

# The future role of protected areas in urban landscapes

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## Zusammenfassung

Städte stellen für die Mehrzahl der weltweiten Bevölkerung die alltägliche Landschaft dar und profitieren dabei durch Ökosystemdienstleistungen, die durch städtische Grünflächen generiert werden. Daher wird städtische Natur auch zunehmend Bestandteil von globalen Biodiversitätsprogrammen sowie von Strategien zur nachhaltigen Stadtentwicklung.

Da sich Stadtlandschaften jedoch in sozialen und ökologischen Merkmalen unterscheiden, erfordert die Umsetzung von Naturschutzmaßnahmen in Städten einer genauen Überprüfung, warum, wo und wie städtische Natur zu schützen ist. Aus diesen Gründen stellt dieser Beitrag eine dreiteilige Beurteilung des aktuellen städtischen Naturschutzes in Südschweden vor.

## Abstract

Cities constitute everyday landscape for the majority of Earth's population that thereby benefits from local ecosystem services generated by urban green areas. Therefore urban nature is increasingly becoming part of global biodiversity conservation programmes as well as of strategies for urban sustainability. However, since urban landscapes display distinguishing social and ecological characteristics, implementation of nature conservation policies in cities requires reconsideration of why, where and how to protect urban nature. This paper presents a three-parted assessment of current urban nature conservation in southern Sweden. In the first part nature conservation patterns, described as the number, size, age, land cover patterns and official objectives of designation, of all 1869 nature reserves in southern Sweden, were analysed in relation to municipal degree of urbanisation. In the next part land use changes over time in the proximity of 16 nature reserves in the ten largest Swedish cities were examined. In part three the perceptions of the nature reserves' surroundings, as expressed in management documents and by managers, were assessed in five areas in Stockholm County. It was found that urban nature reserves share certain characteristics that separate them from reserves in rural settings. It was also found that urbanisation adjacent to nature reserves followed the general urbanisation patterns and neither additional increase nor decrease in urban settlements could be detected. Furthermore, the practical management showed limited recognition of potential cross-scale interactions in time and space. In summary the results describe a landscape where urban protected areas become increasingly conceptual and physical isolated. This is a trajectory that risks causing urban biodiversity decline and hence impact the generation of urban ecosystem services and also decrease the public support for nature conservation. For urban nature to become acknowledged as a valuable and integrated part of cities there is a need to shift focus from backward looking protection of nature remains to management of multifunctional landscapes safeguarding the potential for future ecosystem services.

## 1. Introduction

For long time cities have been excluded from scientific and political discussions about biodiversity (DEARBORN & KARK 2009; KAREIVA 2010 et al.). However, increasingly many urban regions have been acknowledged as biodiversity hotspots (CINOTTA 2000

et al.; KENDLE & FORBES 1997; RICKETTS & IMHOFF 2003), e.g. located in estuaries, along coastlines and in fertile plains. In addition the importance of urban nature for generating various ecosystem services is becoming recognised in programs for urban sustainable development (BOLUND & HUNHAMMAR 1999; CHIESURA 2004; MAAS et al. 2006; UNEP 2011). As a response there is an increasing will to initiate nature conservation programs in cities (ALFSEN-NORODOM 2004 et al.; IUCN 2003; TRZYNA 2007).

The main strategy for biodiversity conservation is to establish protected areas with restricted use and objectives for preservation of natural and social values (BALMFORD 2002 et al.). Today 13 per cent the Earth's surface consists of such protected areas (UNEP-WCMC 2008) and there are numerous national and international institutional frameworks for their establishment and management. Until recently these strategies and tools have had little relevance to urban land use planning, but the current global urbanisation implies two things of importance. First, that urban environment is getting closer to larger protected areas worldwide (MCDONALD 2008 et al.) and second that protection of urban nature becomes increasingly important for sustainable development of cities as well as safeguarding urban biodiversity as part of the global biodiversity (UNEP 2011). Along with urban developments, nature protected areas are now established inside the cities creating a new landscape pattern where strictly nature protected areas are bordered by densely urbanised areas. The overall aim of this paper is to discuss the ecological and social aspects of this new urban landscape pattern. The paper is a synthesis of a three part study of urban protected areas in southern Sweden and is a condensed version of a PhD thesis in systems ecology defended in February 2011 at Stockholm University (BORGSTRÖM 2011). Details on methods and results is found in following publications BORGSTRÖM et al. (2006), (2011), BORGSTRÖM (2009) and BORGSTRÖM et al. (forthcoming).

## 2. Southern Sweden as a study site

There are two main reasons for the selection of study site. First, that Sweden has a long tradition of formal urban land use planning (ALFREDSSON & WIMAN 1997) and that Swedish cities largely escaped war damages compared to many other European cities. Second, that Sweden has more than 100 years experiences of formal nature conservation programs (LUNDGREN 2009; SWEDISH PARLIAMENT 1909). These traditions provide long records of land

use strategies that have been implemented in form of urban development and nature conservation and are highly relevant for understanding the emerging urban landscape pattern.

In Sweden 85 per cent of the population lives in cities<sup>1</sup>, although the population density is relatively low (23 inhabitants/km<sup>2</sup>). Due to large differences in physical and cultural geography between the northern and southern parts, the study was delimited to the southern regions (fig. 1). These are the most urbanised parts, where 32 per cent of the land area hosts 84 per cent of the total population and the ten largest cities are located. Today 10.6 per cent of the Swedish land area is protected and the major part constitutes nature reserves. Therefore the focus of this study was nature reserves. Compared to national parks, land in the nature reserves can be privately owned and the rules are adapted to local conditions. Approximately 70 per cent of all nature reserves in Sweden are found in the south (as of 2006 census).

Even though the urbanisation peaked during the mid 1900s the Swedish urban population is growing continuously. To meet this growth the main Swedish urban planning strategy is densification of built up areas, which means that small green areas within the built up areas are exploited to avoid urban expansions into the larger green structures (BOVERKET 1994). In the largest Swedish cities 27 per cent of the total land area is currently unexploited (ibid), but this proportion, as well as the amount of green area per citizen, is decreasing (STATISTICS SWEDEN 2010). One of the Swedish national environmental objectives is "A good built environment" and includes means of limiting further exploitation of urban nature (SEPA 2010). To fulfil this objective the government assigned the three

largest urban regions in Sweden to establish programs for urban nature conservation (SWEDISH MINISTRY OF ENVIRONMENT 2002). The rate of implementation of the programs varies, and is largely dependent on municipal priorities. Still this assignment implies that there is a Swedish political interest in preserving urban nature by establishment of urban protected areas.

### 3. Aims and methods of the three study parts

The study addressed urban nature conservation at sub-national, regional and local scales and applied both quantitative and qualitative methods.

I: It has been shown that urban landscapes are different compared to for example forests and agricultural lands (ALBERTI 2008). The aim of the first part of this study was to examine if such special characteristics also could be detected for urban protected areas. Furthermore this first part aimed at describing the current pattern of urban nature conservation in southern Sweden. The analyses included 1869 nature reserves in 209 municipalities where the relation between number of nature reserves per municipality, nature reserve size, age, land cover composition and composition of official objectives and municipal degree of urbanisation were statistically analysed (for details see BORGSTRÖM 2009; BORGSTRÖM et al. forthcoming).

II: Studies suggest that urban green areas attract urban settlements (CROMPTON 2005), but such relationship has not been studied specifically for formally protected urban nature. If such relation exists within cities, it implies that urban nature, and especially protected areas, run a higher risk compared to less attractive environments, to become surrounded by built up areas and hence losing ecological connections to other green structures. The second part of this study aimed at examining land use changes in the surrounding of nature reserves over time. In this regional study 16 nature reserves found in the ten largest cities in Sweden were assessed using comprehensive land use maps from 1950-2009. Land use changes in two buffer zones surrounding the nature reserves (500 m and 1000 m) were statistically compared to land use change in the whole city (for details see BORGSTRÖM 2011 et al.).

III: There are important scientific and political incentives for integrating nature protected areas into larger contexts (AHERN 1999; COUNCIL OF EUROPE 1994; EUROPEAN COMMISSION 2000, 2010; SELMAN 2009; TURNER 2005). Also urban planning and urban ecology are promoting large-scale approaches as the future for urban green areas in general (FLORES 1998 et al.; GORDON 2009 et al.; LOVELL & JOHNSTON 2009). From the perspectives of urban nature protected areas, this means relating local measures to neighbouring and regional structures, as well as short term management practices to strategic time frames. In the third part of the study the practical management of five different urban green areas in the Stockholm County was evaluated. The managements were assessed using criteria of ecosystem management that emphasise recognition of spatial and temporal scales and scale interactions (CHRISTENSEN 1996 et al.). Main sources of data were management documentation and interviews with managers (for details see BORGSTRÖM 2006 et al.).

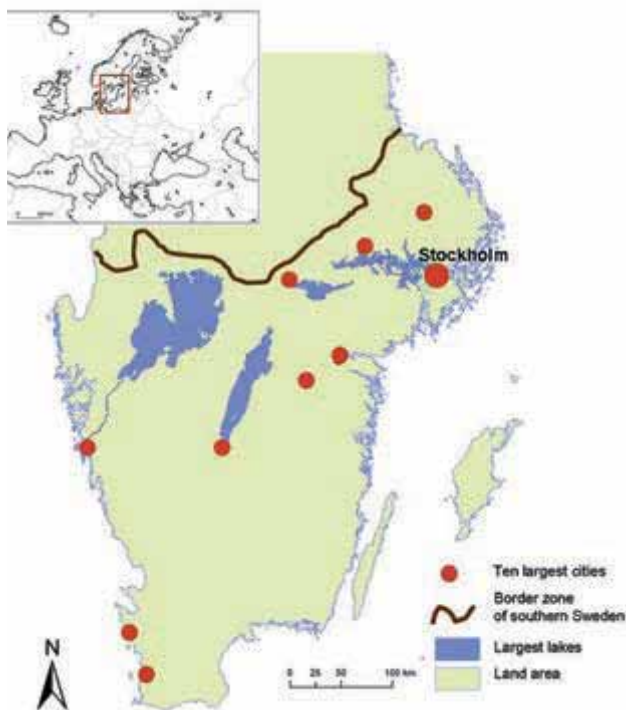


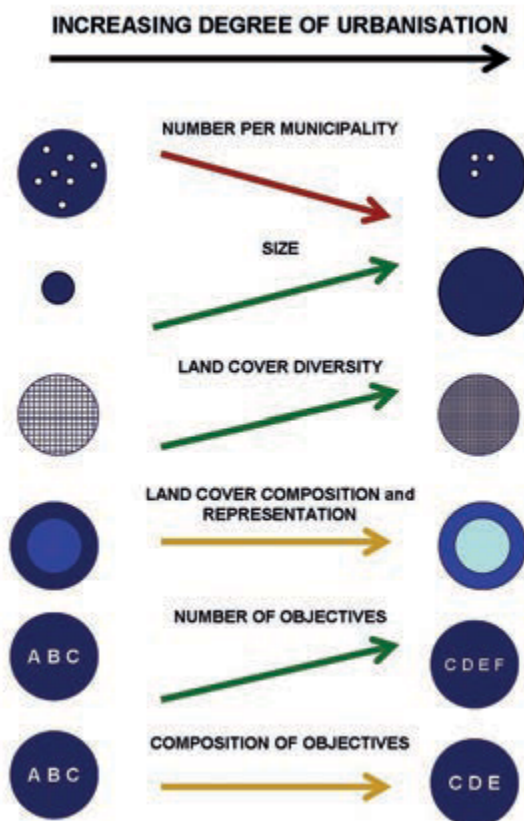
Fig. 1: Southern Sweden (55-60°N, 10-20°E)

<sup>1</sup> City definition: "An area with more than 200 inhabitants and 200 meters between the buildings at the most (STATISTICS SWEDEN 2006)

#### 4. Main results

A specific urban nature conservation signature: In the analyses of the first part of this study it was shown that urban nature reserves are different compared to rural ones (fig 2.) (BORGSTRÖM 2009; BORGSTRÖM et al., forthcoming). The more urbanised a municipality was, the fewer and larger were the nature reserves. It was also shown that the urban nature reserves displayed a significantly higher diversity of land covers and a different land cover composition. Similar land cover changes were seen both inside and outside the urban nature reserves but to a different degree. As a result the representation of different land covers also changed with increasing degree of urbanisation (BORGSTRÖM 2009).

Motivated by multiple objectives: Also motivations for establishment of protected areas differed between urban and rural nature reserves. Generally urban nature reserves are established based on more objectives that are more socially oriented compared to rural (e.g. outdoor recreation) (BORGSTRÖM et al., forthcoming). The emphasis on social values implies that the nature reserves are not protected from humans, but instead established for human benefits. This pattern corresponds to a strong competition among land uses where multiple values, including social, are needed to achieve broad acceptance of nature conservation decisions. It is also likely that many of the nature reserves were founded upon already articulated values in for example designated outdoor recreation areas. Even if such strategy leads to effective protection of multiple values, it also means that the selection of nature conservation areas is based on



**Fig. 2:** Urbanisation effects on nature conservation patterns. Green arrows indicate an increase with increasing degree of municipal urbanisation, red arrows a decrease, while yellow arrows indicate qualitative changes (BORGSTRÖM 2009; BORGSTRÖM et al., forthcoming).

other measures than strategic consideration of current social and ecological values and future needs. A positive consequence is that the social focus and multiple values create as strong identity that appeal to the broad public. Even if an important part of urban nature consists of new or restored nature, these categories of official objectives were seldom used for motivating urban nature protection (BORGSTRÖM et al., forthcoming). Hence it seems to be a focus on existing and even former values in Swedish nature conservation and less interest in areas with potential for the future.

Reactive nature conservation: The second part of the study could not detect that establishment of urban protected areas neither enhances nor limits urbanisation at the landscape scale. Instead it showed that the proximate land use patterns largely followed the overall urbanisation trend in the cities (BORGSTRÖM 2011 et al.). The establishments of nature reserves were also found to occur in the aftermath of local urbanisation suggesting that the nature conservation process is directed by perceived and articulated threats from exploitation to certain locally defined values and thus have limited possibilities to impact the surrounding land which is already built up.

Uncoupled management: The evaluation of practical management showed that several spatial and temporal scales were recognized, although interactions across scales were seldom acknowledged (BORGSTRÖM 2006 et al.). Connections between regional and local spatial scales, as well as between long and short time scales, were missing. This is likely a result of the human dominance in urban landscapes that effectively hides many ecological patterns and processes (ELMQVIST 2008 et al.). As an example, a land use division between a nature reserve and a residential area is usually more evident than ecological connections such as a species habitat that stretches over the division or the function of the residential area as an ecological link between the nature reserve and another green area. Since the urban landscape is perceived as hostile by many species, such ecological connections across the urban matrix are highly important (LINDBORG 2008 et al.; MÖRTBERG 2007 et al.).

#### 5. An alternative model for future urban nature conservation

The revealed patterns of urban nature protection described in this study are likely reflections of the urban landscape characters, rather than conscious adaptations to the urban context. However such adaptations are urgently needed to make these areas more useful and functional in the urban landscape. Crucial for future urban nature conservation is the current limited recognition of the surrounding urban landscape, where the nature protected areas risk becoming isolated islands. This is a vulnerable trajectory where these areas are passive receivers of urban dynamics, instead of being active elements of importance for the whole urban system (ERIXON et al., forthcoming). The lack of social and ecological linkages between the protected areas and urban landscape might decrease the public support for conservation and cause degradation of biodiversity and hence impact the flows of ecosystem services. Then the question is if nature protection is at all a useful tool in cities and two arguments promote their continued existence. First, because as long as the different interest of land use in a city is unbalanced in decision making, strong tools are necessary to sustain urban nature and functional ecosystem that provides ecosystem services. Second, because the current renewal of general nature conservation policies needs the urban landscape as a testing



ground since the anthropogenic challenges are especially pronounced here. To make better use of existing and future urban protected areas an alternative model where urban nature, including conservation areas, is perceived, planned and managed as valuable and integrated parts of the urban landscape is needed. This model includes strategies for: i) active planning and management of multiple ecosystem services, ii) focus on border zones and iii) proactive approaches.

### 5.1 Protecting multiple ecosystem services

The diversity of official objectives used for motivating urban nature protection is challenging in practical management, but given the current shortage of and continued decrease in urban nature, multiple values are necessary and should be actively enhanced and created. An useful concept in this context is multifunctional landscapes that has emerged from discussion on sustainable agricultural landscapes (BRANDT & VEJRE 2004). This concept can be used at different scales in the city and has potential to bridge the division between urban and nature. Still, when using multi-functionality in planning urban land uses, the qualitative questions of what functions and for whom, need to be addressed. Here the concept of ecosystem services is highly relevant since it aims at linking ecosystem functions to human needs and values (MILLENNIUM ECOSYSTEM ASSESSMENT 2005). Crucial questions for the future planning and management of urban protected areas as part of the urban landscapes then become: What ecosystem services are needed now and in the future? Where and at what scale are they needed?, and What kind of urban nature and biodiversity can provide such ecosystem services? An area can for example become protected because of its potential for future local food production, for mitigation of floods due to climate change or because of its importance as an ecological link between core areas at the landscape scale.

### 5.2 Intermediate urban zones

In an urban setting the promoted large scale approaches means bridging the many divisions and borders throughout the landscape. Conservation areas must be linked to other formal as well as informally managed urban green areas and also to the built up areas. While multi-functionality and ecosystem services can be conceptual tools in this endeavour, there is a need of spatial focus where this bridging needs to take place. Currently urban planning and nature conservation are least interested in the outskirts, near the borders of their authority. However, such edges are since long time known in ecology for their richness and in cities these can be called intermediate urban zones. They are not completely built up and not unexploited. In these locations the co-existence of several ecosystem services can be powerful connectors between the citizens and urban nature. Community gardens, cemeteries, golf courses and other semi-intensive urban land uses are examples of existing important intermediates that need to be highlighted and multiplied. Due to their location, they are likely the areas most prone to urban exploitation, and therefore probably need some kind of formal agreement to be sustained. Such zones are also important since they increase the total area for ecosystem service production in the urban landscape and hence decrease the risk of conflict between incompatible ecosystem services (BENNETT 2009 et al.; KREMEN 2005).

### 5.3 Increasing the amount of green

Currently urban nature conservation is directed by recent or ongoing urban development possessing threats to existing or former values.

This reactive approach offers limited space for strategic planning and leads to increased vulnerability and difficulties in achieving common goals such as sustainable cities. In most cities urban nature is decreasing with consequences such as decreasing accessibility for citizens and ecological connectedness, and conflicts of interests in the remaining areas. If there is a similar shortage in housing or infrastructure, it becomes a political prioritisation and strategic programs for development are often created. A similar strategy would be useful in the case of urban nature, where the forecasted decreases could be met by strategies for how to increase the amount of urban nature. This is not just about greening the built up elements such as roofs, walls and roadsides, but also actually creating new urban nature. Currently there is a strong trend in Europe to build on former industrial sites, railways and harbours. In many cases these sites are nearly zero in nature and hence no nature is lost when they are exploited. However, such locations do not necessarily need to be densely built. They can instead be viewed as opportunities where interest and investments are focused to a particular site and thereby substantially contributing to the overall green structure in urban landscapes. Maybe such industrial and other non-nature sites of potential future importance due to location in the urban landscapes should be assigned as nature protected areas.

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