An Ecosystem Services Approach To Guide Densification

Exploring the Relationship Between Green Structures and Densification

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Helena Sandberg

How can the ecosystem services approach provide a method to guide densification so that qualities in green structures are taken care of when densifying?

Abstract

Urban sprawl with its consequences is said to be the most important question to deal with in future planning, among others by the EU-commission. Today, densification is the main way to deal with this. At the same time there are many questions remaining about the effects of densification. The question of how to densify with quality is imperative, but how to do so is not clear.

This thesis explore the relationship between green structures and densification with the main question: *How can the ecosystem services approach provide a method to guide densification so that qualities in green structures are taken care of when densifying?*

It uses the ecosystem services concept as a way of viewing quality in green structure. The work is presented in three steps - designing a process for working with ecosystem services and densification, testing it and reflecting upon the result. The communities Bjärred and Borgeby in Lomma municipality work as a test site.

A process including research of ecosystem services, analysing of found material and developing of design solutions was formulated and tested. It worked well as a method to guide densification and was also found to have many possibilities to meet problems in today's green planning.

The main advantages found was that the concept open people's mind to how many things a green area can be, that it brings cross-professional work groups together and that it is pedagogically and rhetorically useful.

There were also challenges or negative experiences with the concept including lack of necessary information, time demanding tasks and hardship in illustrating the complexity. The negative aspects are thought to arise partly because it is a new concept and it will take some time to develop practices.

The thesis is concluded with a proposal of an improved process for working with ecosystem services within planning.

Contents

Reading Instructions

This thesis is divided into five sections – an introduction that presents the choice of subject, a background section that explains issues connected to the subject and puts it into context and three sections that present the project work divided between designing a method, testing the method and reflecting upon the method.

The *Introduction* can be found on pages 9-14 and contains information on choice of subject, focus and question formulation, delimitations, personal goals and process.

The *Background* section can be found on pages 15-52 and has five chapters that in different ways explain the context around the work. The first chapter present and discuss our relationship to nature and how it has effected green planning through the times (p. 16-24), the second gives and introduction to the ecosystem services approach (p. 25-29), the third discuss today's challenges for architects and planners and how densification is connected to them (p. 30-35) the fourth discuss densification as a new and old phenomena and what arguments there are against and for it (p. 36-43) and the fifth present the case study area Bjärred-Borgeby in Lomma municipality (p. 44-52).

The three project work sections are called *Designing*, *Testing* and *Discussion* and can be found on pages 53-132. *Designing* (p. 53-58) describes the work of designing a method to guide densification that led to a stepwise approach.

Testing (p. 59-114) describes the testing of the stepwise approach in the case study area and is divided between the three chapters Assessment, that deals with assessing what ecosystem services you have and their status, Guidelines with Idea Bank, that presents a way of formulating objectives for a design proposal based on the outcome of the assessment, and Design Proposal, that presents the design proposal for the case study area.

The *Discussion* section (p. 115-132) discusses the usefulness of the concept and the tried process, reflect upon the architect's role in such a process and if the way to work provides any answers to the challenges seen for today's green planning. It concludes by giving suggestions for an improved process.

Introduction

The introduction gives a background to the choice of subject for this thesis and includes information on the focus and question formulation, delimitations, personal goals and process.

All through my architectural education there has been talk about densification and many of the tasks have been connected to Gothenburg municipality's attempt to densify the city. Densification has been described as the answer to many of our time's issues such as rising energy demand, segregation and urban sprawl. The projects have mainly been carried out on a building level so for my master thesis I decided to expand my knowledge around densification on a planning-focused level.

When preparing for my thesis work I stumbled upon a suggestion from Lomma municipality to perform a thesis about densification. This provided a good opportunity to connect the work to a practical case.

Densification

From the industrial revolution onwards an increasing number of people have been moving to urban areas. Today over half of the earth's population and more than 70 % of Europeans live in cities[1]. At the same time there has been a trend of sparser city structures enabled by the social and economic development leading to the phenomenon of urban sprawl. Today urban sprawl with its consequences of destroyed biotopes, fewer green areas, loss of valuable farmland, car dependence, air pollution, social segregation etcetera is said to be the most important question to deal with in future planning, among others by the EU-commission[2]. Densification is the main way to deal with this.

At the same time there are many questions remaining about the effects of densification. One much discussed area is the relationship between green structures and densification where two of the main fears are negative effects on plant- and animal life and reduction in the quality of life for city dwellers due to destruction of green areas. There are also discussions about how we as an increasingly urbanized species are losing our connection to and understanding of nature, an understanding very important for sustainable development. The question of how to densify with quality is imperative, but how to do so is not clear.

The Ecosystem Services Concept

The ecosystem services concept is a new and exciting way of researching quality in green structures. It is used to describe the connection between nature, economic activity and human well-being and can be described as the value to human societies as a result of the state and quality of natural capital. Examples include food and temperature regulation, but also recreational and spiritual values. The different ecosystem services contribute to human well-being by providing different services that we need for our existence and therefore it is essential to keep a resilient level of natural capital to help ensure human well-being.

This concept provides a way of looking at green structure that highlights the connection between us humans and our surroundings, which can be a useful angle in the search for methods for sustainable development. It is a rather new concept and few examples of implementation within the planning field exist.

Ecosystem Services and Densification

The ecosystem services concept seems to look at some of the qualities the critics argue the compact city concept lack. This raises questions such as: Can ecosystem services be a way of looking at qualities in cities that balance the densification discussion? Can they be a way to discuss and decide where to build and how to build when densification is considered so that it is done with quality? How could the approach be incorporated into planning and the challenge of sustainable development? These thoughts gave birth to the focus and theme of this thesis.

Focus and Question Formulation

This thesis explore the relationship between green structures and densification with the main question:

How can the ecosystem services approach provide a method to guide densification so that qualities in green structures are taken care of when densifying?

It tries to move away from the normal way of thinking about densification where the starting point is the built structure, to taking its point of departure in the green structure and its qualities. By doing so it will try to find a way of prioritizing in the strive for balance between built structure, green structure and infrastructure in a sustainable development of communities.

It uses the ecosystem services concept as a way of viewing quality in green structure and tests if it is a viable method to use to guide densification.

Delimitations

The work is connected to a deepened comprehensive plan for the communities Bjärred and Borgeby in the northern part of Lomma municipality and therefore deals with the same area as the coming plan. The thesis will be finished in time to serve as an input to the revision phase *(granskningsfas)*.

The main focus of the thesis is to design a process for working with ecosystem services and densification, test it and reflect upon the result. The communities Bjärred and Borgeby are the site for the case study, but the work is otherwise freestanding from the municipal work.

Projects involving ecosystem services are usually carried out in multi-professional groups and borders on many other subject fields than architecture and planning. It is one of the concept's advantages, but also meant that I have had to venture into unfamiliar areas the work. In those cases I have tried to find persons or literature that I could rely on for information. This has worked fairly well, but of course there are still part of the work that would benefit from a closer co-operation with other professionals. What professions that might be and what role the architect would have is raised as a question in the closing discussion.

Personal Goals

- To learn what issues that are important to discuss regarding densification at a planning level and research problems and possible solutions connected to them
- To learn more about the ecosystem services approach in connection to planning - are there methods viable to use in connection to planning and densification?
- To get practical experience in the above mentioned areas by relating the issues to the case of Bjärred and Borgeby in Lomma municipality

By doing this I expand my theoretical and practical knowledge in an area that I haven't treated so much in my earlier education.

The Process

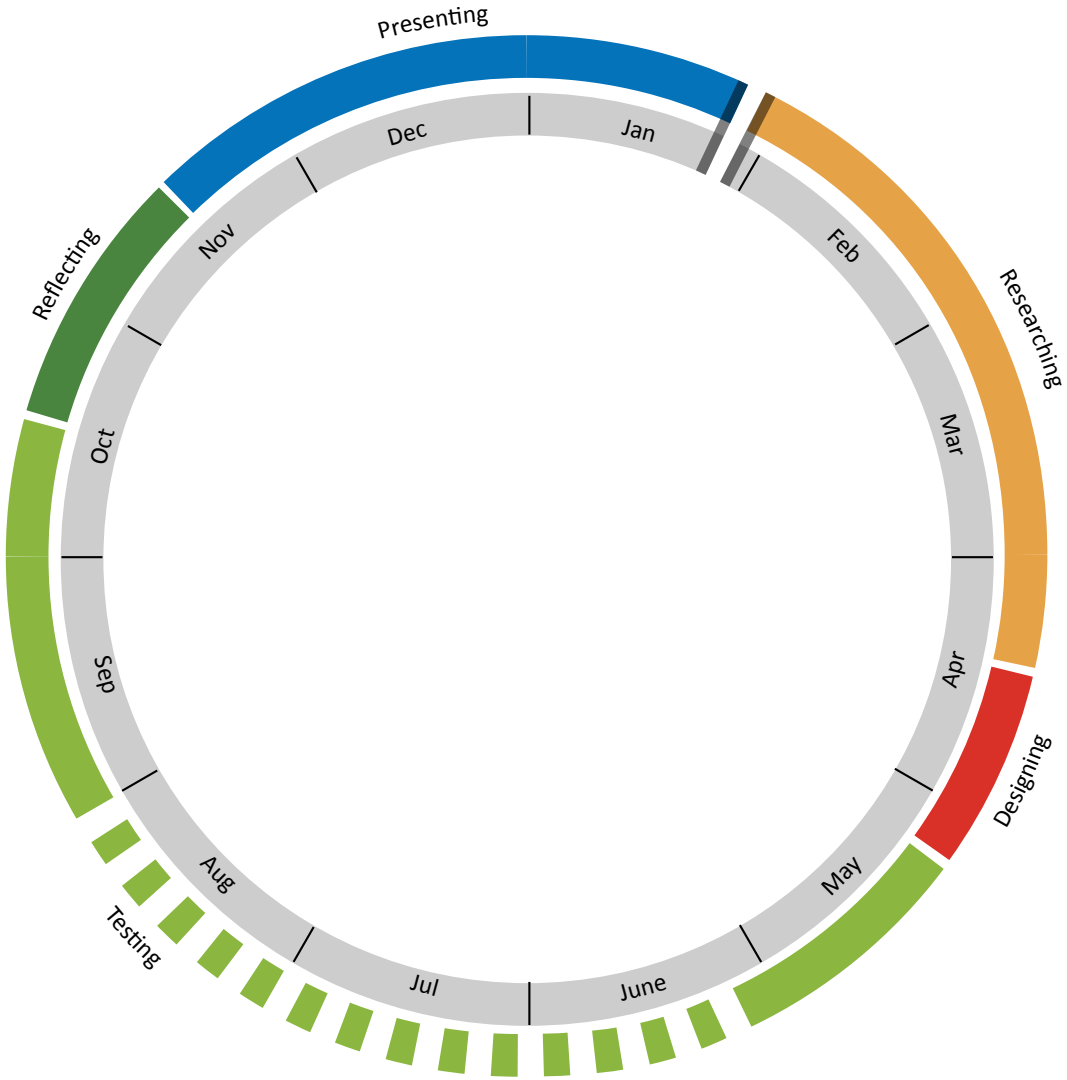
The process had is point of departure in the question *"Can Lomma and Bjärred be densified and how?"* formulated by Lomma municipality. The first part of the work was directed towards finding a perspective for the study. It did so by looking at the current discourse among planners and experts, at how planners, politicians and inhabitants in Lomma see densification and making a general analysis of the municipality and the two communities. It ended with a decision to focus on green structure and densification. The theme was chosen to be relevant for the case study area and connected to the general densification discussion. The ecosystem services concept emerged as an interesting way of viewing quality in green structure at a mid-term seminar and was chosen as the main angle.

The second part of the work was to design a possible process for the work. It included research of different ways of working with ecosystem services and how they could be used. A process including research of ecosystem services in the area, analysing of found material and developing of design solutions was formulated.

The third part tested the designed process. Depending on experiences during the work the different steps and methods were changed, but the main structure remained the same.

Lastly, part four was to reflect on the outcome of the

process and whether the method is a usable planning method or not. The discussion covered the concept, the process, the planner's role in the process, possibilities for green planning and suggestions on an improved process.



The process

Background

The following chapters present the background and starting points for the work. They present and discuss our relation to nature and how it has effected green planning through the times, give an introduction to the ecosystem concept, discuss today's challenges for architects and planners and how densification is connected to them, discuss densification as a new and old phenomena and present the case study area. Each chapter ends with a reflection.

Our Relationship to Nature

We humans have always been dependent on nature for our survival and nature has played a big role in our cultural development.[1] This dependency is based on the reliance on natural resources for our needs and forms the base of our economy. Everything from clothes and food to buildings are made out of processed natural resources.[2]

The relationship between man and nature, or built structure and green structure, has changed through the times. This has affected the way we see and value nature and thus also how we build and plan our society.

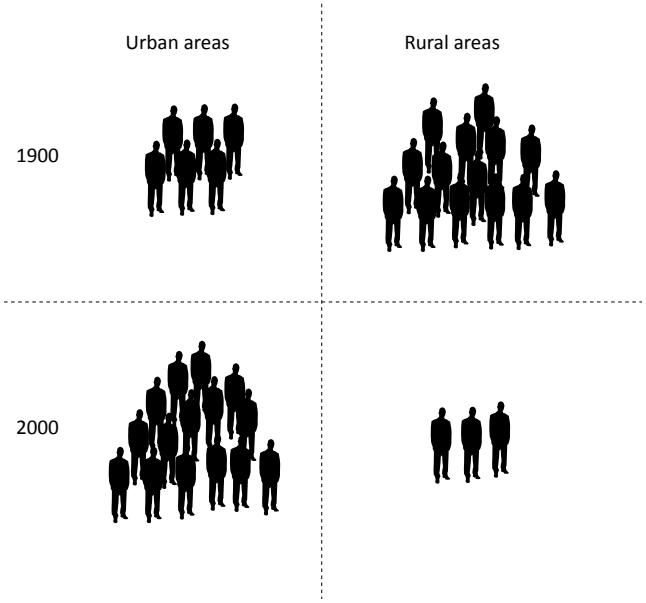
Up until the middle of the nineteenth-century cities in Sweden were closely connected to their surrounding countryside. Around the year 1800 Sweden was still a nation of farmers, as nine out of ten Swedes lived in the countryside[3]. The cities that existed were small and rural and not only a place for people, but for animals and crops.[4] Without the car and other fast communications the surrounding area that had a close connection to the city was limited[5]. The cities' garbage was sorted for reuse and the latrine was used as fertilizer in the agriculture. The inhabitants lived close to animals and crops. They had a natural relationship with nature and saw themselves as participants in the natural cycle.[6]

With the dawn of urbanization this connection to nature started to change. Eivor Bucht describes the shift in mind of the countryside dweller that moves to town like this:

"The urban dweller develops another attitude. To be in, consume, nature for its beauty and richness of experiences becomes the main connection. The urban dweller observes and analyzes nature. Since she doesn't live with and in nature her experience becomes based on short snapshots of nature, which she carries with her in the urban day-to-day life, separated from the countryside.[7]" [author's translation]

This change occured gradually and up until the 60ies the ties to the countryside still existed for many Swedes. In the 50-ies around 1,7 million Swedes lived in the countryside and almost every family knew someone who was a farmer. The big change that broke these bonds came in the sixties with changes in agricultural practice because of new machines, the use of commercial fertilizers and pesticides.[8] These technical advances turned the landscape into a production landscape[9]. In one generation 1,5 million Swedes left the countryside[10]. Today around 85 % of the Swedish population live in urban areas[11].

Following this change in people's settling patterns, the last decades has seen a change in the view of landscape from a production landscape to an experience based landscape with values for recreation, tourism, cultural heritage and biological diversity. This goes together



Percentage of population living in urban vs. rural areas in Sweden in the years 1900 and 2000. Many moved to the cities during this century and that changed our relationship to nature.

with us getting more and more spare time, during which we use the landscape for activities such as fishing, bird watching, canoeing and much more where we consume the experience based values.[12]

This separation of the city, the place where we live, and the countryside, the place for recreation, has led to a lack of understanding of our intrinsic connection to

nature and our dependence on the natural resources. Today our ties to nature are invisible to many children born, raised and living in our cities.[13]As said in the report *Grönstrukturens synliggörande* from Chalmers Architecture*: "one can dread that the now rising generations are more adapted to the city and the artificial indoor-life[14]"* [author's translation]. This non-understanding is treacherous in the way that we don't know what effects it has. In the extreme perspective failing to understand our dependency and connection to nature can lead to faulty decisions that undermine our societies' existence.

Environmental Paradigms

These different relations and views on nature has affected the development of our society and the focus of the planning professions. To better understand the differences these diverse views on nature can be described as different 'environmental paradigms'. Næss has identified five different perspectives reaching from a human centered to a nature centered view on nature that lead to different views on societal development. They are: *frontier economics, environmental protection, resource management, eco-development* and *deep ecology* (see illustration to the right).[15]

When the industrial society developed, *frontier economics* was a given condition. Not until the first environmental problems could be seen did voices for environmental protection arise. Those first problems occurred locally,

Perspective	View on nature	View on societal development
Frontier economics	Nature's value is directly linked to man's ability to use the resources, which are seen to be unlimited.	Require economic growth and increased resource use. The industrial society's continued development with expanding conurbations is desirable and unproblematic.
Environmental protection	Resembles frontier economics, but has a greater interest in people's health and well-being. Negative effects of man's resource use should if possible be limited.	Resembles frontier economics, but acknowlages the need for certain governance to balance development- and protection interests. The cities environmental problems can be solved with technical development.
Resource management	Acknowledge resource- and pollution crises as limiting for human activity. The 'sustainable development' concept of the Brundtland commission adheres to this perspective, which also entails protection of endangered species.	A relatively technocratic perspective. Continued economic growth is presupposed, but within by nature given frames. Urban development shall be governed with demand on energy- and resource management, recycling thinking, technological development and restrictions on development.
Eco-development	Nature has an intrinsic value, beside the value for man. The conservation interest is not only for endangered species but for entire ecosystems.	The recycling thinking and resource demands resemble resource management, but are not as technology minded. All development is to occur within by nature given frames. Comprehensive view and integrated solutions, that also encompasses social system, is sought after. The cities ecosystems shall be enhanced. To nature adapted technological development is presupposed to satisfy ecological and social goals.
Deep ecology	Man is part of nature. Human development can by principle not be made on the expense of other living species.	Economic and material growth in our part of the world is mainly evil. Great skepticism to large cities and complex technical systems. All human activity shall be suited to natural cycles and ecosystems. Liquidation and dismantling of the large scale technical systems is preferable.

Image 1. Different environmental perspectives, their view on nature and the resulting influences on development.

were visible for everyone and included for example emissions in water and air and garbage piles. Throughout the 19-hundreds Swedish law and legislation was successfully adapted to the *environmental protection* perspective. The last decades the knowledge about the second generation of environmental problems, which has regional or global effects, has been the focus. Those include for example dispersion and enrichment of environmentally dangerous substances in air, land and water. It has led to an adaption of the environmental- and building legislation's preambles (*portalparagrafer*) to incorporate the *resource management*-perspective. Much of the environmental assessments and control is directed towards the *environmental protection* perspective. At the same time, many ideas and projects within planning and architecture today are focused on the *resource management* and/or *eco-development* perspective.[16]

Green Planning Through the Times

Planning of land use has gradually become more and more comprehensive. Planning of the built structure and infrastructure came first, followed by green planning.

Long before that the first settlements were developed. For a long period of time there were no "plans" for how to develop them. Instead they were developed by adapting to the local context in terms of grouping and location of buildings, materials and building technology. Depending on the land ownership, natural surroundings, economical power etcetera in the area different types of local building and "planning" traditions developed.

Eventually, the larger settlements developed local building codes to solve sanitary, technical and spatial problems. These codes did not apply to the countryside. With the breakthrough of industrialism in the end of the 19th century, cities in Sweden started to grow fast. Many people moved to the cities and new industries were developed in a fast rate. Soon, the competition for land in the cities was evident. Industry and private land owners battled for property at the same time as the working class lived under poor conditions. A need for planning arised and the 1874 building code was a first step towards a unified and centralized building and planning law in Sweden. In 1907 a new city planning law enabled a more detailed regulation of land use for different functions and also design of buildings.

During the early 1900-hundreds the city planners interest in greenery was mostly connected to the local topography and character. The "green lungs", views, open spaces and natural profiles were important for the spatial design of the city.

Lack of land suitable for development in attractive locations forced a knowledge development within geotechnics during the first half of the 20th century. By the 50ies and 60ies this technology was able to change nature according to the needs of settlement development. It was used to a large extent during the same decades when a rapid expansion in many regions demanded fast development. The 60ies was also a time when a great deal of people moved from the countryside to the cities and many small municipalities merged into bigger ones.[17] This era can be described as belonging to the environmental paradigm *frontier economics*.

The big changes in people's settlement patterns during the 60ies called for increased planning and "physical site planning" was born. According to a description from the 70ies its role was to coordinate the municipalities' planning in order to balance the public interest in intact nature for recreation, leisure and tourism against demands on new, often environmentally degrading, industries.[18] The focus was therefore to map nature as a resource for different land uses. With this, focus changed and *environmental protection* became the overarching environmental paradigm.

The 70ies saw the building of many housing units. Affected by the 'green wave' of the 70ies villa areas with a large degree of green areas were common.[19]

Eventually the big boom of expansion slowed down and changed the reality for planners. The focus in the

Image 2. An example of a city plan from the early 1900-hundreds.

80ies was to use knowledge of the land's structure and characteristics to better use this resource without destroying for coming generations.[20] This was also manifested in the 1987 release of the Brundtlandt report, which defined sustainable development as a *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs.[21]"* During the 80ies the focus shifted from *environmental protection* towards *resource management.*

In the beginning of the 90ies biological and ecological aspects started to gain ground in planning. One reason for that could be the concept of sustainable development that had then spread into the consciousness of planners. The 1992 UN Conference on Environment and Development in Rio saw the signing of the Convention on Biological Diversity, which further spawned the interest and focus.[22]

The concept 'green structure' was introduced in the 90ies and helped to raise the status of green structure and balance it against built structure and infrastructure. The concept also implied the need to look at city greenery as a structure and joint resource and not as single objects.[23]

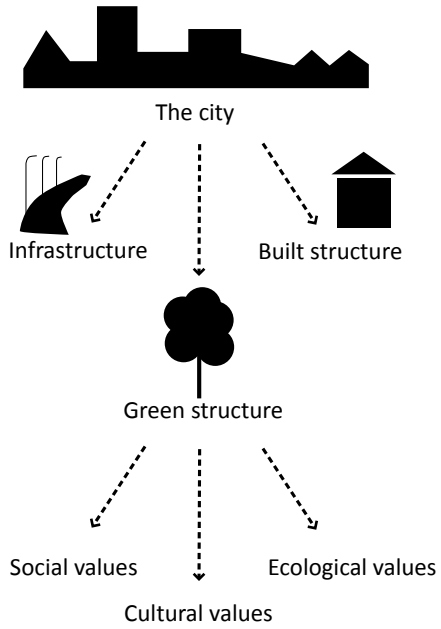
This led to the adding of the phrase "a suitable structure of green areas" to the the Planning and Building Law (PBL) in 1996 with the motive to protect the unbuilt land, foremost to secure access to nature- and park areas for inhabitants of settlements. Green structure was described as a self-written counterpart to built structure and infrastructure. When the Environmental Code (MB) was launched in 1998 it also pressed the importance of green areas, especially near and in settlements.[24] Before the 90ies green structure had never had a strong position within physical planning. This now changed , at least at the master plan level.[25]

The definition of the concept framed in the 90ies was that green structure was all land and water areas that are undeveloped or covered with impervious surfaces[26]. A publication from the Uppsala county administrative board in 2000 describes it like this:
In cities:

- Resort regions, areas for country walks
- Sport grounds, golf courses
- Parks, railway parks, neighbourhood parks, other parks
- Parkways
- Villa gardens, courtyards in multi-family residential areas, castles- and mansions and
- Cemeteries

On the countryside or city surroundings:

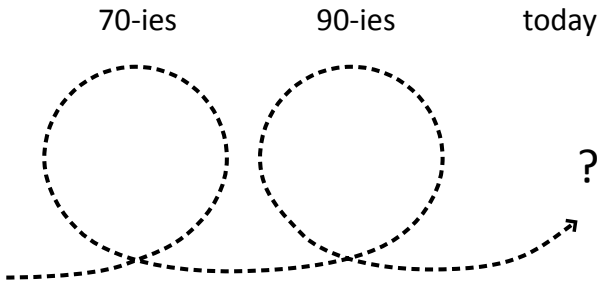
- Woodlands, other natural areas,
- Farmland, pasture, meadows,
- Resort regions, areas for country walks
- Lakes, watercourses
- Coastal areas, beaches, peat soil and
- Impediment around roads, buildings etcetera.[27]



A classical picture of the view of green structure from the 90ies. The city was seen as made up by built structure, infrastructure and green structure. Green structure had ecological, cultural and social values.

The main focus was greenery within city limits. The functions and value of green structure was described within the three groups ecological-, cultural- and social aspects.[28]

Seen in a time perspective the interest in green aspects have had cyclic peaks – one in the 70ies during the "green wave" and one in the 90ies. Since the 90ies much of the way green planning is done and structured has continued on the same track. Today we might be experiencing the beginning of another peak with an increased interest in sustainable development and the will to incorporate knowledge from different disciplines in planning. A tendency can be noticed that at least partly reaches an ecocentric view where nature has a value in its own[29], one characteristic of the environmental paradigm *eco-development.*



The interest in green aspects have had cyclic peaks – one in the 70ies during the "green wave" and one in the 90ies. Today we might be experiencing the beginning of another peak.

Green Planning Today

Municipalities have the responsibility to establish two levels of planning today – one comprehensive level and one detailed. Green planning is usually connected to the more comprehensive level, either as part of a comprehensive plan for the entire municipality or as part of an elaborative addition to the comprehensive plan.[30] As shall be explained a bit more below, the content, scale and use of green plans can vary extensively between different municipalities. There are research indicating that a majority of Swedish municipalities doesn't yet have green plans as well as that some municipalities see green issues as being dealt with only at the detailed planning level, a very localized level.[31]

The purpose of planning in Sweden is in essence defined in the PBL and MB laws. PBL, chapter 2 § 3 states that *"Planning in accordance with this law shall, taking into account the natural and cultural values, environmental- and climate issues as well as inter-municipal and regional conditions, promote 1. an appropriate structure and an aesthetically pleasing design of buildings, green areas and communication routes 2. from a social point of view a good habitat that is accessible and useful to all social groups 3. promote sustainable management of land, water, energy and raw materials as well as environmental conditions in general, and 4. a strong economic growth and effective competition[32]"* [author's translation]. Chapter 2 § 7 further elaborates that in areas with cohesive settlements special attention shall be given to among other things the need for parks and green areas.

The MB's main focus is *"to promote sustainable development so that present and future generations are ensured a healthy and sound environment. Such a development is based on the recognition that nature has*

a protective value, and that man's right to change and use nature is associated with a responsibility to manage the nature well[33]*"* [author's translation]. In connection to the use of land and water areas the third chapter states that *"Land and water areas shall be used for the purpose or purposes for which the areas are most suited depending the nature and location of the area as well as present needs. Preference shall be given to uses that result in a from the public interest's view good housekeeping*[34]*"* [author's translation] Areas that from a general point of view are of important public interest because of their natural, cultural or outdoor life values shall as far as possible be protected against measures that could significantly damage the environment. The need for green spaces in urban and near urban areas is of particular concern.

In 2004 Elisabeth Lundgren Alm together with four colleagues at Chalmers Architecture released a report namned *Grönstrukturens synliggörande* that among other things researched how contemporary green planning work. Municipalities in the Västra Götaland and Halland regions in Sweden were asked to send in their green planning documents. From the collected documents they then researched purpose, limitations and work forms for green planning in the municipalities.

Many of the municipalities motivate their green plans with a need to show and explain greenery's role in the city and highlight its multi-functionality. One big purpose of this is often to give more weight to the green issues in comparison to other issues. When the different documents were compared with regard to what functions of green structure they talked about and what importance these were given an average weighting looked like this:

Function	Mentioned in plans
1. *Recreation*	*all*
2. *Biological diversity*	*almost all*
3. *City design*	*almost all*
4. *Cultural identity*	*almost all*
5. *Air and climate*	*2/3*
6. *Sustenance*	*½ usually mentioned but not explained further*
7. *Pedagogics*	*½ usually mentioned but not explained further*
8. *Biological municipal technology*	*½ usually mentioned but not explained further*
9. *Health*	*½ usually mentioned but not explained further*

The top two represent the two most common overall focuses of the plans – recreation and nature conservation. The plans are often limited to the areas owned and cared for by the municipality, what is called the 'formal green' as opposed to 'actual green'. Some also include open space. The scale used differs. Green plans focused on the settlements and the recreational issues is normally in a more detailed scale, whereas

Image 3. Recreation is a function mentioned in practically all green structure plans today, followed by biological diversity, city design and cultural diversity in almost all of them.

plans more directed towards nature conservation often involve larger areas and have smaller scales.

As mentioned before green planning is usually connected to the comprehensive level of municipal planning. The work is often initiated by the civil servants themselves, for example connected to a review of the comprehensive plan. In about half of the municipalities the work was carried out by a interdepartmental group, mostly headed by someone representing the "planning-side". The other two most represented departments are the technical side, often through a park-division, and the environmental side, for example by a municipal ecologist.[35]

Experienced Problems Connected to Today's Green Planning

The group behind *Grönstrukturens synliggörande* summarized their research of today's green planning by naming six main problems. They are presented below.

Built in conflicts with others parts of planning and the concept of 'green structure'

Depending on the situation or perspective chosen when discussing sustainable development conflicts between green planning and other aspects of planning can arise. There is for example an inherent conflict between conservation and development of green structure and densification and effective transport. Depending on if you research traffic or green structure the strive for sustainable development will focus on different, sometimes conflicting aspects.[36]

With the introduction of the concept 'green structure' during the 90ies the status of the green structure in relation to built structure and infrastructure grew. At the same time it presents a problem when the green aspects are treated as special, separated from other planning questions.[37] The critique is that the view of greenery and green structure is becoming more and more unbalanced and undistinguished since it is treated as an underlying infrastructure instead of an intricate part of the environment. One specific problem mentioned is that the generality of the concept 'green structure' has meant that often only general values and meanings of green structure are mentioned. This presents a problem in situations of development where arguments compared belong to different scale levels. This leads to a situation where green structure is always in the defensive and conservatory stand[38] and the inherent conflict between green issues and other areas are spurred further. This problem has also been noted by Region Skåne that writes *"the nature- and recreation areas are often treated as separate areas in the comprehensive plans that are or should be protected instead of assets that can be developed[39]"*[author's translation].

In all, the concept of 'green structure' has helped lift the aspects, but now it needs to be reconnected and integrated in the other planning.

Lack of Methods

One of the main problems today is the lack of methods to express, claim and integrate the qualities of green structure into planning- and design processes. It is connected to many of the aspects presented below, but mainly comes down to an inability to make visible and use different actors' knowledge about the green structure and to go from an argumentation of conservation to one of development.

There is a big need to develop different methods to make visible the qualities and knowledge about green areas[40].

The Value of Green Structure

Even if green structure is perceived of as more important today than some decades ago it is still treated much as a reserve for development and expansion of the city. Land for expansion is economically worth far more than forrest- or agricultural land and it has therefore been easy for cities to buy land and develop it.[41] Each of the development projects are often commendable and made to meet needs, but fail in an overall judgement of the collective consequenses of all the projects. This is hard to see in a single detailed plan and a more general picture is needed.[42] Also, the type of economic valuation used normally doesn't take into account other aspects of value such as social, recreational or spiritual[43].

The Extent of Green Structure

Many municipalities talk about the city's collective green structure in their plans, but normally they only look at the areas the municipality owns, the formal green structure[44]. Since there are many more green areas in cities such as gardens and yards one should talk about two types of green – the formal green structure and the actual green structure, which can be significantly larger than the formal.[45]

Scale

Different things are visible in different scales and one important part of green planning is to link the overall scale's structural principles to the detailed scale's closeness and precision. There is a need to identify relevant planning levels for green structure where different functions and reasonings can belong.

Unclear Definition of Biological Diversity

As mentioned before the ecological aspects gained importance in the 90ies. Many municipalities relate to a responsibility to keep the biological diversity, but it is often referred to as for the sake of natural experiences of the inhabitants. Few municipalities explain what they mean with biological diversity or what kind that is good. This can be a problem since what is good for protection of biodiversity might not be the same as for the inhabitants' experience of biodiversity.[46]

Challenges and Possibilities Connected to Green Planning

The research team behind *Grönstrukturens synliggörande* also sees three main challenges for green planning connected to the aspects above. In short they are;

1. The adaption to a sustainable development
   For city planning this is about transforming a political vision to a processes of planning, designing and management of the city landscape. This demands that social as well as physical and economical structures are changed and created to support sustainable decisions and actions. Green structure can through its link between the city inhabitant and nature play a big role here.

2. The disintegration of the cityscape
   The latest decades' development has led to a zoning and transport culture and a fragmentation of the city landscape. The city landscape is full of emptiness, in-between spaces and unexpected functions. As a large part of the landscape is greenery a large challenge for green planning is to find ways of letting the multi-functionality of green structure handle the in-between spaces.

3. The communicative challenges of the city planning
   From a point where politicians and planners had power to control the development we move towards a point where it's more about guiding and creating areas for co-operations with other parties. The city development process becomes a meeting between the global and local, the technical, environmental, institutional and other aspects. In such a meeting communication and learning are central issues. Since the green structure is close to and engages many it has a potential to identify and motivate local involvement in planning processes.[47]

As can be seen in the challenges green structure presents possibilities in supporting sustainable development. It is an important link between man and nature that engages people, it can link different parts of the city landscape to each other and support communication between people in planning and development processes. In summary it has the potential to question the divide between man and nature.

A big part is the need to find ways of recognizing the value of nature, not as an opposite but as connected to us. As said by the Swedish Association of Architects *"The roles and the interaction between the city and the surrounding landscape must be made visible. A long-term sustainable society demands respect for the agricultural- and forest industries and nature's cycles of water, energy and materials.*[48]*"*

Lastly the research team behind *Grönstrukturens synliggörande* discusses how green knowledge and quality can be made visible and used in planning in five points. They are;

1. To open up for new levels of planning
   Today there are two central levels of planning in Sweden, the state level and the municipal level. The research team can see limitations in this, both upwards and downwards from the municipality in the hierarchy. Planning organs for the regional and truly local level could complement the existing picture.

2. To take an holistic approach to green structure and see behind property boundaries
   The research project showed that normally only 50 % of the greenery is formal greenery and accounted for in the green plan. If the green plan is to work as a guide for the greenery in general it needs to incorporate aspects of the actual greenery connected to different city development strategies.

3. To not get caught up in a conservation oriented sectorial interest, but connect different city development questions to each other in a multi-sectorial planning
   Instead of continuing today's separation of green issues from other planning issues one should work to incorporate green planning issues into other planning questions.

4. To embrace experience-based knowledge from different actors
   This is about seeing scientifically founded knowledge as one knowledge among others and also value for example experience- and situation generated knowledge. This is the type of knowledge created in communication between different knowledge and actors. It should be given time and place to develop and integrate into the planning process.

5. To see also the cultural factors that influence people's use of the green structure
   In short this is about people behavior. Factors such as social context, culture, tempo, movability etcetera acts together with physical qualities and accessibility in how a place is used.[49]

Reflections

That our relationship to nature gets weaker and weaker is a gradual change that at the time can be experienced as small. With time it has started to become a big change that effect planning and the strive for a sustainable society a lot. It has become even more important to incorporate it into planning and a holistic perspective on green structure is needed. It seems ecosystem services can have a lot to offer connected to these issues.

The points mentioned in *Grönstrukturens synliggörande* has influenced the work and they were also used to examine the process after it had been carried out.

The Ecosystems Services Approach

Ecosystem services is a concept used to research and describe the connection between nature, economic activity and human well-being. Ecosystem services can be described as *"the flows or value to human societies as a result of the state and quality of natural capital*[50]*"*. Examples of ecosystem services can be food and temperature regulation, but also recreational and spiritual values.

The different ecosystem services contribute to human well-being by providing different services that we need for our existence and it is therefore essential to keep a resilient level of natural capital to help ensure human well-being.[51] This chapter presents ecosystems, the ecosystem services concept and different ways to work with it.

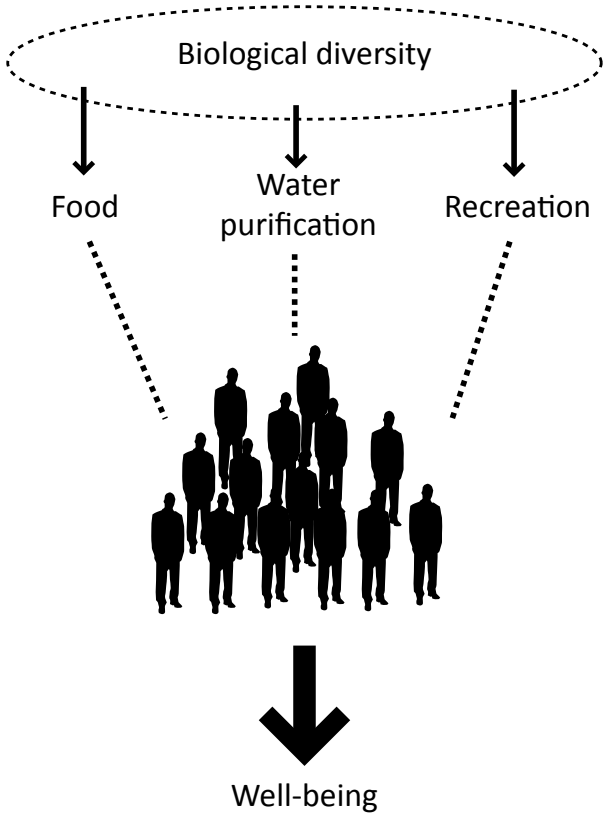
The Ecosystem Services Concept

The base of ecosystem services is biodiversity, defined by the Convention on Biological Diversity as *"the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems*[52]*"*. When considering ecosystem services both quantity and quality of biodiversity are important.

Today there is evidence pointing to a degradation of ecosystems, such as the Millennium Ecosystem Assessment. It found that 15 out of 24 researched ecosystem services had been degraded. The same assessment showed only 4 enhanced services and 5 in an overall steady state but in trouble in some parts of the world.[53] Of the 4 enhanced services three were within food production, which shows the efforts made to increase food production to feed a larger human population.

Other signs of degradation are world fisheries in decline, degradation of agricultural land by erosion, salinization, nutrient depletion and alterations of the nitrogen, phosphorus, sulphur and carbon cycles causing algal blooms, acid rain etcetera. This degradation is often followed or caused by the loss of knowledge and understanding about ecosystems in local communities. At the same time the demands for ecosystem services are predicted to grow with the anticipated growth of the population and world economy. [54]

If ecosystems are degraded too much they might reach their tipping point, meaning that their function in all and their ability to provide ecosystem services changes drastically. One major factor for the degradation and loss of ecosystems and biodiversity seen today is the failure to incorporate them into decision-making[55]. The combination of increased demand and degradation weaken the transformation into resilient ecosystems and a sustainable development in general. This will affect human well-being through an increasing difference between supply and demand as well as increased vulnerability when ecosystem services fail to protect people against natural disasters such as floods and drought.[56]



The biological diversity around us provides many different ecosystem services that effect us and contribute to our well-being. Some of those services have no substitutes.

The ecosystem services approach offers a way to research the values of nature, connect them to human well-being and above all incorporate them into decision-making. One possibility when incorporating them into decision-making is giving them an economic value, making it possible to include them in the normal cost-benefit analyses used in decision making.[57]

Another threat to ecosystems is climate change, which is considered to be one of the most important threats to biodiversity. Being able to include ecosystems in decision-making and investing in their resilience can provide a cost-effective strategy in mitigating and adapting to climate change.[58]

The question of which species or how many individuals that are needed in the future to provide a resilient life in earth's ecosystems cannot be answered now. Ecosystems destroyed because of lost species or fewer genetic variations will not be re-creatable.[59]

More indept information about ecosystems can be found in attachment one.

The Resilience of Ecosystems

Ecosystems are in no way in a static stage, but instead open to different influences. In 1973 C S Holling showed that ecosystems are in constant change with a few dominating processes that capture ecosystems in stages that we tend to read as natural. According to Holling, there are four main processes or phases.

It starts with the r-phase, which stands for exploitation and establishment, a phase where an ecosystem start to develop, for example after a fire (see illustration to the right). These first plants often include flowers and herbs, which are good at tapping the stored energy and poor at competing. This phase has much potential for biodiversity and the number of species will continue to climb to reach its peak in the end of this phase, but the use of energy will not be optimal. The next phase, called the k-phase, is characterized by conservation. Now energy is stored most efficiently and biodiversity is also lower. This lower diversity makes the system vulnerable to disturbances. The next phase, the omega-phase, is the disturbance or accident, where a lot of energy is lost (for example during a fire as the example above). The last phase, the alpha-phase, symbolizes reorganization and renewal of the system after the accident. This renewal relies to a great extent on ecological memory and the sites linkages to other ecosystems in other phases. If these connections are not there the ecosystem risks tipping into a new stability domain.

Today, many see humans as a natural part of these phases. In cultural landscapes we intervene to keep the ecosystem in one phase or also to push it to another. For example, many cultural landscapes are kept in the r-phase by continuous management. This is usually

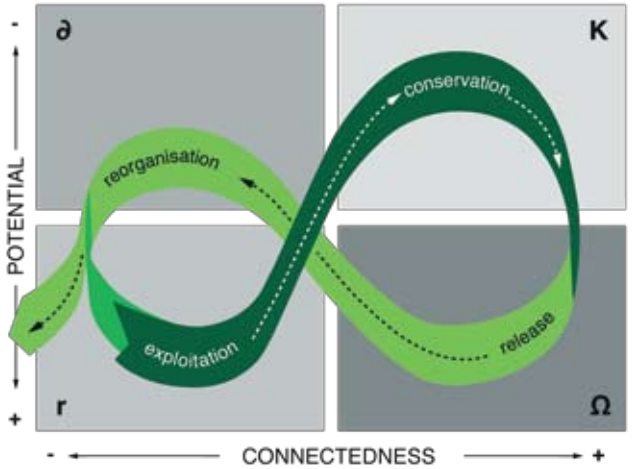


Image 4. The four main processes and phases of ecosystems as described by Holling. The r-phase of explotation and establishment, the k-phase of conservation, the omega-phase of disturbance and the alpha-phase of reorganisation and renewal. For more information see the text 'Resilience of Ecosystems' to the left.

accomplished by small instances of disturbance, such as cutting the grass, and it is also shown that small disturbances can be beneficial to diversity.

Holling defined the resilience of ecosystems as an ecosystem's ability to absorb disturbances, renew itself and continue within a specific state. His research shows that it is the system's resilience that decides its durability and ability to cope under stress. Two main factors in this are ecological memory and response diversity.

Ecological memory is about an ecosystem's ability to renew itself in the alpha-phase. This depends on three points: access to support areas, mobile links and biological legacy. Support areas are similar environments that were not affected by the disturbance. Disturbances affect different types of landscapes differently so diversity at the landscape scale is important. Mobile links are organisms that can transport seeds and the like from one area to another, an important part of regrowth. Biological legacy is the amount of surviving animals and plants, as well as seeds available after the disturbance.

Biological legacy links to the notion of response diversity, which is how different organisms in the ecosystem contributing to a certain ecosystem function cope with disturbances. If all organisms respond negatively to a disturbance the response diversity is low. If they don't, some will still be able to perform the function after the disturbance and the response diversity will have been high.[60]

Frameworks for How to Work with Ecosystem Services

There are many different framework for how to work with ecosystem services. Some are designed specifically for the task of working with ecosystems; some are used in other areas but have been developed to include ecosystem issues. Different disciplines, philosophical views and schools of thought work with and value ecosystems in different ways[61]. This section will give a brief overview of the main existing frameworks around valuing ecosystems.

Different Frameworks for Valuing Ecosystems

In TEEB (The Economics of Ecosystems and Biodiversity) *TEEB for Local and Regional Policy Makers* an overview of different conceptual frameworks is given. The frameworks presented are separated by two aspects; their relation to monetary valuing and focus of the approach. They are either purely monetary, non-monetary or a combination of monetary and non-monetary and the focus differ between socio-ecological, economic, ecological and developmental issues.[62] The different frameworks are presented below.

The Millennium Ecosystem Assessment (MA)

This framework focuses on the connections between ecosystem services, human well-being and poverty. It does so from the main idea that our socio-economic choices affect ecosystems and that the ecosystem services in their turn affect human livelihoods. It divides ecosystem services into supporting, provisioning, regulating and cultural services.

Total Economic Value (TEV)

TEV is also concerned with how nature and ecosystems affect human well-being, but focuses on the economic dimension. It includes a categorization of ecosystem benefits into different types of values that can be monetized. They are then summarized to give the total economic value of the ecosystem/ecosystem services. The different categories include direct use value, indirect use value, option use value and non-use value.

Framework	Focus	Relation to monetary value
The Millennium Ecosystem Assessment	Socio-ecological	Combination
Total Economic Value	Economic	Monetary
Key Biodiversity Areas	Ecological	Non-monetary
Critical Natural Capital	Ecological	Non-monetary
Sustainable Livelihoods Approach	Developmental	Combination

Image 5. Different conceptual frameworks for how to work with ecosystem serivces, their focus and relation to monetary valuing.

Key Biodiversity Areas (KBA) and Critical Natural Capital (CNC)

Both these frameworks focus on identifying areas/ecosystems that are valuable from an ecological point of view. KBA is designed to find local areas which are important for species conservation on a global scale

and CNC to evaluate if an ecosystem can be seen as critical natural capital, meaning that it performs important and irreplaceable ecosystem services that don't have a substitute. None of them are made to incorporate economic valuation.

Sustainable Livelihoods Approach (SLA)

This framework is concerned with well-being from a livelihood perspective, meaning that it tries to understand how an individual, household or community secures well-being over time and how policy proposals might affect these different stakeholders. It takes into account natural, economic, human and social capital as a way for stakeholders to reach a "livelihood resilience" and be able to cope with shocks and seasonal effects.

Similarities and Differences between the Frameworks

As can be noticed by the descriptions above each of these frameworks have been developed by people with different priorities. TEV represents the economist's views, KBA and CNC the ecologist, SLA the development planner's and MA is a generalist approach[63]. Depending on your need you can choose which framework to use.

All of them more or less follow the general 6 step approach presented by TEEB;

1. *Specify and agree on the problem*
2. *Identify which ecosystem services are relevant to the decision*
3. *Define the information needs and select appropriate methods*
4. *Assess the expected changes in the flow of ecosystem services*
5. *Identify and assess policy options*
6. *Assess distributional impacts of policy options*[64]

Monetary or Not

The question of monetary valuing is one of the biggest discussion points around ecosystem services valuation and also something that separates the conceptual frameworks, methods and tools applied in the different steps of the process. A system needs to be applied to somehow determine the importance of one service compared to another, but using monetary valuation is not the only way. Other methods to guide decisions include multi-criteria analysis, which integrates monetary values without monetizing certain sets of benefits and participatory appraisal techniques. Both is stakeholder focused and incorporates some kind of ranking to prioritize preferences.[65]

The main idea with economic valuation is to make different types of services comparable using a common metric[66]. This will make them comparable to each other and also to other economic interests in the economic system our society relies on, making it hard for the system to stay biased towards ecosystem degradation and over-exploitation. Economic valuation of ecosystem services can be done in a number of different ways using methods such as market prices, replacement costs, the contingent valuation method etcetera[67]. When deciding on including monetary valuation it is important to be clear on why, what and how the valuation is to be done.

This is a challenging task and the method has also received criticism. The main point is that there are situations where it is impossible to value nature because it is simply priceless. It is also seen as unethical and some are worried that less biodiversity will be conserved using the line of thought that "when something has a price, you can buy it". In the UK, where a national ecosystem assessment has taken place, wildlife organisations are fairly positive about ecosystem services, but the general consensus seem to be that economic valuing should be used alongside scientific and moral justifications to help conserve nature[68].

The arguments used by the pro-side include that since transactions in the market take place in a monetized domain it is better to value nature in monetary terms than not to value it at all, risking that it is priced as worthless rather than priceless. They also see that a scenario where a price on nature makes it easier to buy is much less likely to happen than that it is traded for

nothing.[69]

A line can be drawn between utilitarian and non-utilitarian values. Utilitarian values are values where people derive benefits from the use, actual or potential, direct or indirect. Non-utilitarian values are valued even if they don't contribute directly to human well-being. Many ethical, religious and cultural points of view recognize this type of intrinsic value to non-human species and ecosystems.[70]

Whether or not to include economic valuation should be decided depending on the task at hand. It is also important to know the purpose of the assessment to use the most appropriate valuation method. Who the stakeholders and end-user are and what resources that are available are both important aspects in determining method. *TEEB for Local and Regional Policy Makers* states that *"A robust ecosystem valuation is likely one that reconciles economic and non-economic values."* [71]

Reflections

Reading about ecosystem services and ways of working with them it is clear that choosing framework and deciding upon if the process shall involve monetary valuing or not are large decisions to make and that depending on what you choose the outcome can be very different. This knowledge was used when designing the method (see pages 53-58).

Another important learning is a widened view of what a natural ecosystem is. Normally, that is described as something without any interference from man. These ecosystems are also seen as having a high biodiversity. Reading about the four phases of ecosystems you learn that ecosystems need disturbances to stay in certain phases, such as with cultural landscapes, whereas in other phases disturbances bring them into chaos. This understanding calls for a diversified view on ecosystems and also ecosystem management.

The Search for Structures for a Sustainable Development

Architects and planners have always sought the ultimate way to plan and build our society. Different ages with different events, inventions and evolutionary cycles have provided the context and presented different challenges. Today we live in a global world where the aspects shaping planning and building are major global trends such as population growth, urbanization, resource depletion and climate change. The main challenge is to find structures for a sustainable development.

Population Growth

Population growth is not a new phenomenon. World population has grown steadily since the dawn of man. The difference is the rate of which the population is growing. In 1800 there was an estimated 0.98 billion people on the planet. In 1900 there was 1.65 million.[72] In comparison the next hundred years saw a rise in population to 6.1 billion and the prognosis for the future is continued growth with predictions of 9.3 billion people in 2050.[73] The world population growth rate is 1.2 % (2011) and on decline, but the pace is slow and it will be a long time before it reaches 0 % in today's pace[74]. In Sweden the population in 2010 was 9.3 million, predicted to reach 10.9 in 2050[75].

Urbanization

In 2007 we passed the mark where half of the world's population lived in cities. From only 37 % in 1970 the urban population reached 47 % in 2000 and is predicted to reach 60 % in 2030. This is estimated to mean an annual urban population increase of 70 million people.[76]

Australia and New Zealand, together with North America, South America and Europe are the most urbanized parts of our world.[77] Today more than 70 % of the Europeans live in cities[78]. Numbers for Sweden can be seen below.

Even though Europe and Sweden are already largely urbanized regions larger city conglomerations in Sweden are experiencing a net in migration higher than the mean urbanization rate of the country. This when people move from smaller to larger urbanized regions. The situation is the same in the neighboring countries. The three big-city-regions in Sweden – the Stockholm, Göteborg and Malmö areas have a clear net in-migration from the rest of the country.

Resource Depletion

As we become more and more people on earth we also consume more and more. As can be seen by the graph to the rigt (image 7) an increase in resource consumption in all four resource categories of biomass, minerals, metals and fossil fuels can be seen between 1980 and today.

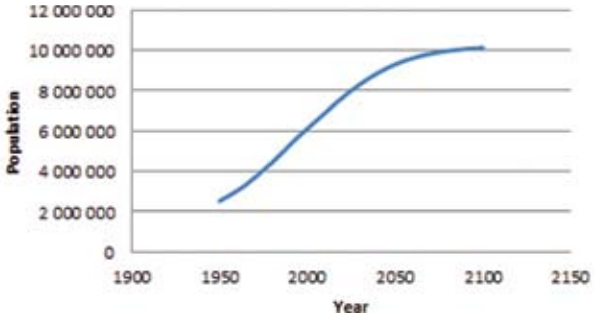


Image 6. Measured and expected world population growth between 1950-2100.

Measured and expected global urban population by in the years 1970, 2000 and 2030.

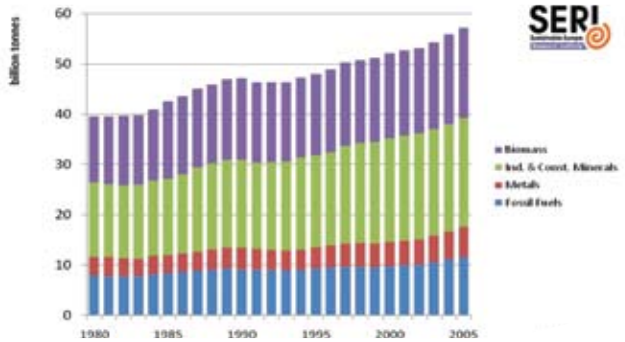


Image 7. World resource consumption between 1980 and 2005.

The United Nations have warned that global consumption of natural resources might triple by 2050 unless nations take drastic steps and find ways of doing more with less. The report in question explains the resource consumption as exploding. From a modest increase of 43 billion tons during the 20th century, use is already expected to be 10 billion tons higher now than in 2000 and up to 81 tons higher in 2050.[79]

Some of the most vital resources are what we call non-renewable, meaning that they cannot be reproduced within a human lifetime. Taken together with a high consumption rate it means that we are quickly running out of vital resources. The picture to the right shows an example of how long it will take for key minerals to run out. With increased resource use, the time span will be shortened further.

One of the resources much discussed is oil. In 2007 the dissertation *Giant Oil Fields – Highway to Oil* revealed calculations of future production of oil. The worst case scenario showed a peak in production in 2008 and the best case in 2018.[80] Discussions on whether or not we have reached the peak are ongoing, but a majority of forecasts show a drastic drop in production in the next decades.

Not all countries share the same access and use of resources. If you look at private consumption, the 12 percent of the world's population living in North

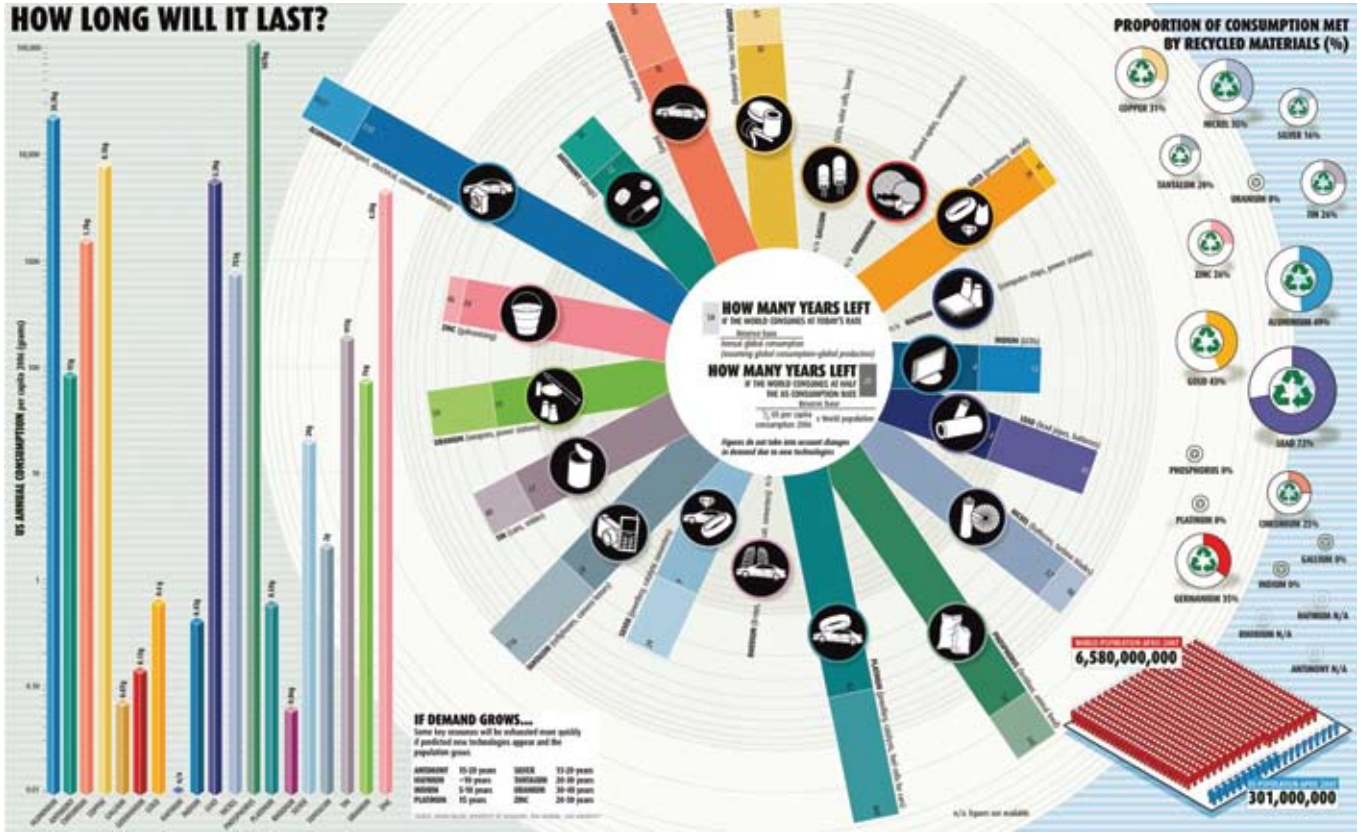


Image 8. Time left before certain key minerals are finished. The middle illustration shows how many years different minerals have left until they are finished. The darker part of the stacks show how many years it will take if the world consumes at half the US consumption rate. The annual US consumption is shown to the left and the portion of consumption met by recycled materials to the right.

America and Western Europe does 60 % of private spending in the world, while the 1/3 in South Asia and sub-Saharan Africa does only 3.2 %.[81]

One way of looking at resource consumption is the Ecological Footprint. It calculates the area needed to support a person, city or nation taking into account how much land and water it needs to provide resources, the space for accommodation and for absorbing the waste and emissions given of.[82]

Calculations have shown an available 1.9 hectares of biologically productive land / person on earth. Today the mean use is 2.3.[83] According to the Global Footprint Network we now use 1,5 planets to provide us with resources and absorb our waste. The national ecological footprints clearly shows the difference between countries when it comes to resource consumption (see image to the right).

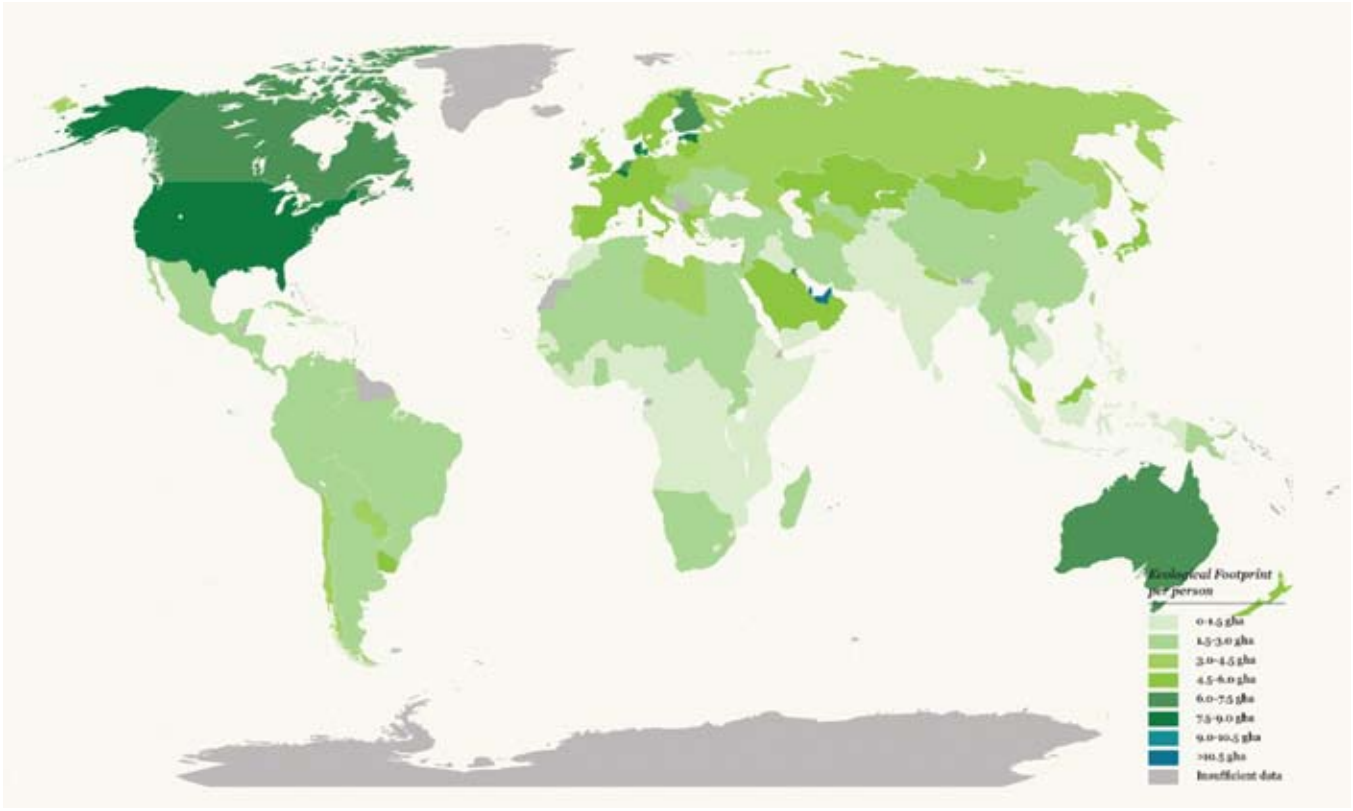


Image 9. Ecological footprint in different countries. Darker colors describe a bigger ecological footprint. The image clearly shows the difference between countries where North America, Australia and parts of Europe have large footprints.

Climate Change

Climate change has been called the overriding environmental issue of our time with economic, health, safety, food provisioning and security dimensions by the United Nations Secretary General[84]. The Intergovernmental Panel on Climate Change (IPCC) defines it as *"a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer[85]".*

The observed changes in climate are increases in average air and ocean temperatures, melting of snow and ice and rising sea levels, brought about by a general warming of the system. The latest IPCC report from 2007 among other things states that eleven of the last twelve years have been the warmest years in the instrumental record (dating back to 1850), that global sea level rise has occurred at a rate of 1.8 mm/year since 1961 and at a rate of 3.1 mm/year since 1993

and that satellite data of the Arctic sea show an 2.7 % decrease in ice cover/ decade since 1978.[86]

The same report mentions changes in atmospheric concentrations of greenhouse gases and aerosols, land cover and solar radiation as the main causes of climate change since they alter the energy balance in the climate system. Humans contribute greatly to the increase of concentrations and the amount of greenhouse gas emissions. Human activities have grown greatly the last centuries and between 1970 and 2004 there was a 70 % increase. The consistency between observed changes and warming and spatial agreement between different locations seen today is very unlikely to be caused only by natural variability.[87]

The impacts are already being seen around the globe, some of which are presented to the right.

What Does this Mean for Planners?

This combination of population increase, increasing consumptions, urbanization and climate change present today's challenges to planners and architects. Where and how can we accommodate a growing population in a way that bring resource use to a sustainable level in an equitable way? This is one of the main questions in today's focus on sustainable development and the work of finding structures for sustainable development.

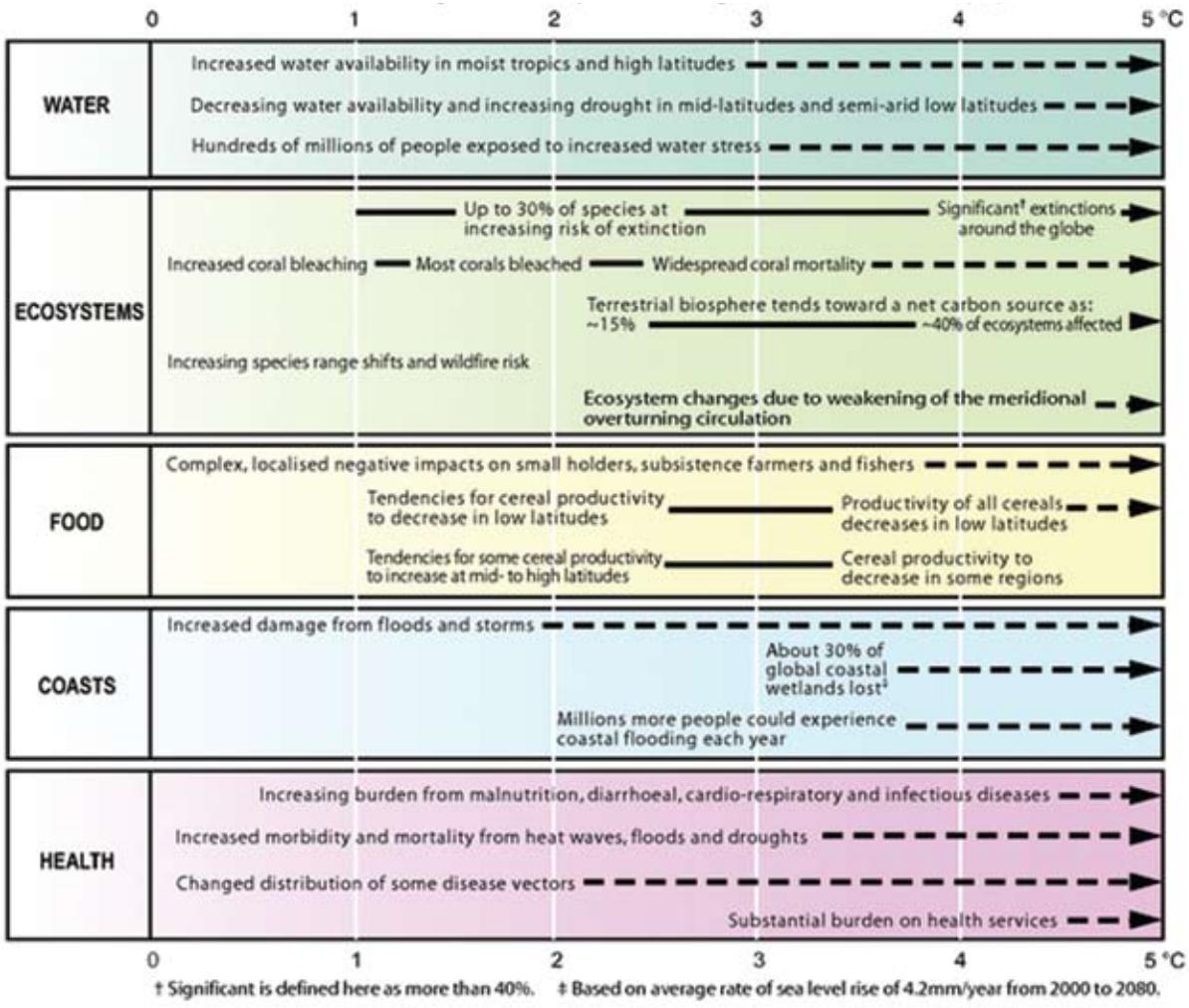


Image 10. Examples of impacts in different areas associated with projected global average surface warming. As the global average annual temperature increse (shown on the y-axis) impacts can be felt in different areas. Some come with a small temperature change, some needs a bigger one.

This focus on sustainable development is a reaction to the trends explained above and a realization that the current society we live in, especially the one developed the last decades, does not live up to the thought of a sustainable society. Instead it was planned after an infinite use of resources.

There are many definitions of sustainable development; the most used being that of the Brundtland report from 1987, which defines sustainable development as a *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs[88]"*.

Sustainable development is further commonly seen as having three dimensions – a social, an economical and an ecological dimension. These are all strongly interconnected and solutions need to be developed and applied that takes all dimensions into account[89]. The goal is a societal development that meets all three needs of an economically prosperous, socially equitable and ecologically sound society. Linking back to the environmental paradigms discussed in chapter one, there is a clear tendency of *eco-development* and to some extent *deep ecology* in today's ambitions.

The challenge has been described as *"the implementation of the global and multi-dimensional political vision of sustainable development into local and multi-dimensional real world situations[90]"*.

Much of the focus in this has been on the city and a sustainable way to build cities. This is understandable taken the percentage of people living in cities, the amount of resources they consume and waste they produce. The city is and has been seen as the problem, but therefore also as a promising place to implement solutions. In the 1990-ies EU launched *The Green paper on the Urban Environment* that connected environmental problems with urban form and also in Sweden sustainable city building has become a political goal[91]. This can for example be seen by the publishing and issuing of *Hållbar stadsutveckling: En politisk handbook från Sveriges Arkitekter* in 2008.

Densification as One Answer

The main answer to the challenge of a sustainable city development has been densification, an idea summarized in the concept of *the compact city*. Densification is not a new concept, but it has had a renaissance during the last decades.

The main idea is the need to build dense to shorten distances leading to less car use and lower energy use. It would be a city built on public transport, walking and biking and where more people can use the same systems for heating, waste disposal etcetera.[92] In later years it has been accompanied by the notion of the mixed city, a reaction to the way cities have separated and divided functions into different areas. The compact city concept argues that the approach to meet and tackle contrarious interests on place would create a better city with lively places where people move during different times of day. It would also shorten the travel distances needed to go from one function to the other.[93]

There has also been critique against the concept of the compact city. One is that the concept is too simple, that it reduces the problem to be only about resources, another that it's wrong to say it works everywhere, from the big metropolis to the small country village.[94]

Today it is a general strategy for Swedish municipalities to densify their communities. At the same time it stands clear that you cannot simply build more buildings within city limits and thus the problem will be solved. Densification has to be done consciously and with reference to the cities' qualities, built and un-built.

Many questions are still debated. An initial analysis of topics connected to densification discussed today was made by examining newspapers, books and other publications. The result was a number of questions and discussion topics presented on the next side. The many issues show that there are still many things that are seen as uncertain. The main themes are: general questions, green areas, transport/travels, housing qualities, urban environment, social issues, technical systems and implementation.

Generally

- In what structure should cities grow? (densification, "finger growth", satellite areas, concentric etc)
- Is the sustainable city dense or sparse? Is there a difference from city to city?
- How much does the physical environment effect habits and behavior and how much do they depend on something else?
- At what level should the discussion about the city's development / densification take place? (municipal level, between municipalities, regional)
- Does densification work everywhere? (different types of cities, regional aspects etcetera)
- How can a balance between built-up areas, green structure and infrastructure be achieved?

Green areas

- How can you densify while retaining the qualities that green areas provide?
- How much can you densify before the green structure becomes too weakened? What is a reasonable green standard?
- How can the green values removed by densification in green areas be compensated? How can existing green areas become more qualitative?
- How can green and blue areas be integrated in the city web?
- What is the relationship between the city and the countryside?
- What's more important, quality or quantity?

Transport/travels

- What city structure produces the most energy efficient transport patterns?
- How can a more effective transport system be created for more people on the same space?
- How do you densify to encourage transport alternatives within public transport, walking and biking ahead of the car?
- How can you integrate traffic in a denser environment so that safety, security and availability are secured?

Housing qualities

- How can you build dense without renouncing qualities such as light conditions, views and privacy and avoid bad air quality, sound pollution etcetera?
- How can densification help create a better micro climate?
- How do people want to live?

Urban environment

- What does densification mean to the character of the city?
- How can you treat areas of cultural importance?
- How can densification be adapted to the future and its needs?

Urban life

- How does densification effect the public space of the city? What does it mean for the need of meeting places and a safe urban environment?
- How can densification enrich and vitalize the urban life?
- How can densification improve integration, equality and public health?
- What hinders the mixed city?
- What family-/household structures are there?

Technical systems

- How can existing systems (electricity, water etc) cope with densification?
- How does densification effect the treatment of storm water and how can eventual problems be solved?

Implementation

- Development agreements etc. are adapted to new construction. How do they work in a situation with densification?
- What areas should be prioritized for densification? Where the potential is the biggest, where it is most useful or where it is most interesting for the market?

Topics connected to today's densification discourse presented in themes.

Reflections

These changes in our environment effect planners and architects and are necessary to incorporate in our work. The overall goal needs to be to create a sustainable development. As said this is really a political vision and to find ways of implementing it is the challenge. In this challenge lies to bring these global issues down to a local level. Any process must be related to this, so also one involving ecosystem services.

It is also clear that densification as a simple answer to the future sustainable city is false. As always, the picture is more multifaceted then we first see and one answer surely doesn't work everywhere. A deeper discussion on densification is therefore found in the following chapter.

The Densification Discourse

The discussion about densification within planning- and building professions is not a new phenomenon. It has been one of the main questions throughout planning history.[95] This is not surprising when you think about the city's characteristics. Among its key features are large numbers of human beings and buildings within a limited space. High density is per definition an aspect of the city. It even defines what kind of urban settlement we see. Weather we call it a city, town, village or other is highly dependent upon how many people and buildings it houses.[96]

The standpoints in the discussion can be divided between two main groups: centrists and decentrists. Both groups arose in the end of the 19th/beginning of the 20th century as a reaction to the 19th century cities. Today, there is also recognition of a third group commonly called compromisers.[97]

The first of the two standpoints to be articulated was the decentrist view which arose as a reaction to the dense, unhygienic cities of 19th century, especially in England. New Lanark is one of the projects stemming from this time. In the following decades' debate some of the most influential persons where Ebenezer Howard, Frank Lloyd Wright and Le Corbusier. Howard and Wright represented the decentrist side and Le Corbusier the centrist.

Ebenezer Howard presented his Garden city initiative where he said that *"every man, every woman, every child should have ample space in which to live, to move and to develop[98]"*. In his designs he was looking to unite the best of town and countryside and suggested cities of 32000 people on 1000 acres of land surrounded by 5000 acres of agricultural land. The agriultural land would be both a source of produce for the town, as well as a way of preventing the town to spread outwards. Instead further growth would be accommodated by more similar cities. A version of Howards work shows groups of Garden cities linked together by rail, forming a bigger city together. Today, Howard is more and more seen as a member of the compromise-view because of his focus on a type of contained decentralization. This is considerable different from for example Wright's view.

Wright can be seen as the extreme decentrist. He believed in the individual and her possibility to choose a suitable lifestyle. With the arrival of the car and electricity he saw no future in cities. Instead each citizen should have their piece of land and the homestead would be the basic living unit. Factories, schools and other functions would be scattered in a predominantly agricultural landscape. If Howard wished to marry town and country, Wright wished to merge them.

Le Corbusier saw a completely different solution to the problems of the 19th century city. Instead of decreasing densities, he wanted to increase them to 'decongest our cities'. High tower blocks would lead to more open space and better circulation of air.

The discussion continued during the following decades, with two clear stands, but slowed or even stopped in the seventies when a reaction to large scale planning came.[99] As Breheny writes:

"Planners had become mere pragmatists, either no longer interested in 'big' ideas or convinced that the big idea was that there should be no such idea.[100]"

With the vision about sustainable development the discussion about density arose once again and gave birth to movements such as New Urbanism, advocating the centrist view[101]. Today, the notion of the compact city has become the main big idea, but there are still different stands in the issue and discussions about density in relation to a sustainable development.

Before we look at today's discussion we shall look into density around the globe and different ways of measuring and experiencing density.

Density Around the Globe

Density around the globe varies greatly. Sweden has a comparably low density with 22,2 people/km2[102], but the difference between parts of the country is big. In 2001 37 % of the population lived in the three big city

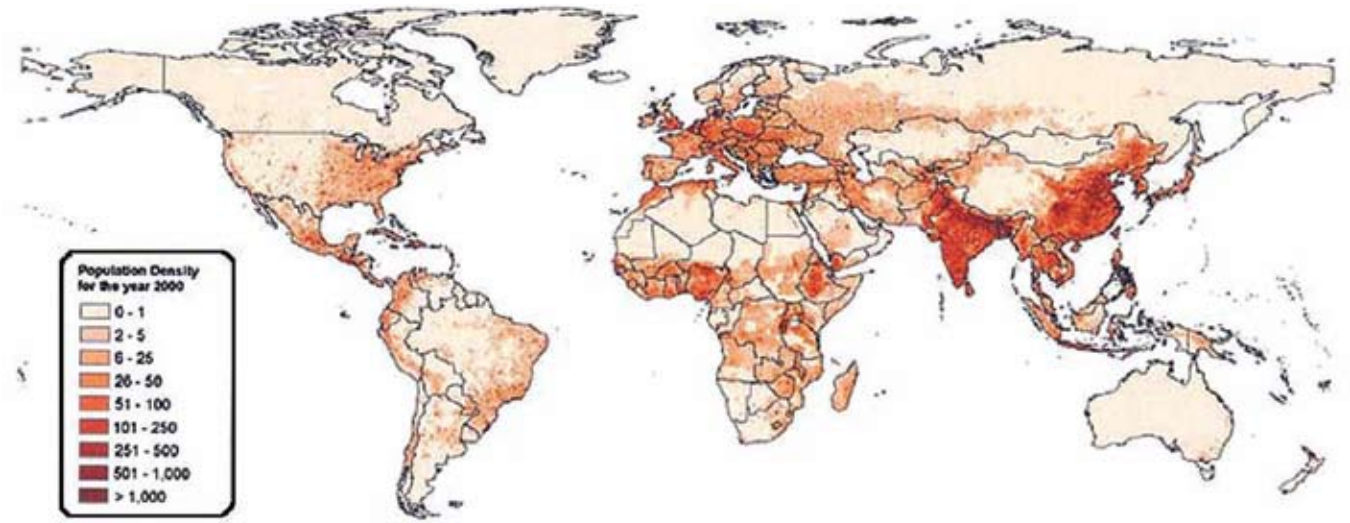


Image 11. Density around the globe. Darker colors mean a higher density. Especiallt India, Bangladesh and China stands out as dense countries.

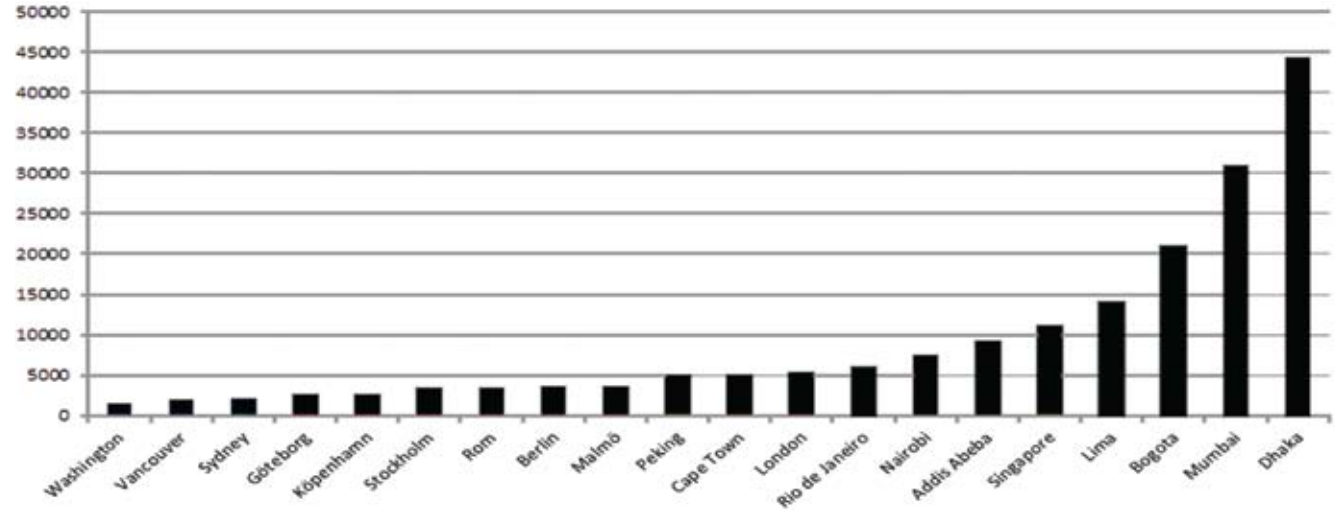


Image 12. Persons /square kilometer in different cities. Asian, South American and African cities are more dense than European, North American and Australian cities.

regions, constituting only 4 % of the land.[103] Swedish cities are also sparse in an international perspective[104]. According to a newly published edition of *Demographia World Urban Areas* North American and European cities are the least dense and South American and Asian the most.

Interestingly the globalization trend we examined in the previous chapter does not mean that global densities in cities are growing. Instead, it is diminishing. As an example Europe's cities have grown an average of 78 % geographically since the 1950ies, but the population has only grown with 33 %. The same can be seen in the US and China[105]. Figures for Sweden show that cities have quadrupled their land use / inhabitant since the 50-ies[106].

Measured and Perceived Density

The city is per definition a place where many people and activities coexist[107], a dense place. This concept of density in cities can have two different meanings – measured density or perceived density – that are used in different situations and for different purposes. Measured density is connected to an abstract concept of space and relates to physical aspects in the environment. It is for example measured in persons / square kilometer or built-area in relation to un-built area. Perceived density on the other hand is highly subjective and connected to a social space – to for example spaciousness and the presence of other

people. A dense measured density is not necessarily a dense perceived density and vice versa. Both types of density must be considered in planning.[108]

Different Ways of Experiencing Densification

As described the experienced or perceived density is subjective. A person that has written about this is Inger-Lise Saglie in her *Density and town planning – implementing a densification policy.* She sites Y-F Tuan's *Space and place* from 1979 and argues that how we look at space is conditional of our cultural background and earlier experiences. This explains why a person from Dhaka perceives 'too dense' as a much higher measured density than a person from Malmö. Secondly Tuan mentions that the perception of density depends on contrast – for example between different housing areas in a city.

Tuan argues that spaciousness (as a counterpart to crowdedness) is connected to the sense of freedom and prestige world-wide. Interestingly he finds that the feeling of crowdedness is mainly connected to the presence of other people and writes "people, more than things are likely to restrict our freedom and deprive us of space". On the other hand he also explains that there is a line between the feeling of people watching out for one another in a positive sense and curiosity in a negative sense.

Image 13: Dhaka and Malmö. When an environment is experienced as 'too dense' depends on your cultural background and earlier experiences.

This has been further researched by Norberg-Schultz, also cited in *Density and town planning – implementing a densification policy*, who describes different ways of dwelling or living. He sees four modes of dwelling: the natural mode connected to the settlement, the collective connected to urban spaces, the public dwelling connected to the institutions and the private dwelling connected to the house or home. Saglie puts the two together and argues that a qualitative investigation of dwelling in high density could expand the understanding of dwelling to being not only in the private dwelling mode described by Norberg-Schulz, but also the more public modes.[109]

In connection to *The UK Strategy for Sustainable Development* from 1994 The British Department of Environment was commissioned to investigate intensification and among other things when it is acceptable to urban residents. They found that there was no correlation between density of a neighborhood and satisfaction with an area, which talks against the idea that low density is more desirable. On the other hand people in places where density had increased the most were more dissatisfied. They also found that in high status areas where people were more concerned of the adverse effects of intensification densification was less acceptable. In general people were more positive about previously derelict or vacant land being densified than land that they regarded as recreational land. They were more negative towards redevelopment

as opposed to new builing on un-built land, extensions or conversions. They also saw housing development as better than non-residential uses. Interestingly, the DoE also found that intensification in the form of more people in the area was generally seen as positive as it increased perceptions of safety,[110] which speaks against Tuans view. Another survey of the attitudes of the residents in Perth confirmed that people in high status areas were more resistant towards intensification. It found that the approval rate increased the closer to the city center people lived and that younger residents were more positive about higher densities.[111]

The Densification Discourse

The current discussion about densification and urban form started in the late eighties when the challenge of sustainable development put planning and urban form as a central part of promoting the vision[112]. Both centrists and decentrists of today have arguments connected to many of the main themes of the denificaiton discussion that was presented on p. 35. Some of the most used are be presented below.

Transport and Travels

One of the main motives for densification is the need for reduced pollution to halt global warming. The centrists argue that urban confinement will reduce the need for travel by giving shorter journeys and increasing the amount of travels by public transport. One of the most known studies in this area is one by Newman and Kenworthy. They relate petrol consumption per capita and population density in a number of cities around the world and the result shows a clear pattern where higher fuel consumption is associated with lower densities (image 14). The same result was reached by a UK study from ECOTEC in 1993, which also showed that increase i urban size relates to more travels. It found that residents in rural areas travelled twice as far as those in the cities and virtually all increase was accounted for by car travel.[113]

Many support this view. Many also agree on that sustainable cities must be in the scale suitable for walking, cycling and effective use of public transport.[114] Ingerlise Saglie points to empirical research showing that both density and centrality is favorable in a Nordic sustainable development context among other things since it will lead to a low volume of transportation[115].

Of course, Newman and Kenworthy has also received criticism, for example for being too concentrated on one variable: densification. Critics argue that other factors such as household income, gasoline price and habits are important factors[116] and that the relationship is only true for North American and Australian cities, not European. Example used are Copenhagen, Stockholm and Brussels have the same amount of car travel / inhabitant but very different population density.[117] Other arguments against this claim is that half of private car travels are non-work travels that don't change much due to densification[118] and further that calculations show that there is not much to gain in terms of reduced energy use by travels in dense cities.

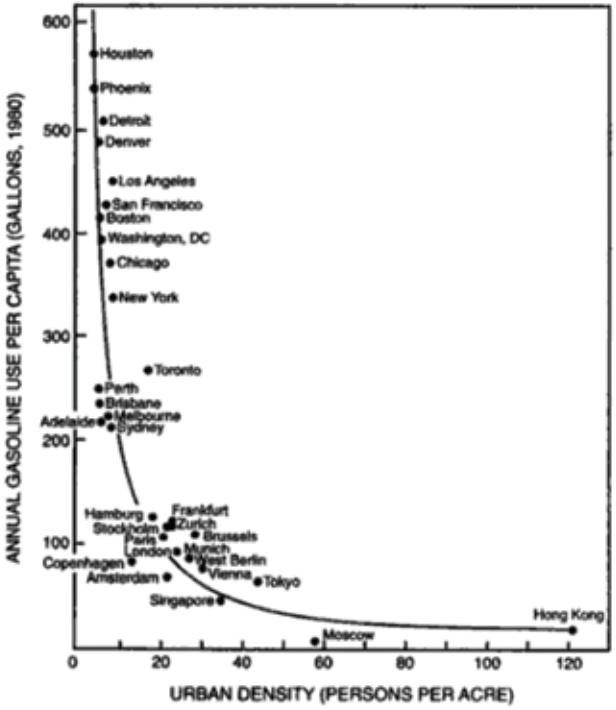


Image 14. Annual gasoline use per capita vs urban density in different cities in 1980. Study by Newman and Kenworthy.

One fraction of the current decentrist movement are the so called 'free-marketers' that prefer to leave the market to determine optimum solutions. They argue that given free will markets mechanisms will produce

polycentric patterns with relatively low energy consumption. Two of the most known free-marketers are Gordon and Richardson from the US. They also object to the reduced travel claim by arguing that commuting distances (in the US) have been stable or falling the last years, despite a decentralization effect. This because not only housing, but also work has been relocated to the suburbs and most trips are now from suburb to suburb. On the other hand there are also people in support of Newman and Kenworthy claiming that such a market-led urban dispersal will lead to increasingly inefficient urban forms.[119]

Green Areas

Urban development and the state of green areas have a direct linkage[120] and it is also one of the most discussed issues connected to densification. Centrists argue that urban containment will deliver environmental benefits because of the reduction in loss of open land. This will safeguard the countryside and the habitats it provide.[121] Naess has also found it to reduce the pressure on land for development in a Nordic context[122].

On the other hand decentrists argue that it is only a way to put the pressure back on urban areas with results of loss of urban green space – i.e. the quality in the countryside might get better, but on the account of the quality of life in cities[123]. Breheny sees one of the main contradictions of the compact city to be the desire to both green the city and to use urban land more effectively, i.e. densify. Some argue that densification would be detrimental to environmental quality.[124] Others say that some green field development would be inevitable even with higher urban densities[125]. Berg and Florgård argue that development of urban green areas often goes against the will of the inhabitants, the need of resource protection and a healthy economy. They say there are many studies indicating the meaning of greenery for physical and psychological health of people and that a good, available green structure is a strong support for the social sustainability in an area. They see the city greenery as important both for the city's economic efficiency, the esthetical and cultural values.[126]

There are also people arguing that there is a difference between cheer quantity and quality of greenery where it is not only important how much green areas there are but what quality they have.[127] From an environmental point of view it is clear that cities increase resource use, fragment the landscape and causes loss of natural areas by for example producing heat islands, causing water pollution, contributing to desertification and changing energy and material fluxes. On the other hand it is also understood that *"it is not urbanization per se that necessarily causes negative impacts on the environment, but rather the particular types of urban systems and the way of industrial production as well as deficits in urban governance[128]".* Sassen among others see cities not only as polluters, but sites for innovation.[129]

Housing Qualities, Urban Environment and Urban Life

When it comes to housing qualities, urban environment and urban life the arguments and discussions all deal with quality of life and flow into each other. They are therefore presented together.

Quality of life is part of the argument from both centrists and decentrists. Centrists see the city as a meeting place and a cultural area full of diversity – exiting because of its 'edge'[130]. Paul Bæk Pedersen also puts it in connection to healthy lifestyles in the book *Sustainable Compact City* and writes:

"Dense cities for the ability to create social sustainability, where city life and diversity occur because there are different, and mixed, functions present in the city – residences, work places, cultural institutions, day-care centers, outdoor areas, sports facilities etc. And where a space is created for the co-existence of different income levels, culture and ethnicity, to name but a few aspects.

Dense cities to create cities that are healthy, where physical activity, sport, play and exercise are given as a natural part of each individual's daily life. Where easy and fast access for pedestrians and cyclists, in the city, and out in the surrounding landscape, creates good conditions for the promotion of healthy lifestyles.[131]"

Another argument is the chance to improve architectural qualities by repairing the urban structure through

densification.[132] Centrists argue that decentralization would 'sap the lifeblood of cities'.

The decentrists see quality of life as something else and even if they acknowledge that some groups of people of particular ages, occupations and levels of income may choose to live in high density, they see it as an exception from the main will.[133] Others have also questioned the idea of the compact city in relation to other prevailing thoughts and wills[134] but there are also indications that preferences are changing and that the 'detached house with an ample garden' is losing ground as a preferred housing type[135]. Breheny see today's decentrists as two groups: free-marketers who say that it is the interference by planners in land markets that causes problems and that market solutions would optimize the urban forms produced, and good-lifers who want a lifestyle that is decentralized geographically and institutionally.

The good-lifers focus on 'rural values' and in their ultimate version of quality living want geographically dispersed communities where each household have enough land to be self-sufficient in crop production. They also see opportunities in the use of telecommunications.

The free-marketers see the market as the best and most efficient way of solving urban problems (and forms). By this they indirectly support decentralization by arguing for a relaxation of planning policy. They argue that planning policy is responsible for high land and property prices.[136] This view is shared by Rådberg that says that the compact city strategy reduces the amount of land ready for development in cities, increasing the land prices and forcing people out of cities[137]. The free-marketers have been met by criticism, among others by Bourne who says he suspects that continued promotion of urban dispersal will contribute to *'the evolution of future urban forms that are increasingly inefficient and socially inequitable*[138]'.

Technical Systems

Part of the discussion is also about the city's technical systems, where just as with transport, it is argued that densification can lead to more effective use of the system. Johansson lists four advantages of a dense city for its systems:

- Collective solutions for wiring and grids can be arranged
- The number of possible customers for connection to heating-, water-, sewage- and garbage system increases
- It could become easier to create closed loops of materials such as metals, glass, paper etcetera and to care for hazardous waste
- More flats in multi-family housing units give less heating need per unit[139]

This view is shared by Paul Bæk Pedersen and others that see lower energy and material uses as one of the benefits with dense cities[140].

The decentralists is of a different opinion and Johansson has listed also the advantages of a decentralized or sparse structure for its systems:

- Short transports for nutrients in closed loop cycles
- The human pressure on nature can be divided into smaller currents that nature can deal with easier
- It will be easier to find surfaces for energy plants built on renewable energy such as wind power, biofuels and solar collectors
- Areas for local treatment of surface- and sewage water as well as composting and other treatment of waste can be found

One of the advocates of the sparse structure is Folke Günter, a system ecologist. He argues that only the sparse structure is possible in the future because of the dense city's dependence on cheap fossil fuels. He sees the solutions in shortening the distance between housing and farming to create local solutions. In his vision a normal farm supports and is in nutrient balance with around 200 persons. These could be grouped in four to create 800 people living in a somewhat close connection to each other sharing water- and sewage systems etcetera.[141]

Implementation

When it comes to implementation a problem is seen

in the mismatch between strategic benefits and the perceive disadvantages at the local level. Tools to ensure successful implementations are seen to be lacking.[142]

The Middle Way

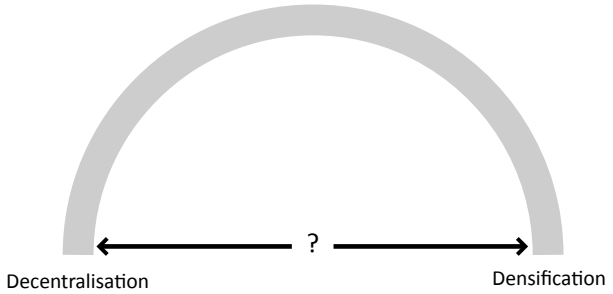
When looking at the above themes it is clear that the ideal dense city is not only defined as dense. It should also be a mixed city, a city built on public transports etcetera. It also stands clear that it is a complex phenomenon and that both centrists and decentrists present valuable arguments. The way I see it location and context seem to be key things to consider when discussing densification. Depending on what kind of setting you are in densification will be more or less suitable. This has also been noticed by Johansson that say both densification and decentrification might be needed in the future. For her the interesting part is how or where we should densify or decentrify.[143]

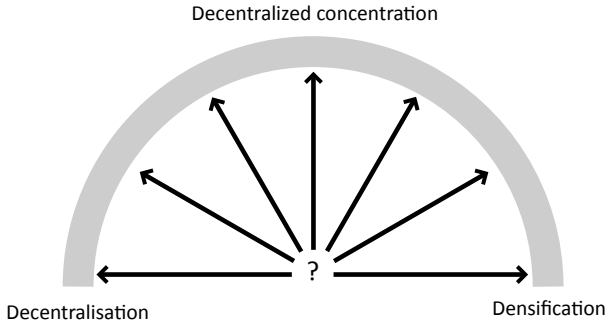
Jenks, Williams and Burton in *The compact city – a sustainable urban form* say that there is no consensus between centrist and decentrists, but also that arguments for a compromise – decentralized concentration - begin to provide answers. This view they say, needs a regional perspective, not just that of the city, but of its surroundings as well.[144]

One person that has written about decentralised concentration is Breheny. For him it is clear that there are merits to be taken from each of the extreme positions and also things to discard. He questions why this view has been slow to emerge and find that it might be that compromise positions are never very fashionable. For him a compromise position has many good sides. He writes:

"From the centrist case it can adopt continued, indeed tougher, containment, urban regeneration strategies, and a whole range of new intra-urban environmental initiatives. There will be environmental gains, but not at the expense of quality of life. From the decentrist case it can allow for the controlled direction of inevitable decentralization – to suburbs and towns able to support a full range of facilities and public transport, and to sites that cause the least environmental damage.[145]"

In my opinion it is also important to provide different types of sustainable living simply because we are all different. Trying to get all people to live in dense city structures is bound to fail for many reasons. Therefore there is a need for different sustainable living concepts where the decentralized concentration can be one that provides a good way to see cities or rather city regions. This is certainly needed as prognoses show a huge increase in urban inhabitants in some parts of the world and also the already large percentage living in cities in other parts, for example in Sweden. Jenks, Williams and Burton share the same view and writes *"The search for the ultimate sustainable urban form perhaps now needs to be reoriented to the search for a number of sustainable urban forms which respond to the variety of existing settlement patterns and contexts that have been identified.[146]"*





Today's density discussion is often about densification or not, with the alternative of decentralisation as shown by the top illustration. It would benefit from a broadened view of possible solutions that takes location and context as key elements to considder as in the bottom illustration.

To Densify with Quality

When developing this concept it is very important to see it not only as connected to a denser building structure, but to other concepts of quality such as the mixed city and a city built on public transports. Otherwise it risks being far from sustainable. An example could be densification in a suburb that will give beneftis but without a good public transportation network will still increase car traffic. In short, all aspects of density must be thought of in each context to have a qualitative densification. Most of all it needs to present people with good environments to live in or they won't live there.

Many other share the same view[147]. Jenks, Williams and Burton write *"It is the quality of life that might be offered by the various solutions to sustainable urban form that is crucial in making them attractive and achievable options … There are clear arguments to suggest that the compact city needs to provide an environment where people will want to live, and which provides the services, facilities and transport that will encourage them to change to more ecologically lifestyles, particularly in relation to the use of the car.[148]"* Paul Bæk Pedersen talks about the need for architectural quality to be discussed in conjunction with compact building and mentions daylight conditions, spatial quality and attractive open areas[149]. The Swedish Association of Architects have also raised the question in their book *Hållbar stadsutveckling* where they pinpoint one of the fundamental questions in urban development to be *"How do we balance the density and greenery so that they together create an attractive and sustainable city?[150]"* [author's translation]

Reflections

The normal context to discuss when talking about densification is the inner city alternative, but it is just as important to discuss the suburbs. We need to make the whole city, including suburbs, offer a quality of life that is attractive and sustainable.

In this aspect, Bjärred/Borgeby presents an interesting case study area that could fit into a vision for a Skåne with a 'decentralized concentration' featuring small dense suburbs around the larger conglomerations. One big issue to solve to make it sustainable is transport.

Case study area: Bjärred and Borgeby in Lomma municipality

In the first part of this thesis research to get to know Lomma municipality was done. Te result is presented in this chapter for you to get to know the area.

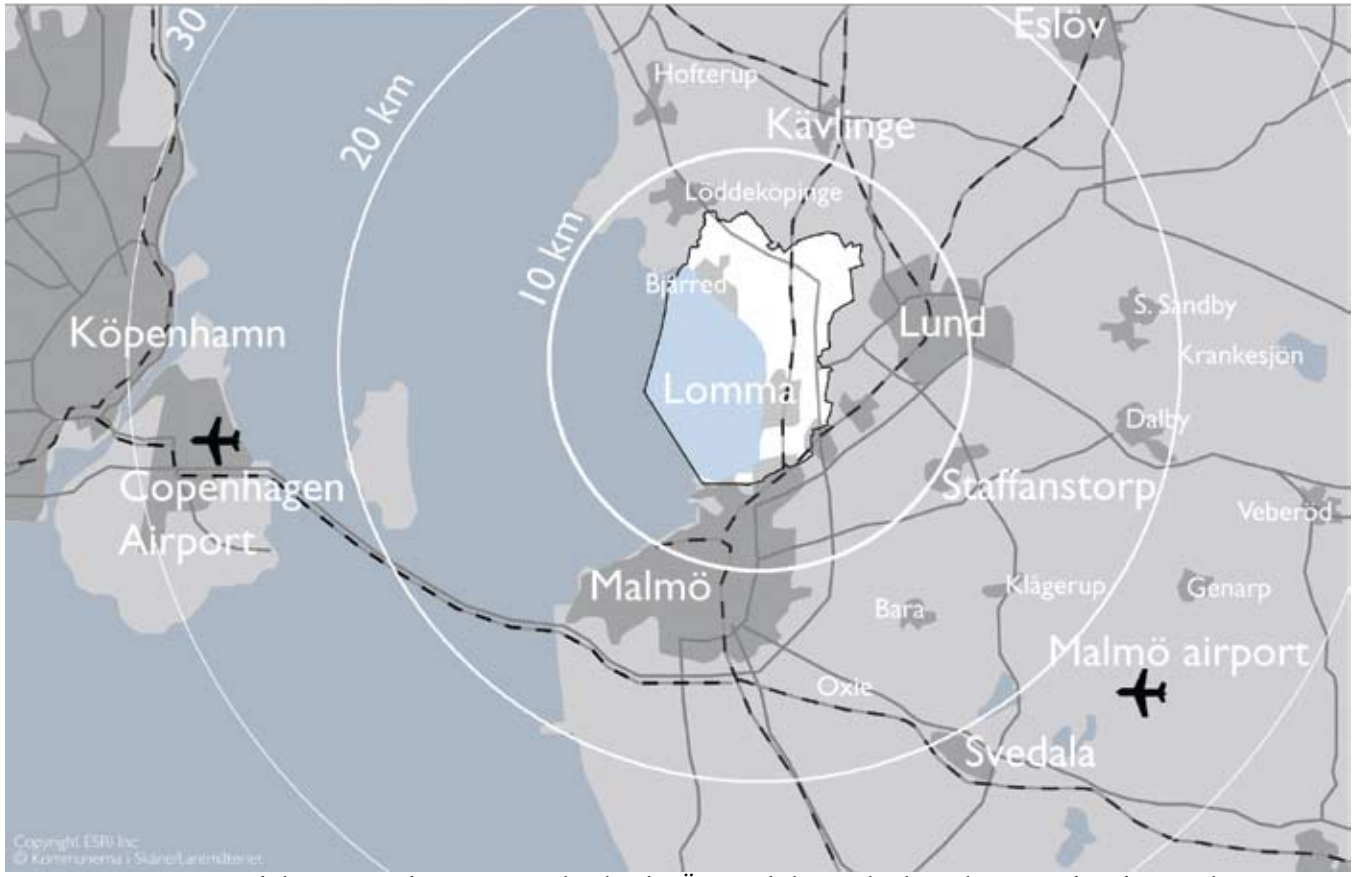


Image 15. Lomma and the surrounding region. It lies by the Öresund close to both Malmö, Lund and Copenhagen.

The municipality lies in the southwest part of Skåne on the Öresund coast. It borders the municipalities of Kävlinge, Lund, Staffanstorp and Burlöv. Also Malmö and Copenhagen is near. The municipalty's total land area is 56 km2 and the water area is 34 km2. The last six years the population has grown with about 350-600 persons/year[151] and in the end of 2011 the population was 22 017 persons[152]. Almost all municipalities in Skåne has a prognosed increase in population during 2009-2018. For Lommas part an increase of 7,5 – 9,9 % is predicted[153].

The municipality's main community is Lomma in the southern part of the municipality. Further up north along the coast lies the community of Bjärred, which is also close to Borgeby. In the inland there are two smaller communities called Flädie and Fjelie[154].

The place where Bjärred and Borgeby lies has probably been inhabited for a long time, but the communities as we know them today are relatively young. Borgeby was first to be close to Borgeby castle, today on the other side of E6. The current position was set around 1860 when land was parcelled along Västkustvägen for those who didn't want to buy larger pieces of land during the reparcelling out of land (*laga skifte*). This formed into a village during the end of the 19th and beginning of 20th century. The inhabitants worked in the brick-industry or were farmers. Bjärred formed gradually with a start in the end of the 18th century when two farmers asked to be parcelled out to the areas near the shore. There was probably also some smaller fishing houses along the coast, situated on the farmers' land but used by fishermen. During the second half of the 19th century people started coming to Bjärred as a summer attraction and rented the houses. During the decades around 1900 many

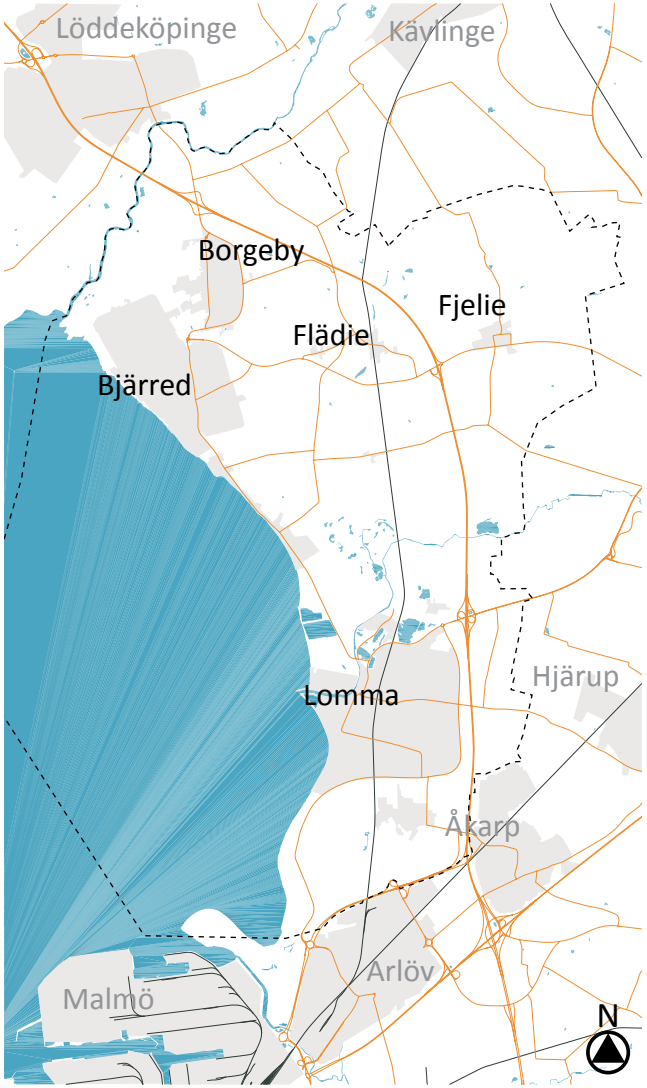


Image 16. Lomma municipality. Scale 1:120 000

summer houses were built in the area. A railroad track was laid between Lund and Bjärred and AB Bjärreds Saltsjöbad, a spa resort, was inaugurated. In the early 20th century also year-round houses were built. The time as a spa resort ended during the 30ies and after the war the community developed as a housing suburb to Malmö and Lund. Large areas with new houses were built during the 60-ies and 70-ies according to the style of the time.[155] After that a few additions of new housing areas has been made. Recently a rather large area in Borgeby has been developed with new housing.

Today the southern and northern parts of the municipality houses almost as many inhabitants, with ca 1000 people more in the southern parts[156]. Compared to Sweden Lomma's inhabitant's consist of more small children and less young adults than average[157].

Compared to the national average there is more detached housing and less apartment buildings, especially in Bjärred where 82,8 % of the housing units are detached housing. If you look at housing forms the municipality has a high amount of self-owned housing and low amount of rented housing compared to the national average. The amount of condominiums is more or less equal[158]. The municipality's inhabitants earn more than the average Swede.[159]

The density counted as inhabitant / square kilometer shows that considering the high amount of detached

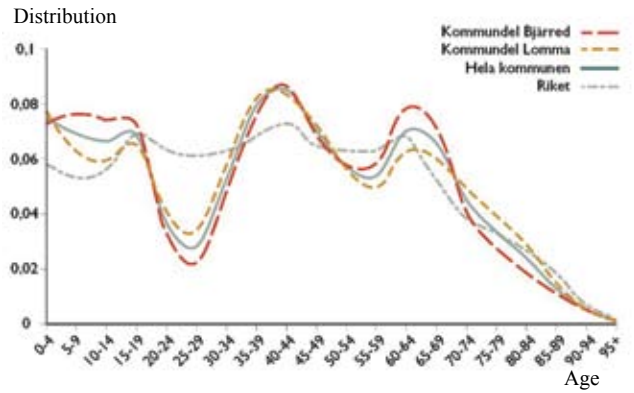


Image 17. Age distribution in Lomma compared to Sweden. Lomma's inhabitant's consist of more small children and less young adults than average.

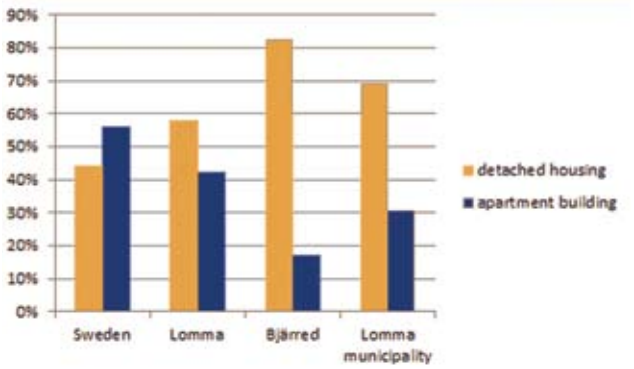


Image 18. Percentage of housing types in Lomma and Sweden. Compared to the national average there is more detached housing and less apartment buildings, especially in Bjärred.

housing Lomma and Bjärred are pretty dense. They are not far from the densities in Helsingborg and Göteborg.[160] Walking in the areas they are perceived as low-scale, but rather high density low scale areas.

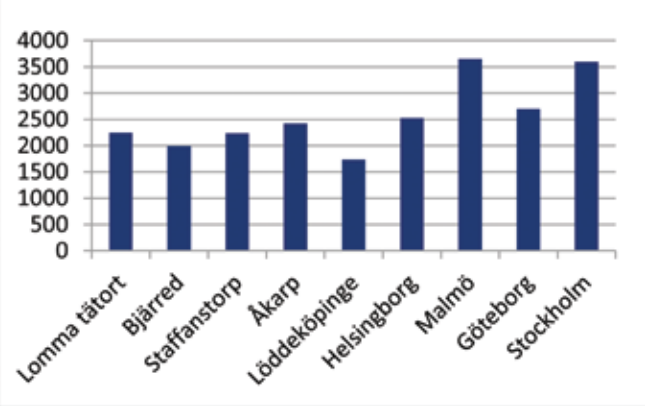
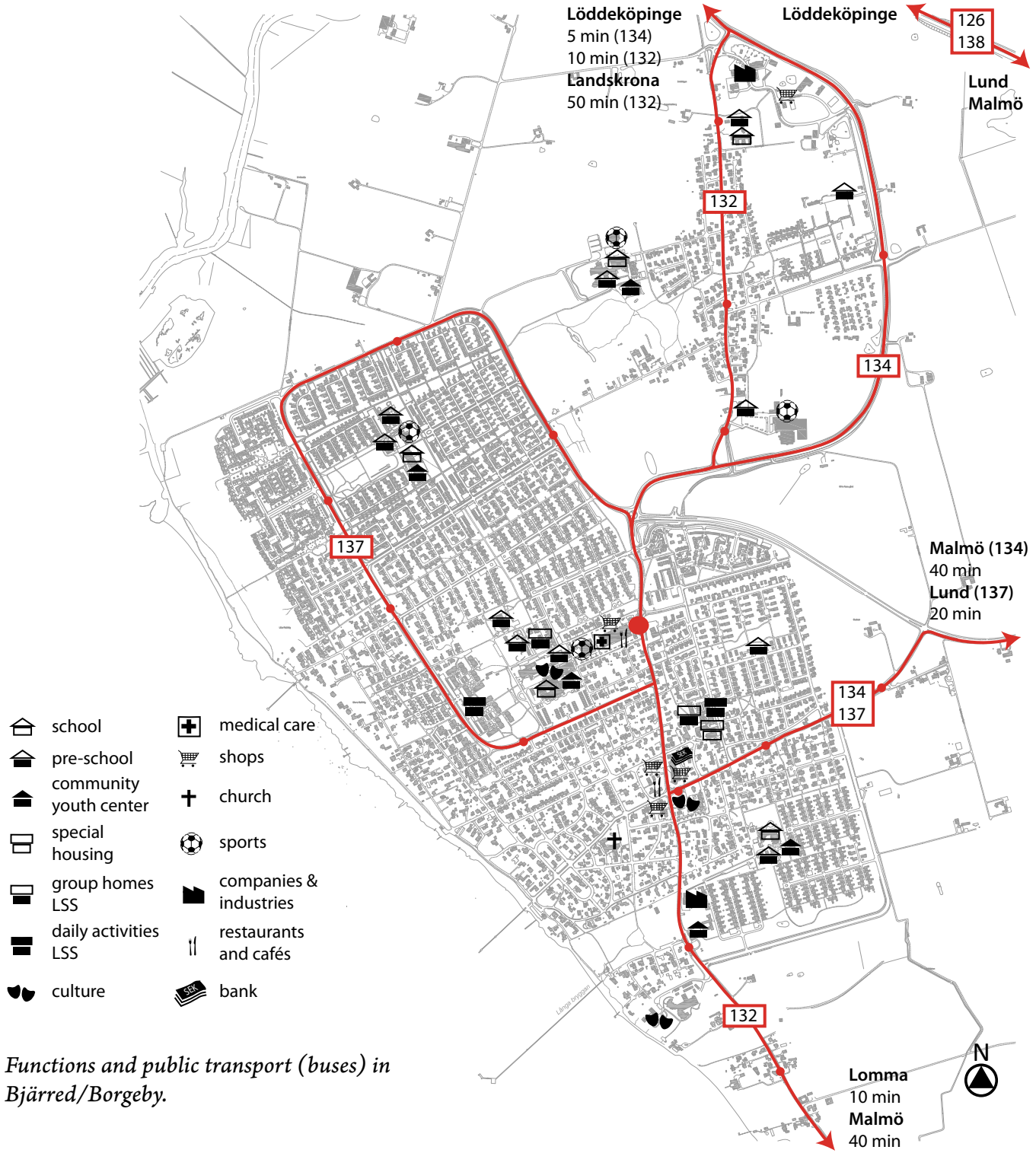


Image 19. Number of inhabitants per square kilometer 31 dec 2010. Considering the high amount of detached housing Lomma and Bjärred are pretty dense.



Functions and public transport (buses) in Bjärred/Borgeby.

SWOT on Bjärred and Borgeby

Strengths	Weaknesses
High natural values (the creeks, Öresund)	Car dependency
Very fertile agricultural land	Lack of public transport
Small municipality = short distances to public and commercial functions	Uneven age structure in population
	Lack of differentiation in housing forms
Large variety of workplaces, educational options etc. in the region	Less and less commercial service
Cultural heritage (brickmaking, bathing resorts)	Lack of work places
Strong and popular sports associations	Uneven in and out commuting levels
Attractive place to live	Small amount of green areas with right of public access
SLU (Swedish University of Agricultural Sciences)	Lack of outdoor meeting places, for example sports facilities
Good bicycle and walking paths in the communities	Dormitory suburb
Communities suited for walking and bicycling (size, flat land)	

Opportunities	Threats
Service- and knowledge based company structure	Regional enlargement
Regional enlargement	Unbalanced in-migration
In-migration	Urbanization
Urbanization	High pressure on the housing market
High pressure on the housing market	High demand for detached housing
Well developed public transport in the region	Lack of cooperation between municipalities
Competition around unbuilt land	Unsustainable large scale farming
	Competition around unbuilt land
	Flood prone area

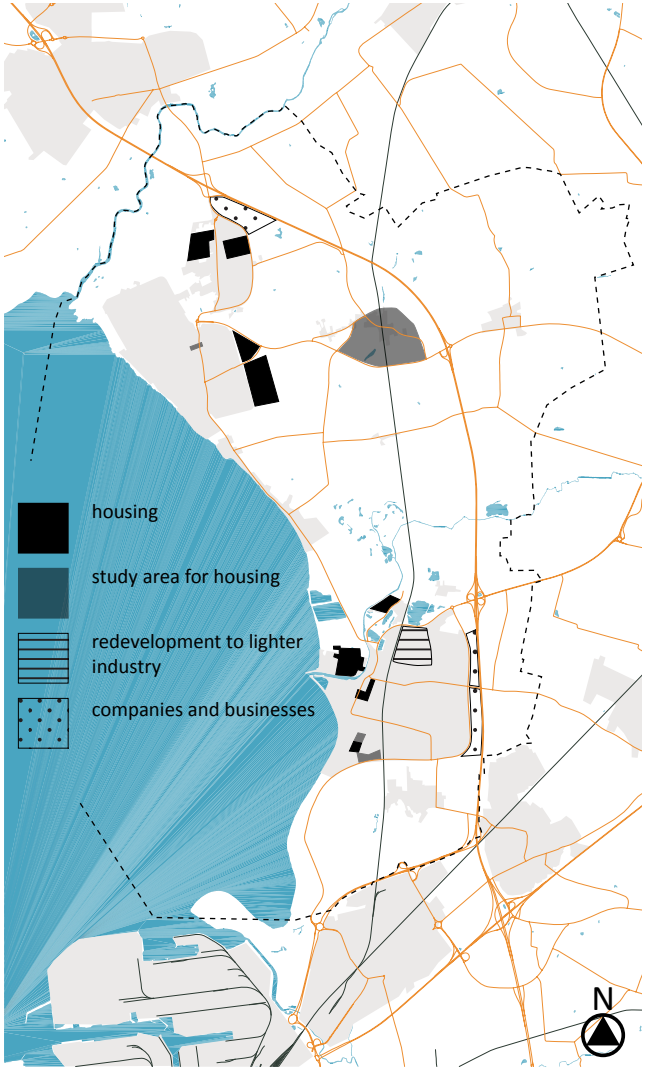


Image 20. Development areas for the coming 10-20 years. Source: Lomma municipality. Scale 1:120 000

Thoughts on Densification in the Municipality

Part of the research was interviewing the local government commissioner, the former and current head of planning about densification in the municipality. They were among other things asked: What is a sustainable densification to you? What do you see as imperative for the realization of a sustainable densification within the municipality? and What kind of densification does Lomma municipality need? The research also involved taking part of a document called *LommaPanelen tycker till om viktiga utvecklingsfrågor i ett översiktsplaneperspektiv.* The document presents the conclusions of a dialogue in LommaPanelen, a citizen panel, which was part of the work connected to the comprehensive plan adopted in 2011. Below is a summary of what the interviewees and panel thought on the issues. The panel's thoughts are presented in *italic*.

Sustainable Densification

- Densification on land with low value
- To compensate the values taken away
- Balance between built up and green structure
- Not to take away values and if you do they should be compensated
- Near public transport and service
- Adapted to the specific place
- Use benefits from location advantages
- Builds on the character, advantages and quality of the community
- Ecologically, economically and socially good

The Most Important Questions for a Sustainable Densification

- Don't think it is possible do densify more than possibly central environments
- Not to take from farming structures or green values
- Balance the built with the natural environments
- Grow with afterthought!
- Building higher buildings
- Parking spaces in the 70ies-areas, can you use them?
- Plots for municipal needs
- The 'compensation-concept'
- Not to destroy environments typical of the communities
- Cooperation with other municipalities
- Protect green values and the low-scale community
- Protect the farmland
- *New areas must be built for all ages*
- *Varied development that creates a more dynamic community*

Densification Needs

- Land for businesses and enterprises
- What happens with houses not needed in the future?

- Combined businesses/enterprises and housing is interesting
- Municipal service needs
- Attractive urban environments in community centers
- *Meeting places outdoors that call for fellowship and community*
- *Sports facilities, indoors and outdoors*
- *Pre-schools*
- *Activities for children and youth*

Densification and Green Structure

- Should not destroy these green values, they create attraction
- Balance the built with the natural environments
- Problematic, how do you solve the compensation?
- The 'compensation-concept'
- *Protect and take better care of green oasis*
- *Some densification can take place where the green areas are not used*

Densification and Travels

- Far too many commute by car
- In a situation where we have to choose between 2 green values (keep the farm land or use it to gain public transport)
- Crucial to Lomma's development
- Trying to reduce the in-migration, can not continue to grow like this
- Works primarily with better buss connections, secondarily with trains
- Vision for Pågatåg and light rail.
- Too little politican pressure to realize Pågatågstrafik
- Cardependant
- *Something have to happen with the public transport to make the inhabitants in Lomma leave the car at home*
- *Some bikeroads end abrupt*

Lommas Ecological Context

The municipality is characterized by its location at the sea and can be described as entailing three zones – the shorezone, the coastal plain and the inland plain. All three are strongly influenced by man and are almost to 100 % cultural landscapes.[161] The landscape is different from most of Sweden because of its geology. The Scandic bedrock ends in the northern part of Skåne and south of that the geological context is more similar to Central Europe with sedimentary rocks. In the Lomma area the bedrock is mainly limestone.[162] It is the same sedimentary rock that was crushed during the last ice age and today forms the fertile boulder clay that is the main characteristic for the area between Lund, Malmö and Helsingborg where Lomma lies.[163]

The area is called the Lund- and Helsingborg plain and is one of 25 characteristic areas in the province Skania. Its main characteristic is the fertile plain with an open

Image 21. The map above shows southwest Skåne and the current land use beige indicates farmland and green forrests. Lomma is indicated with an arrow.

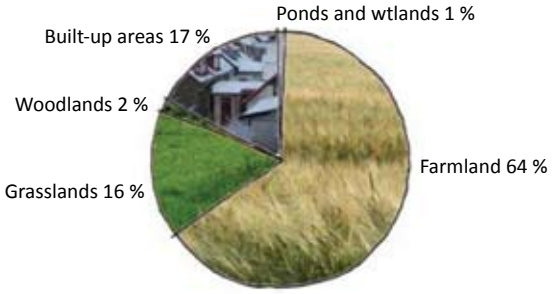


Image 22. The land use in Lomma municipality.

Image 23. Bjärred and Borgeby surrounded by farmland and with the green areas in or close to the communities.

landscape heavily influenced by infrastructure and settlements. It is a typical modern farming landscape with sparsely scattered rather large farms. The main natural values are along the coast and the streams running through the area. The wood cover is highly limited and scattered.[164]

If we take a closer look at Lomma municipality with the example of an aerial shot of Bjärred and Borgeby it gives a clear view of the area. It shows very clearly the surrounding farmlands and also that the green surfaces are situated close or in the settlements. Even though the natural green areas are not many, they often have big nature and culture values.

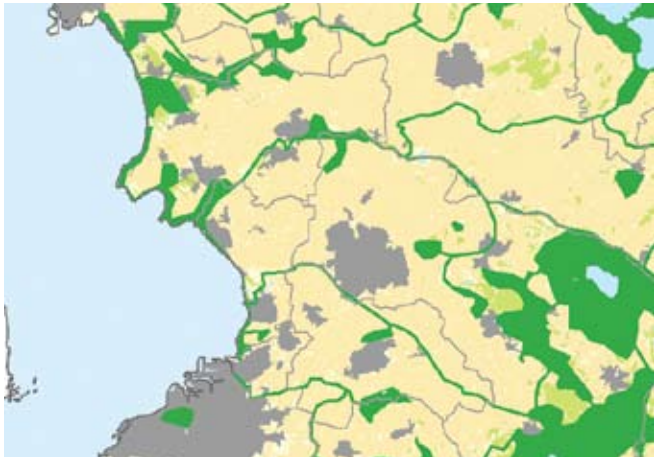


Image 24. Ecological structures in the area marked in green.

The document *Grönstruktur i Skåne – Strategier för en utvecklad grönstruktur* shows the current green structure in the provinse. Above is the map with a close up on Lomma. Here the green values along the coast and streams can clearly be seen.

Image 25. Suggested additions (red) to the existing green structure (green) near Lomma.

The document also presents a view of a future improved structure. For Lommas part is talks about strengthening the existing structures and connecting them through new ones, though the new connections are not within Lomma municipality.

Image 26. Different types of protected and valuable nature as shown by the comprehensive plan.

The closeness of the natural areas to the settlements can be seen on the map of valuable natural areas from the municipality's comprehensive plan. The areas are further specified in the municipality's green plan and the nature types mentioned are coast and shore, woodland and coppice, farmed land, meadows and pastures, disused and derelict land, ponds, streams and wetlands and the marine environment.[165]

Reflections

The area presents a special situation because of the surrounding farmland for two reasons. Firstly because it creates a situation with very little common ground outside the communities for the inhabitants, and secondly because the large scale farming probably has the effect that biodiversity is higher in the urban areas than around them. Of course this combination makes the green areas in the communities very important, both for the inhabitants as recreational areas, an as refuge for animals and plants.

This makes it important not to densify without giving something back to the inhabitants. Use the thinking that you can densify with many things – buildings are one but greenery and recreation opportunities are other. Also, use densification to give the community what it doesn't have and needs, such as apartment buildings or new teaching facilities.

Designing

The first part of the work was to design the process. It was designed to be flexible, but within frames not to drift away during the work. The large frame was set by choosing a framework to work with. That framework was then adapted to the task at hand by developing a stepwise approach with parts both from the framework and traditional architectural methods. These steps were then carried through and developed as the work proceeded.

An Ecosystem Services Approach to find Concepts for Densification

Choosing Framework

As presented in the chapter *The Ecosystem Serivces Approach* there are different frameworks for valuing ecosystem services, such as The Millenium Ecosystem Assessment (MA), Total Economic Value (TEV), Key Biodiversity Areas (KBA), Critica Natural Capital (CNC) and Sustainable Livelihood Approach (SLA). I see that many of the frameworks can contribute in assessing the value of green structure to guide densification. Depending on what stage of the process you are in and what initial research has shown as important characteristics of the ecosystem services in the area you are looking at it can for example be valuable to use SLA to find important stakeholders or TEV to highlight the value of green structure compared to the income gained by developing an area.

That all frameworks can relate to a task within planning seems natural considering that basically all assessments within urban planning deal with both people, economy and ecology as part of the sustainable development vision. Therefore it also seemed natural to choose a general framework as the main framework for this thesis. By starting with a general research and analysis the possibility also exists to, based on the findings, highlight certain aspects, for example by including other frameworks in part of your work. Seeing that the two parts we research regarding ecosystems as a way of guiding densification is the natural habitat and social habitat it also makes sense to choose a socio-ecological perspective as a main frame.

A framework described as both general and concerned with socio-ecological connections is the MA framework. This thesis takes it as a point of departure in creating a process that can use ecosystem services to guide densification.

A division between methods used to develop options and methods used to choose between options can be made. Connected to densification the difference could be described by the difference in asking "Where should we densify?" and "Should we densify or keep the greenery here?" where the latter one is connected to a certain geographical place, like a plot, and the first one is free to develop options in many places. The task of guiding densification foremost needs a method that develops multiple choices, but it can also be followed by a method that chooses between those options. The MA framework can support this.

The Basics of the MA Framework

The MA framework divides ecosystem services into four groups – provisioning, regulating, cultural and supporting services.[1] Provisioning services are products gained from ecosystems such as food, fiber, fuel and fresh water, but also genetic and biochemical resources. Regulating services are gained from the regulating processes going on in different ecosystems such as air quality maintenance, erosion control, water regulation and storm protection. Cultural services are the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences and range from spiritual and religious values on to educational values and sense of place. Cultural services relate to human values and behavior and are bound to differ from place to place and between different cultures. Supporting services are needed for the production of all other ecosystem services. They also differ from the other three categories in that their impacts on people are either indirect or occur over a very long time. They include the production of oxygen, soil formation and water recycling.[2]

The ecosystem services are the basis for the framework and relates to human well-being and drivers of change as can be seen in the picture to the right. The ecosystems and humans are constantly interacting. Changing human conditions both directly and indirectly effect ecosystems and ecosystems affect human conditions. These interactions can take place in different spatial scales and time perspectives.[3]

A more indepth presentation of the MA framework can be found in attachement two.

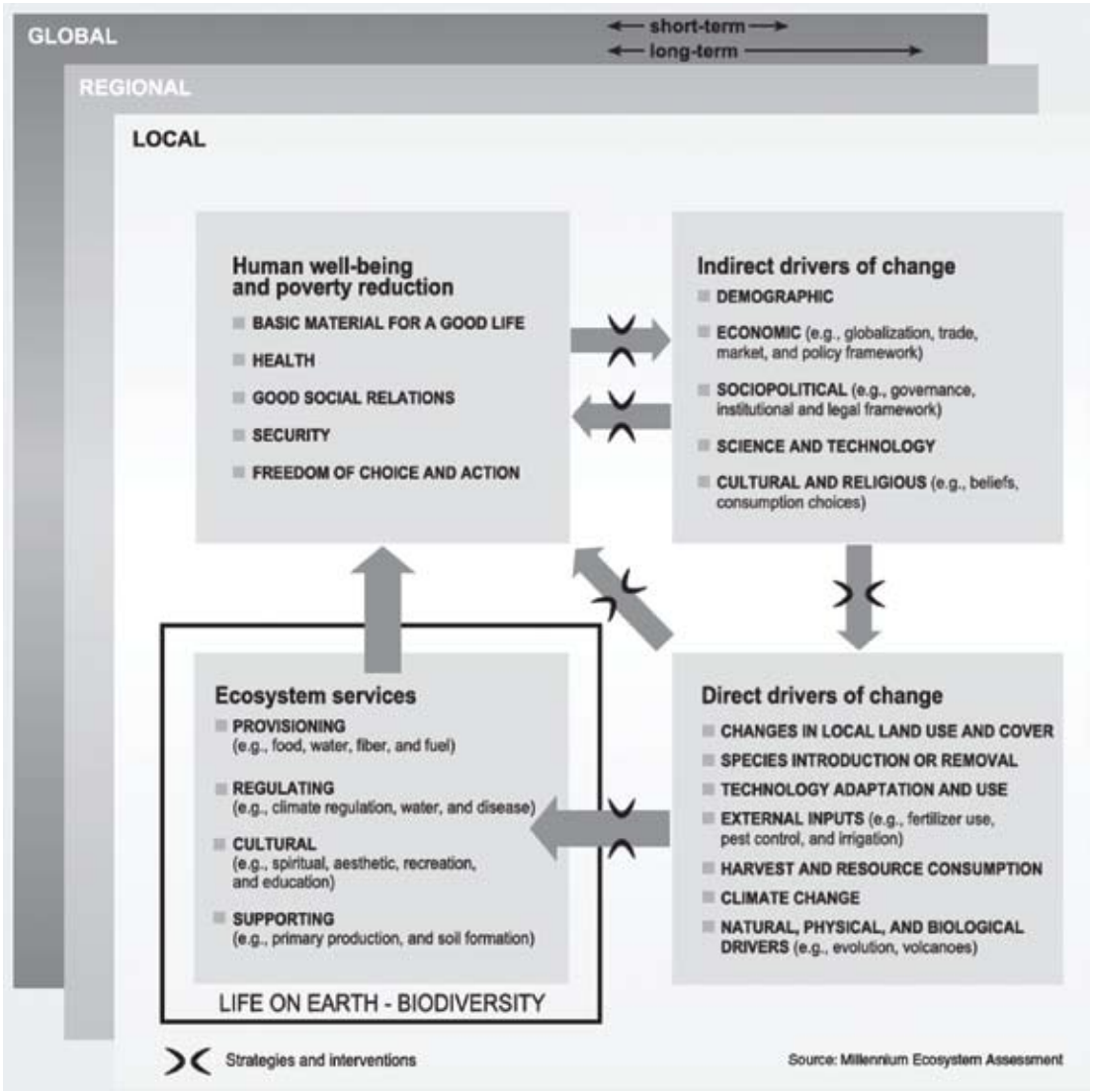


Image 1. The Millennium Ecosystem Assessment Conceptual Framework.

The ecosystem services are supported by biodiversity (lower left corner). They contribute to human well-being (upper left corner).

The ecosystem services are affected by drivers. Indirect drivers such as population (upper right corner) can lead to changes in direct drivers (lower right corner) that effect the ecosystem services. Human well-being is affected by and affect the drivers.

These interactions can take place at different scales - geographical and time scales.

The Analytical Approach of the MA

An MA-assessment is normally performed after the MA analytical approach with nine tasks. They are designed to be suitable to many different disciplines. They are grouped into three stages, indicating that many of the tasks can and probably will be done simultaneously. The first stage entails the tasks that identify ecosystems and their links to services, human well-being and drivers. There is also a task of selecting indicators in this stage that leads into stage number two.

The second stage are tasks that use the indicators and knowledge from stage 1 to assess changes in the ecosystems and their services and how that influence human well-being.

The last stage entails scenario development, that tries to see what could happen to the ecosystems in the long-term future (up to 100 years) and a response options task that analyzes what can be done about it. The last task in group 3 is about analyzing uncertainty and communicating the certainty level by which the different findings can be established. This is seen as important since this field is new and the body of knowledge changes rapidly.[4]

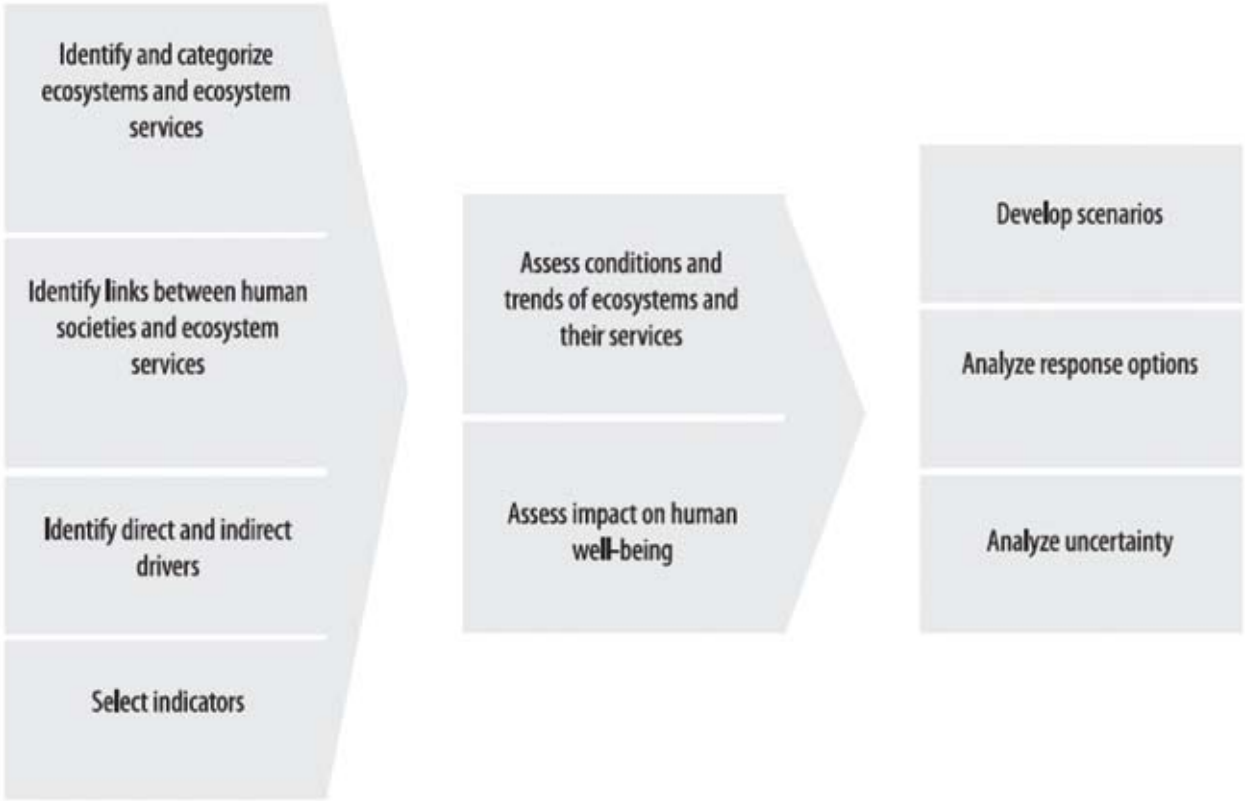


Image 2. The analytical approach of the Millennium Ecosystem Assessment and its main tasks. The nine tasks are divided into three stages. The first stage's main objective is to identify, the second to assess and third to analyze.

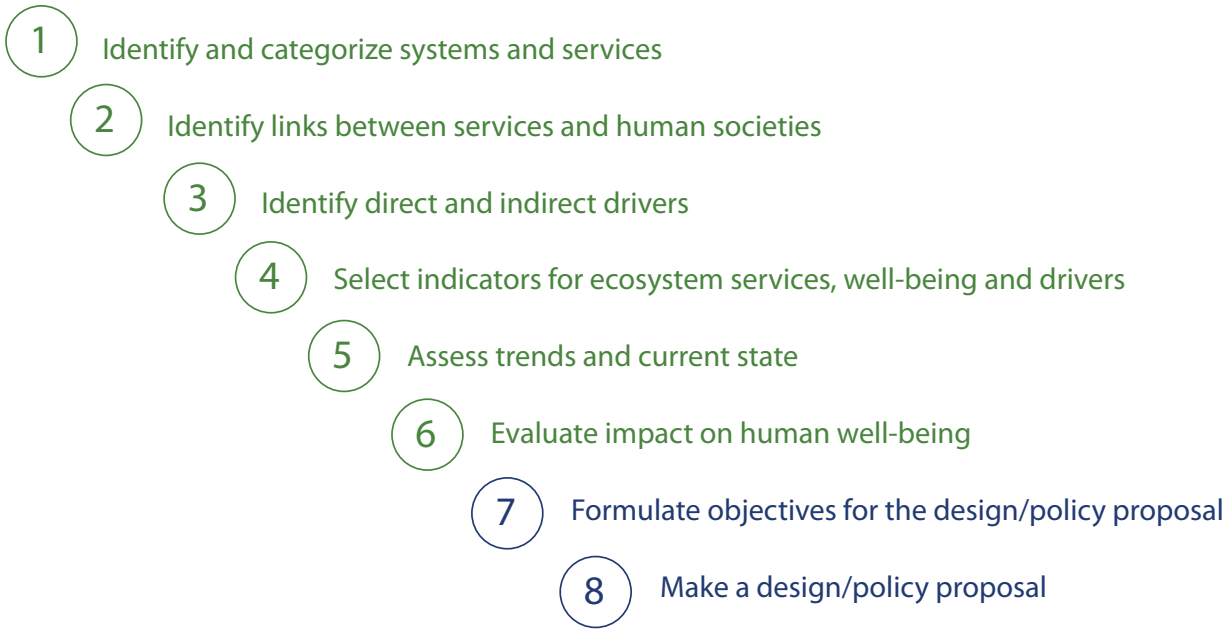
Developing the MA Process to Suit Project Needs

After deciding upon the framework and learning more about it, a schematic picture of assessment steps for the work was made. Inspiration was taken from the MA analytical framework presented above, mainly from the first 6 steps or stage 1 and 2. This was then supplemented with tools from my background within architecture and planning and another two steps were added.

The two steps were *Formulating objectives for the design/policy proposal* and *Make a design/policy proposal*. The last two steps were changed to make the assessment more suitable for a solution-oriented architectural/planning project in the sense that it wishes to find one place-based solution.

Before starting the assessment an initial thought of methods, sources and outcome for each step were written down.

The steps were then carried through and developed as the work proceeded. What you see here is the first sketch version of the process. Each chapter that presents the steps also has reflections on the process. In the concluding discussion you can read a summarizing reflection and an attempt at an improved set of steps.



Assessment steps (initial MA-steps in green and added steps in blue)

Testing

This chapter presents the testing of the process through the different steps. The presentation of each step ends with a reflection.

Assessment

Step 1-6 of the process were about assessing the ecosystem services in the area. It includes identifying and categorizing systems, identifying links between systems, services and human societies, identifying direct and indirect drivers and assessing state and trend of the ecosystem services.

Step 1 - Identify and Categorize Systems

Ecosystems and ecosystem services are clearly related to land-use and surface cover. Therefore one common way to categorize ecosystems has been by land-use.[1] The MA categorizes among others marine systems, inland systems and dryland systems.

Land-use is a process defined by the anthropogenic activities in a given area. The characteristics of vegetation and built structures are what can be seen and interpreted to represent these processes. Different land-uses have different ecological patterns and processes.[2]

Much of what has been done so far in terms of characterizing ecosystems is in a larger scale, international (such as the MA) or on a country scale (for example in the UK). At those scales the urban area is seen a one land-use type and ecosystem in itself. For the task of looking at settlements like Bjärred ad Borgeby and their near surroundings a more detailed and varied categorization is needed. This especially since land-uses are particularly diverse and intensive in urban areas[3].

One categorization method that can be used is urban morphology types (UMTs). The assumption here is that physical properties and human activities define the ecological properties of urban areas. The different UMTs have different characteristics depending on the past and present land-use and are also related to the types used in land-use planning, which enables them to act as a bridge between urban ecology and urban planning. The usual procedure involves mapping through aerial photographs and has been tried for example in Manchester and Munich.[4] The UMTs can then be transformed into different ecosystem types.

The two researchers Boland and Hunhammar at Stockholm University has analysed some of the ecosystem services generated by urban ecosystems and exemplified them with examples from Stockholm. They have identified seven urban ecosystems.[5] In many ways these ecosystems match certain groupings of UMTs in green and blue areas in the categorizations used in Manchester and Munich.

Drawing on these two examples a categorization of UMTs in Bjärred/Borgeby has been performed after which the different UMTs where categorized into a number of ecosystems.
Of course, there was a need for adaptation to the local situation that need other ecological features than Stockholm, Manchester and Munich. Therefore a quick study on Lomma's ecological context was first conducted. This is now presented in chapter five.

Mapping of UMTs

The quick outlook found that a mix of the UMTs used in Manschester and Munich together with some clearifications could work well for Lomma. The mapping was conducted from aerial photographs with help from photos taken during earlier visits to the areas.

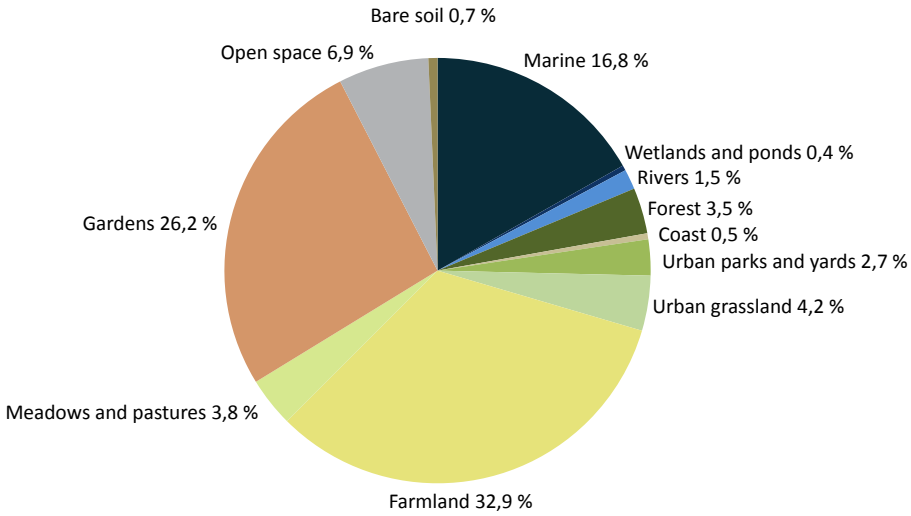
After the mapping was finished the UMTs were grouped into 11 different ecosystems types, drawing on Bolund/Hunhammars types for Stockholm, categorizations in Munich and Manchester as well as the different naturetypes presented in Lomma municipality's comprehensive plan. These are presented on the next page. A table representing the translation from UMTs to ecosystems can be found as an attachment.

- Formal open space
- Lawns
- Lawns with nature like elements
- Sportsfiels
- Churches etc
- Other institutions
- Schools and nurseries
- Arable lands
- Meadows and pastures
- Major roads
- Refuse disposal
- Disused and derelict land
- Mixed uses
- Woodland and coppice
- Lakes and sea
- Rivers streams
- Ponds and storm water treatment
- Wetlands
- Shore
- Town centre
- Retail
- Low density - Villas
- Medium density - Row houses
- High density residential - Multi-storey

Urban morphology types in Bjärred and Borgeby
Scale 1:30 000

Wetlands and ponds
Urban parks and yards
Urban grassland
Rivers
Open space and impervious surfaces
Meadows and pastures
Marine
Gardens
Forest
Farmland
Coast
Bare soil

Ecosystem types in Bjärred and Borgeby
Scale 1:30 000



Percentage of different ecosystems in the area.

Reflections

It took a lot of research to find examples of how categorization of ecosystems in urban areas could be done. The main problem was that most ecosystem litterature is written without reference to cities or with cities seen as one ecosystem. Literature within the field of urban ecology provided the answer. Urban ecology is a relatively new research field and it is recognized that there is a lack of knowledge in many areas of the field. That probably explain the lack of examples of methods. I only found one article that dealth with urban ecological features and its connection to land-use and surface cover. The same article presented the method of working with UMT categorization using aerial photographs.

The method was easy to use and the adaptation of the ecosystems types to Lomma was relatively easy. This mainly because of the new comprehensive plan that presents the most common nature types in the area, types that fitted very well with the other categorizations and UMTs. The nature types from the comprehensive plan provided input into the more natural ecosystems in the area, whereas the more urban ones were derived from the urban ecology field and the Bolund/ Hunhammar article.

Step 2 and 3 - Identify Links Between Services and Human Societies & Identify Direct and Indirect Drivers

The next step was to identify links between the services in these ecosystems and human societies. Drawing on one of KIT Arkitekter's illustrations connected to the Albano project in Stockholm and earlier experience with systems modelling a model for working with and representing the found material was made. Its main purpose was to structure and present material from many different sources. Once the work started it was realized that the sources talked about the links as well as the drivers and processes within the ecosystems simultaneously and step 2 and 3 of the assessment steps flowed into eachother.

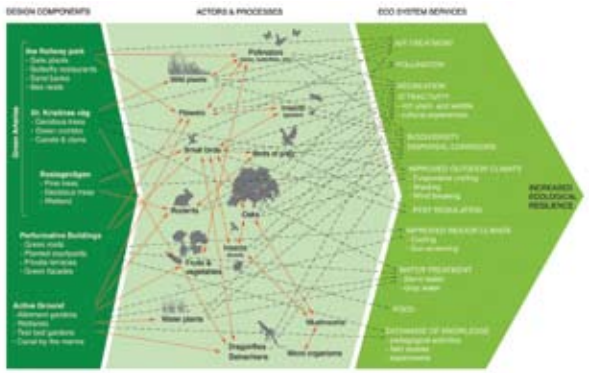
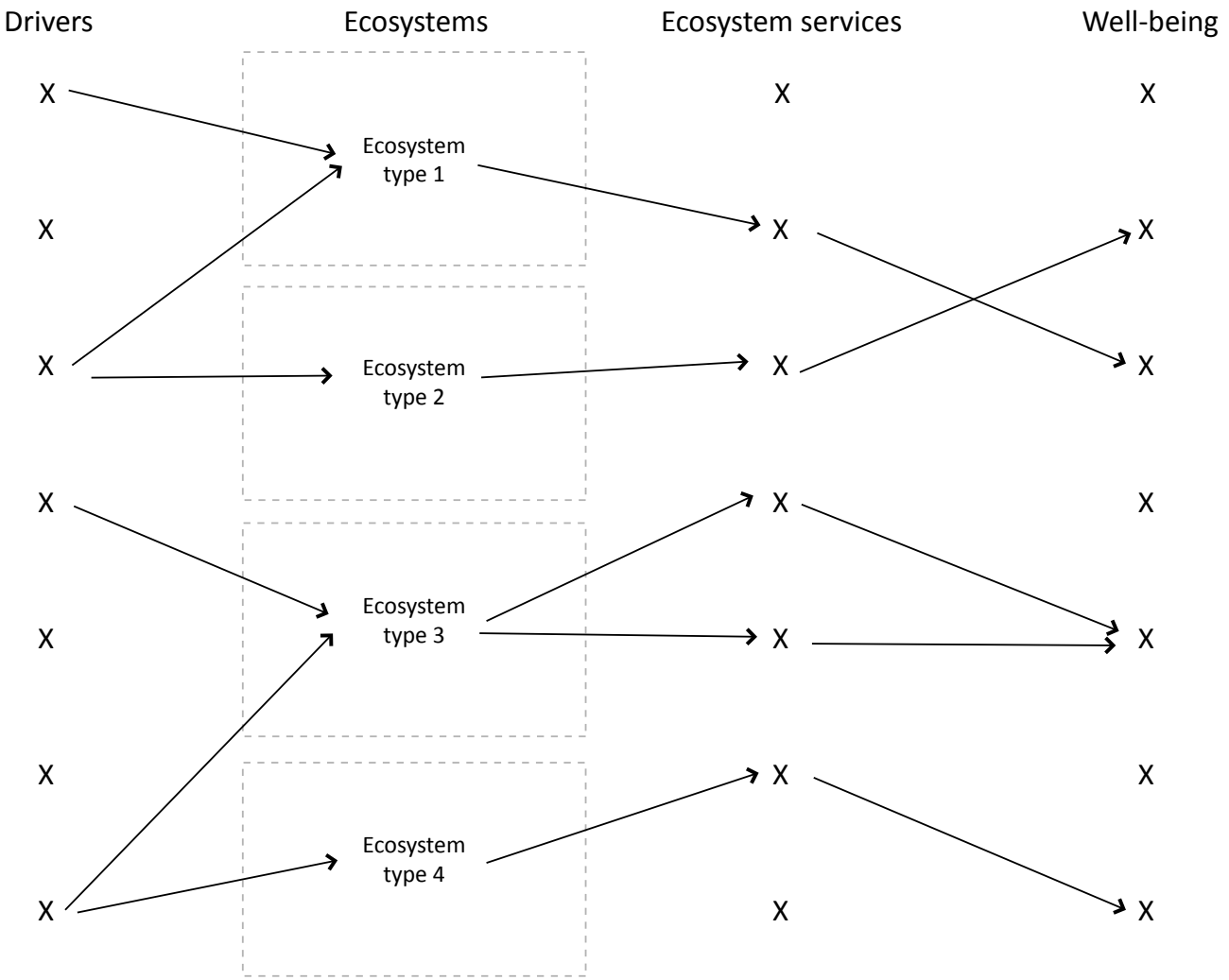


Image 1: The illustration from the Albano Project.



The model used to research the different ecosystems. The drivers to the left affects the different ecosystems. The processes in the ecosystems generate different ecosystem services that provide us with different kinds of well-being.

The Model

The model used incorporates the actors, processes and ecosystem services fields from KIT Arkitekter's illustration. It further adds drivers that influence the actors and processes and well-being that is the outcome of the services. The field with actors and processes is divided into different ecosystems.

The scale of the content in the fields differs. The ecosystem field uses the ecosystems found in step 1 of the assessment and is very local. The other fields entail both local, regional and national content that effect or is effected by the ecosystems.

The work with filling the model out was made one ecosystem at a time. They were then added together in a large illustration showing how they are connected. The information was taken from different soures, mainly written ones. They included:

From Lomma municipality
- *Översiktsplan för Lomma kommun* (The comprehensive plan)
- *Naturmilöprogrammet* (The green plan)

With focus on Skåne:
- *Det skånska landsbygdprogrammet,* The County Administrative Board in Skåne Län
- *Det skånska kulturlandskapet,* Emanuelsson, U. Naturskyddsföreningen in Skåne
- *Från Bjärre till Österlen,* The County Administrative Board in Kristianstad Län
- *Svenska landskap*, Sporrong, U. & Ekstam, U.

With focus on urban ecology and ecosystem services:
- *Växter och djur i stadsnatur*, Florgård, C.
- *Byøkologisk guide,* Munkstrup, N. & Lindberg, J., Dansk byplanaboratorium
- *Ecosystem services in urban areas*, Bolund, P. & Hunhammar, S.
- *Urban ecology*, ed. Niemelä, J & Breutse, J.
- *Applied urban ecology,* ed. Richter, M. & Weiland, U.

There was also a workshop held with municipal civil servants. This ensured that the civil servants was updated on the thesis work and gave a confirmation that the initial thoughts on ecosystem services generated in Bjärred and Borgeby was shared with the civil servants.

There were six civil servants with different background at the workshop. They included the head of planning, the head of the park division, one planner, one planner/landscape architect, one architect and one environmental strategist.

The participants were first given a presentation on ecosystem services. They were then paired into three groups with the task of naming ecosystem services for different ecosystems in the area. To their help they had a presentation from TEEB of the four different ecosystem services groups of the MA and an aerial photo of Bjärred/Borgeby. One group worked with forested areas, one with parks and yards and one with the different water features. The groups were deliberately divided so they were formed of persons with different professional background. The work focused both on ecosystem services provided today and possible services in the future. When the groups were finished they wrote their ecosystem services down, pinned the paper to the wall and presented their findings to the other groups.

Two services were also added that wasn't on the list before - Attraction and Meeting Places. Together the two methods gave a list of around 30 different ecosystem services. They are presented on the next page together with their relation to the different ecosystems.

	Meadows and pastures	Open space/ Impervious surfaces	Rivers	Farmland	Coast	Wetlands and ponds	Urban grass-land	Forests	Urban parks/ Yards/ Gardens	Bare soil	Marine
Air quality maintenance	●					● ● ○		● ● ●	● ○		
Attraction	● ●			● ● ●	● ● ●	● ○ ○		● ● ○	● ● ○		● ● ●
Meeting places		● ○			●	○ ○	● ○		● ○ ○		
Biological diversity	● ● ●	●	● ● ●	● ○	● ●	● ● ●	● ○	● ● ●	● ● ○	● ○	● ● ●
(Living) building material	○						○				
Composting							○		● ○		
Ecological knowledge	●		○	○	○	○ ○ ○	○	● ○ ○	● ○ ○		○ ○
Erosion control			○		● ○ ○						
Tourism	○				● ○						● ○
Rainwater drainage and storage	● ●	○	● ● ●	●		● ● ○	● ○	● ●	● ○ ○	●	● ● ●
Pollination	● ●	○	● ○	○ ○	●	● ●	● ○ ○	● ○	● ● ○		
Biological control		○		○ ○	○	○ ○	○ ○	○	○ ○		
Micro-climate regulation	●		● ●		● ○	● ○ ○		● ○ ○	● ○ ○		●
Carbon sequestration and storage	● ●			● ○	●	● ● ○	● ○	● ● ●	● ● ○	○	
Cultural heritage	● ●		● ●	● ● ●		●		● ●	● ○		
Recreation	● ●		●		● ● ●		● ○	● ● ○	● ○ ○		● ● ○
Aesthetic appreciation and inspiration	● ●		●	● ●	● ●	● ●		● ●	● ○ ○		● ●
Characterizing landscape	● ●		● ●	● ● ●	● ●	○		● ● ●	○		● ● ●
Ornamental resources					●			●	●		
Energy			○	○ ○			○		○		○ ○ ○
Water			○ ○			○					○
Food provision	●		○	● ● ●			○		○ ○		●
Water purification		○				● ○ ○	○ ○		○ ○		
Soil purification		○ ○								○ ○	
Soil formation	● ●						● ○	● ●	● ○		
Qxygen production	●	●		●	●	● ● ○	● ○	● ● ●	● ○ ○		
Nutrient cycling	● ●	○ ○	●	● ○ ○	● ○	● ● ○	● ○	● ● ○	● ○ ○	○	● ●
Water cycling	● ●	○	● ● ●	●		● ● ○	● ○	● ●	● ○ ○	●	● ● ●
Provisioning of habitat	● ● ●	●	● ● ●	● ○	● ●	● ● ●	● ○	● ● ●	● ● ○	● ○	● ● ●

The relationship between the found ecosystem services and the different ecosystems. The dots indicate what ecosystems that produce and could produce each service.

● Produces services today
○ Possible production in the future

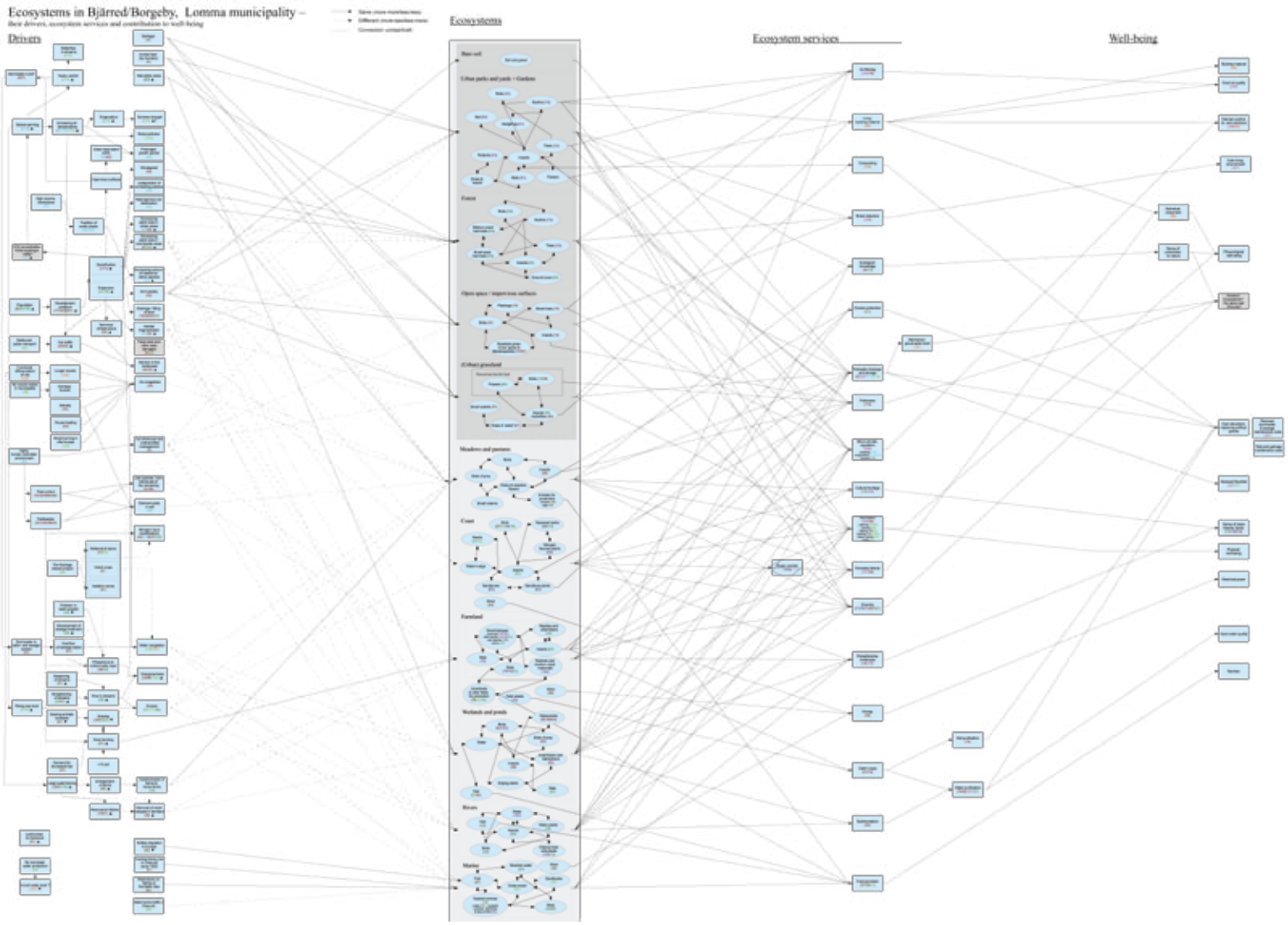
Reflections

The types of ecosystems were revised during these steps when similarities but also differences between UMTs and ecosystems became known. Coast became a separate ecosystem, as well as Urban grassland, when it was discovered that they differentiated too much from Meadows and pastures. On the other hand Urban parks and Yards were combined because of their similarities.

The use of system thinking was a good method to research the connections. It really showed the interconnectedness of drivers, ecosystems and services. At the same time, the system depicted became very complicated and hard to use as a communicative illustration, though you could present it just to show the interconnectedness and complexity. You can see it on the next page.

Partly, this was because of lack of a good computer programme for modeling complex systems. It would be nice with one where you gave the flows, variables and connections and the computer programme generated an 'optimal picture'. Partly, it was also because the system contained soo much information. But I believe that with more time a readable and clearer system could have been reahed without a computer programme too.

City planning as practise is very broad in the sense that it relates to many other subjects and issues. Therefore all types of ecosystem services can be relevant for a planning "problem". The broad result of this step was good and gave an understanding of the possibilities. On the other hand it also ended with a lot of information. It proved impossible to continue working with all services in the next steps considdering my time span and a need to focus the work arose. One could also notice that some of the services were more relevant than others for the task, for example some belonged to other sacles and could not be handled at a community level. The decision was made to move the prioritizing task originally thought for step 7 to before step 4.



The entire, complicated, system. The drivers are to the far left, the different ecosystems from step 1 against the grey background and the generated ecosystem services and well-being follows to the right.

Prioritizing Among the Services

To decide what ecosystem services are important to keep and strengthen in an area can be done by consultants (in this case me) based on planning documents and other knowledge about the area, but it is also an important political question where politicians and civil servants should have their say. In an extended dialogue also citizen, associations and other stakeholders could be involved in the process.

In this case two workshops were conducted – one with civil servants and one with politicians. The participants were all asked the question "What ecosystem services should be prioritized in future planning in Bjärred and Borgeby?". They were then given 12 markings each to put next to those ecosystem services they judged were the most important. Of the 12 markings more than one could be placed on each service if wished. The result was a collective ranking. After the ranking the result was discussed among the group. Since there were two groups the result could also be compared.

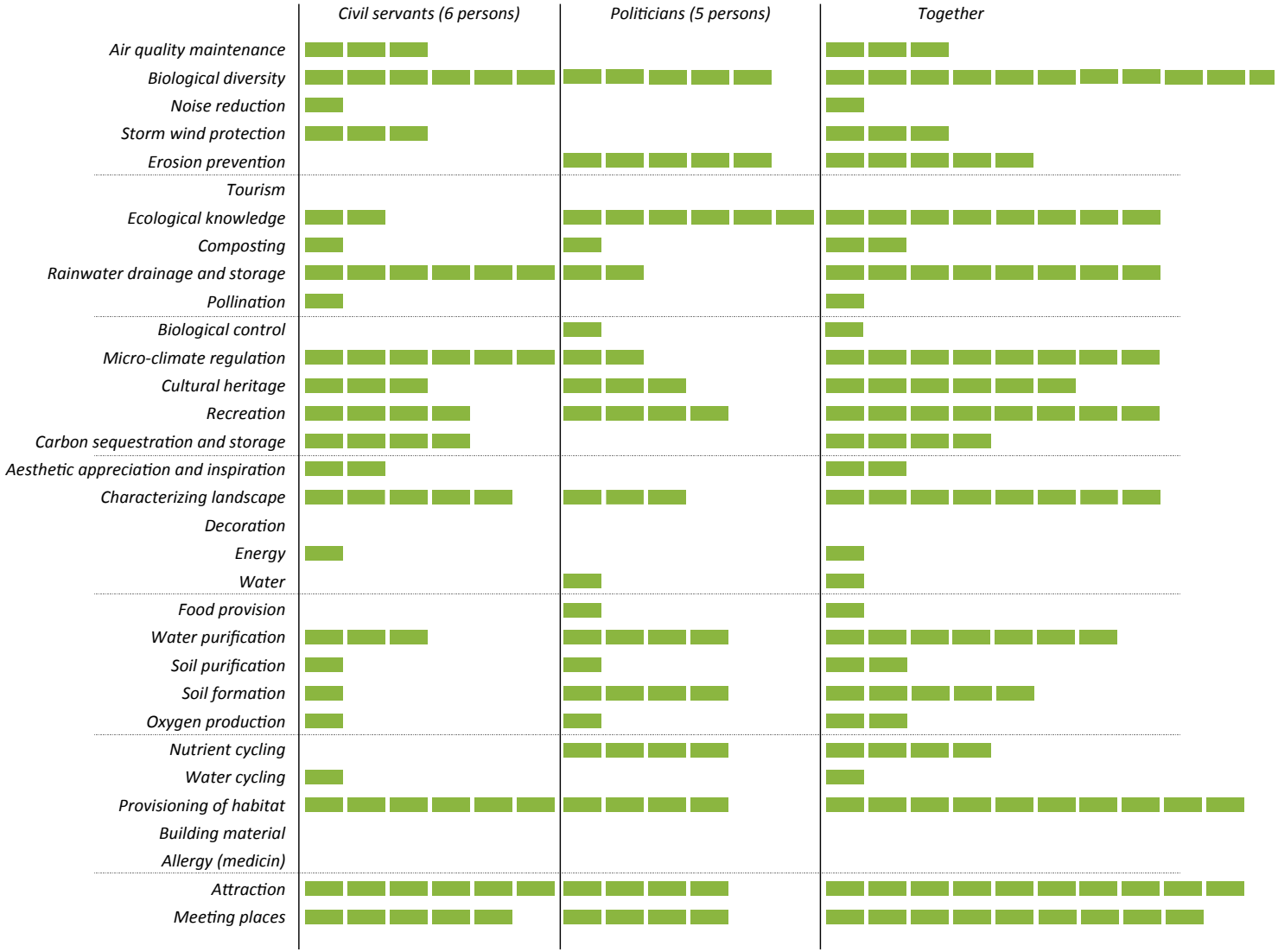
In the first workshop there were six different civil servants with different background. They included the head of planning, the head of the park division, one planner, one planner/landscape architect, one architect and one environmental strategist. In the second workshop five politicians from the municipal board took part.

The result can be seen on the next page. Overall the politicians and civil servants choose the same services as important. Those were Biological diversity and Habitat services, Attraction, Meeting places, Purification of water, Recreation, Cultural heritage and Characterizing landscape. There were also some differences. The civil servants favored Drainage and storage of rain water, Regulation of micro-climate and Storage and binding of carbon dioxide, whereas the politicians favored Erosion control, Ecological knowledge, The natural cycle and Formation of soil.

If you combine the two groups' answers the services Biological diversity and Habitat services, Attraction, Meeting places, Ecological knowledge, Drainage and storage of rainwater, Regulation of micro-climate, Recreation, Characterizing landscape and Cultural heritage and lastly Water purification were deemed the most important to prioritize in the future.

Some of the services picked had a lot in common with one another. The most connected ones were Biological diversity and Habitat, Characterizing landscape and Cultural heritage and Drainage and storage of rain water and Water purification. From the discussions that followed it was clear that Biological diversity and Habitat was seen as prerequisites for all the others services and therefore was placed on top. After them came Attraction and Meeting places that were seen as important for the inhabitants in the municipality –

Civil servants and politicians prioritizing among the services.



The result of the ranking workshop presented as number of dots put next to each service for each group and added together.

both existing and potential. The following ones were in their turn seen as services supporting attraction and meeting places in different ways. Ecological knowledge was also seen as essential to have biological diversity at all, foremost by the politicians.

The focus during the workshops was Bjärred and Borgeby and the participants therefore foremost choose services that were important for the urban area. Ecosystem services belong to different scales, from the very local to the regional and global. Therefore a selection of ecosystem services for the continuing work should not forget to examine what is important in other scales.

In this case the workshops serve as an input for the local scale and investigations were made to see if more services should be added that were more regional or global in their focus. In the judgement special focus was given to the changed climate that can be expected in the future and services that are important for sustenance on a larger scale.

Two services were added – erosion control and pollination. Erosion control is a local and also regional service that can have a big importance in the future with higher water levels. Calculations of sea-level rise show that the Öresund water level can rise with up to 66 centimeter between 2070 and 2100. At high-water levels during storms the expected level is 189 centimeter on a 100 year return time.[6] Bjärred is highly situated to be so close to the sea with all but some houses over 4 meter above sea level, but erosion can still become a problem with the sand, moraine and clay moraine foundations. According to the county administrative board they are usually relatively stable, but in a water-saturated condition landslides can happen, especially in steep areas[7].

Pollination is important for the agricultural areas around Bjärred and Borgeby, which are some of the most fertile lands in Sweden. Many of the crops are dependent on pollination through insects such as bees. Today a lack of natural biotopes generates a lack of pollen- and nectar plants needed for the bees' survival, creating a threat to their health and pollination work[8]. The Swedish Board of Agriculture published a report about the issue in 2009 after worrying reports from USA, Canada and other European countries of big losses of honeybees. They calculated that a loss of 40 % of the Swedish bee colonies could mean a loss of 200-300 million SEK under three years. They further explained that the areas in most need of pollination from bees are Skåne, Östergötland and Västra Götaland.[9]

Biological Diversity

Attraction

Meeting Places

Ecological Knowledge

Drainage and Storage of Rainwater

Regulation of Micro-climate

Recreation

Characterizing Landscape

Water Purification

Cultural Heritage

Pollination

Erosion Control

The selected ecosystem services

Reflections

The workshops were a good way to reconnect to the municipality and worked well as a ranking method. An interest from both civil servants and politicians was experienced and the result from the workshop was asked after. Apart from providing me with information to continue my work it also gave the participants an idea of the concept of ecosystem services that I think was appreciated. As the local government commissioner said: ”Thank you for reminding us of these important questions that are sometimes missed when you talk about development” [author’s translation]. As this is one of the important tasks of this thesis and method it felt good to accomplish some of that during the workshops.

A selection of ecosystem services for the continuing work should not forget to examine what is important in the other scales. In the future that aspect can be added to the workshops.

Step 4-6 Assessing Trends and Current State

The next step was to assess trends and currents state of the chosen ecosystem services in three steps. The steps were highly connected and therefore performed simultaneously.

The are three steps dealing with assessment of ecosystems in the MA is:

4. Select indicators for ecosystem services, well-being and drivers
5. Assess trends and current state
6. Evaluate impact on human well-being

It is supposed to draw mostly on existing information and not generate new primary knowledge, but as we will see, information is not always available. MA differentiates between state and trend where state is a snapshot of its the ecosystem service condition at a given area and at a particular time and trend is an analysis of the change in state over time. An indicator could be connected to the status, causes or outcome of the service. Ideally it meets a number of demands and is policy relevant, scientifically sound, simple to calculate and easy to understand, practical and affordable, sensitive to relevant changes, suitable for aggregation and disaggregation and usable for projections of future scenarios. You can also measure the integrity of the ecosystem, for example by looking at the extent of it, the degree of fragmentation etcetera.

The MA sees well-being as multidimensional and includes conditions other than monetary income. They mainly see it through the definition that poverty is the absence of well-being and for example connect to the Millennium Development Goals for their indicators. The indicators are divided in the groups basic material for a good life, heath, security, good social relations, freedom and choice. I relate it to Maslow's hierarchy of needs.

Step six entails to quantify certain elements of the causal links between ecosystem services and human well-being that has been identified earlier (step 2). This could be followed by an economic valuation of the service, but it is not essential to do so.[10]

As you can see step 4-6 poses a big and rigorous task. During the thesis is was found that lack of information or the time it takes to find it can be a problem, especially when looking for information that has data available for the present and past. Because of this the process was simplified and basically used the indicators it could find information about.

It also chose to concentrate on evaluating the ecosystem services, leaving drivers and human well-being to be known factors, but not assessed in more precise terms. Information was taken both from written sources such as the comprehensive plan, the community analysis of Bjärred/Borgeby and differernt documents by the county administrative board as well as from interviews and workshops with civil servants and politicians in Lomma. Each service is presented in a short text, followed by a section on the status and trend. A summerising picture can be seen in the end.

Biological Diversity

Urban areas are both rich and poor biotopes, depending on what species that are examined. In communities situated on plains, such as Lund, Malmö and also Bjärred and Borgeby the number of plant- and animal species in them is larger than in the surrounding agricultural landscape. In the communities both highly artificial and natural environments exist in comparison with the highly artificial environment around them.

Urban areas also have their special climatic conditions, for example due to the heat generated by hard surfaces and housing. In general, urban areas have a milder climate than the surroundings. Since the farming- and forestry biotopes are impoverished the urban areas might prove an important refuge for threatened species.

Different green areas have different opportunities for diversity. Old city parks can have a rich diversity, often because of their age and the lush layout. Areas from ca 1930-1960 are designed with functionalistic ideas in mind. Before that parks were 'parlors' and now they became 'living rooms'. Landscaped parks were mixed with nature areas and the flowers gave room for bushes and trees, either standing alone or in small groups. In the 1960-1980ies the green area / inhabitant in Swedish cities skyrocketed as norms demanded more space, for greenery as well as for traffic. The industrial building methods meant that large parts of nature were removed during construction of areas to be built up again afterwards. The areas were often designed as big lawns with single trees and edges of bushes with the result of very little variation. In the 80ies and onwards the green spaces became smaller again and the principle of sparing nature and including it in the areas were used again. The spaces were planted with flowers, bushes and trees and variation gets higher and higher in them as time passes. On the downside is that the rather small areas are not connected to each other so well which aggravates the spreading of species.[11]

Land use outside of protected areas and sustainable use of ecosystems are important factors in ecosystem function and the survival of many species.[12]

Many countries signed the convention on biodiversity in 2002 and unified put the goal to significantly reduce the loss of biological diversity until 2010. The EU took one more step and said they would eliminate the loss completely. The goals were not achieved and instead there are warnings that the risk of massive loss of biological diversity has increased.[13] When The International Union for Conservation of Nature updated and analyzed their international red list in 2009 40 % of the investigated species were found to be extinct or endangered.[14]

Status and Trend

For Sweden 16 environmental goals has been put up (*miljömålen*). The 16th is "A rich plant- and animal life" and has three sub targets: halt loss of biological diversity, less share of endangered species and sustainable use. The prognosis for 2020 is that none of them will be met in Skåne. This depends on among other things:

- Many areas with high values are isolated in the landscape
- Pressure due to rationalization and large-scaleness in farming and forestry, development and infrastructure increases
- Lack of biotopes and drainage in the landscape
- Lack of flowering plants due to hard usage of agricultural landscape and infusion of nutrition
- Genetic impoverishment in species[15]

Lomma municipality has worked with something they call 'naturelike plantings' in Bjärred/Borgeby. It is a group of trees and bushes where species that are naturally occuring at the site are chosen. These have been planted in the communities to increase the inhabitants' possibilities of experiencing nature where they live.[16] This should also increase biodiversity, espiecally in the green areas of 70-ies that have little variation.

There are probably more species in Bjärred/Borgeby than in the surrounding areas, but the number of species are probably decreasing both in and around the community.

Attraction

Attraction is a wide service that relate many of the other services that make Bjärred an attractive place to live and be in. Of the chosen services Biological diversity and habitat, Recreation, Characterizing landscape, Cultural heritage, Regulation of micro-climate and Ecological knowledge all contribute to Attraction. It also connects to the chapters Housing qualities, urban environment and Urban life and To densify with quality in chapter four.

Status and Trend

Some of the main attractions connected to the green structure in Bjärred and Borgeby today are:

- The forest like areas. The few trees in Bjärred makes the ones there are much appreciated. The beech forest in the southern part creates an entrance to Bjärred from Lomma and is a big part of Bjärred's identity. It meets the ocean, something that is unusual in Sweden.[17] Other areas with forest are Domedejla, Augustenborg, Plommonskogen and partly Gyllins ängar[18].
- The views. A recent neighbourhood analysis mentions the views over the open agricultural landscape and the sea as an important attraction and part of the areas' identity.
- Green and safe walking- and bicycle paths. The same programme mentions that many of the paths for pedestrians and cyclists run through green areas, creating a nice but also safe way to move about in the neighbourhood.[19]

The expression 'lush Lomma municipality' (*lummiga Lomma kommun*) have been coined to put an emphasis on that a charater with trees and greenery creates attraction.[20]

The 'naturelike plantings' mentioned above has contributed to an increased variation in some green areas and none of the existing attractions connected to green areas are treathened. At the same time many of the green spaces look the same. People also say they miss flowers compared to the situation in Lomma.[21]

Meeting Places

As with Attraction Meeting places is a service that is supported by other services. Of the chosen services Recreation, Cultural heritage, Regulation of micro-climate, Ecological knowledge and Attraction all have a connection to Meeting places. Either they create a good environment where meetings can take place, such as Regulation of micro-climate, or they spawn activities that automatically bring people together, such as Recreation or Ecological knowledge.

Meeting places outdoors are special in the way that they are one of the few non-commersial spaces left in the city where all have access[22].

Status and Trend

A neighbourhood analysis of Bjärred and Borgeby lists the nodes where people meet or important societal functions are. Of the five presented, only one has a clear connection to the outdoors, the sports centre in Borgeby. The other four are – the centre, the civic hall, the community youth centre and the new commerce area in the north of Borgeby.[23] Many citizen feel that the centre needs to be freshened up, mainly the building.[24]

Both citizen and civil servants see a lack of meeting places in Bjärred and Borgeby.[25] The citizens specifically talk about outdoor meeting places when they say that "meeting places outdoors that spawn community and fellowship should be invested in[26]" [author's translation].

Ecological Knowledge

Diversity of biotopes in urban areas also has an important function in our personal development, not least the childrens'. Ecological knowledge or ecological insight is very important as a base for environmental thinking. When more and more children are raised in urban areas and only see nature sporadically this insight diminishes. Therefore, a close by nature is important.[27]

Helen Hasslöf describes the situation in her text Tankar om hållbar utveckling och lärande this way:

"To make informed decisions, both in everyday situations and in politics, requires that we all have a good understanding of what our decisions lead to. Then we can form conscious values that can be put into action. Here the concept of action competence becomes relevant. Action competence involves both factual knowledge, conscious values and the ability to act. To achieve understanding an ability to see connections, analyze and identify conflicts of interest, evaluate different positions and ablility to express oneself are important skills to achieve action competence.[28]" [author's translation].

Through learning about nature in nature you get a better understanding for what you learn, or as Anders Szczepanski expresses it "The direct physical contact with nature- and culture phenomena increases the autenticity in the learning and puts reality into context[29]" [author's translation].

This type of local ecological knowledge can be enhanced through good design of a community's green structure, for both children and adults to enjoy and learn from. It has in some places been noticed and used as an asset in design of school yards. Some schools also use nearby green areas for tutoring[30].

Status and Trend

Today children spend more and more time indoors and there is even something called a 'nature deficit disorder'[31]. The knowledge of biodiversity among adults is also thought to diminish as we move further away from nature. Not many see their gardens as part of a green structure and think about their layout in that aspect. You now see more and more gardens being covered with stone surfaces or turned into big lawns. So also in Bjärred and Borgeby[32].

Lomma municipality works with something called 'Nature bases' for the children in preschools and schools. The main purpose is to provide a closeness to nature for the children, but also to make it easier to have pedagogical classes in nature by making material etcetera ready and available in close connection to the nature bases.[33]

There has also been an increase in huts built by children since the natural plantings were introduced to the green areas.[34]

Drainage and Storage of Rain Water

Drainage and storage of rainwater has become an increasingly important part of planning. It is connected to the ecosystem service of Water purification in many ways, but there is one important difference. Water purification is both about storm water and grey water, whereas this one only concerns storm water.

Two big advantages with local drainage and storage of storm water instead of leading it away is that the groundwater levels are being recharged and therefore can keep the balance easier and that the system can adapt to heavy rainfall easier. With the right design the water can also be used as a resource in urban areas and be purified before reaching the recipient.[35]

Status and Trend

In Skåne the intense farming has led to many streams and wetlands being filled up or straightened[36]. Today there is no storm water in Bjärred or Borgeby that goes directly to the sewage facility, but parts of it go out into the ocean un-cleaned.

The freshwater is not dependent upon the groundwater level since the water is taken from the lake Bolmen. Never the less that might not be a possible option in the future, since there are indications it will become too warm when the mean temperature goes up. The groundwater level in the municipality is ranked as good. At the same time the water infusion is uneven and the farmers are building water dams on the fields to compensate for that.

The municipality is right now preparing a new water- and sewage plan that will address potential drinking water supply. Since 1992 there has been a programme to establish wetlands in the municipality, but mainly on the countryside. Bjärred has one stormwater pond, Borgeby has four.

There is a stream in a culvert in the eastern parts of Bjärred and there are plans of lifting it to the surface again and then transforming it to slow the water speed.[37]

Regulation of Micro-Climate

Plants' contribution to regulation of micro climate include for example regulation of sun/shade, natural ventilation/leeward, temperature regulation and reduction of noise pollution. Greenery helps reduce temperatures through evapotranspiration of water, trees and bushes can protect from noise, wind and cold and the sun gives warmth. In northern areas reduction of wind speed and optimal use of the sun is very important.[38]

Urban climate differs somewhat from the surrounding landscape because the city structure affects the meteorological conditions. The main differences are in air temperatures and wind speeds near street level. The conditions created are often very localized and differs within the community. On average, temperatures in cities are warmer than the surrounding countryside due to a number of reasons. Givoni mentions some:

- Differences in the overall net radiation balance between the urban area and the surrounding open country
- Storage of solar energy in the mass of the buildings in the city during the daytime hours and its release during the night hours
- Concentrated heat generation by the activities taking place in the urban area year-round
- Lower evaporation from soil and vegetation in the urban built-up area as compared with an "open" rural area
- Seasonal heat sources: heating of the buildings in the winter etcetera[39]

The main conditions affecting the wind are the regional wind and temperature differences between denser built-up areas and the surrounding countryside that can generate an airflow towards the centre.[40]

Status and Trend

Skåne's climate is one of the warmest in Sweden and because of the open landscape also quite windy[41]. This has brought about a tradition of avenues in the agricultural landscape to prevent soil erosion by the wind.

The wind in the Bjärred/Borgeby area comes mainly from the north[42]. In the commuity the beech trees at the north and south entrances to Bjärred functions as wind breaks.

The 'naturelike plantings' are also a way to create a better micro-climate. They contribute with leeward sides, a more even temperature and makes the air cleaner.[43]

Recreation

The green structure in cities gives different opportunities for relaxation and recreation. The closeness to green areas is important for the use of the areas and Boverket has put up a limit of 300 meters from housing, schools and preschools for daily use[44].

Status and Trend

In Lomma municipality there is a very limited area of green commons/person compared to Skåne and the rest of Sweden. Each inhabitant have 0,025 hectares or 250 m2, compared to 0,47 in Skåne and 4,6 in Sweden. This makes availability and quality of the areas even more important.[45] In Bjärred and Borgeby many live in villas and have their own gardens. The public areas range from the natural to the more artificial and well-kept. The most popular areas for recreation are the beach walk, Gyllins ängar and Domedejla[46].

During the last years densification has taken place in some places in Bjärred and Borgeby as well as extensions of the communities out into the farmland. The quality of the green areas has increased due to the nature like plantings during the same time. The beach walk has opened and become a very popular recreational track.

Characterizing Landscape

Characterizing landscape is a service closely connected to the identity and attraction of a place.

Status and Trend

In Bjärred and Lomma it is strongly connected to a visual quality of living in the community. The main part people think about is the agricultural landscape and the sea with clear views and openness.[47] For Bjärred's part it is also about the beech forest in the southern part that creates a landmark and entrance to Bjärred from Lomma and is a big part of Bjärred's identity. In the northern parts of Bjärred, by the roundabout at Fjelievägen, is naturlike plantings with for example beech that in the future will create a similar character from the north[48].

The expression 'lush Lomma municipality' (*lummiga Lomma kommun*) have been coined to put an emphasis on that a charater with many trees and greenery in the communities should be kept and developed.[49]

There are no imediate threats towards the views, openness or tree entrances seen today.

Water Purification

Water purification is usually done by filtering the water through vegetation or the ground. There are three different types of purification that can be accomplished - particles in the water can be filtered out, organic substances can be degraded and so can nitrogen pollution. These demand different situations to work.[50]

It is possible to use water purification in the landscape for both storm water and wastewater treatment. Basically the concept makes use of the physical, chemical and biological processes in nature (the same we resemble in a conventional wastewater treatment plant) to purify the water and there are many different methods.[51] Today it is mainly used for storm water.

Status and trend

In Lomma there has been construction of wetlands as buffers between the farmland and streams since 1992, though these are mainly situated in the countryside.

Open water was earlier often seen as dangerous in a community and an example of the outcome is Trollsjödammarna. They used to be located near the see, but was filled in when people complained of mosquitos and drowning risk.

Today, no storm water from Bjärred/Borgeby goes to the municipal waste water treatment plant, but some of it goes unpurified into the sea. There are some examples of storm water ponds in the communities. The wastewater goes to the treatment plant where it is purified and realeased into Lödde å. The remaining sludge is spread on farm land.[52]

Within the scope of the deepened comprehensive plan for Bjärred and Borgeby there are thoughts of opening up a culverted stream in eastern Bjärred and slow the speed of the water flow.[53]

Cultural Heritage

The service is linked to green areas that in one way or another have a connection to cultural and historical events in the area. The areas give identity to the community, is a part of the attraction to the place and signals belonging to the inhabitants. Compared to Characterizing landscape this is usually smaller things.

Status and Trend

The cultural heritage links in Bjärred and Borgeby's green structure consists mainly of the old gardens and nurseries/orchards, the two-three areas with older and higher trees that are significantly different from the surrounding landscape and the green areas associated to the SCAFT-planning principle of the 70ies.

Old gardens and nurseries/orchards exist for example east of Norra Villavägen (garden), Löddesnäsparken (garden), Alfredshällsparken (nursery), Bundys park (nursery) and Plommonskogen (garden)[54]. The main areas with older trees are Bjerreds Saltsjöbad and Löddesnäsparken where the trees in the old spa park respective farm garden has been allowed to grow old[55]. Beech trees are especially associated with entrances to Bjärred[56]. Areas that are the result of the 70ies SCAFT-planning principle can be seen in many places, perhaps most clearly in northern Bjärred and the area around the centre and Bjärehovsparken[57].

The green plan mentions development of Bjerreds Saltsjöbad that connects to the old function and a development of the northern beech entrance to match the southern[58]. The cultural programme recommends the development of a programme for how to treat the vegetation in the SCAFT-areas[59].

Pollination

Pollination is vital for the growth of much of our food. FAO[60] (The Food and Agriculture Organisation of the United Nations) estimate that from the ca 100 crops that supply the world with 90 % of all food as much as 71 % needs pollination[61]. The bumble bee is considered a more effective pollinator than the bee, but there are larger numbers of bees. One bee community could have the same number of individuals as 160 bumble bee families.[62] The farming of crops that demand or benefit the most from pollination is located in the "flat countries" of Sweden – Skåne, Östergötland and Västra Götaland. They are also areas where there is often a lack of pollen and nectar.[63]

Pollination is further not only a question of getting a harvest or not. It is also about the quality of the harvest (see image 2 to the right)[64].

Status and Trend

In general, pollinating insects are getting more scarse in both numbers and species. The main reason is changes in the landscape and a more intense farming, but also insecticides, climate change and new vermin play a role.[65]

There are around 40 species of bumble bees in Sweden. Of them 15 are common in the agricultural landscape. The last 50 years have seen a large drop in the number of bumble bees, especially in the "flat countries". Some species of bumble bees are now even on the red list for endangered species.[66]

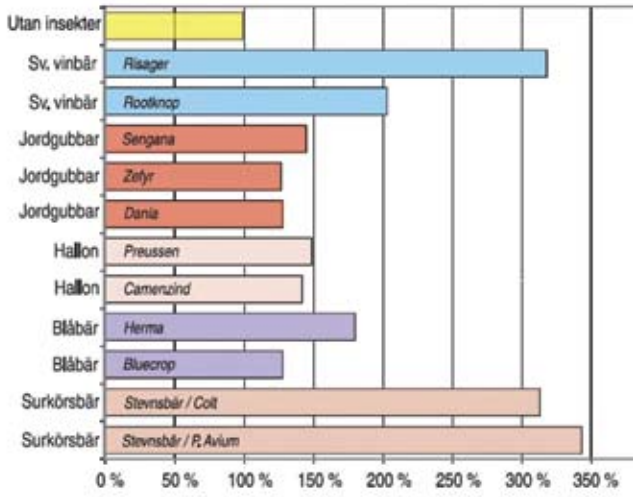


Image 2. The importance of insects for harvest size. The image shows percentage of harvest size for different berries with pollinators present compared to a harvest without present pollinators (yellow).

Bees in the world die partly because of winter losses and partly because of Colony Collapse Disorder (CCD), a relatively new phenomenon. CCD is not confirmed to exist in Sweden, but symptoms have been registered in other countries, including Denmark. The winter of 2002/2003 Sweden registered one of the biggest winter losses ever and since then they have been big during 5 of the 8 years. A special kind of mite with associated viruses are thought to be the main causes of bee death, but also stress, deceases, feeding shortage and pesticides could have influence.[67]

Jordbruksverket has calculated the value of pollination of commercial crops in Sweden to 189-235 million SEK (calculated on the product price prior to refinement). They further say that a loss of 40 % of the Swedish bee communities could mean a 200-300 million SEK loss of income during three years.[68]

Erosion Control

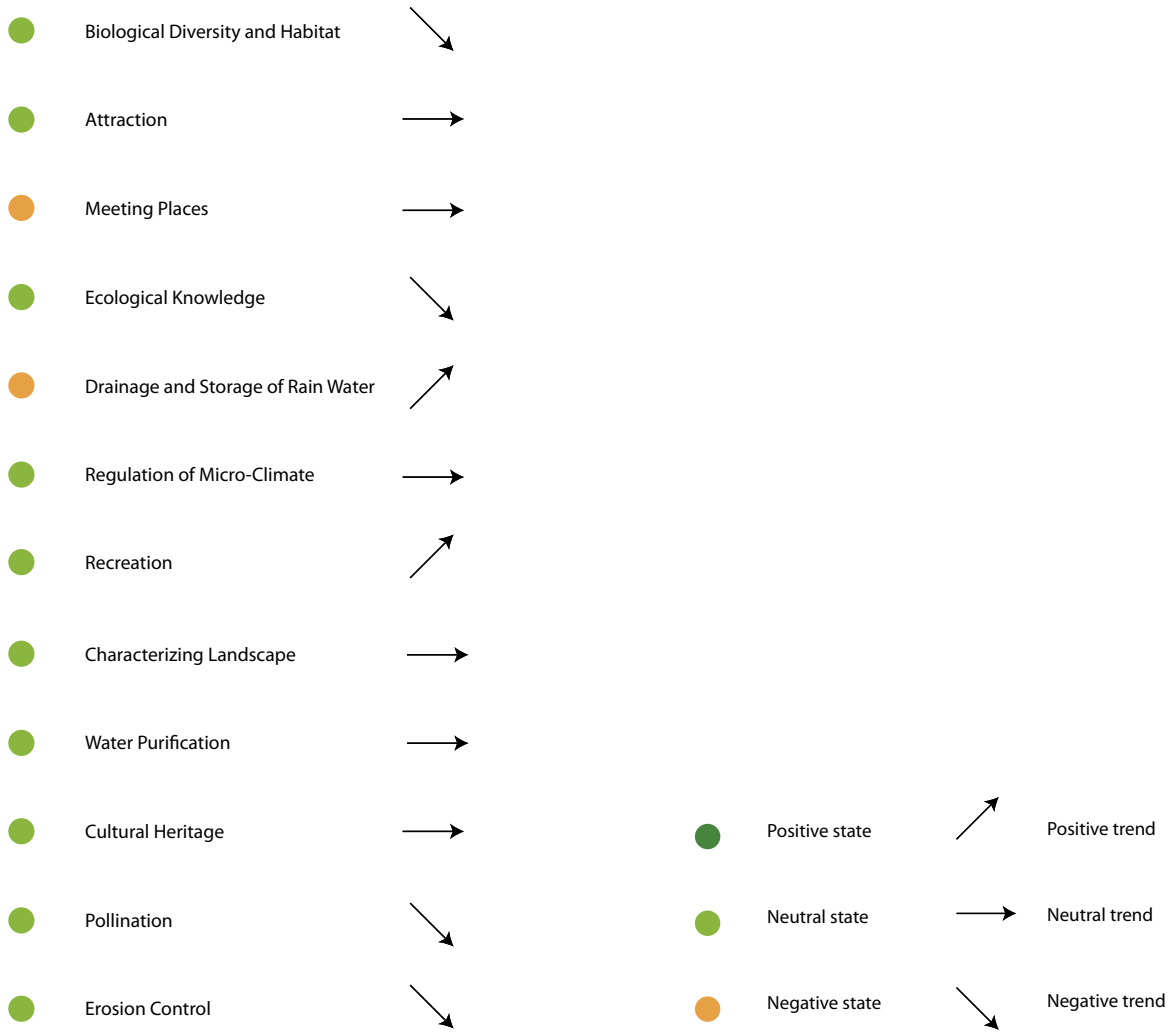
Erosion is defined as "abrasion and sculpting of bedrock and soil cover by the action of waves, flowing water, wind or ice[69]" [author's translation]. It is a natural process, constantly ongoing. Wave erosion is caused mainly from wind waves, but can also be cause by for example shipping traffic. Wind erosion is more limited in Sweden but occur in areas without vegetation cover, for example sandy beaches, dunes and farmland.

Shore erosion is the process that leads to loss of material from the beach and the near beach seabed. It is caused mainly by high water level, waves and currents.[70]

A huge part of Europe's inhabitants live and work near the coasts. The population in the near coast municipalities has increased greatly the last decades and huge investments have been made in infrastructure, housing etcetera near the coasts. This has turned the natural phenomenon of erosion into a growing problem.[71]

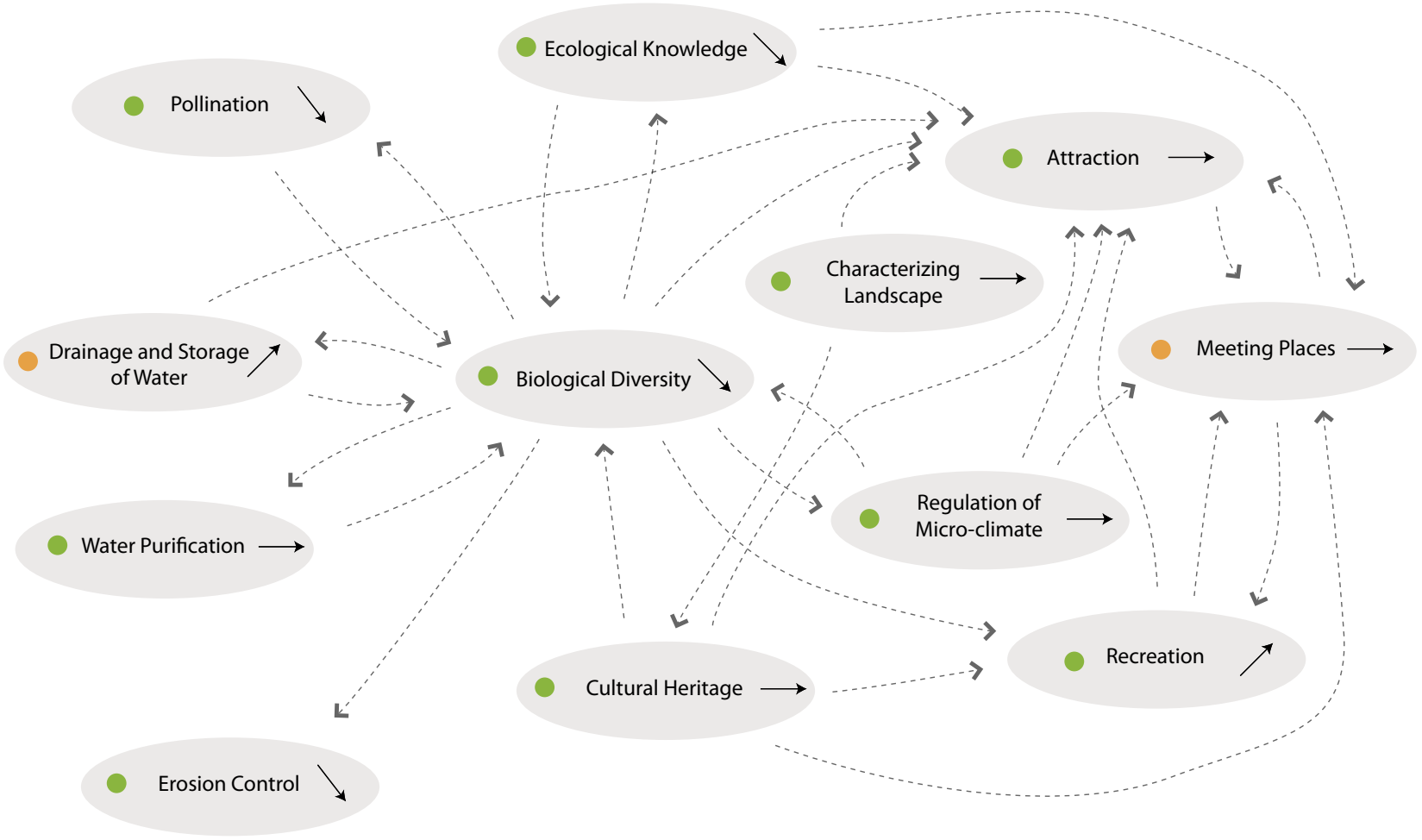
Status and Trend

Erosion is affected by factors of the nature and climate, and with a now changing climate the factors change. Sea level rise together with changes in wave- and wind conditions affect erosion.[72] A rising sea-level means that earlier unaffected beach areas will be reached by the water. Further, stronger winds will generate larger waves and transport more silt. It is also predicted the number of extreme weather events such as storms will increase.[73] Areas in Sweden that are especially vulnerable to erosion along shorelines are Skåne, Halland, Öland and Gotland.[74]



Summarizing picture of the probable status and trends of the different ecosystem services in the area .

How Do the Services Affect Each Other?



This picture shows how the services are connected to each other. The connectedness creates a win-win or lose-lose situation since what happends with one service effect many others.

The picture also shows how clearly meeting places and attraction depend on the other services and that biological diversity supports and are supported by many other services.

Reflections

During these steps it was easier to judge the trend than the status. Most sources talked about the trend from a 'relative to what we have'-perspective, leaving status mostly out of the picture.

Since there is sometimes a lack of local information that is simply not in written sources, the workshop with the civil servants was excellent. It gave a lot of information that I couldn't have found anywhere else, such as about the nature bases. If there is time a workshop should be help with inhabitants as well.

It worked fairly well to use the information at hand. It was pretty easy to find and even though it presented a large variaton of 'indicators' on the well-being of the services, it gave an overall picture. Therefore, I think it's ok for the purpose of the research to use what you can find.

I also think it was ok not to assess well-being and drivers. Well-being is very hard to measure in a globally connected area such as Bjärred/Borgeby since the connections between local ecosystems and well-being are mixed with connections between the inhabitants and ecosystems in other places. For example, the food come from so many places that it is hard to measure food availablity and connect it to the local site. Similarly, it is hard to look at physical well-being and connect it only to local recreation options in the green structure. To know the connections established step 2 seem sufficient for the task at hand.

When it comes to the drivers they were mentioned in some cases in the assessment as background information for each service and the connections were with me from the research in step 2. It worked quite good to take the drivers into step 7 and use them to develop solutions on how to strengthen the services without assessing them. Also, assessing all of the drivers would be unnessesary since only a few can be affected by design of green areas and densification. The others belong in other implementation areas, in the municipal administration and elsewhere. If the assessment is only done with the design of a green plan/deepend comprehensive plan in mind I believe it is enough to assess the services themselves.

Possibly it might be a good idea to assess both drivers and well-being if the assessment is done to provide information to multiple areas in the municipal work and administration.

Guidelines with Idea Bank

The seventh step in the assessment dealt with formulating guidelines for the design proposal. Guidelines were developed both for the chosen ecosystem services and densification in general.

The guidelines were formulated from an overarching goal of a sustainable development in ecological, social and economic terms, with a focus on issues connected to the ecosystem services. The topics for guidelines concerning densification was taken from the earlier outlook into what issues that are important to discuss connected to densification.

It is the first step in establishing what could be a good green structure in the area, defined as a green structure that keeps and develops the chosen ecosystem services for the future. This will feed in to this thesis's line of thought: *What is a good green structure? > How does that effect densification? > Adjustment/Adaptation.*

The guidelines builds on the information collected in earlier steps and were developed through reading different texts, earlier experiences and projects. The different services also support each other as was showed earlier.

The guidelines should be seen as a toolbox to be used when planning and contains a number of guidelines to strengthen each service together with examples of suitable deisgn components. It is not fixed but could and should be updated as new examples and good practise is developed.

The coloured dots connected to each guideline indicate to what scale it belongs - comprehensive (ÖP/FÖP) or detailed (DP/site development). Still, work on the comprehensive scale must have a thought on how the connection to the DP level-guidelines will be made and vice versa. The comprehensive level is marked in orange and the detailed in green. A filled in point means a lot of involvement, a framed point some involvement.

Guidelines for the Ecosystem Services

Biodiversity

Increase the variation
Expand the concept of greenery
Provide food producers
Provide water
Design for ecological memory
Diversify the management
Make information available

Increase the variation

Increased variation of everything from ground cover to type of plants and degree of natural or artificial plantings is good for biodiversity.

- Greenery of different age
- Variation of climatic conditions
- Variation in ground cover
- Differentiation in contoll (“tidyness”) of environments
- Traditional/native plants in contrast to the non-traditional in the gardens, for example through ‘naturelike plantings’
- Both pine- and decidious forrest

Expand the concept of greenery

This is about integrating the greenery in urban design, not only in parks but everywhere. Greenery can be vertical as well as horizontal and exist in all types of places.

- Both tidy and un-tidy environments
- Performative borders - f.e. sidewalk gardens, biological fences
- Green buildings/constructions - green roofs (extensive and intensive), green walls, pergolas, espaliers
- Include greenery in other functions, f.e. sitting
- Use the roofs as parks, farming areas etcetera
- Invite plants and animals to use buildings
- Green links - roadsides, railway tracks, green areas, water corridors

A park and walkway that is also a roof. The Floriade, Venlo.

Provide food producers

Animals are dependent upon food and shelter. To attract them to an area plants that produce food like berries and flowers are good.

For examples see the Pollination heading.

Provide water

Both open and covered water expand the possibilities for a number of species greatly in an area. Combine it with protective vegetation for the best result.

- Water corridors
- Include water storage and purification features in urban setting *For examples see the Water storage and water purification heading*

Design for ecological memory

Ecological memory increases the ecosystems ability to renew itself. It depends on three points; access to support areas, biological legacy and mobile links. Access to support areas can be established through creation of green links between similar areas.

- Green links - roadsides, railway tracks, green areas, water corridors
- Nature friendly crossings (underpasses, overpasses etcetera)
- Diversified ecosystems, connect the ecosystems patches belonging to a type there is little of

Diversify the management

To increase variation a diversification of management is needed. Both protection, maintenance and development is needed.

- Differentiation in contoll ("tidyness") of environments
- Differentiation in management actors (municipality, property owners, associations, citizen, students etcetera) "sidewalk landscapeing permit", summer jobs for youth

Image 3. A tree canopy bridge constructed of rope for arboreal mammals.

Make information available

Make people aware of the biological diversity around them and it's preconditions in different ways. This way they get a better understanding and can support the efforts in their actions.

- Information signs
- Web site, social forums
- Community maps (edible fruit here, all green areas etcetera)
- Events for the community or special interest groups: Bioblitz, workplaces' health maintenance, nature guides, Bjärred day, school activities with parents and children, nature school (naturbaser), festivals ex dark-sky festival, farmer's market
- Information to households "Welcome to Bjärred/ Borgeby - these are our green areas"
- Community nature centre
- Community nature guides that give walks, talks etcetera
- Showcase ecosystem services in public green areas

Image 4. A bioblitz is an intense and short period of biological surveying done by scientists, naturalists and volunteers.

Attraction

Increase the variation
Expand the concept of greenery
Give places identity
Provide posibilities for citizen influence
Provide easy accessibility
Diversify the management
Make information available
Provide beautiful surroundings

Increase the variation

A variation of outdoor places and vegetation provide visitors with different experiences.

For examples see the Biodiveristy heading.

Expand the concept of greenery

By integrating the greenery in urban design, not only in traditional ways but innovatively, new, existing and beautiful environments can be created all over the area.

For examples see the Biodiveristy heading.

Give places identity

Keep and enhance places of importance for the areas identity. Name places of importance.

- Use traditional plants
- Information signs
- Community maps
- Name places
- Use places' historic past in the present development (f.e. orchards in Bjärred/Borgeby)
- Use plants that are connected to the community identity (e.g. beech trees in Bjärred/Borgby)

Image 5. Orchards have earlier existed in many areas of the communities and the traces are still visible. These can be used and developed to help build the identity and beauty of the place.

Provide possibilities for citizen influence

Give inhabitants in the area possibility to affect their environment and contribute to the development of the green areas.

- Differentiation in management actors (municipality, property owners, associations, citizen, students etcetera) "sidewalk landscaping permit", summer jobs for youth
- Polls to decide on special development proposals
- Include in development work

Image 6 & 7. Before and after a sidewalk landscaping permit in San Fransisco. The sidewalk landscaping permit gives inhabitants the right to design, plant and take care of a piece of sidewalk.

Provide easy accessibility

Places of interest should be easy to find and reach. This demands good locations and design and connects to "Make information available"

For examples see the "Make information available" suggestions under the Biodiversity heading and "Provide every-day connection to nature" under the Ecological knowledge heading.

Diversify the management

A diversification of management increases variation.

For examples see the Biodiveristy heading.

Make information available

Make people aware of the different places in the area through signs, events and other.

For examples see the Biodiveristy heading.

Provide beautiful surroundings

An aesthetically pleasing environment is always nice to be in.

- Variation and beauty in greenery including: Variety in ground cover, traditional/native plants in contrast to the non-traditional in the gardens, green buildings/constructions, green roofs (extensive and intensive), green walls, pergolas, espaliers, flowerbeds in row, avenues, solitary trees, green links - roadsides, railway tracks, green areas, water corridors
- Art and decoration together with greenery including: Fountains, water stairs etcetera

Meeting Places

Provide including meeting places
Provide easy accessibility
Build meeting places on common interests
Make information available
Provide for a variety of activities in the same places

Provide including meeting places

Meeting places should be open for everyone. By integrating different functions people with different background meet.

For examples see the "Build meetingpaces on common interest" suggestions.

Provide easy accessibility

Meeting places should be easy to find and reach. This demands good locations and design and connects to "Make information available"

For examples see the "Make information available" suggestions under the Biodiversity heading and "Provide every-day connection to nature" under the Ecological knowledge heading.

Build meeting places on common interests

A meeting place builds on a common interest such as sports, nature, farming and culture or a common location such as a junction or node.

- Greenhouse
- Events for the commuity or special interest groups: Bioblitz, workplaces' health maintenance, nature guides, Bjärred day, school activities with parents and children, nature school (naturbaser), festivals ex dark-sky festival, farmer's market
- Community nature center

Image 8. A community nature center could be a meeting place for schools and other groups as well as inhabitants and provide interesting knowledge about the nature in the area.

- Connect current meetingplaces to the outdoors (outdoor eating, strolling, gathering) schools, shopping center etcetera
- Scouterna, 4H, fältbiologerna, friluftsfrämjandet
- Schools, elderly care, special workforce
- Community nature guides that give walks, talks

etcetera
- Build meetingplaces around showcasing of ecosystem services

Make information available

Make people aware of the different events and meeting places in the area through signs and other.

For examples see the Biodiveristy heading.

Provide for a variety of activities in the same places

Direct and provide possibilities for necessary, optional and social activities in the same places.

For examples of activities see the "build meeting places on common interests" under the Meeting places heading and "Make information available" under the Biological diveristy heading.

Ecological Knowledge

Invite institutions/associations to use green areas
Provide an every-day connection to nature
Provide easy accessibility
Make information available

Invite institutions/associations to use green areas

By inviting institutions such as schools, day care centers, elderly care and interest groups to use the green areas for activities they can spread knowledge both to their members and others.

- Differentiation in management actors (municipality, property owners, associations, citizen, students etcetera) "sidewalk landscapeing permit", summer jobs for youth
- Learning outdoors - Use nature in school pedagogics "educational storyboards"
- Connect current meetingplaces to the outdoors (outdoor eating, strolling, gathering) schools, shopping center etcetera
- Examples of institutions and associatoins: schools, elderly care, special workforce, the scouts, 4H, fältbiologerna, friluftsfrämjandet

Provide an every-day connection to nature

By increasing the number of impressions people get from nature in their daily life knowledge and appreciation for nature will increase. Impressions include bird song, pouring water and beautiful flowerbeds.

Image 9. Learning outdoors in any subject brings both children and adults closer to nature.

- Differentiation in management actors (municipality, property owners, associations, citizen, students etcetera) "sidewalk landscapeing permit", summer jobs for youth
- Information signs
- Community maps
- Nature equipment libraries
- Practical exercises (schools, associations etcetera, connects to differentiation in management)
- Engage people's senses (smelling, hearing, tasting, seeing, feeling)
- Learning outdoors - Use nature in school pedagogics "educational storyboards"

- Walking school bus
- Community camping area/tree house/viewing platform
- Community nature center
- Community natureguides that give walks, talks etcetera
- Showcase ecosystem services in public areas
- Edible parks
- Walking Actions Groups and Bicycle Users Groups

Provide easy accessibility

Meeting places and sites connected to ecological knowledge should be easy to find and reach. This demands good locations and design and connects to "Make information available"

For examples see the "Make information available" suggestions under the Biodiversity heading and "Provide every-day connection to nature" under the Ecological knowledge heading.

Make information available

Make people aware of the different sites, events and meeting places in the area through signs and other. Provide information on the ecosystems, ecosystem services and our connection to nature.

For examples see the Biodiveristy heading.

Image 10. Community nature guides that give walks on different themes are a popular way to get together and experience nature.

Image 11. A walking school bus is a group of children walking to school with one or more adults. It's a safe, fun and healthy way to get the children to school where they can also experience nature.

Drainage and Storage of Rainwater & Water purification

Store and treat water close to the source	●●
Lift storm water channels to the surface	●●
Slow and fast water speed	●
Integrate in urban environment	●●
Use a variety of tretment metods	●○
Re-use water and aim for cloased loops	○●

Store and treat water close to the source

Storage and treatment of water as close to the source as possible eases the pressure downstream. Think in terms of source control, onsite control, slow transport and downstream control in that order.

- Source control: infiltration on lawns, permeable pavings, rain gardens, local ponds, vegetated roofs
- Onsite control: permeable pavings, green filter stiprs, rain gardens, surfaces for temporary flooding, ponds
- Slow transport: Swales, ditches, creeks, canals
- Downstream control: Ponds, lakes, wetlands

Lift storm water channels to the surface

Lifting the channels to the surface enables on surface treatment by plants or ground and increases awareness of water issues among inhabitants.

For examples of surface layouts see "Store and treat water close to the source", especially under "Slow transport" and "Onsite control".

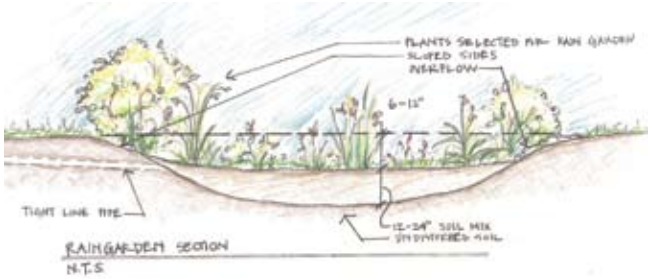


Image 12: A raingarden section.

Slow and fast water speed

An alternate fast and slow water speed takes care of different pollutions in the water.

- For faster water speed (that mixes water with oxygen) use hight differences for water falls, water steps etcetera. If no hight differences exist you can use pumps to create fountains and such.

  For slow water speed see "Slow transport" under "Store and treat water close to the source"

Integrate in urban environment

Integration can create aesthetically pleasing environments and save space

- Use greenery on buildings to store and treat water
- Integrate storage and treatment in green houses

  For examples of surface layouts, see "Store and treat water close to the source" and "Slow and fast water speed".

Water elements can provide a beautiful and artistic addition to the urban environment. The Floride, Venlo.

Use a variety of treatment methods

By adapting the treatment methods after location and using different types understanding of possibilities increase.

For exampeles see "Store and treat water close to the source" and "Slow and fast water speed".

Re-use water and aim for closed loops

Storing and treating water on site connected to re-use of water effectively eases the pressure on the system downstream.

- Water harvesting
- Reuse of grey water, for example for irrigation

Recreation

Provide a variety of functions ●○
Provide easy accesibility ○●
Make information available ●

Provide a variety of functions

Provide possibilities for different types of recreation. Physical exercise, contemplation and meeting places are all needed.

For exampeles of functions see "Make information available" under the Biodiversity heading, "Provide possibilities for citizen influence" under the Attraction heading, "Provide an every-day connection to nature" under the Ecological knowledge heading and "Build meeting places on common interest" under the Meeting places heading.

The beach walk is an important and popular recreational area in Bjärred/Borgeby.

Provide easy accessibility

Meeting places and sites connected to recreation should be easy to find and reach. This demands good locations and design and connects to "Make information available"

For examples see the "Make information available" suggestions under the Biodiversity heading and "Provide every-day connection to nature" under the Ecological knowledge heading.

Make information available

Make people aware of the different sites, events and meeting places in the area through signs and other.

For examples see the Biodiveristy heading.

Characterizing Landscape

Keep and develop tree-entrances
Keep view out int o the surrounding landscape
Rediscover and highlight traditional landscapes

Keep and develop tree-entrances

The beech trees at the northern and southern entrance to Bjärred are a part of the community's identity.

- Beech trees
- Trees as entrances
- Avenues

The beeches at Bjärred's southern entrance is a characterizing element that signals 'home' for the inhabitants.

Keep view out into the surrounding landscape

Central to the attractivity of Bjärred is the view out into the surrounding landscape.

- Landscape museums

Rediscover and highlight traditional landscapes

"Landscape museums" over areas typical for development in Bjärred could be created to strengthen identity and spread knowledge.

- Orchards

For more examples see Keep and develop tree-entrances and Keep view out into the surrounding landscape above.

Cultural Heritage

Give places identity
Rediscover and highlight traditional landscapes
Make information available

Give places identity

Keep and enhance places of importance for the areas identity. Name places of importance.

See the Attraction heading

Rediscover and highlight traditional landscapes

"Landscape museums" over areas typical for development in Bjärred could be created to strengthen identity and spread knowledge.

See the Characterizing landscape heading

Make information available

Make people aware of the different sites, events and meeting places in the area through signs and other.

See the Biodiversity heading

Regulation of Micro-climate

Use trees and greenery as wind, sound and dust protection
Provide wintergreen plants
Provide sunny, protected spots

Use trees and greenery as wind, sound and dust protection

Planting trees and greenery in strategic positions will provide wind protection and collect dust.

- Trees and avenues
- Biological fences
- Leeward plantations
- Green buildings/constructions - green roofs (extensive and intensive), green walls, pergolas, espaliers
- Air cleaning plants

Image 13. Pergolas and espaliers are one way of providing leeward sites.

Image 14. Air cleaning plants can be places both inside buildings and at sites in the community with a high level of pollution.

Provide wintergreen plants

To give wind protection in the winter, wintergreen plants are good.

- Use both pine forrest and decidious forrest
- Ivy etcetera

Provide sunny, protected spots

In the early spring and late autumn sunny and leeward places provide a nice micro-climate.

- Green houses

For more examples see "Use trees and greeney as wind, sound and dust protection" above

Image 15: Greenhouses are a good wat of providing sheltered and wintergreen spots in our climate. Backagården outside Ystad.

Erosion Control

Provide vegetation

Provide vegetation

Vegetation through trees or lower plants keeps the sand in place.

- Traditional and native plants (to contrast the non-traditional and foreign in the gardens)
- On land and in water f.e. grass wrack

Image 16: Grass wrack

Pollination

Provide navigation patterns
Expand the concept of greenery
Provide food producers
Provide water
Leeward nesting sites

Provide navigation patterns

Bumble bees orient themselves after borders, lines and single objects. Flowers in a row are a good line object. It can for example be used to draw them out into the agricultural surroundings.

- Flowerbeds in row, could be color coded
- Avenues
- Solitary trees
- Along green links - railway banks, roadsides etcetera

Expand the concept of greenery

Integrating the greenery in urban design, not only in parks but everywhere, supports the bees and bumble bees.

For examples see the Biodiveristy heading.

Provide food producers

To attract and support bees and bumble bees it is important with food from the early spring to the late autumn. Both nectar and pollen is needed in different rounds.

- Edible parks, for animals as well as humans

- Good plants for bees: willow, sallow, red clover, white colver, borad bean, birdsfoot trefoil, phacelia, raspberries, roses, comfrey, blue-weed, lupin, red and black currants, bluebottle, scabish, catch-fly, self-heal, common toadflax, hyssop, bay willow, dead nettle, lingonberry, blueberry, bitter-vetch, tufted vetch.
- Good trees: mountain ash, swedish whitebeam, hawthorn, guelder rose, black thorn, beech, hornbeam, oak, rose-hip, hazel, appel tree, cherry tree

Provide water

Both open and covered water expand the possibilities for a number of species greatly in an area. Combine it with protective vegetation for the best result. It should be at least within 300 m of the nest.

See the Biodiveristy heading.

Leeward nesting sites

Bees and bumble bees need leeward nesting sites.

- Huts with the entrance to the south or protected by greenery
- Railways embankments

Image 17: A beautiful bee nest.

Guidelines for Densification

Transport/travel

Shorten distance between different functions
Provide soft transport
Give priority and serviceto pedestriands, cyclists and public transport
Accessibility
Provide safety for pedestriands and cyclists
Provide fast “commuter” bike tracks

Shorten distance between different functions

A mix of functions in different places shortens the distance one needs to travel. Work for a continuous service level in Bjärred.

Provide soft transport

Increase the possibility to go by bus and train, but also by foot and bicycle. The systems should be run on renewable energy.

Give priority and service to pedestrians, cyclists and public transport

In areas where soft transport and cars meet, the soft transport should be prioritized. Service such as air pumps should be provided to cyclists.

Accessibility

The accessibility to public transport stops should be good both geographically and physically. Densification should be near stops. Routes should be named for easy identification.

Provide safety for pedestrians and cyclists

Pedestrians and cyclists should feel safe in the traffic and at public transport stops.

Provide fast “commuter” bike tracks

Special bike tracks between Bjärred and Lund and Bjärred and Lomma could be implemented.

Image 18: The Cycle Super Highway in London, a fast commuter bike track.

Housing Qualities

Provide service
Provide public, semi-public, semi-private and private environments
Provide a mix of housing sizes, building typologies and tenure form
Provide safety an activity through active street floors
Test new typologies

Provide service

By localizing the service to good locations at junctions or hubs a good level can be maintained.

Provide public, semi-public, semi-private and private environments

The more collective forms of living can be developed through more areas that are semi-public and semi-private as a compliment to the many private and public areas of today.

Provide a mix of housing sizes, building typologies and tenure form

By mixing up the types of houses, housing sizes and tenure forms in Bjärred the amount of people able to stay in the area would increase. An example is that elderly that don't want to stay in their house will have an opportunity to stay because they can rent an apartment.

Provide safety an activity through active street floors

An open and street centred design of the public functions would vitalize and add safety to the outdoor areas.

A good example of an active ground floor in Bjärred.

Test new typologies

Work could be started to find new typologies of housing that combines the advantages with countryside or suburban living with higher densities.

Urban Environment

Densify according to character
Keep heritage layer

Densify according to character

There is a need for higher density, but height and size of buildings should also be adapted to the character at the site. Soul and scale of the community.

Keep heritage layer

Highlight historic parts and events in the community's history and keep a layer of historic buildings.

Bjärred and Borgeby's heritage layer include many buildings from the 70ies and the seaside resort period.

Urban Life

Provide a mix of functions
Densify for multiple use
Provide active street floors
Provide public, semi-public, semi-private and priate environments
Provide a mix of housing sizes, building typologies and tenure form
Provide a variety of activities in the same places

Provide a mix of functions

A mix of functions would attract different groups of people during different hours of the day.

Densify for multiple use

Densification could be carried out in a way that enables different uses of the buildings during the day/week. An example is a school that could be rented out to organizations in the evening.

Provide active street floors

An open and street centred design of the public functions would vitalize and add safety to the outdoor areas.

Provide public, semi-public, semi-private and private environments

The more collective forms of living can be developed through more areas that are semi-public and semi-private as a compliment to the many private and public areas of today.

Provide a mix of housing sizes, building typologies and tenure form

By mixing up the types of houses, housing sizes and tenure forms in Bjärred different people would be drawn to the area and create a diversified mix.

Providing a mix of housing sizes, typologies and tenure forms in Bjärred and Borgeby among other things means to provide more apartments.

Provide for a variety of activities in the same places

Direct and provide possibilities for necessary, optional and social activities in the same places to spawn action and liveliness.

Technical Systems

Use existing systems if environmentally friendly
Flexibility
Renewable energy sources
Produce energy
Aim for closed loops
Effective ventilation
Use as much daylight as possible in new productions
Smart lighting systems

Use existing systems if environmentally friendly

If the existing systems are environmentally friendly densification opens up for collective use with cost savings. If the system is not environmentally friendly it can be used in a transition period, but there should be a plan for how to replace it.

Flexibility

By building so that building systems or functions in the building can be changed later on flexibility could be provided.

Renewable energy sources

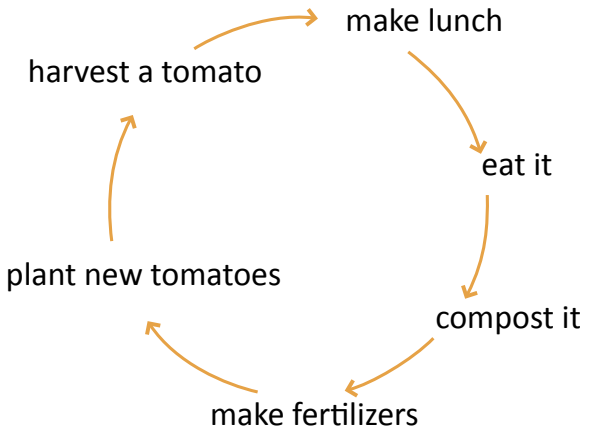
New buildings should use renewable energy sources.

Produce energy

If possible new buildings should produce energy.

Aim for closed loops

Waste and water resources should be in resource loops where as much of the resource is reused as possible. Water can be recycled on or close to the site.



A simple example of a closed loop.

Effective ventilation

Heat exchangers, ventilation controlled by continuous CO2 measurements and other localized ventilation examples that save energy and cost should be implemented.

Use as much daylight as possible in new productions

Daylight makes us feel good and saves on the operating costs for buildigs.

Smart lighting systems

LED lighting, motion detectors and other examples that save energy and cost should be implemented.

Reflections

During the work it was noticed that the guidelines differed much in scale, where some belonged to the comprehensive level and some to the detailed. This led to a marking of the ones that belong to the comprehensive level to ease the differentiation and know what to look at in each scale, even though the scales of course have a strong connection with one another.

This section could be developed into a seperate publication on how to work with increasing ecosystem services in Bjärred/Borgeby. With small alterations it could work also for Lomma.

Design proposal

The last step was to design a proposal with ideas for both a green structure and densification in the area. During this work the original line of thought of the thesis *What is a good green structure? > How does that effect densification? > Adjustment/ Adaptation* directed the work. First the guidelines for ecosystem services were used to reach a good green structure. Then places for densification in this structure were sought out and developed relating to the guidelines for densification. Finally, examples of an implementation in three places were developed.

What is a Good Green Structure?

In this first part a mapping of the current geographical disposition of the different ecosystem services together with the guidelines developed for the ecosystem services in step 7 were used to find a suitable green structure for the area. The guidelines match different scales and on this level, foremost guidelines directed towards the ÖP/FÖP level were used. The result is a comprehensive green structure providing the frames for more in-dept design and development the different places and projects in Bjärred/Borgeby. The considerations for each service can be seen below.

Biodiversity

Design for ecological memory was important to increase the connectedness and stress hardiness of the ecosystems in the area. An ecosystem that provides many services, but occupies a small part of the land is forests. This makes it especially important to save forested areas and to connect them to each other.

Water availability expands the chances for species habitat greatly. The green structure was designed to provide more water, mainly through local storm water treatment. In some areas it is concentrated along green links between larger green areas to further support animals along their routes.

The gardens are not marked as part of the structure, but are still seen as vital assets that can contain large parts of diversity. They are counted as part of the land areas surrounding the structure and are not included, among other things because the municipality can't influence their design easily. As other areas they lie like islands between roads etcetera. The green structure is designed to serve as a connection between different garden areas and between gardens and more natural areas so as to avoid some of the barrier problems there are.

Part of the design to deal with road barriers is also nature friendly crossings, overpasses, underpasses etcetera to encourage species to spread. There is little research done on this so Bjärred/Borgeby could become a frontier runner in this. For some species (brids, insects etcetera) roads can actually become green arteries linking the areas instead of separating them. This is done by providing avenues along roads, water and flowers.

Increase in plant variation and diversification of management goes hand in hand to provide an array of different environments for different species. The character of the different green areas have been enhanced and develope to support this. Where possible nearby institutions, associations and maybe also private persons should be given areas to manage to diversify the management.

Some areas are marked as green opportunities. Here greenery could increase! Some of the places demands an expansion of the concept of greenery. That could mean green roofs, green facades and buildings adapted to the surroundings ecosystems to strengthen them.

Attraction

The increase in plant variation mentioned above also makes the area more exiting and attractive. As examples visitors can experience more natural areas in Domedeijla and along the shore, an older species rich park at Löddesnäsparken, a more formal city park at Bjerehovsparken and a historically connected spa park at the southern entrance.

This is supported by an expansion of the concept of greenery, providing greenery in unexpected places and a differentiation of management making it possible for people to contribute to their vision of the parks.

Meeting Places

The different characters in the green areas also provide for different activities and meeting places are built around sports, culture and nature in different places. The sports center already has a natural location in Borgeby. The connection to the rest of the area is strengthened by a marked running/walking track around the communities with start and finish at the center. Trees are planted in the area to provide a better scenery and micro-climate.

The nature base in Domedeijla is developed to provide information and interesting information not only to the pre-schools and schools but to all passer-byers. It is also complemented by one in Bjerehovsparken that provides information on the more urban nature and one at the beach that tells about the beach and meadow nature. A community nature center can be located close to one of them. If located near Domedeijla or the beach it can be placed to provide a view over the river estuary. In the community park it can be connected to a greenhouse with café, perhaps run by one of the schools or as an LSS activity?

Ecological Knowledge

The meeting places are designed to incorporate green elements and connection to the outdoors. Especially the nature centers and community nature center provide nice excursion goals that also teach people about their surroundings.

Other means that are not in the plan could include maps, signs, arranged events and walks etcetera.

Drainage and Storage of Rainwater & Water Purification

Wetlands, ponds and waterways are created by lifting underground waterways to the surface and by taking care of the storm water locally. Two larger wetland areas are created to clean the water before it reaches the sea, one in the north and one in the south east.

The grey and black water continues to be sent to the municipal VA-verk that purifies the water before releasing it into the Lödde stream. The sludge produced by the processes are spread as nutrition on the fields nearby. New development should test purification on site if the area exists.

Recreation

The areas' different characters give possibilities for both physical exercise (sports area, outdoor gym, running track), contemplation (old spa park, beach, Domedeijla) and meeting places (Bjerehov, nature center, sports area).

Characterizing Landscape, Cultural Heritage & Regulation of Micro-climate

The beech-forests in southern and northern Bjärred are kept and northern Borgeby (the business/company area) is provided with more beech trees to arrange for a similar setting there. The avenues around the sports area are kept and complemented by new avenues in different places to connect to the old Skåne tradition and get a better wind climate in the community, yet keeping the views into the surrounding landscape. Historical sites are lifted forward, such as the orchards and spa park.

Erosion Control

The beach is complemented with local types of plants that bind the sand and prevents erosion. The seabed is planted with grass wrack.

Pollination

The gardens provide a good food base for the bees, but navigation patterns out into the surrounding landscape is needed together with access to water and food support in the early spring and late autumn. The planned light rail track is designed to function as a green link for bees out into the landscape. Water is provided along some of the main green links in the area.

Places in the Plan

1. Augustenborg
Developed into a forrested area and expanded to connect with the nearby forrested areas.

2. N. Borgeby entrance
Beech forrest

3. Västanvägens wetland park
Takes care of storm water. Possible site for a community nature center.

4. Domedeijla
Developed as a nature base. Possible site for a community nature center.

5. Borgeby community park
Activity park with pollination corridor

6. Löddesnäspromenaden
Dispersal corridor between the beach and Domedeijla. Stormwater treatment.

7. Borgeby sportcenter
Complemented with naturelike plantings and more avenues.

8. The beach
Nature base.

9. Löddesnäsparken
"English park" with many different species

10. N. Bjärred entrance
Beech forrest

11. Bjerehov
Community park with playzone and green house café.

12. The center
Community square and park

13. Bundys park
Forrest-park

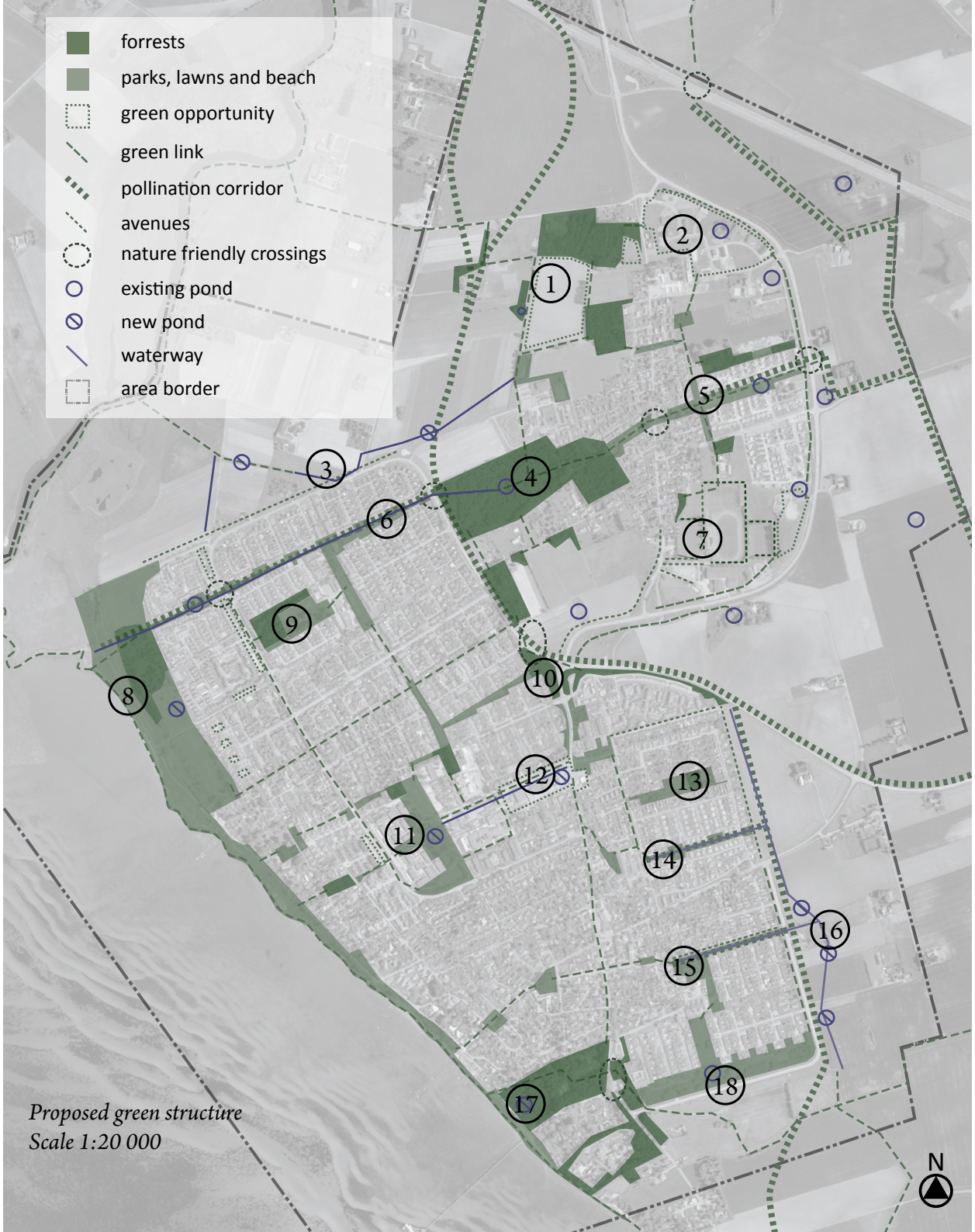
14. 27:ans park
Pollination corridor and stormwater treatment.

15. Alfredshällsparken
Orchard-park

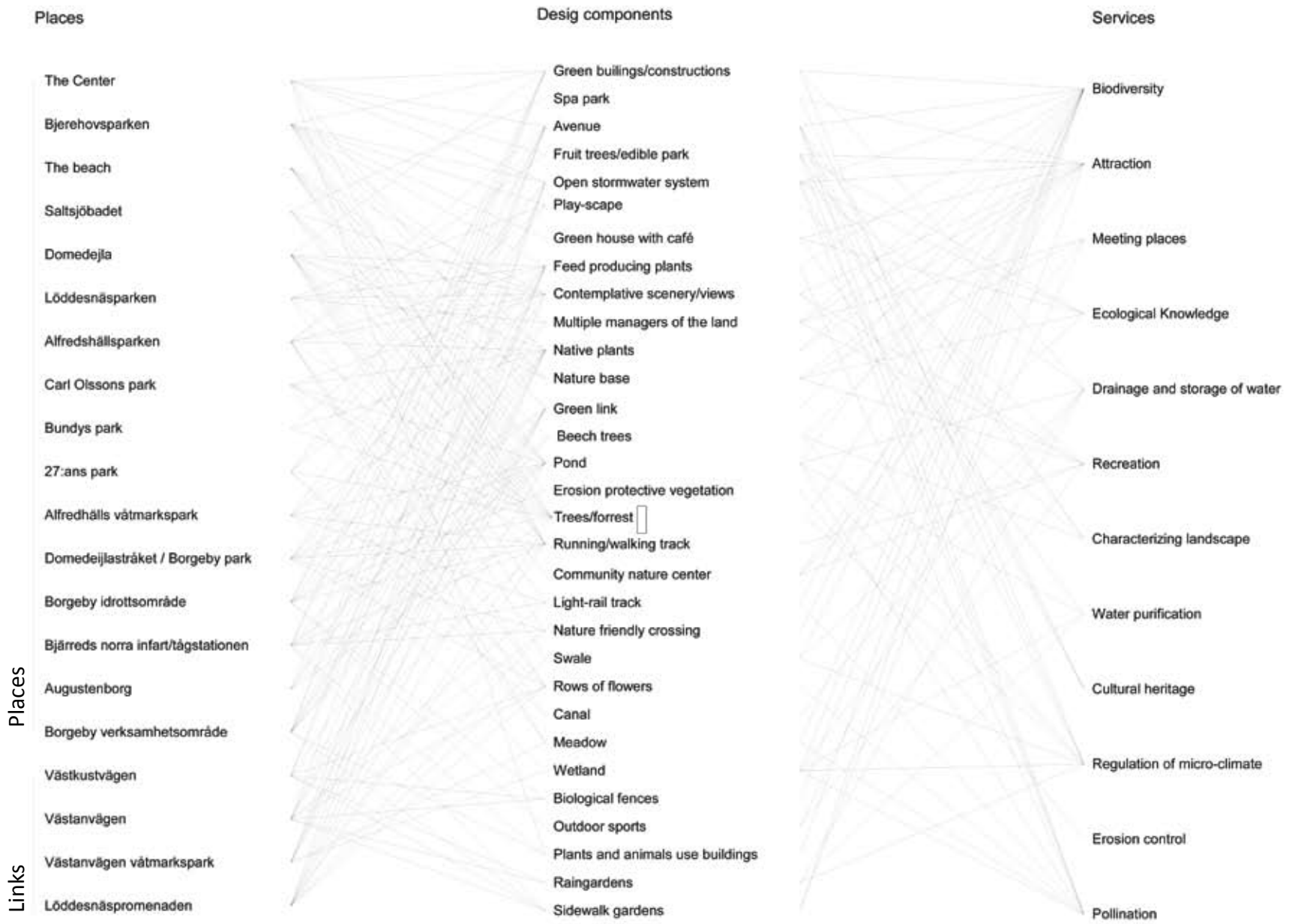
16. Alfredhäll's wetland park
Takes care of storm water.

17. Reuvenated spa-park

18. Carl Olssons park
Meadow-park with naturelike plantings



Proposed green structure
Scale 1:20 000



This graph shows that different ecosystem services are generated in the plan through the use of different design components (from the guidelines) in different places in the plan. Three places are presented more in depth on the pages 107-113 together with enlargements of parts of this graph.

How Does that Effect Densification?

The first step after the sketch over a possible green structure was finished was to see what possibilities it left for densification. A quick scan showed that there were still opportunities available. The picture shows the available options geographically, indicating if it is a single plot or a larger area. There are mainly single plot opportunities or options to complement existing buildings by adding floors or rebuilding. In Bjärred, the area around the center represents the most opportunities that are not single plot opportunities. In Borgeby there are opportunities for larger densifications, but since the community is so small and their location is mainly in the outskirts they may be viewed as extensions too.

A look at the guidelines for densification was made to see if any of the found areas could be seen as unfavorable judging by those terms. Of the different guideline themes transport/travel and urban environment are much relevant for the FÖP-level. The same goes for the parts of housing qualities and urban life that deals with the provision of service and mix of functions, housing sizes, building typologies and tenure form. Other guidelines are more suitable for the DP/project-scale.

Transport/travel

Transportation is a very important part of a sustainable future in Bjärred and Borgeby. Densification without

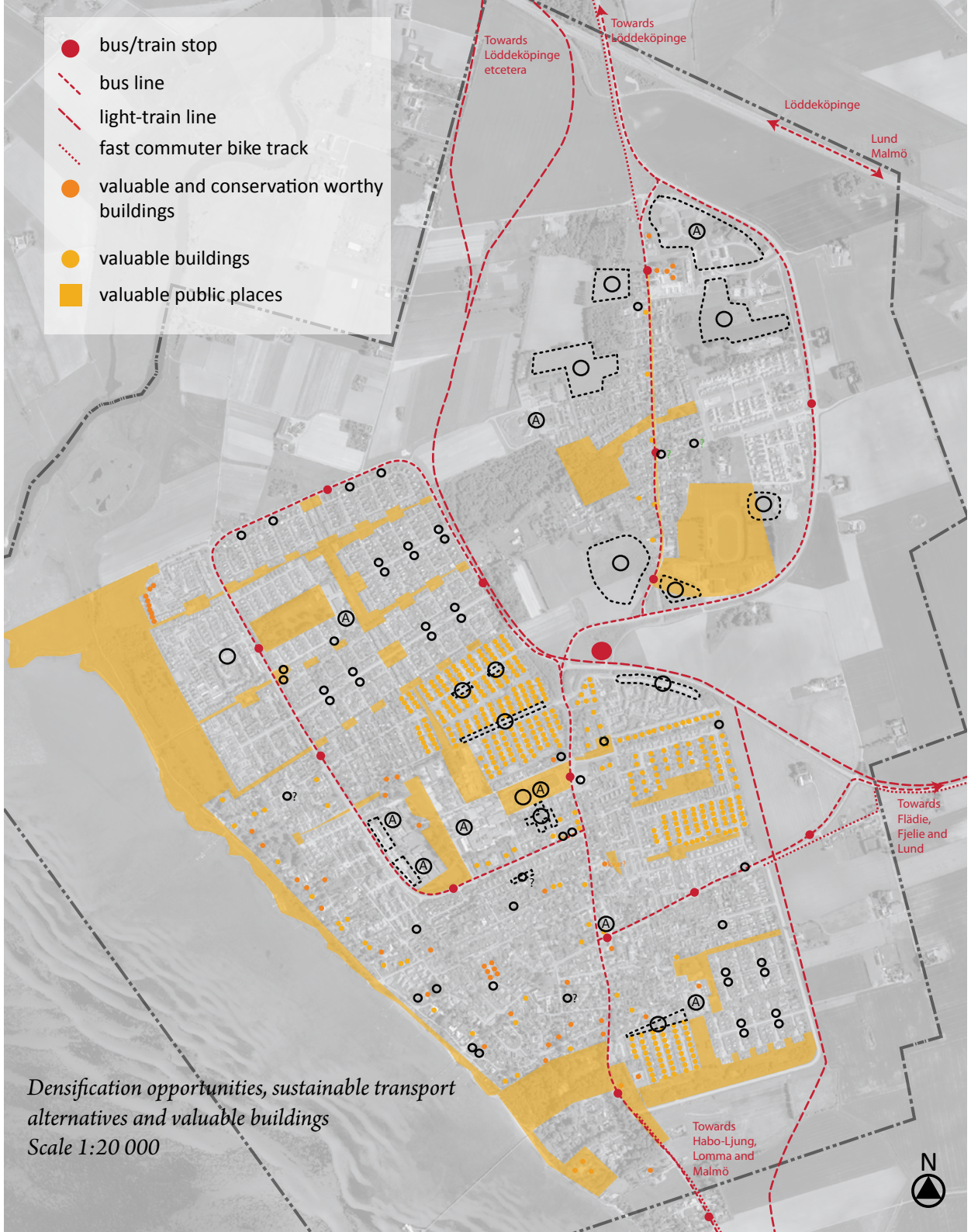
Densification opportunities in the green structure (black)
Scale 1:20 000

smart, sustainable transport options will only feed even more cars onto the roads to Malmö and Lund. The municipality already has land reserved for rail-bound transportation from Bjärred/Borgeby to Lund, Lomma and Löddeköpinge. This reserved land is used for a light-rail train with a stop between Bjärred and Borgeby.

It's also important to keep the service level in Bjärred. The center is revitalized by opening the building up and increasing the connection to the outside, densifying with new housing on top and a park outside the building. Pedestrians and cyclists are given more space to go to and from functions. Fast commuter bike tracks are provided to Lund, Lomma and Löddeköpinge.

A mix of functions can lead to both less travels and a strengthened urban life. Opportunities to complement the many housing areas in Bjärred/Borgeby exists in Borgeby verksamhetsområde, where the shops and businesses can be complemented by offices. That can also be true for the shops along the Södra- and Norra Västkustvägen where densification by addition is possible. Housing combined with small shop spaces can be built facing today's centre if the gas station moves.

It's important that the light-rail train is not a barrier between different areas for both humans and animals. Instead it should be turned into a green link between areas by covering the embankment with grass, flowers



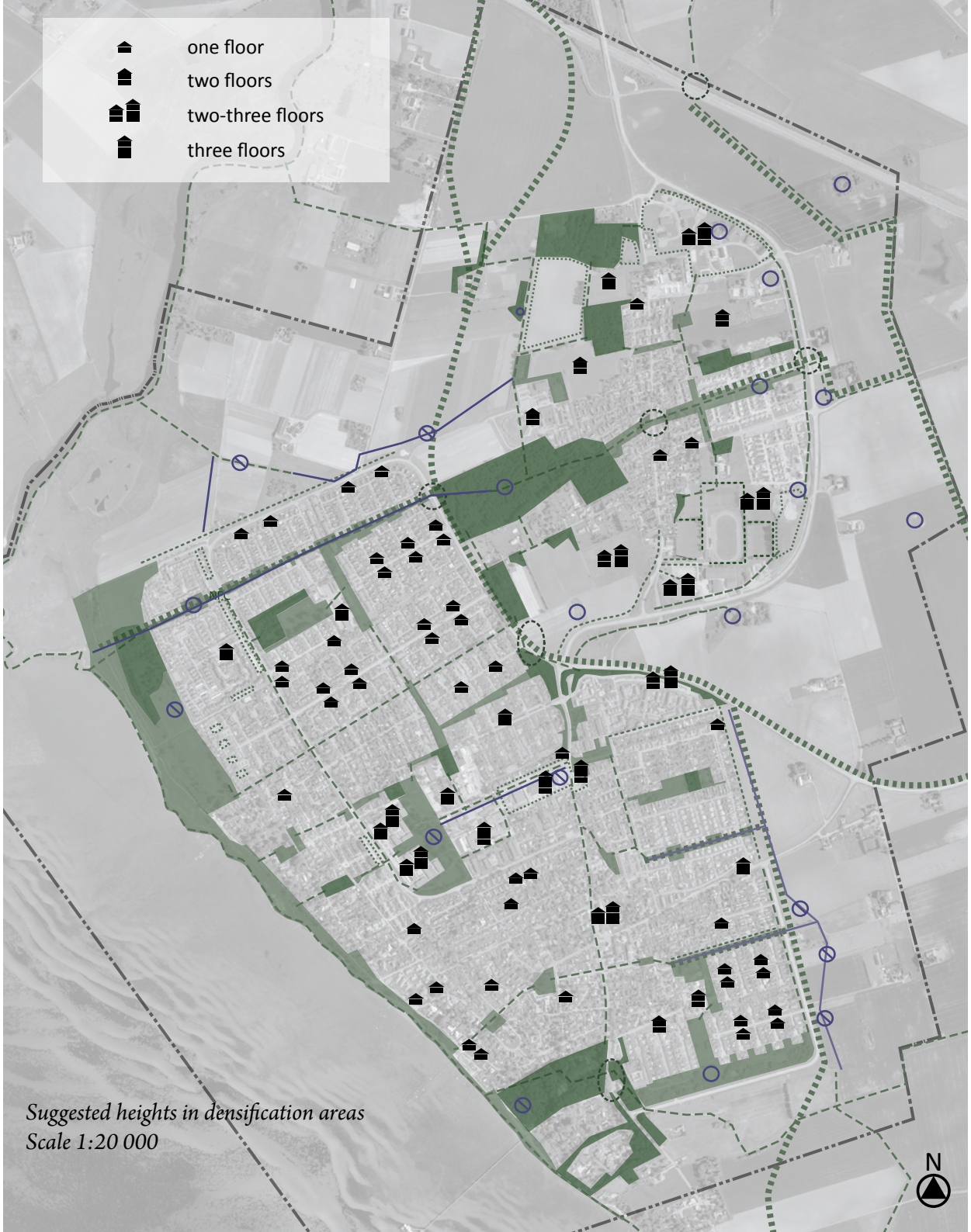
Densification opportunities, sustainable transport alternatives and valuable buildings
Scale 1:20 000

and other plants. One important functions of it would be as habitat and dispersal corridor for bees and other insects from their nests into the fields. This way the densification guideline can be part of the ecosystem service pollination. It's also important to provide underpasses when needed, for example by the wetland south of Bjärred. When possible the light train line should be done in a tramlike way without major hight differences.

Urban Environment

The urban environment theme is about densifying according to characterand to keep a heritage layer. An investigation was made into the cultural programme for the municipality. The programme presents both buildings and areas that are part of the area's past and valuable to preserve.

Some of the areas appointed as densification areas are also part of the cultural programme. Most of the guidelines do not contradict densification or the green structure's development. The only area where densification is possible but might not be preferable is in the area north of Bjärred center with row-houses (Nordmannavägen and Leifs väg). The cultural programme mentions that the fourcourts to the houses shouldn't be fenced in and that higher hedges etcetera are inappropriate. It also mentions Nordmannavägen and the high whitebeam hedge along the northern side that together with the private hedges on the other



Suggested heights in densification areas
Scale 1:20 000

side give the street scape 'an almost architectural expression.'[75]

When it comes to densifying according to character the main thing in Bjärred/Borgeby is the height and size of buildings. It's a low scale community and densification here is something else than in a large city. Still, to increase density more floors are preferable. An overview with suggested heights has been made. In general, a higher number of floors are suggested near the center and in larger new areas, whereas infill densification in existing low-scale housing areas is lower. To keep nice the low-scale community feeling of Bjärred and Borgeby, the highest number of floors suggested is three. A fourth floor on parts of a building or a fourth floor with a recessed facade like in Lomma harbor would also be ok, where the indication shows three stories.

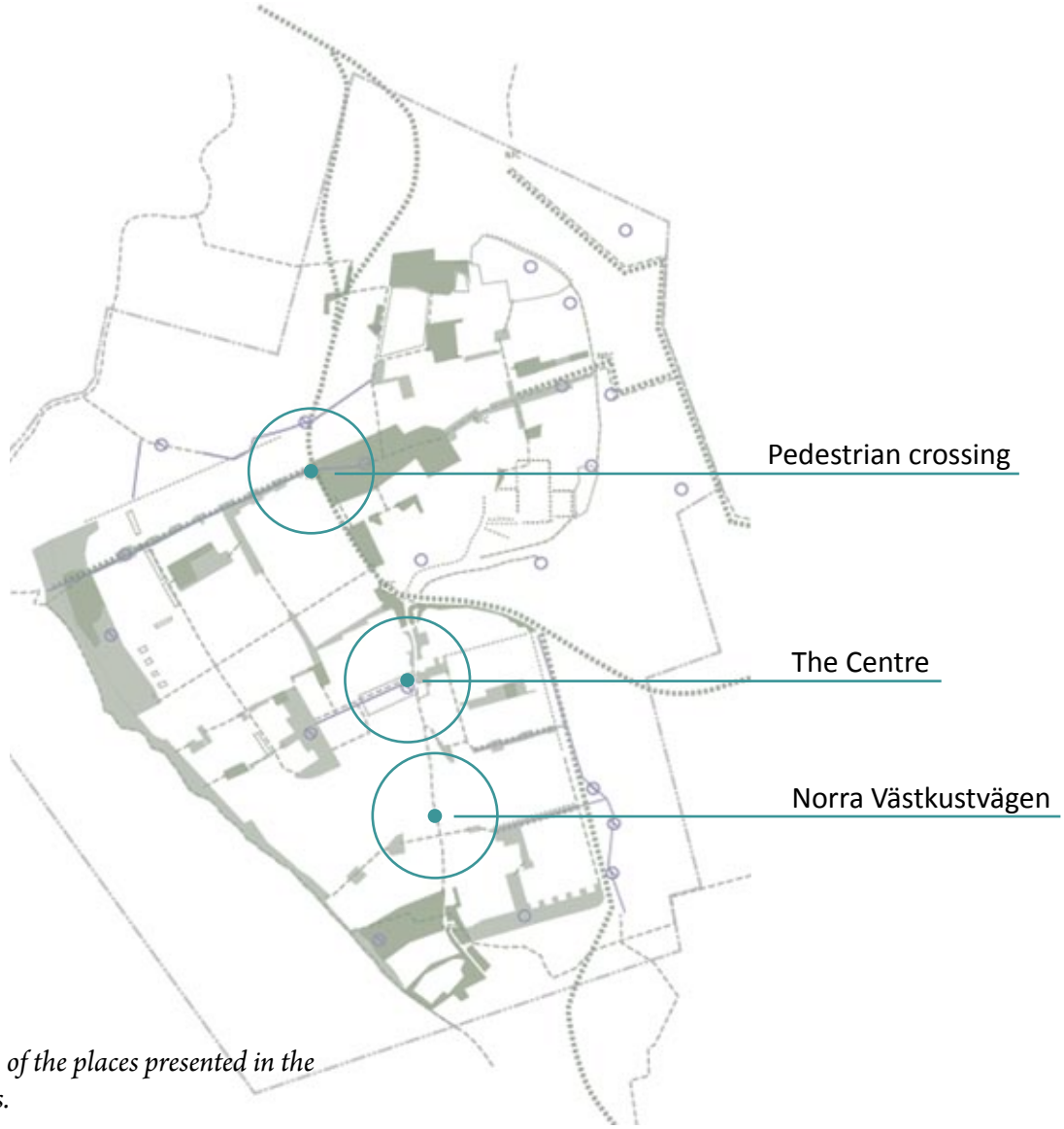
Housing Qualities and Urban Life

As said before it's important to work for a continued service level and mixed functions in Bjärred. The center is revitalized, Borgeby business area and the shops along Södra- and Norra Västkustvägen could be complemented by additions of offices. Housing combined with small shop spaces can be built facing today's centre if the gas station moves.

Today, Bjärred and Borgeby has a pretty one sided stand of houses. Apartments are sparse and so is housing with rental as tenure form. The central locations near to bus or train stops are preferable for apartments. It's also a good housing form for additions, even though row-house like additions also work. New type of typologies should be tested that tries to combine the best of suburban living with higher densities – maybe 'city villas' with 4-6 appartments and access to a small garden can attract inhabitants and complement the current house stand? A possible test site is by Mellanvångsvägen.

Sketches

To give an idea of what the result can look like three of the places in the proposed green structure have been expanded upon. The chosen places are the center, a section of Norra Västkustvägen and the pedestrian crossing between Domedejla and Löddesnäs-promenaden over Västanvägen. The center is a clear place, whereas the other two are paths or links.

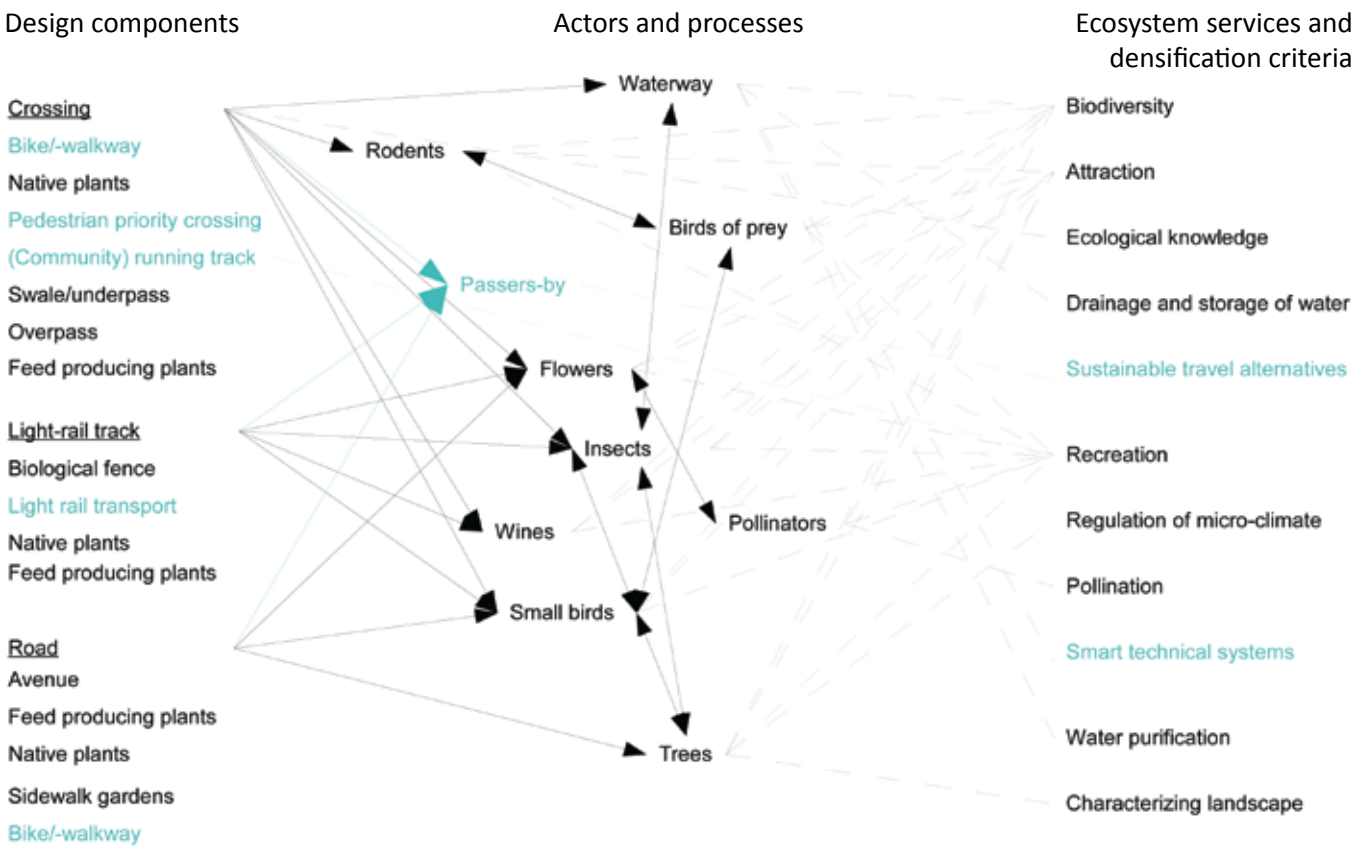


The locations of the places presented in the three sketches.

Västanvägen/Domedejla

This example shows what a nature friendly crossing might look like and explains one of the advantages that can come from the light rail track. Nature friendly crossings are a pretty new phenomenon and here it is used as an umbrella term for different ways of making it easier for animals to cross a road. In large the different options are land bridges, canopy bridges, glider poles (overpasses), culverts, tunnels, bridges (underpasses) and corridor plantings. Here both a culvert, a canopy overpass and other measures are used and targeted at different species. Since this is a new area, tests should be conducted to see how well the different ways work. Another important function of the passage is to direct animals into Löddesnäspromenaden, one of the major dispersal corridors in the community.

The light rail track functions as a green link and dispersal corridor for pollinating insects into the surrounding landscape. The embankment could also be a good place for bee nests.



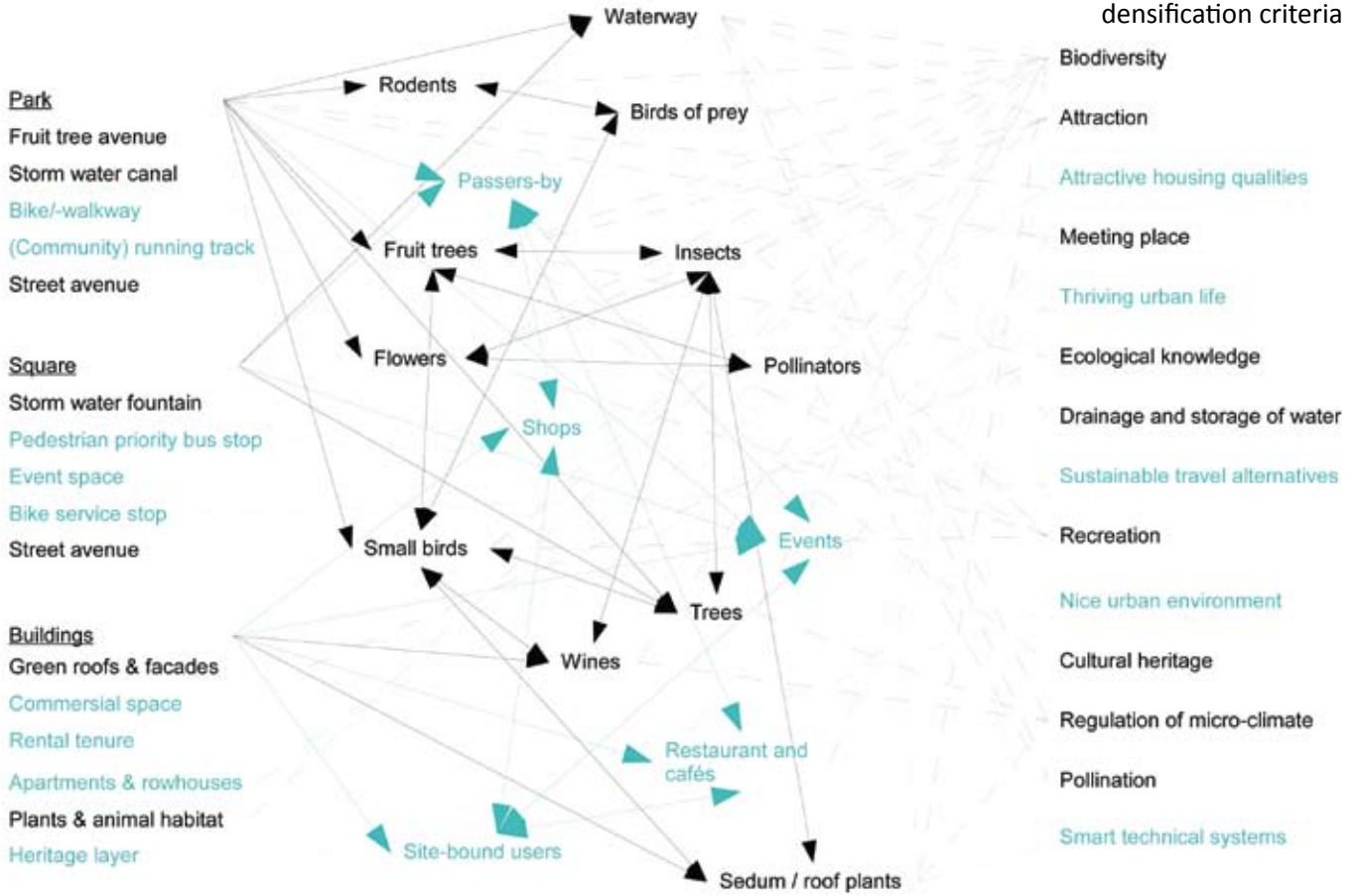
The design components, actors and processes and met ecosystem services and densification criteria at the place.


Light rail track with grass and flowers that provides a dispersal corridor and pollination service to the fields
A biological fence provides a border between the train and pedestrians, while being animal friendly and giving a nice view
An overpass in the form of wines provide a good crossing for scansorial mamals and birds.
A hightened crossing with green ground cover, high evapotranspiration and pedestrian priority makes it easier for pedestirans and animals to cross.
Avenue along the road - dispersal corridor, nice view, air cleanser and wind breaker in one
Underpass for amphibians and small rodents that continues as a stormwater swale

The centre

Here an example of how you can densify and make a community greener at the same time is shown. In this case densification is achieved through additional floors on the existing building. There is also a new building on part of what today is a parking lot. To boost the place as part of the green structure facades and roofs have been made part of the green structure and part of the parking lot has been turned into a park. There is still parking place on the other side of the building that should cover the need for spaces and even that can become greener with more trees and a ground cover that evapotranspires such as gravel in a net.

The center's direction is changed to be more outwards to attract more visitors and together with the park and square strengthen the area as a meeting place. The bus station to the left stays as today to provide a stop near the center and the new apartments, of which some can be directed to provide senior housing.



The design components, actors and processes and met ecosystem services and densification criteria at the place.

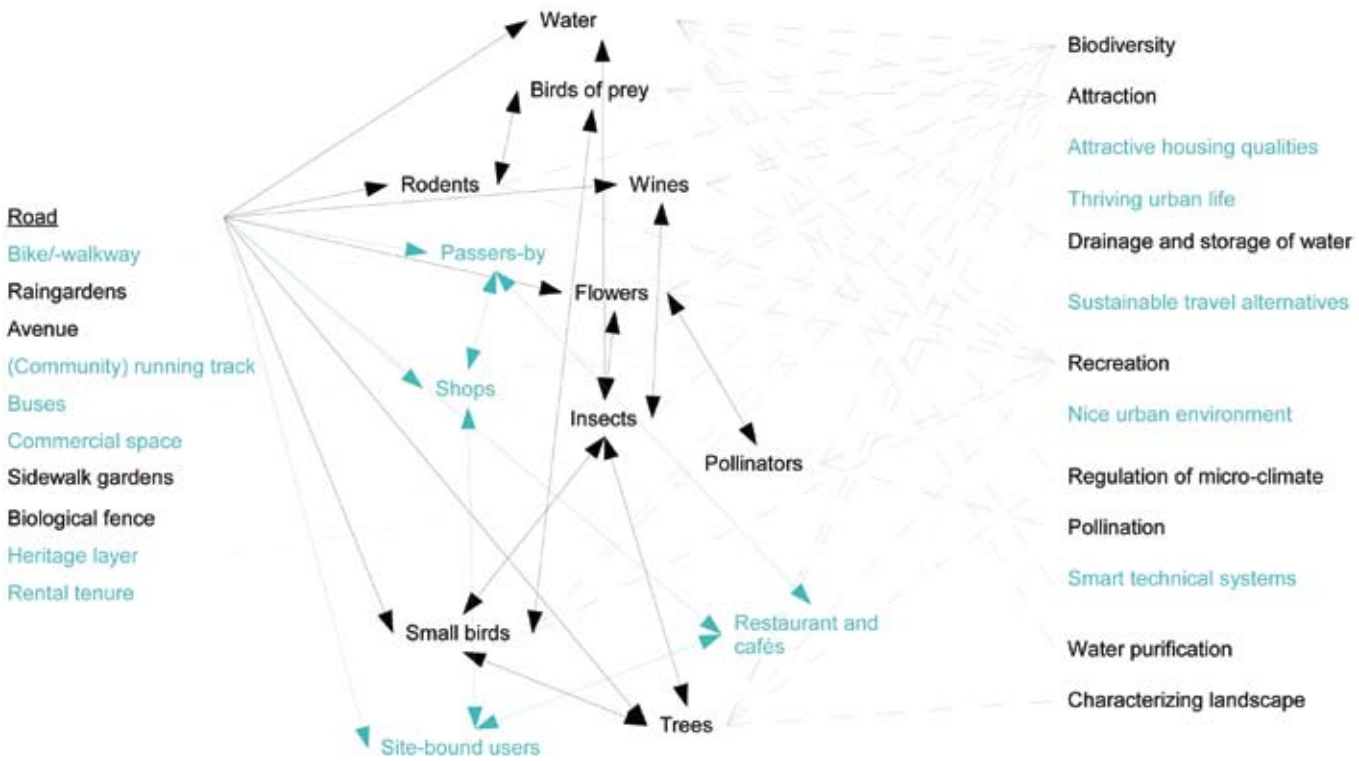

Densification with appartments and rowhouses on the roof , a new building and a reorientation of the center outwards brings more life to the area.
Green roofs and facades increases biodiversity, helps drain, store and purify storm water, reduce heating-need f or the buildings and provide a better outdoor climate for the park.
The new park and avenue strengthen the connection to Bjerehovsparken from the center, give pedestrians and cyclists priority, provides a green lung and strengthen the center as a meeting place.
A fountain is the start of an open stormwater system that collects the water from the roofs and roads and then transports it trough a canal down to Bjerehovsparken where it meets a pond.
The ‘Apple promenade’ provides a green link between the center and Bjerehovs-parken, links back to the old orchards in the area, provides a nice view and give ecological knowledge to people passing by.

Västkustvägen

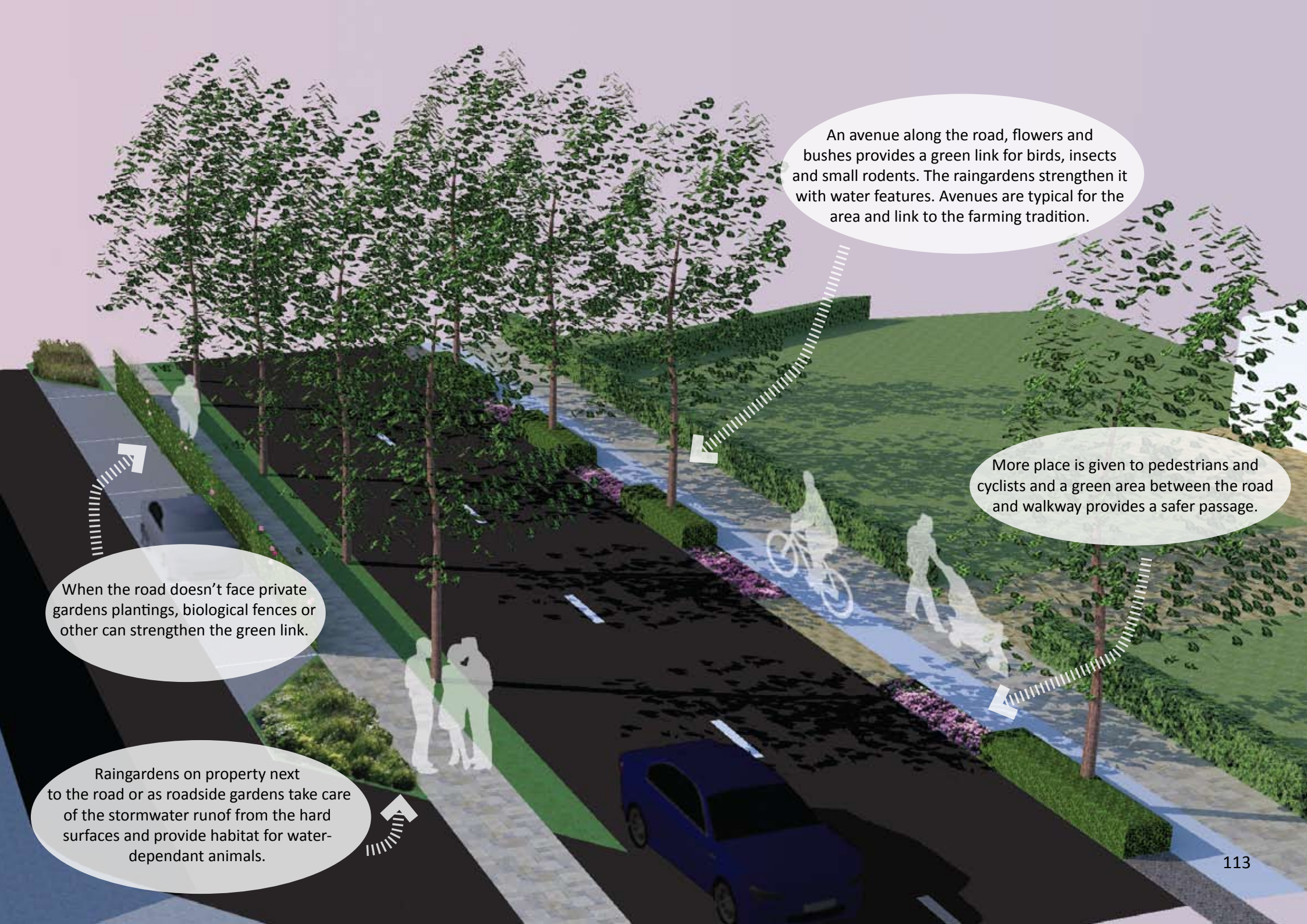
This section of Norra Västkustvägen near the crossing with Lundavägen shows how the road could be changed to work as a green link and give more space to pedestrians and cyclists. The road is given a greener look through an avenue and other components that also give many ecosystem services to the area. The greenery is used to create a distance between the cars and pedestrians/cyclists to create a safer traffic situation.

In this place the road is 12,9 m wide and a section of the road is as follows; bike/-walkway 2,75 meters, street garden 0,85, road 7, street garden 0,85 and walkway 1,45.

The width of the road varies between different places in Bjärred and this part is in the middle width-wise. If need arises one could concentrate the pedestrian movement to one side only and where there is extra space increase the sidewalk gardens' width.



The design components, actors and processes and met ecosystem services and densification criteria at the place.


An avenue along the road, flowers and bushes provides a green link for birds, insects and small rodents. The raingardens strengthen it with water features. Avenues are typical for the area and link to the farming tradition.
More place is given to pedestrians and cyclists and a green area between the road and walkway provides a safer passage.
When the road doesn't face private gardens plantings, biological fences or other can strengthen the green link.
Raingardens on property next to the road or as roadside gardens take care of the stormwater runof from the hard surfaces and provide habitat for water-dependant animals.

Reflections

Having a set green structure before selecting densification sites didn't provide any problems. There were still areas to densify and that will probably be the situation also in other places in Sweden seeing that Skåne has so little green structure. It seems very profitable to do something like this before you densify to get an overal view of the green structure and not risk it being destroyed by single projects. As it were now, I ran into new developments in the area that I wouldn't have placed where they were if I would have had the green plan. The only area where it was hard to get a good public green structure were the older parts, that didn't have so much excess surfaces, but htey also have rich garden faunas.

One question during the work was how deep into each site in the plan the work should go. The method and guidelines provided an easy step between the comprehensive and detailed level. Even though the final design should be decided upon from place to place it was important to show the connection between the site and the comprenhensive level and give guidance for how it should be developed. It is also very important to test the overall ideas on each site. Apart from presenting each site briefly connected to a map of the green structure the decision was to show three sites in the plan more in-dept. This also gave the opportunity to show what services that were developed at each site more easily than through the comprehensive map. In a real situation prefarably sketches for all main places and main ecosystem services functions for each site should be presented to contretize the document an dease implementation. It also makes the ideas easier to communicate to those outside the project group.

Discussion

This chapter discusses the usefulness of the concept and the tried process, reflect upon the architect's role in such a process and if the way to work provides any answers to the challenges seen for today's green planning. It concludes by giving suggestions for an improved process.

The discussion will take it's point of departure in reflections spawned by the work and be complemented with inputs from personal experiences of about one year's work as a municipal planner, an interview with KIT Arkitekter, one of the few examples of architects working with ecosystem services in Sweden, and the master thesis essay *Konceptet ekosystemtjänster och dess möjliga roll i planeringen av stadens grönstruktur* by Elin Claesson.

KIT Arkitekter has worked together with Stockholm Resilience Center and the Royal Institute of Technology on a project for Akademiska Hus, the Albano Resilient Campus. It connects to the resilience-work of the Center and uses different design components to reach an increased ecological and social resilience. Ecosystem services are a vital part of the increased resilience. They have also been involved in a project in Norrköping called Knepien Syd.[1] The difference between their projects and this thesis is the scale. Albano and Kneipen Syd deals with small parts of a city, whereas this thesis works with an entire community.

Claesson's essay is written in connection to Gothenburg University and the department for Human and Economic Geography at the School of Business, Economics and Law. Her main objective is to research the usability of the concept of ecosystem services in planning of urban green structure and she has interviewed four persons connected to projects in Malmö and Stockholm. Both cities are relatively new to the concept, but Malmö has come a bit further in incorporating the concept in different projects. Stockholm has just started the work with the project Norra Djurgårdsstaden.[2] It can be noted that none of the interviewees are planners or architects, but three ecologists from the environmental departments of the cities and one communicator from Albaeco connected to the Stockholm project.

The Concept

The work with this thesis has led to meetings with persons where the concept has been present in different ways. Surprisingly, no-one ever had any problems with understanding it; on the contrary they often embraced the concept quick and came with their own thoughts. One example of this quick embracement is when I explained the concept for a colleague in the coffee queue. She had no prior knowledge of the concept and did not work directly with questions relating to the issues, still she immediately said "Ok, so for example, they are chopping down the forest close to where I live and replacing it with salix plants. Then one might wonder if that's really providing more ecosystem services or not?".

That the concept is so easy to grasp should be seen as a big advantage, as long first introduction to it can be avoided and therefore ease communication with non-experts. It also seem to open people's mind to how many things a green area can be and what they do for us that we otherwise take for granted, which is pedagogically important in the work for a sustainable development. This has also been noticed by Claesson's interviewees that among other things say *"That the concept explains the complexity of nature in a pedagogical way makes it a good tool to explain processes and functions in nature in an easily understandable way"* and "*You can view ecosystem services as a method, to see nature with a pair of glasses that makes you see new things"*[3] [author's translations]. I think one of the main reasons for this

is that the concept provides an umbrella term and a structure that helps us think. Instead of thinking of a tenfold concepts at once, you only need one that you instead link to many functions.

This also seems to make the concept rhetorically useful. Claessons's interviewees see it as a powerful argument for protection of nature when it is in conflict with other interests. One of them say *"… persons that might have used the argument of threatened species, tried to explain that we have red-listed beetles and we can't fell [the forest] here. Then they experience no response what so ever. But when they can talk about ecosystem services it becomes clearer for people who might not have an understanding for what nature does"*[4] [author's translation]. A rather high level of interest in the concept and findings was noticed during visits in Lomma, both from politicians and civil servants that for example wanted feedback from workshops. The positive attitude towards the concept was also noticed by the local government commissioner's good bye after a workshop when he said *"Thank you for reminding us of these important questions that are sometimes missed when you talk about development" [author's translation]* and the fact that the municipal ecologist could use the result in her work.

An important sign of usefulness seen of the concept in Lomma is also the revision of the local environmental policy to entail the writing *"in all planning, development and management of land resources the protection of the ecosystems' structure and function to uphold ecosystem services shall be a prioritized goal"*[5] [author's translation], approved 2012-10-25.

This said there is criticism and fear that the strong rhetorical aspect of the concept can be used to market 'the wrong' projects, a way of green washing non-sustainable projects to get them approved. If you see it cynically it would be a way to get development to happen. This has also been noticed KIT Arkitekter and they describe it as important for them to keep a balance between representing the developer's side at the same time as not losing in credibility and delivering ideas and solutions with a real function.[6] I see that projects involving ecosystem services can often be seen both as projects that incorporate ecological issues and projects that push development, depending upon how you view them. The sales aspect comes automatically and it could be used for the wrong reasons by those who want to. Two ways of avoiding green wash by making sure that what was promised and designed really happens could be to press an openness through the whole project and to follow up on what was decided.

An interesting question is whether the development would take place without the sales aspect of the ecosystem services approach or not? Many argue it would, and then it would be better to have a project with the approach instead of one without it that would happen anyway. In those cases the approach could be a way to steer the power and economic investment of the market to places that are favorable in an ecological perspective and to a design that strengthen the surrounding ecosystems. Surely, the green wash aspect is something one need to be aware of when working with this and other 'green' concepts and find ways to deal with.

There is also criticism directed at the concept for being too simplified. Claesson's interviewee at Albaeco fear that the appreciated pedagogical quality will lead to a simplified picture of nature that might disregard expert knowledge and impair the understanding of the complexity in nature. This seems to be a concern mostly voiced by theoreticians that according to Claesson devote much of their criticism of the concept to the problematic of handling nature in a pedagogical way so that people understand, but with enough complexity not to degrade nature by giving a simplified view[7].

In a way two sides, or two levels, of the concept has been seen during the work. The first level is the one talked about before, easy to understand and grasp, the second one goes deeper, was harder to understand, demanded more time and was also harder to communicate. Several reasons for this can be seen, where some are connected to the concept and some not at all.

That the overall concept is presented very general can play a role. The available frameworks provide

little guidance when it comes to designing work flows and processes. Instead it is up to the person doing it and that can lead to both very shallow and deep perceptions of the concept. On the other hand this is also a strength that allows for a site/project specific fit of the concept and co-operation between different professional groups. This generality is probably also because the concept is so new. It has not been many years since it was first launched by the MA and then TEEB. It can be expected to take some years before it settles and good processes to work with it are found. This view is shared by one of Claesson's interviewees that expect a couple of years where people who work with ecosystem services will have to use trial and error to find a good way to use the concept[8].

A second reason that can be seen when working with the concept in urban environments is the lack of knowledge we have in urban ecology. A lot about the plant and animal habitat in cities is still unknown[9] and projects in cities will have to cope with that. To understand a deeper level of the concept when there is a lack of or no information and sometimes contradictory information is hard and the risk for over-simplification increases. This also means that there is always a research aspect to work with ecosystem services in planning- and architectural tasks so far and that follow up is important.

Specific for this thesis has also been that I as an architect and planner have performed all the steps in the process on my own. Normally this kind of work would be performed by a group of many with different professions. Some of the extra research that lead to would have been unnecessary in a more diverse group where all could have contributed with their expertise. With the presence of other professions, the understanding of the deeper more complex parts of the concept would surely also have been easier.

To find a good balance between this ease of understanding and the complexity during the process will surely be an important part of developing a way to work with ecosystem services in the near future. A big part of it is the communication between stakeholders with different background and level of understanding and to make it allow for both easy understanding and complexity. A more in-depth discussion on who the different stakeholders during the process are and what the architect's role in the process could be can be found in a separate chapter below.

The fact that this type of work would be performed by a group of many diverse professions is one of its main advantages. Administrations divided into different departments and the many levels of decision-making and stakeholders within planning still suffer from tunnel vision regarding their own issues and sectorial interest priority is sometimes a problem. A work form that brings people from different departments and groups together is a valuable contribution to better co-operation between the groups. Connections will be made and experiences shared that will enrich the work also after the project is ended. If that meeting takes place on equally unknown ground – such as a new and general concept – it can be a way to develop a common language between different professions. That could make discussions easier and the dichotomy between the conservatory and the development-directed professions could become easier to overcome.

One of the reflections from the work is that the different scales of planning seem to merge when working with ecosystem services and strategic decisions of what belongs to different scales had to be taken - such as dividing the guidelines into guidelines for the comprehensive level and the detailed level. To start with common guidelines and then implementing them at different levels indicates that the relation between actions taken on different levels can become more integrated and strengthen each other.

A part of the concept that has had a lot of attention in the media is monetization of services and before moving on to the process a few words should be said about it. It is a challenging and complex task that has also received criticism. The main argument against it is that there are situations where it is impossible to value nature because it is simply priceless and the huge workload demanded to do it. The main argument for

it is that since transactions in the market take place in a monetized domain it is better to value nature in monetary terms than not to value it at all, risking that it is priced as worthless rather than priceless. This thesis work has chosen not to include monetary valuing, but to work with other means, for example ranking. The main reason for this is the difficulty in performing a monetization calculation and the unnecessary high workload it would generate, the risk of a non-precise valuation and the lack of faith in what it could accomplish on a community scale. In general it seem monetary valuation could work on smaller items/a more detailed scale and when you have two alternatives to choose between. An example could be a green roof versus a brick or use the natural wetland versus build a treatment plant. Considering the workload and impreciseness of larger calculations, it doesn't make sense to make exact valuations in designs with so many parameters as a community plan. Instead one might use examples, as some of the ones under the status and trend chapter to instill a sense of how valuable the green structure is. The projects in Malmö and Stockholm mentioned by Claesson doesn't include monetization either.

This part will concentrate on the eight step process that was designed for the work and how it worked for the task of planning the green structure to guide densification. The work used the MA's 9 step analytical framework as a base for the process, but supplemented the last steps with tools from architecture and planning to make the assessment more suitable for a solution-oriented architectural planning project.

Apart from the general step layout the framework provided recommendations on what to consider when performing the different steps, but had very few recommendations on methods. The assessments that have been done, for example the MA assessment or the UK assessment, are on a large scale and thus very general. They are also not done to lead into a specific issue or project like here. This meant that much of the process was designed specifically for this thesis, but with the framework as a basis. The result has been a mix of methods from other professions (such as the use of UMTs) and methods known to me from before (such as system thinking). The different steps with the methods used can be seen in the illustration on the next page. The methods mapping of UMTs, system thinking, ecosystem service definition workshop, ranking workshop and guidelines will now be commented on.

UMT mapping was used during the first step to identify ecosystems in the area. The method was unknown to me before the thesis work, but was easy to understand and perform. The tricky part was to decide what UMTs and ecosystems to use for the mapping. Good help came from other examples and those examples together with information from the municipality's comprehensive plan gave the end result. It was also a good way to depict the many ecosystems in the community compared to the few surrounding it, putting diversity in a new light. The opportunity to measure how much of each ecosystem there were was also good to have when ecosystems were connected to ecosystem services later on. It took some time to map the area, but the feeling is that having done it once will make the work much quicker the next time when the categories etcetera are clearer and easier detectable.

System thinking was early a very natural method for the task of researching and depicting connections between ecosystems, ecosystems services and human well-being and it was used in several of the steps. It provided an understanding of the interconnectedness between the different components in the system that you couldn't get by reading books. Depicting the system was also one of the best ways of communicating the findings since it could hold a high level of complexity and still be readable. On the other hand there was a limit to that and some systems became too complex to work as communication material other than to communicate the complexity. The systems that became too complicated where the ones showing

Steps		Used Methods
1	Identify and categorize systems	Urban morphology type mapping through aerial photographs
2-3	Identify services and links between services, drivers and human societies	System thinking, workshop and litterature studies
	Prioritizing among the services	Workshops
4-6	Select indicators for ecosystem services and assess trends and current state	Workshops, litterature studies
7	Formulate objectives for the design proposal	Guidelines through litterature studies, earlier experiences
8	Make a design proposal	Sketches, systems thinking

The process and it's steps together with the methods used for each step (initial MA-steps in green and added steps in blue)

the entire picture of the community, whereas those looking at specific places in the green structure or specific ecosystems were readable. Considering the risk of oversimplification discussed above it seems important to show the complexity there are, even if it is not readable to a 100 %. After that it can be broken down into parts to explain in more detail what goes on in each place. That is why the design proposal looks specifically at three places. Combining place specific explanations with explanations regarding each service should provide a good overview and input to the next step in the planning process.

The work of depicting the services could also be helped if a good computer programme could be found that let you give data for variables and connections and then generate an 'optimal picture' of the system. If it would let you also put it new variables, such as a design component, you could see the effect the component would have on the system. I've worked like this around one specific place before and it worked very well, but when there is too much data it becomes too complicated to do it yourself with the programmes that have been available to me during this thesis.

Two different types of workshops were conducted. One was a type of ecosystem service definition workshop with civil servants. The other was a ranking workshop to decide what ecosystem services were the most important for future planning in Bjärred/Borgeby and

was performed twice, once with politicians and once with civil servants.

The first workshop was conducted after my research on UMTs and ecosystems in the area. The motives were several: to connect back to the municipality, to get input to the ecosystem services list and to make sure I as an outsider hadn't missed anything vital. It went very well and using work in smaller groups were each group discussed ecosystem services connected to specific ecosystems they came up with a list of ecosystem services that was almost equal to mine in numbers. They also added two to my list. The discussions following the group work also provided me with invaluable information that I hadn't gotten without the workshop since it was not in written sources. Two things seemed especially important for the success of the workshop. One was the presence of persons from different departments and with different professions within the municipality and the fact that it was made sure each group consisted of a mix. They complemented each other very well and I heard a lot of interesting discussions. The other was the presence of the municipal environmental strategist that with her already existing knowledge and interest in ecosystem services came with valuable comments that gave birth to interesting discussions.

The second type of workshop involved ranking of the found ecosystem services and was conducted with both politicians and civil servants, though not simultaneously. It provided a way to value the ecosystem services to each other without involving monetization. The method selected provided each participant with 12 stickers to put next to the preferred ecosystem services. The participants were told they could put all on one service or spread them out as they liked. The usual ranking displays a "winner" followed by a second, third etcetera. The method used here allowed for more variation, both for the single participant and the final result since there could be for example three number ones. In my opinion this was good and made it easier on the participants to choose among the services. If they had been asked to rank the most important services from one to ten it would have been harder. Since the workshop was a way of prioritizing among the services, what is essentially a political decision, it was very important that the politicians were involved in the step. Not consulting them on such a decision and continuing the work could lead to a lot of work for nothing if there is not agreement on the services to work with. There was unfortunately not room for that, but a discussion between politicians and civil servants on their choices afterwards would have been very interesting, an interest also noticed among the two groups.

On the other hand it is impossible to know that the services chosen are the exact 'right' services. In this case I added two services that were connected to a

more regional scale since I saw that they could affect and be affected by the local scale of the community. Maybe the need would have been felt to incorporate even more services if the eyes would have been lifted to a global scale? You could argue that all services are important and that a prioritization is impossible. At the same time it was necessary to prioritize to lessen the work load.

Ways to work for more accuracy in selection of services could be to effectively incorporate outlooks into other scales. For example if you work on the local scale to make a quick glance into regional, national and global issues to know what might be important there. Involving many groups representing many angles in decisions are also important. Maybe people with knowledge in other scales could act as 'experts' or guides during the selection of services?

Of course the type of conceptual framework you use when valuing what services to work with affect the outcome. The MA and many other frameworks are human-centered perspectives that deal with the well-being nature gives us. In the extreme version of the framework the type of well-being brought to other organisms are not interesting. The type of services that don't bring us anything or that bring us things we don't want, sometimes referred to as dis-services, are not welcome. Used wrongly, we might chose services that gives us well-being but bring many other species hardship. One example of this could be said to be today's large scale farming. How could we deal with this?

Seeing that biodiversity is the foundation of all ecosystem services it makes sense to say that should always be included in the work. You could see it as it always being the most important ecosystem service or as an overall goal in the work with improving all ecosystem services. That way, a design as the example of large scale farming would not come around. It also makes sense to balance the different service to each other to avoid one taking over. Further development and thought around how to prioritize among services is a natural part in further developing methods to work with ecosystem services in planning, especially since planning is affected and affect basically all services, not only a few.

The guideline method was used to take the step from the research to the design part of the assessment. It uses the lessons learnt in previous steps and formulates a design handbook with multiple ways of increasing the services. This was also the first step to incorporate densification issues in the form of guidelines for a sustainable densification. Working like that to incorporate other issues than strictly ecosystem services worked well. During the design phase it was good to have a similar structure on both parts of the guidelines and it felt doable even with other issues than densification. Formulating guidelines with attached design components also makes it easy to add and change information when knowledge within the area expands. Providing examples to the guidelines in the form of design components was necessary to concretize the work.

During the work the process has been changed a few times as new insights were made. Many of these insights were connected to information, too little or too much of it. Too much information mainly when the decision was made to move the prioritizing among services up in time to avoid too much unnecessary work. Too little of it when it was decided to skip some parts of step 4-6 because there was simply no information or that it was very hard to find, but it was more or less felt during most of the steps. Too much information is easier to deal with than too little and prioritizing among the services worked very well into the process. Too little information and hard-found information led to many work hours and possibly lack of important information. The main loss is probably connected to the drivers. If I had more information on the drivers' trends I could say that this or that design component is more important to implement since this is happening with this or that driver. As it is now, I can't prove that, only presume. Luckily, it seems knowing how the drivers are changing is not so important for suggesting design solutions as to prioritize between them.

The number of hours you have to put into a process is an

important factor for how usable it is for a municipality. If it takes too much time compared to what you get out of it fewer will choose to use it. Therefore it is important to consider what could make the processes less work intensive, especially regarding finding what services there are in areas and their current status and trend. One could also ask if all steps in the process were useful for the end result or if some things are not relevant when working on a planning project. There could perhaps be two ways for a municipality to use the initial MA steps – one way that is more simplified and provide information necessary for the planning task at hand or the full MA way that feed information into many other municipal projects and gives birth to solutions other than through design and planning. It could for example be environmental goals, resource management on the business side, regulations and encouragements to be more environmentally friendly for citizen and much more. That way the plan would be combined with other policies to support the services.

An important aspect of the process that was not part of the MA process was the line of thought *What is a good green structure? > How does that effect densification? > Adjustment/Adaptation.* Putting the green structure instead of the built structure in the first room like that gave a good impression. There were almost no problems or conflicts when densification sites had to adjust to the green structure in this case. There were still places to choose to densify even if some were "lost" in the main green structure. Where you densify didn't seem as dependent on specific sites as the green structure to function well in this example. Instead densification seemed to be more about how you densified at the site, how many stories and what typology of building. If I hadn't looked at the green structure first the result would not have been as cohesive as now and dispersal corridors weaker. I also found recent densifications that I would have designed differently if a plan for the green structure had been done first. A thought that have crossed my mind is if it would have worked as well in other types of urban settings seeing that this is a small suburban community. Factors that could change are the size of the area, the size of areas of common access (seeing that Skåne has few such areas this number would increase in most cases), typologies etcetera. Judging by the experiences from this project it seems like the concept it quite adaptable to differentiations in such factors, much because of its generality and the possibility to work on different scales. What this thesis have done connected to an entire community could work on a district-scale in a larger city and be preceded by a more overall analysis of the city. Exactly what scales to work with is probably best decided on for each situation, but examples could be the municipality, the city, the community, the district, the block or the property.

To sum up one can say that both positive and negative things have been found in the concept and process as can be seen by the list below. It shows that ecosystem services have a good potential of being a way of looking at the quality of green structure that balance discussions. It could lift green issues to a new level and make the view of green structure more facetted and integrated with other questions, such as densification. Still, there are things to work on, some of the most important being the lack of information and handling of the balance between simplicity/pedagogic and complexity.

The Multi-professional Group

Positive	Negative
• General concept – give's room for project specific implementation	• Time demanding
• Concept easy to grasp	• Too simplified picture of nature's complexity
• Explains the complexity of nature in a pedagogical way	• New concept – no best practice
• Open people's mind to how many things a green area can be	• Lack of knowledge in urban ecology
• Rhetorically useful - powerful argument for protection of nature	• Lack of necessary information
• Needs cross-professional work groups	• Big information load
• Suitable for work on many scales and bring scales together	• Hard to monetize
• Possible to monetize	• Could be used to push 'bad' development projects

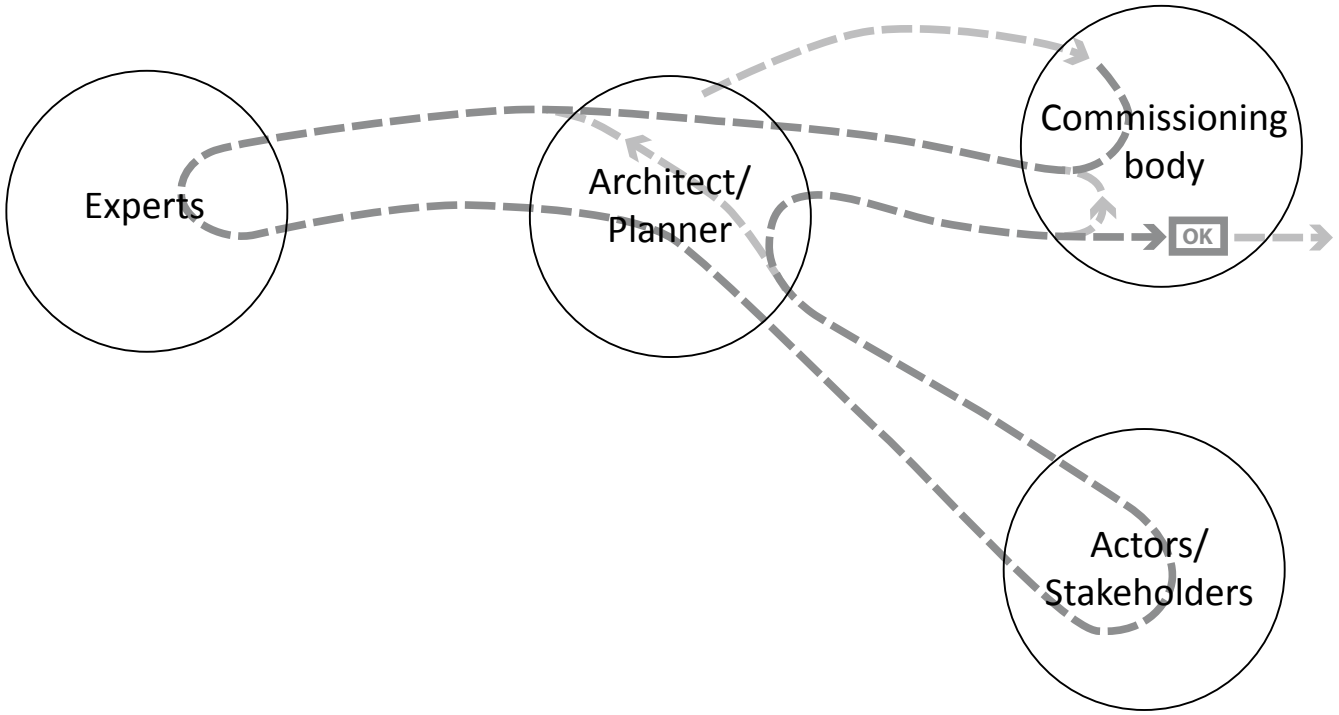
Positive and negative experiences from the work

As we read in chapter one, green planning is performed by an interdepartmental group in half of the cases. It is normally headed by someone representing the "planning-side" and the other two most represented departments are the technical side, such as the park-division, and the environmental side, for example by a municipal ecologist. During my work those two professional groups are perhaps what I have missed the most. Information from the head of the park division and the municipal environmental strategist in Lomma has been much useful. Other professions that have come to my mind are a human geographer for the connections between ecosystems and humans and in case of a monetary calculation an economist.

One of the ecosystem services projects that have been done is Albano, involving KIT architects but also many other. The work was carried through in a loose network called patchwork and the participants were: two architects from KIT, an architect within the urban planning field, an architect working with citizen participation and communication of projects, an architect with focus on sustainable design, two system ecologists and one ecologist/sociologist focused on governance. For KIT's second project they brought in one of the system ecologists and the architect within the urban planning field. From their point of view someone with experience from property management, like a developer or someone with a more commercial take would have been good. They think it would have been easier to carry through some ideas if they had a more credible way of calculating costs and how long time it takes before they pay back.

Apart from the group, different stakeholders on the site play an important role. For KIT an important part of the project is to make the different stakeholders feel involved – both present and possible future stakeholders.[10] In a municipal aspect the politicians as final decision-makers are another important stakeholder. How and when to include the stakeholders and politicians in the processes are important decisions to take.

The Planner's Role



A schematic picture of the process and involved groups in a planning- or architectural project. The architect/ planner has a clear project leader status, but also other roles such as interpreter of information, visualizer and communicator.

The normal way planning- and architecture projects start is with a commission to do something. It comes from a commissioning body, such as a private developer or a municipality. The suggestion could also come from the architects/planners before being confirmed by the commissioning body. When it comes to planning projects, especially on the more comprehensive level of this thesis, the commission is normally from the municipality. This puts the employed architect/ planner (from now on *planner*) in a project leader position and it's up to him/her to plan and execute the work. During that process, connections with other professions and different stakeholders are made for expert knowledge and opinions and also back to the commissioning body for part time approval and guidance. Usually the planner/architect together with some experts from other professions constitutes the project group. The work ends in a proposal for the commissioning body. The processes of the project can be described by the picture to the left.

It is in this environment the planner works. What does the relation to the different groups mean for the planner's role? The role as project leader has already been noticed. That is confirmed by KIT Arkitekter that has had the as they put it *"the classical architect role of co-ordinator"* in their projects and compares it to being the editor of a newpaper. They also see their role much as that of the visualizer that shows the others what the project could look like[11], how the ideas of politicians, experts and citizen could manifest themselves. It means a role of information interpreter, taking in information from all other parties and transforming it to a synthesis and communicating it to the other parties. The visualizations make the ideas concrete and real. According to KIT an important part of this in work with ecosystem services is to question other professions' views, just as they should question the architects'[12]. That way, things are put on the table for discussion and bring the project forward as well as providing important experiences to improve the process.

Inherent in the role of translator is the role as

Potentials for Green Planning

communicator, both to get input to the process and communicating the output to the different groups. In my experience it is a lot about taking the experts knowledge and filtering it down to a level suitable for the project that is also easy to explain for non-experts. In this lies a task of making sometimes very theoretical research and knowledge suitable for practical work, something also found by KIT Arkitekter in the Albano project[13]. This connects to the earlier discussion on the balance between showing the complexity of nature and simplifying it to readability for better understanding. One of the architect's and planner's main roles is to do this. Finding a good balance for that helps to achieve a good and successful project, both because the result gets better with good communication during the process, but also because good communication helps to "sell" the project, vital for a realization[14].

Chapter one presented an overview of green planning through the times together with problems, challenges and possibilities seen with today's green planning connected to the vision of sustainable development. Can the ecosystem services concept be used to face the problems and challenges and spur the possibilities?

During a look at the points mentioned (see p. 22-24) it's clear that ecosystem services has the possibilities to stand up to the majority of them. Mentioned problems are: A built in conflict with other parts of planning and the concept of green structure because it is treated as an underlying infrastructure, Lack of methods to go from an argumentation of conservation to one of development, The neglect of values in green structure and treatment of it as a reserve for development and expansion, That non-formal green structure are not part of green plans, Weak links between the overall scale's structural principles to the detailed scale's closeness and precision and lastly An unclear definition of biological diversity. It has already been said that ecosystem services give more light on green structure and makes people see it in a different way. The experience I've had with this thesis is that it provides a very good way to think of green structure in development terms that lift the many values in green structure as its priority. Even if monetization of values wasn't done it this project, it has its advantages for valuing of green structure. The experience is also that this project incorporated the non-formal green structure more than what is normally done when all greenery was part of the research steps. It was also related to in the proposal, even though that could have shown better in the illustrations. How to incorporate it more could be something to look at in further work. Ecosystem services seem to be usable in many different scales and maybe it could provide a way to link the different proposals and plans better to each other by providing something concrete to follow up. Since biological diversity is such a big part of working with ecosystem services it seems very natural that it should be defined before the project starts. It was in this project.

Three challenges are mentioned: Using the potential in the green structure as a link between the city inhabitant and nature to give an understanding for sustainable development, Using the multi-funtionality of green structure to handle the many in-between spaces in our cities and Creating areas for co-operation with other parties in the planning process. Both thinking according to the ecosystem services concept and living in an environment with different ecosystem services design components should increase citizens' understanding of nature. There is a huge potential in linking meeting places to ecosystem services and providing information on ecosystem services in the urban space in a fun way. That the concept provides a way of thinking about green structure in development terms and releases ideas on creating new functions in green spaces it is one way of developing and utilizing

in-between spaces. By providing a way of looking at dependence of services given by the green structure the concept should also have a way of motivating involvement by stakeholders to protect the resources through different processes. I believe it is also easier for citizen in a community to talk about how they would like to develop their green structure, than for example where to densify because many are close to and use the green structure. It's also good to create a meeting place around something conceived as positive, e.g. to get a nicer, better green structure than where to densify, which is usually seen as negative by many citizen. To get off to a good start in dialogues like that could be very useful for following work.

Lastly five possibilities are mentioned: To open up for new levels of planning, To take an holistic approach to green structure and see behind property boundaries, To not get caught up in a conservation oriented sectorial interest, but connect different city development questions to each other in a multi-sectorial planning, To embrace experience-based knowledge from different actors and To see also the cultural factors that influence people's use of the green structure. Based on the comments on the problems and challenges I see that the ecosystem services concept have base to spur especially three of them, even though it doesn't work against the other two either.

The first is to provide the basis for a holistic approach through lifting green structure to a level more equal to the built- and infrastructure. Choices such as looking at the green structure first in different projects provide a very important part of that and I believe that by doing that through ecosystem services glasses the green structure and it values weighs heavier even when other aspects are added. This because our dependence of the services becomes clear and the concept encompasses many more values than the normal way of looking at green structure's connection to humans which is mainly through recreation. Jonas at KIT Arkitekter talks about issues connected to this when he says that he sees his work much as "*development without compromise [between green and other values], a development where both social and ecological values are strengthened because of the development*[15]".

By providing a way to look at development of green areas and not only conservation the concept might also help surpass the dichotomy between development of built- and infrastructure or conservation of green structure to a development of all of them. Hopefully this can provide the basis for a more multi-sectorial way to plan. The correct use of the system can also show how ecosystem services are a way to get other "urban" services we want, such as meeting places and exchange of knowledge and conveying that interconnectedness can also give a good imperative to incorporate green issues in planning projects on an equal base to other issues.

Lastly, the concept is a lot about scientifically founded knowledge, but also about learning from each other over professional borders and incorporating place-specific knowledge from different stakeholders. Having a general concept as ecosystems to provide the platform for discussions can be very useful to build bridges between professions and different stakeholders and spur learning and creation of new knowledge.

All together one can see that there is a lot of potential in the concept, but it also needs to be taken care of to give all the benefits. How the process is designed is very important to make this happen.

Suggestions on an Improved Process

Based on experiences from the thesis work and conclusions drawn in the above discussion a new process has been drafted. It presents an improved version of the processes performed in the thesis and also adds thoughts on professions in the project group. Each step is presented more in-depth below and summerized in picture in page 129.

Pro-process

Before work is started, possible actors/stakeholders connected to the green structure and the ecosystem services should be identified. Examples of actors/stakeholders could be the schools and preschools in the area, different associations that use the areas, housing companies, companies etcetera. They are stakeholders with a lot of knowledge that can contribute to the work, but also possible actors in implementing the ideas that come forward. To involve them early on is important and before start a list of possible actors/stakeholders should be prepared.

Step 1

An outlook into the area's ecological context should be made to place the project in a larger scale. If earlier work such as an analysis of regional ecosystem services or a comprehensive plan has been done, this might be about collecting information from these projects.

Based on the ecological context profile and typical urban UMTs/nature types, a mapping of what different ecosystems that exist within the project area should be done. The mapping doesn't have to be perfect, but should give an idea about where different ecosystem exist and how much of each ecosystem there are. Typical ecosystem types and corresponding urban UMTs can be found in attachment number two. If a biotope mapping of the area already exists this can be used.

Step 2

Based on a list of the existing ecosystems in the area workshops could be held with politicians, civil servants and actors/stakeholders to identify what services these ecosystem give the community. The workshops could be carried through with the help of aerial photographs or walks through the area. Both current and possible ecosystem services should be sought after and paired with what human well-being they contribute to. As a second part of the workshops the different groups' visions and wishes for the area should be discussed. This could also be seen as them expressing their wanted well-being.

Step 3

Based on the visions a prioritization of the found ecosystem services should be done to find the most important ones for the area. Ranking as it was performed in the thesis was a very good way to do this. It could be done with all groups simultaneously or at three different occasions and then combined.

As choosing the ecosystem services to work with is a big step in the process this step should end in a political decision as well as documentation on the work, the decision and coming work to send to participating actors/stakeholders.

Step 4

After these first phases follows two tasks of more research-like character that is performed by the project group, possibly together with external experts.

The first task is to identify drivers of change of the chosen services. A brain-storming session with the project group will take this far and additional information can then be sought by members of the project group or external consultants.

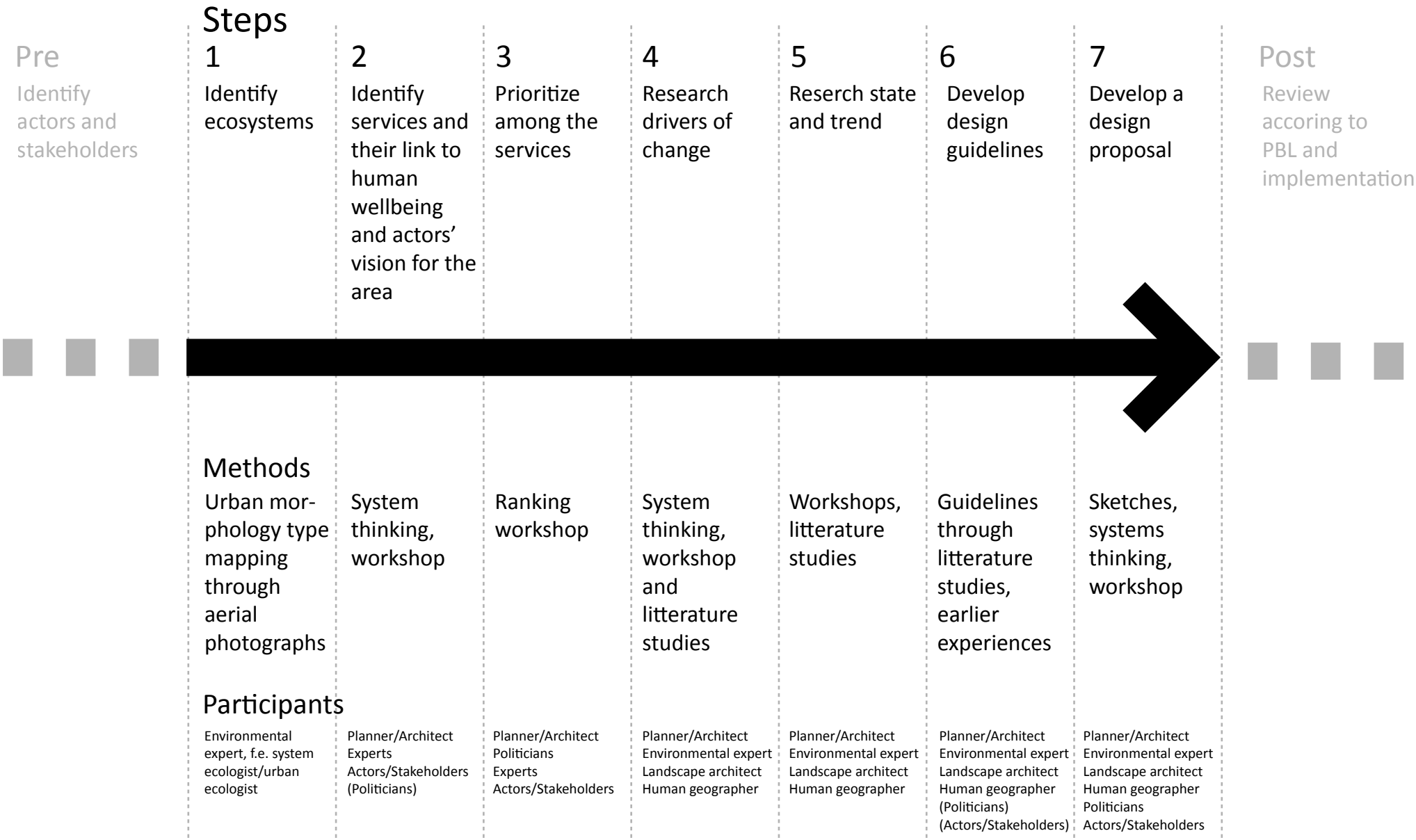
Step 5

The second task is to research the trend of the chosen services. This can also be done for the drivers and well-being. This should not become too complex and time consuming, but simply use what information there already are to give an indication.

The steps should end in a documentation of the found results to be used in coming steps.

Step 6

This step is performed by the project group and develops design guidelines for increasing each service



Suggestion on improved process

based on the knowledge from previous steps. If the work is done connected to other issues, for example densification, it can be combined with guidelines for that. For clarity, the guidelines should be divided between guidelines for a comprehensive planning level (ÖP/FÖP), a detailed planning level (DP/project). The design guidelines are developed by the entire project group, but with an emphasis on the planner/ architect.

If a general analysis was performed the information from the precious steps could also be used to develop suggestions on increasing services that is outside the plan the planning-project is aiming at. These ideas can be summed up in a separate document and be driven as separate project by suitable division within the municipality.

Step 7

Based on the ecosystem services guidelines at ÖP/FÖP level a green structure design proposal is developed. If the work is done connected to other issues the guidelines for that issue and the design proposal is used to layer a design proposal for that upon the green structure proposal.

The merged proposal is taken one step further by indicating focus and possible ecosystem services projects in different areas of the plan. The suggestion is preferably complemented by a list of possible actors for implementation of the different projects. Actors/ stakeholders connected to the different areas in the plan could be part of the design process by a workshop where they use the guidelines to come with their own ideas for focus and projects.

Post-process

These first steps of the process can be seen as a programme phase for the plan that then evolves into the making of a consultation proposal (*samrådsförslag*). When that is approved by the politicians it goes through a consultation and review processes established in the planning- and building law that lets the actors/ stakeholders and many others give their thoughts on the plan during meetings and exhibitions. The process ends when the plan is adopted by the municipal council.

The process after the plan is adopted is vital for the implementation and to avoid it becoming a shelf warmer. To get the work going it is suggested that a road-map for the coming ten years is written and adopted by the politicians. The road-map can be created by the project group in co-operation with actors/ stakeholders from the process that like to become part of the implementation. The road-map should state what is done when by whom and include all from the quick-wins that can be implemented right away to projects that demand more work before they can be realized. The quick-wins are important to show people who put effort into the plan that something is happening. Prioritization between different implementation projects could for example be based on the results from step 4-6.

For implementation of development projects by private developers one thought is that the guidelines can be translated into the kind of green surface factors used for example in Malmö during Bo01. It can also be used in architectural competitions as a vital part of the judgement of the projects with the "most ecosystem service positive project" as winner.

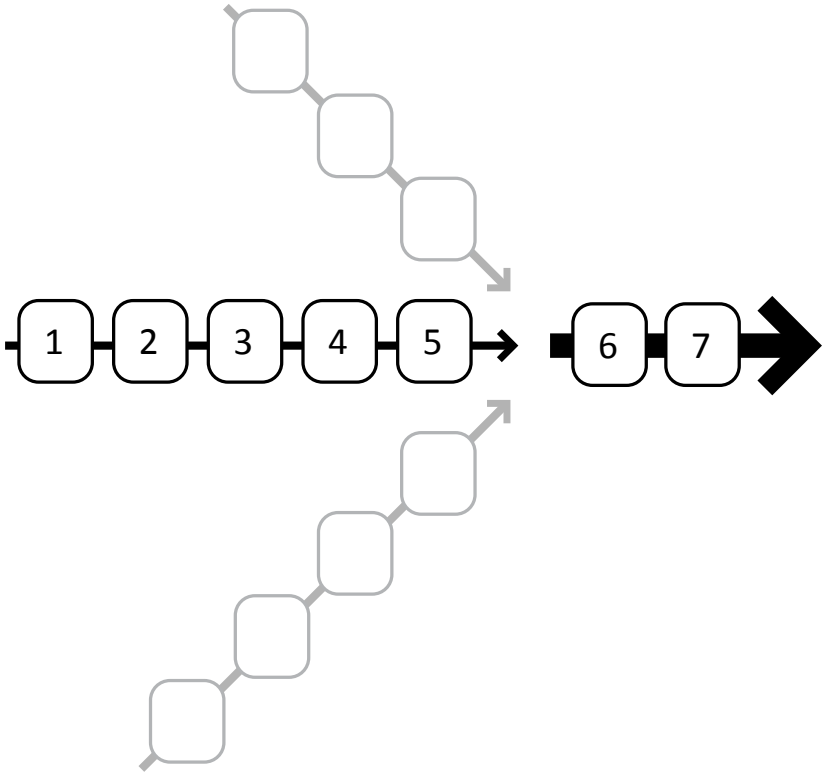
Another concept used in connection to greenery and development is the balancing principle. The main thought is that the one that takes away functions in nature should give them back and that in direct correlation to the project (the one is often the builder or developer). Lomma has started working with it and for instance tested it in the project Lomma Hamn. The concept is about keeping the ground's, water's and vegetation's ecological functions, but also health functions connected to nature- and culture landscape. The work is done in four steps. First, negative actions should be avoided as much as possible, then follows minimization of unavoidable negative effects, equalization of negative effects in their context and lastly compensation of the function in the same or another place.[16] Lomma municipality is now aiming at formulating a clearer method with rules for how to

use the principle that specifies what to compensate and how.[17]

One way to do that could be to identify what ecosystem services are provided in the area and what values they give and then that is what would be compensated. This way what is compensated and how to do it could be diversified. If a tree has to be taken down it doesn't necessarily have to be compensated with another similar tree, but with something performing the same functions. I believe this could be combined with the green surface factor concept. In my regard they complement each other good since one of them is for compensating what you take away and the other for improving the environment to become better than before.

Linking the Process to Other Issues

It is important that processes are open so that the issue of the process, in this case ecosystem services, can be related and discussed together with other subjects it is connected to.



The process works both when you only work with ecosystem services and when you want to include other issues. Step 1-5 deals with ecosystem services specifically, but step 6 and 7 can be opened up and provide for other issues to be discussed together with ecosystem services.

The process presented above works both when you only work with ecosystem services and when you want to include other issues. Step 1-5 deals with ecosystem services specifically, but step 6 and 7 can be opened up and provide for other issues to be discussed together with ecosystem services. In this case, densification was the issue included, but it could be other issues depending on the project's specific needs. The included issues are most likely preceded by steps assessing, analysing and valuing them as well. This way step 6 and 7 becomes a merger of several processes where values can be weighed against each other.

Footnotes

Introduction

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Pictures

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Front side (from upper left:
Mills Wallpapers
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Attachments

This part includes a description of ecosystems, a description of the MA Framework, a table for translation of UMTs to ecosystems and selected maps in a larger format.

Description of Ecosystems

To understand the ecosystem services concept fully an overview of ecosystems in general can prove useful.

An ecosystem is defined as *"an ecological system containing all living things and its habitat in a certain geographical area"* where the term system means *"a unit of matter and its energy content at a certain state"*[1] [author's translations]. It belongs to the science of ecology, meaning the economy or house-keeping of nature, that deals with many different aspects of processes that regulate the relationship between the living world's different parts (the biosphere) and the non-living surrounding world. Ecology often analyses the relationships within and between populations of one or many species through qualitative and quantitative, biotic and abiotic parameters. Ecosystems are one of many biological organization levels used within ecology. To understand the mechanisms of ecosystems demands a wide understanding of the natural sciences and ecology includes or connects to many other disciplines.[2]

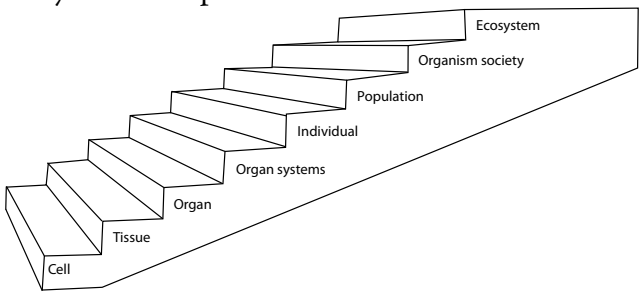


Image 1. Biological organization levels.

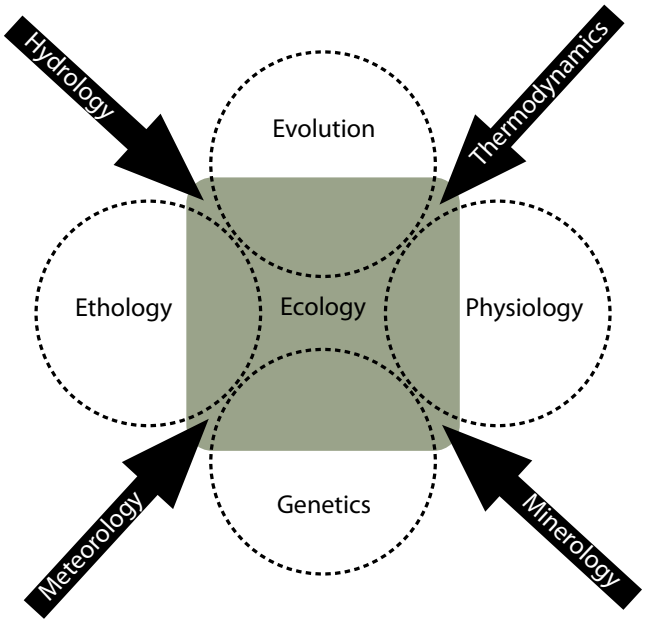


Image 2. Ecology and its connections to other disciplines.

To understand the basis of ecology and ecosystems one needs to be familiar with some of the basic laws of nature, such as the matter principle, the energy principle and the law of entropy. The matter principle state that matter cannot be created or disappear. This connects to the understanding of the material cycles and recycling. If matter is not flowing through the system, there will be impoverishment in some places and accumulation in others. The energy principle (also known as the first law of thermodynamics) state that energy cannot be created or disappear, it can only be transformed from one energy form to another. The law of entropy (the third law of thermodynamics) states that the general disorder increases (matter and energy wants to spread). This means that matter and energy generally speaking is transformed into something less useful.[3] There is also a second law of thermodynamics stating that there is no process whose only result is that heat from a single heat source is completely converted into mechanical work.[4] A concept connected to this is exergy, which measures the energy's quality or ability to perform mechanical work. For example 1 kWh electricity and 1 kWh room temperature contain the same amount of energy, but 1 kWh electricity can perform much more mechanical work and therefore has a higher amount of exergy.[5] This means that when the general disorder of energy increases and it is transformed into something less useful, it loses exergy.

To translate what this means for ecosystems you can say that ecosystems are made out of matter and powered by energy. The energy circulating in ecosystems is constantly converted into less useful energy, energy with less exergy.

The main supplier of energy to the earth's ecosystems is the sun that supplies the earth with high exergy energy. Through different processes in ecosystems this energy is transformed into low exergy heat that is radiated out from the earth's surface. The amount of energy in both cases is the same, but the exergy is very different. It is

those transformations of the sunlight's energy from radiation energy to chemical energy that powers the processes of cells, individuals and ecosystems.

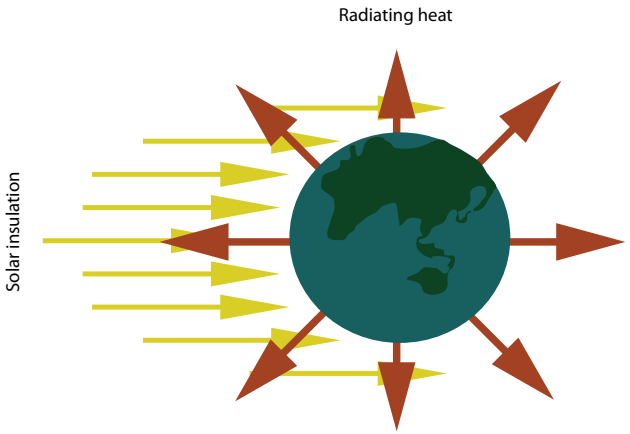


Image 3. Earth theoretical energy balance.

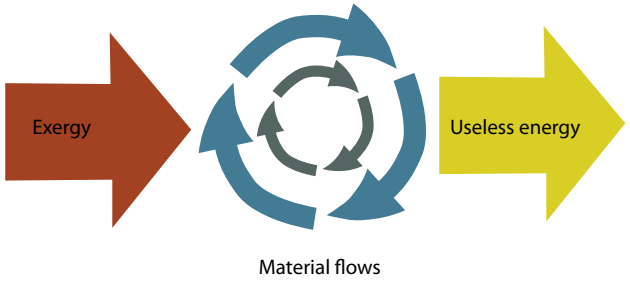


Image 4. Ecosystems and the energy from the sun.

All living things demand this constant flow of energy. If it stops, they slowly start to die. *"Living things are so complex, so well-ordered arrangements, that each disruption in energy infusion leads to some kind of destruction*[6]*"* [author's translation]. For ecosystems this can be for example disturbances in food chains that cause damage to the entire system.

Ecosystems are usually divided into three different structures: the environmental structure, the species structure and the trophic structure. The environmental structure describes the different external factors that define the ecosystem, their proportions and availability. External factors are for example energy provision (light and nutrition) and land and water composition and quality. The species structure basically constitutes the flora and fauna and include the system's organisms, how big their populations are etcetera. Lastly, the trophical structure tells the story of how energy and nutrients flows through the system. It describes what different functions each species have, i. e. what species that are producers, consumers and decomposers; different so called functional groups.

There are both natural ecosystems and cultural ecosystems that are controlled by humans. They both have the same basic content and principles but the way energy and matter flow through them are different.

The natural systems are completely driven by sun energy that through photosynthesis become available to the system. The different functional groups must all use some of that energy to maintain their life and therefore the further up the food chain you climb, the less exergy remains. Only 10 percent of the exergy put into one level of the food chain makes it to the next, the other 90 are used and the excess heat given of. Generally speaking the natural ecosystems are self-sustaining in matter needed to "build" the organisms, because the matter is reused, part of a closed loop. In reality, not many ecosystems are totally closed, but are influenced and influence surrounding ecosystems.

Cultural ecosystems are different. Since man started farming 10 000 years ago we have manipulated the systems more and more. We have taken nutrients from one ecosystem and put them in another to increase our yield from the services that ecosystem provides, usually food. In the beginning this was made by simple methods, such as the spreading of cow dung to increase fertility of the land, but ever since we discovered fossil fuels agriculture has been driven not by direct sun energy, but by another kind of energy, stored energy. The flow of material has turned from circular to linear flow, as the left overs of the production was put in garbage piles. With this two main links in the natural ecosystem have been broken – to live from the excess of the natural resources and to reuse the nutrients consumed. Cultural ecosystems are often very simplified. While most natural systems

are characterized by an abundance of species, the culturally affected land often has only one – it is monocultural. Today, almost all areas we inhabit are part of the cultural landscape, where natural landscape exist within small areas spread as islands. The cultural landscape has four subdivisions: the agricultural landscape, the built landscape (roads, houses, power cords etcetera), the extraction landscape (mines, gravel pits, peat) and manipulated water landscape (lakes, rivers, dams etcetera changed to meet human needs).[7]

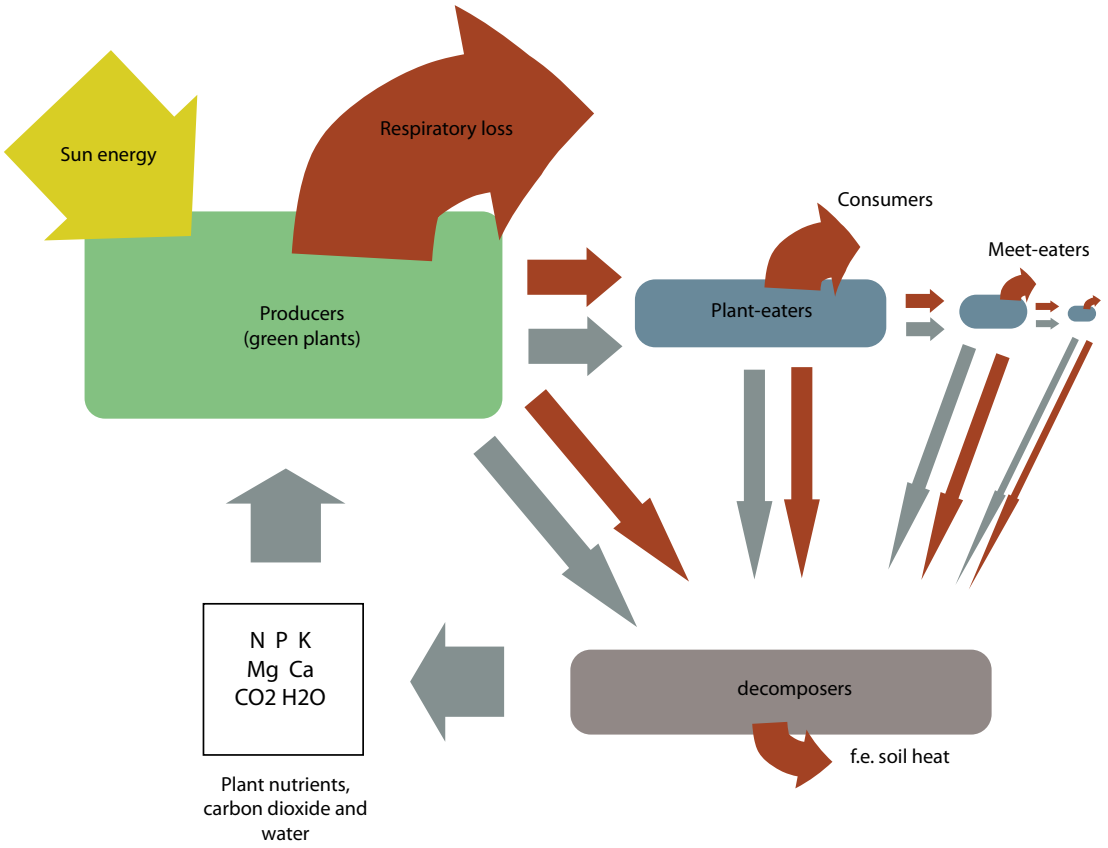


Image 5. The natural ecosystem

Description of the MA Framework

The Millennium Ecosystem Assessment (MA) framework was launched by UNEP in 2003 and focuses on the connections between ecosystem services on the one hand and human well-being and poverty on the other[8]. It was developed as a part of the UN initiative to perform a global assessment of the consequences of ecosystem change for human well-being and to analyze available solutions, The Millennium Ecosystem Assessment. It was designed to help decision-makers:

- *Identify options that can better achieve core human development and sustainability goals.*
- *Better understand the trade-offs involved – across sectors and stakeholders – in decisions concerning the environment.*
- *Align response options with the level of governance where they can be most effective.*[9]

Even though MA places human well-being as the focus, it sees that biodiversity and ecosystems also have intrinsic value and that the decisions people make concerning ecosystems considers both intrinsic value and well-being. It describes ecosystems as *"a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit*[10]*"* and see that humans are an integral part of ecosystems. It divides the ecossystem services into four groups - provisioning, regulating, cultural and supporting services.[11]

Provisioning services are products gained from ecosystems such as food, fiber, fuel and fresh water, but also genetic and biochemical resources. Regulating services are gained from the regulating processes going on in different ecosystems such as air quality maintenance, erosion control, water regulation and storm protection. Cultural services are the nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences and range from spiritual and religious values on to educational values and sense of place. Cultural services relate to human values and behavior and are bound to differ from place to place and between different cultures. Supporting services are needed for the production of all other ecosystem services. They also differ from the other three categories in that their impacts on people are either indirect or occur over a very long time. They include the production of oxygen, soil formation and water recycling.[12]

Human Well-being and Poverty Reduction

The ecosystem services affect and are essential for human well-being and poverty reduction. Human well-being includes basic material for a good life, freedom of choice, health, good social relations and security. It links to poverty because poverty can be defined as the deprivation of well-being.

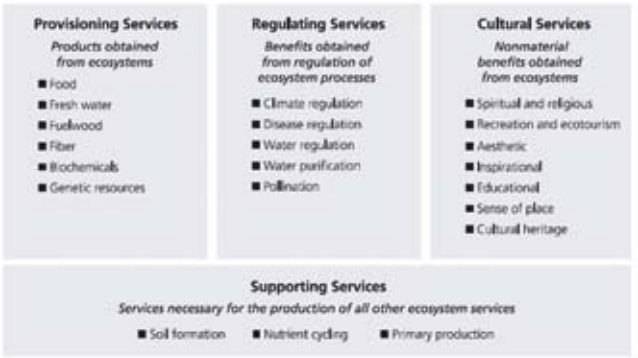


Image 6. The division of ecosystem-services.

Below follows some examples of how human well-being can be affected by changes in ecosystem services. Basic material for a good life mainly connects to provisioning services such as food production, but also to regulating services such as water purification. Health is also linked to provisioning and regulating services, including those that distribute disease-transmitting insects and pathogens in water and air. It can also be linked to spiritual and recreational services. Social relations are mainly affected by changes to cultural services, which affect the quality of human experience. Security can for example be effected by a lack of provisioning services leading to a conflict over declining sources, changes in regulating services that increases the frequency of floods or other catastrophes and loss of ceremonial or spiritual attributes of ecosystem that weaken the social relations in a community. Freedom of choice and action is based on the existence of all other components of

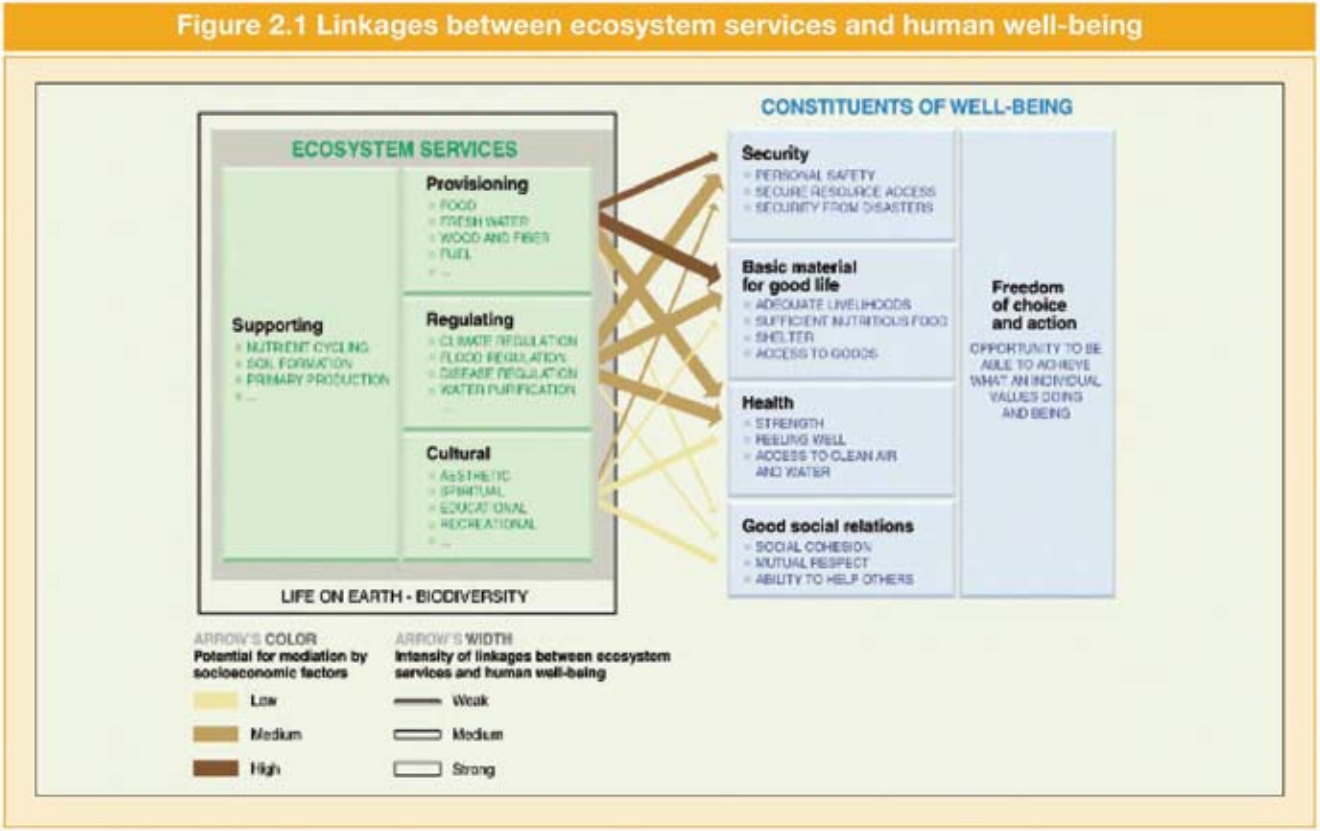


Image 7. An illustration of the connections between ecosystems services and human well-being as seen by the MA framework. The arrows show how different types of ecosystem services connect to the foundations of human well-being. As indicated by the intensity and color of the arrows, especially provisioning and regulating services have strong links to well-being.

well-being and is therefore also influenced by changes in all types of ecosystem services.

The MA framework sees the ecosystems and humans as constantly interacting. Changing human conditions both directly and indirectly effect ecosystems and ecosystems affect human conditions. These interactions can take place in different spatial scales and time perspectives.

In some cases the services that ecosystems provide have substitutes, such as water treatments facilities instead of wetlands and fertilizers to account for bad soil fertility. It is important to bear in mind that this is not true for all ecosystem services and that it can be economically disadvantageous to use substitutes. Also, available substitutions vary with your social, economic and cultural background and are often very limited to people with lower incomes.[13]

The bottom left corner shows the ecosystems and their services, based on biodiversity and life on earth. Biodiversity either produces the services directly, as is the case with food and genetic resources, or influence the services provided, such as recreational services. MA also recognizes that diversity of species has an intrinsic value, separated from human concern. The ecosystem services affect and are essential for human well-being and poverty reduction shown in the upper left corner.[14]

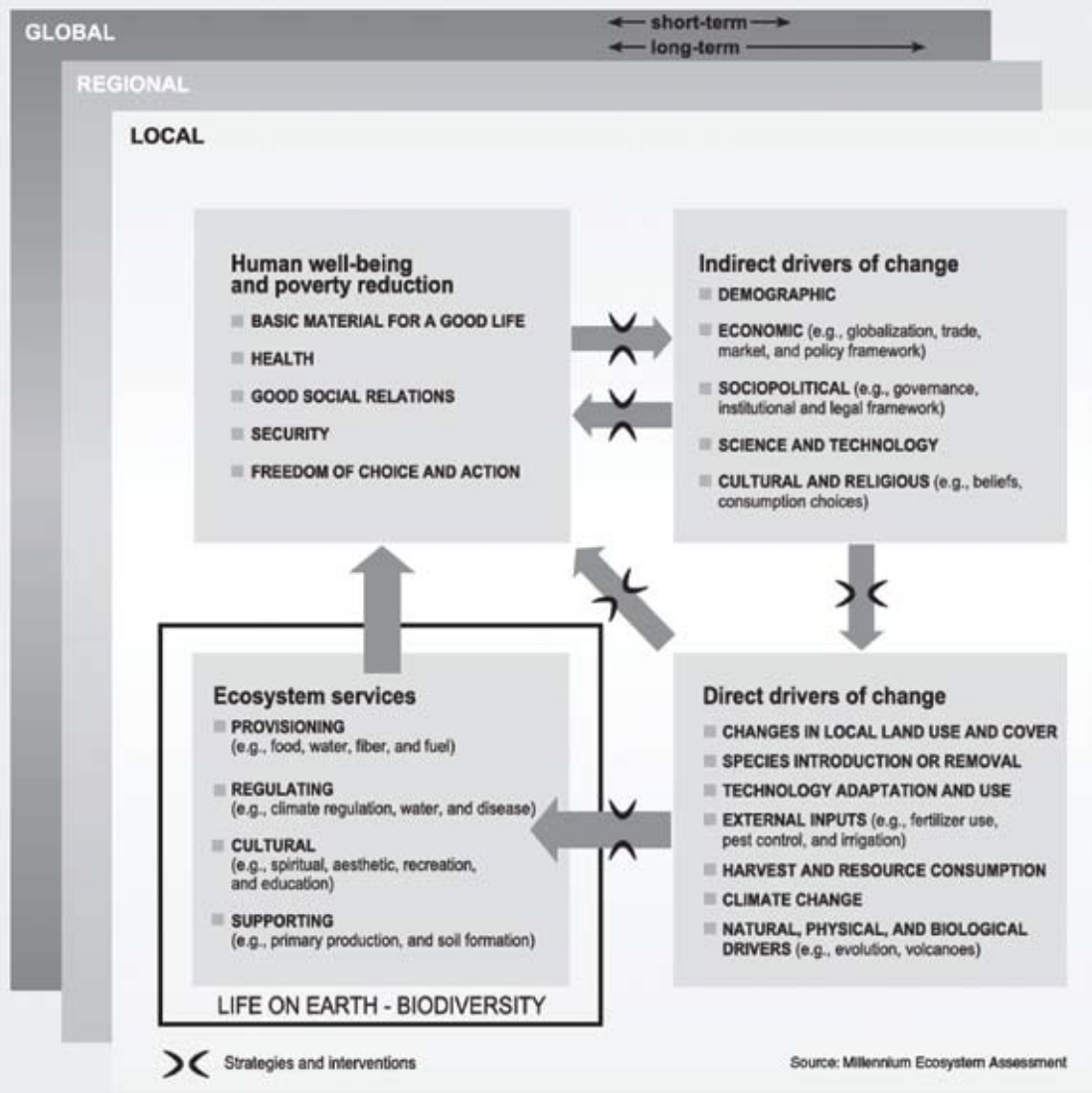


Image 8. The Millennium Ecosystem Assessment Framework.

Drivers of Change

The other two parts of the framework are drivers of change (seen to the right in the picture) that are the factors that cause changes in ecosystems. MA recognizes that there are indirect and direct drivers. Direct drivers clearly effect ecosystem processes, can be identified and also measured more or less accurate. Indirect drivers on the other hand, are more unclear and often influence one or more direct drivers. Therefore, they are harder to see and measure, and can often only be understood by establishing its effect on a direct driver. The indirect and direct drivers often operate synergistically.

Since MA is designed to provide decision-makers with material for their decisions, drivers are divided between endogenous drivers, which can be influenced by a decision-maker, and exogenous, that cannot. Whether or not a driver is endogenous is dependent on scale, spatial and temporal. One example is that a local decision-maker can influence certain things that a national cannot, and that certain decisions are only endogenous in a longer time perspective (for example population).

As can be seen in the graph, the indirect drivers are primarily demographic, economic, sociopolitical, scientific, technological, cultural and religious. They are further describes as:

The indirect drivers of change are primarily:

- *demographic (such as population size, age and gender structure, and spatial distribution);*
- *economic (such as national and per capita income, macroeconomic policies, international trade, and capital flows);*
- *sociopolitical (such as democratization, the roles of women, of civil society, and of the private sector, and international dispute mechanisms);*
- *scientific and technological (such as rates of investments in research and development and the rates of adoption of new technologies, including biotechnologies and information technologies); and*
- *cultural and religious (such as choices individuals make about what and how much to consume and what they value).*[15]

Direct drivers are primarily physical, chemical and biological, for example land cover change, climate change, use of fertilizers, harvesting and water pollution.

In both groups it is clear that the drivers are changing. World population and economy is growing, the climate is changing, and information technology advances etcetera. These changes in drivers of ecosystem services lead to changes in ecosystem services that in their turn lead to changes in human wel-being and drivers.

One important point when it comes to drivers and their interconnectedness are that decision easily have consequences outside the decisions themselves. These consequences are called externalities and can be both positive and negative. A positive one might be a beekeeper motivated by the profits made from selling honey, which also makes the surrounding orchards produce more apples because of the bees' enhanced pollination.[16]

Spatial and Temporal Scales

The last part of the MA framework are the spatial and temporal scales, included because processes are expressed in different timespans and geographical areas. MA means that different ecosystem services often have their characteristic scales, and those spatial and temporal scales are closely related. These are important to find, to assess the service at an appropriate level.

Social, political and economic processes have characteristic scales, which often do not match the ecological processes. According to MA many environmental problems have their origin in this mismatch. Connecting the different scales to each other is described as very important.

Outcomes at a given scale are often heavily influenced by interactions of ecological, socioeconomic, and political factors emanating from other scales. Thus focusing solely on a single scale is likely to miss interactions with other scales that are critically important in understanding ecosystem determinants and their implications for human well-being.[17]

Ecosystem Services and Natural Resources

Ecosystem services and natural resources are two connected concepts used to describe values in nature. Natural resources are defined as *natural phenomena in the form of matter or energy sought after and used by man*[18] whereas ecosystem services are defined as *services provided by nature that man are dependent upon.* Ecosystem services are usually divided between provisioning, regulating, supporting and cultural services[19]. In this division natural resources can be seen as a part of ecosystem services, but ecosystem services are much more. The natural resources fit in under provisioning services together with food production etcetera.

Natural resources are divided into three groups with different rate of renewal – stored resources, fund resources or flowing resources. Stored resources are non-reproducible meaning that they cannot reproduce within one for man reviewable timeframe since they have formed during thousands and thousands of years of geological processes. All fossil fuel are stored resources, but also sand, gravel and minerals[20]. Fund resources can give continuous yield if they are taken care of, such as water, land and biological resources,

for example plant- and animal life. Examples can be a forest or a herring stock. Flowing resources are in principal unlimited, for example sun light, atmosphere and the water in the hydrological cycle.[21]

Table for Translation of UMTs to Ecosystems

Below is a table showing the ecosystem types and corresponding UMTs. In some cases the same UMT belongs to two different ecosystems.

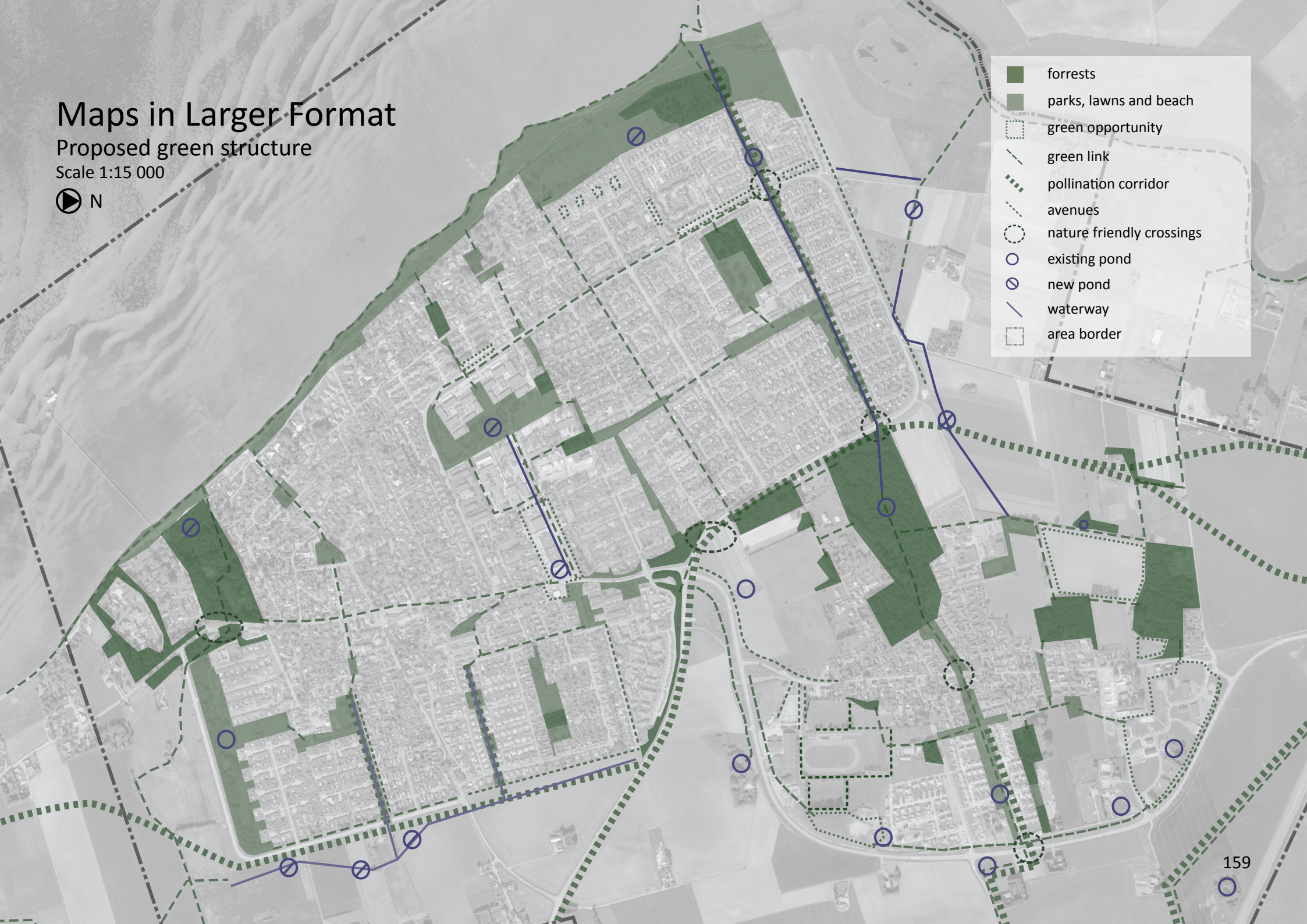
Ecosystem	UMTs
Marine	Lakes and sea
Wetlands and ponds	Wetlands, ponds and storm water treatment
Rivers	Rivers streams
Forest	Woodland and copice
Coast	Shore
Meadows and pastures	Meadows and pastures
Urban parks/yards	Lawns with naturelike elements, high density residential, churches
Urban grassland	Lawns, disused and derelict land, sportsfields
Farmland	Arable lands
Gardens	Medium density residential, low density residential
Open space/impervious surfaces	Formal open space, high density residential, other institutions, schools and nurseries, mixed uses, retail, town centre, major roads, refuse disposal
Bare soil	Disused and derelict land

Maps in Larger Format

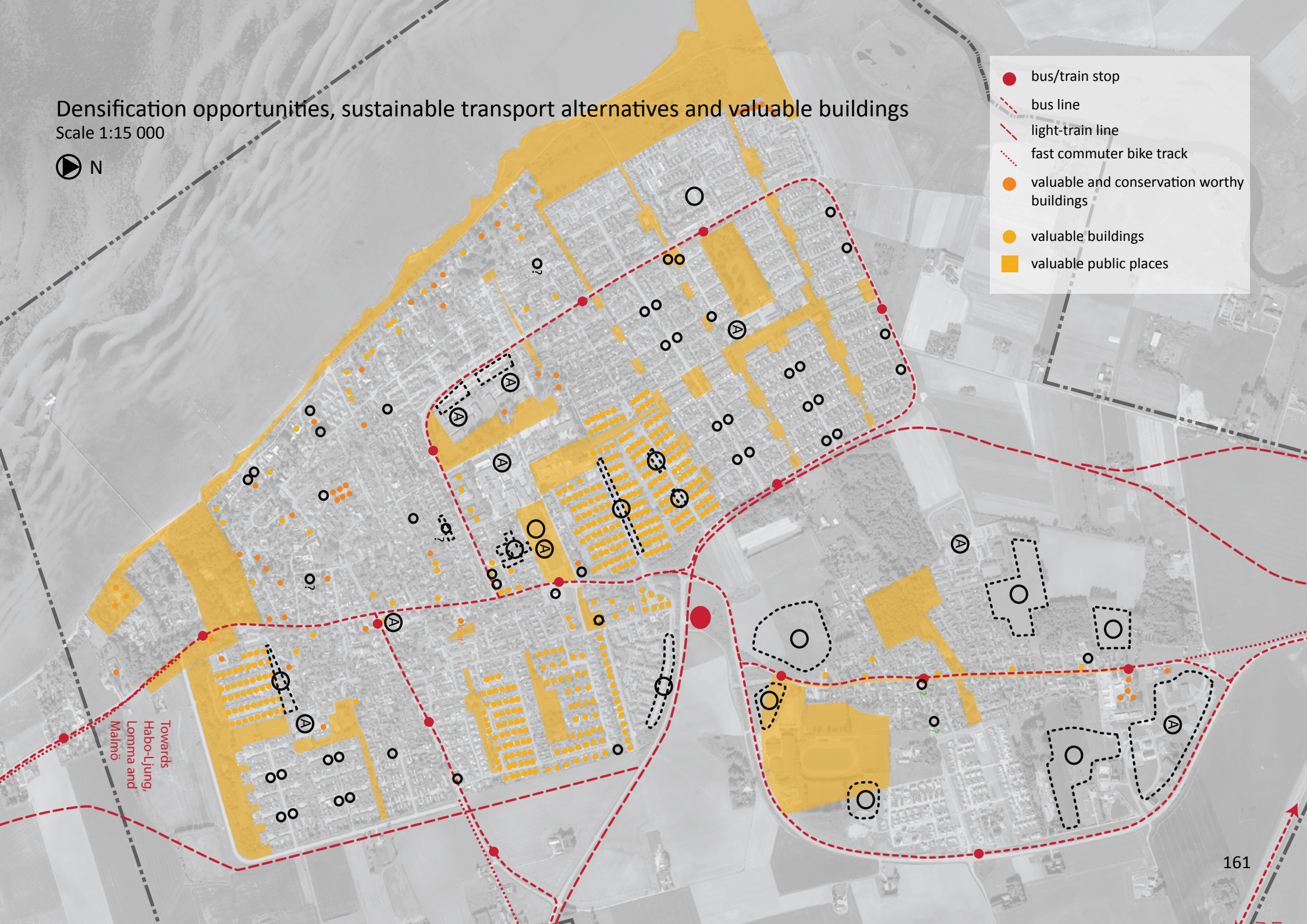
Proposed green structure

Scale 1:15 000

N




Densification opportunities in the green structure
Scale 1:15 000
N
single unit opportunity
multiple unit opportunity
addition opportunity


Densification opportunities, sustainable transport alternatives and valuable buildings
Scale 1:15 000
N
bus/train stop
bus line
light-train line
fast commuter bike track
valuable and conservation worthy buildings
valuable buildings
valuable public places
Towards Habo-Ljung, Lomma and Malmö


Suggested heights in densification areas
Scale 1:15 000
N
one floor
two floors
two-three floors
three floors