PLANNING FOR URBAN BIODIVERSITY IN A DIVIDED WORLD

A Thesis

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Master of Regional Planning

by

Jennifer Rae Pierce

January 2015

ABSTRACT

Despite over two decades of effort, biodiversity loss has persisted at increasing rates. Interests focus on protection of key habitats, while the drivers of biodiversity loss continue unabated. With repeated failure to meet biodiversity targets, we need to investigate more integrated ways to stop biodiversity loss.

Traditional local land-focused biodiversity conservation creates conflict and ignores wider-reaching impacts. A more promising approach considers the entire system of impact and dependence between cities and humanity, a concept herein named the bioshed. The bioshed expands the conversation around biodiversity preservation to include a wide array of dependencies of humans on biodiversity.

This initial survey explores how urban biodiversity planning today connects the broad array of issues interrelated to biodiversity, if at all. It asks three questions: (1) how strong is the concept of biodiversity within urban plans, (2) do biodiversity plans consider the complete bioshed in the urban context, and (3) do frameworks for biodiversity planning include all aspects of the bioshed?

To answer these questions, I looked at 65 plans from cities worldwide, 48 of which are biodiversity plans, and four guideline programs each with over 30 city participants. As a mixed models/mixed methods study, I combined automated lexical analysis with manual term searches and categorization of concepts. I developed a simple integration index to allow for direct comparison of various plan and guideline documents. I found that biodiversity is rarely used, inconsistently defined, and lacks strong connections to any particular set of related themes.

BIOGRAPHICAL SKETCH

Something surprising I have learned during my studies at Cornell is the importance of acknowledging the bias from which one approaches life in order to be more candid about the analysis being given, and also to increase self-awareness. My personal value system and epistemology influence the ways that I think about the world, and accordingly how I organize and communicate my thoughts. The journey of creating this document has definitely been a personal one that has its roots far earlier than I had first thought. Therefore, I will open this thesis with a self-reflection rather than the standard autobiographical summary.[1]

As a white upper-middle class American born in 1980, I was born into what I now recognize as a privileged life. My childhood involved regular relocation across the U.S. as my father was stationed at various military bases. I loved the rhythm of moving and the opportunity to redefine myself every couple of years. I absorbed the local cultures and transformed from Southern bell, to Northwesterner, to California valley girl, and so on.

Other than moving, my growing-up story is a typical one in many ways for people in my demographic; a suburban landscape of nearly identical builder's homes, each with its own mowed lawn and garage. Fortunately, my parents valued the importance of exposing children to less manicured landscapes, and often paid premium rates to live near green belts.

Being an only child until I was ten, I spent many hours playing by myself in these wild oases in the neighborhood. My time there and even with family pets at home was often quite spiritual for me. I instinctively viewed nature as God's artwork and beloved creation. As I grew up, I maintained a fascination with all things wild. With the various public education campaigns increasing awareness on environmental deterioration, I

[1] Bell (1998) discusses the importance of self-reflection on learning

channeled this fascination into a life goal of somehow "saving nature" that sticks with me today.

My first major global and cultural explorations occurred during my high school years. My family had just moved to San Antonio, which I found to be a Tex-Mex smorgasbord of spanglish, flamenco dances, and marvelous beans and rice dishes on a backdrop of Texas wildflowers and sprawl. I went on short mission trips to poor neighborhoods in Latin America where I observed a rich love of life contrasted with poor living conditions. On one of these trips, I stood alone at the top of a Costa Rican mountain, the wind blowing in my face as I overlooked a volcano alternately shrouded and revealed by mist. There, I silently dedicated my life to the fulfillment of God's plan for me though I did not yet know what that would be.

I would not have any further direction until after I had applied to leading biology programs across the U.S. near the end of high school. Like many soon-to-be college freshmen, I was concerned about where I was taking my life. I went through a period of much reflection and prayer. Late one night, I felt an answer had come to me: I was to study architecture. This was quite a departure from biology, but I had a freewheeling trust that this was the answer to my dedication to follow God's path back in Costa Rica.

After a year in transition and a new round of applications, I found myself in the architecture program at the Illinois Institute of Chicago, located in Bronzeville, an impoverished black neighborhood in Chicago. At that time, the campus was sandwiched between two public housing projects. One was torn down toward the end of my tenure there, leaving many already disadvantaged people struggling for housing.

Ah, Chicago! Having been raised among families similar to mine in terms of race, life stage, and income, the new world of the city with its diversity of people was an endless source of discovery. In Chicago, I fell in love with the city and its constant inundation of new experiences. At the same time, living surrounded by poverty for five years internalized for me the imperative of increasing equity between people. The fact

that the poor people I saw both in this neighborhood and in my subsequent work designing public facilities were predominantly people of color did not escape my notice. I discovered that my sheltered childhood had kept me from an understanding of injustice. I now felt that there must be a place for social equity in my work.

In my last year of undergraduate studies, I married Glen and both of us flew to Paris for a semester abroad. This opportunity to live in another vibrant urban environment further solidified my love of cities and of cultures. Upon returning to Chicago, the two of us built a household together and filled our home with pets, fostered and adopted, before even purchasing a couch for the living room.

After completing the architecture program, I worked for several years in sustainable design. I became accomplished in green materials, green roofs, and green standards. I gained a reputation for boisterous encouragement of environmentally friendly features and was fortunate to have the means to live a car-less and vegetarian lifestyle (my prime ecological footprint was at that time air travel, which I generally offset at least in terms of carbon). However, I found that architecture wasn't meeting my need for combining equity and the environment. It seemed as if the important decisions happened before the architect gets involved - namely, what to build and why, where, and for whom.

This journey led me to uproot myself, my husband, my three cats, and my dog from our condo on the south side of Chicago to the tiny town of Ithaca to study City and Regional Planning. At Cornell University, I have picked up some new tricks in conservation biology, participatory planning, environmental policy, and more. This thesis represents the culmination of a long-term interest of mine, namely, the intersection of ecology and the amazing world of human culture, social dynamics and spirituality. And yes, I am biased. I believe we can and must plan in a way that celebrates the diversity both of humans and the rest of creation.

I dedicate this work

to the 15,000 estimated

cheetahs left in the wild. [2]

I hope that these and many other inspiring creatures

will remain for millennia to come.

[2] Population estimate by the Smithsonian Conservation Biology Institute
http://nationalzoo.si.edu/SCBI/endangeredspecies/cheetah/default.cfm

ACKNOWLEDGEMENTS

This thesis would not have been possible without the constant support of my husband who was there for me to offer encouragement, advice, and the meals in bed that make long hours of work bearable. Somehow, he never tires of my antics or doubts my ability to do something worthwhile. Thank you, my love and my best friend.

Many people at Cornell University also dedicated time to the creation process. I have benefited from the wisdom and feedback of my committee: William Goldsmith from the planning department, Keith Tidball in natural resources, and Josh Cerra in landscape architecture. Others provided advice and inspirational ideas, including Linden McBride, George Homsy, Neema Kudva, George Frantz, Frank Wayno, and John Forester. Funding from various organizations at Cornell supported research related to this thesis, including The Graduate School, the Einaudi Center and the Department of City and Regional Planning.

I owe a great deal of gratitude to the people at the ICLEI Cities Biodiversity Center for believing in me and introducing me to the international world of urban biodiversity, especially Russell Galt and Kobie Brand. With their support, I was able to meet with and interview many of the leaders in urban biodiversity. Some of these new acquaintances went above and beyond to aid my research, including Naomi Tsur, Helene Roumani, Dâmaris Da Silva Seraphim, and Fábio Duarte de Araujo Silva.

Additional thanks are due to my family, especially my parents, for their love and for setting me up for success early in life.

My work has also been inspired by the work of those brilliant people that left their mark on the world, including Buckminster Fuller, Friedensreich Hundertwasser, Edward O. Wilson, Eric Sanderson, Jane Goodall, and Bill Mollison. I am also grateful to the Mayor of Buea, Cameroon, who finally gave me the push I needed to go into planning when he explained to me his dilemma dealing with waste accumulation in his town.

TABLE OF CONTENTS

LIST OF FIGURES

Note: Images are by author unless otherwise indicated.

LIST OF TABLES

ABBREVIATIONS

BES	Biodiversity and Ecosystem Services
BSP	Biodiversity Strategy Plan
CAP	Climate Action Plan
CBD	Convention on Biological Diversity
CBI	Cities Biodiversity Index
CBO	Cities Biodiversity Outlook
CUBES	UNESCO-Columbia University Joint Programme on Biosphere and Society
GBO	Global Biodiversity Outlooks
GPCB	Global Partnership on Cities and Biodiversity
ICLEI	ICLEI - Local Governments for Sustainability [ICLEI originally stood for International Council for Local Environmental Initiatives)
ICLEI CBC	ICLEI Cities Biodiversity Center
IPCC	Intergovernmental Panel on Climate Change
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IUCN	International Union for the Conservation of Nature
LAB	Local Action for Biodiversity
LBAP	Local Biodiversity and Action Plan
LBSAP	Local Biodiversity Strategy and Action Plan
NBSAP	National Biodiversity Strategy and Action Plan
NParks	National Parks Board Singapore
SCBD	Secretariat of the Convention on Biological Diversity
TBD	To be developed
TEEB	The Economics of Ecosystems and Biodiversity
UN	United Nations

UNCED	United Nations Conference on Environment and Development, also known as the Earth Summit
UNEP	United Nations Environmental Program
UNESCO	United Nations Educational, Scientific, and Cultural Organization
UNHABITAT	United Nations Human Settlements Programme
URBIO	International Conference of Urban Biodiversity and Design
URBIS	Urban Biosphere Initiative
WWF	World Wide Fund for Nature

CHAPTER 1: INTRODUCTION

1.1 Overview

Biodiversity is crucial to humanity's survival. Loss of biodiversity is one of, if not the most, pressing concern of our time.[3] Over ten years of worldwide effort have not reduced the accelerating rate of biodiversity loss.[4] Why? This analysis of urban biodiversity plans reveals part of the answer using the concept of the bioshed.

The bioshed is herein defined as the system of dependence and influence between humanity and biodiversity.[5] The bioshed connects biodiversity with all aspects of civilization, including economic, political, and social issues (see fig. 2a). Cities have vast biosheds. These complex urban biosheds reach far beyond city borders[6] and across social, sectoral, and academic divisions. In light of this, one might expect biodiversity protection to be an integral part of urban planning. On the contrary, city plans typically address biodiversity as a subcategory related to land conservation, if they mention it at all.

Lack of awareness of the bioshed is at the root of the gap between the necessity of biodiversity and its inclusion in urban plans. If the reach of the bioshed were understood fully, biodiversity's interconnectedness and foundational significance would be undeniable and the scope of biodiversity protection would widen and become more effective. Due to the interconnected nature of cities, one of the first places that bioshed understanding might appear is within city biodiversity plans. This study reveals a lack of such an understanding.

---

[3] Rockström (2009) identified biodiversity loss as the most pressing environmental problem today, outweighing climate change

[4] The third Global Biodiversity Outlook (GBO-3) indicates an overall failure to achieve biodiversity targets and an increasing rate of decline in biodiversity (SCBD 2010)

[5] Pierce (2014a) defines the bioshed in more detail and explores it in the context of Jerusalem

[6] Puppim, et al. (2011) calls the impact of cities on the biodiversity of wider regions the "regional biodiversity influence." Cronon (1991) and Ernstson, et al. (2010) discuss the wide impact of city's marketsheds. Lenzen et al. (2012) connects urban activities through globalization to worldwide biodiversity loss.

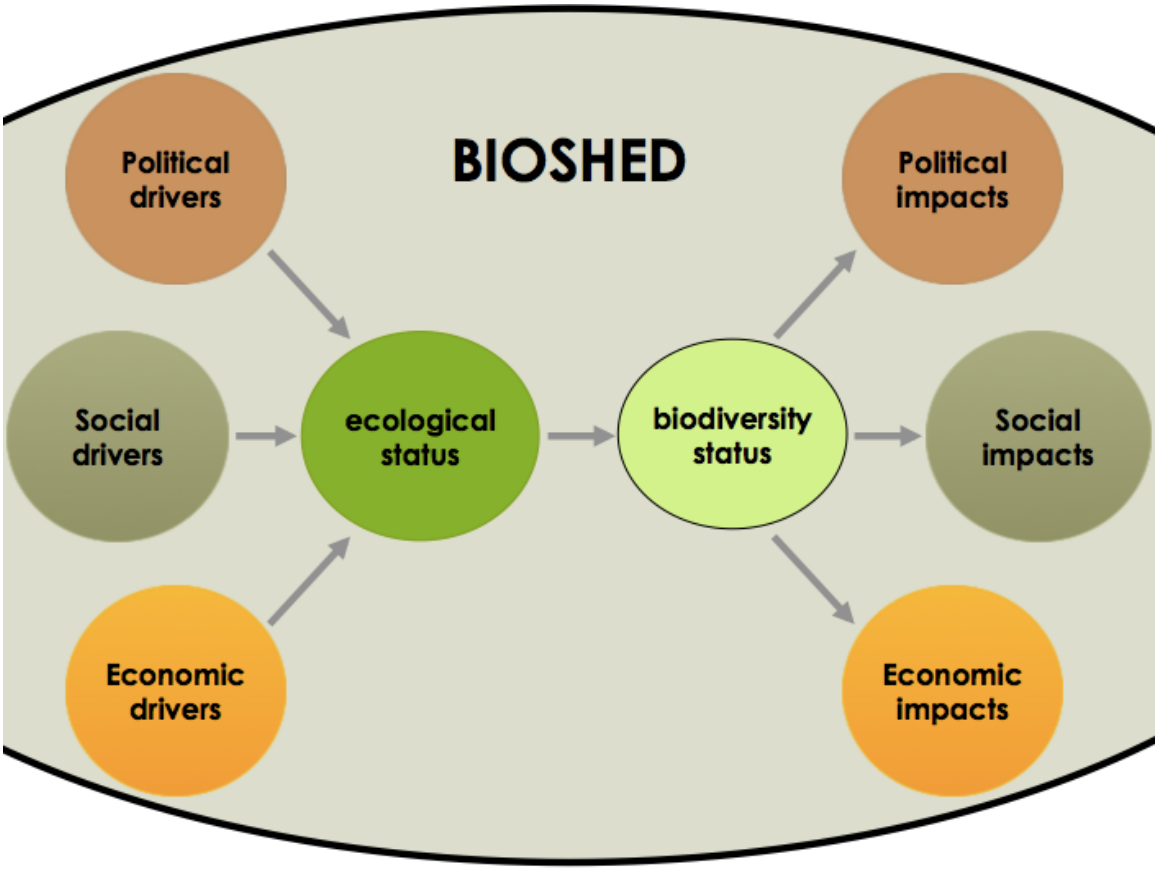


FIGURE 2A: THE BIOSHED
The bioshed consists of political, social, and economic drivers of ecological status as well at the impacts of biodiversity on these three areas
Source: Pierce 2014a

A deep understanding of the bioshed provides new possibilities for biodiversity protection efforts. Cities have great potential to reduce biodiversity loss worldwide[7] because of the wide reach of their biosheds. If cities expand their biodiversity planning beyond local land conservation to reflect the true size of their biosheds, they can make great strides in protecting biodiversity around the world.[8]

1.2 Hypothesis

[7] The Nagoya declaration (2010) and the Secretariat of the Convention on Biological Diversity (2010, 2012) tout the potential of local governments to address global biodiversity loss.
[8] Many attendees came away from Rio+20 feeling that local governments are the change drivers for finding solutions to global environmental problems (Ki-moon 2012, Smith 2012, Tsay 2012, Llana 2012).

Herein, I explore the question, "*why isn't biodiversity integral to urban planning?"* I believe it is because planners do not fully grasp the system of connections between biodiversity and humanity, which I refer to as the bioshed. Understanding the implications of biodiversity loss requires a systemic viewpoint uncommon in today's world of division and specialization. This lack of understanding is exacerbated by conflicts and lack of dialogue between environmental scientists, social activists, and economic leaders. Protection of biodiversity can be interpreted as something that would be "nice" but isn't essential when other concerns are more pressing. Worse, it can be seen as a win/lose issue wherein biodiversity protection appears to be in opposition to economic or social concerns, rather than underpinning them.

Another explanation could be the resistance of the term "biodiversity" to green washing or reinterpretation to mean something else, a common complaint against the term "sustainable." Perhaps biodiversity resists redefinition because it is difficult to understand and often misinterpreted as unnecessary; used as another term for nature. Or perhaps the planning discussion prefers to focus on one environmental concept at a time, and other terms are more tenable, such as energy conservation, ecosystem services, climate change, or sustainability. It may be that while planning expanded to include social issues in the 1960s,[9] biodiversity has not yet made this leap, so it is stuck within land conservation and green space planning.

While this study will not provide a definitive answer to these questions, I intend to provide an initial review of biodiversity within urban planning for consideration.

First, I seek answers to my question by looking at how comprehensive plans refer to biodiversity. Is it "baked in" per se, considered throughout and discussed in multiple sections? Is the full extent of the bioshed included when referencing biodiversity? Then, I investigate whether or not biodiversity plans consider the complete bioshed, including

[9] At least in the U.S. (Clavel, 1986)

economic, cultural, and social factors. Finally, I will investigate frameworks for biodiversity planning to see if these guideline documents that are used to create the plans outline the full extent of the bioshed.

These three analyses together open the conversation about how limitations of biodiversity in urban plans reflect an incomplete understanding of the bioshed.

1.3 Research Questions

This study presents a preliminary analysis of current urban biodiversity plans and associated frameworks worldwide. It addresses the following questions:

1. How strong is the concept of biodiversity within urban plans?
2. Do biodiversity plans for urban areas consider all aspects of the bioshed?
3. Do framework documents used to guide biodiversity plans include all aspects of the bioshed?

I think contemporary biodiversity planning is a self-limiting practice that considers only a small fraction of the bioshed. Despite "substantial lip service to the contrary," it occurs largely in isolation from non-environmental goals and viewpoints.[10] This is despite the fact that improvements in biodiversity contribute to many other priority areas in health, resource management, food security, ecosystem services, economic sustainability, and cultural preservation.[11] Ecologists, biologists, and environmental scientists prepare biodiversity plans from a conservation mindset that focuses on the removal or restriction of human use in priority areas. The plans suffer from a lack of understanding of the social and political dynamic of resource consumption and marketplace activity. As a result, biodiversity planning activities miss the message

[10] Tidball and Weinstein (2011, p. 371). They suggest the Environment Shaping method, based on five elements: (1) asset-based approach (rather than needs-based), (2) systems view incorporating both physical and social feedback loops, (3) participatory methods, (4) local perceptions driving policy decisions, and (5) a focus on objectives rather than sectoral subdivisions.
[11] SCBD (2010); UNEP (1999); Mader, et al. (2001); Posey (1999)

of how the bioshed is inclusive of all aspects of civilization. This, one main problem is the disinterest or ignorance by natural scientists of social, political, and economic factors.

The good news is that by expanding biodiversity planning to address the complete bioshed, planners can build new alliances and tap into a much larger toolbox of solutions. More importantly, as the understanding of the bioshed increases, systemic solutions can address causes of biodiversity loss with far-reaching impact, rather than focusing on symptoms within city borders.

This study provides an initial look at how biodiversity planning has thus far attempted to convey the broad array of issues included in the bioshed, if at all.

CHAPTER 2: BACKGROUND

2.1 Significance of Biodiversity

Biodiversity in one word encompasses the wonder of life on earth from the driest deserts and thickest forests to the variety of the cheetahs' spot patterns and the marvelous shapes and color ranges of finch species. Biodiversity makes possible nature's capacity to adapt to unexpected occurrences, an ability referred to as resilience. It also constitutes complex relationships that together produce the ecosystem services supporting humanity. Its influences are found everywhere. Even within the human body, vast arrays of living organisms operate in synergy within the human micro-ecosystem.[12] Nations depend on the direct and indirect products of biodiversity for economic strength. Cultures around the world marvel at and are inspired by their biodiversity heritage. People seek a spiritual connection and a feeling of peace in the message of connectedness, humility, and belonging that biodiversity embodies.

Defining Biodiversity

Biodiversity by definition appears simple: the variety of life. But, within this definition hides a multiplicity of scales and interdependent relationships that complicate comprehension and assessment of biodiversity. The scale at which to consider biodiversity ranges from global-level ecosystems down to microscopic genes and includes everything in between. Biodiversity accounts for variety between ecosystems both endemically and regionally, expressed respectively as alpha and beta diversity.[13] Within ecosystems, biodiversity refers to species variety, including both quantity and

[12] Hulcr, et al. (2012) found that the bacteria of human navels are as unique as fingerprints. Bik, et al. (2010) show the same thing for bacteria in human mouths. Chivian and Berstein (2008) show human health's dependency on biodiversity.

[13] Whittaker (1972) defined alpha (within habitat) and beta (between habitat) diversity as the two factors used to determine gamma diversity, the measure of biodiversity over the landscape.

relative abundance of species, together called species diversity.[14] Within species, biodiversity refers to the genetic variety that contributes to the robustness of the gene pool, called genetic diversity. Relationships between and within the various scales of biodiversity form the full web of life. This degree of complexity can make a seemingly simple reference to "biodiversity" difficult to appreciate comprehensively.

Even the definition put forth by the CBD that breaks down biodiversity considerations by scale to landscape, species-level, and genetics,[15] underemphasizes the interrelationships between and within these elements that strengthen ecosystems and the function. A simple count of biodiversity can miss the crucial element of functional extinction, in which certain elements have become so rare that they no longer perform their role within the ecosystem, although they are still present to a lesser degree.

2.2 Status of Biodiversity

Scientists estimate that the loss of biodiversity is reaching rates that exceed the innate capacity of life as we know it to persevere. With each passing day, this loss becomes more evident. It reveals itself in decreasing rates of crop pollination, loss of fish stocks, and even in increasing financial investment holdings in natural resources as the market begins to recognize their rarity and fragility.

Determining the Status of Biodiversity

The complexity of biodiversity renders direct measurement of its overall status impossible.[16] Instead, scientists project overall rates of loss based on local surveys, suitable habitat availability, and, more recently, remote sensing of plant life. Other

[14] Tuomisto (2010) Clarified the equation for species diversity as a function of species richness (quantity of species) and species evenness (relative abundance).
[15] SCBD (2010)
[16] Scientists do not even have consensus on the amount of biodiversity currently on the planet. The total number of species is not known within one or even two orders of magnitude, with some estimates at 9 million total species and some at 30 million invertebrates alone (Wilson, 1988); (Mora, et al., 2011).

efforts to quantify the status of biodiversity focus on correlated indicators. While debate continues regarding exactly which indicators capture biodiversity in a comprehensive way, biodiversity loss continues unabated. See appendix X.0 *Measuring Biodiversity Loss* for further discussion.

The combination of decreased speciation rates with increased extinction rates spells the potential for long-reaching damage to the biosphere as a whole. In fact, the Stockholm Resilience Center named loss of biodiversity as the most urgent global crisis, exceeding that of climate change and the disturbance of the nitrogen and phosphorous cycles (see Fig. 2a).[17]

A crisis like this calls for efficient measurement of the status of biodiversity over time. Several new methods of rapidly assessing biodiversity have recently been suggested. Tzoulas and James developed an urban biodiversity method that rapidly assesses the biodiversity of vascular plants in urban areas using checklists.[18]

[17] Rockström (2009)
[18] Tzoulas and James (2010)

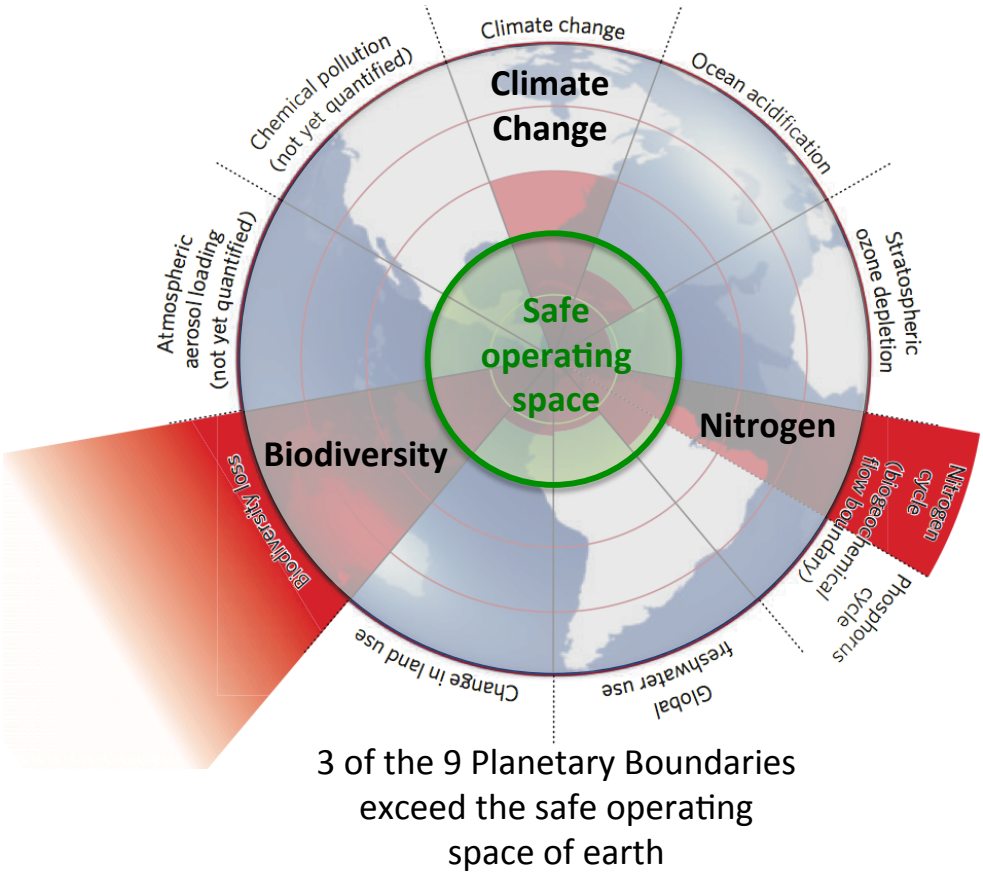


FIGURE 2B: PLANETARY BOUNDARIES
Original source: Rockström (2009) Note: image has been modified

Use of crowd-sourcing techniques based on volunteer datasets reviewed by experts, such as eBird, have increased recently.[19] In the last year, scientists discovered that carrion flies could be used as "DNA banks" of local mammal biodiversity.[20] A new fly-over technique automatically maps tree species according to canopy structure and the "spectral traits" of their foliage.[21]

[19] Fink (2011)
[20] Calvignac-Spencer, et al. (2013)
[21] Asner (2013) describes new technologies that combine Light Detection and Ranging (LiDAR) techniques with imaging spectroscopy deployed from airplanes to generate area maps of plant species. He explains that if this technology is sent into orbit, it could provide a revolutionary picture of the plant diversity of the planet.

Indicators of Current Biodiversity Status

The Secretariat of the Convention on Biological Diversity (CBD) is the key international organization for the protection of biodiversity. The CBD document is a legally binding treaty developed in 1992 that covers conservation of biodiversity, protection of indigenous knowledge, awareness of biodiversity, and the equitable use of genetic resources and biotechnology. The Declaration of the CBD has been signed by 192 countries and the European Union.

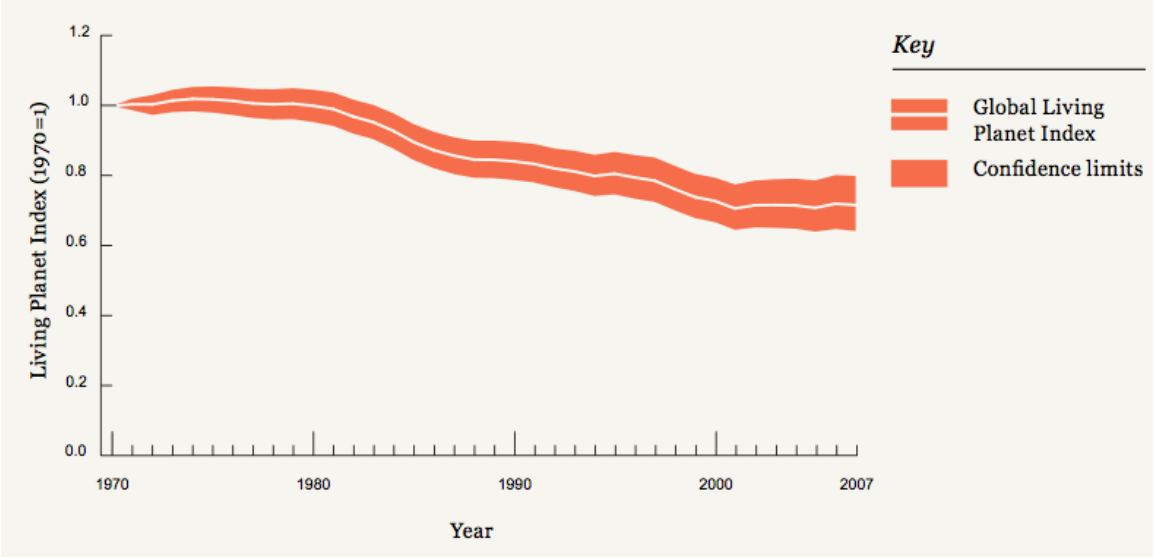


FIGURE 2C: THE LIVING PLANET INDEX
The World Wildlife Fund shows that vertebrates have declined by about 30% in the last 30 years.
Source: WWF Living Planet Report 2010

The Secretariat of the CBD, in partnership with the United Nations,[22] produces a periodic report called the Global Biodiversity Outlook. The conclusions of the report are a synthesis of 110 status reports submitted by national governments as well as hundreds of scholarly articles. The third such report, called GBO-3, was released in 2010. GBO-3 indicates an overall failure to achieve biodiversity targets and an increasing rate of decline in biodiversity.[23]

[22] Specifically, the World Conservation Monitoring Centre of the United Nations Environment Programme (WCMC-UNEP).
[23] The report also included a public comment period in 2009, gathering over 1,500 comments (SCBD, 2010).

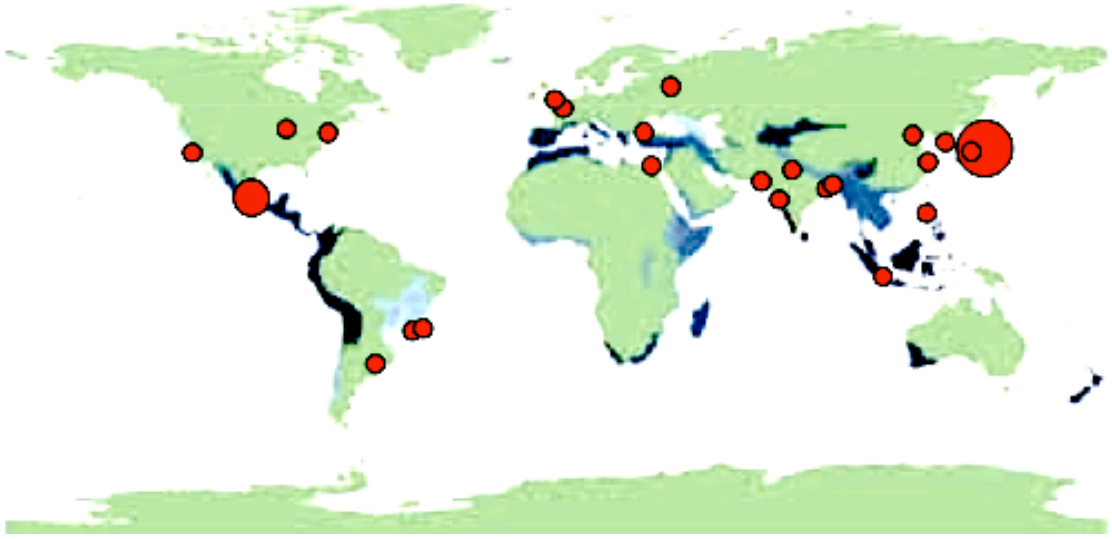
Status of Urban Biodiversity

Expanding cities have a direct effect on biodiversity loss that is becoming more apparent every day. High population growth rates in cities correlate with high rates of habitat loss that can trigger designation as a "biodiversity hotspot," thus the trend of growing cities within hotspots (see fig. 2d). Patterns of urban biodiversity identified by the Secretariat of the Convention on Biological Diversity (SCBD) include:

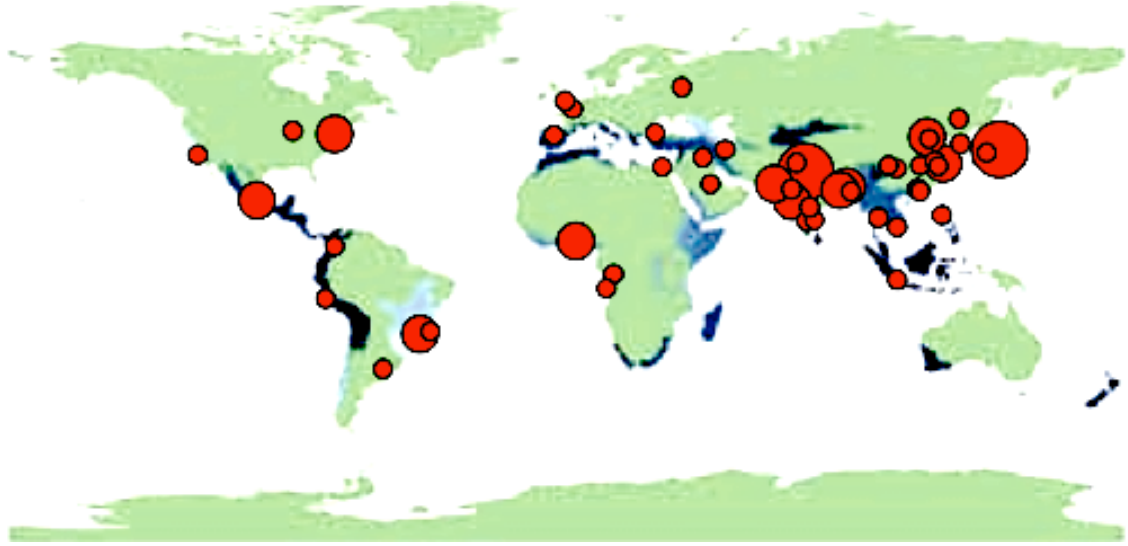
- Older cities tend to have higher plant biodiversity
- Wealthier neighborhoods tend to have higher plant biodiversity
- 5% of vascular plant species and 20 % of avian species occur in cities
- 50% or more of native regional plant species are found in cities

The SCBD's publication, the Cities Biodiversity Outlook (CBO), calls for a new type of urban ecosystem that reconciles human and ecological requirements. A major barrier to this goal is the lack of capacity and awareness at the local levels of government. One key takeaway message is the importance of diverse stakeholder involvement in urban areas.[24] The CBO's call for increasing local capacity and awareness, and for involving diverse stakeholders can, at least in part, be met by increased integration of biodiversity planning.

[24] SCBD (2012); The importance of stakeholder involvement was reinforced in ICLEI's publication on mainstreaming biodiversity in local government (Pierce 2014b)



2000



2025

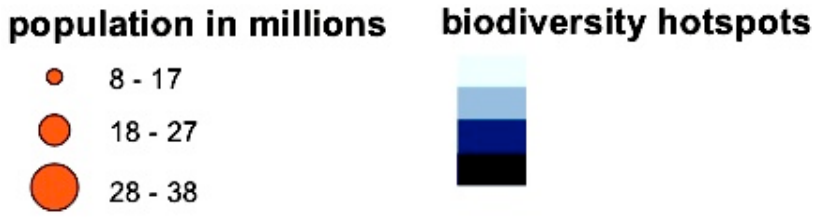


FIGURE 2D: CITY POPULATION GROWTH IN BIODIVERSITY HOTSPOTS
City population growth from 2000-2025 mapped over global biodiversity hotspots.
Original image source: SCBD (2012).

2.3 Global Urban Biodiversity Efforts

Coordinated global efforts for urban biodiversity began in 1990 when the Chicago Academy of the Sciences held a conference called Sustainable Cities: Preserving and Restoring Urban Biodiversity. It was one of the earliest major gatherings on urban biodiversity.[25]

In 1992 in Rio de Janeiro, the UN held the first Earth Summit (UNCED) where the Convention on Biological Diversity (CBD) as well as Agenda 21 were opened for signature. While the CBD focused on national governments, Agenda 21 included sustainable development at all levels, including local governments.

In March 2007, over 34 cities adopted the Curitiba Declaration on Cities and Biodiversity, which affirmed their commitment to the 2010 Targets set by the International Union for the Conservation of Nature (IUCN) in 2006.[26]

In 2008, the Global Partnership on Cities and Biodiversity (GPCB) brought together the major international groups working on urban biodiversity, including the SCBD, ICLEI, UNEP, UNHABITAT, the IUCN, Countdown 2010, UNESCO, several academic institutions and the governments of Curitiba, Bonn, Nagoya, Montreal, and Singapore. The goal of the GPCB is to support cities in the protection of biodiversity.[27]

The Aichi Biodiversity Targets were adopted in Nagoya, Japan in 2010 and include 20 target items to be reached by 2020. They are a key part of the CBD's Strategic Plan for Biodiversity 2011-2020. They include targets specifically focused on increasing awareness of biodiversity and increasing integration of biodiversity. The majority of the targets specify goals to reduce biodiversity loss.[28] As of 2010, 170 countries had produced National Biodiversity Strategy and Action Plans (NBAPs).[29] That

[25] Carreiro and Zipperer (2008)
[26] http://www.cbd.int/authorities/gettinginvolved/globalpartnership.shtml
[27] Müller (2010)
[28] SCBD (2012)
[29] SCBD (2010)

same year marked the UN's International year of biodiversity, since expanded into the decade of biodiversity in 2010-2020.

In 2012, the UN established the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).[30] They held their first plenary session in January of 2013.

Despite coordination of local and national efforts globally over the last twenty years, biodiversity planning has not produced recorded biodiversity loss abatement at a scale larger than isolated projects.[31] Biodiversity loss, like many contemporary environmental problems, is a prime example of a multifaceted, systemic problem that requires a holistic approach not easily solved by technological advancement.[32] Despite this, I believe that there is much room for growth and improvement of the movement for biodiversity preservation. There is especially hope for future efforts to succeed by broadening the message of biodiversity protection by emphasizing its cultural, social, and economic benefits. A more integrated campaign, led by urban centers, would unite many groups in common interest to bring about a world that is more just, equitable, fascinating, and biodiverse.

2.4 Biodiversity in the Urban Context

Understanding the importance of biodiversity in an urban context requires a systemic view of the relationship between social, political, and economic elements and biodiversity. The urban context for biodiversity protection is different in five crucial ways; its natural history is often forgotten, it is human-centric, land has a high economic value, it is heavily developed, and it has a large regional impact. (1) Urban ecosystems

[30] http://www.ipbes.net/about-ipbes.html
[31] SCBD(2010)
[32] Kurz (2012); Secretariat of the Convention on Biological Diversity (2004), Practical principal 9; Secretariat of the Convention on Biological Diversity (2012). Here I am loosely defining an interdisciplinary approach to include not only interaction between people from various disciplines in terms of their training, but also across city departments and across public and private sectors, as per Pierce (2014b).

overlay a natural and social history of local and immigrant communities (both human and other species) that have often been forgotten or hidden. By either mixing, physically covering, or deliberately altering these histories, contemporary city culture sometimes abandons its multiple heritages in favor of a more "global" or "universal" culture or physical manifestation that denies its unique context. This denial transforms into general ignorance and becomes a barrier to reconnecting biodiversity to a city's heritage in the minds of the people. (2) Urban ecosystems are human-centric spaces that serve as nodes of activity for human culture, communication, and exchange. Much of their natural heritage has been altered beyond recognition and has been lost from collective memory. For planners to justify biodiversity as a crucial part of this ecosystem, they must speak to the human-centered benefits of biodiversity initiatives and must conceptualize biodiversity protection more broadly than as the restoration of pre-anthropogenic forms. (3) In general, urban land has higher economic value than land in more remote areas. Urban land use that eschews development potential in favor of biodiversity benefits must multitask, performing many functions in order to justify an atypical use under the hegemony of economic "highest, best use." (4) When land is costly, biodiversity protection needs to move outside the box and onto waterways, rooftops, and walls. Even highly developed areas have potential biodiversity benefits that can coexist with development, often symbiotically. (5) Acting in cities, nodes for the exchange of goods and ideas for a wider region, biodiversity planners must harness the potential for urban biodiversity planning to have a regional impact. Without thinking regionally, planners are missing out on a huge area of influence for biodiversity protection that is a major opportunity of an urban location.

As a result of these five differences, goals for urban biodiversity protection and the methods for their measurement should also differ accordingly.

Dearborn and Kark indicate that the conservation of biodiversity in an urban setting has a different set of goals to be considered as compared to more natural

landscapes. They summarize urban biodiversity goals into the following seven categories: preservation of vital local biodiversity, conservation or creation of corridors for nearby natural areas, research model to increase understanding of climate change conditions, education opportunity for urbanites, provision of ecosystem services, ethical obligations, and improvement of human health.[33] Even these seven goals are self-limiting to land use opportunities. Dearborn and Kark do not consider greater market and cultural forces, other than educational opportunities.

The History of Urban Ecosystems Must be brought to Light

Biological communities in cities are "radically altered," complicating the communication, measurement, and protection of biodiversity. Cities' remaining natural characteristics are often limited and degraded, even the more permanent aspects such as hydrogeological patterns. If historic conditions can be understood, the mix of cultural heritage means that conserving urban biodiversity is more complex than simply restoring a selected historic ecosystem.

Sanderson's work to identify the historic character of New York City was a laborious one, largely made possible by extremely detailed maps he discovered that were created during the civil war. He used these maps, and others, to reconstruct the city's ecosystem of 400 years ago, including the influence of the indigenous Lenape people.[34] He could not use local knowledge networks because there is not a reliable record of natural conditions that remains in memory. For the most part, there wasn't a record in print until he published his analysis of the maps in 2009. Even many of the more recent ecological resources, such as the oyster colonies that once made New York harbor one of the main sources of oyster meat in the world, have been forgotten by the majority of local inhabitants, their memory swept away as cleanly as the dredging and overfishing of the

[33] Dearborn and Kark (2012)
[34] Sanderson (2009)

canal that spelled doom for the oysters in the 19th and 20th centuries.[35] Common knowledge of the oysters has only recently resurfaced due to the efforts of several restoration and outreach groups in the city.[36]

The case of New York's historically high biodiversity and contrasting contemporary ignorance of its natural heritage is a story shared by many cities around the world. The work of urban biodiversity planning must therefore include the telling of this heritage and the knitting together of people with their ecological histories. The loss of memory of what once was manifests itself in a phenomenon known as "sliding baselines" in which the point of reference changes over time, resulting in a gradual shifting of what is considered normal. In fisheries, sliding baselines manifest in the decreasing expectation of catches as revealed by trophy catch photographs. Photographs from 1957 show tourists proudly standing in front of catches of several huge fish as big as they are. By the 80's a large catch photograph from the same location shows fish lined up that are slightly bigger than the tourist's head, and by 2007, a proud catch may consist of a few fish as big as someone's forearm.[37] Unless this history is revealed by comparing the photographs over time, there may not be an awareness of a decreasing catch over time. Without a strong historical connection to what was, it can be difficult to communicate what is missing today. Much like the fisheries problem, the story of what was becomes crucial in setting expectations for the public in terms of what their city in its healthy ecosystem could and should look like.

Rediscovering the local history is just the tip of the iceberg when it comes to sensitivity to the multiplicity of heritages present in urban locations. After all, many people who live in a city come from different areas with their own natural heritage. These immigrant populations have their own non-native ecological histories as part of

---

[35] City of New York Department of City Planning (2011)
[36] New York/New Jersey Baykeepers, Urban Assembly New York Harbor School, SCAPE, New York City Department of Parks and Recreation and Department of Environmental Protection
[37] Helmuth (2008)

their diaspora. Less recent immigrant groups are also part of the layering of an urban ecological memory, planting familiar foods, bringing their own livestock and pets, stocking waterways with familiar fish species, and gardening with ornamentals from around the world. A straight restoration of a historic local ecosystem woven within the contemporary urban environment would be a denial of these diasporas that is inappropriate in the urban context. Therefore, urban biodiversity planners must be sensitive to this layering of cultures with its interplay between local and non-indigenous. Biodiversity planning must balance the criticality of the local ecosystem within its region and as a marker of local heritage, and the respect for contemporary cultures that comingle elements from around the globe.

Building a strong coalition of support for urban biodiversity restoration is predicated upon a shared history of the biodiversity that once was, and its cultural, social, and economic implications today.[38]

Urban Ecosystems are Human-Centric

More than any other, urban ecosystems are human-centric habitats. Biodiversity planners must wrestle with human social, cultural, and economic activities and needs. They cannot focus solely on a more traditional "nature" based justification.[39] The highly altered and human-centric urban context raises questions of how biodiversity is measured and which values to prioritize.

---

[38] Fullilove (2013) delves into the significance of history and the connection of the psychological aspects of a community with planning

[39] That being said, urban ecosystems have more biological value than their newness on the geological time scale might suggest. The urban environment has its own unique conditions, such as urban heat island effect. Ecologists are now discovering that it is possible for some species to assimilate or adapt to these conditions, even in the short period of time that urban habitats have existed. For example, scientists discovered two new species recently that are both endemic to New York. A new species of centipede, *Nannarrup hoffmanni*, was discovered in the leaf litter of Central Park and is believed to be endemic to the park itself (Foddai et al., 2003; Szlavez, Warren, and Pickett, 2011). A new species of leopard frog, also limited in range to Manhattan, was discovered in 2009 (Newman, et al. 2012). Therefore, some utopian vision of converting cities "back to the country" may eliminate important habitat space that harbors new endemic species.

Judging the value of non-native but diverse species groups in the city must be considered not only in terms of ecological value, but also its importance to local culture, educational value, place-making, and ecosystem services to the community. Contrary to expectation, species biodiversity of plants, birds, and arthropods sometimes increases around cities compared to the surrounding areas even though overall species richness, which takes into account abundance, is lower.[40] Much of the increase in plant diversity is the result of deliberate and indeliberate non-native plantings and the inability of local plants to survive in urban conditions.[41]

This issue brings up an underlying values question between native and non-native species, with reification of the local on one side and human traditions of aesthetics and foods on the other.[42] Ecologists themselves are divided on the issue of the value of non-natives. If non-natives contribute to species diversity, and species diversity is good, does that make them good? Much of the "bad press" around non-natives results from the ambiguity about whether or not an introduced species will behave invasively, upsetting the balance of the native ecosystem.[43]

---

[40] Available information is biased towards temperate locations and nonmicrobial species (Faeth, Bang, and Saari, 2010). Also, these results generally refer to peri-urban conditions rather than dense, central city conditions (Dearborn and Kark, 2012). Marzluff (2005) recorded a curvilinear relationship between bird biodiversity and development density in Seattle, peaking in intermediate disturbance conditions surrounding the city.
[41] Szlavez, Warren, and Pickett (2011); Zerbe (2004) compares cities in Korea and finds that non-native plants contribute to species richness in urban conditions.
[42] Dearborn and Kark (2012)
[43] Sagoff (2005); Szlavez, Warren, and Pickett (2011)

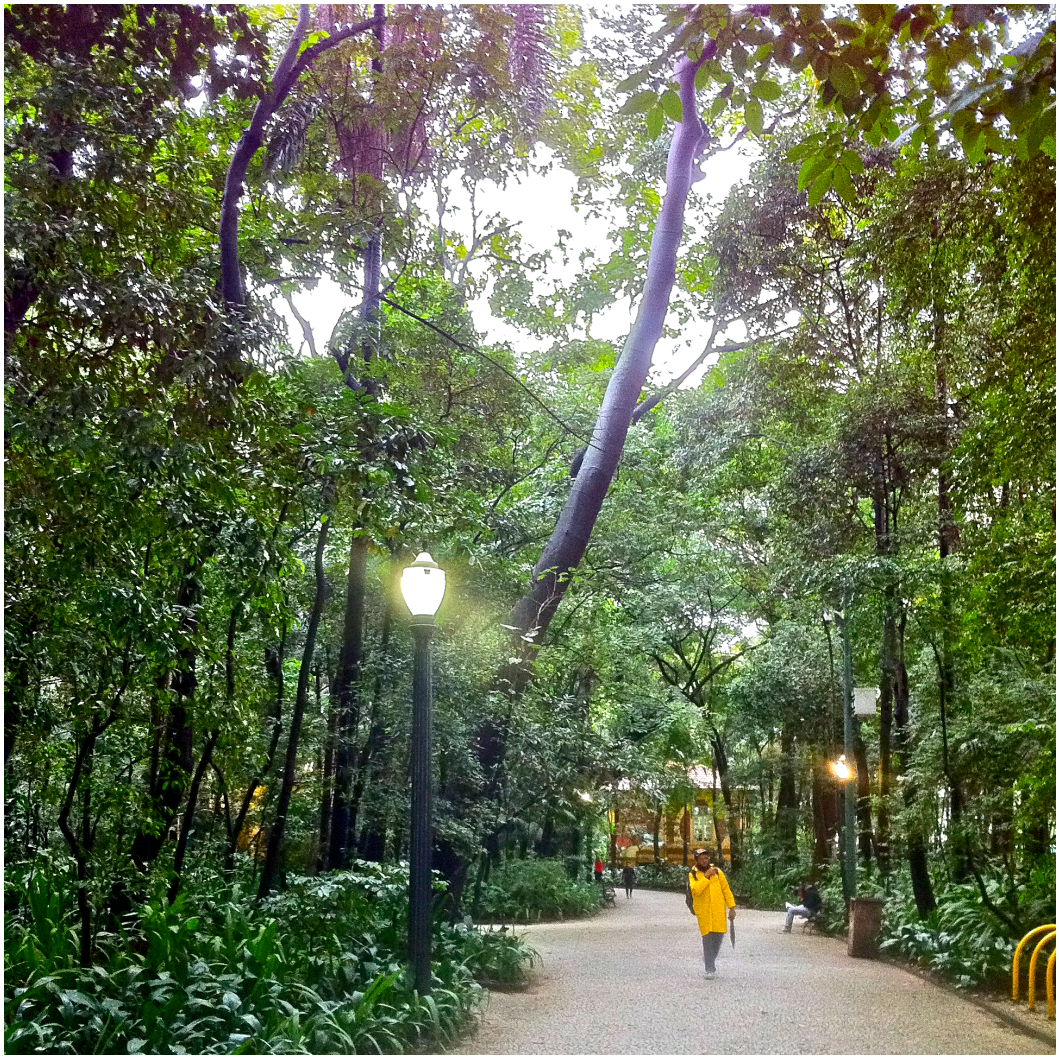


FIGURE 2E: TRIANON PARK IN SÃO PAULO
(Parque Tenente Siqueira Campos) is in the center of the main stretch of Paulista Avenue in downtown São Paulo.

As a result of the high ratio of non-native species, urban ecological communities can be difficult to understand and accurately value by traditional ecological metrics. Is a garden of traditional Chinese plants appropriate in a predominantly Chinese community in the Western hemisphere? What if plants from China are planted in a mixed community because of their aesthetic popularity? These questions require consideration

from many different perspectives, just one of which is ecological. Other values, such as cultural and spiritual implications, should be considered, and need to be communicated.[44]

Urban Habitats Must Multitask to Justify a High Economic Value

Urban habitats must clearly serve functions that people with different viewpoints can value.[45] Biodiversity conservation is one of these functions. To combat the economic argument of "highest best use," habitat areas must serve as many functions as possible, including ecosystem services that are economic, political, cultural, and social.

Even when it comes to maximizing conservation, urban environments have certain nuances that can make them more challenging. As in rural areas, habitat patch size in cities remains the most important determinant of an ecosystem's capacity to support biodiversity.[46] But, the high cost of acquiring urban land limits cities' ability to rely on patch size to meet conservation goals. In cities, local biodiversity protection should concentrate on increasing habitat quality, or intensity,[47] and connectivity.

Ecosystem services such as stormwater infiltration, temperature regulation, pollution reduction, recreational opportunities, stress reduction, spiritual significance, and place-making become important in justifying a biodiverse component in the urban fabric. The value of a biodiverse strip along the right-of-way adjacent to the street increases when the community values it not only as habitat space, but also for providing pedestrian safety, beauty, increasing land values, air filtration, stormwater infiltration, and cooling.

If urban habitats also take advantage of their potential as educational centers to increase awareness of ecosystem services and appreciation of nature, their impact reaches even further. For example, the Arbor Day project in Chicago put price tags on trees

---

[44] Irvine, (2010), Kurz (2012), Fuller (2007), Sime (1993), and Posey (1999) discuss the cultural and spiritual values of biodiversity.
[45] Kowarik (2011)
[46] Irvine, et al. (2010)
[47] Pierce (2014a) describes the use of the term "intensity" for urban biodiversity goals in Jerusalem.

along downtown streets indicating their economic value over the next 15 years so that passersby could appreciate the value of street trees.[48]

Biodiversity Can Coexist with Development

Land in cities is often densely developed. As a result, biodiversity conservation can do more when expanded beyond simple terrain. It should climb walls, cover roofs, and include waterways. It can also expand beyond publicly-owned lands. Private spaces, even those that have been developed, can benefit from biodiversity. Owners can be incentivized to support biodiverse initiatives. One example is the RPPNM[49] program in Curitiba, in which the city identifies private forested land of high value in terms of biodiversity. Owners of this type of land can choose to conserve forest on their land in return for tax reductions.

Incentives are not always needed if values to the owner can be communicated. For example, a green roof can be an expensive piece of infrastructure if conceived solely as habitat for birds and insects. However, its additional functions of sound abatement, insulation, stormwater regulation, cooling, aesthetics, and relaxation space can be combined to increase value.[50] These types of initiatives require collaboration with landowners and the communication of undervalued aspects of biodiversity.

Cities Have Regional Impact

Biodiversity conservation in cities is only achieving a tiny fraction of what is possible if it ignores regional impacts. Biodiversity planners need to reach beyond the realm of habitats to include regional impacts, especially on markets and cultural drivers. Besides their unique nature in terms of their additional considerations for biodiversity

---

[48] The arboretum workers valued the trees using the National Tree Benefit Calculator (Brotman, 2011)
[49] RPPNM stands for Private Reserve for Municipal Natural Heritage (original in Portuguese: Reserva Particular do Patrimônio Natural Municipal)
[50] Oberndorfer, et al., (2007)

protection, urban locations are also pivotally important to a global strategy to reduce and stop biodiversity loss.[51] As cities grow, the average carbon and land use footprint of each individual person decreases at a predictable rate, with a doubling in city size corresponding to only 85% increase in both factors.[52] This phenomenon results from the increased efficiency of infrastructure and interaction afforded by agglomeration. Similarly, cities serve as increasing centers of innovation and specialized activity. Bettencourt and West conclude that "cities are the crucible of human civilization, the drivers towards potential disaster, and the source of the solution to humanity's problems."[53]

Planning for biodiversity in a dense city calls for consideration not only of local land use, but also the greater impact of the city's market shed regionally and globally, referred to as the eco-footprint.[54] Regionally, overall benefits can accrue to local ecosystems if an urban location encourages dense habitation combined with reduced incentives for sprawl.[55] This must be balanced with the needs of habitat connectivity and providing access to natural areas for city inhabitants. On the global scale, market and political forces driven by cities create the drivers for habitat destruction.[56]

2.5 Theoretical Foundations of Urban Biodiversity Planning

Even though urban biodiversity planning is in its infancy, there is a long history of cities seeking to improve upon their ecological impact through better planning, defined here as eco-city planning. This summary illustrates the struggle to relate ecological pressures with social, political, and economic issues in the urban context.

---

[51] SCBD (2012, 2013)
[52] Bettencourt and West, (2010); notable exceptions to this land use trend exist in many areas in the United States, wherein land use can increase by many times the rate of population increase due to sprawl-encouraging policies (Szlavez, Warren, and Pickett, 2011)
[53] Bettencourt and West, (2010, p. 913)
[54] Rees and Wackernagel (1996); Puppim, et al. (2011) calls this "regional biodiversity influence"
[55] Sushinsky, et al. (2012)
[56] Lenzen, et al. (2012) links international trade with biodiversity loss in developing nations

In 1864, George Perkins Marsh published *Man and Nature*, the first influential treatise on the impact of human activities on the planet. He emphasized a crucial need to restore "disturbed harmonies"[57] and saw humans "as essentially a destructive power."[58] He investigated both direct impacts, such as deforestation, and indirect impacts, such as soil erosion. Lowenthal commented that Marsh "demonstrated that human impacts were largely unintended, often harmful, and sometimes irreversible."[59] His work inspired American environmental leaders in the 1900s such as Olmsted, Thoreau, and Udall.[60]

Once cities banished agricultural activities to the outskirts in the name of cleaner air and drained away wetlands for development and to keep mosquitos at bay, there began a counter thought to bring some of nature back into the urban realm. This idea was first manifest through private gardens enjoyed by the wealthy, then public parks. The manicured gardens of Europe embodied control over plants and animals and inspired similar designs internationally. In contrast, the gardens of East Asia created natural-looking, stylized landscapes around human aesthetics. As early as the second and third centuries in China, gardens designed for emperors included artificial mountains, ponds, forests, and ravines.[61] The Garden of General Liang-Ji was even populated with rare and somewhat domesticated animals under the Emperor Shundi to fulfill a vision of an idealized nature. As Europeans began to travel to China in the 1700s, they brought back these ideas and combined them with current painting landscapes to create the Picturesque landscape movement, led by Capability Brown. Frederick Law Olmsted (1822-1903) applied these ideas to public municipal parks in the United States. His idea was to provide an escape from the urban condition, right in the center of the city. His interventions were some of the first large-scale attempts to introduce nature to urban

[57] Marsh (1864/1965, p. 3)
[58] Marsh (1864/1965, p. 36)
[59] (1990, p. 122)
[60] Platt, et al. (1994)
[61] NNRICP (2009)

locations, and he was successful in implementing his designs in many cities across the United States.

Ebenezer Howard's Garden City movement began in the first half of the twentieth century in Britain and spread across the world. Howard sought an escape from the crowded urban condition and to "restore the people to the land."[62] His designs featured small towns of about 30,000 people with a large central park, tree-lined streets, permanent agricultural belt, and curving roads. The use of green elements was primarily with an aesthetic and health improvement purpose, though Howard referred to nature in an integrated way, saying "our kindly mother earth, at once the source of life, of happiness, of wealth, and of power."[63] Others, such as Clarence Stein, Henry Wright, and Clarence Arthur Perry, built upon the Garden City idea just as the age of the automobile was dawning. Their vision incorporated social ideas such as affordable housing with pedestrian safety and resulted in the creation of the superblock.

Sir Patrick Geddes (1854-1932) was a founder of the planning profession and was trained as a biologist and botanist. He supported the Garden City movement, but took a more broad and ecological approach. He argued that "the case for the conservation of Nature and for the increase of our access to her, must be stated more seriously … and is a prime condition of … continued progress towards enlightenment."[64] He encouraged the preservation of natural areas between cities and access to nature for urban dwellers. He challenged the park design of his time, comparing their aesthetics and function to "mansion-house drives" rather than natural ecosystems.[65]

Le Corbusier, as a member of the International Congress of Modern Architecture (CIAM), authored La Ville Radieuse (1935) and the Athens Charter (1943). These works introduced the idea of Towers in a Park, in which the extant built environment is replaced

---

[62] Howard (1898, p. 323)
[63] Howard (1898, p. 323)
[64] Geddes (1915/1950, p. 51).
[65] Geddes (1915/1950, p. 53)

by open, if monotonous, green spaces with repetitious skyscrapers at regular intervals. The Towers in a Park idea often includes a green belt, large central park, and separated automobile/pedestrian ways, all ideas from prior movements. Corbusier simplified nature into green lawns with occasional trees. Curtis criticized him stating, "to create open space without greenery was to devalue the idea of the community living in nature."[66]

Corbusier also simplified the complex system of social spaces for humans using zoning to organize and separate uses, resulting in single use communities. Corbusier's ignorance of the diversity needed to generate a resilient community fed critique of the social disadvantage of neighborhoods dominated by his Towers in a Park concept. According to Platt, Corbusier "failed to examine the functions to be performed by open space and to relate its location, extent, and condition to the physical and biological processes of urban habitat."[67] Another hindrance to implementation of this design scheme was its insistence on replacing any previous development. Despite these challenges, the concept found traction as part of urban renewal, a method of replacing "undesirable" communities, and was incorporated into many socialist city plans.

Reacting to previous urban design concepts that focus on aesthetics and uniformity to the detriment of community, Jane Jacobs (1916-2006) rejected her predecessor's methods and outcomes. She was the first planner to incorporate the social aspect of street life and the importance of diversity in city planning. In this way, she was a pioneer in Integrated Planning. She lived among the working class, and was thinking of this group rather than influential businessmen and politicians when she spoke of parks as being negative spaces that required adjacent lively destinations to keep them safe. Jacobs called cities "complex problems" and rejected the idealist visionary type of urban design touted by her predecessors.[68]

---

[66] Curtis (1986, p. 293)
[67] Platt, et al. (1994) in reference to Platt (1972).
[68] Jacobs (1961)

In 1967, Ian McHarg published Man and Nature, which presented for the first time the ecological view of urban planning, in which the suitability of land for particular uses is analyzed and placed into a hierarchy alongside social and economic suitability to integrate decision-making. He suggests a map of physical and ecological features on a map, such as aquifers, steep slopes, cultural artifacts, and forest, which is qualified and overlaid onto more standard elements of decision making, such as efficient travel distance or land values. The resulting diagram illustrates the optimal location for the type of development in question, such as a new highway. In this way, ecological concerns can be reviewed alongside economic, cultural, and political drivers, resulting in reduced degradation of the environment. This is especially true if decision makers consider environmental health a crucial part of everyone's quality of life. McHarg saw interconnections between ecological health, community health, and individual health. He explains, "the problem of man and nature is not one of providing a decorative background for human play, or even ameliorating the grim city: it is the necessity of sustaining nature as a source of life, milieu, teacher, sanctum, challenge and, most of all, of rediscovering nature's corollary of the unknown in the self, the source of meaning."[69] McHarg felt that traditional academic divisions were detrimental to planning for humans, saying, "man is natural, and therefore there are no divisions between the natural and the social sciences."[70]

Paolo Soleri combined ecology and architecture to create a new way of living he termed Arcology and explained in *Arcology: The City in The Image of Man*."[71] He suggests cities as multi-level, man-made topographies serving as vessels for human-centered flows of goods and people. Such cities are compact, high-density, and surrounded immediately by the natural landscape. He connects this more ecological way of living with increased spiritual development. Soleri's goal of a sustainable habitat for

[69] McHarg (1967, p. 19)
[70] McHarg (1967, p. 124)
[71] Grierson (2003).

mankind is to be "more lively containers for social, cultural, and spiritual development."[72] During the energy crisis of the 1970s, arcology included energy efficiency measures as well, including agricultural greenhouses that reduced the use of energy and water. While the concept of arcology is intriguing, its implementation proved too difficult due to the vastness of these integrated structures that are at once both a city and a single development. Soleri's prime attempt to create an arcology is Arcosanti, in Arizona. Thus far, it is vastly underbuilt and underpopulated. Its 100 or so inhabitants are a far cry from the 5,000 originally intended. Contemporary proposals such as Masdar City represent a renaissance of the arcology idea and are now underway.

Christopher Alexander wrote *A Pattern Language,* containing principles for the built world and its relationship with the nature: 1) the built environment should be a continuation of the land, reflecting a wholeness integral to nature, 2) this continuation of the land also operates at the landscape and community scale in harmony with the earth, 3) the process of creating our environment is continuous and requires abandonment of applied ideas and concepts, 4) the inner voice of each individual that is capable of differentiating a living and right structure must be allowed to prosper and flourish so that people can speak up to improve their world.[73]

One lesson from planning's history that is slowly reaching mainstream audiences is the benefit of interweaving the uses and typologies of city dwellers and spaces, mixing income and uses to create a diverse and interesting urban community. This "flies in the face of traditional planning-by-zoning" and challenges planners to think in more complex ways about cities.[74] Rybczynski points to the success of collaborative projects between developers, governments, and the public. He urges piecemeal urbanism for increased

[72] Grierson (2003, p. 7)
[73] Alexander, Ishikawa, and Silverstein (1977)
[74] Rybczynski (2010)

flexibility and lower risk along with demand-side urban design, in which the public tells us, through market mechanisms, what they enjoy.[75]

Contemporary Visionaries

Richard Register introduced the term "ecocities" in 1987. In his book, he says "we need to look at the whole system of which we are a part."[76] He sites the car/sprawl/freeway/oil complex as the prime driver of habitat destruction and other environmental damages. He focuses on compact city design that maintains farmland, flood plains, and coastal zones as relatively undeveloped. He suggests an adjustment of Paul and Anne Ehrlich's well known formula of humanity's impact on the environment: I = PAT, or Impact = Population x Affluence x Technology. He would add Land Use to the equation to yield I = PLAT, then change the term Impact to Effect, so that it can account for beneficial effects as well. His designs for eco-cities focus on pedestrians, public transit, density, food production, and vertical diversity. He describes the city as an organism, in contrast to Corbusier's analogy of the machine. He sees the city as a place of positive interaction between people and the environment. "When built and functioning well, the city can be an excellent tool for bringing culture into harmony with nature" (p. 49). He calls for maximizing the high potential for biodiversity in cities through stream restoration and rooftop vegetation, while also addressing human needs through three-dimensionalizing urban spaces, using rooftops, terraces, and tunnels.

The New Urbanism movement started by Andres Duany combined the community-building ideas of Jane Jacobs with the aesthetics of the Garden City to generate a mixed-use, street-focused vision for the city. These ideas have approached hegemony for many planners in North America and Europe, under the leadership of the Congress for New Urbanism, founded in 1993. But, most of the communities that have

[75] (2010)
[76] Register (2006)

implemented New Urbanism, and the accompanying Smartcode, have been in the suburbs, rather than city centers. They also have a rather one-dimensional approach to nature, with trees and lawns pasted over public spaces and an occasional nod to the water cycle via permeable surfaces and bioswales. Their prime contribution to the ideas of nature in the city is to reduce sprawl in order to increase conservation of wilderness areas.

Landscape Urbanism emerged as a response to New Urbanism, with the intent of reversing the focus of urban design from buildings to landscapes. Its central tenets as voice by James Corner include respect for natural processes, particularly towards ecological change and context.[77]

Movements such as green urbanism and ecological urbanism call planners to reconsider the potential of cities to operate within ecological boundaries much like a large organism that is symbiotic with the landscape and that allows for healthful lifestyles with a high quality of life.[78] Green urbanism calls for increasing urban agriculture among other measures. Thus far, this theory has not become integrated into the dialogue to address global biodiversity loss. Understanding the social and economic drivers of biodiversity loss both in urban areas and their marketsheds calls for the integration of social sciences, economics, and conventional ecological approaches.[79] Another recent movement by Charles Anderson is called Emo Urbanism, and addresses the emotional aspect of the urban landscape as well as incorporating concepts of entropy associated with urban ecology. It addresses the making of place via memory and ecology, the resultant landscape is termed "urbanature."[80]

---

[77] Corner (2006)
[78] Beatley (2000a)
[79] The integration of social and ecological understanding, called the Social/Ecologial systems approach, has been called for by the SCBD (2012, 2013) and many academics (Pierce 2014b; Szlavez, Warren, and Pickett, 2011; Nagoya declaration, 2010; Carpenter, et al. 2012; Elmqvist, et al. 2004; Yli-Pelkonen and Niemela 2005; Ernstson, et al. 2010; Tidball and Weinstein, 2011; Collins, et al. 2011; Liu, 2007). Also two of the Long-Term Ecological Research Cites (LTER) in Boston and central Arizona (Phoenix) in the U.S. are current areas of social and ecological research interchanges (Szlavez, Warren, and Pickett, 2011).
[80] Emo Urbanism lacks a formative text as yet, but is taught by Charles Anderson at the Unviersity of Southern California, and discussed via blogs such as http://emourbanism.tumblr.com/ and http://emourbanlandscapes.tumblr.com/.

Sanderson, a landscape ecologist, conducted an intense study of the New York City landscape of 1691 – prior to European colonization. He then suggested a citywide restoration project to be achieved over the next 400 years that would interweave a restored version of the ecosystem from 1691 with highly dense neighborhoods and some farmsteads that would accommodate human population projections.[81] His plan addresses the urban nature of the site by interspersing extremely dense human habitation with fully restored waterways, forests, and other historic ecosystems. Even in his utopian plan for the distant future, he does not suggest eradication of human use, nor segregation of humans from the natural landscape, but a reconnection between humans and the natural heritage of New York.

Van Valkenburgh, designer of Brooklyn Bridge Park, in New York City, is an example of one of today's leading urban landscape designers. He promotes the idea of parks as part of the urban landscape, not an escape from it, as in Olmsted's vision. Brooklyn Bridge Park embraces and repurposes historical structures, from piers to industrial warehouses. He populates his spaces with art and retail in addition to spaces defined by greenery, vistas, and pathways. And in the case of Brooklyn Bridge Park, a neighborhood initiative spurred its development, rather than decisions by only developers and politicians. The concept of embracing multiple uses for green spaces as well as an attempt for greater social justice in their design and implementation has been growing.

Today, urban waterways are experiencing a renaissance. More stringent water pollution standards and the movement of industry outside of major cities (at least in more affluent countries), has revived the idea of waterways as the heart of public green space. Cities along waterways develop riverwalks and linear parks along harbors, and those without often promote flood zone parks, such as Dallas and Phoenix. The new public opinion of waterways as public resources has come quite a ways from Corbusier's

[81] Sanderson (2009)

opinion of rivers as "a kind of liquid railway" akin to the "servant's stairs" of the city. [82] The prime introduction to waterways as a central feature of a city to be highlighted is in Burnham and Bennett's 1909 plan for Chicago. Though it is important to note that by then Chicago had reversed the direction of the Chicago River, a channelized waterway that carted effluent away from Lake Michigan, the jewel of the city's plan, with miles of parkways along its front.

2.6 Urban Biodiversity Planning Today

Planning for biodiversity in the urban context is a relatively new field, with most of the work occurring in the 21st century. Past studies typically focused on particular physical locations, such as Swedish cities, Seattle, etc. and also typically focused on ecological or land use issues rather than an integrated approach. I believe this study to be the first large compilation of urban biodiversity plans around the world.

The imperative of moving out of the land conservation approach, especially in urban conditions, has become clear in the last few years. Framing humans as a disturbance in an urban condition is difficult to justify and the removal or restriction of human access is a challenge to implement at any large scale,[83] but that has not prevented some recent scholars to insist on it as the prime conservation measure, even in urban areas.[84]

Cities have just begun to create urban biodiversity plans or other types of plans that reference biodiversity. The 65 plans in this study include both types and span the globe (see fig. 2f). They range in date from San Francisco's Sustainability plan from 1997 to Mexico City's biodiversity plan, released in January of 2013 (see fig. 2g). While biodiversity plans were released prior to 1997, these have since been updated and only the most recent version is included here.

---

[82] Le Corbusier and Etchells (1971)
[83] Gill (2009)
[84] Hostetler, Allen, and Meurk (2011); Sorace (2001)

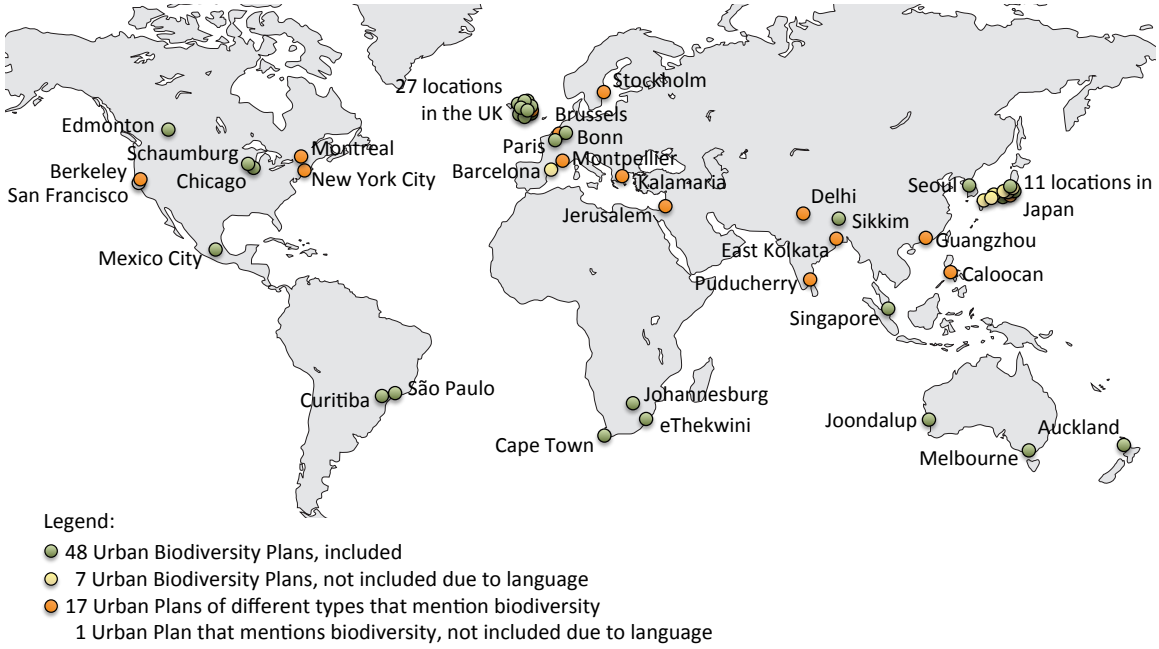


FIGURE 2F: WORLD MAP OF PLANS IN THIS STUDY

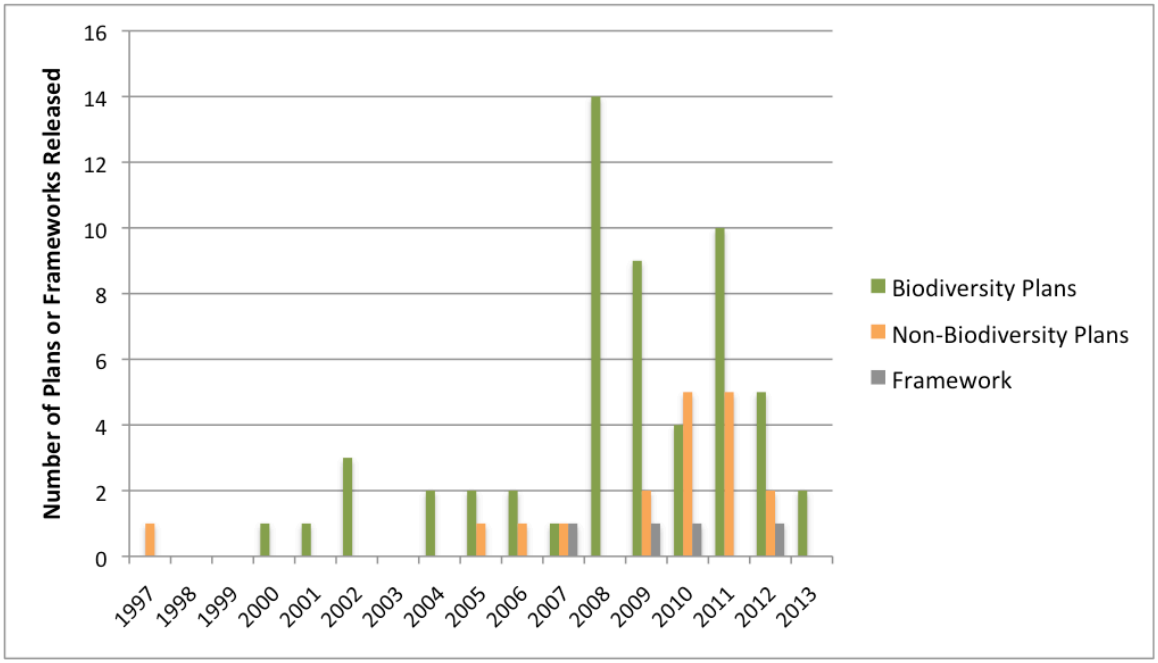


FIGURE 2G: TIMELINE OF PLANS IN THIS STUDY

CHAPTER 3: GOALS AND METHODOLOGY

3.1 Purpose Statement

Traditional conservation calls for the preservation of existing "intact" land areas first, followed by related actions such as connecting natural areas and restoring degraded lands.[85] These ideas are driven by two misconceptions: first, a concept of nature vs. humanity and second, a focus on the symptom of habitat loss. In the first misconception, nature is presented as being at odds with humans: at its best when separate from humanity. The second misconception addresses the symptom of land use rather than underlying causal behaviors such as consumption and patterns of development.

Biodiversity conservation[86] has followed in the footsteps of traditional conservation, equating preservation of biodiversity to removal of humans from the land to achieve the restoration of "pristine" wilderness and focusing on land use instead of human behaviors. Biodiversity efforts have traditionally identified "biodiversity hotspots" in which to focus conservation efforts. Hotspots are land areas with high levels of existing biodiversity but that are experiencing alarmingly high rates of habitat destruction. Thus, biodiversity conservation focuses on the removal of humans from high-value natural areas.

In the urban context, both of these concepts have been applied. They are revealed through the limitation of biodiversity initiatives to urban parks and fringe "natural" areas. This viewpoint questions whether biodiversity has any place in the urban context at all – after all, cities dedicate their land use to human centric purposes, few "natural" urban areas still remain, and the purchase of urban land is expensive.

---

[85] Ansel Adams and the Sierra club were the authors of this idea, reinforced in the Conservation Biology Journal. Aldo Leopold was the first to take these ideas to task, but they still have a hold on much of environmental conservation practice. These ideas live on in the focus on preservations, such as in the dialogue of conservation biogeography that focuses on protected area networks (Whittaker, et al., 2005). Beatley (2000b, p. 13) suggests similar solutions focused on purchasing conservation land even in urban contexts despite the high cost of urban land.

[86] I refer here to "biodiversity conservation" to indicate the dialogue of biodiversity protection that uses the traditional conservation model.

Framing biodiversity conservation in opposition to and separate from the activities of humans played out in a battle over land has resulted in general losses for biodiversity conservation efforts in favor of development.[87] Geisler suggests that "narrow reliance on formal protected areas yields conservation refugees, environmental backlash, and set-backs to sustainability efforts."[88] Success stories are small and few, limited to site-specific restoration projects that do not match the scale of the problem. The targets set by the Convention for Biological Diversity for 2010 have not been met, and even its leaders consider them to have failed.[89]

More recent dialogues on biodiversity protection have come to acknowledge the narrow view of this framework[90] and the resulting hindrance to biodiversity preservation. Detaching biodiversity protection from a fundamentalist argument between conservation of land and human use of land results in a more complex and nuanced view that lacks easy traction with general audiences. Even experts in development and ecology alike have difficulty expanding their view to a more systemic approach.[91] The Global Biodiversity Outlook indicates a scale and integration problem, stating, "there has been insufficient integration of biodiversity issues into broader policies, strategies and programmes, and the underlying drivers of biodiversity loss have not been addressed significantly."[92] Navarro and Tidball suggest that the illegibility of biodiversity as a concept is an obstacle to reaching biodiversity goals.[93]

Wood et al. conducted the Root Causes Project across ten biodiversity hotspots around the world. They define root causes of biodiversity loss as those that underlie the

---

[87] Alfsen, et al. (2010)
[88] Geisler (2010, p. 119) calls for a different approach he calls reconciliation ecology.
[89] SCBD (2010). The primary success that the Global Biodiversity Outlook touts is a reduction in deforestation rates in tropical regions. Note that this "success" is not even a halt in deforestation, but a reduction in its rate.
[90] UNESCO's Man and The Biosphere project acknowledges the importance of recognizing man as within the ecological system. It seeks to "recognize and support sustainable urban interactions" (Alfsen-Norodom, et al., 2004, p. 4).
[91] Navarro and Tidball (2012); Savard, et al. (1999) discusses only negative interactions between humans and nature in urban environments in detail, but calls for more studies on potential benefits.
[92] Secretariat of the Convention on Biological Diversity, (2010, p. 9)
[93] (2012). One effort to get around this illegibility is to reframe the biodiversity discourse into an ecosystem services discourse (CBO).

more obvious proximate causes of loss. Even in these ten non-urban contexts, the root causes lie in socio-economic factors. Wood et al. critiqued traditional approaches to local biodiversity conservation as being "only of peripheral relevance" to the biosphere.[94] They recommend an approach that considers a wider array of factors and reaches beyond the local context to address the root causes of biodiversity loss. Interestingly, the root causes of these remote areas often lie in commercial markets and politics that are created in urban areas.

So far, efforts have not recorded widespread reduction of biodiversity loss, or even measured reduction in any particular city.[95] I believe this may be due in part to the fact that very few efforts have had sufficient time to measure their impact, but also because the two false conceptions identified here are largely followed by biodiversity conservation efforts: identifying nature as against humanity and addressing the symptom of land use rather than the problem of consumption and development patterns. To address biodiversity loss in a meaningful way, each of these two false concepts must be replaced by their more holistic counterparts: humanity as a part of nature and addressing behaviors of consumption and development patterns rather than the symptom of land use.

The default idea of removing human use from biodiverse areas needs to be replaced with new ideas that interweave and overlap conservation purposes with complimentary human use, including resource extraction and development. This will open up huge areas of land, including urban areas, to the application of conservation. E.O. Wilson made an aggressive, and many would say fantastical, suggestion when he called for setting aside 10% of land globally for conservation.[96] Even in this "aggressive" concept, 90% of the land is left for human use only with no conservation imperative.

---

[94] Wood et al. (2000, p. 6)

[95] None of the urban biodiversity plans investigated have indicated measured success at a citywide or regional scale. There are successes at the smaller scale. For example, Hawthorne Grounds (in Southampton BAP, p. 19), the Seagrass Watch program in Singapore (NBAP, p. 20) and the restoration of Cheonggy-cheon Stream in Seoul (BAP p. 44). The Global Biodiversity Outlook stated that some specific actions have had success. The most significant is the reduction of deforestation in some tropical countries, saving 31 at risk bird species from extinction (out of 9,800) (CBD, 2010).

[96] Wilson (1988)

Planners need to consider all 100% of land areas as potential for increasing biodiversity while simultaneously being inhabited by humans if we are to succeed in halting biodiversity loss. This requires a new concept of comingling conservation with human use.

The traditional "biodiversity hotspot" defined as a disappearing land area should be reframed as hotspots of the causes of biodiversity loss to be targeted. Identifying "causal hotspots" requires a systemic analysis of the marketplace and the social and cultural drivers behind it. Strengthening this framework of biodiversity protection should start in the centers of these social and cultural drivers: cities.

3.2 Initial Explorations

Prior to developing research questions for this study, I formed an initial understanding of the issues inherent in biodiversity planning through some preliminary data collection and observations in the summer of 2012. This work included visiting sites of initiatives in Brazil and South Africa, participating in several conferences surrounding the United Nations Conference on Sustainable Development in 2012 (known as Rio+20), conducting unstructured interviews, and gathering feedback from a workshop I led. Much of this work had a second purpose: to aid in the development of a biodiversity mainstreaming toolkit for ICLEI's Cities Biodiversity Center.[97]

Site Visits

I was fortunate to be able to visit biodiversity projects in Curitiba and São Paulo, Brazil and in Cape Town, South Africa. In Curitiba, I visited several major parks, the Botanical Garden greenhouse where native plants are grown for city use, the Education Center, the Free University for the Environment, and the Children's Environmental

[97] This toolkit was published in March of 2014 (Pierce 2014b)

Education Center. I observed a class of kindergartners learn about plants in the garden of the senses by exploring their surroundings blindfolded (see Fig. 3a). I toured a private undeveloped lot that had an existing native forest enhanced by newly planted native trees. Its restoration was part of Curitiba's privately owned forestry restoration transfer development rights incentive program, called RPPNM.[98] In São Paulo, I visited parks and toured the new animal hospital under construction in an important forested preserve in the city. In Cape Town, I visited the Biodiversity Garden, noting its innovative public awareness signage and artwork.

FIGURE 3A: JARDIM BOTANICO IN CURITIBA
Kindergarten students learn to experience plants in the Garden of the senses by being blindfolded.

[98] RPPNM stands for Private Reserve for Municipal Natural Heritage (original in Portuguese: Reserva Particular do Patrimônio Natural Municipal)

I also climbed Table Mountain and Lion's Head peak; both are protected areas easily reached on foot or short drive from my downtown apartment. At the botanical garden, I explored the unique plant life found in the Fynbos ecosystem endemic to Cape Town and observed many school groups during visits. I had the opportunity to meet with the team designing a new public educational center to be located near the Biodiversity Garden. These visits instilled in me a sense of the level of innovation occurring in unexpected places and reinforced my desire to review local plans around the world. They also showed the variety of implementation projects taking place in various cities, each with their own philosophy.

Conferences

Rio+20 attracted not only the attention of nations' leaders, but also local environmental leaders from around the world. The Rio+20 conference held a Cities Leadership Day dedicated to local initiatives and also featured many booths and panels discussing local actions. The confluence of great local players in one place at the same time generated additional events, and two other conferences just prior to Rio+20 focused on local environmental initiatives. The first, the Urban Nature Forum, specifically discussed biodiversity in cities. The second, ICLEI's World Conference, covered sustainability issues faced by local governments. Between these two conferences and the events at Rio+20, I had the opportunity to discuss biodiversity initiatives informally with many actors in the local environmental realm. I also noted that several of the more formal lectures and panel discussions had urban-focused environmental topics. I observed a great deal of hope focused towards cities and what they were capable of in terms of addressing global environmental concerns, contrasted with a stern critique of achievements by global attempts at the national level thus far.

Interviews

I conducted fifteen in-person unstructured interviews with practitioners in biodiversity planning from several countries. I selected the individuals based upon convenience sampling and snowball sampling in an attempt to gather information on a wide variety of biodiversity planning techniques and contexts. Most of the interviews took place during the conferences and the site visits I mentioned earlier. During the interviews, I struggled to find a common vocabulary and identified disparate goals from the various locations that lacked unity. Interviewees framed their biodiversity efforts very differently, from a focus on human health and species recovery in São Paulo to a three-legged-stool approach focused on economic and social benefits in Raleigh, North Carolina, U.S.A. Ideas and quotes from these interviews highlight issues discussed in the analysis section of this document.[99]

Workshop Feedback

At the Urban Nature symposium in Belo Horizonte, Brazil, in June 2012, I conducted a workshop wherein I gathered feedback on current biodiversity planning efforts. Forty participants from around the world worked in pairs to fill out a feedback form I generated. The participants included government officials, heads of environmental departments, academics, and NGOs. Just under half of the participants worked in Brazil, and others were from Argentina, Israel, South Africa, New Zealand, the United States, Japan, Sweden, and Belgium. The form I handed out listed some preliminary ideas called "tips" intended to address barriers to mainstreaming biodiversity planning.[100] It asked for feedback on whether or not the participants had used the techniques indicated by the tips in their cities, and what additional tips or barriers they face. The original form and the results of this workshop are included in the appendix

[99] Pierce (2014b) contains the outputs of many of these interviews
[100] These tips were then updated following the workshop and publish in Pierce (2014b)

(sections X.1 and X.2). Results from this workshop showed that interdepartmental teams, partnerships, and participatory planning in some form commonly took place as a part of biodiversity planning. They also indicated a wide variety of biodiversity protection efforts. Despite this, barriers to the full implementation of biodiversity protection ideas were commonplace among responses. Participants named general ignorance of the issue, lack of funding, lack of support from officials and other departments, and lack of capacity as barriers that impeded conservation efforts.

As a result of these preliminary explorations into local biodiversity initiatives, I refined my understanding of the issues before developing a specific research focus. I began to understand the complexity of biodiversity as it is communicated in practice and the various ways that biodiversity is planned and implemented worldwide. I also gained a better feel for the global context and the struggles of global actors that are increasingly looking towards networks of cities to address biodiversity loss.

3.3 Methods

The purpose of this concurrent mixed models/mixed methods study is to better understand the research problem by analyzing both planning documents and common frameworks that led to the development of such documents. In this study, document analysis with both quantitative and qualitative aspects provides an overall picture of urban biodiversity plans. Additionally, comparison of these documents with the initial unstructured interviews and the frameworks supplements the document analysis to further explore this relationship.

The methodology proposed here involves the integration of qualitative and quantitative analysis across all three areas of inquiry. The first question, regarding biodiversity as a concept, uses interviews and both manual and unsupervised lexical analysis. The second question, regarding whether plans integrate social, cultural, and economic aspects of biodiversity, uses manual and unsupervised analysis as well. The

third question uses the results of the lexical analysis with a review of current models to look back and explore the underpinnings to the development of the plans. By using the unbiased quantitative and qualitative lexical analysis supported by manual analysis to obtain reliable and useful results in the face of a messy problem, I am following the triangulation method of mixed methods mixed models, developed by Tashakkori.[101] Mixing both qualitative and quantitative analysis across all phases provides results that are highly valid, verified by the presence of five features: triangulation, complementarity, development, initiation, and expansion.[102] The triangulation process seeks a degree of corroboration and convergence across different methods. Complementarity is illustrating and clarifying one method through another. Development uses the end results of one method to inform another. Initiation recasts questions raised by using one method and applies these new paradigms to develop questions for the other method. Expansion enhances the breadth of the study through the use of multiple method types. In this case, I exhibit these properties in my study starting with my own theories based on the initial understanding investigations (discussed in section 3.3) that are then enhanced and informed by unbiased lexical analysis to come to a combined, new starting point. From there, I develop further reasoned arguments for manual analysis and compare them with existing biodiversity protection planning frameworks that will challenge me to question the previous results iteratively.

Methods

I selected an unsupervised content analysis approach to review 48 biodiversity plans as well as 17 other types of plans that refer to biodiversity. I chose to use the Leximancer software over other kinds of content analysis because it allows me to analyze large amounts of text in a pseudo-quantitative and unbiased method that can be

[101] Tashakkori and Teddlie (1998), Tidball (2012), Tashakkori and Teddlie (2003),
[102] Greene, Caracelli and Graham (1989)

repeated.[103] Leximancer automatically generates themes using an algorithm that is unsupervised. In an unsupervised analysis, the computer software uses an algorithm to identify concepts and themes in the text without any previous framework or bias. By contrast, in a supervised analysis, the researcher introduces bias through his or her own implicit or explicit framework of codes and themes. After investigating the use of concept maps generated automatically by Leximancer, I found that the maps themselves were not stable enough to produce a repeatable result, but that the concept co-occurrence data was consistent and could be exported for additional statistical analysis. Therefore, I chose to utilize the concept strength identification and co-occurrence raw data rather than the concept map visualization output from Leximancer for my analysis.

The plans that were analyzed include: 48 biodiversity plans; 4 climate change plans, 4 comprehensive plans, 1 wetland plan, and 8 sustainability plans that each contain the term biodiversity. The plans are not limited geographically nor in scale, but I did limit them to only those places which average at least 3,000 people per square mile[104] to ensure an urban context. The plans cover city-states, cities, regions, counties, and provinces. I analyzed each type of plan in aggregate, grouped by commonality, and individually.

I specifically addressed each of the three research questions in the following ways:

1. In the non-biodiversity plans, I reviewed how biodiversity is expressed as a concept generated by Leximancer. I looked at whether or not and how strongly it manifests as a concept or a theme, and how it relates to other identified themes. I manually counted the frequency of the biodiversity term.

[103] Smith and Humphreys (2006); Tidball, et al. (2012); Penn-Edwards (2010).

[104] I use density instead of population numbers to ensure an urban context without the need to worry about particular boundary areas, such as metro area versus city boundaries. The resultant plan areas have populations ranging from over 11 million to just under 50,000. They include entire cities, city-states, areas within larger cities, local regional areas and provinces (states). The density limit serves to ensure that all included plans are working within a dense, urban context. It is higher than the U.S. census definition of "urban" at 1,000 people/sq. mile, but lower than China's urban threshold. At this level of density, over half of the inhabitants can safely be assumed to be living in an urban condition.

I also generated frequency diagrams of the co-occurrence of biodiversity[105] with other concepts as compared to other terms in the same document. I compared this with a sampling of other common terms (green, development, area, and community) to determine whether "biodiversity" had a more or less consistent co-occurrence with other concepts.

2. I investigated the themes of the plans and identified concepts and themes that are social, cultural or economic, rather than nature or land-based. Using the Leximancer concept outputs, I classified the concepts according to six categories: (1) social, (2) cultural, (3) economic, (4) land conservation/ecological, (5) educational, and (6) other, or neutral terms. I then developed an index for the degree of integration that accounts for the quantity and frequency of categories 1-5. I graphed the result, with a consistent color for categories 1-5. The resulting number and associated graph provided a numeric value and a visual diagram that answers the hypothesis. From these analyses, I could order and categorize the plans according to their degree of integration. I could also look for patterns that correlated with a greater degree of integration.
3. I repeated the process from question 2 on documents describing the four selected frameworks. I then used retroductive reasoning[106] to compare the plan documents with the biodiversity planning conceptual frameworks.

Manual Word Search

To determine the frequency of the term "biodiversity" in the more general plans, I conducted a search using Adobe Reader's automatic search feature, combined with tools found in Microsoft Word. This allowed me to selectively remove instances of "biodiversity" appearing as part of a name or logo, and in the header or footer of a document.

I also manually reviewed each occurrence of the word in the non-biodiversity

[105] I extracted these data from Leximancer for further analysis in spreadsheet form.
[106] Retroductive reasoning is a method in which observations are explained by the development of a theory or model.

plans, and decided to add the term "diversity" in order to capture examples in the text of "bio-diversity," "species diversity," "bird diversity," etc. In the manual review, I counted the term only if it referred to diversity in a biological sense, rather than social or economic. For example, I did not count occurrences such as "cultural diversity" or "housing stock diversity."

I counted in two ways: by pages that contain at least one occurrence, and by word count, with each occurrence counting as one. I divided the page numbers by the total number of pages of the original document to obtain the percentage of pages containing the term. I divided the word count occurrence by the total word count, as determined by pasting the entire document into Word and using the automatic "word count" feature. Some documents did not allow for word selection due to the file type, and I first converted them into a text document. I reviewed documents in English, Spanish, Portuguese, and French in their respective languages.

Manual Analysis of References to Biodiversity

To review references to biodiversity in the non-biodiversity plans, I extracted the reference and its context. If a section contains biodiversity in the title, then I extracted the entire section, but if it was in a paragraph, I extracted only related sentences. Then I color-coded the references by categories derived from the text itself. From this analysis, I was able to generate a chart of the various biodiversity references. Some sentences referred to biodiversity only in passing, or as part of a list of various items, and did not impart any particular meaning to the term, so I left those occurrences out of the analysis.

Leximancer Analysis and Outputs

Leximancer[107] is a software that extracts lexical co-occurrence information in an

[107] This analysis uses Leximancer version 4 via its web-based platform.

automatic and unsupervised manner.[108] It derives concept words from the text itself using seed concepts pulled from the text in an iterative process that then generates concept words. The software selects concept words based upon words that occur frequently, but not consistently, implying that they are indicative of a particular idea in the text. Words such as "and" are too frequent to be a concept and are automatically excluded. Leximancer's system of analysis is by nature unstructured and unbiased, generating a set of data that can be verified. It also allows for rapid analysis of large amounts of text.

The output data include the relevance and the count of each concept term and the connectivity of each theme. The relevance is the frequency of each concept as a percentage of the most frequent concept (set at 100%). The count is the numeric frequency of occurrence of each concept word per unit of analysis, generally one to three contiguous sentences. Theme connectivity is also expressed as a percentage with the strongest theme used as the benchmark, at 100%.

Within each concept, there is also a co-occurrence count and percent likelihood for each other co-occurring concept. The count is the quantity of text blocks that contain both concepts. The percent likelihood is the bi-directional conditional probability of the two concepts occurring in the same text block.[109]

Leximancer then uses these data to generate a concept map that illustrates the conceptual structure of the text. The concept map is a spatial arrangement of the concepts positioned relationally in a concept tree. The diagram is enhanced and simplified by the use of themes, illustrated as overlaid spheres and named according to their strongest theme word. These three elements: the concept words, the concept tree, and the theme bubbles, constitute the diagrammatic output generated by Leximancer in image format. However, the concept map has problems with stability during clustering that causes random variability.

---

[108] Smith and Humphreys (2006); Tidball, et al. (2012); Penn-Edwards (2010); Leximancer (2011)
[109] Leximancer (2011)

I achieved some degree of verification of the concept map's stability by repeating its generation at least ten times in a process called reclustering. Each time Leximancer generates the concept map, it randomly arranges the identified themes in a three-dimensional space. These themes then arrange themselves, or "cluster" according to the strength of their relationships. The reclustering process repeats this each time with a random starting position. A stable concept map will have a low degree of variability between each reclustering (other than mirror-image or rotational variation). It will also tend to have a limited number of possible overall structures, resulting in a few similar clustering results.[110] High variability when reclustering indicates that the concepts are too interrelated, generating an unclear set of relationships and many possible varieties of layout on the page. If this occurs, the Leximancer manual recommends that the researcher review the automatically generated concepts and carefully remove terms that are overly common in the context of the particular topic.[111] It may also be necessary to revisit the settings used for the automatic analysis to ensure their appropriateness for the text type. However, many text analyses have more than one possible visual layout despite settings adjustments.

In this case, many of the documents had several variations that Leximancer generated during reclustering. As a result, I chose not to use the concept map, but only the theme output data related to each concept and co-occurrence data between concepts because these data do not change.

The use of the Leximancer software made this study in its form possible because it can quickly compare a large amount of text in an unbiased manner. I used only the concept data for "biodiversity" for my analysis, along with a handful of other terms for comparison purposes (development, green, area and community). I also looked at the co-

[110] It is common for Leximancer to determine a few possible concept map structures for a given set of data. Theme bubbles have variability, and therefore the stability of the structure clustering is best determined by looking only at the concept tree, with the theme bubbles turned down to 0% visibility (McFadden and Smith, 2013).
[111] Leximancer (2011). Penn-Edwards (2010) used this procedure as well.

occurrence concepts with biodiversity.

For a comparative analysis that could combine together documents from various locations, I converted non-English text to be analyzed in Leximancer into English. I used Google Translate for the bulk of the documents followed by a manual review and minor manual revisions of the two translated documents. Converted texts included Montpellier's Comprehensive Plan, translated from French, and Mexico City's Biodiversity Plan, translated from Spanish. One Portuguese document and one Japanese document each included a complete English translation offered by the government that I used instead of translating the original version myself.

Leximancer Settings

Leximancer has an automatic system of analysis with default settings that can be manipulated manually to suit the document type or to focus on particular researcher-set themes.[112] For the purposes of this analysis, I used the default settings for the analysis with some exceptions, each explained below.

The unit of analysis the Leximancer typically uses to identify the presence of concepts is two sequential sentences, defined as a "block." In this case, I altered the setting to use only one sentence per block because many of the documents have a lot of spreadsheets and bullet points.[113] Also, due to frequent spreadsheets and bullet points without a period at the end, I decided to have the blocks break at the paragraph.

Rather than differentiate between name-like concepts and word-like concepts, I had the software treat both types the same. Without this setting, many words became duplicates because they appeared in department and program names.

The concepts seeds editor allows for removal and addition of particular concepts by hand. I used this feature to add the concept "biodiversity" to documents or document

[112] Smith and Humphreys (2006); Tidball, et al. (2012); Penn-Edwards (2010); Leximancer (2011)
[113] This decision was confirmed by Leximancer's support team (Leximancer, 2013)

groups in which the term was too infrequent to appear on its own. I also removed concepts that were location names and some frequent words, including: etc., San, Francisco, Brussels, Berkeley, York, including, and during.

I ran the analysis of the non-biodiversity plans and plan groups both as a standard analysis of the full document and as a specific analysis of only the parts containing the "biodiversity" concept. To do this, under the concept coding settings, I set biodiversity as a required concept. This means that the analysis includes only those blocks of text that include the biodiversity concept. It ignores the rest of the text.[114] This allowed me to look in more depth at the sections with biodiversity, and also helped to reduce the influence of large texts that only have a few mentions of biodiversity.

Leximancer Limitations

During the analysis process, I identified some unexpected limitations to Leximancer's data. These include a bias towards documents with more text and variability in the theme bubbles and the concept trees during reclustering.

The bias towards larger text means that each block of text, in this case a sentence or bullet point, carries equal weight. This means that when combining documents into one analysis, each document will influence the outcome proportionally to its size in text block units. Therefore, larger documents have a greater influence over the outcome. The documents under analysis range in size greatly. For example, the non-biodiversity plans range from Puducherry's 3,838 words to New York's 102,264 words. To counter this, I analyzed each document individually, or in the case of the frameworks, all documents related to each framework as a set. I only combined analyses from the numbers produced from the individual analysis so that each document carried equal weight, no matter its size.

[114] Leximancer (2011)

The degree of variability during reclustering ranged between plans and groups of plans. In each case, I reclustered the concept tree at least ten times to check for variability. Some analyses did not vary more than slightly, but others had up to five different variations. As a result, I decided not to use the concept maps, and instead to use only the raw output data that is stable for my calculations.

3.4 Data Limitations

The data are biased in three ways: (1) towards groups that keep information on their biodiversity plans on the web in a searchable format, (2) towards English speaking areas and also (3) by lacking a control dataset. I made every attempt to gather all the biodiversity plans and frameworks that meet my density criteria. Ultimately, I eliminated some plans from the analysis due to language barriers. I also did not attempt to get an idea for the representative quality of the plans included as a part of the realm of planning or sustainability planning as a whole.

Bias Due to Accessibility

To locate plans, I searched the Internet extensively and also reached out to my professional network for additional documents. In an effort to locate plans mentioning biodiversity in larger agglomerations of people, I added a specific search of the fifty largest cities and metropolitan areas of the world as well as the denser states of India, Japan, and the UK by name, to a more general search that picked up smaller or more obscure locations' documents. I would therefore expect my data to have some bias towards larger cities and these regions.

Additionally, I had access to some plans that are not available on the web due to my involvement with ICLEI, so the documents included also have a bias towards participants in ICLEI's programs.

Bias Due to Language Barriers

I located seven plans available only in Japanese. I did not include them in the analysis due to difficulty in translating concepts from non-European languages into English and because I do not know the Japanese language. I also searched for the term "biodiversity" in Spanish (biodiversidad), Catalan (biodiversitat), Portuguese (biodiversidade), and French (biodiversité), though these searches were less extensive than those in English. Furthermore, I converted plans located in other Latin-based languages into English using Google Translate for inclusion in the Leximancer analysis. I used the original language files for word searches. I read the original files in Spanish, French and Portuguese for basic comprehension, since I have skills in these languages.

Bias Due to Lack of a Control Dataset

The data collected on the comprehensive and sustainability plans do not have a baseline for comparison to plans that do not mention biodiversity. Nor is there an idea of the population size of all comprehensive plans, so I do not know what percentage of the total my sampling represents. The plans included are all those plans that I could find that mentioned biodiversity at least once. No doubt, these plans are only a small fraction of all plans available for urban areas. Therefore, the conclusions from this study cannot be extrapolated to the world of planning documents as whole, but only to planning documents that contain the term "biodiversity," and even within this set, undoubtedly I have only a representative sample of an unknown total population.

CHAPTER 4: ANALYSIS OF PLANS AND CONCEPTUAL MODELS

4.1 Non-Biodiversity Plans

The search for plans containing the term "biodiversity" but that were not specifically biodiversity plans identified 18 plan documents and websites. One of these, a greening plan for Yokohama, Japan, I did not include in the analysis because I could not locate a translation in English. The remaining 17 included 8 sustainability plans, 1 wetland plan, 4 climate change plans, and 4 comprehensive/development plans.

TABLE 4A: PLANS INCLUDED IN THE ANALYSIS.[115]

Location	*Plan Type*	*Country*	*Area*	*Date*
Brussels	Sustainable City Plan	Belgium	City	2012
Delhi	Greening Delhi Action Plan	India	City	2007
Jerusalem	Green Plan	Israel	City	Mar 2012
Liverpool	Sustainability Plan	England	City	2010
Montreal	Sustainable Development Plan	Canada	City	2010
San Francisco	Sustainability Plan	U.S.A.	City	1997
Stockholm	Sustainability Plan	Sweden	City	2011
Stoke on Trent	Sustainability Plan	England	City	Aug 2011
East Kolkata	Wetland Conservation and Management Plan	India	Sub-city	Jul 2005
Berkeley	Climate Action Plan	United States	City	Jun 2009
Kalamaria	Adaptation Action Plan	Greece	City	Apr 2011
Puducherry	Action Plan on Climate Change	India	City	Aug 2010
Worcester, MA	Climate Action Plan	U.S.A.	City	Dec 2006
Caloocan	Development Plan	Philippines	City	2010
Guangzhou	Economic and Social Development Plan	China	City	2011
Montpellier	Development Planning Improvement Toolkit (AURA)	France	City	2009
New York City	PlaNYC; Comprehensive Plan	U.S.A.	City	Apr 2011

[115] For more detailed information on each document, see the appendix section X.3

I analyzed each of these plans for the *strength* of biodiversity as a concept both individually and in groups. Then I categorized them according to how they *referred* to biodiversity for further analysis in subgroups.

Strength of Biodiversity as a Concept

On average, biodiversity is not a strong concept when compared to other concepts in the non-biodiversity plans. Occurring in 187 text blocks, biodiversity as a concept is ranked in 66th place, with only 5% relevance relative to the most common concept, "city" (see Fig. 4a). However, this low average ranking is highly impacted by large documents with a low biodiversity ranking, such as PlaNYC.

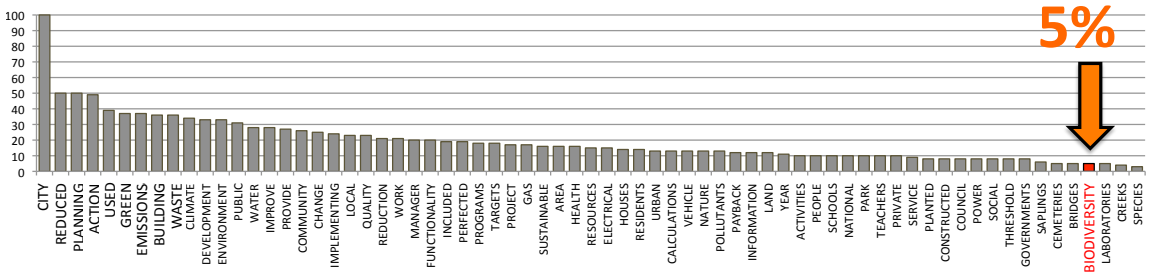


FIGURE 4A: CONCEPT RELEVANCE

Concept relevance for the top concepts of all non-biodiversity plans, an average. Biodiversity is highlighted.

When averaging the concept relevance of each plan weighted equally, the percent relevance jumps to 10%. By comparing the frequency of biodiversity, both as a term[116] and as a concept, between the plans, I obtained a more nuanced picture that was consistent around the 10% figure. This analysis also indicated a much higher incidence in the sustainability plans and the wetland plan (see Table 4b and Fig. 4b).

[116] This manual search also counted "bio-diversity" and "diversity" that were in reference to species or habitats rather than social or economic issues. For example, I did not include "housing diversity" but did include "amphibian diversity."

TABLE 4B: INCIDENCE OF BIODIVERSITY BY PLAN TYPE ON AVERAGE.[117]

Plan Type	*Biodiversity Concept Relevance*	*Pages Containing "Biodiversity" term*	*"Biodiversity" term average occurrence per 1,000 words*
Sustainability/Greening Plans	13%	17%	1.7
Wetland Plan	9%	37%	2.3
Climate Change Plan	7%	2%	0.3
Comprehensive/Development Plans	5%	5%	0.3
All Non-Biodiversity Plans	**10%**	**12%**	**1.1**

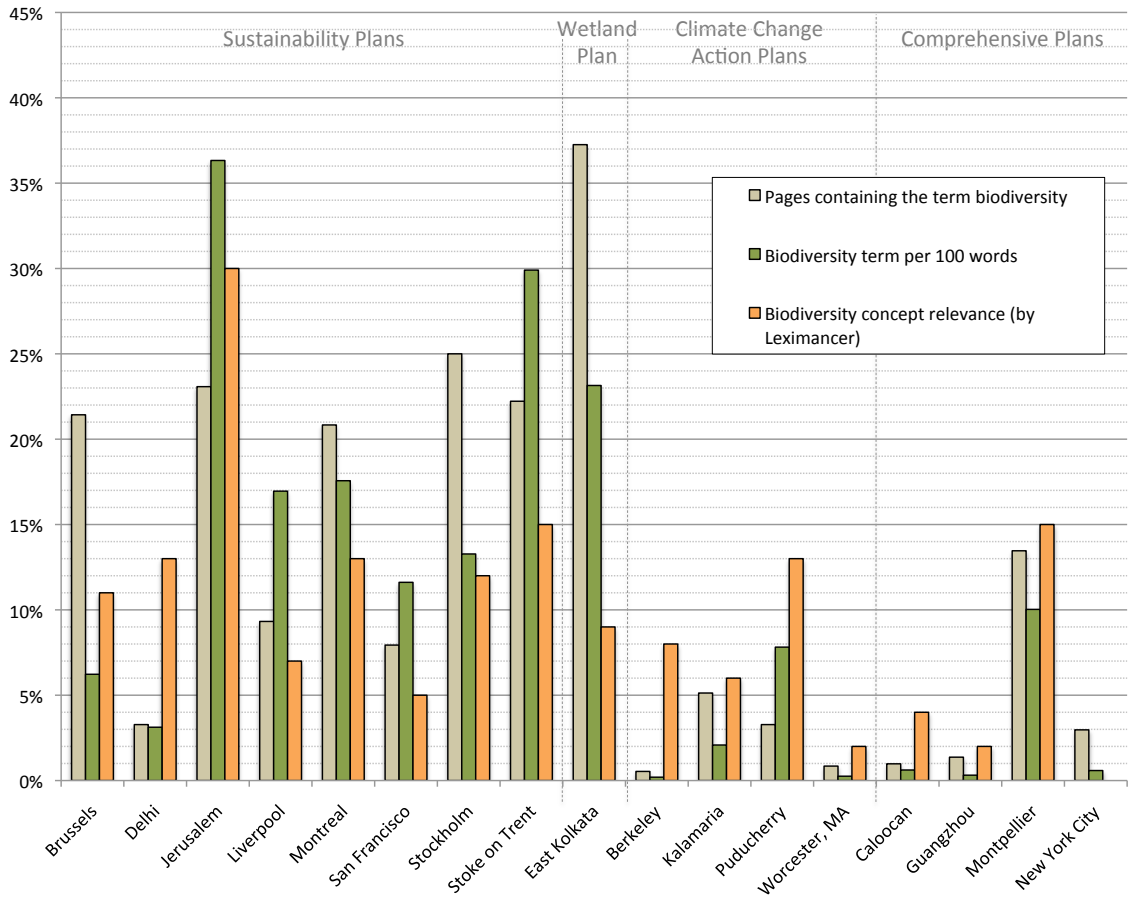


FIGURE 4B: "BIODIVERSITY" FREQUENCY IN NON-BIODIVERSITY PLANS

Another way to look at the strength of biodiversity as a concept is to compare it to other environmental concepts (see Fig. 4c).[118]

[117] The calculations in this table treat each plan equally, and are not weighting them by size.
[118] These data are weighted by text size.

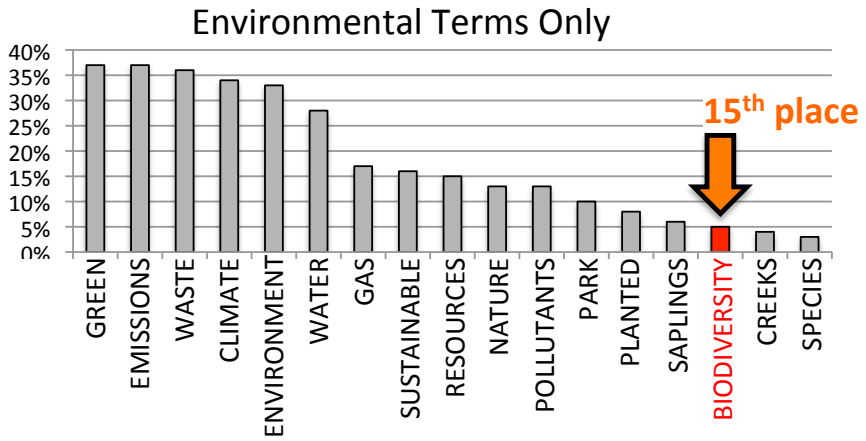


FIGURE 4C: ENVIRONMENTAL CONCEPT RELEVANCE AMONG NON-BIODIVERSITY PLANS.

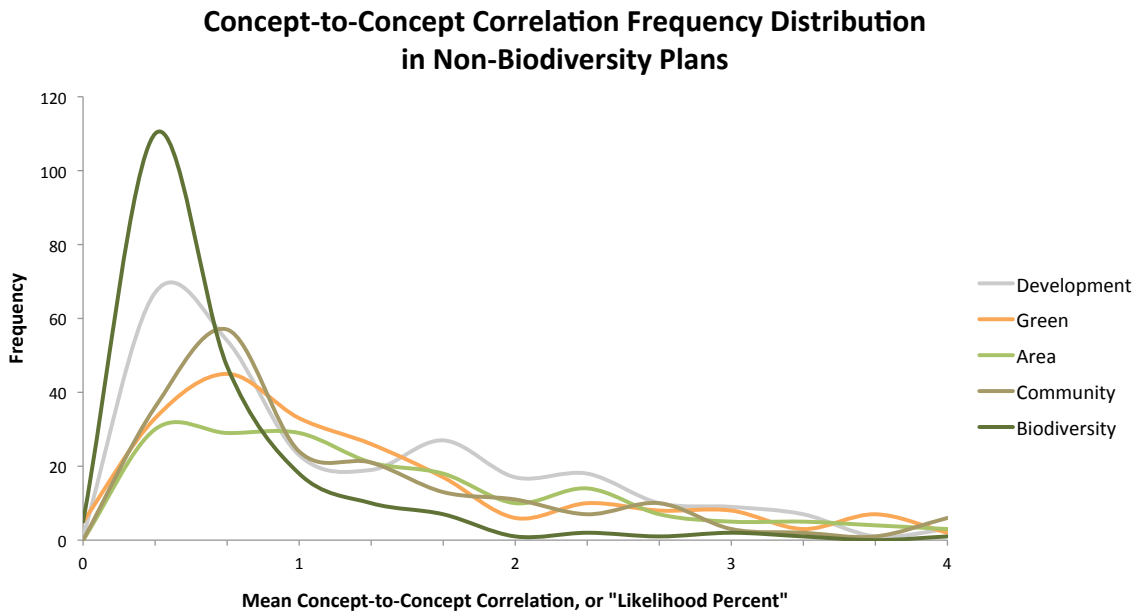


FIGURE 4D: FREQUENCY DISTRIBUTION OF SELECT CONCEPT-TO-CONCEPT CORRELATIONS.

Frequency refers to the number of concepts that co-occur with the sample concept. The "likelihood percent" refers to the percent chance that two concepts will occur together. For example, the chart shows that about 18 concepts have a 1% chance of bi-directional co-occurrence with "biodiversity."

To further understand how biodiversity relates in the text to other concepts, I used the co-occurrence percentage between biodiversity and other concepts (see Fig. 4d). A frequency distribution of these co-occurrence percentages reveals that biodiversity has a weak connection to other concepts, and that it is connected to a higher number of concepts overall when compared with "development," "green," "community," and

"area." I selected these terms for comparison because they include some concrete ideas, such as development, and some abstract ideas, such as green, and they also vary in terms of their relative frequency in the documents, from "green" at 6th place down to "area" at 33rd place. Also, there is one term each in economic, environmental, social, and land conservation/ecology topics. The frequency distribution below shows that "biodiversity" has a frequency diagram with a high peak skewed farthest to the right. The shoulders are the smallest, with the tail at nearly zero. The other terms have small bumps in the tail, indicating concepts that have a strong bidirectional correlation.

Lastly, I took a more specific look at the concepts with the 20 highest average bidirectional correlations from all the plans, and the top 3 highest in each plan side by side (see Fig. 4e). This revealed that the top three terms are "water," "management," and "local," in order. Also, "water" reappears in the top three terms of seven of the plans; "management" in four, and "local" in two.

To understand how non-biodiversity plans refer to biodiversity, I looked at each instance of the term in context and established ten categories of how biodiversity is conceived in the documents. I categorized the use of the term within the ten categories (see Fig. 4f).[119] Refer to the appendix, section X.4 for the text excerpts color-coded by category.

[119] A minority of the references did not have a category, such as when biodiversity appears in a long list of things to be considered. In cases like this, I did not count the reference as being in any category, rather than arbitrarily assign one.

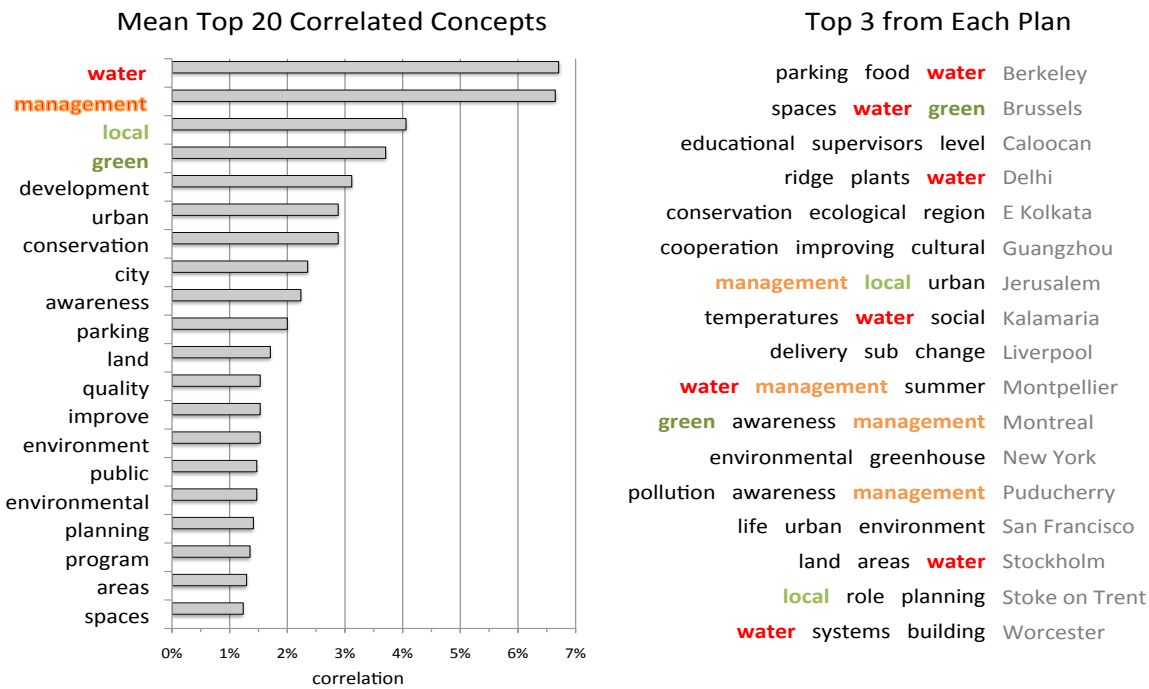


FIGURE 4E: TOP CONCEPTS CORRELATED WITH BIODIVERSITY IN THE NON-BIODIVERSITY PLANS

In Non-Biodiversity Plans, Biodiversity Is…

Location	Justification for Habitat Conservation	Benefit of Green Networks	Determinant of Building Regulation	Impacted by Climate Change	Indicator of Ecosystem Health	Link to Ecosystem Services	Provider of Eco-Education	Creator of Economic Opportunity	Connection to Spirit/ Culture	Key to Quality of Life
Jerusalem	1	1	1			2	1	2	5	5
Stk. on Trent		1			2			1	2	1
S. Francisco	3							1	2	1
Brussels		2	4		1				2	2
Montreal	1	2		1	1		1			
E. Kolkata	3		2				1	1		
Stockholm	4	5	4			4				
Liverpool	2	5	2			1				
Montpellier	2	2								1
New York		3					1			
Kalamaria				1	1					
Guangzhou	2	1								
Puducherry					2					
Worcester				1						
Caloocan			1							
Delhi	1									
Berkeley	1									

Land Use/Ecological

Social, Economic, Cultural

FIGURE 4F: CATEGORIZATION OF OCCURRENCES OF BIODIVERSITY IN NON-BIODIVERSITY PLANS.

Quantities shown are the number of occurrences of the term biodiversity.

Biodiversity Is…

The three most common biodiversity references in the plans relate to green areas and land conservation. These reference categories are: justification for habitat conservation, benefit of green networks, and determinant of building regulations. These categories include everything from references to core natural areas, restoration areas, tree canopy expansion, green roofs, and development limitations. Less common ecologically-oriented references primarily think of biodiversity loss as either a result of climate change or an indicator of ecosystem health. Seven of the 17 plans, or 41%, solely refer to biodiversity in terms of land conservation or ecological ideas. These plans are not only the least integrated, but also have the least total number of references to biodiversity each, ranging from just one reference to three. They include all of the climate change plans, one sustainability plan (Delhi) and one comprehensive plan (Caloocan). They vary widely geographically, in size, and in terms of developed/developing conditions.

Another set of seven plans primarily refer to biodiversity in terms of land conservation and ecological issues, but also include at least one reference in another category. These plans vary in terms of type; one wetland plan, four sustainability plans, and two comprehensive plans, though the sustainability plans are generally more integrated than the comprehensive plans. I call plans in this category "moderately integrated."

The final grouping consists of three sustainability plans that refer to biodiversity primarily in non-ecologically focused ways. I call these "more integrated." Even though they clearly show a more nuanced and systemic understanding of biodiversity, their action items tend towards the same ecologically-driven projects. For example, one of Jerusalem's primary biodiversity action items is Gazelle Valley, a nature reserve in the center city.[120]

[120] Pierce (2014a) explores the biodiversity planning in Jerusalem and the potential for the bioshed concept applied in this city.

TABLE 4C: LIST OF ALL OF THE BIODIVERSITY PLANS

Separated by plans in the UK and outside of it (continues on the following page).[121]

PLANS OUTSIDE THE UK:

Location	*Type*	*Country*	*Area*	*Date*
Aichi Prefecture	LBSAP	Japan	State	Mar-13
Auckland	Indigenous BSP	New Zealand	City	Jul-16
Bonn	LBSAP	Germany	City	2008
Cape Town	LBSAP	South Africa	City	2009
Chiba Prefecture	LBSAP	Japan	State	Mar-12
Chicago, IL	LBAP	United States	City	2011
Curitiba	LBSAP	Brazil	City	2012
Edmonton	LBSAP	Canada	City	2009
eThekwini (Durban)	LBSAP	South Africa	City	2008
Johannesburg	LBSAP	South Africa	City	2009
Joondalup	LBSAP	Australia	City	2009
Melbourne	Conservation Plan	Australia	City	Nov-15
Mexico City	LBSAP	Mexico	City	Jan-17
Nagoya	LBSAP	Japan	City	Mar-14
Paris	LBAP	France	City	2011
Saitama Prefecture	LBSAP	Japan	State	Mar-12
Sao Paulo	LBSAP	Brazil	City	2011
Schaumburg, IL	LBAP	United States	City	May-08
Seoul	Biodiversity Report	Korea	City	2008
Sikkim	BAP	India	State	Aug-16
Singapore	NBSAP	Singapore	City-state	Jul-09
Waitakere (now Auckland)	LBSAP	New Zealand	City	2008
Aichi Prefecture	LBSAP	Japan	State	Mar-13

[121] For more detailed information on each document, see the appendix section X.3

PLANS FROM THE UK:

Location	*Type*	*Country*	*Area*	*Date*
Belfast	LBAP	Ireland	City	2007
Birmingham and Black Country	LBAP	England	Region	Jul-04
Brighton & Hove	LBAP	England	City	Feb-16
Bristol	LBAP	England	City	2008
Cardiff	LBAP	Wales	City	2008
Cork City (in Cork County)	LBAP	Ireland	City	2009
Dublin	LBAP	Ireland	City	2008
Dun Laoghaire-Rathdown	LBAP	Ireland	County	2009
Edinburgh	LBAP	Scotland	City	2010
Exeter	LBAP	England	City	Nov-09
Glasgow	LBAP	Scotland	City	2000
Greater Manchester	LBAP	England	County	2009
Greenwich (in London)	LBAP	England	Sub-city	2009
Kingston upon Hull	LBAP	England	City	2008
Leeds	LBAP	England	City	2000
Leicester	LBSAP	England	City	2011
Lincoln	LBAP	England	City	2006
London Region	LBAP	England	Region	2010
Newcastle and North Tyneside	LBAP	England	Region	2011
North Merseyside	LBAP	England	Sub-county	2008
Norwich	LBAP	England	City	2002
Portsmouth	LBAP	England	City	2012
Sheffield	LBAP	England	City	2002
Southampton	LBAP	England	City	2006
Westminster (in London)	LBAP	England	City	2008
Worcestershire	LBAP	England	City	2008

4.2 Biodiversity Plans

I identified 48 biodiversity plans meeting the density criteria for urban plans. An additional 7 plans were not analyzed due to language barriers. Of the 48 plans, 26 are from locations in the United Kingdom.

TABLE 4D: THE CONCEPT CATEGORIZATION FOR AUCKLAND, AS AN EXAMPLE.

The Relevance % column is the output data from Leximancer. These percentages are then copied over into the appropriate category according to the concept. Note that most concepts are considered to be neutral and don't fall into any particular category. This table reveals that of the non-neutral co-occurring concepts with Biodiversity, 54% of them are land use/ecological in category, none are educational, 5.9% are social, 10.2% are economic, and 29.9% are cultural. I repeated this process for each biodiversity plan.[122] Table continues on the following page.

Concept	*Relevance %*	*Land Cons/ Ecological*	*Educational*	*Social*	*Economic*	*Cultural*
biodiversity	100					
indigenous	50					50
strategy	33					
ecosystems	26	26				
management	25					
council	22					
region	20					
protect	20	20				
objectives	20					
including	18					
achieve	16					
species	16	16				
environmental	16	16				
measure	14					
provide	13					
development	12	12				
community	11			11		
actions	11					
natural	11	11				
resource	10				10	
Concept	*Relevance %*	*Land Cons/ Ecological*	*Educational*	*Social*	*Economic*	*Cultural*
work	10					
services	9				9	
proportion	9					
land	8					
projects	8					
ensure	7					
change	7					
monitoring	7					
range	7					
climate	6					
national	6					
maori	6					6
agencies	5					
AUCKLAND	Total	101	0	11	19	56
	Percent	54.0%	0.0%	5.9%	10.2%	29.9%

[122] The concept categorization charts for all biodiversity plans are in the appendix section X.7

I analyzed each of these plans for the *degree of integration* they exhibit in terms of to what degree they include social, cultural, educational, and economic concepts as well as land conservation and ecological concepts. Then I ranked them according to how integrated they are in order to look for patterns that correlate with greater integration.

Degree of Conceptual Integration of Each Biodiversity Plan

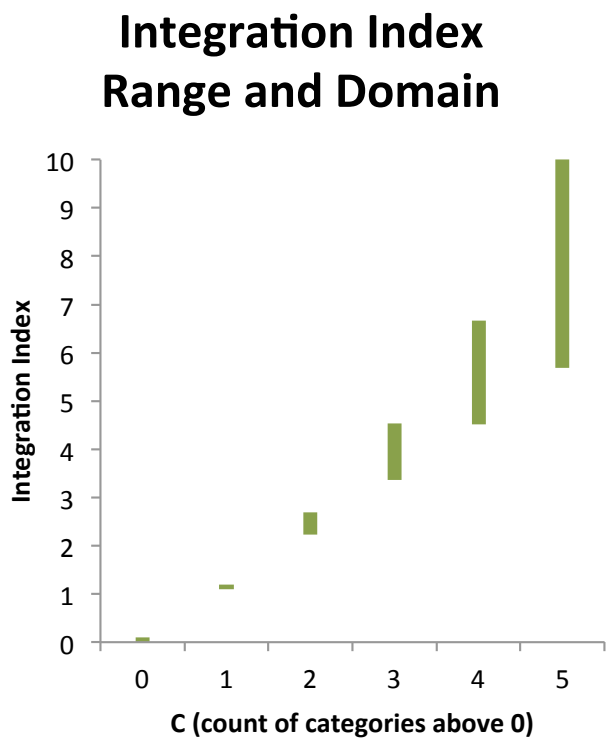
To determine how integrated each plan is conceptually, I exported the concept relevance output from Leximancer for each plan and then categorized the resulting numbers according to various overarching ideas: land conservation/ecology, social, cultural, education, and economics. The table below illustrates the categorization for one sample document. Many concepts, such as "city," do not fit into these categories and were not used. From these categorizations of the relevancy percentages, I calculated an overall percentage for each idea found within each plan.

In order to rank the plans according to their level of integration within each category, I devised an integration index that would provide a higher number (up to 10) as plans approach an even spread among all five categories, and a low number (down to about 1) if only one category is used. The index weights the number of categories included, as well as the evenness of the distribution. The calculation is as follows:

$$\textbf{Integration Index} = C / (SD + 0.5)$$

C is an integer between 0 and 5 that equals the quantity of concept categories above 0% of the categorized content

SD is the standard deviation of each of all 5 categories' percentages (adding 0.5 eliminates the division by 0 problem and generates a manageable range from about 1 to 10 for the index)



C	*Max*	*Min*
0	0	0
1	1.11	1.11
2	2.68	2.23
3	4.53	3.37
4	6.67	4.52
5	10.00	5.68

FIGURE 4G: RANGE AND DOMAIN OF THE INTEGRATION INDEX.

For example, Auckland has 4 categories of co-occurring concepts (all except for education), and the standard deviation of the percentages (54.0%, 0.0%, 5.9%, 10.2%, and 29.9%) equals .20. So, the integration index for Auckland is 4/(.20 + 0.5), which equals 5.7, the highest integration index of all the plans. On the other hand, Schaumburg has a less integrated plan with 91.6% land conservation/ ecological co-occurrence, 8.4% social, and 0.0% for all three other categories. This yields an integration index calculation of 2/(.36 + 0.5), which equals 2.3, a lower value than Auckland, reflective of Schaumburg's lower degree of integration. I repeated this process for each plan to derive a comparable integration index (see Table 4e).

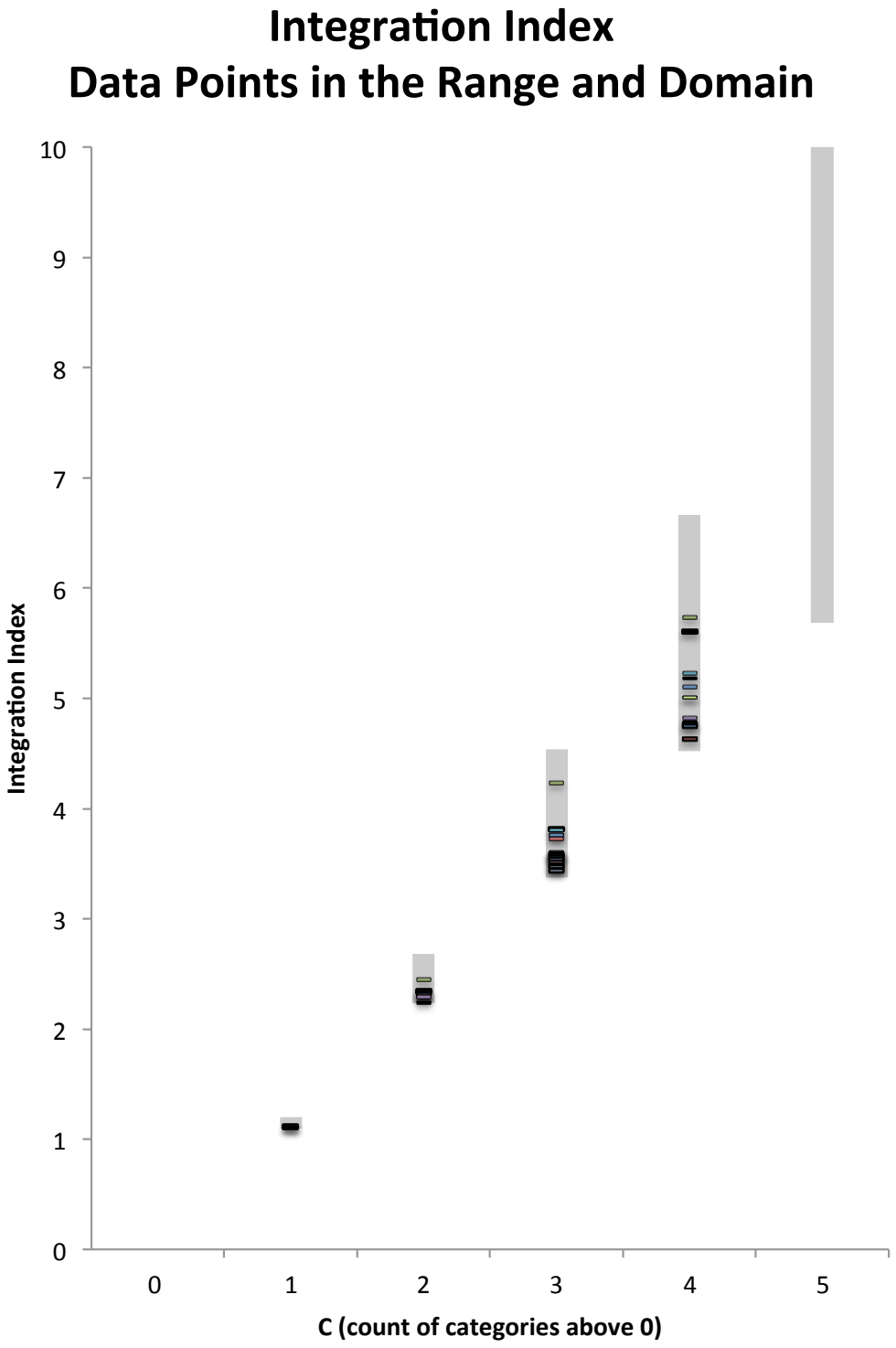


FIGURE 4H: INTEGRATION INDEX DATA POINTS IN THE RANGE AND DOMAIN
Plotting the integration index of each biodiversity plan over the range and domain of the integration index reveals the distribution of the integration index of the plans.

I then graphed each plans' integration index value within the range and domain of the integration index values, revealing that plans tend towards the lower range of possible values (see Fig. 4h). The breakdown of each plan is indicated in table 4e. Further breakdown that shows the categorization counts for each plan can be found in appendix X.7 *Concepts Categorization*.

TABLE 4E: INTEGRATION INDICES CALCULATIONS AND CATEGORIZATION FOR EACH BIODIVERSITY PLAN.

Location	*Land*	*Education*	*Social*	*Economic*	*Cultural*	*SD*	*C*	*Integration Index*
Auckland	54.0%	0.0%	5.9%	10.2%	29.9%	0.20	4	5.73
Chiba	56.8%	0.0%	30.8%	9.4%	3.0%	0.21	4	5.61
Nagoya	72.4%	0.0%	13.0%	6.9%	7.8%	0.27	4	5.23
Glasgow	73.4%	3.5%	0.0%	7.4%	15.7%	0.27	4	5.18
Waitakere	76.3%	0.0%	6.6%	11.4%	5.8%	0.28	4	5.10
Birmingham & Black Country	79.0%	0.0%	12.7%	2.7%	5.6%	0.30	4	5.01
Mexico City	79.0%	2.4%	5.1%	13.5%	0.0%	0.30	4	5.01
London Region	85.5%	0.0%	10.8%	2.2%	1.5%	0.33	4	4.82
Singapore	87.1%	3.2%	6.6%	0.0%	3.2%	0.34	4	4.78
Edinburgh	88.1%	0.0%	4.9%	4.5%	2.6%	0.34	4	4.76
Saitama	88.4%	0.0%	5.8%	2.9%	2.9%	0.34	4	4.75
North Merseyside	92.6%	0.0%	3.0%	2.8%	1.6%	0.36	4	4.63
Paris	54.3%	32.0%	13.7%	0.0%	0.0%	0.21	3	4.24
Sheffield	76.5%	0.0%	12.6%	0.0%	10.8%	0.29	3	3.81
Norwich	76.5%	0.0%	16.1%	0.0%	7.4%	0.29	3	3.80
Joondalup	78.6%	0.0%	7.1%	14.2%	0.0%	0.30	3	3.76
Liecester	78.0%	0.0%	19.8%	2.3%	0.0%	0.30	3	3.75
Curitiba	79.8%	2.7%	17.5%	0.0%	0.0%	0.31	3	3.72
Dublin	86.0%	0.0%	5.9%	0.0%	8.1%	0.33	3	3.61
Chicago	86.6%	0.0%	7.8%	5.6%	0.0%	0.33	3	3.60
Johannesburg	86.6%	8.8%	4.5%	0.0%	0.0%	0.33	3	3.59
Belfast	87.0%	6.5%	6.5%	0.0%	0.0%	0.34	3	3.59
Brighton & Hove	87.2%	0.0%	5.9%	6.8%	0.0%	0.34	3	3.58
Aichi	87.2%	0.0%	8.0%	4.8%	0.0%	0.34	3	3.58
São Paulo	87.3%	0.0%	5.7%	0.0%	7.0%	0.34	3	3.58
Sikkim	88.4%	0.0%	7.9%	3.7%	0.0%	0.34	3	3.56

Location	*Land*	*Education*	*Social*	*Economic*	*Cultural*	*SD*	*C*	*Integration Index*
Southampton	88.6%	4.0%	7.5%	0.0%	0.0%	0.34	3	3.55
Leeds	89.4%	0.0%	0.0%	4.1%	6.5%	0.35	3	3.54
Cork City	89.7%	0.0%	2.4%	0.0%	7.9%	0.35	3	3.53
Westminster	90.6%	0.0%	6.1%	0.0%	3.3%	0.35	3	3.51
Bristol	91.8%	3.7%	4.5%	0.0%	0.0%	0.36	3	3.49
Greenwich	92.2%	0.0%	6.0%	0.0%	1.8%	0.36	3	3.48
Lincoln	92.9%	0.0%	5.0%	2.1%	0.0%	0.37	3	3.47
Bonn	94.0%	0.0%	3.4%	0.0%	2.7%	0.37	3	3.45
Newcastle & North Tyneside	94.6%	0.0%	2.8%	0.0%	2.6%	0.37	3	3.44
Seoul	81.9%	0.0%	18.1%	0.0%	0.0%	0.32	2	2.45
Cape Town	90.7%	0.0%	0.0%	9.3%	0.0%	0.36	2	2.34
Schaumburg	91.6%	0.0%	8.4%	0.0%	0.0%	0.36	2	2.33
Edmonton	91.6%	0.0%	8.4%	0.0%	0.0%	0.36	2	2.33
Kingston Upon Hull	93.5%	0.0%	6.5%	0.0%	0.0%	0.37	2	2.30
eThekwini	93.7%	0.0%	0.0%	6.3%	0.0%	0.37	2	2.30
Dun Laoghaire-Rathdown	94.3%	0.0%	5.7%	0.0%	0.0%	0.37	2	2.29
Worcestershire	94.6%	0.0%	0.0%	5.4%	0.0%	0.37	2	2.29
Cardiff	98.3%	0.0%	0.0%	0.0%	1.7%	0.39	2	2.24
Exeter	100.0%	0.0%	0.0%	0.0%	0.0%	0.40	1	1.11
Greater Manchester	100.0%	0.0%	0.0%	0.0%	0.0%	0.40	1	1.11
Portsmouth	100.0%	0.0%	0.0%	0.0%	0.0%	0.40	1	1.11
Melbourne	100.0%	0.0%	0.0%	0.0%	0.0%	0.40	1	1.11

Then I graphed each plans' concept categorization distribution from most to least integrated according to the index in order to compare cities (see Fig. 4i). This visualization reveals that the categorization of biodiversity within the plans varies considerably, with a general trend of land conservation/ecological as the dominating category.

I also produced scatter plots of the integration index with other aspects of the plans, such as gdp, population, and country (see Fig. 4j). One revealing plot was of the integration index over time, separating UK from non-UK plans. The trend line indicates

increasing integration in plans outside the UK, but a general decline in integration for plans within the UK (see Fig. 4j). We can also see that plans in the UK are on average less integrated than those outside the UK.

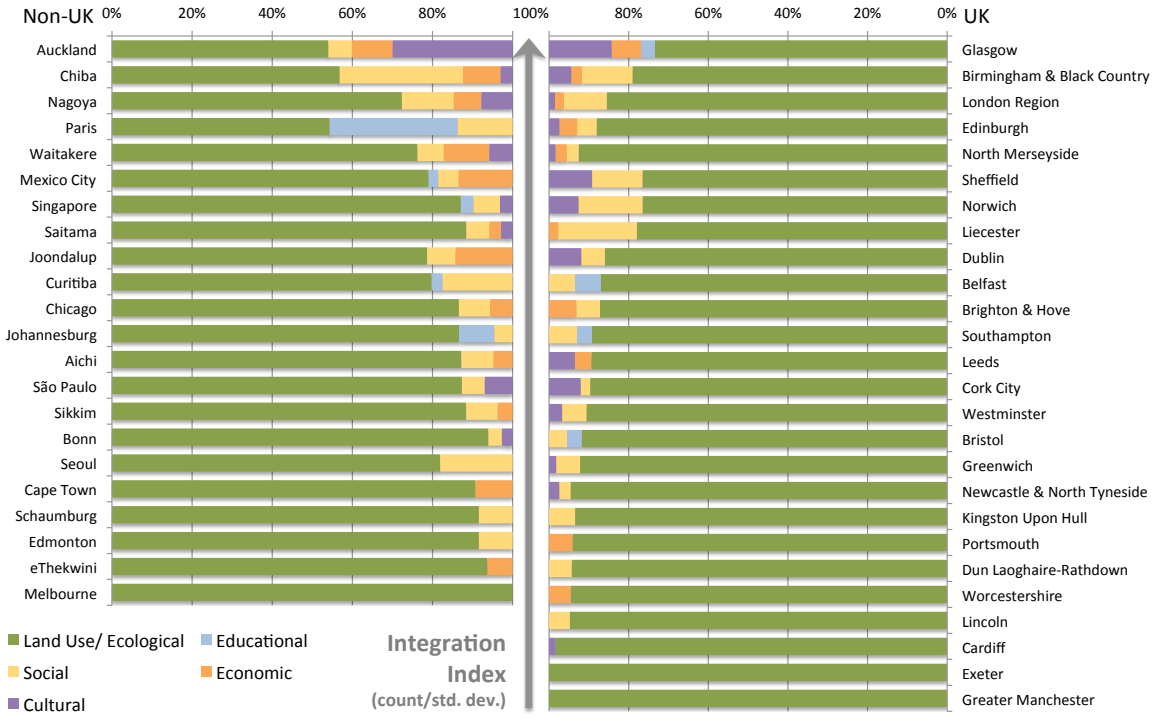


FIGURE 4I: CATEGORIZATION CHART FOR EACH BIODIVERSITY PLAN, SIDE BY SIDE
Categorization chart for each biodiversity plan in order by integration index. Non-UK plans are on the left and UK plans are on the right.

Particular outliers are of interest. Chiba prefecture and Auckland both are highly integrated outliers, while Melbourne is a lower-than-usual outlier. It is significant to note that both Auckland and Melbourne are of slightly different types than the other plans. Auckland is an indigenous-focused plan, and Melbourne is a conservation-focused plan. Also, the Chiba document under analysis is an abbreviated version of the full document, available only in Japanese.

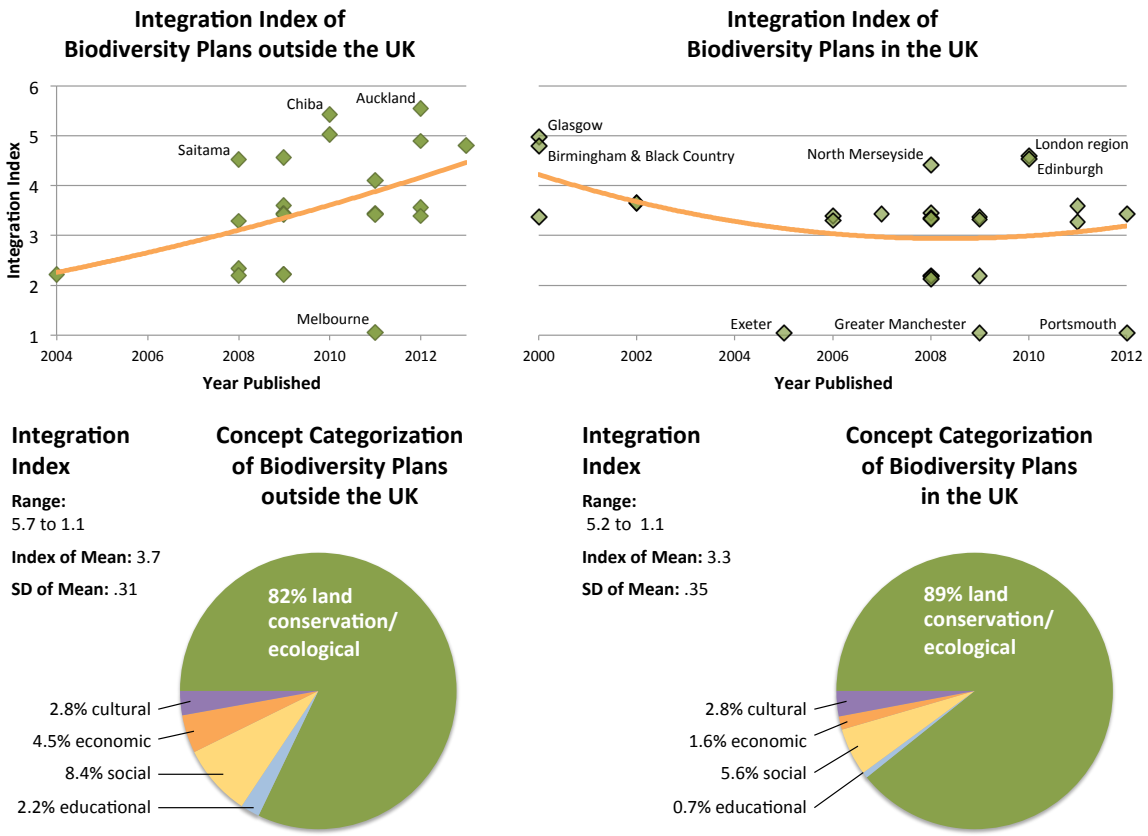


FIGURE 4J: SUMMARY OF INTEGRATION INDEX WITH LINEAR REGRESSION AND CATEGORIZATION DATA BY LOCATION.

Comparing the integration index with a binomial variable indicating participatory practices in the development of the plans revealed an average increase in the integration index of 0.70 for participatory plans over plans that do not indicate participatory processes. I determined whether plans would count as participatory or not by searching the documents for the term "participat" which would account for various endings, such as participatory and participation, and the term "process." Then, I reviewed each occurrence to determine its context. To earn the designation of participatory, the plan must meet three criteria, all determined by reviewing the document itself. First, the participatory processes must occur during the development of the plan, as opposed to participatory options during implementation. Second, the plans must mention that they actually were participatory, not just stating the theoretical importance of community

involvement, such as in the Singapore plan. Third, the participation must occur outside of an input period after a first version of the document has already been created, such as in an environmental impact analysis. To review the actual text excerpts and designation of participatory or non-participatory for each plan, see the appendix section X.8.

This particular result requires additional review because it may be that there is a correlation simply because of the descriptive nature of the writing. It may be that plans with a more descriptive tendency would both describe its biodiversity actions in a more integrated fashion and would describe its participatory actions more in-depth. Therefore, it is possible that this correlation has more to do with the plan document style or quality than an actual link between participation and integration.

TABLE 4F: AVERAGE INTEGRATION INDICES

Average integration indices for various groupings of plans by the properties discussed above.

Grouping	*Mean Integration Index*	*Standard Deviations from Mean*	*Difference (from mean or alternate)*
All Biodiversity Plans (standard deviation is 1.19)	3.49		
Non-Participatory Plans	3.25	.20	
Participatory Plans	3.95	.39	0.70
Not Using Frameworks	3.62	.11	
Using Frameworks	3.90	.35	0.28
Plans from the UK	3.32	.14	
Plans from outside the UK	3.70	.18	0.38
South African (3 plans)	2.32	.98	-1.17
Australian (2 plans)	2.44	.88	-1.05
American (2 plans)	2.96	.44	-0.53
Brazilian (2 plans)	3.65	.14	0.16
Japanese (4 plans)	4.79	1.10	1.30
New Zealand (2 plans)	5.42	1.62	1.93

The average integration index increases by 0.28 for plans that used the planning frameworks discussed in the next section, but this increase is not as marked as that for participation. Marked differences in the integration index also occurred by location, but

only in the case of the UK are there enough plans to make any generalizations (see Table 4f).

4.3 Biodiversity Planning Frameworks

The four frameworks described here are all currently in use by many cities around the world. They all focus especially on the urban condition and on biodiversity. Some offer certification or official programs, but all of them have a step-by-step process or scoring system that they recommend for biodiversity planning.

Each one has its own perspective that has led me to categorize it according to its particular emphasis. ICLEI's Local Action for Biodiversity (LAB) Pioneer Program provides flexibility in terms of the specific actions taken by the cities and focuses more on political commitment to biodiversity. The Cities Biodiversity Index, by the Singapore National Parks Board, focuses on conservation activities and outcomes. The Economics of Ecosystems & Biodiversity (TEEB) for Local and Regional Policy Makers stresses human-centric benefits of ecosystem services and how to assess their value economically. Lastly, the Urban Biosphere Initiative (URBIS), also suggests a more human-centric approach, but this time with a focus on rights and equity. Respectively, they emphasize the political, ecological, economical, and social aspects of urban biodiversity planning.

The world of urban biodiversity applied internationally is a small one. With the exception of the CBI, the frameworks have all been largely developed by the same major NGO players in international biodiversity efforts (the IUCN, the CBD, ICLEI, various UN branches, etc.) The CBI has involvement by many of these groups even though it is mainly led by the parks department of Singapore. All of these systems are commonly discussed at international urban biodiversity conferences and other events, and the cities that are active at these events are the same cities that become involved in the testing and implementation of these systems. The various frameworks generally have a more cooperative than competitive relationship. The LAB Pioneer program and URBIS are

both implemented by ICLEI's Cities Biodiversity Center, an office that also consults for both TEEB and CBI.

If anything, it is surprising how different these frameworks are given how interconnected and cooperative their development has been. This diversity may be reflective of the variety of conceptual thought occurring within this small network of actors in urban biodiversity.

Local Action for Biodiversity (LAB) Pioneer Program

ICLEI - Local Governments for Sustainability created the LAB Pioneer Program[123] in partnership with the major international biodiversity groups, including the International Union for Conservation of Nature (IUCN) and the Secretariat for the Convention on Biological Diversity (CBD). The program itself was developed in partnership with many NGOs and a steering committee that included representatives from local governments around the world.[124]

TABLE 4G: STEPS OF THE LAB PIONEER PROGRAM

Steps	*Description*
1. Create and publish a biodiversity report.	Document the existing biodiversity and current management practices.
2. Sign the Durban Commitment	Local government signs this document, committing to protect and enhance local biodiversity.
3. Compile an LBSAP (Local Biodiversity Strategy and Action Plan)	Outline an overarching strategy and specific actions to fulfill the city's goals for biodiversity. Align with the national biodiversity plan, if any.
4. Commit politically to the LBSAP	The local council must approve the LBSAP.
5. Implement three biodiversity projects	Projects can be new or amended policies, or can be on-the-ground actions.

The Pioneer Program is a five step process for local governments that involves the creation of a biodiversity assessment report, signing the Durban Commitment, producing

[123] More recently, LAB has offered two additional programs on public awareness and on the connections between biodiversity and climate change. This study analyzes only the Pioneer program.
[124] LAB (2007); ICLEI (2010, 2013a, 2013b)

and committing to a biodiversity plan (called an LBSAP), and implementing three projects/policies. Twenty-one founding LAB local governments developed the Durban Commitment, which acknowledges the significance of biodiversity loss on human well-being and the responsibility of local governments to consider the impacts of their actions on biodiversity. It involves a commitment to produce regular reports on local biodiversity status, contribute to global knowledge networks, produce and implement a plan for biodiversity that includes citizen awareness, antipoverty measures, and public participation.[125] Participation in the program requires a fee that then gives participants access to technical support from the ICLEI Cities Biodiversity Center.

LAB Pioneer's focus, therefore, is on building the capacity of the local government and politically committing it to action. In terms of rhetoric, the program emphasizes local biodiversity rather than regional impacts on biodiversity. It recognizes the importance of producing a political climate for action and implementation by requiring involvement of the city council and the mayor through official commitments.

The first 18 LAB Pioneer cities joined in 2007, growing to 24 in the first two years. Today, 17 cities have submitted biodiversity reports, 14 have submitted LBSAPs, and 29 have signed the Durban Commitment. 12 of the biodiversity plans analyzed in this study were submitted to ICLEI as part of the LAB Pioneer program.[126]

Cities Biodiversity Index (CBI)

The National Parks Board of Singapore along with the Secretariat for the Convention on Biological Diversity (CBD) and the Global Partnership on Cities and Biodiversity (GPCB), created the Cities Biodiversity Index (CBI), also known as the Singapore Index. The CBI generates a numeric indicator for a city's biodiversity based on

[125] ICLEI (2008)
[126] The other 2 governments that submitted an LBSAP did not met the urban density threshold I established for inclusion in this study.

particular metrics.[127] The metrics fall into two categories. Part 1 gathers baseline information on the city's current and historical conditions in order to understand the status of local biodiversity within context climatically and regionally. Part 2 provides a value for each section indicated, ultimately generating the city's score. The exact scoring is still being worked out through a beta program.

The sections as described indicate the priorities of the CBI. The focus of this framework is primarily native ecology-centric, calling for removal of "invasive aliens" and limitation of humans within core areas. The only economic reference is to the degree of cost burden that the city has committed on their budget to biodiversity protection. It accounts for some educational and public awareness elements, but otherwise largely gives the impression of a "humans vs. nature" perspective reflective of traditional conservation dialogues.

TABLE 4H: SECTIONS OF THE CBI

Part I: Profile

Section	*Information Requested*
i Location	location and climate
ii Size	size and boundary map
iii Population	population and density of city and region
iv Economic Parameters	GDP, GNP, per capita income, key economic activities, drivers and pressures on biodiversity
v Physical Features	geography, altitude, impermeable area, brownfields info
vi Biodiversity Features	list/map ecosystems, list species of vascular plants, birds, butterflies, and at least 2 more taxonomic categories, provide their abundance data, the ecological history of the city and any restoration initiatives
vii Administration	agencies, departments for biodiversity, reserves and parks with their size and categorization system
viii Links to Websites	city's site, agencies, and relevant environmental sites

[127] Singapore National Parks Board (2013); UNEP and SCBD (2009); (Chan, 2012; Chan, et al., 2010)

CBI Part II: Indicators

Section	*Indicator*	*Information Requested*	*Point Range*[128]
Native Biodiversity	1: Natural Areas	percent of land area with natively inhabited areas only slightly or not impacted by humans	0 to .2
	2: Connectivity Measures	natural areas <100m apart / all natural areas	TBD
	3: Biodiversity in Built-Up Areas	number of native bird species in built-up (not natural) areas	TBD
	4-8: Change in Species	Net change in native species (reintroduced minus extinct) in each taxonomic group	0 to 4
	9: Protected Areas	protected/secured natural areas / total area	TBD
	10: Invasive Species	# of invasive alien species / # of native species	0 to .3
Ecosystem Services	11: Water Regulation	permeable area / total land area	TBD
	12: Climate Regulation	tree canopy cover / total land area	TBD
	13: Recreation/ Education	area of parks with natural areas / 1,000 people	0 to .9
	14: Recreation/ Education	formal education visits of children under 16 to parks with natural areas per year	0 to 4
Governance and Management	15: Budget	spending on biodiversity admin / total city budget	TBD
	16: Projects	Number of biodiversity projects implemented by public and private entities per year	TBD
	17: Biodiversity Plan	Status of LBSAP; number of CBD initiatives	0 to 4
	18: Institutional Capacity	Number of biodiversity-related functions (e.g. museums, gardens)	0 to 4
	19: Institutional Capacity	Number of government agencies cooperating on biodiversity	0 to 4
	20: Participation	Existence of public consultation on biodiversity	0 to 4
	21: Participation	Number of institutions outside government participating	0 to 4
	22: Education	Existence of biodiversity education in school curriculum	0 to 4
	23: Awareness	Number of outreach events held per year	0 to 4

[128] The point ranges given are often converted from the numbers arrived at through the calculations. The final point range is given here in order to convey the prioritization of the various sections.

An intriguing item is the inclusion of a bird species count in built-up areas under indicator 3, acknowledging the potential for development and conservation to occupy the same space. The time horizon is limited, with historical data going back only to 2010, without a suggested future projection.

The developers of this program include technical experts from academia and NGOs, all of whom specialize in science, conservation, and/or public policy, and also city representatives from biodiversity-related departments. These developers gathered in a series of "expert workshops" to work out the details of the system. Nine months after their first workshop in February 2009, the experts released a draft CBI which was tested in 15 cities. A second workshop held In July of 2010 resulted in the development of the User's Manual released two months later and the test cities expanded in number to 20. In November 2011, Singapore hosted the third expert workshop. The User's Manual remains the primary resource for the cities involved in the program today. Over 30 cities have provided data for the development of the system, and over 50 cities are in progress of applying the index to their location. Over 300 cities use some aspect of the CBI for their own purposes. Nine cities in this study are included among them, citing the CBI as a resource in their own plans, or being named in the CBI materials.[129]

The Economics of Ecosystems and Biodiversity (TEEB) for Local and Regional Policy Makers

TEEB, a subsidiary of UNEP, produces guidebooks that combine economics and environmental protection, each with a different focus. TEEB for Local and Regional Policy Makers addresses local governments. Its message is that the values of biodiversity have gone unrecognized and that valuation and assessment can help to bring these values into light in order to aid decision making and ultimately to improve biodiversity

[129] Stockholm mentions using the CBI in its plan. Curitiba, Bonn, Edmonton, Joondalup, London, Montreal, Nagoya, Paris, Singapore, and Waitakere are also participants (Chan, 2012; Chan, et al., 2010)

protection. This framework focuses on the human side of biodiversity. It especially references connections between biodiversity, ecosystem services, and human livelihoods. It talks about systems rather than specific species.

TEEB was developed by a mix of scientists and economists from multinational NGOs and from national governments of Europe (with a strong German influence) and Japan. The guidebook reflects their perspectives by focusing on structured economic prosperity and an optimistic view of the availability and accuracy of information.

TEEB as a whole array of guidebooks began in 2007 with the launch of a global study on the economics of biodiversity. The Phase I interim report came out the following year. In 2010, TEEB released Phase II and the TEEB for Local and Regional Policy Makers guidebook. In 2012, TEEB released a set of case studies called the TEEB for Local and Regional Policy and Management Report. TEEB is now entering what it calls Phase III.

The guidebook is not a certification system, but is more like a toolkit that introduces policy makers to a wide array of systems for assessment and to various ways of thinking about biodiversity planning. It does offer a step-by-step process, with most steps offering several possible methods to choose from.

TABLE 4I: STEPS OF THE TEEB APPROACH

Steps	*Justification/Options*
Step 1: Specify and agree on the policy issue with stake- holders	A stakeholder analysis brings in differing opinions. Management of frameworks is provided for mainstreaming across departments
Step 2: Identify which services are most relevant	Determines which ecosystem services are central to the society/economy
Step 3: Define information needs and select appropriate methods	Results are used for cultural services, awareness, ecosystem monitoring, and payment schemes.
Step 4: Have ecosystem services assessed	Assessment via: socio-ecological, economic, ecological, and/or developmental frameworks.
Step 5: Identify and appraise policy options	Options include participatory debate and cost-benefit analysis using multiple criteria. Appraisal uses a long-term approach.
Step 6: Assess distributional impacts	Options include a poverty assessment and a Sustainable Livelihoods Approach to determine dependence.

The overall feel of the guidebook is one that emphasizes areas of cooperation between stakeholders and government, and an optimistic "you choose" vibe. Its analyses attempt to weigh long-term costs versus short term benefits. It does not use "human vs. natural" competitive rhetoric. There is no reference to a historical pristine state or in fact to any particular historical context, but is rather future oriented. It is looking at "scenarios" and "possibilities."

The guidebook does refer to some inherent values, but these are more like options to be considered than absolutes. For example, there is an optional framework that prefers endemic and native species and ecosystems over non-natives. Analysis options often include special considerations for vulnerable human populations in particular.

Despite having biodiversity in its title, the guidebook refers twice as often to "ecosystem services" (642 times) than to "biodiversity" (315 times).[130] Additionally, 26% of the instances of the term biodiversity[131] are immediately paired with the term "ecosystem services." This pairing of terms could be an attempt to strengthen the association by the reader between biodiversity, a traditionally more "conservation"-minded concept, and ecosystem services, an economic and human-centered concept.[132]

Urban Biosphere Initiative (URBIS)

The Urban Biosphere Initiative,[133] abbreviated as URBIS, is a relatively new network inspired by the idea of applying UNHABITAT's Man and The Biosphere program and the CBD ecosystem approach to cities around the world. The program connects practitioners and researchers in urban biodiversity with each other for inspiration and collaboration.

Discussions of URBIS began in 2003, with its first 7 partner cities established in

---

[130] The Quick Guide version is even more extreme, with 28 instances of "ecosystem services" versus 4 of "biodiversity."
[131] This does not count proper noun instances, such as when it is found as part of a website or a program name.
[132] Statistics determined by the author via word search
[133] Alfsen et al. (2010)

2009. By 2010, the founding members developed and signed the Nagoya Declaration, a call for a social and ecological approach to urban planning. In 2012, ICLEI officially launched the network at the Urban Nature Conference, gathering over 40 signatories in the first week. The signatories include cities, academic institutions, and NGOs.

The network specifically emphasizes a transdisciplinary approach combining social and cultural dimensions of biodiversity plans with science and education. It also mentions the importance of the city's role as a driving force in its marketshed, and the crucial role of local stakeholders and support at larger scales of government.

The next step for URBIS is the formation of a designation that cities can earn to recognize their efforts in biodiversity planning. This designation has not yet been released, but its basic tenets will include an initial assessment of biodiversity conditions, planning activities and challenges, creation and implementation of goals, and an iterative process of self-evaluation.

TABLE 4J: TIERS FOR URBIS DESIGNATION

Tier 1	Inventory of activities, plans and concerns, including a SWOT analysis.
Tier 2	Establish the vision and goals related to socio-ecological urban practices.
Tier 3	Develop Comprehensive Plans and identify partners and technical requirements.
Tier 4	Implement Plans
Tier 5	Evaluate progress. Complete a self-assessment

URBIS offers a new way to think about urban biodiversity from the rights-based perspective. Its focus on the social aspects of biodiversity makes it stand out from the other plans. It discusses equity as a responsibility even in biodiversity planning. While the tier designation is relatively open-ended and, so far, focuses more on the process than the substance, this framework leans more strongly towards social issues than economic issues. As it develops the designation system, it remains to be seen whether the rights-based rhetoric and social equity will hold, or if the details will fall back on more conservative values as we saw in the CBI.

CHAPTER 5: SYNTHESIZED RESULTS AND DISCUSSION

An initial summary of these results was briefly presented in a paper and presentation at the PolcyMIX conference in February 2014.[134]

5.1 Strength of Biodiversity as a Concept

Frequency of "Biodiversity"

The initial results indicated a relatively low frequency of the term "biodiversity" in the non-biodiversity plans, albeit one that varied by plan. Biodiversity also has a low frequency even when compared with other environmental terms alone.

The low frequency of biodiversity in non-biodiversity plans indicates that non-biodiversity plans either have a low level of interest in or a low capacity for discussing biodiversity issues. Comprehensive plans have the lowest level, which is disappointing, but not all that surprising since they are not often prepared with much input from a biodiversity team, especially not cross-sectoral input.

Low levels of the biodiversity term in climate change plans is surprising due to the high degree of discussion of climate change in biodiversity literature. Opportunities to discuss biodiversity in climate change plans include biodiversity both as indicator and as mitigation factor. Biodiversity loss is a result of climate change and therefore can serve as an indicator of climate change impacts. Conversely, increased biodiversity boosts resilience to the negative impacts of climate change. Cities provide opportunities for the study of the effects of climate change on biodiversity and/or species that will adapt well to climate change because they often provide a warmer and more extreme microclimate. Clearly, there are lost opportunities here for integration across environmental issues. This observation held true in interview with an anonymous biodiversity plan preparer in a U.S. city. Facing political pressure for more climate change action, her department lost

[134] Pierce 2014c

interest in her biodiversity plan. She admitted she hadn't thought of strengthening her biodiversity plan by reinforcing the potential synergies between climate change and biodiversity and as a result, the biodiversity plan went unfinished. Her example is indicative of the higher popularity, traction, and understanding of "climate change" versus "biodiversity" and the lost opportunities for biodiversity initiatives that can't communicate synergies between the two.

The low frequency of the term biodiversity is even more dire when considering that these plans are only 17 out of the many plans worldwide on sustainability, climate change, and overall comprehensive plans. The other plans did not contain a single occurrence of the term, as far as I could find. This means that in most cities, if biodiversity shows up in plans at all, it is limited to a specific "biodiversity" plan. But this is only true of the 50 or so cities around the world that have a biodiversity plan. For the others, the term may never appear in planning documents at all.

Consistency of "Biodiversity"

In addition to low frequency, biodiversity also suffers from low consistency of definition and correlated concepts. For non-biodiversity plans, the emphasis of the definition changes plan-to-plan, with a pretty stark difference made evident by sorting the plans according to type. It seems that practitioners are still wrestling with the idea of what biodiversity means in cities and how to communicate it to a wider audience.

The categorization in Fig. 5a can be simplified to divide the plans three ways (see Fig. 5b); plans that have more social/ecological/cultural references, more land conservation/ecological references, or have exclusively land conservation/ecological references.

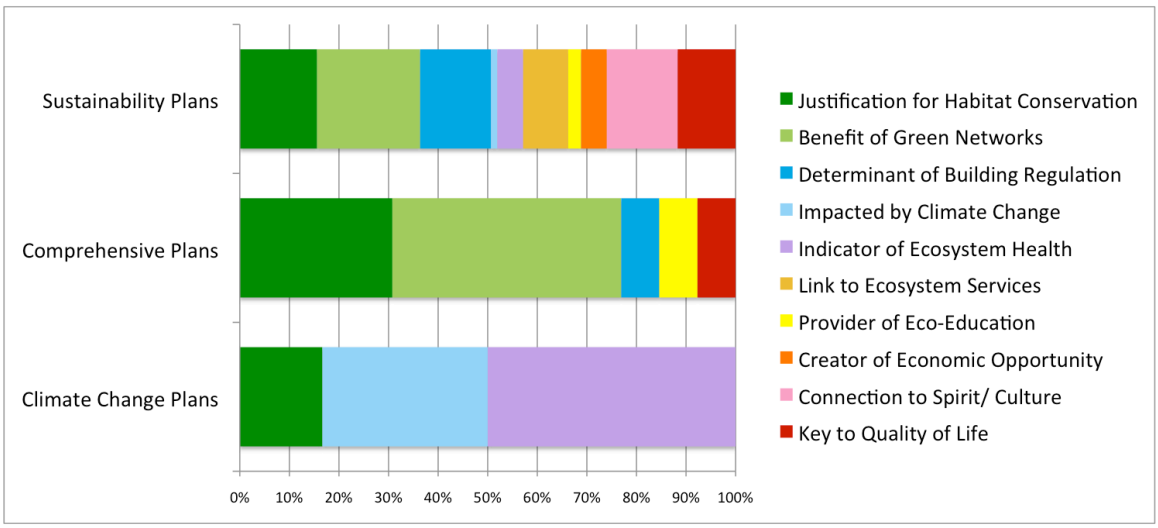
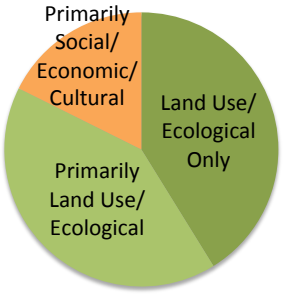


FIGURE 5A: CATEGORIZATION OF BIODIVERSITY REFERENCES BY PLAN TYPE OF NON-BIODIVERSITY PLANS.

Non-Biodiversity Plans, Biodiversity Is…

Location	Land Use/ Ecological	Social/ Economic/ Cultural
Jerusalem	3	15
Stoke on Trent	3	4
San Francisco	3	4
Brussels	7	4
Montreal	5	1
East Kolkata	5	2
Stockholm	13	4
Liverpool	9	1
Montpellier	4	1
New York	3	1
Kalamaria	2	
Guangzhou	3	
Puducherry	2	
Worcester	1	
Caloocan	1	
Delhi	1	
Berkeley	1	
Total	**66**	**37**
Count	**17**	**10**



Biodiversity "is not just about the loss of exotic species and conservation, but rather, about the vital resources which underpin the wealth, the health and wellbeing of us all."
-Green Jerusalem

"Protecting and enhancing biodiversity … will bring clear social, economic and environmental benefits."
- Stoke on Trent City Council
Sustainability and Environmental Policy

FIGURE 5B: SIMPLE CATEGORIZATION OF BIODIVERSITY REFERENCES BY PLAN TYPE OF NON-BIODIVERSITY PLANS

Sustainability plans use a wide array of categories for biodiversity and some come pretty close to an even distribution of categories other than land conservation. The land conservation/ecological category is still over half of the references, at 57%. Something interesting happens between Comprehensive Plans and Climate Change Plans. Other

than the first and most common category, "justice for habitat conservation," they do not share a single other category in common. Climate change plans include "impacted by climate change" - obviously - and "indicator of ecosystem health." But, comprehensive plans talk about biodiversity in terms of green networks, building regulations, eco-education and quality of life. Why is there such an extreme difference between them? With climate change plans having such lower overall occurrences of biodiversity, and being focused on climate change, the categories indicated make a lot of sense. The odd part is that the comprehensive plans, which should be the most broad, skip over those same issues. Perhaps those cities cover those issues in separate climate change plans of their own? It is unclear why this is the case, but this is definitely an area where increased consistency is needed between plan types so that the public isn't being confused by the available plan documents.

The frequency distribution analysis of co-occurring concepts for biodiversity and other similar terms reinforced the idea that plans lack a clear and consistent way to refer to biodiversity, even when compared to such loose terms as "green."

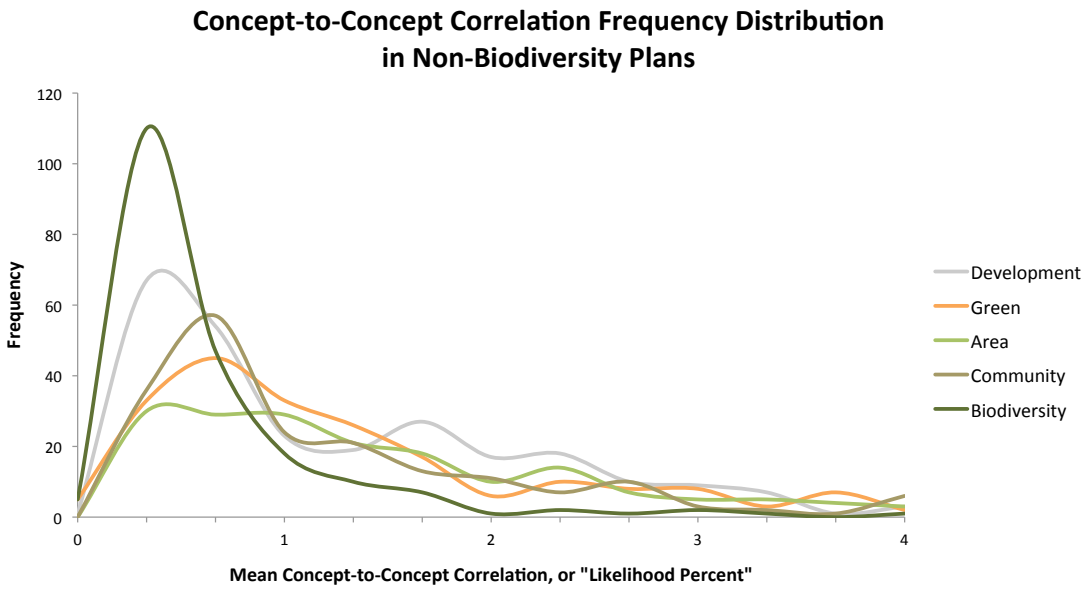


FIGURE 5C: CONCEPT-TO-CONCEPTS FREQUENCY DISTRIBUTION IN NON-BIODIVERSITY PLANS

The TEEB framework shows one way of handling ambiguity for the term. It pairs biodiversity with ecosystem services consistently through the document, like a marketing mantra. The reader will therefore tend to naturally associate the terms with one another after reading them paired up over the document. A similar phenomenon is appearing with the emergence of the acronym "BES," which stands for "Biodiversity and Ecosystem Services." It is most prominently used in IPBES, the biodiversity equivalent of the IPCC. Another new term is "biocultural," which merges culture and biodiversity. Exeter's Biodiversity Plan pairs biodiversity and heritage in this excerpt:

> *Biodiversity is intimately related to underlying geology. An appreciation of local geology and the opportunities that arise to study it, such as quarries and cuttings, is considered to be part of our natural biodiversity heritage.*

The passage doesn't require the word "heritage" at the end, but its inclusion clarifies the meaning of biodiversity. Biodiversity encompasses not only the scientific potential of the rocks as geological objects, but also the historic relationship between humans and the rocks.

Overall, biodiversity can mean many things to many people. The ambiguity of its meaning is reflected in both the text itself and the text analysis. Some plans clarify this ambiguity by pairing biodiversity with other words.

5.2 Integration of Social, Economic, and Cultural Aspects of Biodiversity

Among the non-biodiversity plans, the sustainability plans were the most integrated and had the most frequent references to biodiversity. The small sample size of non-biodiversity plans makes any conclusions difficult to apply to a broader population, especially considering the much larger number of non-biodiversity plans that lack any reference to the term biodiversity.

Among biodiversity plans, participatory plans were more integrated than non-participatory plans. This may be because there is a more diverse group of people working on participatory plans. For example, Chiba allows the public to write its own version of the plan while the experts write a second version at the same time. Both submit their plans to the council to produce the final. This type of document production is a controlled form of democratic centralism, as described by Gramsci. In democratic centralism, pressures that arise from the bottom are merged with "leadership from above" to generate adjustments that keep the system in balance between top and bottom.[135] This result also conflicts with the fears of some planners, such as Bach, a planner in Berkeley, California, in the late 1970s, who claimed that increasing participation would narrow plans to individual interests, each "pushing their own needs."[136]

Drawing conclusions from the impact of participation on integration has its own limitations. It may be that the apparent correlation is not reflective of a link between participation and integration but is instead because when a plan is written with high quality or with a particularly descriptive style, it may tend to include a description of both an integrated understanding of biodiversity and a participatory approach. Also, I am not capturing unofficial or unrecognized attempts to participate or other counter-hegemonic movements that may be influencing the outcome in a participatory manner because I am only looking within the planning documents themselves to find descriptions of participation rather than from other sources. So the participation variable is limited to only recognized elements of participation. I have made some attempt to weed out largely token elements of participation[137] by counting only those documents that cited input by the public early on in the process. Therefore, I am attempting to count examples of active

---

[135] Gramsci (QC1634, p. 188), quoted by Joll (1997). Gramsci contrasts democratic centralism with a less desirable form of centralism which reinforces its own ideas, rigidly resisting and even avoiding pressures from disenfranchised groups.
[136] Clavel (1986)
[137] Token elements of participation would include those lower on the ladder of citizen participation as delineated by Arnstein (1969). Innes and Booher (2004) showed that legally required elements of participation (in the U.S.) do not meet basic goals of participation and can even be counterproductive.

participatory democracy or deliberative democracy. I do not count weaker forms, such as liberal democracy, or other effective forms that are less official and therefore difficult to measure, such as radical democracy.[138]

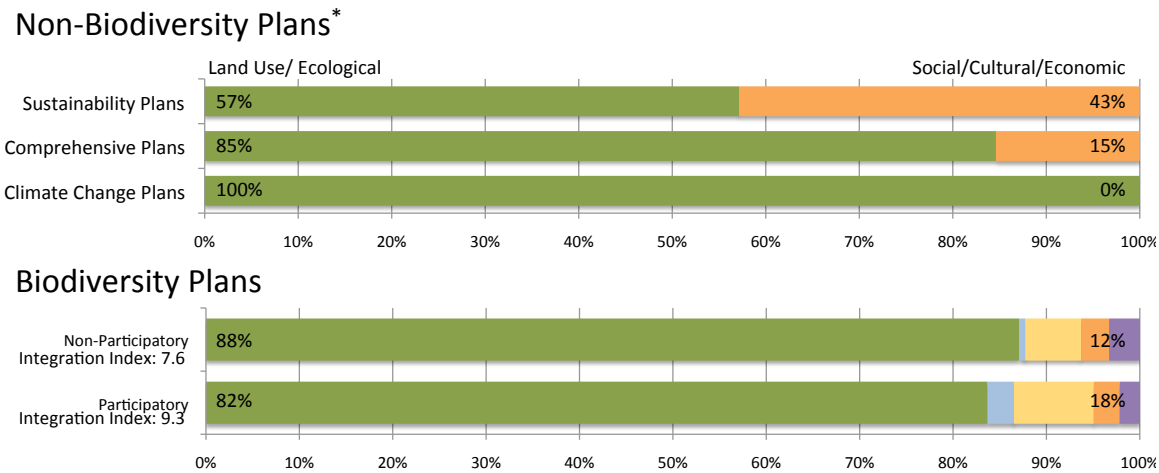


FIGURE 5D: STRONGEST CORRELATIVE PROPERTIES WITH INTEGRATED PLANNING

Some of the biodiversity plans had particularly high integration indices, and each has its own method for communicating biodiversity. Auckland Council's Indigenous Biodiversity Strategy links the term "indigenous" with biodiversity and refers throughout to cultural aspects of biodiversity, particularly related to the indigenous Maori. Nagoya's Plan constantly manipulates scale to illustrate global impacts of local ways of life (see Fig. 5e).

[138] Purcell (2008) describes each of these forms of democracy. Participatory democracy values an active population that participates in governance to the extent that all people are politicians. Deliberative democracy favors the rational discussion that ideally leads to consensus for the common good. Liberal democarcy is the hegemonic view of today in which democracy constitutes voting for represeentatives. Radical democracy argues that difference and conflict are the elements of a democratic society, and that a constant struggle to defeat hegemonies keeps democarcy alive.

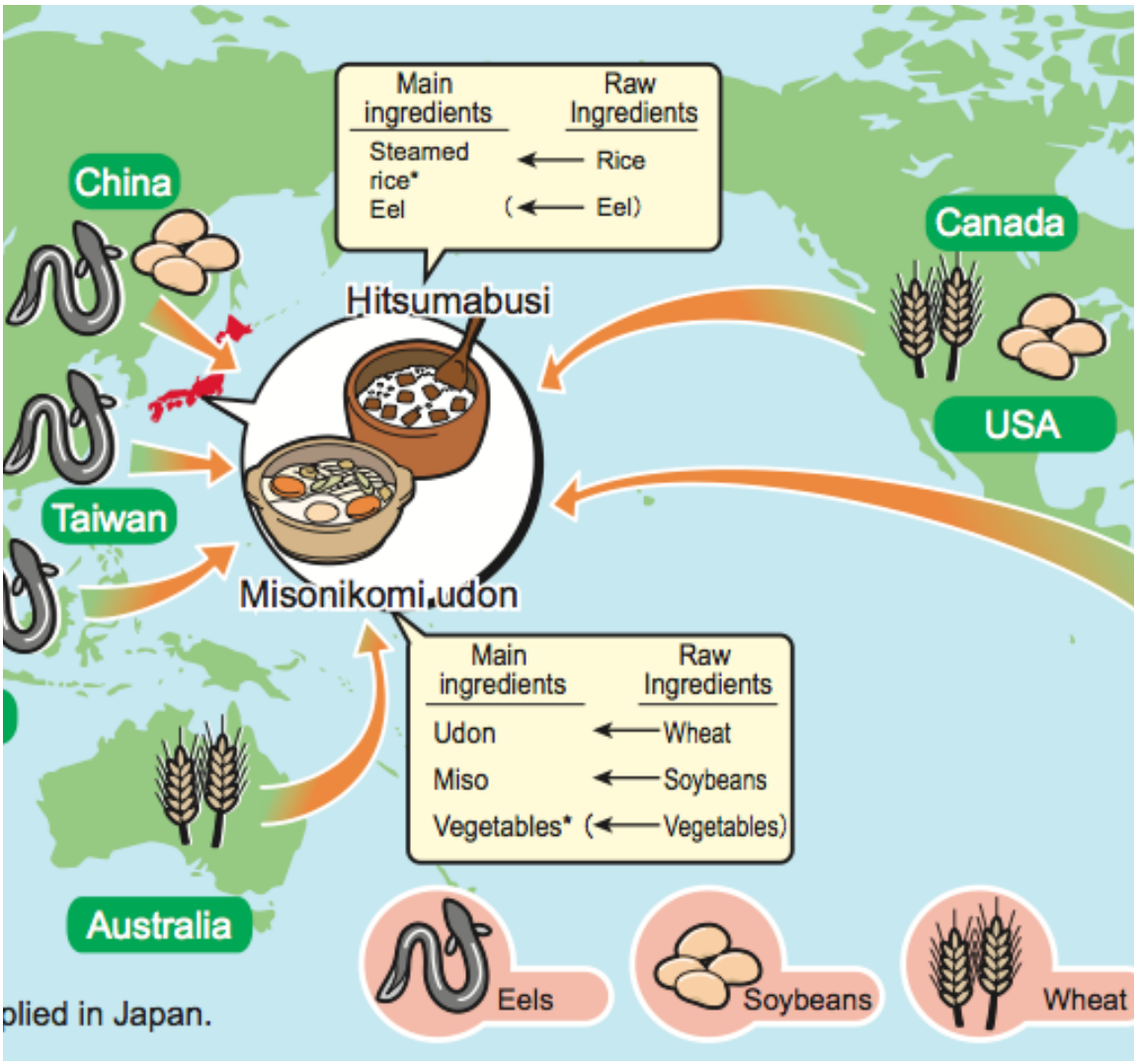


FIGURE 5E: IMAGE EXCERPT FROM THE NAGOYA
Image excerpt from the Nagoya plan showing a connection between global food system and local common foods.

The UK plans in general and Melbourne have lower than usual integration indices. These plans are mandated by national law and must include species plans. This requirement may have quashed the creative ideas of the planners, reducing the potential for an integrated interpretation of biodiversity. Alternately, it may be that when a plan is required rather than self-initiated, planners working on the plan may not be as well suited towards that particular plan type, nor as enthusiastic, thus lowering the quality of the product.

5.3 Frameworks for Urban Biodiversity Planning

The concepts assessment and the manual assessment of the four frameworks both confirmed a rather simple division between the plans in terms of which aspects of biodiversity planning are included in which framework (see Fig. 5f). Each framework has a different primary focus. LAB concentrates on political issues, building support, obtaining commitments, etc. The CBI focuses on ecological issues, and particularly on native biodiversity; it seems the least oriented towards the urban condition. TEEB concentrates on the economic viewpoint and offers many options for users, including some that touch on other issues like vulnerability. URBIS takes the social perspective and discuss rights and equity with its documents, though major parts of their program have not yet launched. In essence, no one framework offers a fully integrated package, but combining aspects of various frameworks could give something close. None of the plans have a large cultural component.

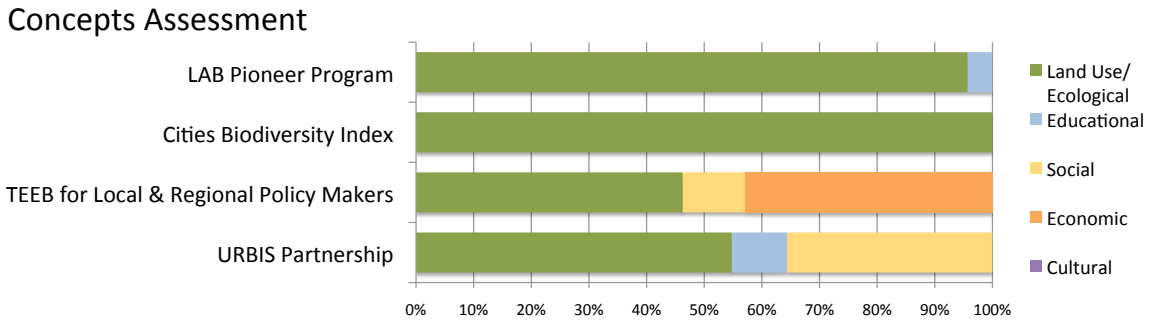


FIGURE 5F: CONCEPTS ASSESSMENT OF FRAMEWORKS

None of the frameworks discuss a participatory approach to their development, so the documents reflect the priorities of their steering group and founding members. A more participatory approach to producing the frameworks could increase the diversity of concepts contributing to the frameworks. This may result in stronger frameworks that are more integrative, and it may also work to combine the best aspects of the existing frameworks into a single document. This could be dangerous, however, since as the

frameworks currently each have their own focus, they offer options for a local government seeking to develop an urban biodiversity plan. By reviewing multiple frameworks, a biodiversity planner could put together a more integrated planning process that leads to a more integrated plan.

Another indicator of the effectiveness of the frameworks is to compare the integration index of plans that used at least one of the four frameworks with those that didn't (see Fig. 5g). The difference between these two groups indicates a slight increase in integration when using a framework. However, this small increase is quite small compared to the increase indicated for plans that discussed participatory planning.

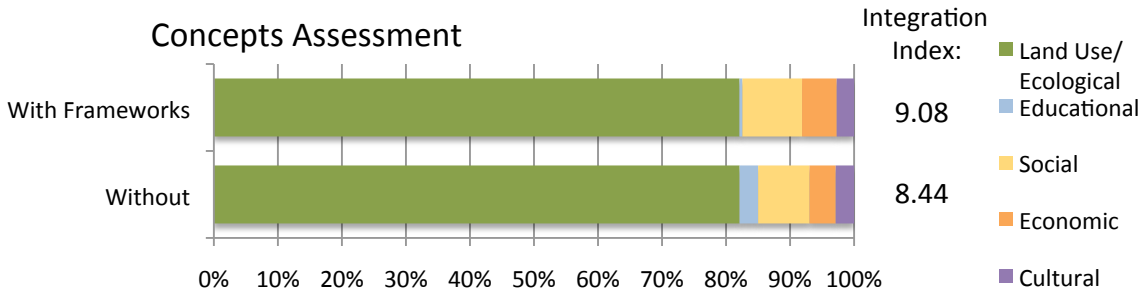


FIGURE 5G: INTEGRATION ASSESSMENT OF PLANS WITH AND WITHOUT FRAMEWORKS

The failure of any of the frameworks to achieve integration across a plethora of factors is reminiscent of the issues Altschuler identified for planners when they were attempting to plan comprehensively. Altschuler (1965) indicated that planners were in a dilemma between overspecialization and overgeneralization. If they were to operate comprehensively, they would have little ability to claim expertise over specialists in various subtopics, such as transportation or economic planning. But, if they stuck to land conservation planning, they would not be able to weave together elements of planning holistically. He suggests an expertise in weaving together various interests, or an expertise in knowing the will of the public. Biodiversity planners face a similar, but not identical dilemma, for how can they know more about community health than a

specialist? They must also develop skills in collaboration, but they can work towards a broader understanding of biodiversity's impacts and values from other perspectives. If they do this, they can build more support for their initiatives, and improve biodiversity conservation as well. But, they may simply not have the expertise on the various topics that would give them sufficient common of the various disciplines in order to speak authoritatively. This is why collaboration and diverse participation becomes crucial, both in developing frameworks for biodiversity planning, and in incorporating biodiversity into urban plans.

CHAPTER 6: CONCLUSION AND IMPLICATIONS

6.1 Conclusion

Urban conditions call for integrated biodiversity planning that accounts for the effect of social, cultural, and economic factors unique to urban biodiversity. Defining biodiversity in a way that synergizes these ubiquitous and powerful factors, while communicating the power of an integrated plan to improve human wellbeing is crucial to attracting broader support for biodiversity preservation. Expanding the conversation around urban biodiversity to include the complete bioshed has the potential to sidestep the traditional conservationist's fight over land use that constricts human activities and conflicts with human-centric interests.

Investigating biodiversity plans as well as other types of plans that discuss biodiversity has shown that most planners discuss biodiversity in a narrow manner: only as it relates directly to local land use. They generally do not discuss biodiversity in terms of social or economic factors. Therefore, there exists a great potential to expand the discussion to include a wider array of factors. This wider discussion could use the term bioshed as a tool for expressing the idea that many aspects of society (culture, politics, economics, etc.) are drivers of biodiversity, and are impacted by the status of biodiversity, as expressed in fig. 2a at the beginning of this document.

The four widely used frameworks for biodiversity planning reviewed here also do not provide a holistic picture that incorporates all of these factors. These frameworks must be combined to support a more integrated planning process, and even a combined approach would hardly address cultural and educational factors. A participatory process that empowers local community members to be involved in authoring the plan may help in generating a more integrated concept of biodiversity. Using a participatory process has been shown to be the primary factor associated with an integrated urban biodiversity plan. Increased participation also presents great potential to generate place-based

innovative ideas for the biodiverse cities of the future and has other benefits, such as contributing to furthering democracy and increasing equity.[139]

6.2 A Vision for Planning and Framework Development

A city is not a forest. Nor is it a wasteland. Ecosystems in many cities today have become hotter, less permeable, and rife with interrupted nutrient cycles. Many people accept the hegemonic condition of cities as places that are this way "by nature." Some urbanites prefer being in the center of the action and are willing to accept these trade-offs. But what if cities could be transformed into a new type of ecosystem, one in which cyclical systems for water, wastes, and other nutrients are integrated into a bustling social and cultural human-centric urban fabric? Can we create a world in which urban dwellers have an inherent understanding of their role within their ecosystems because it is functioning all around them? A world with an inherent understanding of the bioshed?

I believe that when urbanites can recognize species endemic to their city, when indigenous foods are celebrated alongside a plethora of options from local diasporas, and when tree canopies and vegetated surfaces form a continuous carpet over rich and poor neighborhoods, then our cities will reach new possibilities for biodiversity awareness and protection. And, when cities, broadly defined as the institutions and actors in an urban location, apply this integrated thinking to their regional and global marketsheds; their demand for sustainable and just resource harvesting will reform our countryside; their reduced need for energy intensive resources will ease burdens on habitat loss; and their sensitivity to the value of nonrenewable resources will shape a new economy. I see the possibilities of this future in an integrated understanding of biodiversity planning. The central axis to make this vision our future is in the world's major cities.

[139] Purcell (2008)

This may sound like a fantasy, but I have seen these ideas at play in some of the great cities of our world today. I have seen Capetonians purchase armloads of the huge protea blooms that are the specialty of their local ecosystem; I have seen huge wooden crates full of the popular pinhões, a common appetizer of Araucaria tree nuts endemic to the area, in the grocery stores in Curitiba; I have seen high schoolers in New York form scientific diving teams to secure spat they grew in labs with the goal of restoring oysters to New York's once teeming harbors. These biodiversity-celebrating activities integrate social, cultural, and economic strength with environmental protection and enjoyment.

Implications for Planners

As planners, we have a responsibility to spread visions of awesome possibilities with the people in our local communities and to help them generate their own network of biodiverse neighborhoods that support well-being. Achieving this will require campaigns for systemic awareness of biodiversity and what it means to integrate it into social, cultural and economic elements of the city. These campaigns should be tailored to place, relate to the concerns of the people, address multisectoral concerns, and provide inspiration and a cooperative spirit.

The integrated plans for biodiversity that I envision celebrate immigrating cultures, the education of children about natural processes, endemic species, food systems, job creation, local heritage, and the whole health of humans; spiritual, mental and physical.

Developing these kinds of plans needs input from diverse perspectives. Added to the teams of ecologists and planners, there should also be indigenous peoples, representatives of vulnerable populations such as the poor and elderly, economists, business and landowners, spiritual leaders, youth, communications experts, and artists. The diversity of the team strengthens the plan's ability to reach out to a diverse audience and to sustain political support. For example, developers and landowners are a resource

for planners, ecologists, and designers to create solutions lie that make economic and ecological sense. Every one of these groups should have ownership in the plan itself, not just in the implementation phase, so early involvement and power sharing is crucial.

The use of frameworks for biodiversity planning should be done cautiously to prevent the framework itself from limiting solution possibilities by the way that it frames terms and methods. Framework selection and application should not occur until after brainstorming phases with diverse stakeholders have already generated a plethora of potential actions. Afterwards, a framework (or two, or three) can be selected to achieve a specific goal such as gaining access to technical assistance or international acclaim. A review of several frameworks and the possible combination of systems may be helpful to meet diverse goals set by the group.

The terminology used to communicate biodiversity can open or close the audiences' mind to ideas being presented. Define biodiversity carefully, using a systemic definition that already draws people to think more holistically. This definition can be an initial activity of the stakeholder group. Then draw this definition out into the rest of the document. Regularly link the term "biodiversity" with other terms, such as "ecosystem services," "biocultural," "heritage," "livelihood," "tradition," "resource," "inheritance," "creation," "character," "rights," "well-being," and "health." Use pictures and other media to make this connection come alive and to personalize it to your city. Be sure that your action items reflect this systemic viewpoint and don't fall into the trap of focusing on land use wars.

In the plan document and in the process of plan creation, change scales frequently, from global down to the individual. This will help participants and audiences to internalize connections between global markets, everyday choices, and public policies in their area.

Planning education systems should focus more on building the skills needed to generate an integrated biodiversity planning process and planning documents.

Environmental issues should be taught systemically, including the input from diverse disciplines, and especially detractors. Planners need to understand the concerns of a wide array of people.

Implications for Planning Directors

Defining the reach of particular planning documents in cities too narrowly can generate a stumbling block for integrated planning. For instance, a "Biodiversity and Land Conservation Plan" can be self-limiting right in the title compared to a "Biodiversity and Whole Health Plan" or a "Cultural and Biological Heritage Preservation Plan." While a "Sustainability Plan" might be too generic, trying to fit biodiversity into a "Climate Change Plan" seems to quash much of the biodiversity conversation and related potential. Also, the example of the United Kingdom illustrates that the requirements of producing species plans and habitat plans focus biodiversity plans into only one aspect of analysis and inhibit integrative thinking.

In other words, the degree of exactness that the city provides in defining what a biodiversity plan should look like, and even whether it is its own document or a part of a larger plan is important. The exact scale will vary by city size, but be sure to retain flexibility of content, while stipulating a transparent and inclusive process. When in doubt, go broader and bring in stakeholders to keep it place-specific rather than requiring the division of the plan into something arbitrary, such as by species.

Connecting with a network of cities for borrowing ideas and inspiration is a great way to keep the process moving and to find ideas. Just be sure not to get stuck in constant "pilot" phases. The time to scale up is upon us, and learning from the many pilot projects done around the world can aid in development of more widespread programs in a cost effective and less risky manner.

6.3 Suggestions for Future Research

This study has provided a first pass at urban biodiversity plans around the world and some of the more popular contemporary urban planning frameworks. It has revealed several interesting phenomenon that could use additional review, and also sets the stage for more in-depth study.

Further Study

The concept of the bioshed could use some testing in the field. A test application of the term could be investigated via biodiversity planners in order to gage its usefulness as a communication tool with politicians, the public, fellow planners, and the scientific community.

To more fully answer the questions raised in this study, interviews and focus groups with biodiversity planners could be developed that would answer more completely questions raised in this overarching investigation. Topics could include degrees of public participation, definitions of biodiversity, the diversity of the framework steering committee, and more. At the case study level, a more intense investigation could reveal these topics in greater nuance within their context.

A second step that would further define issues inherent in urban biodiversity plans would be a comparison with the non-urban (less than 3,000 people per square mile) plans.

As time goes by, some measure of implementation success of the plans studied here would provide important quantifiable information to support (or disprove) the significance of integration in planning effectiveness.

The biodiversity frameworks under investigation could be expanded to include a wider group, and also to include various National Biodiversity Strategy and Action Plans (NBSAPs) and other national level policies to see how they impact LBSAP formation. The UK, India, and Japan would be especially good locations to study this dynamic, since there is a high degree of interplay between scales of biodiversity planning there.

Related Questions

One question not answered here, but that has risen to the surface, is whether the term biodiversity is worth keeping on the agenda. Could "ecosystem services" serve as a more effective surrogate? Or some combination of "ecosystem services" and bioculture? Is "biodiversity" too scientific for use outside of academia? Or does the term "biodiversity" engender a systemic understanding that another term cannot replace?

The emergence of the concept "water" as having the strongest bidirectional correlation with "biodiversity" is worth looking into. Could planning for water security be a way to bring people into the conversation of biodiversity protection?

Overall, this study has established an initial database of urban biodiversity plans. But, it does not go in depth within any particular location, climate, or culture. Future investigations will hopefully build on this knowledge to provide a clearer picture of biodiversity planning and its barriers so that we can slow and even reverse trends of biodiversity loss and achieve a vision of biodiverse cities.

APPENDIX X.0:

MEASURING BIODIVERSITY LOSS

The rate of net biodiversity loss is the sum of two dynamic processes; rate of loss and rate of gain. Typically, biodiversity rates provided at a planetary scale refer to loss or gain of species.[1] Speciation and extinction are the species--level equivalents of birth and death of an organism, acting at the geological time scale. The extinction of a species is as inevitable as the death of an individual. But, also like the various life forms, species have life spans that vary widely.[2] Like the birth and death rates that together constitute population growth rate, speciation and extinction rates together constitute the most common reference to net biodiversity gain or loss.

While biodiversity theoretically refers to all forms of life, from charismatic whales down to the microbial, it is typically measured using more tangible groups, such as avian species, invertebrates, plant life, or general habitat variety. Even so, determining whether a species has actually gone extinct is extremely difficult because it requires proving the negative. Doing so at the global scale is so difficult that it rarely occurs.[3] Therefore, extinction rates refer to predictions of overall rates rather than aggregations of the status of individual species. Measurements of extinction rates depend on theories of island biogeography, which equate habitat loss to the species--area relationship and other factors such as the distance from the island to the mainland. Essentially, the less interconnected habitat area that is available, the lower the number of species that the land can support. These models then find application on the mainland. As suitable

---

[1] Pierce (2014a) provides a systems--level look at biodiversity loss

[2] Geologic time scale is measured in millions of years ago (MYA). Lawton and May (1995) synthesized various estimates of average species life spans. Invertebrates average 11 million years, marine animals 4--5 million years, and mammals 1 million years. Humans (homo sapiens) evolved no earlier than 0.5 MYA (Leakey, 1994).

[3] Only 1,200 species have been declared officially extinct in the last 400 years. Local extinctions are easier to determine (Stork 2010).

habitat space becomes more and more isolated due to land use change, the remaining habitats are like islands in a sea of uninhabitable space. To determine global extinction rates, scientists extrapolate measured quantities of particular taxa across habitats and taxonomic groups.

Extinction rates historically vary. The so-called "normal" extinction rate[4] is punctuated by periods of mass extinction. Scientists believe that today, the rate is at least 100 times the historic rate, and that it will increase another ten- to one-hundredfold this century.[5] This higher-than-normal rate contributes to the theory that we are currently facing the sixth mass extinction event.[6]

But, what about speciation rates? Whether or not the rate of speciation also varies or is relatively constant is currently a subject of debate.[7] Many biologists contend that global simplification and shrinkage of habitats contribute to a speciation crisis.[8] The consequences of a low rate of speciation by itself are unclear. Despite uncertainty, there is little dispute over the net decrease in biodiversity as a result of combined speciation and extinction rates.

---

[4] The normal extinction rate is also known as the background extinction rate and its numerical value is debated. There are several different methods to calculate global extinction rate, each with their own results, and each speculative (Stork 2010). For example, the background extinction rate for mammals is estimated to have been 0.2--0.5 extinctions per million species per year (Mace, 2005).

[5] Miller and Spoolman (2012, p. 96)

[6] Stork (2010); Lenzen, et. al. (2012)

[7] Speciation that occurs in bursts is called punctuated equilibrium, whereas the more constant version is called phyletic gradualism (Eldredge and Gould, 1972).

[8] Miller and Spoolman (2012, p. 96)

APPENDIX X.1:

INITIAL WORKSHOP FEEDBACK FORM

Name 1: _____ Name 2: _____

Interactive Sharing Worksheet
Please indicate whether you or your organizations have used these techniques by circling yes/no/NA (not applicable) under number 1 or 2. If yes, explain how.
If no, explain the barriers to implementing this tip.

Tip 1. Empower a separate integrated body composed of diverse members
1: yes/no/NA 2: yes/no/NA

Tip 2. Implement a policy that mandates cross-review at specific project stages
1: yes/no/NA 2: yes/no/NA

Tip 3. Strengthen high-level support & departmental/organizational reputation
1: yes/no/NA 2: yes/no/NA

Tip 4. Diversify perspectives within your department/organization
1: yes/no/NA 2: yes/no/NA

Tip 5. Build relationships with other departments/groups outside of BES.
1: yes/no/NA 2: yes/no/NA

List any additional tips or barriers to implementation you would like to add here.
1: 2:

How could this toolkit be more helpful for you?
1: 2:

APPENDIX X.2:

INITIAL WORKSHOP FEEDBACK

Group	*Location*	*1*	*Explanation*
1	Brasil	Y	e.g. project ORLA - Coastal Management prgram w/different government and non-gov stakeholders. National Biodiversity
1	Sol Plaatje, S Africa	Y	1. Mayoral Cleaning Project. 2. Greening Project. Stakeholders, communities, CBO's, NGO's
2	Sol Plaatje, S Africa	Y	youth, people with disabilities, departments
2	Sol Plaatje, S Africa		
3	São Paulo	Y	To produce good architectural projects of parks, to produce the municipal policy and practice of compensation
4	Cape Town	Y	
4	Cape Town	Y	
5	Rio de Janeiro	N	Conflict of interest among stakeholders
5	Manaus	Y	implementation of a multi-institutional wing cabinet
6	City of Morón, Argentina		
6	Sete Lagoas		
7	Sol Plaatje, S Africa	Y	

Group	*Location*	*1*	*Explanation*
8	Dunedin, New Zealand	Y	we have many subcommittees, working parties, etc. that include council staff and external stakeholders that are delegated to achieve certain outcomes, e.g. Community Resilience Forum.
9		Y	
9	São Paulo	Y	
10	Tokyo	N	
11	Belo Horizonte	Y	Creating councils to deal with specific issues concerning city panning, environment, etc.
11	Belo Horizonte	Y	
12	Belo Horizonte		BH departments work together
12			LEIF - (see worksheet) Lebeu oberven in Freitousy
13	Kajang, Mauritius	Y	Integrated body of residents with diverse individuel expertise and different racial groups
13	Ithaca, NY, USA		
14	Belo Horizonte	Y	
14	Belo Horizonte	Y	Busca de recursos económicos para dar suporte a conservação do biodiversidade
15	Linköping, Sweden	N A	
16	Belo Horizonte		
16	City of Sorocaba		

Group	*Location*	*1*	*Explanation*
17	Jerusalem	Y	
17	Jerusalem	Y	
18	Brussels	Y	BAP: Participative ≠ narehdden (monepan, NGO, local edu.)
18	NYC	Y	group > plan
19	Belo Horizonte	Y	See our project in the pantanal of Brazil www.jaguarreserve.com
19		Y	on CBI to lisbon
20	Belo Horizonte		
20			
21		Y	integrated bodies at a project level
22		Y	dialogue mapping and stakeholder netwrok analysis
22	Belo Horizonte	Y	NEPES, UGEM (Unidade de gestão Energética Municipal)
23	Johannesburg, South Africa	Y	Sustainable Services Cluster
23	Johannesburg, South Africa	Y	

Group	*2*	*Explanation*	*3*	*Explanation*
1	Y	Some Brazilian policies have a predetermined review timeframe	Y	hosting Rio+20
1	Y	Our IDP (Integrated Development Plan) is for a period of 5 years and is reviewed annually in conjunction with our budget	Y	hosted several major events
2	N	-	Y	by working together on programs, e.g. dept of environment and conservation on greening the city
2		women, NGO's, businesses		
3	Y	the climate change policy	Y	to the production of our Plan of Biodiversity
4	Y		Y	
4	Y		Y	
5	N A		N A	
5				
6				
6				
7	Y	1. We have an approved Sol Plaatje Energy and Climate Change strategy that was developed in 2009 by Council and currently in the process to mainstream the strategy. 2. Has a State of Energy report developed in 2005, in the process to update it.	Y	We have a dedicated Sustainable Energy and Climate Change unit that consists of a SECCU Coordinator and energy officer, which is championed by the executive mayor of Sol Plaatje municipality. Kimberly; South Africa, Institutionalizing Energy and Climate Analysis in other Sections.

Group	*2*	*Explanation*	*3*	*Explanation*
8	not yet	not sure- not yet. Although have requiredthat climate change impact assessmentis done for all major infrastructure projects	Y	we are always looking to strengthen buy-in from a range of high level stakeholders, e.g. including Energy Strategy in our Economic Devleopment Strategy (though not biodiversity related, sorry)
9	Y		Y	
9	Y		Y	
10	N		N	
11	Y	Concerning the evaluation of the expenditure of annual revenue and directing policies and actions to communities through participative decision making	Y	Through establishing partnerships with local and international institutions to empower departmental action
11			Y	
12				
12				
13	N		Y	Involve political representatives and city councillors
13				
14	Y	Elaboração de projetos de obras (empreendimentos) e seu licenciamento ambiental	Y	
14	Y		Y	
15	NA		NA	
16				
16				

Group	2	Explanation	3	Explanation
17	Y		Y	
17	Y		NA	
18			Y	Minister of Environment (<-> pov.)
18			Y	mayor
19	NA		NA	
19	Y	Implementation an monitoring project at national level (Portugal)	N	
20			Y	The ministry of environment, faming among others have formed a task force in 2004 to tackle deforestation. It was headed by the president, but it lost force as high-level staff were not attending the meetings
20				
21	Y	this is in accordance with environmental legislation	Y	
22	N	still planning to do so - but need more links to develop (action?) stakeholders	Y	lobbying activities and appointments to present joint results
22	-	UGEM	Y	SUDECAP (Superintendência de Desenvolvimento da Capital)
23	Y	IDP (Integrated Development Plan), Cluster Plan and SDBIP (Service Delivery Budget Implementation Plan)	Y	Mayoral Committee Approval, __ with launch (Public Ordinance)
23	Y		Y	

Group	*4*	*Explanation*	*5*	*Explanation*
1	Y	e.g. we're trying to mix cities and biodiversity in the Brazilian	Y	e.g. we're trying to mix cities and biodiversity in the Brazilian
1	Y	We are still at early stages of implementation but among others have also finished phase 1 of solar geyser installation to previously disadvantaged	Y	we have different forums from local, provincial to national
2	N	because this is still internal, we have not taken it out of the municipality	Y	we are having a good relationship with Dept of Environment and Conservation, Dept of Agriculture, Keep Kimberley, and NGO's Youth Formation
2				
3	Y	comparing SMMA dept with a very diversified range of professions	Y	with infrastructural Secretariat, Housing Secretariat, Education, Health and Sub-prefectures
4	Y		Y	
4	Y		Y	
5	NA		NA	
5				
6			N	the project is too specific and there is not effort in building these relationships
6			N	the project is too specific and there is not effort in building these relationships
7	Y	1. Including Energy and Climate Change in the IDP (Integrated Development Plan) within our organization. 2. Building-in EE&CC in other departments. We are battling with building it into our procurement policy.	Y	Partnership with NGO's (Sustainable Energy Africa) and a network of other 15 municipality; We met twice a year to discuss successes and challenges, not lessons learned.

Group	*4*	*Explanation*	*5*	*Explanation*
8	Y	looking to improve cross-connections between different departments through an improvement and innovation programme	Y	looking to improve cross-connections between different departments through an improvement and innovation programme
9	Y		Y	
9	Y		Y	
10	N		N	
11	Y	Through participative palnning	Y	Establishing covenants with other institutions to implement join actions
11	Y	participative planning	Y	Creating relationships with other institutions
12				
12				
13	Y	on any initiative	Y	Residents "force" a dialogue with local authorities in the process of institutionalising it
13				
14	Y		Y	
14	Y		Y	
15	NA		NA	
16			Y	Acreditamos que temos que partir de uma relação de confiança entre os grupos para que se obtenha os resultados desejados, por meio de dialogos entra as partes
16				

Group	4	Explanation	5	Explanation
17	Y		Y	
17	Y		Y	
18	N	no	Y	Urban Planning
18	N		Y/N	Personality Driven!
19	Y	w/Brazilian and other nationals reviewing	Y	We have many partners
19	Y	Integration at government level and also often Public Institution level	Y	ICLEI, CBD, …
20				
20				
21	N	Skill sets are not integrated	N	
22	Y	regular __ and broader plannig approach, methodology and scope		
22	Y	NEPES (Núcleo de Estudos e Projetos Especiais da Regional Nordeste)	Y	SMMA (Meio Ambiente)
23	Y	Multi-disciplinary teams to work on programs	Y	Awareness/exposure sessions
23	Y		Y	Training Planners in new environmental impact assessment regulations

Group	Additional	More helpful?
1	sectoral knowledge/interests. The 4-year term in Brazilian Government,	if it could be introduced to the Brazilian government, then reproduced
1	resources (financial resources) a challenge but trying to implement in phases, therefore having a longterm goal and working towards it gradually	it will help a lot as we will be able to use it to our long term benefits and results
2	Problem is lack of financial resources	
2	Officials that are not informed about biodiversity issues	
3	old culture of disrespect to environment. Conflict of interests between housing and infrastructural dept with the environmental orientation	new ideas to break resistances
4	Tips: setting up multi-departmental TASK TEAMS. Barriers: egos/defining and sharing set roles and responsibilities, socio-economic factors	To be simplified with graphics to allow people to get a better understanding, for a greater of public participation processes
4		
5		
5	barriers: conflict of legal competencies	
6		
6		
7	1. Buy-in from other departments 2. procurement policies 3. Capacity development 4. Financial challenges for projects	learn from other municipalities

NOTES:
Respondent's names and organizations are kept confidential.
Each group consisted of 2 respondents.
KEY: Y = yes N = no NA = not applicable

APPENDIX X.3:

PLANS DATABASE

Location	*Country*	*Area*	*Current Population*	*Density/ mile²*	*Plan Type*	*Date*	*Form*	*Status*	*Lang*	*Incl.*	*LAB*
Aichi Prefecture	Japan	State	7,408,640	3,723	LBSAP	Mar-09	web	live	Eng	yes	no
Akashi	Japan	City	290,776	15,301	LBSAP	Mar-11	N/A	N/A	Jpn	no	no
Auckland	New Zealand	City	1,397,300	7,500	InBSP	Jul-12	pdf	complete	Eng	yes	no
Barcelona	Spain	City	1,621,537	41,420	LBAP	2013	pdf	complete	Cat	no	no
Belfast	Ireland	City	281,000	6,386	LBAP	2007	pdf	complete	Eng	yes	no
Berkeley	USA	City	112,580	10,752	CCAP	Jun-09	pdf	complete	Eng	yes	no
Birmingham & Black Country	England	Region	1,100,000	8,029	LBAP	Jul-04	web	live	Eng	yes	no
Bonn	Germany	City	327,913	6,014	LBSAP	2008	pdf	complete	Eng	yes	yes
Brighton & Hove	England	City	273,400	8,041	LBAP	Feb-12	pdf	complete	Eng	yes	no
Bristol	England	City	428,100	9,420	LBAP	2008	pdf	complete	Eng	yes	no
Brussels	Belgium	City	1,830,000	16,857	SuP	2012	pdf	complete	Eng	yes	no
Caloocan	Philippines	City	1,489,040	69,000	CmP	2010	pdf	complete	Eng	yes	no
Cape Town	South Africa	City	827,218	4,300	LBSAP	2009	pdf	complete	Eng	yes	yes
Cardiff	Wales	City	346,100	6,400	LBAP	2008	pdf	complete	Eng	yes	no
Chiba Prefecture	Japan	State	6,201,046	3,115	LBSAP	Mar-08	pdf	complete	Eng	yes	no
Chicago, IL	USA	City	2,707,120	11,864	LBAP	2011	pdf	draft	Eng	yes	no
Cork City (in Cork County)	Ireland	City	119,230	8,272	LBAP	2009	pdf	complete	Eng	yes	no
Curitiba	Brazil	City	1,764,540	10,523	LBSAP	2012	pdf	draft	Eng, Port	yes	yes
Delhi	India	City	11,007,835	10,065	GAP, CCAP	2007	scan	complete	Eng	yes	no
Dublin	Ireland	City	527,612	11,880	LBAP	2008	pdf	complete	Eng	yes	no
Dun Laoghaire-Rathdown	Ireland	County	206,261	4,209	LBAP	2009	pdf	complete	Eng	yes	no
East Kolkata	India	Sub-city	150,000	5,985	WAP	Jul-05	pdf	complete	Eng	yes	no
Edinburgh	Scotland	City	495,360	4,776	LBAP	2010	pdf	complete	Eng	yes	no
Edmonton	Canada	City	812,201	3,074	LBSAP	2009	pdf	complete	Eng	yes	yes
eThekwini (Durban)	South Africa	City	3,442,361	3,892	LBSAP	2008	pdf	complete	Eng	yes	yes
Exeter	England	City	119,600	6,630	LBAP	Nov-05	2 pdfs	complete	Eng	yes	no
Glasgow	Scotland	City	598,830	8,542	LBAP	2001	pdfs	complete	Eng	yes	no
Greater Manchester	England	County	2,682,500	5,440	LBAP	2009	pdfs	complete	Eng	yes	no
Greenwich (in London)	England	Sub-city	214,403	14,245	LBAP	2009	pdf	complete	Eng	yes	no
Guangzhou	China	City	11,070,654	4,425	CmP	2011	web	live	Eng	yes	no
Jerusalem	Israel	City	801,000	17,000	SuP	Mar-12	scan	complete	Eng	yes	yes
Johannesburg	South Africa	City	1,009,035	5,100	LBSAP	2009	pdf	complete	Eng	yes	yes

Location	*Country*	*Area*	*Current Population*	*Density/ mile²*	*Plan Type*	*Date*	*Form*	*Status*	*Lang*	*Incl.*	*LAB*
Joondalup	Australia	City	49,675	3,312	LBSAP	2009	pdf	complete	Eng	yes	yes
Kalamaria	Greece	City	91,279	36,939	CCAP	Apr-11	pdf	complete	Eng	yes	no
Kashiwa	Japan	City	404,252	9,100	LBSAP	Mar-11	N/A	N/A	Jpn	no	no
Kingston upon Hull	England	City	256,100	9,030	LBAP	2008	web	complete	Eng	yes	no
Kitakyushu	Japan	City	983,037	5,230	LBSAP	Nov-10	N/A	N/A	Jpn	no	no
Kobe	Japan	City	1,545,410	7,255	LBSAP	Feb-11	N/A	N/A	Jpn	no	no
Leeds	England	City	750,700	3,574	LBAP	2000	pdfs	complete	Eng	yes	no
Leicester	England	City	329,600	10,800	LBSAP	2011	pdf	complete	Eng	yes	yes
Lincoln	England	City	93,100	6,800	LBAP	2006	pdf	complete	Eng	yes	no
Liverpool	England	City	465,700	10,070	SuP	2010	pdf	draft	Eng	yes	no
London Region	England	Region	8,173,194	13,466	LBAP	2002, 2010	2 pdfs	complete	Eng	yes	no
Melbourne	Australia	City	4,170,000	4,059	BCP	Nov-11	pdf	complete	Eng	yes	no
Mexico City	Mexico	City	8,851,080	15,000	LBSAP	Jan-13	pdf	complete	Span	yes	yes
Montpellier	France	City	255,080	11,620	CmP	2009	pdf	complete	Fr	yes	no
Montreal	Canada	City	1,649,519	11,701	SuP	2010	pdf	complete	Eng	yes	no
Nagareyama	Japan	City	166,493	12,200	LBSAP	Mar-10	N/A	N/A	Jpn	no	no
Nagoya	Japan	City	2,266,249	17,986	LBSAP	Mar-10	pdfs	complete	Eng	yes	yes
New York City	USA	City	8,244,910	27,013	CmP	Apr-11	pdf	complete	Eng	yes	no
Newcastle and North Tyneside	England	Region	470,759	6,211	LBAP	2011	pdf	complete	Eng	yes	no
North Merseyside	England	Sub-county	1,061,000	7,218	LBAP	2008	mix	complete	Eng	yes	no
Norwich	England	City	140,100	9,340	LBAP	2002	pdf	complete	Eng	yes	no
Paris	France	City	2,234,105	54,900	LBAP	2011	pdf	in progress	Eng	yes	no
Portsmouth	England	City	205,400	12,838	LBAP	2012	pdf	draft	Eng	yes	no
Puducherry	India	City	1,244,464	6,600	CCAP	Aug-10	scan	complete	Eng	yes	no
Saitama	Japan	City	1,231,880	14,670	LBSAP	Mar-08	N/A	N/A	Jpn	no	no
Saitama Prefecture	Japan	State	7,190,817	4,905	LBSAP	Mar-08	pdf	complete	Eng*	yes	no
San Francisco	USA	City	3,273,190	6,633	SuP	1997	web	live	Eng	yes	no
São Paulo	Brazil	City	11,316,149	18,690	LBSAP	2011	pdf	complete	Eng, Port	yes	yes
Schaumburg, IL	USA	City	75,936	3,967	LBAP	May-04	pdf	complete	Eng	yes	no
Seoul	Korea	City	10,581,728	45,000	BR	2008	pdf	complete	Eng	yes	no
Sheffield	England	City	551,800	4,000	LBAP	2002	pdfs	complete	Eng	yes	no
Sikkim	India	State	607,688	23,960	BAP	Aug-12	pdf	complete	Eng	yes	no
Singapore	Singapore	City-state	5,312,400	18,943	NBSAP	Jul-05	pdf	complete	Eng	yes	no
Southampton	England	City	239,700	12,260	LBAP	2006	pdf	complete	Eng	yes	no
Stockholm	Sweden	City	871,952	4,600	SuP	2011	pdf	complete	Eng	yes	no
Stoke on Trent	England	City	249,000	6,640	SuP	Aug-11	pdf	complete	Eng	yes	no

Location	*Country*	*Area*	*Current Population*	*Density/ mile²*	*Plan Type*	*Date*	*Form*	*Status*	*Lang*	*Incl.*	*LAB*
Waitakere (now Auckland)	New Zealand	City	208,100	6,503	LBSAP	2008	pdf	complete	Eng	yes	yes
Westminster (in London)	England	City	219,600	26,000	LBAP	2008	mix	complete	Eng	yes	no
Worcester, MA	USA	City	181,045	4,678	CCAP	Dec-06	pdf	complete	Eng	yes	no
Worcestershire	England	City	98,700	7,700	LBAP	2008	mix	complete	Eng	yes	no
Yokohama	Japan	City	3,697,894	22,000	WGBP	Apr-11	pdf	complete	Jpn	no	no

* only a summary of the full document is available in English. The full odcument is in Japanaes and was not included.

ABBREVIATIONS KEY:
AP = Action Plan
BCP = Biodiversity Conservation Plan
BR = Biodiversity Report
Cat = Catalan
CCAP = Climate Change Action Plan
CmP = Comprehensive Plan
Eng = English
Fr = French
GAP = Greening Action Plan
IL = state of Illinois, USA
InBSP = Indigenous Biodiversity Strategy Plan
Incl. = included in the study
Jpn = Japanese
LAB = Participant in the Local Action for Biodiversity (LAB) Pioneer program
Lang = language of the plan document located for the study (some are not used)
LBAP = Local Biodiversity Action Plan (same as LBSAP)
LBSAP = Local Biodiversity Strategy and Action Plan (same as LBAP)
mix = website and pdf material. Printed the website to pdf and combined all for analysis
N/A = not applicable
Port = Portuguese
scan = a not searchable document was converted to a searchable document using the tool at www.onlineocr.net
Span = Spanish
SuP = Sustainability Plan
WAP = Wetland Action Plan
web = available only asa html website. Printed to pdf for analysis
WGBP = Water, Greenery, and Biodiversity Master Plan

APPENDIX X.4:

BIODIVERSITY QUOTE CATEGORIZATION

Here, quotes containing "biodiversity" from each non-biodiversity plan are color coded to the following answers to "Biodiversity is..."

1. Justification for Habitat Conservation
2. Benefit of Green Network
3. Determinant of Building Regulation
4. Impacted by Climate Change
5. Indicator of Ecosystem Health
6. Link to Ecosystem Services
7. Provider of Eco-Education
8. Creator of Economic Opportunity
9. Connection to Spirit/ Culture
10. Key to quality of life

Berkeley

p. 40 2. Goal: Increase and enhance urban green and open space, including local food production, to improve the health and quality of life for residents, protect biodiversity, conserve natural resources, and foster walking and cycling

Brussels

p. 1 As for green spaces and biodiversity, they are an essential resource for ensuring the quality of life in the urban fabric. Their environmental management, the development of playgrounds, and the layout of the Green Trail that allows people to tour the Region via its green spaces are all practical manifestations of this.

p. 4 [Requirements for exemplary buildings] 2) Projects favour eco-design in the choice of materials, respect for natural cycles (in particular for rainwater) and biodiversity, the sanitary quality of spaces, their adaptation to forms of eco-mobility, etc.

p. 15 Besides the energy performance of the projects, which fulfils the passive standards in new construction or very low energy in renovation, demanding ecological criteria are implemented in water management, the choice of materials, 'soft ' mobility and the respect for biodiversity.

p. 17 The Charter of the existing Sustainable Neighbourhoods

- Rationalise consumption
- Move around differently
- Live in a densely populated, active neighbourhood
- Highlight natural heritage and biodiversity
- Preserve natural resources
- Promote sustainable construction
- Save energy
- Reduce waste
- Live better

p. 22 The idea is to design a city with a balanced territorial network, attentive to the preservation of the biodiversity of its hinterland, fossil energy resources and ultimately the climate, and capable of integrating its residents into processes of participation and decision-making. To these ends, the Sustainable Neighbourhoods Facilitator meets with project sponsors to assist them in specifying their sustainable features. He organises specialised seminars and develops tools to

contribute to the emergence of a new vision of property and new practices.
p. 24 With regard to mobility, the project will stimulate all forms of 'soft' mobility: public transport, bicycles, car sharing, etc. Biodiversity and water management are also to be taken into account in construction and in the public spaces.
p. 29 Not only does the Brussels Greenfields plan establish conditions for the sustainable remediation of soils, it also aims for the economic redevelopment of the wasteland treated. In addition, it encourages eco-construction and measures favouring biodiversity and the preservation of the natural heritage.
p. 32 Parkland, woods, the forest of Soignes, private gardens, cemeteries, sports grounds, fields, vegetable gardens and so on represent half of the Region's territory. A wealth of biodiversity exists there which must be protected. This is vital to the quality of life and sustainability of a large city.
p. 32 The green spaces are also biotopes for a wealth of biodiversity: almost 800 different species of plants, and 45 species of mammals, including 17 species of bats, 92 species of nesting birds, and so on.
p. 32 These various initiatives help preserve and develop biodiversity, so that the Green Network plays an ecological role, for example by enabling species to move from one green space to another.
p. 32 Alterations have been carried out in order to separate clean water from wastewater, to restore river flows, to supply ponds and marshy areas with fresh water, and to reduce the amount of water treated in the purification plants. As a result, surface water quality is improving, and this together with the changes made to watercourse and pond banks is helping to regenerate aquatic ecosystems and increase their biodiversity.
p. 33 Brussels harbours a wealth of biodiversity : almost 800 species of plants and 45 species of mammals, including 17 species of bats, 92 species of breeding birds, etc.

Caloocan

p. 22 [OBJECTIVE] To promote bio-diversity conservation and climate change mitigation
[POLICIES] The City Government shall promote environmental protection and bio-diversity conservation as critical policy measure towards sustainable development.
Environmental policies, regulations and measures shall focus primarily on

- Ø Providing incentives for complying industry,
- Ø Promotion of pollution prevention measure rather than control,
- Ø Waste minimization and energy conservation,
- Ø Mutual consultation and coordination
- Ø Land use control

Delhi

[Forests] conserve endemic biodiversity
Natural regeneration cum enrichment planting of Ridge is being taken up to conserve and protect the biodiversity of the Aravalli region by way of afforestation of Ridge through innovative soil and moisture conservation measures.

E Kolkata

p. 4 Action Plan has been worked out to implement the Management Plan for the purpose of Conservation and Management of Wetlands which emphasizes biodiversity conservation, water bird conservation and enhancing fish biodiversity.
p. 8 The wetland, along with a series of beels interspersed across the Gangetic Delta provide support to various forms of biodiversity, and are key to ecological integrity of the region.
p. 10 The broad approach followed takes into consideration the following:

... Integration of biodiversity into regional planning to minimize impacts of developmental activities

p. 11 The IMP broadly focuses on biodiversity conservation and maintaining ecological processes and functions through land and water management.

p. 15 Wetlands sustain the overall developmental activities within the region through their natural functioning, i.e. by regulating flows, supporting highly productive fisheries and agriculture, sustaining biodiversity and their inextricable linkages with culture and belief systems of the communities

p. 29 There has been a rapid change in biodiversity associated with the wetlands due to changes in hydrological regimes and land use. Of the 271 species of birds recorded form the wetlands, only 162 species have been variably noted during the last 30 years. It is assessed that 109 species of birds have become locally extinct, majority being aquatic birds. Similarly, there has been significant loss of vegetational diversity, particularly those of mangroves and other brackishwater species. The wetland which in early twentieth century teemed with a large spectrum of brackishwater and freshwater water fishes, only supports cultivable freshwater species. The presence of invasive exotic fish species Clarius guripinus and Pangasius sutchi pose great threat to the native diversity.

p. 29 There is, on an overall, focus on patch management with engineering measures ignoring interlinkages with hydrological processes and biodiversity. Involvement of multiple agencies with sectoral approaches limits adoption of a holistic management approach and strategy. Absence of appropriate monitoring and evaluation mechanisms limits assessment of impacts of implementation of action plans.

p. 30 Full range of ecosystem services of East Kolkata Wetlands not integrated into developmental plan

East Kolkata Wetlands through their natural functioning form the basis of various developmental activities. However, developmental planning has failed to take into cognizance the role played by these systems. Emphasis has been on engineering measures for quick economic gains at the cost of ecological sustainability. Planning has recognized only the provisioning services of the wetland and to a smaller extent its capacity to regulate wastes, at the same time ignoring other services as flood attenuation, and support to biodiversity. The lack of basic understanding of the nature of wetland ecosystem has led to overall loss of benefits accrued from the wetland through natural processes and functions. An innovative approach needs to be adopted for developmental planning integrating ecosystem services of the wetland. Such an approach would help to mitigate floods, regenerate water quality, enhance resource base and improve overall quality of the life of the marginalized community.

p. 30 Inventorization and assessment of hydrological processes, biodiversity and socio economic aspects are critical to management planning and baseline information needs to be developed.

p. 32 Management Planning for EKW mandates recognition of the full range of ecosystem services and biodiversity of the wetland system and their interlinkages with hydrological and ecological processes within a river basin framework.

p. 32 The goal of management planning is conservation and sustainable utilization of ecosystem services and biodiversity of EKW for ecological security and economic improvement of stakeholders. The purpose is to establish effective management practices for EKW through coordinated actions at river basin level integrating coastal processes.

p. 33 The ecosystem conservation would comprise management delineation and zoning; water management and biodiversity conservation as its subcomponents.

p. 35 OBJECTIVE 7: Biodiversity conservation through habitat improvement of endangered and indigenous studies.

p. 36 OBJECTIVE 8: Ecotourism development for enhancing awareness, income generation and livelihood diversification. Indicator: Interpretation centres established to generate awareness about biodiversity and ecological significance of the wetlands. Strategies: Construction of boardwalks to have closer look of functioning of bheries and some strategic locations identified for biodiversity conservation
p. 39 A Biodiversity Conservation Team is proposed within the EKWMA responsible for habitat management including conservation of waterfowl populations, wetland biodiversity and ecotourism development.
p. 43-44 [ACTION PLAN] BIODIVERSITY CONSERVATION
Habitat restoration
The emphasis of habitat restoration would be on waterbirds, which are integrative ecosystem indicators. It is proposed to carry out systematic inventorization and assessment of key waterbird habitats within EKW basin, i.e. Bartee Beel, Gobadiabad Beel, Nalban and Goltala.
[p. 44] Enhancing fish biodiversity
With focus on culture fisheries, there has been a significant loss of indigeneous species. It is therefore proposed to establish a center for culture of indigenous fish species Goltala. Units for standardization of captive breeding of endangered species are also proposed to be established at Captain bhery.
OTHER
p. 22 Livelihoods of the wetland communities are distinctly linked to wetland resources, with 74% of the working population drawing sustenance through engagement in fish farming, agriculture and horticulture.

Guangzhou

p. 39-40 4. To Perfect Urban-Rural Ecological Security System
In line with the zoning of main functional region and ecological regions, an ecological compensation mechanism will be established and perfected to strengthen ecological restoration and protection. Coordinated effort will be made to carry out regional ecological protection and construction. With natural ecological conditions such as mountain, water, farmland and the ocean well tapped, the second-phase project of "Crystal-clear Water and Green Mountain" will be put into construction. Such natural ecological systems as forest, natural preservation zones, greenway networks, wetland, shelter forest in coastal regions will be improved. Ecological barriers featuring "one barrier. Four sections" will be constructed, while ecological corridors characteristics of "three vertical corridors and five horizontal corridors" will be built, leading to the shaping of an ecological security system that is multi-level, multi-functional, multi-dimensional and well-networked. Forest parks and natural preservation zones will be improved, with a priority placed on reaching 38% of forest coverage. Great effort will be undertaken to plant and restore water conservancy forest, ecological protection forest and ecologically- favorable forest. Effective protection of wetland resources will be conducted, The center of biodiversity will be improved.

Jerusalem

p. 2 Jerusalem has entered into additional international partnerships, such as ICLEI LAB, focusing on the integration of urban nature and biodiversity management in the city's strategic planning.
p. 7 In October 2009, Jerusalem joined the international LAB (Local Action for Biodiversity) Network, a global urban biodiversity program coordinated by ICLEI (Local Governments for Sustainability) for the efficient management and conservation of biodiversity at the local level. In this context, a Forum of Stakeholders representing different municipal departments,

government ministries, park authorities, and pubic interest groups, conducts round-table discussions on a regular basis to promote awareness and foster cooperation for comprehensive and effective local biodiversity policy-making and management
p. 7 An additional goal **of LAB** is leveraging biodiversity conservation for social, cultural and economic development.
p. 7 In this context, Jerusalem has approved going forward with the establishment of a strategic master plan for urban nature (LBSAP - Local Biodiversity Strategy and Action Plan). The primary goals of the plan include integration of urban open spaces into the city fabric through connectivity and accessibility, rehabilitation and restoration of ecological corridors, and formulation of an efficient management system for the city's natural infrastructure.
p. 7 Once completed and approved, the plan will serve as an official statutory tool, empowering the Municipality to enact local biodiversity conservation measures
p. 7 As a LAB Member, Jerusalem plays a prominent role in the LAB Phase Two global partnership program alongside more than 21 cities such as Cape Town, Durban, Seoul, Sao Paulo, Nagoya, Amsterdam, and Curitiba, for the promotion of good practice in local biodiversity management and sustainable urban development.
p. 8 Urban biodiversity is an essential element in sustainable development, and must not be perceived as an obstacle to growth. The preservation of urban biodiversity is a way to enhance and improve the quality of life for city dwellers through contact with, appreciation of, and involvement in urban nature. Urban biodiversity is now considered by experts to play an essential role in global ecosystem continuity, sustainability, and ultimately human survival on Earth. It is not just about the loss of exotic species and conservation, but rather, about the vital resources which underpin the wealth, the health and wellbeing of us all.
2011-2020 have been designated as the UN Decade on Biodiversity. The UN has warned that biodiversity loss is a "wake-up call" for all governments. UN Secretary-General Ban Ki-moon stated that, "Biodiversity is life, biodiversity is our life!"
- a message to all that humanity will suffer if we continue to lose our biodiversity at the rapid rate we are experiencing at present.
p. 11 In accordance with the recently formulated National Biodiversity Plan, local objectives for open space and biodiversity management are based on principles of sustainable urban development including preservation of the natural and built heritage, provision of ample open space, and maximum protection of landscape and environmental values, including ecosystems.
p. 11 In conjunction with its LAB (Local Action for Biodiversity) program, Jerusalem has recently launched the establishment of an LBSAP - a Long Term Biodiversity Strategy and Action Plan for the efficient management of the city's urban nature infrastructure.
p. 13 the establishment of the *Gazelle Valley Urban Nature Park,* which will insure the protection and restoration of the site's unique biodiversity and ecosystems. Recently, final approval was given for the statutory plan to preserve the valley as a natural heritage site, protecting it from any future construction.

Kalamaria

p. 13 Assessing the impacts of and vulnerability to climate change and subsequently working out adaptation needs required good quality information. This information included climate data, such as temperature, rainfall and the frequency of extreme events, and non-climatic data, such as the current situation on the ground for different sectors including water resources, agriculture and food security, human health, terrestrial ecosystems and biodiversity, and coastal zones.

Liverpool, England;

p. 11 Planning for a Low Carbon Economy in a Changing Climate states that local planning authorities should plan green infrastructure as part of wider networks so as to optimise its many benefits, including supporting local biodiversity, healthy living environments, urban cooling, local flood risk management and local access to shady outdoor spaces.
p. 35 [PRIORITY 4:] A green and biodiverse city
[ISSUE] Protecting core biodiversity areas. Creating expansion areas and wildlife corridors. Ensuring that green infrastructure delivery programmes contribute to the delivery of biodiversity action plan habitat targets
p. 73 [PRIORITY 4: A green and biodiverse city]
Liverpool is a green city; more than 60% of the city is green infrastructure if private gardens are included. A number of studies have been carried out to assess habitats and biodiversity across the city including the 2006 Phase 1 Habitat Survey29. Currently Merseyside Environment Advisory Service (MEAS) are undertaking work at the city region scale to develop an ecological framework30.
The city has areas of high biodiversity value with 25 Local Wildlife Sites, four Local Nature Reserves, one SSSI, and the Mersey Estuary, which also has the highest level of designation, as it is both a Special Protection Area and a Ramsar site. The 2008 Ecological Framework for Liverpool identified 608 ha of Core Biodiversity Areas; these are the areas of the city that are most important in nature conservation terms.
All public bodies are required to consider biodiversity conservation; this is referred to as the "biodiversity duty"31. The national target to halt the decline in biodiversity by 2010 has not been achieved and actions will have to continue to meet the target in the future.
Biodiversity is in part a measure of the health of the city's green infrastructure resource. A thriving green infrastructure is likely to have a range of well sustainably managed habitats that support a wide range of species. Providing connectivity offers opportunities for species movement, habitat expansion and enables south-north movement of species as climate warms.
p. 74 Map 21 and Map 22 show firstly the overall distribution of existing green infrastructure functions that can support biodiversity across the city and secondly the areas of the city that have been targeted for either or both of the Land Change actions for this priority.
p. 74 [Biodiverse City map] The functions included in this analysis are: habitat for wildlife, corridor for wildlife, soil stabilisation, pollutant removal from soil/water.
p. 99 [Priority: Biodiversity] Issue: Protect Core Biodiversity Areas. EVIDENCE: Core biodiversity areas are a key green infrastructure asset. Habitat size as well as quality is important. The extent of habitat determines species richness and population size. The urban area is potentially more hospitable to wildlife than the intensively managed agricultural areas on the fringes of the city.
Non core areas also have a role to play in improving the biodiversity of the city. Parks and gardens in particular play a key role, but are not core biodiversity areas. ACTION: Safeguard core biodiversity areas
p. 100 [Priority: Biodiversity] Issue: Creating expansion areas and creating corridors. EVIDENCE: Expansion areas can help to increase habitat area and also provide links to enable species movement. Wildlife corridors may be considered as an aspect of expansion areas providing opportunities for linkage and movement. Private gardens potentially provide a large "nature reserve" for the city as well as helping to create linkage between core biodiversity areas. ACTION: Take opportunities through development, regeneration and land management programmes to expand and connect core biodiversity areas.
ISSUE: Ensuring that green infrastructure delivery programmes contribute to the delivery of biodiversity action plan habitat targets. EVIDENCE: Key factors influencing the value of

green infrastructure for biodiversity are: Typology, Quantity, Proximity of other sites.
ACTION: Design guide includes recommendations from the Green Infrastructure HAP for North Merseyside. Green Infrastructure Target for new development.
p. 109: [ACTION] 4.1. The existing ecological network should be safeguarded. Map 162 shows the existing core biodiversity areas. The distribution of the target areas is shown on Map 163.
[ACTION] 4.3. Biodiversity by Design principles are developed for Liverpool as part of the Design Guide (Action 1.8).

Montpellier [translated from the original in French]

p. 23/34 [Natural Spaces] [The green belt] provides shelter for most animal species and, when properly connected to the network of green corridors, is essential to the development of biodiversity.
p. 25/37 Biodiversity
Urban environments are conducive to the enhancement of biodiversity, which is battered in agricultural areas of intensive cultivation. It is indispensable to the survival of mankind. The development of rich floristic communities in urbanized areas helps to maintain biodiversity and must be automatic for sustainable development. The choice of a variety of plants, coherent with the surrounding ecosystems, can develop favorable diversified urban wildlife habitats. However care should be taken not to encourage allergenic and invasive species (see Red List of the International Union for Conservation of Nature), which is the third cause of loss of biodiversity in the world.
Associated to this, a differentiated management, limiting maintenance and chemical inputs is a condition of development.
p. 25 At the foot of trees, local gardeners allow vegetation to naturally grow, thus promoting biodiversity in urban areas.

Montreal

p. 2 We have set ambitious goals for a more sustainable society including reduced greenhouse gases, better drinking water management, recovery of recyclable and organic matter and the respect for and expansion of biodiversity.
p. 3 [Five plan Orientations, 5.] Improving the protection of biodiversity, natural environments and green spaces.
p. 4 [orientation 5] OBJECTIVE: Improve Montreal's green infrastructures by increasing the canopy cover to 25% from 20% by 2025 compared with 2007. INITIATIVES: **31** Establish a collaborative framework to protect and promote highly biodiverse lands **32** Make use of green infrastructures and ecological services in the city **33** Disseminate information about biodiversity to raise awareness and encourage the public to protect it **34** Reinforce the environmentally friendly management of the city's green space
p. 16 MONTRÉAL IS ON ITS WAY TO ACHIEVING ITS OBJECTIVE OF PROTECTION OF 6% OF THE LAND TERRITORY AND WANTS TO ENTER PROTECTED SPACES IN ITS "RÉPERTOIRE DES MILIEUX NATURELS PROTÉGÉS DE L'AGGLOMÉRATION DE MONTRÉAL" (LISTING OF PROTECTED NATURAL ENVIRONMENTS IN THE AGGLOMERATION OF MONTRÉAL). BUT IT MUST IMPLEMENT TOOLS TO FIND OUT MORE ABOUT THE HABITATS AND BIODIVERSITY IT PROTECTS, IN PARTICULAR BIOINDICATORS AND A CANOPY INDEX. Biodiversity is suffering an unprecedented decline worldwide. Climate change and urbanization are two of the reasons for this. The presence of vegetation and a canopy cover are two of the indicators of biodiversity within the territory. The increase in the canopy cover, in addition to increasing the number of plants and encouraging the infiltration of rainwater helps filter the air and reduces heat islands in the urban environment. These are all decisive elements in facing the

challenges of adapting to climate change. These elements also have an effect on the quality of life of residents of these urban areas.
The U.S. Environmental Protection Agency defines green infrastructures as natural or built infrastructures, such as parks, natural environments, trees on streets, roofs and green walls, filtering ditches and marshes. These provide ecological services that reproduce those of natural environments.
Montréal, with its many green spaces, is well placed in terms of the canopy index—the projection of tree cover on the ground—compared with other major North American cities. One of the means to increase canopy cover and biodiversity is to add plants in densely built areas, particularly by creating a green infrastructure. Montréal currently assesses its canopy index at 20.5% and would like this index to grow to 25% by 2025.

New York

p. 35 We will reconceptualize and green our streets. And because vibrant open spaces both need and support biodiversity, we will increase the health and vitality of natural areas.
p. 44 We will conduct a study to determine best practices for promoting biodiversity in green roof design and construction.
p. 45 Building sites represent nearly half the land area in the city and have a great potential to mitigate the urban heat island effect, increase biodiversity, retain stormwater, and perform other critical ecological functions.
p. 166 Situated on a great tidal estuary, sculpted with gentle hills and rocky outcroppings, and conditioned by four distinct seasons, the natural biodiversity of New York City is sometimes hidden in plain sight. We might not even notice the gull-billed tern pausing for rest in Jamaica Bay, or the red-tailed hawk brows- ing for prey in Riverdale, but the clean water and hospitable trees they depend on are basic elements of our quality of life. The beaver or alewife herring tentatively returning to the Bronx River may be a modern novelty, but their presence can become a living lesson for school children in adjoining neighborhoods, who are also starting to explore that waterway for the first time in generations.
p. 184 [ACTION 13: Support ecological connectivity] Conduct a study to determine best practices for promoting biodiversity in green roof design and construction

Puducherry

p. 11 [Agriculture Department: Objective and Strategy to be adopted]
Conservation of wetlands and wetland habitats. Wildlife conservation and Forest and Wildlife Education. Training to farmer's in Biotechnology, modern
nursery technology and agro-forestry. Conservation of wildlife, biodiversity and creation of Biodiversity Registers. Conservation of sacred grooves
Developing Crop Varieties tolerant to saline, long dry spell and suitable to rain fed agriculture
p. 11 [Fisheries Dept.] Creation of database to record collection and dissemination of information on fish availability status up to 12 nautical miles, climatic changes of the ocean, maintenance of biodiversity registers, demarcation of eco protected areas, conservation of genetic resources of marine flora and fauna.
Conservation of Marine turtles. Promotion of sustainable coastal tourism Setting up of marine oceanarium

San Francisco

p. 33 A sustainability plan for maintaining biodiversity must address genetic diversity, the number and variety of species in the City, the variety and quality of the City's ecosystems, and the ecological and evolutionary processes that sustain biodiversity.
Even in the increasingly urbanized San Francisco environment, there are four primary reasons why protecting and maintaining biodiversity are important. As expressed by Wilson:

- Biodiversity maintains the integrity of life known on earth;
- Through medicine, agriculture and economics, biodiversity provides a range of genetic, biochemical, and physical properties of plant and animal life that are advantageous to human welfare;
- Biodiversity is worthy of preservation because it represents human kinship through common living organisms; and
- Biodiversity is a source of national heritage, giving historic importance to place, such as the San Francisco bioregion with its distinctive assemblage of species of plants and animals.

p. 34 San Francisco cannot turn back the clock and return to its pre-urban environment, but the City can take actions to preserve its remaining biodiversity and restore some of what has been lost. Fundamental to this mission is promoting public understanding of the City's local plants and animals, and managing San Francisco's natural and landscaped habitats in a way that enhances the City's biodiversity. The strategy for preserving biodiversity is presented in the following matrix:

Goal 1	To achieve a greater understanding of biodiversity, its importance, how it is threatened and how to protect and restore it.
Goal 2	To protect and restore remnant natural ecosystems.
Goal 3	To protect sensitive species and their habitats and support their recovery in San Francisco.
Goal 4	To maximize habitat value in developed and naturalistic areas, both public and private.
Goal 5	To collect, organize, develop and utilize current and historic information on habitats and biodiversity.

Indicators:

- Number of volunteer hours dedicated towards managing, monitoring, and conserving San Francisco's biodiversity.
- Number of square feet of the worst invasive species removed from natural areas.
- Number of surviving indigenous native plant species planted in developed parks, private landscapes and natural areas.
- Abundance and species diversity of birds, as indicated by the Golden Gate Audubon Society's Christmas bird counts.

Stockholm

p. 4 This environmental programme is the eighth in the city's history. The programme is based in the challenges existing today, among them the fact that Stockholm is an attractive and growing city where the needs of nature and people complement each other in an environment characterized by function, qualities and biodiversity.
p. 20 The following interim targets will be met during the programme period:
4.1 Land and water areas of special significance for biodiversity will be preserved and developed

1. 4.2 Land and water areas of particular attraction for recreation will be preserved and developed
2. 4.3 Development of other land and water areas will be minimized and compensated

3. 4.4 Where changes are made in land and water areas, these will be designed with future climate changes in mind
4. 4.5 Maintenance of land and water areas will work to preserve biodiversity, ecosystem services and recreational qualities.

p. 21 Stockholm distinguishes itself among other capitals by being green and water-rich with high natural values that strongly contribute to the attractiveness of the city. The structure of spaces covered by vegetation and water is a foundation for the city's biodiversity. It generates ecosystem services as a resource for Stockholmers' recreation and health, as well as for a climate adjustment of the city. Even in Stockholm, biodiversity is affected by, among other things, the fragmentation of interconnected habitats and dispersal routes. The challenge is to create and maintain good conditions for life in the city and promote a long-term sustainable land and water use that contributes to a positive economic development without losing important environmental assets. It is crucial to take care of and develop a functional and appealing green-and-blue structure in order to preserve the unique qualities of Stockholm. Therefore, city development should be based on our need of parks and city-adjacent nature areas and to consider the conditions for biodiversity and its ecosystem services. Through well-weighted efforts, recreational and ecological values can also be re- created or compensated in the event of undeveloped land being claimed for construction.

p. 22 4.1 Land and water areas of special significance for biodiversity will be preserved and developed

This target is about maintaining and developing the function of the green/blue structure which is a prerequisite for preserving the rich plant and animal life and thereby also the robust ecosystems and their ecosystem services. This structure consists of ecologically significant core areas, dispersal zones and habitats for species meriting protection. Some of these also have a regional or national value.

According to this target:

- • Encroachment on irreplaceable functions will be avoided
- • Areas of high value will be protected. Protection according to the Environmental Code should be used for the areas of highest value. Other ways of protecting can be through the Planning and Building Act, with for example area regulations or a detail plan.
- • Actions to strengthen functions in and between areas, for example weak connections, are carried out in cooperation with planning. Encroachment into areas eligible for compensation within a particularly important structure will be compensated, primarily locally with an equivalent function, secondarily in a different location with an equivalent function for the city's green qualities.

p. 23 4.3 Development of other land and water areas will be minimized and compensated

Land and water areas outside of the particularly vital structure have to a large extent a supportive function for the city's biodiversity and thereby also its ecosystem services. Many are for example important to inhabitants having good access to recreational qualities in accordance with the guidelines of the park programme, to climate-adjust the city and as a part of important green connections.

According to this target:

- • Encroachment into these areas should be minimized and compensated, primarily compensated by way of an equivalent function, and secondarily with an equivalent function for the green qualities of the city.
- • Claimed land and water areas lacking a function for the green qualities of the city do not need to be compensated.

4.4 Where changes are made in land and water areas, these will be designed with future climate changes in mind
A sustainable city needs a blooming and lively outdoor environment that is beneficial to biodiversity, which in turn can generate important ecosystem services for residents and activities that are adapted to coming climate changes. Expected changes in Stockholm include more intensive precipitation, raised sea levels and more heat waves, as well as a longer growing season. The City's efforts with ecological foundations, green area factors and sustainable rainwater management constitute important supports in this work.
p. 24 4.5 Maintenance of land and water areas will work to preserve biodiversity, ecosystem services and recreational qualities
Maintenance and restoration of land and water areas are of great importance for the ecosystem services, for example their recreative qualities, as well as for biodiversity. Insufficient, unfavourable or erroneous maintenance ultimately depletes green qualities. A well functioning maintenance is a prerequisite for keeping and developing both ecological and recreative values.
According to this target:
• The City will carry out ecologically oriented maintenance and restoration. Parks and recreative areas will be maintained according to park programs and service plans established by the City Districts.

Stoke on Trent

p. 12 Biodiversity is a key indicator of sustainability and plays a crucial role in improving the quality of life in communities. Stoke-on-Trent contains a series of nationally and locally important nature conservation sites and is home to many protected and priority plant and animal species. Protecting and enhancing biodiversity in line with the UK and Staffordshire Biodiversity Action Plan will bring clear social, economic and environmental benefits for Stoke-on-Trent. Stoke-on-Trent's Local Development Framework outlines how biodiversity will be incorporated into the future of the city and will be both protected and enhanced through development.
We will:
BD1 Encourage and implement the management of appropriate land under Council control, including landscape features, to maintain and enhance biodiversity.
BD2 BD3
Ensure opportunities for biodiversity enhancement are included and implemented in council plans, projects and decision making processes.
For appropriate land that is awaiting redevelopment, plant that land with wildflowers and grasses to improve the visual amenity and enhance the local biodiversity.
p. 18 [Glossary] **Biodiversity** – Biodiversity is the degree of variation of life forms within a given ecosystem, biome, or an entire planet. Biodiversity is a measure of the health of ecosystems. Biodiversity is in part a function of climate. "Biological diversity" or "biodiversity" can have many interpretations. It is most commonly used to replace the more clearly defined and long established terms, species diversity and species richness.

Worcester

p. 29 The impact of climate change will involve more than hotter temperatures. Among other effects, it may produce increased incidences of extreme weather events, like hurricanes and storms; melting of the polar ice sheets, which could result in a rise in overall sea levels and lead to coastal flooding, water resource contamination, and increased stress on ecosystems, in turn leading to desertification and/or loss of biodiversity

APPENDIX X.5

NON-BIODIVERSITY PLANS: CONCEPT RELEVANCE PERCENTAGES

All concepts identified by Leximancer for the combined non-biodiversity plans.

Concept	*Relevance Percentage*	*Concept*	*Relevance Percentage*
CITY	10	ELECTRICAL	15
REDUCED	50	HOUSES	14
PLANNING	50	RESIDENTS	14
ACTION	49	URBAN	13
USED	39	CALCULATIONS	13
GREEN	37	VEHICLE	13
EMISSIONS	37	NATURE	13
BUILDINGS	36	POLLUTANTS	13
WASTE	36	PAYBACK	12
CLIMATE	34	INFORMATION	12
DEVELOPMENT	33	LAND	12
ENVIRONMENT	33	YEAR	11
PUBLIC	31	ACTIVITIES	10
WATER	28	PEOPLE	10
IMPROVE	28	SCHOOLS	10
PROVIDE	27	NATIONAL	10
COMMUNITY	26	PARK	10
CHANGE	25	TEACHERS	10
IMPLEMENTING	24	PRIVATE	10
LOCAL	23	SERVICE	9
QUALITY	23	PLANTED	8
REDUCTION	21	CONSTRUCTED	8
WORK	21	COUNCIL	8
MANAGER	20	POWER	8
FUNCTIONALITY	20	SOCIAL	8
INCLUDED	19	THRESHOLD	8
PERFECTED	19	GOVERNMENTS	8
PROGRAMS	18	SAPLINGS	6
TARGETS	18	CEMETERIES	5
PROJECT	17	BRIDGES	5
GAS	17	**BIODIVERSITY**	**5**
SUSTAINABLE	16	LABORATORIES	5
AREA	16	CREEKS	4
HEALTH	16	SPECIES	3
RESOURCES	15		

APPENDIX X.6

BIODIVERSITY AND COMPARATIVE CONCEPTS' CO-OCCURRENCE DATA

BIODIVERSITY Concept
Statistics from Individual Analysis of All non-Biodiversity Plans

Concept Count

	All	Biodiversity
Mean of Means	11	20.70588
Std Dev	20.4	16.85142

Concept Relevance Percent

All	Biodiversity
3	9.7058824
5.53	7.0689878

Co-Occuring Concepts

	Co-Occurance Count			Co-Occurance Likelihood Percent		
	All	Mean >1	Top 30	All	Mean >3%	Top 20 terms
Quantity	208	14	30	208	5	20
Mean of Means	0.3	1.3	0.9	0.5	2.7	1.7
Standard Dev	0.3	0.5	0.4	0.5	0.4	0.6
Kurtosis	11.0	0.5	2.6	7.8	-2.4	0.3

Top 20 Co-Occuring Concepts

	Mean Count
city	4
water	4
local	2
green	2
management	2
development	2
areas	2
wetland	1
public	1
urban	1
parking	1
conservation	1
land	1
energy	1
buildings	1
environment	1
planning	1
climate	1
quality	1
reducing	1

	Mean Likelihood*
spaces	1%
areas	1%
program	1%
planning	1%
environmental	1%
public	1%
environment	1%
improve	1%
quality	1%
land	1%
parking	2%
awareness	2%
city	2%
conservation	2%
urban	2%
development	2%
green	2%
local	3%
management	3%
water	3%

AREA Concept

Statistics from Individual Analysis of All non-Biodiversity Plans

Concept Count

	All	Area
Mean of Means	11	21.529412
Std Dev	20.4	40.110967

Concept Relevance Percent

All	Area
3	7.1176471
5.53	14.924319

Co-Occuring Concepts

	Co-Occurance Count			Co-Occurance Likelihood Percent		
	All	Mean >1	Top 30	All	Mean >3%	Top 20 terms
Quantity	225	70	30	225	62	20
Mean of Means	2.7	7.8	16.3	3.1	8.5	14.7
Standard Dev	20.6	36.5	55.6	4.4	5.4	4.5
Kurtosis	219.4	69.5	29.6	6.5	0.7	-0.3

Top 20 Co-Occuring Concepts

	Mean Count
city	22
green	19
infrastructure	12
development	10
urban	8
water	8
core	7
public	7
action	6
rural	6
strategy	6
land	6
centre	5
management	5
functions	5
health	5
inner	4
levels	4
assets	4
increase	4

	Mean Likelihood*
green	25%
urban	22%
biodiversity	20%
city	19%
land	19%
water	18%
development	16%
public	16%
energy	16%
inner	15%
rural	14%
greatest	13%
core	13%
centre	12%
management	12%
national	12%
buildings	10%
assets	10%
key	10%
quality	9%

COMMUNITY Concept
Statistics from Individual Analysis of All non-Biodiversity Plans

Concept Count

	All	Community
Mean of Means	11	27.941176
Std Dev	20.4	68.777241

Concept Relevance Percent

All	Community
3	10.235294
5.53	19.6867

Co-Occuring Concepts

	Co-Occurance Count			Co-Occurance Likelihood Percent		
	All	Mean >1	Top 30	All	Mean >3%	Top 20 terms
Quantity	203	86	30	203	21	20
Mean of Means	1.1	2.1	4.1	1.3	4.5	4.5
Standard Dev	1.6	2.4	2.4	1.4	1.5	1.5
Kurtosis	13.2	-1.0	0.9	7.8	5.5	5.5

Top 20 Co-Occuring Concepts

	Mean Count
city	10
action	9
climate	8
development	7
local	7
energy	6
ghg	5
emissions	5
public	5
reductions	5
program	5
implementing	5
environmental	4
plan	3
management	3
green	3
methane	3
waste	3
emission	3
wetland	3

	Mean Likelihood*
development	10%
local	9%
environmental	6%
city	6%
public	6%
green	5%
diversity	5%
management	4%
parking	4%
plan	4%
social	4%
residents	4%
office	4%
implementation	4%
program	4%
society	4%
urban	4%
biodiversity	4%
waste	4%
children	3%

DEVELOPMENT Concept
Statistics from Individual Analysis of All non-Biodiversity Plans

Concept Count

Concept Relevance Percent

	All	Development
Mean of Means	11	98.882353
Std Dev	20.4	118.82965

All	Development
3	34.882353
5.53	29.227304

Co-Occuring Concepts

	Co-Occurance Count			Co-Occurance Likelihood Percent		
	All	Mean >1	Top 30	All	Mean >3%	Top 20 terms
Quantity	288	104	30	288	43	20
Mean of Means	1.3	3.0	6.1	1.6	5.4	7.1
Standard Dev	2.2	2.9	3.8	2.0	2.6	2.8
Kurtosis	30.1	16.3	7.1	10.0	2.2	-0.1

Top 20 Co-Occuring Concepts

	Mean Count
planning	20
department	18
management	10
programs	9
public	8
sustainable	7
green	7
projects	7
government	6
developers	6
activities	6
industry	6
community	5
local	5
energy	5
policies	5
guangzhou	5
plan	5
infrastructure	4
target	4

	Mean Likelihood*
management	16%
city	14%
planning	12%
local	11%
biodiversity	11%
public	9%
sustainable	8%
community	8%
green	8%
plan	6%
water	6%
health	6%
urban	6%
department	5%
activities	5%
economic	5%
growth	5%
energy	5%
use	5%
conservation	5%

GREEN Concept

Statistics from Individual Analysis of All non-Biodiversity Plans

Concept Count

	All	Green
Mean of Means	11	7.9
Std Dev	20.4	26.2

Concept Relevance Percent

All	Green
3	23.9
5.53	23.1

Co-Occuring Concepts

	Co-Occurance Likelihood Percent		
	All	Mean >3%	Top 20
Quantity	251	57	20
Mean of Means	2.6	7.9	13.7
Standard Dev	3.8	4.7	3.5
Kurtosis	6.6	0.1	-1.1

	Mean Likelihood*
management	20%
water	19%
public	19%
biodiversity	17%
use	16%
development	16%
spaces	15%
city	15%
infrastructure	15%
areas	13%
buildings	12%
management	12%
environmental	12%
quality	11%
urban	10%
increase	10%
health	10%
planning	10%
climate	9%
assets	9%

APPENDEX X.7:

CONCEPTS CATEGORIZATION

Document:
CBI Framework

Categories	Ecological	Education	Social	Economic	Cultural
Total	57	0	0	0	0
Percent of Total	**100%**	**0%**	**0%**	**0%**	**0%**

Concept	Relevance %	Count	Categories				
			Ecological	Education	Social	Economic	Cultural
cities	100	207					
indicators	65	135					
biodiversity	60	124					
scoring	28	58					
data	26	53					
species	25	52	25				
include	24	49					
areas	22	46					
management	18	38					
natural	17	36	17				
range	17	35					
local	16	33					
index	16	33					
native	15	32	15				
statistical	14	29					
ensure	12	25					
selection	12	25					
national	12	25					
unbiased	12	24					
services	11	22					
groups	10	21					
workshop	10	20					
urban	7	15					
parks	6	13					

Document:
LAB Pioneer Framework

Categories	Ecological	Education	Social	Economic	Cultural
Total	201q	9	0	0	0
Percent of Total	**96%**	**4%**	**0%**	**0%**	**0%**

Concept	Relevance %	Count	Categories				
			Ecological	Education	Social	Economic	Cultural
city	100	336					
biodiversity	99	333					
natural	40	133	40				
management	32	107					
local	32	107					
project	31	104					
plan	28	93					
conservation	27	92	27				
area	26	89					
species	24	80	24				
urban	22	74					
development	22	74					
environmental	21	70	21				
lab	21	69					
protection	20	67	20				
include	19	63					
city,Äôs	18	60					
information	16	55					
ecosystems	16	53	16				
change	15	52					
green	15	52	15				
diversity	15	51					
climate	15	49					
environment	13	45	13				
provide	13	45					
population	11	37					
action	11	36					
ecological	11	36	11				
water	10	35					
land	10	34	10				
programme	10	33					
park	10	32					
education	9	31		9			
website	8	26					
spaces	5	17					
Ecotype/ environment	4	12	4				

Document:
TEEB Framework

Categories	Ecological	Education	Social	Economic	Cultural
Total	202	0	42	167	0
Percent of Total	**49%**	**0%**	**10%**	**41%**	**0%**

Concept	Relevance %	Count	Categories				
			Ecological	Education	Social	Economic	Cultural
ecosystem	100	1412	100				
services	91	1278				91	
local	88	1242					
makers	77	1084					
policy	72	1013					
regional	66	938					
protected	30	425	30				
management	30	423					
benefits	29	404				29	
provide	27	376					
biodiversity	24	340					
water	22	311	22				
conservation	22	310	22				
estimate	20	284					
economic	19	265				19	
planning	18	258					
development	18	256					
used	17	239					
natural	17	234	17				
important	17	234					
change	16	224					
different	16	224					
decision	16	221					
approach	15	209					
example	14	203					
assess	14	198					
cost	14	196				14	
resources	14	191				14	
public	13	182			13		
box	12	169					
rainfall	12	169					
people	11	160			11		
climate	11	151					
information	11	149					
human	10	147			10		
analysis	10	146					
impacts	10	137					
palm	9	125					
community	8	117			8		
united	8	111					
carbon	7	95					
land	7	94	7				

case	7	92					
based	7	92					
world	6	86					
urban	5	72					
files	4	63					
international	4	59					
environment	4	54	4				
footprint	1	14					

Document:
URBIS Framework

Categories	Ecological	Education	Social	Economic	Cultural
Total	103	18	67	0	0
Percent of Total	**55%**	**10%**	**36%**	**0%**	**0%**

Concept	Relevance %	Count	Categories				
			Ecological	Education	Social	Economic	Cultural
urban	100	87					
planning	30	26					
partnership	29	25					
approach	24	21					
regions	24	21					
environmental	24	21	24				
conservation	24	21	24				
social	22	19			22		
ecosystem	22	19	22				
cities	22	19					
communities	21	18			21		
ecological	20	17	20				
education	18	16		18			
areas	17	15					
biodiversity	17	15					
resilience	16	14					
international	15	13					
york	15	13					
local	14	12					
sustainable	14	12					
policy	14	12					
diversity	13	11					
development	13	11	13				
unesco	11	10					
process	10	9					
network	10	9					
rights	10	9			10		
efforts	8	7					
stakeholders	7	6			7		
human	7	6			7		

Document:

Biodiversity Plan for Aichi

Categories	Ecological	Education	Social	Economic	Cultural
Total	477	0	44	26	0
Percent of Total	**87%**	**0%**	**8%**	**5%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
natural	23	100	100				
preserve	20	87	87				
biodiversity	18	78					
environment	14	61	61				
promote	10	43					
ecosystems	9	39	39				
use	9	39					
forest	9	39	39				
development	8	35	35				
diverse	8	35					
flora	7	30	30				
conservation	7	30	30				
efforts	7	30					
activities	7	30					
species	7	30	30				
ecological	6	26	26				
action	6	26					
agriculture	6	26				26	
residents	5	22			22		
cooperation	5	22			22		
networks	4	17					
impact	4	17					

Document:
Biodiversity Plan for Auckland

Categories	Ecological	Education	Social	Economic	Cultural
Total	101	0	11	19	56
Percent of Total	**54%**	**0%**	**6%**	**10%**	**30%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	202	100					
indigenous	102	50					50
strategy	67	33					
ecosystems	52	26	26				
management	50	25					
council	44	22					
region	41	20					
protect	40	20	20				
objectives	40	20					
including	37	18					
achieve	33	16					
species	32	16	16				
environmental	32	16	16				
measure	28	14					
provide	27	13					
development	25	12	12				
community	23	11			11		
actions	22	11					
natural	22	11	11				
resource	21	10				10	
work	20	10					
services	18	9				9	
proportion	18	9					
land	17	8					
projects	17	8					
ensure	15	7					
change	15	7					
monitoring	15	7					
range	14	7					
climate	13	6					
national	13	6					
maori	12	6					6
agencies	10	5					

Document:
Biodiversity Plan for Belfast

Categories	Ecological	Education	Social	Economic	Cultural
Total	107	8	8	0	0
Percent of Total	**87**	**7%**	**7%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	226	100					
action	90	40					
species	57	25	25				
local	54	24					
city	37	16					
development	36	16	16				
natural	34	15	15				
priority	28	12					
conservation	26	12	12				
wildlife	25	11	11				
environment	24	11	11				
northern	23	10					
bcc	22	10					
international	20	9					
people	18	8			8		
work	17	8					
awareness	17	8		8			
strategy	17	8					
policy	15	7					
groups	15	7					
management	14	6					
environmental	13	6	6				
plants	13	6	6				
involved	12	5					
landscape	12	5	5				
issues	11	5					
staff	11	5					
lagan	7	3					

Document:
Biodiversity Plan for Birmingham & Black Country

Categories	Ecological	Education	Social	Economic	Cultural
Total	298	0	48	10	21
Percent of Total	**79%**	**0%**	**13%**	**3%**	**6%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
action	162	100					
biodiversity	129	80					
habitat	80	49	49				
species	78	48	48				
local	64	40					
wildlife	52	32	32				
conservation	48	30	30				
natural	42	26	26				
areas	42	26					
important	41	25					
gardens	34	21					21
urban	34	21					
management	34	21					
use	34	21					
sites	33	20					
group	30	19					
public	30	19			19		
development	30	19	19				
land	29	18	18				
environment	28	17	17				
plants	28	17	17				
people	25	15			15		
prepared	24	15					
birds	24	15	15				
park	23	14	14		14		
steering	21	13					
uk	21	13					
trees	21	13	13				
value	17	10				10	
example	12	7					
diversity	12	7					
dudley	11	7					

Document:
Biodiversity Plan for Bonn

Categories	Ecological	Education	Social	Economic	Cultural
Total	280	0	10	0	8
Percent of Total	**94%**	**0%**	**3%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
area	620	100					
species	432	70	70				
city	278	45					
nature	225	36	36				
conservation	193	31	31				
biodiversity	139	22					
forests	136	22	22				
city,Äôs	131	21					
protect	118	19	19				
diversity	104	17					
plant	82	13	13				
rhine	79	13					
populations	77	12					
habitat	71	11	11				
result	67	11					
endangered	66	11	11				
european	65	10					
red	65	10					
included	62	10					
communities	62	10			10		
north	61	10					
information	57	9					
common	57	9					
land	56	9	9				
liste	55	9					
biological	55	9	9				
und	55	9					
bodies	54	9					
kottenforst	52	8					
special	49	8					
birds	49	8	8				
gardens	47	8					8
efforts	46	7					
environmental	45	7	7				
via	43	7					
developed	41	7	7				
wild	40	6	6				
tree	39	6	6				
relevant	39	6					
projects	37	6					

green	36	6	6				
ponds	35	6	6				
landscapes	32	5					
largely	32	5					
example	32	5					
agenda	29	5					
shrubbery	17	3	3				

Document:

Biodiversity Plan for Brighton & Hove

Categories	Ecological	Education	Social	Economic	Cultural
Total	382	0	26	30	0
Percent of Total	**87%**	**0%**	**6%**	**7%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
habitat	408	100	100				
biodiversity	389	95					
conservation	349	86	86				
species	335	82	82				
local	322	79					
plan	310	76					
services	213	52					
act	177	43					
ecosystem	153	38	38				
conserving	147	36					
benefits	122	30				30	
management	115	28					
national	114	28					
rural	108	26					
society	107	26			26		
corridors	88	22	22				
city	86	21					
calcareous	82	20	20				
further	69	17					
bhcc	64	16					
urban	59	14					
plant	54	13	13				
practicable	51	12					
hibernation	46	11	11				
dew	39	10	10				

Document:
Biodiversity Plan for Bristol

Categories	Ecological	Education	Social	Economic	Cultural
Total	550	22	27	0	0
Percent of Total	**92%**	**4%**	**5%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
habitat	241	100	100				
develop	155	64	64				
biodiversity	152	63					
action	144	60					
plan	133	55					
wildlife	130	54	54				
species	124	51	51				
conservation	96	40	40				
priority	92	38					
water	90	37	37				
sites	78	32	32				
target	72	30					
city	72	30					
nature	66	27	27				
ensure	65	27					
people	65	27			27		
local	62	26					
green	60	25	25				
grassland	58	24	24				
managers	57	24					
objective	56	23					
areas	55	23	23				
awareness	53	22		22			
programme	50	21					
status	46	19					
interest	44	18					
tidal	43	18	18				
network	41	17					
provide	41	17					
scrub	40	17	17				
land	37	15	15				
important	37	15					
woodland	35	15	15				
population	34	14					
include	33	14					
threats	29	12					
kingfishers	20	8	8				

Document:

Biodiversity Plan for Cape Town

Categories	Ecological	Education	Social	Economic	Cultural
Total	343	0	0	35	0
Percent of Total	**91%**	**0%**	**0%**	**9%**	**0%**

		Relevance	Categories				
Concept	Count	%	Ecological	Education	Social	Economic	Cultural
activity	108	100					
biodiversity	107	99					
city	84	78					
completion	78	72					
development	65	60	60				
implement	64	59					
species	64	59	59				
management	53	49					
strategies	47	44					
areas	43	40	40				
environmental	39	36	36				
conservation	34	31	31				
output	34	31					
planning	30	28					
vegetation	30	28	28				
local	27	25					
fynbos	25	23	23				
natural	24	22	22				
types	24	22					
social	21	19					
strategic	20	19					
south	20	19					
resource	19	18				18	
sustainable	18	17	17			17	
alien	17	16	16				
integrated	14	13					
environment	12	11	11				
program	12	11					

Document:
Biodiversity Plan for Cardiff

Categories	Ecological	Education	Social	Economic	Cultural
Total	472	0	0	0	8
Percent of Total	**98%**	**0%**	**0%**	**0%**	**2%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
action	200	100					
species	169	84	84				
plan	154	77					
habitat	146	73	73				
sites	131	66	66				
current	97	48					
targets	78	39					
woodland	77	38	38				
maintain	75	38					
identify	71	36					
target	69	34					
records	69	34					
population	68	34					
grassland	66	33	33				
areas	66	33	33				
management	62	31					
survey	55	28					
biodiversity	54	27					
status	50	25					
conservation	43	22	22				
lowland	42	21	21				
range	41	20					
local	41	20					
ponds	33	16	16				
wildlife	32	16	16				
nature	30	15	15				
known	30	15					
water	30	15	15				
pasture	25	12	12				
crested	25	12	12				
breeding	21	10	10				
introduction	18	9					
garden	17	8					8
cliff	13	6	6				

Document:

Biodiversity Plan for Chiba

Categories	Ecological	Education	Social	Economic	Cultural
Total	133	0	72	22	7
Percent of Total	**57%**	**0%**	**31%**	**9%**	**3%**

		Relevance	Categories				
Concept	Count	%	Ecological	Education	Social	Economic	Cultural
biodiversity	45	100					
prefecture	33	73					
species	21	47	47				
strategy	18	40					
citizens	16	36			36		
conservation	15	33	33				
local	11	24					
center	10	22					
children	9	20			20		
activities	8	18					
living	8	18					
cooperation	7	16			16		
nature	6	13	13				
making	6	13					
animal	6	13	13				
business	5	11				11	
sustainable	5	11	11			11	
satoyama	5	11					
forestry	4	9	9				
management	4	9					
information	4	9					
list	3	7					
npos	3	7					
red	3	7					
history	3	7					7
forest	3	7	7				

Document:
Biodiversity Plan for Chicago

Categories	Ecological	Education	Social	Economic	Cultural
Total	387	0	35	25	0
Percent of Total	**87%**	**0%**	**8%**	**6%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
natural	156	100	100				
areas	112	72	72				
city	51	33					
land	46	29	29				
wildlife	42	27	27				
habitat	42	27	27				
research	42	27					
green	39	25	25				
sites	39	25					
urban	37	24					
managers	37	24					
biodiversity	33	21					
public	31	20			20		
improve	31	20					
plan	30	19					
including	28	18					
plants	28	18	18				
program	27	17					
work	25	16					
preserve	24	15	15				
park	23	15	15		15		
infrastructure	23	15				15	
conservation	23	15	15				
region	20	13					
species	20	13	13				
climate	19	12					
ecological	18	12	12				
efforts	18	12					
environmental	16	10	10				
district	15	10					
economic	15	10				10	
forest	14	9	9				
county	14	9					

Document:
Biodiversity Plan for Cork City

Categories	Ecological	Education	Social	Economic	Cultural
Total	232	0	6	0	20
Percent of Total	**90%**	**0%**	**2%**	**0%**	**8%**

		Relevance	Categories				
Concept	Count	%	Ecological	Education	Social	Economic	Cultural
city	235	100					
biodiversity	190	81					
species	142	60	60				
plan	77	33					
working	65	28					
habitat	54	23	23				
important	53	23					
local	50	21					
areas	47	20	20				
heritage	35	15					15
birds	35	15	15				
national	34	14					
wildlife	31	13	13				
natural	29	12	12				
environment	26	11	11				
conserve	25	11	11				
lough	25	11					
harbour	24	10	10				
bat	23	10	10				
lee	20	9					
purpureum	19	8	8				
river	18	8	8				
estuary	16	7	7				
animals	16	7	7				
data	15	6					
marine	14	6	6				
people	14	6			6		
directive	14	6					
range	12	5					
diversity	12	5					
public	11	5					
irish	11	5					5
water	11	5	5				
cliff	13	6	6				

Document:

Biodiversity Plan for Curitiba

Categories	Ecological	Education	Social	Economic	Cultural
Total	703	24	154	0	0
Percent of Total	**80%**	**3%**	**17%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
city	139	100					
figure	134	96					
areas	125	90	90				
park	116	83	83		83		
environmental	91	65	65				
natural	79	57	57				
species	74	53	53				
municipal	73	53					
woods	70	50	50				
preservation	69	50	50				
urban	69	50					
river	64	46	46				
actions	59	42					
biodiversity	56	40					
conservation	54	39	39				
region	53	38					
environment	49	35	35				
native	47	34	34				
green	47	34	34				
strategy	45	32					
population	41	29					
project	41	29					
program	38	27					
leisure	38	27			27		
implementation	37	27					
collection	37	27					
equipment	36	26					
public	35	25			25		
main	35	25					

animals	35	25	25				
education	34	24		24			
located	34	24					
forest	32	23	23				
established	31	22					
total	31	22					
water	27	19	19				
waste	27	19					
people	27	19			19		
view	26	19					
activities	23	17					
quality	21	15					
different	21	15					

Document:
Biodiversity Plan for Dublin

Categories	Ecological	Education	Social	Economic	Cultural
Total	436	0	30	0	41
Percent of Total	**86%**	**0%**	**6%**	**0%**	**8%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	165	100					
city	126	76					
site	110	67	67				
plan	100	61					
action	99	60					
natural	79	48	48				
area	79	48	48				
collection	77	47					
brent	73	44					
national	68	41					
heritage	67	41					41
wildlife	67	41	41				
habitat	66	40	40				
bay	63	38					
information	62	38					
island	61	37					
develop	58	35	35				
raise	56	34					
plant	53	32	32				
collation	52	32					
local	51	31					
enhancement	50	30					
parks	49	30	30		30		
annex	47	28					
conservation	46	28	28				
birds	46	28	28				
management	44	27					
awareness	41	25					
provide	40	24					
directive	39	24					
ireland	37	22					
internationally	32	19					
group	30	18					
botanic	24	15	15				
flats	20	12	12				
wild	19	12	12				

Document:
Biodiversity Plan for Dun Laoghaire-Rathdown

Categories	Ecological	Education	Social	Economic	Cultural
Total	366	0	22	0	0
Percent of Total	**94%**	**0%**	**6%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
county	161	100					
biodiversity	161	100					
species	158	98	98				
support	78	48					
habitat	76	47	47				
areas	69	43	43				
status	54	34					
assess	54	34					
plan	54	34					
work	53	33					
current	52	32					
important	49	30					
protected	42	26	26				
action	42	26					
local	41	25					
conservation	38	24	24				
council	37	23					
parks	36	22	22		22		
wildlife	32	20	20				
range	32	20	20				
bird	29	18	18				
includes	28	17					
woodland	28	17	17				
national	27	17					
development	27	17	17				
dublin	27	17					
information	25	16					
red	23	14	14				
list	22	14					
appendix	21	13					
common	19	12					
dlrcc	12	7					
bci	7	4					

Document:
Biodiversity Plan for Edinburgh

Categories	Ecological	Education	Social	Economic	Cultural
Total	612	0	34	31	18
Percent of Total	**88%**	**0%**	**5%**	**4%**	**3%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
sites	242	100	100				
biodiversity	239	99					
species	238	98	98				
habitat	228	94	94				
action	198	82					
management	176	73					
plan	165	68					
area	119	49	49				
work	110	45					
populations	96	40	40				
woodland	94	39	39				
partnership	90	37					
carried	85	35					
following	84	35					
organizations	82	34					
local	82	34					
park	82	34	34		34		
including	82	34					
funding	76	31				31	
conservation	75	31	31				
planting	71	29	29				
natural	69	29	29				
city	66	27					
water	66	27	27				
appropriate	62	26					
provide	62	26					
required	62	26					
priority	61	25					
description	55	23					
wildlife	55	23	23				
recorded	47	19					
rock	47	19	19				
scottish	43	18					18
urban	42	17					
range	40	17					

Document:
Biodiversity Plan for Edmonton

Categories	Ecological	Education	Social	Economic	Cultural
Total	370	0	34	0	0
Percent of Total	**92%**	**0%**	**8%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
natural	274	100	100				
areas	182	66	66				
plan	134	49					
city	88	32					
development	86	31	31				
biodiversity	83	30	30				
ecological	82	30	30				
conservation	81	30	30				
protection	72	26	26				
strategic	59	22					
management	56	20					
parks	53	19	19		19		
network	50	18					
report	50	18					
land	50	18	18				
systems	49	18					
action	44	16					
information	43	16					
local	41	15					
community	40	15			15		
medium	38	14					
policy	37	14					
actions	33	12					
project	32	12					
wetlands	28	10	10				
services	21	8					
urban	21	8					
lead	17	6					
corporate	14	5					
valley	14	5	5				
river	14	5	5				
iclei	14	5					

Document:

Biodiversity Plan for eThekwini

Categories	Ecological	Education	Social	Economic	Cultural
Total	239	0	0	16	0
Percent of Total	**94%**	**0%**	**0%**	**6%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
department	166	100					
environmental	162	98	98				
management	142	86					
development	137	83	83				
biodiversity	131	79					
specific	128	77					
goal	120	72					
plan	119	72					
assessment	99	60					
municipal	78	47					
outstanding	75	45					
activities	71	43					
climate	63	38					
conservation	60	36	36				
services	59	36					
system	54	33					
projects	53	32					
review	52	31					
ensure	51	31					
change	50	30					
durban	47	28					
protection	43	26					
space	37	22	22				
hierarchy	34	20					
emd	27	16					
resources	26	16				16	

Document:
Biodiversity Plan for Exeter

Categories	Ecological	Education	Social	Economic	Cultural
Total	344	0	0	0	0
Percent of Total	**100%**	**0%**	**0%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	97	100					
habitats	70	72	72				
wildlife	59	61	61				
city	51	53					
species	51	53	53				
conservation	41	42	42				
planning	39	40					
local	31	32					
action	31	32					
development	30	31	31				
important	26	27					
areas	26	27	27				
policies	23	24					
value	21	22					
provide	19	20					
management	19	20					
sites	17	18	18				
council	16	16					
framework	15	15					
range	14	14	14				
process	14	14					
land	14	14	14				
woodland	12	12	12				
current	11	11					
urban	10	10					
wide	9	9					
partnership	7	7					
wet	7	7					
working	6	6					

Document:

Biodiversity Plan for Glasgow

Categories	Ecological	Education	Social	Economic	Cultural
Total	486	23	0	49	104
Percent of Total	**73%**	**3%**	**0%**	**7%**	**16%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
sites	395	100	100				
management	353	89					
plans	344	87					
action	313	79					
city	294	74					
habitat	267	68	68				
population	259	66					
protection	248	63	63				
species	230	58	58				
development	206	52	52				
water	203	51	51				
snh	198	50					
services	195	49				49	
fwag	192	49					
factors	184	47					
area	176	45	45				
local	171	43					
heritage	164	42					42
scottish	145	37					37
causing	130	33					
woodland	107	27	27				
culture	97	25					25
education	91	23		23			
swifts	85	22	22				

Document:
Biodiversity Plan for Greater Manchester

Categories	Ecological	Education	Social	Economic	Cultural
Total	853	0	0	0	0
Percent of Total	**100%**	**0%**	**0%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
habitat	368	100	100				
species	267	73	73				
sites	216	59	59				
areas	209	57	57				
management	202	55	55				
woodland	171	46	46				
water	155	42	42				
action	143	39					
ponds	138	38	38				
mossland	132	36	36				
black	120	33					
natural	111	30	30				
crested	103	28	28				
grassland	100	27	27				
develop	98	27	27				
wildlife	91	25	25				
conservation	90	24	24				
local	89	24					
current	88	24					
land	88	24	24				
population	88	24					
importance	82	22					
biodiversity	74	20	20				
breeding	73	20	20				
priority	69	19					
poplar	68	18	18				
trees	64	17	17				
peat	63	17	17				
england	62	17					
national	60	16					
wet	59	16	16				
ecology	53	14	14				
practice	53	14					
best	51	14					
willow	51	14	14				
brown	51	14	14				
bird	45	12	12				
use	41	11					
large	34	9					
include	28	8					

Document:
Biodiversity Plan for Greenwich

Categories	Ecological	Education	Social	Economic	Cultural
Total	569	0	37	0	11
Percent of Total	**92%**	**0%**	**6%**	**0%**	**2%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
habitats	204	100	100				
biodiversity	174	85					
species	170	83	83				
plan	97	48					
action	81	40					
sites	77	38	38				
spaces	57	28	28				
wildlife	57	28	28				
parks	53	26	26		26		
areas	51	25	25				
protection	50	25	25				
grassland	49	24	24				
heath	46	23	23				
conservation	44	22	22				
water	44	22	22				
provide	43	21					
green	42	21	21				
land	41	20	20				
wasteland	40	20	20				
planting	38	19	19				
black	37	18					
management	33	16					
use	33	16					
trees	33	16	16				
bene	31	15					
local	31	15					
woodland	30	15	15				
hedgehogs	28	14	14				
factors	25	12					
residents	23	11			11		
contribute	23	11					
garden	22	11					11
roost	18	9					
common	16	8					

Document:
Biodiversity Plan for Johannesburg

Categories	Ecological	Education	Social	Economic	Cultural
Total	343	35	18	0	0
Percent of Total	**87%**	**9%**	**5%**	**0%**	**0%**

Concept	Count	Relevance %'	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	394	100					
city	351	89					
management	333	85					
action	322	82					
plans	312	79					
conservation	266	68	68				
species	234	59	59				
development	174	44	44				
objectives	167	42					
department	163	41					
space	161	41					
urban	148	38					
ecosystem	145	37	37				
addressed	144	37					
ecological	138	35	35				
programs	130	33					
legislation	129	33					
southern	128	32					
services	127	32					
water	123	31	31				
existing	119	30					
bsap	117	30					
following	113	29					
relevant	112	28					
informed	107	27					
contribute	104	26					
quality	103	26					
network	102	26					
environment	100	25	25				
activities	100	25					
problems	84	21					
used	83	21					
constraint	83	21					
wetland	82	21	21				
awareness	81	21		21			
resources	71	18					
social	69	18			18		
rdl	59	15					
education	55	14		14			
local	50	13					
reserve	48	12	12				
vegetation	44	11	11				

includes	28	7					

Document:
Biodiversity Plan for Joondalup

Categories	Ecological	Education	Social	Economic	Cultural
Total	221	0	20	40	0
Percent of Total	**79%**	**0%**	**7%**	**14%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	162	100					
action	142	88					
city	100	62					
develop	99	61	61				
completion	98	60					
plan	74	46					
areas	68	42	42				
business	65	40				40	
responsible	63	39					
unit	62	38					
local	58	36					
city,Äôs	52	32					
management	48	30					
natural	47	29	29				
ensure	33	20					
community	33	20			20		
species	31	19	19				
project	30	19					
weeds	27	17	17				
ongoing	27	17					
bushland	26	16	16				
key	25	15					
native	24	15	15				
government	20	12					
provide	17	10					
strategic	16	10					
coastal	15	9	9				
catchment	14	9					
water	14	9	9				
wetland	7	4	4				

Document:
Biodiversity Plan for Kingston Upon Hull

Categories	Ecological	Education	Social	Economic	Cultural
Total	658	0	46	0	0
Percent of Total	**93%**	**0%**	**7%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
hull	416	100					
habitats	358	86	86				
management	294	71					
species	281	68	68				
action	274	66					
trees	207	50	50				
term	196	47					
parks	193	46	46		46		
wildlife	192	46	46				
plan	191	46					
current	163	39					
site	158	38	38				
water	157	38	38				
birds	155	37	37				
areas	153	37	37				
common	150	36					
conservation	148	36	36				
grassland	147	35	35				
use	141	34					
biodiversity	138	33					
provide	136	33					
ponds	136	33	33				
plant	135	32	32				
ongoing	134	32					
important	131	31					
city	127	31					
research	124	30					
natural	120	29	29				
developers	110	26	26				
pairs	93	22					
land	86	21	21				
cemeteries	78	19					
decline	72	17					
range	72	17					
local	70	17					
british	70	17					
house	67	16					
numbers	65	16					
affecting	63	15					
song	54	13					
middleton	39	9					
include	31	7					

Document:
Biodiversity Plan for Leeds

Categories	Ecological	Education	Social	Economic	Cultural
Total	674	0	0	31	49
Percent of Total	**89%**	**0%**	**0%**	**4%**	**6%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
species	168	100	100				
habitat	120	71	71				
plans	106	63	63				
grassland	105	62	62				
action	103	61					
area	95	57	57				
sites	91	54	54				
english	82	49					49
management	81	48					
local	68	40					
conservation	67	40	40				
wet	60	36					
population	54	32					
biodiversity	52	31					
key	50	30					
limestone	45	27	27				
national	45	27					
wildlife	43	26	26				
loss	42	25					
provide	37	22					
hedges	35	21	21				
city	34	20					
otter	34	20	20				
crayfish	33	20	20				
field	31	18	18			18	
newt	31	18	18				
water	28	17	17				
atlantic	27	16					
stream	26	15	15				
breeding	26	15	15				
advisory	25	15					
broomrape	25	15	15				
use	25	15					
bats	25	15	15				
harvest	22	13				13	

Document:
Biodiversity Plan for Liecester

Categories	Ecological	Education	Social	Economic	Cultural
Total	513	0	130	15	0
Percent of Total	**78%**	**0%**	**20%**	**2%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
city	106	100					
parks	101	95	95		95		
biodiversity	97	92					
lead	96	91					
partners	91	86					
wildlife	78	74	74				
green	68	64	64				
plan	55	52					
management	50	47					
habitats	49	46	46				
trees	46	43	43				
site	44	42					
local	41	39					
woodlands	39	37	37				
species	39	37	37				
public	37	35			35		
value	33	31					
action	31	29					
meadows	30	28	28				
data	30	28					
urban	28	26					
lowland	26	25	25				
mixed	26	25					
development	26	25	25				
rivers	22	21	21				
streams	19	18	18				
buildings	16	15				15	
change	13	12					
climate	9	8					

Document:
Biodiversity Plan for Lincoln

Categories	Ecological	Education	Social	Economic	Cultural
Total	1024	0	55	23	0
Percent of Total	**93%**	**0%**	**5%**	**2%**	**0%**

		Relevance	Categories				
Concept	Count	%	Ecological	Education	Social	Economic	Cultural
sites	133	100	100				
species	127	95	95				
biodiversity	111	83					
habitat	102	77	77				
nature	96	72	72				
city	87	65					
areas	86	65	65				
management	73	55					
common	70	53					
trees	68	51	51				
water	66	50	50				
planning	62	47					
conservation	61	46	46				
space	59	44	44				
bat	57	43	43				
development	53	40	40				
local	53	40					
park	50	38	38		38		
actions	50	38					
woodland	50	38	38				
ecological	47	35	35				
plants	47	35	35				
land	46	35	35				
wildlife	46	35	35				
priority	42	32					
important	42	32					
grassland	41	31	31				
green	38	29	29				
loss	33	25					
ensure	31	23					
information	31	23					
road	30	23	23			23	
lakes	30	23	23				
range	29	22					
south	26	20					
marsh	25	19	19				
public	23	17			17		

Document:
Biodiversity Plan for London

Categories	Ecological	Education	Social	Economic	Cultural
Total	230	0	29	6	4
Percent of Total	**86%**	**0%**	**11%**	**2%**	**1%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	1225	100					
mayor	622	51					
strategy	534	44					
nature	496	40	40				
conservation	422	34	34				
plans	390	32					
importance	378	31					
wildlife	367	30	30				
proposal	359	29					
boroughs	343	28					
site	279	23	23				
action	272	22					
local	270	22					
development	258	21					
spaces	246	20	20				
city	245	20					
green	232	19	19				
organization	218	18					
lead	191	16					
partners	183	15					
area	170	14	14				
partnership	164	13					
land	164	13	13				
brown	97	8					
accessible	95	8			8		
environment	91	7	7				
people	89	7			7		
environmental	87	7	7				
artificial	85	7					
survey	83	7					
etc.	68	6					
park	67	5	5		5		

quality	67	5					
used	64	5					
community	63	5			5		
sea	56	5	5				
health	54	4			4	4	
planted	53	4	4				
butterflies	52	4	4				
gardening	49	4					4
trust	35	3					
example	34	3					
water	31	3	3				
port	28	2				2	
rivers	25	2	2				

Document:

Biodiversity Plan for Melbourne

Categories	Ecological	Education	Social	Economic	Cultural
Total	440	0	0	0	0
Percent of Total	**100%**	**0%**	**0%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
conservation	396	100	100				
required	290	73					
environmental	288	73	73				
planning	240	61					
appropriate	233	59					
minister	227	57					
contribution	227	57					
habitat	225	57	57				
managed	224	57					
zone	216	55					
land	214	54	54				
significance	168	42					
native	168	42	42				
vegetation	167	42	42				
following	144	36					
frog	96	24	24				
grass	96	24	24				
growling	96	24	24				
golden	96	24					
southern	47	12					
factors	45	11					

Document:
Biodiversity Plan for Mexico City

Categories	Ecological	Education	Social	Economic	Cultural
Total	358	11	23	61	0
Percent of Total	**79%**	**2%**	**5%**	**13%**	**0%**

		Relevance	Categories				
Concept	Count	%	Ecological	Education	Social	Economic	Cultural
biodiversity	238	100					
city	222	93					
environmental	133	56	56				
conservation	129	54	54				
sustainable	104	44	44			44	
development	96	40	40				
use	94	39					
species	85	36	36				
action	78	33					
programs	73	31					
plan	72	30					
objectives	61	26					
protection	60	25	25				
management	53	22					
government	53	22					
promote	51	21					
local	51	21					
sma	51	21					
natural	50	21	21				
activities	50	21					
area	50	21	21				
permanent	49	21					
different	46	19					
resources	41	17				17	
environment	41	17	17				
wildlife	41	17	17				
population	40	17					
ecosystems	38	16	16				
general	30	13					
social	29	12			12		
term	29	12					
educational	26	11		11			
green	26	11	11				
public	26	11			11		
urban	25	11					
federal	24	10					
change	23	10					

Document:
Biodiversity Plan for Nagoya

Categories	Ecological	Education	Social	Economic	Cultural
Total	631	0	113	60	68
Percent of Total	**72%**	**0%**	**13%**	**7%**	**8%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
areas	211	100	100				
living	185	88					
nature	175	83	83				
biodiversity	167	79					
city	156	74					
things	154	73					
water	109	52	52				
environment	95	45	45				
strategy	92	44					
river	87	41	41				
use	84	40					
urban	82	39					
green	81	38	38				
land	80	38	38				
development	75	36	36				
activities	74	35					
policy	72	34					
people	67	32			32		
ecosystem	64	30	30				
life	63	30					
species	62	29	29				
conservation	61	29	29				
trends	61	29					
citizens	60	28			28		
resources	54	26				26	
environmental	51	24	24				
diversity	50	24					
pine	50	24	24				
mammals	46	22	22				
certification	46	22					
products	41	19					
japanese	40	19					19
rice	40	19			19	19	19
human	40	19			19		
century	39	18					
introduced	38	18					
dwindling	36	17					
creation	32	15					15
food	32	15			15	15	15
tidal	31	15	15				
field	27	13	13				
frog	26	12	12				

Document:
Biodiversity Plan for Newcastle and North Tyneside

Categories	Ecological	Education	Social	Economic	Cultural
Total	703	0	21	0	19
Percent of Total	**95%**	**0%**	**3%**	**0%**	**3%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
habitat	224	100	100				
sites	198	88	88				
species	158	71	71				
areas	153	68	68				
north	118	53					
wildlife	104	46	46				
management	93	42					
birds	83	37	37				
water	83	37	37				
woodland	73	33	33				
loss	67	30					
current	61	27					
grassland	60	27	27				
local	59	26					
important	51	23					
status	51	23					
urban	50	22					
provide	50	22					
land	49	22	22				
ponds	49	22	22				
scrub	47	21	21				
river	47	21	21				
park	46	21	21		21		
use	45	20					
development	44	20	20				
biodiversity	44	20					
gardens	42	19					19
description	40	18					
protection	37	17	17				
concern	36	16					
houses	32	14					
conservation	30	13	13				
associated	30	13					
breeding	30	13	13				
red	30	13	13				
nest	30	13	13				
watercourses	26	12					
grey	21	9					

Document:
Biodiversity Plan for North Merseyside

Categories	Ecological	Education	Social	Economic	Cultural
Total	461	0	15	14	8
Percent of Total	**93%**	**0%**	**3%**	**3%**	**2%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
action	1111	100					
priority	1031	93					
managers	637	57					
local	554	50	50				
habitat	552	50	50				
sites	545	49	49				
plans	435	39					
species	428	39	39				
national	361	32					
sefton	348	31					
dunes	344	31	31				
woodland	326	29	29				
land	284	26	26				
ensure	266	24					
wildlife	253	23	23				
conservation	252	23	23				
development	231	21	21				
survey	230	21					
urban	214	19					
causing	212	19					
biodiversity	208	19					
green	206	19	19				
appropriate	205	18					
target	188	17					
reserves	179	16					
botanical	170	15	15		15		
pairs	162	15					
range	155	14					
infrastructure	153	14				14	
sand	150	14	14				
water	147	13	13				
area	133	12	12				
environmental	132	12	12				
status	131	12					
ainsdale	117	11					
trees	110	10	10				
pesticides	108	10					
tetrads	103	9	9				
liverpool	94	8					
countryside	86	8	8				8
plant	84	8	8				
include	66	6					

Document:

Biodiversity Plan for Norwich

Categories	Ecological	Education	Social	Economic	Cultural
Total	176	0	37	0	17
Percent of Total	**77%**	**0%**	**16%**	**0%**	**7%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
city	82	100					
wildlife	37	45	45				
local	33	40					
biodiversity	33	40					
action	31	38					
including	24	29					
species	24	29	29				
habitats	19	23	23				
community	17	21			21		
plans	16	20					
sites	15	18	18				
involvement	15	18					
gardens	14	17					17
river	14	17	17				
urban	14	17					
park	13	16	16		16		
marston	13	16					
earlham	13	16					
marsh	12	15	15				
county	11	13					
wood	11	13	13				
protect	10	12					
centre	6	7					

Document:

Biodiversity Plan for Paris

Categories	Ecological	Education	Social	Economic	Cultural
Total	119	70	30	0	0
Percent of Total	**54%**	**32%**	**14%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	37	100					
awareness	26	70		70			
ecological	24	65	65				
site	15	41					
workshops	11	30					
green	10	27	27				
plan	9	24					
scale	7	19					
strengthen	7	19					
spaces	7	19	19				
regional	6	16					
professionals	6	16					
sites	6	16					
actions	6	16					
participative	6	16			16		
community	5	14			14		
approach	5	14					
underway	5	14					
proposals	5	14					
environmental	3	8	8				

Document:
Biodiversity Plan for Portsmouth

Categories	Ecological	Education	Social	Economic	Cultural
Total	639	0	0	0	0
Percent of Total	**100%**	**0%**	**0%**	**0%**	**0%**

		Relevance	Categories				
Concept	Count	%	Ecological	Education	Social	Economic	Cultural
areas	181	100	100				
sites	169	93	93				
biodiversity	160	88					
scarce	145	80					
portsmouth	140	77					
habitats	134	74	74				
local	113	62					
wildlife	112	62	62				
conservation	107	59	59				
important	93	51					
trust	75	41					
action	75	41					
email	70	39					
harbour	68	38					
managers	64	35					
group	59	33					
natural	55	30	30				
priority	54	30					
coastal	54	30	30				
tel	48	27					
water	48	27	27				
land	46	25	25				
includes	43	24					
bap	42	23					
develop	42	23					
grasslands	39	22	22				
island	34	19	19				
solent	34	19					
environment	33	18	18				
common	32	18	18				
bird	31	17	17				
green	31	17	17				
england	30	17					
south	29	16					
lotus	29	16	16				
supports	27	15					
sea	22	12	12				
lane	21	12					
portsdown	20	11					

Document:

Biodiversity Plan for Saitama Prefecture

Categories	Ecological	Education	Social	Economic	Cultural
Total	551	0	36	18	18
Percent of Total	**88%**	**0%**	**6%**	**3%**	**3%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	40	100					
biological	34	85	85				
diversity	34	85					
conservation	28	70	70				
plants	28	70	70				
animals	27	68	68				
prefectural	26	65					
species	17	42	42				
natural	14	35	35				
developed	13	32	32				
environment	12	30	30				
rivers	11	28	28				
different	11	28					
creatures	10	25	25				
protect	9	22	22				
habitat	9	22	22				
spaces	9	22	22				
japan	9	22					
data	7	18					
book	7	18					
red	7	18					
people	7	18			18		
food	7	18			18	18	18
take	6	15					

Document:

Biodiversity Plan for São Paulo

Categories	Ecological	Education	Social	Economic	Cultural
Total	138	0	9	0	11
Percent of Total	**87%**	**0%**	**6%**	**0%**	**7%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	56	100					
municipal	35	62					
city	30	54					
plan	21	38					
promote	18	32					
encourage	16	29					
species	16	29	29				
areas	15	27	27				
fauna	13	23	23				
related	12	21					
public	11	20					
environmental	11	20	20				
conservation	10	18	18				
green	7	12	12				
projects	7	12					
legal	7	12					
create	6	11					11
increase	6	11					
production	6	11					
information	6	11					
parks	5	9	9		9		
use	5	9					

Document:
Biodiversity Plan for Schaumburg

Categories	Ecological	Education	Social	Economic	Cultural
Total	1099	0	101	0	0
Percent of Total	**92%**	**0%**	**8%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
areas	256	100	100				
restoration	226	88	88				
village	223	87					
site	201	79	79				
natural	194	76	76				
wetland	174	68	68				
management	167	65					
plant	159	62	62				
include	154	60					
water	151	59	59				
species	150	59	59				
community	148	58			58		
native	141	55	55				
provides	136	53					
development	135	53	53				
ecological	134	52	52				
ponds	129	50	50				
quality	120	47					
land	120	47	47				
program	117	46					
habitat	113	44	44				
detention	110	43					
use	102	40					
plan	99	39					
systems	96	38					
grass	95	37	37				
section	93	36					
creek	93	36	36				
vegetation	91	36	36				
projects	90	35					
biodiversity	88	34					
cover	78	30					

work	77	30					
potential	71	28					
conservation	67	26	26				
park	66	26	26		26		
contact	64	25					
stormwater	61	24					
wildlife	60	23	23				
during	50	20					
public	43	17			17		
bluestem	38	15	15				
milkweed	21	8	8				

Document:
Biodiversity Plan for Seoul

Categories	Ecological	Education	Social	Economic	Cultural
Total	539	0	119	0	0
Percent of Total	**82%**	**0%**	**18%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
metropolitan	250	100					
area	168	67	67				
city	160	64					
ecosystem	152	61	61				
government	134	54					
park	121	48	48		48		
management	104	42					
conservation	96	38	38				
project	96	38					
green	95	38	38				
children	87	35			35		
biodiversity	79	32					
plants	73	29	29				
development	67	27	27				
citizens	66	26			26		
total	64	26					
species	64	26	26				
landscape	57	23	23				
consisting	57	23					
animals	55	22	22				
quercus	54	22	22				
figure	54	22					
wild	52	21	21				
kil-dong	47	19	19				
act	47	19					
urban	44	18					
biotope	43	17	17				
hangang	40	16	16				
spaces	37	15					
local	36	14					
stream	36	14	14				
environmental	34	14	14				
various	30	12					
assessment	28	11					
water	26	10	10				
birds	25	10	10				
public	24	10			10		
restoring	23	9	9				
oak	21	8	8				
originates	12	5					

Document:
Biodiversity Plan for Sheffield

Categories	Ecological	Education	Social	Economic	Cultural
Total	581	0	96	0	82
Percent of Total	**77%**	**0%**	**13%**	**0%**	**11%**

		Relevance	Categories				
Concept	Count	%	Ecological	Education	Social	Economic	Cultural
species	352	100	100				
sites	258	73					
managers	244	69					
natural	225	64	64				
conservation	214	61	61				
local	214	61					
areas	206	59	59				
water	187	53	53				
ancient	169	48					48
steering	160	45					
birds	155	44	44				
directive	144	41					
city	132	38					
use	130	37					
public	126	36			36		
action	124	35					
wildlife	124	35	35				
sheff	123	35					
urban	121	34					
history	120	34					34
breeding	118	34	34				
current	117	33					
decline	113	32					
habita	111	32	32				
society	107	30			30		
partnership	106	30			30		
biodiversity	103	29					
support	100	28					
south	99	28					
hedgerows	99	28	28				
national	94	27					
crayfish	94	27	27				
land	93	26	26				
advice	92	26					
ensure	89	25					
loss	86	24					
widie	80	23					
trust	76	22					
streams	65	18	18				
associated	60	17					
house	42	12					

Document:
Biodiversity Plan for Sikkim

Categories	Ecological	Education	Social	Economic	Cultural
Total	427	0	38	18	0
Percent of Total	**88%**	**0%**	**8%**	**4%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	134	100					
conservation	108	81	81				
species	80	60	60				
develop	69	51	51				
plants	53	40	40				
forest	53	40	40				
areas	52	39	39				
action	40	30					
management	38	28					
local	37	28					
different	36	27					
including	36	27					
use	36	27					
diversity	33	25					
government	31	23					
change	31	23					
research	31	23					
national	30	22					
communities	30	22			22		
identify	30	22					
biological	28	21	21				
support	26	19					
institutions	24	18					
natural	24	18	18				
resources	24	18					
agriculture	24	18				18	
wildlife	22	16	16				
wild	22	16	16				
endangered	21	16	16				
park	21	16	16		16		
actions	20	15					
fauna	18	13	13				
various	15	11					

Document:
Biodiversity Plan for Singapore

Categories	Ecological	Education	Social	Economic	Cultural
Total	303	11	23	0	11
Percent of Total	**87%**	**3%**	**7%**	**0%**	**3%**

		Relevance	Categories				
Concept	Count	%	Ecological	Education	Social	Economic	Cultural
biodiversity	89	100					
conservation	82	92	92				
nature	70	79	79				
species	33	37	37				
natural	22	25	25				
city	22	25					
programme	20	22					
environment	17	19	19				
nparks	14	16					
national	14	16					
international	13	15					
development	13	15	15				
world	13	15					
ecosystems	13	15	15				
use	12	13					
reserve	12	13					
public	11	12			12		
management	11	12					
monitoring	11	12					
groups	10	11					
biological	10	11	11				
diversity	10	11					
people	10	11			11		
chek	10	11					
school	10	11		11			
beautiful	10	11					11
various	9	10					
pulau	9	10	10				

Document:
Biodiversity Plan for Southampton

Categories	Ecological	Education	Social	Economic	Cultural
Total	535	24	45	0	0
Percent of Total	**89%**	**4%**	**7%**	**0%**	**0%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	183	100					
nature	167	91	91				
city	123	67					
conservation	121	66	66				
local	113	62					
sites	101	55	55				
plan	99	54					
council	98	54					
spaces	93	51	51				
development	86	47	47				
policy	71	39					
wildlife	70	38	38				
strategy	68	37					
information	68	37					
protection	65	36					
management	65	36	36				
environment	62	34	34				
species	61	33	33				
provide	57	31					
community	55	30			30		
area	54	30	30				
action	52	28					
important	50	27					
habitats	49	27	27				
access	47	26					
public	46	25					
work	46	25					
education	44	24		24			
use	42	23					
authorities	34	19					
national	32	17					
environmental	32	17	17				
interest	28	15					
government	28	15					
people	28	15			15		
special	27	15					
common	19	10	10				

Document:
Biodiversity Plan for Waitakere

Categories	Ecological	Education	Social	Economic	Cultural
Total	302	0	26	45	23
Percent of Total	**76%**	**0%**	**7%**	**11%**	**6%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
biodiversity	110	100					
initial	108	98					
strategy	87	79					
funding	83	75					
action	79	72					
management	60	55					
species	60	55	55				
area	51	46	46				
ranges	44	40					
ecosystems	44	40	40				
city	39	35					
council	34	31					
provide	32	29					
regional	32	29					
community	29	26			26		
natural	28	25	25				
green	25	23	23				
resources	25	23				23	
indigenous	25	23					23
conservation	24	22	22				
services	24	22				22	
native	23	21	21				
habitat	23	21	21				
goal	22	20					
local	20	18					
environment	19	17	17				
water	19	17	17				
streams	17	15	15				
use	16	15					

Document:
Biodiversity Plan for Westminster

Categories	Ecological	Education	Social	Economic	Cultural
Total	608	0	41	0	22
Percent of Total	**91%**	**0%**	**6%**	**0%**	**3%**

Concept	Count	Relevance %	Categories				
			Ecological	Education	Social	Economic	Cultural
plan	204	100					
parks	200	98	98				
action	199	98					
biodiversity	147	72					
habitat	107	52	52				
green	99	49	49				
spaces	95	47	47				
species	90	44	44				
bats	85	42	42				
society	84	41			41		
wildlife	77	38	38				
date	76	37					
city	74	36					
management	74	36					
sites	73	36	36				
house	66	32					
water	64	31	31				
thames	62	30	30				
royal	61	30					
develop	60	29					
environment	52	25	25				
conservation	52	25	25				
regent,Äôs	48	24					
area	46	23	23				
group	45	22					
garden	45	22					22
birds	44	22	22				
hedgehogs	33	16	16				
snout	32	16	16				
local	30	15					
land	29	14	14				

Document:
Biodiversity Plan for Worcestershire

Categories	Ecological	Education	Social	Economic	Cultural
Total	855	0	0	49	0
Percent of Total	**95%**	**0%**	**0%**	**5%**	**0%**

		Relevance	Categories				
Concept	Count	%	Ecological	Education	Social	Economic	Cultural
habitat	811	100	100				
sites	778	96	96				
management	734	91					
action	590	73					
plan	552	68	68				
species	483	60	60				
areas	437	54	54				
wildlife	416	51	51				
biodiversity	415	51					
nature	411	51	51				
conservation	382	47	47				
current	368	45					
survey	368	45					
tree	346	43	43				
county	330	41					
grassland	311	38	38				
water	310	38	38				
plantations	286	35				35	
rivers	279	34	34				
local	274	34					
trust	267	33					
wyre	256	32	32				
grafton	241	30					
summary	237	29					
legal	235	29					
scrub	213	26	26				
development	208	26					
ponds	199	25	25				
recorded	186	23					
national	179	22					
data	175	22					
research	172	21					
project	165	20					
population	163	20					
hills	161	20	20				
legislation	156	19					
further	152	19					
status	147	18					
information	147	18					
distribution	145	18					
land	144	18	18				

environment	139	17	17				
using	136	17					
severn	128	16					
arable	114	14				14	
act	111	14					
range	103	13					
ground	82	10	10				
warbler	80	10	10				
bird	73	9	9				
grebe	64	8	8				
hartlebury	60	7					

APPENDIX X.8

PARTICIPATORY/NON-PARTICIPATORY PLAN DESIGNATION DATA

Documents:
Biodiversity Plans

Location	Participatory	Relevant Text
Aichi Prefecture	yes	p. 2 Fundamental Approaches (3) Encourage widespread participation and cooperation: build a network of residents, businessmen, non-profit organizations, and specialists that can collaborate on many fronts.
Auckland	no	-
Bonn	yes	P. 84 "Germany – including the City of Bonn – has an extensive system, most of it legally enshrined, for enabling the public to participate in decisions. In planning, for example (land-use plan, development (building) plans, etc.), legal obligations apply whereby the public must be informed at an early stage, and drafts of plans must be publicly displayed. In a complementary regulation, authorities and other institutions responsible for the public interest must be requested to provide opinions relative to proposed plans. Furthermore, citizens have the option – acting either on their own, as private persons, or as members of nature conservation associations or citizens' associations / initiatives – to be informed about municipal decisions. Working in relevant associations, citizens can also help shape decisions – in the present context, via the relevant landscape advisory boards.
Cape Town	no	p. 13 "extensive consultation involving various interested parties, including local government and non governmental organizations
Chiba Prefecture	yes	p. 4-5 Citizen participation and town meetings, with diagram. "with the help of Chiba's citizens, experts, and the prefectural government."
Chicago, IL	no	p. 6 lists contributors, including NGOs, city departments, businesses, and federal agencies
Curitiba	no	

Edmonton	yes	p. 17 "extensive public engagement process"
eThekwini (Durban)	no	-
Johannesburg	no	p. 13 "Municipal Systems Act (2000) According to the Municipal System Act (Act No. 32 of 2000), all municipalities have to undertake an integrated development planning process to produce integrated development plans (IDPS). Integrated development planning is a process by which municipalities prepare 5 year strategic plans that are reviewed annually in consultation with communities and stakeholders.
Joondalup	no	-
Melbourne	no	p. 12 diagrams the process, with a public input for the environmental impact report only
Mexico City	yes	p. 29. Four workshops with 30 collaborators (2 planners, 1 lawyer, the rest environmentalists, all professionals) were held June-Sep 2012, which identified the main problems of biodiversity in the city and corresponding objectives and activities.
Nagoya	yes	p. 5 of chapter one outlines the process, with public participation, academia, and NPOs
Paris	yes	p. 1-3 discuss public participation, involves experts, professionals, NGOs, public, has an internet input component.
Saitama Prefecture	no	-
Sao Paulo	no	-
Schaumburg, IL	no	- consultant working with the city
Seoul	no	p. 49 section on Integration discusses mainstreaming across departments p. 56-57 section 4 on Public Participation discusses the Green Seoul Citizens Committee, and how the plan supports many citizen-led initiatives, but does not discuss citizen input.
Sikkim	yes	p. 44 an initial workshop with gov't, academia, NGOs, business, and local citizens generated the draft for the plan and a follow up workshop allowed for more input
Singapore	yes	p. 2 last paragraph discusses the importance of community involvement

Waitakere (now Auckland)	no	p. 12-13 Acknowledges roles for maintaining biodiversity by the Ministry for Environment, Dept of Conservation, Auckland Regional Council, Waitakere City Council, Conservation Groups, Land Owners, and Iwi (indigenous groups).
Belfast	yes	p. 24 "For the local population to gain ownership of the LBAP process, we consulted with the general public and those who are currently involved with biodiversity, both at a strategic level and on the ground. This was achieved by various means, including letter, personal interview and workshops. In particular, consultees were asked what issues were important to them and what they considered to be the priorities for biodiversity in Belfast.
Birmingham and Black Country	no	-
Brighton & Hove	no	-
Bristol	no	p. 44 "The Engagement of Business – a vision ‘We want to see business automatically engaging in managing and reporting on biodiversity as an integral part of its processes and activities’"
Cardiff	no	-
Cork City (in Cork County)	yes	p. 15 discusses the Biodiversity Working Group of govt' departments, academia, NGOs, development orgs and local interest groups. It also talks about public consultation including input and a questionnaire
Dublin	yes	p. 7 mayor's statement says "I welcome the actions of the Plan that include both local community and business participation."
Dun Laoghaire-Rathdown	yes	p. 34 list of Biodiversity Plan Forum Group, including NGOs, timetable of planning process including 2 public consultation meetings back-to-back, early in the process
Edinburgh	yes	p. 3 describes partnership working and community involvement process, which indicates heavy volunteer participation and implementation.

Exeter	no	p. 11 mentions "encouraging partnership working where it helps to achieve targets" and lists local authorities, agencies, public, landowners
Glasgow	no	
Greater Manchester	no	-
Greenwich (in London)	no	-
Kingston upon Hull	no	
Leeds	no	p. 7 states that "to succeed, the BAP for Leeds must… engag(e) new partners, such as local businesses" p. 8 steering group includes ngos
Leicester	no	-
Lincoln	yes	p. 19 in 2003 consultation with agencies, volunteer groups, and local residents. community consultation in 2004/05,
London Region	yes	p. 161-163 discusses the consultation process, as required by law, which involves sending out drafts for comment, holding workshops, and sending out questionairres to the public p. 5 "This Action Plan has been produced by the City of London Biodiversity Partnership which is made up of the City of London Corporation, City residents, workers, children, conservation groups and ecologists"
Newcastle and North Tyneside	no	-
North Merseyside	no	
Norwich	no	-
Portsmouth	no	-
Sheffield	no	-
Southampton	yes	p. 33 public event with questions to determine public support for wildlife
Westminster (in London)	no	-
Worcestershire	no	

BIBLIOGRAPHY

Abukhater, Ahmed Baha' El-Deen. 2009. "Rethinking Planning Theory and Practice: A Glimmer of Light for Prospects of Integrated Planning to Combat Complex Urban Realities," *Theoretical and Empirical Researches in Urban Management* 2, no. 11 (May): 64-79.

Ackoff, Russell L. 1981. "The Art and Science of Mess Management." *Interfaces* 11, no. 1 (February): 20-26. *Business Source Complete*, EBSCO*host* (accessed October 1, 2012).

Alexander, Christopher. (1980) *The Nature of Order: An Essay on the Art of Building and the Nature of the Universe: Book Three, A Vision of a Living World*. Berkeley: The Center for Environmental Structure.

Alexander, Christopher, Sara Ishikawa, and Murray Silverstein. 1977. *A pattern language: towns, buildings, construction*. New York: Oxford University Press.

Alfsen-Norodom, Christine, Benjamin D. Lane, and Melody Corry. 2004. *Urban biosphere and society: partnership of cities*. New York, N.Y.: New York Academy of Sciences.

Alfsen, Christine, Laura Dickinson, Keith Tidball, Vahan Galoumian, and Moramay Navarro. 2010. "The URBIS Partnership: An Approach to Achieve Social and Environmental Resilience in Urban Regions." *Policy Matters* 17: 95-99.

Altschuler, Alan. 1965. "The Goals of Comprehensive Planning." *Journal of the American Institute of Planners* 31, no. 3 (August): 186-195.

Arnstein, S R. 1969. A ladder of citizen participation," *Journal of the American Planning Association* 35, no. 4.

Asner, Gregory P. 2013. "Biological Diversity Mapping Comes of Age." Remote Sensing 5 (January):374-376. Doi 10.3390/rs5010374

Beatley, Tim. 2000a. *Green Urbanism: Learning from European Cities*. Washington D.C.: Island Press.

Beatley, Tim. 2000b. "Preserving Biodiversity: Challenges for Planners." *APA Journal* 66, no. 1 (Winter): 5-20.

Bell, S. 1998. "Self-Reflection and Vulnerability in Action Research: Bringing forth new worlds in our learning." *Systemic Practice and Action Research* 11: 179-91.

Bettencourt, Luis and Geoffrey West. 2010. "A Unified Theory of Urban Living." *Nature* 467 (October 21): 912-913. doi:10.1038/467912a

Bik EM, Long CD, Armitage GC, Loomer P, Emerson J, Mongodin EF, Nelson KE, Gill SR, Fraser-Liggett CM, Relman DA. 2010. "Bacterial diversity in the oral cavity of

10 healthy individuals." *International Study for Microbial Ecology Journal* 8 (Aug 4):962-74. doi: 10.1038/ismej.2010.30. Accessed April 7, 2013. http://www.ncbi.nlm.nih.gov/pubmed/20336157

Bilsborough, Darren. The Biophilic City: Can it improve economic prosperity? PB-CUSP Alliance and Parsons Brinkerhoff. Accessed April 7, 2013. http://www.cminus.com.au/media/download_gallery/PB-CUSP%20Biophilic%20Cities.pdf

Brabyn, Howard. 1974. "Man and the Biosphere." *Impact of Science On Society* 24, no. 3 (July 1): 221.

Brotman, Barbara. 2011. "Arbor Day Project to Sprout in Chicago." *Chicago Tribune*, April 25. Accessed April 14, 2013. http://articles.chicagotribune.com/2011-04-25/features/ct-talk-brotman-trees-0425-20110425_1_morton-arboretum-arbor-day-project-tags

Buck, Louise. 2001. *Biological diversity: balancing interests through adaptive collaborative management*. Boca Raton, FL: CRC Press.

Calvignac-Spencer, Sébastian, et al. 2013. "Carrion fly-derived DNA as a tool for comprehensive and cost-effective assessment of mammalian biodiversity." *Molecular Ecology* 22:915–924. Doi 10.1111/mec.12183.

Carpenter, S.R., Folke, C., Norström, A., Olsson, O., Schultz, L., Agarwal, B., Balvanera, P, Campbell, B., Castilla, J.C., Cramer, W. DeFries, R., Eyzaguirre, P., Hughes, T.p., Polasky, S., Sanusi, Z., Scholes, R. and Spierenberg, M. 2012. Program on ecosystem change and society: an international research strategy for integrated social-ecological systems. *Current Opinion in Environmental Sustainability* 4: 134-138.

Carreiro, Margaret M. and Wayne C. Zipperer. 2008. "Urban forestry and the eco-city: today and tomorrow." *Ecology, Planning, and Management of Urban Forests*: 435-456. Accessed May 3, 2013. http://www.srs.fs.usda.gov/pubs/ja/uncaptured/ja_carreiro001.pdf

Chivian, Eric, and Aaron Bernstein. 2008. *Sustaining life: how human health depends on biodiversity*. Oxford: Oxford University Press.

City of New York, Department of City Planning. 2011. Vision 2020: City of New York Comprehensive Waterfront Plan. (March). Accessed May 12, 2013. www.nyc.gov/waterfront.

Clavel, Pierre. 1986. *The Progressive City: Planning and Participation, 1969-1984*. New Brunswick: Rutgers University Press.

Collins, S.L., Carpenter, S.R., Swinton, S.M., Orenstein, D.E., Childers, D.L., Gregson, T.L., Grimm, N.B., Grove, J.M., Harlan, S.L., Kaye, J.P., Knapp, A.K., Kofinas, G.P., Magnuson, J.J., McDowell, W.H., Melack, J.M., Ogden, L.A., Robertson,

G.P., Smith, M.D., and A.C. Whitmer. 2011. "An integrated conceptual framework for long-term social, ecological research." *Frontiers in Ecology and the Environment* 9: 351-357.

Corner, James. 2006. Terra Fluxus. *Landscape Urbanism Reader*.

Cronon, William. 1991. *Nature's metropolis: Chicago and the Great West*. W.W. Norton, New York.

Curtis, William J. R. 1986. *Modern Architecture since 1900*. Phaidon, London.

Department of the Environment, Food and Rural Affairs (DEFRA). 2002. *Working with the Grain of Nature*. Defra Publications, London.

Dollinger, Doug. 2010. "Integrated Planning," *Optimum Online* 40, no.3 (Aug).

Eldredge, Niles, and S. J. Gould. 1972. "Punctuated equilibria: an alternative to phyletic gradualism." In *Models in Paleobiology*. Edited by S T.J.M. Schopf, 82-115. San Francisco: Freeman, Cooper and Company. http://www.blackwellpublishing.com/ridley/classictexts/eldredge.pdf

Elmqvist, T., Colding, J., Barthel, S., Borgström, S., Duit, A., Lundberg, J., Andersson, E., Ahrne, K., Ernstson, H., Folke, C., and J. Bengtsson. 2004. The Dynamics of Social-Ecological Systesm in Urban Landscapes: Stockholm and the National Urban Park, Sweden. *Ann. N.Y. Academy of Science* 1023: 308-322.

Ernstson, Henrik, van der Leeuw, Sander E., Redman, Charles L., Meffert, Douglas J., Davis, George, Alfsen, Christine, and Thomas Elmqvist. 2010. "Urban Transitions: On Urban Resilience and Human-Dominated Ecosystems." *AMBIO A Journal of the Human Environment* 39 (8): 531-545. Doi 10.1007/s13280-010-0081-9.

Fink, Daniel, Marshall Iliff, Steve Kelling, Brian Sullivan, and Chris Wood. 2011. "eBird engaging birders in science and conservation." *Public Library of Science Biology* 9, no. 12 (December).

Foddai D, Bonato L, Pereira LA, and Minelli A. 2003. "Phylogeny and systematics of the Arrupinae (Chilopoda: Geophilomorpha: Mecistocephalidae) with the description of a new dwarfed species." *Journal of Natural History* 37:1247–1267.

Fullilove, Mindy Thompson. 2013. *Urban Alchemy: Restoring Joy in America's Sorted-Out Cities*. New York: New Village Press.

Geddes, Patrick. (1915/1950) *Cities in evolution*. New York: Oxford University Press.

Geisler, Charles. 2010. "Must Biodiversity Hot-Spots Be Social Not-Spots? Win-win Ecology as Sustainable Social Policy." *Consilience: The Journal of Sustainable Development* 4, no. 1:119-133.

Gill, Nicholas, Waitt, Gordon, and Lesley head. 2009. "Local engagements with urban bushland: Moving beyond bounded practice for urban biodiversity management." *Landscape and Urban Planning* 93: 184-193.

Greene, Jennifer C., Caracelli, Valerie J., and Wendy F. Graham. 1989. "Toward a conceptual framework for mixed method evaluation designs." *Educational Evaluation and Policy Analysis* 11, 3 (Fall): 255-274.

Grierson, D. 2003. Arcology and Arcosanti1: Towards a sustainable built environment. *Electronic Green Journal* 18: 2-19. Accessed Sep 27 2014, http://search.proquest.com/docview/197582702?accountid=10267

Groves, Craig and The Nature Conservancy. *Drafting a Conservation Blueprint: A Practitioner's Guide to Planning for Biodiversity*. Washington, DC: Island Press, 2003.

Helmuth, Laura. 2008. "Our Imperiled Oceans: Seeing is Believing." *Smithsonian Magazine*. Accessed July 5, 2013. http://www.smithsonianmag.com/science-nature/seeing-is-believing.html#

Hulcr J, Latimer AM, Henley JB, Rountree NR, Fierer N, et al. 2012. "A Jungle in There: Bacteria in Belly Buttons are Highly Diverse, but Predictable." *Public Library of Science ONE* 7, no. 11. doi:10.1371/journal.pone.0047712. Accessed April 6, 2013. http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0047712

Hansen LJ and Hoffman JR. 2011. *Climate Savvy: Adapting Conservation and Resource Management to a Changing World*. Island Press, Washington DC.

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

Houdet, Joël. 2008. "Integrating Biodiversity into Business Strategies." *The Biodiversity Accountability Framework* (November).

Innes, Judith E., and David E. Booher. 2004. "Reframing Public Participation: Strategies for the 21st Century." *Planning Theory & Practice* 5, no. 4 (December): 419-436.

Irvine, Katherine N., et al. 2010. "Chapter 10: Ecological and Psychological Value of Urban Green Space." *Dimensions of the Sustainable City*. M. Jenks, C. Jones (eds.) Liecester: Springer Science and Business Media. doi 10.1007/978-1-4020-8647-2_10.

James, P. at. Al. 2009. "Towards an Integrated understanding of green space in the European built environment." *Urban Forestry and Urban Greening* 8: 65-75.

Joll, James. 1977. *Antonio Gramsci*. New York: Penguin Books.

Kowarik, Ingo. 2011. "Novel Urban Ecosystems, Biodiversity, and Conservation." *Environmental Pollution* 159: 1974-1983.

Kennedy, Christopher, et al. 2012. "Sustainable Urban Systems: An Integrated Approach." *Journal of Industrial Ecology* 16, no. 6: 775-779.

Ki-moon, Ban. 2012. "Remarks to 'Cities Leadership Day.'" *UN News Centre* (21 June). Accessed 12 March 2013. http://www.un.org/apps/news/infocus/sgspeeches/statments_full.asp?statID=1575#.UVsInRn8slE

Kurz, Tim and Catherine Baudains. 2012. "Biodiversity in the Front Yard: An Investigation of Landscape Preference in a Domestic Urban Context." *Environment and Behavior* 44, no. 2 (March): 166-196.

Lawton J., May, R. 1995. *Extinction Rates*. Oxford University Press, Science.

Lenzen, M., D. Moran, K. Kanemoto, B. FOran, L. Lobefaro and A. Geschke. 2012. "International trade drives biodiversity threats in developing nations." *Nature* 486 (June 7): 109-112.

Leakey, Richard E. 1994. *The origin of humankind*. New York: BasicBooks.

Llana, Sara Miller. 2012. "Rio+20 welcomes heads of state, but change driven at local level." *Christian Science Monitor* (June 20, 2:34 pm EDT). Accessed 12 March 2013. http://www.csmonitor.com/World/Americas/2012/0620/Rio-20-welcomes-heads-of-state-but-change-driven-at-local-level

Liu, J., Dietz, T., Carpenter, S.R., Alberti, M., Folke, C., Moran, E., Pell, A.N., Deadman, P., Kratz, T., Lubchenco, J., Ostrom, E., Ouyang, Z., Provencher, W., Redman, C.L., Schneider, S.H., and W.W. Taylor. 2007. "Complexity of Coupled Human and Natural Systems." *Science New Series* 317 (September 14): 1513-1516.

Löfvenhaft, Katarina, Cristina Björn, and Margareta Ihse. 2002. "Biotope Patterns in urban areas: a conceptual model integrating biodiversity issues in spatial planning." *Landscape and Urban Planning* 58: 223-240.

Lowenthal D. (1990) "Awareness of human impacts: Changing attitudes and emphases. In *The Earth as transformed by human action*, ed. B. L. Turner II et al. New York: Cambridge University Press.

Mader, André, Sheila Patrickson, Elisa Calcaterra, and Jacques Smit. 2011. *TEEB Manual for Cities: Ecosystem Services in Urban Management*. Geneva: The Economics of Ecosystems and Biodiversity. Accessed April 6, 2013. http://www.teebtest.org:80/wp-conten...0Manual%20for%20Cities_English.pdf

Marsh, G. P. (1864/1965) *Man and Nature*. Ed. D. Lowenthal. Cambridge University Press.

Marzluff, John M. 2005. "Island Biogeography for an urbanizing world: how extinction and colonization may determine biological diversity in human-dominated landscapes." *Urban Ecosystems* 8: 157-177.

McFadden, Ted and Andrew Smith. Leximancer customer support. Personal email communication. April 14, 2013.

McHarg, Ian. (1967) *Design with Nature*. Garden City, N.Y.: Natural History Press.

Meadowcroft, J. 1997. Planning, Democracy and the Challenge of Sustainable Development, *International Political Science Review* 18, no. 2: 167-189.

Miller, G. Tyler, and Scott Spoolman. 2012. *Sustaining the Earth: an integrated approach*. Australia: Brooks/Cole, Cengage Learning,

Mora C, Tittensor DP, Adl S, Simpson AGB, Worm B. 2011. "How Many Species Are There on Earth and in the Ocean?" *Public Library of Science Biology* 9, no. 8. doi:10.1371/journal.pbio.1001127

Nagoya Declaration: Towards a social ecological approach to urban planning. October 23, 2010. Acquired as a pdf via personal email from Keith Tidball on 21 March 2013.

Navarro, Moramay, & Tidball, Keith G. 2012. Challenges of biodiversity education: A review of education strategies for conserving biodiversity. *International Electronic Journal of Environmental Education 2*, no. 1. Accessed May 7, 2013. http://www.iejeegreen.com/index.php/iejeegreen/article/view/42/26.

Newman, Catherine, Jeremy A. Feinberg, Leslie Rissler, Joanna Burger, and Bradley Shaffer. 2012. "A new species of leopard frog (Anura: Ranidae) from the urban northeastern US." *Molecular Phylogenetics and Evolution* 63, no. 2 (May): 445-455.

Nara National Research Institute for Cultural Properties (NNRICP). 2009. *Paradise and Gardens in Eastern Asia*. Okamura Printing Industries, Nara. Pdf. Accessed Sep 27, 2014. http://www.nabunken.go.jp/org/bunka/pdf/pgea-eng.pdf

Oberndorfer E, Lundholm J, Bass B, Coffman RR, Doshi H, Dunett N, Gaffin S, Kohler M, Liu KKY, Rowe B. 2007. "Green roofs as urban ecosystems: ecological structures, functions, and services." *BioScience* 57: 823–833.

O'Brien, Geoff, et al. 2008. "Climate adaptation from a poverty perspective." *Climate Policy* 8: 194-201.

Penn-Edwards, Sorrel. 2010. "Computer Aided Phenomenography: The Role of Leximancer Computer Software in Phenomenographic Investigation." *The Qualitative Report* 15, 2 (March): 252-267.

Pierce, Jennifer Rae. 2014a. *The Bioshed of Jerusalem: a model for urban biodiversity planning, visioning, and communicating*. Master's Thesis for Central European University. July.

---. 2014b. *The Nature of Mainstreaming: A Local Integrated Planning Toolkit for Biodiversity*. ICLEI Cities Biodiversity Center. May.

---. 2014c. *Planning for Urban Biodiversity in a Divided World*. PolicyMIX conference. Feb.

Platt, Rutherford H., Rowan A. Rowntree, and Pamela C. Muick. (1994) *The Ecological city: preserving and restoring urban biodiversity*. Amherst: University of Massachusetts Press.

Platt, R. H. (1972) "The open space decision process: spatial allocation of costs and benefits." Research paper 142. Chicago: University of Chicago Department of Geography.

Posey, Darrell Addison. 1999. *Cultural and spiritual values of biodiversity*. London: Intermediate Technology.

Prip, C; Gross, T; Johnston, S; Vierros, M. 2010. *Biodiversity Planning: an assessment of national biodiversity strategies and action plans*. United Nations University Institute of Advanced Studies, Yokohama, Japan.

Puppim de Oliveira, J.A., et al. 2011. "Cities and Biodiversity: Perspectives and governance challenges for implementing the convention on biological diversity (CBD) at the city level." *Biological Conservation* 144: 1302-1313.

Purcel, Mark. 2008. *Recapturing Democracy: Neoliberalization and the Struggle for Alternative Urban Futures*. New York: Routledge.

Pyle, R. M. 2003. "Nature matrix: reconnecting people and nature." *Oryx* 37: 206–14.

Ramaswami, Anu, et al. 2012. "A Social-Ecological-Infrastructural Systems Framework for Interdisciplinary Study of Sustainable City Systems: An Integrative Curriculum Across Seven Major Disciplines." *Journal of Industrial Ecology* 16, no. 6: 801-813.

Rees, William and Mathis Wackernagel. 1996. "Urban ecological footprints: Why cities cannot be sustainable—And why they are a key to sustainability." *Environmental Impact Assessment Review* 16, no. 4–6 (July–November): 223-248. doi 10.1016/S0195-9255(96)00022-4. Accessed 5 July, 2013. http://www.sciencedirect.com/science/article/pii/S0195925596000224

Register, Richard. 2006. *Ecocities rebuilding cities in balance with nature*. Gabriola, B.C.: New Society Publishers. http://public.eblib.com/EBLPublic/PublicView.do?ptiID=478800.

Rittel, H.W.J., Webber, M.M. 1973. "Dilemmas in a general theory of planning," *Policy Sciences* 4: 155–169.

Rockström, Johan. 2009. "A Safe Operating Space for Humanity." *Nature* 461 (24 September): 472-475.

Rybczynski, Witold. 2010. *Makeshift metropolis: ideas about cities*. New York: Scribner.

Sagoff, Mark. 2005. "Do Non-native Plant Species Threaten The Natural Environment?" *Journal of Agricultural and Environmental Ethics* 18: 215-236. Doi 10.1007/s10806-005-1500-y

Sanderson, Eric W. 2009. *Mannahatta: a natural history of New York City*. New York: Abrams.

Savard, Jean-Pierre L., Philippe Clergeaub, and Gwenaelle Mennechez. 2000. "Biodiversity concepts and urban ecosystems." *Landscape and Urban Planning* 48:131-142.

Secretariat of the Convention on Biological Diversity (SCBD). 2012. Cities and Biodiversity Outlook - Action and Policy. Montreal. Accessed Dec. 28, 2012. http://www.cbd.int/en/subnational/partners-and-initiatives/cbo/cbo-action-and-policy-executive-summary/cbd-cbo1-book-f-web-rev2

--- 2013. DRAFT Cities and Biodiversity Outlook - Scientific Analysis and Assessment. Montreal, chapters 2, 3, 4, 7, 8, 10. Accessed March 3, 2013. http://www.cbd.int/en/subnational/partners-and-initiatives/cbo/cbo-action-and-policy-executive-summary

--- 2010. *Global Biodiversity Outlook 3*. Montréal, 94 pages.

--- 2004. *CBD Guidelines: Addis Ababa Principles and Guidelines for the Sustainable Use of Biodiversity*. Accessed Dec 28, 2012. http://www.cbd.int/sustainable/addis.shtml

Singapore National Parks Board. 2008. Concept Paper on The Development of A City Biodiversity Index Within the Convention on Biological Diversity, Version 2. Accessed March 8, 2013. http://www.cbd.int/doc/groups/cities/cities-2008-bio-index-en.doc

Smith, A. E., and Humphreys, M. S. 2006. "Evaluation of unsupervised semantic mapping of natural language with Leximancer concept mapping." *Behavior Research Methods* 38, 2: 262-279.

Smith, Tierney. 2012. "After Rio+20 stalemate and impasse at UNFCC talks is it time to focus locally on climate action?" *Responding to Climate Change* 7 (July, 6:33 am). Accessed 12 March 2013. http://www.rtcc.org/after-rio20-stalemate-and-impasse-at-unfccc-talks-is-it-time-to-focus-locally-on-climate-action/

Sorace, A. 2001. "Value to wildlife of urban-agricultural parks: A case study from Rome urban area." *Environmental Management* 28, no. 4: 547–560.

Staudinger, Michelle D., Nancy B. Grimm, Amanda Staudt, Shawn L. Carter, F. Stuart Chapin III, Peter Kareiva, Mary Ruckelshaus, Bruce A. Stein. 2012. "Impacts of Climate Change on Biodiversity, Ecosystems, and Ecosystem Services: Technical Input to the 2013 National Climate Assessment." *Cooperative Report to the 2013 National Climate Assessment*. Available at: http://assessment.globalchange.gov

Stork, Nigel E. 2010. "Re-assessing current extinction rates." *Biodiversity Conservation* 19: 357-371. Doi 10.1007/s10531-009-9761-9201

Sundseth, Kerstin and Geert Raeymaekers. 2006. "Nature in Cities Across Europe: A review of key issues and experiences." *Biodiversity and Natura 2000 In Urban Areas*, November.

Sushinsky, Jessica R., et al. 2012. "How should we grow cities to minimize their biodiversity impacts?" *Global Change Biology*: 1-10. doi: 10.1111/gcb.12055

Suzuki, Hiroaki, et al. 2010. "Eco^2 Cities: Ecological Cities as Economic Cities. The World Bank. Accessed March 8, 2013. http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1270074782769/Eco2CitiesBookWeb.pdf

Szlavez, Katalin, Warren, Paige, and Steward Pickett. 2011. Chapter 6: Biodiversity on the Urban Landscape. In *Human Population: Its Influences on Biological Diversity*. Eds. R.P. Cincotta and L.J. Gorenflo. Ecological Studies 214: 75-101.

Tashakkori, A. and C. Teddlie, eds. 2003. *Handbook of mixed methods in social and behavioral research*. Thousand Oaks, CA: Sage Publications.

Tashakkori, A. and C. Teddlie. 1998. *Mixed Methodology: Combining Qualitative and Quantitative Approaches*. Thousand Oaks, CA, Sage.

Tidball, Keith G. 2012. Greening in the Red Zone: Valuing Community-Based Ecological Restoration in Human Vulnerability Contexts. (Doctoral Dissertation), Cornell University, Ithaca, NY.

Tidball, Keith G., and Weinstein, Elon D. 2011. "Applying the Environment Shaping Methodology: Conceptual and Practical Challenges." *Journal of Intervention and Statebuilding* 5, no. 4.

Tidball, Keith G., Svendsen, Erika S., Campbell, Lindsay K., Falxa-Raymond, Nancy, & Wolf, Kathleen L. 2012. "Preliminary Analysis of TKF 'Book & Bench' texts using unsupervised semantic mapping of natural language with Leximancer concept mapping." in *Civic Ecology Lab White Paper Series* 11. Ithaca, NY: Cornell University.

Tsay, Shin-pei. 2012. "Cities will determine success after Rio+20." *Devex* (2 May). Accessed 12 March 2013. https://www.devex.com/en/news/78132/print

Tuomisto, H. 2010. A consistent terminology for quantifying species diversity? Yes, it does exist. *Oecologia* 4: 853–860. doi:10.1007/s00442-010-1812-0

Tzoulas, Konstantinos and Phillip James. 2004. "Finding Links between biodiversity and human health and well-being." *Environment*: 208-217.

Tzoulas, Konstantinos and Phillip James. 2010. "Making biodiversity measures accessible to non-specialists: an innovative method for rapid assessment of urban biodiversity." *Urban Ecosystems* 13: 113-127.

Tzoulas, Konstantinos and Phillip James. 2005. "Surrogate measures for urban biodiversity, human health and well-being." *Environment*: 826-838.

United Nations Environment Programme (UNEP). 1999. *Cultural and spiritual values of biodiversity*. London: Intermediate Technology.

United Nations Environment Programme (UNEP) and Convention on Biological Diversity (CBD). 2009. "Report of the First Expert Workshop on the Development of the City Biodiversity Index." February. Accessed 8 March, 2013. http://www.cbd.int/doc/meetings/city/ewdcbi-01/official/ewdcbi-01-03-en.pdf

"User's Manual for the City Biodiversity Index (revised edition)," Sep. 27, 2010. Accessed March 8, 2013. http://www.cbd.int/authorities/doc/User%27s%20Manual-for-the-City-Biodiversity-Index27Sept2010.pdf

Weinstein, Elon, & Tidball, Keith G. 2007. Environment shaping: An alternative approach to development and aid. *Journal of Intervention and Statebuilding* 1 (Spring).

Whittaker, R. H. 1972. "Evolution and Measurement of Species Diversity." *Taxon* 21: 213-251. doi:10.2307/1218190

Whittaker, Robert J., et al. 2005. "Conservation Biogeography: assessment and prospect." *Diversity and Distributions* 11: 3-23.

Wilson, Edward O., ed. 1988. *Biodiversity*. Washington, D.C.: National Academy Press.

Wood, A., Stedman-Edwards, P. and Mang, J. 2000. *Root Causes of Biodiversity Loss*. London: Earthscan Publications Ltd.

Yli-Pelkonen, Vesa and Jari Niemelä. 2005. Linking ecological and social systems in cities: urban planning in Finland as a case. *Biodiversity and Conservation* 14: 1947-1967.

Zerbe, Stefan, Il-Ki Choi, and Ingo Kowarik. 2004. "Characteristics of Non-native Plant Species in the City of Chonju, Southern Korea." *Ecological Research* 19: 91-98.

Analyzed Planning Documents:

Aichi Prefecture. 2009. The Aichi Environmental Conservation Strategy -Towards Preserving Biodiversity and Sustainable Use, March. Accessed 2 March 2013. http://www.pref.aichi.jp/global/en/projects/environment.html

Applied Ecological Services. 2004. Biodiversity: A Plan for the Village of Schaumburg, May. City of Seoul Nature & Ecology Division. Accessed March 1, 2013. http://www.ci.schaumburg.il.us/GreCorn/Green1/Documents/Biodiversity%20Recovery%20Plan.pdf

Auckland City Council. 2012. Auckland Council's Indigenous Biodiversity Strategy, July. Accessed March 1, 2013. http://www.aucklandcouncil.govt.nz/EN/planspoliciesprojects/plansstrategies/Councilstrategies/Pages/home.aspx

Belfast City Council. 2007. Local Biodiversity Action Plan for Belfast. Accessed March 3, 2013. http://www.belfastcity.gov.uk/biodiversity/index.asp

Birmingham & The Black Country Biodiversity Plan Steering Group. 2000. Birmingham & The Black Country Biodiversity Action Plan: A Framework for Action, July. Accessed March 3, 2013. http://www.wildlifetrust.org.uk/urban/ecorecord/bap/html/main.htm

Brighton & Hove City Council. 2012. The Brighton & Hove Local Biodiversity Action Plan, February 6. Accessed March 3, 2013. http://www.brighton-hove.gov.uk/index.cfm?request=c1248574

Bristol Biodiversity Partnership. 2008. Bristol Biodiversity Action Plan for People and Wildlife. Accessed March 3, 2013. http://www.bristol.gov.uk/page/environment/bristol-biodiversity-action-plan

Caloocan City Planning and Development Department. 2010. Caloocan City Medium Term Development Plan 2011-2013. Accessed March 1, 2013. http://www.caloocancity.gov.ph/site/PDFs/medium-term-development-plan2011-2013.pdf

Cape Town Environmental Resource Management Department. 2009. Strategic Plan. Accessed July 1, 2012 via personal communication with the ICLEI Cities Biodiversity Center.

Cardiff Council Strategic Planning & Environment. 2008. Cardiff Local Biodiversity Action Plan 2008. Accessed March 3, 2013. http://www.cardiff.gov.uk/content.asp?nav=2%2C2870%2C3139%2C3940%2C3976

Chiba Prefecture. 2008. The First Prefectural Biodiversity Strategy of Chiba, March 26. Accessed March 2, 2013. http://www.bdcchiba.jp/event/kikaku/pdf/cop10-strategy-eng.pdf

Chicago Department of Planning and Development. 2011. Chicago Nature and Wildlife Plan Update: A Strategy to Enhance Urban Ecosystems 2011-2016, August. Accessed March 1, 2013. http://www.cityofchicago.org/city/en/depts/dcd/supp_info/chicago_nature_andwildlifeplan.html

Chicago Wilderness. 1999. Biodiversity Recovery Plan, Final Draft for Public Review, September. Accessed March 1, 2013. http://www.cityofchicago.org/city/en/depts/dcd/supp_info/chicago_nature_andwildlifeplan.html

Chun-hi, Lee, et al. 2008. Seoul Biodiversity Report 2008. Accessed March 1, 2013. http://www.4shared.com/office/dIcq4Hx1/seoul-biodiversity-report.html

City of Berkeley. 2009. Climate Action Plan, June. Accessed March 7, 2013. http://www.cityofberkeley.info/uploadedFiles/Planning_and_Development/Level_3_-_Energy_and_Sustainable_Development/Berkeley%20Climate%20Action%20Plan.pdf

City of Lincoln Council. Development Strategy Team. 2006. Lincoln Biodiversity Audit 2008. Accessed March 3, 2013. http://ourcityourfuture.co.uk/doclib/FINAL_DRAFT_LINCOLN_BAP_1_.pdf

City of Liverpool. 2010. Draft Liverpool Green Infrastructure Strategy Action Plan Version 1.0. Accessed March 3, 2013. http://www.greeninfrastructurenw.co.uk/liverpool/

City of London Open Spaces Department. 2010. Biodiversity Action Plan 2010-2015. Accessed May 3, 2013. http://www.cityoflondon.gov.uk/things-to-do/green-spaces/city-gardens/wildlife-and-nature/Documents/CityGardensBAP2010_2015.pdf

City of Melbourne Department of Sustainability and Environment. 2011. Biodiversity Conservation Strategy for Melbourne's Growth Areas, November. Accessed March 2, 2013. http://www.dse.vic.gov.au/land-management/land/native-vegetation-home/strategic-assessment-agreement-for-future-melbourne-growth/conservation-strategies/DRAFT-Biodiversity-Conservation-Strategy_web-without-maps.pdf

City of Nagoya Biological Diversity Planning Office. 2010. The 2050 Nagoya Strategy for Biodiversity, March. Accessed July 1, 2012 via personal communication with the ICLEI Cities Biodiversity Center.

City of New York. 2011. PlaNYC, April. Accessed March 1, 2013. www.planyc.gov

City of Stoke-on-Trent. 2011. Stoke-on-Trent City Council Sustainability and Environmental Policy, August. Accessed March 3, 2013. http://www.stoke.gov.uk/ccm/content/environment/climate-change/sustainability-and-environment-policy.en

Conservation and Management Plan of East Kolkata Wetlands. June, 2005. Accessed March 1, 2013. http://www.ekwma.com/uploads/cmp_ekw.pdf

Le Corbusier, and Frederick Etchells. 1971. *The city of tomorrow and its planning*. London: Architectural Press.

Cork City Council. 2009. Cork City Biodiversity Action Plan 2009 - 2014. Accessed March 1, 2013. http://www.corkcity.ie/media/corkcity_biodiversity_actionplan.pdf

Department of Forests and Wildlife, Govt. of NCT of Delhi. 2007. Greening Delhi Action Plan 2007-2008. Accessed March 1, 2013. http://forest.delhigovt.nic.in/action_plan0708.html

Deprez, Bernard. 2012. Brussels: From Eco-building to Sustainable City. Accessed March1, 2013. http://documentation.bruxellesenvironnement.be/documents/BxlVilleDurable_ANGL.PDF

Dun-Laoghaire Rathdown City Council. 2009. Treasuring Our Wildlife: Dun-Laoghaire Rathdown Biodiversity Plan 2009-2013. Accessed March 1, 2013. http://www.dlrcoco.ie/parks/BiodiversityPlan.pdf

Edinburgh Biodiversity Partnership. 2010. Edinburgh Local Biodiversity Action Plan 2010 - 2015. Accessed March 3, 2013. http://www.glasgow.gov.uk/index.aspx?articleid=6054

Exeter City Council. 2005a. Exeter Biodiversity Action Plan. Accessed March 3, 2013. http://www.exeter.gov.uk/CHttpHandler.ashx?id=8714&p=0

--- 2005b. Exeter Biodiversity Strategy. November. Accessed March 3, 2013. http://www.exeter.gov.uk/CHttpHandler.ashx?id=8713&p=0

Gagnon, Chantal. 2010. Montréal Communiy Sustinable Development Plan 2010-2015, Summary Version. Accessed March 2, 2013. http://ville.montreal.qc.ca/portal/page?_pageid=7137,78111572&_dad=portal&_schema=PORTAL

Giboudeaux, Fabienne. 2011. A Biodiversity Plan for Paris. Accessed March 1, 2013. http://www.kankyo-net.city.nagoya.jp/citysummit2010/images/kaigi/session5/04_paris.pdf

Glasgow City Council. "Local Biodiversity Action Plan." Welcome to Glasgow. Accessed March 3, 2013. http://www.glasgow.gov.uk/index.aspx?articleid=6054

Glasgow City Council. 2001. Biodiversity Action Plan, September. Accessed March 3, 2013. http://www.accessglasgow.org/NR/rdonlyres/734E5A9C-2470-4B1E-81BA-8960A1A1577D/0/LBDAPlbapbooklet.pdf

Government of U.T. of Puducherry. 2010. Draft Action Plan on Climate Change Approach and Activities, August. Accessed March 1, 2013. www.indiaenvironmentportal.org.in/reports-documents/draft-action-plan-climate-change-puducherry

Greater London Authority. 2002. Connecting with London's Nature, The Mayor's Biodiversity Strategy, July. Accessed March 1, 2013. http://legacy.london.gov.uk/mayor/strategies/biodiversity/biodiversity_strategy.jsp

Greater Manchester Biodiversity Project. "Biodiversity Action Plans 2009." Greater Manchester Biodiversity Project. Accessed March 3, 2013. http://www.gmbp.org.uk/site/index.php?option=com_content&task=view&id=9&Itemid=27

Greenwich City Council. 2009. Greenwich Biodiversity Action Plan. Accessed March 3, 2013. http://www.royalgreenwich.gov.uk/downloads/file/539/biodiversity_action_plan_mar_2010

Groundwork Liecester and Liecestershire. 2011. Liecester's Biodiversity Action Plan 2011-2021, November. Liecester City Council. Accessed July 1, 2013 via personal communication with the ICLEI Cities Biodiversity Center.

Guangzhou Municipality. 2011. Outline of 12th Five-Year Plan for Economic and Social Development of Guangzhou Municipality. Accessed March 2, 2013. http://english.gz.gov.cn/publicfiles/business/htmlfiles/gzgoven/s3711/201109/857541.html

Hachtel, Monika and Chmela, Christian and Schmidt, Peter and Sander, Ulrich. (2008). Bonn Biodiversity Report 2008. Accessed March 2, 2013

Hampshire and Isle of Wight Wildlife Trust. (2012). Draft Portsmouth Biodiversity Action Plan. Accessed March 3, 2013. http://80.175.62.116/media/PLN_DraftPortsmouthBAP.pdf

Hand, Lin and Ian Barker. 2006. Biodiversity Action Plan. Accessed March 3, 2013. Southampton City Council. http://www.southampton.gov.uk/s-environment/Biodiversity/action.aspx

Hilton-Brown, Derek and Jackie Hunter. 2011. Newcastle & North Tyneside Biodiversity Action Plan. Accessed March 3, 2013. http://www.newcastle.gov.uk/environment/environment/biodiversity-action-plan

Hull Biodiversity Partnership. 2008. "Hull Biodiversity Action Plan." *Hull Biodiversity Partnership,* March 3, 2013. http://www.hull.ac.uk/HBP/ActionPlan/index.htm

Jerusalem Municipality. 2012. Green Jerusalem: A Sustainable Future for an Ancient City! March. Accessed March 1, 2013. http://www.jerusalem.muni.il/jer_main/TopSiteJeruEng.asp?newstr=4&src=/pdf_books/GreenJerusalem/index.html

Leeds City Council. 2000. "Biodiversity and Planning." *Leeds.gov.uk*. Accessed March 3, 2013. http://www.leeds.gov.uk/council/Pages/Biodiversity-and-Planning.aspx

Merseyside Biodiversity Group. 2008. "North Merseyside Biodiversity Action Plan." Biodiversity and Wildlife in North Merseyside. Accessed March 3, 2013. http://www.merseysidebiodiversity.org.uk/

Montpellier. 2009. Améliorer l'Urbanisme par un Référentiel d'Aménagement (AURA). Accessed March 2, 2013. http://www.cbd.int/doc/nbsap/sbsap/fr-sbsap-montpellier-fr.pdf

Municipal Secretariat for Environment of São Paulo (SVMA). 2011. Local Biodiversity Strategies and Actions Plan of São Paulo City, July. Accessed July 1, 2012 via personal communication with the ICLEI Cities Biodiversity Center.

Municipality of Kalamaria 2011. Deliverable 3.2: Adaptation Action Plan and Political Statement, April. Accessed March 1, 2013. http://www.grabs-eu.org/downloads/Municipality%20of%20Kalamaria%20CAAP.pdfhttp://w

National Parks Board Singapore (NParks). 2005. Conserving Our Biodiversity: Singapore's National Biodiversity Strategy and Action Plan. July. Accessed March 1, 2013. http://www.nparks.gov.sg/cms/docs/nbc/NBSAP_2009.pdf

Norwich City Council. 2002. Biodiversity Action Plan for the City of Norwich, July. Accessed March 1, 2013. http://www.norwich.gov.uk/Environment/ParksAndOpenSpaces/WoodlandsHeathsAndMarshes/documents/BiodiveristyActionPlanForTheCityOfNorwich4.pdf

Saitama Prefecture. 2008. What is Biodiversity? March. Accessed March 2, 2013. http://www.pref.saitama.lg.jp/uploaded/attachment/451192.pdf

Secretaría del Medio Ambiente de la Ciudad de la México (SMA). 2013. Estrategía y Plan de Acción para la Biodiversidad de la Ciudad de la México 2013-2023. Secretaría del Medio Ambiente, Dirección General de Zoológicos y Vida Silvestre. México, D.F. Accessed March 20, 2013 via personal communication with the ICLEI Cities Biodiversity Center.

Secretaria Municipal do Meio Ambiente da Prefeitura Municipal de Curitiba (SMMA). 2012. City of Curitiba Biodiversity Report – 2012 LAB Local Action for Biodiversity an Iclei Initiative Enhancing Urban Nature Through a Global Network of Local Governments. Accessed March 2, 2013 http://www.biocidade.curitiba.pr.gov.br/biocity/02.html

Sheffield Wildlife Trust. 2002. Sheffield Biodiversity Action Plan. Accessed March 3, 2013. https://www.sheffield.gov.uk/out--about/parks-woodlands--countryside/ecology-service/biodiversity-action-plans/sheffield-local-biodiversity-action-plan.html

Sikkim Biodiversity Conservation & Forest Management Project (SBFP). 2012. Sikkim Biodiversity Action Plan. August. Accessed March 2, 2013. http://sbfpjica.org/Publications/docs/SBAP/SIKKIM%20BIODIVERSITY%20ACTION%20PLAN%20Aug%202012%20FINALWEB.pdf

Stack, Mairéad and Siobhán Egan, ed. 2008. Dublin City Biodiversity Action Plan 2008 - 2012. Dublin City Council. Accessed March 1, 2013.

http://www.dublincity.ie/SiteCollectionDocuments/DCC%20Biodiversity%20Action%20Plan.pdf

Stockholm. 2011. The Stockholm Environment Programme 2012-2015. Accessed March 3, 2013. http://international.stockholm.se/PageFiles/135805/The%20Stockholm%20Environment%20Programme%202012-2015.pdf

Sustainable City. 1997. Sustainability Plan. Accessed March 2, 2013. http://www.sustainable-city.org/Plan/Intro/intro.htm

Waitakere City. 2008. LAB Biodiversity Action Plan. Accessed July 1, 2012 via personal communication with the ICLEI Cities Biodiversity Center.

Westminster Biodiversity Partnership. 2008. Westminster's Biodiversity Action Plan. Accessed March 3, 2013. http://www.westminster.gov.uk/services/environment/greencity/biodiversity/biodiversity-action-plan/

Williams, Carissa. 2006. City of Worcester, Massachusetts Climate Action Plan. December. Accessed March 7, 2013. http://www.worcesterma.gov/city-manager/energy-task-force/climate-action-plan

Worcestershire Biodiversity Partnership. 2008. Worcestershire Biodiversity Action Plan. Accessed March 3, 2013. http://www.worcestershire.gov.uk/cms/biodiversity.aspx

Frameworks:

Alfsen, Christine, Laura Dickinson, Keith Tidball, Vahan Galoumian, and Moramay Navarro. 2010. "The URBIS Partnership: An Approach to Achieve Social and Environmental Resilience in Urban Regions." *Policy Matters* 17: 95-99.

Chan, Lena. 2012. Singapore Index on Cities' Biodiversity, 3 July. Accessed April 28, 2013. http://www.worldcitiessummit.com.sg/pdf/Dr_Lena_Chan.pdf

Chan, L., Calcaterra, E., Elmqvist, T., Hillel, O., Holman, N., Mader, A., & Werner, P. 2010. User's Manual for the City Biodiversity Index, September 27. Accessed April 28, 2013. http://www.cbd.int/authorities/doc/User%27s%20Manual-for-the-City-Biodiversity- Index27Sept2010.pdf

Local Action for Biodiversity (LAB). 2007. Pioneer Program Brochure. Accessed April 28, 2013. http://archive.iclei.org/fileadmin/template/project_templates/localactionbiodiversity/user_upload/LAB_Files/Publications/LAB_Brochure.pdf

ICLEI – Local Governments for Sustainability (ICLEI). (2010). Local Action for Biodiversity Guidebook: Biodiversity Management for Local Governments. Edited by Laros, Marlene T. and Lee Jones.

ICLEI Cities Biodiversity Center (ICLEI CBC). 2008. The Durban Commitment: Local Governments for Biodiversity. Accessed April 28, 2013. http://archive.iclei.org/fileadmin/template/project_templates/localactionbiodiversity/user_upload/LAB_Files/Resources_webpage/DC_English_August_2011.pdf

--- 2013a. "LAB Pioneer City Profiles." *ICLEI,* Accessed April 28. http://archive.iclei.org/index.php?id=12286

--- 2013b. "LAB Pioneer Project Descriptions." *ICLEI,* Accessed April 28. http://archive.iclei.org/index.php?id=12286

TEEB. 2010a. TEEB - The Economics of Ecosystems and Biodiversity for Local and Regional Policy Makers. Accessed April 28, 2013. http://www.teebweb.org/wp-content/uploads/Study%20and%20Reports/Reports/Local%20and%20Regional%20Policy%20Makers/D2%20Report/TEEB_Local_Policy-Makers_Report.pdf

--- 2010b. A Quick Guide to The Economics of Ecosystems and Biodiversity for Local and Regional Policy Makers. Accessed April 28, 2013. http://www.teebweb.org/wp-content/uploads/Study%20and%20Reports/Reports/Local%20and%20Regional%20Policy%20Makers/D2%20Quick%20guide/TEEB%20D2%20quick%20guide_English.pdf

Tidball, Keith G. 2012. Evolution of the "URBIS" Urban Biosphere Initiative, June. Accessed April 28, 2013. http://www.slideshare.net/kgtidball/evolution-of-urbis-iclei-belo-horizonte

Interviews:

Branco, Angela Maria, interview with author. June 10, 2012.

Duarte de Araujo Silva, Fabio, interview with author. May 22, 2012.

Guimarães, Eduardo, interview with author. May 29, 2012.

Govender, Natasha. interview with author. August 15, 2012, 2pm.

Hammarlund, Katrin, interview with author. August 15, 2012, 2pm.

Massaburi, Didas, interview with author. July 6, 2012.

Narvelo, Widar, interview with author. October 2, 2012, 8:30am.

Neto, Raphael Frederico, interview with author. May 25, 2012.

Neves, Hélio, interview with author. June 10, 2012.

Nutty, Mussa, interview with author. July 6, 2012.

Pinto, Eliseo Souzar and Edmilson Ferreira Costa, interview with author. May 23, 2012.

Prosser, Julian, interview with author. August 2, 2012.

da Silva Seraphim, Dåmaris, interview with author. May 30, 2012.

Rios, José Fernando, interview with author. May 23, 2012.

Roumani, Helene, interview with author. June 14, 2012.

Siegal, Yoel, interview with author. June 14, 2012.

Tsur, Naomi, interview with author. June 14, 2012.