MT ELIZA escarpment restoration plan

SUMMARY booklet

WMC Resources Ltd
Centre for Urban Bushland Management

Botanic Gardens & Parks Authority, 1999

Inquiries should be made to:
Botanic Gardens & Parks Authority,
Kings Park and Botanic Garden
West Perth WA 6005
Email: postmaster@kpbg.wa.gov.au
Web: www.kpbg.wa.gov.au

ISBN 1 876479 02 7
333.7209941

WMC Resources Ltd is gratefully acknowledged for funding the project as a gift to the people of Perth.

summary booklet

introduction

This booklet summarises the Mt Eliza Escarpment Restoration Plan. It briefly describes the research findings and how these relate to the restoration program, and looks at the demonstration (focus) sites that were developed for validating restoration techniques. The final section is a series of tables which summarise the restoration techniques that have been developed.

The escarpment project is important as a demonstration site for urban bushland restoration, as the principles developed here are applicable to ecological restoration in other bushland areas. This booklet has been developed for schools, land care groups, and other people interested or involved in caring for bushland remnants to use when planning their own bushland restoration projects.

In particular the tables at the end of the booklet may assist with planning by listing the disturbances, detailing the type of impact that requires addressing, and then outlining the best control strategy to deal with each individual impact.

introduction

Kings Park is a major icon in Perth and has been part of the city's cultural history since the days of the Swan River colony. A key section of the Park and by far the most visual is the Mt Eliza Escarpment. Long term use has resulted in extensive areas of the scarp becoming degraded. Disturbances in the area have included timber extraction, limestone quarrying, track construction, and planting of exotics for soil stabilisation and landscape enhancement. As a result native vegetation cover has been lost, weeds have invaded, incidences of soil slips and rock falls have increased, and biodiversity has declined. In addition, fire frequency increased due to wildfires, and feral animals invaded the Park impacting on the native flora and fauna.

The escarpment is an important urban bushland remnant because it portrays a community type which is poorly represented in the Perth region. The limestone heath communities and associated fauna lie within the Spearwood geomorphic unit. Also several animals which have significant conservation value are confined to the scarp, including the Scarp Snail and trapdoor spiders.

In 1996, a partnership was formed between WMC Resources Ltd and the Botanic Gardens and Parks Authority to establish the WMC Centre for Urban Bushland Management within Kings Park. The first project to be undertaken under this banner was a five year restoration program for the Escarpment, with the intent of undertaking progressive rehabilitation in key areas using techniques and processes established during a three year period of research.

The broad objectives of the plan for the Mt Eliza Escarpment are to achieve ecosystem recovery by maintaining and restoring structural and functioning complexity (including increasing species richness, and removing / controlling unnatural disturbances). Both cultural heritage constraints (Aboriginal significance, landscape views, historical paths and gardens, etc.) and public safety requirements (access, fire control, etc.) are important considerations in achieving this objective.

The research phase of the escarpment restoration project has identified successful control options for major weed species including bridal creeper (*Asparagus asparagoides*) and bridal veil (*Asparagus declinatum*). Soil stabilty studies have identified risk sites and stabilisation protocols based on plant root density and root tensile strength properties. Appropriate revegetation techniques, habitat rejuvenation measures and fauna requirements have also been developed.

weed control

The presence of bridal creeper is linked with areas that receive increased water run-off such as surface run-off from rain or garden sprays; and areas of subsurface seepage. This association also applies to kikuyu. The effects of shading on bridal creeper/ veil is also significant. Where areas are well shaded or over shaded, bridal creeper/veil is prevalent. Where an open canopy with high light levels exists (often a result of frequent fire), the areas are comparatively free of bridal creeper. In areas where the density of native or exotic vegetation is unnaturally high, the best management strategy for control of bridal creeper and bridal veil control is habitat rejuvenation. This means thinning tall vegetation to recover natural light intensities. Control or diversion of artificial drainage is also necessary. Potential invasion-prone sites must have all gaps in the understorey filled by direct seeding, revegetation and ongoing weed control.

Trials on manual and herbicide control methods for bridal creeper/veil showed that excellent success was achieved by spraying plants with Brush-off® at a rate of 2.5g/ha in the period May to July, prior to flowering.

erosion / gully restoration

Erosion gullies along the escarpment have developed from modifications to surface drainage patterns and access tracks. Numerous natural drainage gullies have similarly been degraded. Restoration of these gullies is a key priority for the escarpment.

Use of high water (phreatophytic) species, in combination with brush and biodegradable matting to intercept surface run-off in erosion gullies and promote water loss through evapotranspiration is recommended. This system requires drainage control measures which reduce velocity without including water removal, resulting in increased water infiltration. In the case of the escarpment, this means there is a higher risk of solution erosion of the limestone bedrock, which in turn may result in surface slips where load mass becomes crucial.

The use of bioenginerering techniques to repair shallow and deep erosion gullies is under experimental testing along the escarpment.

rock/ soil stability

Slope management for the escarpment require both soil surface stabilisation for protection from rainfall and wind erosion, and deeper subsurface soil stabilisation to protect slopes from larger landslips. Studies have focused on the role of vegetation in soil stabilisation. General findings include:

- compaction increases with depth through the soil profile;
- compaction increases upslope due to deposition of colluvial soils;

• bridal creeper and shallow grasses are most effective at 0-10cm; native herbaceous monocots (eg. *Mesomelaena psuedostygia, Lepidosperma* spp., *Desmocladus* spp.) are superior soil-reinforcers at 20cm; woody species (eg. *Dryandra sessilis, Allo-casuarina humilis, Hibbertia hypericoides*) below 20cm.
• herbaceous species are superior to woody dicots due to higher root mass, greater tensile strength and greater flexibility. *Conostylis candicans* rated the best species tested for soil stabilisation properties.

habitat rejuvenation/ revegetation

Direct seeding trials have used a minimum sowing rate of 50-500 viable seeds/m^2 , and greenstock plantings 6-8 plants/m^2 (mixed herbs, shrubs and tree species), to achieve a saturation density. This is considered essential to minimise re-invasion from weeds and allow for natural seed and seedling attrition rates. Direct seeding has shown superior results in the second season for most species after a period of seed aging, as many species maintain a dormancy state during the first year. Organic mulches are used across the slope to minimise seed losses, trap nutrients and suppress weeds.

Application of smoke water should be either a pre treatment or directly applied to the site in the first year of seeding. Field application in the second autumn following direct seeding is also highly recommended.

Revegetation trials will require several years of monitoring to establish patterns of survival, growth and weed succession.

focus sites

Four key areas were chosen as areas for developing and validating restoration techniques. These key areas are known as focus sites. They are the ongoing experimental areas for monitoring of restoration procedures and development, and measurement of completion criteria. Successful restoration of these sites is a major goal of the project. The focus sites are the first areas to have concentrated on priority weed removal, slope stabilisation and public safety works, and revegetation.

Each site was chosen according to the following criteria:

- They are boundary zones between bushland in good condition and degraded areas, which act as source areas for weed invasion and/or erosion;
- They mark the end boundaries or major population nodes of key weed species;
- They are in high profile public areas;
- They represent a full range of restoration challenges likely to be encountered elsewhere along the escarpment, which will enable comprehensive experimentation and proofing of restoration techniques, as well as enabling ongoing research into the processes of restoration.

Kennedy Site

Key objective: Rejuvenation of habitat by thinning of excessively shaded zones to reduce bridal creeper dominance and facilitate natural recruitment and restoration of original limestone community.

Brewery Site

Key objective: Reintegration of degraded boundary zones with natural heath community.

West Scarp

Key objective: Reintegration of scarp base dominated by bridal creeper and exotic pines and unstable soils. It will require pine removal and revegetation of gullies using high water-use species.

Memorial Site

Key objective: Habitat enhancement to prevent further encroachment of grass into the native vegetation of the escarpment, and control access. Enhancement includes the use of mature grass trees and zamia palms.

Focus sites are designed to help refine the procedures for futher restoration along the escarpment. The assessment of focus site restoration allows sites to be ranked against completion criteria to aid the process of refining techniques used to restore similar areas.

The restoration plan divides the Mt Eliza Escarpment into nine zones, based on habitat condition and similarity, as well as key restoration tasks. In most cases each zone contains a focus site that will provide the basis for extension of works into the surrounding area. The following table provides an overview of the disturbances and restoration requirements and strategies for the Mt Eliza Escarpment. While the overview is based on specific examples, it can be drawn on by bushland regenerators as a guide to developing their plans.

DISTURBANCE/ TYPE OF IMPACT	CONTROL STRATEGY
1. WEEDS	
Loss of habitat diversity. • Bridal creeper - extensive, particularly along path boundaries, beneath tree and shrub thickets, and extending along lower escarpment. • Bridal creeper, kikuyu and couch invasion extends 10-20m into bushland due to run-off from adjacent gardens. • Agave - common understorey component. • Veld grass - common weed invader, particularly along pathways. Exotic plantings have: • Displaced native species • Destabilised soils • Caused rock fracturing • Resulted in loss of habitat diversity. For example, pines have reduced native understorey and promoted slope instability. Similarly dense strands of *Callitris* and *Pinus* have caused excessive shading, soil acidity and loss of understorey species.	i. Where appropriate remove exotic trees from unstable slopes-cut to base in summer/autumn, wipe stumps with herbicide if required (depending on species). ii. Stabilise with jutemat. iii. Revegetate with marri woodland species or limestone heath species as appropriate to each area. Direct seed on gentle slopes. Some areas of marri woodland will require raking and removal of dead biomass before undertaking revegetation works. iv. Spray bridal creeper, grasses, and oxalis with herbicide between May-August. Spray grasses and replant low herbs on steeper slopes (>20°). Spray bulbous weeds in winter/spring. v. Where accessible, cut agaves to base and wipe or inject stumps with herbicide. vi. Mulch and densely plant buffer strips between good vegetation and walks/paths. Note: Access to some areas may require ropes, fall arrestors, and safety harnesses.

WEEDS cont'd	
Palm trees, a small fig, and exotic woody weeds at the base of the scarp need removing.	vii. Install drainage controls at top of escarpment to reduce point run-off from irrigated lawns, paths and gardens, and permit diffuse rainfall run-off. This will require converting to irrigation system drippers or low jet sprays with no overspray onto scarp, installation of collection kerbing at low points, construction of drainage transpiration ditches, and hard surfacing of major access paths. Use of high water-use species (eg. *Lepidosperma gladiatum, Juncus pallidus*) required to intercept run-off. viii. Rotary hoe dead kikuyu zone, plant and seed. ix. Thin *Callitris* stands on upper to mid-escarpment.
2. FIRE	
Weed invasion (veld grass, annuals), minor destabilisation of slopes.	i. Protection - installation of fire control points along top of escarpment. ii. Where necessary reduce fuel load through weed control and revegetation program.
3. EROSION	
Gully Erosion Numerous shallow to deeply incised gullies resulting from rainfall run-off and surface run-off from boundary tracks.	i. Enhance native vegetation cover along track boundaries to reduce water run-off. ii. Grade deeply incised gullies at the head if necessary to facilitate interception of subsurface flows and dense revegetation. Heads of deep gullies may also need filling to create gentle slope.

EROSION cont'd	
These have been eroded further through trampling effects and loss of vegetation cover. Gullies can be key focus areas for bridal creeper invasion.	iii. Stabilise gullies using vegetated palisades. Use jutematting on steep embankments. iv. Install open brush fences within deep gullies at approximately 10 - 15m intervals to trap sediment and stabilise plantings. v. Plant gullies with high water-use species (eg. *Lepidosperma gladiatum, Isolepis nodosa*) to promote water uptake and trap sediment.
Sheet Erosion Common along lower escarpment due to steep gradients, extremely soft soils and poor vegetation cover. Weed removal will generate further erosion-prone sites.	i. Exposed or denuded areas to be secured with fibremulch (Jutemat) immediately after removal of exotics. ii. Undertake saturation planting with shallow and medium-rooted species with high tensile strength properties (eg. *Conostylis candicans, Lepidosperma gladiatum, Mesomelaena pseudostygia, Melaleuca acerosa, Acanthocarpus preissii, Desmocladus asper*). iii. Where impacts are severe, conduct works in maximum 10m bands to avoid excessive erosion during restoration works. iv. On steep denuded slopes establish strips of native vegetation before removing weeds. v. Remove exotics in summer/autumn to avoid rain erosion. vi. Monitor annually after winter.

EROSION cont'd	
Soil Slips Localised soil slips at base of limestone outcrops. This is a public safety issue.	i. Secure with jutematting and use wire gabion mattressing where necessary. ii. Establish dense herbaceous cover using shallow-rooted species with high shear-strength properties (eg. *Acanthocarpus preissii, Conostylis candicans*). iii. Close access to slip areas.
Rockfalls Common on steep, mid to lower slopes. Threatens public safety, causes erosion, weed invasion, flora and fauna damage.	i. Install safety fence at base of scarp. ii. Loose outcrops may need to be stabilised with wire gabion mattressing during removal of exotics. iii. Avoid deep-rooted species in revegetation works to minimise risk of root fracturing. iv. Ensure use of shallow-rooted herbs and creepers when revegetating limestone outcropping areas.
4. ACCESS TRACKS	
Numerous access tracks have caused erosion and localised soil slips, tracks create avenues for weed invasion, rubbish dumping and increased fire risk. This may impact on public safety and the conservation of animal populations.	i. Close and restore using above gully restoration techniques. ii. Close and rehabilitate all minor and informal tracks. iii. Where necessary control public access through barrier plantings (eg. *Acacia pulchella, Grevillea crithmifolia*).

5. DISEASE	
Some canker at top of scarp in *Banksia attenuata* and *Banksia menziesii*. No evidence of *Armillaria luteobubulina*.	i. Monitor annually.
6. FERAL ANIMALS	
Fox dens have been noted; rats present and are a major predator of the Scarp Snail (*Bothriembryon indutus*).	i. Develop feral animal control program. ii. Research re-introduction of native mammals.
7. ADJACENT LAND-USE	
Transition bushland. Botanic gardens generate invasion of weeds, and increased surface run-off which in some areas has resulted in gully formation. Similarly there is intrusion of grasses and irrigation run-off along the boundary of grassed areas and bushland.	i. Enhance transition areas by weed control and revegetation using native scarp understorey species. ii. Replace exotic gardens with transition beds using native scarp species and mulch to buffer weed invasion and surface run-off. iii. Install alternative irrigation system. iv. Liaise with neighbouring landholders/councils as required where impacts are increased by adjacent land-use. v. Establish defined transition boundary between grass/bushland boundary areas.

For more detailed information

on the research and restoration works carried out on the escarpment refer to the Mt Eliza Escarpment Restoration Plan, available from Botanic Gardens and Parks Authority.

BOTANIC GARDENS
& PARKS AUTHORITY

Botanic Gardens & Parks Authority
Kings Park and Botanic Garden
Fraser Ave
West Perth WA 6005
Phone : 08 9480 3600

WMC Resources Ltd
QV1 Building 37th Floor
250 St George's Tce
Perth WA 6000