Q-BOOK ALBANO 4

Sustainability

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CONTENTS:

1. INTRODUCTION
1.1 Albano Resilient Campus (ARC)
1.2 Albano as a critical urban development project for Stockholm
1.3 Albano as a leading example of contemporary international urban design

2. APPROACHES
Sustainable urban development in the perspective of resilience theory
2.1 Historical development of resilience from its ecological origin
2.2 Change and diversity as a strategy for adaptive management
2.3 Self-organisation and place-based learning lead to decentralisation
2.4 An expanded conceptualisation of urban development

3. OBJECTIVES
3.1 New urban services through synergy effects and linkages
3.2 Objectives for the ecological systems
3.3 Objectives for the social systems

4.COMPONENTS:
Critical institutional and spatial components in sustainable urban development
4.1 Identifying the tools of urban development
4.2 Social-ecological design components
- 4.2.1 Green arteries
- 4.2.2 Active ground
- 4.2.3Performative buildings
- 4.2.4 Property rights/rules
- 4.2.5 Social networks
- 4.2.6 Local culture

4.3 Ecosystem services and urban system services
- 4.3.1 Exchange of knowledge
- 4.3.2 Publicity
- 4.3.3 Recreation
- 4.3.4 Biodiversity

5. CONCLUSIONS:
Social-ecological compositions
5.1 The Albano case
5.2 Design of Active Ground
5.3 Design of Green Arteries
5.4 Design of Performative Buildings
5.5 Institutional compositions
5.6 Implementation

6. EPILOGUE:
Social-ecological design principles and their institutional framework

7. REFERENCES

1. INTRODUCTION:
Albano Resilient Campus

1.1 Albano Resilient Campus (ARC)

The world around us is changing ever faster, forcing urban developers and planners to take on greater challenges than ever. Globally, urban residents will increase dramatically over the coming decades and this development is today taking place at the cost of cultural landscapes lost. In order to function cities are completely dependent on their hinterlands. Nearly all available land is today used by people and the goods produced are primarily consumed in cities, rendering the division of urban and rural as distinct entities less and less relevant. Growing populations and global warming increase the pressure on the land to produce not only victuals but energy crops and raw material for manufacturing as well. Functioning ecosystems are a prerequisite for the continuation of these services. At the same time the condensation and hotbed for social networks that cities offer is not only the foundation for our society but also a way for necessary knowledge development and implementation of effective solutions to many of these problems.

From an ecological perspective two global challenges are of particular importance in this context; to slow down the extinction of species and the ecosystem services generated by the interplay between organisms, and to reduce the emissions of greenhouse gases to mitigate the climate change. To meet this challenge we need new models and new ways of thinking, where cities are better integrated with the living ecosystems. Can we preserve, or even strengthen, locally generated ecosystem services at the same time as we develop new, modern urban environments?

In addition to producing goods and food the ecosystems supply other services contributing to better living conditions; trees and other plants absorb pollutants and regulate light and wind conditions, wetlands purify water, flowers promote pollination which in turn contributes to food production etc. (Bolund and Hunhammar 1997; MA 2005). If such ecosystem services could be built into the urban environment much would be gained. In the future development of the Albano area there is a strong potential for doing this and meet the challenges facing us. Q book 4 demonstrates how such a development could be effected and how Albano could become a unique example of sustainable urbanisation.

Sustainability is a broad term and can today mean almost anything. Our take on sustainability focuses on social-ecological design aspects and is founded on the resilience theory, which in essence deals with how buffering capacity and potential for renewal in relation to internal and external disturbances can be built on a system level. One central concept is ecosystem services, i.e. the goods or processes that the

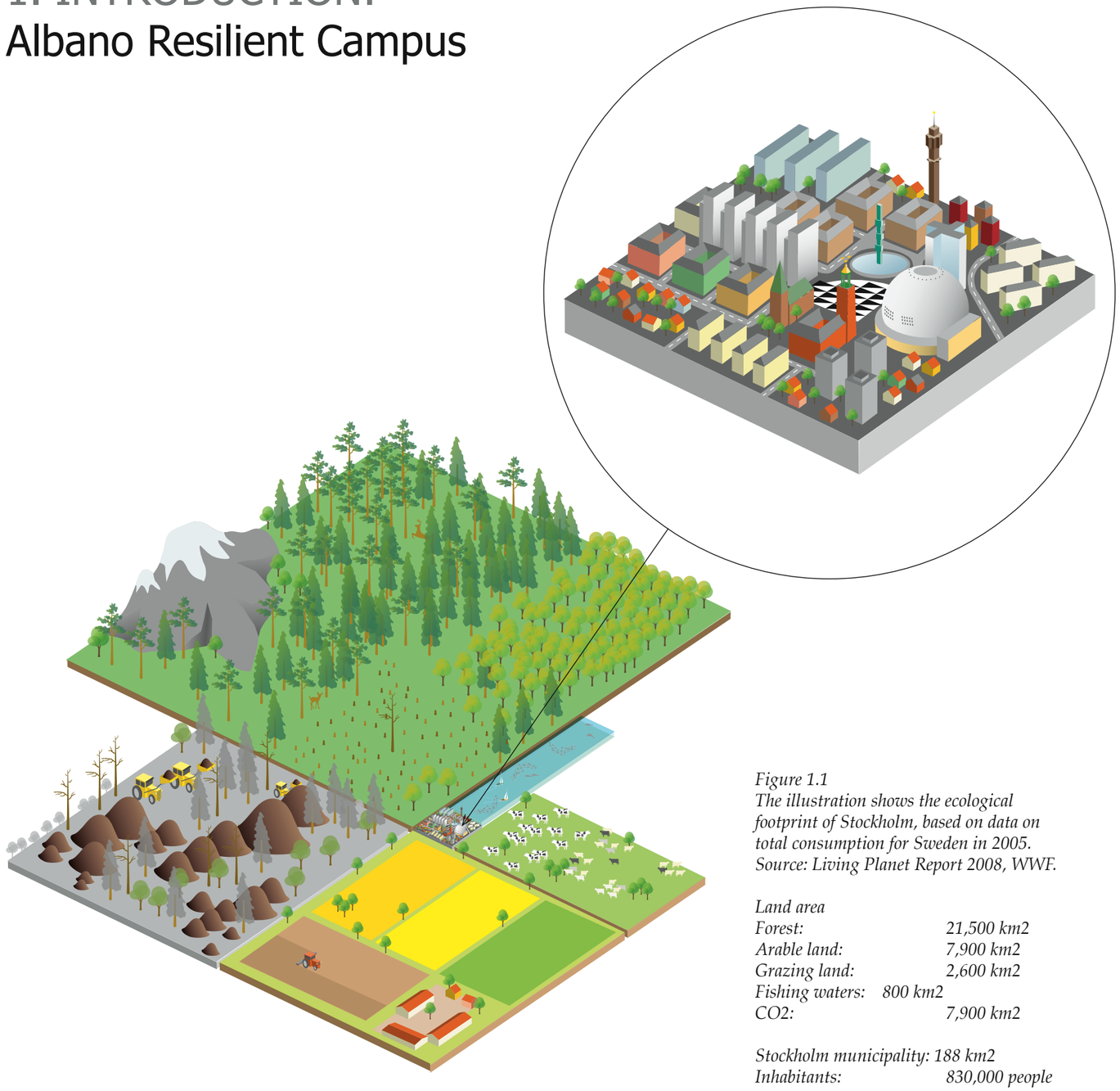


Figure 1.1
The illustration shows the ecological footprint of Stockholm, based on data on total consumption for Sweden in 2005. Source: Living Planet Report 2008, WWF.

Land area

Forest:	*21,500 km2*
Arable land:	*7,900 km2*
Grazing land:	*2,600 km2*
Fishing waters:	*800 km2*
CO2:	*7,900 km2*

Stockholm municipality: 188 km2
Inhabitants: 830,000 people

living ecosystems generate and that are used directly or indirectly by people. Examples include food, fuel and building material, but also regulating and supporting services, such as pollination, natural pest control, protections from floods, purification of water and air, which are invisible in the economic systems (Bolund and Hunhammar 1997; Barthel et al. 2005; MA 2005). Our work is also drawing on on-going research on urban and ecological systems carried out at KTH and Stockholm Resilience Centre. This means we view ecosystem services as supported and maintained both by social institutions within the city and the physical layout of the city. We focus less on technical solutions, although these are of course important, and more on the elements that directly influence how the city is developed and used. Shape plays an active, performative part in the sustainability work and is not just an aesthetic expression. Thus we also present different "social-ecological compositions" – a number of different suggestions for the physical form this development could take.

One tenet in the social-ecological approach is to start from a site's local conditions, and in Albano these are special. It is located in the National Urban Park of Stockholm and has great ecological and cultural values to both preserve and make use of. It is part of the great Gustavian palace project surrounding Brunnsviken, with sight lines and ideals stemming from the 18th century. Albano is part of a cultural landscape characterised by the long history of use and the forward looking management. Today, however, the site is a brownfield located in one of the most sensitive areas of the park where the Roslagsvägen road separates Hagaparken from Norra Djurgården. Albano is also part of a string of university facilities and departments lining the park, but the transportation passages traversing the area today isolate Albano from the rest of the city rather than connecting the two. Albano has the potential to grow into an educational centre of great importance not only for Stockholm but internationally as well, and to bridge the gaps between the different parts of the National Urban Park, strengthen ecological corridors and function as a welcoming entrance to the park from the city.

Based on resilience theory, described later in chapter 2, Q book 4 suggests a number of different measures. Importantly, these include design of both spatial and institutional components, so-called critical social-ecological design components. The concept of institutions is used within the social sciences as societal institutions and includes the formal and informal rule systems, rights and practices that affect social practice (Ostrom 1990; Hanna et al. 1996). The discussion on urban design most often revolves around physical components such as urban shape and housing typologies and rarely includes the institutional framework. We include these issues, especially management

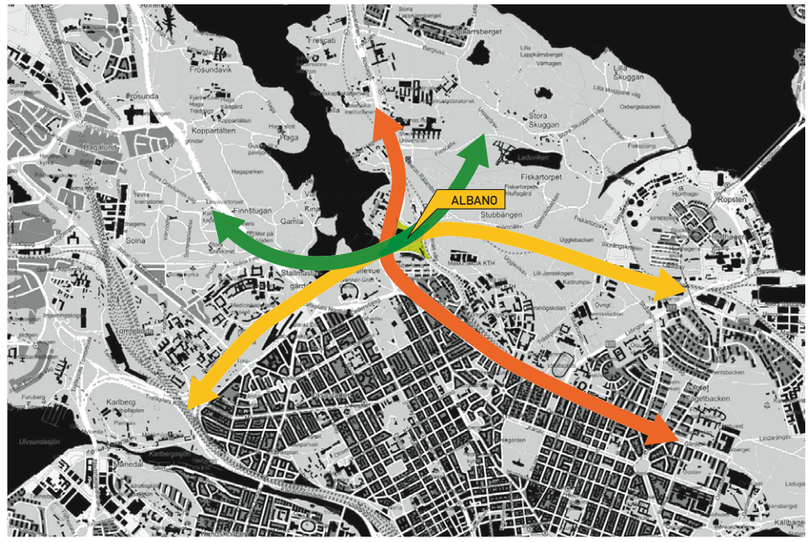


Fig. 1.2 Albano has potential to strengthen important social and ecological linkages.

institutions, which can keep up activities at the site and promote place based learning and the capacity to change. We argue for a polycentric management (Folke et al. 2005; Ostrom et al. 2007) where different local actors and users share responsibilities. By connecting users in different networks place specific hands-on knowledge can be combined with analytical knowledge from research institutes. This provides the basis needed for an adaptive attitude where measures and methods can be adapted to the place based knowledge accumulated over time.

Spatially, the landscape is divided into smaller management units, which makes it possible for a diverse set of actors, users and biotopes to exist side by side. Buildings are designed to interact with the landscape performatively, with green roofs, walls and yards that can support ecological functions such as water treatment and dispersal of birds and pollinators while at the same time offer an inspirational educational environment to researchers and students. To become a living public space Albano must be connected to the rest of the city, with roads as well as public transportation. A number of important, access creating connections are presented as green arteries, i.e. important dispersal routes for a multitude of different organisms.

The objective is to make the whole area to work as one big research laboratory for sustainable urban development where different solutions can be tested full-scale and, by involving different actors, continuously contribute with new knowledge on how social-ecological systems develop. The activities will form a natural continuation of the area's history, with a tradition of usage as an experimental field for agriculture, forestry and landscape planning reaching back to the reign of Gustav III. We believe Albano Resilient Campus can highlight and elaborate an approach to urban planning where change is normal and the key to a city's success lies in how well it can adapt to changing conditions and engage a multitude of actors in a continuously ongoing development.

1.2 Albano as critical urban development project for Stockholm

Today, large transformations are taking place in the border zone between the northern part of central Stockholm and adjacent areas. In the new development plan for the city the area is divided into three parts: Norra Station, Albano and Norra Djurgårdsstaden, all three described as strategically important for the city centre (Stockholms översiktsplan 2010, SBK, Stockholms city). The shared vision for all three areas is to integrate them with the central city and what it has to offer in terms of urban lifestyle while at the same time keep and strengthen the high cultural and natural values present in the areas.

Norra Djurgården and Norra Station are important for the city's future housing supply and many new housing developments are already being planned. However, the development plan emphasise the importance of the northern central part of the city and its boundary zones for Stockholm's role as a future knowledge city, especially highlighting Norra Station and Albano. In this regard, Albano's strategic location is unique.

This corresponds with the ambitions held by the building proprietor Akademiska hus and the primary tenant Stockholm University. From their perspective, more specific questions of developing internationally competitive knowledge environments and how the research environment may contribute to the development of advanced sustainable construction both of specific buildings and the cityscape as a whole are added to objectives of an integrated and living urban environment with preserved natural and cultural values. The fact that Albano is situated in the National Urban Park of Stockholm, an area of national interest, and that one of the future tenants will be the Stockholm Resilience Centre with an international reputation within the field of sustainable development is further bringing these matters to a head.

Taken together, these issues make Albano one of the most important development areas for Stockholm city, Akademiska hus and Stockholm University, offering a unique opportunity to build an internationally competitive research environment which at the same time is a leading example of sustainable urban development, both of highest importance for Stockholm's future economic and social development.

Fig. 1.3 Albano's critical position where the National Urban Park is crossed by a highway.

Fig. 1.4 Appointed development areas in northern Stockholm according to the new general plan.

1.3 Albano as a leading example of contemporary international urban design

The unique conditions found in Albano should also be put in a larger perspective to more completely identify the target of the pending development. Without simplifying unreasonably, one might say that cities have always been about exchange – socially and culturally certainly, but always with and underlying attractor of economic exchange. The situation is much the same today, but we can see one important shift, especially among the developed economies, from production and exchange of goods to that of knowledge, where universities and colleges have become the equivalent of the factories of the industrial time. For many cities the critical challenge within planning and construction is thus to change into attractive areas for developing and exchanging knowledge in collaboration and competition with other cities around the world. No place or project in Stockholm is of greater importance for the success of such a transformation than Albano.

If this is the primary target for urban design in many cities today, our present time also puts new demands on how such a project should be carried out and of what it need to include. Previously, the focus for urban design has been to shape the physical environment and to guide and support different kinds of social and economic processes. The agreed upon assumption has been that urban development is something apart from nature and as such often in conflict with nature conservation concerns. However, with the current environmental situation this is an untenable assumption and the great challenge urban design is facing is, as discussed earlier, how ecosystems can be integrated into an urban development aimed at long-term sustainability.

Stockholm has an international reputation for leading the way within sustainable urban development and has an internationally acclaimed and cited example in Hamarby Sjöstad. Progress within this field is fast and Stockholm need to move forward to maintain its position, both in terms of the principles used for finding future solutions and how these might be practically implemented. Albano, together with the adjacent Norra Djurgårdsstaden, is the best opportunity Stockholm has to develop an internationally leading example of how this challenge might be met.

Fig. 1.5 Albano is situated centrally in relation to several important education centres.

Fig 1.6 Albano has potential to become one of several gateways between the city and the Park.

2. APPROACHES:
Sustainable urban design in the perspective of resilience theory

2.1 Historical development of resilience from its ecological origin

Resilience as a concept visualises the dynamics of nature caused by disturbances and change. The concept was developed in the 60ties and 70ties based on ecological research on how the dynamic interplay between predators and prey can relate to the stability of ecosystems (Holling 1961; Folke 2006). An important insight was offered 1973 by C.S. Holling who showed that ecosystems may have several stable states. Thus, nature is not in "balance", bur in constant change where a few dominating processes tend to "capture" ecosystems in certain states that we perceive as natural. Small changes in slow variables (e.g. pH in lakes or the frequency of larger disturbances such as fires or storms) may over time cause ecosystems to shift abruptly in their character and function. A classic example is the shallow lake that shifts from clear to turbid with profound implications for plants and animals. Another example is where former coral reefs have shifted to a new algae dominated state, a shift partly caused by the reduction of algae browsing organisms due to overfishing, diseases and contaminants. Holling (1973; 1978) defined resilience as an ecosystem's ability to absorb disturbances, renew itself and continue within a specific state. His research made it clear that it is the system's resilience that decides the durability of variables and relations within the system, and thus its aptitude for renewal and endurance when under stress. A transition from one state to another means a shift in dominating relationships and variables when a threshold is crossed.

During the 1990ies and the early 21st century these thoughts gained momentum in the scholarly discourse and later also within policy. A qualitative difference arising when you use this perspective instead of focusing on single species (e.g. red listed species) is that ecosystem functions and processes become the target of management. These must be incorporated into planning to maintain the system's resilience. Tightly coupled to this change in thinking is the view that ecosystems are dynamic and that man is an integrated part of nature. As a consequence, and contrary to traditional conservation biology, humans are seen as actors upholding resilience and biodiversity within historical, cultural landscapes rather than a destructive force (Cities are often placed on cultural land) (Berkes and Folke 1998; Barthel et al. 2005).

Since the resilience concept paved the way for the insight that ecosystems have many different alternative stable states, management within this framework has come to focus on how tipping points may be avoided. One approach on management based on the resilience concept is called adaptive management (Holling 1978; Gunderson et

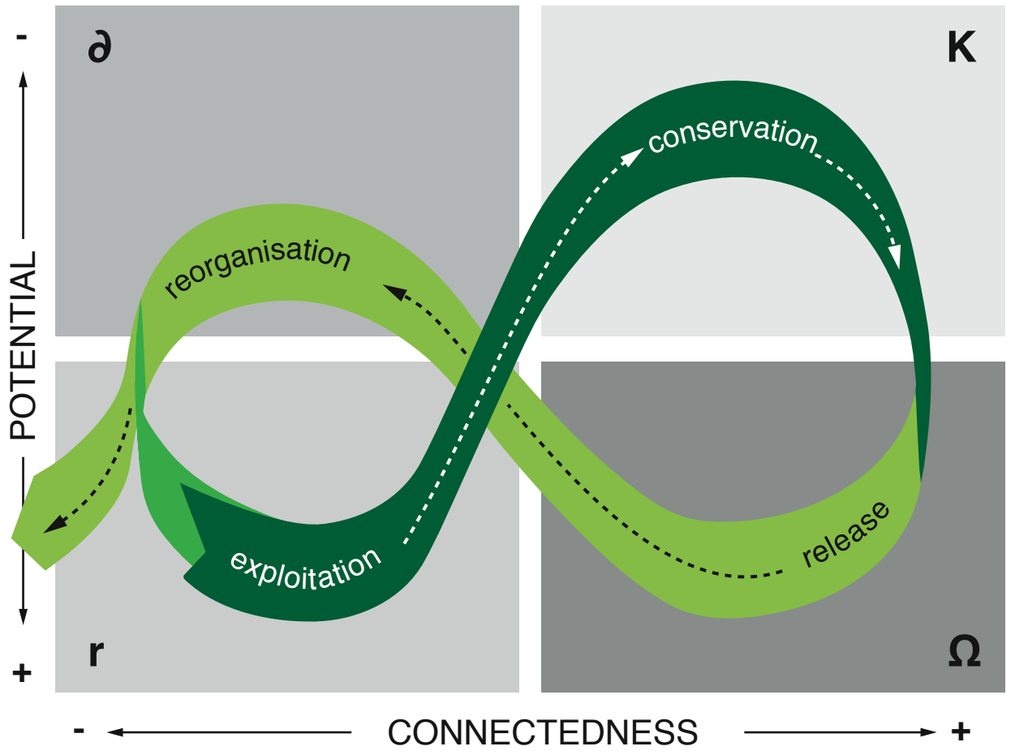


Figure 2.1
The diagram illustrates how ecosystems evolve over time. You start reading from the lower left corner, with the system in the so called r-phase. The r-phase stands for establishment/exploitation of unvegetated land, e.g. land cleared by a fire. At this stage the land has great potential for development of biodiversity and the ecological memory will decide which species will be present. With time, generalists good at tapping the stored energy but poor at competing will establish. These include e.g. herbs and flowering plants. Over time the number of species will climb and biodiversity will be highest at the end of this phase, but use of energy is not optimised. This stage is where you find many cultural landscapes kept in the r-phase by continuous management. In the next phase, the K-phase, energy is stored most efficiently. Biodiversity is lower as the system is dominated by a few strong competitors. Low diversity renders the system vulnerable to disturbance. "The K-phase is an accident waiting to happen" as Holling phrased it (Holling 1978). The omega phase symbolises the accident/disturbance. It entails loss of energy, for example heat during a forest fire. The alpha phase symbolises re-organisation and renewal of the system after the accident. Renewal relies to a great extent on the "ecological memory" of past phases and the disturbed site's linkages to other ecosystems in the r- and K-phases. If these are not accessible in the alpha phase the system risk tipping into a new stability domain.

al. 1995). The message was that uncertainty and surprises must be disregarded and that management of natural resources should use change as a strategy rather than just responding to it.

2.2 Change and diversity as a strategy for adaptive management

Change as a strategy builds on the insight that all systems are exposed to disturbances of different kinds and that a certain level of disturbances is beneficial to diversity (Grime 1973). This can be exemplified by traditional agriculture where hay meadows have high biodiversity and the hay making itself an intermittent small scale disturbance preventing the system from reaching a climax phase (the K-phase, see figure). Human use is keeping down the populations of strong competitors and thus providing space for a multitude of herbs that would otherwise have been outcompeted. Without the hay making as a social practise the meadow is soon overgrown, first by grasses, aspen and other strong competitors for the sun light, and then, after half a century, by less biodiversity rich spruce forest. The spruce forest represents the K-phase; a system rich in stored energy but with low potential for change and thus vulnerable to large scale disturbances such as disease or fire (Holling 1978). The system has low resilience in the K-phase, despite the quite stable appearance. Small scale periodic disturbances thus promote biodiversity at different scales. Awareness of this dynamic is important for social-ecological resilience, and is often found in traditional societies with a long history of managing local natural resources (Folke et al. 2003).

Change is just as prominent within the human domain. A comparison between and autocratic society and a democracy may serve as a graphic illustration of change as a strategy is important for the maintenance of resilience. An autocratic, top-down controlled society with shared world views and values may respond quickly to changes through clear lines of command. On the other hand, static world views and values may become a liability rather than an asset over the long term as they relate to an ever changing larger world. An autocratic government may be successful, perhaps especially in swiftly growing nations and corporations, but history has shown that it is difficult to maintain public acceptance of a top-down world view. The collapse of the Berlin wall may illustrate this: The wall shut out disturbances and changes to the point where the whole governance regime collapsed from interior strain and tensions (compare with the example of the storm Gudrun and monoculture forest below). The constant debate and strife of democracies may be seen as tedious and time consuming, i.e. an obstacle when decisions are needed quickly. Yet history shows that groups and societies allowing dialogue and debate about values and world views are better at absorbing information from the surrounding world. Change as a strategy welcomes alternative world views, critical discussion and intermittent small scale disturbances in ecosystems according with traditional practices. To include small scale change/ disturbance thus "lets off the steam" and reduces the risk of large scale disturbances and chocks (Folke et al. 2003).

What, then, is the relationship between diversity and ecological resilience? More recent ecological research has revealed response diversity and ecological memory as two central functions (Elmqvist et al. 2003; Bengtsson et al. 2003). Response diversity defines the different ways species (and populations within the same species) organisms contributing to the ecosystem function (e.g. pollination) may react to a disturbance. To illustrate: If all pollinators would respond negatively to climate change the response diversity is low and the function is in risk of being lost over time. If instead the response diversity is high pollinators will respond very differently, and the ones being positively affected can increase and thus compensate for the ones that decline, thus sustaining the function (Elmqvist et al. 2002). The knowledge we have today on which species contribute to response diversity for different functions is limited, calling for preservation of all species as a precaution.

Swedish forestry and the storm Gudrun in 2005 may be used to highlight the relation between response diversity and resilience. Heterogeneous landscapes (so called mosaic landscapes) stand a better chance of surviving storms than do homogeneous ones (monocultures) as strong winds will act differently depending on vegetation and land-use. Looking back it is evident that the top-down driven, monoculture based forestry of 2005 was especially ill suited to deal with a disturbance like Gudrun. The strategy founded on the economic efficiency of growing even aged Norway spruce led to catastrophically large wind-felled areas, with most of the spruce stands being affected in the same way. The system had low response diversity. The areas least affected where the more heterogeneous ones where the diversity of species, age and land-uses interacted (Hahn et al. manuscript).

Ecological memory deals with how renewal may take place after a chock even when local populations have been lost. Three points are crucial. The first point is access to support areas, i.e. similar environments not hit by the disturbance. Diversity at the landscape scale is important since heterogeneous landscapes are more likely to contain support areas, for example after a storm, since disturbances play out differently depending on vegetation and land-use. The second point is presence of mobile links, i.e. organisms (e.g. birds and insects) able to transporting new seeds to the disturbed area and thus initiating regrowth. The

third point depends on the intensity of the disturbance and is called biological legacy. It includes seeds hidden in seed banks and surviving plants and animals. If the disturbance is intense, e.g. a severe forest fire, the legacy is small and the area become more dependent on the first two points (Bengtsson et al. 2003). An important conclusion within adaptive management of ecosystems is that you must be aware of these dynamics and facilitate their operation.

Holling and Meffe (1996) described what happens if knowledge about the dynamics of ecosystems is lost within management organisations (see also figure 2.2):
"An ultimate pathology emerges when resource management agencies, through initial success with command and control, lose sight of their original purposes, eliminate research and monitoring, and focus on efficiency of control. They then become isolated from the managed systems and inflexible in structure." (Holling and Meffe 1996).

2.3 Self-organisation and place-based learning lead to decentralisation

At the same time as the theories around adaptive management evolved researchers within aid programmes were observing how local groups were dealing with problems of resource partitioning and trust building, learning and adaptive capacity (Ostrom 1990; Pretty 1995; Adger 2000). One important aspect for the growth of these social values was a policy allowing local groups the freedom to decide themselves on the rules and regulations dealing with natural resources. Self-organised rule systems are, as demonstrated by Ostrom (1990), followed to a greater extent than externally imposed rule systems. Furthermore, she showed that such self-organisation entails lower transaction costs for monitoring and eliminating "free riding" problems (Ostrom 1990). These insights interbred with theories on adaptive management, strengthening the belief that a certain decentralisation was necessary within conservation biology, which was quite novel in a time dominated by the belief in "the tragedy of the commons". The thinking behind the tragedy of the commons made it clear that management by the state or private ownership are the only possible ways for managing natural resources sustainably (Hardin 1968). Ostrom's research, however, showed that social and ecological values indeed may benefit from being managed by polycentric solutions where power is shared by local and central levels (Ostrom et al. 2007; Folke 2005), findings that led to reformulation of the theory of the tragedy of the commons and the Nobel Prize in economy for Elinor Ostrom in 2009.

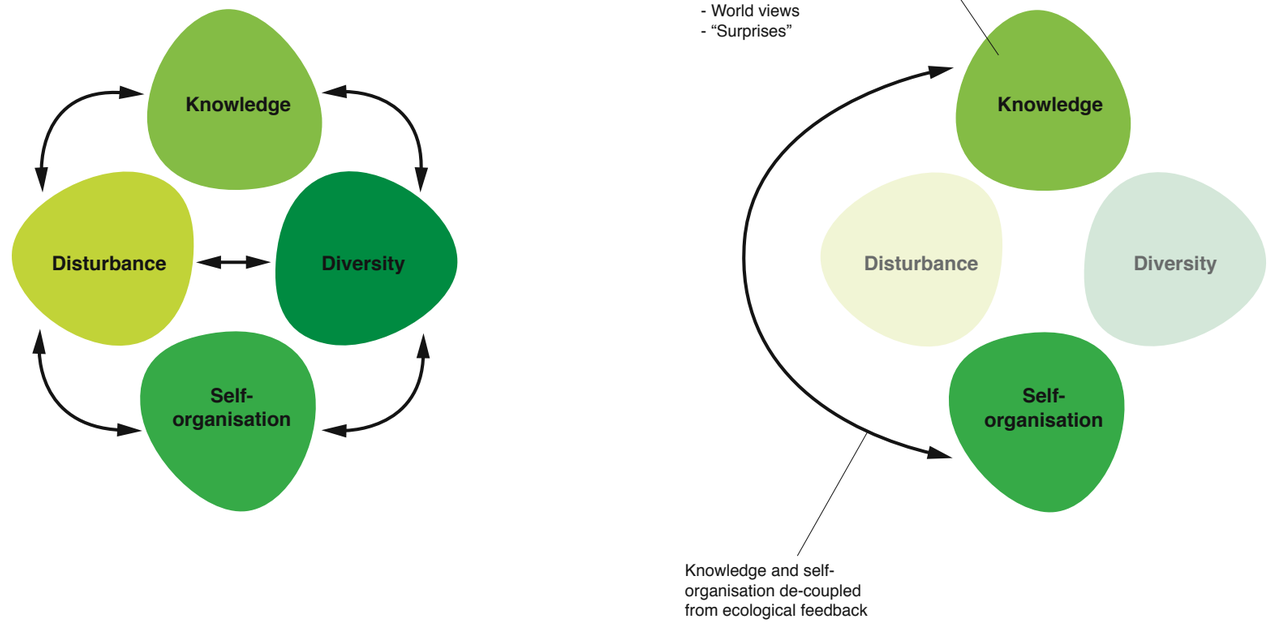


Figure 2.2
The figure presents different aspects of social-ecological systems that build resilience when they interact. Learning about the external and internal environment leads to improved ability to self-organise in response to such signals. Change is a disturbance that creates conditions for greater diversity, e.g. through democratic debate or hay making in a meadow. If the social-ecological system self-organises and learns in relation to diversity and change, signals from the social-ecological system is detected and capacity to adapt stored. The right hand figure illustrates a disconnection from the ecosystems. When the generation of knowledge and self-organisation are disconnected from change and diversity in the ecosystems the result is self-organisation towards economic markets and efficiency. Since diversity is no longer promoted this tends to lead to pathological management of natural resources (adapted from Folke et al. 2003).

Based on the insights delivered by Ostrom and others research progressed from focusing on how management should be organised to promote ecological resilience to seek a better understanding of the principles deciding the resilience of coupled social-ecological systems (Berkes and Folke 1998; Adger 2000; Berkes et al. 2003). An international and transdisciplinary research team studying different traditional societies that had sustainably lived off local ecosystem services for a long time noticed how these societies used traditional ecological knowledge in their daily life to deal with uncertainty and used small scale and continuous change to avoid large scale chocks (Berkes and Folke 1998; Berkes et al. 2003).

The concept adaptive co-management grew from the meeting of these thoughts (Colding et al. 2003; Olsson et al. 2004). It emphasised and demonstrated clearly the pivotal role played by individuals and local groups living and working closely to the ecosystems. It is the local groups on the ground that monitor and notice change. It is the local groups that understand change as contingent on a system's history and are able to respond swiftly to disturbances based on experiences of past changes (Folke et al. 2003; Colding et al. 2006; Andersson et al. 2007). Place-based learning is ever on-going within groups interacting with the local environment and with time this results in shared experiences and a mutual history. This dynamic is captured in the concept social-ecological memory (Barthel 2008; Barthel et al. 2010). Self-organisation of local groups managing ecosystems leads to a place-based learning and storing of social-ecological memory (see figure). This understanding calls for involvement of local groups in adaptive co-management of ecosystems and their services (ibid). The transdisciplinary theory development outlined above has resulted in the current focus of the Stockholm Resilience Centre: research on integrated social-ecological systems, what determines their resilience and the flow of ecosystem services to society (http://www.stockholmresilience.org/).

2.4 An expanded conceptualisation of urban development

The discussion above on resilient urban development where the city is seen as a fully integrated social-ecological system challenges practice within urban design and demand considerable knowledge development. With the dynamic view of ecosystems these may not only be protected and preserved, but also be changed and even created, a new opportunity for integrating ecosystems into development practice opens up (traditionally practice has been most concerned with shaping physical space to support social functions). The historically well established, but in the perspective of the challenges of our time unfortunate, dichotomy between man and nature could finally be bridged, leading to a new understanding of both the city and humans as a natural and integrated part of nature.

The keyword is ecosystem services, opening our eyes to how very dependent on and connected to the nature we still are. It opens up for a public welfare perspective on ecosystems facilitating their integration on equal footing with different social systems. The interplay between all these systems must be managed in urban development. Not the least must it be more clearly formulated as practical solutions.

Together with this challenge many parallels can be seen between traditional urban design and the discourse on resilience. As our perhaps most obvious example of complex social systems, cities have often displayed a high degree of resilience in exactly the sense described above. Many cities have existed for centuries, despite having been constantly exposed to dramatic disturbances like war and natural hazards, or transformations instigated by social or technological development. Thus they have proven their ability to adapt and survive. It is quite easy to see how fundamental ideas from resilience thinking, like diversity, self-organisation and knowledge, have been decisive in these processes. This opens up for a wider discussion on the potential to view also social systems from a resilience perspective, as briefly suggested above, but especially interesting here is to view the city from such a perspective and how it might include ecosystems.

The city as a social system is tightly linked to the spatial structure of the city, making it a social-spatial system and setting it apart from social systems in general. This means that it is a system that has assumed an explicit spatial structure for its existence. The density and intensity characterising the city as a social system places particularly high demands on its spatial underpinnings, which has contributed to the development of cities to an advanced technology. The important distinction is that the spatial system is a means for the social system, i.e. it provides a structure for social processes. This has great similarities with how we understand ecological systems and may thus be a first step towards an integration of the process oriented systems, the ecological and the social, and a potentially shared framework: space.

What differentiates ecological and social systems in this context is how the spatial system has been used much more explicitly to influence social systems, not least cities, to promote and strengthen as well as hinder or counteract them. Here we may speak of urban design as an intervention with different kinds of self-organising social systems with the aim to achieve certain targets. This has often happened without much reflection and the spatial systems have been viewed as more or

less as part of the social. That is an interesting question in itself, where there is cause to view spatial and social systems as deeply integrated, and thus more similar to spatially explicit ecological processes than we might first have thought. The important thing is, however, to realise that this remains unformulated within urban design. Even if cities as spatial systems house unusually complex social systems, knowledge within urban design as a technology is more dominated by tested solutions than scientific principles. For a long time this was quite enough, but with the increasing pace of social development and the new and specialised demands placed on cities during the 2000th century, a tangible crisis came about clearly demonstrating that the current knowledge was not enough. This crisis has intensified over the last decades as demands for sustainability has been added on top of everything else.

During the 2000th century attempts at developing more scientifically based knowledge the development of cities began, and though many steps have been taken we still are far from a comprehensive theory about the city (Batty 2005). Urban morphology is an important and fundamental field for urban design, a field where the last decades have seen rapid progress. Of significance is the research tradition named space syntax, which has a system-theoretical approach to the analysis of urban shape, and which has been proven able to establish strong links between the city as a spatial system and the city as a social system (Hillier and Hanson 1984; Hillier 1996). The starting point is to develop methods to describe and capture the systemic properties of urban shape, including the ability to quantify these for finding patterns and correlations between shape and social phenomena. Connections have
been found between urban shape and the way people travel by foot through the city, where such movements have been shown to be important for other social phenomena such as social segregation (Vaughan et al. 2005), security (Hillier and Xu 2004), housing rentals (DeSyllas 2000) and distribution of shops (Cutini 2005).

Here we can find a basis for a more analytical development of the knowledge on the spatial system's influence on and ability to house the city's social system and extend the analysis to also include the ecological systems. More research is needed on the spatial logics of both social and ecological systems, which is under way (Colding 2008; Marcus 2009), and this report is one of the first concrete examples of the application of this knowledge development.

3. OBJECTIVES:
Social-ecological synergies

3.1 New urban services through synergy effects and linkages

The objective behind this work has been to contribute with a forward looking document that may function as a long-term platform for working with sustainability issues when Akademiska hus proceed with work on Albano. As the ambition was to be forward looking and long-term some of the issues raised in the report are insufficiently explored today to get a complete answer, but raising them is a good way of starting the work on finding the answers. At the same time, the situation here is no different from urban design in general, which has always been characterised by the necessity to act before having all the answers. The lesson learnt from this is that solutions should be sought that are open-ended and general enough not to curb future potential. This procedure should of course also apply to the development of Albano and its specific issues. Thus, this report should be seen as a long-term document serving as a starting point for the continued studies along the pathways here suggested, but also as a source of concrete advise on what can be done already, thus both highlighting what is short-term feasible and what is long-term necessary.

The primary approach has been to deal with sustainability in depth and to argue for urban design that transcends the old dichotomy between ecological and social systems. This is not just about including the ecological systems alongside the more traditional urban systems but to understand their linkages and interplay, making all systems a natural and integrated part of future urban design. Today we are still far from what would have been seen as a utopian idea not that long ago, both because of the demands of the present global environmental situation and because of the rapid knowledge expansion we now see within the field. A simple question the sceptic should ask is why all tomatoes and tulips are coming from the Netherlands, a country urbanised to 90% of its surface.

The ambition has been to work at two levels simultaneously. One is to investigate the needs for such development with the intent of formulating a theoretical basis general enough to be valid for other projects in other places. The other is to test these principles on an actual case, Albano, where site specific conditions and local conflicts over objectives test their validity and show how they must be adapted to a specific case. The intention has also been to provide a solid foundation for further work on sustainability in Albano, which means a lot of effort has gone into providing suggestions that include as much of the theory as possible. The hope is that this should inspire future discussion and research, as well as continued practical application in future urban design.

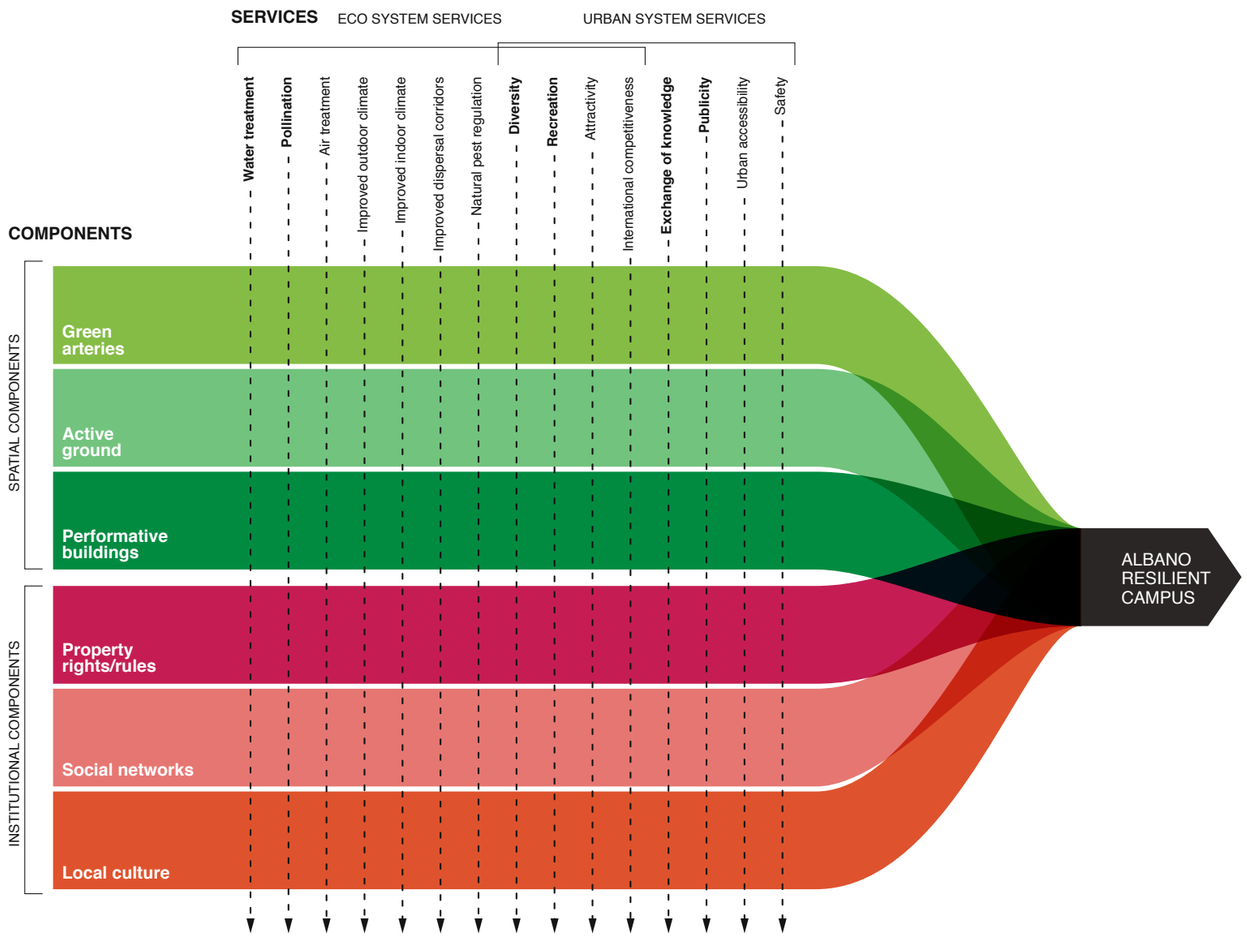


Figure 3.1

One important aspect has been to step away from urban design where sustainability is limited to "green" applications, or seen as an addition through technological systems, and instead embrace performative urban design, i.e. a series of overlapping systems and conditions generating different services – an urban design not only talking about sustainability but actually doing the job.

We have made a distinction between ecosystem services and public services to gain precision in our analysis and to understand how we may best support them through urban design, though we realise very well how tightly interwoven the social and ecological systems are. This understanding is and must be the starting point for treating the city as an integrated social-ecological system.

Every urban design faces the task of supplying and supporting a multitude of services, which can be expanded to include also ecosystem services. In our work we have been unable to cover all these services and the particular demands they place on urban design. Instead, we have made a selection to illustrate what it might look like. It is important to emphasise that ecosystem services, just like more traditional public services, are subjective and not objectively necessary. In all urban design there are trade-offs where some services are strengthened to the cost of other. If the city is an expression of the society a certain city is the expression of one specific society, excluding a number of other potential societies. In the same way, urban design supporting one ecological system does so at the cost of other.

At the same time, urban design is rarely that specific in the system it supports. Some level of generality allows freedom and variation within certain bounds. Moreover, we have chosen uncontroversial services supported by most people, including the politicians we have elected to govern us. Thus we do not think our choice is controversial but still want to underscore that the services have been chosen and may thus preclude other. There is a tendency within the sustainability discourse to phrase things as forcing necessities and not admitting that sustainability too is laden with values and choices.

3.2 Objectives for the ecological systems

As the Albano site today has low biological values management should first focus on increasing these values, and strengthening the biological values in adjoining areas. From a landscape ecological perspective Albano is located in the middle of an urban-rural gradient and is historically part of the National Urban Park. A millennium of co-evolution between humans and nature in the park has resulted in a cultural landscape rich in biodiversity and appreciated ecosystem services. A prerequisite for future generation of these services in the park is continued management founded on the long co-evolution (Barthel et al. 2005). Many of the historical and present land-uses thus supports the generation of ecosystem services in this unique urban park, e.g. the many gardens support pollination and biological pest control (Barthel 2008).

Thus, Albano has the potential to function both as habitat and a dispersal route for organisms living in semi-urban areas, also known in the literature as urban adapters (Croks et al. 2004; Andersson et al. 2007; Ahrné 2008). This group includes many organisms we associate with gardens and small scale farming, i.e. landscapes where humans and ecosystems have co-existed for a long time. Birds, pollinating insects, small mammals and amphibians are some examples of the animals we find in this group. It is here, at the interface between urban and rural, that these organisms are found in greatest abundance (ibid). However, these comparatively small habitats need to be connected in green networks at the regional scale to ensure exchange between populations and thus long-term survival. Another important point is that these small areas support similar biotopes in the surrounding landscape (ibid). The greatest obstacles for preserving biodiversity in such areas are ecological barriers isolating populations and poor quality of the local habitat, which depends on local management (Barthel et al. 2005; Andersson et al. 2007).

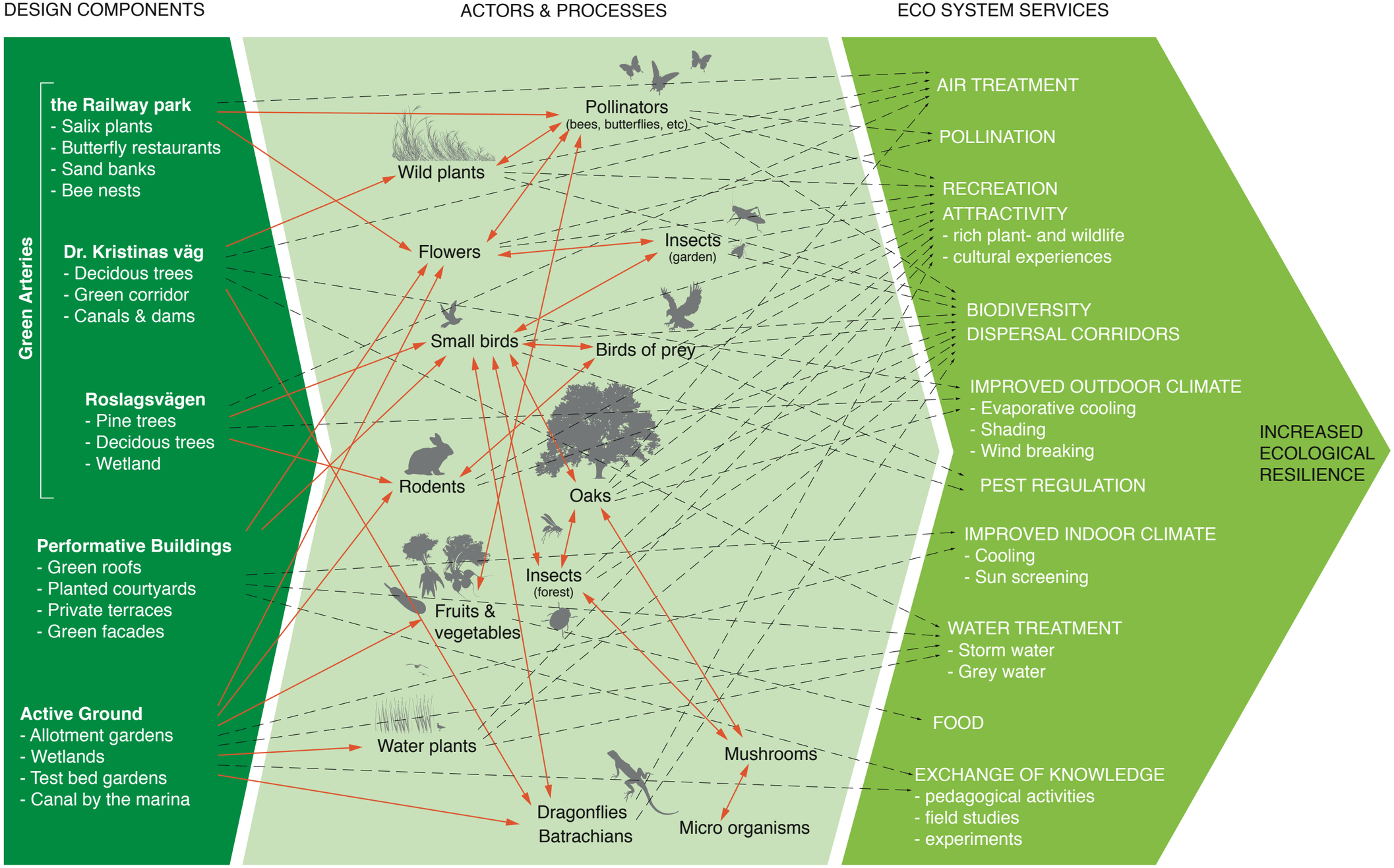
Albano today is a degraded ecosystem and constitutes together with the road Roslagsvägen an ecological barrier preventing animal movement between a number of core areas along the Brunnsviken inlet and in Norra Djurgården. The most important ecological objectives for Albano are to give room for continuous management of high quality habitats for a variety of organisms generally found in garden landscapes and specifically in the National Urban Park, and to shape buildings, land-use and roads so that they form corridors connecting Brunnsviken and Norra Djurgården.

If these two primary objectives are heeded Albano Resilient Campus should strengthen the ecosystem services today generated in the

Objectives for the ecological systems

Figure 3.2
The diagram shows ecological processes on the property. To the left are the spatial components we put in to create conditions for certain actors and processes in the area (in the middle). These in turn generate a number of ecosystem services listed to the right.

The services and the components are selected in accordance with the discussion in this and the previous chapters. The spatial components will be described in greater detail in the coming chapters.


DESIGN COMPONENTS
ACTORS & PROCESSES
ECO SYSTEM SERVICES
Green Arteries
the Railway park
- Salix plants
- Butterfly restaurants
- Sand banks
- Bee nests
Dr. Kristinas väg
- Decidous trees
- Green corridor
- Canals & dams
Roslagsvägen
- Pine trees
- Decidous trees
- Wetland
Performative Buildings
- Green roofs
- Planted courtyards
- Private terraces
- Green facades
Active Ground
- Allotment gardens
- Wetlands
- Test bed gardens
- Canal by the marina
Pollinators
(bees, butterflies, etc)
Wild plants
Flowers
Insects
(garden)
Small birds
Birds of prey
Rodents
Oaks
Insects
(forest)
Fruits &
vegetables
Water plants
Mushrooms
Dragonflies
Batrachians
Micro organisms
AIR TREATMENT
POLLINATION
RECREATION
ATTRACTIVITY
- rich plant- and wildlife
- cultural experiences
BIODIVERSITY
DISPERSAL CORRIDORS
IMPROVED OUTDOOR CLIMATE
- Evaporative cooling
- Shading
- Wind breaking
PEST REGULATION
IMPROVED INDOOR CLIMATE
- Cooling
- Sun screening
WATER TREATMENT
- Storm water
- Grey water
FOOD
EXCHANGE OF KNOWLEDGE
- pedagogical activities
- field studies
- experiments
INCREASED
ECOLOGICAL
RESILIENCE

Figur 3.2

National Urban Park, rather than weakening them. Three ecosystem services from figure 3.1 have been chosen to illustrate the value of following the ecological objectives above.

Pollination, e.g. from wild bees and butterflies, is today decreasing around the world as a result of changes in land-use and habitat loss, despite our dependence on it (Steffan-Dewenter et al. 2006; Klein et al. 2007). Albano should be designed to counteract this trend and strengthen research and learning on the importance of pollination.

Water services. Amphibians are under considerable threat from today's urbanisation (Löfvenhaft 2002), and Albano together with the road Roslagsvägen constitutes a movement barrier and a source of pollutants. New wetlands should be established to support a bundle of ecosystem services that we have chosen to call water services. Albano should contribute to alleviating the isolation of populations of amphibians and be designed so that water is purified at the site before reaching the surrounding landscape.

Seed dispersal. The oak is a keystone species at this latitude. Approximately 1500 species depend on the oak for habitat, food or shelter. Natural regeneration of oak populations is in turn dependent on another organism for long distance dispersal, the Eurasian jay. The birds hide acorns in the ground, and as some of the acorns are forgotten new oaks appear far from the seed trees (Andersson 2007). To strengthen oak regeneration Albano should be designed to support seed dispersal in the landscape.

As knowledge on the dynamics and functions of ecosystems in urban environments is yet incomplete we consider an adaptive approach to management to be important; one where "learning by doing" is an important feature. This approach to ecological design includes for example that ecological field studies are linked to ongoing university courses to investigate how "social-ecological designs" can be strengthened and improved over time and that monitoring and evaluation of management practices are happening continuously.

With Albano being located within the borders of the National Urban Park development is partly dictated by the 3rd chapter 7§ of the act concerning the management of natural resources and the law protecting the National Urban Park.

Apart from social-ecological design of the highest quality, Albano should help increase the knowledge about the National Urban Park, its cultural history as well as its ecology. The establishment of a visitor centre on the site is thus seen as important. Valuable insights for how such a centre could be designed may be gained from Kristianstad Water Realm, where an eco-museum constitutes the hub for the operation by creating an arena where different interest groups can meet and the different values in the landscape are communicated to the public. A visitor centre creates a public space for the rich cultural and biological history encompassed by the park but still to some extent untapped.

In our vision for the campus area we have also considered the management, the institutions and the knowledge basis necessary for sustainable management. If at all possible we want to avoid passive management done on entrepreneurial basis, which is only too common in many parks, and instead promote public participation in the management (sensu Ostrom 1990). A positive side effect is the pedagogical lessons on the human dependence on ecosystems potentially derived through interactions with schools and universities.

3.3 Objectives for the social systems

Stockholm City, Akademiska hus and Stockholm University all agree over the strategic importance of Albano for the connections between the many colleges and university departments that line the border between the dense city centre and the parkland of Norra Djurgården. The intention is to preserve as much as possible of the high quality natural environments while at the same time extending the attractions and qualities of the city centre to Albano. The nature areas and knowledge institutes are today characterised by low accessibility and therefore less utilised than they could be. This also means that many of the knowledge institutes have a poor supply of goods and services and the premises are occasionally felt to be unsafe. Taken together, these factors lower the areas attraction. Moreover, the area has surprisingly weak links between the major institutes, Karolinska Institutet, Stockholm University and the Royal School of Technology, which despite the closeness to rail-bound transportation have very little exchange between them.

Among all the potential services that could be made available through new development and design we have chosen to highlight a few that we see as particularly important for Albano and adjacent parts of the city. The first is Albano as a learning environment where exchange of knowledge is crucial, and where Albano could become the hub for knowledge exchange between many different university departments and institutes. The second is publicity, which is central for the attractiveness and to ensure that the area does not develop into a monoculture but truly become a public space where also people outside academia find reasons to visit and spend time. The third is to further develop the supply and access to the great recreational values, both cultural and biological. This would be an important contribution to the establishment of a truly public space, which in turn is important for creating an attractive environment for knowledge exchange.

Objectives for the social systems

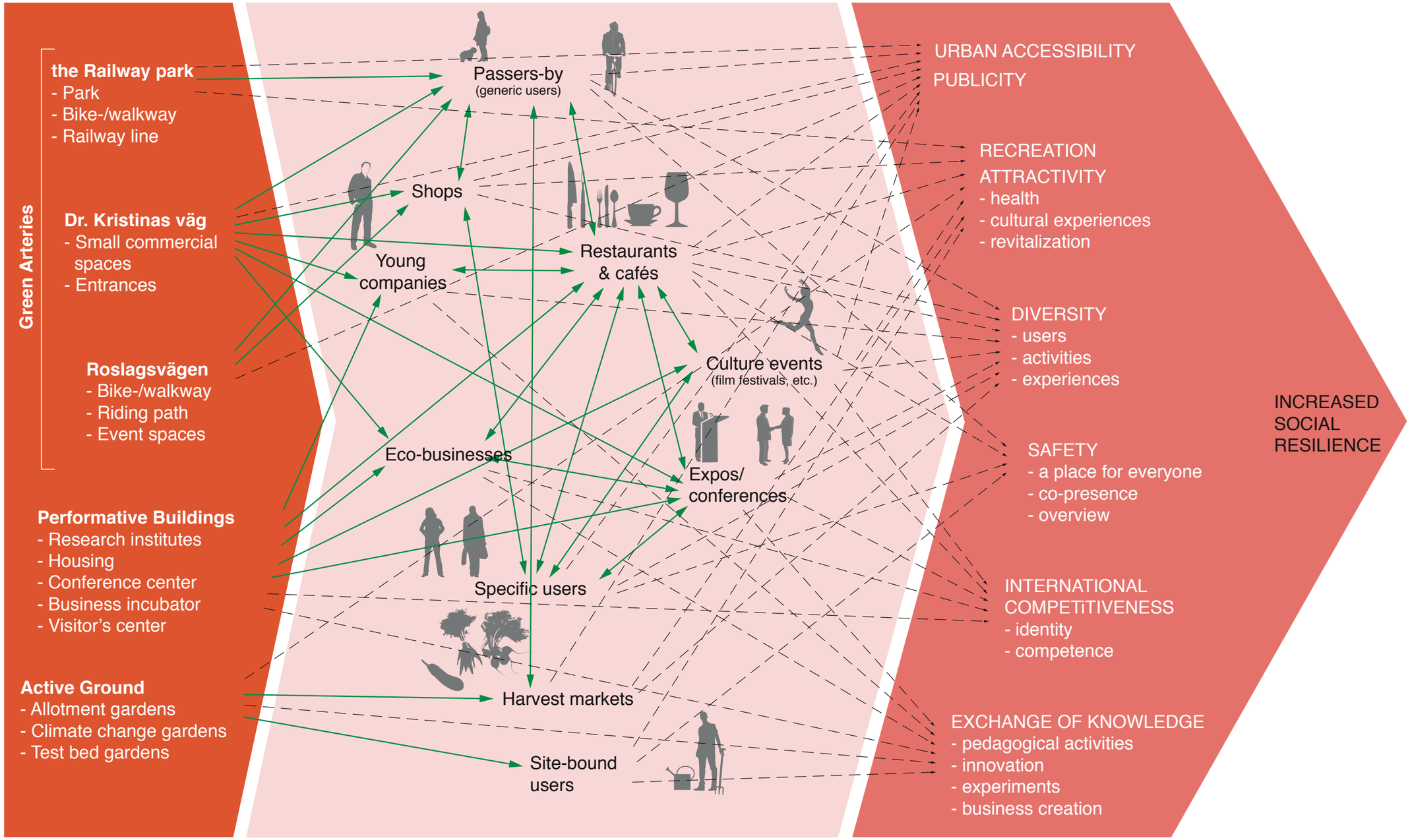
Exchange of knowledge. The new project has great potential to attend to and improve the connections between Albano and its surroundings to develop Albano into an academic meeting place for knowledge exchange. First priority is to make it easier to travel by foot or bicycle between the universities and the other institutions. To improve accessibility and the experience of nearness there is reason to tie in Albano into a more continuous urban fabric with non-academic targets for enhanced exchange between the universities and the city. Finally, the area needs a clear structure facilitating connections that create natural meeting spaces. These could include everything from foyers and lounges to indoors public spaces, but also be restaurants and cafés run by enterprises outside the university.

Publicity. To make Albano an attractive knowledge environment it is crucial to attract people not normally visiting the universities and institutes. This would make the area more an integrated part of the life of the rest of the city. In turn, this would make it more attractive to the people working there and put it in a public context and prevent it from becoming an isolated institute. The connections to the rest of Stockholm University and KTH must be considered, as well as the connections to Roslagsvägen, which is today connecting many of the major institutes in the area. With the new development Albano could become a new hub and destination, especially if connected to public transportation through new tram or metro stations.

Recreation. There is a strong potential for developing the great experiential values offered by high quality natural and cultural environments into recreational destinations for the Stockholmers. This applies also to public spaces that can be created with the help of the new development and new activities. Central is to make sure the area does not develop into a academically dominated monoculture but truly become a public space where also people outside academia can feel at home and contribute to a more diverse social environment. All in all, Albano could become a node with a rich supply of recreational environments dedicated to social exchange, nature and culture experiences interlinked with learning, and exercise and health related activities.

Figure 3.3
The diagram shows social processes on the property. To the left are the spatial components we put in to create conditions for certain actors and processes in the area (in the middle). These in turn generate a number of services listed to the right.

The services and the components are selected in accordance with the discussion in this and the previous chapters. The spatial components will be described in greater detail in the coming chapters.


DESIGN COMPONENTS
ACTORS & PROCESSES
ECO SYSTEM SERVICES
Green Arteries
the Railway park
- Park
- Bike-/walkway
- Railway line
Dr. Kristinas väg
- Small commercial spaces
- Entrances
Roslagsvägen
- Bike-/walkway
- Riding path
- Event spaces
Performative Buildings
- Research institutes
- Housing
- Conference center
- Business incubator
- Visitor's center
Active Ground
- Allotment gardens
- Climate change gardens
- Test bed gardens
Passers-by
(generic users)
Shops
Young companies
Restaurants & cafés
Culture events
(film festivals, etc.)
Eco-businesses
Expos/ conferences
Specific users
Harvest markets
Site-bound users
URBAN ACCESSIBILITY
PUBLICITY
RECREATION
ATTRACTIVITY
- health
- cultural experiences
- revitalization
DIVERSITY
- users
- activities
- experiences
SAFETY
- a place for everyone
- co-presence
- overview
INTERNATIONAL COMPETiTIVENESS
- identity
- competence
EXCHANGE OF KNOWLEDGE
- pedagogical activities
- innovation
- experiments
- business creation
INCREASED SOCIAL RESILIENCE

Figur 3.3

Apart from above mentioned services we have also identified the following two targets for both the social and ecological systems, which will contribute to the areas resilience.

Place-based learning. This kind of learning is strongly connected to adaptive management as adaptive management requires good local knowledge. We can bring in several of the components we have described to reach the final place-based learning. Through an Active Ground the area is divided into several management units with different user rights, which strengthen the ability to self-governance. Thus an effective and adaptive management is promoted, which in turn offer more opportunities for place-based activities and thus greater local knowledge and better conditions for place-based learning. Such learning feeds back into the system by contributing to an effective and adaptive management.

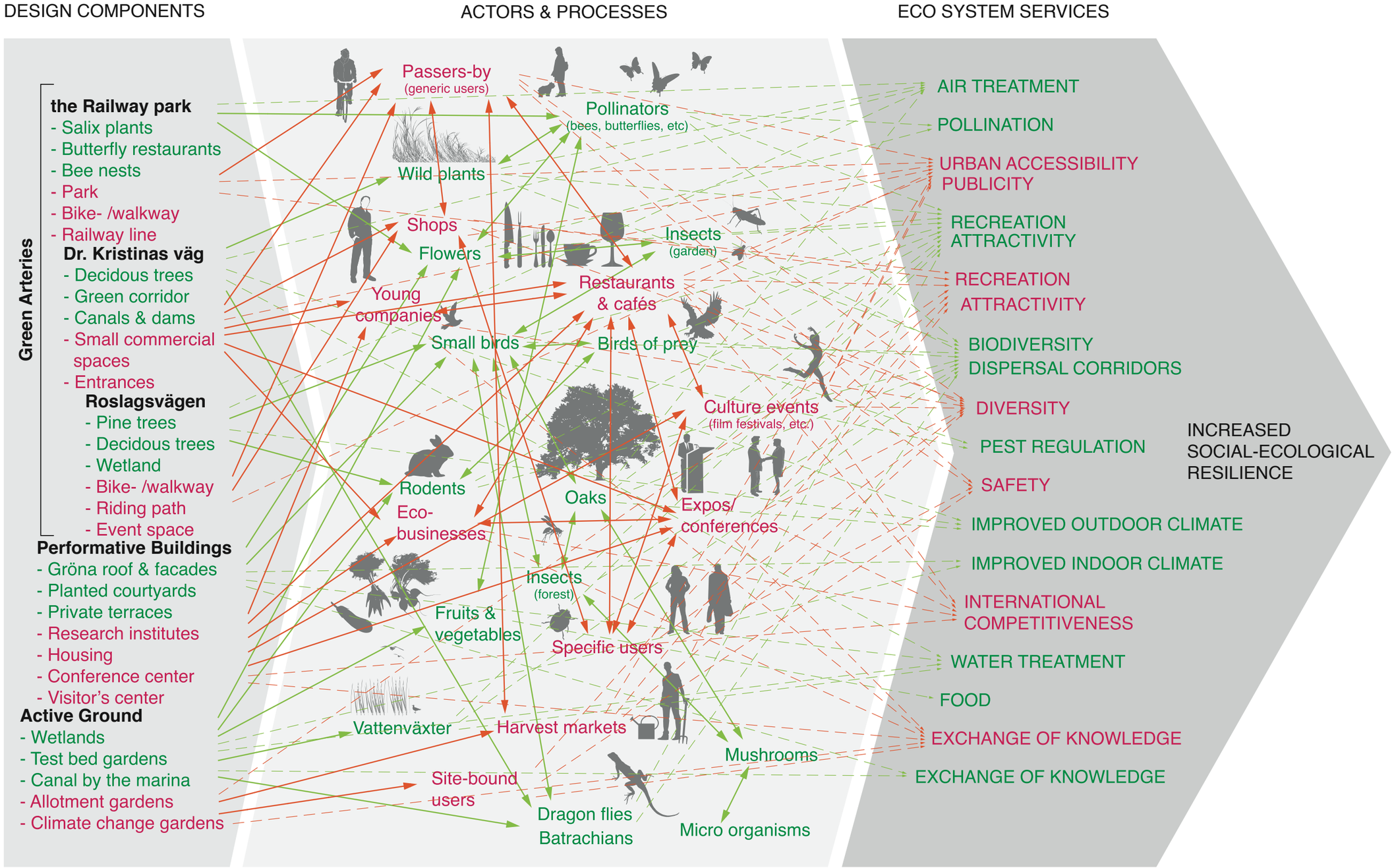
Adaptability. Management needs to continually follow and adapt to changing conditions when need arise. With this outlook, buildings and development need a form that is not static and set once it is in place. Instead it should be possible to continuously rebuild, reshape and adapt to new needs. Some solutions might prove to be more difficult to adapt than other and we need to look for solutions that could easily be altered or where great generality allows changes in function and content. It also requires a professional knowledge focusing more on how we may build on already existing structures rather than starting on something new. For this we need administrative units that are capable of continuously facing up to changes and new needs. As suggested earlier, smaller units and better local knowledge seem important, but need the freedom of a management right. Then again, small units may lack both the competence and the resources necessary to carry out important changes.

The problem with the extinction of experience is a negative side effect of urbanisation. People living in cities are becoming mentally disconnected from the living ecosystems as spontaneous presence and management have become impossible. This leads to ecological ignorance also at a practical level (Kaplan et al. 1998; Miller 2005; Barthel 2008) and is a threatening development strongly advocating the creation of living ecosystems within urban landscapes. The combined surface area of all the cities of the world is only about 2% of the total terrestrial surface and might increase with a few percent over the coming decades, but the power resides in the cities: not too far into the future cities will house 2/3 of the world population. With future urbanisation comes the responsibility to counteract the extinction of experience through actively promoting experience based learning about man's dependence on ecosystems. Research shows that own experiences of local ecosystems through different kinds of public participation may stop or at least slow down this extinction (Kaplan et al. 1998; Miller 2005; McDaniel and Alley 2005; Armitage et al. 2008; Barthel 2010).

Within the transdisciplinary research project "Co-management for building adaptive capacity in urban landscapes" scientists and scholars attached to SRC have gained considerable knowledge about sustainable ecosystem management of the National Urban Park (see for example Barthel et al. 2005; Borgström et al. 2006; Colding et al. 2006; Ernstson et al. 2010). This project was part of the Millennium Ecosystem Assessment, a UN instigated program aimed at strengthening our knowledge about the status of Earth's ecosystems and their ability to provide us with ecosystem services. Conclusions from this project supports the argument that Albano Resilient Campus should tackle the problem with extinction of experience by promoting public participation and place-based learning within the area's active grounds, including the educational activities going on in the surrounding area.

Figure 3.4
The figure to the right illustrates how spatial morphology can be designed to create high quality urban areas and services while at the same time supporting local ecosystem services. Green arteries, for example, will promote services such as urban accessibility, attractiveness, recreation and publicity as well as supporting ecosystem services such as biological pest control, seed dispersal, air- and water treatment. Spårparken may serve as an example of how this could work. It increases accessibility by providing a pleasant cycle- and walkway for people. It will be lined by greenery consisting of plants chosen for their ability to support ecosystem services like pollination. The same spatial components thus support important ecological and social processes both, showing how these are intimately interrelated and in reality impossible to separate.

The services and the components are selected in accordance with the discussion in this and the previous chapters. The spatial components will be described in greater detail in the coming chapters.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- Pine trees
- Decidous trees
- Wetland
- Bike- /walkway
- Riding path
- Event space
Performative Buildings
- Gröna roof & facades
- Planted courtyards
- Private terraces
- Research institutes
- Housing
- Conference center
- Visitor's center
Active Ground
- Wetlands
- Test bed gardens
- Canal by the marina
- Allotment gardens
- Climate change gardens
Passers-by
(generic users)
Pollinators
(bees, butterflies, etc)
Wild plants
Shops
Flowers
Insects
(garden)
Young companies
Restaurants & cafés
Small birds
Birds of prey
Culture events
(film festivals, etc.)
Rodents
Eco-businesses
Oaks
Expos/ conferences
Insects
(forest)
Fruits & vegetables
Specific users
Vattenväxter
Harvest markets
Mushrooms
Site-bound users
Dragon flies
Batrachians
Micro organisms
AIR TREATMENT
POLLINATION
URBAN ACCESSIBILITY
PUBLICITY
RECREATION
ATTRACTIVITY
RECREATION
ATTRACTIVITY
BIODIVERSITY
DISPERSAL CORRIDORS
DIVERSITY
PEST REGULATION
SAFETY
IMPROVED OUTDOOR CLIMATE
IMPROVED INDOOR CLIMATE
INTERNATIONAL COMPETITIVENESS
WATER TREATMENT
FOOD
EXCHANGE OF KNOWLEDGE
EXCHANGE OF KNOWLEDGE
INCREASED SOCIAL-ECOLOGICAL RESILIENCE

Figur 3.4

4. COMPONENTS:
Critical institutional and spatial components in sustainable urban design

4.1 Identifying the tools of urban development

A crucial issue for the integration of social and ecological systems into urban development practice is that the deepened understanding of how the ecological systems, alongside the social, are expressed spatially. In today's practice space and how it is shaped through buildings, landscape planning, etc. the primary instrument for supporting and guiding different social systems. To do this in an informed way we need research on the spatial logic of these systems. In the same way and for the same reasons we need the same information about the ecological systems. Even though we primarily discuss urban design, the discussion could be broadened to apply to also other types of interventions, for example 'urban planning' or 'urban governance'. These may be perceived as different levels of a directed intervention with the city's different self-organising systems such as social networks, economic markets and ecosystems.

None of these interventions can act directly on these self-organising systems, but instead create, maintain and shape the conditions for them through different means. Interestingly in this context, the method for all these interventions at a given level can be said to be the same: urban space. It is by assuming a spatial shape or by receiving a physical location in the city that these systems become urban, and it is through their spatial aspect that we can influence them through spatial interventions.

Spatial interventions are executed at different levels, which to some extent can hide the fact that they all deal with urban space. The most evident example of how space functions as a means in this context is perhaps urban design. Within urban design you try to reach and influence different self-organising systems in the city, for example where people move and spend time, by shaping and structuring urban space through building and landscape design, both affecting the urban form. In summary, you could say that urban design try to guide self-organising urban systems by shaping and structuring urban space through urban form.

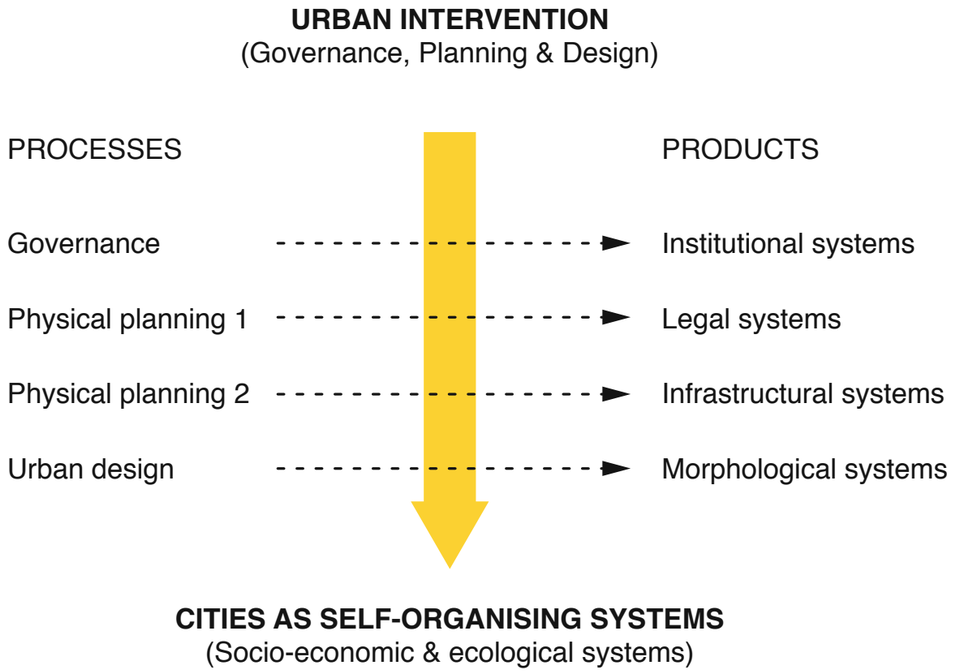
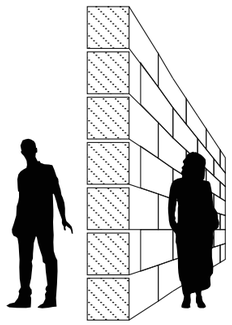
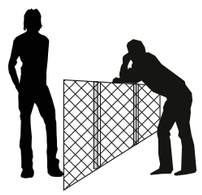


Figure 4.1
A model for how different kinds of urban interventions for reaching targeted actors and processes (the self-organising systems) use different mediating systems (institutional systems etc.). One important conclusion is that all these systems target the spatial component of the self-organising systems (Marcus 2009 in progress).

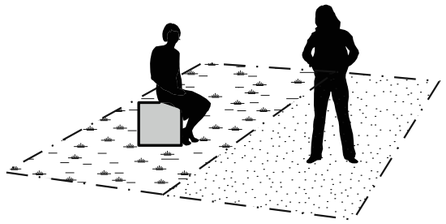
Figure 4.2



Solid walls



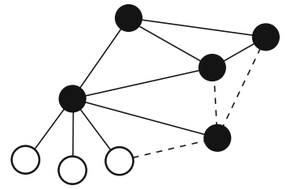
Permeable walls



Property boundaries

Formal institutions:
Laws & regulations

Informal institutions:
Local culture & traditions



Social networks

Urban form is not something that exists in isolation and is not the only instrument affecting the self-organising systems of the city. The urban form exists within a framework of rules and regulations dealing with how land may be used and where development is one use among many, or rather, a way to create conditions or strengthen the potential for certain uses. If land is planned for housing this usually involve construction of some sort to make this possible. The plan and its directions, as well as the different legal act that they are based on, can all be seen as instruments for influencing the self-organised systems of the city, trying to guide them towards desired trajectories just as the urban form does.

You could say that we have moved up one step in the hierarchy, where instead of urban design we speak of urban planning. However, urban planning is a broad concept usually including more than is described here, for example infrastructure. Simplifying somewhat, you can still speak of urban planning as, analogously to urban design, an attempt to guide self-organising urban systems by formulating rules and regulations, especially concerning urban land-use.

Such rules and laws do not exist in a vacuum either, but are found within a framework of what is usually called social institutions. The rules and regulations we just described and that are central for urban planning is but a specific section of such social institutions. The concept of institutions is broad, and apart from the already mentioned rules and regulations there are other institutions especially important in this context, e.g. organisations such as governmental offices, municipal managers and property owners, and owner rights such as private ownership, public ownership and cooperative ownership. Such institutions can also be seen as tools for guiding and maintaining the city's self-organising systems.

All in all, we have a system of different tools at different levels, fitted together in a nested hierarchy like boxes within boxes. They can all be linked to different professional practises aimed at guiding and governing the self-organised systems towards achieving different political objectives. Urban governance primarily work on an institutional level, where formulation of rules and regulations in an important part. Urban planning is carried out within the institutional framework, allocating land-uses and proposing development schemes. Finally, urban design is primarily concerned with urban development and form.

There are a number of reasons for bringing out the tools of urban development in this way. First it clarifies where more knowledge is needed. In the case of urban design, for example, it becomes evident that we need a better understanding of how urban form affects both social and ecological systems to reach different goals, e.g. resilient urban design. Second, it helps us see how different systems may be managed together with the help of the same tool, for example how urban design by means of urban form can reach and influence social and ecological systems at the same time.

4.2 Social-ecological design components

Here, we have chosen to simplify this discussion to two different types of instruments, spatial and institutional. The spatial include primarily different components of urban form and the institutional comprises owner rights and forms of management. In the following section the services chosen earlier as especially important for Albano will be discussed, from the basis of these two types of instruments, to see how they may offer spatial and institutional support and thus help with the long-term achievement of the objectives set for the area. We see it as a translation process where each service is fitted spatially and institutionally. The intent is to look for general patterns that will allow us to create a comprehensive spatial and institutional structure where all services can co-exist – if at all possible. We have identified six important components, three spatial and three institutional. Each is described separately below, but it should be remembered that there is an advanced interplay between all of them.

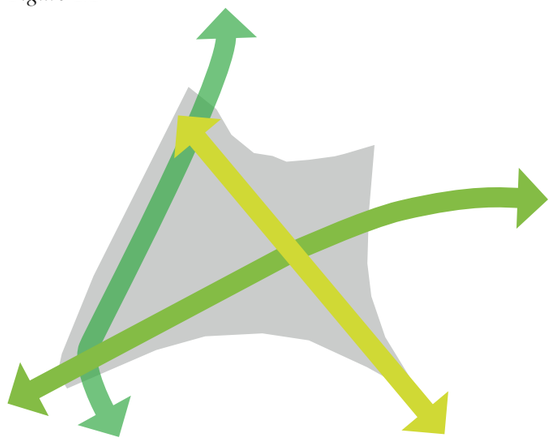
4.2.1 Green arteries

Green arteries are spaces managing flows and access between people, activities and places as much as between animals, plants and different biotopes. The way this space is structured is decisive for connections and encounters between all these entities. Inversely, this space may also obstruct or even hinder such connections and encounters, something that may be problematic or desirable depending on the situation. Apart from the structure itself it is important to consider such an artery's capacity to carry different sizes and kinds of flows. There is a difference in how mice, jays and people, and a difference between people on bicycles and in cars etc. A long-term structuring green artery should be capable of handling a great variety of different flows. Such arteries should also be established on different scale levels, for example between an area and its surroundings, within the area, within different parts of the area and within buildings.

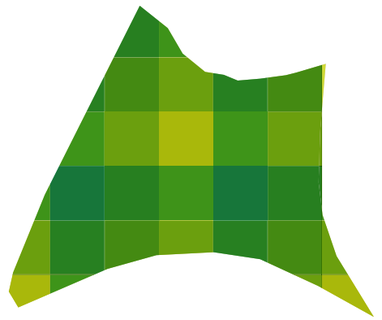
4.2.2 Active ground

Active ground refers to the division of land, buildings or space into several parts to promote and support the development of differences and diversity. You may consider this the very reason you build walls to separate one room from another, i.e. to create a cue for your memory saying these are different things. This is also how space has been used to create social differences in society. For green arteries, this means that some things are categorised and not others, that some distinctions are promoted over others. This, of course, is a subjective issue that must be continuously discussed. To create a general structure able to sort things into different rooms is the basis for creating differences but not the same as saying what should be separated.

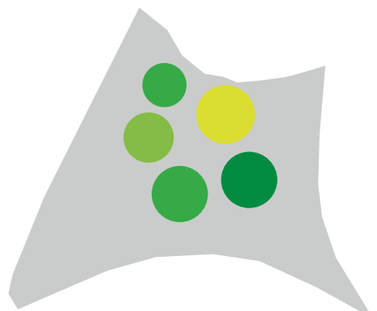
Figure 4.4



Green Arteries
- accessibility through linear paths



Active Ground
- diversity through division



Performative Buildings
- intensification at certain spots

4.2.3 Performative buildings

Performative buildings can be seen as a tool used when you want to intensify or condense a public or ecological service that in itself interacts with a building's technical, programmatic and aesthetic functions. From this perspective, buildings can be said to do two things: to intensify or condense a certain activity, and to give the activity some permanence over time. Thus, buildings can be said to be a means through which advanced activities and activities dependent on longer time perspectives can be supported. The building is more or less part of the activity it supports and the activity is the reason for constructing the building, which is why we call them performative buildings.

4.2.4 Property rights/rules

Property rights are a kind of social institution that governs management of natural resources and ecosystems (Hanna et al. 1996). There are different levels of property rights where ownership is the strongest, since it allows you to exclude people and sell the property. Tenancy is a time bound leasing contract with the owner where the manager may fence in part of the area but not all of it. Allotment areas are one example of tenancy. User contracts are contracts between the landowner and a local association entitling the association to manage the area but not to exclude the public (Hanna et al. 1996). Tenancy and user contracts in combination could be used for Albano.

Albano is located in an area that is owned by the state, but as the area has a well developed hierarchy of management responsibilities we have choose to use user rights rather than ownership rights. User rights are tightly connected to specific management units or properties and thus to what we call Active ground. Through a clear division of the area it can be assigned to different managers with different user rights. User rights are the institutional side of the management unit where the action space for the manager is determined. To whom the property right belong, what is allowed and what is not etc. There must be congruence between the shape and location of a management unit and the content of the property right belonging to it. For example, certain activities may require certain amount of space, and some locations may be more or less suited for the activity, depending on activities in adjacent areas.

More concretely, we see it as highly prioritised that property rights are defined and assigned to the different habitats on the Albano property. These include areas which the different managers today have the right to care for and manage. These may take the shape of the user contracts today used by municipalities and private associations for managing municipal land. User contracts have primarily been used for park management in central Stockholm and some of the

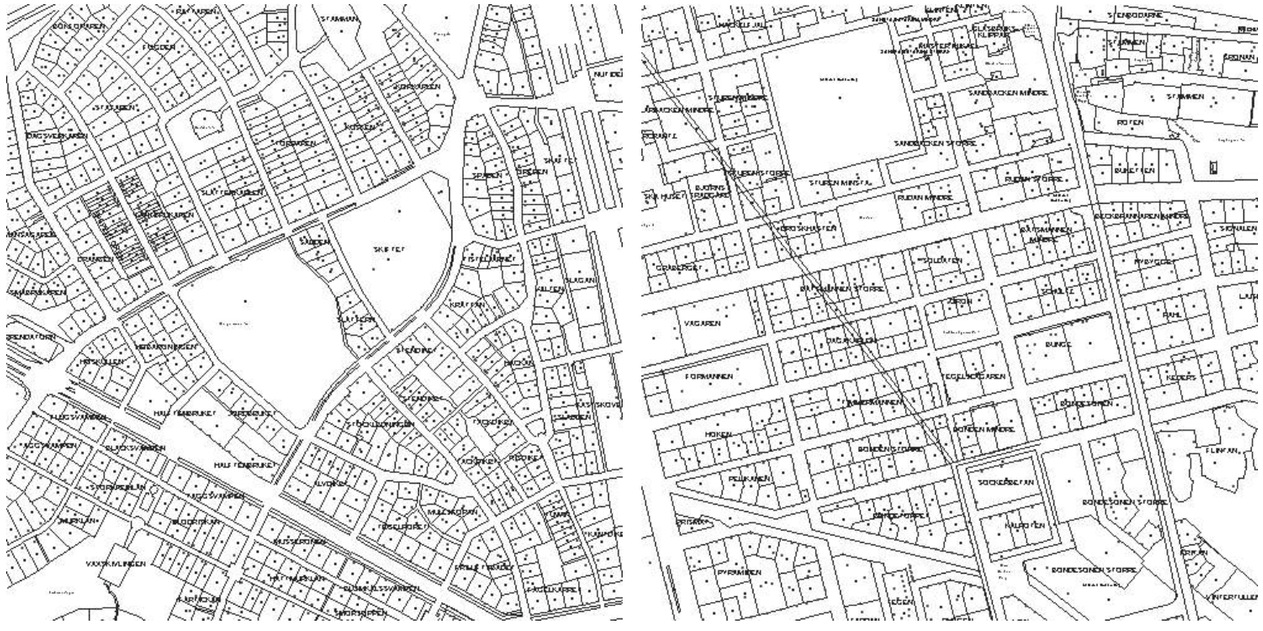


Fig. 4.4 Parcel maps over Enskede (left) and Södermalm (right), both in the same scale.

adjacent municipalities. The framework could easily be applied to other organisations. Thus we consider it important that user contracts are written between Akademiska hus and the manager of each site. The contracts may range from a single flowerbed to participation in the management of a nature area. Users in this context might be allotment garden associations, residents (individuals), learning institute, daycares, boat clubs and others. User participation builds on collaboration with the landowners, organisations and associations etc. The user takes on a greater responsibility for management, meaning that the management of certain areas can keep high quality. Diversification also leads to a multifunctional land-use that can, at least potentially, promote biodiversity.

4.2.5 Social networks

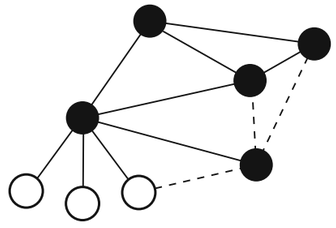
Social networks are the patterns of stable relations between actors in and around Albano. Social networks are more than just short, occasional encounters - they require people to meet regularly and form some kind of mutual relationship which allows transfer of information, shared understanding and knowledge making (Borgatti 2009)

4.2.6 Local culture

Local culture is about establishing norms and practices that support social networks between the groups interacting with the area's social and ecological systems, and how decisions at different levels may be reached (Ernstson et al. 2010). To achieve this we suggest a long-term strategy for developing a "culture of collaboration", i.e. to make management decisions through discussions between stakeholder groups habitual. The format could be an inclusive forum where issues are discussed and decisions reached. Between these big meetings there should be more frequent smaller meetings engaging only subsets of users. A scale crossing actor could be supported, perhaps in the form a foundation, which over time could connect all these meetings and groups. This local tradition of collaboration requires stakeholder groups to allocate resources and delegate responsibility within their organisations to always be able to participate in these discussions about the management of the area. Formal user contracts should be formulated with in mind.

Property rights/rules

Local culture & traditions



Social networks

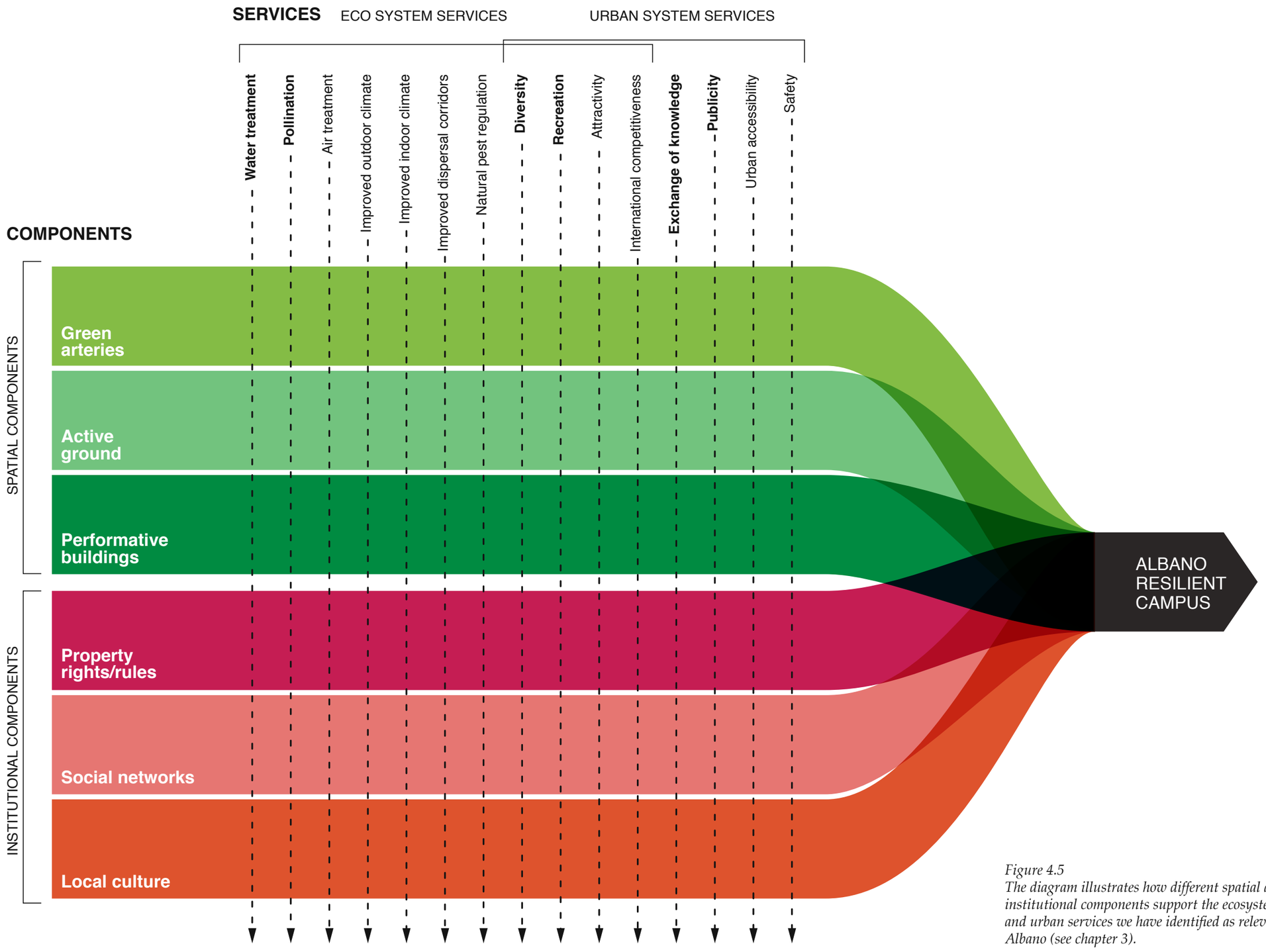


Figure 4.5
The diagram illustrates how different spatial and institutional components support the ecosystem- and urban services we have identified as relevant for Albano (see chapter 3).

4.3 Ecosystem services and urban system services

Above we chose a number of services, generated by ecosystems and traditional urban systems both, that seemed particularly important for the suggested development of the Albano area. There are of course many more, but we have chosen a small subsample for highlighting the principles underlying resilient urban design. Below follows an account of these ecosystem and urban system services based on how the design components presented earlier may contribute to the maintenance and support of these services. Each service is first described and then some thoughts are presented on it might be supported by the different components and finally a suggestion for a concrete solution for Albano.

4.3.1 Exchange of knowledge

Background
One fundamental aim with Albano Resilient Campus is to create a knowledge environment of highest international standards, both for research and education, and for dealing with environmental and sustainability issues. The overarching theme in the current discussion about knowledge development is meetings, putting exchange of knowledge in focus. We can see two fundamental prerequisites for any kind of exchange, including exchange of knowledge.

First, conditions promoting differences must be created. We need a diversity of knowledge environments with different theoretical profiles, and that differences are found and supported at many different levels: between individuals, between research labs, between departments, and between universities and the rest of the society. Without differences there is no reason for exchange, which is true for exchange of knowledge as well as social exchange in general, including economic exchange. Thus it is important not to forget the need for promoting differences and diversity in urban design.

Second, conditions promoting meetings and encounters where the exchange can take place must be created. It could be formal meetings, which are often planned and located to squares or meeting-halls. The true challenge for urban design is, however, to create conditions for informal meetings, the ones that are not planned in advance. Two crucial things to remember: 1) Space should be seen as a system of flows where meetings take place at strategic nodes. To create informal meeting places is less about designing specific urban spaces and more about their location in the larger system. 2) We must remember that meetings take place at different levels and that these meetings have different functions. We spoke earlier of meetings ranging from between individuals to university – public, and what is important is to

create conditions for meetings at all these levels. Such an environment may successfully support and facilitate the exchange of knowledge (Bergström et al. 2010).

Green arteries

Green arteries are the spaces managing the flows between separated environments where differences can evolve. It may be spaces connecting different work stations in a building and thus individual researchers with different expertise; meetings and exchange between these researchers are fundamental for successful research. Green arteries also include spaces that connect research labs or departments, or the universities to the rest of the society. The organisation of this space is crucial for the extent it contributes to and facilitates informal meetings, or, as may happen, the opposite. It is thus very important to establish green arteries on different scales, accessible and easy to use for many different individuals, environments and activities within Albano while at the same time avoiding activity specific passages.

It is very important to tailor the details of the design of these spaces to the different levels and the different meetings taking place. We must conceive green arteries that stimulate different meetings depending on their location, e.g. within a research environment, a department, a university or a city. All these constitute different social contexts and conditions. For example, it seems to be easier to discuss research related issues within a research lab, where everyone knows each other and has much in common, than at the departmental level where scientific approaches and views differ more and people know each other less well. Never the less, such departmental meetings may be the starting point for future contacts and more effective exchange. All these social-spatial situations need to be managed skilfully to establish a well functioning knowledge environment that prioritises exchange of knowledge.

More concretely, a number of green arteries should be planned and established at Albano on different scales. Two of them are of particular strategic importance: 1) the passage following alongside the industrial rail line, much of which is raised somewhat above the Albano area; and 2) an extension and rerouting of the road Drottning Kristinas Väg to join the road Roslagsvägen. The first has the potential to become part of an extended tram system and provide a swift and efficient link from Karolinska Institutet, the new Karolinska University Hospital and Albano to the new development at Norra Djurgårdsstaden and Värtan. This section is in turn just one part of the new tram system that will connect onwards toward Sundbyberg and Västerort in the west and the new rail lines from Värtan towards Stockholm city in the east. The artery should be designed to also attract cyclists and pedestrians.

The second artery is the road Drottning Kristinas Väg, already called "the academic road". Realising the hopes for Drottning Kristinas Väg as an academic meeting place will require placing and design that truly make it an attractive alternative for moving between the university centres. Today, it is primarily used by drivers trying to avoid traffic jams instead of being a vibrant academic environment. To increase the number of cyclists and pedestrians between the three academic nodes KI, KTH and SU, tree issues matter: 1) It must connect to the future Albano in a natural way, and lead on to SU. 2) It must be places so that it is lined by potential starting points and destinations. 3) It should provide an attractive connection with the tram system at Albano. Thus, we suggest a partial rerouting over Albano to connect on to Roslagsvägen, which, with the construction of Norra Länken, can be redesigned to a much more attractive green artery with many starting points and destinations, including SU.

Active ground

Active ground in this context means division of land or buildings into several parts and thus promotion of the development of differences, e.g. different knowledge profiles. Again, it is important to consider many different levels, within research labs and institutions as well as within the universities as whole. The larger society must also be present and partake of the knowledge development going on at the universities. On the most general level this could be realised by placing public roads and passages in connection to and through the university campuses where different departments and research environments could advertise themselves. More specifically, it could be done by establishing other activities and land-uses in direct connection to the campuses, e.g. residential areas, service establishments like restaurants and shops, and public spaces like libraries or exhibition venues. The core is to create separate spaces for different activities that can stimulate meaningful meetings.

Thus it is important that Albano does not become a monolith with only one main actor and instead from the start is planned as a whole made up by part with at least some independence, i.e. several management units. Akademiska hus and Stockholm city should be the primary managers, but it is important to pass on at least partial management responsibility for land and buildings. This places certain demands on the design of technical systems, accessibility and fire zones.

Performative buildings
Performative buildings offer an opportunity for strengthening both the development of differences in knowledge profiles of for example research labs and make sure they have the specific spatial facilities needed to develop their uniqueness. These could be work stations, laboratories, workshops, seminar rooms etc. The probability for informal meetings could be increased by connecting designed spaces for promoting meetings to strategic nodes in the spatial structure, e.g. cafés, assembly halls, squares or parks. These need to be designed to be relevant for the place and meeting intended. Location is crucial not only for the social character of a place but also how it may be designed. A park at a very strategic location becomes more like a square and need more impervious surfaces to avoid soil erosion than do a more isolated park, a big assembly hall might be an attraction in itself and may not need the very best location.

The design process must view buildings as fundamental production instruments for knowledge development and exchange of knowledge from the start. Previously, the focus has been buildings with special uses and equipment, e.g. laboratories and experimental workshops. Today, when advanced computer technology has made even very complex laboratory experiments something you can do on a lap-top the question of what kind of buildings we need has become much more general to its nature. In the fast changing academic environment generality is an important factor for the creation of a long-term framework for flexible use of buildings in support of knowledge exchange. The social exchange between individuals and groups is much emphasised today and therefore places to meet have become central in the discussion on knowledge development. Performative buildings must provide advanced social environments, both field specific research environments like departments and labs, and inter- and transdisciplinary environments like foyers, cafeterias and lecture halls together with public spaces outdoors.

Property rights, social networks and local culture
Successful knowledge development is tightly linked to the potential for developing differences and specific knowledge profiles. Through polycentric property rights this could be taken one step further and not stop at being a spatial division of land but one reflected in jurisdictional units with the possibility to manage their own resources. This would be extremely interesting from the perspective of research activities as it opens up for independent institutes and research centres with the freedom to make quick changes , develop their own networks and follow different developments in general.

The actors behind such property rights do not have to be the research environments themselves and could include different other actors focusing on the exchange of knowledge. Conference venues, for example, if run by someone external to the university, could be used for activities outside academia, which in turn could offer new possibilities for meetings between the university and the world around. It might also be actors more progressively engaged in arenas for such activities. Stockholm has the interesting example of Färgfabriken, which has established itself as an area for general meetings and is actively trying to establish linkages between different professions within urban development. This arena outside the established organisations and institutions has been vital. For such an independent activity is a property right of its own.

We suggest that Akademiska hus, as the primary manager of the academic environments and their service facilities within the area, delegates responsibility and assign property rights to assisting managers, both for academic activities and their facilities, and for service activities like apartments and commerce. Thus there will be a more fertile ground for developing research environments with strong identities and distinct knowledge profiles making them internationally competitive. Other actors capable of competently running and

developing places for knowledge exchange, from conference venues to 'third places' and local association driven activities, should be welcomed.

Such polycentric property rights linked in social networks open up for an adaptive management capable of keeping up with swift changes and windows of opportunity that are encountered in today's knowledge based society. It could be financial opportunities, new collaborations, use of own premises etc. With a polycentric responsibility for the management a more efficient and for the activities relevant management can be promoted, be it a research institute, a conference company or an allotment garden association with the ambition to communicate the knowledge on local cultivation.

In relation to the exchange of knowledge this can be taken from a purely managerial issue to actually address the development of knowledge about the local environment or the use of the local environment as a study area. For Albano, the area itself is of strategic importance for the local and regional ecosystems, and there are many reasons for studying it, which should be considered when deciding on which new and advanced knowledge environments to establish in the area. Not the least such research could be combined with studies of an advanced social-ecological system; a place-based learning that could give birth to a local adaptive management and an urban structure that could change and develop continuously.

Taking yet another step further, you may view the development from a pedagogic and public awareness perspective where such activities as described above can open up for interactions with the public, which could visit facilities or find out about new findings. This could be done either through exhibitions or by visiting the areas under study, which could be designed to accommodate such pedagogical activities. It is also possible to visualise special institutions charged with the task to run and develop this side of the activities, e.g. an exhibition hall, an auditorium or a small museum.

4.3.2 Publicity

Turning Albano into an internationally competitive knowledge environment with developed interfaces for meetings and exchange of knowledge at many levels requires that the area is perceived as genuinely public. There are many reasons for this, but foremost is the nature of knowledge development and knowledge exchange in today's society where research and education are far from isolated activities tied to the academic environments. Instead, the modern society and cities in the developed economies should be seen as permeated by knowledge development and knowledge exchange, and academic environments are condensed nodes in a larger knowledge system rather than environments with exclusive rights to such activities. Companies and other public administrations and offices are active in knowledge development, which makes exchange between all actors a necessary factor in all urban design. The backside is that the scrutiny and quality assessment of new knowledge, as well as access to it, may short-circuit. This is another fundamental reason why nodes for knowledge development and exchange should be situated in contexts exposed to the public. This can be achieved through different forms of public access to new knowledge, e.g. databases, public libraries, publications in journals. Universities, colleges and different research centres need also be placed in a public context.

Green arteries
Fundamental for creating a public space is that it is physically accessible to the public. This goes beyond avoiding locked doors and fenced in areas. It must be easy getting to and through such spaces and they must be parts of a contiguous urban space. There are many ways for achieving this, but one of the basics is to make sure that there are public and easily navigated passages leading to and through such environments. Such passages should not only lead to the area itself but also connect to other areas in the city, making sites like Albano parts of a greater whole. This will contribute to more people moving through the area, adding to the sense of publicity, and to people with other intentions and interests spending time in and around the academic environments, which adds diversity and stronger publicity.

Publicity is not a question of who owns the land or the rules and regulations governing what is allowed to do in different places. Publicity is established through human practice. Many people using a place in a way that resembles a public space not only leads the perception of the place as public but to legal treatment as a public space. To claim a place as public the degree of accessibility and connections to surroundings are crucial, which is why placement and design of green arteries are fundamental. There are different kinds of passages, not

Publicity

least arteries for different kinds of transportation which enhances the potential for movement and flows. The different means of rail bound transportation are important for Albano. Existing good coverage by the metro and Roslagsbanan, and possibly a tram line in the future, should be taken advantage of and built upon. Car traffic should not be made more difficult, especially since we know very little of the cars of the future. Bicycles are today increasing exponentially, which must be taken into account.

Especially important for publicity is the potential for moving around in and through an area on foot. In many ways it is when you are walking that you contribute to the feeling of publicity. By foot you can reach areas otherwise difficult to reach, and at a pace that will keep you present in the area for a longer time. Passages of this kind are thus seen as particularly important. Two factors decide the accessibility of a passage for pedestrians: its geographic distance to other passages and places, and its mental distance to other passages and places. If the geographic distance is too great the destination will be less accessible and visited less often. Great distances may thus work just as well, and much more subtly, as locked doors if you want to keep an area secluded. We also need to consider the mental distance to other passages, places and parts of the city. The mental distance is about ease of navigation, which decreases with the number of turns and changes in elevation. Short geographic distances can through design and placement become passages that feel mentally much longer. Sometimes there are reasons for creating such mental distances, for example if you want seclusion, but it lowers the accessibility. Thus it is important to bridge both geographic and mental distances if you want to achieve good accessibility, which is a prerequisite for true publicity.

Active ground

Good accessibility is not enough to achieve true publicity. Not only the number of people present is important; it is the diversity and composition of people, their different backgrounds and reasons for being there that makes an urban space feel truly public. This quality can be partly promoted by making sure an area like Albano is accessible, not only from the nearest surroundings but also from further away. It can also be supported by offering opportunities for a wide array of activities, or many different practitioners of the same activity, within the area. Here the concept active ground is fundamental. Diversity is promoted by the division of the area into many management units with different property and user rights. This in turn contributes to more people for various reasons visit the area and contributes to a greater diversity in the public space.

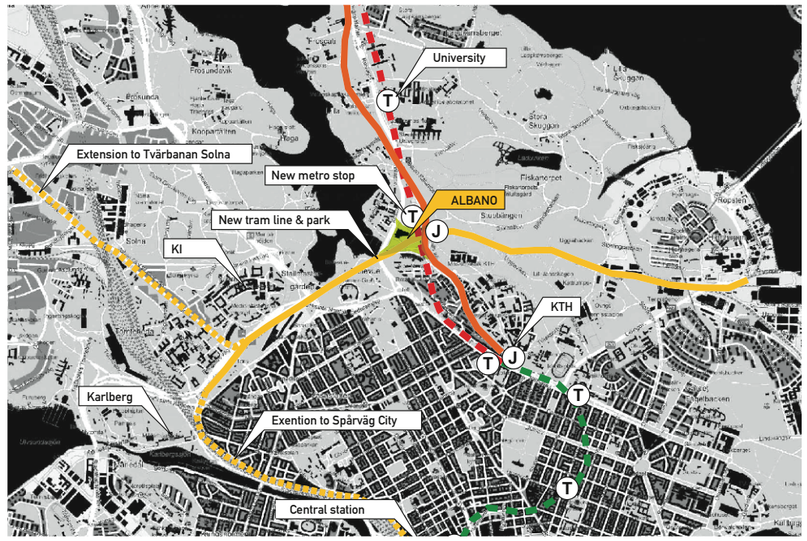


Fig. 4.6 Potential for expanded railways.

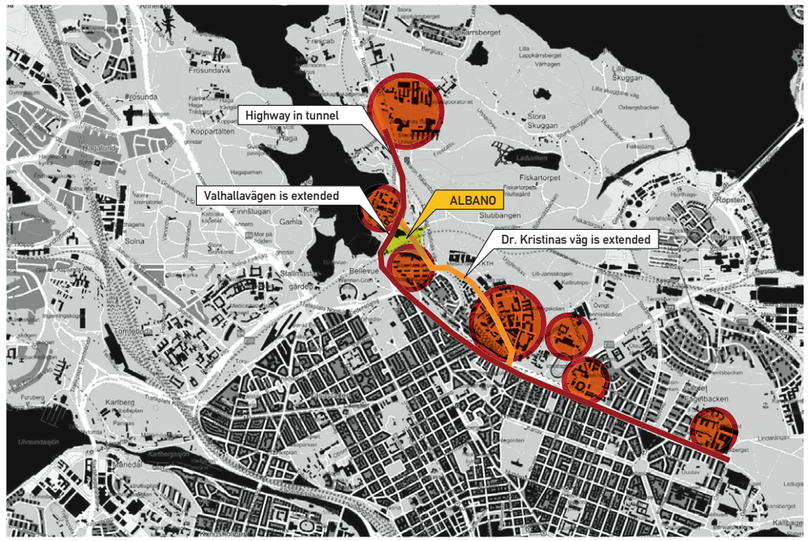


Fig. 4.7 Potential for expanded cycle- and walkways.

Performative buildings

Designing buildings and places to support such purposes may further strengthen publicity. It might be assembly halls and auditoriums, but also public spaces outdoors, specially designed to facilitate public meetings, manifestations and events. With the kind of knowledge environment intended for Albano opportunities for sharing spaces for events and manifestation, both indoors and outside, by academia and the rest of the society seem very good. Here what is often referred to as 'third place' is important, i.e. informal meeting places outside the entities home and work. Cafeterias and restaurants are seen as especially important since they can be used both by people working in the academic world and people outside it. In this context it seems interesting to expand the concept to include public knowledge institutes, e.g. libraries and museums. It would be an inspiring challenge to design these in accordance with the needs of our present knowledge based society so that they may function as meeting places between academia and the rest of the society. Perhaps especially interesting for Albano are association based activities where local associations in collaboration with groups of researchers or public administrations could engage in local activities such as allotment gardening, experimental cultivation, trade with local produce, etc. All with great potential for exchange with the rest of the public.

Property rights, social networks and local culture

The importance of devolving the initiative to develop public spaces should be rather evident by now. You can easily imagine the difficulties facing a central manager trying to develop and supply an attractive selection of knowledge facilities, meeting places and service providers, especially if the intention is to attract also people from outside academia. A polycentric structuring and delegation of property and user rights to more managers and managers of different kinds create potential for specialisation and special competence within different fields and a much greater diversity in the supply. This cover the whole range, from running conference venues that can be used by both academia and the rest of society, via knowledge institutes like libraries, museums and 'third places' like cafés and restaurants, to local associations and corporations, all of which can be run by different managers with different property rights.

Such a polycentric distribution of management should provide greater capacity to adapt to local conditions or external changes. Trends may change quickly and with them markets, which must be understood. It might be the number of visitors to conferences to choices offered by restaurants, where not the least the number and type of students can be critical. Connected to this is the potential to develop local knowledge about what is economically feasible given a certain market and the site specific conditions for good management. Especially important is the potential for communicating knowledge about the local environment, which is of great interest to many Stockholmers and not just to those locally active. Here the public spaces described earlier are important.

4.3.3 Recreation

Recreation

Whatever the ambitions for research and education at Albano are, the location demands equally high ambitions for the area as a place for high quality recreational experiences. Albano has the potential to become one of the most important entrances to the National Urban Park, both to the western part around the Brunnsviken inlet and to the eastern Norra Djurgården with its unique assets and variation in recreational environments. More than an entrance, Albano could become a dense node both making the other parts of the park more accessible and offering an aggregation of recreational opportunities in itself. Developing the Albano area in congruence and agreement with already existing recreational values is one of the primary objectives. These values are based on the unique cultural history and biological values present in the National Urban Park. Recreational use of the area is important also for increasing publicity and increasing the exchange of knowledge between academy and the rest of the society. We see great opportunities for synergies and co-development of different activities within this interface, opportunities that must not be lost in future planning.

Green arteries

To ensure that Albano assumes the role as one of the main entrances into the National Urban Park and a node for the unique recreational opportunities existing there, Albano must be made as accessible as possible. For doing this green arteries are essential. Aside from the discussion already had on the importance of rail bound transportation and the road Drottning Kristinas Väg, we now want to bring up the road Roslagsvägen and the connecting road Valhallavägen as the perhaps potentially most important green artery in the area. Already, this passage functions as a connected line accessing and touching at the National Urban Park in a series of more or less manifest entrances. Unfortunately it is marred by a high load of heavy traffic, reducing the attraction and accessibility for pedestrians and cyclists. With the construction of Norra Länken the traffic load will be reduced, especially the heavy and most disturbing traffic, we see new opportunities to change the form and use of Valhallavägen – Roslagsvägen.

We suggest that this passage, from its origin at Hakberget, past all the institutes along Valhallavägen, via Roslagstull and Albano, to the tunnel entrance to Norra Länken close to Stockholm University, is designed as an access promoting interface between the CBD and the partially and unevenly developed parkland of Norra Djurgården. Albano should be designed to become one of the most important entrances to the National Urban Park with a concentrated set of recreational destinations on the site itself, e.g. parks, experimental fields and starting points

for different cultural and nature walks. The site could also become a starting point for jogging and cycling tracks of high quality as well as for canoeing on the Brunnsviken inlet.

Active ground
To make Albano attractive in this regard diversity, again, should be supported. As before, we see division of the land and distribution of property rights to many actors as important. It can provide a wider array of recreational activities, e.g. connected to research institutes or association based activities such as allotment gardening and experimental fields. Actors interested in recreational services are of course especially important. Services could be commercial, like gyms or renting out bicycles or canoes, or non-profit like dissemination of knowledge to the public through a visitor centre with activities that for example could include tours in the Park.

Performative buildings
To give the above suggest function a focus, a building especially designated as a visitor centre should be planned and built. It should emphasise human cultivation and management of the biological landscape has over time created the unique environment we see today. The centre would become both a starting point for visits to the Park and a place for exhibitions, including thematic, temporary exhibitions. The centre should be a small and alert museum with a strong local connection that can keep up to date with current issues within the environmental debate and complement the Natural History Museum. One important aspect for strengthening the identity of this museum is to design the building itself to exemplify sustainable construction and showcase some of the most recent technology. The building should be able to be changed of over time to reflect best practice as our understanding changes and develop, and thus be a prime example of performative sustainable building.

Property rights, social networks and local culture
We have already argued that it is important to make sure that the supply of activities and services is not only something offered from one central actor – and this is just as true for recreational activities. Diversity should be built bottom-up by means of a polycentric management composed of many different managers and kinds of management. Thus it is important divide the land, and sometimes buildings, into several management units with different property and user rights.

The expectation from theory is that such diversity should be more sensitive and adaptive to changing conditions. For example, a more local and site specific management may quickly change the recreational activities on supply to fit the weather.

Such a diverse management structure offers great opportunities for place-based learning at Albano, with regard to recreational issues. This is achieved through the development of better and more attractive recreational opportunities and activities through good local knowledge, and through offering learning about the site and the rest of the National Urban Park recreational activities, e.g. cultural and nature walks, exhibitions and publications.

4.3.4 Biodiversity

As the Albano property today has low biological values new development its maintenance should be seen as an opportunity to significantly increase these values. Apart from rich recreational and cultural historical values the National Urban Park offer a rich biodiversity. Of all the plants and animals in the province Uppland
approximately two thirds can be found in the Park, including some 800 vascular plant species and close to 250 bird species. Among the insects we find as many as 60 red-listed species, of which 29 are critically endangered and 27 vulnerable. Furthermore, 32 red-listed species of fungi, some 20 vascular plants, mammals (including several species of bats), amphibians, reptiles, fish and birds are noted. The by far most important substrate for insects is the old, hollow oaks. As much as 80% of the red-listed insects are associated with old oaks and lindens. Thus, the oak is a "keystone species" for the Park, i.e. a species contributing with critical resources to a number of other organisms, which would not be able to survive without it. 25% of all trees in the National Urban Park are oaks, and the Park together with the oak population in lake Mälaren valley constitute one of the largest in northern Europe – for which Sweden has an international responsibility. As the oak has biological value and is strongly connected to unique cultural historical values it is important for the management of the Albano site to help secure a viable oak population at greater spatial and temporal scales.

Green arteries
The passages passing by the Albano property (e.g. Roslagsvägen, Drottning Kristinas Väg, the Railway park, etc.) should be designed to support as much as possible the indigenous biodiversity found in the National Urban Park and other ecosystems in Stockholm. The passages should be designed to facilitate movement and dispersal between different areas and thus serve as "habitat corridors" (Forman 1995). In other words, the passages should function both as habitat on the Albano site and as links connecting green areas on greater spatial scales. Studies of birds have shown that for example treed alleys can connect isolated green areas and offer alternative foraging habitat and breeding sites (Fernandez-Juricic and Jokimäki 2001). This would be especially true for ground foraging birds and those nesting in trees. To get best result management should strive for vegetation complexity and reducing human induced disturbances as far as possible (Fernandez-Judicic 2000). Many studies from different cities have also shown that rail line habitats may house a rich flora and fauna (see e.g. Kowarik 1995; Tikka et al. 2001; Zerbe et al. 2003). The oak plays an important role for maintaining biodiversity in the National Urban Park and its surroundings, and is in turn dependent on the Eurasian

Diversity

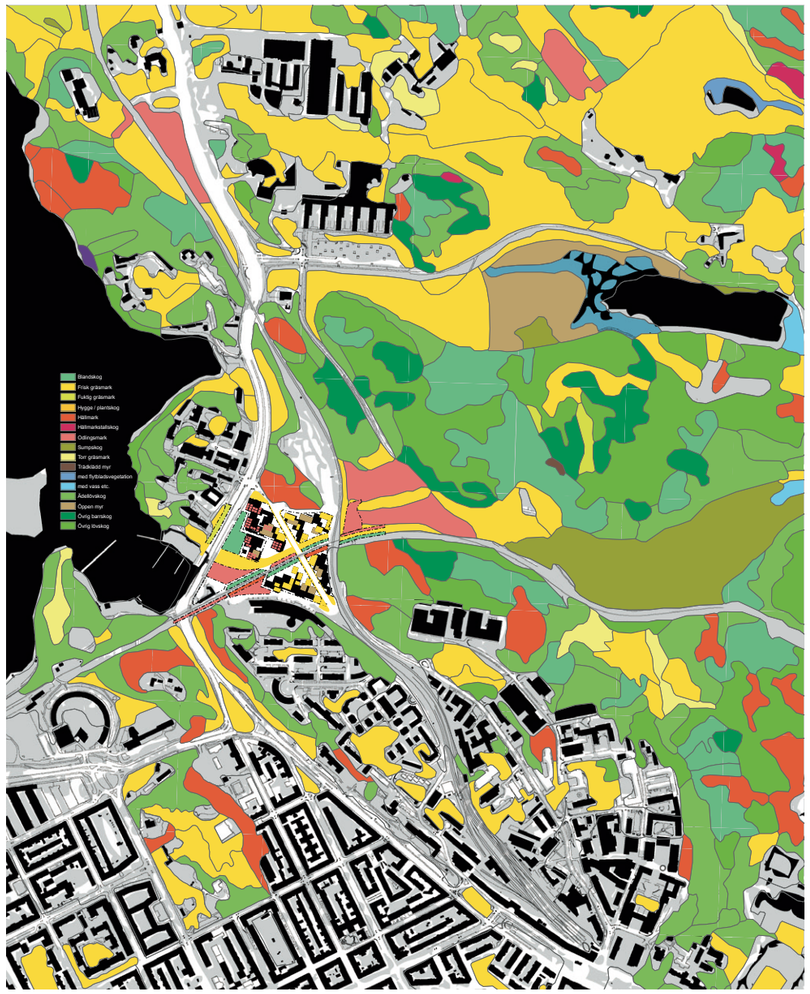


Fig.4.8 Albano in relation to the Stockholm Biotope map.

jay for long-distance dispersal. Studies from the park show that the jay require conifers for successful breeding (Lundberg et al. 2008) (see picture), and stands with conifers are thus important. Moreover, as the jay is a poor flier and preferentially does not cross open areas because of the risk of raptor attacks. To promote dispersal the Albano area should have dense tree corridors facilitating movement between Hagaparken and Norra Djurgården.

Such corridors would not only promote jay movements but also that of other animals. Tree species composition along the passages should include both deciduous and coniferous species. To promote insect and seed eating birds at the Albano site new bird habitats should be structurally diverse, i.e. have many different layers of vegetation. The wet environments in the National Urban Park are very important: the wetlands Lappkärret, Spegeldammen, Lillsjön, Laduviken and Isbladskärret, as well as the swamp forest Uggleviken, all sport rare birds, dragonflies, amphibians and snails. In a SRC study of amphibians and other freshwater organisms in the Stockholm Metropolitan Area (Colding et al. 2009) the general shortage of ponds was noted, threatening amphibian populations over time. The link between Hagaparken and Norra Djurgården is especially weak due to the barrier effect of Roslagsvägen. Establishing new ponds, many new ponds, in the Park is very important to build resilience for freshwater organisms. Our outline includes a number of wetland passages and pond systems (blue arteries) that could serve as habitat and migration routes for amphibians and other freshwater organisms. Lighting is another design component to consider. Street lights along the passages should be of a kind that does not attract moths, which would then become easy prey to other animals.

Active ground

Active ground presupposes that the land is managed actively by one or several actors or groups. Having many managers managing the Albano property together but with different objectives strengthens the potential for a more heterogeneous landscape. Diversity creates opportunities for a multitude of different "habitats". i.e. environments suitable for different plant and animal species. Access to suitable habitat does not necessary mean that an organism will be present, but it increases the probability. We want it to be clear, however, that the near urban location and the number of people expected to move around on and through the Albano site make it unlikely that more disturbance sensitive organisms will be found in Albano.

Figure 4.9
The Eurasian jay play a key role for natural regeneration of oak in and around the National Urban Park by moving acorns over longer distances. The jays cache acorns for eating in the winter but never retrieve many of them. These acorns may then germinate and become new oak trees. The jays, in turn, depend on dense stands of conifers to hide their nests and avoid predators. In other words, to promote oaks you need a landscape of oak stands mixed with conifers. Source: Hougner et al. (2006).

Performative buildings
To promote biodiversity in the Albano area in general, new green areas should be structurally diverse, i.e. have many layers of vegetation. The combinations of structures in our suggestion for development, i.e. allotment gardens, park trees, green roofs and walls, could work both foraging and nesting habitats, as well as stepping stones promoting animal movement through the area to Hagaparken and Norra Djurgården, and further on towards Södra Djurgården. As birds contribute to seed dispersal over longer distances the ecological design of the ARC area could strengthen today weak ecological processes connecting the National Urban Park and the green wedges of Stockholm. For a building, a green roof and green walls offer extra insulation, wind break and reduced temperature fluctuations, reducing the need for heating and cooling during winter and summer, respectively. The carbon reducing effect of an expanded 3-dimensional green surface improves air quality.

Property rights, social networks and local culture
Biodiversity is managed and maintained through active practice. Earlier SRC studies have shown that biodiversity in the Stockholm region is depending strongly on a number of different user groups and actors, and that "locally managed" green areas (e.g. allotment gardens, golf courses, gardens and backyards) interact functionally with nature reserves and parks managed by the municipalities (Colding et al. 2006). In the suggested outline for the different green areas on campus we have specifically considered the management of these and the institutions and the knowledge basis needed for sustainable management. We want to avoid passive management done on entrepreneurial basis, which is only too common in park management. Instead, public participation in management is promoted (sensu Ostrom 1990), where pedagogical lessons about man's dependence on ecosystems can be connected to school and course activities. We want to establish a "system of sponsors" for the different nature areas created at the Albano site; from sponsors of "climate change gardens" and allotment gardens to "teeming" wetlands. Through the sponsor system different actors and user groups are given a clear management responsibility – an "adopt-a-plot" strategy developed and used in other cities around the world to strengthen public participation. The strategy could lead to reduces management costs as management to a large extent is carried out on a voluntary, non-profit basis.

The climate garden could, for example, be established with the help of personnel from the botanical garden Bergianska Trädgården, which could thus "sponsor" the activity together with SRC. In the same way, we would like to see freshwater experts from the Natural History Museum sponsor the wetland system on the ARC site, in collaboration with researchers from SRC.

The green areas on the Albano property should promote increased public participation in the management of urban ecosystems, where lessons about man's dependence on ecosystems are promoted through different activities. This to counteract the "extinction of experience" (Miller 2005) stemming from increased urbanisation and potentially problematic for transforming into more climate smart and sustainable society. Place-based learning should be developed together with course activities at SRC, where students could be engaged in studies of the performance of green walls, green roofs, ecoducts, wetlands, gardens, corridors etc., in relations to the ecological processes they are meant to support. An important aspect of this pedagogical process is that activities in nearby schools are connected to the site. You could, for example, establish a cultivation plot in the area managed by one of the schools, in line with the "adopt-a-plot" strategy. We also envision a so called "climate change garden" at the site. These gardens have been established in a few cities outside Sweden to demonstrate what might happen to for example the vegetation as a consequence of climate change. Another measure to increase learning within the area would be to establish one or more "business parks", e.g. a yard managed by a certain department/tenant in the area. The method has been successfully applied in the Netherlands to make land-use more efficient and contribute to "multiple land-use" planning (Snepp 2008). How to best manage these yards is an important issue for the place-based learning taking place on the Albano property.

As knowledge on ecosystem dynamics and functions in urban environments is far from complete it is important to have an adaptive approach at the Albano site. In such an approach "learning by doing" is an important element. The approach includes combining ecological field studies with different educational activities at Albano Campus to investigate how the ecological design may be improved over time through continuous monitoring and evaluation. This should be done within the framework of co-management, social networks and local culture of decision making that bring together multiple actors and make them exchange knowledge and experiences.

4.3.5 Pollination

One of the tenets for resilience building at Albano is to strengthen the ecosystem services today generated by the National Urban Park rather than weaken them. Many of the historical and current land-uses in this unique urban park support ecosystem services. Pollination, for example, is supported by the gardens in the Park (Barthel et al. 2005). Worldwide, pollination is today seeing a decline caused by changes in land-use and habitat loss (Steffan-Dewenter et al. 2006; Klein et al. 2007). Albano should strive to counteract this trend. When pollinators are lost biodiversity in general suffers. Many plants, and associated organisms, depend on pollinators for their dispersal and continued survival. With a weakened pollination service it will become more difficult to produce food since 2/3 of all food products depend more or less on pollination; a disquieting thought when population increase will demand increased production. Thus it is central for societal development not to forget neglected ecosystem services like pollination (MA 2005). Diversity and population sizes of pollinators is today higher in gardens than in agricultural landscapes, and thus the ecosystem service of pollination has higher resilience in urban landscapes, even though land-use changes could change this very quickly. At the possible event of a future transformation to a more traditional agriculture the pollination service could return to the agricultural landscape. The urban, or peri-urban landscape, is thus a potential source area for pollination services. Thus it is important to manage pollination in cities as insurance for future food production when climbing oil prises will challenge the industrialised agriculture.

Green arteries

Wild bees and other pollinating insects (e.g. butterflies) need a continuous supply of flowers and places to nest. These two features must not be too far apart for daily movements between to be possible. Thus, pollination requires good dispersal routes. These can take the shape of corridors and be established within Albano's so-called green arteries. Such corridors should contain a continuity of flowering plants throughout the season, from end of April to October. Plants flowering early are especially important for the pollinators. Pollinators need places where they can nest, and nests can be build easily and place along the green arteries. These two measures together would provide a spatial support for the migration of pollinating insects.

The Buff-tailed bumblebee's life cycle serve as a good example. The queens wake up from winter dormancy half starved. They need to find food within days not to die from starvation. Plants flowering early, like Salix spp., near the nest site provide them with food and thus help maintain large bumblebee populations later in the season. Without

Pollination

Fig. 4.10, 4.11, 4.12 Allotment gardens at Söderbrunn and pollinators within the area.

these early flowering plants the queen will die and with her a whole population's ability to pollinate plants later in the season.

Active ground
Most pollinators are dependent on a network of high quality and diverse micro-habitats, rather than large, contiguous of more homogeneous habitats (Beismejer et al. 2006). Research has shown that urban gardens support pollination and biodiversity in urban landscapes (Biesmejer et al. 2006; Davis et al. 2009; Goddard et al. 2010), especially small-scale, traditional and intensively cultivated gardens like allotment gardens (Andersson et al. 2007; Barthel et al. 2010). Studies of allotment areas in Stockholm have shown that they meet the criteria for suitable habitat for pollinators, i.e. good foraging and migration possibilities between gardens (see picture). Allotment areas at Albano will have a strategic position as the last, before the CBD, outpost in a line of allotment gardens running through the National Urban Park. Thus, they are important elements in Albano's 'active ground' in support of the pollination service.

The use of artificial fertilisers and pesticides is in general little tolerated in the allotment areas of Stockholm, and should be banned outright in Albano to fully support pollination. Organically cultivated allotment gardens help create good habitats for wild bees and other pollinating insects as they, relative to other gardens, have a bounty of pesticide-free flowers during a prolonged growing season. With gardens like that, Albano will have a continuously flowering mosaic landscape to a very low cost, promoting pollination also outside Albano. Moreover, survival for insect eating birds is improved by such management since it enhances the number of insects. Other practices and protective norms within the allotment gardening movement, e.g. put up nesting boxes, bird baths and providing food during winter, further increase the quality of these habitats for birds. This promotes another ecosystem service important for food production: biological pest control.

Other components that may support pollination include experimental gardens for studies of urban ecology and the implications of climate change on vegetation. 'Climate change gardens' has been established around the world to show what climate change may entail. Climate change gardens could be designed and created together with personnel from Bergianska Trädgården and Stockholm Resilience Centre and serve an important educational purpose.

Performative buildings
Green roofs could be designed to offer nesting sites for wild bees. South facing brownfields, in this case exposed gravel and sand, are potential nesting sites for many species of wild bees, some of them red-listed. Vegetation on the roofs, especially of flowering perennials like shrubby cinquefoil and orpine, could facilitate movement and offer foraging. Flowering plants on walls and roofs promote pollination. Putting up hollow sticks (e.g. short bamboo sticks) on the walls supply nesting sites for many wild bees. An uneven wall surface also act as a wind break, creating lee zones closest to the climate shell and thus reducing the need for heating inside the building. Sunny yards should have continuity of flowering shrubs and plants, as well as vegetables, fruits and berries requiring pollination (e.g. squash, raspberry and apples).

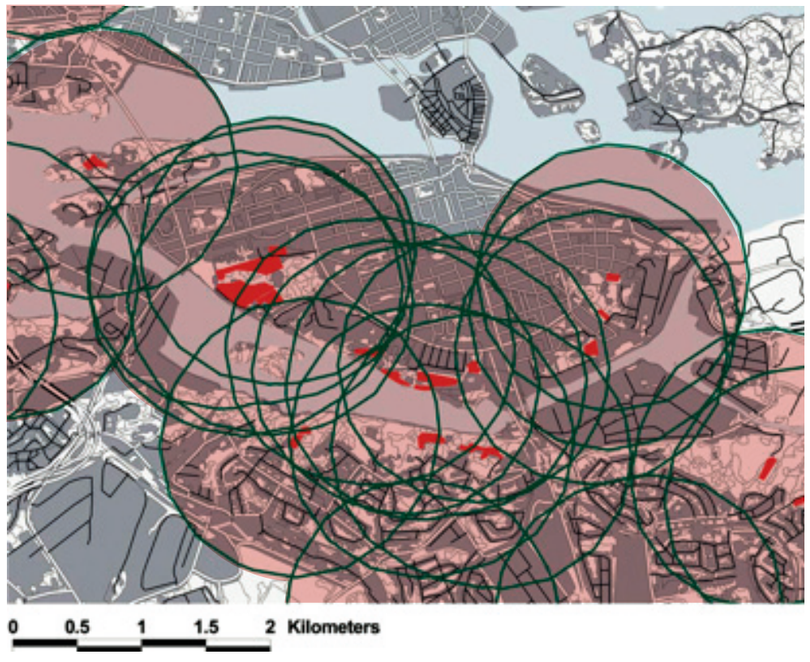


Figure 4.13
A network of allotment areas in Stockholm city. The allotments displayed in the figure can be considered functionally connected by invertebrate metapopulations. City parks, cemeteries, and other inner-city green areas may benefit from pollination by the insects found in allotment areas, especially bees, because foraging distance between allotments and other areas is small. The circles around allotment areas have a 1.0-km radius, which is within the foraging range of most bumblebees (Colding et al. 2006).

Property rights, social networks and local culture
The landowner should grant property rights to civil society groups. Collectively held property rights to active grounds supporting pollination should be time-limited in the same way allotment gardening is today. Collectively held property rights should in this context be held by a well-defined group (Ostrom 1990; Wenger 1998; Barthel et al. 2010; Krazny and Tidball 2009), supported by the national Allotment Garden Association and the landowner. Allotment gardening at Albano would offer an almost cost free management, plus ensuring that there will be people in the area during evenings and weekends. There are five allotment areas in the National Urban Park today, and thus the area around Albano has a history of small-scale urban gardens. The actors watching over the ecosystem service pollination should meet in a local culture of collaboration to continuously network and learn from each other about population changes and disturbances.

Spatial components supporting pollination should also facilitate learning about management of ecosystems, and the institutions and practices necessary to sustainably manage ecosystem services in urban landscapes (Barthel 2008). The problem of extinction of experience described above can be counteracted by architects, constructors and urban planners actively promoting a development supporting experience-based learning about man's dependence on ecosystems (Colding 2010; Barthel et al. 2010). Albano could become a model for how sustainable urban design may mitigate extinction of experience through the establishment of urban gardens focusing on learning about pollination and its requirements.

As a corollary from earlier discussions passive management should be avoided and public participation in management promoted (sensu Ostrom 1990). Through public participation pedagogical lessons, in this case social-ecological memory (Barthel et al. 2010), can be stored in the area and within the active groups. Research on public participation shows that public participation in the management of urban ecosystems may foster sense of place and experience-based learning and memory of local ecosystems, and thus counteract the extinction of experience and build social capital on a local level (Miller 2005; Andersson et al. 2007; Ernstson et al. 2010; Barthel et al. 2010). Examples of public participation in Stockholm include user contracts for housing co-operatives, allotment areas and wetlands co-managed by organisations in the civil society and the city (Colding 2010).

Knowledge about the relation between pollination and active ground, green arteries and performative buildings is incomplete, and thus learning by doing is an important aspect in the management. This approach to ecological design include for example active management done by independent civil society groups, whose traditions and ecological performance are constantly analysed by researchers within urban ecology and ecological design. Thus management of the ecosystem service pollination at Albano becomes a subject for social-ecological field studies connected to ongoing education at Albano. This contributes to science through constant monitoring, documentation and evaluation of design and practices, and to the discussion on how the areas 'ecological designs' can be improved over time to keep up to date with knowledge development. This sub-project makes it possible for Albano to develop into a 'living laboratory' for transdisciplinary research, social-ecological design and urban resilience with focus on the ecosystem service pollination.

Allotment gardens are managed intensively on a non-profit basis by groups in the civil society. A constant 'monitoring-improvement' of management and design as above contributes to an adaptive management. This should be linked to ongoing educational activities at SRC, engaging students in investigations of how well active grounds, green arteries and performative buildings performs with respect to the maintenance of pollination at Albano and the larger landscape.

4.3.6 Water related services

Water is a basic requirement for the survival of humans as well as other organisms. Access to clean water is today one of the most important issues for sustainable development globally. In Sweden, the supply of water is relatively good, but this may change in the future. There is a great potential to make our use of water more efficient. In today's sanitary system we contaminate clean water by mixing it with waste water from different sources, which must then all be purified. The proximity to the Brunnsviken inlet makes water a central issue for the Albano area. The water on the property can be divided into a number of different systems connected to a bundle of services. Since they are all related we have chosen to deal with all of them under the same heading.

a) Run-off water. Could be collected and treated locally in constructed ditches/wetlands. These could be placed along roads and across the whole property, also providing aquatic organisms with dispersal corridors.

b) Grey- and blackwater. There are experiments with greywater (water from showers, sinks and kitchens) treatment through local recycling and this should be tried at Albano as a step in using the area as a knowledge generating laboratory. If greywater is separated from blackwater (from toilets) the latter can be used for biogas production together with organic waste.

c) The water of the Brunnsviken inlet. The water in the inlet is keeping a relatively stable temperature over the year and could thus be used both as an energy source for heating and cooling buildings.

Background
Approximately 12% of animal species are directly dependent on freshwater for their survival. Freshwater living organisms are declining globally, and are declining faster than both terrestrial and marine organisms. A third of all amphibian species has already gone extinct (IUCN 2008) and between a third and half of the remaining ~6000 known species of amphibians are threatened. In Sweden, amphibians are among the most threatened animal taxa. Frogs, toads and newts all have life-cycles that require access to water for survival and reproduction. Amphibians depend on spawning waters in close proximity to suitable terrestrial environments, e.g. mixed forests with a rich herbaceous layer, pastures, forest edges and wet meadows. Form such core areas the amphibian can spread to close-by ponds and wetlands of lesser quality. In poorer habitats reproduction may fail some years, but these areas are never the less important as dispersal

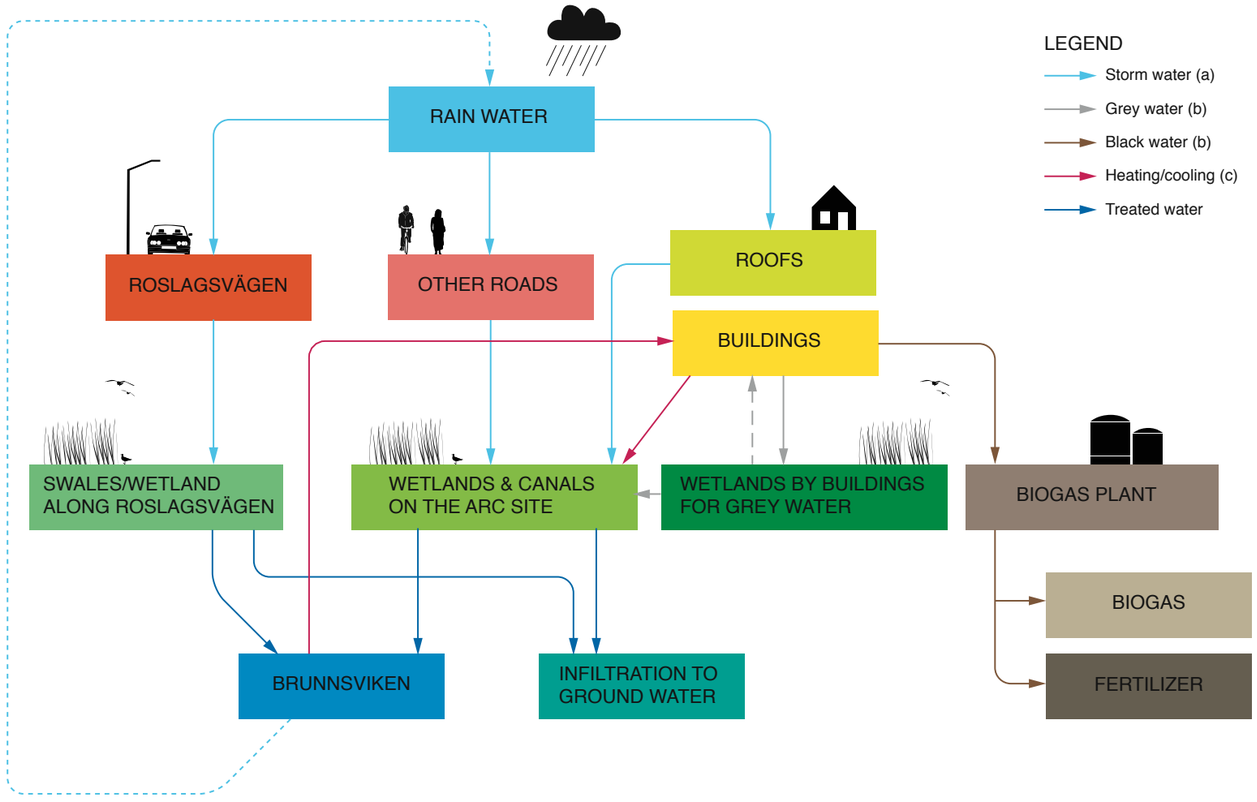


Figure 4.14
Schematic outline of the water system at the property.

corridors between the core areas and supplemental habitat for young animals. In a system like this, the destruction of a core area may lead to the disappearance of amphibians from the whole area, despite an apparent wealth of ponds and wetlands (Colding and Lundberg 2009). Amphibian migration is dependent on dispersal corridors like ditches, brooks, lush meadows, shrublands or forests. These connect populations and make recolonisation possible. The distances between suitable habitats for amphibians in the National Urban Park are today too big, and many of the small water bodies are isolated. As individuals are unable to move between populations, risking local extinctions over time.

Dragonflies are another group of organisms dependent on freshwater environments. Of the 164 known European species, 61 of which occur in Sweden, more than a third are threatened primarily because of habitat loss.

The wet environments in the National Urban Park are very important: the wetlands Lappkärret, Spegeldammen, Lillsjön, Laduviken and Isbladskärret, as well as the swamp forest Uggleviken, all sport rare birds, dragonflies, amphibians and snails. In a SRC study of amphibians and other freshwater organisms in the Stockholm Metropolitan Area (Colding et al. 2009) the general shortage of ponds was noted, threatening amphibian populations over time. The link between Hagaparken and Norra Djurgården is especially weak due to the barrier effect of Roslagsvägen. Establishing a system of wetlands at Albano would improve conditions for freshwater dependent organisms in the whole park. The aesthetic values of such wetlands would further strengthen the experiential values of ARC.

Green arteries

The road Roslagsvägen is the main artery for traffic through the area. Run-off must be taken care of and treated locally through e.g. surface-flow wetlands. Wetlands and ditches could be established alongside the road. The purified water then flows from these to Brunnsviken or percolates down to the groundwater. Run-off water from roofs and other impervious surfaces should be integrated in the over-all wetland system. Roslagsvägen is the greatest barrier for connecting the area's wetland system to Brunnsviken. Overcoming this barrier is crucial for the wetlands' ability to function as dispersal corridors. A common solution in such situation is to establish underpasses for amphibians. We see an opportunity to design such underpasses not only to function ecologically but to become part of the experience for visitors to the park.

Fig. 4.15 A canal behind the marina would allow aquatic organisms to migrate without affecting the activity.

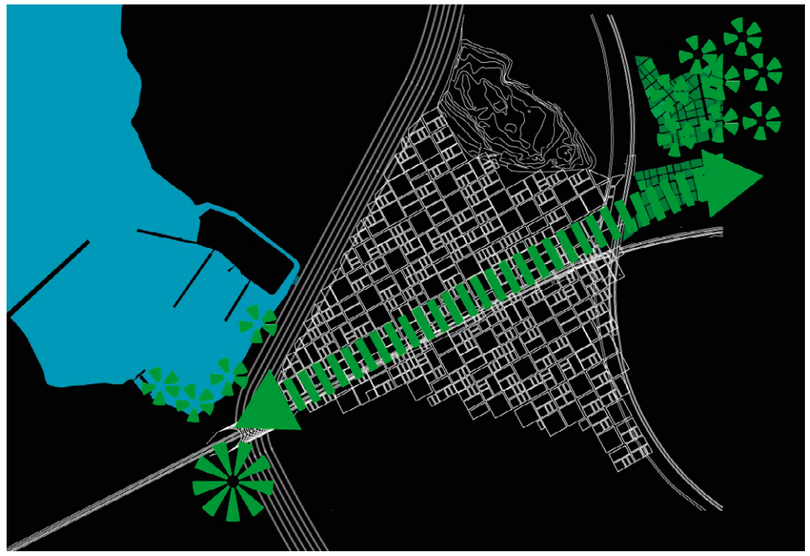


Fig. 4.16 A system of wetlands, ditches and ponds offers dispersal corridors between Brunnsviken, the allotment area and Uggleviken (east of Albano) and connects different populations of amphibians.

Active ground
a) We suggest a system of wetlands with pond and open canals for run-off water for the property. Ditches will function as retention tanks and as boundaries between different land units. They should be integrated with and interrupt impervious surfaces and roads. They should be designed to provide connected dispersal corridors for amphibians and other aquatic organisms, linking Brunswick with the Söderbrunn allotment area and Uggleviken, east of Albano. The wetlands have a pedagogical role in informing visitors on the important ecological function of wetlands. When it comes to land-use planning in general, large impervious surfaces connected directly to sewers should be avoided. Reinforced grass, permeable seams and other permeable surfaces are to be preferred. Ditches should be established next to parking lots. From a run-off perspective, larger parking lots are best placed under ground.
Examples: Augustenborg, Västra Hamnen, Malmö, Sweden; Potzdamer Platz, Berlin, Germany.

b) Treating the water from some selected buildings are integrated into the land-use. Greywater and perhaps also blackwater can be purified biologically in constructed wetlands. After the treatment process the water can be discharged into the larger wetland system, or perhaps be recycled in the buildings as water for washing or flushing toilets. The design should be pedagogic, making the system part of knowledge development and public functions at the property. The system could for example be linked to the visitor centre or a research institute.
Examples: Flintenbreite, Lübeck, Germany; Sidwell Friends, Washington D.C., USA.

Performative buildings
a) Run-off water from the roofs is channelled into the wetland system. The green roofs and walls function as reservoirs and use up much of the water locally, e.g. for the plants growing on the roofs. Green roofs and walls create an evaporation effect cooling the air during summers and thus reduce risk of high indoors temperatures. The extra insulation offered by green roofs and walls reduces the need for heating during winter.

b) Water treatment can be integrated into the design of the buildings and be placed in for example yards or atria. Possibilities for separation of urine should be investigated and, if doable, be coordinated with the development of Norra Djurgårdsstaden. Blackwater could be used together with organic waste to produce biogas. This is already done in the treatment plant Henriksdal, but could be done in a more local treatment plant/biogas plant. The urine would be stored separately and later mixed with the left over sludge from the biogas production to produce an effective, organic fertiliser.
Example: Sidwell Friends Middle School, Washington D.C., USA

Fig. 4.17 Sidwell Friends Middle School, Washington D.C., USA.
Wetlands purifying greywater. The design of these has been integrated into the rest of the landscape.

c) Water from Brunnsviken could be pumped through the buildings. It would, in combination with the thermal mass of walls and beams, function as a heating and cooling element. The system could be operated together with the wetlands by routing the water through the wetlands on its way back to Brunnsviken, thus achieving a symbiosis between Brunnsviken, run-off water management, wetlands and indoors climate regulation. Before doing this, however, the water quality must be evaluated, making sure that the water does not leach the soils or harm the wetland ecosystems by high salinity levels or unsuitable water temperatures.
Examples: Kvarteret Katsan, Folksamhuset, Stockholm, Sweden

Property rights, social networks and local culture

a) Stockholm city is responsible for managing run-off water from the road Roslagsvägen. We propose that the wetlands established on the property are managed by a cooperative, including for example Akademiska hus, the Natural History Museum and other tenants in the area. Ditches and ponds might function as natural boundaries between different management units and through their design support different user rights held by different stakeholders. A centrally placed wetland should be designed to become part of the park areas accessible to the public. Other, more functional and technical parts of the water treatment system, need not be as visible. Legally supported user rights for part some of the wetlands would allow research institutes to independently develop these wetlands as knowledge increases. All kinds of wetlands should be made accessible to visitors and designed to be pedagogic. In that way they will become part of the area's story and make people aware of the linkages between society and ecosystems. An important prerequisite for continuous monitoring, and in extension an adaptive management, is that sampling and evaluations are planned from the start.

b) The surfaces dedicated to purifying the water from buildings may be seen as experimental laboratories that can be redesigned over time to test new types of water treatment. You could for example test which plants are most effective, how the capacity could be increased during winter etc. Through the constant monitoring feedback on the different methods will be more or less immediate, allowing you to adapt quickly or test new solutions to improve the performance. These wetlands may be managed by the property owner or by the tenant, preferably in collaboration with companies or research institutes active in the subject area.

Managing the wetlands as a cooperative – a water association – would bring together several different actors. Meetings within the association would promote and support local social networks. Bringing users' and visitors' attention to the importance of water for ecosystems would increase the public awareness and the respect for ditches and wetlands. The water systems could also become part of the identity for the area. In attempting the latter much can be learnt from the social movements that created Kristianstad Water Realm and its eco-museum.

Fig. 4.18 Flintenbreite, Lübeck, Germany. Wetlands purifying greywater from a housing block. Blackwater is used to produce biogas.

Fig. 4.19 Courtyard inside the Institute for Forestry and Nature research, Wageningen, the Netherlands. Architect: Behnish & partners.

5. CONCLUSIONS:
Social-ecological compositions

5.1 The Albano case

Parallel to theories and strategies presented above, the working group has continuously worked with design outlines for the area. This 'research by design' has been very important to test the applicability of different ideas and for deepen our understanding of the different parts.

In the following chapter we present the conclusions from this work. We have chosen to call the designs resilient compositions since they deal with several of the components described earlier, combining them in different configurations usually including both social and ecological components. The compositions deal with several levels: from large scale plans to local solutions to specific problems. The compositions may be seen as examples of what the physical reality of Albano Resilient Campus might look like. We do not have a final proposal and the compositions should be seen as a basis for continued development of the project.

Fig.5.1 Panoramic view of the new parkland passage.

To get all the functions and uses described in chapter 3the property must be divided into several units with management responsibilities shared by many different actors. From the start it must be clear to the actors which part of the property they are responsible for and what their rights are. Actual use within the units may vary; a unit should not be viewed as having a single function and each actor may well have several activities within its unit. Activities open to the public promoted within each unit.

Conditions are site specific and each actor has specific criteria how to best carry out its activity, which must of course be considered when dividing up the property.

Houses and buildings today follow the general topography and leave the valley running due east from Brunnsviken via the Söderbrunn allotment area (fig. 5.2) relatively undeveloped. Here we envision a strip of parkland reaching through the area. Important historical sight lines from the Bellevue peninsula has generally been considered in earlier development and we see it as important the present landscape contour is preserved, e.g. by adjusting the height of the houses to make sure hilly sky line remains visible.

To attract the people moving between Stockholm University and KTH to pass through the area it is important to make the mental distance as short as possible. Therefore we want to create a sight line and a pedestrian passage diagonally through the area, making sure that the presence of Kräftriket is felt already at Alba Nova on the other side of Roslagsvägen. This passage has the potential to become the natural route for cyclists and pedestrians passing trough Albano.

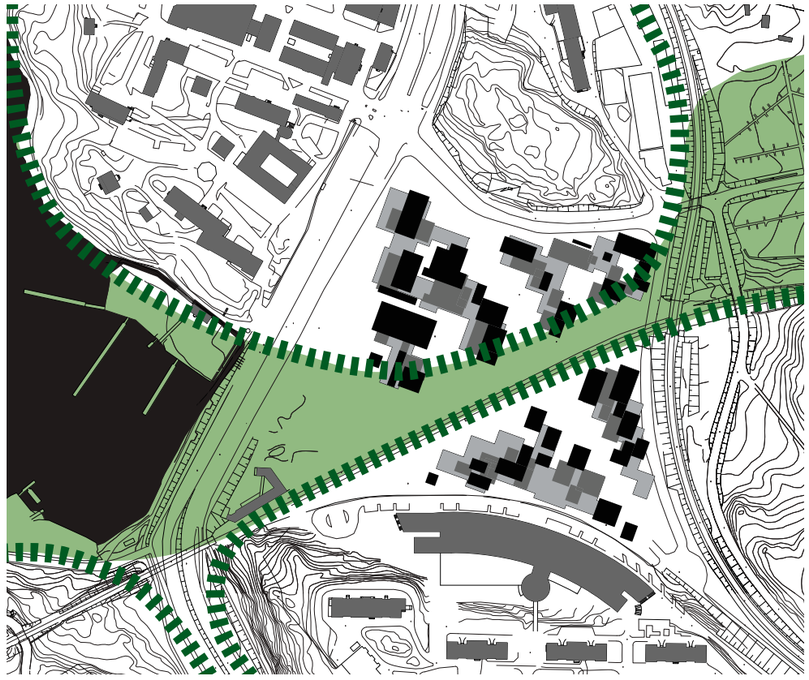


Fig. 5.2 The topography create a valley winding through the area.

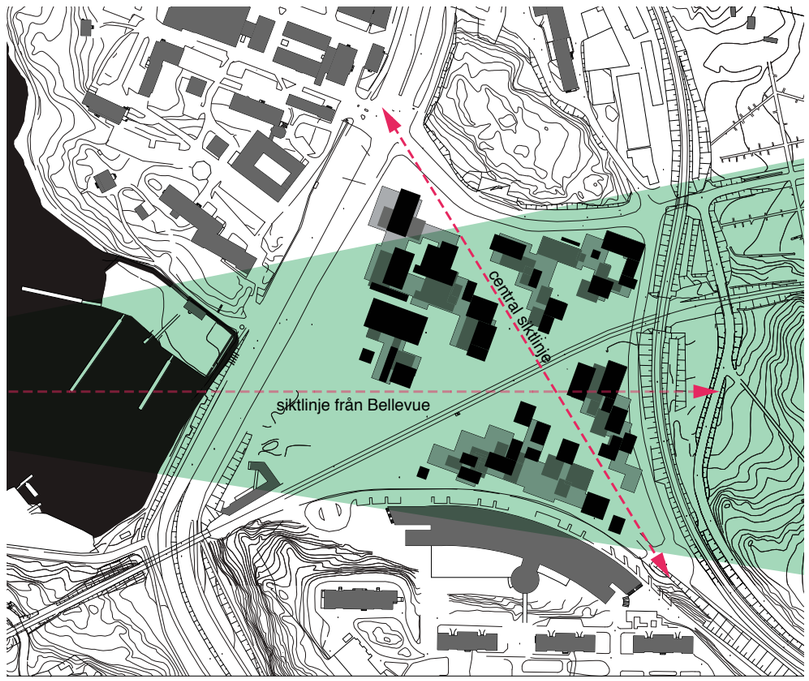


Fig. 5.3 Important sight lines.

The first step is to divide the property and designate the parts to the different spatial components: green arteries, active grounds and performative buildings. The passages (green arteries) will ensure access to and routes through the area for different means of transportation. Trafikverket (the Swedish Transport Administration) will be responsible for rail-bound traffic along Roslagsbanan and the industrial railway. Stockholm city will be responsible for the major roads (except Norra Länken, which falls under the Swedish Transport Administration). We propose a passage of parklands running east-west through the area. This passage will be an important place for meetings and encounters and we suggest a shared management by Stockholm city and Akademiska hus.

For the performative buildings the building proprietor will be ultimately responsible, in this case most probably Akademiska hus.

Active grounds divide the property into a number of units to which different actors are assigned property rights. Actors might be research institutes or cooperatives like for example allotment garden associations or a water association. We further propose an expansion of Söderbrunn allotment area when the road is moved from the east to the west side of Roslagsbanan.

Active Ground
The property is split up to ensure the diversity of actors.

Potential actors:
-See use

Services:
-Diversity
-Publicity

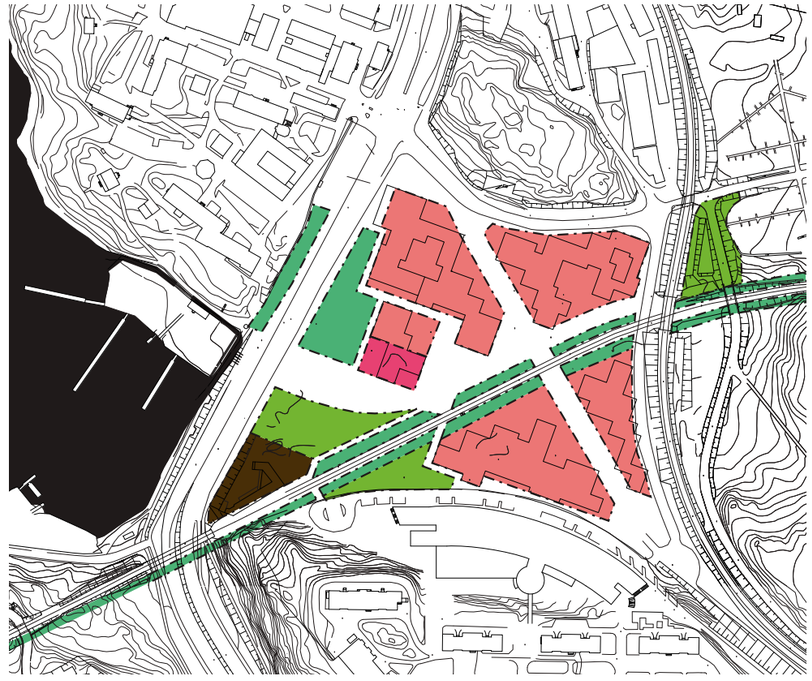
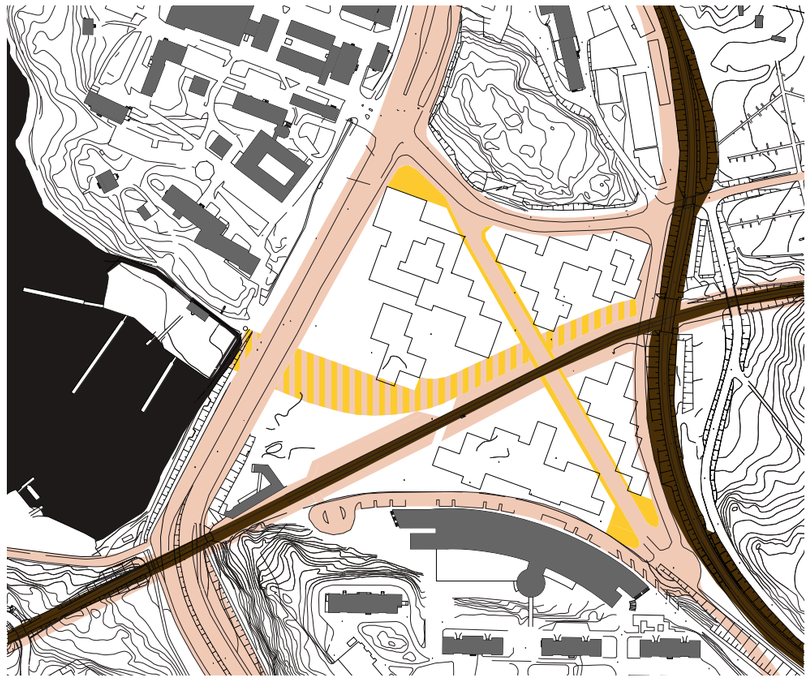


Fig. 5.5

Fig. 5.4



Green Arteries
Connect the city's transportation networks. Clear passages and sight lines through the area. Open public passage of parkland along the valley.

Potential actors:
-Stockholm city
-Swedish Transport Administration
-Akademiska hus

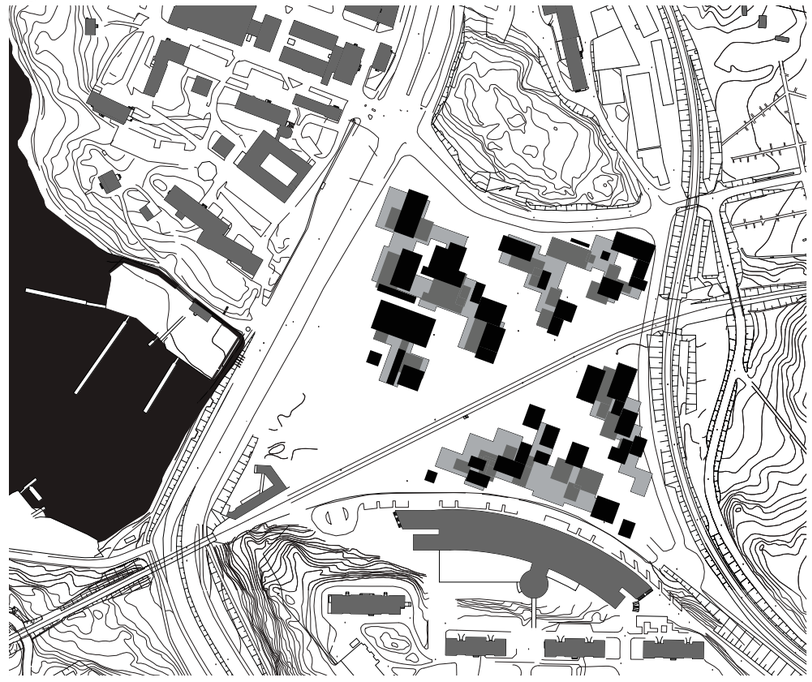
Services:
-Publicity
-Urban accessibility
-Diversity
-Security
-Attractiveness
-Competitiveness

Performative Buildings
Make use of aspects of the cultural history. Clear passages and sight lines through the area.

Potential actors:
-Akademiska hus
-Stockholm University
-Stockholm city

Services:
-Publicity
-Diversity
-Microclimate
-Indoors climate
-Security
-Attractiveness

Fig. 5.6



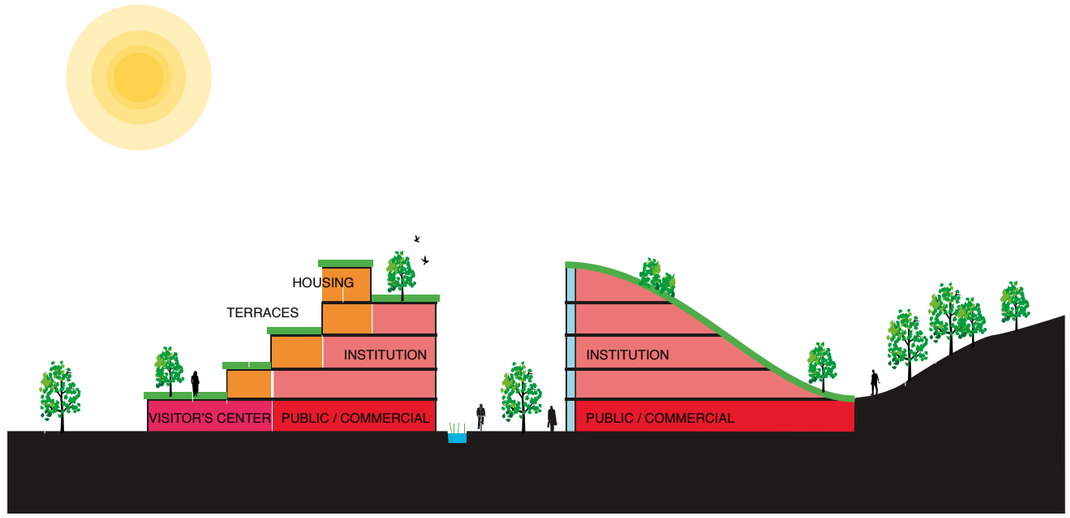


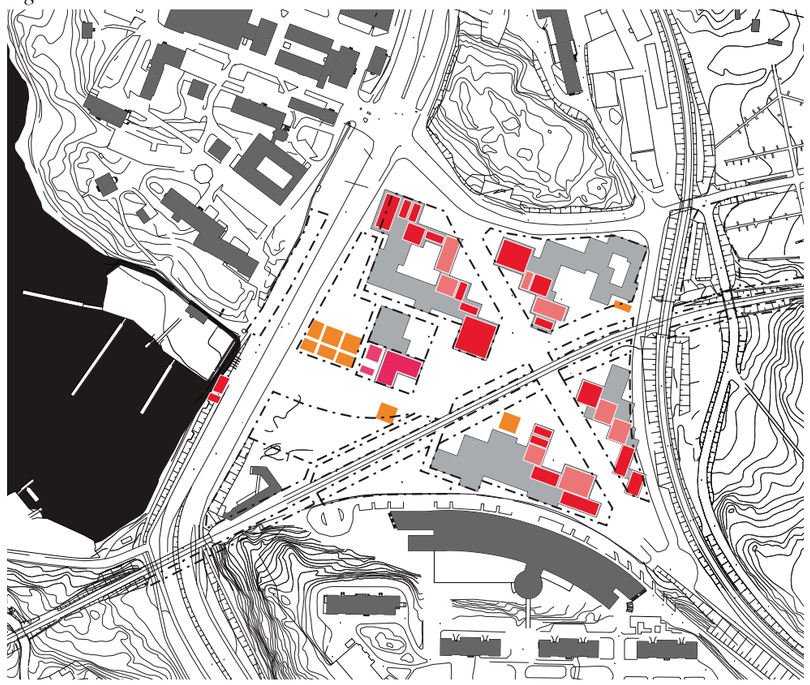
Fig. 5.6

Public activities
Public activities
Preferably at ground level.
Facing the central passages.
Educational functions.

Potential actors:
-Shops
-Restaurants/cafés
-Visitor centre
-Demonstration gardens

Services:
-Publicity
-Diversity
-Security
-Recreation
-Attractiveness
-Competitiveness

Fig. 5.7

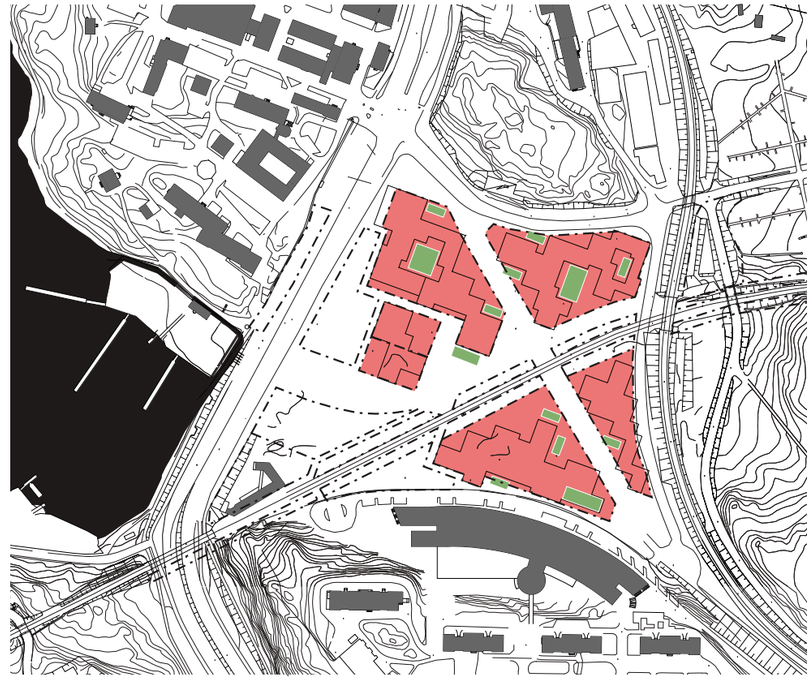


Research & education
Buildings and courtyards.
Vast, connected floors.
Flexible premises. Assembly halls and conference at ground level. Good communications.

Potential actors:
-Stockholm University
-KTH
-Karolinska institutet
-SLU
-Stockholm School of Economics

Services:
-Exchange of knowledge
-Publicity
-Microclimate
-Attractiveness
-Competitiveness
-Water treatment

Fig. 5.8

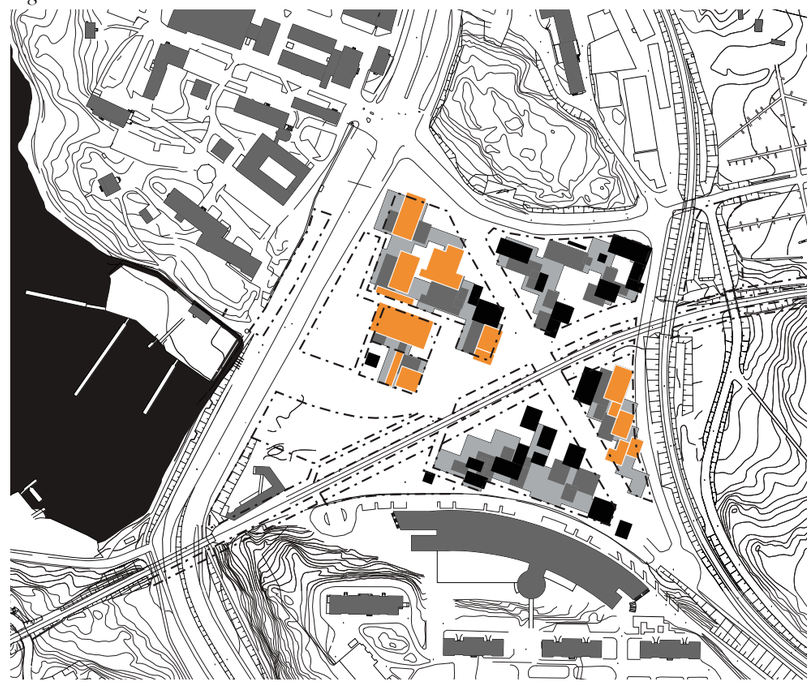


Housing
The upper floors. Attractive, good light conditions. Accessibility.

Potential actors:
-SSSB
-Housing firms

Services:
-Diversity
-Microclimate
-Indoors climate
-Security
-Attractiveness
-Competitiveness

Fig. 5.9



Green roofs
Stepping stones for birds. South facing terraces for the residents. Some roofs connect directly with the ground.

Potential actors:
-Research institutes
-Akademiska hus
-Residents

Services:
-Exchange of knowledge
-Publicity
-Diversity
-Air treatment
-Pollination
-Run-off water treatment
-Microclimate
-Indoors climate
-Recreation
-Attractiveness

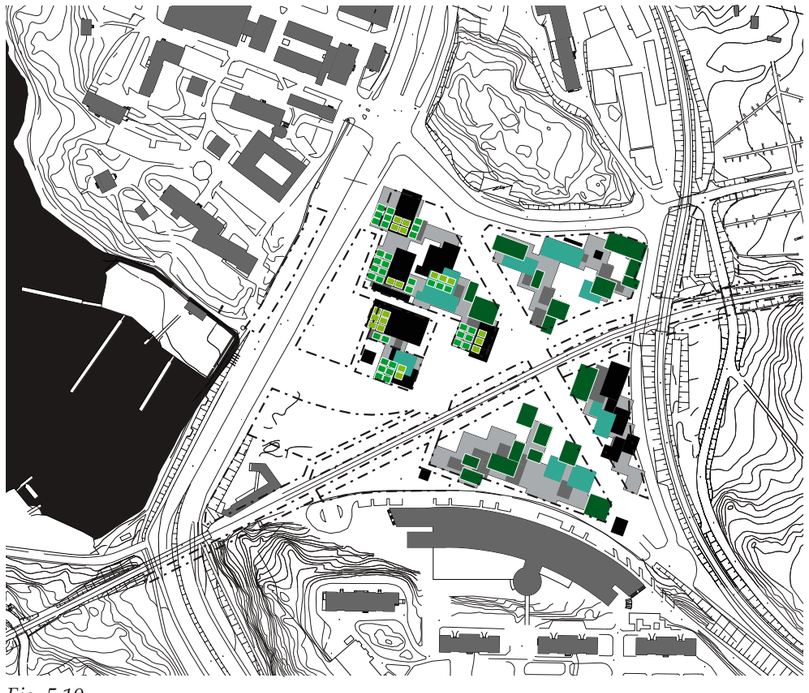


Fig. 5.10

Allotment gardens
Söderbrunn expands. Creates a corridor for pollinators. Units of at least ten plots. Sunny sites.

Potential actors:
-The Swedish Association for Allotment Gardening
-Söderbrunn allotment garden association

Services:
-Exchange of knowledge
-Publicity
-Diversity
-Security
-Air treatment
-Pollination
-Microclimate
-Recreation
-Attractiveness

Fig. 5.11

Water association
Connects Brunnsviken with areas east of Albano. A system of wetlands, ditches and ponds. Public, educational functions.

Potential actors:
-Akademiska hus
-Stockholm vatten
-The Natural History Museum
-The National Property Board
-Research institutes
-Tenants

Services:
-Exchange of knowledge
-Publicity
-Diversity
-Microclimate
-Water treatment
-Recreation
-Attractiveness

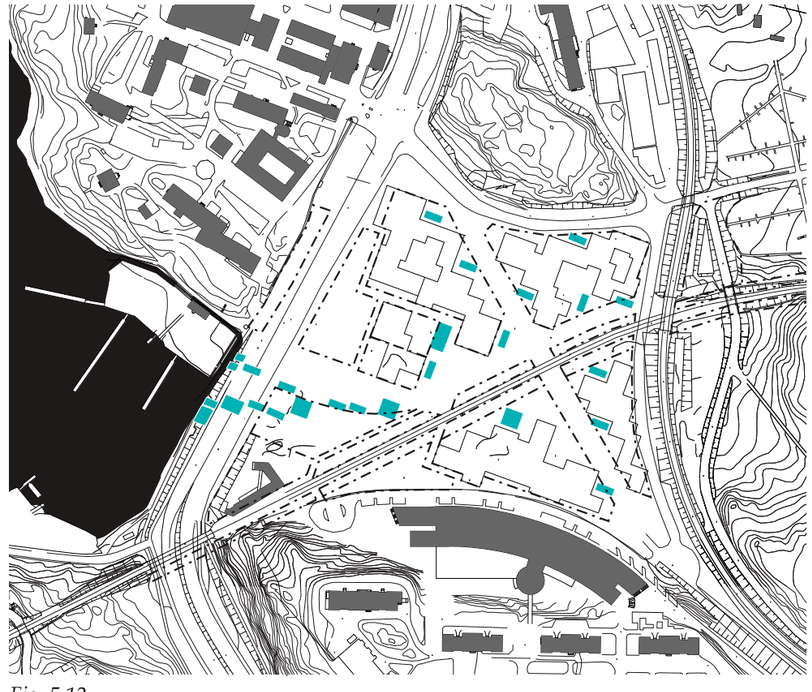


Fig. 5.12

Test bed gardens
Good growing conditions. Public, educational functions, e.g. a climate change garden.

Potential actors:
-The Natural History Museum
-Research institutes
-Bergianska Trädgården
-Stockholm University

Services:
-Exchange of knowledge
-Diversity
-Publicity
-Air treatment
-Pollination
-Microclimate
-Recreation
-Attractiveness

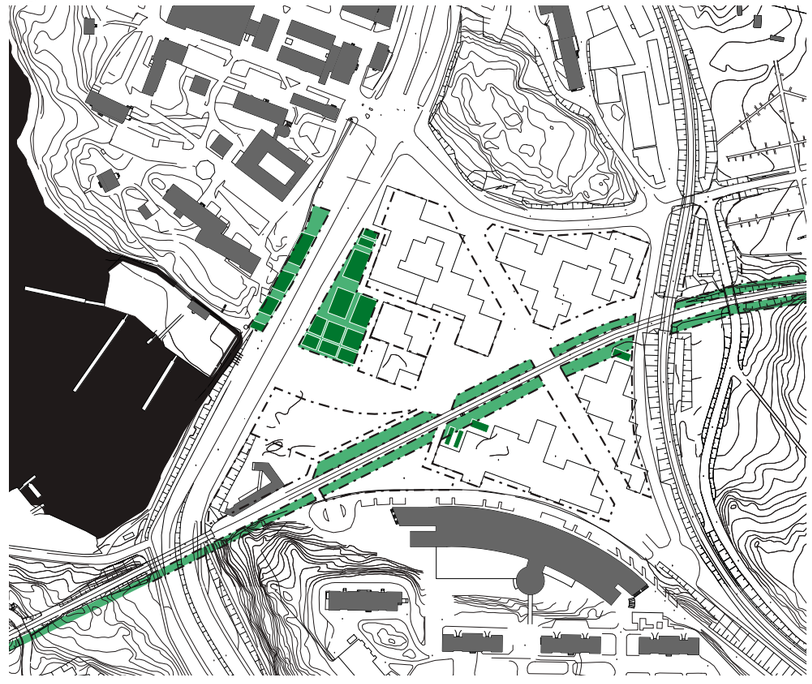


Fig. 5.13

Synthesis
All in all, this leads to a diverse blend of functions, actors and activities in the area. We will find research of highest international standards, allotment gardeners cultivating the land, students milling around in the streets and parklands, people out on their Sunday walks and visitors to the National Urban Park. We will also find a plethora of plants, animals and biotopes. The diversity of environments and actors will be a fertile soil for many different meetings and developments. This is, as explained earlier, one of the central tenets of the resilience theory.

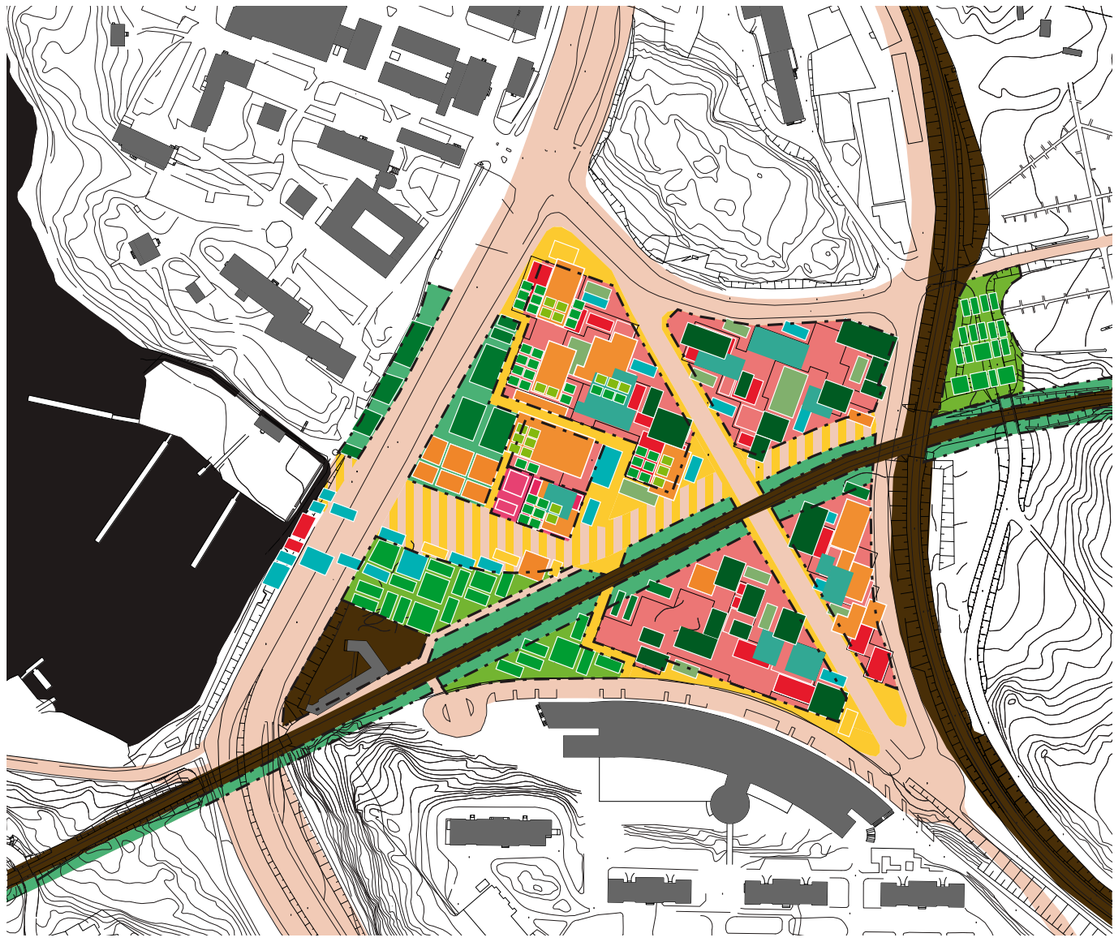


Fig. 5.14

Fig. 5.15 The new development will complement the biotopes in the surroundings.

Fig. 5.16 The parkland passage will be a new gateway between the city and the Park.

To be able to judge the effectiveness of the different measures tested in Albano they must be seen in a broader context. The aim is to get Albano to interact with the rest of the city and strengthen passages for humans as well as other species.

The street system connects to that of the rest of the city primarily via Valhallavägen and Drottning Kristinas Väg, and secondarily via the pedestrian passage along Brunnsviken. Moreover, a new walkway along the industrial railway would connect the Norra Station area, Karolinska, Albano, Norra Djurgårdsstaden and Värtahamnen (fig. 5.17).

The parkland passage through the area will become a new entrance from the city to the National Urban Park, and vice versa. The location of the visitor centre will be strategically important (fig. 5.16).

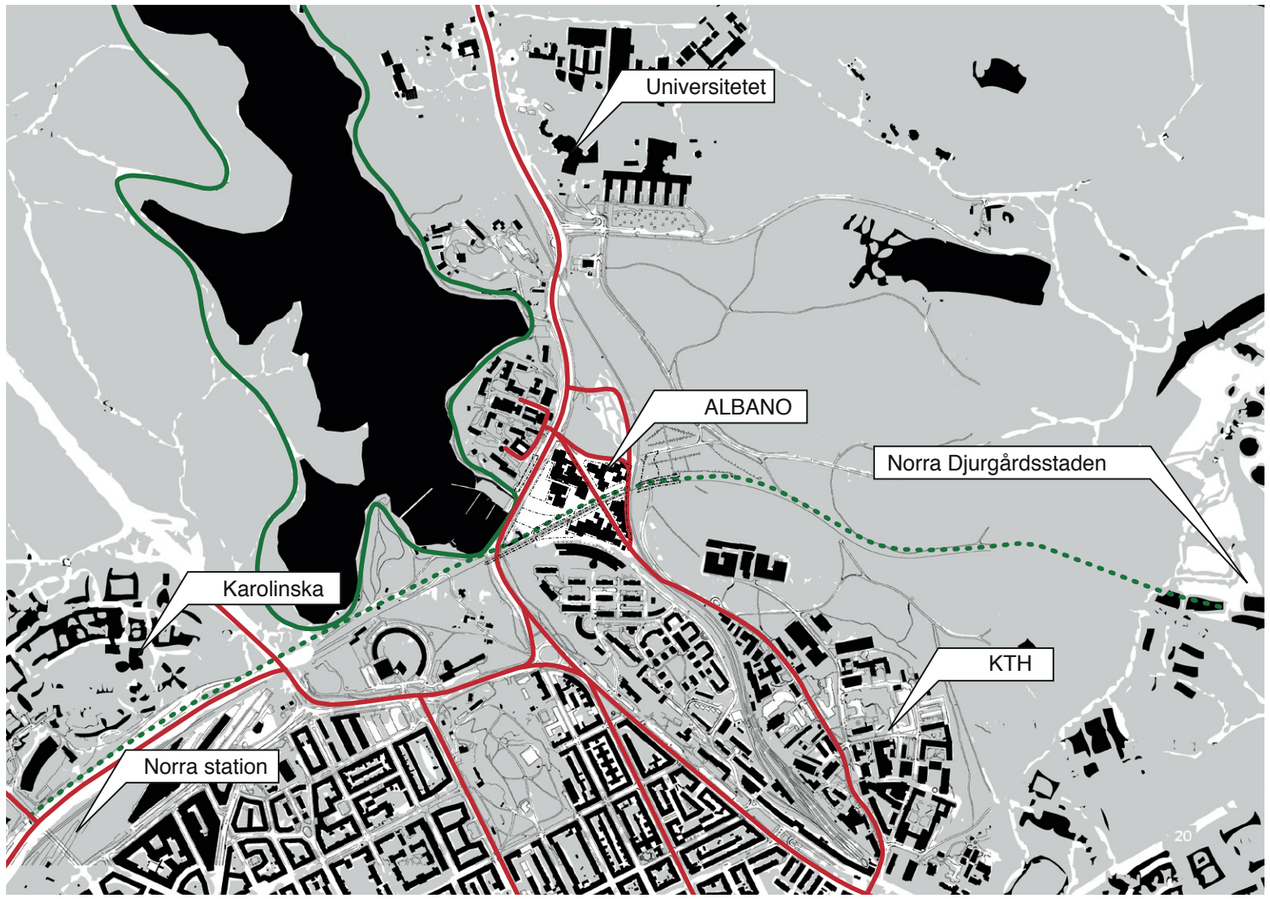


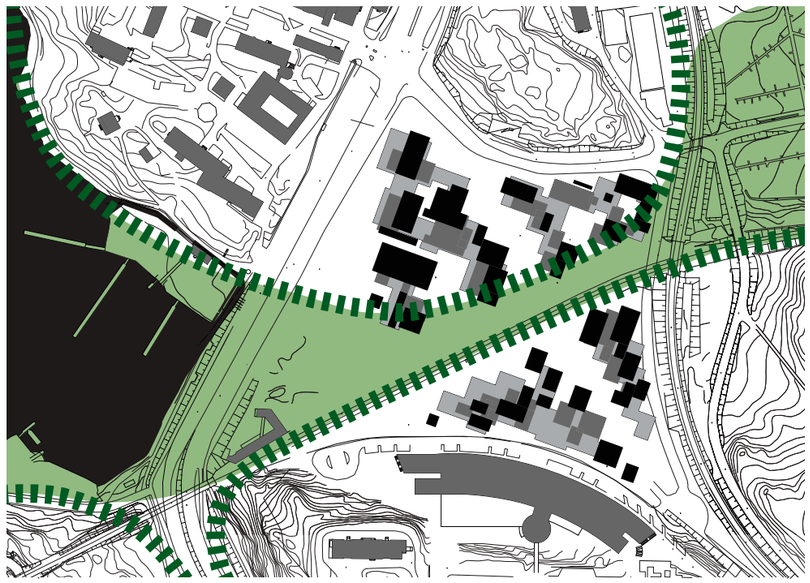
Fig. 5.17 Streets (red) and walkways (blue) connect to the existing street system.

5.2 Design of Active Ground

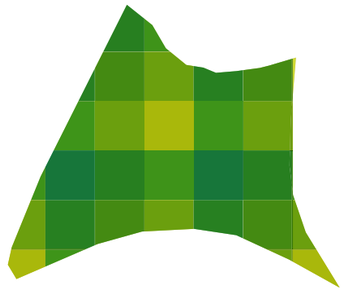
Two things are especially important to remember when designing the landscape. The first is that each actor must have a clear space for action. The boundaries between management units will play a critical role. The second is the multifunctionality of the spatial components. A building or a landscape element has not just one function to fill. A façade is not just something separating inside from outside, it should also advertise the building, let in light etc. It may also have other functions, e.g. serve as a wind break reducing the need for heating, provide habitat for birds and other animals or produce electricity through solar panels.

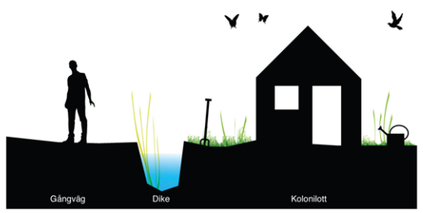
In the same way design can do better than to use simple fences to separate land units. Figure 5.18 is showing a catalogue over a number of performative borders offering additional functions to just separating different units. Examples include ditches (which take care of run-off water, help irrigation and facilitate animal movements) and gabion walls (which combine aesthetics, offer somewhere to sit down, and wintering possibilities for amphibians provided that they reach below the frost line).

On the landscape scale we work with contrasts between open and vegetated areas, and see it as important preserve the feeling of openness in the east-west passage running through the valley.

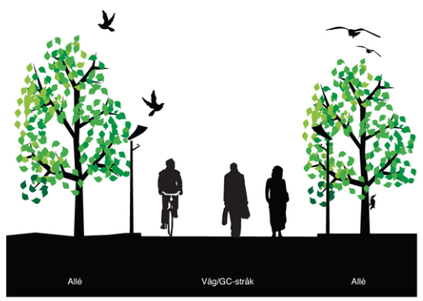


Design of Active Ground

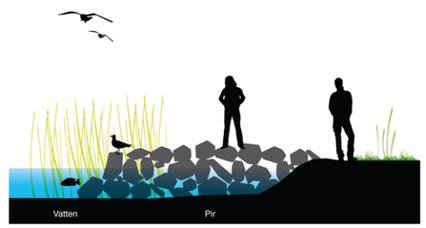




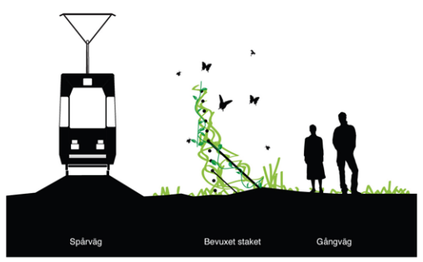
SERVICES
- Dispersal corridor for water-living species
- Water treatment
- Irrigation



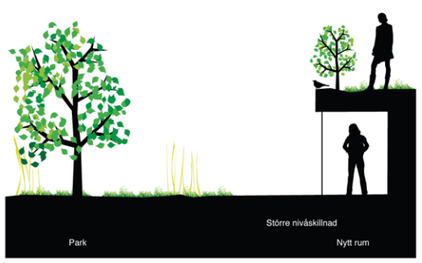
SERVICES
- Dispersal corridor for birds
- Habitat
- Air treatment
- Wind breaking
- Shading
- Noise reduction



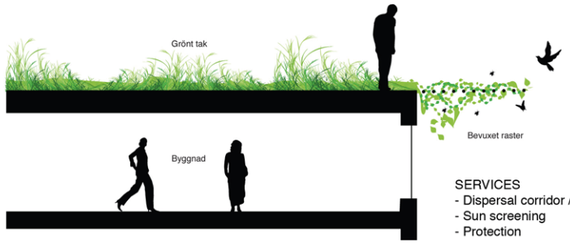
SERVICES
- Habitat for water-living species
- Seating



SERVICES
- Dispersal corridor / habitat
- Visual extention of the park
- Protection from the trains



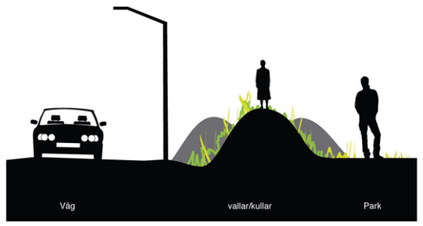
SERVICES
- Habitat for insects & micro organisms
- Seating



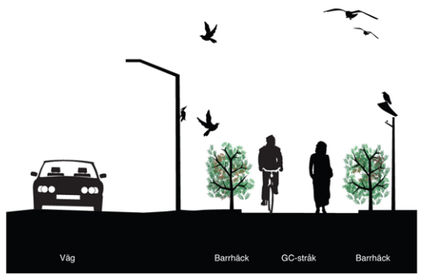
SERVICES
- Dispersal corridor / habitat
- Sun screening
- Protection

SERVICES
- Seating
- Recreation

SERVICES
- Habitat for insects & reptiles
- Hibernation habitat for barachians



SERVICES
- Dispersal corridor / habitat
- Noise screening
- Storm water treatment
- Play spaces



SERVICES
- Dispersal corridor for birds
- Some noise reduction
- Visual protection
- Air treatment
- Wind breaking

Figure 5.18
A catalogue over different so called performative borders.

5.3 Design of Green Arteries

We have identified three main passages on the Albano property – Drottning Kristinas Väg, Roslagsvägen and the Railway park.

Drottning Kristinas Väg
The road Drottning Kristinas Väg is today leading through the KTH campus. We propose an extension crossing Albano and connecting the area with Kräftriket and Stockholm University. This connection has been named "the academic road" in earlier reports.

We see this extension as the central, urban passage through Albano Campus, and the design approach is relevant also for other impervious surfaces in the area. Most of the car traffic will be channelled around the area, which offers certain freedom when designing the passage. It is important that the passage provide a sight line through the area and beyond, thus shortening the mental distance and making sure you 'can see where you are walking'.

In terms of motor traffic the passage should be open for emergency vehicles, snow ploughs and delivery vehicles, but since these will be infrequent a permeable surface could be used, e.g. reinforced grass. These are superior from a run-off perspective, as they allow water to infiltrate directly, and may also function as dispersal corridors for animals and plants. The surface will be interrupted by a scatter of vegetated plots or ditches/small ponds further facilitating water infiltration. The passage should be designed to retain options for future development and novel solutions to transportation issues. Rapid Personal Transit, either on the ground or suspended in the air, might be one such (see fig. 5.19).

The façades facing the passage should be designed to let vegetation continue vertically. This could be achieved either through espaliers, terraces or layered plantings. Such design improves the climate both indoors (through shading and wind break) and outdoors (shading and evaporative cooling).

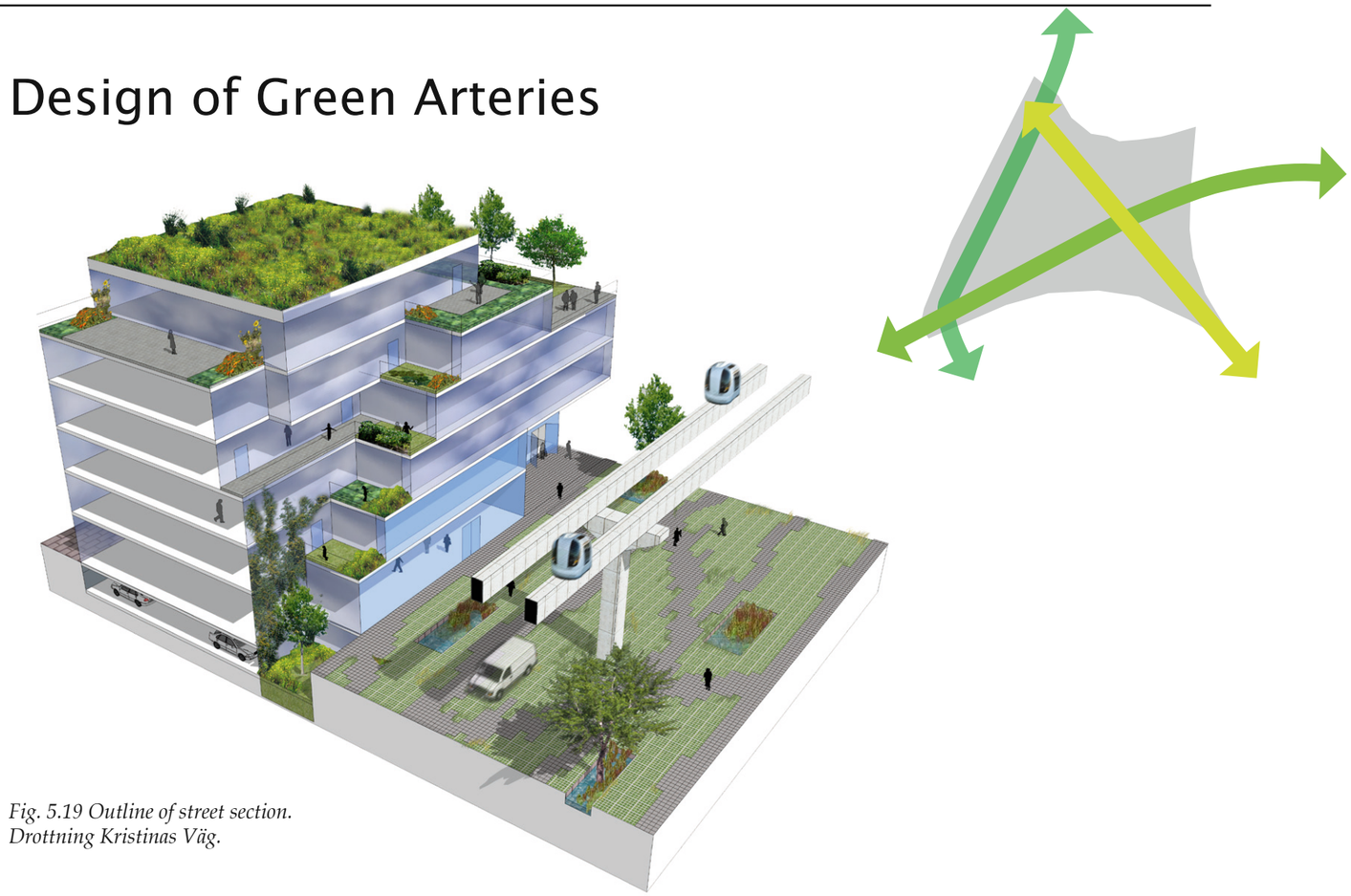


Fig. 5.19 Outline of street section. Drottning Kristinas Väg.

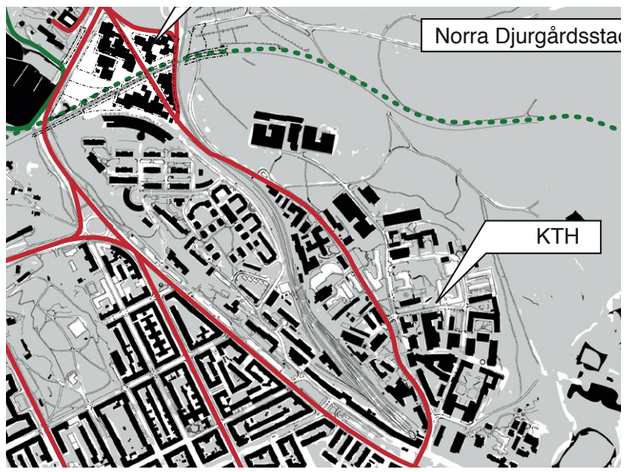


Fig. 5.20 Reference for run-off water treatment: SW 12th Ave Green Street Project, Portland, USA.

Roslagsvägen
The road Roslagsvägen is the main troughfare passing Albano and will remain so even after the completion of Norra Länken. Today it constitutes a barrier running through the National Urban Park, a severing that might be remedied through design. One approach would be to plant vegetation alongside the road. To function as a corridor for bird movements such a passage should be structurally diverse, i.e. contain vegetation with different heights – ground vegetation, shrubs and trees.

Another approach would be to create underpasses under the road. Figure 5.21 shows how the property's system of ponds, ditches and wetlands passes under Roslagsvägen on its way to Brunnsviken. Finally, it passes under a boardwalk along the inlet. Thus we want to demonstrate how ecological features can be made visible and become experiences for the visitors. Making the visitors aware of ecological functions in their surroundings is the first step towards increased understanding and, in extension, changed behaviour.

Fig.5.21 Outline of street section. Roslagsvägen.

Fig. 5.22 Reference, wetland. Riem Landscape Park, Münic, Germany. Architect: LUZ Landschaftsarchitecten.

The Railway park

The Railway park is a linear passage along the industrial railway running east-west through the property. The passage increases the accessibility to and from the area, providing people with a pleasant promenade bordered with greenery. It is important not to place anything that encourages people to enter the safety zone along the railway. Instead, this zone could be stocked with features making it a high quality corridor for a number of species, including pollinating insects, small mammals and birds. The vegetation should be chosen strategically to support ecosystem services, e.g. pollination and seed dispersal. Especially exposed areas may need fences or barriers to ensure security. These barriers could be covered with vegetation.

Wild bees are important for pollination since they provide higher response diversity compared to domestic bees (see chapter 2). Many species of wild bees rely on a continuous supply of suitable flowers and sites for nesting. These two resources must be located close enough to allow daily movements between them. The vegetation in the Railway park could be colour coded (see fig. 5.23) with bands of different colours attracting different species. If these bands recur regularly they may lead organisms from one side of the Park to the other. Wild bees

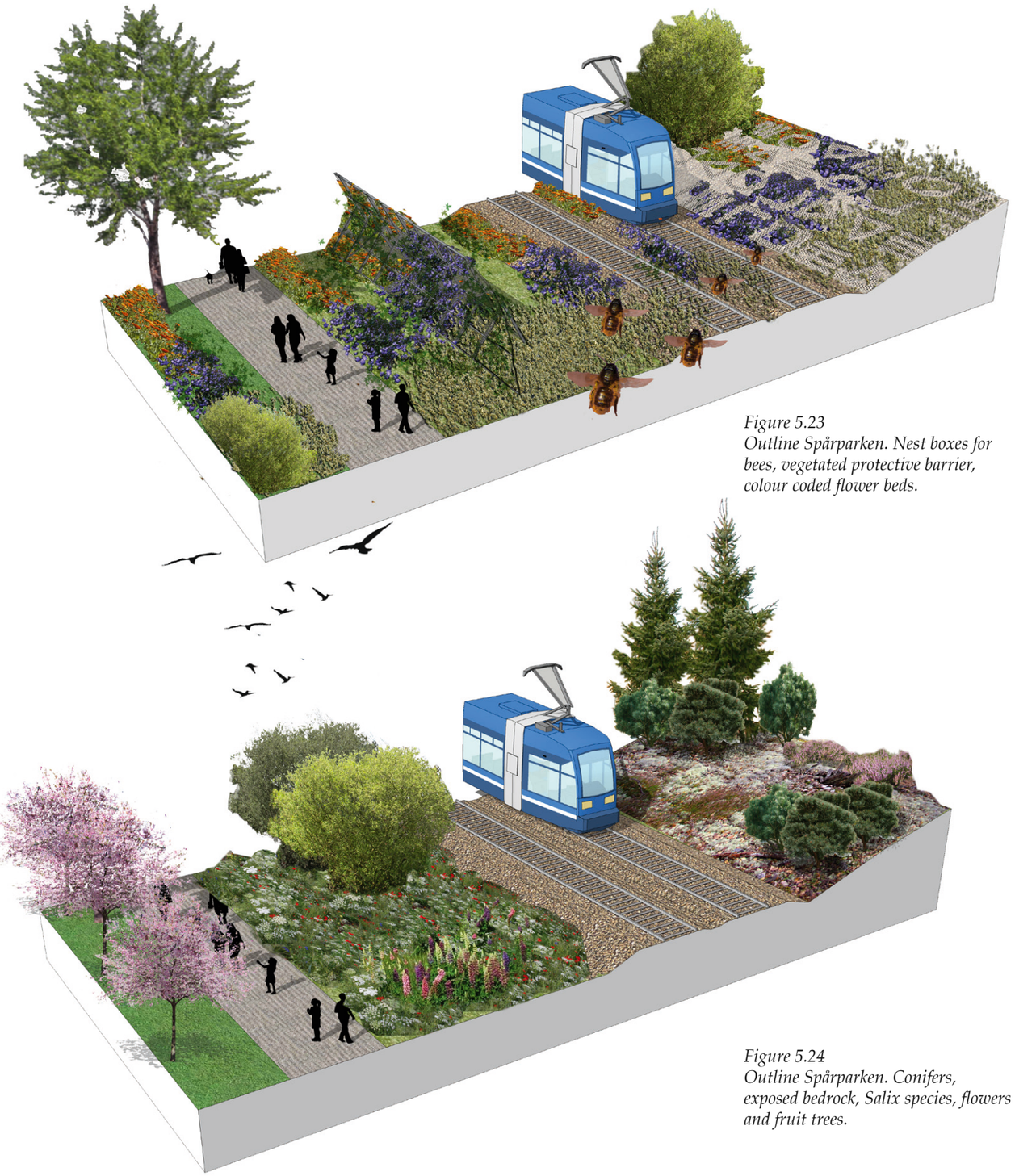


Figure 5.23
Outline Spårparken. Nest boxes for bees, vegetated protective barrier, colour coded flower beds.

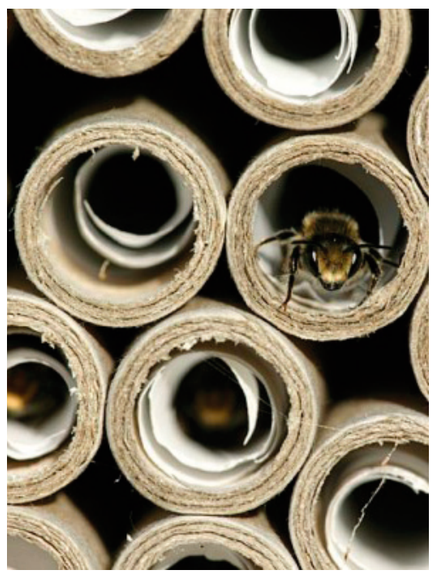


Fig. 5.25 Reference, nest boxes for bees.

Figure 5.24
Outline Spårparken. Conifers, exposed bedrock, Salix species, flowers and fruit trees.

can be further promoted by supplying nest boxes placed in sunny sand or gravel slopes, like those provided by the railway embankment. On a larger scale the nest boxes can be placed to form larger patterns that help the wild bees navigate (see fig. 5.23). To support many different species the passage should contain many different biotopes, not only suitable habitat for wild bees and butterflies but also rock outcrops, coppices with conifers and other trees (see fig. 5.24).

If the harbour or the transports going to and from it would change location or be rerouted in the future the railway has potential to instead become part of the public transportation network. It could connect either to Tvärbanan at Solna or to Spårväg City via Karlbergskanalen (see fig. 5.27).

Where the Railway park borders on built-up areas trees could be replaced with vegetated pergolas, offering shade to the promenade and future railway stations.

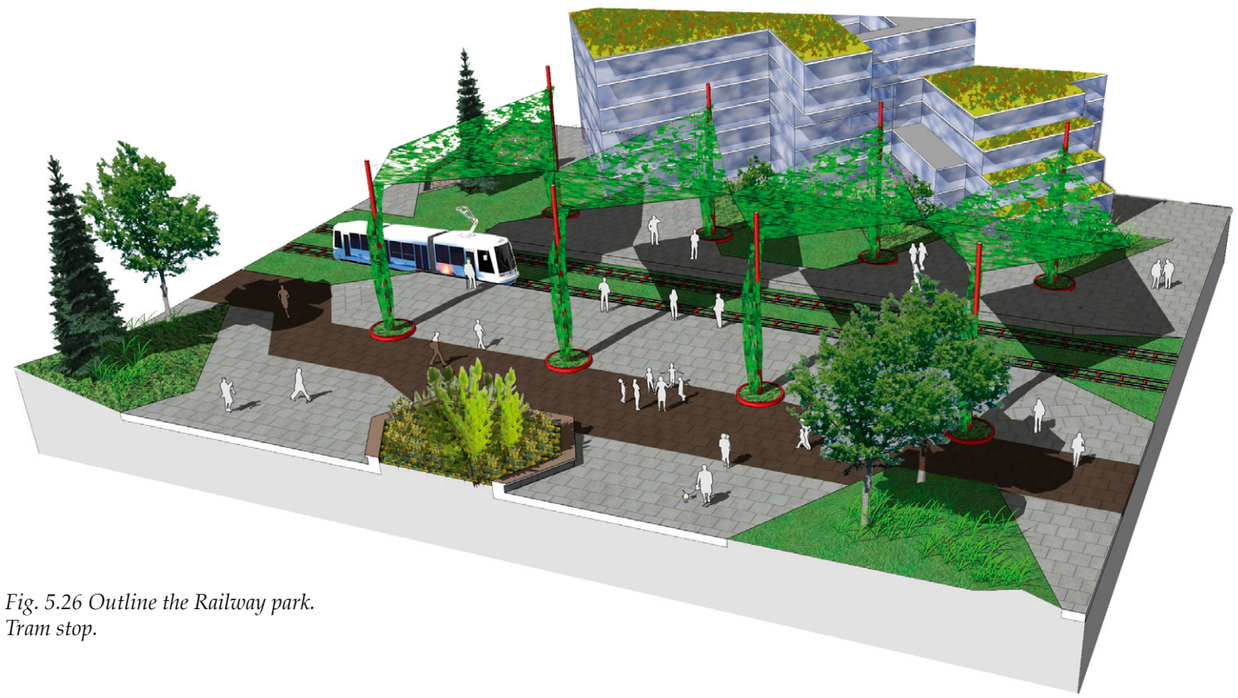


Fig. 5.26 Outline the Railway park.
Tram stop.

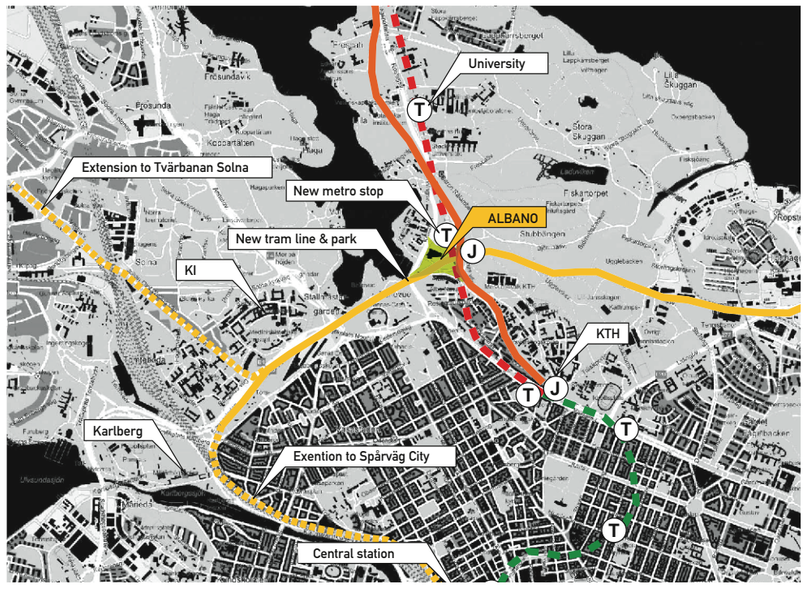


Fig. 5.27 Potential for railway development.

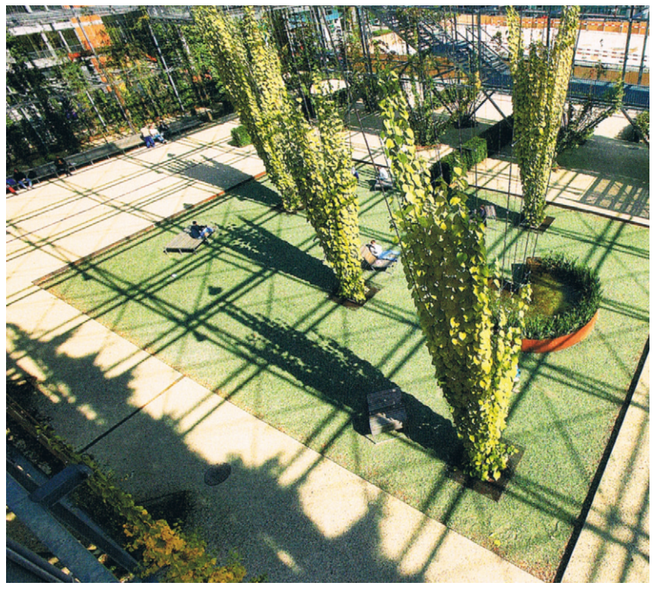


Fig. 5.28 References, pergolas: MFO Park, Zürich, Switzerland.
Architect: Raderschall Landschaftarchitekten Ag + Burkhart & Partner AG.

A very sensitive area is where the Railway park crosses Roslagsvägen. Today, the road is crossed by a bridge. This would be a suitable place for an ecoduct connecting Albano to Bellevue and Hagaparken. Large ecoducts unfortunately often have boring shadowy underpasses. We propose a different design that could have additional symbolic and design values.

A two-layered shell of metal mesh functions as a vegetated tube enclosing the railway. The space between the two shells can be filled with soil, making the tube a plantation and an espalier both. The cylindrical shape provides structural stability. We suggest planting the tube with flowering plants to attract butterflies and other pollinators, like a flowering meadow folding back on itself. This would provide a new entrance to the area and a manifestation of the new development (see fig. 5.26).

Fig. 5.29 Outline of ecoduct.

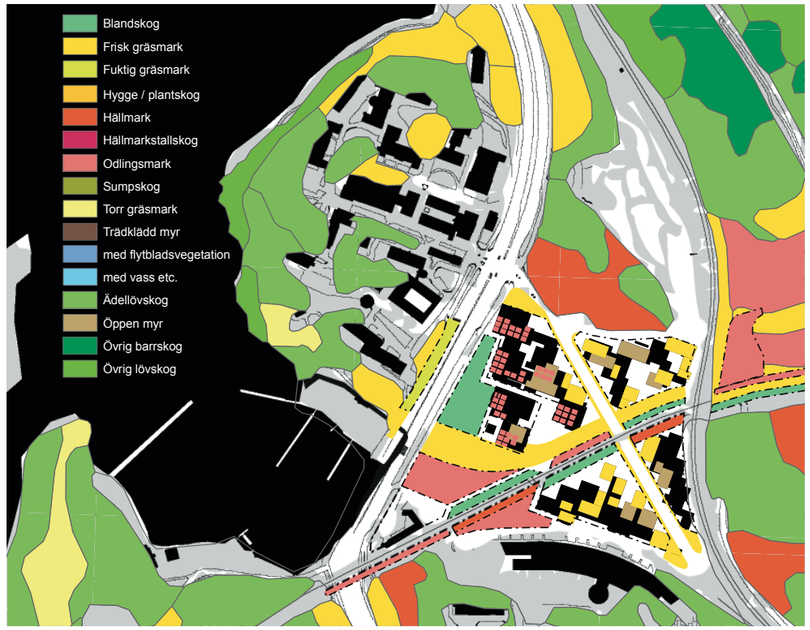


Fig. 5.30 The collage of biotopes along Spårvägen.

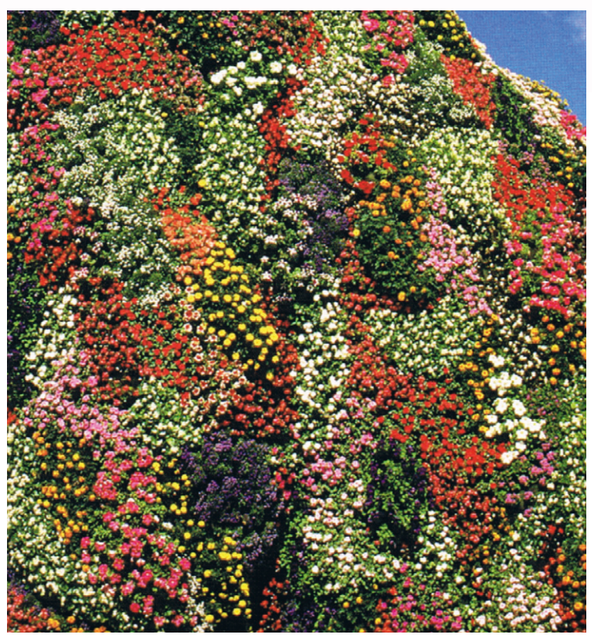


Fig. 5.31 Reference, vertical plantation, Bilbao, Spain. Artist: Jeff Koons.

5.4 Design of Performative Buildings

Strategies based on local conditions should be mandatory. Information on local climate, wind, sun exposure and temperatures for the valley between Alba Nova and Teknikhöjden is fundamental for the design of buildings and outdoors environments. Deliberate placement, form and orientation of buildings, with respect to local climate, provide good conditions for favourable micro-climate and attractive public spaces. Form itself, through bio-climatology, can greatly reduce the need for heating and cooling in the buildings.

The buildings in Albano will be energy efficient, primarily through their placement, orientation and form, i.e. through passive design. Local renewable energy sources will be utilised and integrated into the design, i.e. an active system. Water from Brunnsviken can be used for heating or cooling. The proposed southward facing terraces will be ideal for solar panels.

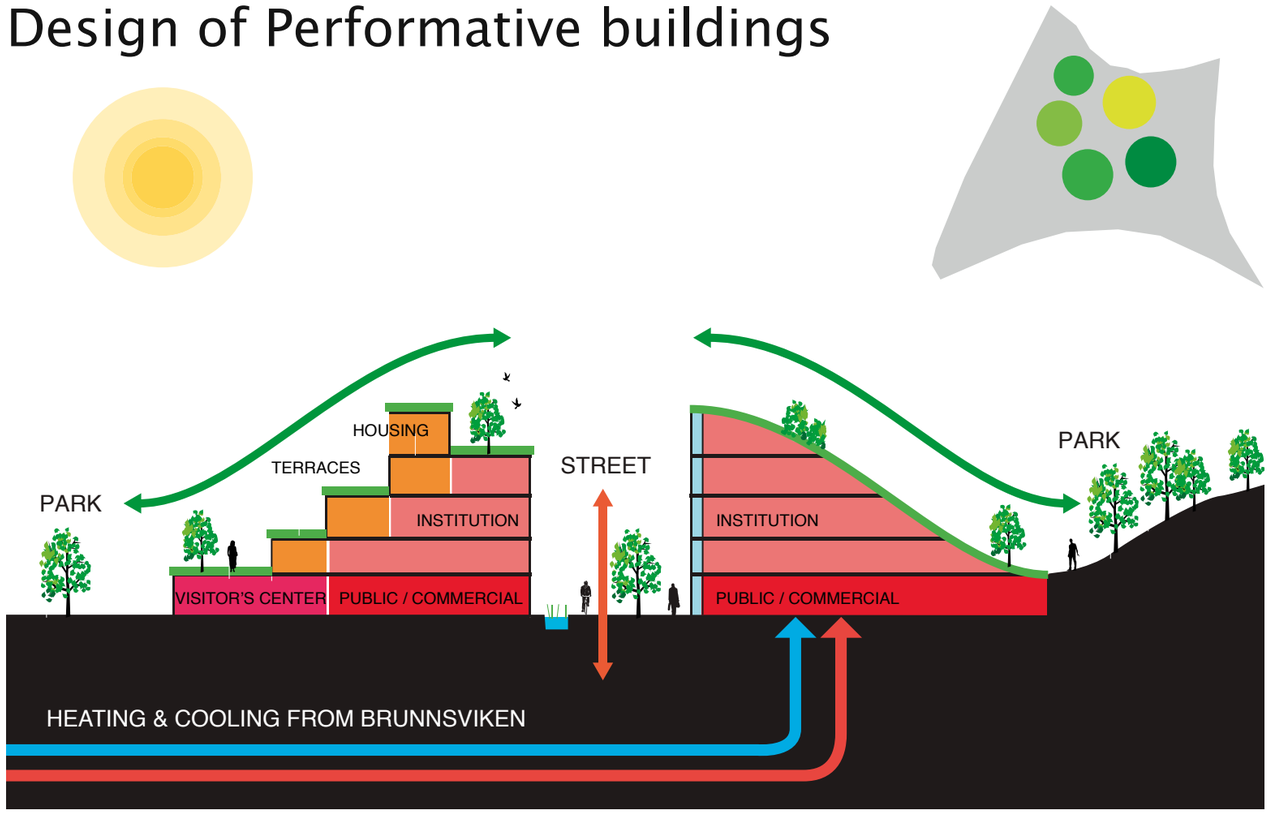


Fig. 5.32 Conceptual outline. Unbroken urban feeling one way and unbroken park feeling the other. Residential apartments with terraces facing south and west at the upper floors.

Fig. 5.33 Reference, terraces. Urbana villor, Malmö, Sweden. Architect: Cord Siegel & Pontus Åsqvist.

Fig. 5.34 Reference, terraces. Acros Building, Fukuoka, Japan. Architect: Emoilio Ambasz.

Fig. 5.36 Reference, educational institution with a vegetated double-shell façade: University of Arts & Human Sciences, Grenoble, France. Architect: Lacaton Vassal.

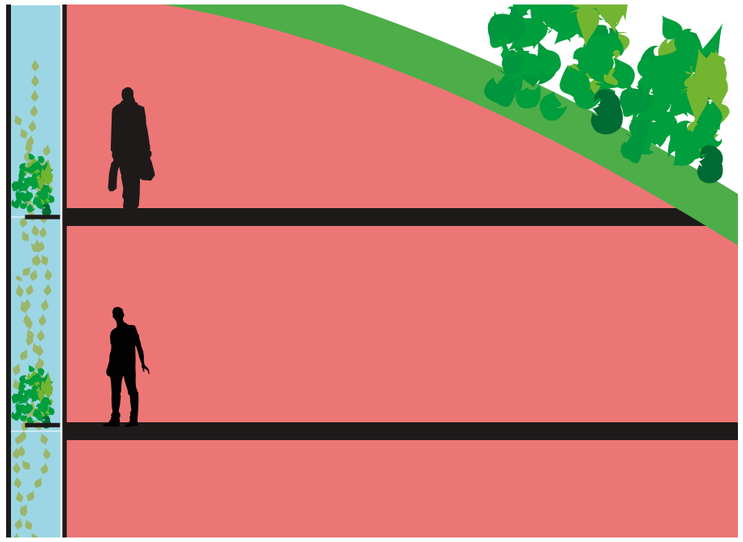


Fig. 5.35 Conceptual outline of a vegetated double-shell façade. The façade functions as a greenhouse, with the vegetation offering shade and better air quality indoors.

Generality is central for reducing the amount of waste products. In the fast changing academic world new demands and needs will arise. The architecture must be designed for long-term usability and to be able to accommodate changing needs with minimal environmental impact. Generality in spatial dimensions, number of floors and installations provide a framework that allows flexible and adaptive use of the buildings over time. When finally in use the new development will consist of zero energy buildings, changing the relation to energy use during the construction phase. Looking at the whole life cycle of a building saving energy in the construction phase and choice of building material become critical for reducing the total energy need. Less energy demanding materials, e.g. recycled materials, are much to be preferred.

The green building components suggested (roofs, walls and yards) have performative qualities in addition to functions as bird habitats etc. The vegetation functions as an insulating layer, offers shade and has an evaporative cooling effect in during summer. Treatment of run-off water is facilitated by the extensive green, permeable surfaces. Multifunctionality should be a guiding principle at all levels.

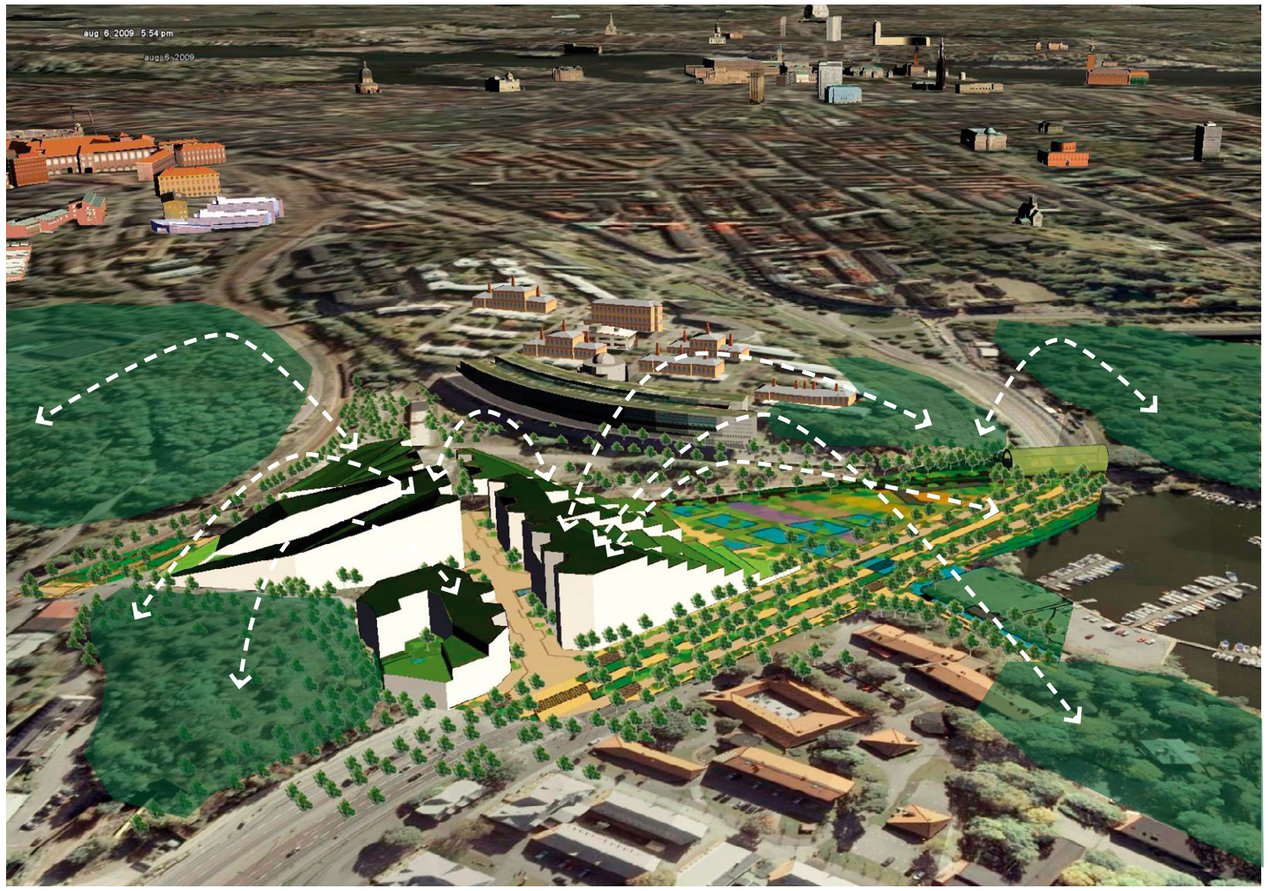


Fig. 5.37 Green roofs function as stepping stones for birds and other flying organisms, connecting Norra Djurgården and Haga.

Fig. 5.38 Reference, courtyard: Institute for Forestry & Nature Research, Wageningen, the Netherlands. Architect: Behnisch & partners.

Fig. 5.39 Reference, roof: Library, Techinsche Universiteet, Delft, the Netherlands. Architect: Mecanoo. A roof functioning as a popular green area during summer and sledge slope during winter.

HYDROPHILE: HYDRODYNAMIC GREEN ROOF
2010

Architectural Proposal

Speculative proposal for a green roof system commissioned for the exhibition Envelopes in 2010.

Project Description

The Hydrophile prototype is part of an ongoing research project exploring the development of synthetic architectural systems that are informed by the formation, function, or structure of biologically produced substances and materials and biological mechanisms and processes. In contradistinction to a biomimetic approach where biological models are emulated for their tectonic and morphological properties, we are taking a design approach that can be characterized as bioinformational - a responsive, bi-directional approach to the design of synthetic systems that takes into account their inherent material and physical biases and integrates them with performances gleaned from the biological realm.

The Hydrophile derives its name in part from the hydrodynamic properties found in the shell of the Namib Desert beetle. A coalescence between formal and material performance occurs at a micro scale in the shell of the beetle where hydrophilic (water attracting) and hydrophobic (water repelling) regions are interspersed to collect and direct the flow of water. In the Hydrophile prototype this principle is applied on an architectural scale for the design of a hydrodynamic green roof system. The extensive green roof typology, usually comprised of a thin, primarily horizontal substrate for growing low-water plants and enabling rainwater runoff is reconsidered in this project to produce an occupiable zone characterized by immersive depth.

The primary performative aspect of the Hydrophile is the cultivation of biotopes on and through a variegated roofscape augmented with systems for percolating water through soil substrates.
Conducting research into the interaction between organic and synthetic matter, we place an emphasis on design techniques where morphological and material properties become allied to generate structural, environmental, and affective performance. In Hydrophile the material properties of synthetic ceramics with varying degrees of porosity and surface treatments are coupled with a morphology of protuberant forms in order to perform as hydrophilic and hydrophobic agents. The protuberant morphology of the roofscape directs the flow of water to irrigate organic matter - dirt.

The Hydrophile green roof is incorporated into a proposed building for bioscience innovation located in the Albano region of Stockholm. Volumes housing the various programs of the bioscience center are suspended within a more extensive building envelope that is partially below grade on the existing site. Visitors to the center will experience the green roof from several vantage points: either from above (walking amidst a dense landscape of indigenous vegetation intertwined with protuberant forms that emit water, air or light); from below (as a suspended ceiling system that pulls down to close proximity with the floor); or from within (in the interior of the auditorium space and specialized laboratory areas designed for the cultivation of vegetation in semi climatically-controlled microclimates). The roofscape is thus extremely varied in section. Each protuberance has a specific performance in the green roof system (i.e. apertures for ventilation, lighting, or irrigation).

The roofscape is incorporated into a system of urban green surfaces that provide important links for the migration of species, possibly supporting existing biotope structures and habitat networks. The plant material for the green roof is established through seeding, planting, and hay transfer from local similar habitats. Thus, it is designed to promote the biodiversity of plant and animal species particular to its local environment.

The vegetation system applied to the roof of the Hydrophile building relates to the existing biotopes in and around the Albano region in Stockholm and ranges from open water surfaces and rich fens to dry heathlands and bare substrate or roof. The main driving factors for the design of the Hydrophile building and its plant communities are the substrate thicknesses, substrate design, and the roof topography / roof geometry. The roof topography is used to direct water to depressions where large amounts can be stored to support wet meadows and even more wet areas such as fens. The substrate thickness is used to create vegetational gradients ranging from shrublands and meadows on thicker substrates to dry meadows and heathland on thin substrate layers.

The substrates on the site are in part based on local soil material. This will reduce the need for transport and utilize a resource that is otherwise without value. The soil at the site is high in pH. The local material is mixed with inorganic porous aggregates such as pumice, lava, crushed leca, or preferably recycled roof tiles. All soil materials are tested for possible toxic or harmful substances.

As the intention of this project is to addresses more extensive urban ecologies, techniques for coupling morphological and material performance will be deployed on a variety of scales in the project taking into account aspects of the local ecosystem including hydrological flows, air currents, vegetational communities, and toxic areas in need of remediation. The proposal is considered as a constituent of an urban infrastructure that enables new patterns of occupancy to emerge on and through the site.

Hydrophile: Hydrodynamic Green Roof
by servo

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Design team
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Green Roof / Ecology Consultant
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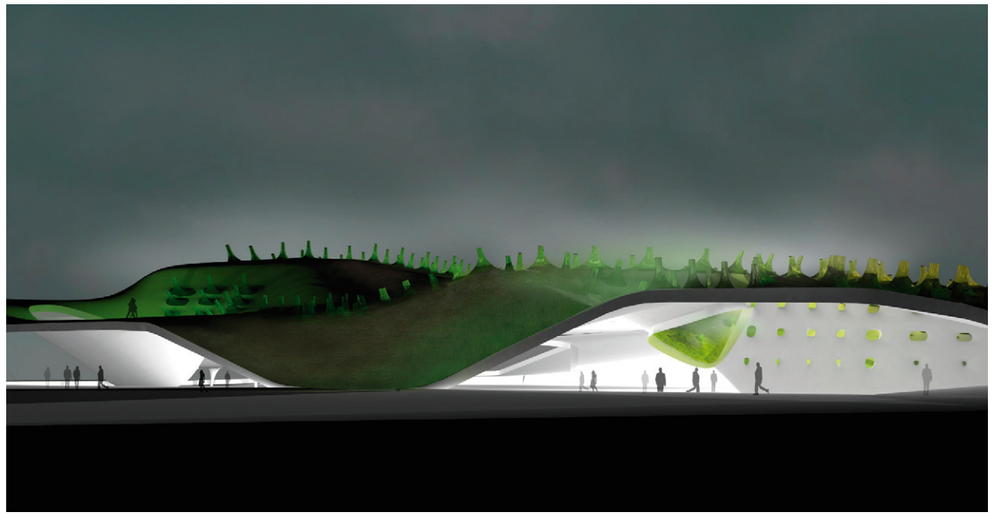
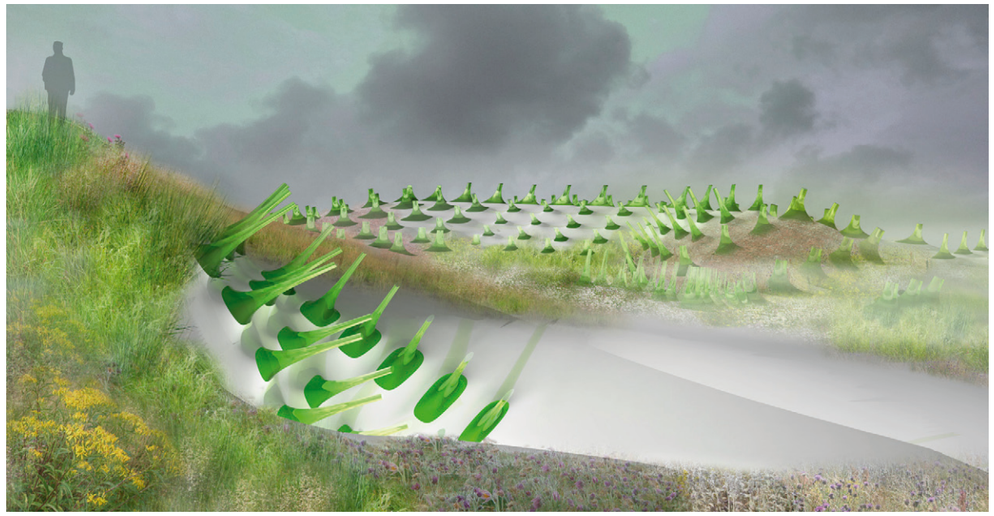
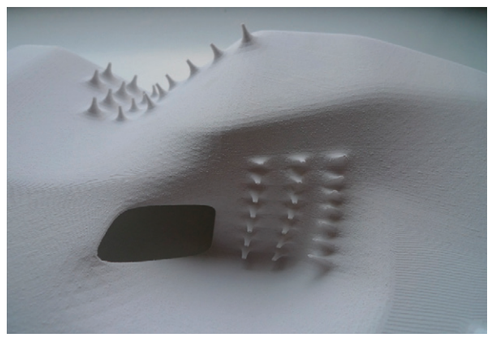
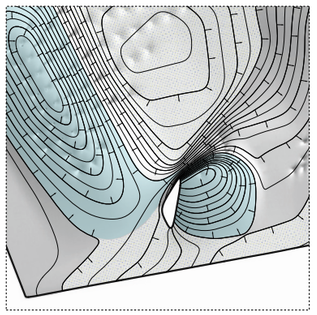








HYDRODYNAMIC DIAGRAM: OF GREEN ROOF CORNER

Fig. 5.40

DRY SYSTEMS

substrate 0 - 70 mm
drainage 11 mm

The thinnest vegetation systems will be dominated by drought tolerant grasses, herb and succulents on the thicker sections, and by bryophytes/moss and lichen on thinner sites and on edges towards bare roofing material.These thin vegetation systems will in many cases look similar to constructed traditional green roof systems or mimic more naturally occurring alvar systems. The substrate layers will have a neutral to alkaline reaction and range from 0 cm depth up to 7cm.
The vegetation will be established using cuttings (succulents) and seeds (grasses and herbs). Planting will be made in certain spots. Bryophytes will be left for spontaneous colonisation

PLAN 1 : 200

SPECIES	PLANT COMMUNITIES
Allium schoenoprasum Arenaria serpyllifolia Erophila verna Geranium pusillum Melica ciliata Satureja acinos Sedum acre Sedum album	**Alvar**
Allium schoenoprasum Artemisia campestris Festuca ovina Festuca rubra Sedum album Thymus serpyllum	**Dry meadow on bedrock**
Allium oleraceum Allium schoenoprasum Anthyllis vulneraria Artemisia campestris Briza media Centaurea jacea Centaurea scabiosa Festuca ovina Filipendula vulgaris Fragaria viridis Galium verum Helictotrichon pratense Helictotrichon pubescens Plantago media Plantago lanceolata Poa compressa Potentilla argentea Potentilla tabernaemotani Primula veris Pulsatilla vulgaris Thymus serpyllium Trifolium montanum Verbascum thapsus Veronica spicata	**Dry meadow rich in herbs on bedrock**



MEADOW VEGETATION

substrate 150 - 300 mm
drainage 25 mm

Increasing substrate layers will allow higher and more dominant vegetation as compared to the drier areas. This will allow a larger range of plants. These systems will have supplementary irrigation with recycled water.

SPECIES	PLANT COMMUNITIES
Anthriscus sylvestris Arrhenatherum elatilīs Artemisia vulgaris Centaurea jacea Cerastium fontanum sp vulg. Cirsium vulgare Dactylis glomerata Festuca pratensis Festuca rubra Heracleum sphondylium Holcus lanatus Knautia arvensis Leucanthemum vulgare Plantago lanceolata Rumex acetosa Veronica chamaedrys	**False Oatgrass meadow**
Agrostis capillaris Ajuga pyramidalis Anthoxanthum odoratum Campanula patula Campanula persicifolia Festuca rubra Helictotrichon pubescens Hieracium aurantiacum Hypochoeris maculata Knautia arvensis Leontodon autumnalis Leontodon hispidus Leontodon hispidus Leucanthemum vulgare Lotus corniculatus Plantago media Poa pratensis Potentilla crantzii Primula veris Rhinanthus minor Scorzonera humilis Verbascum nigrum	**Flower meadow** *This vegetation system is comprised of a rather low meadow type with high herb diversity. It is maintained through cutting but also through careful plant selection. This vegetation type will also include hemiparasitic plants that have been shown to influence plant dynamics and dominance between species.*
Alchemilla spp. Anthoxanthum odoratum Briza media Deschampsia cespitosa Festuca ovina Filipendula ulmaria Galium boreale Geranium sylvaticum Geum rivale Hypericum maculatum Hypochoeris maculata Knautia arvensis Luzula multiflora Potentilla erecta Prunella vulgaris Ranunculus auricomus Rhinanthus minor Rumex acetosa Solidago virgaurea Veronica chamaedrys Viola canina Viola riviniana	**Intermediate rich meadow**





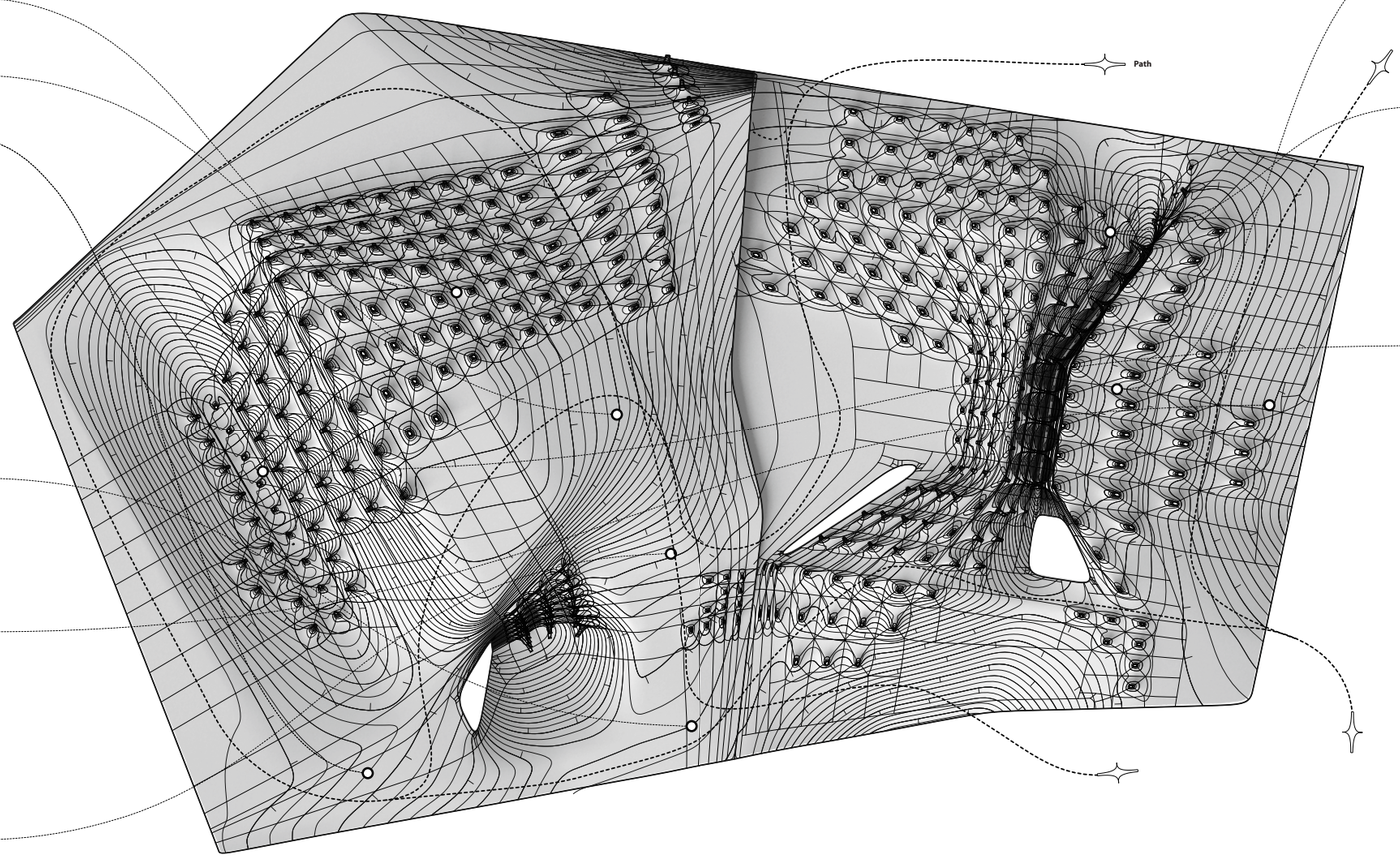


Fig. 5.41

WET SYSTEMS

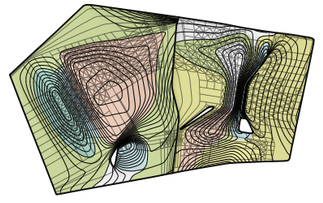
substrate 200- 350 mm
drainage 11 mm

Water is a key element in the roof design of the Albano building.The building is located in the western fringe of the nationalstadspark a short distance from the Brunnsviken bay in the east. A thoughtful design of the water system on the roof and on the lot could would increase available wet habitats in the area and support movement of amphibians from the wet areas in the west and towards the protected areas in east.

PLANT COMMUNITIES	SPECIES
Wet Deschampsia (Tall grass meadow)	Achillea millefolium Agrostis capillaris Anthriscus sylvestris Carex nigra Desehampsia cespitosa Festuca pratensis Festuca rubra Filipendula ulmaria Leueanthemum vulgare Phleum pratense Poa pratensis Potentilla anserina Ranunculus acris Ranunculus repens Rumex acetosa Succisa pratensis
Tall sedge mire	Agrostis canina Caltha palustris Carex paniculata Carex pseudocyperus Cirsium palustre Cladium mariscus Deschampsia caespitosa Equisetum fluviatile Equisetum palustre Eriophorum angustifolium Filipendula ulmaria Iris pseudacorus Lysimachia nummularia Lysimachia thyrsiflora Lysimachia vulgaris Lythrum salicaria Phalaris arundinacea Phragmites australis Schoenoplectus lacustris Solanum dulcamara Thelypteris palustris Typha angustifolia Typha latifolia Viola epipsila Viola palustris
Fen	Carex diandra Carex elata Carex flacca Carex panicea Eriophorum angustifolium Eriophorum latifolium Filipendula ulmaria Menyanthes trifoliata Parnassia palustris Pedicularis palustris (halvparasit) Primula farinosa Succisa pratensis Trichophorum alpinum

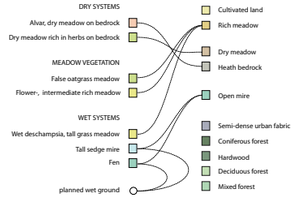




BIOTOPE PLAN OF HYDROPHILE

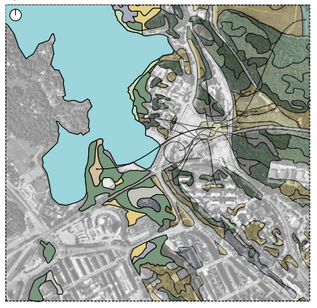
HYDROPHILE BIOTOPE LEGEND



BIOTOPE MAP LEGEND

BIOTOPE MAP OF STOCKHOLM, ALBANO REGION

between Stockholm University and KTH Royal Institute of Technology. 4 km from Stockholm City Centre



Source: reformatted and translated from biotope map of Stockholm [Kartografiskt material]. /data collection: Katarina Löfvenhaft and Siv Runborg during 1994-98; map editor: Joakim Lannek

5.5 Institutional compositions

Institutional Compositions

Resilience through place specific social-ecological design is founded on the ability to learn from constantly changing circumstances and, based on the new knowledge, make new decisions, either to resist or embrace change (adaptive capacity), or to direct change more actively (transformative capacity). The question is who should learn, how they should learn and who should make the decisions. Based on the insights presented in chapter 2 we argue that more learning and decision making should be devolved to the local level. This will require rules and norms for monitoring, learning and decision making within and in relation to the area. In the language used in the resilience literature social institutions (Ostrom 1990) shape the growth and development of such social processes, and we have dedicated this final chapter to the articulation of a number of social-ecological design principles that provide both institutions and physical form that support ecosystem- and urban services. Though based in the Albano Resilient Campus we argue that these principles could be used as starting points for discussing and designing institutions and physical forms in other places as well, with due consideration of the local culture and ecology.

Resilience is not just a matter of ecological or physical design. It is also shaped and changed by social institutions (Hanna et al. 1996; Folke et al. 2005). A clarifying example is Ostrom's studies of fishermen along the coast of Turkey who since the 1970ties have managed to establish a long-term management of fish stocks by an intricate system of rules for where and when – and by whom – fishing is allowed (Hanna et al. 1996). Key aspects for the continuation of such rules, also when new actors enter the arena, are access to social arenas where the fishermen can meet (i.e. real locations like the harbour, the bar or the square) and that actors breaking the rules can be disciplined and sanctioned, either through paying a social price (e.g. people refusing to talk to them) or through a material price (e.g. fines or restrictions on their fishing activities). Relationships, or social networks, between fishermen are important for maintaining a rule system that support long-term fishing. Though Ostrom is less explicit on this point it is clear that the local culture (Berkes and Folke 1998) supporting norms and rules are influenced by these networks (Barnes 1954), and that learning about ecosystem change and which rules work is shaped by the structure of these networks (Bodin 2006; Ernstson et al. 2010). Studies of e.g. allotment gardeners point to similar principles. Results highlight the importance of spatial proximity to each other (an aspect of the physical design) and annual meetings and coffee breaks not only for maintaining rules (e.g. that you must manage actively) but also for facilitating social learning about local ecosystems (Barthel et al. 2010). It is not surprising that the individual can learn more and much faster

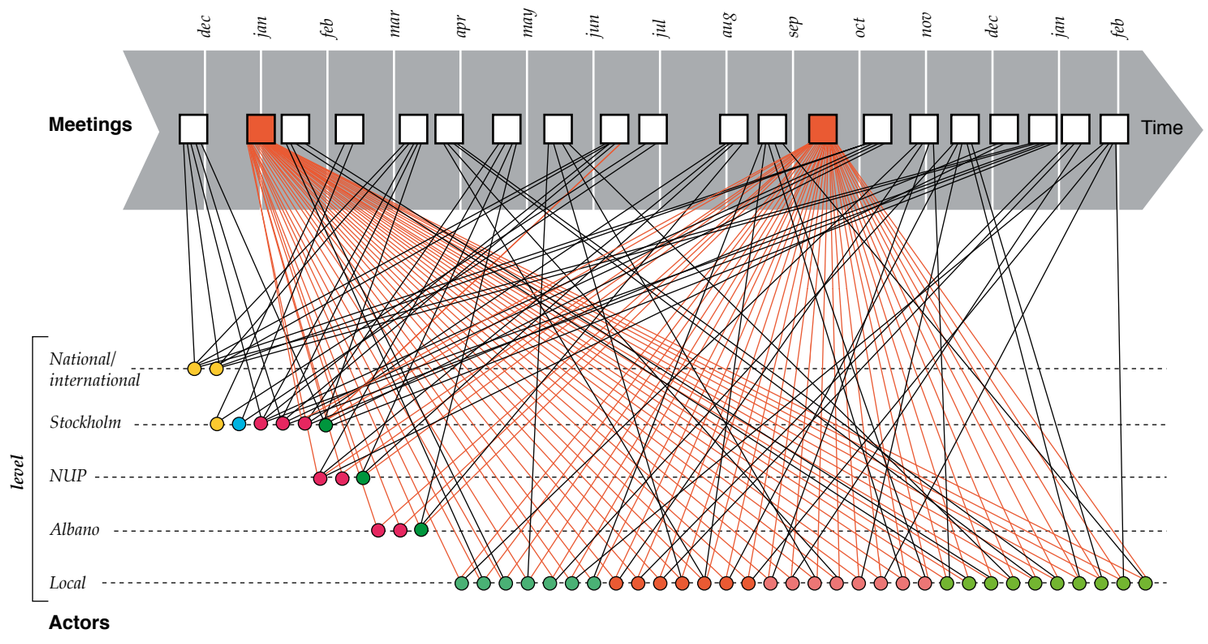


Figure 5.42
The area has a number of actors active at different levels. Several meetings are held during the year where the actors can interact.

if the social practise (e.g. fishing or cultivation) is shared with others, and that the collective local knowledge about ecosystems and their dynamics accumulate over time if the practise is site specific (Barthel et al. 2010). The site specific learning and detailed knowledge about past dynamics that are so important for adaptive management arise through a shared site, shared social networks and shared practise.

Social-ecological design for increased resilience must on the one hand strive to support local knowledge about a site's social-ecological dynamics through the knowledge generating practises of local groups. On the other hand, such site specific, local knowledge must be linked to groups working at a higher level and thus being able to contribute with knowledge about the larger political, economic and ecological context. This could be realised through building social networks, i.e. social relationships strong enough for groups active on different levels to be able to understand and trust each other, where a deeper and more comprehensive picture can be negotiated and re-examined over time (Ernstson et al. 2010). Based on such a scale crossing understanding increased awareness of local dynamics can be used for detection, interpretation and decision making. However, an actor cannot be designated a specific position in a social network (Borgatti et al. 2009). Instead, social networks should be seen as emerging spontaneously in relation to social institutions, culture and spatial morphology.

One mechanism for establishing social relationships is meetings. Meetings socialise (sharing the same experiences and information lead to shared understanding) and increase the time spent together and thus the chances of getting to know each other (Field et al. 2006; Frank 2009). Design can promote meetings, at least to some extent, through establishing rules for where to meet and whom to invite. Research has shown that if people attend the same meetings over time chances are much better that they establish direct social relationships (Diani and Bison 2004; Frank 2009), a fact well known by business executives and social movements.

In figure 5.43 we show how meetings between groups of actors active at different levels, from allotment garden associations and the people managing the wetlands to representatives for Förbundet Ekoparken, Stockholm University, Stockholm city etc., may promote a scale crossing network. The prescribed pattern of meetings may over time act to stabilise social relationships suitable for place-based learning and adaptive management.

The incitements for why individuals and groups should allocate time and resources to come to these meetings are important. Mechanisms are needed that either attract actors to come to the meetings or

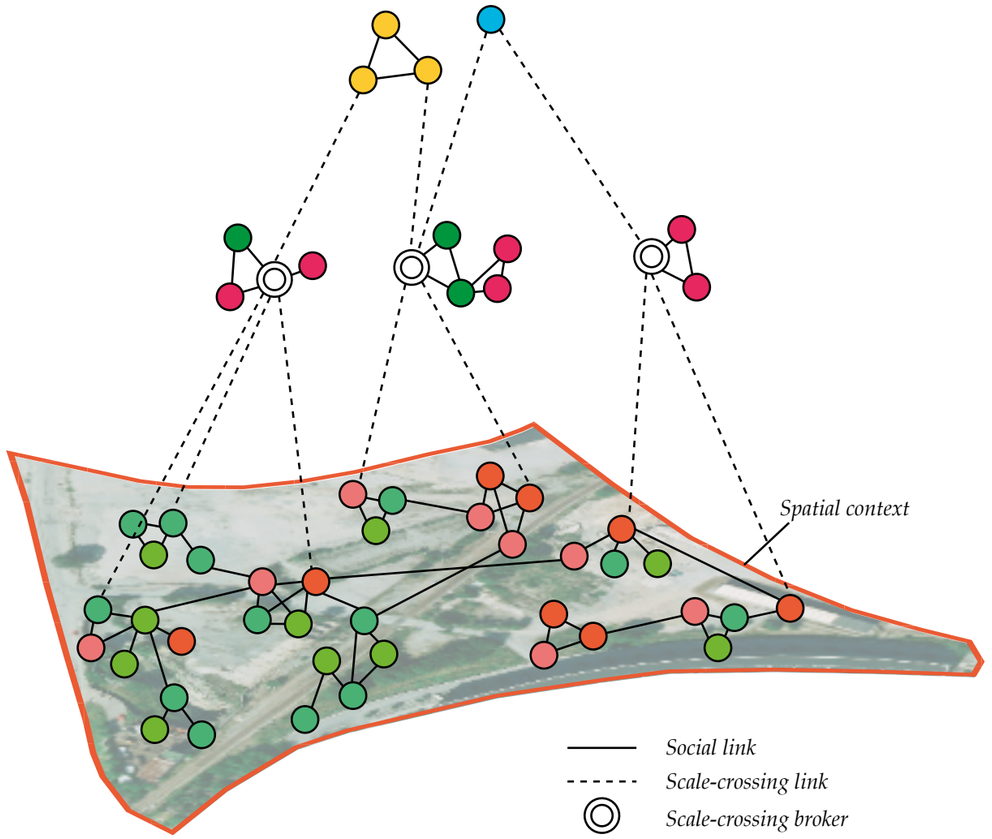


Figure 5.43
An idealised picture of the social network that could be established at the site. Local groups are the foundation, with linkages to each other and to actors at higher societal levels. An important position within such a network is filled by the scale-crossing broker charged with the coordination of the management (Ernstson et al. 2010). This position could be held by a foundation. One important function of this coordinator in times of abrupt and rapid changes is to mobilise resources from different parts of the society and instigate collective action targeting specific problems or opportunities. The ideal network facilitates processes for continuous and place-based learning and mobilisation of the resources needed for collective action in times of crises or opportunities, i.e. adaptive governance of local resilience.

discourage absence, or both. This is where time-bound contracts could be important, and we argue that these are important social-ecological design components together with the form elements of Green Arteries, Active Grounds and Performative Buildings.

Spatial form and institutions for promoting a continuous process of meetings should be visible and understood as part of a tradition of public participation, what we have chosen to call local culture. To be robust such a design should include obligations for everyone with property rights to participate in decision making and knowledge generating activities. This may be implemented through including formal obligations to allocate resources for these meetings within the property rights. Those organisations active in the management of ecosystems on Albano Campus, through tenure, user contracts and ownership, should thus be mandated and obligated to attend meetings. This would include Akademiska hus, Stockholm University, allotment garden associations and other stakeholders but exclude the broader public. The latter would, however, be represented by Stockholm city.

One vision (of many possible) for how this may be organised is to have general meetings two times per year where management of the local ecosystems is discussed. In between these general meetings regular, smaller meetings with fewer participants focus on different ecosystem services. Such a structure for meetings depends on stake groups allocating time, resources and responsibilities so that they can participate in these discussions on the management of the area, always and over time. In summary, social-ecological design includes elements such as social networks and institutions for joint knowledge generation. It promotes the development of a tradition of public participation, i.e. developing the norm and practise of reaching management decisions through discussions between the stakeholders in the area. In the diagram 5.43 we call this local culture.

5.6 Implementation

Sustainable development is a process and approach, not a societal endpoint. The aim for the development of Albano is to expand the limits for what is possible, and to reach highest possible ecological, economic and social values in a resource and cost effective way. Interactions between traditional educational activities and the learning experiment offered by the development add to the area's uniqueness. The target is a locally anchored dynamic, process based urban development model, a collaboration process.

A stepwise development of Albano requires planning to define which spatial components should be established to ensure important ecological and social services from the start. As work progresses each component must be integrated into the whole system and contribute to several interacting functions and processes. The ideal would be for the tree spatial components, Green Arteries, Active Ground and Performative Buildings, to be established in parallel so that their interrelations and interdependencies can be evaluated and inform the next phase of development.

To ensure collaboration all the way from planning to management Albano Resilient Campus should be established through dialogue. It should be an arena for collaboration and interactions between different interests and thus enriching the development of the project in a process based urban development.

6. EPILOGUE:

There are many ways the work presented here could be described. It is an attempt to interpret the very broad concept of sustainable urban development from a resilience theoretical perspective. It is an outline of an emerging field of research integrating resilience theory and urban morphology. It provides an example of a forward looking urban development that fully incorporates the institutional framework into its practice. Finally, it is a concrete proposal for the development of a sustainable campus at Albano.

It all rests on the necessity to embrace a much larger whole than has previously been the case in both research on sustainability and the practice of building cities. The background is, of course, increasing globalisation and the fact that there no longer exists an outside – for good and bad, we all share the same room. Though global news often are frightening, be it melting polar ice sheets, global financial crises or large scale oil spills, the is still a hopeful note in the fact that these news reach all of us, not just a few, and that they identify a global community that has never existed before. Or, as captured in the well-known words of the British renaissance poet John Donnes:

"No man is an island entire of itself;
every man is a piece of the continent, a part of the main. [...]
And therefore never send to know for whom the bell tolls;
it tolls for thee."

Trying to embrace the lager whole and thus become more relevant for the challenges we face, this work has transcended several, well-established boundaries. There are two boundaries we see as especially important. The first is the line drawn between social system concerning people and the ecological systems belonging to nature. For a long time this division has been implicit in how we view the world, though it was only with the dawn of the 20th century we got the tools to make it a way of dealing with the world. Looking back it is almost difficult to see how we managed to deceive ourselves and adopt such a world view when our dependence on the ecological systems surrounding us is so obvious. Starting from the other end it is equally difficult to see how the romantic view of nature as a static and pristine paradise when changes are so apparent, not least the ones we ourselves have initiated. If you look closer it is very difficult to find a single system made by man that does not include ecological processes and ecosystems.

And yet we have attempted to create a parallel world somehow disconnected and independent from nature. This illusion has now caught up with us and we must abandon notions both of our independence and of paradisal nature. There is vast experience to learn from since we in practise never have abandoned our close interaction

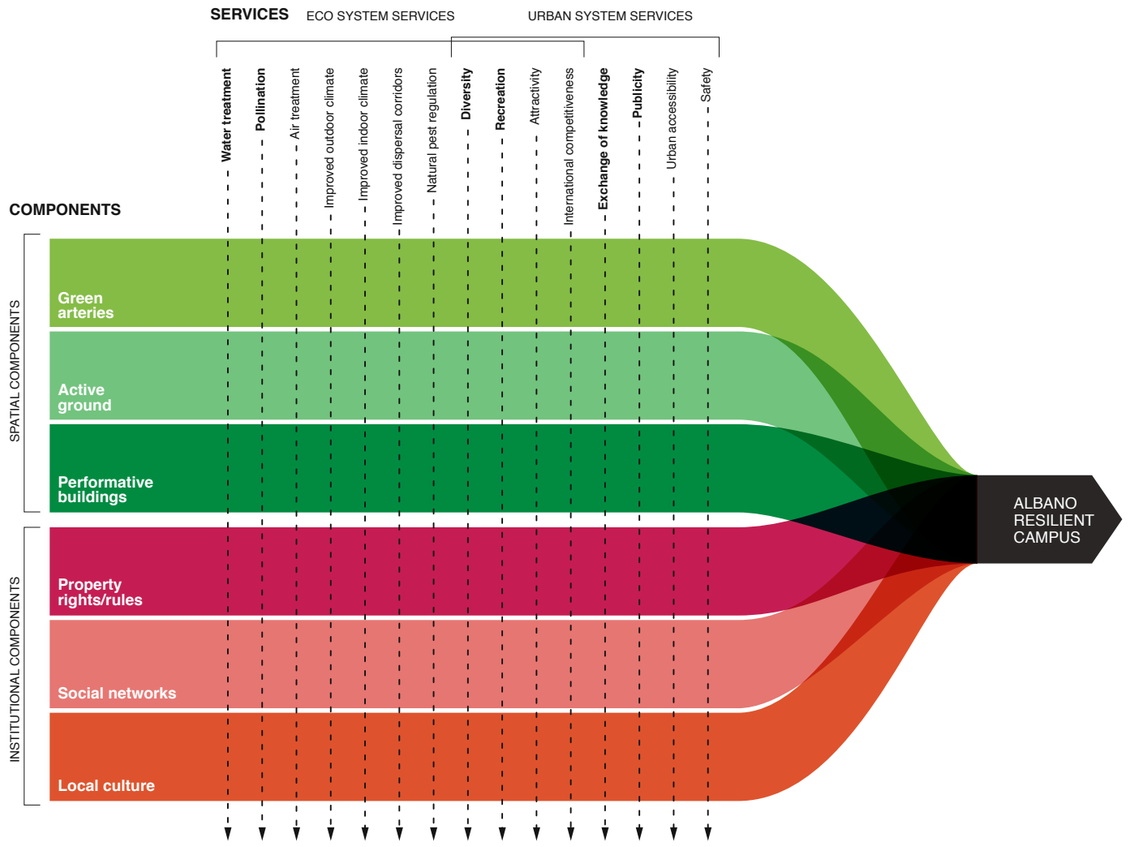


Figure 6.1

with nature and continuously developed methods and knowledge for how to coexist with it. Not in a paradisal primeval state but through consciously influencing and altering nature while at the same time not losing sight of where the limits are and what the consequences of our actions will be. Social-ecological systems have evolved through a continuous learning process and interaction with nature. This is the kind of knowledge we must rediscover and combine with scientific knowledge for dealing with the very complex systems surrounding us.

This outlook is a fundamental must for the many professions involved in urban development through their practise. It is within practice we find the second boundary we have tried to transcend, i.e. the divide between spatial and institutional tools for creating resilient social-ecological systems. The divide is an old one, and one between different professions and disciplines. On one side we find the urban architect who has a strong tradition of using spatial tools for shaping the city, and on the other, with a shorter history and less clear identity, the planner and policy maker who uses primarily institutional tools. Today, this field is fluid and significant redefinitions of concepts and professions both are beginning to become discernible. What we wanted to do was to emphasise the necessity of seeing all these instruments and tools as a comprehensive whole, each end every needed to reach the envisioned targets for urban development. This makes design more than spatial instruments like streets, buildings and different infrastructural systems, extending to and including also institutional systems like property rights, social networks and meeting traditions. It also understand these spatial components and artefacts as natural reflections and integrated parts of evolving activities and local traditions, making knowledge about the performative aspect of these artefacts necessary. All these different aspects need to be intentionally combined into a whole to develop viable and successful urban systems.

This may seem insurmountably complex, but our work has resulted in three central keywords that may guide us across this rugged landscape. It is easy to see how people always have had to deal with impossible situations by acting without knowing the full consequences. First of all, generality. Each construction and artefact, be it institutional or spatial, must be able to accommodate changes or variations on a theme. For example, we will always need to move around, and every development scheme need to deal with this basic need, but we must also understand that the means for transportation are many and that optimal solutions change over time. This diverges from common, expert led practise with its preference for the tailored, site specific solution. The role of the expert will change, but not his or her importance. Expert knowledge is needed to find more general and long-term solutions, moving from expertise to wisdom, if you will.

The second keyword is adaptive capacity, stressing the need to learn to live with constant change. This requires openness when it comes to designing our artefacts, be they spatial or institutional. In practise this happens constantly; walk through any city and you will see buildings undergoing reconstruction to assume new functions or roles. Or think of reorganisations at your work. With better knowledge of the effects of different spatial and institutional forms, and greater emphasis on general solutions these reconstructions could be minimised and thus also the cost in material and human resources. One of the reasons why we find changes troubling is our strangely static understanding of our surroundings, where we expect specific solutions to last forever. This is prominent not least in many of the professions driving urban development; all easily enamoured in specific solutions and reluctant to see them change.

The final keyword is decentralisation, to meet one of the main challenges for sustainability. This challenge runs like a red line through the Q book: the strengthening of social-ecological resilience of a vital flow of ecosystem services and urban services. Uncertainty and surprises are parts of the cities' social-ecological systems, which mean that management, planning and urban development should embrace change as a strategy rather than something you respond to. Such change should be anchored in the local level to fit local needs. Many small scale disturbances or changes promote diversity and reduce the risk of large scale disturbances by letting off the steam. Procedures for continuous monitoring and place-based learning about the local environment are needed to make it possible for local groups to self-organise rules and rights surrounding the management of the local social-ecological systems and the services they provide. Place-based learning within local groups interacting with their environment results in a common history, stored experience and local traditions. This calls for public participation in the planning of greener future cities. Strategies are needed for how to mobilise resources for collective action in times of crisis or windows of opportunity, meaning that top-down governance still has a role to play. Resilience as a strategy endeavours to support local knowledge about social-ecological dynamics at the same time as it calls for collaboration with organisations working at higher levels in society and thus with an understanding of larger spatial scales. Our vision is a combination of public participation and long-term planning of the large scale systems in accordance with the empirical observations that lead to the revision of the tragedy of the commons theory. These highlight polycentric solutions as the way forward for jointly managing our resources and resulted in the Nobel Prize in economics for Elinor Ostrom in 2009 and should inspire and permeate sustainable urban development.

All in all, this result in a substantial redefinition of the practise underlying what we normally call sustainable urban development. However, we want to stress that much of this is already present in today's development processes, and what we need to do is to take them seriously and let them become more influential in the process. In short, to stop relying on expert, top-down and very specific solutions and instead trust more in local knowledge and bottom-up self-organising processes that are allowed to change over time.

Figur 6.2 Panoramic view of the Railway park.

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