- locking the gate into the reserve at the eastern end of the old highway,
- locking the Travelling Stock Reserve (TSR) gate at the Snowy Mountains Highway (after liaison with the Livestock Health and Pest Authority), OR
- placement of signage explaining the need to limit vehicles on the reserve to essential access only,
- liaison with Essential Energy, BVSC weeds staff, Rural Fire Service staff and volunteers and any contractors (e.g. fencing) about the need to wash down vehicles before entering the reserve and not bringing in vehicles unless essential,
- requiring weed control operators to work on foot rather than from vehicles,
- ensuring that weed control is undertaken in the TSR to remove African lovegrass and St John's wort, since washing of vehicles is of limited use if they pick up more seed on their way through the TSR, the only vehicle access route to the reserve.

2. Reduce weed infestations in surrounding areas to limit the possibility of weeds arriving on people (e.g. on shoes, clothing, backpacks) or animals. Areas particularly needing work are those around existing and any new access points, such as the gateway from Colombo Park and a gateway or stile from the cemetery if one is installed, as well as the TSR as discussed above. Currently the main weed of concern is bindyi on the Colombo Park oval and surrounding areas. This needs to be sprayed regularly, and not just the oval but the camping and picnic area, otherwise this site is a source of contamination not only for the reserve but for the wider region. Bindyi seeds are very well adapted for being picked up on shoes and car tyres and transported over considerable distances. The cemetery is another potential source of weeds, and if weed contractors are operating on the reserve they should do the cemetery at the same time, after consultation with the cemetery committee (Ray Alcock).

3. Ensure that any community activities in the reserve do not introduce new weed infestations. People working on the reserve should check boot treads, trouser cuffs etc for seeds before entering. Any future tree plantings on the reserve should be done with minimal preparation (slashing, ripping etc) to avoid bringing in seed. Creation of mown paths should be kept to a minimum, and any machinery used to produce them should be washed first

unless it is dedicated equipment kept on the reserve solely for that use. It is very easy to move weeds around on lawnmowers, brushcutters and the like.

4. Pursue eradication of noxious weeds St John's wort, African lovegrass and blackberry consistently for the next five years. This is probably about the period it will take to bring existing infestations under control, since when spraying weeds, some are always overlooked. While these weeds are present at anything more than a very low level, the work will need to be done by weed contractors, but eventually it should be possible to bring infestations back to the point where volunteers can manage them. Keep a watch for serrated tussock and remove any that occurs.

5. Liaise with BVSC weeds staff annually when planning weeding efforts to ensure that work is coordinated and there is no inefficient duplication.

6. Use professional weeders for the initial knockdown of woody weeds on the reserve, including sweet briar, cotoneaster, hawthorn, African boxthorn, feral pines and feral plum. It is not feasible to remove most of these from the surrounding areas such as the TSR and Common to reduce reinfestation. Because they are largely bird-dispersed, they will continue to arrive from substantial populations of many of these plants in Bemboka. However, once the larger plants are killed, occasional pulling or chipping of seedlings should suffice to keep them from reinvading. Larger woody weeds should be killed by stem injection and left standing, both to avoid extra work, the disturbance to native vegetation and soil involved in removing or burning them and because birds appreciate dead trees as perches.

7. Use local volunteer labour to continue regular patrols of the reserve targeting the easier to manage weeds: those for which hand-pulling or chipping is a viable control method, such as fireweed, thistles, mullein, Buchan weed, stinking roger, cobbler's peg. A monthly stroll around the reserve could be instituted as a combination of social activity, exercise and weeding. When hand weeding only the flowers or seed heads need to be removed for safe disposal. The bulk of the weed material can be left lying on the ground to die, or hung up in shrubs or on fences. The moister peripheral areas of the old highway and adjacent to the river bank appear to be the areas most in need of regular weed patrols, although fireweed also appears around the high point of the reserve.

8. Experiment in highly weedy sites with use of sugar to change the soil and make it less hospitable for weeds. This method operates by increasing soil microorganisms, thereby using up surplus nutrients, tipping the balance in favour of native plants which are better adapted to low nutrient soils. It would very likely not work on weeds which do well in low nutrient soils, such as African lovegrass, but could be used in areas where weeds needing more fertile soils occur. Examples might be the large patch of kikuyu growing on the high point of the reserve, which has been nutrient enriched due to being an old cattle camp, or areas in which panic veldt grass is invading under trees around the reserve perimeter. Quite high dose rates of sugar are used (0.5 kg per square metre), and it needs to be reapplied every few months, so this method could be quite expensive. It is therefore not suited to broad scale weed treatment, but it could be a suitable technique in some areas. Some monitoring of the outcomes would be advisable to determine whether it is having the desired effect on weeds and not having a detrimental effect on any significant native species.

2. Native vegetation management - grazing

The situation in 2012

The dilapidated fencing was replaced right around the reserve and an old internal fence removed in about 2004. Prior to this cattle were occasionally getting into the reserve across the Bemboka River, in addition to the occasional leasing of the reserve for grazing.

The fencing across the mouth of Colombo Creek was washed out in a flood in 2011 and fencing along the river bank has been damaged by falling wattles and branches. This needs maintenance.

The fence between the TSR and the old highway has fallen down. While the newer fence between the old highway and the reserve is still functional, it is not desirable to have animals in the TSR having access to the old highway. The old highway, though only small in area, has the only, or the main, population of two regionally rare plants. These are bulbine lily and lespedeza, two plants which are also present in the cemetery, where mowing and general tidying up is not very favourable for them. As they have shown themselves capable of moving into the old highway reserve from the cemetery, it would be good to encourage their further spread into the reserve. Both are sensitive to grazing and likely to occur only in ungrazed or lightly grazed situations. The lack of a fence on the TSR is not currently a problem as it has not been leased for grazing for some time, but it could become problematic if the management of the TSR changes (for example, if TSRs are sold by the State Government).

It would be preferable not to use grazing for vegetation management on the reserve, although there are some respects in which it can be useful. While occasional grazing can reinvigorate kangaroo grass pasture by removing the bulk of dead matter from the grass tussocks, it is also responsible for the loss of biodiversity in the forb component of the groundcover. The contrast in this respect between the formerly grazed reserve and the mown cemetery is quite marked, with the cemetery having several forbs and one grass which are absent from the reserve. There is also the near-certainty that livestock will introduce the seeds of noxious and other weeds in their manure, particularly African lovegrass and St John's wort.

Recommendations

Ensure that fencing is maintained in a stock-proof state. Minor damage to fences can probably be handled by local volunteers. Anything more will require a source of funding to engage a fencing contractor. Stock-proof fencing is particularly crucial in times of drought, when the Bemboka River is less of a barrier and stock are hungry.

3. Native vegetation management -fire

The situation in 2012

The site has not been grazed since around 2003, apart from occasional minor stock incursions during the 2002-09 drought. With two wet years in 2010 and 2011, the treeless parts of the reserve are now covered in very dense grass growth. These are highly flammable and could be seen as a fire hazard for the nearby township. It may also be ecologically undesirable for this situation to continue for too many years.

It is impossible to say with any confidence what the character of the original grassy woodlands of the granite country of the Bega valley might have been before European impacts. However, the considerable overlap in species between remnants of these woodlands and the natural grasslands and grassy woodlands of the Southern Tablelands suggests that they might once have been fairly similar in appearance. That is, grasses and forbs would have dominated the understorey, and presumably trees and shrubs were relatively sparse. If this is so, it was probably achieved by regular burning by Aboriginals, since in the absence of fire remnants generally turn into dense thickets of eucalypt, rough-barked apple or wattle regeneration, with little species diversity in the groundcover. Plants which are normally found in wetter forests such as pittosporum and various vines which are spread by birds tend to invade remnant stands which are not burnt.

These points suggest that fire may be necessary to maintain the character and species diversity of grassy remnants. Some of these have been observed to dramatically improve their apparent species diversity after a fire. Many forbs are suppressed by dense grass growth, but remain present as tubers or woody roots. The release from shading and competition from grasses achieved by a fire can produce an impressive flowering of native forbs following a burn. This has been pointed out by many researchers in the field of grassland management, and has been observed to be the case in the Bega valley in locations such as the Wyndham and Rocky Hall cemeteries. In the Bemboka cemetery even a small and very cool burn conducted in May 2002 by the following autumn had produced an appreciable increase in native legumes in the burnt area when compared with an adjacent area which was mown at the same time.

Another valuable use of fire is in thinning tree regeneration. There has already been a substantial amount of tree regeneration occur on the reserve, which is in broad terms a good thing. However, in the absence of any grazing pressure to thin seedlings, regeneration can become very thick, and suppress groundcover plants by depriving them of water or light. Given the fact that much of the species diversity of Lowland Grassy Woodland typically occurs in the groundcover layer, it would be preferable to try to maintain at least those parts of the area which are presently grassland in this open and relatively treeless condition. Regular burning is a simple way of achieving this, since fire will keep eucalypt and wattle saplings in check. Larger eucalypt saplings will generally re-shoot from the base, but regular burning will at least keep them small and discourage them from forming a dense thicket which shades out the grassy layer.

Fire frequency is difficult to prescribe, in the absence of any research in grassy ecosystems in this region. However, the prescription usually cited for grasslands in Victoria, where much of the research on grassy ecosystems has been done, is for a fire every 3-5 years.

Given that the reserve has a grazing history it is unlikely that a burn will reveal a high diversity of native forbs. However, it may improve the diversity and abundance of forbs to some extent. It is also likely to reduce the levels of some common weeds of grassy vegetation such as flatweed and fleabane, at least in the first year after the burn. However, to achieve this effect, the fire does need to be reasonably hot. A fire lit in very cool or moist conditions, or where fuel levels are low will not produce sufficient heat at ground level to kill low-growing weeds.

It was planned to burn most of the more flammable parts of the reserve in spring of 2012, but by the time the necessary permits had been obtained there had been some heavy rain and conditions were judged by the Bemboka RFS to no longer be suitable. The intention had been to burn as much of the reserve as would burn on this occasion, with the aim of improving the visibility of weeds, which at the start of the 2012-13 growing season were well concealed in very long dense grass in some areas. A substantial area around the reserve perimeter would be very unlikely to burn in all but the driest conditions, since the shade of the trees in this area makes the groundcover lower and greener, and it tends to be composed of less flammable grasses.

The Hazard Reduction Certificate having been issued in 2012, it should be a relatively simple procedure to renew it in the following season. A Review of Environmental Factors has also been completed for the burn by Council's Natural Assets Manager, Andrew Morrison, though it is not certain that this was necessary. Conflicting advice has been received about the bureaucratic processes which need to be completed before a burn can be done in an Endangered Ecological Community. Council was the determining authority for the Review of Environmental Factors.

In anticipation of the fire, six monitoring transects were set up on the reserve in August 2012. They are 50 metres long and marked by a steel star post at each end. On each transect nine or ten quadrats were done, with all species within the quadrat being identified (as far as possible, since August is not a good time to identify grasses) and their percentage cover recorded. Quadrats are all 1m x 1m, using a frame of this size made from conduit and laid down straddling the tape. Four photos were taken from each end of the transect, facing north, south, east and west, standing just behind the post and with the tip of the post in the foreground of the photo. All transects are located running between weedy and predominantly native vegetation, so that changes in weediness following management actions can be detected. The quadrat data and photos have been retained by Jackie Miles, but copies can be provided on request.

Recommendations

1. A fire should be tried on the reserve at the earliest opportunity. It would have the benefits of reinvigorating the dominant kangaroo grass in the open areas, as without occasional biomass reduction by fire or grazing, kangaroo grass can gradually cease flowering and then begin to senesce and die. Once it reaches this stage of decline it becomes very much more open to weed invasion than healthy, vigorous kangaroo grass. A fire would also make weeds very much more visible and easier to control by spraying or chipping. Fire has the effect of temporarily increasing the physical separation of individual plants, making it easier to spray one plant without spray drift affecting adjacent plants.
2. It would be preferable not to burn the entire Reserve on any one occasion, but to divide it into say four blocks and only burn one in any one year. This would mean that there would be a burn conducted on some part of the Reserve every year, allowing for one year off out of five when conditions are too wet or too dry to burn. This would be a preferable way to proceed, since it would make burning there a regular part of the annual calendar, rather than something which can be put off from year to year and consequently gets forgotten about.
3. If machinery is brought in to mow breaks for fire control, it should be thoroughly cleaned to remove weed seed first. The existing rough track from the eastern gate on the old highway to the north-western corner of the reserve near the river is an obvious choice for one fire break, with another running east-west across the reserve. If it proves impossible to get fire breaks slashed in any one year, then it is unlikely to be damaging if the whole of the flammable part of the reserve were burnt on that occasion, but it would be preferable not to burn all of it every year.
4. Timing: August is a good time to burn, since plants begin growing around this time, with the result that the ground will not be left bare for too long. Ground left bare over the winter is likely to result in increased levels of invasion by exotic annual grasses and herbs, many of which grow through the winter to produce seed in spring. A fire in August will be unlikely to harm nesting birds, while reptiles and frogs will probably have warmed up and be mobile enough to move out of the way of the flames. Fires later in spring could be more damaging to fauna if birds are nesting by then. Late summer might also be a suitable time, since if adequate soil moisture is available most native grasses will continue growing into early winter, to rapidly re-establish the groundcover.
5. If conditions are dry, burning should be deferred for another season, since recovery will be slow and selective grazing pressure on plants from rabbits and native herbivores may be high. If conditions are too wet, or grass too green as a result of winter rains, then fire should also be deferred.

6. Prior to burning the reserve it will probably be necessary to create firebreaks around any infrastructure such as seating which has been installed and the planted trees and shrubs on the banks of Colombo Creek.

7. The monitoring transects should be repeated after any fire, as soon as sufficient growth has occurred post-fire and plants are in an identifiable state. Photos taken from each end of the transects should be repeated immediately after the fire, to keep a record of fire intensity and patchiness, and again when the transects are repeated.

8. It would be desirable to set up a similar fire regime in adjacent land around the reserve, such as the TSR and the portion of the Bemboka Common north of the highway, to assist with weed control and possibly improve their condition.

4. Native vegetation management – plantings and tree health

The situation in 2012

There is some scope for habitat restoration along Colombo Creek as the creek frontage lacks tree and shrub cover, although the banks are stable and well grassed. Without grazing pressure the kikuyu and various weeds such as fleabane could become very tall and thick in this area, which may adversely affect the survival of any trees or shrubs planted there. However, if trees could be got to survive there, the shade they eventually cast could help suppress the kikuyu and encourage the recolonisation of the banks by native groundcover species.

One planting was undertaken by Bemboka Primary School children with the assistance of Jock Waugh in 2008. The original size of the planting is unknown, but in 2012 there were 20 trees (of 7 species), 24 shrubs (of 8 species) and 26 lomandra surviving. Some of the trees are not very vigorous. As 2008 was a period of severe drought it would not be surprising if survival rates had been poor, especially as there was reportedly no maintenance. It appears likely that ground preparation for this planting introduced seed of African lovegrass, since it was abundant within the planting area by 2012. The planting is all of local natives but many of them are not naturally occurring on the reserve, and some such as tree hakea (*Hakea eriantha*) are not a normal component of Lowland Grassy Woodland. The species in this planting are identified as P1 in the accompanying species list for the reserve.

Another planting was undertaken upstream of the 2008 one by Landcare members with assistance from Jackie Miles in November 2012. This was of 33 plants of only three species, 16 snow gum (*Eucalyptus pauciflora*), 11 river peppermint (*E. elata*) and 6 blackwood (*Acacia melanoxylon*). These two eucalypts are not naturally occurring in the reserve, but do occur nearby. The river peppermint seed for the planting was collected on Polacks Flat Road where it runs alongside the Bemboka River, and the snow gum seed from Buckajo Road near Meringola Creek bridge. The blackwood seed was collected from Brogo, although it could have been obtained closer to the site, as blackwood is quite a common understorey plant on creeks near Bemboka, especially near the foot of Brown Mountain. This planting has been protected with more robust wire netting guards wired to two wooden stakes, which should protect the trees from wombats. There is a wombat burrow in the middle of the planting area. The species in this planting have been identified as P2 in the species list.

Apart from the Colombo Creek banks there is no need to plant any additional trees or shrubs on the site. Although the shrub layer is currently lacking from most of the site, a seed source of appropriate species does occur around the edges of the Reserve, and shrubs and wattles will probably gradually spread into the Reserve in the absence of grazing pressure. Indeed the challenge may be to prevent them from becoming too thick and suppressing or altering the composition of the grassy groundcover.

There is potential to try and restore some of the groundcover species diversity, so that the Reserve more closely resembles the adjacent cemetery. This would take some of the conservation pressure off the cemetery, which is after all intended primarily as a burial place rather than a conservation reserve. It would also make the local conservation of these regionally significant grass and herb species more secure, by ensuring they survive on a larger area of land with fewer conflicting land uses and community expectations. Species to be planted on the reserve could be drawn from the wider Bemboka area, and be species which are known to occur within Lowland Grassy Woodland. Appropriate species which are relatively easy to propagate are the following, some of which are already present in very low numbers or a very restricted area within the reserve:

Forbs or small shrubs:

<i>Arthropodium milleflorum</i>	pale vanilla lily
<i>Bulbine glauca</i>	bulbine lily
<i>Bossiaea buxifolia</i>	
<i>Calotis lappulacea</i>	yellow burr-daisy
<i>Chrysocephalum apiculatum</i>	yellow buttons
<i>Chrysocephalum semipapposum</i>	tall everlasting
<i>Cullen microcephalum</i>	mountain psoralea
<i>Desmodium brachypodum</i>	large tick-trefoil
<i>Dianella longifolia</i>	blue flax-lily
<i>Dianella revoluta</i>	black-anther flax-lily
<i>Leptorhynchos squamatus</i>	scaly buttons
<i>Leucochrysum albicans</i> ssp <i>albicans</i> var <i>albicans</i>	hoary sunray
<i>Lespedeza juncea</i>	lespedeza
<i>Lotus australis</i>	Austral trefoil
<i>Podolepis hieracioides</i>	copper-wire daisy
<i>Velleia paradoxa</i>	spur velleia
<i>Vittadinia cuneata</i>	fuzzweed
<i>Vittadinia muelleri</i>	fuzzweed
<i>Zornia dyctiocarpa</i>	zornia
Grasses:	
<i>Austrostipa verticillata</i>	slender bamboo grass
<i>Capillipedium parviflorum</i>	scented-top grass
<i>Chloris truncata</i>	windmill grass

However, if species are going to be propagated for planting into the site, careful attention would need to be paid to collection of seed from an appropriate local source and from a sufficiently large number of plants to maximise the chances of adequate genetic diversity in the planted individuals. The primary aim of the planting would be to establish viable, self-sustaining populations of these species on the site, although the educational benefits from such a project should not be overlooked.

The possible negative effects of planting activities should also be considered. Plants would need to be cultivated in the smallest possible pots, to reduce the soil disturbance involved in planting them. The pots would need to be kept weed-free throughout the growing period to avoid introducing new weed species onto the site.

Because the site carries a listed Endangered Ecological Community, any such activity would need to be carried out under a licence from the Office of Environment and Heritage, or whichever government body is administering the *Threatened Species Conservation Act* at the time. Monitoring of the outcomes would be required, to ensure that the results justify the effort involved, and that there are no adverse impacts on the vegetation of the Reserve.

A simpler method of re-introducing forbs onto the reserve would be to scatter seed into appropriate areas. This would generally be areas with little grass cover so that the forbs could establish free from competition with dense grass growth. Some of the “scalds” created by past herbicide use might be suitable for this purpose, if the effect of the herbicide has abated enough to allow seed to germinate and grow. Scattering appropriate seed soon after a fire would be another means of allowing forbs to establish while grasses are less dominant.

Tree health goes through cycles in the Bega Valley in general and in the reserve. These are usually related to drought and feeding pressure of herbivorous insects like Christmas beetles on the foliage. Rough-barked apples often lose most of their leaves after they have flowered heavily, and they generally recover from this. Tree health is usually conspicuously better closer to the valley margins, where there is presumably a more complete suite of animals which feed on damaging insects. The least healthy looking trees in the reserve are two large old yellow box trees on the highest point, which in 2012 have very sparse foliage. This area was once a cattle camp and is heavily invaded by weeds such as kikuyu and Paddy’s lucerne. It is likely that the soil here is both compacted and has elevated nutrient levels, which could be a direct source of stress to the trees or could be acting indirectly by favouring higher levels of insect attack. Trees with more nutritious foliage are selectively targeted by herbivorous insects. It is also possible that these trees have been affected by herbicide used on the two large African boxthorn plants beneath them. Allowing a shrub layer to develop in peripheral areas of the reserve should result in higher populations of insect-eating animals and ultimately be beneficial for the trees. Regular use of fire may also help to reduce excessive nutrient levels on the old stock camp, if this spot can be burnt (kikuyu in this relatively shady site may be too green to burn in many springs).

A factor which can affect tree health is the presence of either or both of two aggressive native birds, the Bell Miner (or “bellbird”) and the Noisy Miner (not to be confused with the introduced Indian or Common Mynah which has recently begun to invade the far south coast). Currently neither of these birds has been recorded from the reserve but as both tend to be quite mobile, they could appear at any time. Both live in large family groups which behave quite aggressively and tend to drive out most other birds, especially those which might compete with them for food. Both feed primarily on insects, but also partly on nectar, being members of the honeyeater group. They occupy very different habitat, with the Noisy Miner preferring open parkland with scattered trees and no shrub layer and the Bell Miner preferring forest with a dense shrubby understorey. Both can cause eucalypt dieback, and even death, by reducing bird predation on the insects that cause defoliation of eucalypts. In situations such as the reserve, where there is relatively dense riparian vegetation adjacent to open woodland, both could theoretically occur. This has been seen further downstream on the Bemboka River (J. Miles, pers. obs.). Features of the habitat which are likely to discourage these birds from colonising the reserve would be an understorey of medium density, thicker than the Noisy Miner would like but not so dense as to attract the Bell Miner. If either appear it may be possible to encourage them to move on by manipulation of the vegetation. Regular fire is likely to discourage the Bell Miner, as it is probably at least partly reduced fire frequency in the last 30 years or so that has enabled them to move out of gullies and spread across the landscape more widely, as dense shrub and small tree layers establish in drier forest types.

Recommendations

1. Ecologically it is more important to concentrate on weed control than on plantings. However, tree planting does seem to be a more attractive proposition for many people, so it is probably worth continuing with an annual small planting along Colombo Creek for a few years. This should have beneficial effects on the creek banks and may get more local people involved with the reserve. Plantings should receive follow-up care, such as watering if rainfall is limited in the first season after planting, and weed control (preferably by hand)

around the trees. They should be checked after a flood in case any tree guards have been pushed over by flood debris and need to be stood up again.

2. Plantings should be restricted to the creek area, but could extend up-slope from the immediate creek flats into an area of lower slope which is dominated by Yorkshire fog and other exotic grasses and is probably quite a wet area.

3. More trees and shrubs could be incorporated into the area of the 2008 planting, but not until the African lovegrass has been eliminated in this area, otherwise they will only make control by spraying more difficult. Similarly areas with blackberry, St John's wort or other weeds needing to be sprayed should be avoided when selecting areas to plant.

4. Some shrubs could be incorporated into the 2012 planting area at the next planting. However, the most appropriate shrub for growing under trees near waterways is tree violet (*Melicytus dentatus*), which is spread by birds, is already present on the reserve and will probably arrive unassisted once the trees grow up enough to provide perches for birds and to suppress the grass beneath them. The plantings should be monitored in future for the arrival of less desirable bird-dispersed shrubs from the township, such as hawthorn and privet and these should be removed if they appear. A suitable shrub for planting on the drier upper banks is the native weeping broom (*Jacksonia scoparia*) which is sporadically common along the verges of the Snowy Mountains Highway between Numbugga and Bemboka, but is otherwise uncommon in the region because it is highly palatable to both livestock and native herbivores such as the Swamp Wallaby. It is an attractive tall shrub or small tree with silvery leafless branches and masses of yellow to orange pea flowers in spring, which deserves to be more widely planted.

5. The effectiveness of the wire tree guards used for wombat protection in the 2012 planting should be assessed after a year, and if it seems they have been useful, then future plantings should get a similar degree of protection. Small plastic sleeves or mesh guards are of very little use when wildlife occurs in the planting area. The wire guards and stakes can be reused when the trees have grown large enough to no longer need their protection, though this is likely to take at least two years.

6. Preparation for plantings on the creek banks and flats should be by hand only, to minimise the risk of introducing weed seed. Soils on the flats are deep sandy loams and easily dug, so ripping is not necessary. For the 2012 planting dense grass was removed with a whipper-snipper down to soil level, then the grass roots dug away with a hoe to create a small planting hole with a watering bowl around it. It is not necessary to use herbicide, especially if some sort of mulch is used around the planted trees. In 2012 newspaper was used with snail bait placed under it to discourage snails from collecting under the paper and attacking the seedlings.

6. There could be some experimentation with broadcasting of seed of desirable native forbs, collected and spread by Landcare members during working bees. The cemetery is the main potential source of such seed, but the old highway might also provide bulbine lily seed, which is very easy to collect. The Bemboka transfer station also has a small remnant around it with some interesting (and highly threatened by weed invasion) species present. A workshop on seed collection could be held in late summer to give the Landcare members confidence to proceed with this in their own time, and with the assistance of the native plant and weed guides developed as part of the Plan of Management.

7. If forb seed is spread in the reserve the locations should be marked with a short stake and a record kept of the grid reference obtained from a GPS, what species was spread and when, so that the outcome can be monitored up to about a year from the time the seed was spread. It could take as long as this for seedlings to become apparent.

8. If after a few years poor results are apparent from spreading of seed, and if the creek banks are adequately revegetated and Landcare members wish to continue with planting in the reserve, then planting of forbs could be considered. However, spreading of seed may be the more efficient means of establishing forbs, since it requires very little work and the seedlings will establish naturally when conditions are suitable, unlike plantings which may need supplementary watering.

9. The use of sugar to reduce soil fertility and discourage weeds as suggested in point 8 of the weed control recommendations might also be beneficial for tree health, and the high point of the reserve, with its large, probably spreading, patch of kikuyu, would be an obvious location to try this. If this is done then there should be monitoring of impacts on the foliage density, which is most easily done by taking a photograph straight up from a fixed location and comparing the foliage density before and after treatment. One such photo has already been taken at one end of the 50m fire and weed monitoring transect installed in this part of the reserve in August 2012. Of course, foliage density may also vary naturally with the time of year, rainfall and insect numbers.

5. Erosion

The situation in 2012

There is no active erosion on the reserve in 2012, although there is some on the old highway and in the gully it drains to outside the eastern boundary of the reserve. An old car has been dumped in the deepest head cut on the old highway, where it is probably helping to stabilise sediment, so it should be left in place. There has been some active erosion in the gully which flows out of the TSR to the Bemboka River, but given the scale of rainfall events in the La Nina years of 2010-11, this is not surprising. The catchment of this gully is relatively well vegetated and it may stabilise in time. However, advice on stabilising it could be sought from the Catchment Management Authority, and funding could possibly be obtained for this as a small project if it is deemed sufficiently important by Landcare members and the CMA agrees.

There are some small signs of past erosion in minor drainage lines on the reserve, such as on the powerline easement and in a small drainage line flowing to the Bemboka River about half way along the river frontage. Since these did not get any worse in the major floods of 2011 and 2012 it seems likely that they are stable and will require no further action. The removal of grazing has probably helped make this so.

There is a slight possibility that burning of the grass cover on the reserve could create erosion if it is followed by heavy rain before the grass has grown back. The chance of this happening could be reduced by leaving unburnt buffer areas along the small drainage lines. In practice this will probably happen without intervention, since the grass in these areas tends to be greener and less flammable.

Recommendations

1. Keep a watch on drainage lines for erosion after heavy rain and if small head cuts do develop they can probably be prevented from spreading by the laying of cut branches over the area to slow water flow and trap sediment. If anything more major develops, get advice from the CMA on how to repair it.

2. When burning the reserve, try to avoid burning through drainage lines, although this may be impossible in the very upper parts, where the drainage line is poorly defined and heavily grassed.

6. Community involvement and use of the reserve

The situation in 2012

The reserve is currently little used by anyone other than the Bemboka Landcare group and those who need to enter it to maintain infrastructure (Essential Energy) or spray weeds (BVSC staff or contractors). This could change once access across Colombo Creek is improved as the current lack of steps down the steep bank from the gate in Colombo Park and the lack of an obvious crossing point on the creek is a disincentive to people interested in seeing the reserve. Lack of information about the fact that it is open to the public would also prevent people visiting it.

These factors can be addressed by installing steps and a creek crossing point, and by placing signage in Colombo Park near the gate. Access from the cemetery could also be improved by putting a gate in the lower corner of the cemetery adjacent to the TSR. It would be an advantage to have access for weed control activities on this side of the reserve, and currently this requires climbing over or through a tightly strung barbed-wire fence. Walking in through the TSR is often discouraged by the length and density of the grass.

The main potential community use is likely to be for passive recreation, particularly swimming in the Bemboka River. However, caution should be exercised with regard to improving access too much. It would be detrimental to the ecological integrity of the site if access for cars or motor bikes became easier.

If the public is to be encouraged to use the reserve for passive recreation, it would be desirable to provide some interpretive materials to make them aware of the ecological significance of the area. Doing this may make it less likely that destructive uses occur.

If the community begins to use the reserve more it is possible that there will be a demand for paths through the reserve. People are often uncomfortable with walking through long grass due to a fear of encountering snakes. Construction of formal gravelled paths would be expensive and very likely to introduce weed seed. Creation of strips of shorter grass by slashing or preferably whipper-snipping would be a better approach, though even this lower impact method has plenty of potential to introduce weeds. A dedicated whipper-snipper that is used only on the reserve would have the advantage of not introducing any new weeds to the site, though it could still spread weeds within the reserve. It is desirable to keep path construction to a minimum.

There are currently a number of collections of old fencing wire scattered around the reserve, mostly in or adjacent to the old highway. These are a potential hazard to people using the reserve and may become more of a hazard over time as they disappear in the long grass. They need to be removed.

There are markings on one of the power poles in the reserve that suggest it might be marked for future replacement. There needs to be liaison with Essential Energy to ensure that any such activity is done as carefully as possible to minimise damage to vegetation and soils.

It will be necessary to enlist the aid of the local Rural Fire Service brigade to undertake burning off. The Bemboka brigade was willing to undertake a burn in 2012 and will presumably be willing in future. Their assistance in 2012 extended to whipper-snipping firebreaks around the 2008 planting and power poles. Ensuring that weed seed is not introduced on fire trucks and that trucks are not unnecessarily driven into the reserve will be important, especially if RFS involvement becomes a regular annual event.

The site is ideal for use by school groups to study the local ecology. The contrast between formerly grazed remnant vegetation and the cemetery, which has no grazing history, is

instructive. There is some scope for involving the local primary school in habitat restoration along Colombo Creek, and the possibility of collecting seed of regionally significant species from the cemetery and other remnant vegetation patches around Bemboka, propagating and planting them into the Reserve. There may be scope for the Bournda Environmental Education Centre to use the reserve.

Recommendations

1. Finalise the Colombo Creek crossing works and erect some signage at the gate from Colombo Park into the reserve. This signage should include a request to try and avoid carrying weed seed into the reserve, by checking shoes and clothing for seed before crossing the creek.
2. Minimise the number of tracks within the reserve. Visitors could be advised by signs and/or a leaflet of two or three destinations: the high point, for a short walk with a seat at the end from which views of the escarpment can be obtained, the north-west corner of the reserve where there is a gate giving access to the Bemboka River for those wanting to swim or explore the river bank, and a circumnavigation of the reserve inside the boundary fence for those wanting a longer walk. The circumnavigation would require almost no track creation, since the grass is naturally short under the trees which grow round the perimeter. The river walk could follow an existing rough vehicle track along the ridge crest (indicated by additional arrowed posts so people don't wander off it, as the vehicle tracks are somewhat braided at points) from the high point with seating. Walkers who followed the perimeter route could return via this track, as the banks of Colombo Creek are often covered in very dense grass, which does not make for easy walking.
3. If a leaflet is produced it should include some information about Lowland Grassy Woodland and its local, state and national significance, some information about specific plants on the reserve (which could be related to numbered posts located at points along the routes), its value for wildlife, a map of the reserve and the walking routes around it, and an estimate of the time each walk would take. Some warnings about potential hazards such as snakes and ticks (both unlikely to be encountered) should probably also be included. Features of the landscape visible from the reserve such as Bemboka Peak or Indian Head could be identified, and some local history included.
4. There are some old fence posts, remains of a former internal fence, which could be dug out and reused as rustic route markers, or steel posts could be purchased for this. They would need to have their tops protected with yellow plastic covers to make them less hazardous and more visible. They could be numbered using cattle ear tags, and related to points along a guided walk described in a leaflet. Leaflets could be placed in a box on the reserve side of Colombo Creek (to get them out of reach of casual users of Colombo Park).
5. If the public is to be encouraged to use the reserve then cleaning up old fence wire dumps should be a high priority. It could possibly be done, at least in part, by the fencing contractor who repairs the riverside section of fence. There is a large dump of pieces of barbed wire about 2 metres long which presumably are the remains of the old fence which was replaced in about 2004. This is located inside the gate into the reserve opposite the TSR. There are also smaller dumps probably resulting from the replacement of the cemetery fence located in the old highway road reserve near the lower eastern and western corners of the cemetery. These are tangled up with dead branches and will be quite difficult to remove, but as they are not bulky they could be the subject of a Landcare working bee, or could be removed by the fencing contractor.
6. For those with mobility problems a viewing platform on the creek bank overlooking Colombo Creek upstream of the old highway bridge could be erected with some interpretive

signs discussing the history of the site (the old highway) and the biological significance of the reserve. This would be a long-term project probably requiring substantial funding by a grant.

7. Bringing some of these recommendations to fruition will require specialist input, for producing signs and leaflets, so a further grant to pay for this should be applied for.

8. Once the public begins using the reserve, there should be annual assessment of their impacts, much as is done in National Parks around camping and day use areas. This will ensure that if areas are being degraded by too much foot traffic, or if a new weed has been introduced around access points the problem will be detected before it gets too bad and plans can be made to correct it.

Summary of main recommendations

The main recommendations of this Plan of Management are summarised below:

Action	Responsibility
Weeds: Control noxious weeds on the Reserve and the adjacent areas which might act as a reservoir of weed seed: the river bank and old highway road reserve, the TSR after consultation with, and preferably with funding from the LHPA, the section of the Bemboka common north of the highway.	Landcare with consultation and possible funding from BVSC or CMA, employ professional weed control operators for larger weed infestations.
Weeds: Assist with weed control in the cemetery; liaise with cemetery committee (Ray Alcock) before undertaking any work in the cemetery.	Landcare in consultation with cemetery committee and any others doing work in the cemetery.
Weeds: Control woody weeds not declared noxious on reserve, river bank & road reserve.	Bush regen contractors. Possible funding via CMA.
Weeds: Regular working bees to undertake hand pulling or chipping of non-noxious weeds and woody weed seedlings.	Landcare members
Fencing: Repair fencing on riverbank and across Colombo Creek. Remove dumps of old fencing wire near or in the old highway road reserve, which are a danger to the public.	Contractor obtained by Bemboka Landcare for fencing, contractor or Landcare for clean-up.
Fire: Implement regular burning regime on a 3-5 year cycle, burning different parts of the reserve in rotation, although an initial burn of the entire treeless area to improve access to weeds would probably be beneficial. Keep Hazard Reduction Certificate updated annually, to avoid bureaucratic delays which can prevent a fire from being undertaken at the best time of year.	Bemboka RFS and Landcare members in consultation with Bega Valley Fire Control Officer and BVSC Natural Assets Manager.
Reveg: Undertake restoration of riparian tree and shrub cover along Colombo Creek, in the form of a small annual planting. This planting should be maintained by weeding and watering working bees as deemed necessary depending on the conditions, to ensure good results. Set up process for monitoring outcomes of planting activities.	Possible involvement by local school, Landcare group, interested residents.
Reveg: Undertake collection of seed of appropriate species to restore groundcover biodiversity damaged by past grazing. Hold seed collection workshop (and propagation if there is local interest) in late summer. Scatter seed into areas of the reserve which have relatively sparse groundcover, and monitor results.	Interested locals with propagation skills, school, Landcare. FSC Landcare Association Seedbank.
Public access and interpretation to the public: provide access across Colombo Creek and through cemetery back fence, provide signage at one or both these points, devise three walks on the reserve, marked by posts, with seating at one or more points. Create leaflet with text related to numbered posts.	Landcare, consultant and graphic designer for signage and leaflet. Will require grant funding.
Monitoring: Repeat the photo-points and transects for monitoring of changes to vegetation which were set up in 2012, annually or after fire. Monitor weeds throughout the reserve and adjust weeding program as needed. Monitor visitor impacts and ameliorate if unacceptable.	Landcare, consultant. Will require grant funding.