

Shaping an urban landscape strategy to promote biodiversity

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ABSTRACT

Urban biodiversity issues lie at the intersection of two high-level government policy initiatives — the 2000 New Zealand Biodiversity Strategy, and the sustainable cities component within the 2003 Sustainable Development for New Zealand: Programme of Action. The priority accorded to these areas by government through its various agencies ensures that there is wide institutional interest in the potential for urban biodiversity programmes. At the same time, there is enthusiasm for action at the grassroots level, and a growing number of examples of community revegetation and ecological restoration projects. However, urban biodiversity lies within a complex web of statutory and non-statutory frameworks, and has cultural and social as well as ecological dimensions. In order to integrate these dimensions and ensure that local action contributes effectively to higher-level goals, we need practical ways to ‘walk the biodiversity talk’ at the city and district scale.

Landscape strategy offers one way to integrate biodiversity into urban sustainability, and to bridge between national and international goals and grassroots action. This paper first identifies connections between biodiversity and other aspects of urban management, and identifies a range of management issues. Particular reference is made to community development and asset management under the Local Government Act 2002, district plans and rules under the Resource Management Act 1991, open space and reserve management plans, iwi management plans and other key mechanisms. This is followed by a brief review of current directions in urban landscape policy internationally and within New Zealand. Finally, using examples, it is demonstrated how landscape policy concepts such as network, mosaic and corridor; heritage, place and identity; and health, care and regeneration, can be used to provide a strategic landscape framework for biodiversity initiatives.

The key feature of a robust yet flexible strategy is the identification of a landscape structure which utilises a range of management approaches, both public and private, to protect critical ecological processes and systems, create opportunities for biodiversity enhancement, and engage long-term political and community support.

INTRODUCTION

Urban biodiversity issues lie at the intersection of two high-level governmental policy initiatives — the New Zealand Biodiversity Strategy (DOC & MfE 2000), and the Urban Sustainability agenda (New Zealand Department of the Prime Minister and Cabinet 2003). The priority accorded to these areas by government through its various agencies ensures that there is wide institutional interest in the possibilities for urban biodiversity programmes. At the same time, there is enthusiasm for action at the grassroots level, and a growing number of examples of community revegetation and ecological restoration projects.

However, urban biodiversity lies within a complex web of statutory and non-statutory frameworks, and has cultural and social as well as ecological dimensions. We need practical ways to integrate these dimensions and ensure local action contributes effectively to higher-level goals.

Landscape policy and strategy offers one way to connect biodiversity with urban sustainability, and to bridge between national and international goals and grassroots action. In this paper I will first briefly review the current policy context for urban biodiversity and identify some current

challenges in 'walking the urban biodiversity talk' in New Zealand. I then summarise a number of precedents from landscape planning and policy that have addressed in different ways the opportunities and needs of 'nature in the city', and explore potential connections between biodiversity and other aspects of urban management. Using Christchurch as an example, I suggest that a multi-layered landscape strategy can be used to provide structure and direction for biodiversity initiatives.

CONTEXT: URBAN BIODIVERSITY AT THE INTERSECTION OF BIOLOGICAL DIVERSITY AND URBAN SUSTAINABILITY

Over the past decade, biodiversity has emerged as one of the key conceptual foundations for public policy on environment, at both national and inter-governmental levels. Growing recognition worldwide of the widespread loss of species and habitats, due to pressure from development, culminated in the 1992 Convention on Biological Diversity. Adopted at the UN sponsored Earth Summit at Rio, the convention was ratified by New Zealand in 1993. In 1997, the State of the Environment Report (Taylor et al. 1997) highlighted that despite growing environmental awareness and institutional reforms, New Zealand's indigenous flora and fauna continues to be under threat in many areas due to habitat loss and fragmentation, human disturbance, pests and predation.

The release in 2000 of the NZ Biodiversity Strategy 'Our Chance to Turn the Tide' (DOC & MfE 2000) identified a number of biodiversity goals, including shared responsibility and action, Treaty partnership, maintenance and restoration of habitats and populations, and maintenance of exotic genetic resources. Many Territorial Local Authorities (TLAs) now include reference to biodiversity in their statutory planning processes (e.g., see the Wellington City Plan), and a National Policy Statement under the provisions of the Resource Management Act (RMA) 1991 is in preparation. 'Biodiversity' is becoming a convenient and politically credible shorthand for 'nature'.

In parallel to these developments in regard to biodiversity there has also been a rapidly-

growing focus within public policy upon urban issues. Prior to the 1980s reforms, urban areas were largely ignored in conservation policy and planning in New Zealand. Even under the RMA, the city remained 'invisible'. This has all now changed. The Parliamentary Commissioner for Environment (PCE) has drawn attention to the central role of urbanisation in driving landscape change. A combination of population growth, a buoyant economy, traffic congestion, and a new awareness of the environmental impact of cities has placed urban growth management centrally in the wider debate upon sustainable development (PCE 1998, 2001; New Zealand Department of the Prime Minister and Cabinet 2003). Urban biodiversity therefore lies at the intersection of two powerful public policy agendas that are expressed at inter-governmental, national and local levels.

There is also a strong ground swell of community interest in the practical implementation and experience of 'nature' in the city. International precedents for urban nature conservation and regeneration date back to the 19th Century, and in recent decades there have been a series of mainly European initiatives to recreate 'wild' nature in the city (Laurie 1979). In New Zealand, the value of urban areas for experiences of 'nature' historically received less attention, as most energy was directed towards protection of remnants rather than regeneration. Nonetheless, in recent decades popular interest has become engaged with 'ecological' restoration projects on the city margins (e.g., Christchurch restoration projects include the Port Hills, Quail Island, Travis Swamp, and Styx River), and in a few notable cases (e.g., Addington Bush, Heathcote River) towards regeneration within the older city fabric. At the micro scale, the movement towards 'natural' gardens and the use of 'native' planting in parks and gardens has provided the most tangible and widespread expression of 'nature' in the city.

'Urban biodiversity' therefore has the potential to become a powerful policy concept that has a broadly-based popular appeal. In an increasingly global economy and society, the presence of locally distinctive flora and fauna within everyday living environments and neighbourhoods is

gaining political and popular support as a symbol of identity, as well as scientific recognition for its ecological role and values.

ISSUES AND CHALLENGES IN WALKING-THE-TALK

As with many new initiatives, there are risks and challenges facing the effective integration of biodiversity objectives within urban management. They include the state of knowledge and understanding of biodiversity, the ecological dynamics of cities, institutional capacity, the need to 'imagine' biodiversity, and the contests that occur between the (at times) contrasting visions of different professions, stakeholders and communities.

The state of knowledge about urban biodiversity in New Zealand is relatively new and untested, and largely descriptive. The predominant focus of government agencies and public funding upon the conservation estate and iconic species preservation has created a very uneven spread of scientific effort and results, with very little systematic ecological investigation of urban habitats. Much practical knowledge is vested in a few individuals and not widely published. As a consequence, urban landscape ecology focused upon biodiversity outcomes is largely based upon a mix of highly generic principles and very localised experience. Even the meaning of biodiversity is open to interpretation.

This situation indicates a need for a programme of action that can evolve in parallel with the development of knowledge and understanding. We cannot wait for all the detailed scientific investigations to be undertaken, but need a vision to empower biodiversity advocates and to influence the directions of urban change. This requires a programme that is robust in its strategic direction, and flexible in its detailed implementation.

The ecological challenges that face urban biodiversity programmes arise from the nature of cities as centres of human activity. From an ecological perspective, cities are highly

modified, disturbed environments, and are frequently gateways and concentrations of exotic species. The threats posed by the impact of introduced species upon New Zealand's unique biological heritage have been well documented, but the ecological relationships between a highly endemic indigenous flora and fauna and a wide range of introduced species in the urban environment are little understood. However, cities offer a range of opportunities. Exotic species can provide a matrix for indigenous regeneration. The dynamic socio-economic function of cities continually creates new environments, with scope to be utilised for biodiversity goals. Most notably, cities are huge repositories of material and human capital. Urban renewal and change provides a unique opportunity to tap into a flow of capital and resources that far exceeds any conservation budget. The challenge is to use these wider ecological and socio-economic processes to achieve indigenous biodiversity objectives.

Institutional capacity also presents a challenge, in three ways. First, as a new area of scientific investigation, urban ecological restoration is not well embedded within urban governance. Whilst Triple Bottom Line ideals and biodiversity objectives are becoming more explicitly expressed within higher-level policy, the institutional structures and personnel in most TLAs are still dominated by traditional functions and expertise. Nonetheless, the Waitakere eco city experience¹ shows how political leadership can effectively integrate biodiversity into wider goals, whilst in Christchurch the asset management strategy of the former Wetlands and Waterways unit² illustrates what can be achieved with professional vision. The risk is that such initiatives can easily be lost in institutional restructuring and corporate governance.

The second institutional challenge is the cross boundary issue. Greater Christchurch illustrates very clearly how different TLAs can pursue quite different and even conflicting strategies when there is an inadequate regional policy

¹ Editor's note: discussed by Chris Ferkins in these proceedings.

² Editor's note: discussed by Robert Watts in these proceedings.

framework. The Crater Rim of the Port Hills for example marks the boundary of dramatically contrasting policy regimes, and there are similar disjunctures along the western urban fringe. Yet ecological processes that underpin biodiversity play little attention to electoral boundaries.

The third institutional challenge is the interface between public and private sectors. Christchurch has retained a stronger sense of public good and governance than some other urban communities over the past two decades, but the public sector cannot achieve broad biodiversity goals by itself. It is essential to engage private landowners and managers, both large and small. But this can be a time-consuming and at times frustrating relationship, that can be seen to take resources away from direct action. In many overseas urban regions, an important facilitation role is played at a practical level by central or state-supported foundations or agencies. This is notably lacking 'on the ground' in New Zealand. Any urban biodiversity strategy must therefore include a significant commitment to capacity building.

One of the most difficult challenges is the *need to 'imagine' biodiversity*. Biodiversity is an abstract, scientific concept, with a number of different meanings and interpretations. It is easy to envision and gain support for the conservation of a threatened iconic species. It is much more difficult to envision and express the importance of subtle genetic variation, or the long-term viability of particular populations, or the interrelationship between diverse populations. Habitat is a more accessible concept, but can be misleading — the presence of tall bush does not always equate with a healthy regenerating ecosystem. Hence there is a need to develop and utilise scientifically valid and politically appealing metaphors and models to represent biodiversity outcomes. The most successful planners have always known this — concepts such as 'The Garden City', Green Belt, Finger Plan, and Randstadt all express complex ideals in accessible metaphors (Ahern 2002). We need similar devices in urban biodiversity.

However, the biological and cultural history of New Zealand has led to contrasting and *contested visions* about the future of urban

ecology. Recent reports in the *Christchurch Press* highlight the intense passions that arise when a predominantly European ideal of the Garden City, with 150 years of traditions based upon a horticultural approach to plants and a gardenesque aesthetic, meets with post-colonial aspirations for the reconstruction of a more indigenous ecological identity. This tension is not unique to Christchurch, but our history makes the contrast between the positions particularly marked, and this is expressed in the emotions and passions displayed.

The challenge is to develop an aesthetic language that can satisfy both established and emerging ideals. Meurk & Swaffield (2000) have argued in the rural context that greater visibility of indigenous species is essential to order to develop awareness and attachment amongst the wider population. This is an inter-generational process and Meurk and Swaffield suggest that the way forward is to identify structural elements within the productive cultural landscape into which indigenous elements can be introduced, such that the rural landscape retains its function and familiarity, whilst subtly evolving. A similar approach can be adopted within the urban setting.

Finally, there is a challenge of *competing ideologies and expertise*. Just as aesthetic ideals are passionately held and defended in New Zealand, so also is there intense commercial and political competition between professions and disciplines. With limited cash to go around, many sectors and professions want a slice of the action. The city is differently understood by different stakeholders — it is a planning map, economic market, urban village, and ecosystem, and there is a need to place broad goals such as the biodiversity agenda within a multi-disciplinary framework. No single discipline can achieve the goal, but many are needed. As with the contested visions, a shared language is needed.

Given these challenges, it is sensible to reflect upon previous experience and precedent before attempting to invent and implement complex new programmes. In the next section, some precedents from urban landscape planning over the past 100 years are briefly

reviewed, to identify key success factors that might usefully inform contemporary policy on urban biodiversity.

LANDSCAPE PLANNING FOR URBAN NATURE: PRECEDENTS AND PATHWAYS TO SUCCESS

The integration of ‘nature’ within the city has been a feature of many of the most successful landscape planning paradigms, from Howard’s Garden City to contemporary re-configurations of landscape as an expression of urban infrastructure (Corner 1999). In every case, biodiversity, or its antecedents, has been an integral part of a multi-functional landscape strategy, and the interconnection between ecological and human dimensions within a spatial framework is the characteristic quality of landscape-based programmes. What then are some of the most notable precedents and pathways to success? In this section I briefly review examples of ‘classic’ urban landscape planning paradigms, the ‘Nature in Cities’ initiatives of the 1970s to 1990s, and more recent trends in environmental assessment, asset management and ecosystems services management, concluding with the bio-regional agenda and the conceptualisation of urban infrastructure as landscape.

CLASSIC MODERN PARADIGMS

‘Classic’ examples of landscape planning that have incorporated nature in the city include:

- **Olmsted and the ‘Emerald Necklace’.** Olmsted’s reconstruction of the Fenway and Back Bays as part of a linked system of parks around the growing 19th Century city of Boston, Massachusetts remains a classic exemplar of multi-functional integrated park systems, combining stormwater management, transportation corridors, and recreation provision within a matrix of naturalistic revegetation (Zaitzevsky 1982)
- **Howard and the ‘Garden City’.** Intended to balance the dual attractions of town and country, The Garden City movement attempted to provide a ‘green’ experience for all urban dwellers, at every scale from micro (cottage garden) to macro urban structure. In the original context, there was

not the same separation between native and exotic plant material that is polarising contemporary Christchurch — Howard’s ‘Garden City’ (Howard 1985) symbolised an Edenic connection with nature rather than a commitment to the cultivation of exotic specimens

- **McHarg’s ‘Design with Nature’.** The synthesis of urban growth potentials with underlying natural resource patterns and processes proposed by McHarg (1969) provides a benchmark for all subsequent urban and regional planning. Fundamental to McHarg’s approach was a need to understand ecosystems at a regional and local scale, and to use this understanding as a primary generator of urban form
- **Copenhagen ‘Finger Plan’.** One of the best known examples of ‘modern’ city planning, the Finger Plan for Copenhagen, was developed in the 1950s, and illustrates the power of simple spatial metaphors to create order out of chaos. Designed to concentrate urban growth along transportation corridors whilst enabling walking access to open ‘green’ space between the fingers, the Finger Plan provides a rationale for large ‘conservation’ zones close to the urban centre. Other examples include the Dutch Randstadt, numerous ‘Green Belts’, and the growing ‘Greenways’ movement (Ahern 2002).

The common feature of all these exemplars is the strategic and large-scale organisation of space using readily accessible models and metaphors, to achieve multiple functions. Nature conservation (or biodiversity) is integrated with other functions such as drainage, recreation, and transportation, within a unified aesthetic language.

NATURE IN THE CITY

Ian Laurie’s 1979 text *Nature in Cities* crystallised the growing interest amongst designers and planners in post-war Europe in the ‘restoration’ of natural ecosystems and flora and fauna within the modern city. Some relevant examples include:

- **Urban wildflower gardens.** Emerging as part of European post-war reconstruction,

the development of wild flower gardens in urban parks (such as Rotterdam's Bos Park) exemplified two key directions. One, the need to actively restore native plants within cultural settings, and two, the application of detailed understanding of plant reproduction strategies to create self-regenerating native plant communities in artificially created environments

- **Brown-fields restoration.** The environmental legacy of the decline of traditional 'smokestack' industry stimulated a major programme of derelict land reclamation in many developed countries (now more euphemistically described as 'brown-fields'). Attention has now extended to the former Soviet countries, and the approach is evolving from the early focus upon public safety and recreation, to a more integrated restoration of ecosystems as part of a wider economic and cultural regeneration programme. Important recent examples include Duisberg North, that integrates water management, recreation, biodiversity and cultural heritage upon former industrial sites in the Ruhr Valley; Downsview Park, the reconfiguration of a former military base in suburban Toronto, and the 'Fresh Kills' restoration project of a former garbage dump in New Jersey
- **Community action.** One of the critical elements of the 1970s Nature in Cities movement was its engagement with local communities. There was a strong focus upon achieving outcomes for children — particularly re-establishing an educational connection with 'wild' nature, and in many North European projects there was also a significant employment training component. More recently, as government intervention into the labour market has moved out of fashion, voluntary participation has been emphasised
- **'Urban Forestry'**. A primarily European initiative that reintroduces forest and woodland species onto 'brown-field' sites within the city, enhancing biodiversity and recreation opportunities, but increasingly also targeted at environmental goals such as air quality enhancement (e.g., Urban Forestry Unit in the UK). It integrates many of the different dimensions of the Nature in Cities movement
- **Messy Ecosystems, Orderly Frames.** The

challenge of engaging communities with ecological restoration has led to a major programme in the USA (Nassauer 1995) that has identified ways in which restoration can be 'framed' in culturally acceptable ways. Nassauer's work identified a number of key factors, such as the need for 'cues for care'. Put simply, communities are more accepting of restoration projects when they can be seen and labelled as being deliberate interventions, rather than apparently 'neglected' areas. In the New Zealand context, this can translate to a process of framing 'bush' within more conventional urban aesthetics.

The key message from these exemplars is the need for a robust social, cultural and ethical framework for ecological restoration programmes. They will not succeed in urban settings as purely technical projects.

ENVIRONMENTAL ASSESSMENT AND MONITORING IN THE CITY

One of the flow-on effects of the introduction of environmental assessment procedures for major new projects has been the application of similar thinking to existing urban settings. This involves both the re-conceptualisation of the city as an ecosystem, and the application of environmental assessment and monitoring techniques to urban environments, in order to minimise the effects of urbanisation upon natural systems.

- **Environmental Assessment.** Introduction of the process of environmental assessment for major federal projects in the US in the late 1960s stimulated subsequent integration of Environment Agency (EA) protocols into resource management worldwide. In New Zealand the Resource Management Act 1991 formalised EA as a fundamental part of the regulatory planning system at every scale. There is growing attention towards the analysis of urban 'impacts' upon underlying 'natural' systems, and in the design of 'low impact' forms of development (Eason et al. 2003). Although the separation of 'human' from 'natural' processes is practically and conceptually problematic, in urban systems, the 'import' model is widely adopted

- **State of the Environment Reporting Process.** Response models are increasingly used to provide a monitoring framework against which new proposals can be assessed and modelled. At its most basic, this may be expressed as a 'biophysical bottom line', but more sophisticated use of assessment procedures, thresholds and indicators can help focus attention upon critical and achievable objectives at a landscape scale.

The key message for the urban biodiversity agenda from this phase of thinking has been the need to anticipate the ecological effects of actions and investment in urban systems, and to monitor and minimise those effects that are considered to be adverse or negative.

ECOLOGICAL REGENERATION

One of the most notable aspects of the past 2–3 decades of ecological restoration in cities has been the increasing use of self-regenerating processes. Early restoration projects adopted forestry or horticultural type methods, focused upon establishing individual or groups of plants. The high costs of establishment under this approach stimulated a shift towards progressively smaller plants, and towards the management of environments in order to encourage self-seeding and colonisation.

- **Regenerating Systems.** J. T. Lyle (1986) expressed the approach in terms of Regenerative Systems, in which the restoration effort is directed towards design and establishment of 'human ecosystems' that become self-sustaining. The challenge in New Zealand is the dominance in many urban areas of aggressive exotic adventive species, and the lack of seed sources and vectors for indigenous species, following 150 years of agriculture and urbanisation. This highlights the need for:
- **Mixed strategies.** Early work assessing the self-regeneration of indigenous species under mature gorse has been followed by a widening attention to the value of exotic plant matrices at a range of scales from plantation forests to domestic gardens. As

with the cultural initiative of 'framing' nature in familiar cultural symbols, the regenerative approach looks for opportunity to encourage self regeneration within existing exotic plant associations. The time span of regeneration may be several hundred years, but the focus is upon the long-term outcome (e.g., Swaffield et al. 2003).

The message from this is to develop pragmatic but long-term system wide strategies that become self-sustaining.

PUBLIC POLICY OUTCOMES

One of the predominant features of late modern society has been the extension and application of economic concepts, language and models to phenomena that have previously been regarded as outside the economy. In New Zealand, the reporting requirements of the Local Government Act (2002) and Public Finance Act (1989) have created the concept of asset management, in which biophysical resources owned and controlled by TLAs are valued and managed as capital assets. By the same logic, the social benefits from healthy ecosystems are also being re-conceptualised as 'ecosystem services'.

- **Asset Management strategies.** These have now become one of the most influential concepts in landscape management and have developed into a potent mechanism for enhancing urban nature. Exemplified by the Christchurch City Waterways and Wetlands Asset Management Strategy, asset management allows the long-term environmental benefits that will flow from an investment in physical infrastructure to become part of strategic decision making
- **Ecosystem Services.** Conceptually related to asset management, ecosystem services planning identifies, quantifies and manages the outputs and outcomes of ecosystem function as services to society. Hence health benefits that flow from improved access to green space can be enumerated and included in the overall management decision making for urban parks, for example
- **Health and wellbeing.** A rapidly growing dimension of the 'outcomes' approach is the linking of biophysical programmes to public

health indicators. The work of Kaplan & Kaplan (1989), and Westphal (in Martin 2002) for example is highlighting the positive health benefits from access to 'green' environments. This was always part of the 'Nature in Cities' movement, but increasingly the links are being quantified, which enables benefits to be expressed in terms of savings to public health budgets. With aging populations and escalating health costs, governments world-wide are increasingly open to providing support to long-term 'greening' programmes, if tangible public health benefits and savings can be demonstrated.

The key messages from these initiatives are that it can be helpful to identify quantified public benefits from restoration programmes, and where this may be difficult, to align biodiversity objectives with other public programmes for which such benefits can be identified.

BIO-REGIONALISM

In contrast to the asset management models that extend conventional economic rationality, Bio-regionalism is based upon an alternative approach to the economics of environment. As expressed by advocates such as Robert Thayer ('LifePlace'; Thayer 2003) bio-regionalism aims for greater integration between a regions' economy and urban culture and its underlying biological systems.

- **Indigenous ecosystem mapping.** One practical expression of a bio-regionalist perspective is the mapping of pre-human indigenous ecosystems, which demonstrate the underlying environmental adaptations and potential of a locality and region. The maps produced for Christchurch and elsewhere in New Zealand by Lucas Associates and Wildlands Associates provide a base line point of reference for restoration strategies³. The Bio-regionalist agenda argues that they should also form a component of the wider regional culture and economy, although it is important to note that authors such as Robert Thayer are not advocates of an

exclusively 'native only' perspective. Indeed, Thayer (2003) celebrates cultural adaptations and introductions as an integral part of the Sacramento Valley region upon which he bases his bio-regional work

- **Critical regionalism.** When connected with design paradigms such as critical regionalism (Frampton 1983), bio-regionalism provides an aesthetic programme for the enhancement of regional identity (Lynch 1976; Hough 1990) that is grounded in 'deep' landscape form and structure (Lyle 1990).

A key message from bio-regionalism is that cities never exist in isolation from their regional context. A viable urban biodiversity programme needs to be framed within a regional perspective.

INFRASTRUCTURE AS URBAN LANDSCAPE

Technological infrastructure remains one of the major areas of capital investment in any society, both in newly urbanising countries and in post-industrial countries that are renewing old infrastructure. Recent decades have seen a greater awareness of the multiple benefits that can be achieved from infrastructure investment and renewal.

- **Infrastructure as landscape.** Gary Strang (1996) crystallised a growing movement in landscape architecture when he argued for recognition of urban and technological infrastructure as landscape — not an artefact placed within a landscape, but the generator of landscape. Hence just as Duisberg North creates an aesthetic experience and biological resource from the relics of industrial infrastructure, Strang and others such as Corner (1999) argue for the aesthetic and ecological potential of new technological infrastructure. If shaped creatively, infrastructure can enhance the biological and social possibilities of the urban fabric within which it is embedded
- **Green infrastructure.** In Europe in particular, the potential for the 'greening' of both large and small-scale infrastructure has been widely researched and promoted.

³ Editor's note: see the paper by Di Lucas in these proceedings for references to their work.

This ranges in scale from the use of biological processes within buildings (green roofs, air quality etc.), through to water harvesting, grey and black-water treatment, to the large-scale achievement of biodiversity outcomes from motorway construction.

The key message is the opportunity to shape existing and new technology to deliver biodiversity outcomes.

PATHWAYS TO SUCCESS — A LANDSCAPE FOCUSED URBAN BIODIVERSITY STRATEGY

There are a number of practical opportunities for the enhancement of urban biodiversity that emerge from these examples. Pathways to success include the use of a broad landscape vision as an integrating perspective, that is expressed spatially at a range of scales; the utilisation of public and private infrastructure as a vehicle for biodiversity functions; the development of institutional mechanisms focused upon different parts of this broad strategy; developing a robust design vocabulary for ecological restoration that is grounded within a structural 'deep' landscape framework but acknowledges and incorporates cultural heritage values and conventions; and the linkage of biodiversity goals with other aspects of governance in a multi-functional strategy.

Spatial expression at a range of scales within a regional context

We need to identify clear and familiar spatial metaphors for biodiversity. The 'green belt' has been largely undermined by changing planning ideologies and the spatial dynamic of globalisation (Swaffield & Primdahl 2003), and is being replaced by new metaphors such as 'green edge', 'greenway', 'green networks' (Ahern 2002). Biodiversity objectives that can be graphically expressed in space and everyday experience are more likely to be politically accepted and incorporated into wider public policy if they can be 'envisioned' in a way that makes sense on the ground. However, the dynamics of cities and urban ecology mean we cannot work only with simple ideals of bounded space. The nature of the processes

involved require us to think in terms of a range of types of space — bounded, networked, and layered — chosen to give best expression to the dynamics that underpin a particular landscape.

Recognition of the need for different types of spatial expression highlights the need for an hierarchical approach. At a fundamental level, spatial planning for urban biodiversity must link to a regional perspective and to deep landscape structure. This may be natural and/or technological, but needs to have a long life span, and will be grounded in the natural systems of the region. In the interstices of the deep structure, at meso and micro scale, there are a wide range of urban settings which will need different types of biodiversity programme. Some will follow through the patterns of the deep structure, but others will be highly modified environments — commercial buildings, cultural infrastructure, residential neighbourhoods — each of which offer different opportunities for biodiversity. Some will offer medium to long-term stability, others will be transient, and an urban biodiversity strategy must recognise the opportunities and needs of each. Short-term 'vacant' land can potentially offer habitat for adventive species whereas tall forest clearly needs long-term stability.

Strategic Adaption and Location of Public and Private Infrastructure

A key lesson from overseas and New Zealand initiatives in recent years is the need for 'soft' agendas such as biodiversity to identify ways to piggy-back upon the dominant flows of urban capital. The annual 'conservation' budget at every scale in New Zealand is dwarfed by the scale of investment in technological infrastructure, buildings, and even routine maintenance of existing facilities. The success of the former Waterways and Wetlands Unit in using the asset management framework to re-naturalise streams and create green corridors illustrates a more general opportunity to link biodiversity to the major flows of urban capital. An urgent task for biodiversity researchers is to ask: Where is money being spent? How can it be adapted to deliver biodiversity outcomes? Where are there under-used land or community resources that could be enrolled for either short or longer-term biodiversity outcomes?

Equally important is to ask, what are the current barriers to such a strategy? Can Resource Management policy and rules be further developed to achieve biodiversity outcomes? Does the Building Code enable or prevent the ‘greening’ of buildings? What are the cross-sectoral relationships? We know for example that education of children about biodiversity is a vital long-term investment, yet does the Ministry of Education asset management and investment policy enable or sufficiently encourage the ‘greening’ of school grounds?

Institutional Mechanisms

Asking questions about cross-sectoral relationships highlights the need for effective institutional mechanisms. When the RMA Act 1991 was introduced it was hailed by many as a great opportunity to achieve more creative environmental outcomes from the development process. In some settings advocates claim that the use of the effects-based approach and environmental compensation mechanisms can dramatically enhance long-term sustainability through, for example, indigenous revegetation, and this clearly provides a mechanism for biodiversity enhancement (Scott 2002). It could also be argued that the greater flexibility in regulation in rural areas has allowed greater diversity of land use and in turn increased the variety of land cover, and hence aspects of biodiversity. At the same time however, the RMA has been widely criticised for its ineffectiveness in achieving strategic integration. This highlights the need for a suite of institutional mechanisms. An urban biodiversity strategy will need at least five different components:

1. **Vision.** The introduction of the new Local Government Act (LGA) strengthens the ability of TLAs to develop long-term community visions and plans, and requires them to do so. The Styx Vision (Christchurch City Council) is an exemplar of how a community vision statement can provide a framework for biodiversity programmes at the local scale, and the new LGA extends this District wide
2. **Strategic investment.** The existing protocols of Annual Plans and Long-Term Financial Plans have established a basis for development of

an urban biodiversity strategy, and the Annual Plans of Waitakere City and Wellington City provide illustrations of how biodiversity goals can be embedded in this framework

3. **Organisational partnerships.** The range of institutions involved in urban infrastructure make partnerships an essential feature of any landscape focused urban biodiversity strategy. Examples of potential partners include the new RailTrack company, Transit NZ, The Port Company, Tertiary Institutions, The Airport Company, Government Departments such as the Corrections Department, and at a local scale, schools, businesses, etc. The choice of partner will depend upon the strategic value of their land holding, and of course willingness to collaborate
4. **Community projects.** These are another form of ‘partnership’ that constitute a key element of an urban biodiversity agenda. Again the Styx Vision provides one exemplar, and the Addington Bush Society another contrasting model. The challenge identified above in terms of contrasting visions becomes critical at this scale, and highlights the need for a robust overarching strategy within which individual communities can find their place
5. **Resource Management Act provisions.** Ranging from broad guiding policy to specific incentives and rules, these provide an essential tool to shape new development.

The key point is that these different mechanisms (most if not all of which are individually familiar to urban biodiversity advocates) need to be incorporated within a coordinated programme.

A robust aesthetic ‘language’ of biodiversity

One of the most challenging aspects of urban biodiversity is the contest of aesthetic values associated with the incorporation of indigenous species within urban areas. It is richly ironic that New Zealand commentators can describe New Zealand indigenous species as of little value as horticultural garden species, whilst northern hemisphere gardeners have long valued them precisely for their ornamental qualities. This highlights the way in which the aesthetics of biodiversity are highly contextual.

Nassauer's (1995) concept of messy ecosystems, orderly frames, and more specifically of 'cues for care', suggest a design approach in which indigenous species are framed within a familiar cultural design vocabulary. This may take several forms. At the macro scale, the deep ecological structure of the landscape (expressed in the Indigenous Vegetation Maps) provides an archetype language of potential vegetation structure — tall forest, mixed shrub-land etc. In the strategic green infrastructure of the city this language can, over time, be progressively restored based primarily upon indigenous species. In the cultural and residential parts of the city, there will be a continuing social demand for a wider range of plant associations, but the 'deep' language can still be developed with exotic substitutions. The Victorian plantsman William Robinson was a master at introducing exotic species into predominantly (English) woodland settings, and his work provides a guide for Urban Biodiversity advocates, to place attractive and familiar introduced species within an indigenous New Zealand framework.

Some areas will inevitably remain structured by exotic species, as exemplars of the City's European Heritage. However, one of the keys to achieving a more complementary relationship between exotic and indigenous will be a more sophisticated use of design language and vocabulary — utilising Nassauer's insight that many people want to see evidence of human care in the environment. Indigenous species do not always have to look like a bush remnant; many are well suited to more formal arrangements. Similarly, as Nassauer showed, the strategic use of mown grass, edging, signs etc. can provide 'cues' that an area is well loved and maintained. At the micro scale, domestic gardens can be highly formal in structure yet incorporate a wide range of indigenous species.

The recent media coverage of tensions between proponents of exotic gardenesque approaches to urban space and those seeking to introduce a greater proportion of

indigenous species highlights the need for a much more sophisticated design approach and understanding to the introduction of indigenous species than has frequently been evident. One badly executed 'native' introduction can set back the progress of wider biodiversity goals out of all proportion to the site specific gains that are made. Developing a design vocabulary based upon a careful understanding of conventional and restoration design traditions is therefore a critical part of any long-term biodiversity strategy.

Multi-functional strategies

Finally, it is clear that an effective urban biodiversity strategy will incorporate a high level of integration between different landscape functions. As the Asset Management Strategy for Wetlands and Waterways has shown, biodiversity objectives are more likely to be achieved if they can be connected with other local body objectives. One notable feature of the European work reported by Chris Baines⁴ is the need to think across sectors and organisations. Urban Biodiversity requires a systems perspective in which the condition of land is more relevant to future biodiversity potential than its formal planning designation (Breuste 2003).

Some of the potential multi-functional opportunities are already well recognised but not necessarily incorporated in all urban governance — the alignment of stormwater management with biodiversity is the most obvious example. Others include air quality and microclimate management, recreation, private lifestyle and gardens. Some sectors are less well developed. At present, for example, most transportation infrastructure is surrounded by large areas of mown exotic grasses (e.g., the Southern Motorway and International Airport in Christchurch), or expanses of abandoned aggregate (railways). Whilst there are some operational reasons, in many cases the management of these large areas is a cost with little return. An urban biodiversity strategy will find ways to utilise this land to reduce costs and/or increase benefits. Similarly, green infrastructure in association with buildings can reduce energy demand whilst enhancing

⁴ Editor's note: see Chris Baines paper in these proceedings.

biodiversity. The key feature of the asset management strategy examples is the ability to achieve long-term operational savings from appropriate capital investment that create other benefits. It may well be that the most important expertise missing in the urban biodiversity project are accountants that can think laterally.

CONCLUSION

My aim in this brief overview has been to scope some of the challenges facing urban biodiversity programmes, drawing out some generic lessons from landscape planning and suggesting areas in which these pathways to success could be applied. The account has been inevitably broad, but does offer an overarching message, which is the need to be strategic in outlook, analysis and action. When available resources are over-bid (and when are they otherwise) it is essential to identify the actions that are most likely to succeed and will produce best returns. After an hiatus of nearly two decades, there is a growing realisation that protection of natural resources is not enough — they also need to be able to regenerate; that isolated reserves are ineffective; and that ad hoc effects-based management is vulnerable to adverse cumulative effects. The urban biodiversity agenda is one of a number of urban initiatives gathering momentum. As I have suggested, it is not entirely new ground. Biodiversity is in many ways a re-expression of earlier 'nature in cities' movements, and some important lessons can be drawn forward. However, the wider environment has also changed, and this phase of urban ecological regeneration needs and can benefit from important developments in the past decade or so.

I have highlighted the need for:

1. A clear and coherent spatial framework — a lesson known for many years but lost in the non-spatial ideology of the 1990s
2. The creative use of public and private infrastructure
3. The development of institutional mechanisms
4. A more sophisticated understanding and application of design aesthetics and language
5. An hierarchical multi-functional approach, with projects nested within other urban programmes at a range of scales.

The final challenge is to identify ways in which every part of the urban landscape can contribute to biodiversity objectives. A strategic landscape strategy will identify opportunities at every scale and for every part of the urban mosaic. It will identify a hierarchy of linked actions that include:

- The long-term protection of the deep landscape
- Medium to long-term integration of biodiversity outcomes in major infrastructure planning
- Strategic investment in infrastructure, open space and urban forests to link existing structures and protect future potential
- Progressive incorporation of biodiversity goals into open space and streetscape management
- Education, performance goals and incentives for biodiversity outcomes from minor infrastructure such as buildings, gardens, and car parks
- Opportunist seeding of self-regenerating species in temporary and transient sites.

A comprehensive strategy will be achieved when there is a relevant biodiversity goal and programme for every part of the urban mosaic.

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