UNLEASHING THE POTENTIAL OF NATURE

DISCUSSION PAPER ON CITY ECOLOGY, ECOSYSTEMS AND BIODIVERSITY

CITY OF MELBOURNE

Join the discussion online at participate.melbourne.vic.gov.au/nature

Acknowledgements

Many people have contributed ideas presented within this Discussion Paper including within the City of Melbourne, and researchers at the Australian Research Centre for Urban Ecology (ARCUE), RMIT, University of Melbourne and the Stockholm Resilience Centre.

Cover image of Blue Banded Bee, *Amegilla bee*
Source: Museum Victoria

CONTENTS

PURPOSE AND PROCESS

Purpose

The purpose of this discussion paper is to support conversation and seek comment from our community and stakeholders to contribute to the development of a strategic policy framework for municipal ecology, biodiversity and ecosystem services, or nature within our city.

City of Melbourne has not previously formulated a comprehensive policy position on urban nature. The policies and strategies developed to date have focused on individual components of the city's ecology. To design a new policy framework we must elevate our thinking beyond compartmentalisation; we must consider the ecology of our city from a holistic perspective in order to understand the interactions and dependencies within the system. Using a holistic approach, we can better understand the impacts of policy decisions and the associated trade offs.

Healthy ecosystems and a rich biodiversity are vital for the livability and functionality of our city. We are currently contending with the most complex challenges in the history of our city's development. The way in which we can increase Melbourne's capacity to cope with a rapidly increasing population and plan for future climate change will fundamentally affect the nature that lives within the city, including many plants and animals.

This paper is by no means comprehensive but it does aim to highlight key issues that need deeper consideration. At the end of each chapter you will find a series of questions, which we hope will stimulate discussion. We invite you to join the conversation and share your thoughts and ideas online.

Your contribution will inform the development of a plan for ecology, biodiversity and ecosystem services within the City of Melbourne. This framework will influence the outcomes for nature in our city, which will fundamentally affect residents, workers, visitors and the diverse range of species that make this city home.

Find out more at:
participate.melbourne.vic.gov.au/nature

Process

An indicative timeline for the process is shown below:

FEBRUARY 2015
Discussion paper released for public comment.

FEBRUARY – MARCH 2015
Consultation with community, stakeholders and experts.

APRIL 2015
Closing date for comments on Discussion Paper.

JUNE 2015
Draft strategy released for public comment.

AUGUST 2015
Closing date for public comment on draft strategy.

OCTOBER 2015
Final strategy presented to Council.

KEY TERMS

Ecology

Ecology is the study of plants and animals, and their interaction with the environment. Urban ecology is the study of the relationship between living organisms and their environment in an urbanised context. Living organisms and the ecosystems they form are commonly termed 'biodiversity', a truncation of the words 'biological' and 'diversity'.

Ecosystems

Ecosystems comprise of natural components, such as plants, animals, water, soil, air and their interactions. Cities are urban ecosystems which include both nature and humans, in a predominately human-built environment. Functioning ecosystems are the foundation of human wellbeing and most economic activity (TEEB, 2011).

Biodiversity

Biodiversity is the variety of all life forms on earth; different plants, animals and microorganisms; their genes; and the terrestrial, marine and freshwater ecosystems of which they are a part (National Biodiversity Strategy Review Task Group, 2009). Biodiversity exists at three levels; genes, species and ecosystems.

Ecosystem services

Ecosystem services are the benefits that are obtained from nature that contribute directly or indirectly to human wellbeing (MEA, 2005). They include clean air, noise reduction, climate regulation, water filtration, recreation, nature education, natural heritage, among others. In cities, ecosystem services can come from green infrastructure such as parks, gardens and forests as well as street trees, pop-up parks, wetlands and lakes. These services can be valued in several ways such as economic, ecological, socio-cultural, health or insurance contribution. Ecosystem services can be considered in four categories:

1. provisioning services such as food and fresh water
2. regulating services such as climate amelioration
3. supporting services such as pollination
4. cultural services such as aesthetic contributions and spiritual connections

Ecological resilience

Ecological resilience is the capacity of an ecosystem to respond to a disturbance by resisting damage and recovering quickly. Resilience is dependent on components functioning.

Green infrastructure

There are various descriptions for green infrastructure. At City of Melbourne we use the term to describe the layers and infrastructures in the city that directly provide multiple ecosystem services or support the provision of those services. Examples of green infrastructure in our city include; all vegetation, parks, gardens, reserves, greenways, living green roofs and walls, stormwater and rainwater harvesting interventions, permeable surfaces, waterways and wetlands.

Private realm

This is land that is privately managed. The City of Melbourne currently manages public land under Council control; however much of the land in our city is under private tenure.

CHAPTER 1: NATURE IN MELBOURNE

Many cities around the world are considered biodiversity 'hotspots' and can contain habitat for a variety of threatened plant and animal species. Ecologists have been surprised by the presence and vitality of organisms in and near cities.

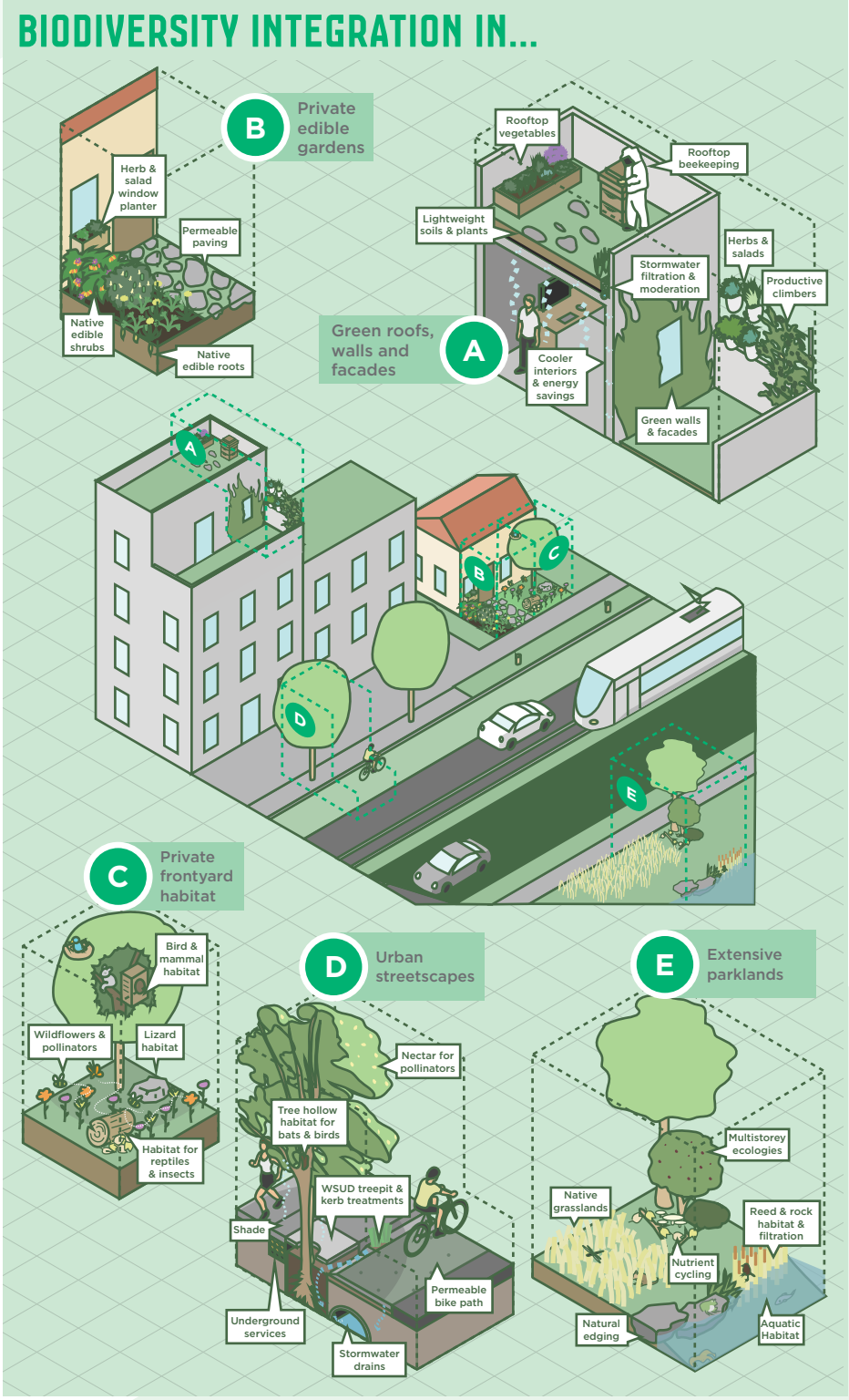
Whilst we hear much about Melbourne's liveability, we tend to hear less about Melbourne as one of the world's most biologically diverse cities. Our municipality is home to a world-renowned network of parks, gardens and streetscapes. These green layers contribute to our status as one of the world's most liveable cities.

Overview of nature in Melbourne

The City of Melbourne has a long and proud natural and cultural history. This began with the Wurundjeri, Boonerwrung, Taungurong, Djajawurrung, and Wauthaurong people of the Kulin Nation, who inhabited a landscape that was rich in wetlands, and open scattered forest (ARCUE, 2012). For the people of the Kulin Nation, Bunjil (an eaglehawk) is the creator spirit of the land, the lore and its people. These people had, and continue to have, an intimate understanding of, and a deep connection with the land – how its seasons work, its plants grow and its animals behave. In fact, the people of the Kulin Nation observed seven seasons annually, not four.

Iuk	Eel Season (March)
Waring	Wombat Season (April-July)
Guling	Orchid Season (August)
Poorneet	Tadpole Season (September-October)
Buath Gurru	Grass Flowering Seasons (November)
Kangaroo	Apple Season (December)
Biderap	Dry Season (January-February)

Source: Melbourne Museum



These ideas provide a basis for discussion and highlight interventions that may enable a more biodiverse habitat to be created within our city.

The arrival of the early Europeans saw the establishment of the Hoddle Grid, and the surrounding greenbelt of large parks and gardens. The historic vegetation communities of Melbourne include native grasslands, grassy woodlands and saltmarsh habitats. Significant biodiversity hotspots within the city contain some remnants of this vegetation, including Royal Park West, Domain Parklands and the Royal Botanic Gardens, Westgate Park and Webb Dock (Williams & Hahs, 2004).

Melbourne is rich in biodiversity. The greater Melbourne area supports some 1,864 indigenous plant species, of which 178 are considered threatened, and 520 indigenous fauna species, of which 136 of are currently considered threatened. Melbourne has one of the highest percentages of open green space of any city in the world, with more than 28 percent, including Crown road reserves (Metropolitan Melbourne Investigation, 2011). Our open spaces comprise over 14 percent of the total municipal area, supporting a range of flora and fauna species, both indigenous and introduced. The urban forest contributes enormously to the types of plants and animals found within the municipality. Through the Urban Forest Strategy goal to double canopy cover to 40 percent by 2040, we expect to see parallel increases in the number of animal species inhabiting the city, from birds to bats to insects and much more. However, Melbourne is currently at a tipping point whereby continued urban growth is likely to result in a loss of biodiversity if ecology is not explicitly and carefully considered in planning, policy and management.

Many plants and animals call Melbourne home. Within the municipality there are many biodiversity 'hotspots', shown on the map over the page.

Birds

182 species of birds have been recorded across the municipality, where over 100 species have been recorded in hotspots such as Royal Park, Westgate Park and the Royal Botanic Gardens.

Mammals

Eight species of native mammals have been recorded, including four species of bats such as the threatened grey-headed flying-fox *Pteropus poliocephalus* and Gould's Wattled Bat *Chalinolobus gouldii*.

Frogs and reptiles

14 species frogs and reptiles have been recorded, including the Common Blue-tongued Lizard *Tiliqua scincoides*, White's skink *Egernia whitii*, and common froglet *Crinia signifera*.

Invertebrates

The City of Melbourne has recently commissioned an invertebrate survey of the city, as no comprehensive survey has ever been undertaken. Known species include many types of butterflies such as the Australian painted lady, *Vanessa kershawi*, and several different types of native bees such as the blue banded bee *Amegilla asserta*, leafcutter bees *Megachile* sp., reed bees *Exoneura* sp., and many species of ground nesting solitary bees such as *Lasioglossum (Chilalictus) brunnesetum*.

Biodiversity present within Melbourne is shaped by many significant features:

- **The city's green open spaces and our healthy urban forest:** To protect our urban biodiversity it is necessary to protect and enhance both large and small open spaces and corridors. Increasing habitat provision in neighbourhoods, business districts and new open spaces is an equally important task (Hosteler, Allen & Meurck, 2011). A critical feature supporting biodiversity in our open spaces is the presence of the urban forest, especially sections containing large old trees and dense understorey. As trees age, they develop cavities and dead wood, which form vital habitat for hundreds of species of animals in the city. Some of our parks such as Royal Park and Fitzroy Gardens contain many large old trees which support significant populations of animals in the city, including microbats, owls, and many bird species. In order to support this across the entire region we need to consider opportunities to enable diverse ecological communities including grasslands, woodlands, saltmarsh, swampland, wetlands and our diverse urban forest.
- **Waterways running through the city:** Major waterways include the Yarra River and Moonee Ponds Creek, both running directly through the municipality, and the Maribyrnong River running along the western municipal boundary. These waterways help to shape the biodiversity present in our city. Other important water bodies include the wetlands in Westgate Park, Royal Park and the Royal Botanic Gardens. These support a diversity of frog and bird species, as do some smaller ponds located in Carlton Gardens, Fitzroy Gardens, Queen Victoria Gardens, Kings Domain and the University of Melbourne.
- **Remnant vegetation communities:** Remnant vegetation in the city is a unique and significant component of our local biodiversity. Such vegetation includes grassy woodland communities at Brens Drive and Royal Park West in Parkville; saltmarsh communities around Webb Dock; riparian and wetland communities along the rivers and creeks, at Long Island in the Royal Botanic Gardens and at Westgate Park in Fisherman's Bend.

Significant natural features of the city are vulnerable.

Nature in the city is undergoing rapid change. As the city expands at its fringes, many rare and depleted ecosystems are being placed under increasing pressure. This is evident in the west of the city where temperate native grassland communities are nearing total destruction. Despite these significant threats to biodiversity, we have the opportunity to adopt many new approaches that can promote biodiversity within the city. We explore these approaches over the next chapters.

Figure 1. The landscape within the City of Melbourne consists of many different features, including parks, waterbodies and remnant vegetation described as Ecological Vegetation Classes (EVCs) and protected under State and Federal legislation (ARCUE, 2012)

CHAPTER 2:
HOW DOES OUR CITY CONTRIBUTE TO THE AUSTRALIAN LANDSCAPE?

Royal Park - an ecological hot spot and the lungs of Melbourne.

Cities play an important role in the conservation of local and regional species, providing a platform for urban inhabitants to understand natural processes that affect the urban environment. Investing in the restoration of regional ecosystems will strengthen our ability to adapt to climate change, and journey to transition to a more sustainable and healthy city (URBES, 2014).

City of Melbourne has maintained and restored regional ecosystems within its boundary

Royal Park is a multipurpose green landscape, which has a rich diversity of native and exotic vegetation. This park maintains populations of native eucalypts, grasses and wattles, while supporting many birds, including several native species rarely seen within highly urbanised landscapes of Australia. A significant population of White's skink *Egernia whitii* can be found near the wetland area. The park provides a variety of settings which encourage participation in recreation. Retaining natural features amongst a space designed for multiple purposes can improve the wellbeing of Melburnians, by providing the space for spiritual enrichment, exposure to nature, a sense of place, physical recreation, social interaction and mental restoration. Further to this, Royal Park, being the City of Melbourne's largest open space acts as the lungs of the city, providing a regional oasis from the surrounding development. Our open spaces need to be considered vital assets of natural capital, as ecological stepping stones of regional significance.

The City of Melbourne and Department of Health have collaborated on the Return to Royal Park project, to reinstate parkland on the site of the old Royal Children's Hospital. Through extensive community consultation, a vision, design principles and a design brief for the parkland were developed. One principle was to create a native park which complements the existing vegetation and landscape character of Royal Park.

Using this principle, native plantings and a variety of vegetation forms have been designed into the new parkland, such as grassland, areas of canopy, and areas of lower flowering native shrubs, to attract native fauna. Other design principles described building a place that provides passive and active recreational opportunities for all members of the community. Consultation with the Wurundjeri Elders was also undertaken to strengthen the connection of the landscape to its indigenous heritage. From this consultation the seven seasons of Melbourne, as referenced in Chapter 1, were explored as one way of enhancing the visitor experience. The seven seasons have inspired the landscape design and planting palette for sections of the parkland, and reflect indigenous stories of fauna, flora and astrology unique to each season. This approach reinforces the native landscape character of Royal Park, and highlights the role of planning and design in facilitating multi-use spaces that have an array of benefits. These benefits not only extend to the community, but also to native fauna and enhance urban ecosystem services.

Successful examples of planning natural landscapes into urban areas

Portland, USA

The Metropolitan Greenspaces Master Plan adopted by Metro Council in 1992 describes a system for regional parks, natural areas, greenways and trails for fish, wildlife and people. The plan identifies 57 urban natural areas and 34 trail and greenway corridors. The plan is implemented by local park providers, schools, business and citizen groups through a combination of open space acquisition, land use standards, incentives and stewardship. They created educational programs to inform the community about Oregon's natural heritage, habitats and projects in order to build appreciation that will lead to citizen actions that supports biodiversity conservation. The regional authority provided technical and financial support for restoration projects garnering a higher level of public interest. Examples include stormwater management projects that mimic natural hydrology, landscaping with native plants, restoring habitat during redevelopment, education and outreach and other conservation actions.

Discussion points

- How can the City of Melbourne improve connectivity with the native Australian landscape?
- How could the city expand representation of the seven seasons of the Kulin Nation?

CHAPTER 3:
WHY SHOULD WE CARE ABOUT URBAN ECOSYSTEMS?

Fitzroy Gardens

Australasian Darter, *Anhinga novaehollandiae* suns his wings under Docklands Link where plastic pollution remains an issue

Nature in cities is a fundamental driver of human health and wellbeing. Biodiversity directly provides ecosystem services such as pollution and water filtration, shade and nutrient cycling. Our urban forest is comprised of 77,000 trees, which remove significant amounts of pollution to clean the air that we breathe each day. This ecosystem service is critical for ameliorating the impact of vehicle and transport emissions in the city and supporting the health and wellbeing of those who inhabit and traverse our city.

As our city has developed, we have witnessed the gradual erosion of nature and decline of ecosystem services. This means that protecting, maintaining and restoring nature in Melbourne is of critical importance to the health and wellbeing of the city's residents, workers and visitors. We must consider how we build and shape our city into the future so that we create a healthy and liveable urban form whilst we contend with the challenges of climate change, rapid population growth and land use change.

More than half of the planet's population now lives in cities, up 30 percent from 50 years ago. By 2050, 5 billion people are expected to live in urban areas, or 60 percent of the projected global population of 8.3 billion. Over the next 25 years, rural populations are expected to decline, meaning that almost all population growth will occur in urban areas (United Nations Population Fund, 2007). The quality of city environments – both their built and natural components – will determine the quality of life for an estimated total of five billion existing and new urban dwellers by 2050. Melbourne's community is expected to increase by 50,000 residents and 120,000 workers over the next 15 years, along with the associated urban development required to accommodate these increases. Creating healthy, habitable, urban living spaces for so many more people will be one of the defining challenges of our time.

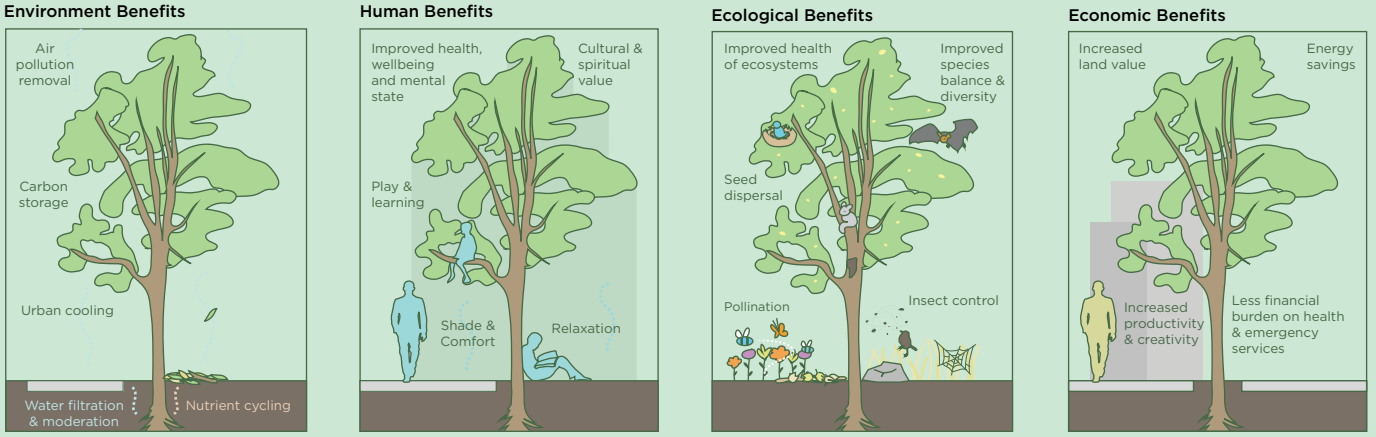
Cities consume tremendous amounts of resources and thus generate large amounts of waste and emissions. Plastic is a particular problem. UNESCO estimates that more than 220 million tonnes of plastics are produced globally each year, a large portion of which ends up in our oceans. The United Nations Environment Programme estimated in 2006 that every square mile of ocean contains 46,000 pieces of floating plastic. These plastics require about 500 years to decompose in the ocean. More than 200 species, including over a million seabirds and more than 100,000 marine mammals, die from this plastic annually. Cities' contribution of plastic impacts immensely on the environment and is crucial to be recognised in urban ecology protection and management.

Figure 2. Keywords linked to the importance of biodiversity to society, as a result of a survey of 158 people in the City of Melbourne. The size of the words is proportional to the amount of times the words were found within answers.

A city's ecological footprint contributes significantly to biodiversity loss, both locally and at the global level. However, cities cannot be viewed as problematic merely because they form a large consumer base. They also hold the key to changing production and resource use – by decreasing waste production, increasing recycling, and moving citizens to more sustainable forms of consumption.

In the coming decades there will be many changes to the local environment due to climate change. Expected changes include an increase in storm and flood events and conversely increased dry periods and extreme heat (City of Melbourne, 2009). These challenges will have significant implications for which species can occur within the municipality. We need innovative solutions to meet the challenges of creating an urban landscape that retains natural elements under the pressure of a growing urban population and an uncertain, complex climate. These solutions must integrate local, national and international knowledge on biodiversity and the social and cultural components of urban ecosystems.

ECOSYSTEM BENEFITS



These illustrations show the potential range of benefits and services that nature can provide to humans and other species in our city.

City of Melbourne users believe biodiversity is very important. Over 50 percent of people recently surveyed reported that they believe biodiversity is 'very important' for the City of Melbourne, and over 70 percent of people reported that they believe it is the responsibility of local government to manage biodiversity in the city (Analysis of City of Melbourne Biodiversity intercept survey). Furthermore, some city users suggested that both public and private realms are very important to the maintenance of biodiversity in the city, including natural areas, public parks, residential gardens, streets and rooftops. Hence, the City of Melbourne is uniquely placed to show leadership in this area.

City of Melbourne has a responsibility to take the lead in the management of urban ecosystems. This is not only because of the large ecological impact the city has on the surrounding natural environment, but also because of the potential the city has for generating innovative solutions for the challenges urban landscapes face. As the capital city of Victoria, City of Melbourne is uniquely positioned to demonstrate how responsible stewardship of urban biodiversity and urban ecosystems can be achieved within a highly urbanised environment; and that these actions also contribute to the health and wellbeing of Melburnians. The diversity of landscapes (i.e. parks, remnant woodlands, residential developments and commercial areas) found in the City of Melbourne continues to be important to the people that live in and visit the city. These landscapes are a reflection of the indigenous, European colonial and immigrant history of the City of Melbourne. Iconic streetscapes in St. Kilda Rd and Royal Parade showcase our colonial European history, while native landscapes in Royal Park and the landscape features of the larger rivers and creeks provide a continuous connection to our natural heritage.

How can we help shape what nature occurs in Melbourne in the future? Focussing on developing an urban form that is sensitive to nature is critical. If we reverse the way we currently trade off nature as we develop the city and move towards nature sensitive urban planning and design we can begin to maximise and harness the power of nature in our city to respond to these challenges and create a more liveable city fabric.

Discussion point

- How can the built environment contribute to the natural environment?
- What kind of urban nature initiatives could we undertake in Melbourne?

Successful examples of community participation

Edmonton, Canada

The City protects and enhances a system of conservation areas within an interconnected ecological network, to promote many ecosystem services for residents. The City restores degraded or damaged ecological systems and linkages to protect, expand and enhance biodiversity. In collaboration with the Province, Capital Region Board and adjacent municipalities, the City developed a comprehensive plan for wetland conservation and integration into the urban environment. The City has focussed on protecting their urban wetland network, as it is recognised the network provides important regulating, supporting and cultural ecosystem services. The City views protecting the urban wetland network into new and existing developments as a key asset of Edmonton's ecological network. The City established conservation easements for privately owned wetlands and requires compensation for the alteration or destruction of wetlands within the City limits. Wetland conservation is integrated into neighbourhood, zoning and subdivision administrative units, recognising the role of urban areas for conserving regional wetlands.

CHAPTER 4:
HOW CAN WE BETTER VALUE AND MANAGE NATURE?

Sunflowers on the border of the meadow at Birrarung Marr

Placing a dollar value on ecosystem services can aid in developing a sustainable future, because ecosystem services generally provide a cost-effective solution to many environmental problems. It is a global issue that we predominantly treat our ecosystem services as if they were free and limitless. By identifying the benefits that nature provides, and by understanding the value of these benefits, planners, educators and managers can move towards creating a resilient city (TEEB, 2011). To begin this process it is necessary to establish which services are central to society and the economy at the local and/or regional scale, and which stakeholders are the most dependent on those services. It is also necessary to understand which services are at most risk, and how present municipal policies can affect them. Assigning an economic value to services can aid in raising awareness, accounting for municipal assets, setting priorities for neighbourhood improvements, and for valuing offsets in development projects.

A loss of ecosystem services in urban areas can incur large economic costs. For example the loss of urban vegetation leads to an increase in energy costs for cooling in summer, while a loss in water regulation leads to increased flooding with consequences for urban infrastructure. Loss of ecosystem services can also affect the health of urban inhabitants, where loss of trees could affect air purification, noise reduction and climate regulation with consequences for pulmonary and cardiac diseases. For example, in Barcelona, Spain, the avoided costs of air purification by trees were estimated to be worth €1.1 million, while energy savings from trees in Sacramento, USA, were estimated in US$18.5 million annually (Gómez-Baggethun & Barton, 2013).

City of Melbourne has been investigating ways to value nature in the urban ecosystem. We have undertaken a process to investigate the environmental benefit of its street trees, where inner-city street trees were calculated to be worth millions (Fairman et. al., 2010). This value was calculated taking into account the benefits of street trees in terms of rainfall interception, carbon sequestration, energy savings and air quality improvements.

Successful examples of valuing ecosystem services

Montreal, Canada

The City of Montreal was able to determine that there is an increase between 5–20 percent in the value of property when is located less than 30 meters from a park, increasing income taxes for the council and increasing house sales.

Mayesbrook Park, London

A partnership between private and public organisations transformed a 45 ha park in urbanized London into a green infrastructure showcase. The site is used to demonstrate how a public green space can help the community face the risks of climate change through solutions for flooding and heat events while providing economic benefits. The new flooding area and new planted shrubs and trees provide storage for floodwater and shading and enhanced habitat for wildlife. The rate of economic benefit vs. cost was estimated to reach 7:1, where the economic benefits were approximately £880,000. Cultural services (such as wellbeing) were evaluated to return an annual value of £820,000, demonstrating how restoration of vegetation can provide economically robust climate change adaptation options and enhance the wellbeing of urban inhabitants.

Cape Town, South Africa

The Environmental Management Department from Cape Town's Council developed the business case for increased investment in and protection of the 9,000 indigenous flowering species and many endangered or critically endangered species. They valued ecosystem services by highlighting their role in tourism, waste water treatment and protection of natural hazards, where the process involved different municipal departments. Nature related tourism in the city was valued at US$137 million, recreation services were valued at US$58-70 million, and water purification and waste treatment services reached US$9.9 million. Natural hazard regulation was valued at US$8.6 million, which was an estimate for the cost of damages avoided by having more green areas.

Discussion points

- What values should underpin our approaches to planning for urban nature?
- How can we get greater recognition for our urban nature values?

CHAPTER 5:
HOW CAN WE UNDERTAKE NATURE SENSITIVE URBAN DESIGN AND PLANNING?

Princes Bridge, Alexandra Gardens

A living container initiative.

One way to increase the biodiversity is to mimic nature on a small-scale, for example, by creating patches of habitat in under-utilised spaces, even temporarily. In 2013 the City of Melbourne installed a 3000m^2 flowering meadow at Birrarung Marr. This small-scale initiative created insect habitat in a space not traditionally viewed as appropriate for nature. The meadow also created a new experience of nature in the city, and its location on Batman Avenue allowed it to be viewed by a vast number of people travelling to and from the city. Other locations in the city that have implemented green technologies with the potential to provide habitat, ecosystem services and contact with nature include green roofs, walls and facades, permeable paving, bio-filters, a living container display in City Square and a new temporary park in Yarra's Edge.

New urban habitat can be created in many ways via the implementation of green infrastructure (ARCUE, 2012). Manufactured spaces such as green walls, green roofs, and the green infrastructure associated with Water Sensitive Urban Design (WSUD) all provide habitat for wildlife, and provide many ecosystem services. Some of these established urban habitats are increasingly being recognised for their role in supporting the biodiversity of urban areas, such as private residential gardens, planter boxes, and nature strips – (see Box 1 over page). Other small-scale initiatives that can make biodiversity more visible in the city include urban agriculture, art installations, pop-up displays and the design of habitat into buildings. As Melbourne plans for urban renewal in sections of the city, an opportunity exists to implement mandatory features such as water capture and storage solutions as new buildings are developed, that also contain designed habitat features such as emergent vegetation, open ponds, nest boxes or flowering plants that can provide resources for local wildlife (see new urban habitats on page 20).

Discussion points

- How can we enhance biodiversity and ecosystem function in a rapidly growing city through urban design and planning?
- What urban nature approaches and innovations from other cities would work well in Melbourne?

NEW URBAN HABITATS

Green roofs

L-R: CH2 Building, Melbourne: succulents in light-weight strata and The Carlton Club, Melbourne

Green facades

Bloomfield Hotel, South Yarra

Green walls

L-R: Illura Apartments, West Melbourne and St Kilda Road Barracks

Planter boxes

Pop-up patch in Federation Square, Melbourne

Pop-up parks

Ballarat Street pop-up park in Yarraville 2014

Community gardens

Docklands Community Garden

Floating habitat

Floating vegetation bed in canal

River restoration

Yarra river restoration

Biodiversity-friendly sculpture

Gardens by the Bay, Singapore

Storm water harvesting

Planting above an underground storm water harvesting scheme in East Melbourne

Sound barriers

Kennedia nigricans climbers Citylink Tulla
Source: VicRoads

Structurally-complex roadside vegetation

L-R: Amsterdam, and Morrah Street Parkville

CHAPTER 6:
SHOULD WE INCREASE NATURE IN THE PRIVATE REALM?

Triptych Apartments, Southbank

There are many ways municipalities can assist the community and businesses to improve nature within the private realm. Pathways include providing incentives and regulation, but also the provision of training resources and educational materials. A key recommendation for increasing the uptake of green infrastructure in the private realm includes developing showcase sites, development of easy to use guidelines and policies that allow for skills development of the industry, development of incentive schemes and clearly expressing the aspirations, goals and targets for any greening programs (GHD, 2013).

Incentive programs provide one way to increase green infrastructure on private property, and therefore contribute to the development of a sustainable and resilient city. Incentive programs can include financial and non-financial incentives, and target specific locations or issues including combined sewer overflows, increasing groundwater recharge, improving CBD walkability and access to green spaces. Different types of incentives can be used to offset the cost of implementation, but also to encourage behaviour change. Incentives programs may include grant or reimbursement programs, penalties for failure to comply, lower permit or development fees for the implementation of targets, or a qualification for more intense development if certain conditions are met.

Grant and award programs may be open to the private realm and community groups to fund improved green infrastructure practices and recognise low-impact development. Examples include grants to fund installation of green infrastructure in commercial, industrial or residential properties located in areas of interest. Features that may attract funding or reimbursement may include permeable paving, stormwater capture or harvesting, or green roofs, walls and facades. Rebates could be proportional to the benefit of the installation, for example the amount of stormwater run-off captured. Furthermore, if successful projects receive awards or recognition, the awareness of green infrastructure solutions may be increased throughout the public and private realms.

City of Melbourne has several resources that are available to facilitate wildlife friendly gardening practices and greening initiatives in the private realm, such as the Sustainable Gardening booklet, the Greening Melbourne's Laneways initiative and the Growing Green Guide.

Successful strategies for involving the private realm in enhancing urban nature

Faenza, Italy

The municipality implemented a bio-neighbourhood incentive program for developers, included in their Planning Regulations. This program achieves energy savings, promotes aesthetics and creates better microclimate conditions in preparation for increased temperatures due to climate change. If developers create buildings with green roofs, walls and water retention systems, in addition to contributing to public green spaces, then they are allowed to extend the external surface area of their buildings in excess of approved standards. The agreement between developers and the city authorities allows for the timely processing of permits, providing an incentive to engage in this type of scheme.

Basel, Switzerland

Basel has the highest area of green roof per capita in the world. They achieve this by a combination of financial incentives and building regulations. Building regulations have required the use of green roofs since 2002, which were initially driven by energy-saving programs and afterwards by biodiversity conservation. The focus on green roofs was promoted by the University community, who worked to influence decision-makers to amend building regulations and offer financial incentives to increase green roof coverage.

Portland, USA

Portland has developed incentive programs such as the Ecoroof Incentive and Clean River Rewards program. The first program has been successful in assisting in the establishment of 17 ha of ecoroofs which are lightweight and low maintenance, offering the property owners reimbursements of US$5 per square foot of eco-roof for retrofitting properties larger than 11m^2, also making the process simple and easily accessible. The second program offers a discount in stormwater utility fees to private-property owners who manage stormwater on site.

Discussion point

- How can the private realm contribute to urban nature?
- How can the City of Melbourne involve the private realm in supporting urban nature?

CHAPTER 7: WHAT SYMBOLISES NATURE FOR MELBURNIANS?

Kookaburra, *Dacelo novaeguineae* Source: Museum Victoria

Rounded leaf noon flower *(Disphyma crassifoliuis ssp. Clavellatum)*

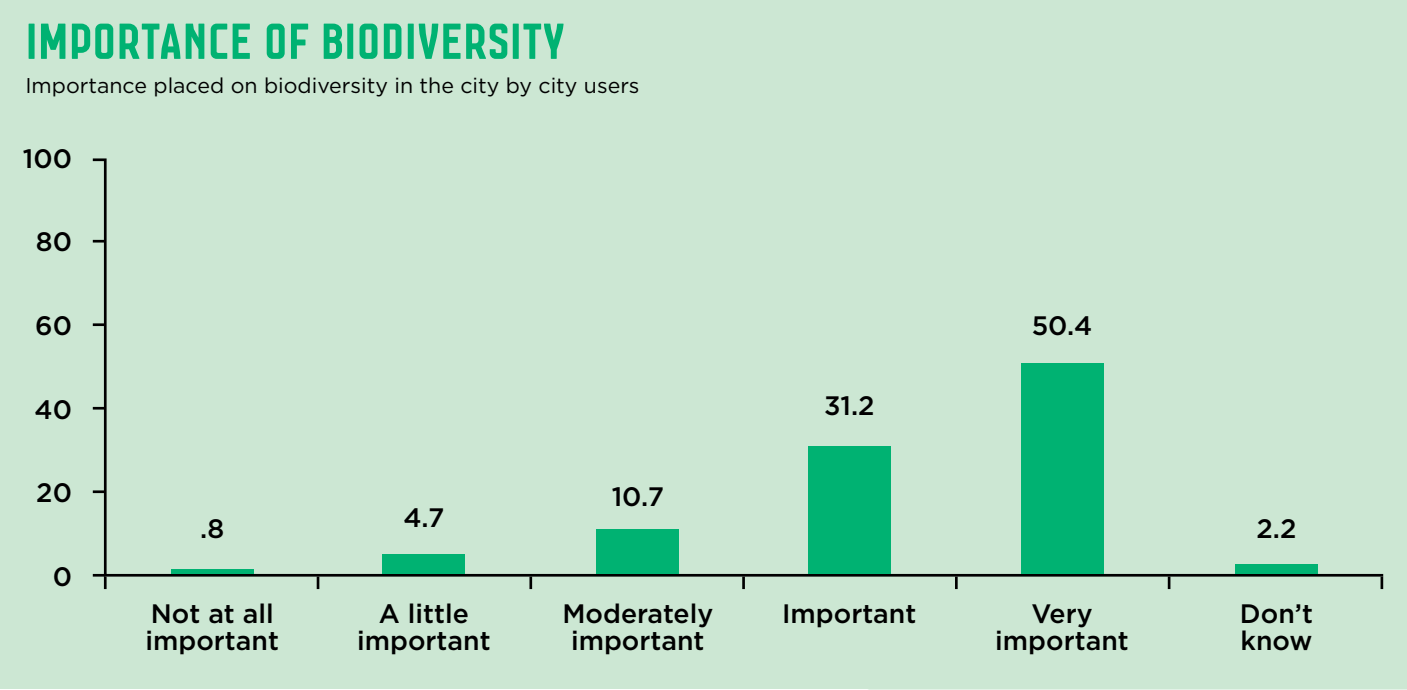


Figure 3: Percentage of responses to the importance of biodiversity in the City of Melbourne, from city user's survey, 2014.

Urban biodiversity is not just about plants and animals. Biodiversity has different values to different people, and can have many important social functions. In cities, biodiversity can help to connect people with nature and natural processes. A diversity of organisms provides different pathways for people to connect with nature. Native biodiversity can contribute to the distinct identity of a city or neighbourhood, helping create a sense of place that differs from other cities (ARCUE, 2012). Introduced biodiversity can help people from different cultural backgrounds adjust to living in a new place by seeing familiar plants and animals. Both native and introduced biodiversity connect people to their ancestors and the natural and cultural history of Melbourne.

In early 2014, we conducted two surveys of residents, workers and visitors to better understand what biodiversity means to people, what biodiversity people experience in the city and how important it is perceived to be. The first survey included 158 people, who were surveyed in nine locations that encompassed public parks, transport hubs, community centres and at public events focussing on the environment. Seventy-nine percent of the people surveyed, had heard the term biodiversity before, with little difference in response between males and females. People under 25 years old were the least familiar with the term biodiversity, and people over 45, particularly in the 65 years and older bracket, were the most familiar with the term, where over 80 percent of people in this demographic had heard of the term. When asked what biodiversity people see around the city, most people recognized different creatures living around the city. Plants were the most commonly recognized component of biodiversity, followed by birds, while reptiles, amphibians and insects were the least commonly observed component of biodiversity. In a larger survey of over 600 city users, more than 50 percent of people agree that biodiversity in the City of Melbourne is 'very important' (see Figure 3 above), even though these people experience biodiversity in different ways.

Many cities have a single species as an emblem, to assist in making all of the components of biodiversity more visible to the wider community. However, there are many other ways we can represent and promote biodiversity, including the use of multi-species icons, creating biodiversity focussed events such as nature festivals and bio-blitzes, installing eco-art and supporting an iconic site. For example, a suggested floral emblem for the City of Melbourne includes the rounded leaf noon flower *(Disphyma crassifoliuis ssp. Clavellatum)*, for its historic significance to the region, shown on page 24. Similar fauna emblems may also be used to represent iconic or regionally important fauna species occurring in the City, such as White's skink *(Egernia whitii)* of Royal Park, which is the emblem of the Friends of Royal Park group.

Emblems of urban biodiversity and ecosystem services

Return of the Sacred Kingfisher Festival, CERES

Each year, CERES (Centre for Education and Research in Environmental Strategies) holds an annual community celebration welcoming the Sacred Kingfisher back to its original habitat, along the banks of the Merri Creek in Brunswick. The Sacred Kingfisher bird has become a symbol of hope, connecting people and place. It is a community ritual and a working process with the Wurundjeri people, various cultural communities and performers of all ages and abilities. As long as the Kingfisher returns each year in Spring, it is a sign the local environment is being cared for.

Giant Panda icon, World Wildlife Fund

The giant panda is perhaps the most powerful symbol in the world when it comes to species conservation. In China, it is a national treasure, and for WWF the panda has a special significance. It has been the organisation's symbol since 1961 when WWF was formed.

Discussion points

- What species are characteristic of Melbourne and should we have an emblem species?
- Could the City of Melbourne promote stories from indigenous culture that represent nature in Melbourne?

White's skink, *Egernia whitii* Source: Museum Victoria

CHAPTER 8:
HOW CAN ECOLOGY HELP US RESPOND TO CLIMATE CHANGE?

Princes Park

The predicted impacts of climate change include rising temperatures, heat stress, water security, sea level rise, flooding, food security, biodiversity loss and ocean acidification. As our city continues to develop, there will be increasing areas of impervious surface which will increase the urban heat island effect. Options for adaptation include shaping urban development and infrastructure towards more sustainable solutions and low carbon pathways (Van Staden, 2014).

Ecosystem driven climate adaptation such as increasing green infrastructure can be complex and require time for implementation but can provide multiple benefits such as shade, evaporative cooling, rainwater interception and infiltration whilst increasing human health and wellbeing. Increasing green cover can help to reduce rainfall runoff by increasing interception. An increase in green cover of 10 percent can reduce the impact of a rain event by close to 28mm. The incorporation of green roofs can reduce rainfall runoff in areas with high building cover up to 18mm per rain event.

Urban temperatures are reduced in areas with higher green cover, whereas low levels of vegetation in city centres can increase temperatures between 3 to 7°C. For the City of Melbourne, increasing vegetation in open spaces, encouraging greening in private property and street planting will help to maintain and reduce urban temperatures (Gill et. al., 2007). It is expected that through the implementation of the Urban Forest Strategy, doubling the canopy cover will decrease municipal summertime temperatures by 4°C.

Carefully planned green infrastructure can help alleviate impacts of climate change to the most vulnerable sectors of society. Priority areas to increase green cover (via creating open space and tree plantings) should be made with consideration to where the most vulnerable populations live, including children, the elderly and socio-economically disadvantaged people. Planting choices should also consider the tolerance of species to a range of extreme drought periods, how the plants may improve site conditions, how the species may age, and the total diversity of species used in an area. Sites with a greater diversity of plant species will have increased resilience in the face of climate change. Many water sensitive urban design features can contribute to climate change adaptation, and should also be considered for reducing run-off and storing water. Any green infrastructure initiatives should also consider the harvesting of rain and stormwater, recycling of grey water, and the storage of floodwater for efficient irrigation. Green infrastructure is dependent on soil health, so initiatives must consider soil biology, soil fertility and soil structure.

How City of Melbourne is responding to climate change

Temperature differences of up to 7˚C have been recorded between the urban centre and Melbourne's surrounding rural landscape, with the dome of the heat island centred on the City of Melbourne's municipality (ARCUE, 2012). By 2070, the average temperature is predicted to increase by 3.4˚C due to global climate change based on business-as-usual scenarios (City of Melbourne, 2009). Managing these urban stressors will enable a broader range of species to persist within the City of Melbourne. The urban forest and open space play an important role in mitigating the impacts of these urban stressors, as outlined in the City of Melbourne's Urban Forest Strategy and Open Space Strategy. There are also opportunities to consider how these urban stressors may be influencing biodiversity, a key consideration for the strategic framework that will be developed.

Some of the risks that Melbourne is subjected to under climate change include reduced rainfall and more frequent periods of drought, extreme heatwaves and bushfires, intense rainfall events, wind storms and sea level rise. The City of Melbourne's Climate Change Adaptation Strategy explores the impacts of climate change on transport, communications, water supply, emergency services, built environment and social systems. We have also developed greenhouse action plans; created guides to sustainable gardening; local food production; how to build green roofs, walls and facades; funded urban forest projects to improve water efficiency in parks and gardens; trialled cool roof techniques; encouraged projects using water sensitive urban design; and assessed the economic impact of the urban heat island effect.

Successful strategies to respond to climate variability

New Orleans, USA

Following hurricane Katrina the city decided to use structural and non-structural solutions to increase resilience of the city to sea level rise, hurricanes and river flooding. One of the main solutions was the restoration of wetlands to act as buffer zones, with detailed actions included in the city master plan, involving restoration of the natural delta, constructing marshes from dredged material, and wetland conservation. Structural solutions included flood defences such as levees and flood gates. In addition to adapting to climate change, the New Orleans strategy also aids biodiversity conservation.

Stuttgart, Germany

Stuttgart had increased urban heat island issues and poor air quality, and actions were taken to mitigate both of these threats. Urban planners exploited the role of natural wind patterns and dense vegetation for the purpose of reducing overheating and improving air pollution. A Climate Atlas was developed for the Stuttgart region, mapping the distribution of temperature and cold air flows according to the city's topography and land use. Based on this information, a number of planning and zoning regulations were recommended which aim to preserve open space and increase the presence of vegetation in densely built-up areas. The planning recommendations build on the legislative framework of the German Building Code and other national, regional and locally developed regulations.

Discussion points

- How can ecology help us respond to and create resilience to climate change?
- What climate impacts do we need to consider for the city's biodiversity and ecosystems?

CHAPTER 9:
HOW CAN MELBOURNE DEMONSTRATE LEADERSHIP?

Source: Jodi Jackson

Cities are hubs of information and innovation – Melbourne is no different. The City of Melbourne could show both local and international leadership in urban ecology and biodiversity by providing best practice and innovative new examples of good governance and management of the public realm. Our city is part of a global ecosystem and we are in a unique position to show leadership to become an ecologically resilient city.

Leadership becomes important when we consider the range of global biodiversity and ecosystems that are under threat. Just as the ecological footprint of a city can have a negative impact far beyond municipal boundaries, city actions can also have a far-reaching positive impact and influence.

Cities can raise biodiversity issues and share lessons through networks such as those established under UNESCO's Man and the Biosphere Programme (MAB), which focuses on the sustainable use and conservation of biological diversity, and the improvement of the relationship between people and their environment or networks of megacities like C40 Cities which aims to harness city innovation to reduce greenhouse gas emissions.

As the global population becomes increasingly urbanised, we risk disconnection from nature unless we start to fundamentally rethink the role and importance of nature within the urban fabric. Now is the time to consider how strong leadership for this city could enable us to unleash the potential of nature, and continue to maintain a liveable city in a climate challenged future.

Examples of governments leading the way in biodiversity, urban ecosystems and the planning for ecosystem services

New York

The New York Smart Growth Program follows sensible, planned growth that integrates economic development and job creation with quality of life by preserving the built and natural environment, seeking to discourage development in open space and encourage growth in developed areas with existing infrastructure. This combination of community planning, land use regulations, government incentives and individual actions have turned investment towards improving the city environment and the quality of life for residents. Environmental benefits include reduced energy and vehicle use; green development; improved water quality due to retaining large areas for absorbing and filtering water naturally; improved habitat and ecosystem function due to building compactly; and improving residents connection to nature by creating spaces in neighbourhoods that allow nature based recreation.

Cape Town, South Africa

Cape Town is an urban hotspot within the Cape Floristic Region with 19 national terrestrial vegetation types, wetlands and coastal ecosystems and 190 endemic plants species. Cape Town is also challenged by high rates of population growth increasing by 55,000 people per year, which significantly increases the risk of biodiversity loss. To deal with this risk, the City established a systematic biodiversity plan that involved: extensive communication, education and public awareness; negotiation of the management of public land; and, improvements in the stewardship of biodiversity on private land. The municipal Biodiversity Plan is aligned with national legislation and policy, such that biodiversity is considered at the municipal level when proposals for new development areas are made. The City created a spatial BioNet plan that defines three different areas: existing conservation areas; areas that are critical for biodiversity; and areas critical to support ecological function. These areas have targets that were established by researchers based on the conservation of vegetation types, species or populations (Holmes et. al., 2012).

Discussion points

- What do we need to do to advance our approach to urban ecology?
- What aspects of global biodiversity and ecosystems under threat should we be most concerned about for our city?

SELECTED RESOURCES

Video Links

Melbourne's Urban Forest:
http://www.youtube.com/watch?v=BplUmxFCE8A

Melbourne's Stormwater Harvesting:
http://www.youtube.com/watch?v=XV4lpOV3faw

Stockholm Resilience Centre on Biodiversity:
http://www.stockholmresilience.org/21/research/research-news/10-4-2013-rich-biodiversity-can-exist-in-and-around-cities.html

Guerrilla Gardening
http://www.youtube.com/watch?v=EzZzZ_qpZ4w

Miracle on Elmer Avenue:
http://www.youtube.com/watch?v=bwcK8IWawY0

Put a value on Nature:
http://www.youtube.com/watch?v=A-QpKiU-NHo

New York's Streets:
http://www.youtube.com/watch?v=LujWrkYsl64

Better block: http://www.youtube.com/watch?v=ntwqVDzdqAU

LA's ecosystems: http://www.youtube.com/watch?v=uGzbDmgQHTo

Milan: http://www.youtube.com/watch?v=zy2hn8PizwI

Cities need bees: http://www.youtube.com/watch?v=DwGoZA8ZpHo

Websites

http://www.thenatureofcities.com/
A regularly updated blog authored by a collective of leading international academics and thinkers on urban nature.

www.MAweb.org
The Millennium Ecosystem Assessment (MA) is a United Nations initiative that provides decision makers and the public with scientific information concerning the consequences of ecosystem change and options for responding to those changes.

www.unep.org
United Nations Environment Programme (UNEP) is the principal environment organization of the United Nations system. It supports governments and their partners to develop and implement environment policies and activities.

www.nature.org
The Nature Conservancy works to preserve the plants, animals and natural communities that represent the diversity of life on Earth.

Books

http://cbobook.org/?r=1&width=1366

REFERENCES

ARCUE - Australian Research Centre for Urban Ecology 2012, Urban Biodiversity and Ecology Report

ARCUE - Australian Research Centre for Urban Ecology 2004, A Review of Biodiversity in the City of Melbourne.

City of Melbourne 2009, 'City of Melbourne Climate Change Adaptation Strategy.' Published online: melbourne.vic.gov.au/climate_change_adaptation_strategy.PDF

Fairman T A, Livesley S J, Summers J, Shears I, & Pohls O 2010, 'Using stratum to estimate the benefits of street trees in Melbourne, Victoria.' Master's Thesis, The University of Melbourne, Parkville, Australia.

GHD 2013, 'Green Infrastructure and the Private realm: International Review report.'

Gill S E, Handley J F, Ennos A R, Pauleit S 2007, 'Adapting cities for climate change: the role of green infrastructure.' Built Environment 33(1), 115-133

Gómez-Baggethun, E & Barton D N 2013, 'Classifying and valuing ecosystem services for urban planning. Ecological Economics 86: 235-245

Holmes P M, Rebelo A G, Dorse C, Wood J 2012, 'Can Cape Town's unique biodiversity be saved? Balancing conservation imperatives and development needs.' Ecology and Society 17(2), 28

Hosteler M, Allen W, Meurk C 2011, 'Conserving urban biodiversity? Creating green infrastructure is only the first step.' Landscape and Urban Planning 100, 369-371

2011, 'Metropolitan Melbourne Investigation: Final Report.' Victorian Environmental Assessment Council

http://www.veac.vic.gov.au/investigation/metropolitan-melbourne-investigation

Millar, S, McMenamin, B & Adato, A 2014, 'Green infrastructure Incentive for residential property in the City of Melbourne.' School of Global, Urban and Social Studies, RMIT

Millennium Ecosystem Assessment (MEA) 2005, 'Ecosystems and human wellbeing: a framework for assessment.' Millennium Ecosystem Assessment Series. Island Press, Washington DC

National Biodiversity Strategy Review Task Group 2009, 'Australia's Biodiversity Conservation Strategy 2010–2020.' Report, Australian Government, Department of the Environment, Water, Heritage and the Arts, Canberra, ACT

http://www.environment.gov.au/system/files/pages/50e1085f-1ef9-4b25-8275-08808133c346/files/biodiversity-conservation-strategy2010-2020.pdf

UN-Habitat 2011, 'Cities and Climate change. Global Report of Human Settlements.' United Nations Population Fund, 2007

http://unhabitat.org/publications-listing/cities-and-climate-change-global-report-on-human-settlements-2011/

URBES 2014, 'Urban biodiversity and ecosystem services. Factsheet 1.' www.urbesproject.org

TEEB - The Economics of Ecosystem Biodiversity 2011. TEEB Manual for Cities: Ecosystem Services in urban management. www.teebweb.org

Van Staden R 2014, 'Climate change: implications for cities. Key findings from the Intergovernmental Panel on Climate Change Fifth Assessment report.' University of Cambridge, ICLEI

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