



BIODIVERSITY MANAGEMENT PLAN

2017 – 2020



ACKNOWLEDGEMENTS

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All relevant International, National, State and Local government legislative authorities. (see Appendix 4)

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All efforts have been made to ensure that information contained in this plan is correct at the time of publishing, but it is acknowledged that organisations mentioned in this plan may change their programs and plans from time to time.

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EXECUTIVE SUMMARY

The University of Melbourne’s vision “to be recognised as a leader in embedding sustainability in all aspects of the University’s operations, teaching and learning, research and engagement” is set out in the strategic document *Growing Esteem 2015 - 2020*. The values and principles to be upheld in the pursuit of this vision are stated in the Sustainability Charter and the details of how this will be achieved are provided in the Sustainability Plan 2017-2020.

To fully achieve the University’s sustainability aspirations, the flora and fauna (biodiversity) present on all campuses will, as far as is practicable under changing climate conditions, be preserved and enabled to thrive within a property portfolio that is continually evolving and changing due to the University’s objective to provide world class teaching and learning facilities.

The most appropriate way to go about maintaining a high standard of biodiversity preservation and enhancement on all campuses is to ensure that managing the flora and fauna on the University’s campuses is embedded in the decision-making processes and informed by the research and experience of its staff, students and alumni.

This Biodiversity Management Plan (BMP):

1. Fulfils the commitment made in the Sustainability Plan 2017 – 2020 to “publish a University-wide Biodiversity Management Plan by March 2017”
2. Satisfies the requirements of the Green Star Communities rating for a Biodiversity Management Plan prepared by a suitably qualified professional.
3. Guides one of the five major operational areas in campus Sustainability – Energy and Emissions, Water, Waste, Campus Engagement and Biodiversity.

The BMP describes the global, national, bioregional and local policy context of the University’s responsibility for its on-campus biodiversity. It goes on to set out a series of targets to meet by 2020 along with present and future challenges and opportunities that will shape the actions required to meet these targets.

Biological diversity – or biodiversity – is the term given to the variety of life on Earth. It is the variety within and between all species of plants, animals and micro-organisms and the ecosystems within which they live and interact.

World Wide Fund for Nature



Pair of Red Rumped Parrots nesting in a hollow in an Elm tree on Grattan Street.

VISION

By 2020 the University of Melbourne’s biodiversity on all campuses will be valued, utilised for “Living Lab” research, managed sustainably and adapting to change, continuing to provide environmental services and benefits for people and the rest of the biosphere.

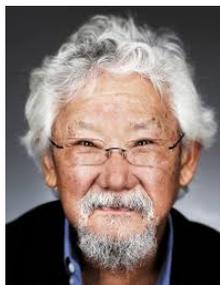
SCOPE

The scope of this document covers:

1. All campuses of the University of Melbourne.
2. The activity of all staff, students, visitors and contractors of the University of Melbourne that impacts on the flora and fauna of those campuses.
3. The biodiversity present on all campuses.

“I can’t imagine anything more important than air, water, soil, energy and biodiversity.

These are the things that keep us alive.”



David Suzuki

CONTEXT

The biodiverse plants, animals and microorganisms that inhabit our campuses are part of the overall ecology of the planet which has no property or other administrative boundaries. Thus it cannot be effectively managed by the University in isolation. The University of Melbourne's Biodiversity Management Plan is consistent with and includes actions from all relevant global, commonwealth, state, bioregion and local government legislation, strategies and plans.

1. Global

The United Nations General Assembly declared 2011–20 the **United Nations Decade on Biodiversity** (Resolution 65/161). The UN Decade on Biodiversity is intended to achieve the goal of significantly reducing biodiversity loss. The United Nations Environment Program (UNEP) Convention on Biological Diversity produced the Strategic Plan for Biodiversity 2011–2020 including the Aichi Biodiversity Targets (Appendix 2). These targets provide an overarching framework for biodiversity management, policy development and other biodiversity-related conventions.

Of the twenty targets, the most relevant for the University to fulfil are:

Target 1

By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.

Target 5

By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.

Target 9

By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

Target 11

By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

Target 12

By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

Target 15

By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

Target 19

By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.

2. National

Australia's *Biodiversity Conservation Strategy* sets a national direction for biodiversity conservation over the next decade.

“In Australia, more than 1,700 species and ecological communities are known to be threatened and at risk of extinction. Degradation of our environment continues and many ecosystems are increasingly vulnerable to collapse. Our biodiversity is declining because of the impacts of a range of threats, including:

- *habitat loss, degradation and fragmentation*
- *invasive species*
- *unsustainable use and management of natural resources*
- *changes to the aquatic environment and water flows*
- *changing fire regimes*
- *climate change.*

Lost biodiversity can never be fully recovered, but through our conservation efforts we can help to ensure that species are able to persist and to restore the capacity of ecosystems to adapt to changes and disturbances—in other words, to build ecological resilience.”

Matters of National Environmental Significance

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), actions that have, or are likely to have, a significant impact on a matter of national environmental significance require approval from the Australian Government Minister for the Environment (the Minister). The Minister will decide whether assessment and approval is required under the EPBC Act.

One of the nine “matters of national environmental significance” is **listed threatened species and ecological communities**. Species in this category are found on at least one of our campuses (Dookie) and more may be discovered. This may mean that any proposed development would have to be assessed under this Act.

The University's legal responsibilities regarding campus biodiversity:

“There is both state and federal environmental legislation that would potentially apply to any landholder / developer seeking to implement a project with potential environmental impacts. Essentially this legislation requires environmental impact assessment and approval where a proposal is likely to have environmental impacts / impacts on threatened species etc. The planning law regime (state and local government) would also be relevant as developments would be required to meet planning scheme requirements, which may require various levels of approval and restrict certain activities, such as clearing native vegetation or interfering with water catchment processes.”

(General-level advice from Dr Anita Foerster, Melbourne Law School)

3. State

The Victorian Government's draft biodiversity plan, *Protecting Victoria's Environment – Biodiversity 2036*, describes a new vision, in which **Victoria's biodiversity is healthy, valued and actively cared for**. This will be achieved by fulfilling two goals:

1. *To encourage more Victorians to value nature*, by increasing the number of Victorians spending time enjoying nature, increasing the percentage of Victorian organisations reporting on and managing their performance to support the natural environment, and increasing the number of Victorians who act to protect nature; and
2. *To ensure that Victoria's natural environment is healthy*, by halting the decline of threatened species and securing the greatest possible number of species in the face of climate change, improving the extent and condition of native habitats, and improving ecological regimes.

The draft plan's approach to setting targets is to focus on the actions and places in the state where the best, most cost-effective results for biodiversity can be achieved (DELWP 2016).

The following excerpts from the Victorian government's Draft plan introduce the crucial role that the University as a private landholder and generator of biodiversity research can play in the preservation of biodiversity:

“Private landholders play an important role in conserving biodiversity, as they manage two-thirds of the Victorian landscape.....losses of native vegetation have been greater on private land than on public,

“What is needed is an approach that ensures that all land and water managers work together to maintain biodiversity, share information, are accountable and support adaptive management.”

“We recognise multiple sources of knowledge (e.g. science-based, traditional, community) and make it accessible as a common foundation for decision making.”

4. Bioregional

A national and regional planning framework has been endorsed by all levels of government as a key tool for identifying land for conservation under *Australia's Strategy for the National Reserve System 2009-2030*. It classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. Other land managers visualise and make sense of a biodiverse landscape using the natural boundaries of major river catchments. Victoria is divided into 10 catchment regions, each with a Catchment Management Authority (CMA). The University currently has campuses in the Bioregions and CMA areas set out in Table 1:

Campus	Bioregion	CMA area
Parkville	Victorian Volcanic Plain	Port Phillip and Westernport
Dookie	Victorian Riverina	Goulburn Broken
Werribee	Victorian Volcanic Plain/Otway Plain	Port Phillip and Westernport
Burnley	Victorian Volcanic Plain	Port Phillip and Westernport
Southbank	Victorian Volcanic Plain	Port Phillip and Westernport
Creswick	Central Victorian Uplands	North Central

INFO BOX

Dookie Campus is located within the Goulburn Broken Catchment Management Authority whose vision for the catchment is:

“Highly valued, resilient and adaptive ecosystems supporting healthy native biodiversity” along with “Healthy, resilient and increasingly productive landscapes supporting vibrant communities.”

Much of the remnant habitat in the Catchment is on public land (about one third of Catchment) but most threatened species and ecological communities depend on private land. As a major landholder with significant remnant vegetation the University will play a crucial role in conserving and enhancing the biodiversity of the region including the Dookie Daisy which is listed as “Vulnerable” in the Flora and Fauna Guarantee Act 1988.



5. Local

The University of Melbourne's campuses are spread over five different local government areas (LGAs) in Victoria – some urban and some rural. Most LGAs have policies and programs in place to protect and enhance biodiversity within their boundaries.

(i) *Parkville and Southbank campuses are located within the municipal boundaries of the **City of Melbourne***

The City of Melbourne has been conducting a robust consultation and research process for several years which firstly produced an Urban Forest Strategy (UFS) that states:

“A healthy urban forest will play a critical role in maintaining the health and liveability of Melbourne.”

The City of Melbourne Urban Forest Strategy divides its urban forest into 10 precincts. The University's Parkville Campus is effectively the 11th precinct and as such it needs to be included in any plans, surveys and projects for the protection and enhancement of the planted environment.

The City of Melbourne is now in the process of finalising a draft Urban Ecology and Biodiversity Strategy. This companion strategy seeks to address a key deliverable identified in the UFS – that of **improving biodiversity**. The draft Urban Ecology and biodiversity Strategy will provide direction about how the City manages and enhances the ecology, biodiversity and ecosystem services within and across their municipality. This strategy recognises that nature is diverse, that there are numerous benefits to supporting biodiversity, and that action is required to support and enhance it.

INFO BOX

“The City of Melbourne is developing an Urban Ecology and Biodiversity Strategy to provide direction about how we manage and enhance municipal ecology and biodiversity.”



The University of Melbourne's research community contributed expertise and advice during the development of both of these key strategies. The Urban Forest Strategy has received global recognition for pushing the bounds of best practice, particularly in terms of the targets and approach to planning for the composition and character of their future urban

forest. This is one example of the mutually beneficial outcomes that can emerge from partnerships between the University and local government, particularly when it can contribute towards planning future management of campus biodiversity, including the planting of resilient species and adapting design for shade and maximum ecosystem stability.

(ii) *Werribee campus is located within the City of Wyndham*

The City of Wyndham's Biodiversity Policy outlines its biodiversity principles, and includes the following commitments:

- **Enhance:** *Local flora, fauna and ecosystems make an important contribution to life in our community. Wyndham City is committed to ongoing, high quality management and improvement of its own natural assets*
- **Plan:** *Wyndham City has a responsibility to lead by example and influence the protection of biodiversity on behalf of the community,*
- **Educate:** *An educated and engaged community will value, support and protect the conservation of local biodiversity*
- **Partner:** *Sustained partnerships will maximise conservation outcomes within Wyndham and the wider region*
- **Monitor, Learn and Adapt:** *Monitoring, Evaluation, Reporting and Improvement (MERI) is integral to ensure that management regimes are effective and benefiting biodiversity*

The City of Wyndham's partnership commitment has the potential to be of benefit to the University's management of the biodiversity of Werribee Campus – giving the opportunity for the two organisations to work together to enhance the natural assets of the campus, especially regarding the highly endangered flora of the Western Plains.

(iii) *Creswick campus is located within Hepburn Shire*

"*Future Landscapes – a Biodiversity Strategy*" is currently being written for the Shire. The intention of the plan is to balance community driven projects and priorities along with natural resource management priorities driven through the state and federal governments. As this Strategy is currently in development, there is an opportunity for the University to provide input in the direction of the Strategy, both through the provision of our Research Community's expertise, but also through practical on-ground actions that can be undertaken at this campus.

(iv) *Burnley Campus is located within the City of Yarra*

The City of Yarra has two key initiatives that could be used to inform and enhance biodiversity outcomes at the Burnley Campus: the *Urban Wildlife Management Plan* and a local policy to encourage the protection of local biodiversity and the few remaining sites of natural heritage - the *Yarra Planning Scheme*.

The *Urban Wildlife Management Plan* covers 12 key elements – all of which are relevant to Biodiversity Management practices across the University of Melbourne campuses. These include:

- Protection of terrestrial fauna habitats
- Protection of in-stream habitat and off-stream wetlands
- Revegetation (consistent with EVCs) to augment habitat and improve habitat link
- Artificial nest boxes
- Fauna friendly lighting
- Weed Management
- Securing fauna habitat through overlays and zoning
- Feral animal control (including foxes, feral cats and rabbits)
- Overabundant/aggressive fauna (native & exotic)
- Domestic animal control
- User related issues (recreational activities)
- Education and community engagement

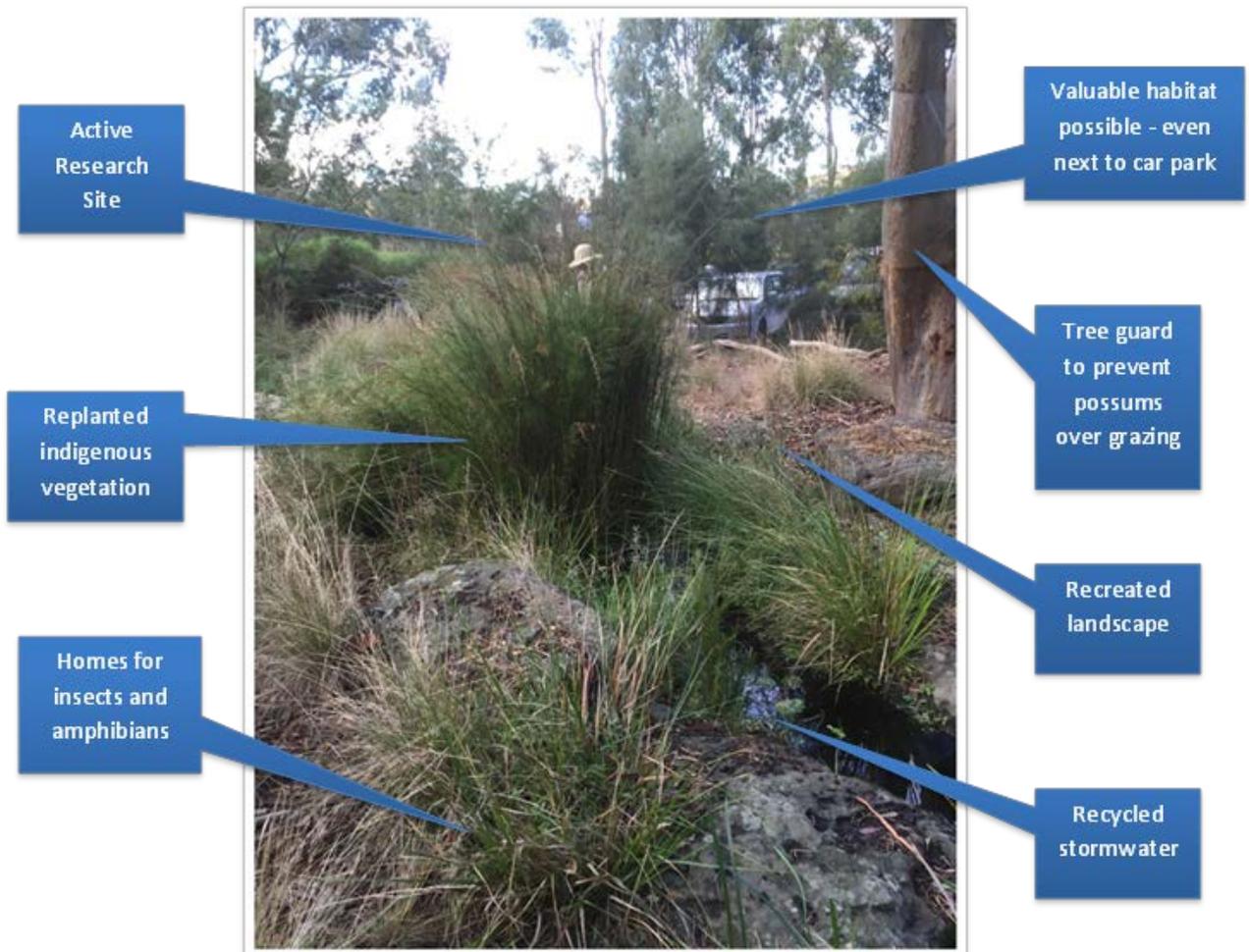
The Yarra Planning Scheme aims to:

- To protect and enhance the City of Yarra's natural biodiversity.
- To protect the long term survival and viability of remnant vegetation.
- To ensure the survival of indigenous species
- To minimise the impacts of introduced flora and fauna on indigenous vegetation
- To manage sites to allow for the natural regeneration of indigenous vegetation

Burnley Campus is currently managed in a way which encourages biodiversity by providing valuable habitat and links to the riparian vegetation along the nearby Yarra River.

An example of the excellent habitat provided is found in the area between the main building and the carpark where indigenous vegetation and water sensitive urban landscaping have created a valuable pocket of habitat for biodiversity.

Multiple biodiversity, landscape amenity and water sensitive urban design criteria addressed in an oasis at Burnley campus.



(v) *Dookie Campus is located within the City of Greater Shepparton*

The City of Greater Shepparton's Environmental Sustainability Strategy (2014 - 2030) contains biodiversity management objectives that can be divided into four key directions.

1. Provide leadership
2. Strengthen and support key partnerships
3. Enable our community
4. Utilise Council's planning and regulation powers

As a major landholder and custodian of significant populations of indigenous plants and animals, the University of Melbourne is ideally placed to establish collaborative projects with Council that will contribute towards innovative and best practice outcomes for biodiversity in this region.

Dookie Biolinks Program

“The Dookie district is a nationally significant high priority area for biodiversity protection and enhancement due to the existence of distinct environmental features including the Dookie College Bushland Reserve, several wetlands, Nine Mile Creek and rare, remnant vegetation on the rocky hills.

The Dookie Biolinks Program is community driven, partnership project that implements the Dookie Biodiversity Action Plan (BAP) priority actions (developed by DELWP and the GBCMA) and aims to achieve landscape-scale change in the extent, quality and connectivity of habitat to help improve resilience within the district’s biodiversity assets. The City of Greater Shepparton and the University of Melbourne are Dookie Biolinks Program project partners”.

ACTION

All relevant global, national, bioregional and local policies and action plans be taken into account and complied with as far as is possible when managing on-campus biodiversity.

THREATS

1 CLIMATE CHANGE

The University of Melbourne has some of the most trusted and long standing climate change research and modelling capacity in the world. The data that has been produced has informed many levels of local and international government climate change and resilience planning. It is reasonable to utilise this expert opinion in planning future management of campus biodiversity including the planting of resilient species and adapting design for shade and maximum ecosystem stability.

The University's Sustainability Plan 2017 – 2020 commits the University to developing and implementing Climate Change Adaptation Plans for each University campus by 2020. These plans will review the best evidence available at the time regarding risks and opportunities related to biodiversity.

POSSIBLE IMPACTS

Victoria's Warmer and Drier Future

- The Victorian Government's website: <http://www.climatechange.vic.gov.au/understand> contains a summary of current thinking about the future climate of Victoria: harsher fire weather and longer fire seasons
- fewer frosts
- more frequent and more intense downpours
- more hot days and warm spells
- less rainfall in Winter and Spring south of the Great Dividing Range; less rainfall in Autumn, Winter and Spring north of the Great Dividing Range
- sea storm surges and coastal erosion that are expected to increase with sea level rise

Land managers are already taking this and more detailed local information into account when planning future biodiversity projects.

There is an urgent need for improved communication and collaboration between agronomic and ecological researchers and research agencies to ensure that future programs consider sustainability in terms of biodiversity as well as pasture and livestock productivity and soil and water health.

Proposed mitigation and adaptation climate change solutions need to be checked for their effect on biodiversity. The following aspects have been identified by the Victorian Government as some of the risks and benefits of these measures:

- Major changes will arise from environmental plantings and regrowth & fire management.
- Other changes will affect forestry, agriculture and feral animal control.
- Most anticipated land-use changes should benefit biodiversity.

INDIVIDUAL ACTION

VicNature 2050: 10 things we can all do to help nature adapt to a new climate

- 1. Listen, engage and work with people*
- 2. Accept natural areas will change*
- 3. Protect reserves; look after nature on private land*
- 4. Remove threats such as clearing, weeds and feral animals*
- 5. Use natural processes like fire, floods to promote diversity*
- 6. Connect landscapes using climate-ready plants*
- 7. Welcome nature into our cities*
- 8. Record changes in our local area*
- 9. Promote diversity in all that we do*
- 10. Stay positive, informed and engaged*

More information on VicNature 2050 and the 10 initiatives is available at www.vicnature2050.org

ACTIONS

The Biodiversity Coordinator will facilitate the establishment of Action Research Partnerships between researchers and operational staff to assist the University to develop the best ways to incorporate mitigation and adaptation actions to give the most valuable biodiversity management outcomes for all campuses.

Biodiversity values will be considered as part of the scheduled update to the University's Climate Change Adaptation Plans.

2 PESTS AND WEEDS

Habitat destruction, competition and predation by pest and weed species threaten the survival of many of Australia's native plants and animals.

Traditionally pests and weeds were seen only as threats to Australia's agricultural production resulting in land degradation and reduced farm and forest productivity.

It is now realised that urban areas are just as important in the management of problem species. For example, the City of Melbourne draft *Urban Ecology and Biodiversity Strategy* states:

"Greater Melbourne is home to many introduced and native pest species. By competing with or preying on other plants and animals, pest species can cause catastrophic declines in species populations and biodiversity. Weed invasion is the most commonly identified threat to native plants. After habitat loss, predation by introduced species (mostly foxes and feral cats) is regarded as being the major threat to endangered terrestrial native animals."

Sustainable weed and pest management practices require finding a balance that delivers desired outcomes without a heavy environmental cost. The University of Melbourne currently has several researchers who are studying these issues and identifying solutions. The broader University community can also play a role through the establishment of Active Research Partnerships, using the campuses as Living Laboratories.

ACTIONS

Periodical reviews will be undertaken of the latest research on weed and pest control measures. Methods chosen to be used will be the least likely to adversely affect the integrity of the biodiversity in the area.

The character and location of each campus will be taken into account when dealing with species that may be characterised as valuable heritage at one campus and unwanted species at another.

3 HABITAT LOSS

The loss of habitat is one of the major factors contributing to the reduction of biodiversity. Habitat loss can occur on large spatial scales, such as deforestation and land clearing, but it can also occur as a series of small losses that combine to form a significant cumulative impact. This incremental habitat loss is particularly important in the urban context where small scale decisions can rapidly build up.

The University of Melbourne campuses support a rich diversity of habitats, but they can sometimes come under pressure in the face of decisions around how to meet the growing infrastructure needs of the University. As part of the Sustainability Plan, the University seeks to minimize the impact of its activities on the existing habitat.

The ACF submission to the Federal Government draft Biodiversity Strategy consultation stated that:

“The most cost effective means to conserve biodiversity is to protect remnant ecosystems in situ.”

Where this is not possible, the University will actively search out opportunities to create and enhance habitat in other locations on the same campus.

CASE STUDY

Habitat works benefit endangered bird species.

In partnership with Friends of the Grey-crowned Babbler, the University of Melbourne, the Norman Wettenhall Foundation and Goulburn Broken Catchment Management Authority, Trust for Nature completed a study in the Goulburn Broken catchment investigating the effectiveness of habitat works in improving the survival of the Grey-crowned Babbler. This endangered, communal bird occurs primarily in woodland habitat on private land and roadsides in northern Victoria. The study found that babbler numbers have increased by 80 per cent at sites where habitat works occurred, compared to sites where no works occurred. Several of the sample sites that contained habitat works were sites protected under conservation covenant or through land purchase, demonstrating the importance of long-term protection of habitat on private land to save threatened species. For more information about this study go to www.trustfornature.org.au



ACTION

A policy of a baseline of “no Net Loss”¹ (with promotion of the better outcome of “Net gain”) will be adhered to across all campuses.

¹The concept of no net biodiversity loss lies at the heart of biodiversity offsetting. No net loss, in essence, refers to the point where biodiversity gains from targeted conservation activities match the losses of biodiversity due to the impacts of a specific development project, so that there is no net reduction overall in the type, amount and condition (or quality) of biodiversity over space and time. A net gain means that biodiversity gains exceed a specific set of losses.

4 WILDFIRE

Major fires on the periphery of Australian cities are reframing perceptions of what constitutes effective landscape planning and vegetation management.

Research indicates that burning patterns used for thousands of years in Australia by the traditional owners maximised the species diversity in any particular area, because burning tended to leave a mosaic of vegetation which had been burned at different times. Most Australian plant communities are adapted to periodical fire events, and many native plants require fire for regeneration.

During the early modern era however, improved capacities to manage wildfire risk led to complacency about the hazard, which in turn has led to urbanization that has not sufficiently accounted for the levels of risk. Areas that are both highly vulnerable to fire and of great importance for biodiversity conservation, are being subject to planning that is not taking into account their biodiversity value. Australian land managers face a major challenge in understanding how to manage fire and ecological burns in close proximity to people and property, in order to both protect human and built assets, whilst maintaining biodiversity.

The University of Melbourne has a long history in conducting research related to bushfire in Australian ecosystems. This expertise can be drawn upon to inform the design and management of our campuses.

ACTION

Maintain and regularly update fire management plans for rural campuses to ensure they contain best practices regarding the minimization of fire risk and the preservation of biodiversity.

OPPORTUNITIES

1. HABITAT RESTORATION AND ENHANCEMENT OF LANDSCAPE AMENITY

The University of Melbourne's campuses are rightly regarded as some of the best managed and highly biodiverse privately owned landscapes in Victoria.

Opportunities for habitat restoration and enhancement include continuing to manage the native vegetation on campuses effectively; planting more indigenous plants on campus; and supplementing scarce resources through considered use of novel habitats (e.g. the installation of well-designed nest-boxes to provide additional nesting opportunities for hollow-dwelling species). The contribution of novel resources in supporting biodiversity has been increasingly recognised. Therefore, all of the existing natural elements on campuses can play a role in supporting the biodiversity on site, significantly expanding options for how habitat enhancement can be achieved.

The University of Melbourne has several features on campus that are regularly featured as demonstration sites of what is possible in terms of managing the built environment for biodiversity. These include the award-winning demonstration Green Roof at Burnley campus, and the widely acclaimed System Garden on Parkville campus. These existing sites not only illustrate the University's commitment to making a difference with its landscapes, they also provide excellent examples of what can be achieved through Action Research Partnerships and the Living Laboratory approach.

The University of Melbourne is currently a major landholder in five local government areas (See Section on local context). Actions that are undertaken to support biodiversity on all campuses, will also make a significant contribution to conservation within the broader landscape.

Urban Campuses:

City of Melbourne and University of Melbourne research supports encouraging smaller patches, closely enough connected for species to pass from one to another. These parcels in close proximity to one another may provide good potential as habitat, for example, median strips and roadside verges can offer refuge for birds, insects and other species if suitable habitat structure is planted. Connectivity and patch size are both important for supporting biodiversity in urban landscapes. Planning should include looking at the surrounding land-use so that decisions complement those made for local parks, green spaces and nearby corridors.

Rural Campuses:

There is a huge opportunity for students undertaking agricultural, forestry and environmental studies to research and communicate the benefits of the ecosystem services that biodiverse landscapes can provide for human land use and also the types of agricultural practices that can enhance biodiversity values of the land.

This is best summed up in this excerpt from the Draft Goulburn Broken Catchment Biodiversity Strategy 2016:

“The link between resilient agriculture and biodiversity is clear. Biodiversity programs aimed at supporting private landholders in the Catchment are integrated with farming systems, so that ecosystem services from nature benefit agricultural production, and that land management practices are sympathetic to nature. Biodiversity is no longer considered in isolation when management decisions are made.”

ACTION

Assess and quantify the landscape context for each campus, and use this information to develop Action Research Partnerships that identify and test critical habitat, resources and improvements that can enhance biodiversity outcomes for each site.

2. PARTNERING TO SHARE INDIGENOUS KNOWLEDGE ABOUT BIODIVERSITY MANAGEMENT

The University is in the process of developing its third Reconciliation Action Plan. The University's vision for reconciliation is:

"...for a holistic, inclusive and two way relationship between Indigenous and non-Indigenous Australians based on mutual responsibility and respect. This relationship requires that each member of the University community develops deep respect and an understanding for the cultures, knowledge and values of the many clans and language groups that make up Indigenous Australia."

There is an opportunity for positive outcomes for both biodiversity and indigenous Australians through the exploration and use of indigenous knowledge regarding traditional local land management practices.

The University of Melbourne is home to the prestigious Murrup Barak Institute - set up to provide *"an enduring contribution to Indigenous Australia through the transformative impact of education and employment in the context of Australia's leading University in teaching, learning, research and employability"*

Staff at the Institute will be approached by the Biodiversity coordinator to begin a process of information exchange and partnering to utilise indigenous knowledge about biodiversity management. The Institute has already done some work in a related area by making a unique cultural and biodiversity experience available to university visitors- Bilibellary's Walk.

"Bilibellary's Walk is named after the Ngurungaeta, or clan head, of the Wurundjeri people at the time of Melbourne's settlement. The walk is a cultural interpretation of the University's Parkville campus landscape.

The walk is designed to help participants hear the whispers and songs of the Wurundjeri people that lie within the University of Melbourne's built environment. The walk alerts us to signs and stories that may not be apparent to visitors, but which provide some insight into the experience of the Wurundjeri people of the Woiwurrung language group who have walked the grounds upon which the University now stands for more than 40,000 years. It is intended to provide the impetus for further exploration of issues pertinent to the Aboriginal community.

Individual indigenous researchers will also be approached for their insights: e.g. Gary Presland's book, "The Place for a Village: How Nature has Shaped the City of Melbourne", has provided insights about the ways that the landscape of the Parkville area had been managed for thousands of years before European settlement, in particular about the eel migration and the sustainable harvesting of this annual resource by the Wurundjeri people.

This kind of knowledge will also be sought from local indigenous community members interested in assisting the University to more holistically manage its urban and rural campuses.

ACTION

The Biodiversity Coordinator will work with relevant indigenous individuals and organisations to obtain local knowledge when gathering information for campus biodiversity plans.

3. GREEN STAR RATINGS

The University has long been a supporter of the Green Building Council of Australia and the Green Star rating scheme. Green Star is a sustainability rating scheme that can be applied to the design, construction and operation of precincts (Green Star Communities) and Buildings (Green Star Design & As-built and Green Star Performance). Under Green Star, projects are rewarded for protecting and enhancing biodiversity in accordance with set benchmarks.

The University has committed to achieving at least a 5 Star Green Star Communities rating for the Parkville campus and this Biodiversity Management Plan is expected to assist the University to help fulfil the requirements of Credit 29 – “Ecological Value”.

ACTION

The Biodiversity Coordinator will develop and publish a University –wide Biodiversity Management Plan by March 2017.

4. CONTRIBUTION OF BIODIVERSITY TO ACHIEVING CARBON NEUTRALITY

The University of Melbourne in its Sustainability Plan 2017-2020 has committed to “achieve carbon neutrality before 2030.” There is an important role (often overlooked) that trees and soil play in processing and sequestering carbon.

The University of Melbourne has partnered with the Royal Botanic Gardens Victoria to undertake an ecological carbon accounting project that quantifies the carbon sequestration potential of different tree species commonly encountered in Victoria's urban landscapes. The University is also home to leading researchers investigating the carbon storage potential of urban soils. This research can contribute to the delivery of strong carbon sequestration outcomes on our campuses through Research Action Partnerships.

“The carbon storage value of a forest is essentially dependent on the trees within it photosynthesising and storing carbon. Different plant species are more efficient at sequestering and storing carbon from the atmosphere. In general, large, slow growing trees with high wood densities tend to store the most carbon in the long term. When such a tree dies, much of the carbon stored within it will be released back into the atmosphere. Changes in biodiversity may directly, and indirectly, affect the likelihood of tree survival and thus carbon storage. Resilience to the changing climate is also becoming a more important issue and biodiversity is likely to strengthen an ecosystem’s ability to survive without significant loss of above-ground carbon storage” <http://www.fauna-flora.org/>



ACTION

Assess and quantify the contribution that the trees and soil make to the carbon balance of the University.

5. RESEARCH CONTRIBUTION

The University's Sustainability Plan 2017 – 2020 commits the University to:

1. *Develop industry partnerships that emphasise our resources for sustainability research including the campus as a living laboratory*
2. *Ensure strong research links to campus sustainability operations and planning*

“Campus as Living Lab” is more than a concept; it is a practice being brought to life on all the University's urban and rural campuses. More than forty University of Melbourne researchers are currently conducting biodiversity related research; aspects of which could be used to manage campus biodiversity. Implementing the Biodiversity Management Plan will support the existing projects and seek new opportunities focussing on the Campus as a Living Lab and Active Research Partnerships.

CASE STUDY

The biodiversity green roof on Burnley Campus has been designed with features that encourage and sustain biodiversity including:

- Indigenous plants representative of Victoria's endangered native grasslands, including known larval food plants or nectar sources for butterflies and native bees.
- Specific habitat features to provide habitat, including logs and sand for insect burrowing, hollow twigs for native bee nesting, and rocks, pavers, tiles and pots for reptile and insect basking.



ACTIONS

Clearly define and promulgate the practices of “Campus as a Living Lab” and “Active Research Partnership”

Harness in-house research expertise and utilise it for the benefit of campus biodiversity

Encourage academics to utilise the campus biodiversity for teaching and learning

6. ENGAGEMENT & EDUCATION

The most visible aspect of staff and student involvement in implementing the Sustainability Plan 2017-2020 will be their engagement with the Green Impact program. “Biodiversity” is one of the categories of actions that will be fulfilled by participant teams. Two primary methods will be used to start the process of engaging and educating the University community about the biodiversity present on campus:

Biodiversity Tours

Biodiversity Tours, showcasing the best of the flora and fauna on the Parkville Campus, have been held in 2016 and will be continued in 2017. This opportunity will be extended to other campuses in future years.

<http://sustainablecampus.unimelb.edu.au/key-areas/campus-grounds/tours/biodiversity-tour>

Wildiversity App

Wildiversity App is a collaborative student initiative aimed at fostering biodiversity awareness and conservation within the University of Melbourne campuses through active citizen science. The idea to create **Wildiversity** App came from the #C15Hack - an annual sustainability workshop held at the University since 2014. The main purpose of the #C15Hack was to address current environmental and social challenges through innovation practices based on design thinking methods. The concept of **Wildiversity** App can be seen as a social tool that encourages students and staff from Melbourne University to explore and understand the wilderness that surround their daily lives at campus. **Wildiversity** will serve as an engagement tool for the Green Impact program and a platform to collect data essential for the conservation and preservation of campus biodiversity.

http://wildiversityunimelb.wixsite.com/wildiversity/about_us

ACTIONS

Biodiversity Tours to be run monthly during Semester – being advertised widely to staff and students.

Fund the on-going use and development of the Wildiversity App and provide engagement activities for staff and students using the Wildiversity app and Wildiversity themed collateral (e.g. Calendar, postcards,).

Collaborate with the City of Melbourne and other relevant partners to run engagement activities such as the BIOBLITZ citizen science event, utilising the Wildiversity App.

Update “Green Impact” program actions with additional biodiversity related activities each year.

MANAGEMENT AND GOVERNANCE FRAMEWORK

GOVERNANCE

The University's Sustainability Executive has the task of overseeing the implementation of the Sustainability Plan 2017-2020. It is planned that the current Landscape Committee become formalised as a subcommittee of the Sustainability Executive, thus making the lines of governance and responsibility clearer. This Biodiversity Management Plan will be presented to the Landscape Committee for ratification and it will then become the responsibility of the Biodiversity Coordinator under the guidance of the Landscape Committee to implement the Plan.

MANAGEMENT

Several Strategies and plans have informed the general management of the various campuses with regards to biodiversity. They include:

Parkville Master Plan 2008

Planning Principle 8 states:

8f. Protect and enhance the diversity of flora and fauna which forms the natural heritage of the University's physical environment."

"Valued landscapes, trees, gardens and open spaces are critical to the University's heritage. Buildings and open spaces will be designed to maximise opportunities for rainwater harvesting for use in the water features and landscape irrigation. Landscaping of open spaces will consider incorporating drought tolerant plant species, where possible, and water retaining garden treatments."

It is noted that a Campus Development Framework is scheduled to be developed this year (2017) which will supersede the Master Plan.

Wildlife Management Protocols for University of Melbourne Parkville Campus 2009.

This is a working document which will continue to inform operational wildlife management practices. It has provided background to the development of the Biodiversity Management Plan 2017 – 2020. Various plans are in development for other campuses including the Creswick Landscape Management Plan.

ACTIONS

Urban Forestry Guidelines for the Parkville and Southbank campuses of the University are developed (in conjunction with the City of Melbourne Urban Forest Plan.)

Mechanisms are set in place to ensure that the Biodiversity Coordinator is included in consultations when planning occurs for any significant campus changes.

MAPS & DATABASES FOR ALL CAMPUSES

There is an old saying that you cannot manage what you have not measured. All efforts will be made to catalogue and map the biodiversity present on all campuses so that it can be more effectively managed and that progress towards targets can be measured accurately.

The following projects are in progress:

- Flora map/database each campus

ArcGIS Maps are being developed for each campus with tree overlays etc.

- Fauna database each campus

Fauna surveys have been conducted in many locations on all campuses during undergraduate courses and research projects. This diverse and often difficult to find data will be uncovered and added to a publicly available database to benefit planners and researchers. e.g. a fauna list has been kept for several years by the Curator of the System Garden (Appendix 3)

ACTIONS

All available, relevant on-campus biodiversity data is collected, collated and integrated into a publicly accessible database, e.g. the Atlas of Living Australia.

Resources are allocated to updating and interrogating the database to assist in the management of on-campus biodiversity.

TARGETS & IMPLEMENTATION TIMELINES

Biodiversity Targets are embedded in the University's Sustainability Plan 2017-2020. This is the first time that biodiversity considerations have been formalised in any of the University's overarching plans.

The primary Targets for the next four years are:

1. Publish a university-wide Biodiversity Management Plan by March 2017
2. Establish biodiversity baseline data for Parkville and Southbank campuses by mid-2017
3. Establish biodiversity baseline data for the remaining campuses by end-2018
4. Complete campus-specific plans and commence implementation by end-2020

More detail on the actions to achieve these targets will be included in the annual Implementation Plan which will be created at the end of every calendar year by the Biodiversity Coordinator. These actions will be designed to move the University towards achieving the Targets and outcomes outlined in the Plan.

Summary of Outcomes

1. The University of Melbourne Biodiversity Management Plan is produced by the end of the first quarter 2017.
2. Baseline Biodiversity data for Parkville and Southbank campuses is obtained in 2017 (in partnership with the City of Melbourne.)
3. Biodiversity planning and implementation related activities are carried out to support the University's commitment to achieving Green Star ratings for its projects
4. The Biodiversity Coordinator is consulted when planning occurs for any significant campus changes.
5. A policy of "No net loss" is adopted to arrest the decline of the number of trees on Campus (only three quarters of those present a decade ago are still in existence.)
6. Once a baseline of the number of major species is established for each campus, that the aim is to maintain or increase the number of species to ensure the health of the ecosystems and to aid in their resilience in a time of climate change.
7. Ecological and biodiversity research carried out at the University be regularly reviewed and relevant findings incorporated into the Plan.
8. Biodiversity preservation and enhancement on all campuses is managed via a "Research Action Partnership" so that the practice of managing the biodiversity present on the University's campuses is informed by the research and experience of its staff, students and alumni.

ACTION

At the end of each year, the Biodiversity Coordinator will evaluate the progress that has been made towards reaching the targets, and create a list of Implementation actions for the following year using the Template in Appendix 5

MONITORING & REPORTING

Evaluating our performance against the Targets and outcomes identified in this Biodiversity Management Plan is a critical element for ensuring that we continue to make effective progress towards achieving our goals.

Progress towards targets will be monitored and reported annually to Senior Management.

This plan will be reviewed in the second half of 2020 and a revised Plan published to cover the years 2021 – 2025.

Evaluation level	Key evaluation questions used to focus evaluation	Examples of data (or evidence) to inform evaluation
1 Annual performance	How did we go this year against what we said we would do?	Outputs (on ground works and capacity building actions or tasks) achieved and funds spent against targets set in the Plan
2 Long-term strategy implementation progress	What actions did we take that were changed from those in the plan? How effective were the implemented measures?	Outputs and assumptions of their impact listed in plan
3 Campus biodiversity condition change	Is the issue still similar to what was described in the strategy? Was the original plan appropriate? Have circumstances (such as new knowledge or different weather patterns) changed sufficiently to warrant a revised strategy?	Resource condition and trends Tipping points Indicators of resilience, adaptation and transformation responses

Adapted from: GBCMA (2015b)

APPENDICES

Appendix 1

BIODIVERSITY OPERATIONS PLAN 2017-2020

Biodiversity knows no boundaries: the plants, animals and microorganisms that inhabit our campuses are part of the overall ecology of the planet. They do not form a stand-alone system that can be managed by the University in isolation. The University of Melbourne's will manage its biodiversity taking into account all relevant global, commonwealth, state, bioregion and local government legislation, strategies and plans.

PURPOSE

This document is one of five area-specific strategies that fit under the operations section of the Sustainability Plan 2017-2021. It outlines the high-level goals and objectives for biodiversity management at the University of Melbourne.

The below targets and initiatives are intended for implementation by Infrastructure Services. In order to be successful, close collaboration with other departments and groups is required.

OVERVIEW

Programs and categories

The Sustainability Team in Infrastructure Services is responsible for overseeing the development and implementation of a Biodiversity Management Plan across the different campuses. This will include:

- a. Context – from global to local
- b. Threats and opportunities
- c. Data collection
- d. Research and engagement
- e. Landscape management
- f. Annual implementation plan

Internal Stakeholders

- Grounds
 - The Grounds team oversees the management and development of all campus grounds, which has a direct impact on biodiversity.
- University Staff & Students
 - Staff and student interaction and knowledge around on-campus biodiversity can have a positive effect on protecting plant and animal species.

External Stakeholders

- City of Melbourne and all other municipalities where the University’s campuses are located.
- Royal Botanic Gardens Victoria
- Ecological Society of Australia
- Atlas of Living Australia

BACKGROUND

What we’ve achieved:

The University has had a working document in place since 2009 – “Wildlife Management Protocols for University of Melbourne Parkville Campus”. This document will continue to inform Wildlife management practices and provide background to the Biodiversity Management Plan 2017 – 2020.

After considerable work by students and staff members at the University, a Biodiversity Coordinator was appointed in early 2016 to develop and implement the institution’s first ever Biodiversity Plan. While the process is still ongoing, the understanding of the current state of biodiversity at each of the campuses is outlined below in Table 1.

CAMPUS	MUNICIPALITY	PLAN	Relationship	Details
Parkville	City of Melbourne	Currently finalising its first Urban Ecology and Biodiversity Strategy and Urban Forest Strategy	Currently partnering for BioBlitz.	BioBlitz is a citizen science event, where experts and members of the community work together to discover, document and learn about the flora and fauna found within the municipal area.
Southbank			Exchange of ideas on planning.	
Burnley	City of Yarra	Urban Wildlife Management Plan	In dialogue	Burnley Campus is known for its extensive historic gardens and cutting edge research into urban ecology, forestry and horticulture
Werribee	Wyndham City Council	Biodiversity Policy		Werribee Campus has great potential for expansion of the flora and fauna currently on campus
Creswick	Hepburn Shire	Plan in process		Creswick campus is the site of the former School of Forestry
Dookie	Greater Shepparton City Council	Biodiversity Plans and Projects	Dookie Bio Links Program project partner	The Dookie district has a high priority for biodiversity protection and enhancement due to the existence of distinct environmental features including the Dookie College Bushland Reserve , several wetlands, Nine Mile Creek and rare, remnant vegetation on the rocky hills.

Table 1 Summary of the status of biodiversity activity of each major campus and the corresponding Local Council

Engagement:

- The C15 Hack produced a team of students who, with the help of the Biodiversity Coordinator and an app developer, produced the WILDVERSITY app – data from which is fed into the Atlas of Living Australia.
- In conjunction with the City of Melbourne, the University’s first BIOBLITZ was held in March 2016. This was a citizen science event open to all staff, students and community members.

What we measure:

GRI	GREEN STAR
G4-EN11: Operational sites in, or adjacent to areas of high biodiversity value	Green Star Communities: ENV2- Ecological Enhancement 1 point awarded for enhancing ecological attributes of the owned site. a. 1 point awarded for a management plan or 20% increase in net biodiversity gain.

Compliance

- **NATIONAL** – Biodiversity Conservation Strategy and Environment Protection and Biodiversity Conservation Act 1999
- **STATE** – Victoria’s Biodiversity Plan “Protecting Victoria’s Environment – Biodiversity 2036”, draft 2016
- **LOCAL** – City of Melbourne Draft Urban Ecology and Biodiversity Strategy
- **INTERNAL** – The University of Melbourne Sustainability Plan 2017-2020

Leadership - What are our peers doing?

INSTITUTION	BIODIVERSITY TARGETS AND ACHIEVEMENTS
Harvard	‘To protect and enhance current green spaces...’
UBC	Currently writing a web resource titled: “Building Biodiversity: A Campus Resource for Teaching, Learning and Doing”
Nottingham	Have seen significant increases in flora and fauna diversity on University Park (where they have a 10 year Biodiversity Management Plan)
LaTrobe	Manage a flora and fauna reserve on Campus approximately 3 hectares in area including a 1 hectare lake.
ANU	Assess the current position of UC campuses on an Australian Universities benchmark and improve by 20% in 5 years (2010-15)

OPPORTUNITIES

Material focus areas – targeting the big culprits (high impact, low cost)

With the University's first ever biodiversity plan currently in development, a number of ongoing opportunities are starting to emerge. Some preliminary recommendations are below, but will be considered as the plan continues to develop:

- The Biodiversity Coordinator is consulted when planning occurs for any significant campus changes.
- A policy of “No net loss” is adopted to arrest the decline of the number of trees on Campus (only three quarters of those present a decade ago are still in existence.)
- Once a baseline of the number of major species is established for each campus, that the aim is to maintain or increase the number of species to ensure the health of the ecosystems and to aid in their resilience in a time of climate change.
- Ecological and biodiversity research carried out at the University be regularly reviewed and relevant findings incorporated into the Plan.
- Biodiversity preservation and enhancement on all campuses is managed via a “Research Action Partnership” so that the practice of managing the biodiversity present on the University's campuses is informed by the research and experience of its staff, students and alumni.

The path towards carbon neutrality 2030

Measuring carbon sequestration could be seen as a part of our overall carbon balance equation. Some of our larger trees have been measured to contain over 15 tonnes of carbon each.

Our 2017-2020 Targets:

- 1. To have a completed a university-wide Biodiversity Management Plan by the end of 1st quarter 2017, with the recommendations to be included in the Sustainability Plan.**
- 2. To obtain Baseline Biodiversity data for Parkville and Southbank campuses by mid-2017 (in partnership with the City of Melbourne) and all other campuses by 2020.**
- 3. Receive all available points available for biodiversity in the University's Green Star Community Rating by 2019 – the date of next submission.**

Appendix 2

UNITED NATIONS AICHI BIODIVERSITY TARGETS

- [Strategic Goal A](#): Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society
- [Strategic Goal B](#): Reduce the direct pressures on biodiversity and promote sustainable use
- [Strategic Goal C](#): To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity
- [Strategic Goal D](#): Enhance the benefits to all from biodiversity and ecosystem services
- [Strategic Goal E](#): Enhance implementation through participatory planning, knowledge management and capacity building

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society



Target 1

By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.



Target 2

By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.



Target 3

By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.



Target 4

By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use



Target 5

By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.



Target 6

By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.

**Target 7**

By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

**Target 8**

By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.

**Target 9**

By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.

**Target 10**

By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity**Target 11**

By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.

**Target 12**

By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.

**Target 13**

By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services**Target 14**

By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.

**Target 15**

By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.

**Target 16**

By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building



Target 17

By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.



Target 18

By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.



Target 19

By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.



Target 20

By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.

Appendix 3

FAUNA LIST FOR THE SYSTEM GARDEN

compiled by Tim Uebergang, Curator.

BIRDS	MAMMALS
Spotted Pardalote	Feral Cat (<i>Felis catus</i>)
Large billed Scrub Wren	Garden Skink (<i>Lampropholis guichenoti</i>)
Powerful Owl	Brush tailed Possum (<i>Trichosurus vulpecula</i>)
Blackbird	Ringtailed Possum
Grey Currawong	Common Mouse
Tawny Frogmouth	Gould's wattled bat (<i>Chalinolobus gouldii</i>)
Red Wattle bird	White-striped freetail bat (<i>Austronomus australis</i>)
Indian Mynah	Lesser long-eared bat (<i>Nyctophilus geoffroyii</i>)
Magpie Lark	Chocolate wattled bat (<i>Chalinolobus morio</i>)
Little Raven	Little forest bat (<i>Vespadelus vulturinus</i>)
Rainbow Lorikeet	European or red fox (<i>Vulpes vulpes</i>)
Red Rumped Parrot	
Eastern Rosella	
	ARTHROPODS
	Bird Dropping Spider (<i>Celaenia excavate</i>)
	European Honey Bee (Italian variety – <i>Apis mellifera ligustica</i>)
AMPHIBIANS	
Southern Brown Tree Frog	

Appendix 4

SUMMARY OF RELATED FEDERAL AND STATE POLICIES AND LEGISLATION

- Our Catchment, Our Communities, Integrated Catchment Management in Victoria 2016-19
- Victoria's Biodiversity Plan "Protecting Victoria's Environment – Biodiversity 2036", draft 2016
- Permitted clearing of native vegetation – biodiversity assessment guidelines (the Biodiversity Assessment Guidelines) 2013
- Victoria's Water Plan (under development, discussion paper released 2016)
- Australia's Biodiversity Conservation Strategy
- United Nations Convention on Biological Diversity
- Environment Protection and Biodiversity Conservation Act 1999 (the EPBC Act) (Commonwealth)
- Flora and Fauna Guarantee Act 1998 (currently under review)
- Catchment and Land Protection Act 1994
- Wildlife Act 1975

Appendix 5

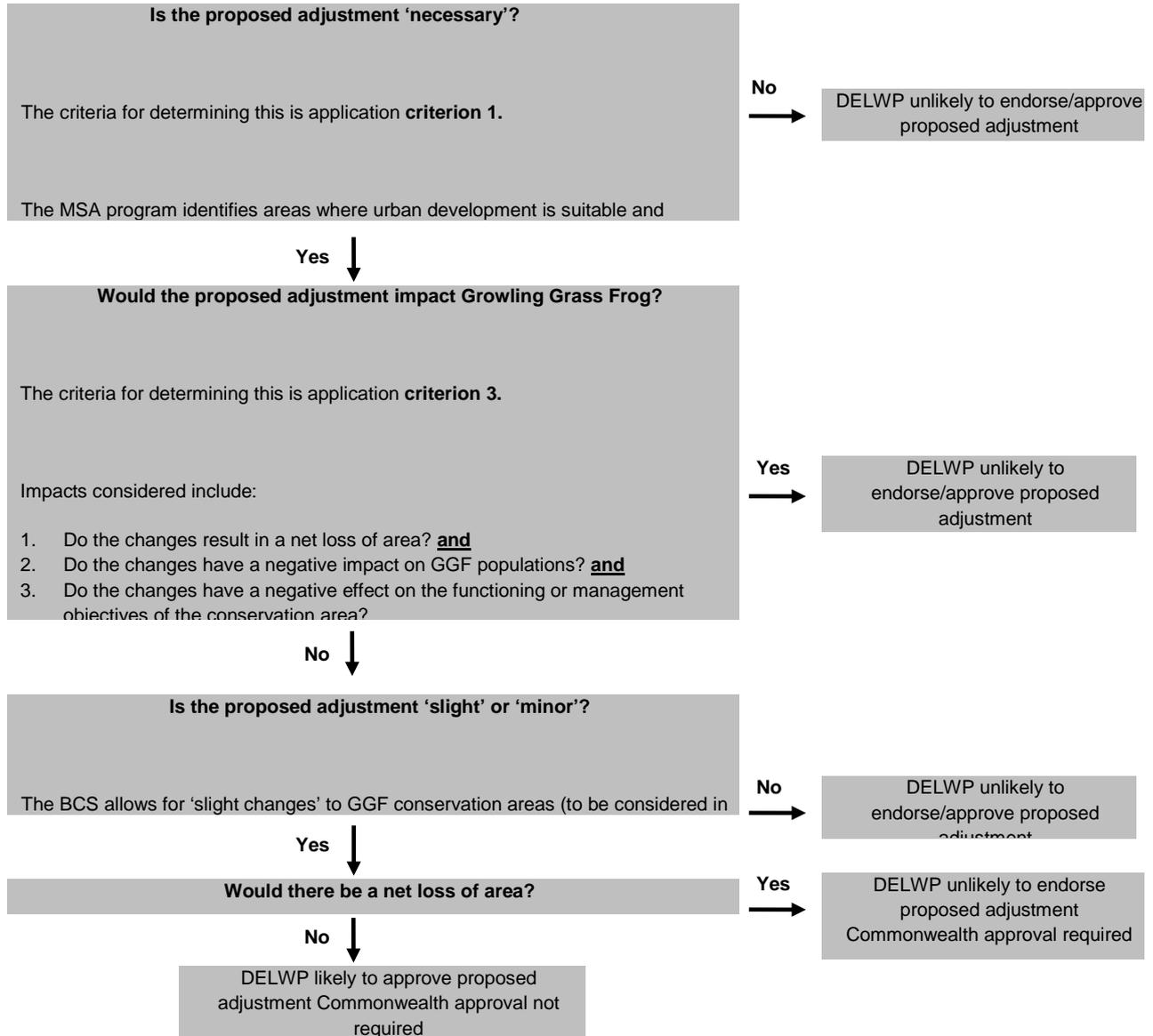
IMPLEMENTATION PLAN TEMPLATE

Start Date	Action	Measure / KPI	Audience	Responsibility	Resources	Timeframe/activities

Appendix 6

EXAMPLE OF DECISION MAKING-PROCESS TO USE AS A TEMPLATE

Decision making process for Growling Grass Frog conservation areas



Appendix 7

USEFUL TOOLS IN THE MANAGEMENT OF BIODIVERSITY:

1. Victorian Biodiversity Atlas

The VBA is the web-based information system designed to manage information about wildlife in Victoria. The system includes species information, including origin and conservation status, along with more than six million records of species distribution and abundance from systematic surveys and general observations across Victoria. It encompasses vertebrate and invertebrate animals, fungi, vascular and non-vascular plants from terrestrial and aquatic environments, including marine waters to the three nautical mile statutory limit. It includes both native and naturalised exotic species (including weeds and pests).

2. For private landowners such as the University, guidelines for any proposed clearing of indigenous vegetation are provided at - <http://www.depi.vic.gov.au/environment-and-wildlife/biodiversity/native-vegetation/native-vegetation-permitted-clearing-regulations/biodiversity-information-tools>

BIBLIOGRAPHY

Adams, C., Araya, N., Denniss, R., He, W., Islam, R., Mudge, N., Yokota, C., 2016 “Growing the Esteem of the University of Melbourne’s Urban Forest” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Alcorn, J. 2015 “What Do We Want? A Biodiversity Plan. When Do We Want It? Now!” Submitted as part fulfilment of GCUM Semester 2, 2015

Chia, E. L., Gurusinga, N., Him, C., Lindsay-Smith, K., Shimojo, K., Sims, S., 2015 “Increasing Biodiversity on the University of Melbourne, Parkville Campus” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Darmanin, M., Edwards, C., Fakhruddin, I., Mah, K.Y.J., Nguyen, T.C.U., Niu, S. and Serrano, M. 2015 “Approaching a Biodiversity management Strategy for the Parkville Campus” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Dorrough, J. Yen, A. Turner, V. Clark, S. G. Crosthwaite, J. and Hirth J. R. “Livestock grazing management and biodiversity conservation in Australian temperate grassy landscapes”

Faulknor, A., Glesta, J., Klein, E., Salt, M., Yao, Y., 2015 “Strategic Planning for Biodiversity Management at the University of Melbourne: A Recommended Approach.” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Forsythe, A., Blain, J., Zhang, K., Rey, A., Pucius, M., 2015 “Briefing Paper: Strategic Planning for Biodiversity Management at the University of Melbourne” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Hou, N., Lambert, H., Ryan, S., Stephenson, C., 2016 “Briefing Paper: Developing a Parkville campus Urban Forest Precinct Plan” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Iaroshevsk, O., Guzman, C. S. S., Ishaq, S., Morales, J. de D., Gardner, D. and Ferraro, P. 2015 “A Future Biodiversity Strategy for the University of Melbourne” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Love, A., Wulandari, D. W. S., Liere, M. A., Flett, S. J. and Gomez, T. 2015 “Project Team 16 Brief” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Moser, S., Gounder, Y., Mullens, C., Pozza, G., 2016 “Briefing Paper – Urban Forest Precinct Plan” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Newton, E., Montenegro, M.P., Stuart-Watt, A., Weston, R., 2016 “Briefing Paper Strategic Priorities for a Sustainable Urban Forest at the University of Melbourne” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Sen, A., Gorwell, E., Vlahakis, K., Zamora, M., Hill, O., Clota, T., 2015 “Planning for Biodiversity in the Face of Uncertainty” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

Tapia, A., Teperman, K., McLean, A., Bukarum F. and Kulkarni, P. 2015 “University of Melbourne Biodiversity Management Plan: First Steps” Submitted as part fulfilment of Masters of Environment – Subject “Interdisciplinarity and the Environment”

USEFUL WEBSITES

<https://www.cbd.int/undb/media/factsheets/undb-factsheet-sp-en.pdf>

<https://www.cbd.int/undb/celebrations/au/undb-au-snapshot.pdf>

<https://www.environment.gov.au/biodiversity/publications/australias-biodiversity-conservation-strategy-summary>

<http://www.climatechange.vic.gov.au/understand#sthash.34uo0kba.dpuf>

(From “Wildfire risk, biodiversity and peri-urban planning in the Mt Lofty Ranges, South Australia”)

http://weconnect.gbcma.vic.gov.au/Wiki_Page/Evaluation_planning_levels_and_decision_making_cycles

http://www.gbcma.vic.gov.au/downloads/Current_Issues/Draft_Goulburn_Broken_Catchment_Biodiversity_Strategy_2016-2021_-_for_comment.pdf

(Goulburn Broken Catchment Biodiversity Strategy draft for public consultation July 2016)

http://www.forest-trends.org/documents/files/doc_3103.pdf

(Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets)

http://participate.melbourne.vic.gov.au/application/files/4214/6524/9371/Draft_Urban_Ecology_and_Biodiversity_Strategy.pdf

<https://www.wyndham.vic.gov.au/sites/default/files/201606/Biodiversity%20Report%202014.pdf>

<http://www.yarracity.vic.gov.au/environment/Animals-and-Plants/>

https://www.islington.gov.uk/~/_media/sharepoint-lists/public-records/planningandbuildingcontrol/publicity/publicconsultation/20122013/20121220goodpracticeguide4biodiversity

<http://www.environment.gov.au/system/files/resources/a7cb5991-e5c1-4c57-9037-1fd053ac8f2b/files/pest-animal-strategy.pdf>

<http://biosciences.unimelb.edu.au/engage/native-australian-animals-trust>

http://wildiversityunimelb.wixsite.com/wildiversity/about_us

The City of Melbourne, 2012, *Urban Forest Strategy: Making a Great City Greener 2012-2032*, The City of Melbourne, Melbourne, accessed October 2, 2016, from <<http://www.melbourne.vic.gov.au/SiteCollectionDocuments/urban-forest-strategy.pdf>>.

http://about.unimelb.edu.au/strategy-and-leadership/reconciliation/action-plan/RAP_2_Now_available