WHAT WE HEARD: DOCUMENTING THE STAKEHOLDER WORKSHOPS

MARCH 2017

URBAN ECOLOGY RENEWAL INVESTIGATION PROJECT

NSW GOVERNMENT | NSW Environmental TRUST

THE NATIONAL GREEN INFRASTRUCTURE NETWORK

Urbanisation is changing the shape and composition of our cities, putting major pressure on biodiversity, water resources, and human health and well-being.

With a growing amount of public and private investment on infrastructure and urban renewal, it is imperative that we inject new rigour into processes that ensure ecological considerations are given a priority in both policy and practice.

To reach this ambitious goal, effective multi-stakeholder engagement is needed to set a collective vision for our cities and suburbs, and achieve this vision through collaboration and innovation framed within the legislative mandate for ecologically sustainable development.

Executive Summary

The UERI project has benefited from the involvement of over 100 people who participated in one of the workshops, a one-on-one interview, a focus group discussion, advisory committee, or a think tank. The engagement with people from diverse agencies and organisations and at numerous levels of influence, has provided a means to draw comparisons with the material uncovered in the literature reviews.

The conversations and interaction amongst the participants expanded our understanding of people's personal knowledge, perceptions and experiences of the issues related to urban ecology and urban development, gained through their own work and daily 'lived experiences'.
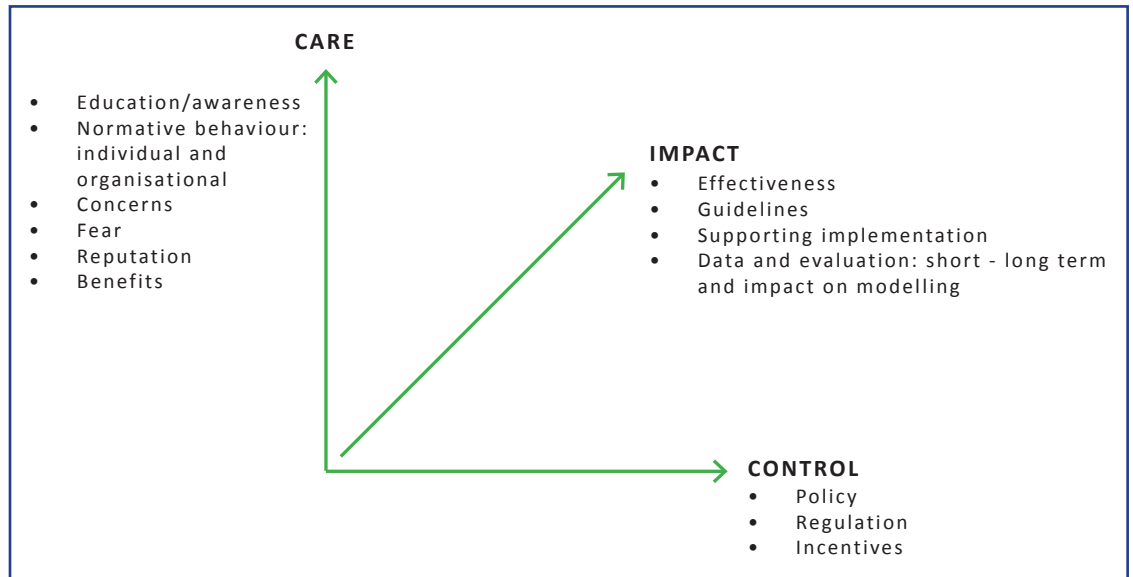
The focus of the research project has been the major cities of NSW: Sydney, Wollongong and Newcastle. We anticipated that participants in the workshops held outside the Sydney CBD would raise slightly different issues, more specific to their locales and/or bioregions. This held true, and was probably most evident in the Wollongong workshop where participants typically framed their discussion of that city's urban ecology in relation to the distinctive topography of the escarpment and its resulting ecosystems.

Another factor that influenced the issues raised for discussion at the workshops was the group of people in the room, and in particular, the organisations and agencies that were represented. At the Wollongong, Parramatta and Newcastle workshops, the proportion of participants representing various departments of local government were 44%, 47% and 65%, respectively. Not surprisingly, in those workshops, the topics of discussion frequently returned to policy and regulation, council procedures (e.g. open space ratios and DA certification), and a call for better integration between local and state government offices to resource, implement and maintain environmental projects.

The expressions of participants' concern and insight have provided indicators for how best to disseminate the messages in the final Blueprint—a product which will potentially have wide distribution and a broad scope of influence from individual urban residents to decision makers at the highest levels of local and state government. Ultimately, many of the people who have contributed to these sessions may well be people who help us deliver the messages of the Blueprint.

During one of the early workshops, Peter Davies, the Project's Lead Researcher, sketched a diagram (see following page) that captured the key themes of the workshop discussions about various ways of achieving urban ecology renewal. In summary, the topics that had been raised seemed to fall into one of three categories: Care, Impact, and Control. We interpreted the themes related to "care" as representing values, benefits, concerns, attitudes, awareness (or lack of), individual or institutional behaviours toward urban ecology that needed to be shifted or refocused or better informed. Comments under the theme of "impact" pointed to the a middle ground approach to increased effectiveness of programs to positively impact urban ecology outcomes such as guidelines, supporting

implementation programs, data and evaluation, modelling scenarios, envisioning short to long term prospects. Finally, discussion of possible "controls" identified high level policies, regulations and incentives to be legislated and enforced, requiring a compulsory or obligatory approach to achieving urban ecology renewal. In summarising the key points that have emerged from the workshop sessions, they have been organised under one of these three categories, as shown below.

CARE

- Education/awareness
- Normative behaviour: individual and organisational
- Concerns
- Fear
- Reputation
- Benefits

IMPACT

- Effectiveness
- Guidelines
- Supporting implementation
- Data and evaluation: short - long term and impact on modelling

CONTROL

- Policy
- Regulation
- Incentives

CARE

Defining urban ecology: It is critical to have a clear working definition of urban ecology that clearly regards human beings as integral to urban ecosystems. Further, humans have agency in shaping the creation, or destruction, or urban ecosystems, and so play a critical role in protecting and/or renewing urban ecology. Put simply, a working definition of urban ecology must acknowledge the integration of nature, people and the built environment. Acknowledge and give serious consideration to the fact that urban landscapes are cultural landscapes, that is, they have been shaped and modified by human beings for many thousands of years—in Australia, not just since 1788.

Understanding context and scale: Address the various settings and contexts in which people interact with, impact and have the potential to renew urban ecology in their work and personal activities. Most of the participants in the workshops could identify how in their daily work lives, they intersected with issues relevant to urban ecology.

Shifting the narrative: Urban ecology renewal projects can generate multiple benefits. Green infrastructure, in particular, has the prospect of achieving co-benefits, for example, in providing ecosystem services, creating connected greenspace for human recreation and linkages for species movement. The story of how these benefits are achieved must be made known more broadly to garner public support.

Education: Various types of education programs, aimed at diverse audiences from children and young people, to local community groups, business owners, elected officials, decision makers in government is needed to help change perceptions and assist people to better understand the issues, identify shared values, and engender commitment to supporting biodiversity protection, resilience and renewal. Education can also help shift the narrative to feature positive messages for healthy cities and healthy urban dwellers.

IMPACT

Inspiring exemplars: Showcase examples of better design, new techniques and technologies that will be relevant to a range of professions and that demonstrate what can be achieved; both local and international examples. Participants named specific projects and identified the kinds of initiatives they believed could be influential with decision makers, particularly at the local government level. These include projects delivered by the private sector on urban developments, infrastructure projects delivered by state government, speculative university projects that project future opportunities.

Leaders and champions: Incentive schemes and social marketing programs to support the champions for change required to boost decision making toward urban ecology, including resourcing for education campaigns, pilot and/or demonstration projects, etc.

Measuring performance: Tools need to be developed, specific to the urban conditions of NSW's major cities, and provide a means of measuring "success" with specific initiatives.

Ongoing research: The evidence-based approach to decision making and policy development requires ongoing research, data generation and analysis, to inform the best ways forward.

CONTROL

Top down, bottom up: Vertical integration of policies and programs for implementation is required from local>state>federal governmental levels to achieve an alignment of aspirations and intentions. The very structures of state and local government agencies need to be reviewed and clarified.

Rigorous policies: Noting the relative efficacy of "the carrot" versus "the stick", participants recognised that rigorous planning and policy instruments needed to be in place that are enforced to actually change business as usual. Strong legislation with clear mandates was largely endorsed, e.g. green infrastructure elements, such as WSUD, green roofs and walls. Conversely, local government officers also noted the reality that they had to "go by the book" in assessing proposals and would like to have more autonomy in promoting innovative approaches to, for example, development and local scale greenspace infrastructure.

Build on work underway: The NSW Government Architect's Green Grid and Green

Cover projects have provided clear, imageable frameworks to focus the public's and government agencies' efforts to create an interconnected network of urban greenspace across the Sydney metropolitan region—an idea that could be similarly modelled for NSW's other major cities of Newcastle and Wollongong. The work being undertaken by the Environmental Panel of the Greater Sydney Commission (GSC) has been running parallel with the Urban Ecology Renewal Investigation and the GSC Environment Commissioner has participated in several UERI workshop sessions, which has potentially provided valuable crossover.

Valuing biodiversity and ecosystems: This refers in a broad sense to people having strong environmental values, and as such would sit under the "Care" category. Here the discussion referred to how a rigorous economic evaluation could be used, for example, to account for ecosystem services and co-benefits that could capture the costs and benefits to society. This could simply focus on the opportunity costs of inadequate public open space for active recreation or be applied more broadly to value ecosystem services from a liveability perspective.

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Introduction

The NSW Environmental Trust engaged the National Green Infrastructure Network (NGIN) to collaborate with the NSW Environmental Trust and stakeholders to undertake the Urban Ecology Renewal Investigation Project. The project is led by Macquarie University with a team of specialists from a broad consortium of research partners, including the University of Sydney, the University of New South Wales, University of Technology Sydney and CSIRO.

The aim of this project is to create a Blueprint to provide the evidence-based case for the conservation, management and enhancement of urban ecology for Sydney, Wollongong and Newcastle. The Blueprint will be relevant to government, industry and the community. There are three streams of research being undertaken as part of this project. They are urban biodiversity and ecology; built environment and landscape design; and planning and policy. The interaction of these research themes will provide an assessment of how urban ecology is integrated in policy and practice in the major cities in NSW and beyond. Importantly, the Blueprint will recommend ways forward to transform our cities based on ecological principles.

As part of our research agenda and consultation, the research team has:
• Undertaken a systematic review of literature, science, current practice and cutting-edge case studies to form a strong evidence base.
• Held five stakeholder workshops with state and local government, industry, professional peak-bodies, and community and research organisations, with two of these workshops held in regional cities, Newcastle and Wollongong.
• Held individual in-depth interviews with key stakeholders.

We have also held a 'Think Tank' session with high level executive decision-makers and practitioners to review the draft desktop review of literature and the draft Blueprint.

As part of this stakeholder consultation, we wanted to consult with representatives from as wide a range of public, private, non-for-profit and peak industry organisations as possible, to understand their perspectives about what urban ecology is and how it relates to their work.

To ensure that the project captured a wide spectrum of opinions and experiences we invited a diverse range of participants from a variety of professional backgrounds whose work and community activities relate directly or indirectly to urban ecology renewal. This document records the comments and ideas that arose during the sessions we conducted. A full

list of attendees at the workshops and the organisations they represented is included at the end of the document, however, specific comments are not attributed to individuals throughout the report.

WHAT WE ASKED

We asked the participants a series of questions about urban ecology in the context of cities. These questions varied slightly across the workshops, depending on factors including participant background, location, recent events and discussions within the workshops. Questions included:

• What is urban ecology, and what does it mean to you in your context?
• What are some examples of urban ecology?
• How do you work with the ideas and issues of urban ecology in your daily work? What does and doesn't work?
• What is it going to take to create change and improve urban ecology outcomes?
• In your experience, and in your organisation, what are the best points of interventions, policies, actions, to create change?
• What would it take to influence or boost decision making in your organisation or field to favour urban ecology?

Each workshop was three and a half hours long. Participants were divided into small groups of about six and were asked to discuss questions posed. The first three questions formed the first part of the workshop and were designed to form a common understanding of the term 'urban ecology'. The final three questions explored what opportunities exist for urban ecology renewal. Participants were asked to move tables after the first round to promote diversity in the conversation and ensure that stakeholders had an opportunity to interact with as many individuals as possible. After each question, participants were asked to report back to the whole group with a summary of their discussions.

The workshops were conducted in line with ethics approval issued by the UNSW Human Research Ethics Advisory (HREA) Panel E: Built Environment.
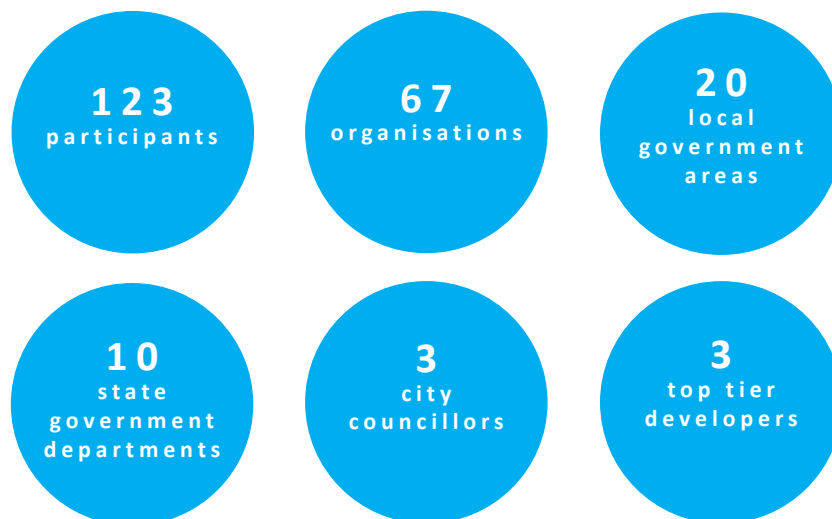
This report forms part of the evidence case, along with the Desktop Review of Literature, to inform the Blueprint for Living Cities: Policy to Practice.

| Urban Ecology Renewal Investigation Project - What We Heard: Documenting the Stakeholder Workshops | + | Urban Ecology: theory, policy and practice in New South Wales, Australia | → | Blueprint for Living Cities: Policy to Practice |

Participating organisations

AECOM
Allied Tree Consultancy
Ashfield Council
Aspect Studios
AUSGRID
Australian Association of Bush Regenerators
Australian Institute of Landscape Architecture Fresh
Bankstown Council
Biosis
Birds in Backyards
Blacktown City Council
Botanic Gardens & Centennial Parklands
Bush-it Pty Ltd
Central Coast Council
City of Canterbury-Bankstown
City of Parramatta Council
City of Sydney
Clean Air and Urban Landscapes Hub, University of Melbourne
Conservation Volunteers Australia
Cooks River Alliance
Corkery Consulting
Department of Environmental Sciences, Macquarie University
Ecological Consultants Australia
e2 Design Lab
Frasers Property Australia
Fungimental
Gecko Plantscapes
Georges River Combined Councils Committee Inc.
Greater Sydney Commission
Green Roofs Australasia
Hornsby Shire Council
Horticulture Innovation Australia
Hunter Development Corporation
Infrastructure Sustainability Council of Australia
Junglefy
Ku-ring-gai Council
Lake Macquarie City Council
Landscape Architecture Program, Faculty of the Built Environment, UNSW
Leichhardt City Council
Macquarie University
Maitland Council
MidCoast Council
Mirvac

National Parks Association of NSW
Nature Conservation Council of NSW
Newcastle City Council
NSW Department of Planning and Environment
NSW Department of Primary Industries
Northern Beaches Council
Office of Environment and Heritage
Parramatta City Council
Parramatta River Catchment Group
Penrith City Council
Property Council of Australia
Rockdale City Council
Shellharbour City Council
Southern Sydney Region of Councils
Sustainable House
Sutherland Shire Council
Sydney Coastal Councils Group Inc.
Sydney Environmental and Soil Laboratory
Sydney Olympic Park Authority
Transport for NSW
Urban Biodiversity Illawarra
University of Newcastle
University of Wollongong
Waverly Council
Western Sydney Parklands Trust
Wollongong City Council

123
participants

67
organisations

20
local
government
areas

10
state
government
departments

3
city
councillors

3
top tier
developers

WORKSHOP 1: SYDNEY CBD

Barangaroo Headland Park, Sydney

QUESTION 1. WHAT IS URBAN ECOLOGY, AND WHAT DOES IT MEAN TO YOU IN YOUR CONTEXT?

The aim of this question was to generate a collective understanding of what urban ecology is or can be, and to bring into light different perspectives of urban ecology.

Participants provided different definitions of urban ecology. This tended to depend on their professional background and work place or context.

Definitions of urban ecology focussed on the intersection of the built and natural environment, and the effect of humans. Recurring themes and key words associated with urban ecology included:
- biodiversity,
- systems (ecosystems, biological systems), and
- biodiversity corridors.

"Urban ecology is a dynamic system that is continually adapting to the influences of human interactions."

Most participants referred to urban ecology in the context of an ecological system. For others urban ecology was positioned as part of the built environment. There were various responses that considered the geographic scale of urban ecology. Many referred to interconnected ecological systems at a large, city-wide scale.

Participants also discussed the flow on benefits of urban ecology and the challenges of dealing with managed ecosystems in urban contexts. Specifically, social and mental health benefits of urban ecology were discussed along with economic benefits (e.g. reduced energy cost induced by cooling building via tree shade). Overall comments noted the importance to demonstrate the benefits of urban ecology through pilot projects of different scales and timeframes. In order to obtain more buy-in, a broadening of the information (and accessibility) of benefits was suggested.

"Urban ecology is an adaptive and dynamic force that is being shaped and managed by humans which provides multiple services within urban metabolism and biodiversity in an urban environment."

Some participants specifically conceptualised the definition of urban ecology in the context of Sydney. They noted that Sydney is a modified environment and while it is constantly changing, they highlighted the importance of maintaining diverse ecological communities to attract favourable species and reduce pests. It was

noted that urban ecology will also improve the resilience of the city.

Urban ecology was also described as a biodiverse ecosystem supporting a vibrant, sustainable and healthy community which is valued by people and policy. Public perceptions of natural ecosystems, their conservation and the notion of aesthetics have an important role to play in discourse around urban ecology.

Urban ecology was also considered to be about designing green space within building envelopes and footprints. This responds to Sydney's urbanised setting, where buildings and greening must be integrated in order to achieve urban ecology outcomes.

Participants identified that urban ecology tries to bring balance through the notion of equilibrium. It is a combination of biological, human and physical components.

> *"Urban ecology is an integration of two opposing views (human/renewal versus biodiversity) that can be joined together to find value for both sides."*

Workshop participants share ideas about urban ecology

QUESTION 2. WHAT ARE SOME EXAMPLES OF URBAN ECOLOGY?

Following from the participants' conceptual definition of urban ecology, this question sought to provide an understanding of the practice of urban ecology. In framing the question, participants could nominate any example, be it national or international, of urban ecology. Many however focused on local examples relevant to their place of work, with the majority being within the Sydney CBD.

Examples of urban ecology mainly focused on incorporating natural systems into the built environment. While most examples were built projects, some participants also offered examples of policy.

Water Sensitive Urban Design A variety of Water Sensitive Urban Design (WSUD) examples were mentioned by many participants, including rain gardens, constructed wetlands and bioswales. Specific sites included Addison Road in Marrickville, Victoria Park in Zetland, the Rouse Hill stormwater detention ponds and Sydney Park. These projects were referred to based on 'soft' landscape principles rather than 'hard' engineered solutions[1].

Landmark buildings and parks The recently completed One Central Park in Chippendale was identified by numerous individuals throughout the consultation. This is a mixed use residential commercial tower

Constructed wetlands at Sydney Park.
Source: City of Sydney (taken 2016)
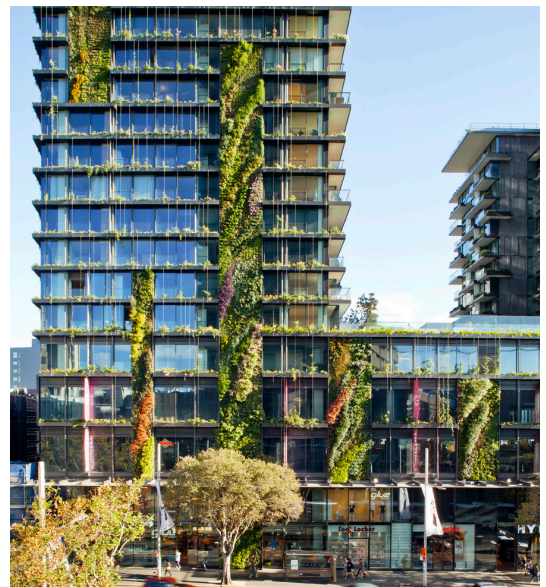
One Central Park, Chippendale.
Source: Simon Wood (taken 2015)

1 'Soft' design solutions are vegetation based, e.g. bioswales. 'Hard' design solutions are constructed, engineered solutions, e.g. concrete lined channel.

with green walls and roof. Green walls and green roofs were also mentioned more generally.

Barangaroo Headland Park in the Sydney CBD was an example of a park that was identified as exemplifying 'urban ecology'. The park was identified as a site that was redeveloped and in that process, created urban habitat and improved biodiversity.

Cheonggyecheon in Seoul, South Korea, was mentioned. This project replaced a freeway with green space for public recreation.

Remnant bushland
Participants also gave examples of remnant pockets of bushland throughout the city and the Sydney coastline. However, these 'natural' urban ecology examples were not the dominant type of example participants presented.

The scale of urban ecology
There were discussions about the scale of urban ecology, ranging from the micro to the macro scales. At the micro level, site specific examples such as a nature strip that had been turned into a native garden were raised. At the macro scale, participants suggested biodiversity corridors such as those identified in Sutherland Shire Council's Greenweb Strategy[2] and River to River Wildlife Corridor (Ryde City and Hunters Hill Councils)[3]. These projects show what local councils are doing in their own areas.

Programs and initiatives
Examples of national initiatives included National Tree Day, run by Planet Ark. A research institution led project 'Habitat Stepping Stones'[4], designed and developed by the Australian Research Institute for Environment and Sustainability (ARIES) at Macquarie University was also mentioned.

Policy examples
Policy examples were less of a focus. Biodiversity offsets were mentioned as an example of urban ecology initiatives.

The 'Habitat Stepping Stones' program was developed by the Australian Research Institute for Environment and Sustainability with funding from the NSW Environmental Trust

2 http://www.sutherlandshire.nsw.gov.au/Outdoors/Environment/Plants-and-Bushland/Greenweb
3 http://www.ryde.nsw.gov.au/Environment-and-Waste/Bushland-and-Wildlife/River-to-River-Corridors-Project
4 http://www.habitatsteppingstones.org.au/about

QUESTION 3. HOW DO YOU WORK WITH THE IDEAS AND ISSUES OF URBAN ECOLOGY IN YOUR DAILY WORK? WHAT DOES AND DOESN'T WORK?

The project team was interested to find out what organisations or practices were being undertaken, and what could be improved, in relation to urban ecology. We were interested to discover where urban ecology was gaining traction and what barriers were present.

Participants talked about how it is hard to measure successful urban ecology outcomes becuase there are not standardised metrics around urban ecology. Discussion focused on barriers that they faced when trying to implement urban ecology. Participants didn't have many contributions around the question of 'what works well?', but there were lots of ideas about what could be improved.

Engage the community
A key theme was that educating and engaging the community is very important. Participants noted that often clients (such as project managers and developers in urban renewal and development projects), the community or colleagues, aren't aware of the benefits of urban ecology, which makes implementation difficult. Effective and efficient communication with the public was seen to be critical to the implementation and success of projects on the ground. Without buy-in from the public, participants felt it was difficult to

generate momentum or support for urban ecology projects. For example, participants suggested that throughout suburban Sydney, many residents do not like the aesthetic of native bushland nor the maintenance required for trees. These perceptions can make it difficult for urban ecology principles to be implemented and adopted throughout the urban landscape.

Changing traditional notions of aesthetics
The notion of aesthetics was mentioned numerous times throughout the workshop. Participants described conflicts between what they were trying to achieve in terms of integrating natural landscape elements in design, and community ideas of aesthetics which were often counter to their intent. This includes public perceptions of trees and maintenance implications (limb drop, leaves and flowers falling onto pavements), conflict between trees and overhead power lines, and perceptions that native bushland is messy.

Demonstrate the value
Participants noted how professionals can demonstrate the value of urban ecology through information dissemination to a

range of other stakeholders such as residents, policy makers, planners, engineers, developers and project managers. Participants suggested putting a dollar value on urban ecology, to show its real worth. If, for example, BASIX (Building Sustainability Index)[4] landscape requirements were updated to integrate biodiversity outcomes then residential developments would provide more opportunities for urban ecology. Currently BASIX is designed primarily to deliver effective water and greenhouse gas reductions across NSW.

Post construction inspections

Participants stated that post construction inspections of developments against their conditional approval rarely occurs. This is often due to resourcing by state or local government or the role of private certifying

authorities in the approval and building inspection process.

An integrated response

Participants responded that a consistent, integrated response is required from and between levels of government. State government needs to set the framework which local government can work within to implement. Without this, it is difficult for industry to generate momentum around the implementation of urban ecology. Currently, policies are too flexible as they are not mandatory. This allows developers to reduce their requirements to incorporate ecology into projects.

Current landuse policies were also seen as too flexible lacking mandatory requirements. This flexibility allows developers to trade off their ecology requirements as part of their project.

Workshop participants share ideas about urban ecology

> "One problem is that many projects or GI/WSUD initiatives are often done as a 'box ticking' exercise. Once the box is ticked there is no incentive for the ongoing maintenance of a site".

4 https://www.planningportal.nsw.gov.au/planning-tools/basix

QUESTION 4: WHAT IS IT GOING TO TAKE TO CREATE CHANGE AND IMPROVE URBAN ECOLOGY OUTCOMES?

Design, policy and planning instruments

Workshop participants commented that, from a practice perspective, multi-disciplinary team meetings at the start of the project need to become business-as-usual. Urban ecology needs to be a core consideration at the start of a project not an afterthought. Multi-disciplinary teams will help break down the 'silo mentality' between disciplines, align the goals of the project team from the outset, enable a diversity of opinion and ideas, and enable a process of shifting professional opinions and norms.

Government commitment through policy and legal reform was viewed as critical to creating change. Policies from the top down (state government) need to champion urban ecology outcomes. If urban ecology can be integrated into planning processes, then outcomes would be much stronger.

"Valuing ecology; building in contractual measures that provide scope/time to see the full value of ecosystem services."

A number of groups made suggestions around existing performance based planning instruments such as BASIX

SEPP. One group suggested the development of a new rating tool, similar to BASIX, which requires a certain amount of urban ecology in order to get development approval. Another group suggested a review of the current BASIX scheme to incorporate urban ecology outcomes alongside energy and water efficiency.

One group suggested retrofitting less dense areas in which there is space. This would take advantage of the low density sprawl of Sydney and make the existing space work harder.

Access to data and public education

Increasing the knowledge-base around urban ecology as well as articulating the co-benefits was considered critical. Specifically, participants noted the importance of educating the community and empowering citizens through information. Good public campaigns can make a significant difference to public values and behaviours. One example that was cited was the 'Life Be In It' campaign in the 1980s and 1990s.

Other important stakeholders to whom information and education should be disseminated to included developers (benefits of urban

ecology), landscape architects (what vegetation species are available in nurseries), maintenance staff (a native garden takes less maintenance than manicured turf).

Understanding what the real issues are around why people aren't engaging was also considered critical. It was considered important to find common values between the government direction and the community. Creating opportunities for people to see the full value of ecosystem services would facilitate greater buy-in.

> *"Time poor people with no time to engage with the big issues."*

Participants discussed the need to acknowledge that many people are 'time-poor' and therefore, awareness campaigns need to be targeted accordingly.

They also noted that if the economic benefits of urban ecology can be clearly demonstrated, then industry would be more likely to support and facilitate urban ecology. One participant noted an example where this is starting to happen, where surveys carried out by a particular developer are now showing that prospective residents want open, green space and places for their children to play outdoors in 'nature'. This demonstrates that the community is starting to support the values of urban ecology. By understanding what people want, developers are starting to change the way that

they design new communities.

Construction management and maintenance

The importance of soil needs to be recognised and valued. Participants noted that during the design and construction phases, it is important to get the foundations right when it comes to soil, otherwise the plants won't grow. Post-construction inspections need to be completed in order to ensure that projects are constructed as per the approved design documentation.

The approach to construction management and maintenance depends on the scale of the project. Technical tools are required for the small, site specific scale. Urban ecology requirements could be included in tender documents, to ensure it is included. Legislation and policy are required at the macro scale. Different strategies and approaches will be appropriate at different scales and points of intervention.
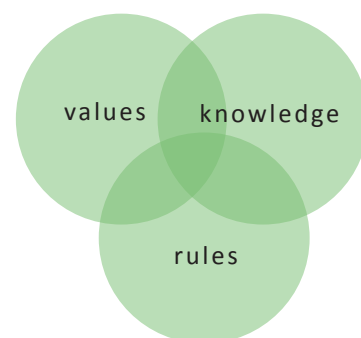
The intersection between values, knowledge and rules is where the highest degree of motivation will be for implementing green infrastructure

QUESTION 5: WHAT WOULD IT TAKE TO INFLUENCE OR BOOST DECISION MAKING IN YOUR ORGANISATION OR PROFESSION TO ADVANCE URBAN ECOLOGY?

We asked participants what change is required to increase influence and decision making and generate positive change for urban ecology. We wanted to find out what were the key points of intervention that could be leveraged in order to achieve better urban ecology outcomes.

Incentive schemes
In this workshop, much of the discussion around points of intervention focused on incentive schemes, such as using a Green Infrastructure rating scheme or economic incentives developed around a Bio-Banking Scheme to encourage industry to integrate urban ecology in their work practices. Participants believed that incentive schemes would encourage increased integration of urban ecology. One suggestion was for economic incentives around a Bio-Banking Scheme.

Recognise best practice projects
Participants also discussed the importance of recognising exemplary work in the field of urban ecology. They suggested an awards scheme which encourages and recognises best-practice work. This would act as a strong incentive, especially for private companies. This suggestion came from private practitioners including developers who thought it would be beneficial. Creating a sense of competition within the industry

can generate innovation and momentum.

Increase data
Increasing the availability of reliable and trusted science, and making it available to educate decision makers and the community was also considered critical. If benefits could be demonstrated over time and at a series of scales, this would increase urban ecology outcomes. Leveraging human values and linking urban ecology to social and mental health benefits could also generate change. Broadening information around the range of co-benefits of urban ecology would provide an incentive for the incorporation of urban ecology into policy.

Implement a top-down approach
Top-down approaches such as changing the regulatory framework to transform business-as-usual and using legislative binding targets, as well as providing funding at strategic points were seen as options to support urban ecology reforms.

A champion for urban ecology
Participants discussed the importance of urban ecology champions, people across a range of disciplines who will represent urban ecology and stand up and fight for it.

5 http://www.cbsm.com/public/world.lasso

Apply community-based social marketing

Participants also discussed the idea of leveraging community-based social marketing (CBSM)[5] to generate effective behavioural change through community engagement via direct contact with the public. The CBSM model provides a structure for delivering programs which foster sustainable behaviour.
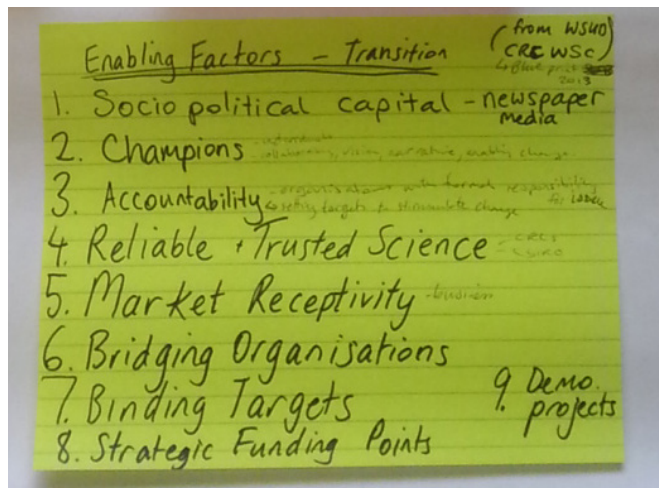
Nine enabling factors to improve urban ecology outcomes as suggested by one group of attendees.

SUMMARY

In this workshop participants suggested a variety of definitions of urban ecology with much of the discussion focusing on urban ecology as the intersection of the built and natural environment, in relation to the co-existence of people's habitat with other habitats.

Examples of urban ecology included WSUD, remnant bushland, landmark buildings and parks, biodiversity corridors and national and university-led initiatives.

The participants who attended the workshop suggested direct and indirect actions that can progress and improve urban ecology outcomes. These included community engagement, post-construction inspections and working with interdisciplinary teams around urban greening, planning and sustainability issues.

In order to create change and improve urban ecology outcomes, improved access to information, better design, policy and planning instruments, and improved construction management and maintenance, are key.

Incentive schemes, a top-down approach, community based social marketing and a champion for urban ecology would help influence or boost decision making to favour urban ecology.

Park featuring water sensitive urban design along Caddies Boulevard, Rouse Hill

QUESTION 1. WHAT IS URBAN ECOLOGY, AND WHAT DOES IT MEAN TO YOU IN YOUR CONTEXT?

The aim of this question was to generate a collective understanding of what urban ecology is or can be, and to bring into light the different perspectives of urban ecology.

Participants provided different definitions of urban ecology. This tended to depend on their professional background and work place or context.

An anthropocentric view

In this workshop there was a focus on an anthropocentric view of urban ecology. This included ideas about the relationship between humans and nature. There was discussion about the impact of humans on the environment in urban areas and about how people experience nature in an urban context. Urban ecology was broadly seen as the ecology of an altered landscape. Participants noted that Sydney is a cultural landscape, shaped by human modification over thousands of years.

> Urban ecology is "the ecology of an altered landscape"

A spectrum

Workshop participants framed urban ecology on a spectrum of impact based on the interactions between humans and nature. These interactions were seen

to operate across geographic (spatial) and temporal ecological and human scales. Human impact encompassed urban development, the cultural landscape and pre-European settlement. For instance, how does regionally based planning, such as the Sydney Green Grid, affect species mobility which is intrinsically linked to the spatial scale. Participants noted that urban ecology needs to be considered at a variety of scales, from global to local.

Urban ecology was also framed around specific places, or a connected series of places, and how these must be considered in relation to connectivity of corridors and broader development patterns.

> Urban ecology "integrates the values into the ecology of a city, recognising it's a different place than the 'natural'."

Definitions of urban ecology were noted as being determined by people's values, experiences and perceptions. This ranged from urban ecology with a 'natural' focus (i.e. a focus on remnant areas of bushland, intertidal zones), to urban ecology with a 'human-centred' focus (i.e. accessibility to nature, manicured landscaping/ aesthetic considerations, choosing

species based on anthropogenic considerations e.g. not wanting to attract "nuisance" wildlife such as flying foxes).

Participants noted that urban ecology includes specific 'built' applications such as green infrastructure and Water Sensitive Urban Design. Participants acknowledged 'blue infrastructure' as well as 'green infrastructure'. Blue infrastructure is related to freshwater and marine interventions.

> *"Urban ecology is an asset:*
> - *good for people*
> - *reduces heat island effect*
> - *sense of people*
> - *health and well-being*
> - *green, leafy suburbs are valuable."*

Urban ecology as an asset

Urban ecology was also seen as an asset fulfilling a range of functions and contributing to the unique character of a place. In this way, urban ecology is also related to place-making. Urban ecology provides ecosystem services in an urban setting. These services include air and water quality, and biodiversity.

There was discussion about the exclusion of bushland reserves from the project brief. Many of the participants disagreed with this as they viewed bushland as an important part of urban ecology.

> Urban ecology *"must capture whole of landscape, including both developed land (including parks, roads and residential, and remnant."*

Participants at the Parramatta workshop share ideas about urban ecology

QUESTION 2. WHAT ARE SOME EXAMPLES OF URBAN ECOLOGY?

Following from the participants' conceptual definition of urban ecology, this question sought to provide an understanding of the practice of urban ecology. In framing the question, participants could nominate any example, be it national or international, of urban ecology. Given that a number of participants represented the City of Parramatta Council, most cases were from the Parramatta area. Participants mentioned a mixture of policy, grey literature and built examples.
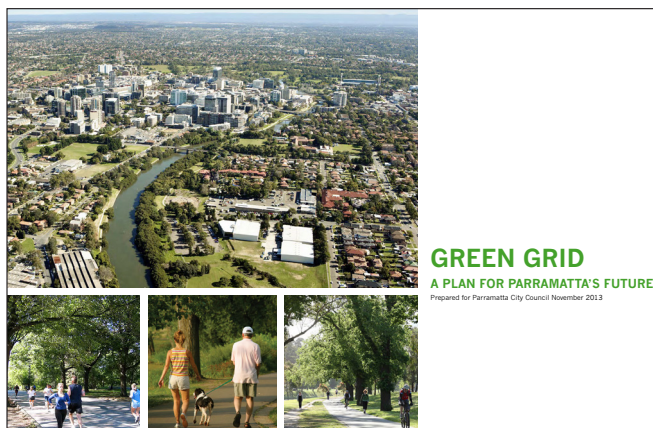
Policy examples
Policy examples included the Green Grid documents for Parramatta and Sydney prepared by the Government Architect's Office: the 'Parramatta Green Grid' (2013)[1] and the Sydney Green Grid[2] contained in 'A plan for Growing Sydney' (2015)[3]. Planning at a catchment based scale was also mentioned.

One participant noted that in Bankstown City Council, Section 149 certificates show if the land parcel is in a transition corridor or conservation corridor. This property notification is designed to help guide development requirements, and retain and enhance urban ecology outcomes.

Built examples
Built examples included the Parramatta City Water Management system[4], and in particular, Red Cow Lane in Parramatta CBD, where water sensitive urban design (WSUD) has been implemented. Parramatta City Council participants generally talked about WSUD and green infrastructure applications of urban ecology in their CBD precinct. Singapore was also noted for its various urban greening projects throughout the city, integrating the concept of biophilia into the urban context.

GREEN GRID
A PLAN FOR PARRAMATTA'S FUTURE
Prepared for Parramatta City Council November 2013

Garden by the Bay, Singapore. Source: D. Emmet (taken 2105)

1 http://architecturebulletin.com.au/winter-2015/the-green-grid/
2 http://www.smh.com.au/nsw/funding-for-parks-and-walkways-the-first-step-on-way-to-sydneys-green-grid-20160724-gqch88.html
3 http://www.planning.nsw.gov.au/Plans-for-your-area/Sydney/A-Plan-for-Growing-Sydney
4 http://www.parracity.nsw.gov.au/live/my_environment/water_and_waterways/water_quality/3

QUESTION 3. HOW DO YOU WORK WITH THE IDEAS AND ISSUES OF URBAN ECOLOGY IN YOUR DAILY WORK? WHAT DOES AND DOESN'T WORK?

The project team was interested to find out what organisations or practices were being undertaken, and what could be improved, in relation to urban ecology. We were interested to discover where urban ecology was gaining traction and what barriers were present.

Strategic Planning Documents

A number of participants discussed strategic planning documents prepared by various local councils. Participants saw local government policy as a good mechanism to assist the delivery and implementation of urban ecology. Participants noted that planning at a catchment scale (e.g. work done by the Parramatta Catchment Trust, now the Parramatta River Catchment Group[5]) also helped improve urban ecology outcomes.

> "Identify natural boundaries and use these, not political boundaries."

Council Barriers

There was a raft of suggestions in relation to what could be improved. One council officer noted that it was very difficult to get Councillors on board, to support urban ecology initiatives. Another council officer noted that it was very difficult to follow up on issues arising post planning approval and construction. A lack of resources to, for example, to undertake inspections or take someone to court where the development has not been constructed according to the approved plans and consent.

Council officers raised the issue that there is a lack of resources when it comes to maintenance and management of green infrastructure projects on public land. These resources include money, expertise and political willingness by operational staff.

> "Is it worth the effort to require on-site measures, or just $$ [developer contributions] and offsets?"

Collaboration

More collaboration is required between state and local government, communities, not-for-profit groups and industry to break down the 'silo mentality'. This also extends to communication between disciplines working in this space. Multi-disciplinary teams were also seen as a way to work together to achieve the best results for urban ecosystems.

Top-Down Leadership

Stronger political will was raised as necessary to enact real change. Stronger leadership is required

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5 www.ourlivingriver.com.au

from the State Government to set a framework with requirements, targets under which local governments can work. This would include legislative reform that provides a focus on urban ecology and linking objectives to measurable targets extending beyond political cycles.

Community Perceptions

Participants commented that community perceptions about urban ecology also need to change. These included perceptions about aesthetics and values, misconceptions about specific species (e.g. flying foxes), and overlooking less visible biodiversity (e.g. nocturnal fauna, subterranean species, cryptic and/or small organisms).

Participants noted that residents across and within LGAs will have different values which affect how they think about and implement green space. Parramatta Council officers noted that there is a public perception that bio-swales are just rubbish collectors and are messy. So while built environment professionals can build urban ecology elements into the urban context, there also needs to be community buy-in to support these elements.

Meaningful community engagement and education is required to shift community perspectives and create buy-in. Engagement and communication strategies need to be pitched for a general audience and planning jargon needs to be removed.

It was also noted that genuine stakeholder engagement needs to take place between state government agencies. This reflected the view that inter and intra agency attitudes towards urban ecology are highly fragmented.

> There is a "problem with [a] lack of alignment of policies:
> * in councils
> * vertical and horizontal."

Parramatta workshop participants discuss their ideas about urban ecology

QUESTION 4: WHAT IS IT GOING TO TAKE TO CREATE CHANGE AND IMPROVE URBAN ECOLOGY OUTCOMES?

This question asked the participants to focus their thinking on what practices or processes need to be improved in order to achieve better urban ecology outcomes. The project team was interested to find out what could be addressed right away to help improve urban ecology. Discussion covered a range of scales, from the lot to the city, and a variety of stakeholders, processes and practices.

Increase Communication
Workshop participants commented that communication within and between different stakeholders needs to be increased. For example, communication needs to be enhanced between council officers and land owners, and between engineering and design departments within council.

A Long-Term Plan
Participants identified that a long-term plan for the Greater Sydney region is needed, to ensure that the goals of different levels of government and planning mechanisms are all aligned and consistent. They stated that planning can't just be about jobs and houses. It needs to be about jobs, houses and liveability. This long-term plan needs to be aligned across all levels of government, to ensure that everyone is working towards the

same goal. Currently there is a disparity between and within state government and councils and within individual councils. This policy also needs to ensure that there is consideration of the importance of interconnectivity across the spectrum of scales, from lot, through to regional.

> *"Planning is currently driven by jobs and housing. Reverse it. Plan the landscape and then fill in the jobs and housing."*

Engage the Public
Participants noted that the value of green infrastructure needs to be demonstrated so that the public can see the benefits. This could include demonstration projects on public land. The example of Lake Parramatta was given. Water quality of the lake has been improved to such an extent that it is now swimmable[6]. Educating the public about the benefits of urban ecology is important as most land is in private ownership. Participants noted that part of increasing community awareness is about considering the demographics of different areas and the awareness of environmental issues, or particular sensitivities that those people may have.

6 http://www.parracity.nsw.gov.au/play/sports_and_recreation/swimming_at_lake_parramatta

One group referenced a key component of the Parramatta River Catchment Groups' mission to make Parramatta River swimmable by 2025: creating a marketing campaign around 'five iconic species' which the community vote for. These species would be used to monitor the health of ecosystems throughout the urban area. This concept could be replicated in other projects. Generating emotional responses to declining biodiversity could also help create interest.

Review Open Space Standards

Participants questioned the open space planning standards being used. Australia uses the UK standard of 2.4ha/1 000 people which dates from the 1940s. The currency of this standard was questioned, as well as the idea of quality verses quantity of urban open space, and open space verses green space.

Lack of Data

There is a lack of information available, and no bench mark for urban ecology. Participants noted that more data is needed in order to make informed decisions. Creating a benchmark would also mean that councils could have a consistent approach and targets for outcomes.

Review of Biodiversity Legislation

Many of the participants were worried about the recently passed (17/11/2016) Biodiversity Conservation Bill 2016 and Local Land Services Amendment Bill 2016[7], and the potential effects these changes could have on biodiversity throughout NSW.

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7 http://www.environment.nsw.gov.au/biodiversitylegislation/review.htm

QUESTION 5: WHAT WOULD IT TAKE TO INFLUENCE OR BOOST DECISION MAKING IN YOUR ORGANISATION OR PROFESSION TO ADVANCE URBAN ECOLOGY?

We asked participants what change is required to increase influence and decision making around making positive change for urban ecology. We wanted to find out what were the key points of intervention that could be leveraged in order to achieve better results for urban ecology.

In this workshop, groups spoke about the need for changes to approaches to both public and private land. Participants made suggestions about policy, education and planning legislation.

On Private Land
A series of recommendations were suggested for private land. They included enforcing the Noxious Weeds Act and creating a BASIX Tool[8] for urban ecology outcomes.

There was discussion about changing the way professionals working in urban ecology relate to the public. Suggestions were around changing the conversation and engaging the community by repositioning urban ecology from an environmental focus to a community/human-centric focus. Changing the narrative to make it anthropocentric could generate more change and motivate the community. It was also seen as important to acknowledge geographic and demographic differences throughout Sydney and beyond.

On Public Land
A series of recommendations were also suggested for public land. Requirements for E2 zoning should be changed to make it harder to re-zone the land in an environmental zone. Currently it is too easy to change this type of zoning, and it gives no long term protection to these areas. Participants also suggested that public land managed by local government and state agencies (e.g. Western Sydney Parklands) be reviewed and used to demonstrate that urban ecology initiatives are achievable and beneficial. If urban ecology principles can be applied on public land and shown to be achievable, then this will encourage up take on private land.

Participants also thought that there needed to be something in it for people, otherwise there wasn't much motivation for change. An example was given of wildlife bridges, where there was only support for their construction if they also served as pedestrian bridges.

Maintenance Budgets
Participants also said that it was important that funding mechanisms from councils and state government be put in place to ensure maintenance of green infrastructure and WSUD elements once they are built.

8   https://www.planningportal.nsw.gov.au/planning-tools/basix

SUMMARY

In this workshop participants focussed on an anthropocentric view of urban ecology, noting the long-term impact that humans have had on the Sydney landscape.

They suggested that urban ecology should be framed to emphasise the benefits it can provide for the public, for example using permeable surfaces to mitigate flooding and increasing tree cover to decrease the urban heat island effect, in order to get more buy-in from the community, government and industry.

There were concerns about excluding remnant bushland from the scope of the project as bushland areas across Sydney formed a critical part of the Sydney urban ecology.

Participants also noted that there is a problem around definitions. The definition of urban ecology needs to be clearer. There needs to be consistent definitions across all levels of government, from national, through to state and local.

Participants identified that the Parramatta Green Grid document produced by the NSW Government Architect's Office provides a good framework for creating an interconnected urban greening network in Parramatta and Greater Sydney.

To influence and improve decision making to favour urban ecology, participants focussed on the need to improve communication between professionals and the public. Policy and legal reform and a greater focus on compliance was seen as critical to advance urban ecology outcomes. This included a review of zoning, the Noxious Weeds Act and BASIX. Increasing maintenance budgets would give council officers and project managers confidence that there are sufficient funds to maintain green infrastructure and/or WSUD elements as necessary.

WORKSHOP 3: NEWCASTLE

Newcastle. Source: Visit Newcastle

QUESTION 1. WHAT IS URBAN ECOLOGY, AND WHAT DOES IT MEAN TO YOU IN YOUR CONTEXT?

The aim of this question was to generate a collective understanding of what urban ecology is or can be, and to bring into light different perspectives of urban ecology.

Participants provided different definitions of urban ecology. This tended to depend on their professional background and work place or context.

Interaction between human and ecological aspects

The discussion about defining urban ecology centred around the notion of an interaction between the human and ecological aspects of the urban environment. The discussions on how to define urban ecology focused on both an ecological and human perspective. One participant captured the discussion and suggested urban ecology be positioned within a human (x-axis) and ecological (y-axis) perspective within which there is a 'sweet spot' that captures the needs of both systems or perspectives. Refer diagram.

The idea which was proposed is that urban ecology can operate within an area of manoeuvrability whereby some projects may emphasise human over ecological aspects and vice-versa. Beyond this area of manoeuvrability, the interaction loses its strength or meaning resulting in projects purely for the benefit of ecology or humans.

Arising from the intersection between the human and ecological aspect was the notion of socio-economic value, noting that while typically the benchmark to achieve with regards to ecosystems tends towards pristine environments urban ecology needs to account for the human aspect.

Ecosystems are complex

Participants highlighted ecosystems are inherently complex and this creates complexity when attempting to consider them in an urban environment. Discussion noted that strategies in one area
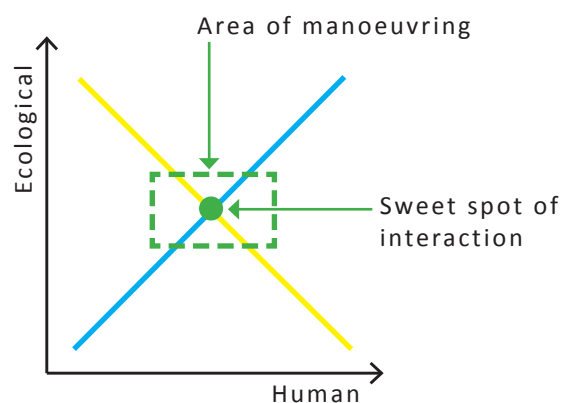

Diagram showing how ecological functioning increases (blue line) as human activities decrease (yellow line). There is a point at which the interactions between the two systems will be mutually satisfactory, shown as the area of manoeuvering.

(e.g. protecting and enhancing remnant forests) would not be relevant to another. Consequently, it was seen as the role of each local government to be the driver of urban ecological initiatives, as each LGA will support different environments and therefore will differ in the types of strategies which are appropriate.

In answering the second part of the question the participants drew from this complexity to highlight the difficulty of integrating urban ecology into their work regardless of their willingness.

"We've been raised to believe in the big urban sprawl."

The role of bushland
Bushland was also brought up with some participants not sure why remnant bushland would not be accounted for in the UERI project. One argument was that bushland cannot be (and should not be) part of the built environment. Another argument highlighted this through the separate legislation which deals with bushland as well as a number of well-established initiatives such as Bushcare. Still some wondered about ecological corridors and connectivity to urban ecology and the potential for missed opportunities to link the two.

The role of education
Education emerged as a prominent theme. Some suggested there

was public dissonance between Australian's love for endemic and iconic species such as the koala and the direct or indirect impacts their own actions may have on that very species. Many seemed to imply that a lack of education or a movement away from the environment also promoted a development-first approach which often did not consider ecological values.

A number of examples were given such as community gardens as successful 'gateway' initiatives to increase citizen participation and ownership which could help overcome this public dissonance.

Lack of legislation
Council officers were clearly frustrated with planning and development approval processes due to the lack of a legal 'backbone' for civil servants to use to protect remnant vegetation or promote innovation. Participants expressed an urgent need for mandatory requirements for protecting and enhancing biodiversity in the assessment process; as anecdotally it appeared there was a general lack of interest in incorporating urban ecological elements into development assessment.

Ecosystem services
Ecosystem services were mentioned in conjunction with urban ecology but also in terms of the lack of understanding or valuing of those services. Resilience and

connectivity were also raised
in terms of the nexus of human
health, healthy ecosystems and
liveable cities. Connectivity was
discussed in relation to retaining
physical, mental and spiritual
connectivity with the environment.

Pervasive risk culture

Risk culture was noted as needing
to be reviewed. Council officers
noted that council culture was risk
averse, always trying to minimise
risk. This minimisation of risk was
noted as being the key driver of
decision making. The minimisation
of risk *ad-infinitum* was perceived
as having a negative effect as
exemplified by the example of the
10/50 Asset Protection Zone rules.

QUESTION 2. WHAT ARE SOME EXAMPLES OF URBAN ECOLOGY?

Following from the participants' conceptual definition of urban ecology, this question sought to provide an understanding of the practice of urban ecology. The examples given ranged from specific projects to more general ideas on what urban ecology project might entail.

Urban ecology and different scales

The participants identified what examples of urban ecology would look like at different scales. At the state level, examples could encompass regulations and corridors; at the regional level, urban growth areas might be identified; and at the local level examples could include the use of BASIX as well as actions by individual developers.

In the broad sense, processes and design elements in small urban developments were perceived as being an important contributor to the overall urban ecological outcomes of an area. However, due to their size, it was acknowledged that medium and larger sized developments could additionally enhance urban ecology by integrating environmental processes, like using recycled materials, into their product supply chain.

Resilience in the Lower Hunter

Newcastle Council worked with the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) to develop a community resilience model for the Lower Hunter in 2013[1]. This was used as a specific example of urban ecology done well with a series of workshops to map out priorities. The feedback from these workshops demonstrated multiple issues in infrastructure resilience which started the thinking process in considering these aspects in infrastructure planning and development for the Council.

Ecological engineering

Another example which was given was of the naturalisation of the concrete channel on Clear
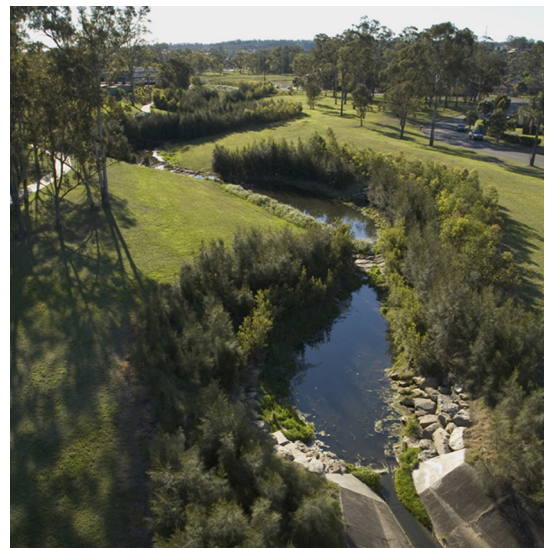
Clear Paddock Creek restoration project. Source: Government Architect's Office

1 https://www.environment.gov.au/system/files/pages/.../aecom-natural-hazards.docx
2 www.fairfieldcity.nsw.gov.au/.../id/.../clear_paddock_creek_restoring_the_waters.pdf

Paddock Creek at St Johns Park in the western suburbs of Sydney[2]. The vision formulated by Fairfield City Council and the Australian Conservation Foundation was to replace the concrete channel with a functional and attractive creek. A participant noted that the project was an example of a successful project, utilising expertise from government and industry to ensure that the project met with current creek naturalisation best practice and allowed for any design improvements to be made throughout the project. The project ended up costing less than typical grey infrastructure stormwater management would have (which have been used in other similar projects).

Sustainable retrofitting and remediation

The Coal Loader Centre for Sustainability was also mentioned for its transformation of an ex-industrial site located near the Balls Head Reserve. The Coal Loader includes community and food gardens, native bush nursery as well as a regenerated waterfront parkland[3]. The aim was to sustainably redevelop the area along with its historic coal loading tunnels by showcasing innovation, enabling practical learning on sustainable living through workshops and creating a community meeting point and a hub for North Sydney Council's range of environmental and sustainability programs.

Lake Macquarie City Council initiatives

A number of examples of initiatives undertaken by Lake Macquarie City Council were mentioned. Council has achieved success in some of its sustainability programs through education, environmental sustainability grants and the Backyard Habitat for Wildlife program[4]. In March 2016 the Council adopted its first Local Adaptation Plan, for Marks Point and Belmont South[5]. This followed work with local residents, landowners, utility providers, local business and Office of Environment and Heritage to identify actions to be taken. These actions include revetments to protect foreshore from erosion, filling land progressively to maintain ground levels above that of the Lake, raising and improving design of infrastructure, and constructing new floors of buildings as well as raising older buildings above projected flood levels.

Lake Macquarie
Backyard Habitat
Planting Guide
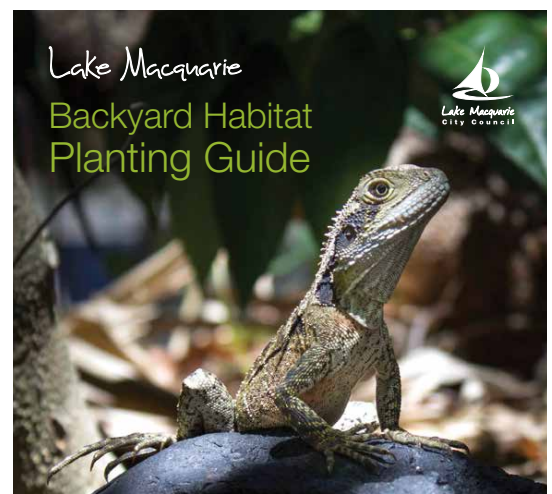
3 http://www.northsydney.nsw.gov.au/Waste_Environment/The_Coal_Loader/Coal_Loader_Centre_for_Sustainability
4 https://www.lakemac.com.au/environment/sustainable-programs/backyard-habitat-for-wildlife-program
5 http://haveyoursaylakemac.com.au/future-flood-planning

QUESTION 3. HOW DO YOU WORK WITH THE IDEAS AND ISSUES OF URBAN ECOLOGY IN YOUR DAILY WORK? WHAT DOES AND DOESN'T WORK?

The project team was interested to find out what organisations or practices were being undertaken, and what could be improved, in relation to urban ecology. We were interested to discover where urban ecology was gaining traction and what barriers were present.

While the examples given in the previous questions were described as successful projects, these remained ad-hoc. Participants noted that projects and initiatives remain disjointed, and not inter-linked. Generally the projects nominated were not seen as having a common purpose or goal and local projects operated independent of one another. Discussions highlighted the difficulty in assessing the relative success of biodiversity outcomes for projects because of a lack of monitoring or data collection.

The following are barriers which were considered by participants:
- **Shifting the 'business as usual' approach:** A few participants highlighted the lack of willingness to innovate or simply update planning or development practices to capture current scientific knowledge of impacts of development, ecosystem benefits, climate change challenges and use

best practice in development and infrastructure technology and systems (WSUD, etc.). The default approach adopted in government is weighed down by law and bureaucracy which does not foster innovation. In the private sector development practices are not up-to-date with latest methods and systems (still building grey, standard, infrastructure over green infrastructure). The default approach appears to be to avoid change as much as possible.

- **Change is slow despite fast-changing conditions:** The notion put forward was in regards to the adaptive capacity (especially in terms of the lack of speed of adoption) of government agencies. While disruption often comes in the form of fast-changing environments, planning policies and government departments appear to lag behind, making the overall adaptive change slow. Participants noted that societies, including industry, government and the public, are mostly reactive as opposed to pre-emptive and proactive. Issues come to the forefront of attention after large disruptions which can bring about change. However, this can result in knee-jerk reactions (e.g. leading to cutting trees down after big

storms as they are perceived as an immediate safety and property hazard).

- **Political barriers:** This encompasses a number of notions. Most mentioned was the lack of political will in supporting planning reforms which include ecological principles as well as a failure to support or maintain existing projects and their general ethos/purpose through changing governments. For example, progress made over decades can be undone by new government or elected officials unwilling to continue to champion certain issues. Politicians which are interested in long-term science-based goals are uncommon.. The need to get buy-in from executives by engaging directors and decision makers at all levels of implementing a project (be it in government or private industry) was noted as important in securing funding and ensuring successful implementation of projects. Specifically outlining the health and economic benefits of urban ecology was deemed more likely to make change desirable.
- **Education (or lack thereof):** While education is often initially brought up as a barrier it is also perceived as an opportunity. The educational barrier in this workshop was interpreted by the lack of effective communication. Educational initiatives around urban ecology exist but the

difficulty is in translating its benefits to the public.

Other barriers which were mentioned included the difficulty in giving a 'dollar' value to natural areas and ecosystems, the lack of strong legislation to protect urban ecology strategically and the lack of use and availability of performance metrics which give accurate and long-term assessments.

Wyong Shire Council's new airport: a case study

Participants from Wyong Shire Council raised the issue of locating a new airport in the area[6]. Council had championed (for some two decades) the creation of a Green Corridor and Habitat Network. This was integrated into the 2012 North Wyong Structure Plan. In 2015, Council initiated discussion around the need for an airport to cater for demand.

Plans emerged which showed the proposed airport location cutting across the state government-supported green corridor and into Lake Macquarie LGA. The anger from the public who supported the Green Corridor and Habitat Network arguably encouraged council to relocate the airport to the existing Warnervale Airport and expand the facility. However the controversy continues as Council has released the 89 hectares of land they purchased (indicated roughly in yellow on the aerial image below) for industrial and business park development.

This highlights the concern expressed by some of the participants with regards to the longevity or maintenance of urban ecology projects. It reveals counter-productive actions at the local government level. The green corridor's efficacy and benefits may be compromised by new development.
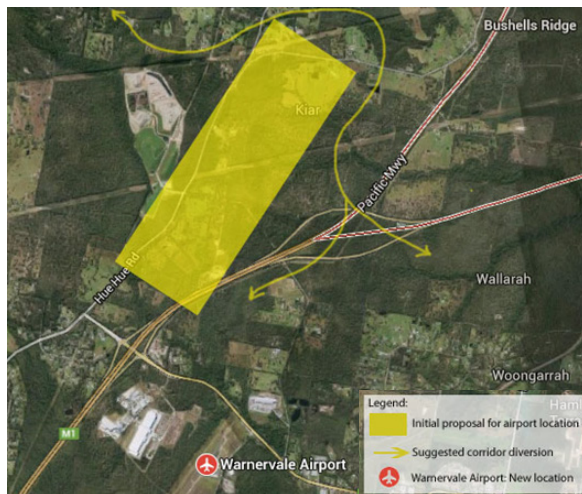
The proposed and final location for the airport.
Source: Wyong Shire Council (2016)

6 https://www.wyong.nsw.gov.au/for-business/central-coast-regional-airport

QUESTION 4: WHAT IS IT GOING TO TAKE TO CREATE CHANGE AND IMPROVE URBAN ECOLOGY OUTCOMES?

This question asked the participants to focus their thinking on what practices or processes need to be improved in order to achieve better urban ecology outcomes. The project team was interested to find out what could be addressed right away to help improve urban ecology. Discussion covered a range of scales, from the lot to the city, and a variety of stakeholders, processes and practices.

Changing developers business-as-usual practice

The pressure for land was considered an immediate issue for urban areas. There is a daily struggle against developers to keep land as open space and/ or for public use. Participants perceived developers as unwilling to cooperate in retaining or incorporating greening noting that developers were rarely interested unless it was required. Participants noted that small and medium size developers needed clearer and more accessible (with less jargon) information to understand the benefits of adopting environmental measures in their practices and the ways of implementing these measures. For larger developers, the discussion focused on how they could be motivated to undertake "super-green" or best practice projects for instance through model suburbs but noted there was only a

small market for it.

Stronger legislation

The participants drew from the opportunities identified in the previous questions with a focus on creating better legislation which can give a strong legal backbone for urban ecology projects.

Improving community awareness

Education was also mentioned by multiple participants in terms of helping to raise community awareness of urban ecology. Community buy-in was seen as essential to ensuring its up-take and maintenance.

A strong evidence base

Another important point which emerged was that of having strong research to provide an evidence base for projects and the decision-making process, as well as for the public.

> *"Better informed decision making that balances considerations."*

Demonstration projects

A suggestion related to this was to have more built examples of best practice or innovation in the field, especially examples which demonstrated longevity. These tied into the point of needing to make urban ecology orientated

changes desirable. This could be done by demonstrating benefits through research as well as in-situ via detailed monitoring and performance assessments.

> *"Need local examples you can touch and feel."*

Connecting green and blue space

The linking of good green space with good blue space (i.e. water) was brought up as a means of improving urban ecology outcomes. Through blue infrastructure such as constructed wetlands or a green foreshore erosion wall (such as Lake Macquarie's foreshore Eco Walls[7]) the overall biodiversity of an area would be increased, benefiting both blue and green space.

Off-limit nature reserves

Participants felt that 'having nature for nature's sake' seemed to be missing from most discussions. Some argued that in order to have healthy ecosystems and increase overall biodiversity, and have resilient green corridors, 'off-limit' areas were necessary. Traditionally however, the focus has largely been an anthropocentric one. Participants noted that nature has been mostly considered in terms of how it services humans, whether recreationally or otherwise.

While urban ecology implies human interaction, participants noted that it might be worth considering that some natural habitats may have more overall value when protected and placed off-limits. This has been done in fragile, endangered or recovering ecosystems. Nature for nature's sake may thus end up improving overall urban ecological outcomes especially for biodiversity (and specific fauna and flora) but without an apparent, direct value to humans.

> *"people want to live near/interact with nature/bushland but the interactions degrade the values that they love."*

Newcastle workshop participants share ideas about urban ecology

7 www.livinglakemacquarie.org/process/seawalls.html

QUESTION 5: WHAT WOULD IT TAKE TO INFLUENCE OR BOOST DECISION MAKING IN YOUR ORGANISATION OR PROFESSION TO ADVANCE URBAN ECOLOGY?

We asked participants what change is required to increase influence and decision-making to have a positive impact on urban ecology. We wanted to find out what were the key points of intervention that could be leveraged in order to achieve better results for urban ecology.

Buy-in from decision-makers

In this workshop there was general consensus on the need to get decision-makers involved with the issue of urban ecology. Simply put management needs to be involved at all levels (from managers to directors); unless decision-makers are engaged and willing participants projects are unlikely to include urban ecology initiatives unless external/mandatory requirements are enforced.

The identification of areas which can be immediately earmarked for current and future projects was mentioned as a means to boost decision-making.

Measuring the economic value

Participants also noted how placing economic value on urban ecology would likely increase its perceived value as it would be considered as an asset to maintain, improve and/or protect. There was some disagreement with the straight-forwardness assumed by this point. While cost analyses could be used as benchmarks, some participants wondered whether such analyses were meaningful and fully understood. Questions were also raised as to how to capture the qualitative and quantitative complexity of urban ecology.

> *Utilise "cost-benefit quantification to convince the hard-to-convince sector of the community."*

Workshop participants discussing urban ecology

SUMMARY

In the Newcastle workshop participants discussed ideas of urban ecology which focussed on the interaction between human and ecological aspects. They acknowledged the complexity of ecosystems and how socio-economic values are often imposed on environmental values.

Examples of urban ecology ranged in scale and type. Clear Paddock Creek restoration, the Coal Loader Centre for Sustainability and the community resilience model were key projects mentioned.

Participants noted a number of barriers to the implementation of urban ecology including political barriers, an unwillingness to innovate, difficulties in keeping up with the pace of change and lack of education.

In order to improve urban ecology outcomes, business-as-usual needs to change, stronger legislation is required, community awareness needs to improve, demonstration projects need to be constructed, off limit nature reserves need to be created and blue and green space needs to be connected.

To improve processes to favour urban ecology, buy-in from decision-makers is required, as well as placing an economic value on ecosystems.

Green wall, One Central Park, Chippendale

QUESTION 1. WHAT IS URBAN ECOLOGY, AND WHAT DOES IT MEAN TO YOU IN YOUR CONTEXT?

The aim of this question was to generate a collective understanding of what urban ecology is or can be, and to bring into light the different thoughts about urban ecology.

Participants brought different ideas about the definition of urban ecology depending on their professional background and work place context.

Interaction, Interplay, Integration or Interface
Participants suggested a variety of definitions of urban ecology. They focussed on the interaction, interplay, integration or interface between natural and human systems. Participants suggested that urban ecology was about integrating natural systems into the built environment, and that ultimately it is all part of one system. They also acknowledged the complexities of achieving this integration.

Climate Change
Participants raised the idea that urban ecology is a means of creating resilience to climate change in the long term, and can be a front line defence. For example, vegetation assists with carbon sequestration and mitigates the Urban Heat Island (UHI) effect.

A Changing Concept
Participants also noted how ideas around urban ecology had changed over the past decade. Ten years ago urban ecology was mainly related to bush regeneration, but now there is more of a shift towards initiatives like water sensitive urban design (WSUD) and community gardens. Urban ecology is now also seen to have broader effects, including the potential to improve people's health and wellbeing.

Scale
The concept of urban ecology was also discussed in terms of scale, from the micro to macro scale. Understanding this difference in spatial scale is critical to form a comprehensive view of ecology in urban areas. Participants suggested the 'backyard to bioregion' tag line. It is essential to consider privately owned small-scale plots/areas and how they form part of, and thus contribute to, the overall urban matrix. Urban ecology was also about taking opportunities to use the existing built environment to achieve urban ecological outcomes, 'bringing life to the concrete'.

Defining Urban Ecology
Participants engaged in a lively discussion about the definition of urban ecology. They noted that it isn't a widely understood concept beyond the science, planning and built environment professions who deal with it day-to-day. Urban ecology is still a relatively new concept, so education and community engagement is important.

QUESTION 2. WHAT ARE SOME EXAMPLES OF URBAN ECOLOGY?

Following from the participants' conceptual definition of urban ecology, this question sought to provide an understanding of the practice of urban ecology. This question was not a big focus of this workshop and was not discussed in great detail. Specific examples weren't provided when discussing this question. Rather greater discussion focussed on the definition of urban ecology (Q1).

Participants mentioned policy and planning precedents, as well as a range of community projects. Policy examples included local council biodiversity plans which recognise and aim to protect locally vulnerable species, strategic land use planning to promote green corridors, and programs to promote backyard ecology. These examples focussed on sustainably managing natural and urban environments.

Community based examples included bushcare community groups, community native nurseries and community gardens. These examples are often initiated by local community members, sometimes with the support of a local council, but not always.

> *"interpretation of urban ecology has changed over the past decade. It is more than bushland and bushcare. Now it includes WSUD, intertidal and seawalls, urban creeks and community gardens."*

Workshop participants at the second Sydney CBD workshop share ideas about urban ecology

QUESTION 3. HOW DO YOU WORK WITH THE IDEAS AND ISSUES OF URBAN ECOLOGY IN YOUR DAILY WORK? WHAT DOES AND DOESN'T WORK?

The project team was interested to find out what organisations or practices were being undertaken, and what could be improved, in relation to urban ecology. We were interested to discover where urban ecology was gaining traction and what barriers were present.

Participants talked about how it is hard to measure 'success' when it comes to urban ecology. There isn't a standard or guideline to utilise when measuring the success of an urban ecology project. Success could be based on a number of different factors. This makes it difficult to identify and compare projects or programs which are successful and should be expanded.

Discussion focused on barriers that participants faced when trying to implement urban ecology. Examples of 'road blocks' that were mentioned included a lack of communication between and within organisations, availability of indigenous plants, lack of a consistent approach across state and local governments, and lack of understanding of the complexity and connectivity of ecological systems. Crime prevention through environmental design (CPTED)[1] principles were also noted as a barrier to implementing diverse plant assemblages in public urban settings like parks.

Participants spoke about examples of local councils which have identified ecologically valuable bushland. They suggested that by using the visibility of that bush, council could educate the public about its value.

One state government participant noted that there is a misalignment of ecology and the economy. They noted that in politics, the economy is a priority. When cost savings are accounted for there is more impetus to act upon them. This misalignment was seen as something that needed to be improved in order to implement urban ecology.

1 http://www.police.nsw.gov.au/community_issues/crime_prevention/safer_by_design

QUESTION 4: WHAT ARE THE BARRIERS AND OPPORTUNITIES FOR ENHANCING URBAN ECOLOGY IN CITIES?

The project team was interested to find out what are the barriers and opportunities to implement and enhance urban ecology. Participants spoke about a range of barriers which prevent them from applying urban ecological principles in their context, as well as opportunities they see. This question is about the effectiveness of current practices related to urban ecology and how it can be improved.

Numerous barriers were suggested by the workshop participants. There were two broad categories of barriers. The inverse of many of these barriers formed many of the suggestions for opportunities.

Awareness and Education

The first category of barriers raised by the participants related to awareness and education. Participants noted that some members of the public are afraid of nature, for example, afraid of spiders and snakes, or falling tree branches. Education around perceived and actual risk is required to re-educate community members with disproportionate fears. They also identified that some members of the public just don't care and are completely disconnected from nature. This disconnection leads to disengagement with the environment and a feeling of apathy toward the environment. Others are comfortable with their standard of living, business-as usual ways of doing things and don't want to change.

The challenge for awareness and education initiatives is two-fold. Firstly, to turn bio-phobia to bio-philia, and secondly, to engage the public with issue without over-loading them with information.

It was noted that the public values open space, even if they don't regularly use it. There could be an opportunity to leverage this to start a conversation about the benefits of urban ecology. Having people tune out because of information saturation was identified as a risk, but increased education was seen as an opportunity to enhance urban ecology in cities.

> *"utilise biophilia - lots of people feel connected to and like green space."*

Participants identified that there is a lack of understanding from many professions involved in the planning and building of cities. Those in 'environment' professions generally hold higher standards or appreciation of the natural environment, and therefore position it as a core consideration.

Participants also identified a 'silo-mentality' in many organisations, where divisions work separately and rarely share information.

> *"lack of understanding, quantitative and qualitative research data, legislation, education, training, and skilled and diverse workforces in urban ecology."*

Participants commented that there is no consistent way to value ecosystems. This was perceived as a barrier to enhancing urban ecology. Without a framework to value the natural environment, it can be difficult for an individual to understand and appreciate the true worth of ecosystems. This lack of a framework makes it difficult to defend or promote   urban ecology, especially in the development sector.

There are many different ratings tools in the market. An industry-wide tool would introduce a benchmark which would help reduce confusion and enable a consistent approach.

Research, Policy and Governance
The second category related to research, policy and governance. Lack of Australian and Sydney based research means it is hard to implement or defend urban ecology requirements when there is no data to support initiatives. Rapid rates of growth are resulting in increasing urban development and densification. Participants identified that data is needed now

2 https://www.planningportal.nsw.gov.au/building-or-renovating/development-applications-through-council/statement-environmental-effects

to help influence this urban growth.

Participants identified the opportunity to create an industry wide planning tool to standardise practice and provide a base line for urban ecology outcomes.

One participant spoke about the Environmental Planning and Assessment Act, which invokes the requirement for a Statement of Environmental Effects (SEE)[2] for development approvals. It was noted that this mechanism, which could deliver urban ecology outcomes, is not effective or useful in delivering gains for the environment for a number of reasons. SEEs could be utilised more effectively by mandating stronger qualification requirements for those preparing and reviewing the document. Currently, SEE's are not usually prepared by anyone trained in ecology. Introducing a requirement that, for a certain size development (e.g. 3 dwelling developments, or 1000 sq metres), a SEE must be done by a qualified professional.

Another barrier was that political agendas rarely align with ecological priorities. The state government's priority of 'jobs and houses' often means that there is little consideration of environmental factors. This needs to change if urban ecology is to be taken seriously and implemented in our urban areas.

> *"implement a policy to mandate a certain number of green infrastructure systems in our cities and connect to each other."*

QUESTION 5: WHAT IS IT GOING TO TAKE TO CREATE CHANGE AND IMPROVE URBAN ECOLOGY OUTCOMES?

Question three asked participants to think about what it is going to take to create change and improve urban ecology outcomes.

Participants spoke about a range of options including legislative changes, industry guidelines, planning instruments, changing the narrative and increased collaboration.

Statutory Support

Participants commented that statutory support is required to improve urban ecology outcomes. Participants spoke about the Technical Guidelines for Urban Green Cover in NSW[3] published by OEH and the Government Architect's Office in 2015. It was suggested that these guidelines be legislated to mandate elements. A number of other specific mandatory elements were suggested (see Box below). It was suggested that one way to ensure these elements were incorporated was by mandating conditions through 'contract[s] and deeds'.

Participants acknowledged that although there were good local urban ecology initiatives, local government requires strong direction from the state government to support (financially and politically) these initiatives

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Mandatory elements that participants suggested for incorporation into legislation:

- 60% of roof area needs to be green roofs in any new development over a certain size
- Any new seawall needs to have built in measures for increasing habitat
- Connectivity
- Minimum canopy cover requirements
- Minimum soft surface cover requirements
- Mandatory landscaping which conforms to the ecological environment of the area (using plants of local provenance or mixes of plants from nearby ecological communities)* or minimum proportion of native plants
- Minimum vegetation cover percentage

* Participants note this was currently difficult due to the lack of plants of local provenance stocked in nurseries/available to the public.

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3 http://climatechange.environment.nsw.gov.au/Adapting-to-climate-change/Green-Cover

so as to counter local political pressure given.

Legislative changes would be a positive step, but it needs to be coupled with cultural changes. These cultural changes need to be directed at both development sector agencies, as well as the public as the public can influence political decisions though grass roots pressure. Embedding living infrastructure and green infrastructure into sub-regional planning is a key opportunity to embed these elements into planning instruments.

"Local council staff like having strong state policy and regulations to enforce biodiversity conservation and sustainability - to overcome local economic drivers and interests."

Change the Narrative
Developers need to change their mindset, but this cultural shift needs to go beyond developers and planners, to the public. Strategic environmental education has disappeared in recent years. Re-establishing a education/marketing campaign that has a positive message like 'Healthy city, Healthy living' is more effective at generating action.

Collaboration
Increased inter-disciplinary and inter-agency collaboration is also required. At a council level, there is an opportunity to leverage the council amalgamations to increase collaboration. Councils need to share information and collaborate in order to improve urban ecology outcomes.

A Champion
It was also suggested that a champion for urban ecology was needed. Someone to promote urban ecology, take a stand, and drive change is needed in order to improve outcomes. Participants provided examples of where certain professionals championed the integration of urban ecology in particular projects.

Political will and insistence is also required. A participant provided the example of a council in the inner-west creating a formal resolution to ensure that all plans of management for parks must add biodiversity.

DO WE NEED A DISRUPTIVE EVENT OR A SERIES OF INCREMENTAL EVENTS?

The second part of this question asked the participants to think about whether a big impact event or a series of smaller events would create the impetus and momentum for change.

Participants referred to the east coast low storm in June 2016[4]. It was a disruptive event and had a significant impact on Sydney beaches such as Collaroy. They

4 http://www.abc.net.au/news/2016-06-16/engineers-waiting-for-collaroy-residents-to-have-houses-cleared/7516184

spoke about knee-jerk reactions to the impacts and the fact that there is lots of information available but that often the public ignores the risk. In general, it was noted that extreme weather events were not really generating much change.

Participants spoke about the need to push back against the status-quo and generate some disruption to business-as-usual. Council amalgamations could be an example of a disruptive event, which could act as an opportunity to create change and increase communication between local government areas. Introducing mandatory ecological deliverables would be a disruptive event, but would have a positive outcome.

An incremental change could be the introduction of Urban Ecology Guidelines, which are clearly illustrated with images and show the desired outcome for particular types of urban ecology. Participants noted that if these were referenced in planning controls, it would become a more disruptive event.

Participants agreed that disruptive events as well as a series of incremental events are required to generate meaningful change.

Introduce "Urban Ecology Guidelines with images, showing desired outcome for particular development types, referenced in planning controls"

Damage to beach front homes at Collaroy. Source: Peter Rae (taken 2016)

QUESTION 6: WHAT ISSUES NEED TO BE ADDRESSED IMMEDIATELY AND WHERE ARE THE EFFECTIVE POINTS OF INTERVENTION?

We asked participants what change is required to increase influence and decision making around making positive change for urban ecology. We wanted to find out what were the key points of intervention that could be leveraged in order to achieve better urban ecology outcomes.

Planning Reform

Planning reform needs to be implemented to re-focus outcomes around urban ecology. This would legislate ecological connections across the metropolitan area. Draft District Plans have been released for each of the six Sydney districts by the Greater Sydney Commission[5]. Integrating ecological corridors based on the Sydney Greed Grid into this document is critical.

"committed planning reform that places open space and natural areas on an equal footing with the built environment."

It was also suggested that the approach should utilise the existing framework of planning policy, and improve the existing structures that are already in place.

Participants noted that the existing Biodiversity Banking and Offsets Scheme, 'Bio-banking'[6], could be improved. Improving Bio-banking was seen as a challenge due to ecological complexity, but changing what we use as surrogates to make them more applicable was seen as a positive improvement. Using an improved Bio-banking scheme, however, was controversial, with the use of even an improved version described as 'deeply disturbing' and a 'disaster for biodiversity'. It was suggested that the best approach would be to 'rip [Bio-banking] up and start again with an evidence-based approach'.

It was also noted that the current bio-certifying requirements are not leading to good outcomes for biodiversity. One issue with these bio-certification tools is that often they are just based on vegetation surveys, which can miss threatened fauna. For example, bio-certification missed the presence of threatened species at the Ingleside greenfield release area[7] on the Northern Beaches, which is using the Precinct Planning model.

Communication

Participants felt that discourse between strategic planners and those in the urban ecology field needed to be increased. Greater levels of communication will generate conversation and improve understanding and sharing of ideas and concepts.

5 http://www.greater.sydney/district-plans
6 http://www.environment.nsw.gov.au/biobanking/
7 http://www.pittwater.nsw.gov.au/ingleside/outcomes/documents

Awareness Campaign

An awareness campaign that addresses the fear of nature was identified as an effective point of intervention. Participants discussed that much of the public are afraid of nature and that a campaign would help reduces levels of fear.

Incentives

Participants felt that incentives would provide an effective point of intervention. Effective incentives would motivate the private sector to engage with urban ecology. Incentives could include monetary rebates, offsets or mandatory urban ecology outcomes as part of Corporate Social Responsibility (CSR).

> *"lever existing networks of corporate social responsibility to get green credibility and give back."*

QUESTION 7. WHAT ARE THE MOTIVATORS AND/OR INFLUENCES AROUND ACHIEVING URBAN ECOLOGY?

The project team was interested to find out what participants considered the motivators and influences in achieving urban ecology. Suggestions focussed on what state and local government could do to in this space.

Environmental Education Campaigns

Strategic environmental education campaigns that can be scaled up or down to optimise messaging and influence behaviour change over the long term could be used to motivate the community. Participants referenced the effectiveness of the 'Life. Be in it.' campaign which was launched in the mid-1970s. This awareness campaign was run by the Department of Health to target rising Australian obesity levels. A key influencer of how people think about urban ecology can also be as a result of experiences that people have as a child. Environment education through avenues such as media campaigns and school programs can help reach children and teach them about the importance of urban ecology and to value it. Sustainability education at primary, secondary and tertiary level needs to be implemented.

> *"strategic environmental education campaigns that are escalated or downsized to optimise messaging and behaviour change."*

Performance Based Ratings Tools

A key theme from this question was the concept of performance based rating tools, and the idea of performance as a measure rather than as a metric. Using a framework which measures performance, like NABERS[8], would motivate the design and implementation of urban ecology outcomes. The participants suggested that using performance measures rather than design aspects (e.g. like BASIX[9]) would be a more disruptive tool and lead to better urban ecology outcomes.

> *"regulation by performance rather than by design."*

Demonstration Projects

Case studies or demonstration projects can provide tangible examples of urban ecology. Inspiring case studies can generate positive interest and momentum.

Legislation

Legislation is required to motivate the industry. When there is no requirement to implement green infrastructure like green roofs, developers often do not see the benefit of building them.

Implementing effective environmental triggers in Local Environmental Plans (LEPs) will influence urban ecology outcomes.

8 http://www.environment.nsw.gov.au/business/nabers.htm
9 https://www.planningportal.nsw.gov.au/planning-tools/basix

SUMMARY

At the second Sydney CBD workshop urban ecology was defined around ideas of the interaction, interplay, integration or interface between natural and human systems. Participants also raised issues of scale, the relationship with climate change, and the current limited understanding of urban ecology in the broader community.

Participants discussed that performance should be used as a measure rather than as a metric, when evaluating the success of urban ecology initiatives. They felt that performance based ratings tools are powerful.

There was a difference in opinion across participants as to how best improve urban ecology outcomes in NSW. The majority of participants felt that the existing frameworks should be used and improved where necessary. Other participants had the opinion that new frameworks that position urban ecology as a central theme as part of legislative reform are required.

Participants raised a series of suggestions to motivate change. These included a 'champion' for urban ecology, environmental awareness campaigns, demonstration projects and stronger legislation.

Northern Wollongong. Source: Steen Barnes (photo taken 2014)

QUESTION 1. WHAT IS URBAN ECOLOGY, AND HOW DO YOU WORK WITH IT IN YOUR ORGANISATION?

The aim of this first question was to determine the different perspectives of what urban ecology is, or can be, to the different professions that participants represented. Highlighting the different perspectives of urban ecology and discussing the ways that organisations incorporate elements of urban ecology into their workings, allowed participants to start thinking about the scope of 'urban ecology renewal' that could be integrated into this workshop.

Overall, the participants' definition of urban ecology fell into two categories: 1. Ecosystems in urban environments, and 2. Cities as ecosystems. These definitions spanned multiple spatial scales, from global to small scale.

1. Ecosystems in urban environments

Some participants defined urban ecology as ecosystems that occur within urban and peri-urban areas. These ecosystems were separate from the built environment, and covered 'everything that is left over/in between the development'. This notion of urban ecology recognised that ecosystems and biodiversity can exist within urban landscape. However, as ecosystems were viewed as separate from the built environment, the logical extension of this definition is that

as cities become more developed, the amount of area available for biodiversity decreases.

2. Cities as ecosystems

The other definition of urban ecology viewed cities as ecosystems. Participants highlighted that urban ecology integrates living systems within urban areas, and covers the interaction of these living things with man-made and built elements of the landscape. Consequently, urban ecology includes the relationship between people, the environment (animals and plants, as well as water and air), and buildings.

As people were recognised as an important component of urban ecology, two key themes emerged about the role of humans at the human/nature interface. Broadly, these covered the modification or protection of urban ecosystems for human purposes (e.g. health and wellbeing, aesthetics/comfort/risk), and also the responsibility of humans in maintaining urban ecosystems for the sake of nature by providing opportunities for biodiversity to thrive and survive in the urban environment. In both themes, humans were seen as an integral part of shaping urban ecosystems. These modifications included what species are

introduced and encouraged, and what species are 'pushed out', waste management, and changing water and air quality. Consequently, urban ecosystems may not always be replications of non-urban ecosystems, but may involve the creation of new types of ecosystems.

The extent to which urban ecosystems deviate from natural ecosystems was seen as a source of conflict between individuals who place higher value on ecosystems resembling pre-European natural areas, and those who value a more modified type of urban ecosystem which is 'fit-for-purpose' and reflects aesthetic and safety preferences. Understanding that humans play an important role in shaping the urban ecological landscape led to a focus that therefore humans could be responsible for the improvement or creation of urban ecosystems and design of 'liveable places'. That is, that urban ecology could be seen as an 'aspirational term' rather than a descriptive term, and needs to include 'renewal into the definition'.

The term, 'green infrastructure' was an important part of the discussion of the definition of urban ecology. This term highlights the integration of nature, people and the built environment. It was thought that invoking the term 'infrastructure' to describe urban ecology renewal initiatives like plants and trees, adds value to nature, and demonstrates that importance of these natural elements to humans. Furthermore, if nature is seen as 'infrastructure' then it should be included in the assets of a council, and could shift the source of funding from operational costs to capital funding.

There was a consensus that humans need to recognise that they are part of the urban ecosystem rather than a separate entity. Education was put forward as a way of changing this mindset 'from seeing nature as a part of the human environment, to humans being a part of the natural environment'. Through education, the focus could shift to 'the impacts that humans have on ecology, rather than the other way around' and 'the benefits of urban biodiversity rather than the risks'. Creating this balance with nature was seen as a priority.

> *"[We need to] change perceptions - [to] people's place within urban ecology, not ecology within the urban ecology"*

Urban ecology: a Wollongong focus
The participants demonstrated their understanding of the definition of urban ecology using examples from Wollongong and surrounds. For example, the urban landscape was defined as 'everything east of the escarpment'. Urban ecology therefore included vegetated streetscapes, rail way corridors

and highway interchanges, and other greenspaces, both public and private, including backyards. Through relating urban ecology to Wollongong, some of the unique features of Wollongong as a large city were highlighted, particularly the connection with the escarpment and the close connectivity of the city to surrounding natural greenspace. Due to this close proximity, the participants identified that high urban biodiversity, especially of birds, was a notable feature of the Wollongong area.

The close proximity of nature (bushland) to the city was viewed as under threat due to pressure for urban expansion to push development further up the escarpment. Additionally, new housing developments (e.g. West Dapto[1] and Calderwood[2])

on old farms in peri-urban or 'transitioning areas' were highlighted by several discussion groups as being a threat to urban ecosystems through increasing urban sprawl. Planning in Wollongong was also described as being very 'car–dependent' which was due to the lack of good public transport in the area.

Participants at several tables also discussed good examples of the integration of humans, nature and the built environment in the Wollongong area (e.g. the campus redevelopment at Wollongong University[3]). They also identified greenspaces within the city that could have their ecological and social outcomes enhanced through urban ecology renewal initiatives (e.g. MacCabe Park).

The escarpment behind Wollongong. Source: Steen Barns (photo taken 2014)

University of Wollongong's Innovation Campus. Source: University of Wollongong (photo taken 2010)

1 http://www.wollongong.nsw.gov.au/services/majorprojects/westdaptourbanrelease/Pages/default.aspx
2 http://www.shellharbour.nsw.gov.au/Build/Plans,-Controls-and-Policies/Land-zoning/Calderwood.aspx
3 http://www.innovationcampus.com.au/index.html

QUESTION 2. WHAT ARE SOME EXAMPLES OF URBAN ECOLOGY?

In order to develop an urban ecology renewal blueprint, it was important for the project team to determine the barriers to urban ecology renewal that participants currently face or perceive within their organisation and the broader community. Additionally, the project team was interested in potential opportunities that could help in the implementation and enhancement of urban ecology. This question is about the effectiveness of current practices related to urban ecology and how it can be improved.

A large number of barriers were discussed, which ranged from very organisation-specific barriers to more general cultural and social barriers. In general, these barriers were also recognised as potential opportunities. Below, we synthesize the barriers and opportunities that were discussed in the workshop. We have combined barriers and opportunities into eight broad themes.

The influence of developers
Increasing development, and the influence of developers, is seen as a major barrier to the enhancement of urban ecology through the loss of urban greenspace and the resultant reduction in biodiversity. One participant noted, that urban planning in Australia puts developers first, whereas in some European countries (e.g. Sweden and The Netherlands), people are the first consideration. This was supplemented by comments about the Land and Environment Court, that was deemed to be 'pro-development'. This impact of developers was identified as a 'tragedy of the commons' where the developers receive the financial benefits from the development, but the costs (i.e. loss of biodiversity, remnant habitat, greenspace, and associated ecosystem services) are shared by the whole community.

The shrinking area of lots, and the amount of those lots covered by the building envelope was highlighted by nearly all workshop groups as a barrier to the amount of greenspace in the city and subsequent declines in biodiversity. The cause of this reduction in private greenspace was attributed to 1. increasing urban population densities; 2. the desire for large houses that cover almost all of the available lot; and 3. the 'economics of lot sizes' resulting in the subdivision of larger properties (i.e. the traditional ¼ acre block) into smaller villas with higher proportions of concreted areas. Overall, this has led to the increase in medium density housing, with 'pocket backyards and no space for trees'.

> *"Development driven by economics of lot sizes"*

It was recognised that considerable opportunities exist in the planning phases of new subdivision developments and lot redevelopments. It was highlighted that it is harder to plan for biodiversity once the development has already been built, so urban ecological principles need to be built into the design in the planning stage.

> *"Developers need to have benefits for incorporating urban ecology into the design phase. At present this is just dependent on EEC's and Threatened Species Impacts"*

At a metropolitan or precinct scale, bushland areas (including areas of no public access), public greenspace, community and verge gardens, and food production areas needs to be incorporated into the development plans. This could include the transition from single-level developments to multi-level developments, in order to reduce the amount of area the development takes up. Additionally, incorporating functional design elements that enhance biodiversity into the buildings needs to be done early in the planning phase. It was recommended that urban ecology principles be regulated at the development planning stage with the effective use

of external certifiers to make sure that developments met the landscape requirements specified in development consent. These principles have been applied in Sutherland Shire's Green Web strategy[4], which mandates a minimum proportion of native vegetation to be planted in private gardens depending on their proximity to core bushland or use as green corridors. To maintain rigor, the engagement of a certifier should not be done by the developer. However, it was expressed that even with certifiers of vegetation and landscaping requirements, there is no mechanisms to ensure long term adherence to these standards. Incentives, like reduced Development Application (DA) fees, could also be given to developers (both individual properties and large-scale housing developments) for the inclusion of urban greening values in to the design phrase.

Risk – individuals and institutional
Perceptions of the environment and nature were seen as one of the major impediments to the protection and enhancement of ecological principles in urban areas. Overall, these could be synthesised into two main themes: fear of nature and risk, and conflicting priorities/values.

There was an acknowledgement that some people have a fear of nature and that these fears contribute to the individual

4 http://www.sutherlandshire.nsw.gov.au/Outdoors/Environment/Plants-and-Bushland/Greenweb

choices they make in regards to the environment. These fears are sometimes due to a lack of understanding about the natural world, while others are grounded in the perceived risk associated with 'green' areas. Even for individuals that do not fear nature, they can perceive different components of the urban ecosystem as risky. For example, bushy areas are often seen as dangerous, and trees are seen as risky and often removed due to limb drop and bushfire risk. The measures taken to reduce the level of risk often outweigh the level of risk associated with nature. Examples were given which demonstrated when human risk was prioritised over biodiversity and ecological values (e.g. removal of trees from school grounds, even when professional advice said some trees posed no risk; species of trees that are fire retardant being removed under the 10/50 Vegetation Clearing Code of Practice[5]). The participants acknowledged that it was important to shift attitudes towards nature, so that they focus on the positive benefits of nature as well as the risk. Education about the co-benefits derived from nature could help people would make more rational environmental decisions that were appropriate to both the derived benefits and the associated risks. In order for the benefits of urban ecology (e.g. mental, physical health, air quality, economic, environmental and social) to be known, the participants called for a stronger evidence base demonstrating the co-benefits of urban biodiversity and greenspace and the need for this information to be easily accessible.

Participants at the Wollongong workshop

5   www.rfs.nsw.gov.au/__data/assets/.../1050-Vegetation-Clearing-Code-of-Practice.pdf

The notion of risk was equally seen as a barrier when applied to businesses/organisations. Businesses and organisations were seen to attempt to minimise financial and legal risks (i.e. getting sued or not getting a return on investment). This risk-adverse culture stifles creativity to incorporate urban ecology initiatives into their practices, instead preferring to use business-as-usual approaches.

Differences in values

The participants expressed that conflicting values is a barrier to the motivation for, and the uptake of, ecological initiatives. Some of the conflicting values raised were surrounding what people wanted on their own private land (e.g. the number of rooms and size of those rooms in houses) and the land surrounding their property. These conflicting values could limit the size of private greenspace available for planting, but also affect the landscaping they use in those greenspaces. For example, it was highlighted that there was a 'culture of indifference to [the] use of native plants in landscaping' and that people have a negative perception of trees and the associated mess. It was noted that most tree removal in private

areas is due to the mess the tree causes. Conflicting values may also arise due to other environmental priorities (e.g. solar panel/shade conflict). Differing values also affected natural areas surrounding private properties, with views of water being more valued than the view of a tree, often leading to the subsequent (illegal) removal or poisoning of trees blocking views.

Differing values were also expressed as a potential source of conflict in reconciling the goal of urban ecology and urban biodiversity. For many people the goal of urban ecosystems should be to resemble pre-European habitats, while for others 'just making things more green' was adequate. These different value systems have implications on how rehabilitation is undertaken in the urban landscape as well as moderating perceptions of land clearing for development. Several different sources of conflict including 'replication vs creation', 'native vs introduced ecology' and 'preservation vs restoration' were raised. Not having a common viewpoint on the outcomes of urban biodiversity and ecology was seen as a possible barrier. However, education aimed at increasing the value of the existing urban ecology (i.e. natural water ways, bush

remnants, dune ecosystems) was seen as an important opportunity.

Education was identified as an opportunity to make ecological decisions and actions a higher priority. The participants expressed the idea that through education we could improve 'the general public awareness and understanding of the benefits and need for healthy [urban ecology] and biodiversity'. These benefits should include both the public health and ecosystem service benefits.

The economic benefit of having natural greenspace near properties was noted as a way to increase economic value, this was especially true of greenspaces with less human-intervention and more natural/unchanged/unkempt systems. As such communities are demonstrating that they value greenspaces and government and developers would benefit from incorporating more projects aimed at enhancing urban ecology and biodiversity to maximise liveability and desirability.

Integrating urban ecology into private/residential properties

Universally, it was acknowledged that privately owned land, could be, or is, valuable for the enhancement of biodiversity in urban areas, and could even contribute to establishment of green corridors. Consequently, there was concern about the trajectory towards the smaller lot sizes due to the increase

in medium density housing. It was also recognised that there was a cultural shift towards a desire for larger houses, which has lead to housing floor space ratios reaching close to the maximum allowance. Overall, this has lead to smaller backyards, and smaller amounts of deep soil zones available for the establishment of trees. Being able to reduce the maximum standards for floor space ratios on lots was seen as an opportunity which could increase the amount of private greenspace available in urban areas. Moving from single level dwellings to multi-level dwellings was recommended as a way of increasing areas of private greenspace without compromising on the house size.

Although it was recognised that private backyards could contribute to ecological goals in urban areas, there were conflicting views about how heavily private homeowners could be relied on for the integration of sound ecological practices into their backyards. It was acknowledged that there was an opportunity to encourage good ecological practices in private greenspaces by the establishment of minimum landscaping requirements as part of DA applications, or by providing

"Reduc[e] DA fees for the inclusion of urban greening values into the design phase (pre DA). This could be for individual properties and large scale housing developments."

incentives (e.g. reducing council rates, financial incentives) for the establishment of habitat or the incorporation of native plantings into backyards.

Additionally, it was recommended that councils provide free consultation to property owners of what to include and what to plant in their backyards to increase biodiversity. However, although these were viewed as good recommendations, they were seen as temporary solutions, and focused more on the establishment of biodiversity friendly gardens rather than the maintenance of them. Once the DA approval occurs, or the incentive is received, there is no further mechanism to ensure commitment to maintain the biodiversity friendly practices. Furthermore, even if one owner is committed to the maintenance and provision of native vegetation and habitat features in their gardens, once the property was bought by a new owner, these measures may be lost. Finally, the ability of residents to source native plants, especially of local provenance, was seen as a barrier, as many commercial nurseries do not stock these plants.

Organisational or institutional barriers decreasing collaboration/ communication between disciplines
Barriers within organisations, or between levels of government were expressed by participants as issues which affected measures to protect or improve urban ecosystems and biodiversity.

In many of the large organisations, including councils, it was highlighted that there was a lack of collaboration and communication between different disciplines/ roles. This lack of communication was often driven by 'professional cultures and attitudes' and the physical distance between where departments sit. Additionally, due to different values, there could be conflict between departments about the implementation of biodiversity or urban ecology programs. It was noted that there are good initiatives out there, but 'getting everyone on board is hard'. This conflict was particularly apparent with engineers who often veto the planting of trees as they are not 'essential infrastructure' and increase the maintenance budget.

> *"getting everyone on board is hard"*

It was suggested that a way of overcoming this barrier was to integrate different sectors of an organisation better to ensure that ideas can get implemented. For example, it was noted that landscape architects and biodiversity officers at local council are generally in different divisions and do not have much, if any, cross over. Equally it was highlighted that designers make the processes, and then hand over plans to the landscape architects who have to try and interpret the plans. Encouraging collaboration

between the different sectors within an organisation could create better urban ecology outcomes and resolve some of the conflicts between departments in the uptake of environmental projects. Collaboration was hindered by the lack of buy-in from management which often did not prioritise principles of urban ecology.

A commonly expressed opinion at the workshop was that there was tension between local and state governments. Local councils expressed the view that the state government imposed requirements and/or restrictions onto councils (e.g. urban sprawl, BASIX restrictions, environmental impact assessments and offsetting) which could be sources of tension and often impeded the council's capacity to protect or enhance their local biodiversity.

Offsetting and biobanking was a common tension that was raised, with participants commenting that it was not working and resulted in a reduction in urban greenspace. Participants thought that preservation of what urban ecosystems they already have was important, and the replacement of urban habitat after its removal for development was not equivalent to the value of the original remnant habitat.

Policy and regulatory constraints and opportunities

Policy and regulation was seen as both a constraint and an opportunity for protecting and enhancing local biodiversity. There was a general consensus that local government policies were needed that support urban ecology. One workshop group expressed the need for development control plans (DCP) to be updated. Similarly, when there were adequate DCPs, it was expressed that decisions made by council needed to be grounded in what was written in the DCPs. However, DCPs are seen just as guidelines and not always followed. Additionally, it was seen that there was a gap between planning approvals for re-zoning and the development application and conditions set up at that stage. It was noted that more comprehensive mapping of previous re-zoning applications and approvals for assessing current DAs was needed.

The protection of trees was seen as a major priority for urban ecology. Tree removal on private property by owners and on public land by government and utilities was seen as too easy, despite polices despite polices such as Tree Protection Orders (TPOs). Current tree protection policies were viewed as being 'diluted', and there was a general consensus for the creation of policies that made it more difficult to remove trees. A potential opportunity in this area was for trees to be managed and valued as assets (i.e. getting the asset managers

6 http://www.theleader.com.au/story/2208211/greening-the-shire-with-1500-extra-trees/

on board with this) with the creation of a database for trees of significance, especially hollow bearing trees. It was suggested that this register of trees will give trees more value, and shift the focus of trees from the potential risk they could cause to other infrastructure, to the recognition of their own value as assets. An alternative policy-based approach to dealing with the loss of trees in urban areas, was highlighted by a discussion of Sutherland Shire's Green Streets program[6]. The Green Streets program tries to mitigate the loss of canopy trees due to illegal removal, development and old age by planting clumps of tree seedlings of mixed species of local provenance along verges and other council land. The project adopts a 4-1 replacement policy, which is levied from developers/home owners requiring tree removal and environmental fines for illegal removal.

> *"Tree management policies are being diluted offering more opportunity for tree removal than tree protection"*

Integration of urban ecology principles into other operational divisions

Biodiversity corridors which connect greenspace (including parks) were highlighted as an important part of the urban matrix for enhancing biodiversity. It was recognised that these corridors could be established along creeks and through the creation of coastal walks. Corridors using green belts along urban streams and water courses were also seen as being an opportunity to enhance the connectivity of greenspace in cities.

Rail corridors, highway verges and other forms of linear infrastructure (e.g. power lines) were mentioned as excellent opportunities for providing continuous wildlife corridors while still maintaining key infrastructure. The planting of natives, particularly of local provenance, along linear infrastructure was seen as a way of establishing these green corridors. Seeds used for planting corridors could be collected from the trees marked for removal prior to construction. However, the agencies (e.g. AusGrid and RMS) responsible for these large areas of public land were viewed as barriers to the utilisation of this land for improving urban ecology. Many of the management practices purported to be used by these agencies were detrimental to urban ecological goals (e.g. poisoning of weeds and the cutting down of trees). Many of these maintenance decisions were driven by the perceived risk associated with vegetation and supported by exemptions for clearing and building. It was recognised that opportunities exist if these state agencies collaborate with councils or local community and environmental groups (e.g.

Landcare) to enhance the ecological outcomes of these spaces. For example, one participant talked about a collaboration between Landcare and RMS to increase the urban ecology outcomes along the Foxground Berry Bypass. By working with local Landcare groups, the collection of local seed and the planting of local plant species was incorporated into the tender, design and construction process of the highway.

> *"State agencies not prioritising their large transport corridor land holdings for environmental management"*

Opportunities are further enhanced if multiple agencies can be brought together on a single project. For example, it was noted that 'Existing road corridors offer an area where tree plantings can occur, however hampered by electrical/ water utilities which require maintenance at expense of trees. A management plan aimed at moving electrical utilities below ground will reduce maintenance costs and increase areas of planting trees and vegetation'.

Cost (time, personnel and monetary) of urban ecology strategies.

The constraints that were associated with the costs associated with urban ecology projects was a theme highlighted by most discussion groups. These costs were mainly identified as monetary costs, but also included the ongoing staffing and time costs that were associated with most urban ecology initiatives.

Constraints surrounding costs arose mainly from the low priority for funding/resources/staffing that ecology and the environment receive from organisations. Part of the issue is that for many urban ecology projects, the costs include both capital costs, but also ongoing maintenance. These ongoing maintenance costs (e.g. mowing, weeding, pruning, dredging) can be a disincentive for undertaking urban ecology projects, with issues of who will fund the maintenance, and who is responsible for the upkeep, being important considerations at the onset of the project. Participants noted that the ongoing costs associated with maintenance of greenspace can also be used as an argument to sell off 'redundant' greenspace.

Opportunities to change how environmental projects were funded to help with meeting ongoing financial maintenance costs were raised. These included spending Section 94 contributions on biodiversity management (as well as infrastructure), extracting more money from developers or making developers fund projects. Additionally, changing the language surrounding environmental projects to be recognised as 'green infrastructure' could allow funds to

come out of capital budget (large) rather than operational budgets (small).

Using life cycle analysis as a decision support tool was highlighted as a way of justifying the initial upfront costs associated with urban ecology projects. These life-cycle costings calculate the costs spent, and benefits derived on a project over the lifespan of the infrastructure. Integrating these costs and benefits across the life-span of the infrastructure can demonstrate the value associated with urban ecology projects, over traditional practices. These projects can even lead to savings in the long-term and can demonstrate the big picture benefits of engaging in urban ecology projects. It was proposed that the advantages of life-cycle costing could be demonstrated

by calculating life-cycles costings for good existing urban ecology projects. Additionally, professional development would be required to enable personnel to be able to perform these life-cycle analyses.

Wollongong workshop participants

QUESTION 3: TO WHOM SHOULD WE TARGET EDUCATION? WHAT WOULD THAT EDUCATION LOOK LIKE? WHAT IS THE SCALE OF THAT EDUCATION?

Question three asked participants to think about the role that education plays in promoting awareness for, and uptake of, urban ecology and biodiversity strategies. As education was recognised as important in shifting public awareness and changing perceptions of nature, participants were asked to further describe which groups we should be targeting our education effort towards. Furthermore, we asked participants to consider how that education should be delivered.

The participants highlighted that while environmental education has had a long history, it seems to have a low impact. Also traditional ways of environmental education which are aimed at children or youth, have a rate of change that is too slow to address current ecological problems. Additionally, often outreach environmental education attracted members of the public who are already 'converted', or fail to reach people from a wide range of ethnicities. Consequently, participants highlighted that we need to be targeting different types of groups for environmental education, rather than focusing on children alone, and that we need education which demonstrates the benefits and value of urban greenspace in order to change perceptions of nature. Additionally,

the participants suggested that this education be implemented in experiential ways that embrace technologies, and demonstrated through good ecological examples and lead by champions.

TO WHOM?

There was a debate as to whether environmental education should focus on educating the general public, or whether education should more focus on individuals who have the capacity to make change. In general, this argument was linked to whether it was thought that we needed bottom-up pressure, or top-down leadership in order to make long term environmental change. Consequently, four main groups were identified as targets of education.

1. Educating the decision makers

Individuals in decision-making positions within organisations are often responsible for which urban ecology programs are implemented, and which are not. However, these decision makers often do not have an education or background in the areas in which they are empowered. It was therefore recognised in several workshop groups that in order to make changes that benefit urban biodiversity and ecology, we need the people who have the 'power' to make the decisions to value

biodiversity and the environment. Often there are good initiatives in place, but they do not have the support from upper management. The 'power of influence' was seen as critical in aiding the push for more urban ecology programs in cities. Educating the people who make the decisions in their organisations was therefore seen as critical. This education could be through training, or through experiential learning, where high level managers are taken to demonstration sites so that they can experience the 'vision' of urban design incorporating ecological principles.

2. Eco-literacy in schools

While it was recognised that ecological literacy/eco-literacy is already taught in schools, there was a push to improve it and increase its importance in the curriculum. One workshop group suggested that 'eco-literacy needs to be understood as a STEM discipline' in both schools and universities. Additionally eco-literacy could be incorporated into the curriculum of other disciplines, rather than exclusively being about science. The importance of making the teaching of this eco-literacy relevant and exciting was highlighted with the incorporation of technology and dramatic visualisations raised as possible ways of achieving this.

3. Adult education

There was a strong emphasis in this workshop on the need for

environmental educators to target adults. One participant noted that 'kids are not the answer for education – except to get to the parents'! Adults were seen as valuable to educate as they are ultimately making the decisions in society and need to be able to make environmental decisions based on sound ecological knowledge. More 'hard evidence of the multiple benefits' of urban ecology needs to be incorporated into education. It was seen important to especially target young adults (under 35 years of age) as they often want to make a change but do not feel that they can. By listening to them, and following through on their suggestions, we can demonstrate to them that they can make a change.

4. Continuing professional development/business engagement

Education was described as 'horizontal and vertical learning', therefore participants thought that environmental education should not only be incorporated into schools, but also into businesses through professional development. For example, it was recommended that landscape architects participate in more professional development to learn about ecology and local native species selection. Through professional development, businesses are able to keep up to date with the latest environmental practices and enable them to make informed decisions about incorporating ecological principles

into their practice, whilst justifying these decisions from a co-benefit/life cycle cost perspective. The integration of ecological practices could even be formalised into a type of 'corporate challenge'.

WHAT WOULD THAT EDUCATION LOOK LIKE?
Dissemination of information
Participants expressed an overall problem about the lack of public access to environmental information. This lack of access can lead to ignorance about the components in local ecosystems, and the importance of those components to the functioning of that ecosystem. Additionally, knowledge of the co-benefits of good urban ecosystems for humans (i.e. health, wellbeing and other ecosystem services) is often lacking, leading to a misrepresentation of nature as scary or risky. How we disseminate information to the public was therefore seen to be vitally important, especially due to the rapid growth of urban ecology. There was a call for an 'urban ecology handbook' that was widely accessible, as well as more 'hard evidence' of the co-benefits. Additionally it was recommended that councils increase the uptake and promotion of several environmental education programmes that already exist which foster an awareness of local biodiversity and/or encourage ecological actions aimed at enhancing urban biodiversity, like

Birds in Backyards, Habitat Stepping Stones and Backyard Buddies.

> *"Biggest issue with regard to enabling improved UE outcomes is the general public awareness and understanding of the benefits and need for healthy urban ecology and biodiversity"*

Experiential learning, including place making, workshops and citizen science
Involving the community directly in urban ecology was seen as a positive way of creating an awareness of local biodiversity and demonstrating the potential benefits of urban ecology. Ideas to create these interactions included involving people through an interaction with a space (i.e. place making) or through citizen science. Workshops, community gardens and open days can allow the public to practice and implement urban ecology strategies through hands-on approaches. Food production initiatives were identified as an important way of engaging students in urban ecology outcomes. Incorporation of food production and other eco-literacy programmes like bee keeping and native nurseries were also highlighted as a way of engaging children in ecological strategies that can have long-term community benefits.

Through citizen science, researchers and councils are engaging with people so they feel like they are

contributing to the understanding of the impacts of urbanisation on local biodiversity and ecosystem services. Additionally, citizen science allows the general public to develop an appreciation of their local biodiversity. Birds, in particular, were seen as good tool to engage the public in citizen science, as they are a conspicuous part of urban ecosystems. Receiving feedback and updates on their results made citizen science more likely to be effective as participants feel their contribution to have been valuable and acknowledged.

Technologies
Technology was highlighted as a key way in which environmental educators could engage with and excite people about urban ecology. The use of apps, especially with respect to citizen science, was seen as a valuable opportunity for education, especially for children and youth. This technology could also be a way of engaging people with the ecology in their urban surroundings.

Champions and (inspirational) demonstration models
It was seen that there was a lack of good examples and models for demonstration of the incorporation of ecological practices into urban areas. Inspirational demonstration models could be used as a way of engaging and inspiring the public and demonstrating that good ecological design can work. It was expressed that these exemplars

should be able to demonstrate the benefits of urban ecology and biodiversity and would be most helpful if they included the life cycle cost at present value. Additionally, participants said that we needed influential champions, who are equipped with up to date ecological knowledge and tools, to promote the cause of urban ecology.

> *"Lack of good examples and models for demonstration"*

SUMMARY

A key finding from this workshop was the need for inter and intra organisational support for urban ecology as a decision making consideration.

Integration of urban ecology will require:
- Changing minimum green space ratios and incorporating landscaping into DA and certification was seen as an important opportunity.
- Better integration within organisations, between organisations and levels of government is needed to implement more environmental projects to improve urban biodiversity.
- Top down leadership and bottom up pressure are both important in changing how we incorporate urban ecology practices into our cities. Education was therefore important for the general public, but also for businesses and decision makers.
- Education of people to recognise the place of humans in urban ecology and make decisions, based on evidence, that enhance urban ecology outcomes.
- Education is an important strategy in changing perceptions about risk and increasing the value of nature.
- Technology and experiential learning, including place making, workshops and citizen science, are important strategies for environmental education.
- Champions and good examples of practices that enhance urban biodiversity.

One Central Park, Chippendale

PART 1: DEFINING URBAN ECOLOGY IN CITIES

In all workshops we opened our break out session discussion with the question, "What is urban ecology, and what does it mean to you in your context?" Through this question we were able to elucidate the spectrum of definitions that our stakeholders held about urban ecology. We were additionally able to collate some of the examples which participants put forward to either aid their description of urban ecology or provided as key exemplars of urban ecology.

The overwhelming finding which emerged across all five workshops was the diversity of responses which participants gave to define urban ecology. Participants defined urban ecology as either a scientific discipline; an entity or combination of entities; a process or series of processes; or an interaction between entities and/or processes. The lack of consistency between definitions was attributed to the definition meaning different things to different professions, being generally ill-defined and being a relatively recent definition which has continued to evolve. Definitions tended to depend on their professional backgrounds, work place or the context in which their organisation operates.

Most of the definitions of urban ecology expressed by workshop participants included some component of both the 'natural environment' and 'humans and the built environment'. These definitions consequently can be positioned along a spectrum based on the emphasis placed on either humans or nature (Figure 1).
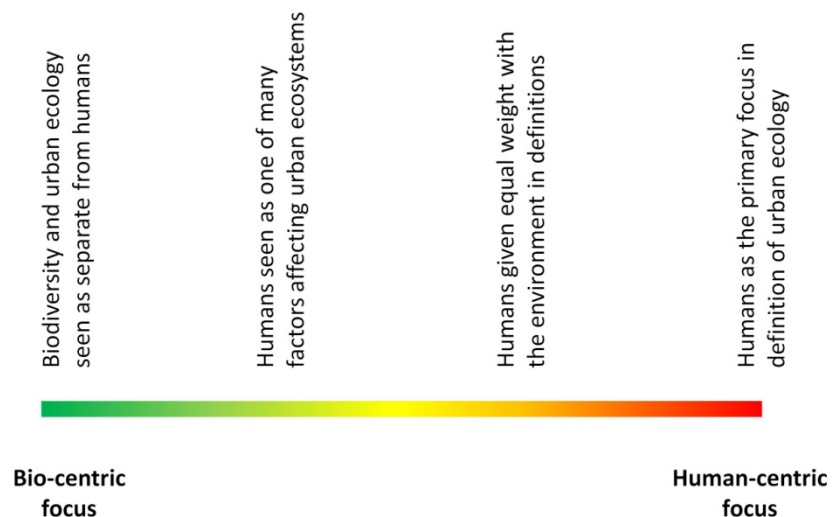
Definitions of Urban Ecology

Figure 1: The spectrum of definitions of urban ecology given during stakeholder workshops. These definitions ranged from bio-centric definitions, which focused just on nature without humans, to human-centric focused definitions which were about the benefits of nature to humans. Most definitions of urban ecology were positioned somewhere in between the two ends of the spectrum.

Participants that defined urban ecology as more bio-centric completely separated biodiversity and urban ecosystems from the built environment, noting that biodiversity can 'exist' within the urban environment and that developed areas are opposite to natural areas. Examples given focused on examples of ecosystems what were perceived to have little modification by humans including remnant bushland areas and intertidal zones.

For most participants, the definition of urban ecology included humans and/or the built environment interacting with natural and physical components of ecosystems. Humans were either (1) given the primary focus of these definitions, (2) included as equal part of the definition with the environment, or (3) seen as just one of many factors that influence/defines urban ecosystems (Figure 1). The incorporations of humans into the definitions was phrased differently, ranging from 'impact/modification', 'experience', 'relationship' or 'interaction'. Examples of more human-centric views of urban ecology included WSUD and blue/green infrastructure which was incorporated into the built environment. Participants highlighted the need to recognise the impact humans have on nature, and conversely the impact nature has on humans. Inherent in more human-centric definitions of urban ecology is that humans play a pivotal role in shaping, through impact and modification, urban ecosystems. Extrapolating this idea, is therefore the acknowledgment that humans can make decisions and actions to improve, or degrade, the current state of urban ecosystems.

For bio-centric definitions urban ecology goals tended toward rehabilitation of ecosystems to pre-European states, or protection of remnant ecosystems (or those now resembling remnant ecosystems). Conversely, human-centric definitions allowed the goals of urban ecology to be driven by the needs of humans, where more novel ecosystems, which were modified to be 'fit-for-purpose' for human needs (including aesthetic, financial and safety/risk considerations, and ecosystem services). These more human-centric goals often started with the build environment, and asked questions of how to incorporate nature into these developed areas. The lack of a consistent goal for urban ecology, driven by the nature/human spectrum of urban ecology, creates tension even between proponents of urban ecological initiatives in particular areas.

It was acknowledged that the value placed on either nature or human-centric goals need not be fixed, but could differ depending on a site specific basis. This idea of individualised goals/solutions for different areas was linked to a discussion in some workshops that urban ecology is complex. This complexity reflects that cities (and the spaces therein) are functionally diverse by the nature of their land use and how people use that land, and the ever-changing diversity and dynamics of ecological systems within and between cities. Despite this, most participants rarely explicitly distinguished between types of development (e.g. in-fill and greenfield) or differences between outer, middle and inner regions of a city. Additionally, while there was some acknowledgement that different components of biodiversity have different requirements and needs, this was not reflected in most responses. For example, most urban ecological projects given were about vegetation and urban greening, while the marine ecosystem was largely overlooked.

In many of the definitions given, urban ecology were phrased in an aspiration tone. That is, participants did not describe what urban ecology is, but the benefits it can achieve. These benefits were often focused around specific ecosystem services (e.g. UHI and carbon sequestration), but others just used aspirational terms (Box A).

Urban ecology examples given by participants were seen to operate across spatial ("backyard to bioregion"); and temporal scales, and also ranged across the bio-centric/human-centric spectrum (Table 1). The main type of urban ecological projects or initiatives given were at

the district/regional scale. Interestingly, most participants provided examples of urban ecology that were specific to their own district/region. This demonstrates that district level urban ecological projects may only have a district/regional level impact, but these projects are highly visible within the community and could aid in creating awareness about urban ecological issues and benefits. It also highlights how urban ecology projects can be seen as an important components which have the potential to contribute to the unique character of a place (i.e. place-making). The focus on district level examples suggests that in funding case studies or exemplars of urban ecology, there is a need to reflect on the interaction between the local and district level and how these can be used to inspire and raise community and industry awareness and practice. Despite this community level approach, there was also an emphasis on highlighting key, innovative flagship examples of urban ecology like One Central Park in Sydney or large city-wide international examples, e.g. Cheonggyecheon. These examples were put forward by multiple participants across multiple workshops and demonstrates how businesses which drive urban ecological innovation or cities which adopt large scale projects could generate positive publicity and international recognition.

Table 1: Named examples of urban ecology provided by participants. These examples were either given to aid in their descriptions of urban ecology, or in response to the question "What are some examples of urban ecology". Participants also gave more unspecific examples of urban ecology including: backyards, vegetated streetscapes, railway corridors, highway interchanges and bushland remnant patches.

Site installation	Parks	Lot/Local	District	Region/ Metro	State/ National	International
WSUD in Red Cow Lane, Parramatta	Cenennial Park, Sydney	One Central Park, Sydney	Street Alive Program (North Sydney Council)	The Sydney Green Grid		Cheonggye-cheon, South Korea
Flower pot rock pools, Blackwattle Bay, Sydney	Baranga-roo Reserve, Sydney	Cup and Saucer Creek wetland, Canter-bury - Banks-town	Marrickville Council rain-gardens and WSUD	Par-ramatta River Catch-ment Group		

Site installation	Parks	Lot/Local	District	Region/ Metro	State/ National	International
	Headland Park, Mosman	Wollongong University campus re-development, Wollongong	Bush Backyards Scheme, Blue Mountains City Council			
	Sydney Park Wetlands, Sydney		Bankstown City Council Biodiversity Strategic Plan 2015-2025: Conservation Corridors and Section 149			
	MacCabe Park, Wollongong		Asset management approach: Newcastle Urban Forest Policy, Newcastle City Council			
			Penrith City Council WSUD Policy and Technical Guidelines			
			Hornsby Shire Council resident engagement through identifying native vegetation			

PART 2: PATHWAYS TOWARDS TRANSITION

In part 2 of this discussion, we collate the responses to the following suite of questions:
- Question 3: How do you work with the ideas and issues of urban ecology in your daily work? What does and doesn't work?
- Question 4: What are the barriers and opportunities for enhancing urban ecology?
- Question 5: What is it going to take to create change and improve urban ecology outcomes?
- Question 6: What would it take to influence or boost decision making in your organisation or field to favour urban ecology?
- Question 7: What issues need to be addressed immediately and where are the effective points of intervention?
- Question 8: What are the motivators and/or influences around achieving urban ecology?
- Question 9: To whom should we target education? What would that education look like? What is the scale of that education?

Each workshop group was asked a subset of questions 3-9 (Appendix 2). These questions were asked of the participants in order to determine the organisational context in which urban ecology initiatives and planning take place. Through this context, participants were able to discuss barriers which they perceived within their organisations and suggest possible mechanisms which could be leveraged or changed in order to enhance the incorporation of urban ecological principles in their practices.

When asked to discuss the barriers and opportunities that exist for enhancing positive urban ecology outcomes, participants focused more on barriers. While not made explicit, the bias of the discussion towards barriers reflects the composition of environmental and landscape architecture professions at the workshops and the frustration that many individuals in these fields feel in trying to protect, promote and innovate to achieve positive urban ecological outcomes. These barriers included operational procedures, the lack of integration between the organisations, levels of management and disciplines, the need for more communication and education, and the inability to regulate and enforce mandatory urban ecological principles in developments (infill and greenfield). In most of the workshops, however, participants recognised that barriers could also be the source of opportunities to enhance urban ecosystems. The re-phrasing of barriers into opportunities in all workshops demonstrates the current level of motivation that exists, at least within the fields and sectors which were represented at the workshops, for protecting existing urban ecosystems and changing the status quo in order to adopt more ecologically-sound practices in cities.

On the following page we have summarised the key themes (Figure 2) raised during the discussion of questions 3-9. The size of each circle reflects the number of times eachwas mentioned durings the workshops. We have synthesised responses to questions 3-9 together due to the repetition in which the following themes were raised across questions (Appendix 2).
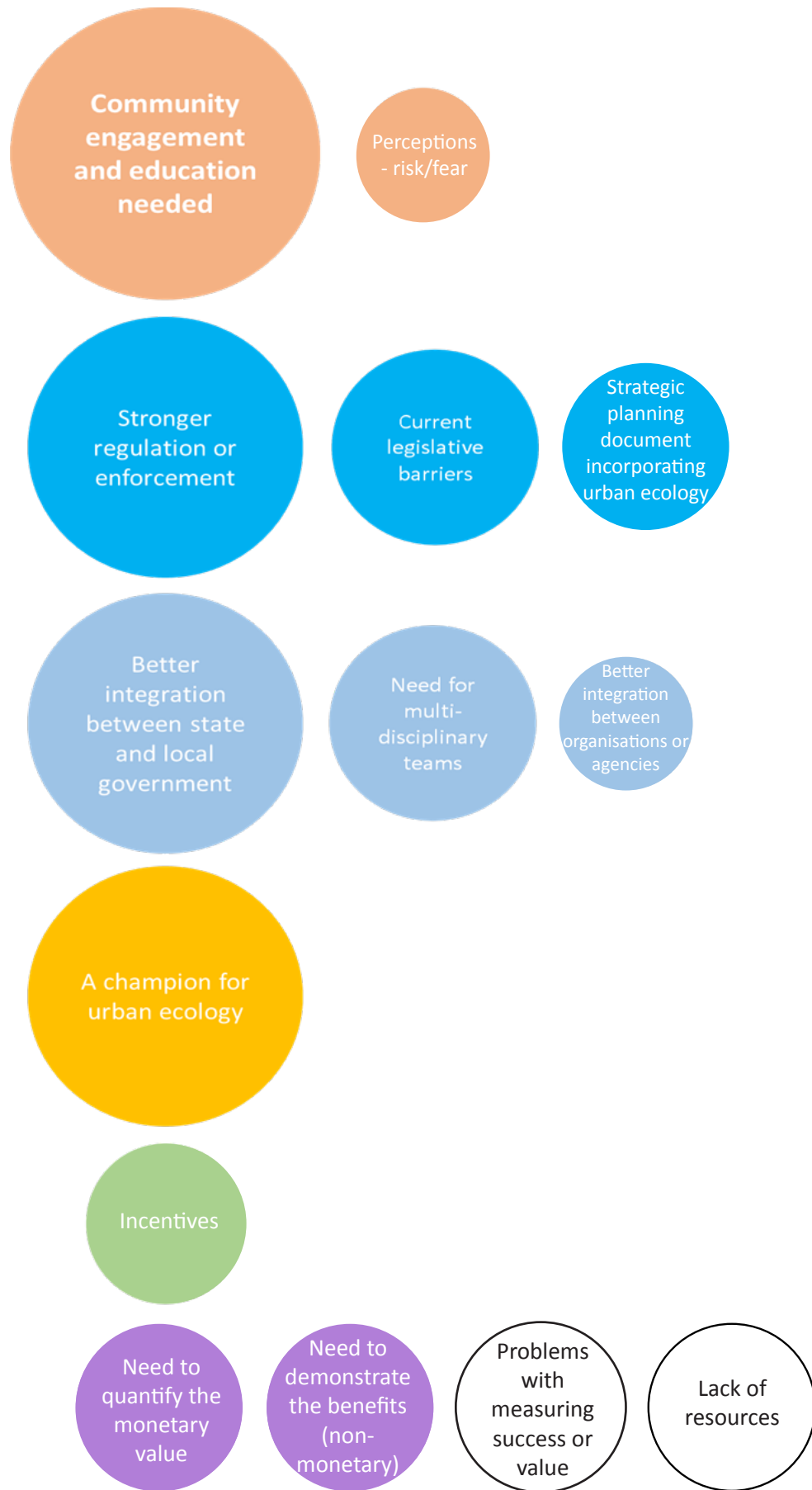
Figure 2. Key themes raised during discussions of questions 3 - 9.

Inter and intra-institutional collaboration

One of the major barriers participants identified was the lack of inter- and intra-institutional collaborations. Lack of integration was raised in all five workshops. In most workshops increased integration and collaboration between sectors or organisations was highlighted as a key aspect which could encourage the promotion and implementation of positive urban ecology outcomes in more projects. The specific organisation or disciplines which were identified as needing greater integration differed between workshops and ranged from the small-scale (i.e. between projects, or between divisions/disciplines within organisations), to the larger-scale (collaborations between councils, agencies, organisations). The need to align the policies and practices between levels of government was also highlighted as a fundamental opportunity for increasing the amount of successful urban ecology initiatives in Sydney, Newcastle and Wollongong.

The large number of divisions and organisations which were identified as requiring better integration and alignment on urban ecology projects and objectives reflects the multi-scale nature of urban ecology projects. These projects need to be supported and implemented from the state and regional scale to the local and lot scale. A key challenge in the implementation of urban ecology will be how to foster a common commitment to adopting and integrating urban ecology initiatives and to facilitate communication. Below we discuss some of the key barriers and opportunities discussed by participants around the lack of integration in trying to achieve better urban ecology outcomes.

Integration between state and local governments, and between local councils.
In all five workshops, participants made direct mention to tensions between local and state governments. These tensions arose from differences in values and practices towards urban ecology outcomes resulting in an inconsistent approach. Many participants in the workshops spoke about the need for greater political will from the state government to create stronger policies and frameworks within which local government can work. They highlighted that state planning needed to be shifted from a focus on job and housing, to additionally incorporate liveability. Despite the call for stronger legislation from the state government, there was also considerable discussion on the flaws of current state government legislation and practices, and how these current policies can stifle the ability of local government to protect their local biodiversity and the environment (Box 1).

Better integration between state and local government

Current legislative barriers

Box 1: Existing legislation identified by participants as needing review due to negative effects on urban biodiversity and ecosystems.

- 10/50 Vegetation Clearing Code of Practice: viewed as facilitating the clearing of trees regardless of their fire hazard risk
- Crime Prevention Through Ecological Design: hindering the adoption of complex understorey vegetation layers in public areas
- Open space planning standards: based on U.K standards developed in the 1940, and does not specify the quality (in terms of urban ecology principles) of open space.
- BioBanking Offsetting scheme: viewed as resulting in the removal of existing ecosystems leading to overall habitat loss.
- Requirements for E2 zoning: these zones were seen as too easy to re-zone and thus loses long term protection
- Tree Protection Orders: viewed as 'diluted' and needed to be make stronger to make it more difficult to remove trees on private by owners and on public land by government and utilities.
- Local Environmental Plans (LCPs): need to be updated to include effective environmental triggers to enhance urban ecology outcomes.

While some local councils were identified or reported that they were implementing effective urban ecology initiatives, there was a lack of consistency between councils as to what they do and the coordination at a district and regional level. Participants in the Parramatta workshop highlighted the need for a long-term plan for urban ecology at the Greater Sydney scale to align the planning mechanisms, practices and goals of urban ecology at a larger spatial scale and recognise the connectivity across councils. The application of larger regional scale plans could equally be applied to the larger metropolitan areas of Wollongong and Newcastle. Council amalgamations were seen as potentially important opportunities for increasing integration of already existing urban ecology projects and initiatives.

Integration between stakeholders and disciplines

Better integration between organisations or agencies

One issue raised by participants was the problem of achieving urban ecology outcomes while working in a multi-stakeholder or multi-disciplinary context. The participants highlighted that there was a mismatch between the values, goals and practices of environmental professions or divisions, and other sectors, organisations and disciplines. Consequently, urban ecology outcomes were often overlooked or minimised due to conflicting priorities from other stakeholders or divisions. Participants gave examples of this lack of integration:
- between departments within organisations and councils;
- between different organisations; and
- between state government agencies.

One of the key causes identified for this lack of integration was insufficient communication between divisions within organisations, and between stakeholders representing different fields. Reasons given for the lack of communication were the physical separation of disciplines within the organisation, and also the separation between professional cultures and attitudes. Participants called for more inter-disciplinary and inter-agency collaboration. Establishing multidisciplinary teams or having representatives from key agencies meet at starting of projects was seen as critical. These multi-disciplinary or multi-agency teams would encourage the alignment of goals, and offer a diversity of opinion and ideas, and facilitate a process of shifting professional values and norms.

Leadership from decision makers

Buy in from the top

Regardless of the type of organisation or government level, the importance of having decision makers which support and/or champion the incorporation of urban ecology principles into their practices was seen a highly effective way of increasing urban ecology outcomes in cities. This support from decision makers included stronger leadership and the need for greater resourcing (through monetary, time, personnel, expertise and the availability of local native plants) to support the management and maintenance of urban ecology projects over time (Box 2 below). In addition, strong leadership is needed in driving innovation and uptake urban ecology strategies. While there is inherent risk associated with changing 'business as usual' procedures to enhance urban ecological outcomes, the lack of support of innovation can stifle the positive momentum for incorporation of urban ecology into built environment projects, or large-scale uptake of existing initiatives. The lack of support of innovation was particularly recognised in middle-sized developers, which may not have the risk management strategies, or expertise to drive innovation. In four of the five workshops,

participants either gave examples of scenarios where people in leadership roles (e.g. politicians, councillors, managers) were unsupportive of urban ecology initiatives which hindered the protection or enhancement of local biodiversity and have urban ecological benefits, or acknowledged that changing the values and mindset of those in power, could be an opportunity for increasing the up-take of urban ecology strategies. However, across all workshops, there were only two examples given of when people in leadership positions championed urban ecology or were encouraged to integrate urban ecology principles into their practices. This unequal balance between negative examples of where those in power are unsupportive of urban ecology projects, compared to positive examples of leaders championing urban ecology demonstrates the barriers that many participants faced with managerial support in their organisations.

> **BOX 2: SOLUTIONS PRESENTED IN WORKSHOPS TO HELP INCREASE THE RESOURCING FOR MANAGEMENT AND MAINTENANCE OF URBAN ECOLOGY PROJECTS**
>
> - Use some section 94 contributions for biodiversity management
> - Leverage money from developers for use in urban ecology projects
> - Make developers pay for urban ecology projects
> - In government, recognise urban ecosystem elements as essential infrastructure so that funding comes out of the capital works budget rather than operational budget
> - Develop funding plans to support ongoing management and maintenance of urban ecology projects at the onset of a project

In the Wollongong workshop, where there was a greater emphasis on education, participants highlighted the need to target education to those in power. This education should demonstrate the vision, benefits and value (monetary or otherwise) of urban biodiversity and ecology. Without this support from decision-makers, participants noted that urban ecological initiatives would be unlikely to be implemented within organisations without the enforcement of external or mandatory requirements.

A champion for urban ecology
In a similar leadership theme, in several workshops participants thought that a champion for urban ecology was needed to promote change. This champion should be up-to-date with current research, and promote urban ecology, take a stand and drive change. The need for a spokesperson may be indicative of the inability for some participants to generate change from their position within their own organisations. Having key powerful individuals promoting the same urban ecology values provides support for individuals' arguments within their own organisations.

Policy and planning interventions
In all five workshops participants discussed that current practices were inadequate for protecting or supporting biodiversity and urban ecosystems. Current landuse policies were also seen as too flexible and lacking in mandatory requirements. For example, in local government urban ecology goals specified within development control plans were only seen as guidelines, which were not always adequately enforced. Similarly, while the Environmental Planning and Assessment Act already has a requirement for a Statement of Environmental Effects (SEE) to be made, the statements are rarely assessed by people trained in ecology and are seen more

A champion for urban ecology

Stronger regulation or enforcement

as a 'box ticking exercise'. These SEEs, if given to resources (time and qualified personnel) to assess them thoroughly, could be used as a tool to protect local biodiversity and urban ecosystems. The call for stronger statutory support to improve urban ecology outcomes was voiced in all five workshops. Stronger state government policies which championed urban ecology outcomes was identified as a key opportunity for broad-scale adoption of urban ecological practices. Developing legislation which incorporates urban ecology outcomes was seen as important as it creates change which extend beyond political cycles.

Need for strategic planning document / incorporation of UE into planning

Participants thought it was essential to mandate the incorporation of urban ecology principles into the planning stage of developments, as they thought it was harder to make modifications to support biodiversity once a development was built. Consequently, much of the discussion in the workshops around regulation focussed on development applications and the roles developers could play. Although some (usually large) developers are leading the way in incorporating urban ecological principles into their developments, the majority of the developers are not following their example. There was a general consensus that if the incorporation of urban ecology requirements was made mandatory, developers would have to adopt urban ecological components into their practices. Without mandatory requirements, however, developers would not voluntarily incorporate elements such as green roofs into their designs. Participants from one workshop suggested mandating recommendations specified within existing guidelines, for example the Technical Guidelines for Urban Green Cover in NSW (2015), to ensure the incorporation of green infrastructure like green roofs and walls.

Industry ratings tools

Industry rating tools were put forward as a possible way of ensuring that urban ecological principles and elements were incorporated into projects. Some of these rating tools currently exist but need to be enforced in order to set an industry-wide benchmark for urban ecology. Participants suggested that rating tools, or other standards based schemes that required a minimum level of biodiversity sensitive urban design could be incorporated as a mandatory requirement into development applications. Consensus on whether these standards should be based on elements incorporated into the design stage of a development (using existing frameworks like BASIX) or on the performance of urban ecology initiatives (like NABERS) was not consistent. While design elements could be easily assessed, performance-based measures would be harder to assess due to the lack of a consistent single metric, or suite of metrics which are agreed upon to successfully measure the outcomes of urban ecology.

Performance based metrics

Problems with measuring success or failure

While not specially relating to performance-based standard schemes, participants in several of the workshops highlighted that the inability to easily and consistently measure the 'success' of urban ecology projects or 'value' ecosystems was a barrier to developing standards or benchmarks with which to guide urban ecology practices.

Incentives

Opposite to mandatory approaches, participants in three workshops suggested the use of incentive schemes to encourage the inclusion of urban ecological principles into projects on private lands. Incentive schemes suggested were either financial (e.g. reduced development application fees or council rates), offsetting or as a contributor to Corporate Social Responsibility. Another way suggested to incentivise the inclusion of core ecological principles into projects was to create an award scheme that recognises good practice. While awards for best-practice were

identified in just one workshop, this workshop had a larger number of participants working in design fields. Recognising best-practice work and allowing companies to leverage that recognition in the promotion of their organisation can help to incentivise ecological practices. Creating a competitive element, the awards scheme was predicted to foster innovation and momentum in the design space, at least for the higher tiered developers.

For many of the mandatory requirements, incentive schemes or performance-based awards, issues arose about how best to assess them and to ensure that the requirements set out in development applications had been met. At the moment, one of the barriers which participants from councils discussed was the inability to enforce landscape requirements set out with the development application procedure. The inability to enforce landscaping requirements was most often due to a lack of personnel and time to send certifiers to properties to inspect if the landscaping requirements had been met (although see Sutherland Shire, WWH5). Changing practices to include post-construction inspections to ensure compliance was seen as an important requirement in enhancing urban ecology outcomes. However, even if the incorporation of urban ecology principles into the planning and development stage could be enforced, there was no long term strategies to ensure that these landscaping elements (e.g. the retention of native plant species, the addition of ground and mid-storey cover) are maintained in the long term, especially if the lot is sold to new owners.

Enforcing urban ecology requirements into the development applications creates disruptive change at the scale of the lot or precinct. Reflective of the nature of the multi-scale approach to the problem of urban ecology, participants also specified that stronger strategic planning was needed at the regional or district scale. Landscape level planning should include measures that map and protect bushland areas and ecological-sensitive areas (e.g. flying fox camps), public greenspaces, food production areas, biodiversity corridors and riparian zones. The need for strategic planning was identified by participants in all five workshops. The new district plans being prepared by the Greater Sydney Commission was seen as opportunity to incorporate these urban ecology landscape elements into strategic plans, although representatives from councils also suggested updating DCPs. Additionally, comprehensive landscape mapping for urban ecology landscape elements and current and historic environmental zoning was recommended. Having maps which specified environmental areas which had been previously re-zoned would help personnel make landscape-level, rather than lot-level, decisions about the current applications for re-zoning.

Mapping opportunities

Urban ecology education and awareness

Providing education and promoting engagement and awareness for urban environment was a key theme across all workshops. Participants were quite broad in who they thought we should be educating, the types of education strategies that should be used (Box 3), and the topic which these awareness campaigns should cover. Interestingly, despite recognising the complexity of urban ecology when describing their definition of urban ecology, there was only one instance throughout the workshops where it was highlighted that most people did not understand the complexity of urban ecology. Instead, participants thought that education was needed to promote the benefits and importance of urban ecology to the community and professionals, and to demonstrate how best to incorporate urban ecological principles into practice.

Educating the public about the value of urban ecosystems through 'visible' bushland areas in the local environment.
- Free consultations to property owners of what to include and what to plant in their backyards to increase biodiversity.
- Having the community vote for five iconic species to use as 'flagships' around which urban ecology strategies can be developed leading to better overall urban ecology outcomes in the community.
- Providing opportunites for positive interactions with nature within the local community area (e.g. place-making)
- Using citizen science to engage the public in urban ecology and allow them to be a part of the data collection which demonstrates the value of biodiversity and urban ecosystems.
- Supporting community gardens and urban food production.
- Developing outreach and interactive tools aimed at engaging the public with their local biodiversity and ecosystems through technology (e.g. apps).
- Using workshops, open days and eco-literacy programs (e.g. native bee keeping and planting natives) to engage the public with nature and increase biophilia.
- Demonstrating how to achieve urban ecological outcomes using positive demonstration projects in public areas.
- Influencing long-term behaviour change and public values through strategic environmental education campaigns (like the Life-Be-In-It campaigns in the mid-1970s) and community-based social marketing (CBSM).

Community engagement and education needed

Community engagement and education was the most mentioned theme across all workshops and questions (Figure 1; Appendix 2). The reoccurrence of this theme was reflective of community education and engagement being commonly cited as a solution to barriers associated with public perceptions of urban ecosystems. Negative perceptions of which impede the incorporation and maintenance of urban ecological elements into private greenspaces were associated with risk, aesthetics and conflicting values and priorities (Table 2).

Table 2: Negative perceptions perceived to be held by members of the community which affects the incorporation of urban ecological principles in public and private space.

Negative perception	Issues
Risk/fear	• Reactionary practices in response to manifestations of risk (e.g. removal trees due to media coverage of housing damage during storms) without consideration of the immediate threat individual elements pose. • Failure to counterweigh the long-term benefits provided by urban ecosystems and associated biodiversity, against perceived levels of risk • General 'fear of nature' irrationally increases the perceived risks associated with nature and the environment • The removal of habitat is supported by policies (e.g. CPTED and 10/50 Vegetation Clearing) which do not assess the site-specific risk or consider the benefits derived by that urban ecology element.

Negative perception	Issues
Aesthetics	• Native species or remnant habitat is not always viewed as aesthetically pleasing as exotic species or 'designed' greenspaces. • Biodiversity-friendly habitat components are often associated with disorder and mess (e.g. providing fallen logs and sticks on the ground, trees creating 'mess', leaving old trees for hollow provision). • Biodiversity-friendly management practices are often associated with disorder and mess (e.g. decreasing mowing, pruning and raking management)
Conflicting values and priorities	• Protecting areas for biodiversity and habitat provision within cities can clash with other landuses, which the public could prioritise more. • Some of the public feel disconnected with nature which leads to disengagement with their local ecosystems and can lead to apathy. • How people prioritise the area available on private land can lead to conflict between incorporating urban ecology elements into greenspace and the desire for larger houses. This conflict is heighted with the decreasing sizes of lots • Conflicts with other environmental priorities.

To shift these negative perceptions, or change the priorities that the public place on urban ecology, community engagement and education was seen as critical.

Whom we should target our education was a specific question in the Wollongong workshop. In general, although targeting children was seen as important through eco-literacy and other community engagement strategies, it was recognised by participants that this is a long-term strategy and has very little impact in the short term. Participants suggested targeting education towards adults as they are the current decision makers in the community and they need to be equipped with a knowledge base to make sound ecological decisions. As an extension of this participants recommended that education be targeted at people in key decision making positions within their organisations. Furthermore, in three workshops, participants highlighted the need to provide urban ecology education opportunities for professionals working in fields which have the capacity to affect the incorporation of urban ecology principles into projects, such as landscape architectures, developers and project managers. Participants suggested that these opportunities could be through ongoing professional development or through formal tertiary education courses. In this way, organisations can keep up with the latest environmental practices and enable them to make informed cost/benefit decisions about incorporating urban ecology principles into their practices.

In one workshop participants reflected that the current format for community engagement needs to be reviewed as it does not appear to be shifting practice. Participants highlighted that education needs to be meaningful and effective. To do so, it has to be pitched at a level appropriate for a general audience. Education also needs to promote aspects of the urban environment to which the public can relate. Consequently, education needs to focus on the benefits to the individual of healthy urban ecosystems and biodiversity, both in financial (Box 4) and non-financial (e.g. mental and physical health, air and water quality, environmental and social) metrics. Additionally, participants, especially in the Parramatta workshop highlighted the need to recognise that communities are diverse

Professional development & awareness of urban ecology needed

culturally, geographically and socio-economically. Therefore, for public education to work, educators need to adapt their strategies to meet their diverse needs and backgrounds.

Quantifying monetary value needed

BOX 4: PUTTING A FINANCIAL VALUE ON ECOSYSTEMS

In four of the workshops, participants highlighted that one way of valuing an ecosystem was in financial terms. Some participants, however, were ethically opposed to this suggestion due to the intrinsic value of ecosystems. Reasons which participants had for financial valuing of ecosystems were:

- In many sectors the economy is given a higher priority than ecology. By demonstrating that urban ecological practices can provide financial benefits in the long term, environmental protection may be given a higher priority. Life-cycle analyses can demonstrate the value of urban ecology over its life-span based on the ongoing costs and the financial benefits it can provide.
- Property prices are higher in areas with greenspace compared to those without.
- Components of urban biodiversity (e.g. trees and greenspace) could be managed as 'assets' which would make aspects of the urban ecology seem more valuable. Labelling aspects of the urban ecosystem as 'assets' promotes their benefits, shifting perceptions away from potential risk (e.g. Table 1) to their benefits

Need for greater evidence base / access to data (e.g. demonstration models)

Part of the issue with demonstrating the benefits of urban ecology to the public and relevant professions, is that there was a perceived lack of local research, or that research is not disseminated to the public (Figure 3). Some participants called for an Urban Ecology handbook or guideline which could inform them of how to do incorporate design elements or adopt practices which support biodiversity.
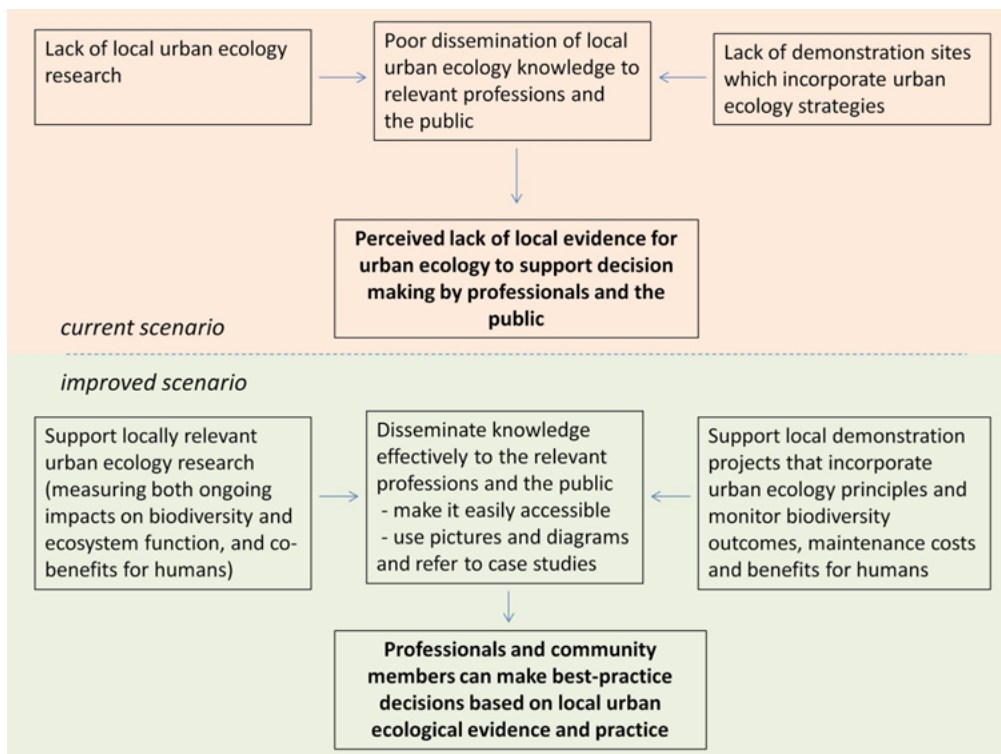
Figure 3: Factors contributing to a current perceived lack of local evidence available to support decision making around urban ecology (orange panel), and suggestions workshop participants suggested to improve the local evidence base surround urban ecological practice (green panel).

One problem with generating an urban ecology handbook, however, is the lack of agreement towards what ecology goals we should aim. This lack of a common benchmark was raised as a barrier to the type of urban ecology in cities. The different objectives were evident even between participants in the workshops despite most having an environmental or landscaping focus in their workplace. These differences were highlighted in the answers participants gave to the first question of "what is urban ecology", and the examples of urban ecology that they put forward as exemplar case studies (see Part 1 of the discussion). Overall, this demonstrated that there is a spectrum of urban ecology goals (Figure 4).

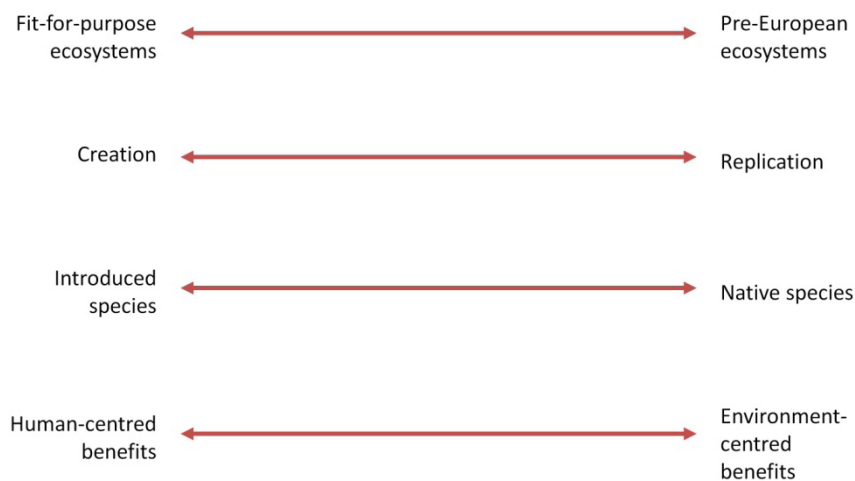| Fit-for-purpose ecosystems	←——————————→	Pre-European ecosystems
Creation	←——————————→	Replication
Introduced species	←——————————→	Native species
Human-centred benefits	←——————————→	Environment-centred benefits

Figure 4: Four spectra of urban ecology goals, ranging from highly-modified ecosystems which range from those created/designed in order to be fit-for-purpose in order to meet human centred values, aesthetics and ecosystem services to those that are managed for their ecological outcomes and reflect the original habitats which existed prior to urbanisation. The goals for each ecosystem within the urban ecological landscape can therefore be described using the position which they sit along each spectrum.

APPENDIX

Constructed wetland, Sydney University

Workshop participants

- Adrian Forrest (Mirvac)
- Cathy Oke (Clean Air and Urban Landscapes Hub, University of Melbourne and Melbourne City Council)
- Brinlee Pickering (Australian Institute of Landscape Architecture Fresh co-chair)
- Lyn Raffan (Office of Environment and Heritage)
- Jessica North (Department of Environmental Sciences, Macquarie University)
- Nathaniel Larkin (AUSGRID)
- Duncan Webb (Sydney Coastal Councils Group Inc.)
- Nicole Boyd (Infrastructure Sustainability Council of Australia)
- Angus Blackmore (Infrastructure Sustainability Council of Australia)
- Chris Kennedy (Environmental Trust)
- Emma Brooks (City of Sydney)
- Robbie Renu (Gecko Plantscapes)
- Suze Dunford (Office of Environment and Heritage)
- Mia Dalby-Ball (Ecological Consultants Australia)
- Meron Wilson (Hornsby Shire Council)
- Mark Blanche (AECOM)
- Rebecca Simpson (Office of Environment and Heritage)
- Kate Medcalf (City of Canterbury-Bankstown)
- Emma James (e2 Design Lab)
- Michael Mobbs (Sustainable House)
- Fiona Shadbolt (Sydney Coastal Councils Group Inc.)
- Alisa Bryce (Sydney Environmental and Soil Laboratory)
- Tim Williams (Aspect Studios)
- Jane Nalder (Aspect Studios)
- Janice Bagot (Office of Environment and Heritage)
- Wendy Evans (Macquarie University)

Workshop participants

- Janice Bagot (Office of Environment and Heritage)
- Craig Bush (Blacktown City Council)
- Jennifer Charlton (OEH)
- Penny Colyer (Ku-ring-gai Council)
- Adam Cook (City of Parramatta Council)
- Catherine Evans (UNSW)
- Dr Leroy Gonsalves (NSW Department of Primary Industries)
- Jacinta Green (Parramatta River Catchment Group)
- Paul Hackney (City of Parramatta Council)
- Kate Hopkins (OEH)
- David Kirkland (Western Sydney Parklands Trust)
- Shaun Mooney (Bankstown Council)
- Soren Mortenson (Australian Association of Bush Regenerators Representative)
- Cathy Oke (Clean Air and Urban Landscapes Hub) (CAUL)
- Jacob Sife (Kur-ring-gai Council)
- Roderick Simpson (Greater Sydney Commission)
- James Smallson (City of Parramatta Council)
- Glenda Steain (NSW Department of Primary Industries)
- Lin Yang (City of Parramatta Council)

Workshop participants

- Alejandro Barreto (Biosis)
- Suzanne Pritchard (Australian Association of Bush Regenerators Representative)
- Tim Gowing (Penrith City Council)
- Michael Tinlin (Maitland Council)
- Stephen McLeod (Maitland Council)
- Noel Corkery (Corkery Consulting)
- Kristy Munro (Newcastle City Council)
- Lindsay Field (Newcastle City Council)
- Matt Bell (MidCoast Council)
- Megan Sharkey (University of Newcastle)
- Peter Dixon (Office of Environment and Heritage)
- Karen Douglas (Central Coast Council)
- Vanessa McCann (Central Coast Council)
- Dr Suzanne Laucht (Central Coast Council)
- Rebecca Dugan (Central Coast Council)
- Rochelle Lawson (Central Coast Council)
- Heather Stevens (University of Newcastle)
- Annette Young (Lake Macquarie City Council)
- Scott Anson (Hunter Development Corporation)
- Karen Partington (Lake Macquarie City Council)
- Angel Troke (Lake Macquarie City Council)
- Adam Kennedy (Lake Macquarie City Council)
- Evelyn Craigie (Industry Assessments, Department of Planning and Environment)

Workshop participants

- Olivia Leal-Walker (Frasers Property Australia)
- Peter Bourke (Transport for NSW)
- David Martin (Sydney Olympic Park Authority)
- Stephen Summerhayes (Cooks River Alliance)
- Matthew Dillon (Green Roofs Australasia)
- David Dekel (Rockdale City Council)
- Richard Griffiths (Department of Planning and Environment)
- David Eckstein (City of Sydney)
- Helen Sloan (Southern Sydney Regional Organisation of Councils)
- Judy Christie (Australian Association of Bush Regenerators representative)
- Svetlana Kotevska (Georges River Combined Councils Committee Inc.)
- Yolanda Gil (Western Sydney Parklands Trust)
- Andrew Booth (Junglfy)
- Nick Chapman (Ashfield Council)
- Geoff Hudson (Environment Trust, Office of Environment and Heritage)
- Leanne Hanvey (Environmental Trust, Office of Environment and Heritage)
- Geoff Doret (Sutherland Shire Council)
- Katherine Howard (Sydney Coastal Councils Group Inc.)
- Jon Stiebel (Leichhardt City Council)
- Sharyn Casey (Horticulture Innovation Australia)
- Francesca Muskovic (Property Council)
- Daria Rech (Penrith City Council)
- John Martin (Botanic Gardens & Centennial Parklands)
- Sue Stevens (Waverly Council)
- Dominic Rolfe (Macquarie University)
- Chris Spraggon (Bush-it Pty Ltd)
- Katie Oxenham (Southern Sydney Region of Councils)
- Madeline Hourihan (Rockdale Council)
- Waminda Parker (Nature Conservation Council of NSW)
- Margot Law (National Parks Association of NSW)
- Sonja Elwood (Northern Beaches Council)
- Ana Villaca (University of Wollongong)
- Michelle Zirkzee (Fungimental)
- Tom Grosskopf (Office of Environment and Heritage)
- Sophie Golding (City of Sydney)
- Jacqueline Marlow (member various not-for-profit organisations)
- Janice Bagot (Office of Environment and Heritage)

Workshop participants

Wollongong workshop

- Alison Haynes (University of Wollongong)
- Cr George Takacs (Wollongong City Council)
- Jodie Cooper (Shellharbour City Council)
- Stevie Medcalf (Sutherland Shire Council)
- Cr Jill Mirren (Wollongong City Council)
- Helen Wilson (Wollongong City Council)
- Emma Brown (Wollongong City Council)
- Elli Kircher (Wollongong City Council)
- Jedda Lemmon (Office of Environment and Heritage)
- Bart Schiebaan (City of Canterbury Bankstown)
- Renae Hockey (Conservation Volunteers Australia)
- Adam Woods (Conservation Volunteers Australia)
- Jared Pescud (Wollongong City Council)
- Leon Fuller (Urban Biodiversity Illawarra)
- Emma Rooksby (Urban Biodiversity Illawarra)
- Jerah Fox (Wollongong City Council)
- Holly Parsons (Birds in Backyards)
- Mark Spence (University of Wollongong)
- Gary Leonard (Botanist and Arboriculture Consultant)
- Pascal Perez (University of Wollongong)
- Gaby Kirwood (Wollongong City Council)
- Axton Aguiar (University of Wollongong)
- Cathy Blakely
- Shanaka Herath (University of Wollongong)
- Warwick Varley (Allied Tree Consultancy)

Workshop questions

Questions asked	Q3	Q4	Q5	Q6 and 7	Q8	Q9
Workshop asked	1 - 4	4 and 5	1 - 4	1 - 4	4 only	5 only

Question 3: How do you work with the ideas and issues of urban ecology in your daily work? What does and doesn't work?

Question 4: What are the barriers and opportunities for enhancing urban ecology?

Question 5: What is it going to take to create change and improve urban ecology outcomes?

Question 6: What would it take to influence or boost decision making in your organisation or field to favour urban ecology?

Question 7: What issues need to be addressed immediately and where are the effective points of intervention?

Question 8: What are the motivators and/or influences around achieving urban ecology?

Question 9: To whom should we target education? What would that education look like? What is the scale of that education?

Key themes	Q3	Q4a	Q4b	Q5 & Q6	Q7	Q8
Problems with measuring success or value	1,3, 4	4		2		
Lack of resources	2,4	5		2,4		
Shifting business as usual	3	4	4			
Risk associated with change or innovation		5				
Political priorities		4,5		3		
The 'influence of developers'		5	3,4	3		
Shrinking lot sizes		5				
Disruptive vs incremental change			4			
Lack of integration of	3					

projects						
Better integration between state and local government	1,2,4	5	1,2,3,4		4	
Better integration between organisations or agencies	2,4	4,5	4			
Need for multidisciplinary teams	2	4,5	1,2,4	4		
'Buy-in' from the top	3	4	4			
Community engagement and education needed	1,2,3, 4	4, 5	1,2,3	2, 4, 1,3	4	5
Lack of ecological understanding	4					
Professional development and awareness of urban ecology needed	1	5		3		5
Perceptions – aesthetics	1,2					
Perceptions – risk/fear	3,1	4,5		4		
Perceptions – values (including apathy)		4,5				
Quantifying monetary value needed	1,3,4	5		3		
Need to demonstrate the benefits (non-monetary)	3	5	1	1,2		
Changing a nature to an anthropogenic				2		

focus						
Need for strategic planning doc and or incorporation of urban ecology into the planning stage	2,3	5	1,4	4		
Mismatches between temporal scales	3					
Stronger regulation or enforcement	1,2	4,5	1,3,4	1,2		
Current legislative barriers	2	4,5	1,2,4	4		
Performance based metrics	3, 1		1		4	
Incentives	2,3	5	4	3		5
Industry rating tools		5		1,4		
Awards for best practice			3			
Need for greater evidence base/ access to data (including demonstration models)		5				
A champion for urban ecology		4	1,3	1,2,3,4	4	5
Retrofitting to include urban ecology			4	1		5
Connecting blue and green space			1			
Off limit nature reserves			3			
Need for corridors		4				

Participant information statement and consent form

The Urban Ecology Renewal Investigation project research team would like to thank all of the representatives who participated in these workshops, for their time, enthusiasm, perspectives and expertise. Their participation and contributions are extremely valued.

The stakeholder workshops were an opportunity for experts in the field to share ideas, issues and opportunities in their discipline. They were also an opportunity to specifically introduce our research project to these representatives and for them to hear each other's perspectives on the value and future of urban ecology.

The National Green Infrastructure Network Urban Ecology Renewal Investigation project team

Front cover image: Restoring the Waters project at Clear Creek Paddock, Fairfield (Source: NSW Government Architect's Office image library)