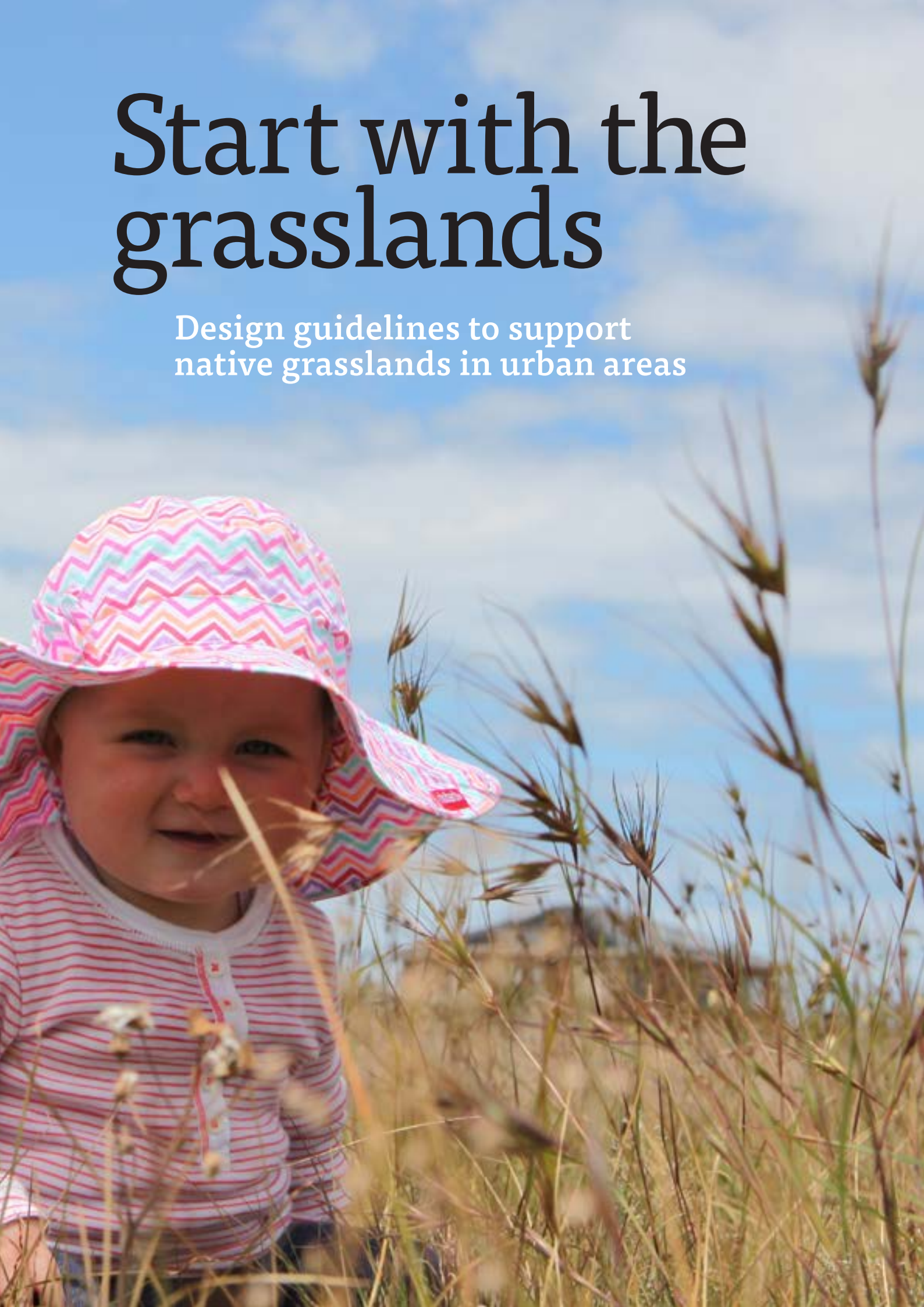
Start with the grasslands

Design guidelines to support native grasslands in urban areas



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Adrian Marshall

Contents

Glossary of terms

Active recreation: Recreation associated with activity, such as playing sport and bike riding; as opposed to passive recreation.

Active surveillance: Surveillance by cameras, security guards; as opposed to passive surveillance.

Ambassador species: A species, the presence of which promotes, within the human community, positive engagement with its immediate environment.

Biodiversity: The wide variety of ecosystems and living organisms from all sources including terrestrial, marine and other aquatic ecosystems, their habitats and their genes, and the ecological complexes of which they are part. Biodiversity also refers to the degree of variation of life forms within a given species or ecosystem, and is a measure of the health of ecosystems. [Source: City of Melbourne 2012]

Biomass: In ecology (and in the sense used here in this document), the mass of living biological organisms in a given area or ecosystem at a given time. As a renewable energy source, biomass refers to biological material from living or recently living organisms. As an energy source, biomass can either be used directly, or converted into other energy products. [Source: City of Melbourne 2012]

Bioregion: A region often with boundaries that are defined by biophysical and cultural features (e.g. watersheds, deserts or rainforests). [Source: Green Building Council of Australia]

Buffer: A designated area (often involving plantings) placed at the edge of a grassland to protect, shield and reduce the impact on the grassland, for instance from weeds, intrusion by humans and animals, or blown litter.

C_3 and C_4: All plants can be classified as either C_3 or C_4 plants. These terms refer to the different pathways that plants use to capture carbon dioxide during photosynthesis. All species have the more primitive C_3 pathway, but the additional C_4 pathway evolved in species in the wet and dry tropics. C_3 plants are adapted to cool season establishment and growth in either wet or dry environments. On the other hand, C_4 plants are more adapted to warm or hot seasonal conditions in moist or dry environments. A feature of C_3 grasses is their greater tolerance of frost compared to C_4 grasses. C_3 species also tend to generate less bulk than C_4 species. [Source: NSW Department of Primary Industries]

Cryptogamic crust: A layer of lichens, algae, fungi, mosses, liverworts and hornworts that grow on the soil of grassland, trapping moisture and significantly contributing to the resilience and health of the grassy ecosystem.

Ecological corridors: Connections across the landscape that link areas of habitat and support ecological processes that occur in a healthy, natural environment, including the movement of species to find resources, such as food and water.

Ecological Vegetation Class (EVC): A unit of vegetation variation (viz. a 'vegetation type'). EVCs are described and recognised in a series of regional reports. They should be relatively consistent in plant species composition and structure. There are approximately 400 EVCs within Victoria.

Ecosystem services: The 'free' goods and services provided by the ecological processes of healthy landscape systems, e.g. organisms and processes which clean air and water, pollinate plants, filter and recycle nutrients, modify the climate and enhance the potential for human well-being through interaction with the natural environment. [Source: Australian Institute of Landscape Architects]

Endemic: Native or restricted to a certain place.

Escarpment Scrubland: An EVC that occurs on steep, cliff lines formed by faulting or erosion. Soils are shallow. Vegetation is characterised by a light cover of woody species such as Acacia spp. and mallee-form or dwarf tree eucalypts.

Exotic vegetation: Introduced species, species not indigenous to an area. In general usage within this document, it is taken to mean not from Australia.

Grassy Woodland: An open, eucalypt woodland to 15 m tall occurring on a number of geologies and soil types. Occupies poorly drained, fertile soils on flat or gently undulating plains at low elevations. The lower strata consist of a few sparse shrubs over a species-rich grassy and herbaceous ground layer. [Source: DSE, EVC 55: Plains Grassy Woodland]

Green infrastructure: The network of natural landscape assets which underpin the economic, socio-cultural and environmental functionality of our cities and towns – e.g. the green spaces and water systems which intersperse, connect and provide vital life support for humans and other species within our urban environments. [Source: Australian Institute of Landscape Architects]

Greenfield land: Undeveloped land identified for residential or industrial/commercial development, generally on the fringe of metropolitan Melbourne. [Plan Melbourne, Metropolitan Planning Strategy 2013, Victorian State Government]

Ground-truthed: Determined by direct observation in the field. Many surveys used in planning and development rely on the extrapolation of data from small or scattered field surveys, and from 'desk' audits, both of which may easily lead to incorrect understandings of ecological conditions.

Growth Areas Authority (GAA): A statutory body that coordinated the planning and development of Melbourne's urban growth areas, in collaboration with local councils, government departments and agencies, industry associations, institutes and forums, and was responsible for developing precinct structure plans. On 9 October 2013, the GAA was replaced by the Metropolitan Planning Authority (MPA), to be responsible for implementing the Victorian Government's metropolitan planning strategy, Plan Melbourne (2013).

Habitat: The area or environment in which an organism or population of organisms is able to live (and breed). A habitat is made up of physical factors such as soil, moisture, range of temperature, and availability of light as well as biotic factors such as the availability of food and the presence of predators. A habitat is not solely a geographic area – for a parasitic organism it is the body of its host or even a cell within the host's body. Habitats also provide all of the resources necessary for the survival of the species or population.

High-quality grassland: Grassland in which there has been little unnatural disturbance over time, where the presence of weeds is low or constrained by the indigenous vegetation and where the structure of the grassland is complex, consisting of tussocks, forbs, cryptogams and subsurface organisms.

Indigenous vegetation: Plants endemic to, or found naturally in, a given area and that form part of the natural biodiversity of a place.

Infill: Development of unused or under-utilised land in existing urban areas. Most infill development sites are in inner and middle suburbs, offering the possibility of better utilising existing infrastructure to accommodate population growth [Source: Plan Melbourne, Metropolitan Planning Strategy 2013, Victorian State Government]. The degree to which land is considered 'unused' or 'under-utilised' is subjective: for instance many areas of grassland may be considered by some as 'unused'.

Infrastructure: Basic urban facilities and networks needed for the functioning of a local human community or broader society. [Source: Plan Melbourne, Metropolitan Planning Strategy 2013, Victorian State Government]

Local Provenance: See *Provenance*.

Master plan: A long-term plan to guide the future development of a site.

Metropolitan Planning Authority (MPA): A statutory body that replaces and expands on the former Growth Areas Authority (GAA). The MPA role is to implement the initiatives and vision set out in the Victorian Government's metropolitan planning strategy, Plan Melbourne (2013).

Mosaics: Spatial heterogeneity of vegetation arising from areas being at varying developmental stages due to different local histories and inherent environmental variability (e.g. in soils, climate, topography, etc.).

Native: Flora or fauna belonging to a large biogeographical region. In Australian terms, native means found naturally in the continent of Australia and not present through some human-assisted agency, such as import of seed in stock fodder or introduction by humans.

Naturalised: Introduced from another region, and grows and reproduces readily in competition with the native flora.

Passive recreation: Not highly active recreation. Not associated with sports, but with activities such as reading, observing and eating.

Passive surveillance: Surveillance by community rather than by deliberate installation of fixed points of observation, cameras, security guards.

Peri-urban areas: The hinterland beyond the metropolitan boundary. (Plan Melbourne Metropolitan Planning Strategy 2013, Victorian State Government)

Place-making: A multi-faceted approach to the planning, design and management of public spaces. Put simply, it involves looking at, listening to, and asking questions of the people who live, work and play in a particular space, to discover their needs and aspirations. This information is then used to create a common vision for that place. The vision can evolve quickly into an implementation strategy, beginning with small-scale, feasible improvements that can immediately bring benefits to public spaces and the people who use them. (From http://www.pps.org/reference/what_is_placemaking/)

Poorer quality grassland: Grasslands that have undergone considerable human-derived disturbance, that are generally not in a stable state, and / or that have a high weed presence likely to increase without active management. Poorer quality grassland may be less structurally rich and missing a layer of forbs, or the cryptogamic crust.

Predator-fencing: Fencing designed to stop the entry of predators (for instance foxes, feral cats) into an area. Predator fencing is necessarily tall. It is usually installed to allow endangered populations of small mammals, reptiles or frogs a chance to increase in numbers without the pressures of predation from introduced carnivores.

Propagules: In biology, any dispersible material that may serve to propagate a population to the next generation. This includes seeds, spores and vegetative structures that can become detached from a plant and give rise to a new plant, e.g. a bud, seed or sucker.

Provenance: The place of origin. A plant of local provenance means it has been sourced from nearby (an arbitrary distance, but reflective

of local conditions), and from a location with similar conditions (such as soil, rainfall). Issues of provenance can be complicated by genetic considerations, in that genetically distinct populations can occur within the same area, and genetically similar populations can be separated by greater-than-local distances.

Public realm: Parts of the built or natural environment that are available for use by everyone on a largely unrestricted basis regardless of ownership. This can include streets, parks, reserves, civic spaces, plazas, arcades and public buildings.

Remnant grassland: Indigenous grassland that survives despite the activities associated with European colonisation. Remnant grassland most often occurs on 'overlooked' land such as roadsides, or paddocks too stony to plough.

Remnant trees: Indigenous trees that survive despite the activities associated with European colonisation.

Resilience: A measure of a system's ability to withstand and respond effectively to adverse events (e.g. flood, bushfire, cyclone, etc). Resilient places are capable of returning to normal function in a quick and efficient manner. In terms of buildings and the public realm, these are built to last. [Source: Green Building Council of Australia]

Riparian zone: The interface between land and a river or stream.

Roads, access: Access roads are local roads used for the routine maintenance of a site.

Roads, primary: Arterial roads, freeways and motorways.

Roads, secondary: Roads connecting to primary roads, generally two-way and designed to carry moderate volumes of traffic.

Setback: The distance from an object and the boundary of the land on which that object is sited.

Signage, interpretive: Signage that aims to communicate information telling a narrative of a place or thing, whether that story be scientific, historic or social.

Spot spraying: Application of liquid weed-killer in spray form, usually through a wand and from a backpack, in a very targeted manner, i.e. to kill one plant but not affect adjacent plants.

Stakeholder: Any individual or group who has a vested interest in the outcome of a body of work. [Source: Australian Government 2009]

Stepping stone corridors: Ecological corridors particularly for birds (and flying insects), in which places of suitable habitat are not continuous but rather organised into a series of places (an archipelago of habitat islands) located sufficiently close together to allow ease of movement from one to another.

Stony rises: Highly irregular terrain formed on recent basalt flows (in particular, of the Victorian Volcanic Plains), stony (or sometimes stoney) rises support unique ecological communities.

Traditional owners: Victoria has been occupied by Aboriginal people with complex land ownership and stewardship systems stretching back many thousands of years. The Victorian Aboriginal Heritage Act 2006 recognises Aboriginal people as the primary guardians, keepers and knowledge holders of Aboriginal cultural heritage. Under the Act, Registered Aboriginal Parties (RAPs) are the voice of Aboriginal people in the management and protection of Aboriginal cultural heritage. There are currently nine RAPs in Victoria. (See http://www.dpc.vic.gov.au/index.php/aboriginal-affairs/registered-aboriginal-parties.)

Tussocks: The form of grasses that grow more or less as isolated plants in clumps, tufts, hummocks or bunches, rather than forming a sod or lawn.

Urban Growth Boundary (UGB): The long-term geographic limits of urban development of Melbourne. The UGB is proposed to be replaced by the Melbourne Urban Boundary.

Urban Heat Island (UHI): The localised increase in temperatures in urban areas compared with the surrounding rural countryside, often by several degrees.

Water sensitive urban design (WSUD): Embraces a range of measures that are designed to avoid, or at least minimise, the environmental impacts of urbanisation associated with traditional water management. WSUD recognises all water streams in the urban water cycle as a resource. Rainwater (collected from the roof), stormwater (collected from impervious surfaces), potable mains water (drinking water), greywater (water from bathroom, shower and laundry) and blackwater (toilet and kitchen) possess an inherent value. [Source: Melbourne Water and City of Melbourne 2009]

Wetland: A transitional area between land and water systems which is either permanently or periodically or unpredictably but repeatedly inundated with water. Constructed surface wetlands use enhanced sedimentation, fine filtration and biological uptake processes to remove pollutants from stormwater. Subsurface wetlands are a complex assemblage of water, soils, microbes, plants, organic debris and invertebrates where water flows through the soil. The soil is permeable and contains gravel and coarse sand. [Source: Melbourne Water 2011, adapted from Melbourne Water and City of Melbourne 2009]

Foreword

This is a much needed and long overdue publication. Australian grasslands are both beautiful and highly functional elements in the urban landscape; with good management they potentially tick all the boxes. My own work in creating designed urban grasslands in western Europe, which led directly to the native meadow landscape that dominated the 2012 London Olympic Park, had its epiphany in the basalt plain grasslands to the west of Melbourne. I was first inspired by these on a visit to the town common at Woorndoo, and the roadsides near Chatsworth, in the Western District, in early December 1986. The shimmering bronze of Spear Grass flowers blowing in the wind, purple stems of Kangaroo Grass tussocks arising out of clumps of sky-blue Pincushions, egg yolk Paper Flowers with the vanilla fragrance of

The native meadow landscape of Olympic Park, designed for the London Olympics, 2012.

Chocolate Lilies drifting by – I immediately realised that this wasn't just a romantic survivor from a distant past, but a plant community that could be used in urban areas both in its native form and as an inspiration for urban cultural interpretations. With the help of some colleagues at the then Victorian College of Agriculture and Horticulture (VCAH), now the University of Melbourne, and in particular John Delpratt, we collected seed and started research on the germination of these species. Two students, Rob Cross and Sue Berkeley, did most of the work and in 1989 we published what I think was the first research article in Landscape Australia on the germination biology of some of the most attractive forbs of these grasslands. Subsequent to this, almost 20 years of research and practice in Sheffield into the use of grassland-like plant communities in urban places have resulted in a design style frequently referred to internationally as the 'Sheffield School', which has changed attitudes to grassland vegetation.

Australian grasslands are now much, much rarer than they once were; not just because they have largely been converted to intensively grazed agricultural grasslands, but because they are in part children of regular burning of the land by the Aboriginal people, which has long since ceased. This relationship with fire as a key agent of management is potentially troubling in an urban environment, because fire in general is conflated with recent bushfire catastrophes, which in themselves are in part a failure to constructively manage fire as a positive ecological factor in the Australian landscape. We need to cherish Australian grasslands; they are beautiful and highly biodiverse, both in terms of plants and animals, and form a tangible connection with the past that fits comfortably with the scale and nature of urban development. Please study this book well; it contains much wisdom that perhaps one day will allow these grasslands to once again become a characteristic, and cherished, element in Australia, as part of the contemporary urban environment.

James Hitchmough
Professor of Horticultural Ecology,
Department of Landscape Architecture,
University of Sheffield, UK

James Hitchmough, photographed here in a grassland meadow in Mongolia, is Professor of Horticultural Ecology and Head of the Department of Landscape Architecture at the University of Sheffield, one of the leading schools in the world. James' own research is split between the design of ecologically based, designed plant communities and how urban human beings perceive these, and the 'Sheffield School' has a growing impact around the world. In practice James is perhaps best known for his collaboration on the London Olympic Park, which created a landscape, on an epic scale, that is both ecologically functional and visually exciting.

Introduction

Drosera peltata, the Pale Sundew, carnivore of the grasslands, digesting its prey. Photo: John Tann, CC BY 2.0

A best-practice manual

Start with the Grasslands provides guidance for the design and management of native grasslands (both large and small) within the Victorian urban context to maximise environmental and social outcomes.

This guide is applicable to large-scale development of peri-urban greenfield sites, urban infill, the reconsideration of existing grasslands within established communities, and the reworking of a grassland's relationship with the surrounding urban fabric to accommodate change in adjacent land use.

Start with the Grasslands has been developed with input from strategic and city planners, urban designers, landscape architects, managers of public open space, ecologists, environmental psychologists, Parks Victoria staff, bush crews, Council land managers and other maintenance staff.

This document provides:

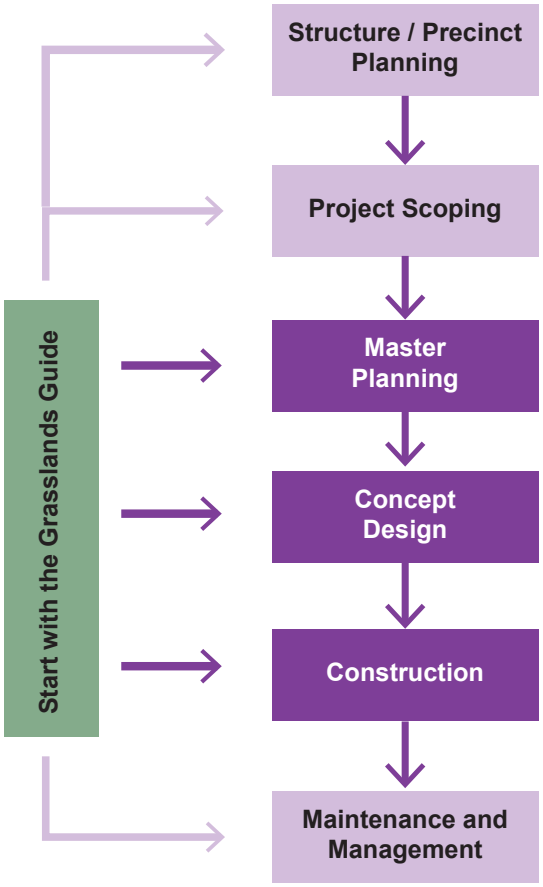
- An overview of the benefits of grasslands to the communities with which they co-exist.
- An understanding of the vulnerability of these ecosystems in the context of planned development.
- An analysis of a number of existing grasslands in Melbourne's north and west and discussion of the lessons learnt from these examples.
- Guidelines for development, from overall planning advice through to the specifics of fence design and strategies to engage communities.
- Checklists to support the guidelines' application.
- References to further information.

Start with the Grasslands is intended for use by practitioners, project teams, contractors, educators, friends groups, land managers, government authorities and other interested parties to support the design of new developments.

Community members will find this document helps them to recognise and lobby more effectively for best-practice urban design around grasslands. It will also increase their ability to manage grassland reserves.

Start with the Grasslands is not intended to provide specific ecological management guidance with respect to weed control, burns and so on.

Start with the Grasslands is predicated on the recognition that grasslands need more than legislation or ecological knowledge to prosper – they need collaborations between professionals at all levels, good design, and the support of the communities with which they interact.



Scope of *Start with the Grasslands* and relationship with the stages of development.

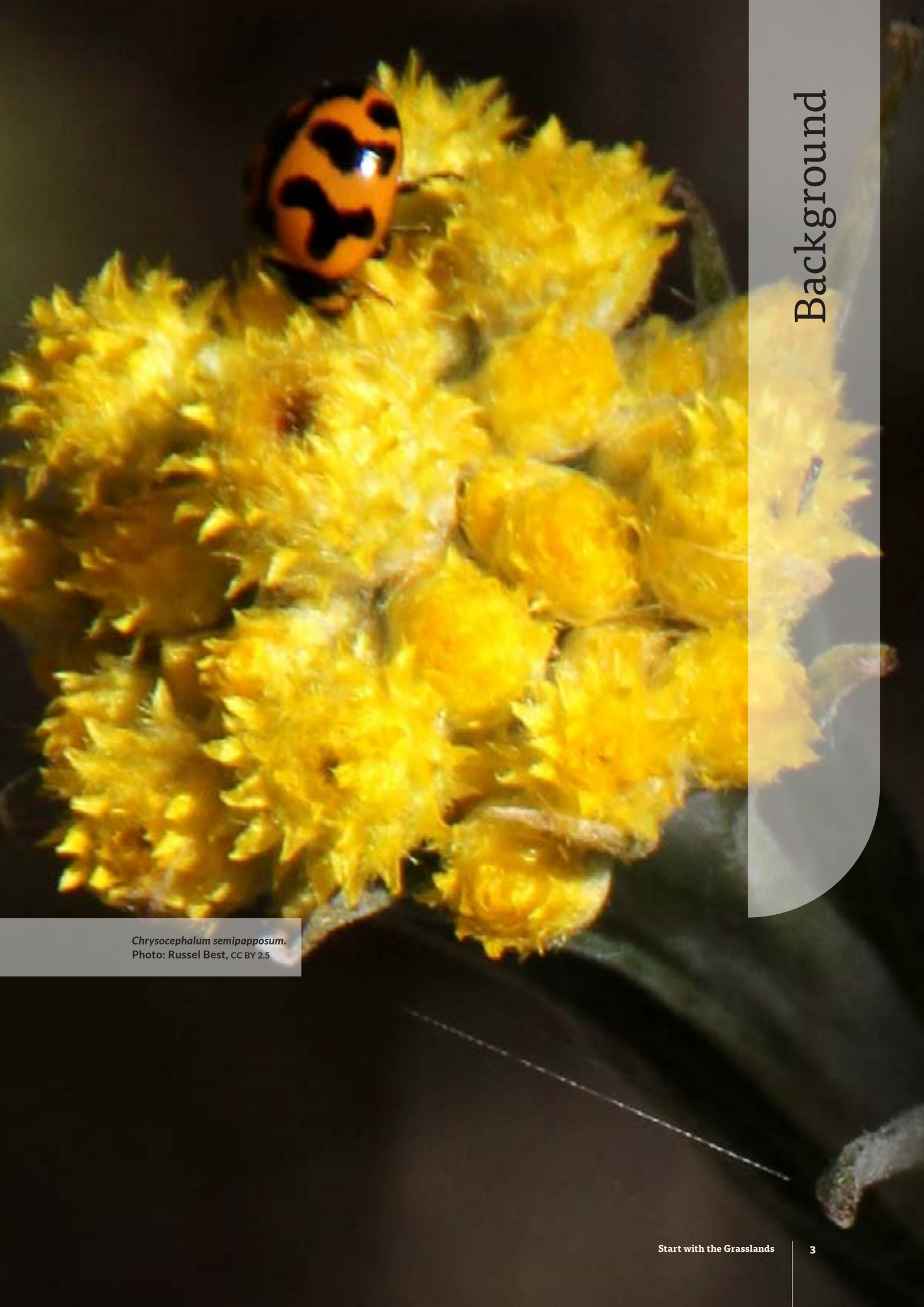
Successful grassland management is a complex process. It is the people who are involved that are the most important factors, whether planners, landscape architects, open-space maintenance staff, or the wider community.

The diagram above demonstrates the typical stages of development. *Start with the Grasslands* is primarily intended for use within the land-use planning, design and construction phases of a development. However *Start with the Grasslands* may assist with decision making at pre-planning and project feasibility stages, as well as ensuring the development meets future maintenance and management requirements on completion of construction.

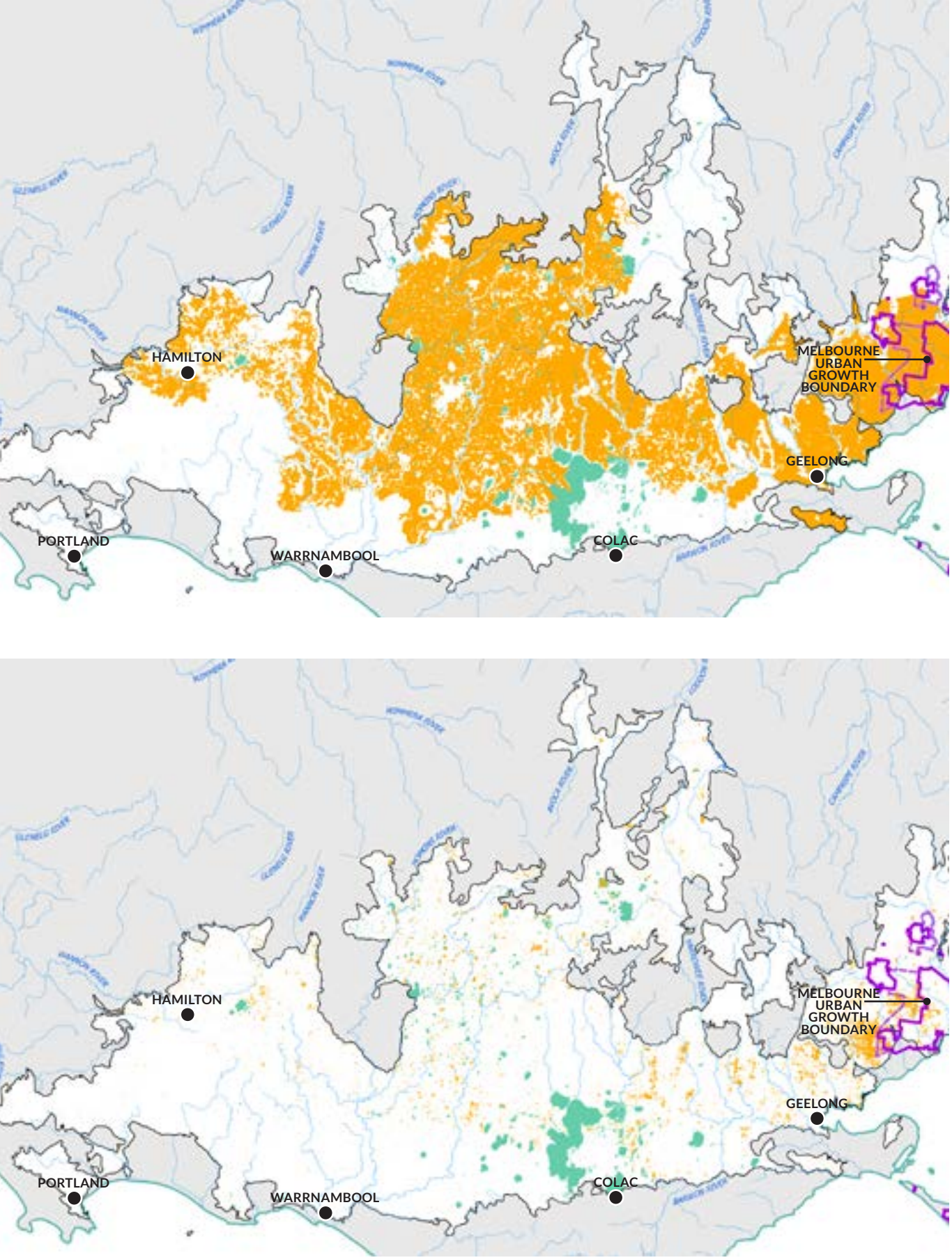
Applicability to other locations and ecosystems

While this document is intended to improve grassland health and management in developed areas, and has been developed from research conducted primarily in Melbourne, Victoria, the general principles, approach, and many of the recommendations of this guide will be applicable to other regions of Australia, and globally, as well as to the care of other natural ecosystems and in particular remnants in the urban context. The principles of collaboration, integration and protection, designing for maintenance, communication, letting people in, and providing 'cues to care', are all transferable.

Background



Chrysocephalum semipapposum.
Photo: Russel Best, CC BY 2.5



Top: Modelled map of pre-1750 native grassland extent within the Victorian Volcanic Plain bioregion, from *Delivering Melbourne's Newest Sustainable Communities – Strategic Impact Assessment Report, 2013.*

Above: Modelled map of current native grassland extent within the Victorian Volcanic Plain bioregion, from *Delivering Melbourne's Newest Sustainable Communities – Strategic Impact Assessment Report, 2013.*

Native Vegetation
- Artificial impoundment
- Wetland habitat
- Natural Temperate Grassland

Urban Growth Boundary

Urban Growth Investigation Areas

Victoria's most endangered ecosystems

It is estimated that grassland and grassy woodland once covered almost a million hectares of Victoria, extending from what is now greater Melbourne to Portland, near the South Australian border. Now less than 2% remains and much of that occurs within and around Melbourne's urban growth zones in the west and north (Kirkpatrick *et al.* 1995). The distinctive grasslands of the central Gippsland Plainsare extinct (Lunt, 1997).

The main thing that newcomers to Australia looked for was grass. 'Surveyors were ordered to describe and depict pastoral potential, and they speckled their plans with details of grass, open and dense forest, and sterile land' (Gammage, 2011, p. 19). The New South Wales Surveyor-General, Major Thomas Mitchell, was sensitive to the beauty of the country he was mapping:

> 'After travelling through a little scrub we descended on one of the most beautiful spots I ever saw: The turf, the woods, and the banks of the little stream which murmured through the vale had so much the appearance of a well kept park that I felt loth to injure its surface by the passage of our cartwheels.' (July 9, in Mitchell, 1839, p. 109)

The most wide-spread grass was Kangaroo Grass, which Mitchell, using the scientific name at the time, referred to as 'anthisteria'. 'Its summer tan was Australia's dominant colour in 1788.' (Gammage, 2011, p. 32)

Early commentaries encouraged the swift occupation of the region for sheep grazing. What the settlers encountered was heavily grassed country (often to shoulder height), sparkling waterways, and large trees scattered or growing in clumps. Time after time, in Victoria and the other colonies, explorers and newcomers commented on the landscape as being like an English gentleman's park – blind to the *creation* of this landscape by the land management techniques of Aboriginal peoples. Gammage has researched multiple examples. He quotes Curr (1883):

> A decline in landscape quality came rapidly. 'Throughout most of the continent', Curr recalled in 1883, 'the most nutritious grasses were originally the most common; but in consequence of constant over-stocking and scourging the pastures, these, where not eradicated, have very much decreased, their places being taken by inferior sorts and weeds introduced from Europe and Africa.' (Gammage, 2011, p. 185)

***A bush fire, Mount Elephant, Victoria*, by Duncan Cooper, circa 1845.**

Pastoralist and botanist, John G. Robertson from near Casterton also witnessed the rapid damage from early sheep grazing (Robertson, 1898). When he arrived in 1840 it was described as 'splendid country' with excellent grasses and free of weeds – 'all the landscape looked like a park with shade for sheep and cattle'. For three or four years little changed, until some indigenous plants began to disappear, replaced by weeds. As the deep-rooted, native grasses died out the soil began to dry out and crack and there were hundreds of landslips. As the land was 'trodden hard with stock, springs of salt water are bursting out in every hollow or watercourse, and as it trickles down the watercourse in summer, the strong tussocky grasses die before it, with all others'. The resulting bare land was further eroded by the action of sun and rain, and the run-off muddied the creeks and rivers. By 1853, 'Ruts, seven, eight, and ten feet deep, and as wide, are found for miles, where two years ago it was covered with tussocky grass like a land marsh.'

Large areas of native grassland have also been destroyed by the use of superphosphate fertilisers and the sowing of introduced species to 'improve' pastures (Kirkpatrick, 1995).

Most recently, urban expansion has threatened many of the remaining areas of native grassland (ACT Government 1997, Williams 2005).

Today, grassland and grassy woodland (Natural Temperate Grassland of the Victorian Volcanic Plain, and Grassy Eucalypt Woodland of the Victorian Volcanic Plain) are both listed as Critically Endangered under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act and TSC Act, 1999). They are home to at least 25 fauna species and 32 flora species also listed or nominated for listing under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In many cases, urban grasslands are now our most biodiverse remaining grasslands.

Amberfield Grassland in Craigieburn where a 1 ha grassland remnant with Golden Sun Moth has been surrounded by houses. Photo: MCMC, CC-BY-3.0

Valuing grasslands as part of good design practice

Conservationists and ecologists are concerned about the destruction of many significant areas of grassland to allow for the expansion of Melbourne's urban area. One concern is that the area of habitat required to support an ecological population or community is often overstated, thereby undervaluing smaller areas of remnant grassland. For example, the Golden Sun Moth can persist in small patches of habitat, such as a 4.5 ha grassland reserve in Nhill (Douglas, 2004). A review of the area requirements of butterflies and moths indicates that most sedentary species require 2 ha or less, and very few species require more than 10 ha for long-term survival.

In the case of grasslands, small can be beautiful. Bias towards larger areas for reservation continues, even though there is considerable evidence that smaller grasslands are quite viable (McCarthy, 2006; Williams, 2005a).

The undervaluing of smaller areas of remnant grassland leads inevitably to greater offsetting of these remnants. Rather than destroying these remnant areas of critically endangered vegetation communities and important populations of threatened species, good design and management can integrate them into the network of smaller conservation reserves within the Urban Growth Boundary that will be complemented by the major western grassland reserves. This would be an effective approach to assist in:

- Conserving species and important genetic diversity within species
- Conserving representative areas of different grassland sub-communities
- Conserving endangered woodland and ephemeral wetland communities that are not strongly represented within any grassland reserves.

Good management outcomes are readily achievable despite a number of small grasslands being considered more expensive to manage than a single larger reserve (Williams, 2005b). Well-considered landscape design and appropriate buffer treatments will minimise the consequences of these small grasslands being more vulnerable to disturbance resulting from weed invasion and rubbish dumping, and the difficulties arising from their requirement for regular burning. Smaller grassland reserves can be a significant, sustainable and valued community asset. Indeed, whilst the on-going management of small reserves is usually considered unduly expensive (Buchhorn *et al.* 1989, Lunt & Morgan 1998, Prober & Thiele 1993), management of small urban grasslands is much less difficult than with other native vegetation because grassland soils are naturally fertile. Fertiliser drift from either atmospheric deposition (particularly of nitrogen) or from run-off from adjoining playing fields or housing does not lead to unmanageable eutrofication because grasslands are 'pre-adapted' to fertile soils.

Critically endangered *Pimelea spinescens* bagged to collect seed at a micro-grassland in the car park outside Bunnings, Watergardens.

While there are some excellent examples of ecologically sensitive development within metropolitan Melbourne, overall improvement is critical if much of our unique grassland is to survive.

The value of grassland landscape systems and processes must be acknowledged and respected as part of good design practice to achieve more sustainable and holistic outcomes. It is important that the protection, enhancement and regeneration of our grasslands are part of the ethical decision-making framework for landscape planning, design and management.

Grasslands are valuable

The development of new urban areas and the preservation of critically endangered grasslands need not be incompatible. Thoughtful planning and good design can provide urban communities with near-to-nature and immersive experiences that promote environmental values and ideas of sustainability. In turn, those informed and engaged communities can provide grasslands with protection and the benefits of stewardship.

A 'nearby nature venue' for active engagement and interpretation. Photo: MCMC, CC BY-NC-ND

Benefits to the community

Grassland is not simply ecology or biodiversity that needs to be preserved. The presence of grasslands in a community can provide:

- **Significant health and well-being benefits**
  - **Interaction with the natural environment:** A well-designed and presented grassland will offer physical and mental benefits by allowing the community to experience a sense of being near to or within nature, and will encourage people to go outdoors, be more active and value their natural environment (Elmqvist *et al*, 2013).

Education in action: close contact with grasslands provides learning opportunities. Photo: It's a wildlife, CC BY-NC-ND

- **Connection of children with nature:** An enriched outdoor environment provides many health benefits for children including opportunities for appreciating nature, learning, exploring and play (Louv & Hogan, 2006).
- **Ecosystem service provision:** People benefit from the environmental services provided by healthy grassland systems, including plant pollination, nutrient cycling, maintenance of beneficial insect populations, air cleaning, pollution treatment, carbon sequestration and water purification (Bolund & Hundhammar, 1999).
- **Enhanced visual amenity:** Grasslands provide opportunities to appreciate beauty and to take in expansive views. There is evidence of the restorative powers of natural landscapes for people's mental and psychological well-being.

- **Provide habitat**
  A healthy grassland provides natural habitat for many species. This includes providing habitat for species that live beyond the grassland. Grasslands may be part of many migration routes, and will be a resource for pollinators that are essential for domestic gardens to flourish and will provide benefits to ecosystems beyond the grasslands themselves.
- **Social capital**
  Grasslands contribute to a sense of community and provide opportunities for people to interact via community planting days, walks and talks, and friends groups.

Grasslands can be a place for traditional owners to engage in cultural practices: here, a digging exercise with Chocolate Lillies. Photo: MCMC CC BY-NC-ND

A stony knoll beautifully integrated into development at Aurora, Epping, an opportunity for vista and a clear opportunity for branding of the estate as sustainable. Photo: copyright James Newman, courtesy MDG Landscape Architects.

- **Cultural identity and sense of place**
  Grasslands provide important cultural connections to the history of the land. They allow traditional owners to maintain their connection to, or to reconnect with, country. Grasslands also provide opportunities to reinforce the identity, unique local character and sense of place via branding and providing differentiation from other neighbourhoods.
- **Education and research**
  Grasslands are an educational resource for adults and children, and also a resource for scientific study.

Benefits to councils and other land managers

Local authorities, such as councils, statutory authorities, Parks Victoria and VicRoads, can benefit from well-planned and designed grassland reserves through:

- Increased community well-being (as outlined previously) and decreasing health costs
- An improved image of an area which can expand political and economic influence
- Improved management processes
- Reduced management costs
- Integration of infrastructure with grasslands
- Management plans that take into account future management needs
- Clearer understanding of management needs across all stakeholders
- Improved compliance with legislation
- Greater alignment of stakeholder expectations
- Smoother development processes

The presence of kangaroos at Ngarri-djarrang (Central Creek), Reservoir, adds to property values as residents respond positively to these 'grassland ambassadors'. Photo: MCMC

Benefits to developers

Well-planned and designed grassland reserves will:

- Have fewer ongoing maintenance costs
- Increase community well-being
- Provide positive branding opportunities, including sustainability branding
- Appeal to increasingly green-conscious purchasers
- Ease asset handover to council
- Have less vandalism and rubbish dumping
- Have a clear management process
- Have clear assessment and response processes
- Offer potential to increase the value of housing stock through proximity to substantial public open space

Grasslands are vulnerable

A number of factors contribute to the damage and degradation of reserved grasslands. The main factors are:

- Weed invasion
- Change in environmental context, for instance surface water flowsPhysical damage through human intrusion
- Rubbish dumping
- Predation of grassland fauna by feral and domestic animals
- Loss of traditional human-mediated ecological processes, such as relatively frequent burning.

These can all be ameliorated through careful design. For instance:

- Weed invasion can be reduced by buffer planting and by maintaining or fostering a relatively dense stand of native grasses
- Grading can prevent nutrient-rich water entering grasslands from adjacent roads and gardens
- Well-planned access points can allow movement into areas of secondary importance, thus protecting core areas of a grassland
- Presenting grasslands as cared for will engender community support
- Presenting grasslands as cared for will reduce instances of dumping, and
- Planning for fire management will make conducting planned burns easier, safer and cheaper.

Weed invasion

All grassland remnants contain weeds as a result of past land-uses and are, in turn, if managed poorly, a source of weeds. The grasslands that are being considered for retention as reserves are rare pockets that have avoided the most serious effects of past land-uses, such as fertilising, seeding for pasture and ploughing.

These higher-quality grasslands, which have a richness of native plant species, are generally more resistant to weed invasion due to the lack of available niches for new species to occupy (Morgan, 2006).

In many cases, the most serious weeds that will damage grassland are already present in the grassland but can be 'turbocharged' – that is, they will become more prevalent and invasive – by changes in site management and new external influences.

New surrounding development increases the potential for a new sequence of weed invasion. Weed invasion tends to occur incrementally from edges, or on newly exposed bare ground. Wind-borne seed is especially problematic and dispersal is more difficult to prevent through maintenance. Illegal dumping and soil disturbance from vehicles or poorly controlled services development may generate point or linear sources of weed invasion deep into the core of grasslands.

Change in environmental context

Urban development changes the environment: hydrology, surface wind patterns, and animal movement are all easily affected. Stormwater drains, runoff from roads and loss of permeable surface area all alter the amount of water available to grasslands. Introduction of nutrients, especially nitrogen and phosphorus, through dumping, adjacent water runoff and fertiliser use will increase the abundance of exotic weeds.

Lycett, Joseph, approximately 1775–1828, Drawings of Aborigines and scenery, New South Wales, ca. 1820, a picture made famous by Bill Gammage's book *The Biggest Estate on Earth*, here shows a mosaic of woodland and grassland maintained by traditional Aboriginal burning practices. (National Library of Australia, PIC an2962715-s20-v)

Serrated Tussock (*Nassella trichotoma*), an invasive exotic grass, has become firmly established at Ravenhall Grasslands, Ravenhall.

Vehicle ruts such as these encourage linear weed invasion deep into the core of grasslands and should be strictly avoided.

A vehicle track at Craigieburn Grassland, Campbellfield, visible as a reddish streak of the invasive exotic Chilean Needle-grass running diagonally across the photograph. Photo: MCMC

Physical damage through human access

Vehicles, especially 4WDs, can cause severe soil compaction, erosion and damage, opening the way for weed invasion and erosion, as well as causing silting and muddying of water courses, and damaging habitat and bird nesting areas. And though some access to grasslands is to be encouraged, it is important that users and managers be aware that just the simple act of walking through grasslands can introduce weeds and pathogens, though the threat this poses is far less significant than other threats that grasslands face. The delicate living soil crust of grasslands, formed in part by lichens, moss and fungi, can also be easily disturbed (Morgan 2006).

Dumping at Denton Avenue Grasslands, Sunshine. Photo: City of Brimbank CC BY-NC-ND

Rubbish dumping

Dumped soil, building and household waste smother grassland plants, leaving patches of disturbed, often nutrient-enhanced soils, where weeds establish. Dumped garden waste may also introduce weeds into grasslands.

Widespread, smaller-scale dumping and wind-borne litter promote the perception that the area is uncared for, and hence of little value, and lead to increased damage from other human activities.

Predation by domestic and feral animals

Domestic cats, which may live at densities many times higher than populations of feral cats and generate an overwhelming predation pressure, are of particular concern in communities adjacent to grasslands.

Although a lesser threat, domestic dogs can easily disturb and prey on ground-dwelling species, destroying nesting sites and burrows.

Feral animals, such as foxes, may benefit from having suburban developments nearby, reaching higher densities and exerting increased predation pressure on adjacent grassland compared with pre-development conditions.

Common Mynas, starlings and sparrows, which favour urban landscapes, may pose a threat to native invertebrates such as the Golden Sun Moth in adjacent grassland.

Posts, fences and other structures may artificially increase hunting effectiveness of both exotic and indigenous birds in grassland areas where prey animals have evolved with a low density of such perches.

Loss of human-mediated ecological processes

Traditional Aboriginal practices of burning grassland on a regular or relatively frequent basis have worked to maintain grassland biodiversity. Burning opens up the gaps between grass tussocks, creating light and space for herbs and other small plants to grow. It is in these intertussock spaces that most grassland biodiversity occurs. Burning also promotes the growth of the lichens and mosses that help form the soil crust, provided that soils are not disturbed (O'Bryan *et al.*, 2009).

Burning will rejuvenate native species, but will also assist similarly fire-adapted exotic weed species, so timing of such burns and follow-up weed control is critical to achieving outcomes that benefit grassland.

Regular biomass reduction, either by appropriate burning, grazing or slashing, is essential to maintain grassland biodiversity.

Responsibility to protect

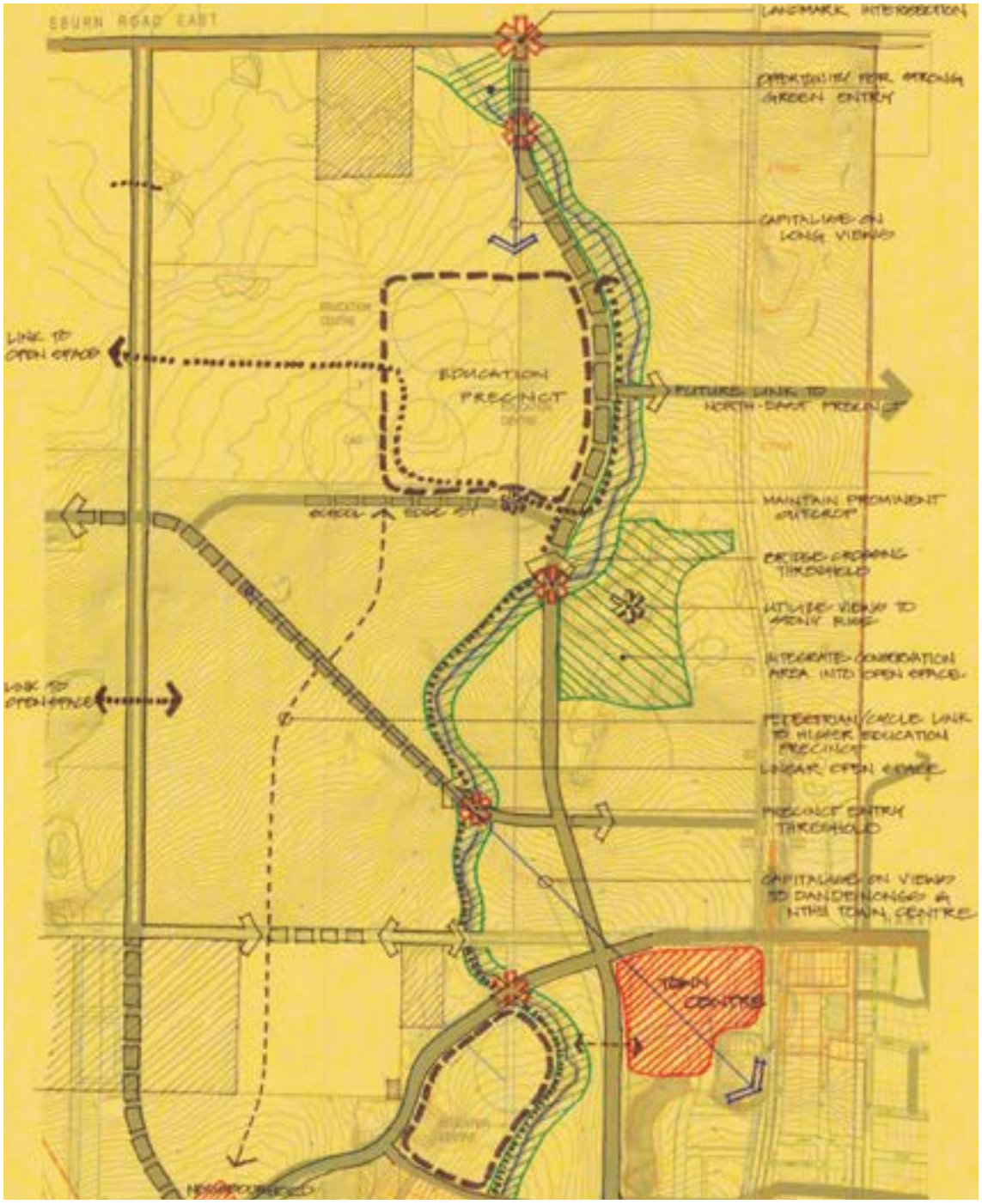
While this publication is aimed at those wishing to protect vulnerable grassland communities, it is worth stating that grasslands are protected under the EPBC Act. Failure to adequately protect these communities can result in fines (at the time of writing) up to $8.5m for corporations, $850 000 for individuals, and jail terms are possible: the Act has a big stick. Even if local and state approval has been given for an action that may result in damage to a grassland, that action may nevertheless contravene the EPBC Act. Managers are urged to seek advice from the federal Department for the Environment's EPBC Act Compliance Section before undertaking actions that may result in harm to grassland.

Seven principles for grassland design

Plantago varia.
Photo: Chris Clarke, CC BY 2.5

Principle 1. Start with the grasslands

By considering grasslands from the very start of the planning process, much can be achieved that could otherwise not be achieved – reduced maintenance costs, beneficial relationships with the community and improved grassland health. It is no simple matter to develop an urban fabric that includes critically endangered grasslands in such a way as to optimise conditions for those grasslands: the issues are complex and there are many stakeholders with competing desires. It is precisely because of this that it is essential to embed, from the very beginning of the planning process, careful and long-term considerations about the needs of the grasslands. The grasslands and the development must be seen as vitally linked. Whole-of-project management principles are important, for example an active weed-reduction program in place early will minimise weed control in the future. Management agreements between responsible authorities, including neighbouring properties not currently under development, will assist best management outcomes for the grasslands.



Opportunities and constraints diagram by MDG for planning of Aurora, Epping, showing consideration of natural features and open space in the planning process. Image: © Courtesy MDG Landscape Architects.

Volunteers taking part in the Victorian National Parks Association Golden Sun Moth monitoring program. Photo: Caitlin Griffith.

Principle 2. Collaborate

By working collaboratively, we can significantly improve grassland health and community perceptions, and reduce the cost of construction and maintenance.

Collaboration from the early stages in planning and design is vital to the ongoing persistence of healthy grasslands. Coordination with ecologists is necessary to understand the specific requirements of a site. Early engagement in the planning process by landscape architects allows a grassland to be better integrated at a regional level. Understanding long-term aspirations for the context of a grassland will assist finer-scale design to be best aligned with that long-term vision. Local knowledge is always useful. Planners and designers need to work with field technicians who are familiar with the site to ensure the on-the-ground realities of grassland management are fully considered. This sharing of expertise can prevent long-term damage to grasslands that may require years of additional maintenance to rectify.

Collaboration with a new, emerging community is also important to create a sense of stewardship over grasslands. It is also important to collaborate with existing users, e.g. bushwalking groups and other recreational users, and the local community.

Through collaboration, we can share knowledge and goals to maximise the outcomes for our grasslands and for the community.

Kayes Drain, Brimbank, supports a strong grassy ecosystem while managing water flow through a housing estate and under the Western Freeway.

Principle 3. Integrate, protect, connect

By sensitively integrating grasslands into larger landscape processes they will be more resilient to adverse change and degradation, whether this is change as a result of surrounding land uses or environmental change.

Keeping habitat corridors whenever possible is important. Grasslands that are connected to larger ecological systems will better support 'ambassador' species such as kangaroos, which in turn help establish strong and positive community perceptions of grasslands. There may also be opportunities to enhance and create new habitat, biodiversity and ecosystem connections to the grasslands; or to integrate the grasslands with broader green infrastructure development planning.

It is also important to seek to protect the local features within a development area to retain niches for ecosystem biodiversity. For example in an area of stony rises, try to preserve such features within the development area.

Grasslands are immovable. Development needs to be planned in a way to minimise damage to grasslands from future land-use conflicts and growth. Locating areas such as town centres that may expand too close to grasslands may lead to future land-use conflict. Conversely, the presence of grasslands can encourage growth in planned directions and provide certainty in development.

Grasslands will come under stress from human intrusion in areas that have inadequate nearby public open space. By locating places for passive and active recreation adjacent to, or near, grasslands, the positive presence of the grasslands is accentuated while at the same time minimising the damage that can be caused by unplanned human access.

Grasslands integrated into the surrounding community will receive greater support, surveillance and care. Good interface design, communication, access, and 'cues to care' will all contribute to such integration. Integrating the grassland values into the broader development will also extend cultural connections, contribute to the precinct's sense of place, and provide wonderful story telling opportunities (both formal and informal).

Connection to large-scale natural systems provides resilience. Here, poor integration means development cuts Ngarri-djarrang (Central Creek Grassland), Reservoir, from the ecological corridor of Merri Creek only a few house lots away. Photo: MCMC CC-BY-NC-ND

Schematic representation of the attributes of ecological corridors. Corridors may be direct between two patches [A-B], a non-direct route such as along a riparian zone [B-C], or a series of structurally non-connected stepping stone corridors [C-D]. (From Victorian Environmental Assessment Council. (2010). *Remnant native vegetation investigation discussion paper*: VEAC.)

Co-location: Bus stop, bike path and grassland information kiosk come together at Ngarri-djarrang (Central Creek Grassland), Reservoir.

Principle 4. Design for maintenance

By ensuring that the maintenance needs of grassland reserves are incorporated into the design of adjacent development, the costs of maintaining those reserves can be significantly reduced. Design for 'maintainability' means greater efficiencies, for instance, ensuring machinery access to areas that might otherwise have to be maintained by hand. Design for maintenance also means improved safety for maintenance workers.

Poor design can inadvertently make maintenance costly. The location and arrangement of maintenance access routes, fences and gates, and their relationship with site-specific details such as surface rock features, soft ground and topography, all affect the capacity of works to be completed cheaply, efficiently and safely.

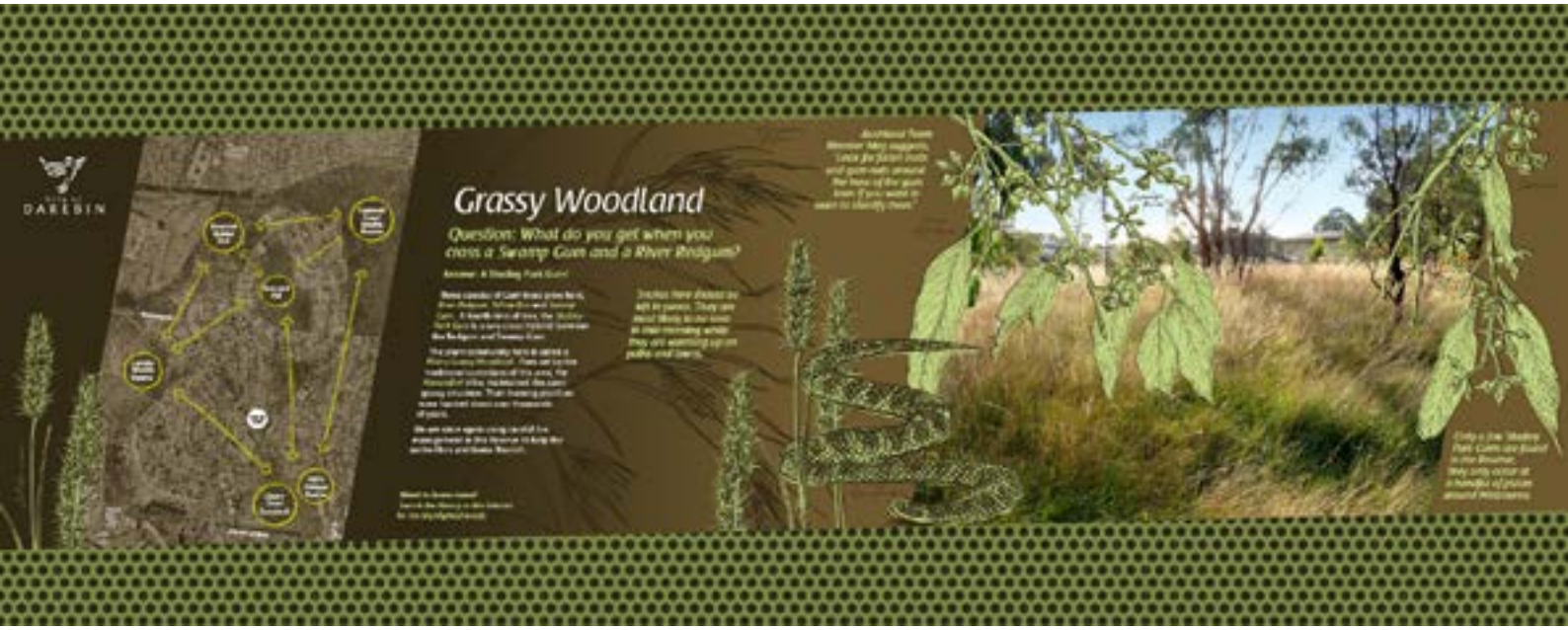
At the same time, maintenance routes should not impact on good-quality grassland, so reservation of areas of adjacent poor-quality grassland may be appropriate to allow space for perimeter maintenance and circulation paths, provided these do not significantly affect species' habitat or populations of threatened species.

Co-location of recreation trails, firebreaks and buffers is often possible during the design stage and can reduce the number of built works impacting on grassland. For instance, a perimeter walking trail can be designed to be wide and strong enough for maintenance vehicles to use and for it to function as a firebreak.

Input from an experienced field technician is valuable in anticipating site-specific maintenance issues and opportunities.

The wide edge of granitic sand at Caroline Springs is an effective barrier to weeds, and any weeds growing can be easily spot sprayed. The adjacent dense plantings are a single species, native, weed suppressing, and do not require any specialist maintenance skills.

Principle 5. Communicate



Clear, informative and well-designed signage, part of a suite of signs for the City of Darebin. Image: Courtesy Aspect Studios.

Communication is a vital tool for both protecting grasslands and gaining community support. Grasslands can suffer from the negative perceptions of being snake-infested, weedy, brown, homogeneous paddocks that pose a fire risk. Communication through good signage, education, and community engagement programs is essential to dispel these negative perceptions. Grasslands need spokespeople.

The tone of communication is important. Grasslands are managed in a generally exclusionary way: rare plants can't have people playing football on top of them. Consequently, grasslands tend to be surrounded by fences and signs that say, in effect, keep out. To avoid this negative message, signage should include explanatory text about the importance of grasslands, and some effort should be made to reduce the visible presence of fencing and to allow some controlled access to grasslands, especially into non-core areas or areas of lower conservation value.

The means of communication can be as important as the tone: for instance materials that look cheap or old-fashioned may not appeal. Much can be made of technology. Web-based resources are easier to keep up to date than print media. Apps for smartphones and tablets can deliver content-rich information. Social media offer opportunities to communicate to a larger audience in a way many will find immediately engaging.

In greenfield developments, a community is being created from the beginning, which provides a unique opportunity to engage people from the moment they first show interest in purchasing or renting within the development. Tools should be available at point of sale: e.g. information packages, planting displays, even a designated part of the grassland as a 'display' area that serves as a focus for the experience of nature.

Communication is also a vital part of the collaborative process outlined in Principle 2, and in creating the 'cues to care' of Principle 7. Communication will inform contractors of management directions and the practices in place. Communication is also essential as part of the adaptive management assessment and response necessary for managing ongoing change and learning. Communication will be key to creating a successful friends group, and it will be essential to spreading the word of the intentions and aspirations of any grassland management strategy.

A newly constructed path and signage beyond the entry through the fence clearly invite visitors into Evans Street Grassland, Sunbury.

Principle 6. Let people in

Allowing some access to grasslands is important despite the potential for human access to cause damage. The richness of detail that grasslands offer is only able to be experienced close-up. Access promotes positive engagement, understanding, education and a sense of custodianship, and prevents the negative perceptions associated with exclusion. Active interfaces enhance surveillance by the community and reduce dumping, vandalism and other damage to the grassland areas.

Access should be carefully balanced against the benefits of secluded areas being maintained within the grasslands. Close contact with humans can discourage species such as kangaroos, and humans can easily disturb the nesting sites of ground-nesting birds.

Active interfaces are most valuable on the perimeter of grasslands, leaving 'core areas' less accessible, thereby reducing human impacts.

The principle of showing people the grasslands by letting them in also suggests we should 'bring the grasslands to the people', New restoration techniques are now making the building of 'new' grassland a possibility. Such novel grassy ecosystems, though in no way a replacement for the complexity of our remnant grasslands, nevertheless can extend and support our remnant grasslands in a way that allows greater contact between the community and these beautiful ecosystems.

The gate at Old Truganina Cemetery, Truganina, has let people in but kept cattle (and trail bikes) out since the cemetery was enclosed, allowing the rare species at the grassland to remain ungrazed.

The detailing and positioning of this lookout on a stony knoll at Aurora, Epping, makes possible close and comfortable appreciation of grassland, and sets up an association of grassland with other high-value nature experiences such as national park visitor centres. Photo: © James Newman, courtesy MDG Landscape Architects.

Principle 7. Provide cues to care

'Cues to care' is a powerful concept first articulated by Joan Nassauer (1995). It suggests that people respond positively to environments that show signs of being cared for. In the case of grasslands, this means that if the *edge* of the grassland – the non-grassland elements *associated* with the grassland, such as edge plantings, fencing, buffers and other such adjacent elements – are perceived to be cared for, then the grassland itself is more likely to be valued.

Cues to care can take many forms, for instance:

- Well-maintained edge plantings
- Fencing that is not just the most cost-effective option
- The orderly arrangement of space, such as median strips and access roads
- Mown lawn
- Well-designed signage that communicates effectively
- An absence of rubbish
- The visible presence of people involved in maintenance.

Cues to care can occur at a range of scales, from the highest visibility entrances being treated with extra attention to detailing, to urban-scale structuring of primary, secondary and access roads, with associated shared paths, medians and buffers.

By approaching the planning and design for grasslands with a deliberate and visible sense of care, much potential harm can be minimised – dumping and vandalism will be reduced, human access will be more respectful, an understanding of grassland ecology and biodiversity will be promoted, and the community will become an active stakeholder in grassland protection and management.

The more visible the grassland edge, the more visibly it should be cared for.

Well-detailed seating and fencing positioned near an entry to Evans Street Grassland, Sunbury, invite people in, offer them engagement with the grassland, and declare the high value of the grassland.

The grassy interface planted at the edge of Ngarri-djarrang (Central Creek Grassland), Reservoir, shows the grassland off to good advantage. Photo: MCMC CC-BY-NC-ND

From planning to maintenance

Arthropodium milleflorum.
Photo: Robert Graner and Jennifer Reading, CC BY-ND

The staging of a development

The overall development of the landscape surrounding grasslands is a complex process that moves through a number of stages. The following table indicates the typical stages of development and the kinds of actions that can be taken to promote grassland health at each stage.

This table is only indicative. The planning process will vary from site to site. Often, not all stages are followed. For instance, the structure planning stage or the master planning stage, may be omitted and the planning process will vary depending on whether the development occurs under the authority of the Metropolitan Planning Authority or beyond the Melbourne Urban Growth Boundary.

There will likely be other regulatory requirements that should be followed throughout the various stages of development, such as planning permit conditions and other legislative requirements.

Grassland in reconstruction, adjacent to Pimelea Terrace Grassland, Cainlea, after replacement of rocks removed from site by a contractor. The site was direct seeded with Wallaby Grasses (*Rytidosperma* spp.) and Spear Grasses (*Austrostipa* spp.) species and another portion of this reconstructed grassland is shown on page 42 following establishment. Photo: City of Brimbank CC-BY-NC-ND

Stage	Example outcomes, general	Example outcomes specific to grasslands	Example professions involved
Structure plan / precinct plan	Land use assigned, road hierarchy and cross-sections, established, planning overlays considered.	Extent and nature of buffer zones to grasslands, and types of adjacent land uses decided. Connectivity of landscape systems determined.	Planners (strategic, city, conservation and landscape), ecologists, economists, senior administrators, Government agencies (e.g. VicRoads), Growth Areas Authority / Metropolitan Planning Authority, local government, service authorities.
Project initiation and preplanning	Stakeholders established, goals established.	Early conversations identify common goals. Start with the Grasslands used to guide best-practice. Development of conservation management plan.	Developers, government development organisations, State government departments, councils.
Master plan	Vision and design principles established. Plantings, housing typologies, overall nature of access, 'story', style, materiality, maintenance access, and management regime determined.	Consider grasslands within design principles for site. Site-specific planning of spatial and functional requirements of the grasslands including extent, adjacent land uses, access, views, archaeological considerations, potential / existing biodiversity corridors, plant selection, staging, connections with green infrastructure corridors, hydrology and WSUD planning to minimise impacts etc. Overlays regarding domestic pets, and regulations regarding burning, may be implemented. Management regime determined.	Urban designers, landscape architects, architects, engineers, planners, surveyors, arboriculturists, ecologists, open space managers, parks management.
Concept design (greenfield or retrofitting)	Detailed design.	Site-specific quality and details of grasslands and surrounds further developed and resolved.	Landscape architects, engineers, ecologists, key stakeholders and authorities.
Transition to construction	Protection of assets. Access roads and display homes built.	Grasslands fenced. Contact with community begins, 'display grasslands' may be developed, cues to care demonstrated. Existing maintenance regimes ongoing, with control of weeds, dust and runoff across construction zone vital. Clear rules established regarding management of subcontractors and penalties for disturbance to grasslands.	Marketing (developer), construction, signage, ecologists, landscape planners and landscape architects, council environmental staff.
Construction	Implementation of roads, buildings, facilities and other infrastructure.	Plantings and rehabilitation works undertaken. Final fencing and edge conditions established.	Contractors, designers / architects, landscape planners, engineers.
Management by developer	Occupation by community.	Community engagement, establishment of new gardens on adjacent land, initiation of friends groups, human pressures.	Environmental staff, grassland managers, contractors.
Management by Council	Asset protected and maintained.	On-going budget and resource allocation to ensure appropriate maintenance and management outcomes.	Public open space staff, bush crews, contractors, friends groups.
Assessment	Feedback to all stages.		All.

Indicative schedule of stages of development and how *Start with the Grasslands* may provide guidance.

Planning guidelines

Stackhousia subterranea.
Photo: Kirsten Bauer, CC BY 2.5

Planning guidelines

A number of specific planning guidelines sit beneath the overarching principles for grassland design and are detailed in the following discussion.

Keep works beyond the reserved extent of grasslands

The reserved extent of a grassland is the area that is intended to be protected. It is inappropriate to use the reserved extent of a grassland for other purposes, such as maintenance paths, firebreaks, its mown edge, fencing, buffer zones and pedestrian and cycle paths, as this will result in loss of grassland.

Guidelines

- Plan the edges of a grassland so that buffer zones, mown edges, fences and adjacent paths are located beyond its reserved extent.
- Reserve areas of adjacent poor-quality grassland to accommodate buffer zones, mown edges, fences and adjacent paths where appropriate.

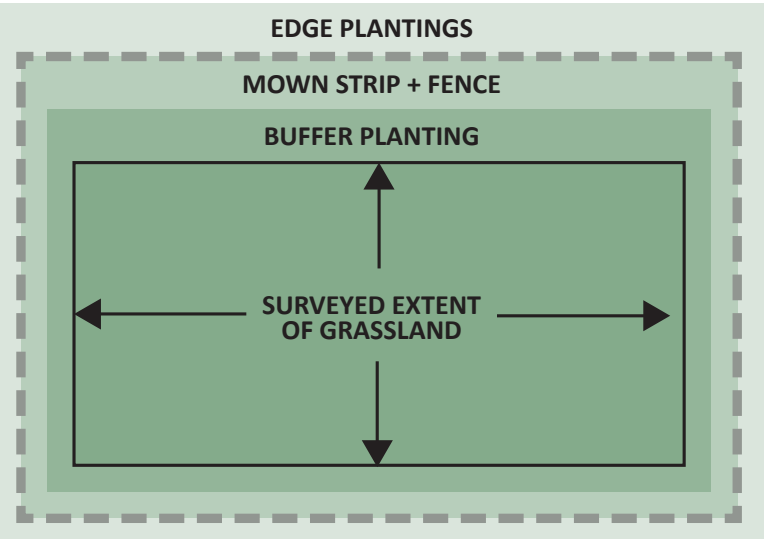


Diagram showing an appropriate relationship between the reserved extent of the grassland, mown strip / firebreaks, fencing and plantings.

Understand the diversity within grasslands

Grasslands are not uniform and contain areas requiring greater or lesser degrees of protection.

The catchment areas of grassy wetlands and ephemeral wetlands included in a grassland reserve often support a rare subset of grassland flora and fauna, which will require greater protection. It is vital to preserve a grassland's pre-existing hydrology.

Grasslands are places where prior human activity has occurred, whether it be pre-settlement Aboriginal activity or post-settlement farming, cattle grazing or mining. This will have had impacts that need to be managed. These may also be places of interest to the visitor.

Grasslands will often include distinctive natural features, such as stony rises or escarpments.

Secluded, core areas may be necessary to ensure fragile ecosystems survive, and in some cases it will be necessary to exclude visitors entirely.

The type and extent of protection required, the species present, and the particular vulnerabilities of the grassland should influence the types of land use adjacent to the grassland.

A weed survey for Chilean Needlegrass (*Nassella neesiana*) reveals the legacy of soil disturbance in a grassland associated with its past use as a golf driving-range at Ngarri-djarrang (Central Creek Grassland), Reservoir. Image: MCMC CC-BY-NC-ND

Old Truganina Cemetery, Truganina, has survived as a patch of remnant grassland because fencing excluded stock from this culturally significant site. Now new residential land use threatens, as urban development begins to surround the site.

Adjacent land uses will impact grasslands differently according to the intensity of land use and the condition of the grasslands. Generally, active recreation, dog off-leash areas and school zones will impact more highly than residential areas and places of passive recreation because the activities typical of those areas have the potential to spill-over into grasslands. Areas where weeds are unlikely to be well controlled (such as unmaintained vacant land) will also have a higherimpact if adjacent to grasslands.

Guidelines

- Understand and define the scope of protection required.
- Prepare detailed and ground-truthed biodiversity maps as part of a conservation management plan as early in the planning process as possible, if not prior to planning then prior to concept design.
- Identify core and non-core areas.
- Plan for most access to grasslands to occur in non-core areas, generally keeping to the grassland edge, with access to core areas occurring only in controlled instances.
- Avoid locating residential areas immediately adjacent to predator-fencing.
- Use the variety of species and ecosystems within the grassland to guide visitor experiences, where possible.

Understand the interaction of grasslands and adjacent land uses

Different adjacent land uses and histories of land-use will present different challenges to the design of grasslands.

History of land-use

Site history is important to consider. The overwhelming impact of weeds is from the legacy of agricultural history and from historical introductions (especially from roadside slashing equipment in rural council areas). The period during which the site's surrounds change from former, often agricultural, use is generally a time of intense disturbance, both physically and in terms of grassland management processes.

Zoning

The zoning of land adjacent to grasslands provides distinct opportunities and constraints for grassland design and management. For example, a school zone adjacent to a grassland will mean both increased activity with consequent pressure on the grassland, but increased opportunity for educational engagement with the grassland.

Co-location of a picnic spot with this small water-treatment wetland in an industrial area adjacent to Cooper Street Grassland (Bababi Marning), is a clever way of introducing amenity to while emphasising natural values.

Fencing is essential at Paramount Park, Derrimut, to protect the grassland from wind-blown rubbish from adjacent industry.

INDUSTRIAL AREAS: OPPORTUNITIES

- Absence of residents and their concerns means management of grasslands can be less complex in industrial areas.
- Promoting human activity around the grassland edge may assist in developing a sense of custodianship (by individuals or local industry) otherwise lacking within industrial areas. For instance, perimeter walking trails have proven good locations for on-leash walking of dogs, and grasslands may provide pleasant spots for a short break, which are otherwise rare in industrial areas. Cafes may benefit from location adjacent to grasslands. Grassland can improve quality of the industrial environment for those working there.

INDUSTRIAL AREAS: CONSTRAINTS

- In industrial areas, there will be a lack of friends groups and community participation.
- Weed invasion will be enhanced as there will often be years where large populations of invasive weeds are allowed to seed from neglected land as well as disturbance arising from incursions of heavy machinery and illegal spoil dumping.
- There will probably be less control of feral animals.

COMMERCIAL AREAS: OPPORTUNITIES

- Grasslands may work well as greenbelt edges to commercial zones: Evans Street Grassland, Sunbury, is an example of this in operation.
- Signage is prevalent in the commercial environment and grassland signage can be bolder as a consequence.

At William Angliss Grassland, Derrimut, the fencing at the public road edge is less exclusionary than the fencing to protect private assets, and its detailing shows some care for appearances.

Evans Street Grassland, Sunbury, acts as a greenbelt edge to the commercial center.

This grassland in the carpark at Watergardens shopping centre, Taylors Lakes, survives despite significant constraints.

Gazania species (*G. rigens* and *G. linearis*) are introduced garden plants that are spreading into grasslands

COMMERCIAL AREAS: CONSTRAINTS

- Grasslands in commercial areas are uncommon. Generally, land values are highest in commercial areas, which tend to be located away from encumbered land, such as land reserved for grasslands. Grasslands in commercial areas will be located in areas of considerable activity, where significant resources are allocated to provision of visual amenity. Grasslands in these environments will generally need to be highly maintained and well presented in order to provide the cues to care necessary to promote positive community engagement.

RESIDENTIAL AREAS: OPPORTUNITIES

- In general, community expectations will be higher in residential areas.
- Interaction with grasslands is maximised, with the potential to increase both the benefits of grasslands to the community and the benefits to grasslands, for instance, improved ecological awareness and sense of stewardship.
- Grasslands here can have an educational role, and can operate as hubs for discussion and promotion of sustainability.
- Grasslands can have a role in building a sense of community, creating identity for a neighbourhood.
- Passive surveillance by the community is high compared to grasslands in other contexts.

RESIDENTIAL AREAS: CONSTRAINTS

- Grasslands exist in contrast to domestic-scale gardens and exotic planting palettes.
- Grasslands will face pressures from populations of domestic dogs and cats if community management practices are not put in place.
- Management activities, such as ecological burning, may need to take into account community concerns to a greater degree than for grasslands in rural edge or industrial contexts.
- Residential zones may, in the longer term, have a greater potential for introduced species to enter from the wider diversity of plant material being used nearby, and perhaps from a higher level of human visitors acting as the means for introduction.
- Residential areas that back directly onto grassland should be avoided at all cost.

A community space adjacent to Maygar Grasslands, Dallas, provides amenity for residents.

Guide to adjacent land uses and responses

The following table outlines the potential design responses to various land uses adjacent to grasslands.

Adjacent land-use	Design considerations
Major infrastructure	Where possible, integrate grasslands with infrastructure to maximise benefits. Plan ahead for the changes such infrastructure will bring,e.g. residential growth, and ensure provision for grassland is maintained throughout.
Major road	Provide fencing to prevent car and trail bike access, where necessary. Ensure off-road access for maintenance, and roadside buffer plantings that are not dependant on burning for maintenance. Consider noise attenuation, if/where necessary. Maintain pre-existing hydrology and connectivity. Consider WSUD techniques. Ensure roadside stops and road infrastructure do not impact on reserved extent of grasslands. Orchestrate driving experience to emphasise grassland diversity. Locate interpretive signage at roadside stops to create entry experience. Consider opportunities for street planting to extend biodiversity and green infrastructure corridors beyond grasslands. Consider views and vistas towards grasslands. Consider road as firebreak.
Secondary road	Provide fencing to prevent car and trail bike access into grasslands. Minimise impacts on natural hydrology and consider WSUD techniques. Ensure off-road access for maintenance. Provide occasional signage. Consider local access points with entry experience. Consider opportunities for street planting to extend biodiversity and green infrastructure corridors beyond grasslands. Consider views and vistas towards grasslands. Consider road as firebreak.
Shared path	Ensure quality of fence and edge plantings reflects the need to respect the grassland and provide cues to care. The more used the path, the more it has the potential to express cues to care. Any shade tree planting along path (where appropriate) to consider extending biodiversity values of grasslands. Consider views and vistas towards grasslands.
Nature trail	Consider removing fencing or using indicative fencing (for example, low, widely spaced bollards). Provide a defining edge to reflect different management regimes. Use tussock planting to create buffer zones along grassland edges to control access. Consider views and vistas towards grasslands. Provide signage/interpretation themed on education.
Passive recreation	Integrate places designed for recreation with grasslands. Consider incorporating nature play. Consider incorporating grassland fauna and flora themes into play spaces. Provide deeper buffers at entry points. Reduce pressure on grasslands from human intrusion by locating public open space nearby, where possible and appropriate. Public open space adjacent to grasslands allows recreation activities to occur away from the protected grasslands, while providing passive surveillance of the grasslands. Consider views and vistas towards grasslands. Consider extending indigenous vegetation beyond grasslands to increase biodiversity. Allow close inspection of grassland flora and provide a key to interpreting species.

Active recreation	Active recreation adjacent to grasslands may be more likely to impact grasslands than passive recreation if activities have potential to move into grasslands. Provide clear fencing and signage to define edges and avoid expansion of active recreation into perceived 'unused' areas. Provide deep buffers and limited entry into grasslands, including consideration of more exclusionary plantings to boundaries. Limit need to enter grasslands through use of signage and clever design that allow views and enjoyment of grasslands from outside. Consider on-site treatment and management of stormwater. Consider extending indigenous vegetation beyond grasslands to increase biodiversity. Allow close inspection of grassland flora and provide a key to interpreting species. Consider views and vistas towards grasslands.
Dog off-leash	It is generally recommended that dog off-leash areas near grasslands are avoided, where possible, to minimise disturbance to native fauna. Provide deep buffers and mesh fencing to limit animal entry. Consider plantings to boundaries that will discourage dog access. Limit need to enter grasslands through use of signage and clever design that allow views and enjoyment of grasslands from outside.
Industrial	Provide fencing. Depending on site, more cost-effective type of fence than that which might be chosen for residential area, could be used. Opportunity to provide lower-maintenance plantings except in strategic locations where higher visual quality of planting is desired, e.g. at entrances to industrial estate, at congregation areas, near any cafe, etc. Encourage creation of places for short breaks, eating and general passive recreation. Create feature of infrastructure, where possible to emphasise the nearby natural values of the grassland, e.g. water treatment infrastructure can also be landscape features. Incorporate signage at frequent intervals, which includes essential services information, e.g. electricity authorities, water authorities. Consider ways to minimise weeds entering grasslands from surrounding properties. Consider treatment and management of stormwater either adjacent to grassland, or on-site if consistent with pre-existing grassland hydrology. Consider extending indigenous vegetation beyond grasslands to increase biodiversity.
Institutional (hospital, tertiary, schools, community)	Consider some extensive, controlled access. Provide good-quality fencing and edge plantings. Provide regular signage. Consider views and vistas towards grasslands. Consider treatment and management of stormwater either adjacent to grassland, or on-site if consistent with pre-existing grassland hydrology. Consider extending indigenous vegetation beyond grasslands to increase biodiversity.
Residential	Provide good-quality fencing and edge plantings. Ensure buffers and grading minimise potential for weed invasion. Separate housing from grasslands with roads. At all costs, avoid residential development that backs directly onto grassland. Consider laws restricting domestic cats. Undertake community engagement. Create active edges to grasslands. Housing should be orientated to take advantage of views towards grasslands. Lots to be orientated to look over grasslands to encourage active edges and to provide passive surveillance to improve safety and reduce undesirable behaviour. Design housing / lots and use construction techniques to minimise extent of cut-and-fill and impact on landform. Residential lots to consider on-site rainwater capture, storage and re-use.
Natural barrier (creek, escarpment)	Fencing not required.
Rural	Ensure exclusion of stock. Consider ways to reduce weed load in surrounding properties.
Estate gateway	Promote grasslands through signage / interpretation, high-quality plantings and fencing.

Schedule of land uses and the potential grassland design initiatives that may be used.

Guidelines

- Consider grasslands' adjacent land uses when planning and designing.
- In industrial areas, promote custodianship through provision of amenity adjacent to grasslands, such as cafes, lunch spots, on-leash dog-walking outside the grassland perimeter.
- Rigorously control wastes from industry to avoid contamination of adjacent grasslands.
- Plan for sufficient space for expansion of commercial centres to avoid future land-use conflict with grasslands. Locate commercial centres away from grasslands.
- Ensure sufficient public open space is provided near grasslands to minimise stress from human intrusion. Consider locating public open space, particularly for passive recreation, immediately adjacent to grasslands.
- Locate potentially higher-impact land uses away from most vulnerable areas of grasslands. Higher-impact land uses include active recreation, dog off-leash areas, loud industries and schools. If not possible, ensure sufficient buffers are in place to minimise impacts.

Residential development fronts both bike track and grassland at Ngarri-djarrang (Central Creek Grassland), Reservoir. While active edges are to be encouraged, the close proximity of the houses has generated ecological and management problems. A road separation would have been better.

Roads

Roads comprise a large portion of the urban fabric, and their influence within the urban environment is complex. Clear conflicts exist between fauna and roads: the risk of collision most obvious. Roads fragment the landscape, and act as barriers to movement at all levels, from birds to beetles. Roads result in polluted runoff and noise pollution. Roads make excellent firebreaks, but the presence of major roads can make conducting of burns more difficult. Roads bring people into contact with grasslands (albeit initially at speed). Roads can also create isolation: for instance, it is unlikely people will cross a freeway to get to a grassland, or that they will stop to dump rubbish on a freeway. The verges of roads may also be excellent locations for plantings that extend and support grassland communities.

In general:

- Locating major roads next to grasslands should be avoided.
- Development, such as housing or industry, should be separated from grassland by road.
- Roadside plantings should extend or support grassland communities.

Guidelines

- Avoid major roads next to grasslands.
- Use roads to separate grasslands from development.
- Plant roadsides with species that support grasslands.

Provide active edges

Road edges provide more active edges than back or side fences, increase surveillance, reduce the incidence and severity of rubbish dumping, give grasslands a greater sense of being of public value, and act as a firebreak. Road edges assist in management, reducing ongoing costs.

Guidelines

- Provide grasslands with road edges rather than edges to residential or industrial land use.
- Avoid back fences adjacent to grasslands at all costs. Where back fences are adjacent to grasslands, design them to allow surveillance out into, and engagement with, grasslands. Provide firebreaks and buffers.
- Encourage lots and buildings to be orientated to look over grasslands.

Stakes mark out an area recently discovered to be good-quality native grassland at Bon Thomas Reserve, Deer Park.

Plan for future management

Management needs

Incorporating site-specific management needs with development design can save considerable expense and labour in the middle- to long-term. For instance, it is important to have practical access routes and access points that are appropriate to elements of the terrain, such as surface rock features, soft ground and topography. Gates should be located to allow easy maintenance. Shared paths may also allow maintenance vehicle movement. Planning appropriate locations to wash down machinery will facilitate machine hygiene and reduce the spread of weeds .

It is useful to consult experts with experience in conducting the type of ecological burns necessary for grassland maintenance, early in the design process. Access to water is also very important. Co-location of recreation trails, firebreaks and buffers is often possible during the design stage.

Input from an experienced field technician is valuable in anticipating site-specific maintenance issues and opportunities.

Buffer plantings and fences at the edge of grasslands help to catch wind-blown rubbish, reducing the amount that enters grasslands. Maintenance crews can more easily collect rubbish from a planted (or fenced) edge than from throughout grasslands.

Designing for management needs will simplify conducting burns and reduce occupational health and safety risks.

Ensuring adequate long-term resources

Establishing a recurrent budget, or multi-year funding, sufficient for ongoing review, supervision of adjacent works, maintenance, and community engagement is important. A clear recurrent budget allows planning for additional works through additional funding.

Documenting the site and the success of management practices is an effective tool for establishing good levels of funding. See also Adaptive management, p. 47.

Asset ownership

It is important to plan for the capacity of future owners when creating assets. For example, asset ownership may be transferred from developer to council, or between government authorities, service providers and council, or to an organisation such as Trust for Nature.

High-maintenance plantings may strain a council budget and result in the plantings being poorly maintained. In such cases, it is often better to create a simpler and easy-to-maintain planting.

A situation may arise where different authorities are responsible for different parts of a grassland, e.g. what lies within and without the reserved extent of a grassland. Close coordination and clear communication are necessary in such circumstances.

Be strategic about location of quality plantings and detailing

For instance, include biodiverse plantings and high-quality fencing at key, high-usage, high-visibility entrances and provide lower-maintenance planting options and cheaper fencing in larger-scale areas of less visibility and community importance.

Plant stable plantings or plantings that will develop successfully over time .

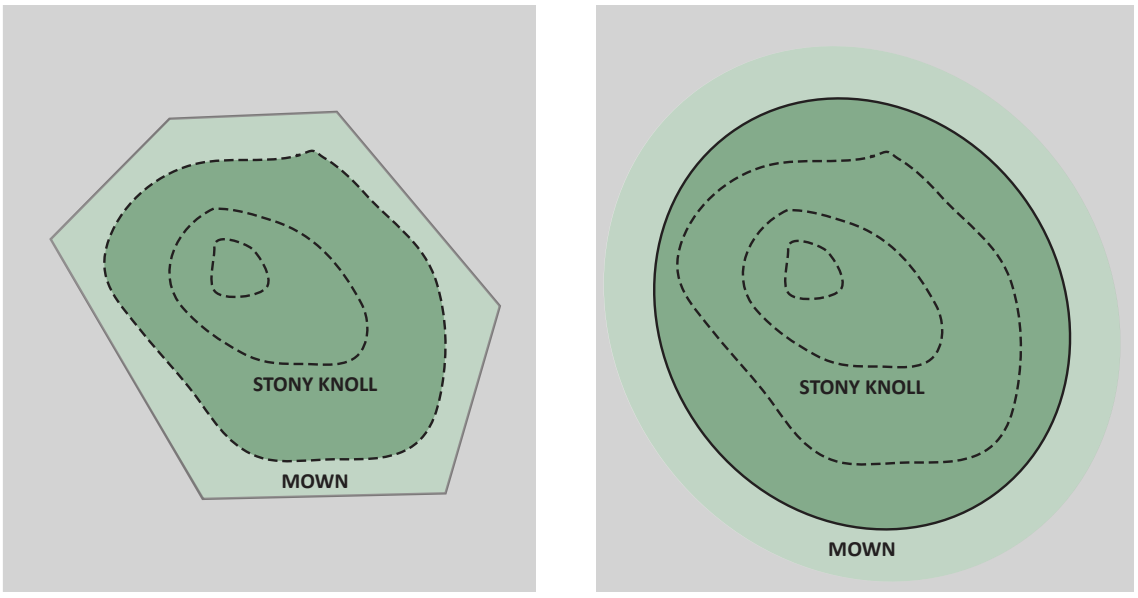
Contractors

Make no mistake: it is important to ensure contractors are aware of the aims and processes of the grassland management strategy.

Contractors are an integral aspect of grassland management. It is essential that clear lines of communication exist, that information of relevance is well documented, and that skill levels are adequately assessed.

Processes should be put in place to induct contractors into the overall aims and strategies of the grassland management plan.

It is also important to establish contracts that work. For instance, the type of work required to conduct a burn will involve appropriate Occupational Health and Safety guidelines, liaising with local community groups, door knocking, liaising with the Country Fire Authority or Metropolitan Fire Brigade and traffic authorities prior to the burn, as well as conducting the burn and following up with appropriate weed control in the weeks and months afterwards.



Two scenarios. On the left, a stony knoll is fenced-in tightly, requiring brush-cutters to be used, an expensive process compared to mowing. On the right, the immediate area around the stony knoll is treated as grassland to be preserved, and the mown area is moved back and can be slashed by tractor in a far more cost-effective process that may result, too, in improved form for integrating into further design and planning.

Skill levels and maintenance

Grasslands exist in a hierarchy of management inputs and funding, in part dependent on the quality and values of the grasslands. Low-quality grassland will not generally be set aside specifically for conservation, though it may be incorporated into larger areas of public open space and managed under its own regime.

All grasslands will degrade in the absence of an appropriate level of maintenance and all can be degraded by management that is unskilled or inappropriate to the state the grassland is in. Generally speaking, it is easier to maintain the vegetation quality of low-quality and high-quality grassland remnants compared to medium-quality grassland because:

- The greater resilience of high-quality grassland with higher natural regeneration capacity and resistance to weed invasion means the maintenance role may be limited to ensuring continuation of a critical level of ecological processes.
- Low-quality grassland is likely to have plateaued with mix of weeds and a small subset of robust remnant plant species. It is likely to be the product of a history of low levels of maintenance input over many years so may be relatively simple to maintain.
- Medium-quality grassland is frequently in a dynamic state where vulnerable plant species are in the process of dying out due to long-term or short-term changes in management. Maintenance at a 'medium-quality' state will require observation and dynamic responses to the changes that are going on. Reintroducing ecological processes and other active restoration is likely to be needed just to halt degradation and so maintain the existing species composition.

Guidelines

- Consult experts practiced in conducting the type of ecological burns necessary for grassland maintenance, early in the design process. Co-locate recreation trails, firebreaks and buffers, where possible.
- Consult an experienced field technician to anticipate site-specific maintenance issues and opportunities, and plan fencing, access routes, access points, and access to water accordingly.
- Consider shared paths that can also allow maintenance and vehicle movement.
- Ensure long-term budgets are in place and adequate, and plan to those budgets.
- Consider the capacity of future asset owners to maintain assets, when planning.
- Locate resource-intensive elements in areas where they will have the most impact.
- Consider the skill levels required to maintain grasslands and associated plantings.

Managing biomass

For many grasslands, especially those dominated by Kangaroo Grass (*Themeda triandra*), it is well understood that without some form of biomass (herbage) removal, through fire, grazing or slashing, the dominant grasses will inhibit the growth of other species, reducing biodiversity (Lunt and Morgan 2000). The majority of the plant species in grassland grow in the spaces between grass tussocks. Without regular reduction in the size of the tussocks, the canopy of the tussocks closes over these spaces, shading-out smaller plants such as lilies, daisies and peas: the tussocks will out-compete the non-grass species that grow between the tussocks.

Therefore, disturbances that periodically reduce biomass are necessary to maintain diversity. Different disturbance regimes will have different impacts, but in the long-term the lack of any disturbance is considered worse for biodiversity than burning, grazing or mowing (Morgan 1999).

Burning

Reducing biomass through controlled burning is an effective management tool and can be used successfully in urban areas, if planned carefully. The timing and frequency of burning are critical to maintain grassland diversity and burns need to be planned in conjunction with fire protection requirements. When using fire to manage biomass, it is important to establish a fire management plan early. This will help in determining firebreaks, location of access and water points and traffic management needs and will facilitate integration with the local municipal fire management plan. Any fire management plan should include a strategy for communicating the benefits of ecological burns to the community. Good

Areas burnt one year apart as part of a rotating burning strategy at Evans Street Grassland, Sunbury.

Before and after a burn.

communication with neighbours, both residential and industrial, is critical for alleviating concerns and minimising potential impacts from smoke.

Where possible, firebreaks should be beyond the reserved extent of grasslands and low-biomass areas, such as mown parks, can provide additional protection. If planned carefully, firebreaks may also serve as informal paths through grasslands, however, their location will primarily be determined by fire protection requirements. In a peri-urban environment, fire protective works are an essential component of all planned burning, including in some cases the construction of mineral earth (ploughed) breaks and the use of heavy earth-moving equipment such as graders and slashers. Such activities may (when poorly controlled) further damage the grasslands that the planned burn is designed to protect.

It is important to consult experts with experience in conducting the type of controlled burns necessary for grassland maintenance, early in the design process.

Slashing

Slashing can be a valuable tool to control grassland biomass. Ideally, slashing should be followed by raking of the cut biomass to remove it. If using slashing as a tool to manage grassland biomass, careful planning must be undertaken to ensure that the frequency and timing of slashing don't prevent flowering and seed set. The spread of weeds by vehicles and equipment, soil compaction and damage to vegetation can also be negative impacts of slashing. Vehicle hygiene protocols should be developed and implemented and include, where possible, identified areas outside grasslands for washing down vehicles. Much damage has been done to grassland through failure to implement appropriate machine hygiene.

Grazing

Grazing is an option for reducing grassland biomass, especially in areas that have been historically grazed. However, the timing and duration of grazing are crucial to prevent negative effects on some species, reducing biodiversity. Additionally, careful consideration needs to be given to: fencing design, protection of sensitive areas such as wet areas, ease of moving stock, soil compaction and trampling, and the presence of stock in an urban area. As such, if considering grazing in grassland areas to manage biomass, it is important that expert opinion is sought to ensure both biodiversity and husbandry requirements can be met.

Guidelines

- Establish a fire management plan early.
- Identify adjacent areas of low-biomass that may provide additional fire protection.
- Locate, if possible, firebreaks to become useful trails through grasslands.
- Locate boundary firebreaks beyond reserved extent of grasslands.
- Timing and frequency of biomass reduction are important.
- If considering grazing, seek expert opinion early in planning process to determine if appropriate.
- Establish and implement vehicle and equipment hygiene protocols.

The Golden Sun Moth Playground at Malcolm Creek, Craigieburn, is an excellent example of using a rare species to promote engagement. This playground is very popular, caters to all age groups using a mix of off-shelf play equipment and custom designed play facilities with an extraordinary huge colorful moth play structure as the centerpiece, which encourages kids to climb up its hollow legs, into its red body, play games to learn about it's habits and slide out it's popular 'poo tube' (actually 'ovipositor') tail. Photo: Courtesy Thompson Berrill Landscape Design, © Stockland.

Determine the required scale of plantings and buffers

It is important to determine the scale of plantings during the planning process in order to provide sufficient space for plantings and sufficient setback of tall plantings from both grasslands and predator-fencing. Grasslands can be adversely affected by the close proximity of trees, through leaf litter suppressing growth, through trees' differential response to fire, and through shading.

Grasslands sometimes require unsightly predator-fencing and it is desirable to screen such fencing. Plantings to screen the predator-fencing will have to be set back from the predator-fencing, or they will provide access routes for predators to enter grasslands.

Industrial development beside grasslands can be unsightly, and appropriate plantings can enhance views.

In areas where grasslands are adjacent to high-activity areas, such as sports fields, playgrounds, or dog off-leash areas, it is useful to increase the depth of buffer-zone plantings to provide additional protection.

Guidelines

- Consider if screening is required (for instance when residences are near predator-fencing) and ensure sufficient setback of screening plantings from grasslands.
- Plan buffer-zone planting depth according to adjacent uses.
- Buffer core areas with additional planting when these areas occur close to potentially high-impact land uses.

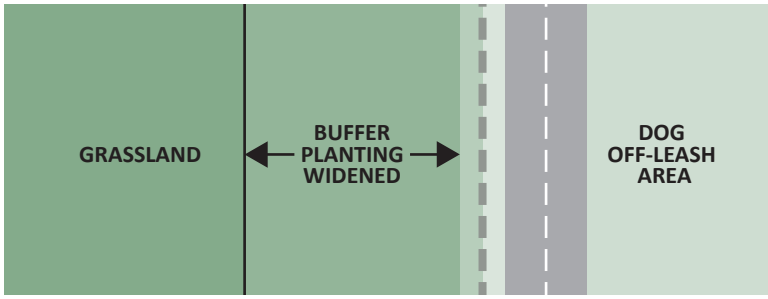


Diagram showing a widened buffer in response to an adjacent dog off-leash area.

Consider overlays

Planning overlays are powerful tools for controlling development. Overlays can be used to control environmental weeds. For instance, Bayside City Council's Neighbourhood Character Policy provided the vehicle through which a community group achieved a ban on environmental weeds in the area around a remnant being developed. Reference materials can be incorporated into the local planning scheme to ensure that relevant documents must be considered during development. One example of this is the inclusion of the Merri Creek Management Committee's 1997 Merri Creek Management Plan and its draft 1997 Merri Creek Concept in the City of Yarra's local planning scheme.

Consider other forms of legal protection

There are various legal mechanisms available to restrict the actions that can be performed on land. Covenanting is the most well-known of these. For example, a Trust for Nature covenant was placed on Evans Street Grassland, Sunbury. While the potential for development on the land occupied by the grassland may still be a political issue locally, its legal protection allows for more confident planning and spending. Further information on these legal mechanisms can be obtained from organisations such as Trust for Nature and Bush Heritage.

Prevent predation by domestic cats and dogs

Domestic cats and, to a lesser extent, dogs can do significant harm to native wildlife, including protected species. It is important to educate pet owners on their responsibilities, and on the effects that domestic animals may have to wildlife. Legislation to contain or curfew cats will be more acceptable to the community if it is already in place prior to residents moving into greenfield developments. Some councils have useful recommendations and requirements on preventing predation by domestic cats and dogs.

Guidelines

- Provide educational material on the effects of domestic pets, and owners' responsibilities.
- Establish legislation at council level to contain or curfew cats in areas adjacent to grasslands.
- Contact local authorities to determine extent and nature of existing domestic cat and dog controls.

Engage the community

Community engagement with grassland management needs to be encouraged from the very beginning of development. Access, signage, consultation, maintenance and high-quality edge design can all encourage this.

Rare species and interesting fauna are excellent tools for engaging people.

Interpretive signage at key locations can highlight grasslands as places of interest and significance.

Signage can also highlight species appropriate for home gardens, and recommend ways to source those species.

Grasslands can be incorporated into development branding.

Develop early adoption by friends groups to promote interaction, protection, maintenance, understanding and long-term community support. Ensure that the scale of effort in establishing a friends group is understood from the outset, as poorly functioning friends groups may be counter-productive in ensuring grassland health.

Encourage sustainable methods of gardening and public open space maintenance in proximity to grasslands. Educational programs could be implemented to limit use of pesticides, restrict the growing of domestic species that may tend to invade grasslands, and minimise dumping of garden waste.

Snakes

There are many misconceptions about how dangerous snakes are. Death by snakebite is very uncommon: in the last decade in Victoria, only two people have died as a result of snakebite (Anderson 2011). Wearing suitable clothing, such as boots and long trousers, significantly reduces the danger. Snakes are more likely to be found beside creeks than in grasslands. If residents are worried about the chance of having a snake on their property, by removing rubble and water sources, and ensuring good 'housekeeping' – keeping the property tidy – they can significantly minimise any risk.

Because development destroys a great deal of snake habitat, it is common for a new estate to experience initial problems with snakes as the snakes seek new places to live. These problems usually decrease over 5 or so years.

Uncertainty about snakes can be common in migrants new to Australia.

There are two schools of thought on how to respond to the issue of grasslands and snakes. On the one hand, many people believe that snake awareness programs, run in conjunction with a professional and ethical snake handler, can provide positive messages about 'living with snakes'. In many cases, it is argued, other messages about the value of grasslands cannot take root until people's fear about the risk of snakebite is addressed. On the other hand, many land

Case study: Snakes and grasslands: the experience of Merri Creek Management Committee (MCMC)

Snakes are an important part of our local ecology, even along inner-city creeks and in urban bushland reserves. The most commonly encountered snakes in Victoria are highly venomous. It is illegal to injure or kill any wildlife in Australia and we need to learn to live alongside them.

Residents of urban areas are often unaware of simple measures they can take for themselves and their pets to avoid dangerous encounters with snakes. A disproportionate fear of snakes can translate into avoidance of the grassland landscapes that people strongly associate with snakes. These feelings make it hard to engage the community about grassland values. A challenge for grassland managers is to transform fear of snakes into a healthy respect and appreciation.

Signs and symbols alerting visitors to the presence of snakes are commonly used to fulfill land-owners' commitment to public safety. However, signs alone have limited scope for awareness-raising. Brochures can address the questions that commonly arise and provide nuanced answers. A brochure translated into several community languages has been successfully used in the City of Darebin for over a decade.

Open mown or paved spaces bordering a reserve may provide 'transition spaces' where nervous visitors can build confidence to enter grasslands where visibility is more limited. However, paving and mown grass make ideal basking sites, especially for sluggish snakes in the morning, and so are likely places for a close encounter.

A reptile show conducted on Ngarri-djarrang (Central Creek Grassland), Reservoir, acquaints people with the beauty of reptiles.

MCMC has found that events that include opportunities to get close to reptiles, combined with simple safety messages from experts, have been the most powerful means of raising awareness. A number of ethically run wildlife shows, which promote snake awareness and respect for the animals, are available for hire in Victoria. Before hiring a wildlife show, seek references and, if possible, attend a performance as some older style 'snake pit' shows sensationalise snake danger and will have precisely the opposite effect to the one that is intended.

managers believe that it is best to minimise discussion of snakes, the argument being that by talking about snakes we create additional worries about snakes in the community. In practice, it will always be important to judge the attitudes of those in the community, and to consult with Council and reputable snake handlers, before deciding on an appropriate strategy.

Guidelines

- Establish an easily accessible place where prospective residents can engage with grassland.
- Educate residents through schools, neighbourhood houses, church groups and other community hubs.
- Consider running snake awareness programs.
- Direct concerned individuals to local snake handler.
- Include grassland information at point of sale and display homes.
- Encourage early adoption of grasslands by friends groups.
- Contact local authorities to see what support exists for friends groups. VNPA also hosts a friends network to provide support and advice.

A lookout, combined with a raised walkway, makes a very engaging feature at Cypress Views Grassland, Caroline Springs. Photo: © Dianna Snape.

An old tree leaning against a large rock at the edge of Ngarri-djarrang (Central Creek Grassland), Reservoir, may make an excellent playspace for children.

Here at Pimelea Terrace Grassland in Cairnlea, free access is allowed to the constructed grassland on the right, removing any need for entry to the protected grassland on the left.

Engage with the Traditional Owners

Temperate grassland has a long history of Indigenous cultural practices and land management including frequent burning. Grassland was managed for food – primarily seeds, tubers and fauna – and other resources. Grassland is an essential part of the culture of the land's Traditional Owners and will often include sites of particular cultural significance. Developing partnerships with Traditional Owners to re-establish traditional cultural practices and share stories of place can have long-lasting benefits. Genuine partnerships are built on mutually respectful relationships that require time and commitment to grow. The knowledge held by the Traditional Owners, and the stories of the past that we are able to tell through our own understanding, are both key elements in developing a sense of place and promoting community engagement.

The shallow depressions or 'gilgais' at Craigieburn Grasslands are characteristic of this grassland ecosystem. In ecological terms, this area of gilgai-dominated grassland (until recently heavily grazed) is of low significance. It is still an excellent and non-sensitive destination within the grassland to interpret gilgais

Guidelines

- Respectfully invite participation of Traditional Owners and acknowledge their connection to Country when planning for and managing grassland reserves.
- Where possible, consult and involve Traditional Owners and Indigenous communities and encourage participation in planning and management of grasslands, especially in relation to preservation and management of Indigenous cultural heritage values.
- In consultation with Traditional Owners, use place naming to emphasise traditional cultural significances.
- In consultation with Traditional Owners, identify opportunities to interpret and use traditional knowledge as way of creating sense of place in broader community.

A damp area at Ravenhall Grassland, Ravenhall, displays its own particular set of species.

Allow and orchestrate access

As a general principle, some limited access to grasslands should be encouraged. Curiosity about grasslands should be fostered. Grasslands offer an immersive experience, and, through being in grasslands, people can truly understand the richness of the ecosystems present there, the qualities that they can offer. Grasslands are highly sensory environments, full of visual detail, sounds of insects and birds, the rustling of the wind through the grass, and tactile qualities. Moreover, grasslands are usually mosaics that vary according to soil moisture, aspect, slope, geomorphology and so forth and it is only through exploration that these subtleties are discovered. Immersion is a powerful way of experiencing these sensations and countering the negative perception that grasslands are uniform.

Educational access will create goodwill and understanding, which will serve to create community

engagement with grasslands and protect grasslands in the long term.

Informed human presence creates surveillance and serves to protect grasslands.

Firebreaks can be used to offer access routes into grasslands.

The means of movement into and through grasslands needs to be orchestrated on a case-by-case basis because the destinations will be highly specific to the location. It may be that certain natural features offer themselves as obvious destinations. Prior usage may have created sites to explore. Conversely, areas of obvious temptation may be areas of particularly high ecological value or archaeological sensitivity, to be protected at all cost. There are many opportunities to create sets of experiences within grasslands. High-quality grassland can be 'hidden' within medium-quality grassland, and access orchestrated to avoid these core areas.

Consider levels of fencing. Within fenced grasslands, areas of additional fencing may be appropriate to signal that that area is particularly off-limits to humans, for instance, around a scar tree, the health of which may be endangered by compaction of soils, or around restoration sites.

Consider prompts to movement and exploration, for instance, viewpoints, places of shelter, features of interest.

It may be possible to fence high-quality grassland in an exclusionary manner in a residential area if a medium-quality grassland adjacent or nearby is opened for access. Without the nearby medium-quality grassland, people may resent the 'keep out' nature of the high-quality grassland.

Guidelines

- Encourage some limited access to grasslands.
- Concentrate access at grassland edges and more degraded areas, with access to core areas occurring less often and in carefully controlled circumstances.
- Use grassland diversity to find places of destination within grasslands, e.g. places of play, learning, discovery and poetic experience.
- Encourage educational access.
- Promote adjacent human presence that creates surveillance.
- Use firebreaks as access routes into grasslands.
- Orchestrate access based on case-by-case understanding of destinations.
- Create sets of experiences within grasslands.
- Consider hierarchy of fencing.
- Consider prompts to movement and exploration.

Minimise noise

Care should be taken to ensure grasslands are protected from excessive, continuous noise – for instance, noise from freeways can disrupt behavior patterns in species that communicate acoustically (Williams, 2012).

Guidelines

- Consider use of noise walls for fauna, not just for humans (this needs to be balanced against possible impact on views).
- Locate noise sources away from grasslands where possible.

Plan to create variety

Grasslands appear as homogeneous places of low complexity. While this is a view often dispelled by education and direct experience of grasslands from within them, this is a perception that needs to be countered at the planning and design level.

Differentiating places by revealing complexity and providing variety, will increase the community's engagement with grasslands.

Guidelines

- Vary edge treatments (for instance, fencing and planting styles), especially at highly visible locations.
- Create entrance experiences.
- Promote variety in types of land uses adjacent to grasslands: for instance, buffer plantings, active recreation, passive recreation, pocket parks, nodes, roadside and shared paths.
- Include variation even within restricted palettes promoted to present development as unified whole. For instance, vary street furniture within set theme, plant acacias but vary species of acacia from place to place.

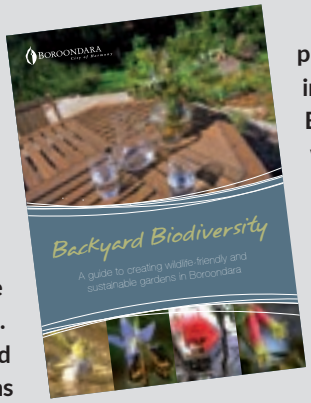
Plan plantings beyond grasslands' immediate edges

Residential gardens, street trees, median strips, nature strips, amenity plantings in commercial areas, screening, remnant trees, waterways, parks and roadside plantings are all plantings that may occur away from the immediate edge of grasslands and that can affect grasslands for better or for worse. For example, these plantings may be:

- Habitat for grassland fauna, or for species that compete with grassland fauna.
- Sources of invasion, either natural or exotic.
- Competitors for resources, for instance, water.
- Part of estate-wide branding strategy.
- Objects of comparison to grasslands.

Case study: Boroondara's Backyard Biodiversity Project

Boroondara City Council runs a popular Backyard Biodiversity project, which helps increase indigenous habitat on private and public land, successfully builds awareness and knowledge around local environmental issues, improves connectivity across the municipality and provides a source of new members for friends groups. Backyard Biodiversity was recognised as a finalist in the 2011 United Nations World Environment Day Awards.



The Backyard Biodiversity project focuses on residents living adjacent to Boroondara's biodiversity corridors. Households are recruited and invited to participate in a series of workshops about the local environment and the 'nuts and bolts' of habitat gardening. Group activities follow on, including a visit to local native/indigenous gardens, a walk, talk and community planting activity with a local friends group and a tour of a local indigenous plant nursery. Participants are offered free plants and a home visit from a landscape designer to provide advice on creating a small habitat garden.

The project was piloted in 2010/11 and has been rolled out across the municipality. Many of the project's participants continue to meet as alumni twice a year for ongoing activities. The project has resulted in some wonderful social and environmental outcomes including the development of a new friends group, over 2000 indigenous plants in home gardens and over 2000 planted with friends groups, plus a measurable increase in knowledge, and skills and new friendships forged!

Knox City Council runs a similar program called Gardens for Wildlife in association with the Knox Environment Society, which is worth exploring as another model for engaging local communities around biodiversity protection and enhancement.

Although these programs extend beyond just grassland ecosystems, they are interesting models that could be used when considering how to promote grassland values and appreciation beyond the public realm and into private gardens.

Boroondara's Backyard Biodiversity project:
http://www.boroondara.vic.gov.au/our-city/environment/environmental-projects/backyard-biodiversity

Knox's Gardens for Wildlife program:
http://www.knox.vic.gov.au/Page/page.asp?page_Id=880

Participants receive 20 free indigenous plants from VINC (the Victorian Indigenous Nurseries Cooperative) to start their habitat garden. Photo: © City of Boroondara

Social outcomes from the Backyard Biodiversity project include new friendships and sharing of resources such as mulch. Photo: © City of Boroondara

Case study: Dumping is Damaging Campaign, Wyndham City Council

Illegal dumping has long been a problem in Wyndham, as it is in other municipalities. In 2009, the clean-up of illegal dumping cost Wyndham approximately $200 000. Dumping is unsightly and can pose significant threats to the local environment and human health.

The Dumping is Damaging campaign explored various education, infrastructure and enforcement actions to tackle the problem of illegal dumping along remote roadsides in Wyndham. The target area was Davis Road between Hogans Road and Boundary Road and the surrounding estates in Tarneit. The campaign later encompassed Manor Lakes, Point Cook and opportunity shops due to overwhelming interest in the campaign from developers and Wyndham's major opportunity shop operators.

The campaign target of a 25% reduction in illegal dumping was far surpassed, showing that the campaign met its aim. Dumping is Damaging was also successful at raising awareness of illegal dumping and what to do if you witness it.

While the issues to consider are complex, in general it will be best to promote species that directly support grassland health by providing habitat and cues to care, and by minimising invasive influences.

Consider providing information, such as planting guides, to the community to encourage such considerations, to communicate grassland management principles and intentions, and to invite them to strengthen those plans by their own actions. By engaging the community on such issues, it is possible to foster a sense of stewardship for grasslands.

Advice on planting should be communicated as early as possible, when planting is likely to take place. Residents are less likely to alter an established garden than plant a new garden. Communication to residents or prospective residents could occur at point of sale, at change of ownership, or change of property occupant (perhaps facilitated through notification agreements with service providers, such as electricity or gas providers).

Developers should be encouraged to include grassland-friendly garden designs as part of house and land packages

Competitions, in which residents win new gardens or plants, can encourage grassland-friendly planting practices.

Planting guidance can include non-grassland-related incentives: for instance, a garden that uses only a little water will be cheaper to maintain, and many grassland species would be appropriate for such a garden.

It will generally be easier to provide insect and bird habitat than habitat for land mammals.

An old stockyard at the edge of Craigieburn Grasslands might make an appropriate destination for visitors to the grassland.

Guidelines

- Develop house and land packages with grassland-friendly plantings.
- Provide planting information to new occupants and to all community members.
- Use plantings throughout development as means of strengthening grasslands.

Adaptive management

Many factors that contribute to successful grassland management can change over time, and it is important when planning to include processes of assessment and monitoring that are able to detect and respond to change. Factors that can change can include:

- Adjacent use of land (for example, an adjacent park becomes used for active rather than passive recreation).
- Movement patterns into grasslands (for example, an access point to a grassland is never used).
- Community expectations and behaviors (for example, residents increasingly want to plant indigenous species in their gardens).
- Stability of edge plantings (for example, the species mix is changing, leading to higher maintenance costs).
- Budget (for example, the maintenance budget is reduced)
- Knowledge of processes (such as burning regimes) and ecological practices (such as how to prioritise weed management)
- Skill levels of contractors (learning over time)
- Change of ownership (for example, transfer of assets to Council)
- Change of conservation value (for example, a protected lizard is discovered, requiring an area to be predator-fenced)
- Change of priorities (for example, a developer designs an area in order to sell property, and after some years hands over the land to a council that wishes the area to be more focused on providing human services)

Guidelines

- Document conditions and management actions so to make comparison with previous states effective.
- Allocate resources to regular assessment and monitoring.
- Ensure processes are in place to communicate and incorporate results of review into existing practices.
- Include past, present and future stakeholders at all levels.
- Engage consultants with access to latest knowledge.

Checklist: planning guidelines

Keep works beyond the reserved extent of grasslands

- ☐ Buffers, mown edges, fences and adjacent paths located beyond reserved extent of grassland.
- ☐ Poorer-quality grassland reserved to accommodate buffers, mown edges, fences and adjacent paths.

Understand the diversity within grasslands

- ☐ Scope of protection understood and defined.
- ☐ Detailed, ground-truthed biodiversity maps defined early in planning process.
- ☐ Core and non-core areas defined.
- ☐ Access planned for non-core areas.
- ☐ Access to core areas in controlled instances.
- ☐ Residential areas not adjacent to predator-fencing.
- ☐ Grassland variety guides visitor experiences.

Understand the interaction of grasslands and adjacent land uses

- ☐ Adjacent land uses considered when planning and designing.
- ☐ Custodianship of grasslands promoted in industrial areas through adjacent amenity such as cafes, lunch spots, on-leash dog-walking.
- ☐ Wastes from industry controlled.
- ☐ Commercial centres located away from grasslands.
- ☐ Commercial centres avoid future land-use conflict with grasslands.
- ☐ Public open space located immediately adjacent to grasslands.
- ☐ Public open space provided near grasslands.
- ☐ Potentially higher-impact land uses located away from vulnerable areas of grasslands. Higher-impact land uses include active recreation, dog off-leash areas, loud industries and schools.
- ☐ Sufficient buffers in place to minimise impacts from adjacent land uses.

Roads

- ☐ Avoid major roads next to grasslands.
- ☐ Use roads to separate grasslands from development.
- ☐ Plant roadsides with species that support grasslands.

Provide active edges

- ☐ Grasslands provided with road edges rather than residential or industrial land use.
- ☐ Avoid back fences adjacent to grassland. If unavoidable, back fences adjacent to grasslands allow surveillance of and engagement with grasslands.
- ☐ Firebreaks and buffers provided to any adjacent back fences.
- ☐ Lots and buildings orientated to look over grasslands.

Plan for future management

- ☐ Experts practiced in ecological burns consulted early in design process.
- ☐ Experienced field technician consulted to anticipate site-specific maintenance issues and opportunities, and plan fencing, access routes, access points, access to water.
- ☐ Recreation trails, firebreaks and buffers co-located where possible.
- ☐ Shared paths designed to allow maintenance and vehicle movement.
- ☐ Long-term budgets in place and adequate.
- ☐ Future owners' capacity to maintain assets considered.
- ☐ Resource-intensive elements located in areas where they will have most impact.
- ☐ Skill levels to maintain grasslands and plantings considered.

Managing Biomass

- ☐ Fire management plan established early.
- ☐ Adjacent low-biomass areas for additional fire protection identified.
- ☐ Firebreaks located to become useful trails, where possible.
- ☐ Boundary firebreaks located beyond reserved extent of grasslands.
- ☐ Timing and frequency of biomass reduction planned.
- ☐ If considering grazing, expert opinion sought early to determine if appropriate.
- ☐ Vehicle and equipment hygiene protocols implemented.

Determine the required scale of plantings and buffers

- ☐ Screening requirements considered.
- ☐ Screening plantings setback sufficiently from grasslands.
- ☐ Buffer-zone planting depth responds to adjacent uses.
- ☐ Core areas buffered with additional planting when close to potentially high-impact land uses.

Prevent predation by domestic cats and dogs

- ☐ Legislation at council level established to contain or curfew cats in areas adjacent to grasslands.
- ☐ Local authorities contacted to determine extent of domestic cat and dog controls.

Engage the community

- ☐ Accessible place established for prospective residents to engage with grassland.
- ☐ Residents educated through schools, neighbourhood houses, church groups and other community hubs.
- ☐ Snake awareness programs considered.
- ☐ Individuals concerned about snakes directed to local snake handler.
- ☐ Grassland information present at point of sale and display homes.
- ☐ Early adoption of grasslands by friends groups encouraged.
- ☐ Local authorities and VNPA Friends Network contacted to determine support for friends groups.

Engage with the Traditional Owners

- ☐ Traditional Owners acknowledged, consulted and participation encouraged in planning and management of grasslands.
- ☐ Place naming used to emphasise traditional cultural significances.
- ☐ Traditional knowledge used to create sense of place.

Allow and orchestrate access

- ☐ Some access to grasslands allowed.
- ☐ Access concentrated at grassland edges.
- ☐ Access to core areas carefully controlled.
- ☐ Grassland diversity used to determine destinations.
- ☐ Educational access encouraged.
- ☐ Human surveillance promoted.
- ☐ Firebreaks used as access.
- ☐ Access based on case-by-case understanding of destinations.
- ☐ Sets of experiences created.
- ☐ Hierarchy of fencing considered.
- ☐ Prompts to movement and exploration considered.

Minimise noise

- ☐ Noise walls for fauna considered.
- ☐ Noise sources located away from grasslands.

Plan to create variety

- ☐ Edge treatments varied, especially at highly visible locations.
- ☐ Entrance experiences created.
- ☐ Variety in adjacent land uses promoted.
- ☐ Variation promoted even within restricted palettes that present development as unified whole.

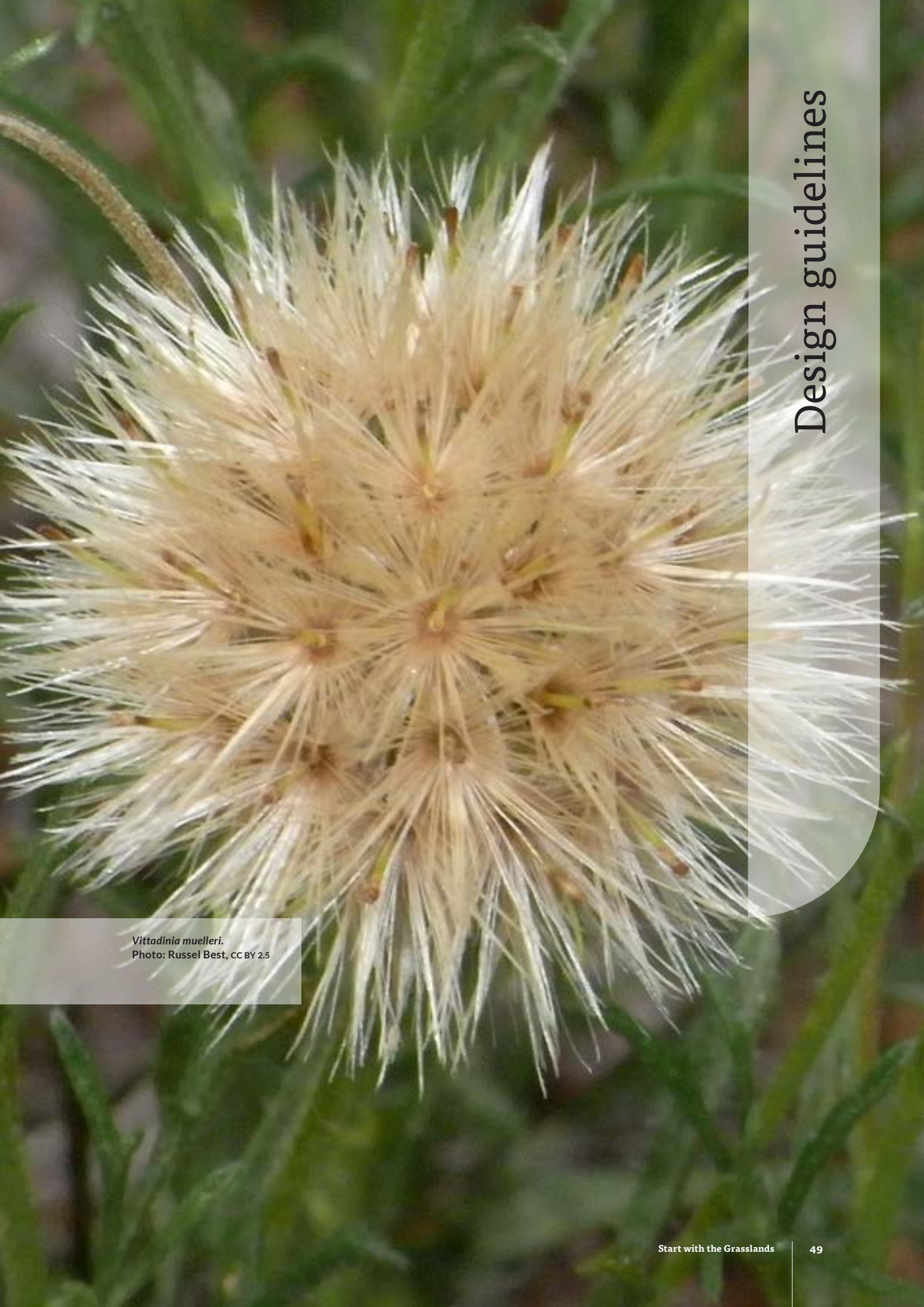
Planning plantings beyond grasslands' immediate edges

- ☐ Grassland-friendly plantings developed for house and land packages.
- ☐ Community members provided with planting information.
- ☐ Plantings throughout development strengthen grasslands.

Adaptive management

- ☐ Conditions and management actions documented to make comparison with previous states effective.
- ☐ Resources allocated to regular assessment and monitoring.
- ☐ Processes in place to communicate and incorporate results of review into existing practices.
- ☐ Past, present and future stakeholders at all levels included.
- ☐ Consultants with access to latest knowledge engaged.

Design guidelines



Vittadinia muelleri.
Photo: Russel Best, CC BY 2.5

Introduction

Well-designed elements of grasslands edges, such as fencing, signage and buffer landscaping, will contribute significantly to the way in which the community engages with grasslands and the way in which grasslands function within the community. Good design can make grasslands less vulnerable to the pressures they experience. This chapter provides best-practice guidelines for the built elements of the grassland environment.

Design Guidelines

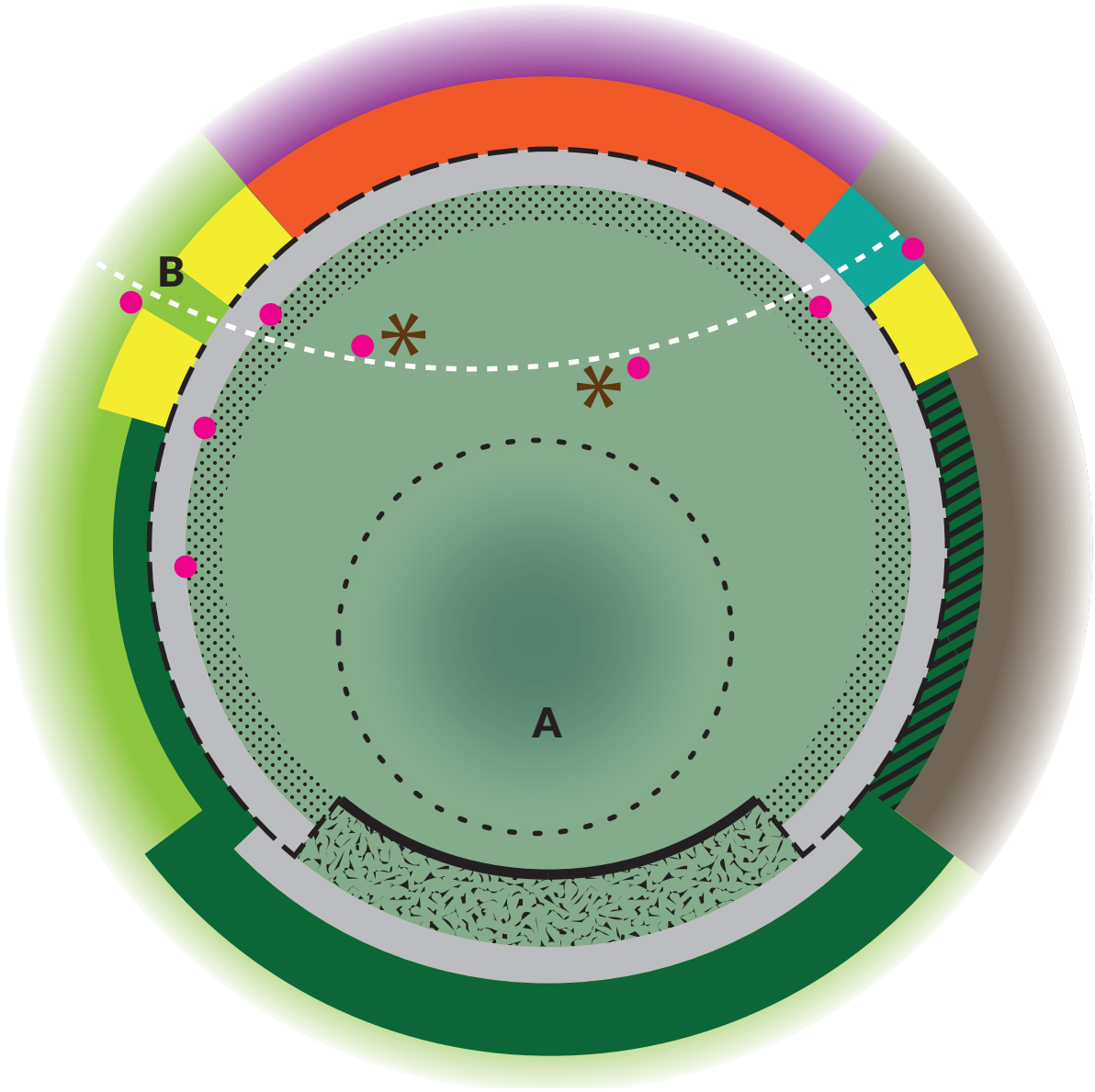
A number of elements are common to most grassland designs. These relate to the edge of grasslands, the interface between grasslands and community, and the interface between grasslands and built urban form. Good design will mediate within this space in such a way as to protect grasslands, assist in its maintenance, and promote a positive engagement with grasslands.

The built grassland edge can consist of:

- Plantings, including:
  - Buffer zones
  - Mown edges
  - Edge plantings
  - Trees
  - Mulches
- Fencing
- Access to grasslands
- Adjacent roads and paths
- Signage
- Lighting
- Grading and batters

A typical grassland edge and its relationship to the quality of grassland and the land use adjacent to the grassland is shown in the diagram on the following page.

Buffer plantings of the dominant tussock adjacent to grassland in the suburb of Williams Landing. Photo: © James Newman, courtesy MDG Landscape Architects.



Surveyed extent of grassland

Buffer planting: simple

Buffer planting: complex

Mown strip / firebreak

Edge planting

Edge planting screens industry

Edge planting as barrier

Display planting

Fencing: allows some entry

Fencing: no entry encouraged

Core area with additional fencing

A

Trail

Signage points

Destination

Passive recreation

Active recreation

Industrial area

Lunch node in industrial area

Diagram showing the effect of various adjacenct land uses on the edge treatment of a well-designed grassland. The typical edge consists, moving outward, of the reserved extent of the grassland, buffer planting, the mown strip / firebreak, fencing, edge plantings.

In places where conservation values are so high that entry into that area of the grassland is strictly discouraged (for instance, shown here at A), edging can be modified to place the buffer and mown strip on the outside of fencing, to make that fencing more exclusionary, and to make buffer plantings more species rich than simply the dominant tussock of the grassland.

At key entry points, such as at B, edge plantings become display plantings.

Trails are kept away from core conservation areas and are orchestrated to provide destinations within the grassland.

Views of unsightly industrial areas are screened.

Signage is placed at all entries, along the mown strip, and at destinations.

At areas of high activity, such as ovals, schools and dog off-leash areas, plantings are thickened and species are chosen that to act as effective barriers to movement.

Planting styles

Edge plantings have a number of functions. They may:

- Act as a barrier to weed invasion and rubbish
- Act as a barrier to human movement
- Provide habitat
- Demonstrate cues to care

The plantings of the grassland edge can be approached in a number of ways. Different planting styles will have different maintenance requirements and different costs and benefits associated with them.

Maintenance requirements are a significant consideration. Complex plantings, while providing rich design opportunities, may also require more skilled staff to maintain them. If the skill and time of maintainers is going to be a limiting factor, then it is best to limit the planting scheme to one that can be successfully accommodated.

Species should not be planted that are likely to invade the grasslands. Species should not be planted that need additional nutrients.

Selection of species is beyond the scope of this publication, however the table below provides some guidance. See Appendix 1: Species Selection for additional information.

Guidelines

- Choose species as barriers to weed invasion and windblown rubbish
- Choose species that can act as barrier to human movement
- Choose species that provide habitat
- Create plantings that, given budget and skill levels, can be maintained well to provide good cues to care
- Do not plant species that are likely to invade grasslands.
- Do not plant species that need additional nutrients.

Palette	Comments
Mown grass	Typical mown edge of grasslands. Be aware that mowing or slashing will change the species composition over time. Mown lawn will not be effective barrier to weed incursion or human access. To reduce costs, ensure access by machinery is possible, and avoid hand mowing. Forms fire break and provides public perception of safety.
EVC palette	Many edge plantings comprise species representative of local EVCs. One of best planting palettes in terms of biodiversity outcomes.
Grassy woodland	Grassy woodland appears more complex than grassland. People will accept grass under trees more easily than treeless grasslands. Trees provide shade and shelter. And grassy woodland is the ecosystem most commonly occurring next to grassland. One of best planting palettes in terms of biodiversity outcomes.
Indigenous	From local area, not restricted to a single EVC. See EVC palette above for comments. Local provenance may be considered a significant factor in sourcing indigenous species. One of the best planting palettes in terms of biodiversity outcomes.
Native	Australian. See EVC palette above for comments. Will provide excellent broad palette for especially showy plantings.
Exotic	Exotic plantings can have high biodiversity values. They may also have considerable community appeal and can be useful tools in providing cues to care and engaging community. Care needs to be taken to ensure such plantings are non-invasive.
Historic	Suitable particularly for heritage situations, these may be combination of indigenous, native and exotic species used from settlement times onwards.
Council palette: complex	Local councils will have palette of plants suitable for local area. Wholesale supplies should be easy and comparatively cost-effective to obtain.
Council palette: simple	Subset of council palette, these will be plants that are easy for unskilled staff to maintain. Wholesale supplies should be easy and comparatively cost-effective to obtain.
Novel landscapes	Direct seeding techniques now allow rich assemblages of species in complex grassy ecosystem to be created from scratch. This is relatively new approach, and it is not known how these systems behave over long-term, though 5–10 year studies show considerable success. Initial maintenance time and costs can be high, but resultant dense planting is often resistant to weeds.
Tussock monoculture	Planting dominant tussock, usually Kangaroo Grass (*Themeda triandra*) or Tussock Grass (*Poa labillardierei*), adjacent to grasslands extends visual sense of grasslands. This can be ideal for making people feel like they are 'in the grassland' when in fact they are adjacent to it. Plant sward densely to minimise opportunity for weeds.
None	Simple, low-nutrient mulch such as gravel provides some weed-suppression and is a low-cost alternative to plantings.

Buffer plantings

Buffer plantings are plantings immediately next to the reserved extent of grasslands. They are intended to act as an informal barrier to human entry, reduce wind-blown rubbish, and to suppress weeds along the edge of grasslands. Buffer plantings will, ideally,vary in width according to the extent that the adjacent grasslands need protecting, and according to the type and extent of activity taking place next to grasslands. In many cases, buffer plantings are constrained by historic circumstances or poor pre-planning, and available space is limited.

Well-planted and maintained buffer plantings will provide cues to care that will, in turn, benefit grasslands.

The most obvious species to plant in a buffer planting is the dominant tussock of the grassland, usually Kangaroo Grass (*Themeda triandra*) or Tussock Grass (*Poa labillardierei*). This presents the buffer as an extension of the grassland, and further protects the grassland by suggesting that people are actually 'in' the grassland when they are in the buffer to the grassland.

Buffers can be used as a landscape feature that highlights the prettier and more robust species within grasslands.

More expansive buffer plantings could well be modeled on grassy woodland EVCs provided tree plantings do not shade out grasslands or overly complicate maintenance through burning.

Direct seeding of species-rich grassland mixes is also increasingly viable as an option for creating buffers. Such 'constructed' grasslands may well provide the best support in terms of ecological services for the grasslands to be protected. Such constructed grasslands cost more to install, and to maintain, than simple single-species tussock plantings.

Guidelines

- Visually blend buffer plantings with grasslands.
- Consider using dominant tussock species of grassland.
- Plant at high densities to suppress weed growth.
- Determine extent of buffer plantings by taking into account both extent that adjacent grasslands need protecting and potential impacts of activity taking place next to grasslands.
- Locate buffer plantings beyond reserved extent of grasslands.
- Minimum width of buffer, 1 m.

Mown edge

Mown edges to grasslands are used primarily as firebreaks, movement lines for maintenance vehicles, and delineations of grassland edge. They provide short

The mown edge at Mt Derrimut Grasslands, Mt Derrimut, cuts into the reserved extent of the grassland and promotes the growth of mowing-resistant species such as *Rytidosperma* spp.

grass, which permits easy detection of basking snakes and reduces the chances of a risky encounter.

Mown edges should generally occur within the grassland fenceline. This allows entry through the fence, the sense of having entered the grassland, while not promoting the actual disturbance of the grassland. The mown edge is a good location for seating and signage elements.

By including the mown edge within the fence, it becomes perceived as part of grassland maintenance – an act of protecting the grassland rather than the land beyond the grassland being protected from grassland. This may be a preferred option in instances where any entry into a grassland is strongly discouraged.

When appropriately mown, the mown edge acts as a barrier to weed invasion.

A well-mown and maintained edge will provide cues to care that will, in turn, benefit grasslands.

Guidelines

- Locate mown edge beyond reserved extent of grasslands.
- Locate mown edge within grassland fenceline except in instances where access to grassland is strictly discouraged.
- Closely mow edge to reduce influxes of weed seed.
- Determine appropriate width of mown edge to allow for movement of maintenance vehicles where required.
- Determine appropriate width of mown edge to allow for it to function as effective firebreak.
- Locate seating and signage within mown edge, except in instances where access to grassland is strongly discouraged.
- Select pre-existing grassland species, or otherwise select non-invasive species.

Direct-seeded roadside: this large planting in Wycliffe, rural Victoria, now contains the second-largest population of the Critically Endangered *Rutidosis leptorrhynchoides* in Australia. Such plantings can be introduced at low cost in many contexts.

Grassland structure interface to Ngarri-djarrang (Central Creek Grassland), Reservoir. Photo: MCMC CC-BY-NC-ND

The edge of Cooper Street Grasslands, Campbellfield, is planted with mid-sized shrubs that, though they 'hide' the grassland from view, also shield the grassland from factory noise, litter, dust etc. The species selection is from local escarpment communities.

Kikuyu being removed after it spread from adjacent mown areas and residential properties into a grassland, smothering vegetation. Running grasses like Kikuyu or Couch Grass in lawns and sporting grounds adjoining grasslands require intensive management and should be discouraged.

By appearing to hide the Maygar Street Grasslands, Dallas, these shrubs suggest there is little of value at the grassland.

Edge plantings

Edge plantings to grasslands need to be competitive to weeds and provide an aesthetically pleasing aspect with a moderate level of dedicated maintenance. They serve to integrate grasslands into the surrounding development, work to prevent intrusion of weeds and rubbish, and control human and animal movement. Taller plantings can control views and screen unsightly views, such as predator-fencing and industrial development, and will need to be set back from the reserved extent of the grasslands to ensure grasslands are not affected by shade, leaf litter and change in conditions.

Sympathetic street tree planting may serve to integrate grasslands into their residential or industrial context. Plantings that are more 'municipal' in style in contrast to the wilderness of grasslands – mass plantings of a kind similar to the types used in council and commercial landscaping – could effectively use indigenous species and serve to integrate grasslands with the surrounding urban fabric.

Kangaroo Grass (*Themeda triandra*), Spiny-headed Mat-rush (*Lomandra longifolia*), Common Tussock-grass (*Poa labillardierei*) and Black-anther Flax-lily (*Dianella admixta*) have all been observed to suppress weed growth when planted at high densities.

Tall and dense plantings that occur next to adjacent residences may need to be buffered to improve the sense of space experienced by those residents.

Edge plantings that are well-planted and maintained will provide cues to care that will, in turn, benefit grasslands.

Be careful not to create hidden areas, for instance, between the edge planting and a fence, which may promote rubbish dumping.

Edge plantings may also introduce plants in close proximity to grasslands, which then spread into the grasslands.

Three approaches to perimeter plantings that have been applied near grasslands include grassland structure, dense shrub and tussocks, and mown native lawn.

Entrance or feature plantings

At locations of high usage, or high visibility, it may be a strategic use of resources or a means of presentation to give the edge planting more prominence so that it becomes, in effect, an entrance or feature planting. These types of planting might include 'pretty' wildflower species, and may be used in conjunction with interpretive signage and promote understanding and community ownership.

Grassland structure

The structure of grasslands is replicated using a small subset of grasses and wildflowers. Shading, sheltering and competition are at close to natural levels to ensure minimal impact on adjacent grasslands. Grassland structure perimeters are particularly appropriate for small grasslands with a high perimeter to area ratio. Such a planting expands the habitat and celebrates the character of small grasslands, which are experienced mainly from outside their border. However, such plantings have higher maintenance requirements than the following types.

Dense shrub and tussocks

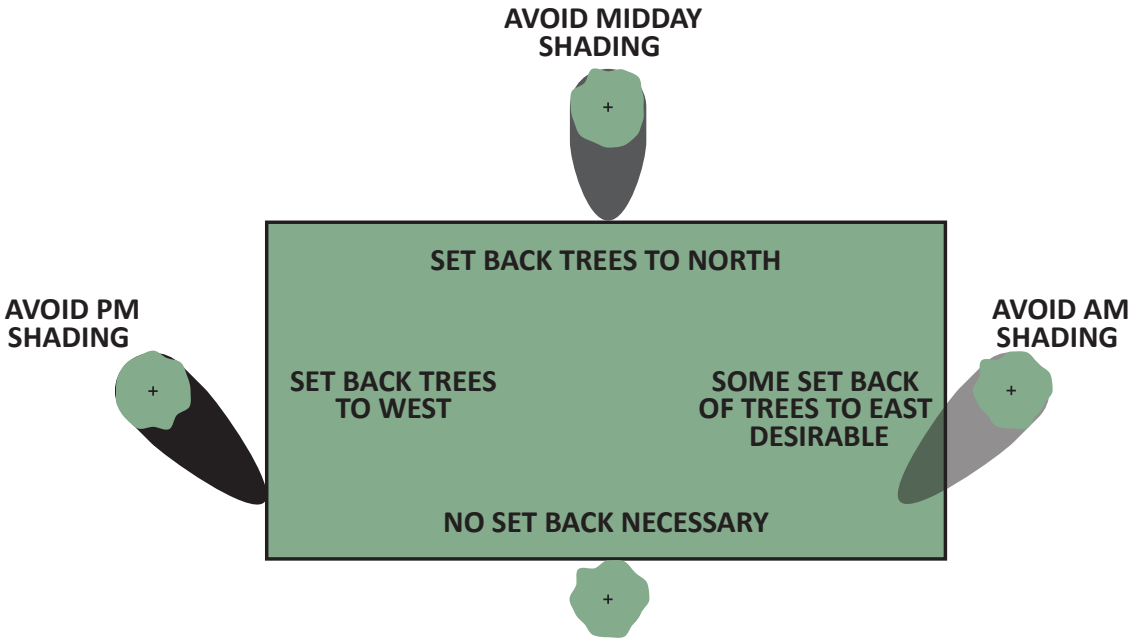
These provide a high level of competition to weeds and require low maintenance. One constraint is that shrubs can shade and compete with adjacent grassland. In addition they may 'hide' grasslands and so may cause unacceptable impact on small grasslands. For larger grasslands experienced mainly from within the reserve, such a planting can reduce the visual impact of surrounding factories and fences. They might be designed to emulate shrubland areas that naturally occur adjacent to grassland, such as Stony Knolls and Escarpment Shrublands.

Mown 'native lawn'

This can be developed in passive open space abutting grassland reserves. Remnant grasses often persist in lawn areas beyond grassland boundaries and may be enhanced with a native grass mix. Enhanced or new lawns might be seeded with winter-growing C_3 (e.g. *Rytidosperma* and *Austrostipa* species) and summer-active C_4 grasses (e.g. *Bothriochloa* and *Chloris*), which thrive with a low-frequency mowing regime. Care needs to be taken to make sure that a mix of C_3 and C_4 grasses is used to ensure effective year-long competition to weeds.

Guidelines

- Set back taller plantings to avoid harm to grasslands.
- Buffer taller plantings to create sense of space.
- Ensure plantings are well-maintained.
- Avoid creating hidden areas that promote dumping.
- Avoid using plants that may then spread into grasslands.
- Select plants that suppress weed growth and plant densely.
- Use indigenous plants.
- Choose plants to control movement.



To avoid shading out grasslands, setback of adjacent trees will depend on solar orientation.

Tree plantings

Trees adjacent to grasslands can degrade adjacent grassland vegetation through 'halo' effect of shade, leaf litter and root competition, and promote weed invasion. Topography and compass location will influence the required degree of setback from grasslands.

Tree plantings can also complicate ecological burning, generating different fuel types.

Guidelines

- Ensure trees are set back sufficiently to avoid impact on grasslands.
- Choose street trees to integrate grasslands into adjacent development.

Shading

Trees and shrubs, whether native or exotic, will increase shade and can therefore change grassland composition over time, reducing the vigour and reproduction of sun-loving Kangaroo Grass and wildflowers. Conversely, competition by trees may be used to positive effect by reducing bulk and reproductive potential of weeds in landscapes surrounding (but not impinging on) grasslands.

Incompatible plantings

Plantings close to grasslands have the potential to impact on grassland values and maintenance. Plantings near reserves should be developed in conjunction with council environmental staff to exclude problem species and layouts. Specifically avoid exotic and non-indigenous native plants that have high proven potential to spread by seed or by vegetative spread into grassland habitats.

Choices of tree and shrub species should also be informed by discussion with the proposed land manager and/or council environmental staff. The following potential effects should be considered;

Rhagodia parabolica **is a native plant, rare near Melbourne, which has recently become popular for freeway plantings. From there, birds have spread its seed, so it now grows below Redgums in grassland hundreds of metres away. The large, dense shrubs are changing the distinct plant communities of the Redgum 'haloes' with unknown consequences for existing flora and fauna. Photo: MCMC**

Stone mulch used to good effect at Cooper Street Grasslands, Campbellfield.

Debris

Debris from trees and shrubs can smother plants or cover bare ground where seedlings would have germinated. The large leaves of deciduous trees can drift and gather a considerable distance from their source.

Change in fire management needs

Trees planted next to grasslands may add more leaf litter to grasslands, which may need removal as part of fuel reduction before controlled burns. Avoid planting trees with canopies that impinge on grasslands as they are likely to necessitate changes to fuel and fire management to avoid scorching or even combustion. Be particularly careful with species with highly flammable canopies (such as conifers and eucalypts).

Mulches

Mulches are important for suppressing weed growth. It is important to consider the type of mulch used. In general, inorganic mulches such as rock and gravel are preferred adjacent to grasslands.

Inappropriate choice of mulch can create problems. For instance, some high-clay-content mulches, such as granitic gravel, may actually provide a good medium for weed growth. Overland runoff and wind may dislodge light organic mulches, causing them to settle on adjacent grassland where they may smother delicate plants. Movement of mulch into grasslands can introduce unwanted nutrients into them

Mulches such as pine bark can also smoulder after ecological burns, greatly increasing the need for protection measures before the burn and the need for watering and inspection if they do, in fact, become alight.

The effects of mulch used on land adjacent to grasslands may be minimised through grading mulched areas away from grasslands.

Guidelines

- Use low-nutrient mulch, such as gravels, adjacent to grasslands.
- Avoid gravels that have significant clay content, such as granitic gravel.
- Avoid mulches such as pine bark that may smoulder following ecological burns.
- Grade mulched areas away from grasslands.

New plantings in gravel mulch at Evans Street Grassland, Sunbury.

The Highlands estate in Melbourne's north has a significant Golden Sun Moth conservation site. Shown here, a well-designed post and rail style fence with recycled plastic bollard and decorative acrylic plate depicting the moth. Photo: © Integrated Recycling.

Fencing

Appropriate fencing of remnant grasslands is essential. Fencing must provide appropriate cues to care, prevent unauthorised vehicle entry, discourage dumping, encourage grassland-positive engagement with the community, as well as, in some cases, be predator-proof.

Fencing has its drawbacks. For instance, fencing will provide more hunting habitat for 'perch and pounce' species such as the Common Myna. Poor fencing design can promote a sense of grasslands being uncared for, discourage engagement with grasslands, and promote dumping.

The best style of fencing is highly context-dependent. Fencing styles send strong psychological signals as to appropriate behaviours.

Fencing should appear to be inclusive rather than exclusive. Generally, it should be kept low and be of good-quality materials.

Fencing should be fire-resistant, unless protected by a firebreak.

Fencing should, in general, allow some entry, but at the same time signify that such entry is limited, and prompt questions as to what are appropriate activities to be undertaken within its bounds.

Fencing should suit the context. In highly visible areas, fencing should be of a better quality. In areas of largely rural or bush parkland context, fencing should present as suitably rural, for instance, star pickets and wire. In industrial contexts, fencing will tend to be more defensive in nature, designed to protect adjacent buildings and property.

Fences should be designed to minimise fenceposts and bollard bases acting as sources of unmown weeds, which generate fire hazard and act as weed seed sources.

Fencing can be 'wildlife-friendly'. When protecting property, avoid barbed wire, replacing it with a wildlife-friendly alternative. Electric fences provide a better alternative. Visibility is often an issue for wildlife, and the use of white nylon sighter wires or white electric fence tapes that flicker in the breeze can minimise this problem.

Pre-construction fencing needs to discourage any access to grasslands before construction. This type of fencing can be temporary, to be replaced by more visually and functionally appropriate fencing as development proceeds.

Predator-fencing – tall, exclusionary fencing that may become necessary when grasslands support critically endangered species, such as the Grassland Earless Dragon (*Tympanocryptis pinguicolla*) – is rarely used in urban situations. If it is necessary to predator-fence an area and early intervention in the zoning process is possible, then good urban design should ensure no residential areas are located adjacent to predator-fencing. If that is not possible, then it is essential to minimise the unsightliness and exclusionary nature of the predator-fencing.

Good, high-quality fencing at Evans Street Grassland, Sunbury. This fenceline is only 350 m long.

Guidelines

- Ensure boundary fences occur beyond reserved extent of grasslands, and in general include mown edge within their boundaries and buffer zone to grasslands.
- Provide appropriate cues to care by ensuring fences are good quality and well maintained.
- Make quality and design of fencing appropriate to its context.
- Grassland fencing should appear to be inclusive rather than exclusive. Generally, it should be kept low, and be of good-quality materials.
- Make fencing fire-resistant, unless protected by firebreak.
- In general, allow some entry to grasslands.
- Minimise fenceposts and bollard bases when they will be difficult to maintain and so act as sources of unmown weeds.
- Keep fencing wildlife-friendly.
- Consult with authorities such as Parks Victoria or Department of Environment and Primary Industries at earliest opportunity to determine appropriate options for predator-fencing.
- Consider additional education programs to counter any negative perceptions that predator-fencing might create.

Fencing between industrial properties and grasslands will almost invariably need to provide an effective barrier to human movement. Note that barbed wire is not a wildlife-friendly fencing alternative.

Steel cable fencing is visually unobstrusive, not uninviting, and is effective at preventing vehicle entry. Shown here, Isabella Williams Memorial Reserve, Albanvale.

In the 'bushland' setting of the Merri Creek corridor, this tidy, simple fence at Bababi Djinanang (Jukes Road Grassland), Fawkner, does not seem out of place.

Unobtrusive picket and wire fencing at Rokewood Common, Rokewood, with well-considered signage.

Chicken wire mesh addition to this fencing at Featherheads Grassland, Cairnlea, makes an unobtrusive barrier to rabbits and domestic animal entry.

Ugly, exclusionary fencing such as this should be avoided whenever possible. When such fencing is necessary, it requires extra care to reduce its impact on aesthetics and public perception, for instance, through screening plantings and interpretative signage.

Poor fencing. The cheap materials and low maintenance of this edge do little to encourage engagement with the grassland.

The view out from Mathews Hill Grassland, Sunshine. The stile is a striking way of keeping bikes out without a gate.

Weathering steel blades make a stylish – and fireproof – addition to a simple fence at Amberfield Grassland, Craigieburn.

Blunt signage and temporary exclusionary mesh fencing were added to the original elegant cable fence of Ngarri-djarrang (Central Creek Grassland), Reservoir. The additions were considered necessary to prevent building contractors on surrounding development dumping rubbish on site. The mesh fence served an unexpected purpose by discouraging dogs from chasing the kangaroos that do so much as 'ambassadors' for the grassland. As adjacent development will soon be complete, and noting the role of the exclusionary fence as perhaps instrumental to the continued presence of kangaroos at the grassland, perhaps it is time to revisit the permanent fencing options.

Alternatives to fencing

Fencing alternatives can perform the same function as fences. Walls, ditches, ha-has and hedges may all be appropriate barriers to movement. Hedges, ditches and stone walls will provide habitat. Each will have its own maintenance requirements.

Guidelines

- Consider using hedges, stone walls, ditches and ha-has.
- Consider use of drainage lines and swales as barriers.

Walking trails through grasslands

Even though access to grasslands is to be encouraged, it is important to note that humans walking through grasslands can introduce weeds and pathogens, though this is far from being the greatest of the threats to grassland. The cryptogamic crust of grassland soil is easily disturbed. Constant use can severely compact and damage soils, opening the way for weed invasion and erosion, cause silting and muddying of water courses, and damage habitat such as bird nesting areas.

A firebreak at Evans Street Grassland, Sunbury, presenting as an obvious movement line through the grassland.

A path worn by frequent use through grassland at Malcolm Creek, Craigieburn, suggests this trail may have to become more formalised to prevent further damage.

This granitic trail through grassland being rehabilitated at Malcolm Creek, Craigieburn, uses public art, seating and signage to make an excellent rest place. Stone walls reference the stone walls common to the northern and western outskirts of Melbourne, and signage provides an explicitly interpretive element to the grassland.

The best form of a trail through grasslands is the ephemeral mown trail.

A mown trail will be less damaging than a constructed trail. However, mowing alters the grassland ecology by promoting mowing-resistant species, such as *Austrodanthonia* species. Any mown trail through grasslands, therefore, needs to be moved on a yearly basis to avoid significant impacts on grasslands. It is also important to note that mowers can often spread noxious weed seeds if strict machine hygiene procedures are not observed. Much damage to grassland has been caused by poor machine hygiene. It is vital that contractors are made aware of this issue.

Trails should be kept away from wet areas and sensitive areas.

Mower hygiene is essential to prevent acting as vectors for weed seed into grasslands and from weedy to 'clean' areas.

Any trail that experiences heavy use should be moved or blocked, if practicable. Fencing options may need to be reviewed. If not practicable, then the trail should be remade in more permanent materials, for instance, as a boardwalk or gravel or even concrete.

Firebreaks have the potential to make excellent temporary trails through grasslands. Where practicable and appropriate, firebreaks should be located to encourage such a function, by terminating at entrances to grasslands and by taking the walker through areas of particular interest – for instance, view points – and through varying ecologies. It is important to remember that firebreaks must fulfill ecological and logistical needs above any role as a temporary trail, with the safety of those conducting the burn paramount.

Ephemeral trails should be supported by appropriate temporary signage.

Guidelines

- Use ephemeral mown trails when making trails through grasslands.
- Move ephemeral mown trails on yearly basis, if practicable.
- Keep trails away from wet areas and sensitive areas.
- Block or move trails that experience heavy use and consider if new fencing is required. If not practicable, then remake trail in more permanent materials.
- Where practicable and appropriate, locate firebreaks to encourage their potential as trail.
- Support ephemeral trails with temporary signage.

Signage

Signage should ideally occur at all entry points, reinforcing the entry experience in a non-repetitive way. It should emphasise the sense of place, and the differentiation of the grassland, its history, importance and the means by which to ensure its survival. Signage should present as inclusive, not exclusive, and can offer clues to further exploration.

Many grasslands are or will be in areas of linguistically diverse communities and the use of translations, icons and illustrations may make messages more accessible.

Signage should be well constructed, graffiti-resistant and, where necessary, fire-resistant.

Temporary signage should be considered for use along ephemeral trails such a firebreaks, and for deployment at seasonally appropriate times elsewhere – for instance, after a burn off. Temporary signage along firebreaks may need to include directional markers if the grassland is large and firebreaks intersect. Temporary signage may be used to reinforce the perception of grasslands as being dynamic ecosystems. Temporary signage should be consistent with the general visual and text style of other signage, but does not require the same standards of construction, graffiti-resistance or fire-resistance.

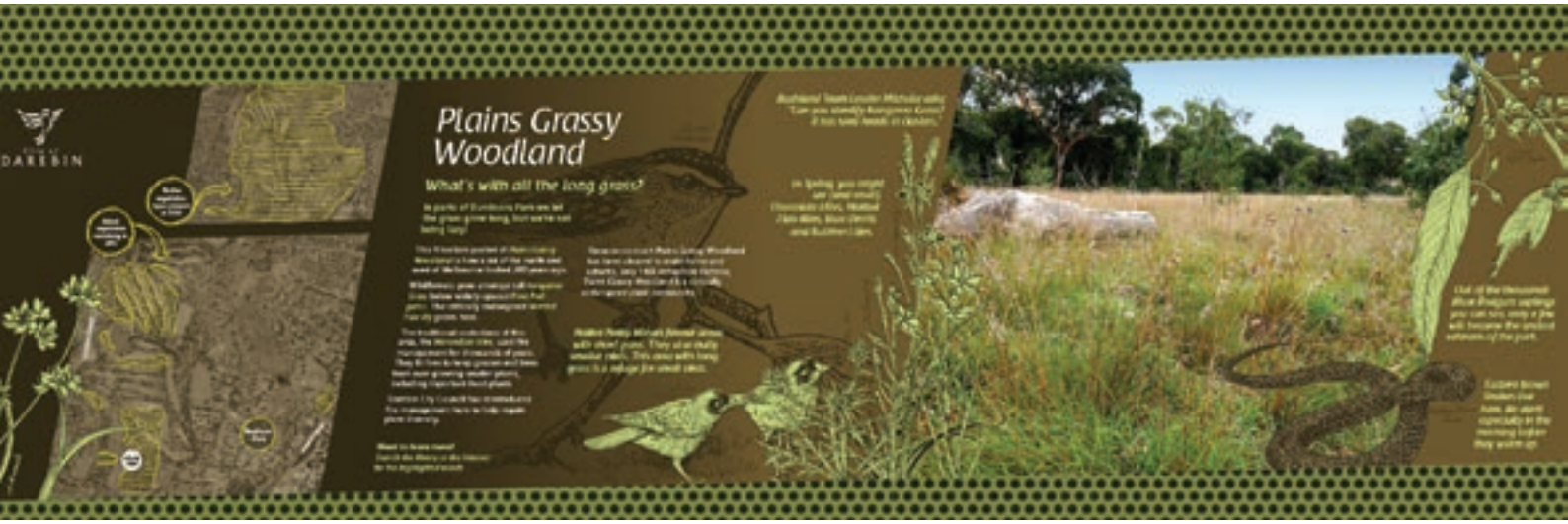
In industrial areas, signage should be frequent, provide appropriate warnings, state significance of site, and advise appropriate contacts in case adjacent stakeholders require access, for example, for emergency repairs to overhead powerlines.

Signage must be maintained to avoid perceptions of neglect.

Guidelines

- Consider development of integrated signage strategy and style guides for whole development site for consistent branding and way-finding.
- Make signage well constructed, graffiti-resistant and where necessary fire-resistant.
- Place signage at all entry points and use content that reinforces entry experience in a non- repetitive way.
- Emphasise sense of place, differentiation of grassland, its history, importance and means by which to ensure its survival.
- Present grasslands as inclusive, not exclusive.
- Utilise best-practice in signage design, e.g. content organisation, correct colour contrasts, font style and size, and legible graphics. Use translations, icons and illustrations to emphasise messages.
- Use theme for each sign and keep content legible and simple. Most viewers spend less than 60 seconds reading content; therefore limit text to approximately 225–300 words.
- Provide information on signage to where viewer can find further information such as website link, QR code or phone number.
- Choose sign type appropriate to location and purpose, such as interpretive, marker, way-finding, regulatory, temporary, etc.
- Consider using temporary signage along ephemeral trails such a firebreaks, and for deployment at seasonally appropriate times elsewhere. Make temporary signage consistent with general visual and text style of permanent signage.
- Ensure that, in industrial areas, regulatory signage is frequent and provides appropriate warnings, states significance of site, and advises appropriate contacts in case adjacent stakeholders require access.
- Locate signage within mown edge.
- Maintain signage to avoid perceptions of neglect.

Tired signage such as this, which promotes the perception that the grassland is not cared for, should be updated.



This sign (and the sign on page 19) is part of a city-wide suite, provide information on history, location, EVCs, and facts of interest to the curious public. Image courtesy Aspect Studios.

A well-considered suite of signs at Evan Street Grassland, Sunbury: vitreous enamel construction for durability and vandal-proofing, clear branding, good visual design, illustration and consistency, combined with informative text. Each sign is located at an entrance to the grassland.

Lighting

Lighting can be a source of light pollution, which can impact on insects as well as birds and other fauna, altering their behavior. It is possible to minimise these impacts by using appropriate lighting.

Street lighting is best located on the side of the road opposite grasslands.

Guidelines

- Use on-pole screening to keep light away from grasslands and to keep light from shining upwards.
- Use lighting that does not attract insects, being lighting that emits little light in the 350-nm (ultraviolet) waveband.

Grading

The way land adjacent to grasslands is graded can have a large impact on the ecology of grasslands. It is important to keep water away from grasslands except along natural drainage lines. Water from adjacent land can carry nutrients, pesticides and other contaminants, such as weeds and pollutants, which alter the ecology of grasslands. Changing the amount of water that a grassland receives will change the ecology.

Unnecessary disturbance should be avoided and measures taken to minimise essential disturbance. Contractors must be provided with information on relevant grassland features, designated spoil pile locations, designated movement corridors, barricade tape, washdown areas. Regular site visits and supervision should be used to avoid costly ongoing restoration resulting from unnecessary soil disturbance.

Guidelines

- Grade adjacent landscape to move water away from grasslands.
- Provide contractors with information on relevant grassland features, designated spoil pile locations, designated movement corridors, barricade tape, washdown areas.
- Regularly conduct site visits.

Road construction

Road construction has the potential to severely impact existing hydrology, in addition to disturbing and compacting adjacent areas during construction.

Ecological communities of considerable importance are often located on roadsides and it is vital that construction authorities and crews are aware of any sites of significance.

Roadside plantings can be important in terms of presenting cues to care to adjacent grasslands and should be treated with the same attention to detail given to other grassland edge plantings.

Guidelines

- Maintain existing hydrology.
- Ensure impacts of construction are minimised.
- Ensure plantings are appropriate to grassland context

Services

Maintenance of services, such as electricity and sewerage, can cause considerable disturbance to grasslands and buffer zones if the location of such services is poorly planned.

Guidelines

- Ensure services are kept away from grasslands and buffer areas where maintenance of such services will disturb those areas.

Retrofitting grasslands

In many developed areas, fragments of remnant vegetation persist, either managed as grasslands or as undeveloped open space. As focus shifts to urban in-fill, and to open space development within urban areas, it is important to consider the presence of grasslands and grassy ecosystems in these plans. Grasslands that occur within so called 'underdeveloped' passive open space face pressures from a variety of areas, for example, from shared trails, signage infrastructure, plantings, playground infrastructure, and informal sporting areas/facilities, all of which can threaten the quality and extent of remnant grasslands or restrict the ability of grassland managers to expand or connect grassland patches.

Grassy ecosystems offer variety in open space, and should be viewed as an opportunity to move beyond the standard mown grass in passive open space. The master planning of the development of passive open space needs to take into consideration the following:

- Is there grassland present, or the opportunity to reintroduce grassy ecosystems.
- Does the grassland have a champion (either a community, organisation, environmental staff, or an active individual)? What management or rehabilitation plans does the champion have?
- There are numerous benefits to the revegetation or restoration of areas adjacent to grassland patches. There may be the possibility of including areas for user interaction with nature without impacting the core areas of grassland that may need the most protection.
- Connectivity for flora and fauna: does the area currently link with other vegetation or could it do so with management and planning?
- Creating novel landscapes: beyond the identified core grassland, it is possible to use other grassy ecosystems to help the transition to more formal open space. People tend to respond well to trees in a landscape, and introducing the trees sourced from appropriate local EVCs, such as the Grassy Woodland and Escarpment Shrubland ecological communities, can help introduce grassy ecosystems to people. It is important to ensure that trees do not shade out grassland, or adversely affect grassland by root competition.
- The future management needs of the grassland and any edge treatments.

Generally, a typical grassland in an established urban setting has a mown strip delineating a core area, or a simple fenceline delineating its boundary. Often there will be little or no access for the community, possibly poor planting, and, in many cases, insufficient visible care of edge plantings. Signage will often be of low quality or completely absent.

Often buffers cannot be established unless there is a reconfiguration of the areas beyond the grassland, for instance, loss of a mown grass area, a playground, or more drastically the narrowing of roads or changes to residential/industrial boundaries. In many instances, street and park trees will have been planted too close to the grassland. Removal of the trees should be considered if they are shading out the grassland. The width of the mown strip should be minimised, if possible, provided it is able to meet maintenance needs.

Providing cues to care is essential. Resources should be put into creating entry experiences at key locations, with overall attention being paid to upgrading fencing quality, providing well-considered signage and improving the quality of edge plantings. Seating should be considered within the fenceline.

Guidelines

- Involve grassland champions in the review process.
- Consider extending grassland with novel landscapes or Grassy Woodland or Grassy Shrubland plantings.
- Minimise width of mown strip, if present.
- Remove trees that are shading-out grasslands.
- Prioritise fencing, signage, edge plantings, seating and direct engagement.

Case Study: Isabella Williams Grassland and developing open space

11 ha
3 ha of heavier soils plains grassland
Just over 1 ha of escarpment shrubland
Adjacent to Kororoit Creek

Isabella Williams Reserve was identified by Brimbank Council in its 'Creating Better Parks – Brimbank Open Space and Playground Policy and Plan' in 2008 as being the site of a District Park with associated infrastructure. A master plan was finalised in 2011.

Prior to masterplanning, the reserve was undeveloped, never subject to high usage and was used primarily by trail bike riders. In 1998, fencing was installed to remove mowing and reduce trail bike and other vehicle damage to a 1.5 ha area of the reserve.

Prior to the site being masterplanned, the site was chosen as the recipient of proceeds from an illegal clearance fine. The fine stipulated a 10-year management plan be put in place and provided funding for the site. The catch was the offset area required was 3 ha, greater than the 1.5 ha originally fenced, impacting on what was available to be developed.

Design took advantage of a pre-existing mound of fill on-site to provide shelter from the wind for the barbecues, playground, toilets, and grassed area and the opportunity to create a volcanic lava flow theme for the formal playground. The design for the wider reserve went through a number of ideas, including a path through the grassland, with the addition of totem poles and surrounding indigenous garden beds throughout the grassland. Whilst showing a desire to engage with the grasslands, such designs had the potential to harm what they wanted to engage with.

When retrofitting grasslands, it is important to understand your position: are you allowing the vegetation to recover or are you are creating novel ecosystems?

When there is space, the creation of novel landscape elements beyond the core grassland offers great opportunities for alternatives to constructed play zones, and space to get away and interact with nature. The surrounds of the 3 ha grassland at Isabella Williams offer land managers and urban designers the opportunity to play with different ecosystems to create a natural space, with grassland elements as well as elements from other ecosystems, without impacting detrimentally on the core grassland. For example, the planting of a sparse line of River Red Gums linking the grassland to the nearby Kororoit Creek will enhance the grassland by reducing the weed spread, providing a visual companion to the grassland vista, creating shade, allowing other grassland species to be planted and reducing mowing regimes. The addition of logs and rocks offer climbing or seating opportunities.

The rear of the mound also offers opportunities for urban designers and land managers to work together and engage with the community to create an escarpment shrubland and natural play space to complement the formal playground.

This site is a work in progress, but gives a good example of how having space to 'blend' a grassland into other elements can create opportunities to broaden the experience offered while maintaining a precious grassland.

Escarpment Shrubland at Isabella Williams. Photo: © City of Brimbank

Expanding the grassland: the fenced area on the left has been recently added to the original extent of the grassland (on right).

The playground at Isabella Williams Memorial Reserve is designed using volcanic flows as a theme.

Checklist: design guidelines

Planting styles

- ☐ Species chosen to act as barriers to weeds.
- ☐ Species chosen to provide barrier to human movement.
- ☐ Species chosen to provide habitat.
- ☐ Plantings able to be maintained well, within available budget and skill levels.
- ☐ Species likely to invade grasslands avoided.
- ☐ Species requiring additional nutrients avoided.

Buffer plantings

- ☐ Buffer plantings visually blended with grasslands.
- ☐ Dominant grassland tussock species used.
- ☐ High-density plantings used to suppress weed growth.
- ☐ Extent of buffer plantings takes into account both degree grasslands need protecting and potential impacts of adjacent activity.
- ☐ Buffer plantings located beyond reserved extent of grasslands.
- ☐ Buffer plantings minimum 1 m wide.

Mown edge

- ☐ Mown edge located beyond reserved extent of grasslands.
- ☐ Mown edge located within grassland fenceline except where access strictly discouraged.
- ☐ Mown edge closely mown to reduce weed seed influx.
- ☐ Mown edge allows for maintenance vehicles, where required.
- ☐ Mown edge sufficient to be effective firebreak.
- ☐ Seating and signage located within mown edge.
- ☐ Pre-existing grassland species, or otherwise non-invasive species, used.

Edge plantings

- ☐ Taller plantings set back to avoid shading grassland.
- ☐ Taller plantings buffered to create sense of space.
- ☐ Plantings well-maintained.
- ☐ Hidden areas promoting dumping avoided.
- ☐ Invasive plants avoided.
- ☐ Weed-suppressing plants selected and planted densely.
- ☐ Indigenous plants used.
- ☐ Plants chosen to control movement.

Tree plantings

- ☐ Trees set back sufficiently to avoid shading grassland.
- ☐ Street trees integrate grasslands into development.

Incompatible plantings

- ☐ Plantings developed in conjunction with council environmental staff.
- ☐ Invasive exotic and non-indigenous native plants avoided.
- ☐ Shading of grasslands avoided.
- ☐ Trees used to reduce bulk and reproductive potential of weeds in landscapes surrounding grasslands.
- ☐ Debris from trees and shrubs removed when they may smother plants or cover bare ground where seedlings may germinate.
- ☐ Plantings of trees that necessitate changes to fuel and fire management avoided.

Mulches

- ☐ Low-nutrient mulch, such as gravels, used.
- ☐ Gravels with significant clay content, such as granitic gravel, avoided.
- ☐ Mulches such as pine bark that may smoulder following ecological burns avoided.
- ☐ Mulched areas graded away from grasslands.

Fencing

- ☐ Boundary fences beyond reserved extent of grasslands.
- ☐ Mown edge and buffer zone to grasslands within boundary fence except where access strictly discouraged.
- ☐ Cues to care shown with good-quality and well-maintained fencing.
- ☐ Fencing of quality and design appropriate to context.
- ☐ Fencing appears inclusive rather than exclusive, generally low.
- ☐ Fencing fire-resistant, unless protected by firebreak.
- ☐ Some entry allowed.
- ☐ Fenceposts and bollards minimised where difficult to maintain or may act as sources of unmown weeds.
- ☐ Fencing wildlife-friendly.
- ☐ If predator-fencing required, authorities such as Parks Victoria consulted to determine options.
- ☐ If predator-fencing required, additional education programs considered to counter negative perceptions predator-fencing may create.

Alternatives to fencing

- ☐ Hedges, stone walls, ditches and ha-has considered.
- ☐ Drainage lines and swales as barriers considered.

Walking trails through grasslands

- ☐ Ephemeral mown trails chosen when making trails through grasslands.
- ☐ Ephemeral mown trails moved on yearly basis.
- ☐ Trails kept away from wet and sensitive areas.
- ☐ Trails used heavily blocked or moved and new fencing considered. If not practicable, trail remade in more permanent materials.
- ☐ Firebreaks located to encourage potential as trail.
- ☐ Ephemeral trails supported through temporary signage.

Signage

- ☐ Integrated signage strategy and style guides for whole development established.
- ☐ Signage well-constructed, graffiti-resistant and, where necessary, fire-resistant.
- ☐ Signage at all entry points reinforcing entry experience in a non-repetitive manner.
- ☐ Sense of place, differentiation of grassland, history, importance and means by which to ensure grassland survival all emphasised.
- ☐ Grasslands presented as inclusive, not exclusive.
- ☐ Bestpractice signage design used: e.g. content organisation, colour contrasts, font style and size, legible graphics, translations, icons and illustrations to emphasise messages.
- ☐ Each sign themed with legible and simple content.
- ☐ Signage directs user to further information.
- ☐ Sign type appropriate to location and purpose.
- ☐ Temporary signage used on ephemeral trails and at seasonally appropriate times elsewhere.
- ☐ In industrial areas, regulatory signage frequent and providing appropriate warnings, advising contacts in case access required.
- ☐ Signage located within mown edge.
- ☐ Signage maintained to avoid perceptions of neglect.

Lighting

- ☐ On-pole screening used to keep light away from grasslands and from shining upwards.
- ☐ Non-insect-attracting lighting used.

Grading

- ☐ Adjacent landscape graded away from grasslands.
- ☐ Contractors provided with information on relevant grassland features, designated spoil-pile locations, designated movement corridors, barricade tape, washdown areas.
- ☐ Site visits regularly conducted.

Road construction

- ☐ Existing hydrology maintained.
- ☐ Impacts of construction minimised.
- ☐ Plantings appropriate to grassland context

Services

- ☐ Services kept away from grasslands and buffer areas.

Retrofitting grasslands

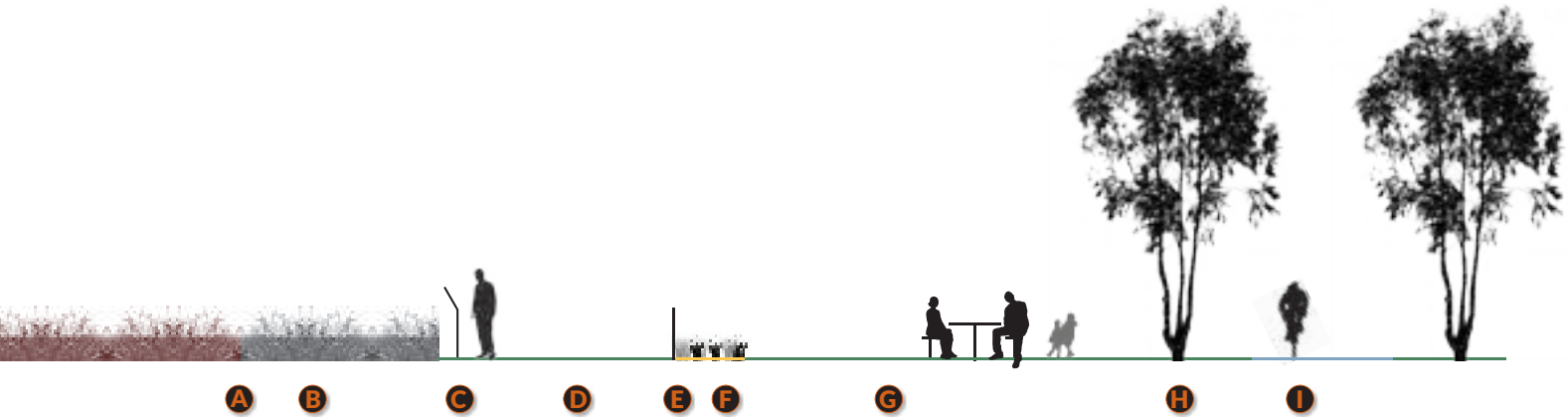
- ☐ Grassland champions involved in review process.
- ☐ Grassland extended with novel landscapes or Grassy Woodland or Grassy Shrubland plantings.
- ☐ Width of mown strip minimised.
- ☐ Trees shading-out grasslands removed.
- ☐ Fencing, signage, edge plantings, seating and direct engagement emphasised.

Typical cross-section

Craspedia variabilis.
Photo: Russel Best, CC BY 2.5

An ideal grassland edge

The section below illustrates an ideal grassland edge, here shown with adjacent public open space. Unfortunately, the ideal grassland edge is often unachievable, a consequence of poor decisions being made early in the planning process, or because a site is constrained for historical reasons.



A The reserved extent of the grassland. All buffers, signage, firebreaks, fences, decorative plantings, paths and related elements occur beyond the grassland. It is vital that space be allocated these elements in the planning process.

B Buffer planting. A dense planting of the grassland's dominant tussock serves to prevent weed invasion.

C Signage. High-quality, fireproof, informative, and part of a suite of educational signs located at all principle entry points.

D Firebreak: Mineral earth firebreaks should be avoided. If the grassland is adjacent to a road, then a firebreak is generally unnecessary.

E Fencing: Welcoming, low, fireproof, of good-quality materials, well-detailed, allowing easy entry.

F Decorative plantings: Indigenous species chosen for visual appeal, ease of maintenance, and be dense enough to suppress weeds. Mulch should be low-nutrient material, such as gravel, to avoid adding nutrients to the grassland.

G Public open space: Generous provision of public open space reduces pressure on adjacent grassland. Grading should serve to maintain pre-existing hydrology of the grassland. Turf should be native if possible, and secondary grassland (i.e. grassland not officially 'conserved' in the grassland itself) should be set aside and used as a basis for the public open space adjacent. Turf should be maintained with only minimal herbicide use.

H Trees: All trees to be well set back to avoid shading grassland.

I Shared trail: Connectivity, and encouraging engagement, are important. Shared trails can be designed to accomodate maintenance vehicles.

Guidelines for transition to construction

Thysanotus tuberosus.
Photo: David Francis, CC BY 2.5

Protect grasslands pre-construction and during construction

In many cases, construction workers will not be aware of the significance of grasslands and can unwittingly cause significant damage through the dumping of building materials and the movement of construction equipment.

Controls should also be in place to stop runoff and wind-borne materials, and vehicles, from entering grasslands.

The nature of maintenance activities needs to be clearly communicated throughout this transition period, for instance, to avoid contractors accidentally damaging grasslands through inappropriate slashing techniques.

All works in close proximity to grassland should require a construction environmental management plan (or similar) to be prepared to the satisfaction of the appropriate authorities.

Guidelines

- Conduct induction programs that educate construction workers on value of grasslands.
- Protect grasslands with fencing before any construction commences.
- Emphasise through signage that grasslands are protected and that no access is allowed.
- Discourage any access to grasslands before any construction commences. Fencing can be temporary, to be replaced by more visually and functionally appropriate fencing as development proceeds.
- Ensure details of appropriate maintenance regimes are understood by all stakeholders to avoid inappropriate maintenance activities.
- Ensure adequate controls are in place to prevent runoff and wind-borne materials from entering grasslands.
- Ensure all works in close proximity to grassland have a construction environmental management plan (or similar) prepared.

Control weeds

Weeds outside grassland areas are a major source of weed invasion into grasslands. This can be particularly true in industrial areas where wind-borne seed from vacant lots and unmanaged or poorly managed weedy areas adjacent to grasslands is a significant problem, especially in promoting the growth of the most persistent threats such as *Nassella* species.

A silt fence at Craigieburn Grasslands, Campbellfield, protects grasslands during construction.

A new fence built with only the most minimal disturbance thanks to careful supervision by an engaged local council. Photo: MCMC CC-BY-NC-ND

Guidelines

- Whenever possible, continue pre-existing management practices, such as grazing or slashing, of adjacent land prior to construction.
- Maintain land within construction areas free of weeds capable of seed dispersal, through appropriate means, such as slashing prior to seed setting or through application of herbicide.

A display garden constructed at the edge of Denton Avenue Grasslands, Sunshine, and adjacent to a major bike path, showcases a broad range of grassland species in an an attractive and accessible manner.

Cues to care

The process of showing care to grasslands and the land adjacent should begin before construction and include providing tidy protective fencing and clear signage and establishing a clear zone around grasslands for maintenance and access. Dumping of rubbish adjacent to grasslands should be discouraged.

Guidelines

- Keep grassland edges well-maintained, with a clear edge for access and maintenance.

Display grasslands

Presentation of grasslands as a valuable asset and important part of the community and development should begin from early in the development process when display homes are being presented to the buying public. These should be accompanied by grassland-friendly gardens that emphasise the beauty and complexity of these places. Information should be provided to educate the potential new community members of the value of these places in terms of biodiversity, health and well-being and ecosystem services.

At the same time, effort should be made to present not only display homes but also a part of the grasslands to the public, with appropriate fencing and educational signage.

Guidelines

- Display grassland plantings at point of sale.
- Create display grassland for potential community members to visit.
- Provide educational signage and brochures.

Checklist: guidelines for the transition to construction and during construction

Protect grasslands pre-construction and during construction

- ☐ Induction programs for education of construction workers conducted.
- ☐ Protective fencing in place before construction (can be temporary fencing).
- ☐ Signage in place before construction.
- ☐ Signage emphasing grasslands protected and no access allowed.
- ☐ Access to grasslands discouraged before and during construction.
- ☐ Details of maintenance regimes understood by all stakeholders.
- ☐ Adequate controls in place to prevent runoff and wind-borne materials entering grasslands.

Control weeds

- ☐ Pre-existing management of adjacent land, such as grazing or slashing, continued.
- ☐ Land within construction areas maintained free of weeds capable of seed dispersal.

Cues to care

- ☐ Grassland edges kept well-maintained, with clear edge for access and maintenance.

Display grasslands

- ☐ Grassland plantings displayed at point of sale.
- ☐ Display grasslands created for potential community members to visit.
- ☐ Educational signage and brochures provided.

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Xerochrysum palustre.
Photo: Russel Best, CC BY 2.5

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Appendix 1: Species selection

Einadia nutans
Photo: Richard Hartland CC BY 3.0

Preferred species for plantings

Use of indigenous plants should be prioritised in plantings around grassland reserves for enhancing habitat and landscape character.

Consider specifying the use of local provenance of indigenous plants and requesting, as part of landscape plans, that provenance of the sourced plants are recorded as part of final completion requirements. Be aware that issues of provenance are complex and contentious. For some species, provenance will be far more important than for other species. If local provenance stock cannot be reasonably sourced, then it may be advantageous to extend the distance within which the origins of stock may be considered. Large plantings of different provenance have the potential to cause undesirable genetic mixing with small local populations of plants. *Conversely, highly localised populations may be susceptible to inbreeding depression (loss of genetic viability) and some outbreeding will be necessary to invigorate the genetic pool.*

The table on the following page shows plant species indigenous to the eastern Victorian Volcanic Plains that have proven value in perimeter plantings for achieving amenity goals with a moderate level of maintenance by crews with competence in maintenance of indigenous plants.

Place of threatened species in landscaping of grassland surrounds

Threatened species should be included in a perimeter planting only as part of a well-considered design in which priorities and function of the planting have been identified. The maintenance and reproductive needs of the threatened species must be identified and genetic issues considered. Maintenance resources required for the plants and their consequent effect on general maintenance programs should be identified.

Benefits of including threatened species in plantings of grassland surrounds include:

- Some species are very attractive and can add to the aesthetic appeal and positive impression of grasslands – *Ptilotus macrocephalus*, *Podolepis* sp. 1, *Dianella amoena* are examples.
- Some threatened species are robust and capable of contributing to the competitive function of a perimeter planting, for example, the data-deficient *Poa labillardierei* var. (Volcanic Plains) is a robust tussock grass with superior drought-tolerance to the commonly planted forms of this species.
- If the planting has been designed well, including due consideration of the genetics of the species (where known),such a planting may fulfill a conservation purpose as a seed orchard or contribute pollen and seed to support a remnant or translocated population within the grassland.
- Inclusion of threatened species may have an educational or interpretive role by making plants accessible. It is often undesirable from a management point of view to promote general access to sites where the species occurs naturally.

Some problems that arise with inclusion of threatened species:

- For very rare plants, there may be an imperative to use propagules for plantings with specific conservation goals.
- Maintenance of rare species within a planting may drain maintenance resources, which might be better spent maximising the planting's overall function as a buffer to weeds .
- Threatened species are often rare because they rely on specific ecological processes that have been disrupted. Resources used to plant such species may be wasted if ecological processes have not been reinstated or a degrading process discontinued. Often the nature of these processes has not been fully identified.
- Planting with plants of inappropriate genetic makeup, for example, genetically identical clones or plants sourced from an inappropriate provenance, may reduce the genetic potential of a nearby remnant population.
- Some threatened species may even act as weeds. *Rhagodia parabolica* has a rare and restricted distribution near Melbourne. It became popular as a landscaping plant in the early 2000s and has since spread into nearby parklands, potentially displacing or altering existing plant communities.

Species indigenous to the eastern Victorian Volcanic Plains that have proven value in perimeter plantings for achieving amenity goals with a moderate level of maintenance.

Note: when considering plantings in areas other than the eastern Victorian Volcanic Plains, please refer to local resources to guide plant selection. Many species in the following list may not be appropriate species choices in other regions.

Note also, this is a very abbreviated list. Major benefits will flow from extending biodiversity significantly beyond this list. It is worth considering some more extensive species lists, such as those available from local indigenous suppliers and councils, as well as species from appropriate EVC descriptions (available from www.depi.vic.gov.au).

Trees (over 6 m)	
Acacia implexa	Lightwood (**dry sites**)
Acacia melanoxylon	Blackwood (**dry sites**)
Allocasuarina verticillata	Drooping Sheoak (**dry sites**)
Tall shrubs (2–6 m)	
Acacia paradoxa	Hedge Wattle (**dry sites**)
Acacia pycnantha	Golden Wattle (**dry sites**)
Bursaria spinosa	Sweet Bursaria
Dodonaea viscosa subsp. *cuneata*	Wedge-leaf Hop-bush
Smaller shrubs (under 2 m)	
Correa glabra	Rock Correa (**dry sites**)
Goodenia ovata	Hop Goodenia
Climbers	
Clematis microphylla	Small-leaved Clematis
Grasses and other tussock plants	
Bothriochloa macra	Red-leg Grass
Dianella admixta (was *D. revoluta)*	Black-anther Flax-lily
Lomandra longifolia	Spiny-headed Mat-rush **(wet sites)**
Microlaena stipoides	Weeping Grass
Poa labillardierei	Common Tussock-grass (**wet sites)**
Rytidosperma racemosum	Stiped Wallaby-grasses
Themeda triandra	Kangaroo Grass
Small wildflowers (higher maintenance)	
Calocephalus lacteus	Milky Beauty-heads **(wet sites)**
Calocephalus citreus	Lemon Beauty Heads **(dry sites)**
Chrysocephalum sp. 1	Plains Everlasting
Wahlenbergia communis	Tufted Bluebell
Groundcovers	
Atriplex semibaccata	Berry Saltbush
Dichondra repens	Kidney Weed
Einadia nutans	Nodding Saltbush (**dry sites**)
Enchylaena tomentosa	Ruby Saltbush **(dry sites)**
Reeds and rushes for wetlands and drainage lines	
Carex tereticaulis	Common Sedge
Ficinia nodosa	Knobby Club Rush
Juncus australis	Common Rush

Actinobole uliginosum.
Photo: Chris Lindorff, CC BY 2.5

Bababi Djinanang (Jukes Road) Grassland

Size: 4 ha

Location: West end of Jukes Road, Reservoir (Melways 18A1)

Management authority: Managed by Merri Creek Management Committee with funds from Moreland City Council

History

Stone tool artifacts have been found on this site, indicating the long history of custodianship of this land by the Wurundjeri tribe of the Kulin nation.

A drystone wall crosses the grassland, probably dating from between the 1850s and 1880s. The fence was constructed of loose surface boulders gathered from surrounding grassland and once supported wooden posts and wire. The site was used for cattle grazing from the time of early colonisation till the 1960s when urban development rapidly covered adjoining areas. A sports oval was extended over part of the grassland in the 1960s and was in use for several years before being abandoned. Open land to the west of the grassland was reserved for a freeway in the late 1960s which halted adjacent development. The freeway proposal was shelved in the late 1990s.

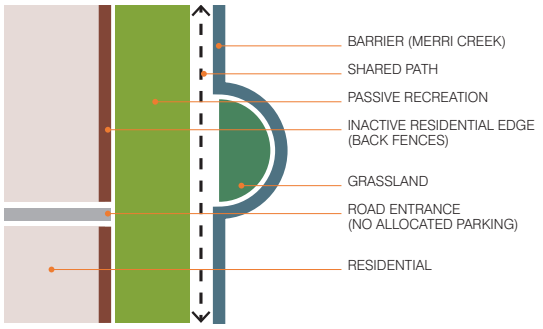
The conservation significance of the site was identified in the early 1990s and ecological management began in 1995. This included rabbit-proof fencing, burning designed to enhance ecological values, weed control, planting and direct seeding. The first management plan was written up in 1997. Extensions to the reserve took place in the late 2000s as formerly unmanaged land was enclosed within a re-built fenceline following wildfire (2007) and vandalism (2010).

Community involvement has been incorporated into management throughout this time and has involved members of the Wurundjeri Tribe Land Compensation and Cultural Heritage Council since 2011. A quarterly birdwatch coordinated by Friends of Merri Creek commenced in 2008. The site has usually been identified as 'Jukes Road Grassland' but was officially renamed in 2013 as 'Bababi Djinanang', meaning 'mother's foot' in Woiworrung, the language of the Wurundjeri.

Grassland values

The reserve is mainly remnant Heavier Soils – Plains Grassland but also includes small areas of Escarpment Shrubland and reconstructed Floodplains Grassy Woodland. The grassland's capacity to support wildlife in an urban context is aided by its situation within the Merri Creek habitat corridor, which links the Dividing Range to the lower reaches of the Yarra

Aerial of grassland context, and context diagram (below).



River corridor. Little Whip Snake, Brown Quail, Rufous Songlark, Flame Robin and Red-capped Robin, all rare near Melbourne, have been recorded on-site. The Merri Creek and distance from houses to the east seem to act as barriers that reduce the pressure of predation by domestic cats on reptiles, ground nesting and feeding birds.

The grassland has a large population of the endangered Matted Flax-lily (*Dianella amoena*). In addition there are more than 60 other indigenous plant species present.

Present context

Bababi Djinanang occupies a bend of the Merri Creek and is part of an extensive creek corridor of remnant and revegetated landscapes and open space managed for passive recreation. An unmade track runs along the creek on the west side of the grassland, and the main Merri shared trail along its east side. Immediately to its east is a large lawn area with residential properties backing onto it. Across the creek to the south are sports fields for active recreation. It has a simple star-picket and wire fence

Looking north.

Looking south.

The creek edge adjacent to the grassland.

and gates designed for rabbit exclusion. A narrow mown strip of lawn runs between the shared trail and the fence.

In 2012, Moreland City Council installed a 'resting area' with a seating platform and associated landscaping at the northern end of the grassland. In 2014, two interpretive signs are planned to replace an interpretative sign installed by Merri Creek Management Committee in 1998. This sign was installed facing the creek-side track while it was still the main recreational route, before being bypassed by the major shared trail in 2007.

Observations

For an observer visiting the area in the years between 2007 and 2012, a combination of location and presentation style made Bababi Djinanang go mostly unobserved. Its simple fence and lack of prominent signage did not advertise its presence. The shared trail does not need to bend to avoid it. The creek track is at a lower level to the grassland and has been allowed to diminish to a footpad to provide a more secluded, wilder experience for park users.

The grassland is not subject to invasive human pressure. Local residents are well supplied with active and passive recreational space, and areas for the experience of nature through the adjacent Merri Creek. No obvious destinations present themselves within the grassland. While gates are not locked, there is no incentive, or local need, to enter the grassland. The adjacent shared trail provides the only means for close experience of the grassland. Visitors and local residents often mention their association of long grass with snakes as being a disincentive for entering the grassland.

The fencing and edging are neat and well maintained and the fencing is an effective barrier to dogs. There is no sense of lack of care along the parkland edge of the grassland. The creek edge is more unkempt, and weedy, but is so within the context of the creek's bush setting.

Adjacent residential properties are oriented away from the parkland, with consequent reduction in engagement with, and surveillance of, the parkland area.

The resting place, seating and projected interpretive signage and pedestrian gates linked by mown trails are anticipated to alter impressions of this area in upcoming years.

Key points

- Fencing and location can combine to 'hide' a grassland in an urban setting.
- Sufficient parks and bushland nearby remove pressure on the grassland.
- Simple fencing can present well and appropriately.
- Location within the larger Merri Creek corridor provides this small grassland with additional resilience.
- The edge typology – grassland, fence, mown strip, shared trail – is an effective and easily maintained edge for a grassland for which access is strongly discouraged. The edge typology could be improved, at higher maintenance costs, by replacing the mown strip with a buffer of the dominant tussocks, *Themeda triandra* and Plains form of *Poa labillardierei*.

Ngarri-djarrang (Central Creek Grassland)

Size: 9 ha

Location: Davidson St, west of Dawson St, Reservoir (Melways 8B12)

Management authority: Merri Creek Management Committee (MCMC), funded by Darebin City Council. Additional grants from regional, state and federal sources have funded projects. Developer funding allowed substantial planning and fencing

History

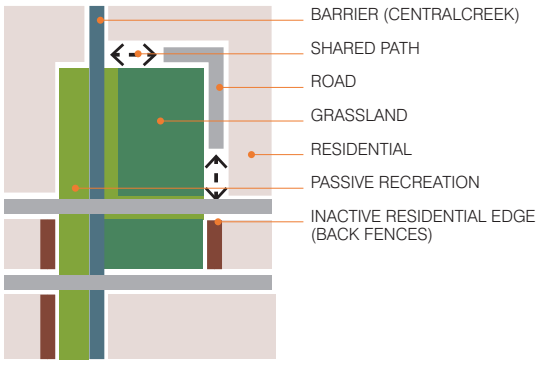
As with Bababi Djinanang (Jukes Road Grassland), stone tool artifacts have been found on this site, indicating the long history of custodianship of this land by the Wurundjeri tribe of the Kulin nation.

Ngarri-djarrang was subjected to intensive grazing from soon after colonisation of Victoria in the 1830s. Old plough lines that are evident on aerial photos also suggest an early attempt at cultivation. Development of surrounding land for housing began in the 1950s. The area now occupied by the grassland reserve was reserved for a freeway in the late 1960s, slowing development, although a local road bisected the site in the 1960s and a ditch was excavated across the northern part in the 1970s. The freeway proposal was shelved in the 1990s. A concerted community campaign to retain the grassland for conservation purposes followed and saw a significant portion protected. However, the last direct link of open space to the habitat corridor of the Merri Creek parklands was lost in the late 1990s and a final major acquisition of land for housing occurred in 2000. This housing development was still incomplete in 2013 with several vacant lots facing the grassland.

The conservation significance of the site was identified in 1987 and a number of botanical surveys were conducted around this time. Anecdotal information suggests that fires illegally lit by local children may have inadvertently provided the ecological process of biomass reduction between the 1960s and 1980s, thus helping retain vegetation values. Formal ecological management began in 1992, including burning designed to enhance ecological values, weed control, planting and direct seeding.

Simple bollard and cable fencing was installed in 1997, which succeeded in protecting the grassland from illegal vehicle access. Higher-quality boundary fencing was installed in the northern block as part of the development to provide attractive interfaces with the new housing. Temporary tall fencing was also installed at this time to prevent building rubbish entering the reserve.

Aerial of grassland context, and context diagram (below).



Community involvement has been invited via community meetings and events throughout this time. Since 2011, members of the Wurundjeri Tribe Land Compensation and Cultural Heritage Council have been involved in management. The site is usually identified as 'Central Creek Grassland' in most literature, but in 2012 the area was officially renamed *Ngarri-djarrang*, meaning 'thigh' in Woiworrung, the language of the Wurundjeri.

Grassland values

The component vegetation types at Ngarri-djarrang are:

- Plains Grassland EVC dominated by Kangaroo Grass (*Themeda triandra*), Tussock Grass (*Poa labillardierei*) and Wallaby Grasses (*Rytidosperma* spp.), with a high diversity of grasses and herbs in which the daisy, pea and orchid families are prominent.
- Stony Knoll Shrubland EVC dominated by various *Acacia* tree and shrub species, Wallaby Grasses (*Rytidosperma* spp), Spear Grasses (*Austrostipa* spp)

and a high cover of rock. This is found in the north-western corner of the site.

- Grassy Wetland EVC, with Swamp Wallaby Grasses (*Amphibromus* spp), sedges and rushes, occupies a small area immediately north of Davidson Street. In the later years of the 'millennial drought' (approximately 1996–2010), a decline in the vegetation quality of Grassy Wetland was suspected to have been exacerbated by removal of overland runoff resulting from development of adjoining housing. Subsequent recovery of restored vegetation is likely to still be more susceptible to degradation owing to altered hydrology.

Present context

Ngarri-djarrang is surrounded by residential developments. The grassland is bisected into a northern and southern section by Davidson Street, which has a wide mown grass edge on both sides and a footpath on the northern edge. The north and south sections have a variety of interfaces. The eastern boundary of the southern section is defined by high back or side paling fences from 1980s-era housing. To the south, it is edged by a street and path frontage with 1990s housing beyond. The western boundary is separated from the revegetated Central Creek by broad mown buffers and beyond this, housing from the early 2000s. The northern section is edged by a concrete shared trail on its western side and beyond with the Central Creek and beyond that, the rear fences of housing dating from the 1960s. To the north, it is separated from terrace-style housing (built 2006) by a pedestrian path. To the east, this section of the grassland is fenced almost at the road edge, with houses from the 2000s beyond.

Fencing is low, cable and bollard style, of good quality, and makes the grassland easily accessible. On the north and east edges of the northern section, head-height mesh and star picket fencing was added to the original fencing as a temporary measure to prevent damage resulting from wind-blown or dumped building waste associated with development. While the effect is exclusionary, cheap and ugly, it has been successful in preventing a serious source of grassland damage. It appears to have also inadvertently contributed to the successful adaptation of a small mob of Eastern Grey Kangaroos to surrounding development, through blocking flight routes towards busy roads and by reducing access by unrestrained dogs, which would otherwise harass them.

In 2013, signage consisted of two large, illustrated interpretation signs installed on Bartrop Street and the northern side of Davidson Street. These were installed in 2000 and are now well beyond their original 'life expectancy'. Other signage is multilingual, plain and, in some cases, directly addressed to the

Road dividing grassland, buffer turf, low fencing, grassland.

Multilingual sign, original fencing subsequently made taller. Poor visual presentation.

Premium housing fronting shared trail and grassland.

Astonishingly, a small group of Eastern Grey Kangaroos have re-established in Ngarri-djarrang (Central Creek Grassland), Reservoir, and persisted for several years. Their grazing has important ecological effects and their presence has been influential in improving people's opinion of the grassland reserve. Photo: MCMC

Interpretation walks with local community as a part of a school holiday program in 2008. Based on a small local playgroup. Photo: MCMC CC-BY-NC-ND

Deep ruts from illegal vehicle access in winter were a common sight prior to fencing of the reserve. Photo: MCMC CC-BY-NC-ND

housing construction workers. An information kiosk is located at the eastern end of the bisecting road, near a bus stop. Vandalism, and keeping the material in this kiosk 'fresh', has been a challenge for management bodies.

A small mob of between five and seven kangaroos are often visible grazing recently burned grassland or seen 'loafing' in the shrubland on a stony knoll in the northern section.

Vehicle access gates in the grassland reserve fence allow access to Central Creek, which is maintained as a habitat corridor and for its role as stormwater infrastructure.

The walking circuit around the northern section of the grassland appears to be well utilised for walking exercise and, anecdotally, the presence of kangaroos appears to constitute an attraction for local residents, generating a level of custodianship. Alternative opportunities for active recreation are available at the nearby L.E. Cotchin Reserve and B.T. Connor Reserve while two (relatively obscure) access points link residents with the extensive Merri Creek Parklands with a number of nature-based and active recreation opportunities.

Observations

The habitat corridor to the Merri Creek was lost before negotiation could be opened with the developer.

Building contractors significantly damaged the grasslands through dumping of waste materials in the development of the site, despite a second layer of fencing and additional signage. This fencing has not been removed: development is mostly completed.

Lack of quality passive or active recreation space nearby has probably increased detrimental human recreational activity in the grasslands.

MCMC has put a lot of effort into community engagement at Ngarri-djarrang. Instances of dumping are relatively rare. The presence of kangaroos has done much to promote positive attitudes towards grasslands. MCMC believes the snake awareness programs they have run with residents have also been instrumental in establishing positive attitudes to Ngarri-djarrang.

Public access is discouraged through high fencing and signage.

Residential side and back fences create a poor interface with the grassland.

A large boulder overhung by a large remnant acacia makes an interesting playspace along the south edge of the north section.

A good partnership exists between MCMC and Darebin City Council across a range of levels, which significantly aids effective grassland management.

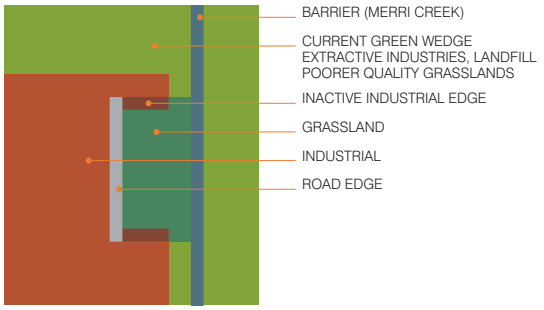
Effort has been made on the east edge of the north section to provide edge plantings that replicate the grassland structure and engage community as wildflower displays. Edge planting is absent elsewhere.

Key points

- Fencing and signage need to be in place before construction starts, and efforts should be made to ensure contractors understand the significance of the grasslands.
- Fencing strategies should be re-examined as circumstances change.
- Kangaroos make excellent 'amabssadors' for this grassland, and their desirable presence should be considered when re-examining fencing.
- Scientific valuing of native grassland and official protection of these values is ahead of wider community perceptions. This hampers efforts to protect grasslands. Addressing community perception is a goal that requires explicit allocation of resources and imagination.
- Following community engagement principles can lead to effective programs in gaining public sympathy and support for native grassland.
- Existing underground and overhead services can complicate grassland management and should be avoided where possible.

Cooper Street Grassland (Bababi Marning)

Aerial of grassland context, and context diagram (below).



Care taken with edge planting to grasslands, gravel mulch, industrial estate.

High incidence of rubbish dumping in industrial area under development.

Size: 38 ha

Location: South of Cooper St, Campbellfield, along west edge of Merri Creek (Melways180K11)

Management authority: Parks Victoria. Site works are mostly tendered out

History

In 1994, 23 ha of the grassland were purchased by the Crown for a reserve. As an outcome of the Craigieburn Bypass hearings, a land swap with a private landowner added 15.5 ha of grassland to the reserve in exchange for rights to develop the remaining 50 ha of grassland, including freeway reserve land. Old quarry land on the east side of Merri Creek opposite the grassland is expected to be added to the Merri Creek Park. South of the quarry on the east bank, a significant frontage from a golf course severed by the Craigieburn Bypass is also expected to be added to the Merri Creek Park. On the west bank of Merri Creek, an area of industrial land (the former Night Soil Depot) has been subdivided for industrial development. A reserve area along the creek frontage was created, part of which is owned by Melbourne Water and part by Hume City Council.

Grassland values

The site is of State to National significance for its flora and fauna and has Plains Grassland, a relatively intact Brown-back Wallaby-grass seasonal wetland, Escarpment Shrubland and Riparian Scrub. The Woolly Tea-tree riparian scrub is considered to be the most intact in north-eastern Melbourne. The endangered *Amphibromus pithogastris* was present at the site but located in the area now under development. The rare species *Agrostis aemula* var. *setifolia* is also present.

In terms of fauna, the Cooper Street site is considered to be of State significance due to the presence of Striped Legless Lizard. Other reptile species recorded include at least four species of snakes and seven species of skinks and lizards. A Common Long-necked Tortoise was also found in a creek pool in 1988.

A number of regionally significant bird species (including Swift Parrot) have been recorded at the site.

Present context

Cooper Street Grassland is edged by Merri Creek to the east and new industrial estates to the west. Its west edge is fenced to 1400 mm with black cyclone wire, accompanied by well-established, indigenous plantings taken from the Escarpment Shrubland

Wetlands for retarding and treating water runoff allow a small park and picnic area at the edge of the grassland in the industrial zone.

EVC. These planting are at times of medium shrub height. Mulch is gravel. Signage is absent. Entry is not promoted. Plantings are fresh and well maintained. Works are ongoing.

Rubbish dumping, mostly of building waste, is significant along the industrial edge of the grassland, and wind-blown rubbish collects against the fence.

A WSUD stormwater wetland, treating runoff from the industrial estate, is co-located with a picnic spot. The industrial estate is a popular hooning location.

The Cooper Street (Bababi Marning) site serves as an important node and link in habitat connectivity for the region, being mid-way between the Craigieburn Grasslands and the Galada Tamboore sites.

Observations

Views are strong along and across the Merri Creek valley, provide a sense of place, and the edge of the industrial estate is unsightly when viewed from within the grasslands. Views into the grassland can be blocked by the edge shrub plantings.

The fencing serves as a barrier to the rubbish entering the grassland. The quality of the fencing appears appropriate to this large grassland in an industrial context. The fencing, at 1400 mm, is however of a height that presents as exclusionary.

The edge of the grassland serves as a way-finding landmark to orient people moving through the industrial estate.

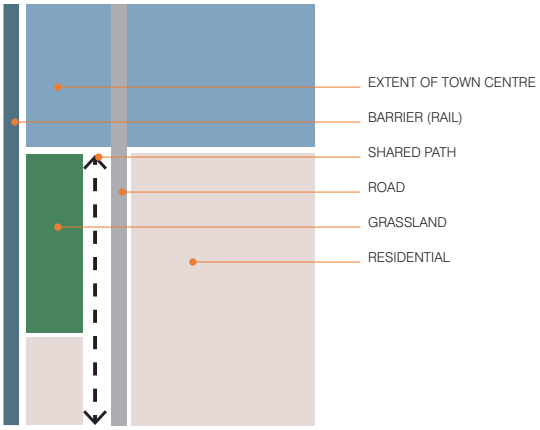
Little intrusion into the grassland occurs because this is an industrial zone.

Key points

- A large grassland gains resilience through being located in a green corridor.
- Rubbish dumping is most likely to occur near areas being developed.
- The frequency of human intrusion is less in industrial areas, but often the impact of that intrusion is greater, for instance, large-scale rubbish dumping, 4WD gouging.
- Black cyclone wire can emphasise presence of rubbish accumulated against it.
- Cyclone wire serves to keep rubbish out of the grassland.
- Vista is an important feature of large grasslands and care must be taken to not introduce unsightly elements into the vista.
- Co-location of grasslands and infrastructure such as water treatment ponds, creates the opportunity for discrete park experiences in industrial areas that otherwise lack these recreational opportunities. These experiences also serve to promote the ecosystem services provided by the grasslands.

Evans Street Grassland

Aerial of grassland context, and context diagram (below).



Evans Street Grassland becomes de facto southern extent of Sunbury town centre.

Size: 4 ha

Location: Evans St (south end), Sunbury (Melways 382D5)

Management authority: City of Hume, Friends of Evans Street Grassland

History

The site was once railway land, believed to have been infrequently used as a site to hold stock for transport to Melbourne. Not much is known about the management of the site, but like most railway land it would have been burnt to keep fuel levels down, and occasionally grazed hard when stock were present. In 1983, the Friends of Organ Pipes saw the site and urged Jim Willis, the renowned botanist, to visit. He was overwhelmed by its richness and diversity, and in 1984 wrote to the Shire of Bulla, which had recently purchased the site from the railways, urging it to conserve the grassland. Notwithstanding this, in 1989 the Shire subdivided the site into eight lots for industrial development, and later decided it would make an ideal location for a discount store and carpark. After a lengthy and occasionally heated tussle, a Memorandum of Understanding was signed in 1993 by the Shire (now City of Hume), the Victorian Conservation Trust (now Trust for Nature) and the Friends of Evans Street Grassland. This MoU expired in 2003, but was replaced by a Trust for Nature covenant, ensuring that the Grassland will be retained in perpetuity for conservation.

Grassland values

The 4 ha grassland, a site of State significance, is a little-disturbed remnant of Plains Grassland, dominated by *Themeda triandra* and a variety of other grasses, including those not typical of Plains Grassland. The site includes a number of species now rare in the region and supports a high species richness of grassland herbs.

The site is flat, with a slight fall from south to north, a lower, scraped area along the rail line on the western side, and a small knoll roughly in the centre, capped by Hedge Wattle (*Acacia paradoxa*). This centre knoll is a lens of Ordovician silcrete, protruding from the surrounding basalt-derived soils. The grassland is dominated by Kangaroo Grass (*Themeda triandra*), though a range of other native grasses contributes to the grass cover (Spear-Grasses, *Austrostipa* spp; Wallaby Grasses, *Austrodanthonia* spp.; and unusually, Five-awned Spear Grass, *Pentapogon quadrifidus* and Long-hair Plume-grass, *Dichelachne crinita*). It is extraordinarily rich in wildflowers for such a small site, with more than 100 native species of grass, herbs

The site is protected by a wide road easement. Note the street tree plantings, exotic on the residential side and indigenous on the grassland side.

Fencing adds to historic character of the site. Entrance into mown edge of the site is encouraged, but no way into the grasslands is provided.

Rail access track dividing grassland, buffer turf, low fencing, grassland.

and sub-shrubs. Most abundant species are Common Everlasting (*Chrysocephalum apiculatum*), Scaly Buttons (*Leptorhynchos squamatus*), Lemon Beauty-heads (*Calocephalus citreus*), Rice-flowers (*Pimelea* spp.), Bluebells (*Wahlenbergia* spp.), Sundews (*Drosera* spp.) and Blue Devils (*Eryngium ovinum*). Several species tend to occur only on or close to the central knoll, such as peas (e.g. *Bossiaea prostrata*, *Dillwynia cinerascens*, *Eutaxia microphylla*), Grass Trigger-plant (*Stylidium graminifolium*) and the floral emblem of the grassland, Blue Pincushion (*Brunonia australis*).

Present context

Evans Street Grassland is bounded by railway line on its north-west edge, the loading area of a supermarket on its north-east edge, buffer planting, shared bike path, a road and residential area on its south- east side and a community centre and residential area to its south-west. The site has become the de facto southern extent of Sunbury's commercial centre. This is a highly visible grassland due to its location at the edge of a commercial centre.

Post and rail fencing along the north-east edge allows easy access, which is promoted through signage.

Observations

Evans Street Grassland stands out as the best presented grassland in Melbourne. The fencing is well detailed, clearly indicates the site is valued, and references the site's history. Seating is provided and is styled to match the fencing. Signage is excellent, a suite of signs describing fauna, flora, history and management. The mown strip is located within the fenceline, as is the seating and signage, all encouraging access to the site. The edge plantings outside the fenceline are indigenous and intended as display. Mulch is gravel and small rock.

Harmful intrusion into the grassland seems minimal, with other parkland nearby adequately supplying local needs.

In the past, pressure on the grassland has primarily been from the threat of development, a threat averted through the covenanting of the site.

Public walks are organised through the City of Hume and Friends of Evans Street Grassland.

A mown firebreak runs across the site, suggesting a route through the grassland.

Key points

- Grasslands of State significance can exist in urban environments. Small, narrow grassland reserves can resist weed invasion from adjacent weedy areas and retain high species diversity if regularly burnt and if they don't undergo any soil disturbance.
- Grasslands can provide a barrier to long-term expansion of adjacent land uses – in this case the Sunbury town centre.
- Location of grasslands beside barrier infrastructure (rail) helps protect grasslands.
- Firebreaks form unofficial paths into the grasslands and this function could be taken into account when planning firebreak locations.
- Vitreous enamel provides graffiti-resistant, high-reproduction quality, long-lasting signage.
- Signage can be used to encourage access and suggest the limits of that access.
- Housing opposite grasslands provides passive surveillance.
- Railway maintenance, for instance, spraying weeds, must not be allowed to impact on grassland flora.