A thesis submitted to the Department of Environmental Sciences and Policy of Central European University in part fulfilment of the Degree of Master of Science

The Bioshed of Jerusalem: a model for urban biodiversity planning, visioning, and communicating.

Jennifer Rae PIERCE

July, 2014

Budapest

Notes on copyright and the ownership of intellectual property rights:

(3) For bibliographic and reference purposes this thesis should be referred to as:

Pierce, Jennifer Rae. 2014. *The Bioshed of Jerusalem: a model for urban biodiversity planning, visioning, and communicating.* Master of Science thesis, Central European University, Budapest.

Further information on the conditions under which disclosures and exploitation may take place is available from the Head of the Department of Environmental Sciences and Policy, Central European University.

Author's declaration

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Jennifer Rae PIERCE

CENTRAL EUROPEAN UNIVERSITY

ABSTRACT OF THESIS submitted by:
Jennifer Rae PIERCE
for the degree of Master of Science and entitled: The Bioshed of Jerusalem: a model for urban biodiversity planning, visioning, and communicating.
Month and Year of submission: July, 2014.

This thesis presents a new concept for biodiversity planning: the bioshed. The bioshed is herein defined as the system of relationships between biodiversity and humanity. It is organized into dependencies and impacts categorized into social, political and economic categories. I ask whether this concept can be helpful for urban biodiversity planners in the field. To answer this question, I chose a mixed-methods exploration of biodiversity planning today in Jerusalem. I used systems network theory and root cause analysis as my theoretical basis to understand biodiversity planning in Jerusalem and then to propose a transformation that takes into account the bioshed concept. My first objective is to understand the recent success in Jerusalem of biodiversity planning, including potential barriers. Then I investigate how the concept of the bioshed is understood by urban biodiversity planners in publications, in discussions, and on the ground. My findings indicate that by emphasizing the connections between biodiversity and social, political, and economic aspects of the city, the use of the bioshed term in urban biodiversity planning may expand discussion of biodiversity. I found that biodiversity planning in Jerusalem tends to underemphasize political issues and to focus entirely on local impacts. It is also plagued by a lack of confidence by many of the biodiversity planners themselves. The bioshed concept provides a framework that can help build a systems-level understanding of what is happening. My vision for a biodiverse Jerusalem builds on the bioshed to suggest a Jerusalem that is intensive, clean, aware, healthy, just, and connected.

Keywords: biodiversity, transformation, systems, socio-economic drivers, root cause, urban planning, visioning

Acknowledgements

The selfless contributions of many people have not only improved this research, but have in some cases made it possible.

At CEU, many professors provided advice that contributed to the quality of this thesis. My supervisor, Jack Corliss, gave many useful suggestions and boosted my confidence in my work. Tamara Steger assisted me in putting together my interview questions and increased my interviewing skills. Alex Antypas, my advisor, contributed the crucial idea of the review session. Alan Watt provided me with support when I needed assistance from the department to fund my studies. Laszlo Pintér connected me to his contact who had done research in the area, broadening my participant pool. The university also provided grant funding that enabled me to conduct onsite research.

The Telluride Foundation awarded me with the Miller-Sidgwick International Exchange Scholarship that funded my year of studies at CEU. My time at Cornell University made possible such an application, and several individuals there also helped me. John Forester and William Goldsmith recommended me for the scholarship. Keith Tidball provided me with access to Leximancer software and has taught me many aspects of how to use this tool.

My husband, Glen Pierce, supports me every day through his understanding and countless cups of hot tea.

Many partners on the ground donated hours of assistance to make my project possible. The Jerusalem Bioregion Center for Ecosystem Management was my main partner throughout the project, providing me with a workspace as well as lending credibility to my work. The director, Helene Roumani, demonstrated faith in my project by personally calling and emailing her contacts to urge them to participate in my study. The chair, Naomi Tsur, advised me throughout the project and provided me and my husband with an apartment and several tea-and-cookie sessions during my time in Jerusalem. Melanie Simon guided me around the city and answered many of my naïve questions with patience. Benjamin Calderon supported me during the workshop alongside my husband so that I could concentrate on facilitation.

The Jerusalem office of the Society for Protection of Nature Israel (SPNI) provided support through supplies for workshops and providing a space for the review session.

The Jerusalem Municipality provided a space for the workshop session. Liron Maoz, head of Planning and Sustainable Development, aided me by arranging the participation of many people at the city, translating some interviews, and with some basic logistics like airport shuttles and car rentals.

The Bethlehem office of the Friends of the Earth Middle East (FOEME), specifically Shamiramis Kutli, connected me with many participants via personal phone calls that led to more contacts in Arab and Palestinian areas.

I also would like to thank the participants who took time to be interviewed, to contribute to the workshop or review session, or to send me datasets of their work. I hope this thesis accurately reflects their input and honors their voluntary contributions.

Table of Contents

9. Appendices

List of Abbreviations

AHG	Arab Hydrologic Group
CBD	Convention on Biological Diversity
CBO	Cities Biodiversity Outlook
COP	Conference of the Parties on the Convention on Biological Diversity
FOEME	Friends of the Earth Middle East
GPCB	Global Partnership on Cities and Biodiversity
ICLEI	ICLEI – Local Governments for Sustainability (originally stood for International Council for Local Environmental Initiatives)
ICLEI-CBC	ICLEI Cities Biodiversity Center
IDF	Israeli Defense Force
IUCN	International Union for the Conservation of Nature
JBO	Jerusalem Bird Observatory
LAB	Local Action for Biodiversity
LBSAP	Local Biodiversity Strategy and Action Plan
NBSAP	National Biodiversity Strategy and Action Plan
NGO	non-governmental organization
PA	Palestinian Authority
PHG	Palestinian Hydrologic Group
SPNI	Society for the Protection of Nature Israel
JNF	Jewish National Fund
KKL	Keren Kayemet L'Yisrael (another name for JNF)
UN	United Nations
UNEP	United Nations Environment Programme
UNRWA	United Nations Relief and Works Agency for Palestine Refugees in the Near East

1. Introduction

Urban biodiversity planning should take a systemic approach that includes indirect drivers of biodiversity loss and communicates the necessity of biodiversity for the basic functioning of cities. When thinking of biodiversity, people may first think of things that are nice to have, like a beautiful and relaxing park, while forgetting that the air they breathe is filtered by functioning ecosystems which are predicated on healthy biodiversity. Cities depend on biodiversity for water, for resilience against hazards, for food, for almost everything. At the same time, cities influence the biodiversity in their area and worldwide through their consumption patterns of goods and services.

In a previous analysis of 67 urban biodiversity plans from around the world, I found that urban biodiversity planning fails to take this broad approach and instead focuses on direct land-based impacts, such as preserving open spaces from development (2014a). A more complete systems approach for biodiversity planning would take into account the web of relationships, both impacts and dependencies, between humanity and biodiversity. I call this web the bioshed.

Factor	*Dependency on biodiversity*
Terrestrial agriculture	Microbiology of soils, pollination of plants requires a strong pollinator community, genetic resistance to disease, the foods themselves
Safety	Resilience to natural hazards such as tsunamis and coastal storms are tied to healthy mangrove and wetland ecosystems on coastlines. Flood mitigation is tied to healthy stream systems. Landslide prevention is tied to strong root systems of plants.
Water and seafood	Healthy watersheds and waterways are needed to provide potable water and to provide seafood that is not poisonous
Culture	Art, musical instruments, many dances, fashion, etc. use the materials, imagery, and design of biodiversity
Clean air	Plants provide oxygen and clean the air
Development	Proximity to parks, streams, and lakes increase value
Medicine	Derived from genetic biodiversity
Spirituality and religion	Statements made by nine major world religions about the essential nature of biodiversity. Indigenous religions often have a spiritual connection with the native species in their ancestral home

Table 1.1: Some examples of how humans depend on biodiversity (Pierce 2014c, template D).

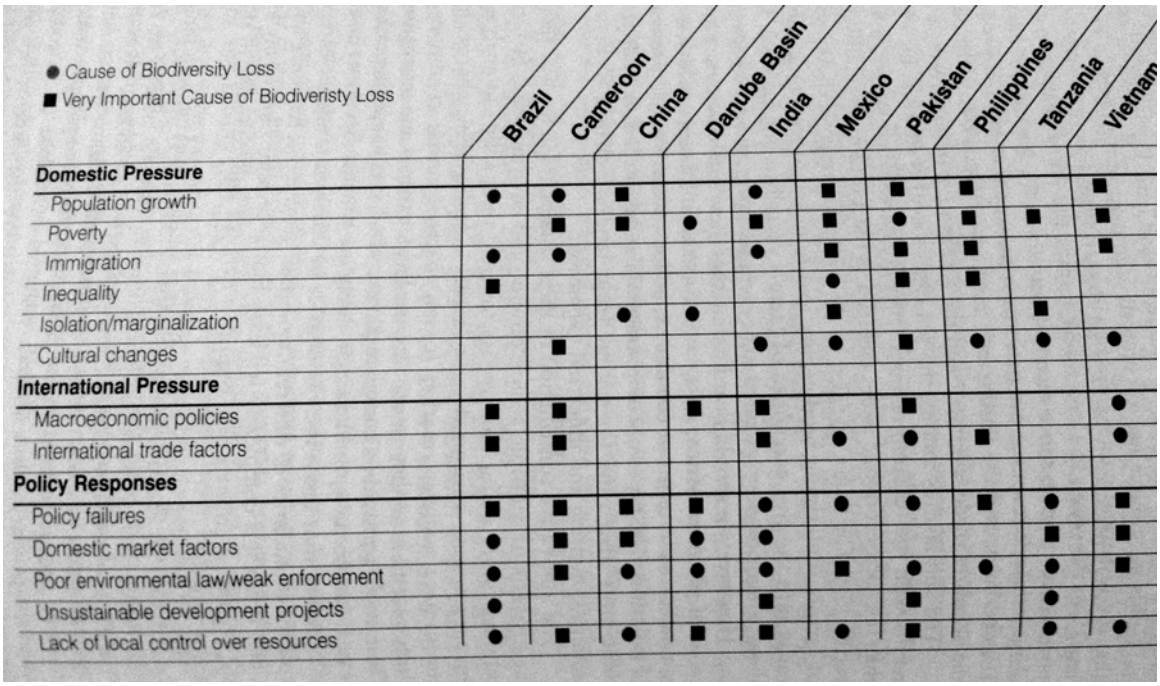


Table 1.2: Identified causes of biodiversity loss in ten wilderness area case studies. The causes are categorized under domestic pressure, international pressure, and policy responses. Source: Wood et al. 2000, table 4.1, p. 62.

The bioshed includes an array of economic, social, and political factors that are not typically

considered in urban biodiversity planning (see Table 1.1 and 1.2 for a few examples). These examples may seem "soft" or idealist, but studies are beginning to solidify these connections that we know intuitively. For example, a study of ten cities in the U.S. showed how urban trees are saving 1 to 7 lives every year just by filtering PM2.5 pollutants from the air, depending on the city (Nowack et al. 2013). This study looked only at one type of plant, trees, only at a single function, air pollution filtration, and only at one pollutant, PM2.5. Imagine what a more comprehensive examination of urban biodiversity might show, and then what more could be accomplished by thinking regionally, or even globally, about indirect impacts originating in cities. This is what the bioshed concept hopes to accomplish.

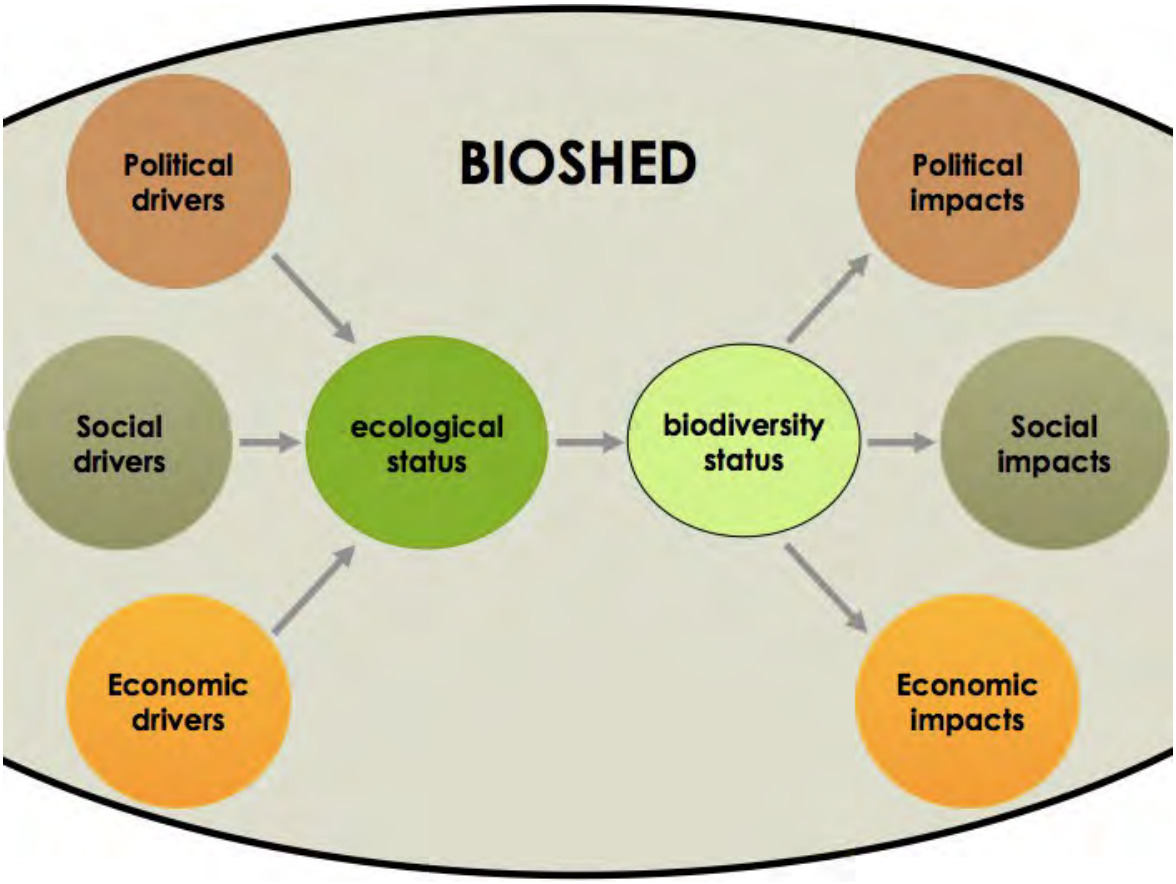


Fig. 1.1: Initial illustration of the bioshed. Biodiversity planning typically focuses on the center two factors: ecological status and biodiversity status.

This thesis will build upon and test the concept of the bioshed using Jerusalem as a case study (see Fig. 1.1). The city of Jerusalem is a good place to test this theory because it is one of the

strongest cities for biodiversity planning in terms of its commitment and comprehensive understanding (Pierce, 2014a).

Project Aims and Objectives

The primary aim of the thesis is to test and further develop the concept of the bioshed via the case study of Jerusalem. This study should give an indication of the bioshed's potential applicability to urban biodiversity planning.

The thesis outlines the process of biodiversity planning in Jerusalem, including its strengths and barriers. In the process, it will also explore how local biodiversity planners of Jerusalem perceive the city's bioshed. It will question whether the bioshed as a concept could help professionals with urban biodiversity planning.

The objectives of the study are as follows:

1. Outline the process and strengths that contributed to biodiversity planning, along with the barriers that prevented further progress.

2. Compare the bioshed concept as communicated by the biodiversity planning documents, understood by the practitioners, and developed based on communications during the workshop. Are certain aspects underrepresented?

3. Identify any potential areas of improvement that Jerusalem's biodiversity planners can make based upon understanding of the bioshed. Also, how might these areas provide lessons for other cities, thereby improving urban biodiversity planning in other cities? Can the model be distilled into a simplified diagram that illustrates principles of the bioshed?

Hypothesis

A more complete understanding of Jerusalem's bioshed will reveal untapped potential for planners to reduce biodiversity loss by expanding their mental and physical network. It will open up new possibilities of actions that benefit biodiversity, from connecting with others to suggesting a new avenue for a project. This process of interviews and interactive sessions will reveal aspects of this bioshed and broaden awareness of biodiversity planners and their partners in Jerusalem that is useful for them and other urban biodiversity planners.

Research Approach

The research takes a mixed methods approach that gathers data from interviews, municipal biodiversity planning documents, an interactive workshop and review session, and site visits. This data is then analyzed in an unsupervised quantitative manner using computer software as well as manually in a qualitative manner. Both methods are triangulated to increase the validity of the results and to strengthen my understanding of the issues. Furthermore, I take a partnership approach with the Jerusalem BioRegion Center for Ecosystem Management that is similar to a participatory action research project in which the participant's feedback is incorporated into the study and the results. My endeavors during this research are intended not only to broaden the knowledge in the field, but also to aid biodiversity planners in Jerusalem today with their goals.

Thesis Structure

Section 2: Background gives the theoretical basis for the project in systems theory while also outlining the context of the literature within urban biodiversity planning. This section also summarizes the conditions in Jerusalem that include the history of the conflict, the politics, the geography, the demographics, development, and infrastructure in the city. Finally, it discusses the major activities of biodiversity planners in the city in terms of policy, activities, and partnerships.

Section 3: Research Questions discusses each research question in more detail, why it is important, and initial ideas about the outcome.

Section 4: Methodology reviews questions of validity, reliability, ethics, and bias. It also provides detailed information on how the data was collected during each phase of the research, and how it was analyzed.

Section 5: Results outlines the direct results of the various data collection methods. It reveals the basic relationships and properties of the data. This section includes the diagrams of the bioshed systems as they are understood at various levels, the outputs of the textual analysis, and the themes and relationships arising from the workshop.

Section 6: Analysis goes into more depth with the results. It synthesizes the data from the

various sources to describe the actors and initiatives involved in biodiversity planning in Jerusalem. It includes my observations about how Jerusalem's biodiversity planning became a success and suggests a framework for understanding biodiversity planning in Jerusalem. I also outline the strengths of and the barriers to biodiversity planning in the city.

Section 7: Conclusions provides an overview of the themes that have arisen from the research as whole, illustrates a vision for a biodiverse Jerusalem, and outlines recommendations for biodiversity planners in Jerusalem and around the world.

2. Background

According to Rockström, Biodiversity loss is the most pressing global environmental problem of our time (2009). Despite global efforts in place to combat biodiversity loss since the 1990's, it continues unabated. As a persistent problem that is intertwined with many other issues, including social, environmental, and economic, biodiversity loss is a prime example of an issue that needs a systems-level approach. While urban biodiversity planning is growing in prominence, it is still in the nascent stages, with the term biodiversity often being misunderstood or causing confusion (Pierce 2014a, 2014b; Tidball and Navarro-Perez 2012).

The urban context serves as a nexus point of civilization's impact on biodiversity. Urban conditions differ from less developed areas and therefore it is likely that urban biodiversity requires a different approach to biodiversity management. But, urban areas have been given less attention than their more rural counterparts, and are only now starting to receive recognition as viable and important areas for conservation.

In the hopes of improving planning for biodiversity, I have focused on an example of progressive urban biodiversity planning: Jerusalem. To provide a solid foundation of background for this exploratory and systems-based research, a wide array of interdisciplinary

material is needed. I include here an introduction to the systems approach and its applicability to biodiversity planning. I review the state of urban biodiversity planning today, drawing largely on my past publication and related thesis. Then I draw the picture of Jerusalem today in terms of geopolitics, geography, and its current biodiversity planning activities.

The Systems Approach

Systems are complex and difficult to understand and predict, containing many parts that seemingly operate according to independent patterns of behavior, while constantly being influenced by drivers that are not necessarily readily apparent. They tend to trick human's capacity to inherently make logical conclusions and predictions, resulting in perpetual problems. Systems, by definition, are more than the sum of their parts, displaying emergent properties that become apparent only at certain scales (Meadows 2008). Modelling such systems can be used to understand their function under various conditions and to expand the arena of factors considered to impact the system (Sterman 2002). This research aims to do both with regards to urban biodiversity planning in Jerusalem.

What are Systems?

Meadows describes systems as adaptive, self-preserving, dynamic, goal-seeking, and self-organizing (2008). A system consists of elements, interconnections, and functions/purposes. The elements include actors as well as stocks. Interconnections describe relationships between the elements and consist of flows of information or physical things. Functions are proscribed to nonhuman elements, while a purpose is used for human elements. These functions or purposes are deduced from actual behavior and can be quite complex, with many purposes attributed to one element that can work at cross-purposes to larger system functions (Meadows 2008). In the case of Jerusalem's bioshed, elements include the various actors and

organizations that influence biodiversity, whether consciously or not. Their purposes may conflict in some cases, or if they are not conflicting, may operate in parallel but not in tandem, such that cooperative synergies are lost.

Systems theory is an attempt to conceptualize complex systems and to improve understanding of them, using such tools as mathematical models and diagrams. While systems theory has come under fire for being too simplistic (Levins 1998), systems scientists have not been deterred, admitting that the fallibility of models does not negate their usefulness (Sterman 2002). Therefore, while this research attempts a systems approach by seeking information from many sources and looking for indirect drivers and feedback loops, it does not expect to develop a comprehensive understanding that includes all of the elements of the bioshed. Another critique of systems theory is that it relies upon quantifiable data in order to generate models, either dropping or guessing numerical values when they are more qualitative or unknown (McLoughlin 1985). This research avoids that problem in that it is not pursuing any numerical quantification or modelling, but only the production of diagrams and descriptions that follow some of the general guidelines of systems models.

Why the Systems Approach?

According to Meadows, systems problems, called messes, are problems which persist despite no one wanting them, such as homelessness and addiction. Messy problems were described in the planning field by Rittel and Weber as "wicked," who explained them to be those problems for which solutions could not be objectively engineered or optimized because they do not fit into a true/false or quantitative framework (1973). Messy problems are an inherent part of the system and cannot be solved without changing or rethinking the system itself (Meadows 2008). Biodiversity loss falls under this category, with the drivers including a myriad of factors, including social, economic, and cultural aspects (Pierce 2014a; Wood et al. 2000).

Systems science is designed to locate and understand feedback loops as a primary driver of behavioral patterns in a system. Feedback loops cause persistent behaviour over time, whether it be a growth, relative stagnancy, or decline. They are defined as circular causal connections between a stock, a flow of the stock, and a set of rules governing the flow. A balancing feedback loop seeks stability. They resist change. A reinforcing feedback loop amplifies change. Most systems have many feedback loops operating simultaneously. The behavior of the system is determined by the dominant feedback loop. The feedback loop that is dominant can shift over time as different balance points are triggered. The principal of nonlinearity illustrates how trigger points can cause shifts in system behaviours. The understanding of biodiversity planning as a system should help locate the feedback loops that generate biodiversity loss.

Another problem that is elucidated through modelling of systems is sub-optimization, a situation in which a subsystem's goals impede the goals of a higher level of the system (Meadows 2008). Policies and goals of actors often face such issues, and it would not be surprising to find sub-optimization in Jerusalem's biodiversity planning process.

There are three levels of understanding systems, the third of which is the primary aim for systems scientists. Event-level understanding is based on outputs of a system that occur at a point in time without reference to the system. It answers the question of "what" and is typical of news (Meadows 2008). Behavior-level understanding interprets events based on the historic behaviour of a system. It answers the question of "why" and this level of thinking, which tends to over-emphasize flows and under-emphasize stocks, can be commonly found in economics (Meadows 2008). The third level, system structure understanding, provides the

source of behaviour for a system. This research must pass through all three levels to describe Jerusalem's biodiversity planning. This is part of the justification for approaching this issue through interviews and a workshop rather than relying on literature. The literature is more likely to answer "what" or even "why" than to provide behavioral patterning that gives broader clues as to the underlying causes of observed issues such as continuing biodiversity loss.

Biodiversity as a Stock

For the purpose of systems modelling, stocks are categorized into nonrenewable and renewable resources. Nonrenewable resources are stock-limited, meaning that they are extracted until the stock is depleted and extraction availability depends on the amount extracted vs. the available stock. Renewable resources are flow-limited, meaning that they can support continuous extraction as long as the rate of extraction does not exceed the rate of regeneration (Meadows 2008). There is a critical threshold of extraction above which renewable resource behaviour becomes like a nonrenewable resource. Biodiversity is the main stock of interest in this case (see Fig. 2.1), and while speciation serves as a flow into the stock, its rate is estimated to be less than 1% of the extinction rate (Rockström 2009), such that biodiversity is best treated as nonrenewable, or at least as a stock facing over-extraction.

While this model may be overly simplistic to cover the full array of biodiversity, in the analysis section a more detailed version is described that connects other levels of biodiversity, such as genetic and ecosystem levels, to species diversity. It should also be noted that defining biodiversity is complicated and no one definition currently dominates. The CBD definition calls out species, genetics, and ecosystems diversity. The technical calculation of

biodiversity is derived from species' abundance as well as number, and can involve questions of alpha and beta diversity (that is, degree of diversity at various landscape scales) (Pierce 2014b). And none of these address issues of functional diversity, nor questions of valuing native vs. alien species. Thus, for purposes of simple understanding, I am illustrating this stock as a species count.

Fig. 2.1: A simple systems diagram with species biodiversity as a stock, and with speciation and extinction as flows (by author).

This problem is further compounded by the fact that people do not have the ability to increase speciation rates in any appreciable way. Over-extraction of stocks can lead to three scenarios, depending on the strength of the balancing feedback: a new equilibrium, oscillation, or collapse (Meadows 2008). At this point, it cannot be predicted when biodiversity will reach an inflection point at which extinction rates and speciation rates are balanced. Historically, mass extinctions have dropped biodiversity low enough to remake the biosphere of the planet with new dominant flora and fauna, a situation that as the current dominant mammal, does not bode well for humans.

System Boundaries

A significant aspect of exploring the concept of the bioshed is wrestling with its boundary. Boundaries do not exist in the real world, but only in mental models wherein artificial boundaries are generated. "We have to invent boundaries for clarity and sanity; and boundaries can produce problems when we forget that we've artificially created them… where to draw a boundary around the system depends on the purpose of the discussion"

(Meadows 2008, 97). On the other hand, a system with boundaries drawn too widely result in an overcomplicated output that obscures the answers to the questions one is seeking. "It's a great art to remember that boundaries are of our own making, and that they can and should be reconsidered for each new discussion, problem, or purpose" (Meadows 2008, 99). In this case, the boundary may not be able to be found in this initial search, but hopefully some initial observations about boundaries can be made, such as how professionals in biodiversity planning think about boundaries in their work.

Guidelines for Improving Systems Models

Systems models are fraught with errors, and can result in horrible outcomes if misinterpreted or poorly constructed. To minimize such errors, Meadows provides some guidance. She recommends creating money models, exposing them to criticism and input from various sources. In this case, I have established a review session to get some level of feedback, and am creating several iterations of models to reduce error and maintain openness. Fred Kofman warns that "we see only what we can talk about" so language must be carefully used and language developed to enable complex systems-level thinking. This is part of the idea about introducing the term “bioshed” so that language can support a systems perspective. Another important tip is to be sure to include items that are qualitative, even if their status must be "guesstimated" under a made up scale (Meadows 2008; Sterman 2002). This is far preferable to effectively erasing them from the model. I am hoping to minimize such a pitfall by postponing the quantification of these models until a later time when understanding can be deeper and wider.

Urban Dynamics

When systems theory is applied to cities, it is called urban dynamics. Researchers have found systems theory helpful in explaining and attempting to transform cities (Alfeld 1995; Batty 2008; Bessey 2002; Forrester 1969). In 1969, Forrester was the first to build a city-level urban dynamics model. He used this model to argue that housing development, and in particular the encouragement of low-income housing, damages the economic prospects of cities, unleashing much controversy (1969). Alfeld applied urban dynamics to several cities across the United States (1995). Bessey used systems theory to elucidate the hierarchical and spatial organization of cities and ecosystems (2002). Batty was the first to expand urban dynamics from a decentralized perspective, with emergent and evolving properties, rather than as a stagnant system that maintains itself within a single equilibrium (2008).

Modifying the System

Ultimately, the purpose of inspecting urban biodiversity planning is to transform the urban system so that it works to sustain and even build biodiversity. Changing elements does not typically change the system, but changing interconnections of function/purpose does. Therefore, attempts to transform systems to become more sustainable must address these less tangible elements. Ultimately, change in a system attempts to reverse, break, or redirect feedback loops, such that the system reaches a new equilibrium state or pattern of behavior that is self-reinforcing. Goals for feedback loops must be set to correct for delays in responses of the system; they must bet set above the actual minimum to overcome delays. In a system with delays, foresight is essential. Biodiversity loss definitely has delays, such as the lifecycle of species and the time required for a population to recover after a decrease in abundance.

Transformation occur at leverage points, but not all leverage points have equal potential for transformation. Meadows provides a hierarchy for leverage points in order to guide systems thinkers to identify transformations at the most effective junction (1999).

Her list starts with shifting constants in a system, such as tax rates as the lowest leverage points. She then lists feedback loops, first the regulation of negative ones then driving positive ones. Flows, first of material, and then information, come next. The top four leverage points, I increasing order of leverage, are the rules or incentives of the system, the distribution of power of these rules, the goals of the system, and finally the mindset or paradigm of the system (1999). Thomas Kuhn provides these tips on how to shift paradigms:

1. Point out failures and discrepancies of the previous paradigm again and again
2. Speak and act, loudly and consistently, from the new paradigm
3. Put people who do this in positions of power
4. Work with change agents and open-minded people; don't bother with naysayers

Table 2.1: Some of Meadows' "Traps and Opportunities" that could be relevant for this project.

Trap	*Fix*
Policy Resistance: caused by misalignment of higher system goals with subsystems (or subsystems wit one another) that results in a push/pull test between actors.	Let go of goals and work together to find larger or different goals that all can agree about.
Shifting the burden to the intervenor: when an intervenor fixes the symptom of a problem, but not the underlying drivers, causing the system to become dependent on and perhaps addicted to the intervenor, eroding its capacity for self-maintenance.	Focus on long-term solutions by restructuring the system instead of short-term relief.
Rule Beating: following the letter of the rule, while undermining its intent.	Restructure the rule to remove the perverse use or undermining behaviour.
Seeking the Wrong Goal: confusing a measured effort with the achievement of the desired result (Ex: GNP)	Alter the measured output to something that more closely correlates with the goal.

Finally, Meadows provides a warning for systems scientists called traps and opportunities, explained in Table 2.1 (2008). By keeping in mind these leverage point tips and avoiding the traps, I hope to suggest a lasting transformation for the system of biodiversity planning in Jerusalem.

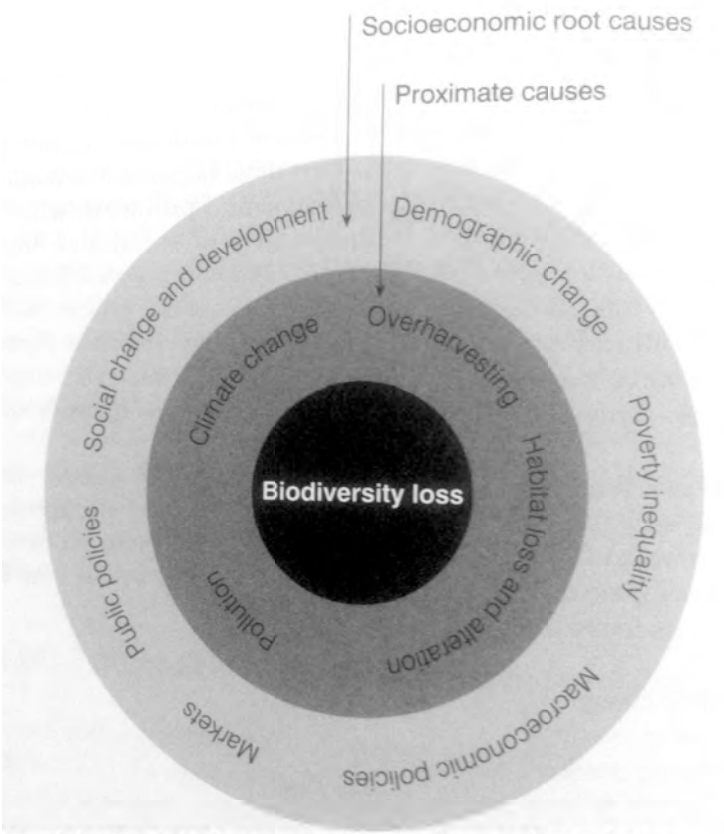


Fig. 2.2: Wood et al. conceptualizes biodiversity loss as having proximate causes that are more direct and then indirect socio-economic root causes. Source: Wood et al. 2000, Fig. 2.1, p. 14.

Causes of Biodiversity Loss

Wood et al. conducted the Root Causes Project to correct the focus of biodiversity conservationists on what it deems the proximate causes of biodiversity loss, namely habitat loss and degradation (see Fig. 2.2). It critiques traditional approaches that focus on protected

areas as "only of peripheral relevance to the central development issues that threaten the viability of the biosphere," (2000, 6). Wood et al. Explains that these proximate causes have underlying forces that lie in socio-economic institutions. They admit that these connections are not well understood, and that when they are studied, they are looked at only at the local level. They argue that socioeconomic factors must be explored at local, regional, national and international to understand the underlying root causes. They undertake such a study on 10 cases around the world and generate concept diagrams for each to show the proximate and root causes of biodiversity loss (see Fig. 2.3). The ten case studies are of more remote wilderness areas, but their root causes connect them to the socio-economic forces that often originate in cities.

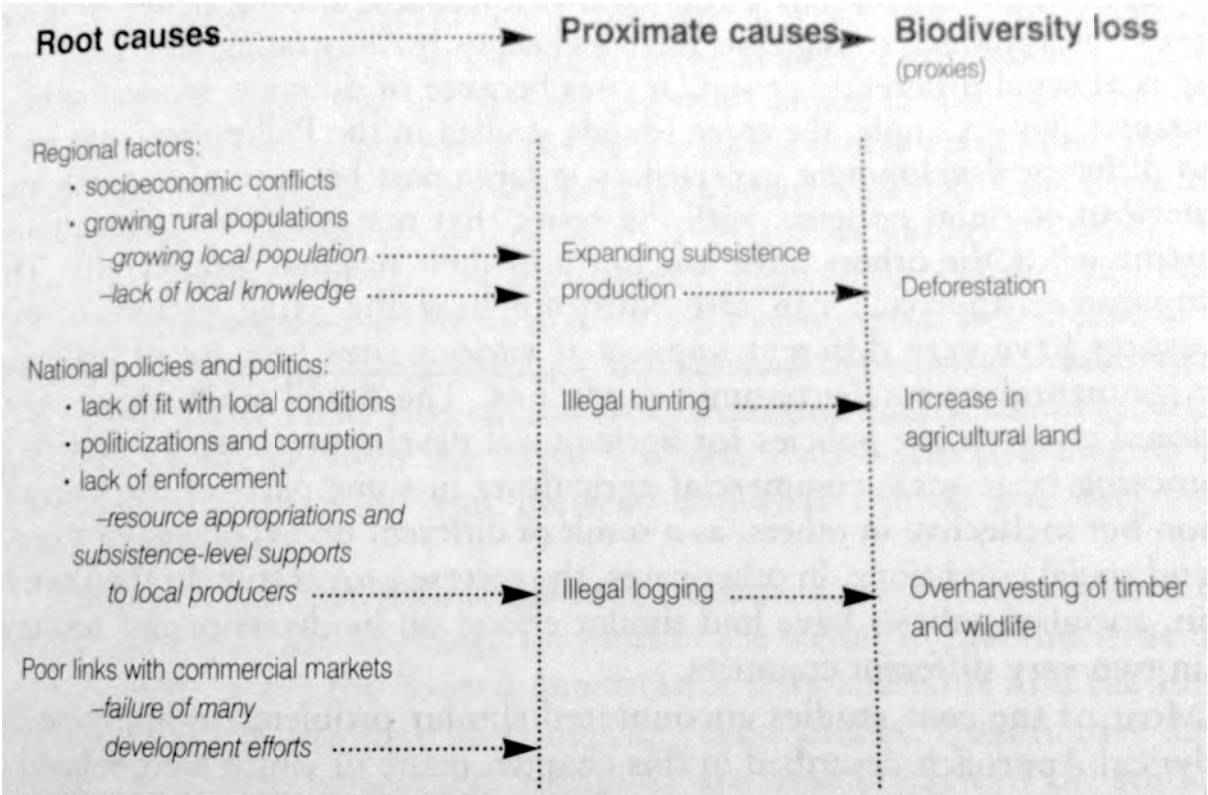


Fig. 2.3: Root and proximate causes of biodiversity loss in the Calakmul Biosphere Reserve in Mexico. Source: Wood et al. 2000, Fig. 2.6, p. 29.

The conclusions from this study include lessons that are applicable here. The first is that underlying causes of biodiversity loss in wilderness areas requires looking outside of these

zones (Wood et al. 2000). This supports the idea of looking where socio-economic forces of society often originate: cities. The second is that a more comprehensive approach is needed that will address socio-economic root causes of biodiversity loss if we are to succeed in stopping biodiversity loss (Wood et al. 2000). They argue that the underlying development model that relies on resource use to fuel economic growth and increasing consumption in order to respond to "domestic and external pressures" conflicts with habitat conservation and that this conflict is not being addressed (Wood et al. 2000, 78).

The Status of Urban Biodiversity Planning today

In 1992, nations formally recognized the urgency of biodiversity loss by creating the Convention on Biological Diversity (CBD), ratified by 194 governments. The objectives of the CBD are "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources" (UNEP 1992, 3). The CBD calls for cooperation among and within nations on biodiversity threats, internal management of biodiversity, and internal protection of biodiversity and indigenous knowledge. There are no targets inherent in the convention, only general obligations to address biodiversity protection (UNEP 1992). The Aichi targets are part of the CBD strategic plan for the current decade, with goals to be met by 2015, 2020, or 2050. Aichi target 17 calls for a National Biodiversity Strategy and Action Plan (NBSAP) to be produced by 2015. To date, 179 parties to the convention have produced NBSAPs (COP 2014). Israel produced its NBSAP in January 2010 (Roumani 2013).

At their tenth meeting, the Conference of the Parties on the Convention on Biological Diversity (COP) developed a document seeking to support subnational governments (COP 2010). It calls for cooperation between levels of government and indicates the importance of local implementation of awareness, monitoring, and evaluation programs (COP 2010). It also

lists suggested activities "based on concrete examples researched with the Global Partnership on Cities and Biodiversity," (COP 2010, 4). The local governments themselves can take on many of these activities, even without federal support. Suggestions indicated in the document are: (1) create local biodiversity plans, (2) engage in international conventions and apply a holistic ecosystem approach to decision making, (3) recognize local efforts in biodiversity preservation, (4) integrate biodiversity consideration into local decisions, (5) increase cooperation among and between various governmental levels, (6) utilize and support the testing of local biodiversity indices, (7) build capacity of local decision makers through biodiversity training and other tools, and (8) increase public awareness and participation in biodiversity issues (COP 2010).

At the eleventh meeting of the COP in October of 2010, they decided to produce a report called the Cities Biodiversity Outlook (CBO) annually. The report is an assessment of opportunities and linkages between cities and biodiversity, or in other words, an assessment of the urban bioshed. The latest report emphasizes the importance of including municipal and local governments in efforts to save biodiversity. It discusses the rapid growth of cities and the general trend of urbanization around the world, but also the dependence of cities on non-urban areas for essential services and resources. It also explains the linkage between healthy local biodiversity in providing ecosystem services to cities that enhance equity, quality of life, and livelihoods (CBD 2012).

ICLEI – Local Governments for Sustainability, once known as the International Council of Local Environmental Initiatives, is one of the main institutions promoting local biodiversity planning. Local governments can become members of ICLEI and have access to its network of case studies and tools. While its main goal is to support the implementation of Local Agenda 21 and other sustainable urban initiatives, it has an office dedicated to urban biodiversity in Cape Town called the ICLEI Cities Biodiversity Center (ICLEI-CBC). In partnership with the International Union for the Conservation of Nature (IUCN), this office

published the Local Action for Biodiversity (LAB) guidebook in 2010 and initiated a LAB program for local governments, first piloted in 2006. In the program, cities pay to join the program and take advantage of the expertise of the ICLEI-CBC office. In 2008, ICLEI alongside LAB participating cities created the Durban Commitment, a charter that acknowledges the significance of biodiversity and commits to its regular measurement and management as a local government. LAB participants commit to five actions: sign the Durban Commitment, produce a biodiversity report, complete three local biodiversity projects, and publish and commit to a Local Biodiversity Strategy and Action Plan (LBSAP) (ICLEI 2010; Pierce 2014a). The LBSAP is meant to be the local equivalent of the NBSAP called for in the Aichi target. Over 30 cities have participated, with many committing to subsequent programs that focus on communications or climate change.

It is not known how many LBSAPs have been produced, but a recent study identified and analyzed 49 biodiversity plans in urban areas, defined as those meeting a density threshold of 1,125 people per square kilometer (Pierce 2014a, 2014b). Jerusalem is the only city in Israel for which I have identified an LBSAP, and the only one in the Middle East. I have identified 192 more local biodiversity plans that do not meet such a threshold via an internet search in 2013. These likely represent only a fraction of those produced, with areas like Japan and the United Kingdom having a great density of local biodiversity plans (Pierce 2014a). India alone has at least 61 subnational plans produced in early 2000 during the process of generating their NBSAP (IMEF 2008).

In 2012, ICLEI-CBC launched the URBIS program, which networks local governments with academia and NGOs to form an online network of urban biodiversity case studies (Alfsen et al. 2010; Pierce 2014a). Jerusalem was one of the partners in developing the program and was an early signatory, signing on at the official launch at the Urban Nature Conference in the summer of 2012.

The Cities Biodiversity Index is the first attempt to quantitatively assess urban biodiversity, though it is still in the pilot phase. It was developed in a partnership between the Singapore National Parks Board, the CBD, and the Global Partnership on Cities and Biodiversity (GPCB). It uses 23 numerical indicators in areas of biodiversity, ecosystem services, governance, education, and maintenance to produce a picture of biodiversity in a locality. Ultimately, it aims to provide a standardized numerical measure for biodiversity status and initiatives for each city that can be used to self-assess progress (Pierce 2014a; Singapore National Parks Board 2013).

In the wake of all this action on biodiversity, it might be expected that biodiversity loss would be at least slowing, but research has not indicated any such trend (CBD 2012). Pierce has suggested that this may be in part due to a gap between the cruciality of biodiversity to humanity and its perceived value in the planning of cities which consume a huge portion of global resources (2014a; CBO 2012). Just 600 of the world's cities house 20% of global population but account for over half of GDP (McKinsey Global Institute 2012). Pierce found, in a comparative study of urban biodiversity plans and framework systems such as LAB and CBI, that biodiversity was consistently linked to questions of local land use rather than economic, social, and cultural issues. In other words, the authors of biodiversity plans self-limit the possibilities of their own plans to primarily those things that relate directly to land preservation. Furthermore, Pierce argues, this self-limitation corners biodiversity planners into a box wherein they are fighting over land with developers, in a humans-vs-nature standoff, a battle that is more often lost than won. She suggests that a more comprehensive approach that addresses multiple issues and explains biodiversity in terms of quality of life and livelihoods is more likely to garner support and to find synergies between people of various viewpoints. Her analysis also identifies Jerusalem's biodiversity planning documents as one of the more promising cities in this area.

Biodiversity planning has traditionally been the territory of ecologists and conservationists.

It has focused on the most in-tact, wild, and remote areas of the planet; places with the least human impact. As the focus has expanded to include urban areas, it has been built from such theories as island biogeography that negate the value of built-up areas and paint development as the enemy (Adams 2005; Brown 2008; Faeth and Kane 1978). Urban areas require a new approach informed by social sciences in order to address development, consumption, and other patterns of behavior that impact biodiversity (Pierce 2014a, 2014b). The traditional viewpoint that human impact is bad and conservation equals the reduction of human impact creates conflict that undermines our ability to find solutions to biodiversity loss. More recent conservationists have suggested that human impact can be positive (Faeth et al. 2011; Marzluff 2005; Newman 2006), and it is here that urban biodiversity planning finds hope.

Jerusalem in Context

Jerusalem is a city unlike any other. Known as a holy city worldwide, it is also contested, lying at the border of Israel and the West Bank of Palestine (also known as the Palestinian Authority, though the UN has acknowledged Palestine under this name since 1988) (see Fig. 2.4). While the focus of this study is Jerusalem's biodiversity planning, the city is steeped in tradition, religion, and, unfortunately, conflict. Any study of the area must also have some understanding of these contextual forces.

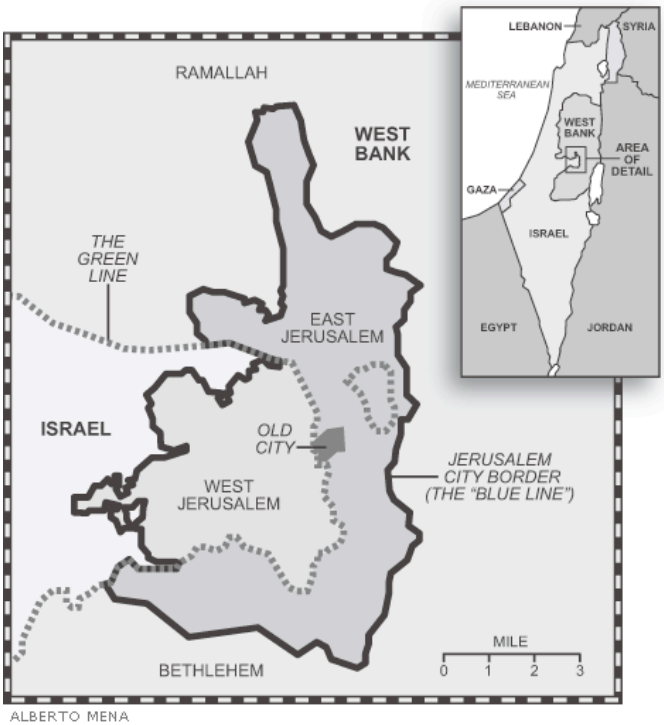


Fig. 2.4: Overall map of Jerusalem indicating East and West Jerusalem in context (source: city-journal.org Alberto Mena).

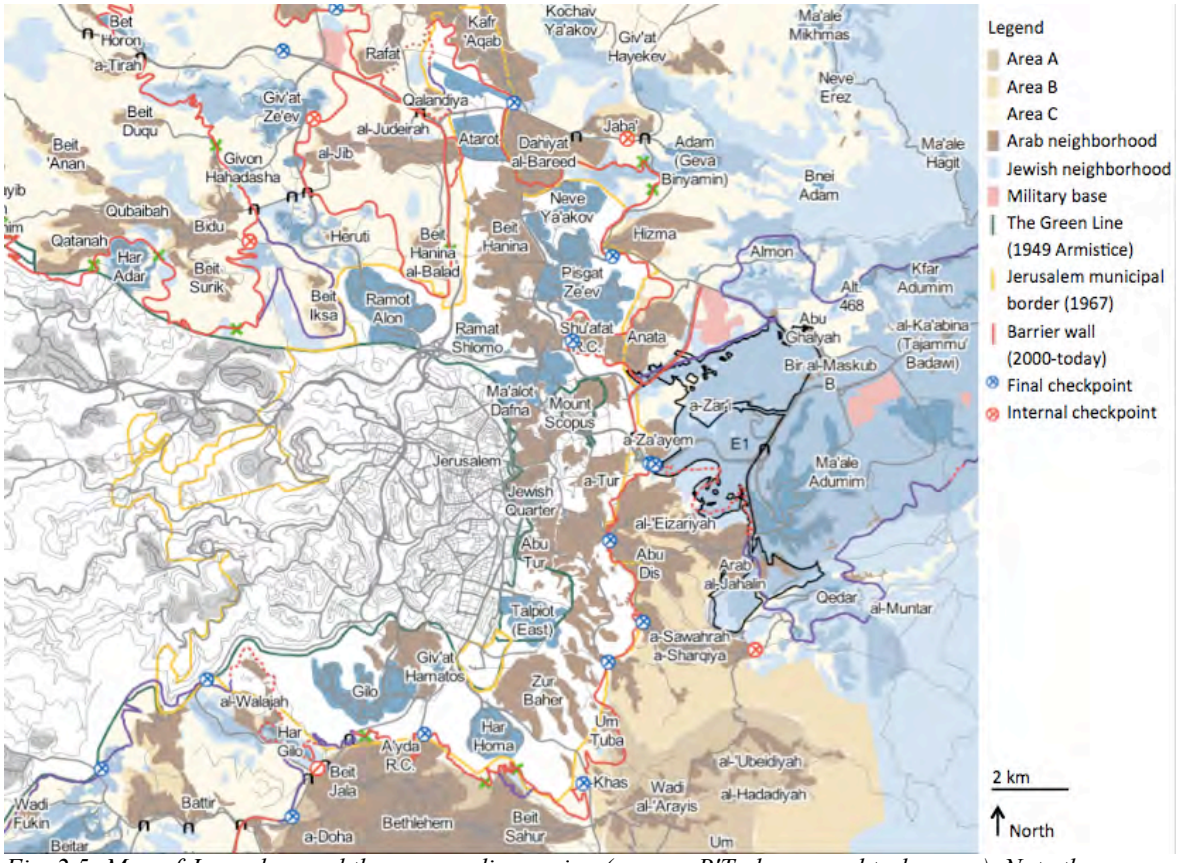


Fig. 2.5: Map of Jerusalem and the surrounding region (source: B'Tselem www.btselem.org). Note the expansion of the municipal borders in 1967 from the Green Line set in 1949 and the barrier wall which meanders back and forth across both sides of the municipal border, but generally follows the 1967 border.

As the desired capital city for both Palestine and Israel and as a holy city for Christians, Jews, and Muslims, Jerusalem is at the heart of the Arab-Israeli conflict. This conflict is made manifest in the separation barrier (also called the security barrier) running roughly along three sides of the city (see Fig. 2.5). While the nature of the barrier's height and materials change along its length, the tallest sections made of reinforced concrete run closest to Jerusalem (see Fig. 2.6). Thus, near the city, this barrier blocks the movement of most terrestrial species. Humans are able to cross at certain checkpoints with approval of the Israeli Defense Force (IDF) which requires certain permits, visas, or identification.

The conflict is also of interest internationally, with the city of Jerusalem not a recognized capital, hosting no embassies. The Israeli government considers the area of East Jerusalem,

annexed in 1963 from the Palestinian Authority by Israel, to be part of Israel and the city of Jerusalem to be an undivided capital. Internationally, Jerusalem is seen as a divided city, with East Jerusalem forming part of the occupied Palestinian Authority. So the geography of the city is connected to politics at the local, national, and international level. For additional background on this conflict, see appendix 2.1.

Fig. 2.6: A section of the wall that runs within municipal borders of Jerusalem and encircles some Arab neighborhoods as well as the UNRWA-run refugee camp of Shu'afat. View is looking South from Pisgat Ze'ev on the Israeli side of the wall (photograph by author).

Natural Geography of Jerusalem

Just as Jerusalem has significance as a religious and political center, its biodiversity is also significant. Jerusalem has one of the highest counts of observed urban species in the world, having counted over 1000 species in its borders (Roumani 2013). Israel's species account for 3.5% of known global species (Roumani 2013).

Jerusalem lies in the heart of Israel, at the confluence of Mediterranean and desert ecosystems. Jerusalem's location is very mountainous, and is centered on a ridge dividing one system of watersheds that run through desert to the Dead Sea to the East from another running through mediterranean regions to the Mediterranean Sea on the West. Precipitation

varies widely from Northwest to Southeast, reaching a peak of 554 mm per year in the hills to the West (Roumani 2013). Water access is particularly limiting in the area; a description of the current status of water access between Israel and Palestine can be found in appendix 2.2. The various sun exposures provided by the varying topography increase microclimate variability and increase the potential for biodiversity. Rock formations also vary, including chalk, marl, layered rock, dolomite, and limestone (Roumani 2013).

Twice a year, migrating birds cross over the city in numbers of over 500 million (Roumani 2013). The strength of Jerusalem's biodiversity determines the ecosystem services of the area, the connection between humans and nature, and the capacity of the city to serve as an educational tool for ecological function and natural heritage. In many areas, rock surfaces are exposed and provide particular rocky habitat preferred by species such as hyraxes. In others, ancient terracing remains and is sometimes still used for agriculture.

A major determinant of the level of biodiversity of Jerusalem is interspecies competition over land, especially between human development and nonhuman use. Jerusalem's biodiversity report points to development, population growth and habitat destruction as the primary driver for the decline of local biodiversity (Roumani 2013). Other drivers include interspecies interactions and the health or suitability of habitat areas. As an ancient city, some species such as swifts have adapted to human occupation and live in and around manmade structures. Jerusalem is a major center for progenitors, relatives of today's crops and other domesticated species (Roumani 2013). Other species, such as the mountain gazelle, have not grown fully accustomed to living among humans. Their urban populations have become isolated in islands of suitable habitat encircled by an ocean of inhospitable developed land.

Demographics of Jerusalem

The population of Jerusalem in 2011 was 804,400 with a majority Jewish (see Fig. 2.7). The growth rate in Jerusalem in 2011 was 2.4% with Jewish populations growing at 1.4% compared to 3.2% for Arabs (see Fig. 2.8). The population of the city is relatively young, with median age for Jews at 26 and for Arabs at 20 (Choshen et al. 2013) (see Fig. 2.9).

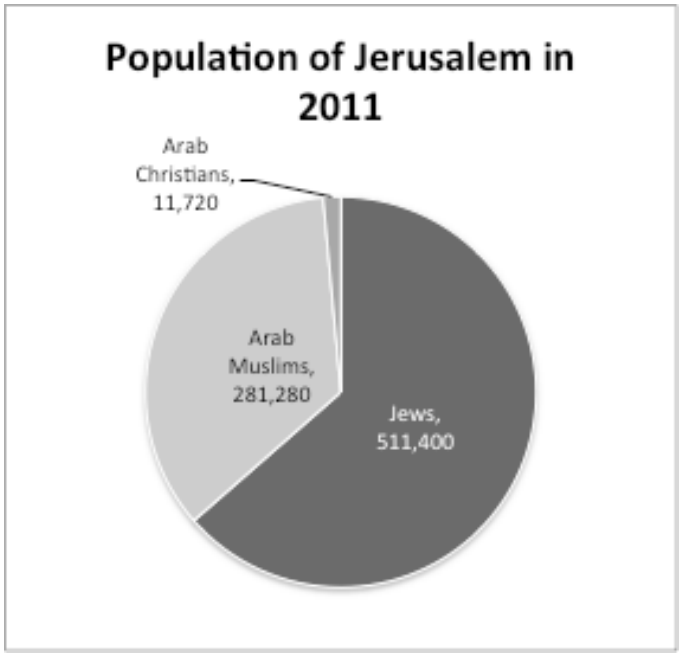


Fig. 2.7: Population of Jerusalem in 2011 by religion. Data source: Choshen et al. 2013.

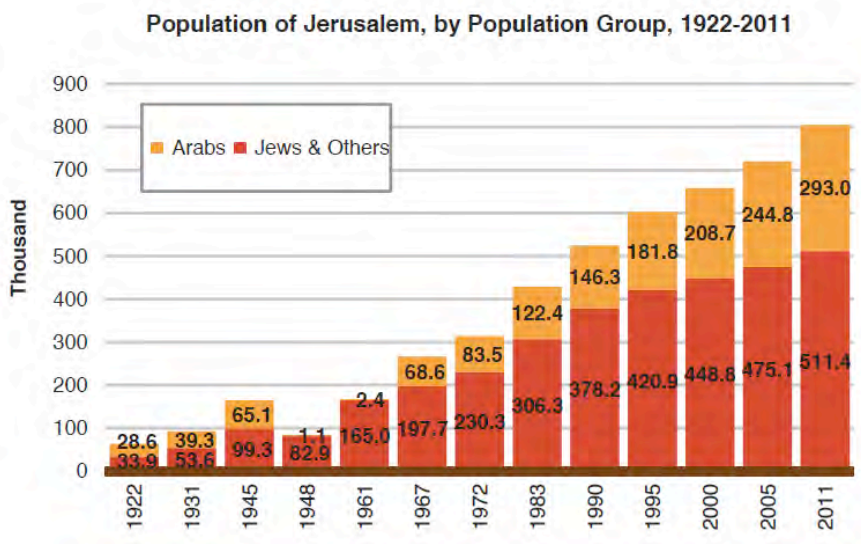


Fig. 2.8: Population Growth of Jerusalem (Choshen et al. 2013)

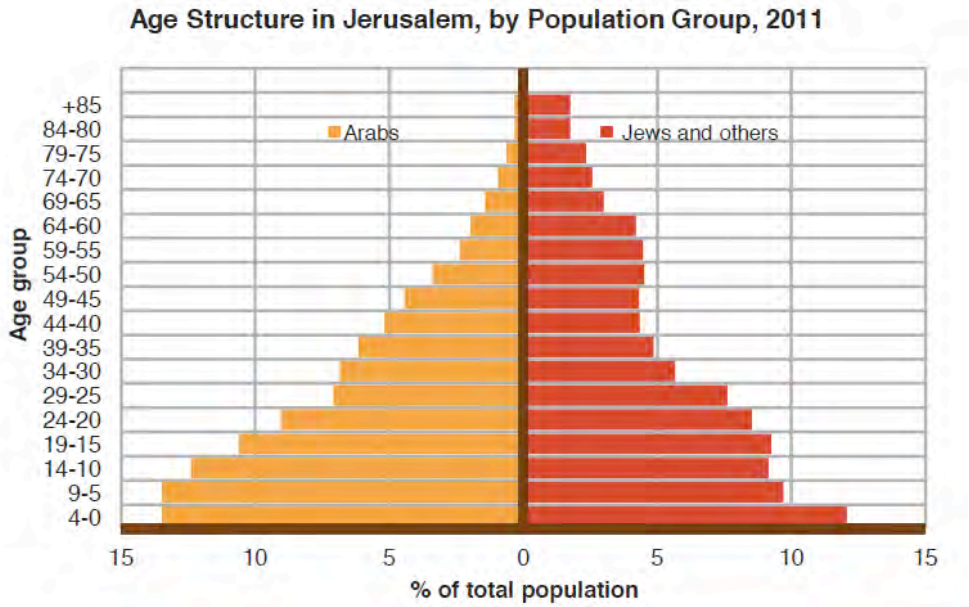


Fig. 2.9: Age Structure in Jerusalem (Choshen et al. 2013).

Jerusalem is poor relative to Israel, with 37% of families below the poverty line compared to 25% in Israel in 2011 (Choshen et al. 2013). The average (gross) monthly salary for an employee at NIS 7,600 (2,200 USD) in Jerusalem and NIS 9,000 (2,600 USD) in Israel in 2010 (Choshen et al. 2013). When compared to its neighbor, the West Bank, Jerusalem is relatively high income. The West Bank's GDP per capita was 1,924 USD in 2010 (Makovsky and Felder 2011) while Israel's was 38,004 USD, ranked 25th globally (World Bank 2014).

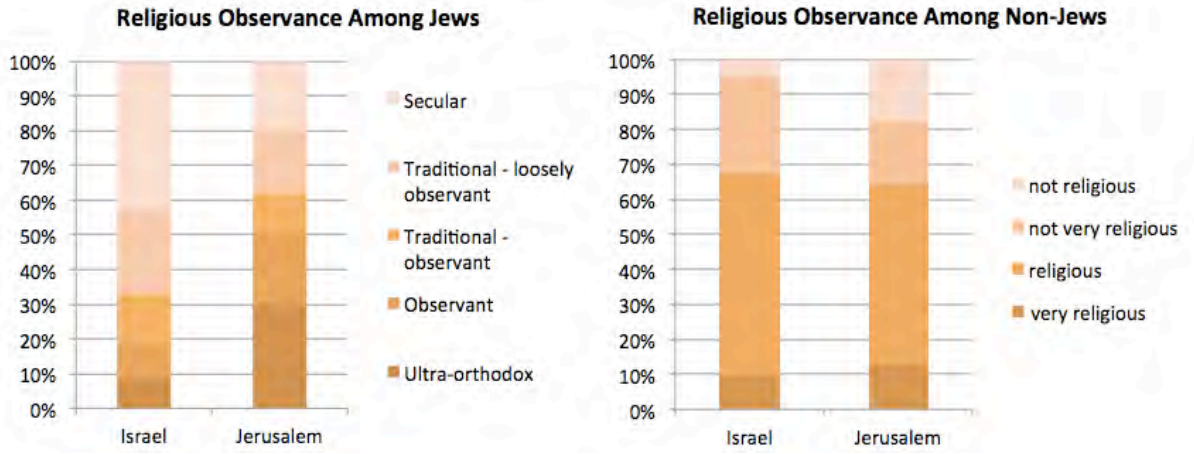


Fig. 2.10: Religious Observance in Jerusalem. Data source: Choshen et al. (2013).

The population of Jerusalem is generally broken down by ethnicity (Arab or Jewish) or by religion (Muslim, Jewish, Christian, secular). Jerusalem's Jewish population is more religious than in Israel on average, but its non-Jewish population is less religious (see Fig. 2.10).

The poverty rate is higher outside of the Jewish population, at 73% of families compared to 24% of Jewish families, though this number is higher for the Ultra-orthodox Jews (Choshen et al. 2013) (see Fig. 2.11).

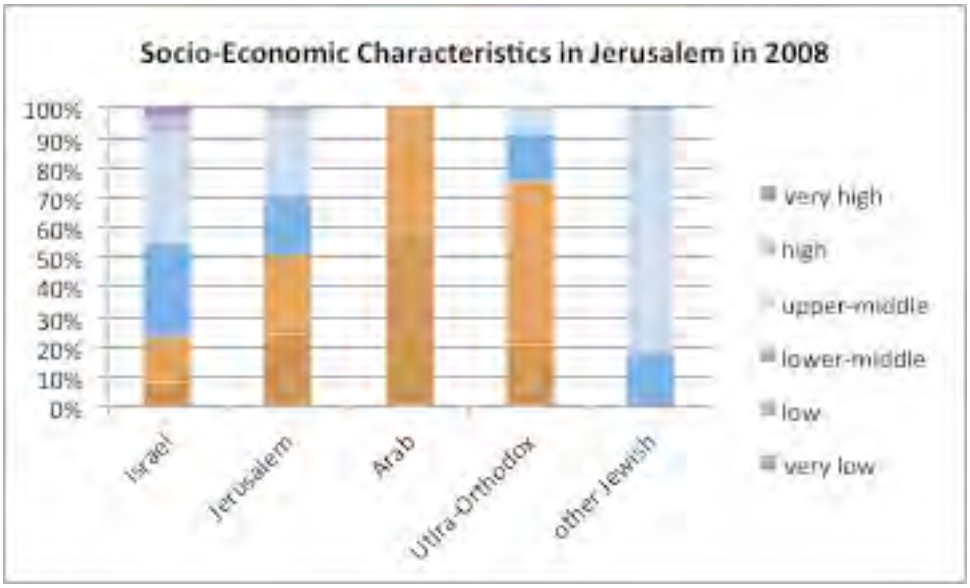


Fig. 2.11: Socio-economic characteristics in Jerusalem in 2008. Data for subdivisions shown are within Jerusalem only. Data source: Choshen et. al (2013).

Politics in Jerusalem

Voters in Jerusalem tend to vote for religious and ultra-orthodox parties in national elections. The voting rate in Jerusalem in 2013 for the Knesset (Jewish parliament) was 65%, compared to the national rate of 68%. The ultra-orthodox have higher voter turnout rates in national

elections than other groups, and support the religious and ultra-orthodox political parties (United Torah Judaism, Shas, and HaBayit HaYehudi). These parties garnered 50% of votes in Jerusalem, but only 23% of all votes in Israel. The Arab parties (Hadash, The United Arab List, and Balad) garnered 1% of votes together in Jerusalem, but 10% nationally (Choshen et al. 2013). This is mostly because most Arabs in Jerusalem are permanent residents of Israel, but not citizens and therefore cannot vote in national elections. They are eligible to vote in municipal elections, however (Choshen et al. 2013).

Since 1967 when East and West Jerusalem were combined, Jerusalem has had four mayors. At the municipal level, the mayoral elections occur every 5 years. At the same time, voters elect some city council members (Matzliach 2013). Mayors run with a selection of deputy mayors and cabinet members that are not necessarily members of their own party but that constitute a mix of representatives to entice the voters. Mayors can be endorsed by multiple parties. Nir Barkat, elected in 2008 and re-elected in 2013, is the current mayor. He became involved in politics when he founded his own political party in 2003 called Yerushalayim Tatzli'ah ("Jerusalem Will Succeed") and then ran for mayor. He lost with 43% of the vote and became the head of the opposition on city council. Five years later he ran again and became mayor, defeating the incumbent, Uri Lupolianski, and ultra-orthodox rabbi. He is considered a secular candidate, and his platform included aggressive development in East Jerusalem (BBC 2008).

Parties in municipal politics are complicated, with over 110 parties having served the city since 1948. Most do not last more than a few years. The current municipal government has representatives of twelve different parties (AICE 2014).

Arab participation in municipal elections is contentious. Some Palestinian organizations discourage voting for any Israeli government because they see it as an act of approval of Israeli occupation. In 2008, Zohir Hamden ran as an Arab candidate for mayor of Jerusalem but he withdrew one month before elections allegedly due to pressure from Palestinian organizations (AICE 2014).

Urban Biodiversity Planning in the Jerusalem Municipality

Jerusalem in particular has a role to play in upholding ancient heritage, due to its importance as a religious site. The ecological aspects of this heritage are of such significance that preservation activities have focused on species mentioned in the Old Testament and/or the Torah. The Jerusalem Biblical Zoo, for example, showcases species of the Bible. In Deuteronomy (8:8), there are seven plant species mentioned in the description of the fertile land of Israel; all of which can still be found in Jerusalem today (Roumani 2013). As a result, public support for local biodiversity can come from the lens of religious-based heritage and nationalism particular to the Jewish state.

The connection between nationalism and the support for local biodiversity preservation expands the scope of interest in Jerusalem's biodiversity to include a more global audience. Supporters of biblical/talmudic traditions reside around the world. They support the preservation of cultural heritage, including natural heritage, specific to Israel and Jerusalem, both financially and politically.

Despite direct benefits of biodiversity to the city and interest in preserving biodiversity as religious heritage, efforts to preserve its biodiversity are in nascent stages, with a high degree of activity in the 21st century. The most important decision regarding the biodiversity of the city today, however, is likely the development plan from the 1950s that followed a British model of building up on the higher elevations but preserving the valleys for agriculture. The result of this decision is that today many of the valleys are still open spaces, wedges of land that reach towards the center of the city from an outer green belt of more natural areas. Jerusalem's activities directly regarding biodiversity have largely occurred in recent years. The Sustainable Planning Department was established in 2009. In 2010, the city completed the Jerusalem Urban Nature Infrastructure Survey. Jerusalem's Local Biodiversity Strategy and Action Plan (LBSAP) is to be completed by the end of 2014 (Roumani 2013).

An urban nature master plan is currently under development that will consider all the open spaces in the city comprehensively. This is particularly important because while 65% of land within municipal borders is open space, only 3% is publicly maintained (Roumani 2013). The rest is agricultural land, forests and groves, or fallow areas. Much of it is in the green belt that rings the city or the valleys preserved from the 1950s. Without a coordinating body for all open spaces, many have become neglected, resulting in both a lack of control but also the preservation of wild, biodiverse spaces in the city. The city is currently developing a regulation that will require a flora and fauna survey of development sites during the permitting process (Roumani 2013).

Pierce compared biodiversity plans across the world and found that Jerusalem's planning documents had one of the most comprehensive descriptions of biodiversity and its influence

across sectors (2014a). The city has been highly involved internationally in promoting urban biodiversity, including being one of the first members of Local Action for Biodiversity (LAB), the founding location for the Green Pilgrim Network, and involved in the founding of the URBIS (Urban Biodiversity) network.

For more detailed information on biodiversity planning activities, refer to the analysis section of this report, which looks at several initiatives in the city as well as the primary actors. In that section, I combine literature review of the various parts along with the primary data I collected.

3. Research Questions

In this study, I consider current and recent activities in biodiversity planning in Jerusalem. I am taking an exploratory approach and therefore am asking broad questions to gather a lot of information. I ask the following questions:

1. What are the conditions that facilitated and limited Jerusalem's progress in biodiversity planning?
2. How do Jerusalem's biodiversity planners approach biodiversity conservation?
    1. How do they conceptualize biodiversity and its main drivers and barriers?
    2. How do they see themselves within this concept?
    3. What are the conceptual borders in which they operate?
    4. How does the city show their concept of the bioshed in their planning documents?
3. What does all of this have to say about the concept of the bioshed?
    1. Is it a helpful concept?
    2. What difference would it make?
    3. How can the bioshed of Jerusalem be communicated?

The first question is intended to increase my understanding of what is happening in Jerusalem

so that I can paint a picture of biodiversity planning in the city. This will build the basis for the next question, where I narrow in my focus to perceptions and approaches of professionals in the field. The final question is an initial test of the bioshed concept that is not intended to provide a final answer, but to explore whether the bioshed concept could be helpful in this case. This provides a foundation for future study on the bioshed concept at a different scale or within a particular focus.

4. Methodology

Grounded theory, as defined by Creswell, is the main type of qualitative research undertaken in this study (2003; Gomez, et al. 2001, Timlin-Scalera, et al. 2003). Creswell describes grounded theory as a multi-stage process in which a theory is tested through the viewpoints of the participants. The various stages allow for continuous refinement of the theory as the research progresses. In this case, the theory of the bioshed is tested through the following stages: analysis of published documents, observational walks, interviews, an interactive workshop and a review session. Analysis of the data gathered from these five sources follows a mixed methods technique, combining unbiased lexical analysis software with computer-assisted manual coding and diagram building. By combining an exploratory qualitative investigation and analysis with quantitative methods of analysis, I increase the validity of the results, as each method of data gathering and analysis compliments and balances the others (Greene, Caracelli, and Graham, 1989; Pierce 2014a; Tashakkori and Teddlie, 2003; Tashakkori and Teddlie, 1998; Tidball, 2012).

Sampling Criteria

The selection of Jerusalem as the study site is an example of an extreme, deviant case selected due to its more comprehensive approach to biodiversity planning compared to over 50 other municipalities around the world (Pierce 2014a). Sampling of study participants was a combination of purposive judgment sampling, snowball sampling, and opportunistic sampling. The observational walks within the city were a combination of convenience sampling of more proximate locations and purposeful selection of sites where urban biodiversity plans were either being implemented or were not successful.

Purposive judgment sampling allowed me to build a sample of participants that would maximize the learning potential of the data collected (Merriam, 2002; Polkinghorne, 2005). Participants in the study and observation locations were selected purposefully by the researcher and several local partners through the creation of an initial list by the researcher which then grew as the partners added names, a type of snowball sampling. The main criteria was to select strategic decision-makers across the city in order to provide a diversity of perspectives, but with an emphasis on biodiversity planning. Participants were selected according to their representative value owing to their institution, environmental perspective, and political stance. Representatives of Jewish, Arab, and Palestinian professional communities were invited to participate. To some degree, convenience sampling occurred due to lack of response or lack of availability from some potential participants. Here is the breakdown of the participant list, with counts of the number of people who were invited and who participated as interviewees, in the workshop, or in the review session:

Category	*Description*	*Invited*	*Interview*	*Workshop*	*Review*
Bio-Region Center	main biodiversity group	4	4	1	3
Society for Protection of Nature Israel (SPNI)	environmental planners	8	5	0	1
Municipality of Jerusalem	diverse departments	30	5	4	0
State of Israel	diverse ministries	10	2	2	1
Community Centers	planners and leaders	4	0	0	0
Other Israeli NGOs	green tourism, forestry	5	2	0	1
Arab or Palestinian NGOs	transport, water, environment	5	5	1	1
Private Companies	real estate, utilities, etc.	5	0	0	0
Academics	university professors	3	0	1	0
Total		*74*	*23*	*9*	*7*

Opportunistic sampling occurred during observational walks and transit journeys through the city, albeit filtered by purposeful decision of destinations and routes. Daily note-taking of observations, route mapping on GIS, and photography enhanced the accuracy of data. Locations were selected based on biodiversity planning activity, convenience of access, and value in terms of providing an understanding of city structure, culture, and history.

Relationships with Study Participants

I had pre-existing relationships with three of the participants, all of whom are involved in the BioRegion Center. I call these participants, along with the rest of the staff at the BioRegion Center, project partners due to their additional involvement in the study. These partners helped to select participants, facilitate interviews, and direct the project. Similar to a participatory action research approach, these partners had some capacity to alter the research

project in order that the outcome could better serve the goals of the BioRegion Center. To reduce bias in the interview outcomes of the partners, each individual was interviewed prior to becoming informed of the detailed intentions of the study, such as the concept of the bioshed itself.

I did not have pre-existing relationships with any of the other participants. Most participants were contacted by BioRegion Center representatives to participate in the study, with the exception of one nonprofit operating from Palestine who I contacted through another researcher in the area. This connection then led to a few more contacts of nonprofits working in Arab or Palestinian areas.

Research Bias

It is not possible to conduct this research free of bias. While I attempt an objective viewpoint, I cannot deny the impact of "the self;" my own culture, values, and identity on the analysis of the data (Creswell 2003; Yeh and Inman 2007).

In this case, the multiplicity of insider/outsider relationships is a useful framework to consider my identity as it may relate to the participants of this research. Suzuki, et al. cautions researchers on falling prey to the idea of a dichotomous descriptor of a researcher as an insider or outsider (2007). Instead, she recalls the "multiplicity of identities" held by individuals that can cast them as an insider in some respects while being an outsider in other respects. The table below lays bare some of these identities and how they may relate to the participants.

Identity	*Researcher*	*Participants*	*Notes*
Gender	female	mixed	People of strict religious following may be more impacted by a mismatch in researcher gender. All participants appeared to hold traditional male/female gender identities.
Class	academic	professional experts	
Income	upper middle	likely same	
Sexuality	straight	straight	Sexuality was not asked outright, but all participants appeared to hold traditional sexuality identities.
Nationality	USA	Israeli, Palestinian, Dual USA/Israel	
Religion	Christian, Presbyterian	Jewish, Christian, Muslim	Jewish participants included people from orthodox and other branches. Religion was not typically asked directly, but was occasionally offered voluntarily. Followers tended to be practicing adherents to their faith.
Race	White, mix	White, mix	
Ethnicity	Euro-USA	Jewish mainly, but also Arab	
Language	English native	varied	Most participants were fluent in English. Several were native speakers. A few were less comfortable in English, and native Hebrew speakers were on hand for translation.
Politics	leftist, environmentalist	varied	Participants were not asked directly, but most of the participants work in the environmental field and are likely to also identify similarly.

The table illustrates that while I am not native to Jerusalem, I share some identities with the majority of the participants, especially in the areas. In this way, there can be some ways in which I can relate to an interviewee as an insider and others in which I am perceived as an outsider.

Ethical Considerations

The main ethical considerations undertaken for this study include confidentiality, informed consent, the relationship between the researcher and the participants, and skewed sampling. Confidentiality is given to each participant in that results are aggregated and individual results are not indicated by name. Recordings of interviews are not shared, and the results of interviews are kept confidential to the reasonable ability of the researcher. Informed consent is obtained by each participant of interviews and workshops prior to their participation using the consent form in appendix 4.1.

To improve the power imbalance that can occur between the researcher and the participants (Hall and Callery, 2001; Susuki et al. 2007), one of the local institutions was brought on as a study partner, and the interview questions were designed to increase openness of participant input. The BioRegion Center operated as a partner on the project, giving strategical advice regarding the overall study methods as well as the research questions. However, these contacts first underwent the interview themselves in order not to bias their own interview responses. Therefore, the power dynamic between these participants and the researcher was more equal than with other participants who did not have an official discussion regarding the study methods. The interview questions are designed to begin open-ended and to allow for exploratory discussion that can follow the participants' lead. Subsequent questions begin to narrow down the topic. At the end of the interview, the participants are invited to add any additional information that was not covered. Suzuki, et al. recommends this additional query, calling it a debriefing (2007).

The selection of participants was biased towards representatives of the Jewish community involved with the BioRegion Center, as these were my contacts prior to initializing the study. While the BioRegion Center is an excellent place to begin my search due to their leadership in biodiversity planning in Jerusalem, they primarily represent Jewish interests. To mitigate this, Arab and Palestinian representatives were specifically included, albeit at a lower number. Also, a second contact who is not associated with the BioRegion center was consulted, and additional participants from the Palestinian communities were invited as a result of this consultation. Despite these measures, the study retains a sampling skewed toward Jewish participants due to convenience and to the strong partnership of the BioRegion Center, a Jewish organization.

Methods

Research methods included document analysis, interviews, observational walks through the city, a workshop, and a review session. Each type of data gathered helped to reinforce and serve as a check on the others, and in some cases I analyzed them separately for comparison with one another. For the data gathering schedule for the 29 days I spent in Israel, see appendix 4.2.

Document Analysis

The research began with a review of biodiversity planning documents produced by the city:

- City of Jerusalem Local Biodiversity Strategy and Action Plan – 2013
- City of Jerusalem Biodiversity Report 2013
- Green Jerusalem

I generated diagrams similar to system networks to illustrate the discussion of biodiversity in the first two documents. Then I analyzed all three documents in Leximancer, an unsupervised lexical analysis software, to gain quantitative outputs that are unbiased and can be repeated (Pierce 2014a, 2014b; Smith and Humphreys 2006; Tidball, et al. 2012; Penn-Edwards 2010). Leximancer provides unbiased output because it generates concepts from the documents themselves, without an applied framework by the researcher. I then exported three pieces of data for the three documents combined; the concept frequency data, concept co-occurrence with biodiversity, and biodiversity thesaurus data. These manual and automated data from the documents were then available for comparison with the interview data results, which underwent similar analysis.

Interviews

I conducted face-to-face interviews largely on an individual basis, and in the workplace of the interviewee, or in a café. The interviews were semi-structured, following a set of predetermined questions, but with occasional follow-up questions as necessary. I adopted some minor adjustments to the wording of the questions over time to add clarity. The interview questions are attached in the appendix 4.3.

At the end of the interview, I asked interviewees to draw a diagram of their role. Guillemin also used drawing exercises with adults in her research (2004). I then gave each participant the same tools; pens in red, green and black, a white A4 sheet of paper, and a stack of small yellow post-it notes. I also showed them an example diagram that I drew (see appendix 4.4). Some interviewees declined to create a diagram so in total 14 people submitted diagrams.

Each interview lasted 30 minutes to an hour and a half. I recorded and then transcribed the individuals' responses. The transcriptions were then analyzed quantitatively in Leximancer and qualitatively in NVivo. In Leximancer I exported two pieces of data for the three documents combined; the concept frequency data and concept co-occurrence with biodiversity, just as I had done with the documents described in the previous section. For the qualitative analysis, I derived concepts from the interviews themselves as well as from theory and personal observations.

Observational Walks

I also maintained a diary on a daily basis that included observations and thoughts outside of interviews. These notes especially focused on observations during walks through the city. The content of the notes began as general as possible, narrowing somewhat over time. In addition, I recorded my walking routes in GIS on a daily basis, and took photographs.

The reasoning behind this data collection was threefold; first, to take the maximum advantage of my time in Jerusalem to gather as much data as possible, two, as some measure of triangulation via a separate source of data that could serve to inform my thoughts and areas of inquiry, three, to familiarize myself with the context such that as locations or conditions come up in the interviews I would have some knowledge of the subject. Triangulation is the use of data from multiple sources followed by analysis that can then lead to further inquiry (Tashakkori and Teddlie 1998). Despite the fact that I have various other types of information that would to some degree serve as triangulation, they largely stem from similar blocks of participant's self-reported experiences, and therefore are less effective as a triangulation tool compared to separate firsthand sources of information (Fielding and Fielding 1986).

Workshop

The five hour-long workshop was intended to observe perceived and potential connections between people of diverse viewpoints around the city, both with each other and with biodiversity using a series of four exercises (see workshop agenda in the appendix 4.5). The workshop was hosted by the municipality of Jerusalem. There were nine attendees, selected in order to include a diversity of viewpoints but to maintain a discursive atmosphere. Participants included the following, some of whom are also interviewees:

- Helene Roumani, Director, Jerusalem BioRegion Center
- Uriel Safriel, Professor Emeritus of Biology, Hebrew University of Jerusalem
- Tamar Raviv, Open Spaces and Urban Nature, Ministry of Environment
- Tal Peri, Planning in the Region of Jerusalem, Ministry of Environment
- Ariella Svikell, Social Department, Municipality of Jerusalem
- Nimrod Levi, Department of the Environment, Municipality of Jerusalem
- Gil Nadan, Strategic Planning Unit, Municipality of Jerusalem
- Gil Reichman, Manager of Environmental Affairs Division, Municipality of Jerusalem
- Mohammed Nakhal, Director, Kidron Valley Project

The workshop activities began with a warmup inspired by narrative picturing, developed by Stuhlmiller and Thorsen (1997) wherein participants privately visualize something, and then describe it. In this case, I asked participants to close their eyes and then to visualize their dream for Jerusalem in their minds. I prompted them with the following questions:

- What does the city look like?

- What are the public areas like?
- What are the people doing?
- How does it smell?
- What does it sound like?

Then, I had two assistants walk around the room and touch the participants on their shoulder, one by one. I told the participants that when their shoulder is touched, they should state a word or phrase that describes some part of their dream for Jerusalem. As the participants said their phrases, I recorded them on a large board. This process continued until everyone had contributed. Participants kept their eyes closed during the response time in order to disassociate the answers with the individuals, and to minimize reactions to individuals' responses so that a safe space for talking could be built. Then, I had them open their eyes and review the responses that I had recorded on the board. I pointed out some areas of overlap and asked them about their observations or any surprises.

Next, I went around the room, asking each person to respond to this question: What is your organization and its main goals? I wrote their responses on the board, and then asked them how these main goals relate, or not, to their dream for Jerusalem. I kept those recorded dream descriptions and goals up on the wall in order to help create a mental and physical space that had been in part shaped by the participants themselves, increasing the perception of ownership and belonging within the group (Pierce and Forester 2014). This exercise also established the precedent of active participation in order to "break the ice" among the participants.

Next I provided the participants with 3x5 cards, each one pre-punched with three brads, as well as a stack of brown twine string pre-knotted with loops on both ends. I asked them to create a physical diagram that followed this hierarchy:

1. Organization Name
2. Organization's actions
3. Activity Outcomes

Each person would have one organization linked to at least one, but probably more, actions. The actions would then connect to the outcomes, and outcomes could be shared between multiple actions.

Then, I broke up the participants into small groups of three or four, and gave each group longer brown twine strings as well as red and green ribbon. I had each person describe their diagram. The people in their group would then connect their diagrams together using the appropriate string, following this system:

- Long brown twine is for existing and active partnerships
- Green ribbon is for newly proposed partnerships that could be applied in the future, or newly realized synergies between activities
- Red ribbon is for activities that are in tension with one another (or, in other words, work at cross purposes to one another)
- Both a red and green ribbon indicates a more complicated relationship between actions or outcomes

Connections between diagrams can be between any category, according to which makes the most sense to the participants. For each connection, I asked them to have a specific reason,

whether it be a shared outcome or a specific project. If it is a new project, they should discuss it specifically with the other person.

I then put the groups together and invited them to connect between themselves using the same method.

The next exercise involved the identification of root causes for environmental problems. I gave each participant a card folded into eight equal sections, and asked them to write on the first section an environmental problem in Jerusalem that they cared about. In the second section, they wrote an immediate cause for the problem, answering the question of "why?" In the third section, they answered the "why" question for what they had written in section two. The fourth section contained the answer to "why" for the third section, and so on until they reached eight, having asked "why" seven times. I wrote the original problem and the final, or root cause, on the board. We then discussed any observations or similarities as a group.

Finally, I asked them to brainstorm some root causes of biodiversity loss and wrote those on the board. We then discussed as a group how these root causes did or did not relate to the original visualization exercise, and the activities and goal of their organizations. I closed with an explanation that I would put the physical connections model into the computer in order to show the connections more clearly.

Throughout the workshop, several small refreshment breaks provided the opportunity to pursue informal conversations between participants.

I followed up on the workshop with an email containing a four-question survey to gage the opinions of the participants and to gather suggestions on how to improve the workshop.

Review Session

The two-hour review session served as another check for the data as well as an opportunity to gather more information. In this session, I presented the data gathered so far, insomuch as was possible at my level of analysis at the time. I summarized the methods and my observations. Finally, I asked participants about the bioshed term to see if it would be helpful in addressing comprehension and communication. At several points, I asked for feedback and opinions from the participants. I provided the data in a simple powerpoint that I edited as we spoke. Even though I invited all of the interviewees and workshop attendees to the review session, there were eight participants as well as three intern observers. The participants included:

- Helene Roumani, Director, Jerusalem BioRegion Center
- Tamar Raviv, Open Spaces and Urban Nature, Ministry of Environment
- Tal Peri, Planning in the Region of Jerusalem, Ministry of Environment
- Ariella Svikell, Social Department, Municipality of Jerusalem
- Mohammed Nakhal, Director, Kidron Valley Project
- Naomi Tsur, Chair, Jerusalem BioRegion Center
- Anonymous
- Eran Brokovich, Ecologist, Jerusalem BioRegion Center

5. Results

Results are listed first by data collection type, then somewhat aggregated according to particular actors in the last section.

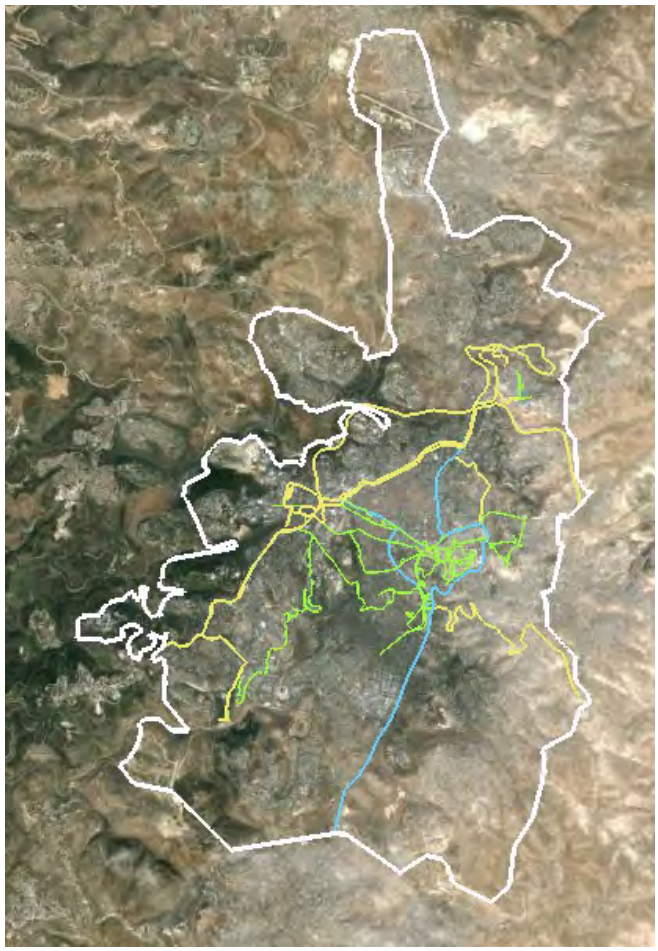


Fig. 5.1: Satellite image with explored areas. White is the outer municipal border of Jerusalem. Yellow are roads explored by car (56.4 km), blue is bus/tram, green is on foot (65.9 km) or bicycle (1.6 km). Base map by Google Earth.

Onsite Observations

I observed conditions in Jerusalem and the surrounding areas in explorations (see Fig. 5.1) and by accompanying biodiversity professionals on their duties. I had many informal conversations with professionals during guided tours as well as lay people on the street. I accompanied Amir Balaban during his nightly maintenance check in Gazelle Valley and a team of

SPNI workers and volunteers on an initial urban nature survey for Giv'atayim, a neighborhood of Tel Aviv. Unless stated otherwise, these are my observations within Jerusalem.

Buildings

Buildings in the city are generally uniform in color and style, and vary from low to mid-rise with a few exceptions. Their facades are typically white limestone, with a simple orthogonal style with unadorned windows and flat roof. Some buildings are concrete or other material, but nearly all buildings follow the same coloring as the stone. In East Jerusalem, concrete finishes are more common, and they generally are also taller.

Despite the hot weather, the building interiors are often comfortable, likely due to the mass of the stone walls, light colors, ventilation to courtyards, and cooler nights. All the residential buildings seemed to use solar hot water panels to generate hot water. While using such a heater, I had water that exceeded my needs in terms of temperature and quantity. Buildings in the Arab neighborhoods as well as in the West Bank generally feature black water storage tanks on the roof. In the West Bank, this is to store water during times when water is not available. In many Arab communities in the West Bank, lack of water is the norm rather than the exception. In East Jerusalem, the water tanks also mark Arab neighborhoods, but community members report that the water supply there is regularly available. In East Jerusalem, the tanks can even cause problems by adulterating the water.

In some areas in East Jerusalem, raw untreated sewage flows where once intermittent creeks directed rainwater. The sewage flowing in the Kidron valley sends up wafts of sewage smell

and, according to professionals, contaminates the agricultural areas in the valley when it rains (see Fig. 5.2).

Fig. 5.2: Kidron Valley. The smell of raw sewage wafts up from the valley below. Note the residences in the foreground and the agricultural areas on the right. Photo by author.

Open Spaces

Parks and other open spaces in Jerusalem vary from intensive sites with lush vegetation to sites that did not seem to have any maintenance regime and appeared abandoned. Paved plazas were also common and often had temporary artwork, markets, or festivals. The majority of park sites featured some combination of herbal bushes such as rosemary and lavender supported with drip irrigation, fields of mowed grass, and rocky herbaceous areas with various thorny or grassy plants. Rosemary was so prolific that its scent pervaded walkways along many parks. Most areas featured mature trees, primarily olive trees, but pine

and other tree types were also common. Use of open park spaces was high, especially in open mowed areas or in and around fountains. Large groups of elementary-aged children of the same sex playing together or of families gathered was common during the day (see Fig. 5.3). In the evening, older groups of youth would gather, often around a campfire (see Fig. 5.4).

Fig. 5.3: Parks in the center city. The one on the left is full of rosemary and olive trees and provides private areas with benches. The one on the right is in the valley just West of the old town. Children gather here to play in the fountains and social on the grass. Photos by author.

Fig. 5.4: Parks southwest of the center. On the right is a newer smaller park surrounded by residences. On the right is a larger older park. Note the remnants of a bonfire. Photo by author.

Litter in open spaces, sidewalks, markets, and side yards was common, and in areas that were not maintained, piled up all over the ground. Garbage collection bins were provided in park spaces and public areas. Well maintained recycling bins were provided alongside waste

collection bins in some neighborhoods, while others had only overflowing waste bins (see Fig. 5.5). Several professionals reported that the discrepancy in service was between Arab and Jewish neighborhoods, in particular for Arab neighborhoods with narrow streets that could not accommodate garbage trucks. Some professionals blamed a discrepancy in service and infrastructure while others pointed to behavioral and cultural differences.

Fig. 5.5: Garbage collection disparities. Left is a garbage bin in East Jerusalem. Right are recycling collection bins for paper and plastic in Kiryat Moshe, in West Jerusalem. Photos by author.

Construction waste was seen many times that had been dumped illegally in unused open spaces in East Jerusalem. Areas that sloped down from the street often served as dumping grounds for a large amount of construction debris and other waste. Professionals suggested that prime drivers for illegal dumping were the cost and inconvenience of proper dumping, low fines, and lack of enforcement.

Public Ways

Streets in the city include; mainly standard roads with mixed use by buses and cars with sidewalks on either side, some narrow pedestrian-only streets, and several wide, fast-moving highway-like roads with on-ramps. Buses, cars, and motorcycles are all common methods of travel.

Fig. 5.6: Transportation routes. Upper left is a dirt pedestrian path that goes around private campuses. Upper right is the bicycle path at the new Railway Park. Lower left is the tram line infrastructure. Lower right is one of the major thoroughfares through the city. Photos by author.

The bus network serves the main city areas with frequent stops and service, but does not have dedicated lanes and therefore sits in traffic. The tram line is quite busy and runs through a major downtown thoroughfare along a dedicated lane. From about the Central Station stop to City Hall the tram street has wide sidewalks with newly planted small trees on either side and no vehicular traffic other than the trams which run about every 7 minutes. From end to end it runs in dedicated lanes in the center of the street, often with medians on either side separating it from other vehicular traffic (see Fig. 5.6).

Traffic on the standard roads was congested, with short trips taking about twice as long as walking during rush hour. Use of bicycles and motorcycles was common, though they were primarily driven along paths designed for other modes of transport, even on the tram way. Railway Park was the only observed dedicated bicycle lane, but attempts to use it during peak

times were made difficult by the many pedestrians, often pushing strollers along the bicycling lane.

Outside of highly residential or retail-oriented streets, pedestrian movement is hampered by development patterns and the geography of the area. Highway-like streets commonly run between neighborhoods, often in the valleys. They generally require a long walk to arrive at a crossing. The hilly terrain of the city causes many streets to follow a zig-zag pattern that is not convenient for pedestrians. It is also not uncommon to arrive upon a privatized area, often a campus, with restricted access that requires a long route around (see Fig. 5.6). Pedestrian travel has at times worn dirt paths along open spaces between two fenced areas.

Accessibility measures such as clicking crosswalks and warning strips are common on larger streets and have been recently installed. Signage in the main areas is in Hebrew, Arabic, and English, but residential areas often have only Hebrew or Arabic signage.

Social Behaviors

There is a lot of contradictory information and lack of knowledge as it pertains to the political and legal situation in the area. I was told contradictory information about voting rights of Arabs, movement rights of Jews into Palestinian areas and the Temple Mount area, tax payment by Arabs, etc. One Israeli soldier, when asked why Jews say they cannot access the Temple Mount said, “don't listen to Jews.” When pressed, both Arabs and Jews referred to the other side as “the enemy.” Different vocabulary was also used by the two groups, with Jews referring to the wall as the security barrier, whereas Arabs call it the separation barrier. There is also contention about how to refer to one another's governments and settlements without

giving the other side legitimacy. Overall, there was an air of fear and distrust between sides, a definitive tension. At the same time, several people reported having friends on the other side of the barrier, either between Arabs or Jew to Arab. One person reported knowledge of a Jew living in a refugee camp in the West Bank out of solidarity with the Palestinians. So on an individual basis, there did seem to be some relationships holding across the barrier and cultural divide.

In additional to the physical barrier between the two cultures, the language barrier holds pretty strongly, with English sometimes serving as the common tongue between an Arab speaker and a Hebrew speaker. There are intercity bus services provided to Arab locations by an Arab company and to Israeli locations by an Israeli company. Arabs were observed traveling on the Israeli buses, but I did not notice any obvious Jews traveling on the Arab bus lines. Similarly, it was more common to see Arabs in the Jewish public spaces than to see the reverse.

Biodiversity

Plants in the city cover any exposed earth, emerging from cracks and growing out of old stone walls and even roofs. Many native plant species were spotted in non-irrigated areas (see Fig. 5.8). Old trees are common, as well as thistles, grasses, and shrubs. Tended gardens feature many flowering and fruit-producing plants such as lemon trees, fig trees, apple trees, olive trees, almond trees, grape vines, and orange trees. Street rights of way are the least vegetated, with only young, small trees if any along the right of way in most areas.

Fig. 5.7: Non-native species commonly observed in Jerusalem.The upper-left is the blue plumbago (Plumbago auriculata), an ornamental shrub from South Africa. Lower left is the laughing dove (spilopelia senegalensis) introduced deliberately for cultural reasons. Right side is the domestic cat (Felis domesticus) shown here in the old town. Photos by author.

The most common vertebrates observed in Jerusalem, other than humans of course, were domestic cats, hooded crows, house sparrows, and laughing doves (see Fig. 5.7). Cats in particular were seen on nearly every block, often scrounging from garbage. Most were

Fig. 5.8: Native flora of Jerusalem. On the left is the common globe thistle (Echinops adenocaulos). Center is the common caper (Capparis spinosa). Right is field eryngo (Eryngium creticum). Photos by author.

young, suggesting short lifespans. Feral dogs were not spotted, but they have been reported. Domesticated dogs were observed. Rock doves (*Columba livia*) were less common around the city than might be expected, primarily spotted in the zoo. One explanation given by a professional for the low numbers of pigeons is that there is no culture of pigeon feeding. Less common, but spotted in the heart of the city, were the jackdaw (*Corvus monedula*), chukar partridge (*Alectoris chukar*), hoopoe (*Upupa epops*), the palestine sunbird (*Cinnyris osea*), the common myna (*Acridotheres tristis*), the white-throated kingfisher (*Halcyon smyrnensis*), and various lizards (see Fig. 5.9). Two palestinian gazelles (*Gazella gazelle*) were identified in gazelle valley. Invertebrates observed included various types of bees, wasps, mosquitos, spiders, butterflies, beetles, ants, and snails.

Fig. 5.9: Native fauna of Jerusalem. On the left is the palestine sunbird (Nectarinia osea). Center is the clouded yellow butterfly (Colia croceus) on lavender (Lavandula augustifolia). Right is the eurasian jay (Garrulus glandarius). Photos by author.

Gazelle Valley

I visited Gazelle Valley on two occasions with guides, and also observed it from the surrounding neighborhood near Holyland (see Fig. 5.10). The first time I observed and

assisted with the nightly routine of checking the security of the perimeter fence, an important task completed every morning and evening. The goal is to eliminate infiltration by jackals or other predators of the gazelles. The site is currently under construction, so the first step is to ensure that the gate used by the construction crew is closed and locked. Then, we drove in a pickup around the perimeter, walking where necessary, to look for signs of digging and any suspicious tracks. We did not spot any Jackals or entry points, but we did spot a few birds (hoopoe, hooded crow) and ate some wild fennel and mulberries. My guide said that his battle with the Jackals was "like a war."

Fig. 5.10: Gazelle Valley overview from the Southwest. This view shows the entire Gazelle Valley, currently under construction. It is a triangular area surrounded on all sides by roads or buildings. Photo by author.

On my second visit, I came in mid-morning and we stood on the foundation for the future visitor's center with exposed dirt for a future pond in front of us. We saw a trespasser with his dog, a german shepherd. My guide spoke to him in Hebrew explaining about the site and that dogs are forbidden. A troop of visiting schoolchildren worked their way along the perimeter of the site, outside of the fence on the other edge of the property. Something may have disturbed the gazelles for we saw two of them dart across the dirt construction area. They continued around the site towards the heart of the construction area. My guide, the site manager, said that the behavior worried him because he wants the gazelles to avoid people and not run toward the construction area. When I asked why, he said that it would jeopardize

future plans for release back into the wild if the gazelles were too accustomed to people. He explained that the gazelles should be visible to people who are peering at them from inside the visitor's center and across the pond, not up close. Special groups of scientists could potentially go out on the visiting center balcony to get a bit closer, but for the most part, the gazelles would be protected from human contact. Remote feeding of the gazelles would be done just often enough to ease counting and status checkups, but otherwise, the gazelles would sustain themselves on the land. The site had been designed to provide areas for the gazelles on one side of the constructed waterways, and for visitors on the other.

The site manager said he could recognize each of the four gazelles currently living on the

Fig. 5.11: Gazelle Valley photographs. The upper left shows an area where trees have been planted. The Upper right shows another field that has a lot of wild fennel growing. The lower left shows the fence surrounding the site intended to keep the jackals out and to separate the gazelles from the road. The lower right shows a more vegetated area of the park. Photos by author.

site. He recognized the two we saw as the mother and fawn from that year. The population had been reduced down to two in 2012 before the fence had gone up that protected them from

predators and from running out onto the highways (see Fig. 5.11). These two had a fawn each year so there were now four. Additional gazelles would be brought in once the site was ready to create a genetically diverse herd of about 30. In the meantime, these four had all 50 acres to themselves, accept for the management workers, construction crew, and occasional dog-walker.

Urban Nature Survey

I accompanied two professionals from SPNI and three volunteers on the initial survey of urban sites requested by the neighborhood of Giv'atayim (see Fig. 5.12). In one long day, we walked around the neighborhood to assess 35 sites that had been pre-selected using satellite imagery (see appendix). The intent of this initial walk was to identify sites that should be looked at further, though some of the areas were privately owned and could not be accessed so we gathered what information we could from the outside. The group would return later on to the more significant sites to gather more specific information and to rate the sites according to their value to urban nature.

Our leader sported binoculars and enough hiking gear to look out of place in this city suburb. He tracked our route so that we could inspect each of the 35 sites. His colleague took pictures and identified birds. The volunteers did not have any particular expertise for the survey, but had enjoyed hiking with the leader before, and decided to join this urban hike for fun.

Assessment of each site did not typically take long, with one walk across sufficient for a declaration such as “these shrubs make good habitat for hedgehogs” or “stairs can often be

good spots for plants, but not this one, it's too modern." The neighborhood had historic significance, so we spent time reading historic information signs about the past residents. One of the volunteers' grandfather had owned a shop in the area.

Fig. 5.12: The path that the team doing the initial urban nature survey for the Giv'atayim neighborhood near Tel Aviv took, 23 km total, starting and finishing at the Tel Aviv bus station in the northwest corner. Giv'atayim is about 50 km Northwest of Jerusalem. Base map by Google Earth.

Most of the sites had too much pavement or mowed lawn to be of much interest, but a couple of them deserved another look. One area featured a very crumbly and porous stone that had geological significance and also provided important plant habitat. Another site was too steep to be suitable for development or even as a park, so it had a lot of native plants growing there, including many flowers, thistles, and bushy plants. Another steep site had a lot of invasive species and would need restoration to improve its value to local biodiversity, the guide explained.

One of the larger unused sites, called Kozlowski's Hill, (site #1 on the map) was teeming with small white snails. We spotted several insects, including three species of butterflies. The guide said that this site also supports turtles and snakes. It was one of the most important sites in the area. The guide explained that there had been another white snail species endemic to only that site, *Trochoidea picardi*, which recently went extinct after a fence surrounding a water reservoir on the site was rebuilt that presumably killed off the species.

In another promising site surrounded by residential buildings we spoke with a local who said she had seen hedgehogs among the bushes. Our guide said that this site was particularly important because the lack of irrigation and no trampling meant that a variety of native plants were thriving there.

Green Mosque

The Green Mosque project is in its early stages. It aims to use Muslim ideas of cleanliness to increase sustainability. The cleanliness concept will be expanded from just the self, to the home, the mosque, the street, and the community. In this way, sustainability can become part of Muslim culture. The Green Mosque is located in East Jerusalem, and is a small private mosque (see Fig. 5.13). So far, plans are being developed to establish rainwater collection, grey-water reuse, and solar power generation. The Green Mosque team has developed a nearby plot of land into a garden which is tended by volunteers. The main barrier to establishing the garden has been the difficulty of securing water access. Permission to connect to municipal water lines took three years to obtain.

Fig. 5.13: Green Mosque project. Left is the garden with newly planted trees and mulch. On the right is the mosque building. The lower roof on the left is planned to hold the rainwater collection cistern, through a partnership with the neighbor who owns the structure. Photos by author.

Interviews

Responses from the interview questions have been compiled and categorized below. The unbiased analysis by Leximancer provides co-correlated concepts with biodiversity for all of the interviews. The top 30 co-correlated concepts (meaning concepts that are likely to be near biodiversity alongside the 30 most common concepts in the entire texts are indicated in appendix 5.8. Categories for the manual analysis were derived from the data for organizational purposes in and were not part of any pre-existing framework.

Ideal and Realistic Outcomes

Participants shared 55 ideal outcomes, dreams, or goals during eighteen interviews. Table 5.1 Lists their responses by category, which vary considerably. Most responses fit into one of nine categories, of which none stand out as dominant. Another eight responses differed so widely that no category could accurately describe them and so they were combined into an

"other" section.

The respondents also provided what they considered to be more realistic outcomes or measures of success in twelve of the interviews. These 15 responses are listed in Table 5.2 by category. The most common response was to aim for progress in a specific, ongoing project. Other common responses relate to improving the physical conditions of the city or to increase influence on decision-making.

Concepts of Biodiversity and the Environment

Twelve interviews contained a concept or definition of biodiversity, and many gave information pertaining to urban biodiversity specifically. Five expressed being unsure about their ability to define or describe their concept of biodiversity, but often still provided some indication of how they thought about it. Three of four definitions of biodiversity connected biodiversity directly to the services that biodiversity provides for people. Each of the quotes from these responses are listed in the appendix.

When speaking about biodiversity conceptually, a wide variety of responses were given, though two tendencies emerged. Seven responses indicated biodiversity as being critical to sustain life. Three defined it more simply as something good. Five others did not fit either of these categories. When it comes to urban biodiversity it was defined either as a critical infrastructure for the city, something that is for people rather than for other species, or something that was less important or in decline compared to non-urban areas. Two respondents active in the management at Gazelle Valley also talked about how urban biodiversity should be managed.

Table 5.1: Interview responses regarding ideal outcomes.

I. Management

1. city management based on outcome for the residents
2. municipality to have an overview of the whole city, not just its own actions
3. to forward the mayor's agenda
4. environmental indices are improving
5. regional resource management for the environment and the citizens
6. decision-making task force for the region
7. a report that conveys value of ecosystem services and is useful for scientists and decision makers

II. Public Awareness

1. raise awareness
2. health education
3. environmental education
4. expand environmental discourses to include nourishing critical natural systems
5. public awareness about biodiversity-related terminology
6. people understand importance of green space for healthy life
7. people see importance of clean city

III. Politics and International Cooperation

1. end israeli occupation and increase cooperation
2. legitimacy for Palestine
3. comprehensive peace agreement in the region
4. dialogue with PA and Jerusalem Municipality
5. cooperate internationally
6. Palestinians to vote and be represented in the municipality

IV. Understanding and Integration of Environment

1. mayor understands sustainability
2. leaders and residents work for quality of life and environment
3. environmentalists not needed; environment is integrated into planning
4. the process moves on its own because there are so many others moving it forward
5. department no longer needed; its part is integrated
6. plans are already incorporating environment; animals and plants

V. Economics and Social Improvements

1. have generational equity
2. improve social conditions
3. increase equity
4. improve economics
5. improve living conditions

VI. Physical Conditions

1. quieter
2. cleaner
3. better waste infrastructure
4. return to historic conditions of environment
5. more open spaces
6. build green buildings

VII. Land Use

1. protect open areas
2. urban renewal to protect open spaces
3. no sprawl; people want to stay in the city
4. protect nature areas

VIII. General Sustainability

1. sustainable city that people enjoy living in
2. sustainable development
3. a new or renewed sustainable neighborhood in East Jerusalem

IX. Outside Influence

1. serve as a model for wildlife sites
2. make gazelle valley a prototype for others with rich biology
3. Jerusalem part of URBIS in a significant role

X. Other

1. strengthen civil society and stewardship in all neighborhoods
2. maximize the carrying capacity of the land for people and biodiversity
3. changing pattern of waste and pollution
4. to do research combining community with biodiversity and ecosystem services
5. average tourist to stay longer and experience the area with locals
6. sustainable heritage agriculture for locals that is economically viable
7. ongoing funding for our work
8. higher salary

Table 5.2: Interview responses regarding realistic outcomes.

I. Specific Projects

1. *determine a critical issue and create a joint project to address the issue*
2. *sustainable neighborhoods project will start*
3. *create science and policy forum*
4. *one building in Jerusalem will be green*
5. *an active community garden where people take responsibility as a group*
6. *SPNI stays involved in Gazelle Valley*

II. Physical Conditions

1. *green space all over the city for people to contact nature*
2. *no solid waste accumulation in the streets and no burning of waste*
3. *more separation and recycling of waste*
4. *to have comprehensive solution for sewage in the Kidron*

III. Influence

1. *that decisions in the city are based on sustainability and good science*
2. *to have professional research output that influences Palestinian water management and policy*
3. *address something in sustainability that we can influence and residents care about*

IV. Politics

1. *one state with equal rights for all citizens*

V. Morale

1. *not to give up and keep trying to change for the better*

Drivers and Barriers to Biodiversity

When asked about drivers and barriers to biodiversity and/or the environment, respondents were more likely to provide barriers that limited biodiversity (16/19) than drivers that helped biodiversity (12/19). Regarding barriers, respondents most commonly gave a political reason about the conflict or governmental priorities. The second most common response related to development, such as land availability or habitat destruction. Other reasons mentioned more than once included lack of financial resources, public attitude, poor regulations. See Table 5.3 for the detailed breakdown. Eleven interviewees mentioned drivers that contribute to biodiversity, and one respondent didn't know any drivers. The responses are detailed in Table 5.4.

Table 5.3: Interview responses regarding barriers to the environment and to biodiversity.

Total	*Barrier Mentioned*	*Subtotal*
18	**Politics**	3
	Priorities of decision makers	4
	The occupation	3
	The wall	2
	Lack of top-down support	2
	Encouragement of population growth	1
	Bureaucratic infrastructure	1
	Israeli government action	1
	Lack of regional perspective	1
8	**Development**	1
	Space/land limits	3
	Infrastructure	2
	Roads	1
	Habitat destruction	1
4	**Lack of Financial Resources**	4
3	**Public Attitude**	
	Awareness	1
	Lack of understanding	1
	Culture	1
2	**Poor Regulations**	2
1	**Invasive Species**	1
1	**People**	1
1	**Gap between decision makers, academics, and those on the ground**	1

Table 5.4: Interview responses regarding drivers to the environment and to biodiversity.

Total	Driver Mentioned	Subtotal
7	***Public Attitudes and Outreach***	
	Education	*2*
	Media	*1*
	Community involvement	*1*
	Love of hiking	*1*
	Awareness	*1*
	National pride	*1*
5	***Organizations or Individuals***	
	Him or herself	*1*
	Local environmental struggles	*1*
	Committed individuals	*1*
	SPNI	*1*
	Regionally focused organizations	*1*
3	***Government Actions***	
	Revised or good regulations	*2*
	Planning to protect open areas	*1*
2	***Physical Conditions***	
	Variety of habitats available	*1*
	Buildings that sustain biodiversity	*1*
2	***Social Connections***	
	Working together is a win-win	*1*
	Network between regulators/permit reviewers and developers/designers	*1*
1	***Academic Research***	*1*

Behaviors

When asked which behaviors drive biodiversity loss, many different responses were given in seven of the interviews. These are; the run for development, killing animals, littering, driving cars, wasting food, unintelligent consumption, wanting to build housing cheaply, a focus on

road development, development on open land, releasing a dog, using water, drinking coffee that is not certified. One person said that "there are so many of them" while another said "I couldn't tell you what they are." One person said that it was "hard to get down to behaviors." Two people talked about the need to raise awareness. One person separated direct and indirect effects.

Of the nine people that discussed their personal actions, all of them talked about their professional work. Only two mentioned activities outside of the professional realm such as composting and bicycle riding, but both were unsure about these personal actions. One said "I don't know that on an individual level that has an impact on biodiversity." The other put it more directly saying, "Aside from my work, I don't know how much of what I do directly benefits biodiversity in Israel. Maybe I should think about that."

How can biodiversity loss be stopped?

When asked ultimately, how biodiversity loss can be stopped, many of the answers were not hopeful. Of the nine respondents, four said it cannot be stopped and one said they didn't know. Another said it would take a catastrophe. The most disheartening statement was "When all the people die and we start a new civilization. I am not kidding."

On the other hand, some more hopeful answers focused on either changing paradigms, mostly through education, or through planning and development pattern changes. One respondent found hope in this question, "How do we look at biodiversity not as a limitation on human behavior but as a way of enriching our lives?" The answers are broken down in Table 5.5.

Response	*Frequency*
It can't be stopped	4
I don't know	1
Change the way people think	3
More education, esp. in Arab neighborhoods	1
Education and awareness	1
A catastrophe	1
Turn human diversity from conflict into creativity	1
Adopt and implement the urban nature plan	1
Get someone in power who understands	1
Increase density	1
Urban renewal	1
Stop growth of cities, roads, and infrastructure	1
Stop development in open areas	1
More nature reserves	1

Table 5.5: Responses to how biodiversity loss can ultimately be stopped.

Geographical Area

Ten respondents described the geographical area that they consider in their work. Table 5.6 gives the breakdown of their responses by organization or organization type. One respondent felt strongly about boundaries, saying "I believe Jerusalem's greatest problems are its boundaries, whether they are geopolitical barriers, security fences, green lies, red lines, blue lines, all the lines that we keep having drawn, but I think those lines are irrelevant and we have to look at the ecosystem pattern, and then we have a region that includes Jerusalem, the municipality itself, the city, and the region around, which, for better or for worse, includes parts of the Palestinian Authority... There is no dialogue going on in the cities between governments. I hope there will be in the future."

Table 5.6: Geographic area considered, responses given.

NGOs in the West Bank	*Bioregion Center*	*Jerusalem Municipality*	*SPNI*
the West Bank	the area surrounding Jerusalem, but it's easier to work on the Israeli side	within the blue line	Israel from Eilat to Medullah
the West Bank, Palestine, and Jerusalem	region including Jerusalem and parts of the PA	within the blue line	no geographical area
	from Jerusalem hills to the Dead Sea		

Anything to Add

I asked twelve interviewees if they had anything they wanted to add or emphasize to provide a very open-ended opportunity for them to contribute something. Nine of them had something to say. Three discussed the need to improve connections: in general, internationally, or between those on the ground and decision-makers. Three discussed the importance of communication: with climate change people, with decision makers, or about the value of biodiversity. Two said that the process of working in biodiversity takes a lot of time. Two discussed political issues; one referring to politics in the municipality and the other about international relations. The quotes from this section are listed in the appendix.

Concept Diagrams

Fourteen of the interviewees provided a sketch of their role; see appendix 5.7 for the diagrams. Table 5.7 shows the breakdown of topics listed by commonality. The most common topics were various social elements such as community, or references to science and research, found in half of the sketches. Almost as frequent were topics of policy, decision-

makers or government, and influence. Six of these drew a representation of themselves in the diagram, all of which in a central role.

Topic	*Frequency*	*Examples*
Social	7	Community, family, public
Research	7	Academia, biology, data
Self	6	Me
Policy	6	Planning, regulation
Influence	5	Planting seeds, advocacy
Decision makers	5	Authority, municipality
Quality of life	4	
Projects	4	Gardening, Kidron Sewage
Open Spaces	3	Parks, open space preservation
NGOs	3	SPNI
Economic	2	Business
Education	2	Schools
Ecosystem services	2	
Development	2	Green building
Transportation	2	
Health	2	
Media	2	
Water	2	
Religion	1	
Dialogue	1	
Relaxation	1	Birding, painting

Table 5.7: Topics from the interview sketches listed by frequency.

According to the scope and personalization of the sketches, I have categorized them. Diagrams with a narrow scope include proximate impacts, or do not include impacts but only list activities. Diagrams with a wide scope include indirect impacts or secondary impacts. Personal diagrams include some representation of the self or of individual daily activities. Impersonal diagrams use an organization rather than the self, or may be too theoretical to list even the organization. Narrow and impersonal diagrams were the least common type, with only two sketches. Narrow and personal diagrams, wide and personal diagrams, and wide

and impersonal diagrams each had four sketches (see Table 5.8).

	Narrow Scope	Wide Scope
Personal	4	4
Impersonal	2	4

Table 5.8: Categorization of the interview sketches by scope and personalization.

Social Network

When asked "Who do you work with most?" respondents gave a picture of influential institutions. I also added a search of various groups in the entire interview to fill out the responses. See Fig. 5.14 for the breakdown. The Israeli government and Jerusalem municipality were the most frequently mentioned, followed by SPNI, academia, and then community centers. Palestinian governments were mentioned less frequently, though this may in part be a reflection of the bias of interviewees who were primarily Israeli.

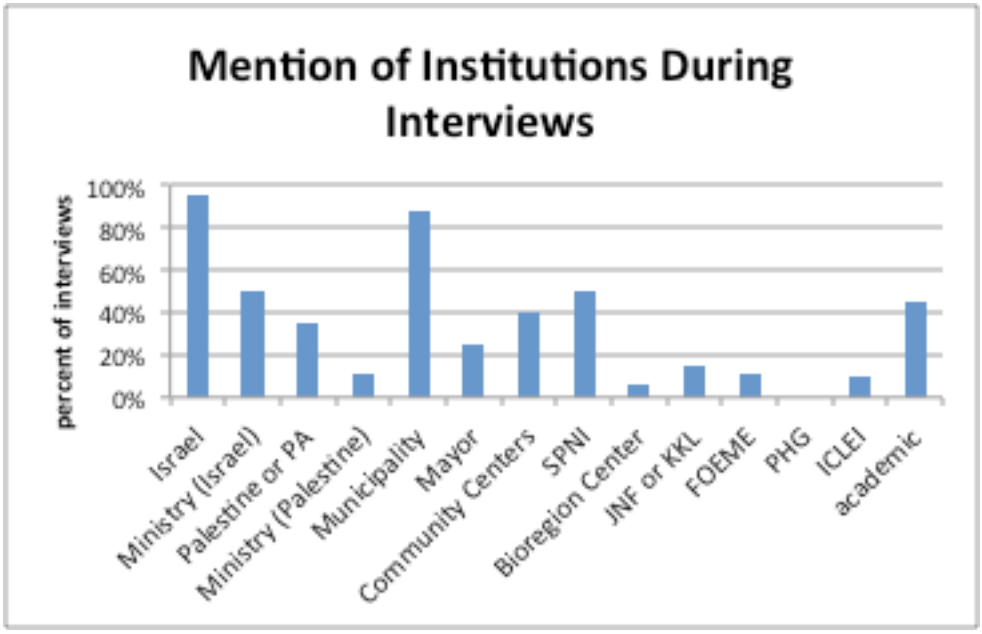


Fig. 5.14: Results of a word search among the interview transcriptions for mentions of various institutions. Mentions made by interviewees of their own institution are not included. Note: the search for "Mayor" excluded "Deputy Mayor" to avoid confusion with the two roles.

Workshop Outcomes

During the workshop, each attendee described their dream for Jerusalem and their organization's goals. Then they created a network of their organizations, activities, and outcomes together using cards and string. They connected to one another's diagrams. We then discussed root causes of environmental problems. See the appendix for the list of goals and dreams that I wrote on the board according to the participant's discussion.

Fig. 5.15: Workshop early stages. Photo by Glen Pierce.

The main themes that came up and were discussed during the workshop were:

- Awareness of the real value of biodiversity. A lively debate between an academic and the practitioners ensued about whether the true value of biodiversity, as something

that was necessary for life and not just something nice to have, was appreciated by both the public and professionals.

- Cleanliness questions, especially regarding solid waste. Making the city clean was the most common sentiment expressed during the "dream" exercise.
- Transit systems were mentioned several times as an important part of the sustainability picture for the future of the city.
- Decision makers not being around. Several times during the workshop, participants mentioned that certain people or organizations should be present, including SPNI and political decision-makers. It was noted that future workshops should involve these groups, but that also the non-attendance of political people was illustrative of one of the problems that the participants face in reaching their goals.

During the networking activity, the participants expressed that the physical embodiment of

Fig. 5.16: Workshop connections activity. Photo by Glen Pierce.

the connections was an important activity for them. Many new programs were suggested as a result of the activity. No conflicting relationships were identified, so none of the red strings were used (see Fig. 5.16). The participants suggested that this may be partly because the organizations that have more conflicting goals or activities did not attend the workshop. The resulting network diagram generated from the workshop was put into the computer for more clarity and was presented at the review session. During the review session, a few small alterations or additions were made. The resulting diagram is in the appendix.

After the workshop, a short survey assessed the overall opinion of the workshop (see all the responses in the appendix). The survey showed that the attendees were satisfied with the workshop and would be interested in more like it. The best aspects of the workshop were finding cooperative actions and potential partnerships around the city. Aspects that they would like to be improved are a wider attendance and a shorter overall length.

Document Analysis Results

Two documents were included in the document analysis; Jerusalem's Biodiversity Report 2013 and their Local Biodiversity Strategy and Action Plan (LBSAP). I analyzed the english version of both documents.

Biodiversity Report

The Biodiversity Report discusses conservation within Jerusalem's municipal border. It details the actions of the city as well as its partners and its plans for the future. For a detailed systems diagram of biodiversity created from the document, see appendix 5.10. Here I will

summarize the document's explanations regarding the bioshed of Jerusalem as a concept.

The definition for biodiversity in Jerusalem given in the report is all of the species, plants and animals, living and functioning in the city. The report refers to aspects of biodiversity unique to Jerusalem, such as the old walls that host many species, and the separation barrier which impedes movement of species. The city also contains many unique habitats formed from old agricultural sites, such as orchards, that are no longer maintained. Several recent development projects have broken ecological corridors in the North and South. These building projects have also have a positive impact on habitats as they have increased rocky habitat for species such as rock hyraxes.

The report clearly states the primary causes for biodiversity loss in the city:

> *"Since the 1960s, the encroachment of building and development into open spaces and the transformation of rivers into sewage conduits have been the dominant factors in biodiversity loss. Road construction, fences and afforestation have led to habitat fragmentation... These factors – housing and development, road construction and urbanization – as well as pollution, and pesticides and poisons used in the agricultural sector, have led to the... loss of species" (p. 55).*

The document primarily refers to the Jerusalem Urban Nature Survey of over 100 sites around the city, and the official designation of about 40 of them for preservation as the prime actions of the city to combat biodiversity loss. In terms of policy recommendations, the report supports the idea that development and biodiversity do not conflict. It says, "a prerequisite for securing the provision of ecosystem services in the face of projected threats is

the recognition that biodiversity conservation supports rather than conflicts with development," (p. 61). It calls for sustainable urban development and cites the 2009 city master plan as embodying these concepts.

The document refers to urban nature as a level of infrastructure on par with other more traditional types of infrastructure planned by the city. It discusses the goal of the LBSAP as restoring, connecting, and managing the city's open spaces and associated policies.

Section 2.4 of the report discusses socio-economic strategies, including equity of open space distribution through the city, capacity building among vulnerable populations, including Arab and immigrant communities, education, and public awareness. It also specifically states that communication programs will also target tourists such that the reach of the programs will go beyond municipal or even national borders.

In terms of policy, the report discusses fragmentation and attempts to mainstream biodiversity planning and management. The report talks about barriers to effective management of open spaces, including the myriad of agencies responsible for open spaces in the city and limited budget. It lists four different agencies other than private ownership for open spaces in the city. It explains strategic efforts to mainstream biodiversity into the municipal government such as the urban nature survey and upcoming associated policy, the LBSAP, and the establishment of the Sustainable Planning Department.

Local Biodiversity Strategy and Action Plan (LBSAP), English Abstract

The LBSAP was published in the same year as the Biodiversity Report, though technically

the english version used here is still a draft and is an abbreviation of the Hebrew version. Many of the authors are the same and so the content would expect to be similar. I will highlight here where the two documents differ. A concept diagram of this document can be found in appendix 5.11.

The LBSAP calls for biodiversity protection in both open spaces and built-up areas, whereas the Biodiversity Report does not speak about protecting biodiversity in built-up areas. The LBSAP mentions water as a scarce resource that is needed for biodiversity, in addition to the other ecosystem typologies identified in the Biodiversity Report. The LBSAP also outlines the biodiversity strategy as specifically including education, leisure, tourism, and social and economic development. The focus of the plan is on mainstreaming biodiversity across the government and in achieving the triple bottom line of economics, environment, and social goals. A new Open Spaces Administration is the primary immediate action item that is to be initiated. This administration is meant to coordinate the activities of the fragmented management of open spaces by various agencies today.

In all, these various data sources and data collection methods have presented an array of ideas and information for exploration in the analysis section to follow.

6. Analysis

Herein I will provide answers to each of my research questions in order. First I will describe the conditions that facilitated and limited Jerusalem's progress in biodiversity planning. I will do this through a conceptual framework that illustrates Jerusalem's planning. I will include an analysis of strengths and weaknesses in the system. Then I will explain how the city's biodiversity planners approach biodiversity conservation by summarizing and comparing the results discussed in the previous section. Finally I will discuss what this says about the bioshed of Jerusalem, how it is understood, and what difference it could make.

Conceptual Framework for Biodiversity Planning in Jerusalem

The recent activities in biodiversity planning in Jerusalem can be explained using the following framework: groundwork conditions that set the stage for future accomplishments, a catalyst phase during which many projects were initiated and implemented, and the ongoing impact of these two elements in the form of policies and projects. Jerusalem exhibits certain strengths that likely have contributed to their success in moving biodiversity planning

forward, but also particular weaknesses that prevented further progress.

Groundwork

The groundwork set for Jerusalem can be understood as having two parts; pre-existing ecological, geomorphological and cultural conditions, and intentional initiatives that are the result of years of work by driven individuals and organizations. Jerusalem has a rich biological heritage. It is located in an ecotone between forests, Mediterranean shrub land and desert and at the confluence of three major land masses over which birds migrate. Its unique location where many species first began to be domesticated means that many agricultural and familiar species are considered part of the biological heritage of the area, such as olive trees, almond trees, and wild fennel.

As a location that has cultural and religious significance with a long recorded history of the relationship between humans and the area, there is a strong link between the city's biological heritage and the Jerusalemites. Evidence of this heritage playing a part in the city includes the biblical zoo, with special areas of the zoo dedicated toward local fauna, signage for many exhibits and also for trees along walkways that links the species to the bible, and a Noah's Ark themed educational building, built to look like the ark. The Green Mosque project expands the religious practice of cleanliness of the body to promote cleanliness of the environment. The Green Pilgrimage Cities project, based in Jerusalem, connects the act of religious pilgrimage to a sustainability journey that increases environmental awareness of pilgrims. Much of the funding requests that bring funds from the Jewish diaspora worldwide appeal to zionist philosophies of protecting the homeland.

The 1950s development plan for the city that preserved the valleys for agriculture rather than building development also set the stage for natural sites reaching into the center of the city. These open valleys often form the basis for the urban nature sites today, such as gazelle valley, though many are now dissected by roads or other development. These intact valleys may have contributed to the local's love of hiking mentioned in some interviews and conversations.

Initiatives in the 20th century have built upon these basic pre-existing conditions with new knowledge and projects. The primary contributor to this knowledge in Jerusalem is the Jerusalem branch of SPNI. As a consistent force for environmental planning in Jerusalem for 60 years, the impact of SPNI should not be taken lightly. The professional level of SPNI's work and their historic connection with local and national governments has enabled SPNI to wield influence over the decision making process. Their size and maturity gives them the institutional capacity to generate professional reports and initiatives. SPNI – Jerusalem has been the sole author or major contributor on many milestone accomplishments in biodiversity planning for the city, including: a report on infill development capacity for housing that negates the argument for both sprawl and developing in open spaces within the city (see Fig. 6.1), the assessment of urban nature sites throughout the city and the application of such information to the city's GIS system, the development of an urban nature survey system, the support for and management of the Jerusalem Bird Observatory and Gazelle Valley, the blockage of an orbital highway in the hills to the West of the city, initiating and supporting community gardens throughout the city, and providing many environmental education programs for both the public and decision-makers. Other organizations contributed to some of these initiatives, but SPNI served as a common thread weaving them together and

strengthening them.

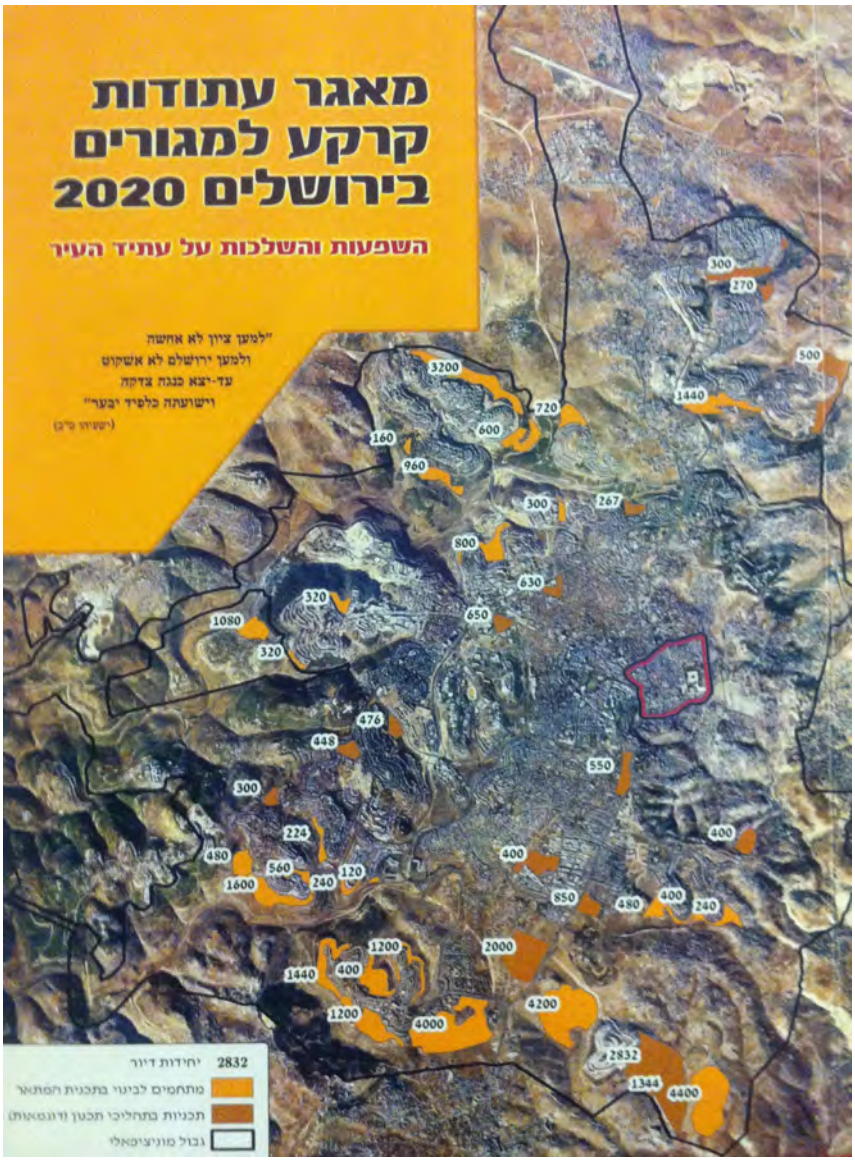


Fig. 6.1: Map of new housing capacity in Jerusalem. This study, by SPNI in 2006, was to determine the capacity for new housing in the city without infilling important natural sites or sprawling outwards. This study contributed directly to the blockage of a proposal of a new orbital road in the Jerusalem hills to the West. Numbers shown are potential new housing units.The head of this report was a planner and GIS expert who volunteered his time.

Another groundwork element for biodiversity planning is the social system of community centers and volunteer work that increases the efficiency and capacity of NGOs such as SPNI. The community center network covers the entire city and gives an automatic plug for groups wanting to reach the public. The community centers were commonly mentioned in the

interviews. This is to a lesser extent in East Jerusalem where community centers exist but are not as effective at reaching the population. The common practice in Israel of volunteer work, such as the National Service that is required by all citizens, provides a pool of cheap laborers that can be hired on at a government-subsidized rate to assist with projects and bring youthful energy to initiatives. SPNI reported using National Service workers in their community gardens outreach, environmental education programs, urban nature site maintenance, and for urban nature surveys. However, East Jerusalem and Palestinian groups did not report using or having access to such volunteer forces. Their staff was generally smaller, resulting in lower institutional capacity.

The impact of SPNI is evident in the interviews where they were the top NGO organization mentioned, and the workshop where their lack of presence was strongly noted by the participants. It should also be noted that there may be some bias towards SPNI because they were well represented in the interviews, with five staff members interviewed, and they hosted my work station and review session.

Catalyst

In 2008, a local activist from SPNI who had been involved in blocking the orbital highway to the West of Jerusalem and in coordinating the Gazelle Valley community action, was elected Deputy Mayor in Jerusalem. Her name is Naomi Tsur. She was not a member of any political party, nor was she involved in politics other than as an activist for environmental causes. Her election was the result of a discussion with the mayoral candidate Nir Barkat, who selected her to run on his ballot. When Mayor Barkat won the election, Tsur found herself in one of the most powerful positions in the Jerusalem municipal government, which

she held until 2013.

These five years marked a time of increased connection between environmental groups and the city. Ten interviewees mentioned her by name, often in the context of discussing how things were different when she was Deputy Mayor, or how on a certain project she could tell me more because she was there. Before Tsur joined the city, she worked at SPNI where she was instrumental in the housing study, blocking construction of the orbital road, and coordinating the community around the Gazelle Valley project. But, during her five-year term with the city, many biodiversity planning projects sprang to life or leapt forward. These include:

- Establishing the city's Sustainable Planning Department
- Establishing the city's urban planning committee
- Securing funding for Gazelle Valley Park
- Gaining recognition for nearly half the urban nature sites
- Completing the first sustainable city report
- Competing the city's first biodiversity report
- Becoming a strategic partner for URBIS and signing the URBIS registry

There was criticism of her time with the city that Tsur lacked political know-how that could have garnered more budget or other influence within the city. Tsur was seen as an outsider among the local politicians, either because of her lack of political savvy, disinterest in the politics game, time spent abroad, activist reputation, or some combination of these factors. In 2013, Tsur failed to win re-election and now devotes her time to the BioRegion Center where she is the Chair and the Green Pilgrim Jerusalem, for which she is the founder and president.

Outcomes

Jerusalem Biblical Zoo

The Tisch Family Zoological Garden, or Jerusalem Biblical Zoo, is located on 100 acres in a valley on the southwest side of Jerusalem. It was originally founded in 1940 on a different location, but in its current form was started in 1992. While some of the exhibits are quite typical of zoos, this zoo places a special emphasis on biblical species (see Fig.6.2). The zoo conducts educational programs and research as well as breeding of endangered species (Roumani 2013).

Fig. 6.2: The Bible Land Preserve at the Biblical Zoo. This photo shows part of the 10 acres of land dedicated towards animals mentioned in the bible and historically found in Israel. Most are extinct in the area today. The wood structure is a viewing platform for the public. Photo by author.

Jerusalem Bird Observatory

Founded in 1994, the Jerusalem Bird Observatory (JBO) is the first urban wildlife site in Jerusalem. It is operated by SPNI staff on a site near the Knesset adjacent to Sacher park. It has a shop and meeting room, bird hide, and urban wildlife area including a constructed wetland (see Fig. 6.3). Activities at the JBO include studying and banding birds, educating the public, and hosting training programs for leaders.

Fig. 6.3: Education center and gift shop at the Jerusalem Bird Observatory (JBO). Photo by author.

Urban Nature Infrastructure Survey

SPNI partnered with Jerusalem Municipality and the Israel Ministry of Environmental Protection to produce the Jerusalem Urban Nature Infrastructure Survey, released in 2010. The survey includes photographs, descriptions, and classifications of 151 open spaces in the

city. This information has since been reduced to 141 sites and has been made part of the Jerusalem Green Map online.

Jerusalem's 2009 Master Plan officially recognizes 69 of these sites, totalling 3,250 hectares of land (see Fig 6.4). The remaining 72 sites, constituting 2,150 hectares, have not yet been recognized. SPNI is currently working towards gaining recognition of all 141 sites. Those sites that have been recognized are subject to the urban nature policy plan, which requires, among other things, a detailed site survey of the biodiversity of the area before development. The result of the urban nature survey is a site catalog card that follows a standard format, per the example for the Bible Hill site found in the appendix 6.1.

Gazelle Valley

Gazelle Valley came about as a community-led initiative in a backlash against a proposed development in a triangular open space of 24 hectares (Roumani 2013). The community was able to stop the proposed development and then to propose its own development scheme. The community members voted on several schemes, selecting one that maintained the entire area as an urban nature wildlife site with research center, visitor's center, and a large area reserved for the gazelles only. As such, the site serves as an example for biodiversity planning and for community activism.

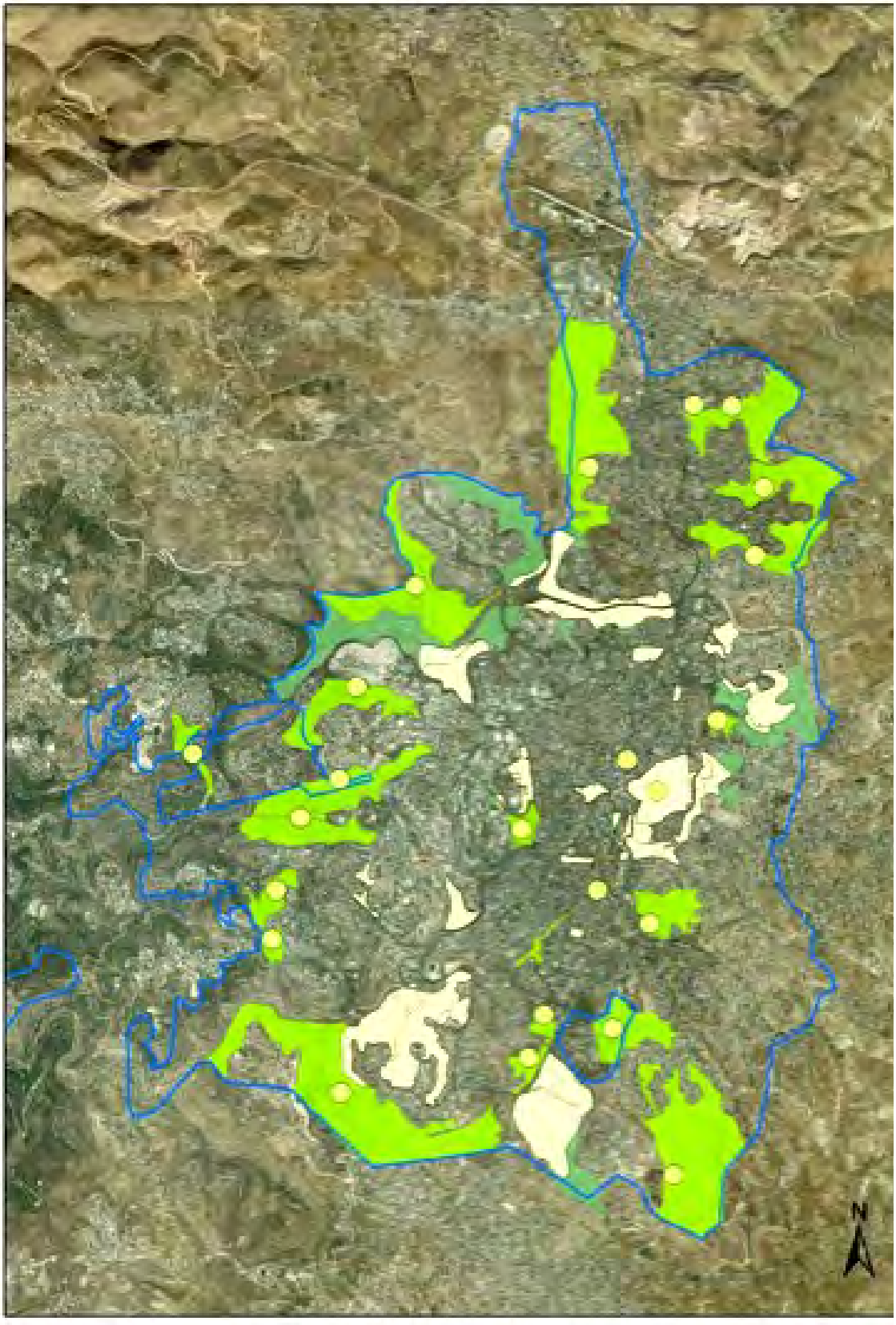


Fig. 6.4: Urban nature sites in Jerusalem. Municipal border is shown as a blue line. Areas in light green and cream were included in the master plan. Dark green areas were not. Source: SPNI.

Barriers

Even though Jerusalem is a leader in the field of urban biodiversity planning, many barriers restricted progress for Jerusalem's biodiversity planners. Many of which are seemingly unavoidable, while others could be corrected with little effort.

During the workshop, the many new connections that were made between organizations that had existing communications indicated that additional cooperation potential existed even between organizations with relatively strong connections and similar goals.

The interviews made clear that political conflict, including issues with fear and trust, present a major obstacle in coordinating biodiversity planning for the region. Despite this, some projects have crossed the divide, but their progress has been slowed by the need to build trust between parties. Differences between East and West Jerusalem and between Israel and Palestine in terms of rights, treatment, and capacity generate an additional divide. The physical wall between the two sides also causes day-to-day difficulties. For example, one interviewee spoke of how he often had representatives from communities on either side of the separation barrier go all the way to Jordan for their meetings because it was easier than gaining passage through the wall.

Social barriers in the city caused by varying religious, ethnic, and other cultural differences makes collective action more difficult. The city's inhabitants speak either Hebrew or Arabic, and often communicate in English or cannot find a common tongue. Religious differences result in dietary differences and sabbath day mismatches that can make meeting over lunch or

on certain days impossible.

When communicating with politicians or other decision-makers, the prioritization of growth ideology and lack of awareness of the significance or repercussions of environmental neglect presents a barrier that is familiar to anyone who works in the environmental field. In this case, budget priorities can be even more difficult due to the perception of Jerusalem as a poor city. Jerusalem is poor compared to other Israeli cities, but not compared to cities in neighboring West Bank, nor cities such as Curitiba which is a leader in sustainable urban development. One could also argue that poor cities are less able to afford degrading their resources. Thus, the city being too poor for biodiversity initiatives is primarily a perception problem.

Since the loss of the biodiversity champion in the city as Deputy Mayor, no new person has arisen to take her place. There is also no movement that I could find to groom a new champion.

The biodiversity planning network of people is rather insular, with its strongest connections being to other environmentalists or researchers. Ties with business and utilities are particularly weak. There is also a weak tie between actors in West Jerusalem and those in East Jerusalem and Palestine. Actors in East Jerusalem had weak ties to Israeli governmental groups at the local and national level, and the reverse was true for actors in West Jerusalem and Palestinian governments. The biodiversity professionals were aware of this shortcoming and confirmed it in interviews and the workshop. They expressed a desire to build stronger connections across these areas.

Biodiversity planners often showed a pessimistic outlook or a lack of confidence regarding their abilities, Jerusalem's accomplishments, or the potential applicability of their work. They appear to underestimate their own knowledge and accomplishments.

Actors in Jerusalem Biodiversity Planning

There are a great many institutions and individuals who are influential in Jerusalem's biodiversity planning. Described here are those about whom information was gathered as primary data from at least three sources. Many other groups are left out primarily because I was not able to contact them personally, such as the elected decision-makers serving on local political committees and community center leaders.

Jerusalem BioRegion Center for Ecosystem Management

The Jerusalem Bioregion Center is a primary, though new, urban biodiversity institution in Jerusalem, with its main goal being to advance "effective biodiversity protection and policy making" (Mission Statement). It is the only organization focused on biodiversity across the region of Jerusalem, and the founders of the Center deliberately branched off from the municipal government in order to take a more regional approach. The center's documentation states that the establishment of the Center marks a "shift from a local to a regional ecosystem management perspective." The main strengths of the Center are its working relationships with the city and with SPNI and its members' pivotal roles in the development of biodiversity planning for Jerusalem, but as an organization it is still in the early stages of defining itself.

The center was conceived in March 2012 as part of the fulfillment of ICLEI's Local Action for Biodiversity (LAB) program. It was formed in January 16, 2014 by several individuals who had already been working with or for the city to promote biodiversity under the guidance of Naomi Tsur, Deputy Mayor of Jerusalem from 2008-2013, and now the chair of the Center. These few founders make up the majority of the staff today. Director Helene Roumani dedicates her full attention to the management and promotion of the center. She is the primary author of the Jerusalem Biodiversity Report and the coordinator of Jerusalem's LBSAP. Prior to her role as director, she was the LAB Coordinator for the Jerusalem Municipality. Yoel Siegel, the strategic advisor, assists on a voluntary basis and also has side initiatives such as the Kidron Valley project with his new company, Interlock Consulting. He was the URBIS Coordinator for the municipality and serves as advisor on several environmental UN committees. Eran Brokovich, the ecologist, heads the science and policy forum but also runs a side initiative for the Israeli Society for Ecology training ecologists to better communicate with decision makers. The center also regularly hosts interns. One of whom, Melanie Simon, will be joining full time as an assistant later this year.

The BioRegion Center has five official objectives, though activities two and three are still in development and activities for the fifth one have not yet begun:

1. Promote awareness and cooperation on biodiversity
2. Create an academic expert forum for policy advice
3. Establish a biodiversity portal online for experts
4. Hold conferences and training sessions for professionals
5. Set up professional guidance for exogenous programs

The Center is currently seeking an environmental issue around which to concentrate their

efforts. They have been discussing topics such as Kidron Valley, trees, waste collection, and local agriculture. They are currently operating off of a three year funding contract.

The Center is hosted by SPNI Jerusalem, offering an office workspace for one to two people and shared facility use. This physical closeness and a history of joint initiatives supports a close collaboration between the BioRegion Center and SPNI Jerusalem. The Center is also closely connected with the Green Pilgrimage Network via Naomi Tsur, who divides her time between both initiatives. The Center's strongest connection with the city is through the Sustainability Department, primarily from personal connections with Liron Maoz, the department head. As an ex-Deputy Mayor, Naomi Tsur also has connections at the political level from her time working with the municipality, though the strength of her ties has diminished with the loss of her official position. The Center's steering committee has representatives from several of the surrounding municipalities, including Ma'ale Adumim, Efrat, and Modi'in (all at least partially settlements in the West Bank), and the director of the United Local Municipal Organization. They meet quarterly, and their next task is to select a focus area for the center from among a list of topics.

Jerusalem Branch of the Society for the Protection of Nature Israel

Founded in 1953, the Society for the Protection of Nature Israel (SPNI) is Israel's oldest and largest nonprofit (Roumani 2013). The Jerusalem branch was founded ten years later and is SPNI's oldest and largest urban branch. SPNI was the main NGO supporting Gazelle Valley, which it now manages on behalf of the city. It runs the Jerusalem Bird Observatory, established the urban nature survey methodology and conducts the surveys, reviews development projects in the city, supports community gardens, produces independent

research, and provides tours and training on environmental issues. In 2011, their environmental education program chose biodiversity as its annual focus (Roumani 2013).

SPNI Jerusalem's staff of over 20 people includes planners, environmentalists, community organizers, agronomists, and many youth in National Service. Staff members served as co-authors on the ecology section of Jerusalem's Biodiversity Report. Naomi Tsur's campaign to preserve Gazelle Valley began while she was an employee of SPNI Jerusalem.

Other than the municipality, SPNI was the most commonly mentioned organization during the interviews. Two interviewees specifically mentioned SPNI's work as being a driver for biodiversity preservation. During the workshop, participants said that SPNI would have been a crucial participant, but unfortunately they did not attend.

Analysis of The Perceived Bioshed of Jerusalem

During the review session, I presented the concept of the bioshed and at first its meaning was unclear to the participants. After we discussed the idea and I showed them the diagram (see Fig. 1.1) there was much enthusiasm for the concept and its potential in Jerusalem. One participant supported the idea but thought the name recalled too much of a physical meaning, such as watershed.

Although the practitioners had not heard of the concept before, their thinking about biodiversity conveys some ideas about the bioshed as they have understood it. The understanding of the bioshed by practitioners in Jerusalem can be understood in three ways;

through documentation, as expressed by the individuals, and in outcomes on the ground. At each of these levels, a different story unfolds that communicates something new about how the bioshed of Jerusalem is understood.

In the documents, the description of causes of biodiversity loss are limited to proximate causes such as development with no mention of root socio-economic or political causes. It is clear that the understanding goes deeper than this however, since the implementation discussion includes socio-economic fixes such as improvements to open space management and educational programs for the public. The documents are locally-focused, with almost no indication of the city's impact outside of its own borders. The only mention I found was of education and awareness programs for tourists who would then take their new ideas about biodiversity home with them.

On the other hand, the goals expressed by interviewees covered a much broader arena, including equity, international relations, increasing the understanding of decision-makers, and the importance of connecting biodiversity with healthy living in the eyes of the public. These goals were narrowed down when respondents were asked about realistic outcomes. At that point, most wanted to continue their specific project, gain influence with the city, or to see some physical improvement. Only two respondents thought on a grander scale, one hoping to keep up morale, and other seeking a political solution of one state with equal rights. Once respondents began to talk about barriers, however, their perspectives broadened again, including political issues, development, financial restrictions, and public awareness. Drivers of biodiversity mentioned in the interviews were almost exclusively social or political in nature. The geographical area considered by respondents was limited to the immediate

region of Jerusalem or within its borders.

When looking at projects on the ground, there is very little attempt by biodiversity planners to address the conflict, to elect political leaders that will champion biodiversity, or to otherwise address the underlying socio-political drivers of biodiversity loss. The exception to this is public education and training of municipal staff. In some cases the politics are deliberately ignored in order to try to find a technical solution, and in others the political aspect of a project seems to be a mystery to biodiversity planners, like a random factor that cannot be controlled.

Overall, it seems that biodiversity planners in Jerusalem have a broad understanding of what is happening in terms of socio-economic drivers to biodiversity, but they do not typically express these thoughts in their publications, nor do they play out in their actions. This could be due to the politically sensitive nature of some of these drivers, or the critical tone that could come across in publishing them. It is also important to note that these publications tend to be made in partnership with the local government and political drivers are often government actions or opinions. Also, the planners are not confident about how to identify and approach biodiversity drivers, so their implementation proposals tend to focus on the proximate causes of biodiversity loss even though they seem to be aware of and would like to address the underlying root causes.

Limitations of Findings

These findings may be biased due to the limited number of participants (see research bias on

page 4.4 for more). This research is intended to be an early, exploratory research and should be substantiated with later investigations.

7. Conclusions

The Bioshed of Jerusalem

Recalling the diagram of the bioshed provided in the introduction (Fig. 1.1), I will describe my understanding of Jerusalem's bioshed in terms of political, social, and economic drivers and political, social, and economic impacts. The drivers are aspects of the city that drive the rate of biodiversity loss. Impacts are the impacts of biodiversity loss on the city. Much of the bioshed is not known. This is a potential area for future research and is illustrative of the potential of this concept applied to the city.

Political Drivers

Rising awareness of environmental issues results in more activists for environmental causes and more political support for biodiversity initiatives. NGOs dedicated to biodiversity push forward the agenda. On the other hand, the socio-political divide of people impedes the ability for environmentalists to move forward. The conflict in the region directly reduces biodiversity through military damages and barriers that block movement. It also creates problems when environmental project proposals, between Israeli and Palestinian

communities, such as waste treatment centers, cannot move forward. NGO groups and academics provide the data and reports needed to convey biodiversity problems and their solutions to the public and decision-makers. Lack of communication between academics, professionals, and decision makers impedes good policy development.

Social Drivers

The national pride associated with being a Holy City with recorded species of thousands of years supports biodiversity. The culture of hiking common the city raises support for and awareness of biodiversity protection. Strong community centers provide an easier connection for these NGOs to the public. The focus on increasing consumption and growth under a capitalist regime drives increasing environmental degradation. The idea that environmental protection is only for the wealthy blocks openness to biodiversity proposals. Much of the terminology associated with biodiversity protection is difficult to understand. The cultural norm of large families within certain communities increases overall growth and consumption. Aversion to changing neighborhoods, especially increasing density, fuels development in open spaces.

Economic Drivers

Increasing cost of housing fuels more development. Funding for massive infrastructure projects, such as from the EU, brings the city revenue. Regulations for the environment are often too weak to provide an appropriate incentive. Damages of the environment are externalities and the full costs therefore are not felt by the responsible party. Fundraising also supports biodiversity initiatives from groups such as the Jerusalem Foundation. Inequality and poverty have both been shown to cause biodiversity loss (Wood et al. 2000).

Political Impacts

Environmental disparity increases tensions between Arabs and Jews and can reinforce stereotypes that contribute to dehumanization of the other side.

Social Impacts

Contact with natural environments reduces stress and has shown to decrease crime. Connection with heritage species increase cultural and religious appreciation and understanding.

Economic Impacts

Loss of biodiversity impacts the most vulnerable in the hardest ways, increasing inequality and creating a positive feedback loop as a driver of biodiversity loss as well. In this case, biodiversity loss contributes to water scarcity which disproportionately impacts the Palestinians who already face extreme water shortages. Flowing sewage contaminates agricultural fields of the most vulnerable, such as Arab neighborhoods in East Jerusalem. This creates health hazards and reduces the output of the fields.

Vision for Jerusalem

My vision for a biodiverse Jerusalem of the future is one that celebrates and enriches human diversity and biodiversity. Its citizens have internalized the concept of the bioshed that encompasses the local natural infrastructure as well as the consumption, growth, and development patterns of the city. They understand that socio-economic factors and

biodiversity are linked because they see these linkages in their daily lives. As a result, citizens of Jerusalem are healthier, happier, more stress-free, and more resilient than ever.

I see Jerusalem as an intensive city where land is not seen as single use, but is full of layers of use. Green roofs and walls transform a human development into a biodiverse development. Playgrounds are also nature sites where children's play is also an exploration of nature. Parks are also urban nature sites. One Gazelle Valley has multiplied and there is now a Hyrax Valley, a Jackal Valley, a Porcupine Valley, a Butterfly Valley, a Tortoise Valley, and a dozen more. Community centers are also gardening headquarters where people learn about growing food and useful plants. Streets are multi-use with dedicated lanes for bicycles and motorcycles and lanes for bus transit. Public ways have been carefully designed for the collection of rainwater, growth of native shade trees, and generous sidewalks.

I see Jerusalem as an aware city with a population that is up-to-date with live information on its natural infrastructure. Each neighborhood has its own set of nest cams and burrow cams and e-collars that track the everyday actions of its species and show them live on the web. Each neighborhood has its local famous animals and even plants that have names and are known by the community. When people check the weather forecast or daily news, they also get an update on their ecological community. School and youth club mascots carry the names of local species. Spotting a kingfisher has become more common than spotting a roaming cat since birdwatching has become popular and cats are kept indoors. When tourists visit, they cannot help but to get to know new species in the area as the tour guides include them as vital members of the local communities. Many are inspired by what they see in Jerusalem and bring these ideas back to their homes.

I see Jerusalem as a clean city where wastewater problems have been eliminated by the widespread adaptation of composting toilets and grey-water reuse systems. Human waste and food waste both are reused for fertilizer, with the city providing a pickup and distribution service for these valuable materials. Water from showers, sinks, and washing machines is used to water local gardens and agricultural plots. Waste dumping problems on abandoned land has been eliminated due to a community land program that promotes local communities to generate a plan for their open dumping spaces to be used for agriculture, urban nature, housing, business, or any use they need. The city approves these plans once the community has cleaned the land. The incentive to dump is also removed by the creation of a construction waste reuse center where construction waste can be transformed into materials for infrastructure such as roadway materials. At the reuse center, you can earn money for submitting construction waste materials.

I see Jerusalem as a healthy city where sickness rates have decreased in poor neighborhoods since sewage flow has been eliminated. Local agriculture has picked up from the community land program increasing access to produce for the city's poorest. New taxes on imported and highly processed food have reduced unhealthy eating practices. Unhealthy foods are also made less available through new regulations that limit foods with preservatives to under a certain percentage of food retail stock. Revenue from these taxes then go to subsidizing healthy, fresh foods. Higher awareness of healthy living combined with a reduced stress environment has reduced smoking rates. Regulations keep smokers out of public ways so that nonsmokers can breathe clean air.

I see Jerusalem as a just city where the diversity of its neighborhoods are celebrated, not only as ecological zones, but also as centers of culture. The community center structure in Arab neighborhoods has been remodelled around the village councils more familiar to palestinian culture and Arabs have become more involved in community initiatives. These councils provide permitting processes for Arab communities and also have the right to veto any demolition project in their community. The village councils provide a line of communication between the city and the Arab communities that has built trust over time and raised voter turnout and constructive activism. Ultra-orthodox neighborhoods have also developed their own system of communal economics that follows their religious beliefs and also reduces strain on municipal resources. A popular tourist program brings tourists through the modern neighborhoods of Christians, Bedouins, Muslims, and Jews of various degrees of observance. The concept of Aliyah, or return to the Holy Land originally developed for Jews, has been expanded to include Palestinians in refugee camps and born in Palestine. Citizenship is provided to all Israelis with full voting rights and no legal distinction between Jews and non-Jews.

I see Jerusalem as a connected city where barriers are no longer needed. Neighborhoods are woven together by a network of pedestrian and bicycle ways. Checkpoints and separation barriers are a thing of the past. Arab and Jewish transportation systems have been connected and streamlined so that people travel easily between them. The tram line has expanded and now serves most of the city, where an increase in density has made service provision more efficient. Whether the city is the capital of two nations or one, the people are one community that recognizes that their fates are intertwined and that their shared love of the land connects them.

How to Achieve the Vision

Getting to this vision of the city starts by recognizing the possibilities and strengthening the connections between people that ultimately will be needed to make the vision a reality. Even though this vision is a vision for a biodiverse Jerusalem, natural sciences and open space management cannot achieve this vision on their own. They must be a part of a wider, social transformation. They must operate at many scales, from local, neighborhood initiatives like the community land project, to the municipal level, to the national level such as citizenship and immigration rights, to the international level. This means that the biodiversity planners of today must embrace initiatives at many scales and must become fluent in socio-economic issues, including politics and human rights as Wood et al. have suggested (2000).

To speak in terms of systems transformation using Meadows' leverage point system, having a vivid vision for the future is the most significant leverage point, called the mindset or paradigm of the system. Biodiversity planners need to communicate a vision for a biodiverse Jerusalem in order to manifest the changes in thinking needed to cascade through the system that will change system goals, power dynamics, rules, information flows, and the rest.

Many of the actions of Jerusalem's biodiversity planners have been working towards just that, such as the creation of Gazelle Valley, a model site for a biodiverse city, and the vision of the Green Mosque, a model for social and cultural integration with biodiversity. But in the absence of a strong vision, it can be easy to lose your way and fall prey to pessimistic thoughts. Therefore, it is crucial that the biodiversity planning community bolster one another and their vision so that their passion can become infectious and help to manifest a

biodiverse Jerusalem.

Tips from Jerusalem

Jerusalem's biodiversity professionals have made several innovations that contribute to their success so far and would be helpful for many other cities. They have; developed a new language for urban biodiversity, introduced a landmark example case, mainstreamed biodiversity planning into municipal government decisions and policy, proactively shaped international initiatives for local biodiversity planning, and discovered the value of discussion without decision-making in government. Each of these actions provide a strong example for others to follow.

By communicating urban nature as a level of infrastructure, they are shifting common ways of thinking of nature as superfluous into something that is as vital as electricity. The idea of urban nature sites as intensive sites, both in terms of social programming and biodiversity helps to differentiate urban nature sites from both wilderness and from typical parks. It also implies the degree of management that is required to have a vibrant urban natures site, one that actively seeks community involvement while simultaneously maximizing the biodiversity through active manipulation of the landscape. The concept of the bioregion as an area that transcends political boundaries in the interest of ecological health and biodiversity is important for biodiversity planning at various scales. The idea of green pilgrimage adds sustainability and community to a very influential and reflective time in someone's life, and connects spirituality or faith with stewardship of the earth. The idea of ecological peace introduces a way for conflicting parties to still have a dialogue on ecological

questions. And finally, the connection between biodiversity and quality of life is vital for communicating the importance of biodiversity to a broad audience.

Gazelle valley is a landmark case for Jerusalem in terms of biodiversity planning and community activism. As an example of community victory over development interests where the community together decided to dedicate a huge area to urban nature, it is significant for the morale of biodiversity planners. It rewards them for their success and stands as a concrete example that they can point to when communicating their vision to the public and decision-makers. The success of Gazelle Valley is a success for the neighborhoods, the activists, and also the entire biodiversity planning community. It also of course provides educational and awareness building opportunities that increase the ability to create a second and a third and a fifteenth Gazelle Valley.

The urban nature sites survey was instrumental in mainstreaming biodiversity planning into municipal government decisions and policy. This survey provided a simple paradigm for planners with categorization of select sites as important for biodiversity. The integration of these sites, with basic data, into the GIS system of the city and into the Master Plan allows city planners to consider the biodiversity of the site when making decisions. In a further step, the development of an urban nature site policy, codifies and mandates particular actions in these areas, such as a site-specific urban nature survey to be conducted prior to any development plan.

Jerusalem's biodiversity planners proactively shaped international initiatives for local biodiversity planning. They have been founding or strategic partners in ICLEI's LAB and

URBIS programs, and have founded the Green Pilgrimage Cities project. They are also active as consultants in UN discussions of biodiversity planning. These activities are important to the global arena of biodiversity planning and have huge potential for sharing ideas between local governments.

Biodiversity planners discovered the value of discussion without decision-making in government with the development of the urban planning committee. The committee at first had the mandate of coming to a decision and making an official recommendation to the council, but this resulted in the council rejecting the committee's recommendations as a usurpation of their power. So, the committee was changed to discussion only rather than official recommendation. The effect of such a shift was to open up the floor to more dialogue. Without the pressure of decision-making, the committee was more free to listen to one another and to new information. Ultimately, their reports were also received more openly and arguably had a stronger influence over the ultimate decision. This shows that power to decide is not necessary to wield influence over local government decisions.

Recommendations for Biodiversity Planners

Despite the success of Jerusalem, several recommendations for biodiversity planners in the city can also be suggested. These recommendations are also likely to be useful for biodiversity planning in other locations.

Problem	*Recommendation*
The scientific definition of biodiversity leaves a lot of the significance of biodiversity out, and the term needs help	When preparing communications materials about biodiversity, include more personal definitions of biodiversity.

to have its concepts conveyed to a wider audience outside of ecologists. The sterile manner in which it is often defined in official documents does not convey the richness of what it means to people and limits the degree of inspiration for the public and decision-makers.	
A general discomfort with the level of knowledge of professionals in the field about biodiversity.	Boost morale on this issue and have informal discussions with academics that improve the comfort of biodiversity planners with their knowledge.
The decision to set aside the political aspects of a project and just stick to technical solutions for expediency, but in the end, the political issues are the main barrier.	Political issues cannot be ignored. Train biodiversity planners in politics or include political professionals on the team. Create political initiatives to elect champions for biodiversity into the government.
Disconnect between personal actions and their impact on biodiversity.	Here again informal dialogue may prove helpful. Have a bioshed luncheon discussion where each person talks about their personal bioshed and how they think about personal impact of biodiversity. Tools such as the eco-footprint analysis can be helpful.
Lack of knowledge of the drivers and barriers to biodiversity.	Training on the topic is essential for biodiversity planning. Recommended resources include the "Users Guide to Assessing the Socio-Economic Root Causes of Biodiversity Loss" by the WWF Macroeconomics for Sustainable Development Program Office, available at www.panda.org/mpo

Implications for Future Research

The bioshed concept requires more investigation before being applied to urban biodiversity planning. I suggest that another level of understanding the bioshed be investigated: that of scale. Adding this third dimension would address Jerusalem's problem of focusing on local impacts and dependencies. Also, the concept should be investigated in the context of other locations and eventually, at other scales from small to large.

8. References

Abu Zahra, B. A. A. 2001. Water crisis in Palestine. *Desalination* 136: 93-99.

Adams, L. W. 2005. Urban wildlife ecology and conservation: a brief history of the discipline. *Urban Ecosystems* 8: 139-156.

Alfsen, C. Dickinson, L., Tidball, K., Galoumian, V., and Navarro, M. 2010. The URBIS Partnership: An Approach to Achieve Social and Environmental Resilience in Urban Regions. *Policy Matters* 17: 95-99.

American-Israeli Cooperative Enterprise (AICE). Accessed 2014. Jerusalem: Israel Arabs and Jerusalem's Municipal Elections. Jewish Virtual Library. Accessed 29 July 2014. https://www.jewishvirtuallibrary.org/jsource/Politics/Jerusalem_Arabs.html

BBC. 2008. Secularist voted Jerusalem mayor. BBC News. 12 November. Accessed 29 July. http://news.bbc.co.uk/2/hi/middle_east/7721298.stm

Brown, G. 2008. A theory of urban park geography. *Journal of Leisure Research* 40, 4: 589-607.

Choshen, M., Korach, M., Doron, I., Israeli, Y., Assaf-Shapira, Y. 2013. *Jerusalem: Facts and Trends 2013*. Jerusalem Institute for Israel Studies. Publication number 427.

Conference of the Parties on the Convention on Biological Diversity (COP). 2010. *Plan of Action on Subnational Governments, Cities and Other Local Authorities for Biodiversity*. UN Doc. UNEP/CBD/COP/DEC/X/22.

---. 2014. Status of development of national biodiversity strategy and action plans or equivalent instruments. July. Accessed July 25 2014 at http://www.cbd.int/doc/nbsap/nbsap-status.doc

Creswell, J. W. 2003. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (2nd ed.) London: Sage Publications.

Faeth, S. H., Bang, C., and Saari, S. 2011. Urban biodiversity: patterns and mechanisms. *Annals of the New York Academy of Sciences* 1223: 69-81.

Faeth, S. H. and Kane, T. C. 1978. Urban biogeography: city parks as islands for diptera and coleoptera. *Oecologia* 32: 127-133.

Fielding, N., and Fielding, J. 1986. *Linking Data*. Beverly Hills, CA: Sage Guillemin, 2004.

Gomez, M. J., Fassinger, R. E., Prosser, J., Cooke, K., Meija, B., and Luna, J. 2001. Voces abriendo caminos [Voices foraging paths]: A qualitative study of the career development of notable Latinas. *Journal of Counseling Psychology* 48: 286-300.

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

Harms, G. and Ferry, T. M. 2008. *The Palestine-Israel conflict: a basic introduction, second edition*. London: Pluto Press.

Hall, W. A., and Callery, P. 2001. Enhancing the rigor of grounded theory: Incorporating reflexivity and relationality. *Qualitative Health Research* 11: 592-625.

Homer-Dixon, T. F. 1999. *Environment, scarcity and violence*. Princeton, NJ: Princeton

University Press.

ICLEI – Local Governments for Sustainability (ICLEI). 2010. Local Action for Biodiversity Guidebook: Biodiversity Management for Local Governments. Laros MT and Jones FE (eds).

India Ministry of Environment and Forests (IMEF). 2008. *National Biodiversity Action Plan.* Arora, S. and Bhati, J.R. eds. November .

Isaac, J. and Ghanyem, M. 2003. Environmental Degradation and the Israeli-Palestinian Conflict. Published by the Applied Research Institute – Jerusalem.

Israel Water Authority. 2011. Israel Water Sector Master Plan – Policy paper – Approved by the Government Council for Water and Sewerage on 4 July (English). http://www.water.gov.il/Hebrew/ProfessionalInfoAndData/ 2012/05-Israel-Water-Sector-Master-Plan-2050.pdf

Karner, M. A. 2012. Hydropolitics in the Jordan River basin: the conflict and cooperation potential of water in the Israeli-Palestinian conflict. Master's Thesis. Dublin: University of Dublin, 20 August.

Katz, D. 2013. Policies for water demand management in Israel. In *Water Policy in Israel: Context, Issues and Options*. Ed. N. Becker, 227-242. Global Issues in Water Policy 4.

Kofman, F. 1992. Double-loop accounting: a language for the learning organization. *The Systems Thinker* 3, 1 (February).

Kuhn, T. 1962. *The Structure of Scientific Revolutions.* Chicago: University of Chicago Press.

Leopold, A. 1968. *A Sand County Almanac and Sketches Here and There*. New York: Oxford University Press.

Levins, R. 1998. Dialectics and systems theory. *Science & Society* 62, 3 (Fall): 375-399.

Makovsky, D. and Felder. 2011 Tracking Economic Growth in the West Bank and Gaza since 2007. Washington Institute. Retrieved 29 July 2014.

MacArthur, R. H. and Wilson, E. O. 1967. *The Theory of Island Biogeography*. Princeton, NJ: Princeton University Press.

Massey, W.T. 1918? The Jerusalem water-supply. *Palestine Exploration Quarterly* 50 (4, 2013): 172-175. Reprinted from the *Daily Telegraph* (August 13, 1918?).

Marzluff, J. 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.

Matzliach. 2013. The Ultimate Israeli Citizen's Guide to the 2013 Municipal Elections. NoFryers. 26 August. Accessed 29 July 2014 at http://nofryers.com/ultimate-israeli-citizens-guide-2013-municipal-elections/#comments

McCarty, W. 2003. Humanities computing. Encyclopedia of Library and Information Science: 1224-1235.

McKinsey Global Institute. 2012. *Urban World: cities and the rise of the consuming class*. June.

McLouglin, J. B. 1985. The systems approach to planning: a critique. Working paper. January.

Meadows, D. 1999. Leverage points: places to intervene in a system. Sustainability Institute (December): 1-19. Pdf.

Meadows, D. H. 2008. *Thinking in systems: a primer.* Vermont: Chelsea Green Publishing.

Miles, M. B. and Huberman, A. M. 1994. *Qualitative Data Analysis* (2nd ed.) Thousand Oaks, CA: Sage.

National Academy of Sciences (U.S.) 1999. *Water for the future: the West Bank and Gaza Strip, Israel and Jordan*. New York: National Academy Press.

Newman, P. 2006. The environmental impact of cities. *Environment and Urbanization* 18, 2 (October): 275-295.

Nowak, D. J., Hirabayashi, S., Bodine, A., and Hoehn, R. 2013. Modeled PM2.5 removal by trees in ten U.S. Cities and associated health effects. *Environmental Pollution* 178: 395-402.

Palestinian Central Bureau of Statistics (PCBS). 2014. Water. Accessed March 16. http://pcbs.gov.ps/site/881/default.aspx#Water

Parks, J. R. 2013. Equitable apportionment and groundwater in Israel and the West Bank. The Lawfare Project. From *The New Jurist* (July 16). Accessed March 12, 2014. http://www.thelawfareproject.org/LP-Articles-Analysis/equitable-apportionment-and-groundwater-in-israel-and-the-west-bank.html

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

Pierce, J.R. 2014a. *Integrated planning for urban biodiversity in a divided world*. Master's Thesis. Cornell University unpublished.

--- 2014b. Planning for urban biodiversity in a divided world. PolicyMIX Conference (February). Leipzig, Germany.

--- 2014c. The Nature of Mainstreaming: A Local Integrated Planning Toolkit for Biodiversity and Ecosystems Services. ICLEI Africa Secretariat.

Pierce, J.R. and Forester, J. 2014. Spatial Aspects of Facilitation Processes. Manuscript.

Rittel, H. W. J. and Webber, M. M. 1973. Dilemmas in a general theory of planning. *Policy Science* 4: 155-169.

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

Roumani, H. 2013. *Biodiversity Report*. Municipality of Jerusalem: 1-93.

Sarewitz, D. 2004. How science makes environmental controversies worse. *Environmental Science and Policy* 7: 385-403.

Secretariat of the Convention on Biological Diversity (CBD). 2012. Cities and Biodiversity Outlook. 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

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.

Sterman, J. D. 2002. All models are wrong: reflections on becoming a systems scientist. *Systems Dynamics Review* 18, 4 (Winter): 501-531.

Stuhlmiller, C. M., and Thorsen, R. (1997). Narrative picturing: A new strategy for qualitative data collection. *Qualitative Health Research* 7: 140-149.

Suzuki, L. A., Muninder, K., Ahluwalie, A. K. A. and Mattis, J. S. 2007. The pond you fish in determines the fish you catch: exploring strategies for qualitative data collection. *The Counseling Psychologist* 35: 295-327.

Tashakkori, A. and Teddlie, C. eds. 2003. *Handbook of mixed methods in social and*

behavioral research. Thousand Oaks, CA: Sage Publications.

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

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

Tidball, K. G. and Navarro-Perez, M. 2012. Challenges of biodiversity education: a review of education strategies for biodiversity education. *International Electronic Journal of Environmental Education* 2, 1: 13-30.

Tidball, K. G., Svendsen, E. S., Campbell, L. K., Falxa-Raymond, N., and Kathleen, W. 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.

Timlin-Scalera, R. M., Ponterotto, J. G., Blumberg, F. C., and Jackson, M. A. 2003. A grounded theory study of help-seeking behaviors among White male high school students. *Journal of Counseling Psychology* 50: 339-350.

United Nations Environment Programme (UNEP). 1992. *Convention on Biological Diversity*. 1760 UNTS 79.

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

World Bank. 2014. GDP per capita, (current international $). World Development Indicators database. Database updated on 1 July 2014.

Yeh, C. J. and Inman, A. G. 2007. Qualitative data analysis and interpretation in counseling psychology: strategies for best practices. *The Counseling Psychologist* 35: 369-404.

History of the Arab-Israeli Conflict

The historical context of the Arab-Israeli conflict can be traced back to 1917 with the Balfour Declaration, a letter by the British declaring support for the establishment of a Jewish national home in Palestine. A year later, the British Empire drove out the Turks from the area that is now Israel and Palestine via the British Mandate for Palestine. During this time, national movements rose up by both the Jews and the Arabs. The Jewish movement, with British support, prepared for the future establishment of a Jewish nation. The British suppressed the Arab nationalist movement that clashed with the Jewish movement beginning with the Arab Revolt of 1936-1939 (Harms 2008).

As the British Mandate was coming to a close in 1948 and the British were pulling out, the UN General Assembly approved a Partition Plan for Palestine, which incited a civil war supported by the Arab Liberation Army. This original plan called for Jerusalem to be a special international zone. The Jews established the State of Israel in May 1948. This inflamed Arab opposition and transformed the civil war into an international one. The final truce expanded Israeli borders to include some of the West Bank following the Green Line. It did not establish an independent Palestinian state (Harms 2008).

Palestinian-Israeli violence continued via regular attacks by both sides with international support. The height of the Palestinian uprising thus far, the Intifada, took place from 1987 until the early 1990s (Harms 2008). Nearly continuous fighting led to increasing pressure for a peaceful negotiation process.

In 1993, the Oslo Peace Process began optimistically with letters between the Palestinian leader and Israel recognizing one another's right to exist. The Oslo agreement sought peace in return for a recognized independent Palestinian State. The Oslo I Accord established the Palestinian National Authority (PNA) and indicated Palestinian authority over some domestic concerns. Both sides committed to a peace, but the most contentious issues were postponed (Harms 2008).

In 1995, the second Oslo Accord, Oslo II, established zones of control within the West Bank. Zone A, 3% of the West Bank, would be under Palestinian control. Zone B was to be under joint control. Zone C was designated as under Israeli control and constituted 74% of the West Bank. Oslo II also dictated water access allocations for the aquifers and the Jordan River, giving the Israelis more than four times the share of groundwater and nearly ten times the river water than the Palestinians (Karner 2012). Israelis began to withdraw from zones A and B, but also established checkpoints between these islands of Palestinian control in a sea of Israeli-controlled zone C land (see Fig. 2.1.1). Withdrawals stopped in 1996. In 2000, negotiations at Camp David failed due to irreconcilable opinions over territorial control (Harms 2008).

As Harms states, "what became known as the 'peace process' offered a period of calm and hope, but failed to transfigure the underpinnings of the conflict" (2008, 169). The dip in casualties during the peace talks increased shortly thereafter with the start of the Second Intifada which proved much more violent than the first (see Fig. 2.6). Developments by 2002 involved the re-occupation of zones A and B, despite UN Security Council condemnation. It also heralded the beginning of the construction of the 700-kilometer barrier wall, still being completed today. This is despite criticism by the UN Security Council and the International Court of Justice (ICJ) (Harms 2008).

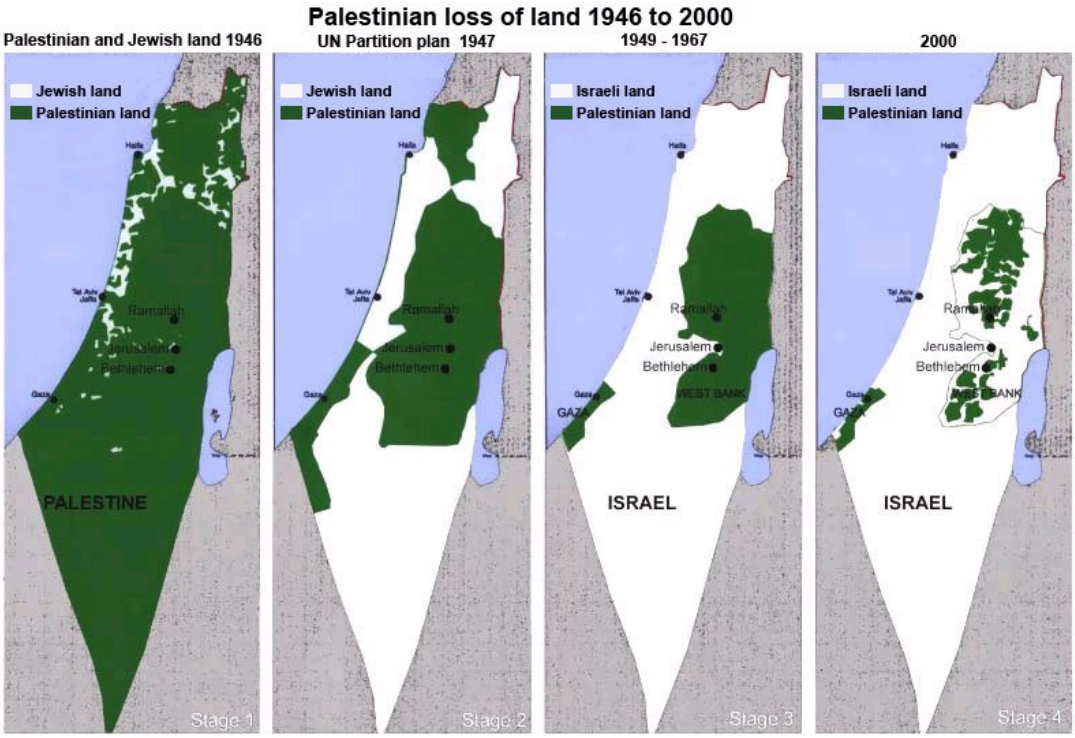


Fig. 2.1.1: Map of Palestinian/Israeli controlled land, 1946 to today. The first panel indicates land areas settled by Jews in 1946. The second indicates the UN partition plan. The third panel is the area Israel declared sovereignty over in 1948. The fourth panel shows areas A and B under Oslo II within the outline of the West Bank. (Source: Pamela J. Olson, http://fasttimesinpalestine.wordpress.com/2009/10/13/maps-of-israel-palestine/)

Rising divisions led to new calls for agreements, and in 2003 proposals included the Road Map, the People's Voice, and the Geneva Accord. All three lay out a two-state agreement, which remains the prevailing discourse today (Harms 2008).

In 2005, Israeli troops and settlers pulled out of the Gaza Strip (Harms 2008). Conditions in the Gaza strip plummeted, with unemployment and malnutrition soaring. Also in 2005, the Palestinians in Gaza responded with the election of Hamas, considered by some to be a terrorist group. The international community and Israel retaliated with an immediate cut of aid critical to the Palestinians. The Palestinian condition divided when in 2007, chasms in Palestinian leadership resulted in a Hamas-controlled Gaza strip and a Fatah-controlled West Bank (Harms 2008). Arab leaders continue to call for withdrawal of Israel and establishment of a Palestinian state in return for peace (Harms 2008).

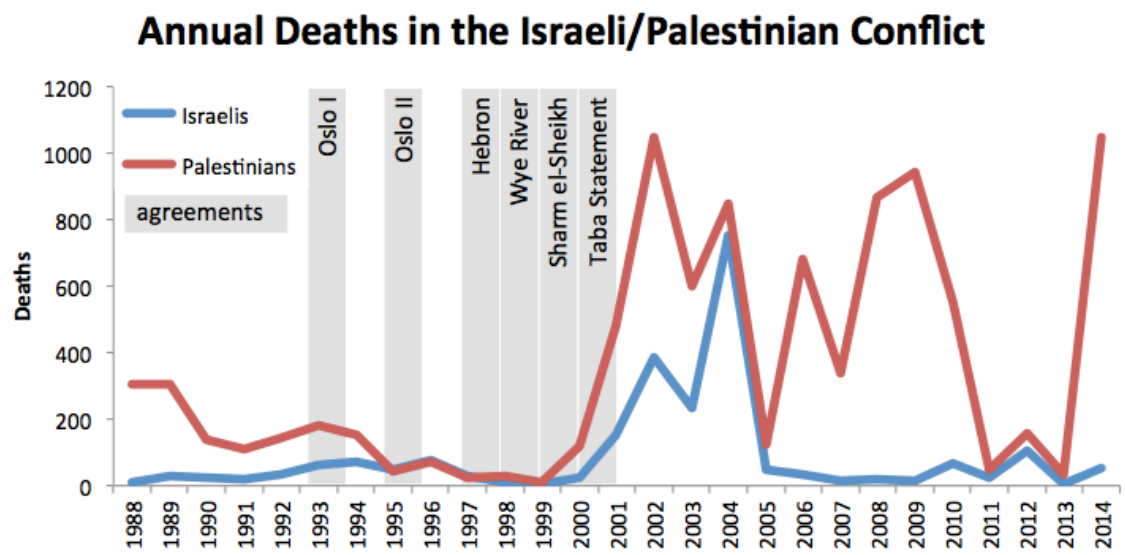


Fig. 2.1.2: Chart of casualties in the Palestinian/Israeli conflict, including combatants and civilians. The Hebron agreement applied the Oslo II zone designations to Hebron. The Wye River Memorandum and the Sharm el-Sheikh Memorandum were intended to reinforce the implementation of Oslo II and to slightly expand the Palestinian-controlled zones (Harms 2008). (source: compilation of B'Tselem, Wikipedia, and reports by the Palestinian and Israeli authorities. Reports vary, so a mid-range number was generally selected. Reports for 2014 are from The Guardian, and are through July 29, 2014.)

At the time of this writing in summer of 2014, the conflict has escalated again into violence between Hamas-controlled Gaza and Israel with a rising death toll. Both parties remain embittered by values arguments over rights to the area and also by daily conflicts between the sides, both in terms of violence and ideology.

Freshwater Access in Israel and Palestine

Freshwater access in Israel and Palestine is one of the most extreme and direct examples of environmental scarcity. It suffers from water scarcity at all three levels identified by Homer-Dixon: supply scarcity, distributional scarcity, and demand scarcity (1999). Katz has identified the sustainable quantity of freshwater available for consumption in Israel in 2012 to be 200 m^3 before desalination, and 300 m^3 after desalination (2013). Palestine has 135 m^3 of water available to be withdrawn per person in 2011 (PCBS 2014). Both are well within the range for absolute water scarcity.

Adding to the supply scarcity of water is the distributional scarcity between Israel and Palestine that began when Israel was first established, bringing new technologies and concepts of water use with them. In 1917, when the British Army captured Jerusalem, they found that the inhabitants relied upon winter rains to fill personal cisterns underneath homes. Holding altogether 360 million gallons, these cisterns were then supplemented by water-carriers (Massey 1918?). The British immediately set about upgrading this system that they judged to be archaic and unclean. They installed standpipes throughout the city where "pure mountain spring water" could be accessed freely by all, resulting in a tenfold increase in water use by June of 1918 (Massey 1918? 173). This increase was the start of unequal water consumption between Jews in Jerusalem and Palestinians in the West Bank that persists today.

Due to political and geographic restrictions established during Oslo II, the primary source of water for the Palestinians today is the Mountain Aquifer, which itself consists of three separate aquifers: Western, Eastern, and Northern. The Western Aquifer straddles the border between Israel and Palestine and lies beneath Jerusalem. It is the most productive of the three aquifers and is primarily recharged by the zone within the West Bank (Parks 2013). The Western Aquifer discharges 362 million m^3 annually. Of this, about 340 million m^3 are extracted by the Israelis, while the remaining 22 are extracted by the Palestinians (Abu Zahra 2001; Isaac and Ghanyem 2003), a disparity of over tenfold.

In 2010, the Israel Water Authority reported water consumption in Israel to be annually 100 m^3 per capita (2011). This number likely counts only domestic use because in 1994 an outside study reported average annual Israeli use at 344 m^3 per capita versus 93 m^3 per capita for Palestinians (National Academy of Sciences 1999). The same report indicated domestic water use to be 98 m^3 per capita annually and 34 m^3 per capita annually respectively (National Academy of Sciences 1999). It is therefore likely that Israelis, domestically and overall, consume three times the amount of water per capita than Palestinians, generating distributional scarcity that is reinforced by Israeli restriction of Palestinian access.

Population projections combined with water needs for sustainable development yield a goal of three times the current supply in Palestine by 2020 (Abu Zahra 2001). For Israel, a total supply increase of 25% is projected in the same time frame (Israel Water Authority 2011). Meanwhile, population growth is projected to drive per capita freshwater availability from 389 m^3 in 1995 to 270 by 2025 (Homer-Dixon 1999). The increase in demand driven by population growth indicates increasing water stress in the future.

Research Participation Consent Form

I am asking you to participate in a research study. This form is designed to give you information about this study. I will describe this study to you and answer any of your questions.

Working Project Title: Jerusalem: An Initial Urban Model for Environmental Planning

Principal Investigator: Jennifer Pierce
Environmental Science and Policy
Central European University, Budapest, Hungary
Pierce_jennifer@student.ceu.edu

Faculty Advisor: Jack Corliss
Environmental Science and Policy
Central European University, Budapest, Hungary
Jack.corliss@gmail.com

What the study is about
This research is an exploratory look at the city of Jerusalem as a system, and how it works, especially as regards environmental issues. This means that I am interested in the connections between the various parts of the city, including private and not-for-profit partners, and the environmental factors that are involved. Ultimately, multiple systems diagrams of the city will be developed and analyzed.

What we will ask you to do
I will ask you to participate in the research through one to two interviews, a workshop, and/or a review session. During these sessions, I will ask you to explain your role in your institution and explain how it fits into the system of connections with other people and institutions, giving examples of successes and challenges you have faced.

Risks and discomforts
I do not anticipate any direct risks from participating in this research.

Benefits
There are no direct benefits to the participant other than any personal insight or connections made with others during the workshop. Information from this study may benefit other people now or in the future to create similar programs based upon your experiences.

Payment for participation: There is no payment for taking part in the study.

Audio Recording
Please sign below if you are willing to have this interview audio recorded. You may still participate in this study if you are not willing to have the interview recorded.

- ☐ I do not want to have this interview recorded.
- ☐ I am willing to have this interview recorded:

Signed: _____ Date:_____

Research Participation Consent Form

Privacy/Confidentiality
Please note that email communication is neither private nor secure. Though I am taking precautions to protect your privacy, you should be aware that information sent through e-mail could be read by a third party.

Taking part is voluntary
The participant's involvement is voluntary, the participant may refuse to participate before the study begins, discontinue at any time, or skip any questions/procedures that may make him/her feel uncomfortable, with no penalty to him/her, and no effect on the compensation earned before withdrawing, or their academic standing, record, or relationship with the university or other organization or service that may be involved with the research.

If you have questions
The main researcher conducting this study is Jennifer Pierce, a graduate student at Central European University. Please ask any questions you have now. If you have questions later, you may contact Jennifer Pierce at pierce_jennifer@student.ceu.edu. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Ethical Research Committee at Central European University. You will be given a copy of this form to keep for your records via email upon request.

Statement of Consent
I have read the above information, and have received answers to any questions I asked. I consent to take part in the study.

Your Signature_____ Date_____

Your Name (printed)_____

Signature of person obtaining consent_____ Date_____

Printed name of person obtaining consent: Jennifer Rae Pierce

Data Gathering Schedule

I spent 29 days in Israel interacting with participants and observing conditions on the ground. Prior to my arrival, I (1) began the literature review, (2) developed initial models of the Biodiversity Report and draft Biodiversity Plan, and (3) conducted initial logistics in coordination with partners in the city.

Below are my daily data gathering and observation activities while in the city and surrounding areas. I worked on data analysis iteratively, that is, parallel to data collection.

Date (2014)	*Activities*
May 22	Orientation and introduction to the Bioregion Center
	Guided walking tour of the Railway Park, Emek Refa'im Community Center and Community Garden, along King David Street and Yafo Street to the Shuk
May 23	Walking exploration of Hebrew University, Ramat Sharett, Holyland, and Manahat, including view of Gazelle Valley and Gilo Park Forest
May 24	Walking exploration of the Old Town, Nahalat Shiya, and Nahlaot
May 25-27	Interviews
June 2	Meeting with Bioregion Center staff
June 3	Interview and walking exploration of Bethlehem
June 4	Interviews in Bethlehem, walking exploration of Neveh Granot, Kiryat Shmu'el, Komemiyut, Mishkenot Sha'ananim, Mahaneh Yisrael, and Yemin Moshe in Jerusalem
June 5	Interview
June 6	Jerusalem Biblical Zoo
	Guided walking tour of Shu'fat refugee camp in East Jerusalem
June 7	The Dead Sea and Masada
June 8	Interviews and driving tour of East Jerusalem's Kidron Valley
June 9	Interview and tour of Jerusalem Bird Observatory
June 10	Interviews
June 11	Gazelle Valley tour, strategic meeting with Bioregion staff
June 12	Israel Museum
June 13-14	Haifa and Nazareth
June 15	Interview
June 16	Workshop
June 18-19	Interviews
June 20-21	Tiberias, Capernaum, and Tel Aviv
June 22	Urban Nature Survey field trip in Giv'atayim, a neighborhood of Tel Aviv
June 23	Review session

Interview Questions

Please state your name, your institution, and your consent to be recorded.

1. Tell me about your role at ___ (institution)?
- What do you do within that role?

2. What would be an ideal outcome for you?
- What is your dream outcome?
- What's the best outcome given the circumstances?

3. How do you think about/conceptualize the environment?
- Are there environmental conditions that benefit or detract from your work in some way?

4. How do you think about/conceptualize biodiversity?
- Are there others who think about it differently?

5. Who do you work with most?
- Is there anybody who is not involved but should be?
- Are there groups or people who help facilitate your work?
- Are there groups that present challenges?

6. What are the main drivers and barriers to biodiversity in the area?

7. What are the behaviors that drive biodiversity loss?

8. What do you think would address these issues that you've raised?
- Ultimately, how can biodiversity loss be stopped?

9. How do your actions come into play when considering biodiversity?

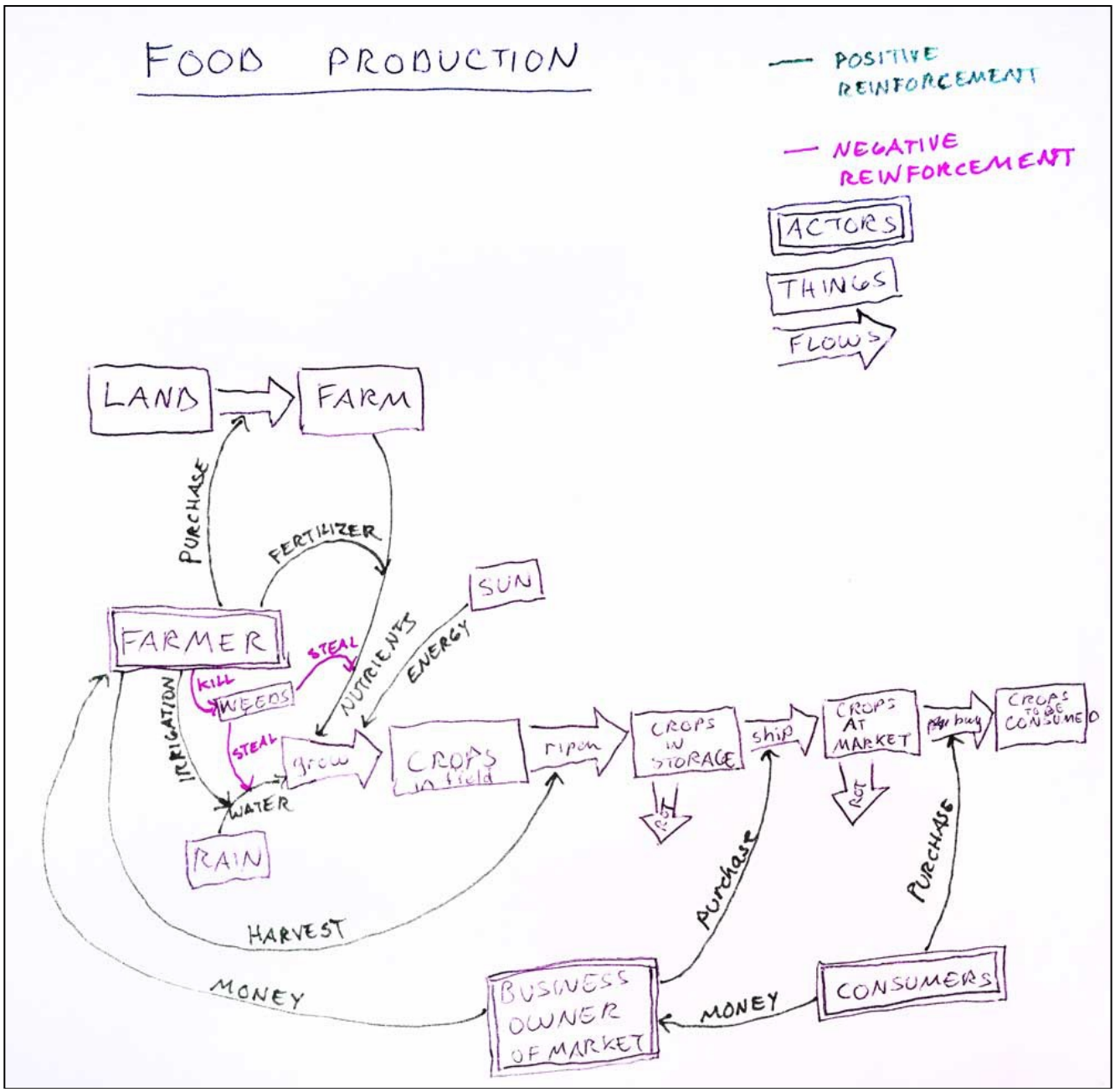
10. What geographical area do you consider in your work and why?

11. Would you sketch a diagram of your role within biodiversity planning?

12. Is there anything we didn't cover that you would like to add?

Sample Diagram

This diagram was shown as an example to each interviewee before drawing their own.



Workshop Agenda June 16, 2014

Facilitated by Jennifer Rae Pierce with support from the Jerusalem Bioregion Center for Ecosystem Management and hosted by Municipality of Jerusalem in the Model Room, Building 1, floor 0.

1. Introductions: 45min 12:15-1pm
    a. Helene - Bioregion
    b. Introduce myself and my assistants
    c. Thank Bioregion
    d. Obtain consent for recording and photographing the event
    e. Have each person introduce themselves, and say favorite native species and why

2. Exercise 1: Visualization: 30min 1-1:30pm
    a. Explain exercise and purpose
    b. Shut eyes; visualize your dream for Jerusalem
        b.i. What does the city look like?
        b.ii. What are the public areas like?
        b.iii. What are the people doing?
        b.iv. How does it smell?
        b.v. What does it sound like?
    c. Think of three words/phrases that describe your vision
    d. Shoulder touch and respond, write down answers
    e. Observations/surprises/patterns/groupings

3. Exercise 2: Organization's Goals: 30min 1:30-2:00pm
    a. Ask around the room: What is your organization and its main goals?
    b. How does this relate (or not) to your vision for Jerusalem?
    c. Observations/surprises/patterns/groupings

BREAK 20min

4. Exercise 3: System Network Creation: 80min 2:20-3:40pm
    a. Explain exercise and purpose
    b. Levels of Mobile
        b.i. Organization
        b.ii. Actions: things they do
        b.iii. Outcomes: impacts of what they do
    c. Turn mobile upside-down, so that those opposite the table can read it
    d. Connect with others' mobiles in small groups of 3-4, using color-keyed strings as follows
        d.i. Brown = existing working partnerships
        d.ii. Red = cross purposes
        d.iii. Green = positively reinforcing
        d.iv. Red and Green = it's complicated
    e. Look for other connections around the table
        e.i. Describe connections made, add any more that can connect as each one is described

e.ii. Is any organization missing? List on board

BREAK: 10min

5. Exercise 4: Root Causes: 40min 3:50-4:30pm
    a. Fold paper into 8 skinny sections
    b. Write environmental problem at top
    c. Ask why seven times and write them in the remaining sections
    d. Record the initial issue and the last (seventh) "why" result on the board for each person
    e. Observe any commonalities and discuss the reasoning behind the seven why's
    f. Discuss root causes of environmental problems in the city, list on board
        f.i. How do these root causes connect to the systems network that was built?
        f.ii. If time, make cards for the main ones (vote if there are too many), and link them into the diagram

6. Closing: 20min 4:30-4:50pm
    a. Discuss how this relates to biodiversity planning
    b. Explain what I will do with the mobile
        b.i. Generate an electronic version
        b.ii. Analyze it, along with the interview results and present findings at the review session
    c. Announce review session to be held 2-4pm on June 23rd at the Jerusalem Bioregion Center

Giv'atayim Nature Survey

Each of the 35 areas visited for the initial assessment are outlined in green.

Excerpts from the Interviews: Concepts of Biodiversity

The quotes below are directly from the interviews and include every identified instance of conceptualizing or defining biodiversity. They also include times when the interview was asked how they thought of biodiversity and expressed being unsure.

- **Being unsure about biodiversity**
  - "I am sure you know more than me. I am not really a specialist in biodiversity but at least there is always relation between the species"
  - "I don't have time to make my knowledge wider in this field."
  - "I don't know if that's a question for me."
  - "It is not my field, it is someone else. But I am for it. The idea is right."
  - "I think we are still at the stage where that is not the expertise of the staff here."

- **Defining Biodiversity**
  - "I can just give you the scientific definition. It is the sum of all animals, plants, all the species that we have around us, the sum of the genes that we have around us, that's it."
  - "Biodiversity means all the kinds of species existing… protection of the species, assisting or enabling the species to continue to prosper in the environment where they are living… or just practicing their normal lives. So biodiversity is also something very important for the life."
  - "It is all of life on earth. So biodiversity is everything that grows around us and the air that we breathe, the water that we drink and use to bathe and enjoy sometimes in other ways. So all the natural resources around us are biodiversity"
  - "To me it is everything. Biodiversity is basically all life forms that give us all the services, either that we need or we enjoy. Very simple. I eat biodiversity, I breathe biodiversity, I wear biodiversity, I drink biodiversity, I make my fortune from biodiversity, I make my life from biodiversity. I film it, I paint it, I talk about it. It is my livelihood."

- **Concepts of biodiversity as underpinning human life**
  - "Some species are there to clean, some species are there to provide another function which is also another service and therefore it is important to keep this kind of biodiversity so that you can get this kind of service out of the environment and you can live as a human being and enjoy that kind of nature and environment."
  - "You cannot live in the world without other animals, germs, insects. Without animals, we cannot survive. We are actually a part of it. We cannot do it ourselves."
  - "Green areas are not because they are green, they are habitat for a lot of living things. Animals and plants and flora and we can't survive without it. I am always telling people, how do you think we have oxygen in the world? Do you think we have it naturally? Who makes the oxygen? The plants."
  - "without biodiversity we won't have any life for a long time. We couldn't sustain as people, as humanity. If we won't have biodiversity.

Everything I do, at the bottom line, is to preserve biodiversity so we will have the ecosystem services, everything. This is the bottom line for me."
    - "It is the basis of life."
    - "It is a very important part of sustainable development because [environmental planning] is not just [about minimizing] nuisances, but to preserve the life and the nature of the city."
    - "Also critical to all infrastructures that if you, I am thinking about ecological cycles, if there is a break in the cycle then everything will collapse, so biodiversity is essential."

- **Concepts of biodiversity as simply good**
    - "It is good. It is very good."
    - "Anyone who gets exposed to biodiversity loves it and wants to be out in it, to do something about, to work in it, to incorporate sustainability into their lifestyles with recycling and so on"
    - "The more the better. I am not getting into details of what inside. Eventually every open space eventually will help biodiversity."

- **Other concepts of biodiversity**
    - "I understand that it's not just nature and wildlife. It's the interaction of the different ecosystems and the chains and the continuity. So, the fact that something grows somewhere is not necessarily relevant to biodiversity. The fact that you have an ecological corridor, you have continuity, you have the conditions needed for a certain species or several species to continue to thrive, or the opposite, is what is significant."
    - "gardens are a pluralistic place where people can meet without barriers. It is for everybody. And it happens that people who would not normally meet will meet in these places, and they are equal. So, yes it does contribute to human biodiversity."
    - "The way I conceptualize it in my position is very different from the way I conceptualize it as an individual"
    - "I think of it as the full compliment of species that exists in any given location, like the actual physical beings in the ecosystem, but I also can see it as the ecosystem itself because sometimes two things can coexist in your mind, they are not the same and they seem contradictory but they can both be true. So the ecosystem itself is made up of species but it is also the home for the species. So when I think about biodiversity I think of it as the building blocks of the ecosystem, what inhabits the ecosystem, I also think of it as the diversity itself, whether it is genetic or how different the different parts of the system are, whether functional or genetic or appearance-wise even, like a multi-layered way of thinking"
    - "When I say or hear the word biodiversity, the picture that I have in my mind is of a really rich rainforest. Everything that entails."

- **Concepts of Urban Biodiversity as Critical Infrastructure**

- "it's critical… it should be seen by all local governments as equal to any other municipal infrastructure, such as roads, transportation, housing, plumbing. The same as anything else."
- "biodiversity is a critical feature of the city's land and infrastructure and must be given a great deal of attention in the planning system"
- "from now on we won't be an ecological system, we won't be natural heritage, we will be wildlife infrastructure or natural infrastructure... The difference between wildlife system and infrastructure is that infrastructure is something you plan, you manage, and if you need to, you renew. This is a new way of looking at nature in the city"
- "biodiversity should be among the priorities of a city's planning structure, in the list of priorities, in the areas that should be addressed seriously when planning the city."

- **Concepts of Urban Biodiversity as being for People**
  - "within a city… you keep the biodiversity more for the people than for the organism… the importance of conservation within these places is very high for participation, for people's welfare, and less so for the species. If you want to conserve species, we need usually large scale areas… it has an important place for education and for people to get to know nature and to appreciate nature. It also has a value for living in the city: to have some green areas to look at, to enjoy, which is also important."
  - "People are still thinking urban parks, they are thinking about lawns and different amenities. Here we are talking about nature, full steam ahead, in one of the most developing areas in town, and using it as an urban infrastructure. The idea is to bring people, to get people to see gazelles, to get people to hear bird song, to get people to eat wild food. And this is a novel way to look at urban parks or protected areas in the city."
  - "I love wildlife… if you have as many animals and plants as possible and as many species as possible, this is how it should be. So the answer for myself is very simple. This is what I like, so I want as much as possible. Whether in urban surroundings or in the wild. I feel like anything else that I would say is just trying to make a point of something that is very simple to me. I want as many birds and mammals as possible."
  - "it is going to be a place where people can learn about wildlife and environmental matters on a daily basis in a very attractive place. So I feel that I have a very large contribution in environmental education. But at the same time I remember that this is an urban wildlife place that has its limitations. It is not the wild. It is a specific niche in biodiversity. It is not like I am in Kenya, managing a reserve of five times the state of Israel with giraffes and elephants. Wildlife here is limited, but still it is amazing and people should be exposed to it. This is the main goal of the park at the end."

- **Urban Biodiversity as Less Important/Less Diverse**

- "there are some kinds of changes in this kind of biodiversity, at least in the plant species, and as you hardly find any other but a few kinds of species"
- "It is the most important thing, for me. I don't think it has so much meaning for the city… In the city is important to have nature and biodiversity for people to know what is nature, but the most important biodiversity is outside the city."
- "the most important thing is to preserve biodiversity so that people won't go and have new villages in the public and open spaces. They will want to live in the city… if we will have better cities so that people will live in the cities, then let the biodiversity flourish in the open spaces"

- **Urban Biodiversity Management**
  - "We made a very essential shift. In a rural area when you are looking at nature, it is something you just preserve. In an urban area you must apply the challenges of the city on the ecosystem. If you segregate a habitat from the open spaces then it is much more susceptible. You have to protect it very actively. This is a classical case, in this site for example, where we are adding habitats, we are improving habitats, we are managing it. We are adding habitats that were never here. For example, our wetland is completely artificial. But, we have added a spring to Jerusalem, which is very effective. It is effective in its carrying capacity. Before, birds didn't come and drink here. They had to fly to the intensive pond in the main park, which is not ideal for birds. Now, they have two sites, the main park and over here. So, we actually doubled the water sources supplying water in the center of town. Instead of having five dragonflies, we now have fifteen dragonflies. Instead of having 50 frogs, we now have 500 frogs at the moment. That means the carrying capacity is growing. According to the way we design and plan and design and manage the site."
  - "We are also looking at the relationship with people at those sites and what are the effect of people on that system, plant, or wildlife. Trying to see how to mediate. To mediate between the swifts on the western wall you actually have to do a lot of communications and make those communications or work on the people who are in charge of managing ancient infrastructure in the forbidden city. It is design and social work."
  - "Urban wildlife has to be a large part of it, has to be managed. It cannot be left as it is. So that is different from regular wildlife… You have a zoo on one side and you have wildlife on the other, it is halfway. That's how it is, so it is not like a zoo."

Excerpts from the Interviews: Anything to Add

The quotes below are directly from the interviews and include every answer to the question "anything to add" that was in the affirmative.

- **The need to connect**
  - “the importance of teamwork and now we are living in such a global world and there are so, so, so many organizations that have detached everything... how to more connect these chains, these beautiful brains all over the world to an issue that concerns everyone involved.”
  - “It is like there is some disconnect. We lack this connection in our day-to-day understanding. We have this incredible international network of connections but day to day we are very insular. So we need to figure out how to use our international know-how to be part of our day to day perspective.”
  - "I am part of an amazing, unique project and I am positive about the outcome, but I need to feel more support and more connection with the decision makers and so that people like myself and people I work with can have more confidence that what they are involved in is going to make the difference in what they are hoping for. This confidence can come from seeing that decisions makers translate what they are doing, sometimes in faraway places, translate it to those people who are working onsite. This is a gap that need s to be narrowed. It would make us much more confident that we are on track and that we are doing an important thing."

- **The need to communicate**
  - “For greater achievement in stopping the change of the balance of biodiversity... [we need] the kind of research ...[that] is really persuasive as to the value of biodiversity, and it can't be economic value, it has to be an absolute value, just as health is an absolute thing. It has to be. And it should have undisputed value of the kind that is otherwise threatening to the human race.”
  - “We've reached such a stupid point that even within the environmental voices, the emissions counters aren't talking to the nature protectors. I think that's the major problem.”
  - "the whole purpose of the assessment is to improve communication with decision makers. So as far as we're concerned, if the report comes out and it's beautiful and amazing and perfect but no one reads it, it is a total failure."

- **It will take time**
  - “It is just going to take a lot of time and effort to actually make a change but I think it is possible and inevitable. We won't have any choice. Maybe it's too optimistic.”
  - “Even though I sound very pessimistic, I still believe that one day we can bring change and if I wasn't an optimist I wouldn't have stayed here

in this job and I wouldn't have tried to do everything that I am doing and I do believe, I know that those kinds of things don't take a day, and they don't take a year. They take years."

- **Politics**
  - “We didn't cover some of the political aspects of the design. And its difficult. You never know where it comes out, when, how. Sometimes it is in front, sometimes it is behind, you don't see it. Every design has some political aspect. It is the most difficult aspect to deal with.”
  - “if the Israelis don't give up their mentality to damage the environment, then the environmental damages which are caused by different actors, one of the major actors is the Israeli army, this is the impact will affect the Israelis and the Palestinians.”

Workshop Exercise Responses

Below are the responses as recorded on the whiteboard during the workshop.

1. **Dreams**
    a. Just – resources are fair
    b. Sustainable
    c. Safe
    d. Shared
    e. No traffic
    f. No exposed wires
    g. Green roofs
    h. Solidarity
    i. Perfect roads, tended to
    j. Fresh smell of bakeries
    k. Good education
    l. Happy, leisurely pedestrians
    m. Walkable
    n. Peace
    o. More light rail
    p. Clean (practical, can be done interiorly)
        i. No refuse
        ii. No obstacles
        iii. Clean air
        iv. Fresh
    q. Flowers
    r. Birds
    s. Green
    t. Open spaces
        i. Connected open spaces
        ii. No tall towers
    u. Open, free movement
        i. No boundaries (physical and social)
    v. Participatory
    w. Cooperative

2. **Goals**

    a. Understanding between Ministry of Environment and ability of the city
    b. Influence plans (Ministry of Environment)
    c. Ensure public buildings and spaces are sustainable
        i. And meet public needs
    d. Promote sense of community, democracy, participation
    e. Grass-roots leadership
    f. Collaboration inside and out
    g. Open discourse creation
    h. Conserve landscapes and biodiversity
        i. Bottom-up and top-down
    i. Empowerment

j. Increasing awareness of the real value of the environment
    i. Essential for life first
k. Influence policy by promoting awareness
    i. Through information and engagement
l. Integrating ecosystem management into planning
m. Promoting cooperation for joint initiatives
n. Education
    i. Changing behavior

3. Who is missing from the workshop?

a. Municipal Departments
    i. Education
    ii. Finance
    iii. Gardens and infrastructure (beautification)
    iv. Legal
    v. Transportation
    vi. Sanitation
b. SPNI and other NGOs
c. KKL
d. RATAG – Authority of Natural Resources
e. Water utility: Hagihon
f. Contractors
g. Developers
h. Business
i. Arab community
j. Haradi (the ultra-orthodox community)
k. State Ministries
    i. Interior
    ii. Health
    iii. Agriculture
    iv. Jerusalem region minister
l. River authorities
m. JTMT – Jerusalem Transportation Masterplan Team
n. Community centers
o. The public
p. Jerusalem Foundation and other funders
q. Politicians, council members
r. Jerusalem city spokesman
s. Environmental reporters?

4. Root Causes Exercise: Problem and the root cause

Problem	*Root Cause*
Poor waste management	Politics, status quo about taxes
Construction waste dumping	Poor planning/regulation
Dirty City	Lack of resources for leaders
Environmental enforcement	budget

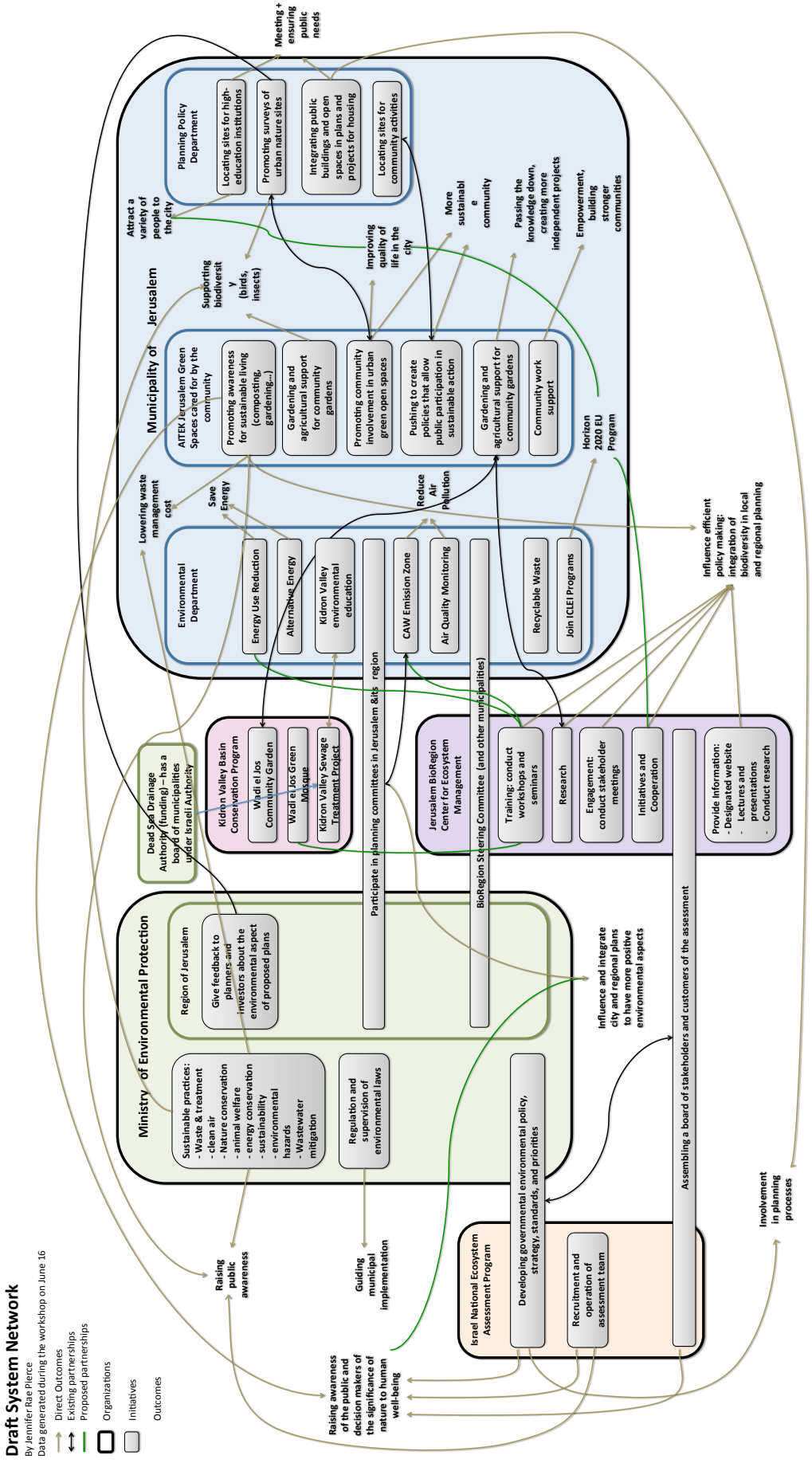
5. Root Problems of Biodiversity Loss

a. Budget/financing issues
b. Education and information
c. Regulation
d. Enforcement and incentives
e. Alternatives
f. Conflicting interest of public, reflected in politics
g. Lack of infrastructure
h. Inequity overall, including political influence and access to resources
i. Longer term thinking is lacking

6. Additional comments

a. There are 3 kinds of decision-makers:
    i. lay people
    ii. professionals and academics
    iii. deciders (not around)

Workshop Session Network Outcome

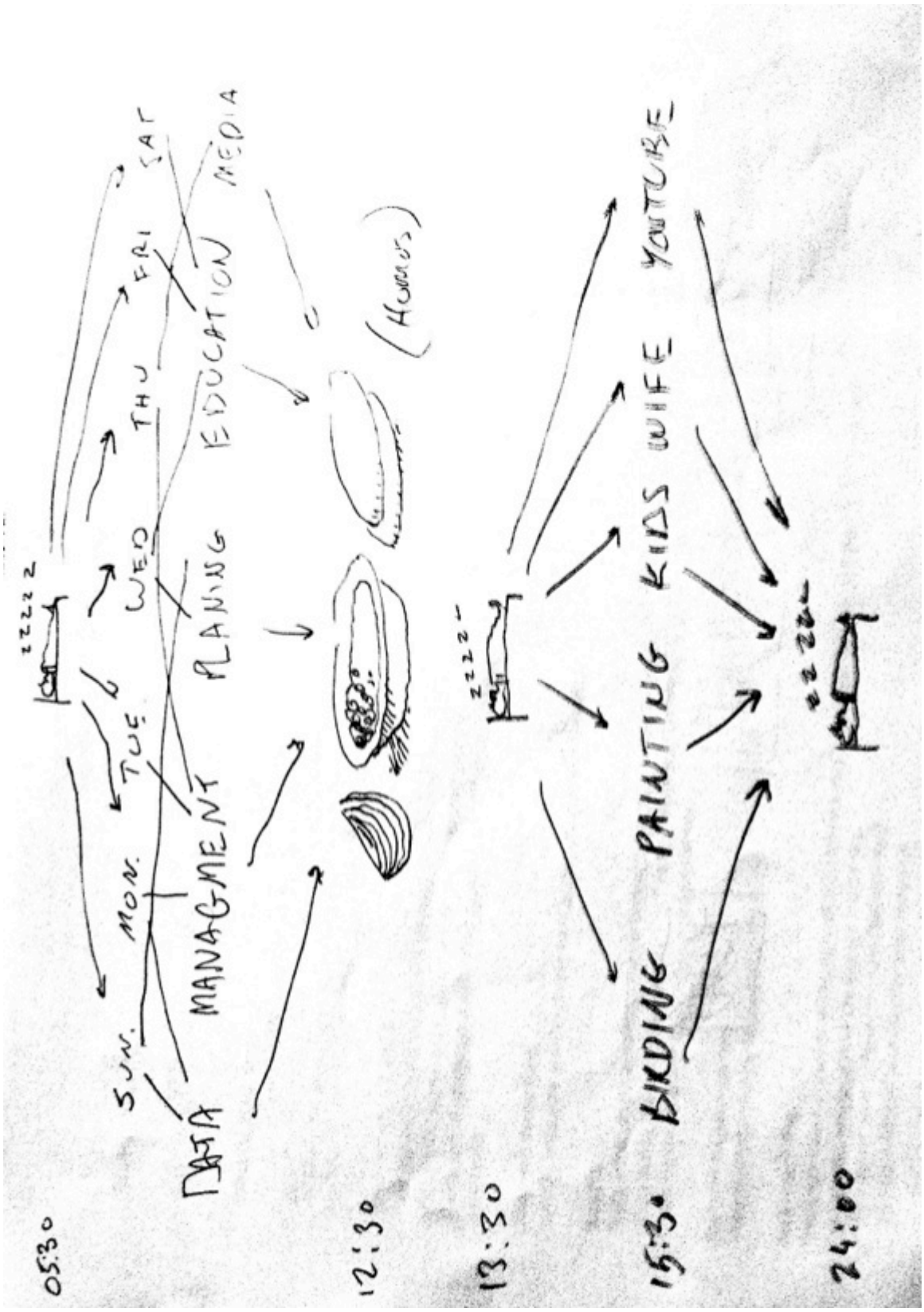


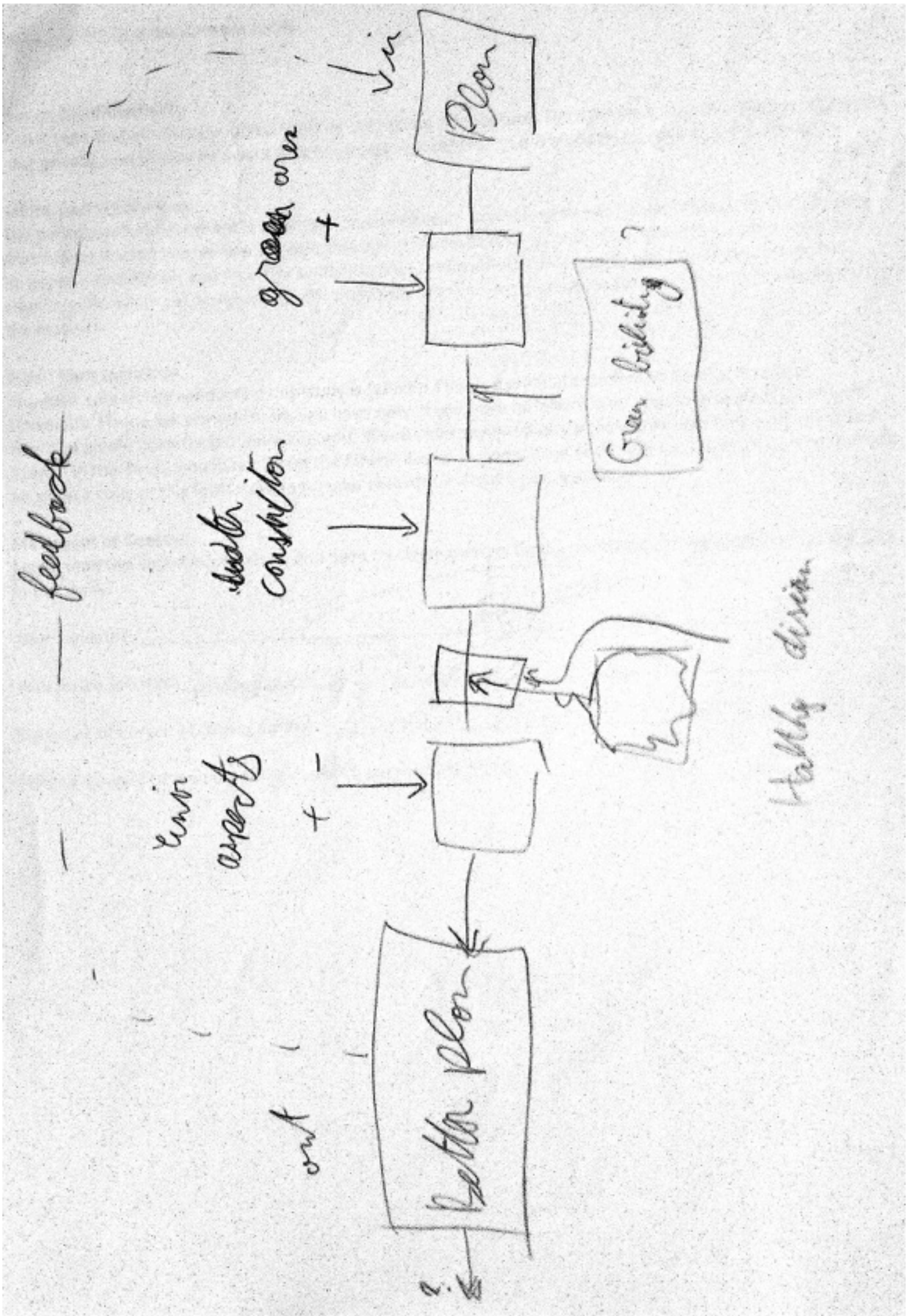
Workshop Survey and Responses

Of the seven workshop attendees, five responded to a feedback survey distributed via email. Each respondent's answers are indicated anonymously below, separated by semicolon.

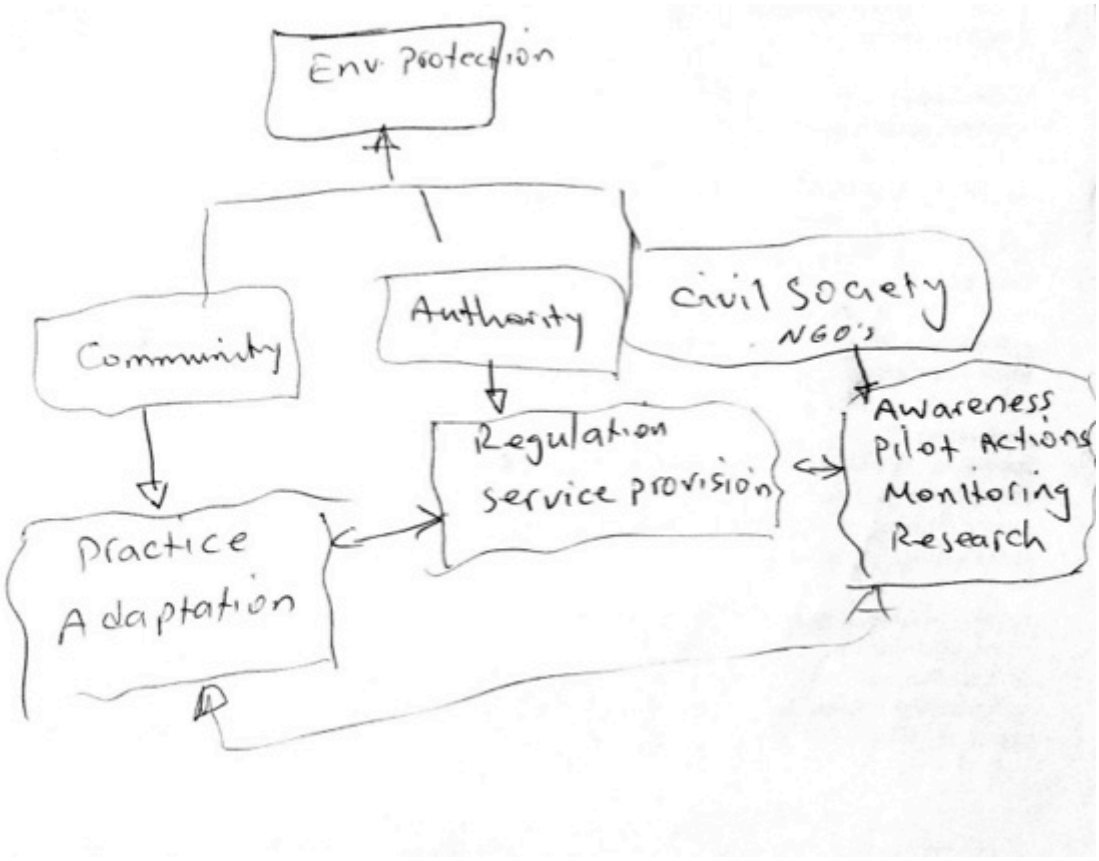
Question	*Responses*
1. How satisfied overall were you with the workshop? Answer from 1 to 5, with 1 being not at all satisfied, and 5 being very satisfied.	4; 5; 4; 4; 4
2. Would you be interested in more workshops like this one in the future?	Yes; yes; yes; yes; yes
3. What was the best aspect of the workshop and why?	Feeling that we can cooperate with others; the discovery of potential partnerships for promoting mutual goals; discussing solutions, creating a visual interpretation of my organization and finding links to others; Knowing more people and actions that are taken to promote sustainability in Jerusalem, because of greater opportunity for cooperation; all of them
4. What about the workshop could have been improved?	Schedule within 9:00 to 15:00; ; it could be shorter. it was hard to sit there for so long. and more people, though I know there were supposed to be more; To get to the table more stake-holders from different fields of occupations; Participation from more different sub-communities

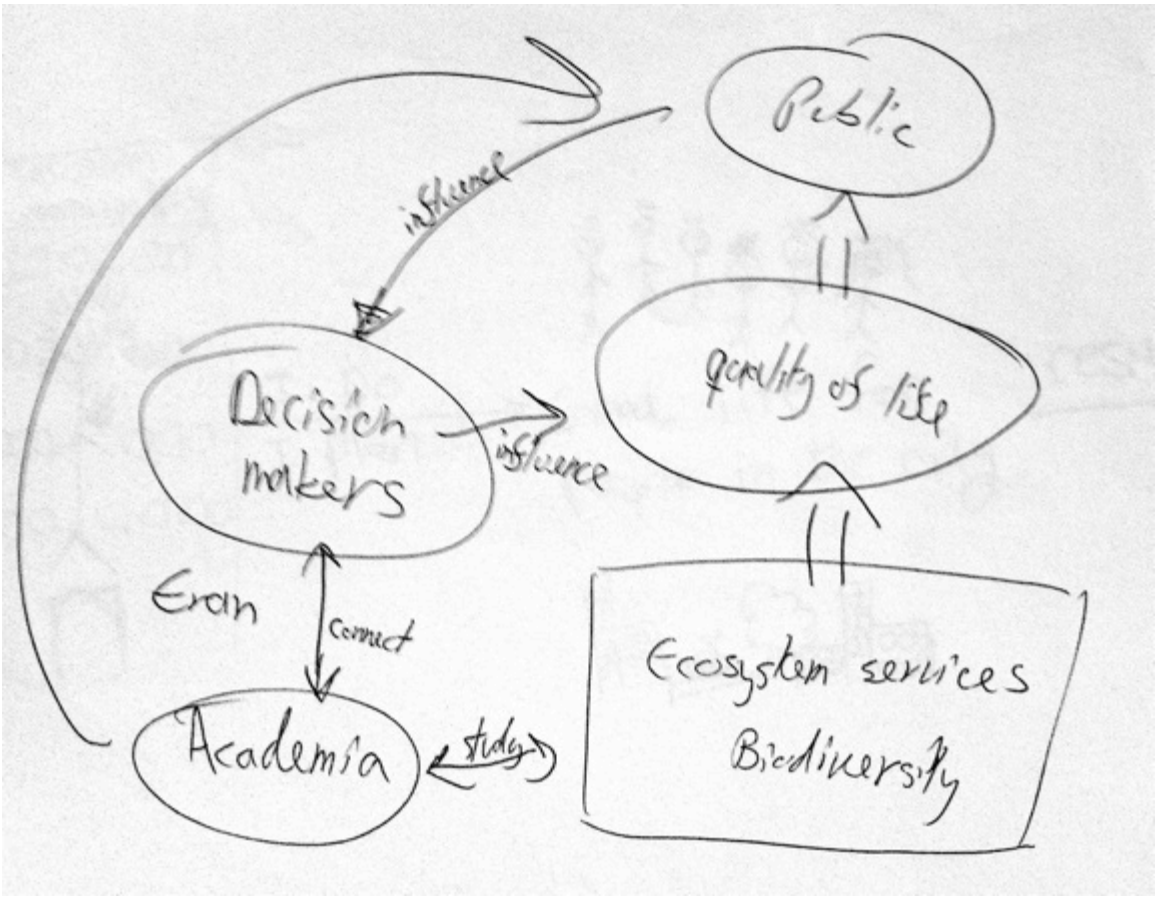
Sketches from the Interviews

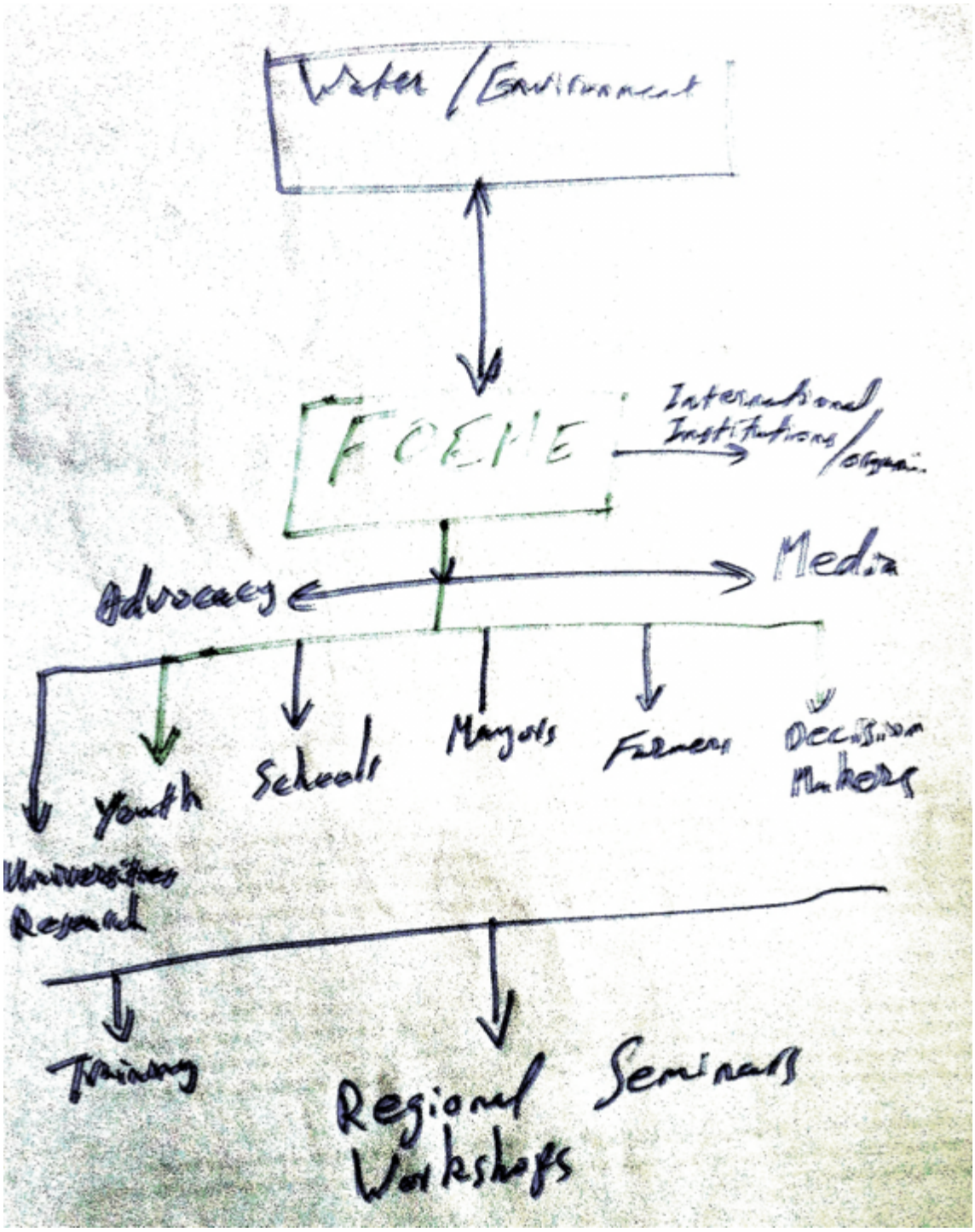


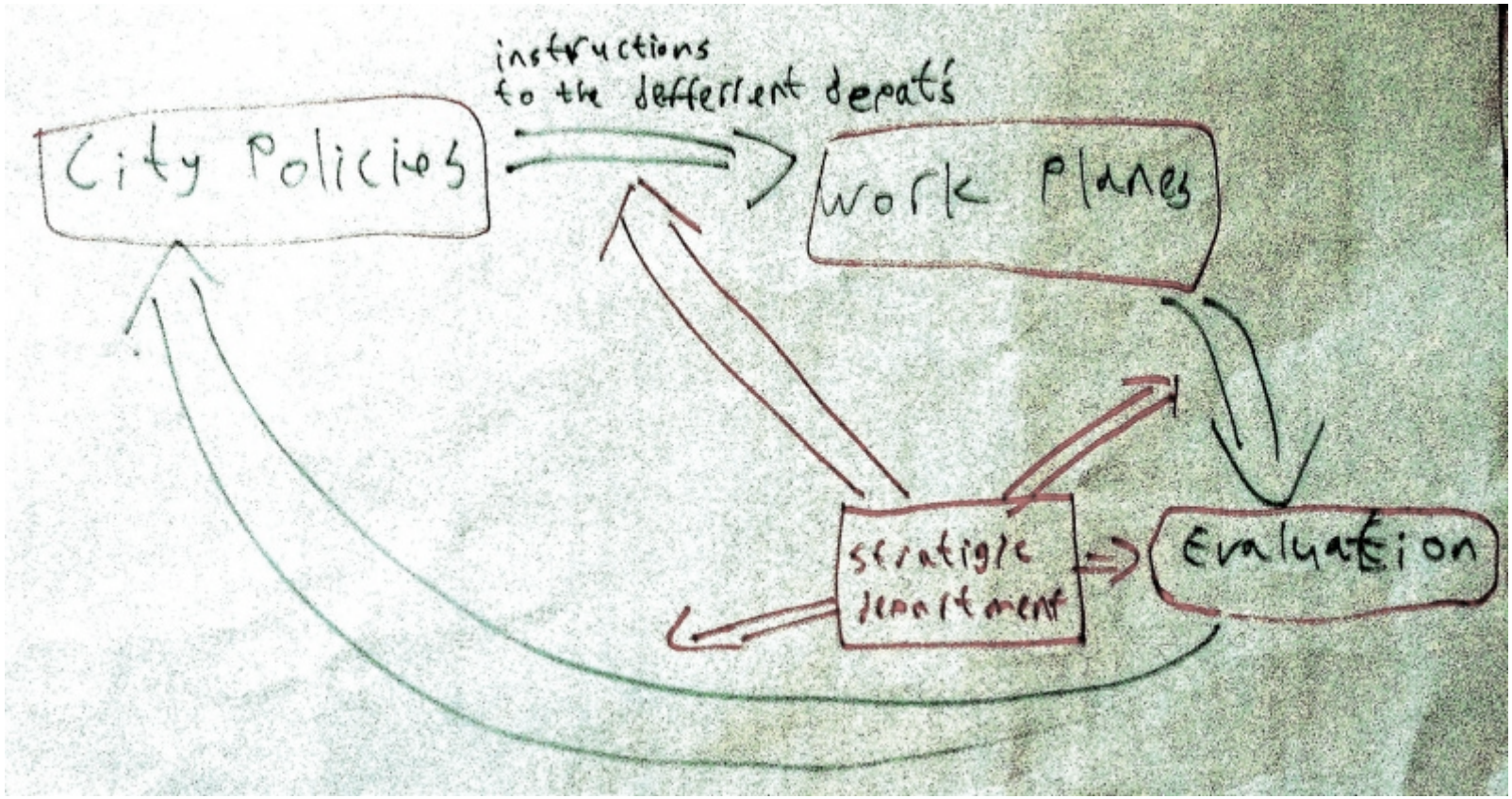


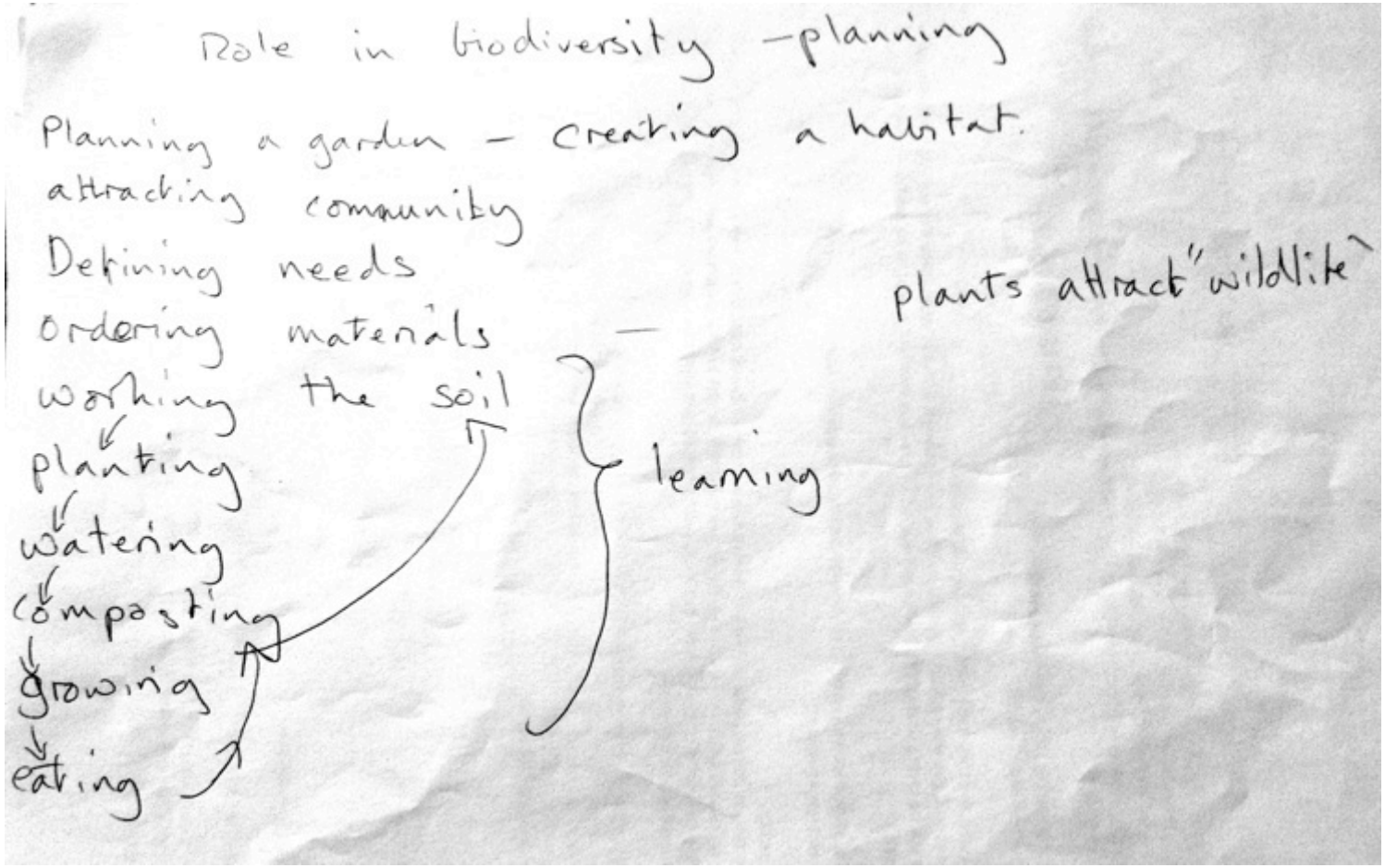
5.7.2

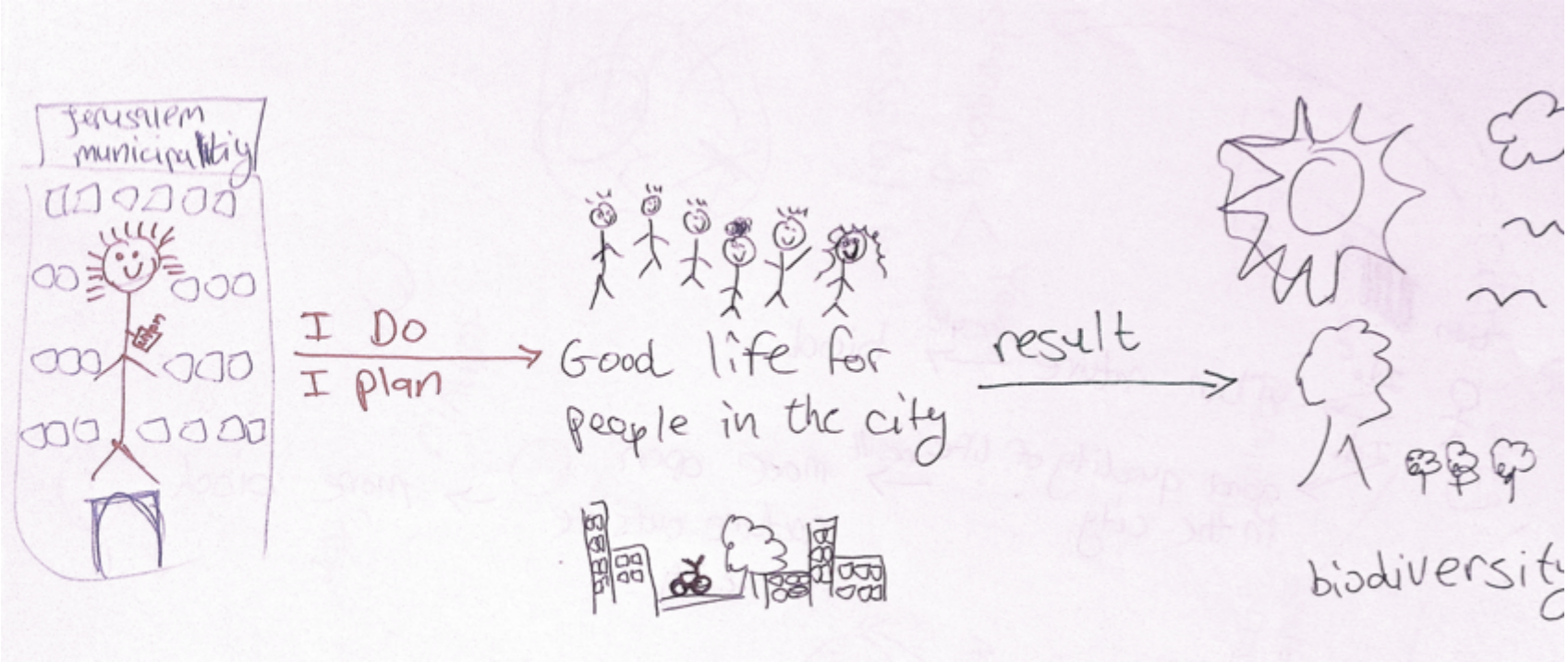




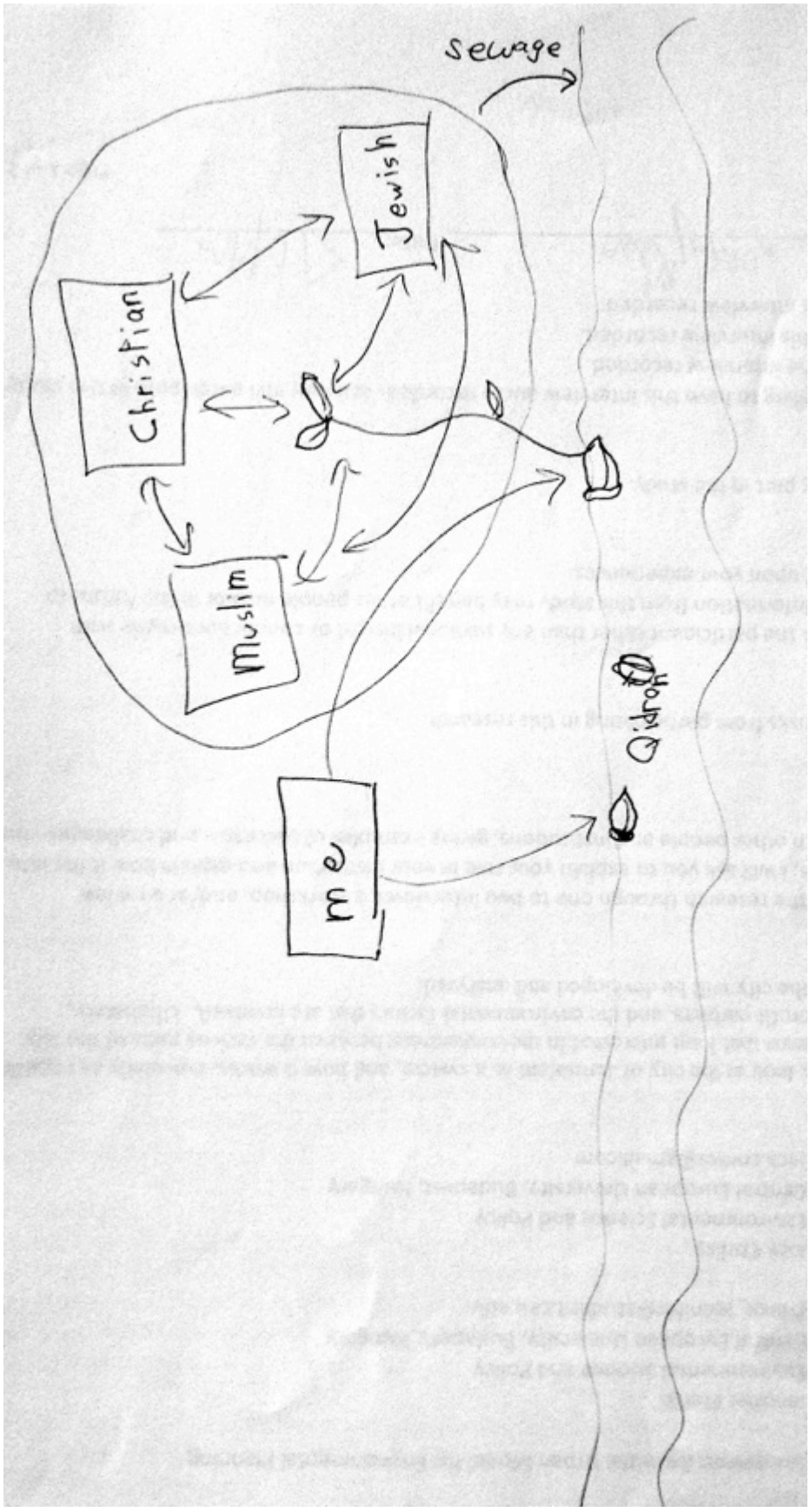


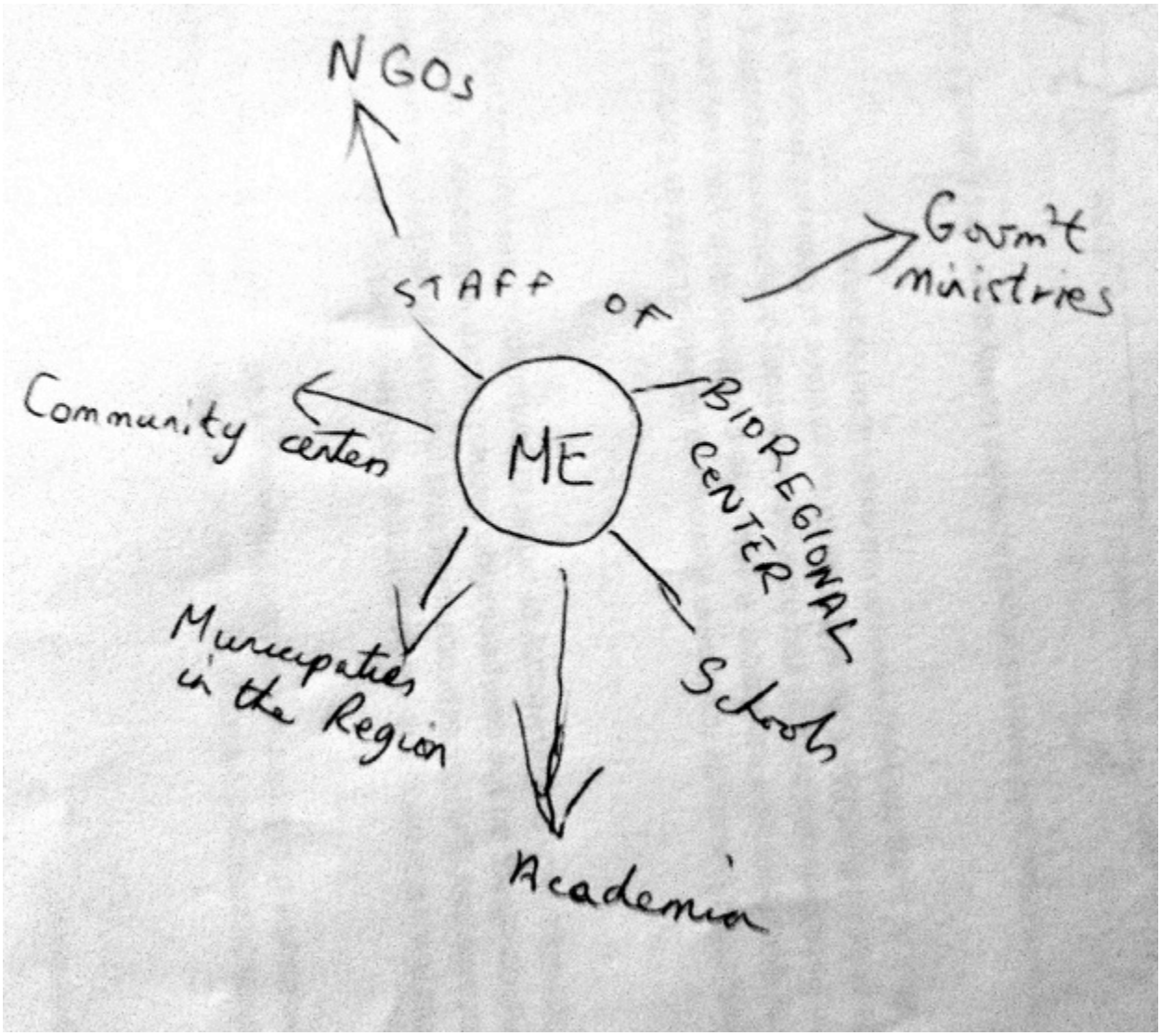

instructions
to the defferent depats
City Policies
work plans
strategic
department
Evaluation

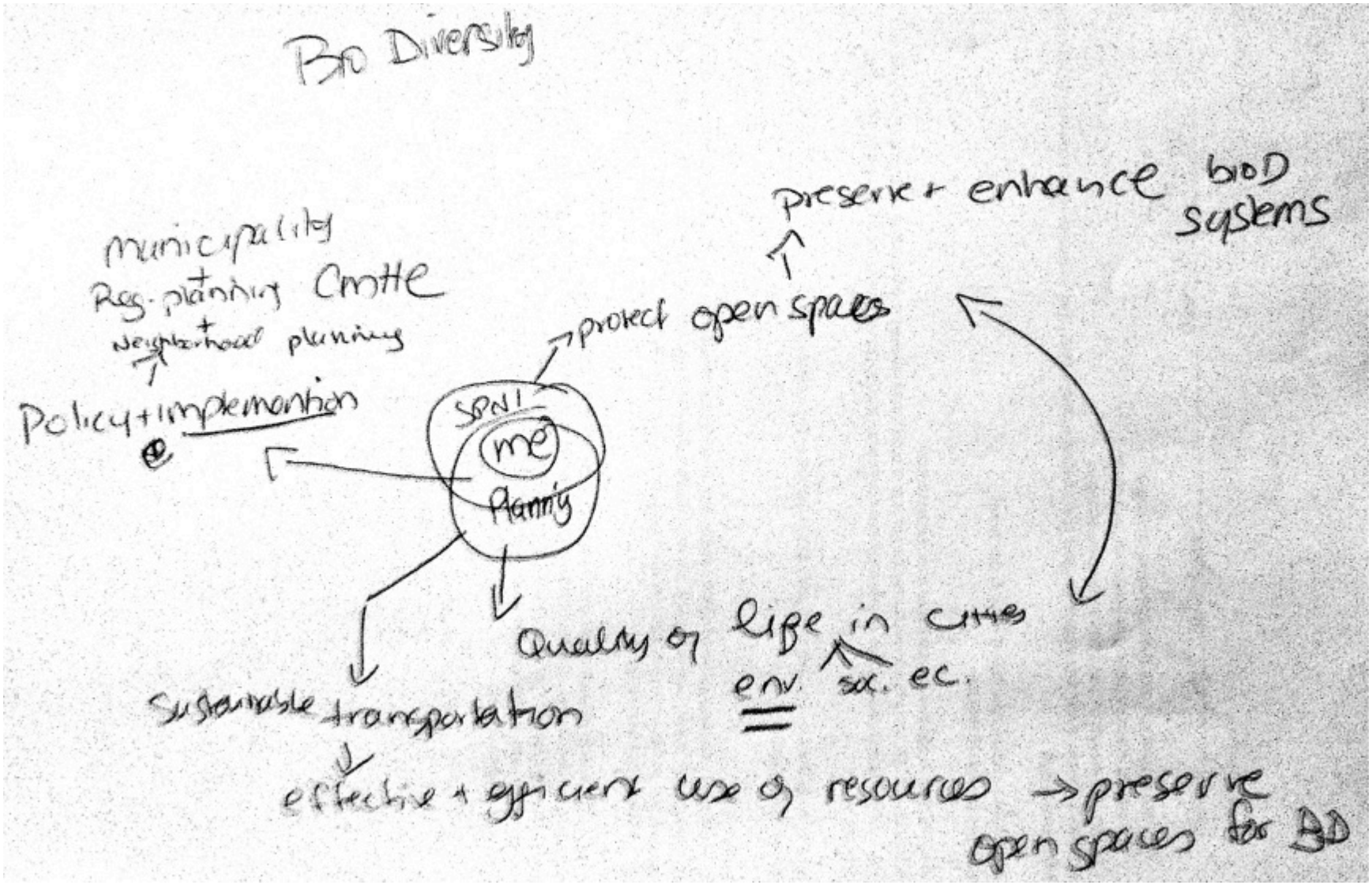

Role in biodiversity -planning
Planning a garden - creating a habitat.
attracting community
Defining needs
Ordering materials
working the soil
planting
watering
composting
growing
eating
learning
plants attract "wildlife"


Jerusalem municipality
I Do
I plan
Good life for people in the city
result
biodiversity

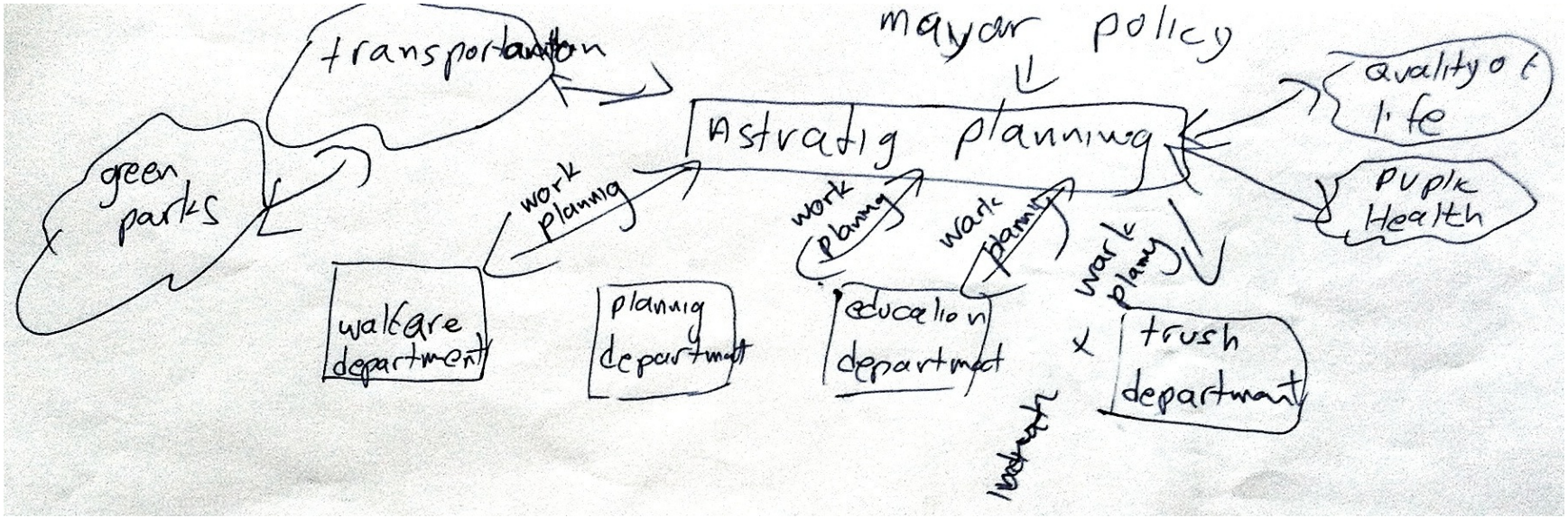
5.7.8



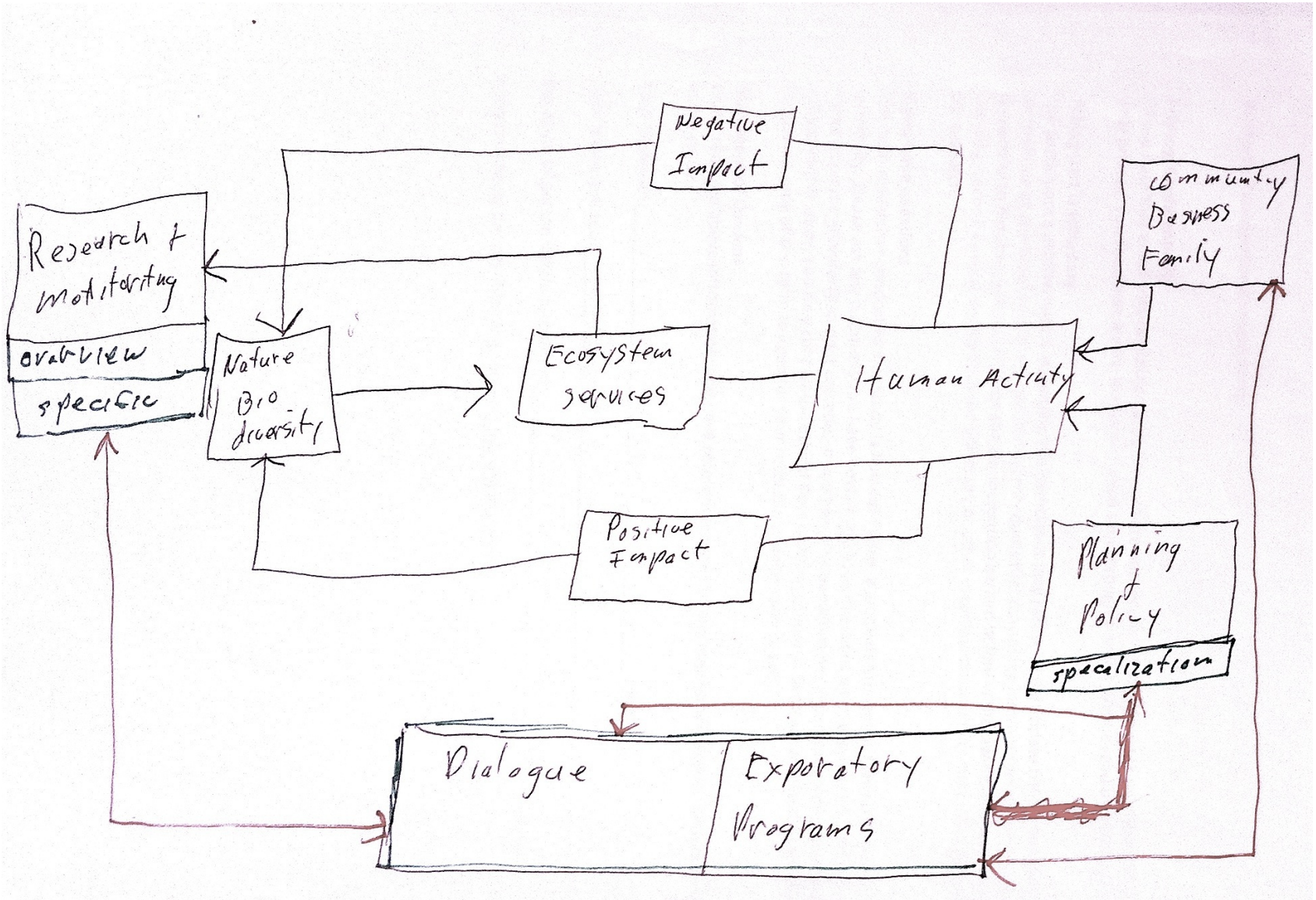



Bio Diversity
preserve + enhance bioD systems
municipality
Reg. planning Cmtte
+
neighborhood planning
protect open spaces
Policy + implemention
spat
me
Planning
Quality of life in cities
env. soc. ec.
Sustainable transportation
effective + efficient use of resources → preserve open spaces for BD

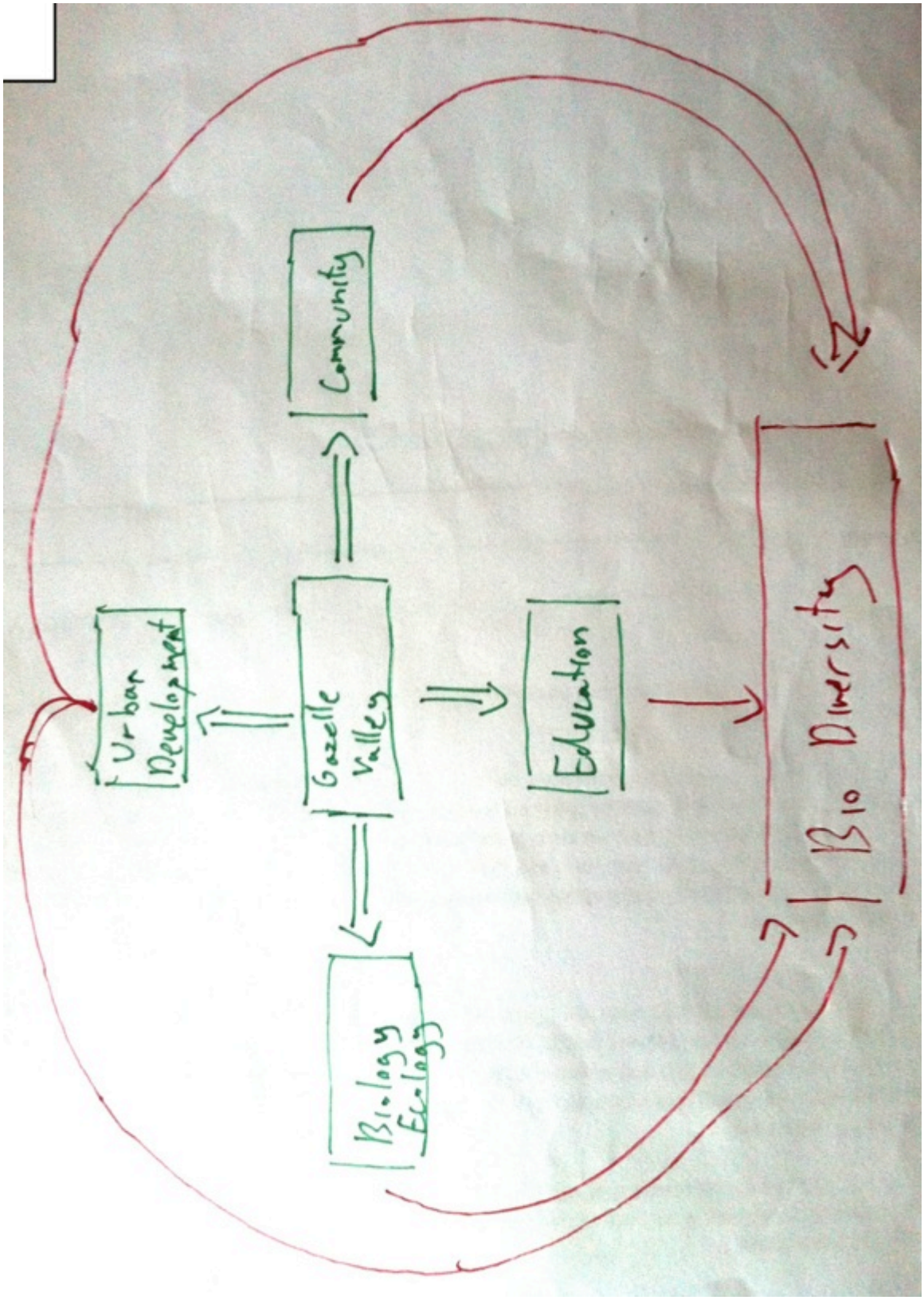
5.7.11


transportation
mayor policy
quality of life
green parks
strategic planning
public Health
work planning
work planning
work planning
work planning
welfare department
planning department
education department
trush department
investment

5.7.12


Negative Impact
Research + Monitoring
overview
specific
Nature Bio-diversity
Ecosystem services
Human Activity
Community Business Family
Positive Impact
Planning + Policy
specialization
Dialogue
Exploratory Programs

5.7.13



Automated Interview Concept Outputs

The data listed here are outputs from Leximancer's automated analysis performed on the interview transcriptions. All interviews were analyzed as a whole text.

Table 5.8.1 shows the most common concepts in the interviews, both as a count and in proportion to the most common concept, "people." Biodiversity is the 5th most common concept.

Concept Rank	*All Concepts from interviews*	*Count*	*Relevance (%)*
1	people	460	100
2	city	334	73
3	work	310	67
4	nature	253	55
4	area	250	54
5	**biodiversity**	**248**	**54**
6	Jerusalem	240	52
7	things	184	40
8	urban	172	37
9	need	169	37
10	environmental	164	36
11	different	153	33
12	environment	147	32
13	plan	146	32
14	community	138	30
15	municipality	134	29
16	important	130	28
17	Israel	122	27
18	open	126	27
19	planning	126	27
20	working	124	27
21	example	114	25
22	time	112	24
23	project	109	24
24	doing	108	23
25	water	97	21
26	take	92	20
27	understand	89	19
28	trying	87	19
29	change	87	19
30	process	84	18

Table 5.8.1: Top 30 concepts in the interviews.

Table 5.8.2 shows the top 30 concepts that were co-correlated with biodiversity. The "likelihood" is the percent chance that the concept will be found with the biodiversity concept.

Biodiv Correlation Rank	*Biodiv Co-correlated Concepts*	*Likelihood (%)*
1	sure	23
2	services	20
3	important	19
4	open	17
4	planning	16
5	local	16
6	look	15
7	means	15
8	city	14
9	things	14
10	create	13
11	use	13
12	level	13
13	doing	13
14	nature	13
15	natural	12
16	place	12
17	understand	12
18	urban	12
19	main	12
20	people	11
21	Israel	10
22	different	10
23	change	10
24	take	10
25	Jerusalem	9
26	building	9
27	trying	9
28	need	9
29	management	8
30	try	8

Table 5.8.2: Top 30 concepts co-correlated with biodiversity in the interviews.

5.9 Automated Document Concept Outputs

The data listed here are outputs from Leximancer's automated analysis performed on the biodiversity planning documents. All the documents were analyzed together as a whole text.

Table 5.9.1 shows all the concepts in the interviews, both as a count and in proportion to the most common concept, "Jerusalem." Biodiversity is the 8th most common concept.

Concept Rank	*All Concepts from interviews*	*Count*	*Relevance (%)*
1	Jerusalem	46	100
2	Recommendations	6	13
3	Israel	5	11
4	Municipality	5	11
5	Mediterranean	4	9
6	nature	45	98
7	sites	39	85
8	**biodiversity**	**33**	**72**
9	city	30	65
10	management	18	39
11	conservation	16	35
12	species	16	35
13	natural	16	35
14	development	15	33
15	habitats	13	28
16	guidelines	13	28
17	protection	11	24
18	local	11	24
19	areas	10	22
20	open	9	20
21	water	9	20
22	significant	7	15
23	including	5	11
24	survey	5	11
25	trees	5	11

Table 5.8.1: Top 30 concepts in the interviews.

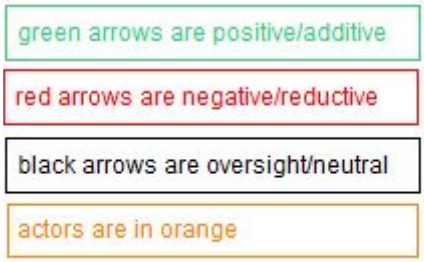
Table 5.9.2 shows all of the concepts that were co-correlated with biodiversity. The "likelihood" is the percent chance that the concept will be found with the biodiversity concept.

Rank	*Biodiversity Co-correlated Concept*	*Likelihood (%)*
1	Israel	100
2	management	100
3	including	100
4	Municipality	80
5	Mediterranean	75
6	conservation	75
7	significant	71
8	guidelines	69
9	city	67
10	local	64
11	nature	60
12	sites	56
13	open	56
14	protection	55
15	species	50
16	development	47
17	habitats	46
18	water	44
19	natural	44
20	areas	40
21	survey	40
22	Recommendations	33
23	trees	20
24	JERUSALEM	13

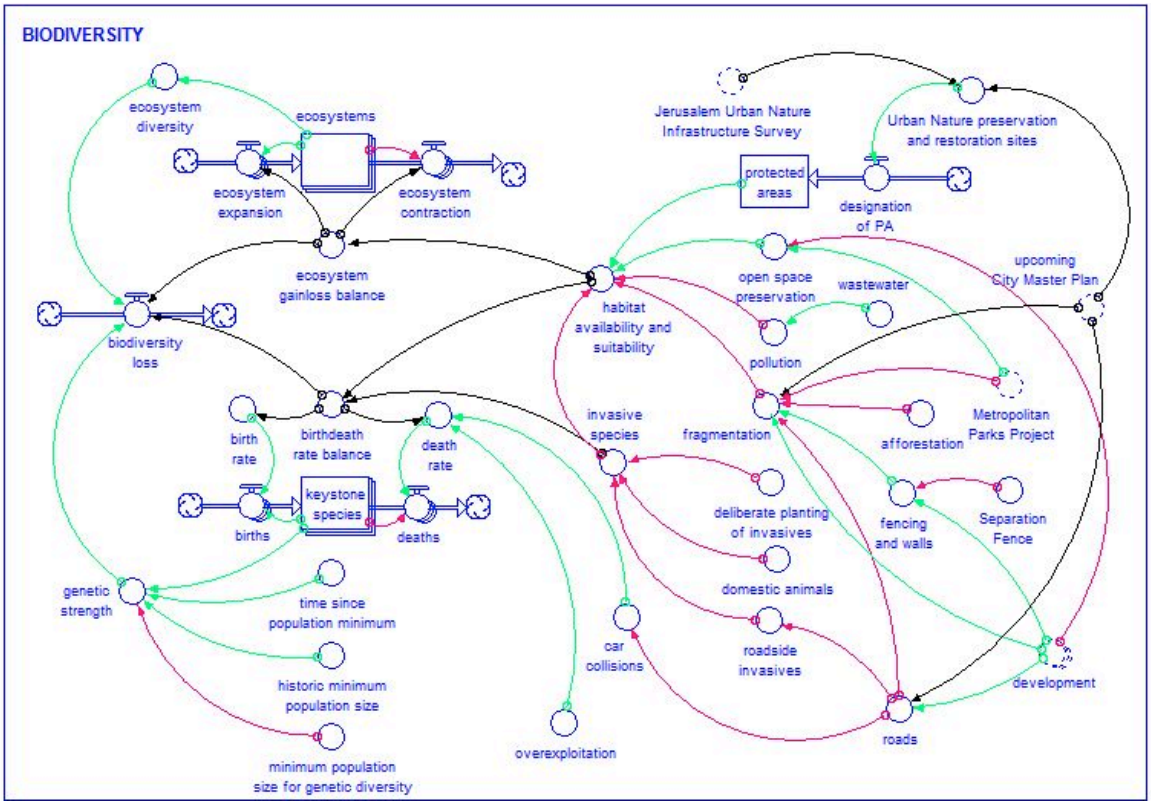
Table 5.9.2: Top 30 concepts co-correlated with biodiversity in the documents.

Systems Model of Biodiversity Report

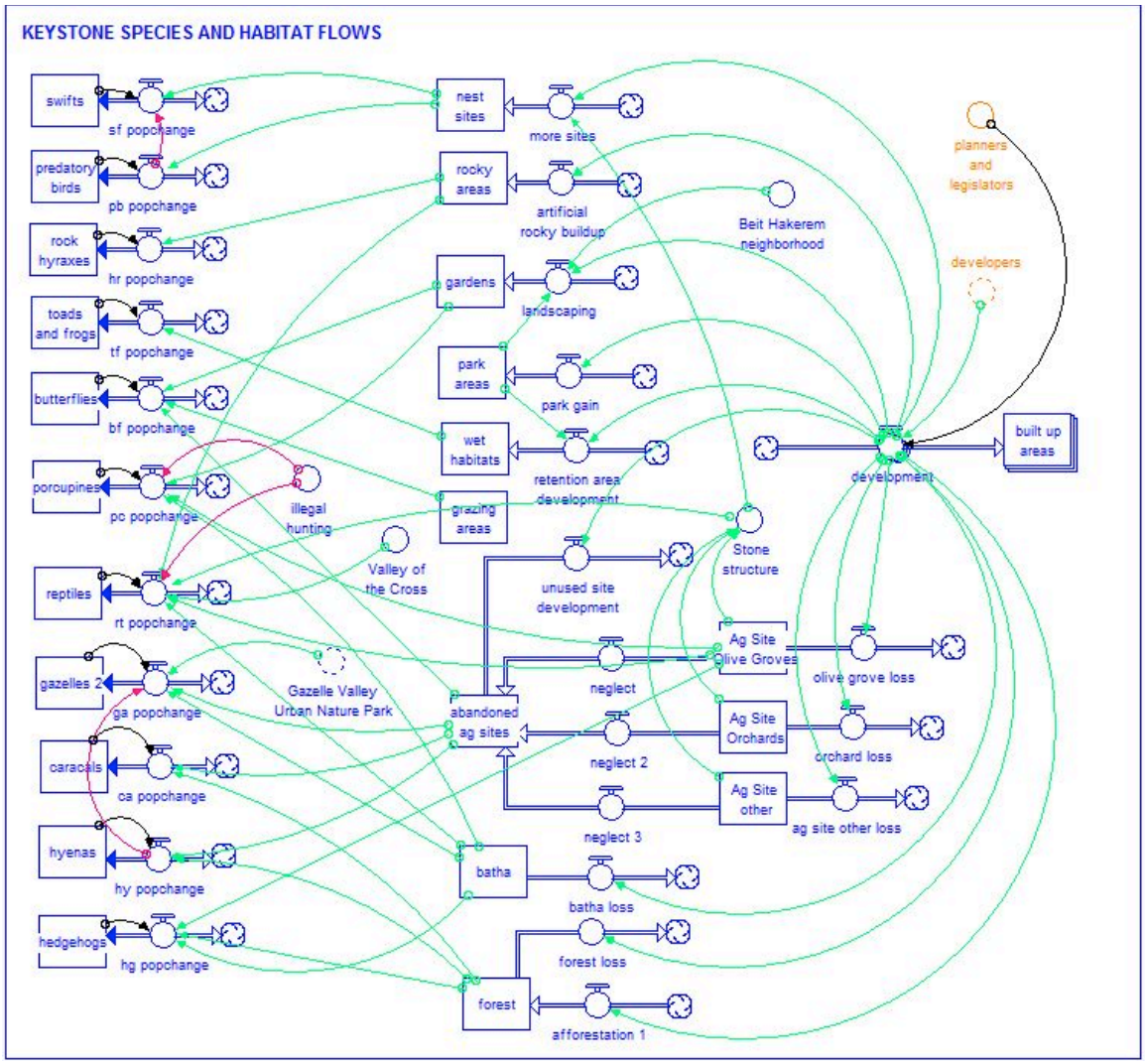
The system that impacts biodiversity loss in Jerusalem is complicated and affected by a wide variety of factors. This model elucidates diagrammatically only the most obvious of such factors: biodiversity loss, keystone species, political and legislative bodies, money flows and land ownership, and public opinion. Each of these factors is modeled in its own diagram, with ghosted figures from other diagrams linking it in to the larger picture. I will describe each of these sub-models in turn. A description of the actors is found at the end of this appendix. Each model uses the same color-coding, following the legend shown here.



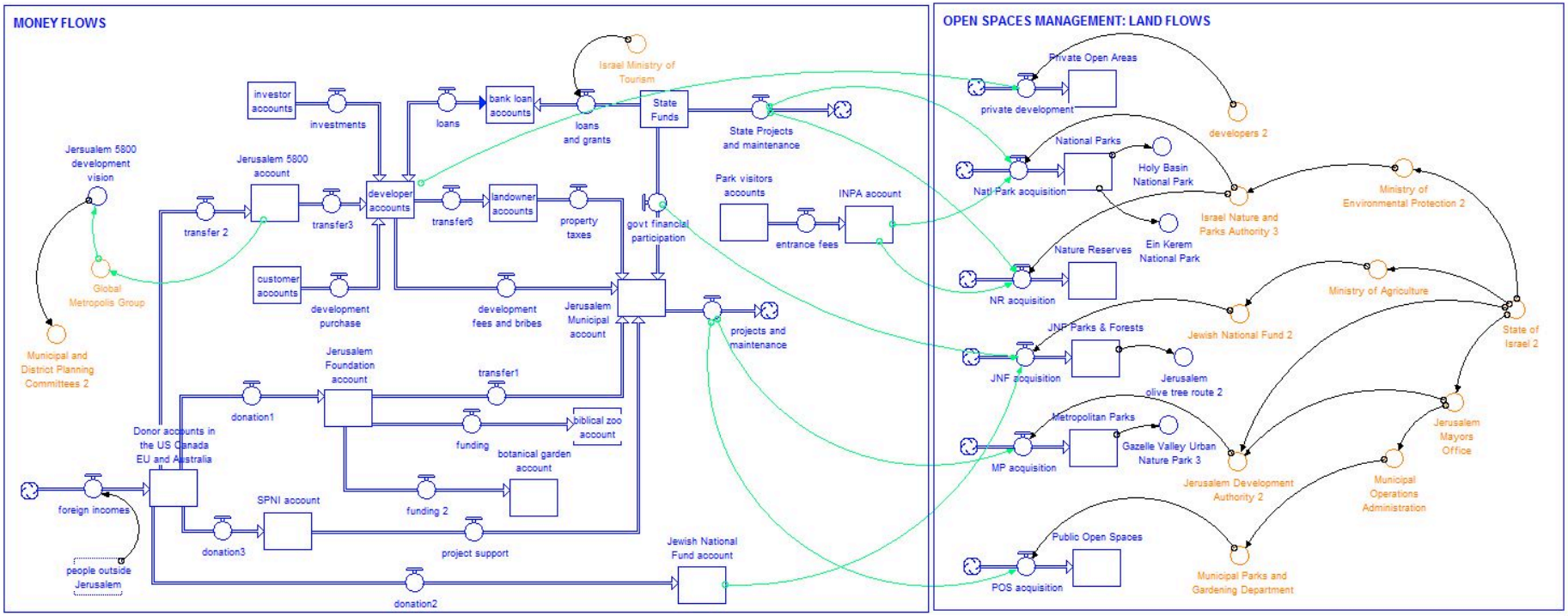
The first sub-model (below) illustrates the concept of biodiversity loss, including its three main factors, landscape diversity, species diversity, and genetic diversity. It then connects these elements to their drivers in the Jerusalem context. The two primary factors that determine biodiversity loss in Jerusalem are habitat suitability and availability, and invasive species. Car collision and particular predators (e.g. roaming domestic species) also increase biodiversity loss. The model illustrates the impact of development on many factors, as well as the capacity of planning and preservation to limit the damages of development.



The second model (below) expands the keystone species section of the biodiversity model to show in more detail how various species are dependent on certain habitat or ecosystem types. Again, the impact of development is clear, though depending on the favored habitat of the species, can create or destroy habitat area. For example, development can lead to additional wet habitats for amphibians or nesting sites for particular types of birds. But in general, built-up areas are less suitable as habitats for most species investigated here.



The third sub-model (next page) shows the ownership of open spaces in Jerusalem on the right-hand side, with the related money flows on the left. Here we see not only the role of developers as purchasers of land, but also how they fit into the larger system of monetary flows. Significantly, their activities not only directly contribute to municipal income through fees and bribes, but indirectly by raising property taxes. Contrastingly, the acquisition and management of open spaces by the city reduces the stock of money available to the municipality. The model also shows the influence of people outside of Jerusalem who constitute major stocks of donation money. For example, the Jerusalem Foundation contributes 16% of the municipal budget by channeling donations from abroad.

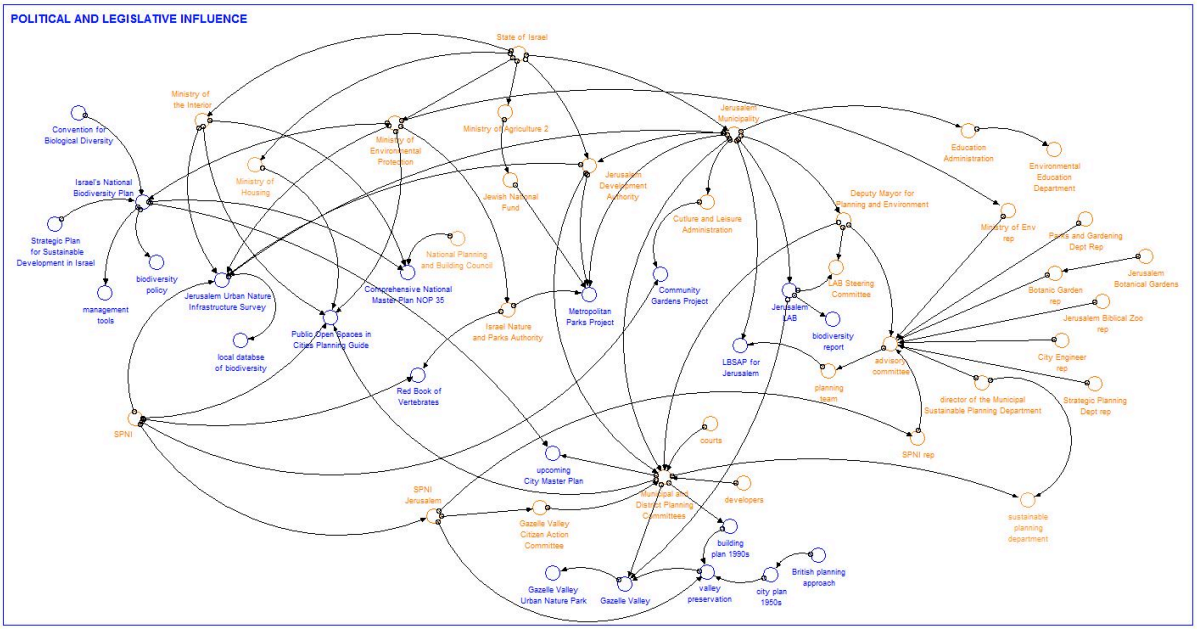

MONEY FLOWS
Israel Ministry of Tourism
investor accounts
investments
loans
bank loan accounts
loans and grants
State Funds
State Projects and maintenance
Jersualem 5800 development vision
Jerusalem 5800 account
developer accounts
transfer 2
transfer3
transfer6
landowner accounts
property taxes
govt financial participation
Park visitors accounts
INPA account
entrance fees
Global Metropolis Group
customer accounts
development purchase
development fees and bribes
Jerusalem Municipal account
projects and maintenance
Municipal and District Planning Committees 2
Jerusalem Foundation account
transfer1
donation1
biblical zoo account
funding
botanical garden account
Donor accounts in the US Canada EU and Australia
foreign incomes
SPNI account
funding 2
donation3
project support
Jewish National Fund account
people outside Jerusalem
donation2
OPEN SPACES MANAGEMENT: LAND FLOWS
Private Open Areas
private development
developers 2
National Parks
Holy Basin National Park
Natl Park acquisition
Israel Nature and Parks Authority 3
Ministry of Environmental Protection 2
Ein Kerem National Park
Nature Reserves
NR acquisition
Ministry of Agriculture
JNF Parks & Forests
Jewish National Fund 2
State of Israel 2
JNF acquisition
Jerusalem olive tree route 2
Metropolitan Parks
Jerusalem Mayors Office
Gazelle Valley Urban Nature Park 3
MP acquisition
Jerusalem Development Authority 2
Municipal Operations Administration
Public Open Spaces
POS acquisition
Municipal Parks and Gardening Department

5.10.3

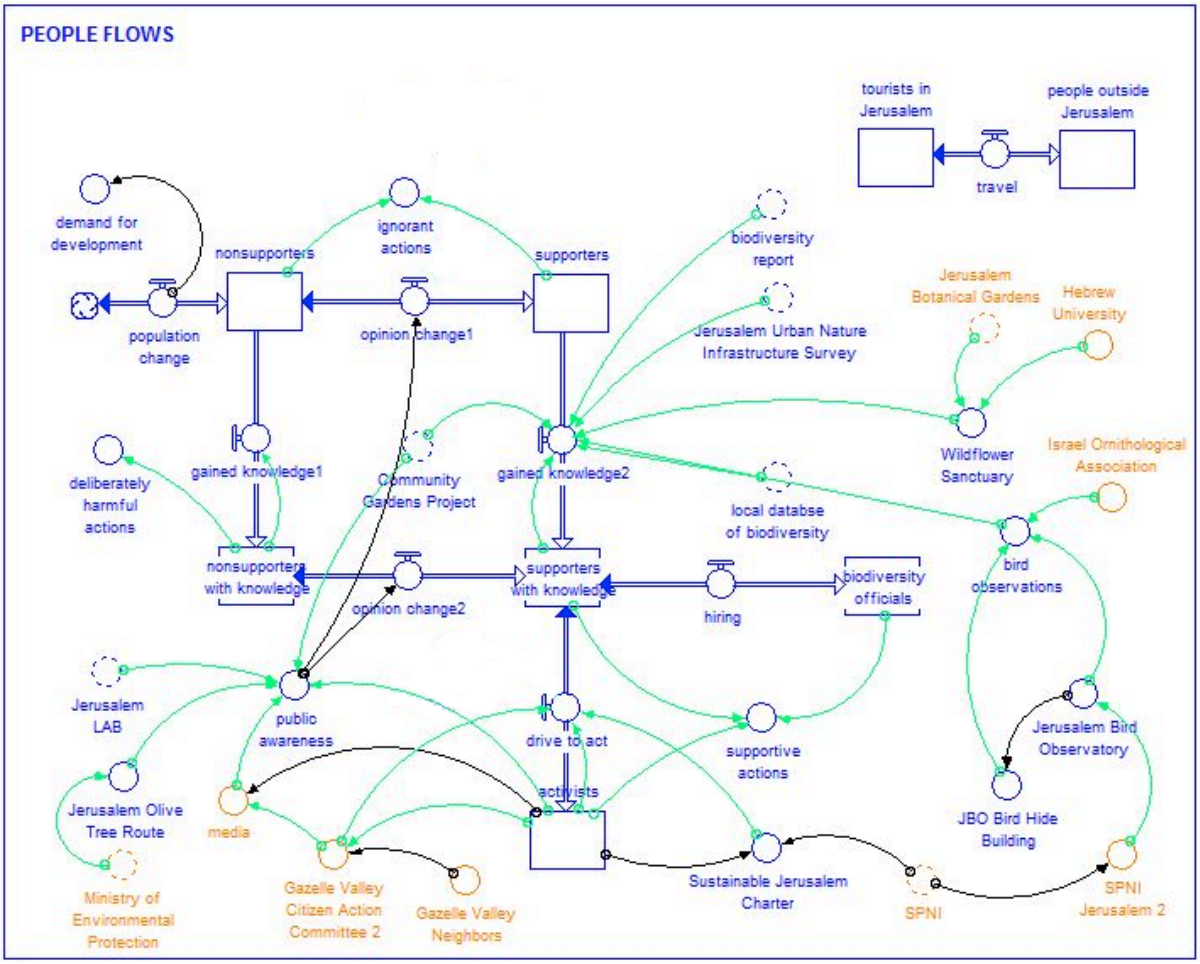
The fourth sub model (below) indicates political ties and projects undertaken to address biodiversity or sustainable planning. It shows the connection between the national government and the municipal government, and highlights the involvement of the NGO, Society for the Protection of Nature in Israel (SPNI). It includes particular detail on the advisory committee of the LBSAP biodiversity plan to show how many different representatives can be involved in one initiative.

Another detail called out in this model is the process involved in the designation of Gazelle Valley, Jerusalem's first Urban Nature Park site. In this case, one of the remnant valleys from the 1950s plan harbors a small herd of gazelles that neighboring people had come to enjoy. When a development plan threatened the viability of the valley as gazelle habitat, the neighbors partnered with SPNI Jerusalem and environmental advocates to form a citizen's action committee. After a long struggle, they managed to stop the development. The action resulted in the nomination of one of their leaders as a Deputy Mayor of Jerusalem, who then fulfilled their goal to establish an Urban Park for the gazelles.

If, as McCarty states, "modeling is essentially a quest for meaningful failure," then perhaps the incomprehensibility of this model of political and legislative relationships has a lesson to teach about the complexity of such interactions in the real world (2003, 1232). One of the main recommendations of the biodiversity planning team is to improve coordination among the various actors by creating another (yes, another) body with the goal of doing so.



The fifth model (below) shows the changes in opinions and knowledge of the public, as influenced by the various actions put forward by the actors in the previous sub model. It is clear that the majority of these actions convert supporters into supporters with knowledge. One notable exception is the gazelle valley issue, which converted the neighbors into activists and resulted in direct community actions for biodiversity, as well as increased media coverage that influences overall public opinion.



The actors indicated in the model are described in further detail below.

No.	Actor	Category	Role Description
1	Private land owners	Consumer	Own over 50% of Jerusalem's open spaces
2	Developers	Business	Decide upon development projects
3	Public	Consumer	Choose products for consumption
4	Permit reviewers	Staff member	Work for the City Planning department (within Building Permits and Supervision department)
5	City Planners	Bureaucracy	Make zoning decisions (within City Planning department)
6	Deputy Mayor – Construction and Permits	Legislator	Sets construction and permitting policies

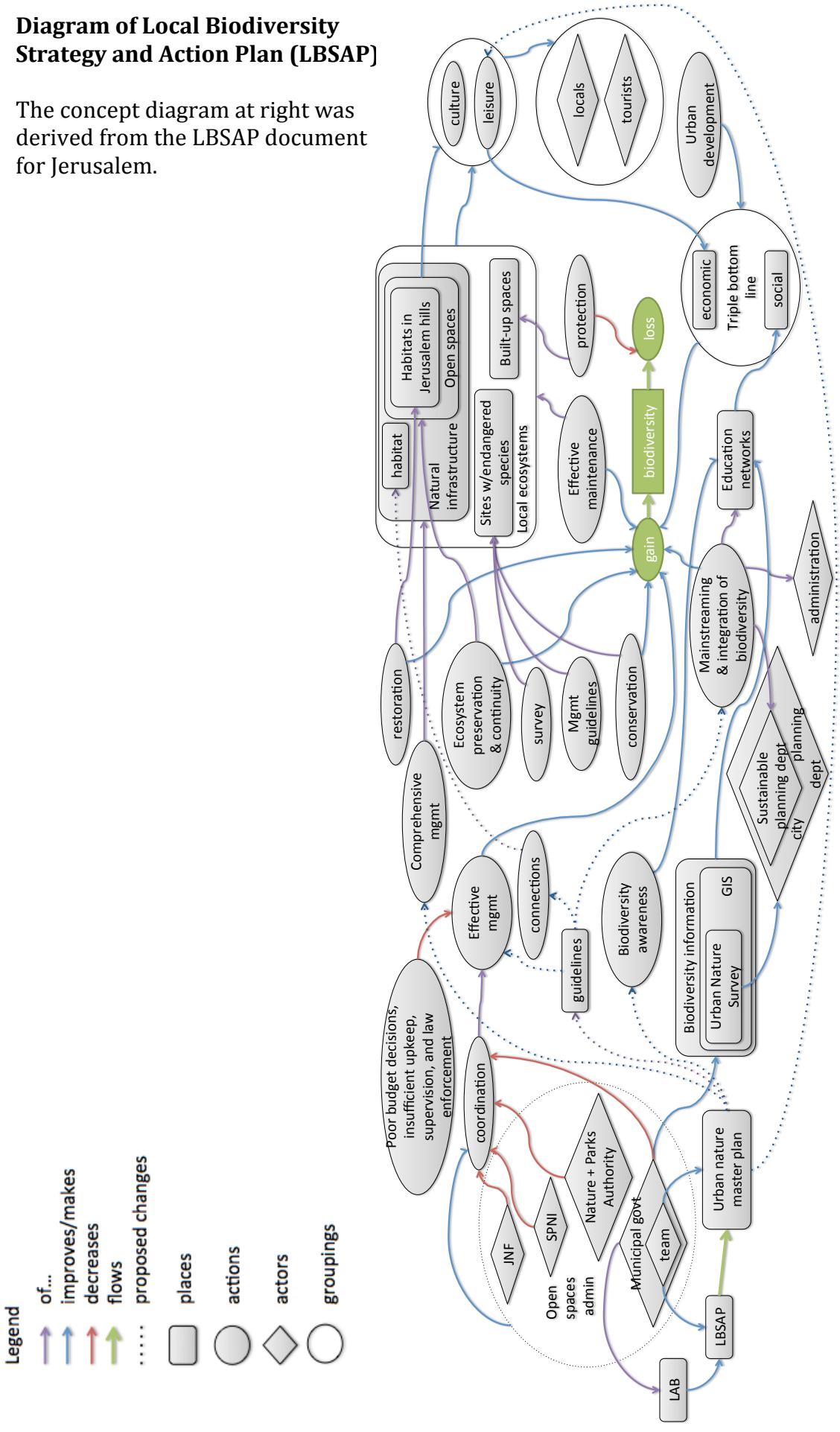
7	Deputy Mayor – Sustainable Planning and Conservation	Legislator	Sets sustainable planning goals and methods
8	Education Administration	Bureaucracy	Defines education goals
9	Traffic and Infrastructure Department	Bureaucracy	Sets transportation goals and projects
10	Culture and Leisure Administration	Bureaucracy	Sets leisure and culture goals and projects
11	Maintenance Administration	Bureaucracy	Manages and maintains public spaces
12	Environment Department	Bureaucracy	Sets environmental goals and projects
13	Sustainable Planning and Development department	Bureaucracy	Sets sustainability goals and projects
14	Public Relations	Bureaucracy	Measures public opinion and issues statements
15	Society for the Protection of Nature in Israel (SPNI) Jerusalem	NGO	Promote environmental activities in Jerusalem, particularly community involvement. Works with the LAB team.
16	Global partners	NGO	Environmental networks that help set goals and share best practices. Includes: ICLEI, IUCN, LAB, WHO, GPN, URBIS, UNESCO
17	Advisory Committee	Committee	17 national ministers, academics, municipal employees, NGO employees, who provide input and data for the biodiversity report
18	Expert Contributors	Committee	17 academics, municipal employees, NGO employees, who provide input for the biodiversity report
19	Jerusalem LAB Stakeholder Forum	Committee	Input and policy recommendations for biodiversity protection. Representatives from municipal departments, government ministries, park authorities, academics, NGOs and CBOs. Has about 25 participants. Headed by Deputy Mayor for Planning and the Environment.
20	Jerusalem Bioregion Center for Ecosystem	Bureaucracy	Upcoming organization to manage data, conduct public outreach, develop programs, and build partnerships

	Management		
21	Naomi Tsur	Activist/lobbyist	Ex-Deputy Mayor of Jerusalem, current Green Pilgrimage Network Ambassador, maintains influence with the local biodiversity discourse
22	ICLEI's Cities Biodiversity Center	NGO	Creates rules for the LAB program, hosts biodiversity conferences
23	Religious leaders	Public leader	Influence public opinion
24	Environmental Protection Committee	Committee	Municipal committee, open to the public
25	Urban Planning Committee	Committee	Municipal committee, open to the public
26	Historic Preservation Committee	Committee	Municipal committee, open to the public
27	Gazelle Valley Neighborhood Group	Activists	Public stakeholders who saved Gazelle Valley from development
28	Israel Nature and Parks Authority (INPA)	Bureaucracy	National agency under the Ministry of Environment. Biodiversity education and parks
29	Jewish National Fund (JNF)	Bureaucracy	National forestry organization under the Ministry of Agriculture. Provides funding and manages forested land in the city periphery. Mainly manages for recreation, education, and natural resource conservation.
30	Jerusalem Foundation	NGO	Sponsors community spaces and promotes cohabitation. Sponsor of the Botanical Gardens and the Biblical Zoo.
31	Forum for Community Supported Urban Green Spaces (ITEK)	Committee	Urban nature awareness
32	Jerusalem Development Authority (JDA)	Legislation	Statutory authority between the state and the municipality. Accelerates development in the city, including a plan for ecological corridors under the Jerusalem Metropolitan Parks Project.
33	Municipal Parks and Gardening Department	Management	Responsible for all developed and officially designated public open spaces in Jerusalem. Advocates endangered species protection and can relocate plants from construction sites. Assists public

			gardening advocates.
34	Jerusalem Botanical Gardens	Provider	Education, research, seed bank, open management of native species gardens. Focus on plants native to Israel.
35	Jerusalem Biblical Zoo	Provider	Native and biblical species conservation and education, including breeding and release programs.
36	Jerusalem Municipal Veterinary Service	Legislation and Provider	Supervises all animal products, handles zoological disease and pests, manages pet-related issues, including spaying.
37	Voting public	Voter	Vote for officials, influence public agenda
38	Ministry of Agriculture	Bureaucracy	Guidance and enforcement on plant aspects of the Aichi Biodiversity Targets

Diagram of Local Biodiversity Strategy and Action Plan (LBSAP)

The concept diagram at right was derived from the LBSAP document for Jerusalem.



Example Urban Nature Survey Card for Bible Hill

Provided by SPNI.

SAMPLE SITE CARD

Site No. 50

Jerusalem Urban Nature Survey – Site Catalog

Bible Hill

Site Classification: Botanical Site

Coordinates: 221438 / 630606

Location: Near the Cinematheque, the Begin Heritage Center, and the Mishkenot Sha'ananim Garden

Streets: Derekh Hevron, David Remez St.

Size: 17 dunams

Borders: The site is bordered on all sides by roads.

Accessibility: The site is accessible by foot, by car, and by public transportation. There is parking at the site.

Site Character: A spectacular botanical site in the heart of the city. The last uncultivated exposed hillock in the center of town. Covered in remnants of semi-steppes scrubland. The site is small in size, but impressive in terms of the large variety of wildlife and flora.

Connection to Other Sites: Bible Hill is not adjoined to other urban nature sites.

Capability to Receive Visitors: Walking Paths

Nuisances and hazards: Invasive Flora

Flora (A complete list of flora appears at the end of the card)

General Description:

Sparse scrubland on rocky ground and exposed rock. The hill has impressive concentrations of geophytes in the fall, winter and spring, which make it one of the most unique blossom sites in the city.

Plant Systems and Location:

Concentrations of flowering are dispersed throughout the site.

Site No. 50

Jerusalem Urban Nature Survey – Site Catalog

Bible Hill

Site Classification: Botanical Site

Land Use Acc. to Jerusalem Outline Plan 2000.
Park / Public Garden, Buildings and Public Institutions

Noteworthy Species: Sea Onion/squill (urginea maritima), Crocus (Colchicum Stevenii), Crocus hyemalis, Autumn Squill (scilla autumnalis), Goldy-Locks (Chiliadenus iphionoides), Crown Anemone (Anemone coronaria), and Ranunculus millefolius

Rare Species: There is a concentration of rare and endangered plant species, including: peucedanum junceum, mullein (Verbascum sinaiticum), Prickly Poppy (Papaver argemone), and Astralagus Asterias

Wildlife (A complete list of wildlife appears at the end of the card)

General Description:

Although the site is small and within the center of the city, since it is located on a watershed line, it attracts many types of birds.

Noteworthy Species: Wood lark (Lullula arborea), Black-eared wheatear (Oenanthe hispanica), Desert Wheatear (Oenanthe deserti), Black Redstart (Phoenicurus ochruros), linnet (Carduelis cannabina)

Rare Species:

Additional Resources:

Surveyed By: Ido Wachtel, Avner Rinot (28.01.09), Avishai Shoresh (03.04.09), Oriya Oren (16.04.09).

Site Card Updated: 11.10.09

Jerusalem Urban Nature Survey – Site Catalog

Site No. 50

Bible Hill

Site Classification: Botanical Site

Panorama, view from the North

Zygaena graslini on spring groundsel, 05.01.05

Anemones, church in background, 03.03.05

Blanket of common chamomile 05.01.05

Hornet on sea onion 23.09.04

Jerusalem Urban Nature Survey – Site Catalog

Site No.
50

Bible Hill

Site Classification: Botanical Site

General Findings	Description
1. Flowering cover	Concentration of spectacular blooming of geophytes in fall, winter, and spring on the whole site.
2.Batha (shrubland)	Sparse Mediterranean shrublands
3. Bird Watching	Excellent observation point for bird watching. Open area along watershed line. The site is unique in its high number of species relative to its very urban location. Good for viewing migrating birds.
4. Rare Flora	There are at least eight different rare plant species on the site

Jerusalem Urban Nature Survey – Site Catalog

Site No. 50

Bible Hill

Site Classification: Botanical Site

Catalogue of Wildlife at Site

	Name	At risk (Red Book)	Assessment of species in Jerusalem
	MAMALS		
1	Erinaceus Concolor (Eastern Hedgehog)	Not at Risk	Common
	BIRDS		
1	Erithacus rubecula (robin)	Not at Risk	very common wintering passage migrant
2	Pychnonotus xanthopygos (Spectacled Bulbul)	Not at Risk	common sedentary
3	Falco tinnunculus (Kestrel)	Not at Risk	sedentary, common breeding
4	Saxicola rubetra (Whinchat)		very common passage migrant
5	Saxicola torquata (Common Stonechat)		common wintering
6	Upupa epop (Hoopoe)	low risk	sedentary, common breeding
7	Passer domesticus (House Sparrow)	Not at Risk	sedentary, very common breeding
8	Sturnus vulgaris (Starling)	no information	very common wintering
9	Alectoris chukar (chukar)	low risk	sedentary very coming breeding
10	Lullula arborea (wood lark)	low risk	rare wintering
11	Muscicapa striata (spotted flycatcher)	Not at Risk	common passage migrant, rare breeding
12	Phoenicurus ochrurus (black redstart)	Not at Risk	common passage migrant wintering
13	Phoenicurus phoenicurus (Common Redstart)	no information	common passage migrant
14	Lanius collurio (Red-backed Shrike)	low risk	common passage migrant
15	Lanius senator (Woodchat Shrike)	low risk	common passage migrant, rare breeding
16	Lanius nubicus (Masked shrike)	low risk	common passage migrant, rare breeding
17	Columba Livia domestica (Feral Pigeon)	Not at Risk	extremely common
18	Parus major (Great Tit)	Not at Risk	sedentary common breeding
19	Chloris Carduelis (Greenfinch)	Not at Risk	sedentary common breeding
20	Luscinia svecica (blue throat)	no information	common passage migrant, rare wintering
21	Burhinus oedicnemus (stone curlew)	low risk	sedentary very rare breeding
22	Motacilla alba (white wagtail)	low risk	common passage migrant wintering
23	Sylvia hortensis	no information	common passage migrant

Site No.
50

Jerusalem Urban Nature Survey – Site Catalog

Bible Hill

Site Classification: Botanical Site

Catalogue of Wildlife at Site

	Name	At Risk (Red Book)	Assessment of Species in Jerusalem
24	Sylvia curruca (Lesser Whitethroat)	Not at Risk	common passage migrant, rare breeding
25	Sylvia atricapilla (Blackcap)	no information	very common passage migrant and wintering
26	Sylvia melanocephala (Sardinian Warbler)	Not at Risk	sedentary, common breeding
27	Apus Apus (common swift)	Not at Risk	common breeding
28	Oenanthe oenanthe (Northern Wheatear)	low risk	very common passage migrant
29	Oenanthe deserti (Desert Wheatear)		rare passage migrant
30	Oenanthe isabellina (Isabelline Wheatear)	Not at Risk	very common passage migrant
31	Oenanthe hispanica (Black-eared Wheatear)	Not at Risk	common passage migrant, rare breeding
32	Corvus corone (hooded crow)	Not at Risk	sedentary very coming breeding
33	Garrulus (Jay)	Not at Risk	sedentary coming breeding
34	Phylloscopus trochilus (Willow Warbler)	no information	common passage migrant
35	Phylloscopus collybita (Chiffchaff)	no information	common winter passage migrant
36	Galerida cristata (Crested Lark)	low risk	sedentary very rare breeding
37	Anthus pratensis (Meadow pipit)	no information	common wintering
38	Fringilla coelebs (Chaffinch)		common wintering
39	Prinia gracilis (graceful Prinia/warbler)	Not at Risk	sedentary, common breeding
40	Nectarinia osea (Palestine Sunbird)	Not at Risk	sedentary, common breeding
41	Streptopelia senegalensis (palm dove)	Not at Risk	sedentary, very common breeding
42	Clamator glandariu (Great Spotted Cuckoo)	Not at Risk	very rare breeding
43	Turdus philomelos (song thrush)	no information	wintering common passage migrant
44	Turdus merula (Blackbird)	Not at Risk	sedentary, common breeding
45	Hippolais pallida (Olivaceous Warbler)	Not at Risk	common passage migrant
46	Carduelis cannabina (Common Linnet)	low risk	common wintering, rare breeding
	REPTILES		
1	Ablepharus rueppellii (Rüppell's Snake-eyed Skink)	Future risk	
2	Laudakia stellio (star lizard)	Not at Risk	
3	Lacerta laevis (Lebanon lizard)	Not at Risk	

Site No.
50

Jerusalem Urban Nature Survey – Site Catalog

Bible Hill

Site Classification: Botanical Site

Catalogue of Vegetation at site

	Name	Status	Endemic	Rarity	Comments
1	Agave Sisalana				Planted
2	Arctotis			Rare	Rare as wild, planted
3	Pinus halepensis (Aleppo Pine)	Protected			Planted
4	Majorana syriaca (Wild Marjoram)	Protected			
5	Spartium junceum (Spanish Broom)	Protected			Planted (natural in North)
6	Peucedanum Junceum			Rare	On high mountains only
7	Ailanthus altissima (Tree of Heaven)				
8	Stachys palaestina		Endemic to Israel and China		
9	Rhamnus alaternus (Alaternus, Barren privet, Italian buckthorn)	Protected			In the past was rare in Judea, common in Northern groves
10	Verbascum sinaiticum			Rare	Common in Jerusalem
11	Verbascum fruticosum (Common Desert Mullein)		Endemic		
12	Galium murale			Rare	
13	Galium judaicum		Endemic to Israel and Syria		
14	Olea europaea (Olive tree)				Planted
15	Bellevalia flexuosa (Common Roman squill)		Endemic to Israel and Syria		
16	Cynosurus callitrichus			Rare	
17	Oxalis pes-caprae (Bermuda Buttercup)				Invasive
18	Urginea Maritima (Sea Onion, squill)	Protected			
19	Eryngium glomeratum		Endemic to Israel, China, and the Hermon Region		
20	Atractylis comosa (Beautiful Distaff-thistle)		Endemic to Israel and Southern Lebanon		
21	Lathyrus odoratus				Invasive

Jerusalem Urban Nature Survey – Site Catalog

Site No. 50

Bible Hill

Site Classification: Botanical Site

Catalogue of Vegetation at site

	Name	Status	Endemic	Rarity	Comments
22	Anemone coronaria (Crown Anemone)	Protected			
23	Arum palaestinum (Palestine Arum)		Endemic to Israel and Syria		
24	Salvia dominica (Dominican Sage)	Protected			
25	Aetheorhiza bulbosa			Rare	
26	Narcissus tazetta (Common Narcissus)	Protected			
27	Colchicum stevenii (Steven's Meadow-saffron)	Protected			
28	Echium judaeum (Judean Viper`s-Bugloss)		Endemic to Israel and Syria		
29	Papaver argemone			Rare	
30	Carpobrotus acinaciformis (Hottentot Fig-marigold)				Invasive
31	Astragalus asterias			Rare in Maritime Region	
32	Thymus pulegiodes (Tabor)				Planted
33	Cyclamen persicum (Persian Cyclamen)	Protected			
34	Chaetosciadium trichospermum		Endemic to Israel and Syria		
35	Amygdalus communis (Common Almond)	Protected			Planted, natural