

EKOPARKEN ASSOCIATION

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CITIES FOR BIODIVERSITY

CONFERENCE IN STOCKHOLM OCTOBER 5-7 2023

Foreword



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This is a report from a conference held in Stockholm on October 5th to 7th 2023. The aim of the conference was to highlight biodiversity in a group of Nordic and Baltic cities, and to present the work they do to preserve and enhance biodiversity, in order for the participants to learn from each other.

The conference was organized by Ekoparken Association/Förbundet för Ekoparken, an organization that was started in 1992 to preserve a large tract of nature, parks and gardens in Stockholm, the capital of Sweden. In 1995 legislation took effect to preserve a 27 square kilometer large area in the midst of the Stockholm metropolitan region. One of the motives for the legislation was biodiversity.

The conference was organized in cooperation with the Swedish Museum of Natural History and World Wildlife Fund, Sweden.

We, the organizers of the conference, extend our deep gratitude to **Sebastian Kvist** of the Swedish Museum of Natural History and **Vicky Lee Vallgren** of World Wide Fund for Nature in Sweden for their support and finally to **The Nordic Working Group for Biodiversity** under **the Nordic Council of Ministers** that gave us financial support without which the conference could not have been arranged.

We now know that cities harbor an amazing amount of biodiversity. It is against this background that we organized this conference and asked what can be done to protect and enhance biodiversity in cities. What do we know, what is being done, what should be done?

The main aim of the conference was to advance practical solutions to foster biodiversity in large cities. By practical solutions we mean not only what, where, and when to plant but also the whole process of regional and city planning down to the earthier matters.

To that aim it is essential to understand the strategic importance of cities when it comes to biodiversity. Why are cities important in this respect? Are not the Amazon and nature reserves around the Globe much more important? In the fight for preserving global biodiversity, is promoting urban green infrastructure the most important? And, in relation to actions taken in other places, are actions taken in cities the most cost-efficient?

Next, it is critical to understand the special characteristics of urban green and urban biodiversity. In order to foster and improve nature in cities it is important to know its kind and context. This may vary among cities, located on different latitudes and altitudes, in different neighboring natural contexts. Cities are man-made, usually built without care for nature. When built – with stone, concrete, asphalt, glass, and steel – nature, often very rich nature, has been wiped out. What has survived and what has thrived in this harsh environment?

From there we must ask what is the potential to develop the urban green and biodiversity in a specific city? And we must also ask what kind of biodiversity should be developed? The alien environment in cities make cities prone to invite new and sometimes invasive species. Are those to be welcomed or fought off? What species are best suited to survive and thrive in cities in the future with global warming and increasingly stormy weather?

The global community acts from a belief that urban green is of strategic importance. The 2022 United Nations biodiversity conference (COP 15) adopted the Convention on Biodiversity (CBD). It pays special attention to urban biodiversity. The European Union directs its member states to adhere to the Green Deal (decided 2020), which includes directives for urban green infrastructure. It is of great importance to understand to what extent international conventions and regulations will govern what should happen in cities around the world.

To make things happen, knowledge and integration of urban green and biodiversity into regional and city planning plus competent gardening is needed. In the first place, knowledge about ecosystems in the city, their characteristics, weaknesses and potentials is needed. Secondly, knowledge is needed about workable remedies and development possibilities. These measures should be set into a strategy for biodiversity.

Only then can things really start happening, provided that decision makers – politicians and high-ranking local government employees – understand the need for urban green and biodiversity and have competent staff people at their disposal.

Åsa Lindhagen, vice mayor of Stockholm, in charge of Climate and environment, at the conference underlined the seriousness of the situation and the importance for global biodiversity of what is being done in cities. She emphasized the importance of demands from the general public for greening the city and welcomes efforts like this conference to raise awareness among a broader public.

The text is mine, based on the lectures given and ensuing discussions. The faults are mine. We, the organizers thank speakers and discussants for their very valuable contributions.

Richard Murray

President Ekoparken Association/Ordförande för Förbundet för Ekoparken

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Cities are important for biodiversity

It has been acknowledged by research that cities are harbors of an amazing biodiversity. This may be contrary to casual thinking. As evidenced, the biodiversity is far richer in or close to Australia's big cities than elsewhere on the continent of Australia.

Dark areas = high biodiversity

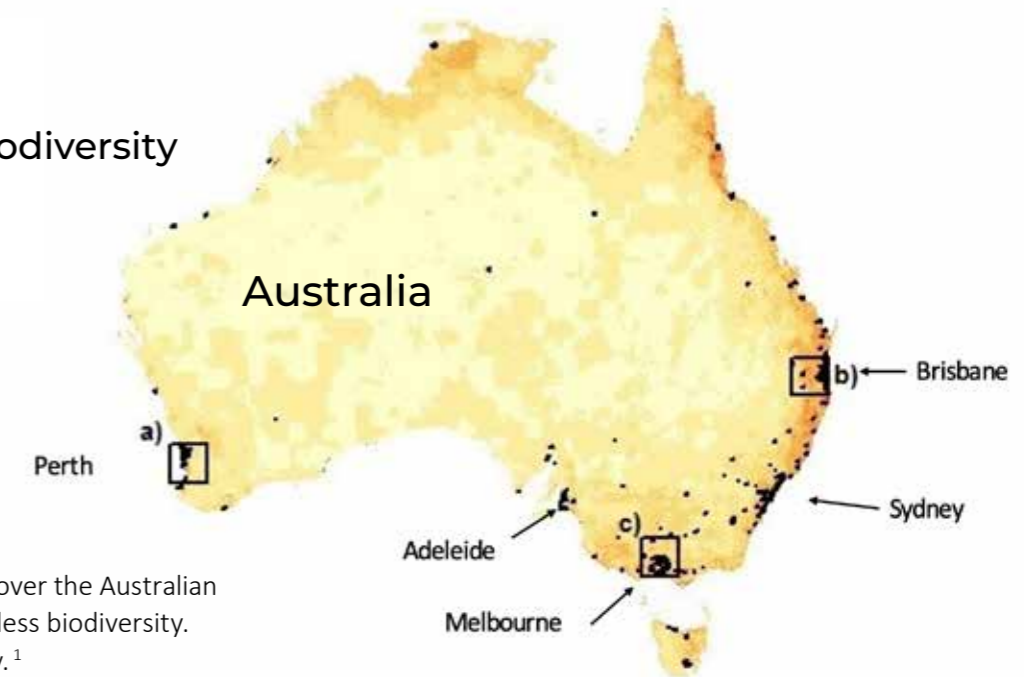


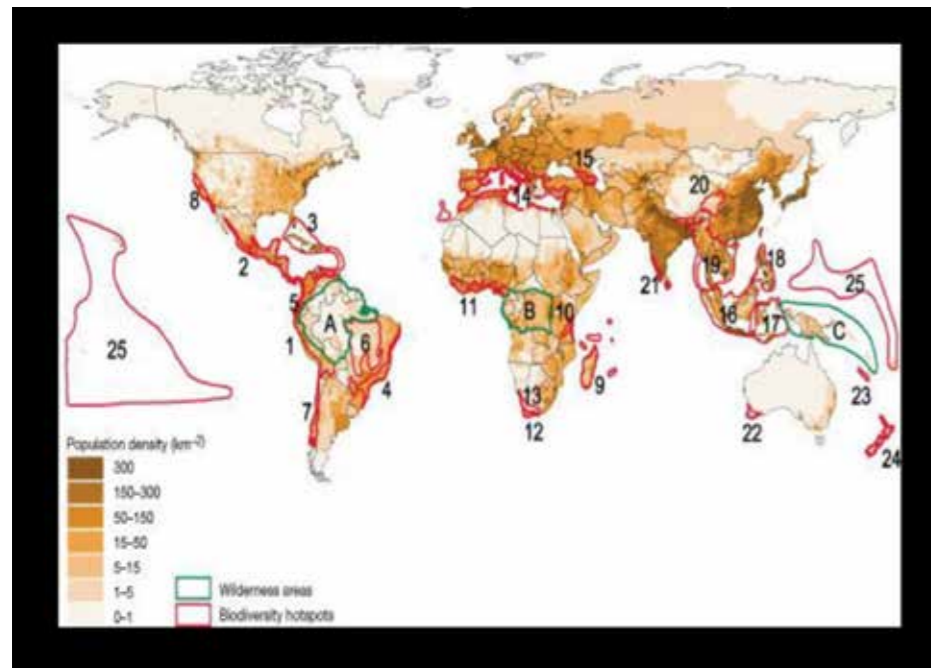
Figure 1. Biodiversity measured over the Australian continent. Lighter areas contain less biodiversity. The darker the more biodiversity.¹

The darker the shaded areas are, the richer is the biodiversity. Looking closely at cities, it is areas close to the city core that are the richest, not the core itself. Not only that, but cities are also hotspots for threatened species.

Why is this so? **Thomas Elmqvist** pointed out that human concentrations of population often coincide with areas of high biodiversity. These are areas of high fertility, which have, over the years, attracted both flora and fauna and people.

People historically have settled in places that today are biodiversity hotspots, according to **Marcus Hedblom**. (See figure 2)

¹ Ives, C.D. et al. *Cities are hotspots for threatened species*, Global Ecology and Biogeography, 25, 2016.



People do not settle by random. We settle in higher extent in some of the 25 global biodiversity hotspots.

Figure 2. Population density and biodiversity hotspots globally.²



Figure 3. Night-lights over Europe show that the landscape is completely urbanized in large areas.³

Judging from figure 2 and 3, restoring nature means restoring nature in an urban landscape.

There are, therefore, good reasons to protect urban nature, safeguard and enhance habitats and wildlife corridors within cities, and also to promote new ecosystems within cities. The countryside, in general, is dominated by monocultures, large tracts of highly specialized agriculture and industrially grown forests. Only 35 percent of terrestrial biomes are still wild. The rest – 65 percent – is cultivated, harvested, built upon, dug into, flooded etc. What is left is very precious.⁴

² Human population in the biodiversity hotspots, Cincotta, R.P. et al. Nature 27 April 2000.

³ NASA Earth Observatory

⁴ Anthropogenic Transformation of the Biomes, 1700 to 2000, Elis, E.C., Global Ecology and Biogeography, 2010.

Alexandre Antonelli pointed out that cities around the world at present grow at a rapid rate – a new Paris is being built every five days! Man will almost exclusively be living in cities, far from pure nature, in a couple of decades. This puts a strain on existing urban green. And it also calls for forward planning of the new cityscape to include enough green areas and to make man comfortably and at ease living with nature.

Vicki Lee Wallgren said that there will be another 1.2 million square kilometers additional urban area in the world by 2050, the size of all of Colombia. Already by 2030 300,000 square kilometer of natural areas will be taken over by urban developments. Mankind is at a tremendous challenge to find ways to live in this world in close connection and cooperation with nature. Much of what needs to be done is to be done in cities.

Thomas Elmquist added that by the year 2050, according to a recent study, i.e. in two decades, due to rapid urban growth, particularly in the global south, 40 percent of the world's protected areas will essentially be “urban parks”, within 50 km from urban areas.⁵ This implies that not only must green areas within cities be cared for but also the adjacent countryside. Maps of central Europe show that highly urbanized areas today are surrounded by Nature 2000 sites.

⁵ Nature in the Urban Century, A global assessment of where and how to conserve nature for biodiversity and human wellbeing, The Nature Conservancy, 2018.

Think globally, act locally – why urban biodiversity matters!

To understand the importance of urban biodiversity a full understanding of global biodiversity is needed. The full breadth of global biodiversity was presented by **Alexandre Antonelli** and is shown in figure 4.

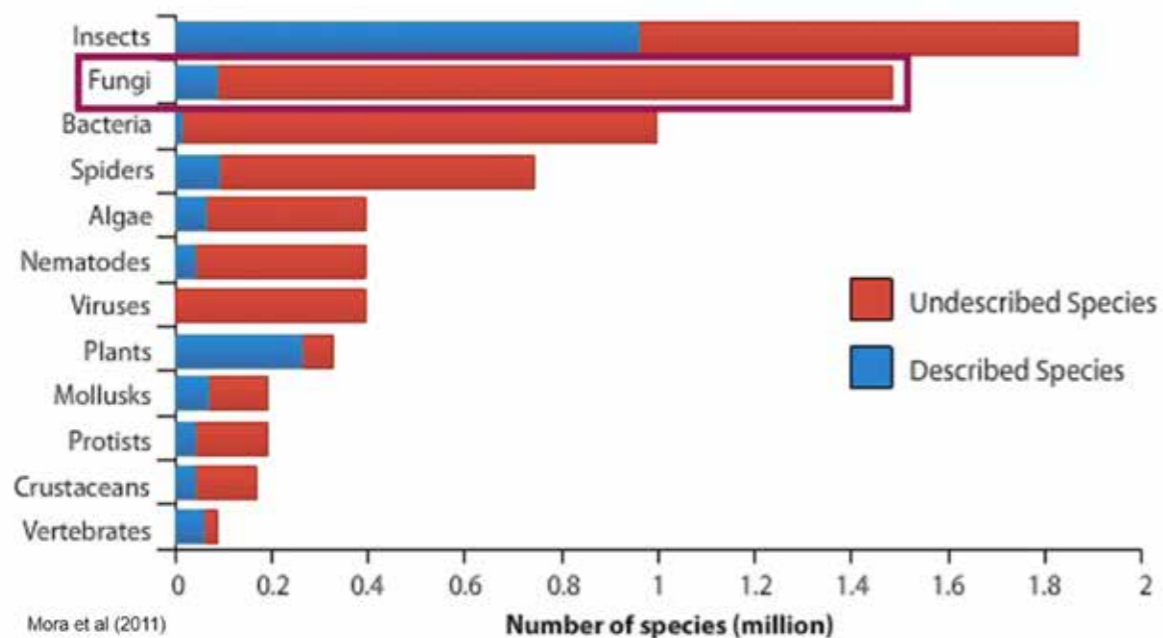


Figure 4. Number of species, various categories.⁶

This is an estimate, and it likely underestimates the number of species. The total number of species on earth is estimated at 8.7 million (+/- 1.3 million). When this estimate was published only 1.2 million species were catalogued, which implies that 86 percent of estimated existing species on earth and 91 percent of species in the ocean still await description and classification.

The question arises, does all this biodiversity exist also in cities? An article from 2014 confirms that something of the sort seems to be the case.⁷ In the soil of a large park in a large city – Central Park in New York – it was found that it “even an urban, managed system harbors large amounts of undescribed soil biodiversity.”

Antonelli called attention to our limited knowledge at present about biodiversity. The rate of increase in yearly discovered and recognized species has increased dramatically over the years. At present about 7,000 thousand “new” insects and

⁶ *How Many Species Are There on Earth and in the Ocean?*, Mora, C. et al., PlusBiology, 2011.

⁷ “This integrated cross-domain investigation highlights that the amount and patterning of novel and uncharacterized diversity in a single urban location matches that observed across natural ecosystems spanning multiple biomes and continents.” Cited from *Biogeographic patterns in below-ground diversity in New York City’s Central Park are similar to those observed globally*, Kelly S Ramirez et al., Proceedings of the Royal Society, 2014.

about 200 “new” plants and 2,000 “new” fungi are discovered every year.⁸ He estimates that we know less than ten percent of the species that exist and that we are dependent on for various roles in ecosystems. He also pointed out that the great biomass is not the birds and wild animals that we see around us but microorganisms such as bacteria, algae, mollusks, insects, and others. Insects make up a very large proportion of that biomass. Our limited knowledge calls for great caution in any of our endeavors.

World Wide Fund For Nature reports in 2022: “this edition shows an average 69% decline in the relative abundance of monitored wildlife populations around the world between 1970 and 2018. Latin America shows the greatest regional decline in average population abundance (94%), while freshwater species populations have seen the greatest overall global decline (83%).”⁹

Antonelli pointed out that the fast growth of cities is to the detriment of natural capital. Produced capital has increased by 100 percent per capita 1992-2014. On top of that is a very large population increase. Cities have grown at a record speed since year 2000. Produced capital includes urban structures, roads, railways, factories, hydroelectric power plants etc. and is one of the major causes of the loss of natural capital. Nevertheless, it is important to remind, the remaining *urban* biodiversity within and around cities is strategic for the preservation of *global* biodiversity.¹⁰

Another part of the reduction of natural capital is the 19 percent reduction of forests globally over the years 2001-2021. Sweden and Finland contribute proportionately very much to the loss.¹¹ This is also a major cause of the reduction of biodiversity.

Still another cause is climate change. It is the extremes in temperature, winds, precipitation, and draughts that are the worst, not the averages.

Today it is estimated that 45 percent of all 350,000 plants are threatened. The rate of extinction with business as usual is reported to be 3 in 4 flowering plants up to year 2100. One million species face extinction. In EU just 40 percent of species and 20 percent of nature types have good enough preservation status. One in five species are red listed in 2020.

The global depletion of natural capital also means a loss of *genetic diversity* – each species has a set of genetic variations that will help a species to survive when the environment – climate for example – changes.

⁸ The discovery of “new” species cannot compensate for the loss of species. Since there are so many unknown species the rate of extinction may be much larger than what has been estimated. Newly found species very often are confined to small, local areas and are often very vulnerable. Many species will be lost before we find them.

⁹ *Living Planet Report 2022*, WWF (World Wide Fund for Nature) and ZSL (Zoological Society of London).

¹⁰ *The Economics of Biodiversity*, the Dasgupta Report, 2021.

¹¹ <https://www.globalforestwatch.org>

The most important measures to reverse biodiversity loss are:

- conservation,
- adopting sustainable production and consumption practices, and
- stopping climate change.

All parts are needed for recovery. Conservation should be directed towards the biologically most important areas, not towards the least costly measures. It is the task of businesses and households to change production and consumption practices. The biodiversity crisis is closely linked to the climate crisis. It is not possible to solve one without addressing the other.

Biodiversity in cities is of special importance for several reasons: 1) we, humans, have to learn to take care of our own "house", the cities that we live in, and its greenery, 2) if we can manage biodiversity in cities – that are warmer, flooded, provide disturbances of many kinds – that may pave the way to restoring the changing natural landscape, 3) species that survive in cities may be more successful in surviving overall, 4) in many cases cities provide habitats to species that have few natural habitats left in the rural landscape and 5) parks, especially large parks, in cities are important as heavens for biodiversity and places for the recovery of endangered species.



Figure 5. Familjelycka (Family happiness) by Robert Högfeltdt, 1938.

Thomas Elmquist argued that cities may be seen as biodiversity laboratories because of their special characteristics. Species have to cope with warmer climate and a range of disturbances, from chemicals to traffic, from light pollution to invasive species. Evolution is still at work and will produce adapted species and perhaps even new species. What happens in cities is, therefore, of great interest for managing biodiversity not only locally but also globally.

Alexandre Antonelli stressed that there is a great potential in cities to restore the ecological value of the urban landscape. There are school yards, railway tracks, roadsides, roundabouts, back-yards, villa gardens etc. that can be restored.¹² The 2.5 million private gardens (320,000 hectares) in Sweden could be converted from neatly cut lawns to flowering meadows. The best advice to garden owners is to do less, be lazy, and let nature work on its own. Good advice is given by Rikare Trädgård (in Swedish), a homepage for gardeners.¹³

The main reason why cities matter regarding biodiversity is that it is in cities where we, humans, live and must learn how to live, harmoniously, with nature.

Global conventions, national goals and local strategies

Alexandre Antonelli's assessment of the Kunming-Montreal Global Multidimensional Biodiversity Framework agreed upon in 2022 is that it is humanity's last hope. On the one hand business has been engaged in the shaping the framework to an extent unheard of previously. That is very promising. Business may, if things catch on, contribute with very large sums of money, technology and organization. On the other hand, he warned, with business strongly involved, that "there is a risk for greenwashing" that we have to look out for.

¹² Gothenburg Global Biodiversity Centre will give you good advice.

¹³ <https://rikaretradgard.se/>

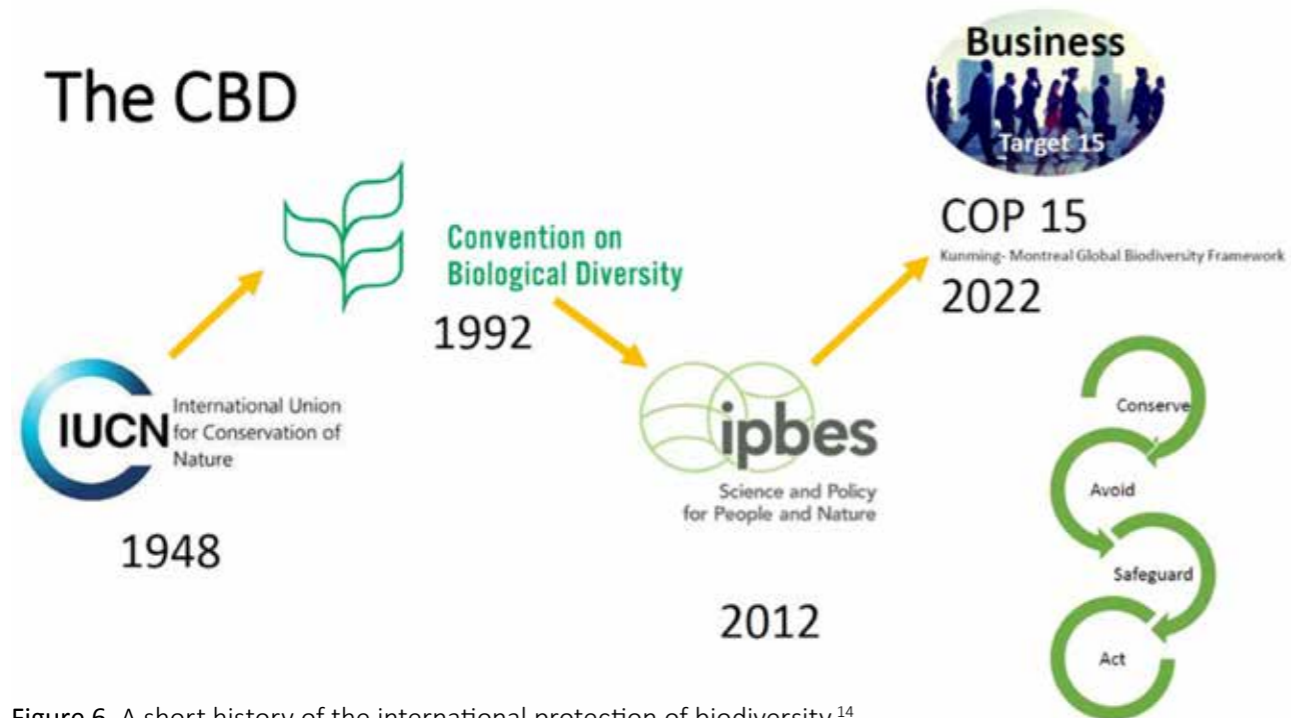


Figure 6. A short history of the international protection of biodiversity.¹⁴

UN Convention on Biodiversity

Johanna Alkan Olsson told the history of biodiversity protection. Loss of biodiversity was recognized at the 1992 UN conference in Rio de Janeiro. A *Convention on Biodiversity (CBD)* was adopted in 1992 at the Rio conference. It was signed in 1993. Initially a convention had been called for by the International Union for Conservation of Nature (IUCN) already in 1948. An *Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (ipbes)* was established in 2012 by more than 130 governments committed to perform regular and timely assessments of knowledge on biodiversity and ecosystem services and their interlinkages at the global level. *Ipbes* later addressed an invitation by the United Nations Conference of the Parties of CBD to prepare a global assessment of biodiversity and ecosystem services, building, inter alia, on its own and other relevant regional, subregional and thematic assessments, as well as on national reports. In 2019 *ipbes* issued *Global Assessment Report on Biodiversity and Ecosystem Services*.¹⁵

A turning point was perhaps reached at the UN Biodiversity conference (COP 15) in 2022 in Montreal. In the *Kunming-Montréal Global Multidimensional Biodiversity Framework*, endorsed by almost 200 countries, emphasis is laid not only on conserving but also on avoiding, safeguarding and acting. This could be a big step forward.

¹⁴ Source: Johanna Alkan Olsson, Centre for Environment and Climate Science (2023).

¹⁵ <https://www.ipbes.net/global-assessment>

The Framework adopted in Montreal 2022 has a huge potential to bend the curves in the right direction. If it is implemented it will be the most important convention in human history, according to **Alexandre Antonelli**. But there is long way to go. The funding gap, estimated by Blomsberg is 850 billion dollars per year until year 2030.

One of the Framework's targets requires almost a *doubling of nature reserves worldwide by 2030*.

The most important target for urban biodiversity in the Framework is no. 12, which stipulates nations to *"Significantly increase the area and quality and connectivity of, access to, and benefits from green and blue spaces in urban and densely populated areas sustainably, by mainstreaming the conservation and sustainable use of biodiversity, and ensure biodiversity-inclusive urban planning, enhancing native biodiversity, ecological connectivity and integrity, and improving human health and well-being and connection to nature and contributing to inclusive and sustainable urbanization and the provision of ecosystem functions and services."*

Another target, no. 2, with high significance for cities and their immediate surroundings, is that *"by 2030 30 percent of degraded terrestrial, inland water, and coastal and marine ecosystems shall be under effective restoration."* This is highly relevant for cities since much of the degraded ecosystems are in urban areas.

Target no. 3 stipulates that *"by 2030 at least 30 percent of terrestrial, inland water, and of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed ..."*

Target no. 6 is also of relevance for cities: *"eliminate, minimize, reduce and or mitigate the impacts of invasive alien species on biodiversity..."*

Target no. 15 has special relevance for business.¹⁶ It encourages business to take a very active role in the restoration of nature and promotion of biodiversity through recommended reporting systems.

These targets are recommendations, strong recommendations, but cannot be enforced by legal means. To be binding, individual countries will have to legislate enforcement. **Johanna Alkan Olsson** argued that such recommendations still may

¹⁶ Target no. 15 Kunming-Montréal Global Multidimensional Biodiversity Framework: *"Take legal, administrative or policy measures to encourage and enable business, and in particular to ensure that large and transnational companies and financial institutions: (a) Regularly monitor, assess, and transparently disclose their risks, dependencies and impacts on biodiversity including with requirements for all large as well as transnational companies and financial institutions along their operations, supply and value chains and portfolios; (b) Provide information needed to consumers to promote sustainable consumption patterns; (c) Report on compliance with access and benefit-sharing regulations and measures, as applicable; in order to progressively reduce negative impacts on biodiversity, increase positive impacts, reduce biodiversity-related risks to business and financial institutions, and promote actions to ensure sustainable patterns of production."*

have effect. If some nations or companies start to apply them, laggards will be criticized, and front-runners praised. This may serve as a leverage for nations as well as for companies to undertake action.

There is a range of positive outcomes that might tempt both national and city politicians and their citizens to act:

- Financial support from the EU Green Deal (see below!)
- Cheaper loans for infrastructure investments
- Attracting taxpayers, workers and business¹⁷
- Attracting nature positive investments
- Setting a good example and being seen as a trustworthy collaborator
- Getting honor and global respect
- Ensuring the wellbeing of its current and future inhabitants

EU Green Deal and Nature Restoration Law

The European Union *Green Deal* is a package of policy initiatives that aim to set EU on the path to a green transition, with the ultimate goal of reaching climate neutrality by 2050. The Green Deal was launched in 2019. It is composed of several policy initiatives. One of these policy initiatives is *Fit for 55*, which is a large package of directives specifically aimed at climate mitigation and adaptation. Major parts of *Fit for 55* were adopted in 2023. Of relevance to biodiversity is the revised regulation on *land use, land use change and forestry sector (LULUCF)*, specifically that part which addresses forestry.¹⁸ Another relevant part is the *EU agricultural policy* to have agriculture contribute to climate action through greener farming practices like organic farming, crop rotation, and preservation of carbon-rich soils. 40 percent of the EU budget for agriculture is to be designated for such practices.

One pillar of the Green Deal that is of particular relevance for biodiversity is the *EU biodiversity strategy for 2030* from 2020.

The call in the Biodiversity strategy is to bring nature back into our lives. On the basis of the EU Biodiversity strategy, a *Nature restoration law* was proposed in 2023 and endorsed by the Council in a somewhat watered-down version. Adopted in June 2024 it rules that “*EU countries must restore at least 20% of habitat areas in poor condition by 2030, 60% by 2040, and 90% by 2050. For areas of habitats subject to restoration measures, member states agreed they would ensure that significant deterioration does not occur.*”

¹⁷ The city of Leipzig is a success story in this respect, see Murray, 2021/2022.

¹⁸ Of relevance for cities is the goal to plant 3 billion trees, including in and near urban areas.

The European Union therefore has adopted roughly similar targets to COP 15.

However, the EU targets are binding, not just recommendations.¹⁹

Of specific interest for urban areas is the obligation for member states to achieve an “*increasing trend in urban green areas*” until a satisfactory level is reached. Also: “*No net loss of urban green space and of urban tree canopy cover should occur by 2030.*”

There are also other pillars in the Biodiversity Strategy such as *From farm to fork* and *Leave no one behind* that have to do with biodiversity and the greening of cities.

Private “law”

The large mass of standards, certification schemes, manuals and indicator systems for sustainable business and sustainable cities should not be neglected, according to **Johanna Alkan Olsson**. There is a risk of “greenwashing”, which must be watched for. But if designed to be truly challenging, the dynamism of market competition, consumer awareness and government procurement could catalyze significant change. *The Green City Accord* is one example of such a system.²⁰

Nature-based solutions for humans – and biodiversity!

Alexandre Antonelli stressed that, although nature-based solutions are extremely valuable for mankind, we must not forget the intrinsic value of biodiversity. Nature has a right to life in its own right.

There is a long list of ecosystem services that come with urban green and nature-based solutions. Ecosystem services are services to humans. In cities, ecosystem services become very visible to people. If nature-based solutions are skillfully deployed so that they serve the needs of urban residents, while at the same time saving and developing biodiversity, an urban green strategy could be very successful from a biodiversity point of view.²¹

The first rated positive effect is that on human health. Today people in cities are the majority of people in the world, and that majority will grow ever larger in the coming years. Not only is green shown to have a direct positive effect on human

¹⁹ The law was promulgated in June 2024 despite objections from a group of six countries, among them Sweden.

²⁰ https://environment.ec.europa.eu/topics/urban-environment/green-city-accord_en

²¹ There are several platforms and repositories on nature-based solutions in Europe. A list is provided in European Environment Agency report 14/2023, *Urban adaptation in Europe: what works – Implementing climate action in European Cities*, Box 8.1, p.90.

well-being in many epidemiological studies but also in purely experimental studies. Selection problems in epidemiological studies have, in more recent studies, to a considerable extent been handled by taking account of confounding factors – age, wealth, income, education, social position, marriage status etc.²² As a result, the positive medical effects of access to nature have been well documented. People living in areas with high biodiversity and heterogeneous areas in the countryside in Finland had more microorganisms and therefore less allergies and less chronic inflammations than persons living in urban areas with less biodiversity in their surroundings.²³ However, there are others that contend that these direct health benefits are not so great or even negligible.²⁴

Indirect health benefits are related to tree canopies cooling the city, urban green absorbing storm waters and trees absorbing air pollution. Such effects work regardless of income, education, and other factors.

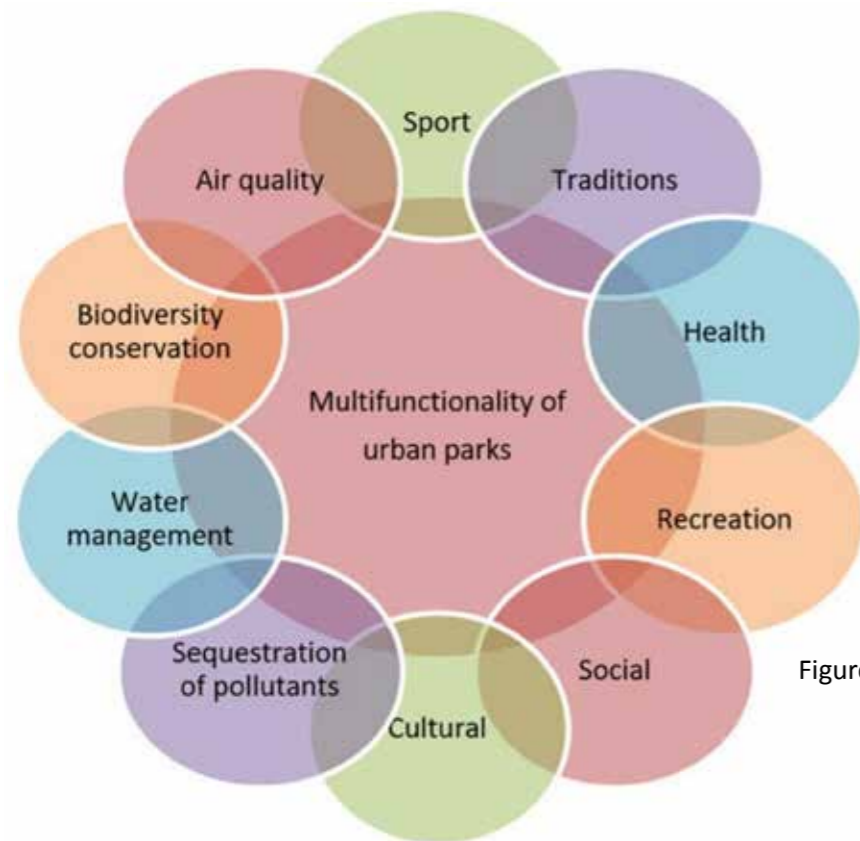


Figure 7. Multifunctionality of urban parks.²⁵

²² Mitchell R, Popham F, *Effect of exposure to natural environment on health inequalities: an observational population study*. Lancet 2008. In this article results are reported from a study of millions of Brits in 2001-2005, controlling for confounding factors. Results are that there is a strong association between residence in the greenest areas and decreased rates for all-cause mortality.

²³ Roslund et al, *Biodiversity intervention enhances immune regulation and health-associated commensal microbiota among daycare children*, Science Advances, 2020.

Puhakka et al., *Greening of Daycare Yards with Biodiverse Materials Affords Well-Being, Play and Environmental Relationships*, International Journal of Environmental Research and Public Health, 2019.

²⁴ Houlden et al., *Is biodiversity of greenspace important for human health and wellbeing? A bibliometric analysis and systematic literature review*, Urban Forestry & Urban Greening, 2021.

Botzat, A., Fischer, L. K., & Kowarik, I. *Unexploited opportunities in understanding liveable and biodiverse cities. A review on urban biodiversity perception and valuation*, Global environmental change, 2016.

²⁵ Breuste, J. et al., *Multi-functional urban green spaces. In Making Green Cities: Concepts, Challenges and Practice*. Cham: Springer International Publishing, 2020.

Multi-functionality of parks and urban green is another way of phrasing the many ecosystem services that urban green provides. There are even more ecosystem services than noted in figure 7 such as cooling, CO2 sequestering, storm water absorption, and pollination just to mention a few. Most but not all ecosystem services are found in urban settings. It has been pointed out that what makes ecosystem services in cities different from ecosystem services in the countryside is that from a human perspective they affect many more people in cities, so much more directly, and are more easily converted into monetary gains (less damage, less health expenditures, cheaper solutions etc.).

Thomas Elmqvist underlined that understanding urban biodiversity is of crucial importance for future life in cities, when shaping nature-based solutions to environmental problems.

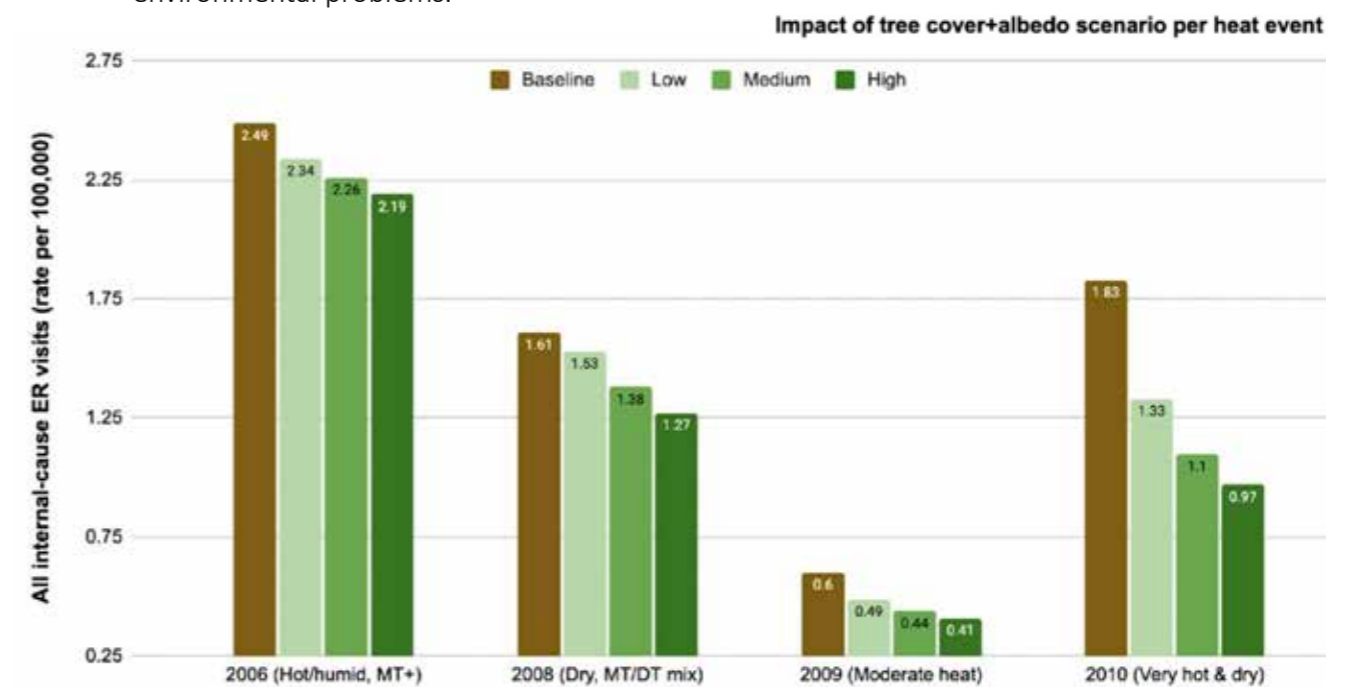


Figure 8. Reduced all-cause Emergency Room visits in Los Angeles county under increased tree cover and during four heat waves.²⁶

An obvious example is the choice of trees. Trees and tree canopy is a very important nature-based solution to lower temperatures in cities. The amount of tree cover in different parts of a city has immediate effects on health (see figure 8!). But what trees should be chosen? What trees will survive in our cities in the future, with both hotter, drier and rainstorm ridden climate (see Henrik Sjöman below!)? This is crucial to know, as well as that new kinds of trees will form new ecosystems, with some existing species adapting to the new set of trees, other species having to move and still others coming from the outside, establishing themselves in the new environment.

²⁶ Sheridan, S, Edith B. de Guzman, David P. Eisenman, David J. Sailor, Jonathan Parfrey, Laurence S. Kalkstein. 2024. Increasing tree cover and high-albedo surfaces reduces heat-related ER visits in Los Angeles, CA. International Journal of Biometeorology. <https://doi.org/10.1007/s00484-024-02688-4>

Nature-based solutions range from the very large infrastructure projects to the relatively small projects of street trees for shade.

An example of the former, a very large-scale nature-based solution to enhance the living conditions in a section of Seoul, is the transformation of the Cheonggyecheon freeway in Seoul in 2003-2005. At a cost of US\$ 281 million the freeway was turned into a river.²⁷

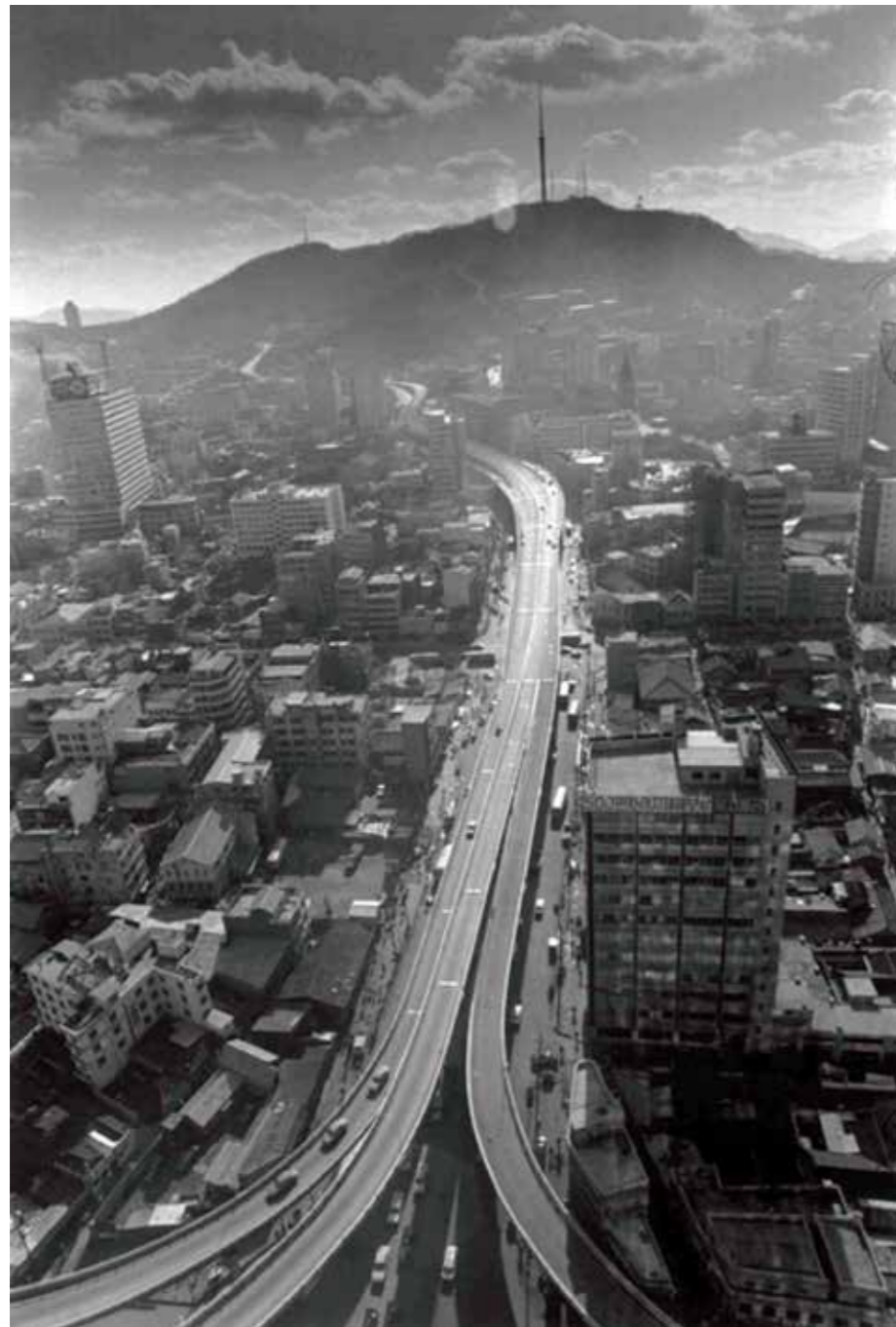


Figure 9. Cheonggyecheon Expressway in Seoul in 1972.²⁸

And this is what it looks like today.

²⁷ <https://en.wikipedia.org/wiki/Cheonggyecheon>

²⁸ Source: National Museum of Contemporary Korean History



Figure 10. Cheonggyecheon river in Seoul in 2012.²⁹

It was argued, as a reminder, that projects like this and what the city of Singapore (see below!) has achieved, comes with a cost both in terms of biodiversity and in terms of CO2 emissions since they require very large amounts of concrete and heavy construction. Producing cement causes huge emissions of CO2 and it causes great damage to the environment when the sand that goes into the concrete is being mined.

These projects are also very neat, almost manicured, and do not contain wild nature. Elmquist thinks that that is a correct observation and can be attributed to the fact that we are now at the early stages of re-naturing cities. We will eventually have to start setting aside areas in cities that are left to themselves to develop in more natural and wild ways.

Marcus Hedblom emphasized that there is a lot more to learn about biodiversity in the urban landscape – it is a fairly novel subject of research. Mycorrhiza and bacteria in the soil of parks has to be investigated, as well as lichens and how new species of trees fare.

Hedblom's main point is that changing the management practices of existing urban green areas has the potential to enhance biodiversity but he emphasizes that such practices rely heavily on human perception and societal norms.

Hedblom restores urban green spaces for recreational use and warns that there may be conflicts between recreational uses and biodiversity. He asked: is it possible to combine human recreation and well-being with biodiversity? Is management a way forward?

²⁹ Source: Grayswoodsurrey, Creative Commons Attribution-Share Alike 3.0 Unported license.

Mean forest cover varies in cities. The average in Swedish cities is 20 percent. In Malmö it is 1 percent, in Uppsala 13 percent and in Stockholm 20 percent. In general, the forest cover is the highest on the urban fringe, and lower in the strictly urban area. Surrounding landscape makes a difference, if it is a forested landscape the city will have more forest cover than if it is a landscape with a mix of forests and agriculture, and very much less if it is a purely agricultural countryside. 57 percent of outdoor recreation occurs in urban or peri-urban areas – using an area totaling 5 percent of Sweden. Since forests are the preferred environment for walks and jogging, this small segment of the land deserves the outmost attention.³⁰ In woodlands, designated areas for recreation can be separated from areas dedicated to biodiversity, allowing for the natural occurrence of dead trees, and fallen branches. Central Berlin in Germany serves as an example where minimal management and free development have been accepted, leading to increased biodiversity.

Real primeval forests are rare in forested Sweden. But really very old trees can often be found in cities.

In Sweden as well as in the United States, 21 percent of urban areas are lawns. In Sweden this means that 51.8 percent of all urban green spaces are lawns. Lawns can be managed differently. As is usually the case, lawns are neatly cut, which makes all cities look alike. You can't distinguish a lawn in London from one in Dubai, Shanghai or Uppsala. Lawns have few species, require irrigation and sometimes pesticides, and herbicides, and emit more CO2 than they absorb.

200 years ago, at the very large mansions in England, the well-cut and manicured lawn was invented. We must now change that culture. There seems to be public support for such a change. It has been shown that people rate grasslands with the highest species richness more positively than others with less biodiversity.³¹

It has also been shown that appreciation is the highest for old deciduous natural forests and next highest is the appreciation for old coniferous production (!) forests. For many people, nature should look a bit orderly, but not too much. Therefore, a way to combine biodiversity and the aesthetic preferences of city residents is to have “messy ecosystems in orderly frames”.

³⁰ A recently released report claims that local politicians in Sweden to 98 percent wish that more care should be taken to defend urban green but that only 47 percent can confirm that their cities and municipalities work with that (*Så kan kommunen stärka folkhälsan genom friluftsliv, Friluftsförbundet*, maj 2024).

³¹ Lindemann-Matthies, P., Junge, X., & Matthies, D. *The influence of plant diversity on people's perception and aesthetic appreciation of grassland vegetation*, Biological Conservation, 2010.



Figure 11. An example of messy ecosystem in an orderly frame. Photo : Maria Ignatieva.

Haymaking, grazed meadows and burned-prairie contains the highest biodiversity in the world: 63 species/m². Just by letting lawns grow wild, their biodiversity will start to increase.

When asked, people prefer the more natural areas compared to the orderly park. Bird song heightens the appreciation. Natural smells are a significant stress reduction factor.

From a recreational point of view, these characteristics are the most valuable, according to stated preferences and demonstrated behavior of people in cities:

- Big, tall trees
- Forests, not too dense or too sparse
- Smaller trails
- Varied forest
- Pasture and paddocks
- Varied topography with views
- Proximity to water
- Quiet and without noise

There are many ways to increase biodiversity and at the same time create interesting natural settings for children to play in and to learn from. It has been

shown that children are activated into more physical play and at the same time experience reduced risks of immune-mediated diseases by being given more natural playgrounds.

Most remnant forests (patches) in Swedish cities are less than 2 ha. It has been shown that interesting micro-forests may be created out of such patches.³²

Hedblom concluded: just by managing the landscape with a specific goal of biodiversity it is possible to create very sought after recreational spots.

Greening cities around the world

Cecil Konijendijk van den Bosch reported that there is, definitely, an emerging trend for greening the cities in the world. Countries like China, the US, and Saudi Arabia have made urban greening into national priorities.



Figure 12. Singapore, built park. Source: WWF, Sweden.

A leader in this movement is the city and state of Singapore. Already in the late 1960s President Lee Kuan Yew proclaimed that Singapore had to be high-tech, economically successful, and green. Since then, Singapore has reclaimed land from the sea and built parks on that land – not houses.

Today Riyadh in Saudi-Arabia has very few trees, with a tree canopy covering only 0.5 percent of the city. The city plans to increase the canopy to 9 percent, creating

³² *Multifunktionalitet i mikroformat. Gestaltning av en urban mikroskog med fokus på biologisk mångfald samt barns tillgång till natur*, Molly Owen, självständigt arbete, Sveriges lantbruksuniversitet, Uppsala 2022 (in Swedish). <https://stud.epsilon.slu.se/17973/1/owen-m-20220629.pdf>

441 new parks. This is an ambitious endeavor that will demand a significant increase in water consumption, which, in turn, will require the city to recycle water far more than today's 15 percent. City government has realized that without urban greening, it won't be possible to live in Riyadh in the future. With summer temperatures already reaching C 50°, unless they green the city, Riyadh will have to move. Environmental impacts are already necessitating moves in places like Indonesia, where Djakarta, sinking, flooded and congested, now is being relocated to Borneo.

Other examples of greening cities are the Greater London City National Park and the many Finnish National Urban Parks. Stockholm instituted a National City Park in 1995. This is now becoming a trend, worldwide. These are parks that are valuable not only locally but also nationally.³³

Konijendijk addressed the question whether these programs for greening cities are realistic. Dutch cities have a tree canopy cover of 16 percent. Many say that they cannot possibly hold more trees or greenery. His answer is that in the first place you have to realize that cities grow, and right now they grow very fast. It is, therefore, now when building new or expanding cities, that you have the opportunity to set aside large areas for nature. Once cities are built, it will be too late – all the green areas, surrounding the present city, will be gone.

Secondly, there is quite a bit of room in existing cities, even densely built ones, that could be greened. Take away room for cars and plant trees! That is what is being done in central Barcelona, where “superblocks” are being created, by limiting general car traffic to just every fourth street. This is also being done in several cities in South America. Initially residents are equally divided between positive and negative responses to these changes, but after two years most residents are positive when they see and experience the positive effects. People start sleeping better, find company on the street corner, people linger and spend more money in the shops etc.

An example of a strong reforestation of a city is Beijing, where 50 million trees were planted in the years 2012-2015. It increased the canopy cover by 10 percent.³⁴ Many years ago mayor Michael Bloomberg in New York set out to have a million trees planted. There is now a call for renewing the effort.

Konijendijk has been involved in producing a policy brief³⁵ for the Nordic Council of Ministers, which builds its recommendations upon four basic principles.

³³ See Murray, 2021/2022.

³⁴ Na Yao et al. *Beijings's 50 million new urban trees: Strategic governance for large-scale urban afforestation*, Urban Forestry & Urban Greening, 2019. <https://www.sciencedirect.com/science/article/abs/pii/S1618866719300378>

³⁵ *Nordic cities: Green, Resilient, Healthy, fostering national policies and initiatives for urban green space*, Nordic council of Ministers, 2021. <https://pub.norden.org/nord2022-018/#>

When creating or strengthening green infrastructure the work should follow the following principles:

- Proximity (green areas should be close to where people live)
- Connectivity (green areas must hang together)
- Diversity (several varieties of green areas should be aimed for)
- Equity (secure an equal distribution of green areas all over the city)

Konijnendijk has formulated a 3-30-300 rule, which is a guideline calling for every urban resident to have a view of at least 3 trees from home, living in a neighborhood with at least 30 percent canopy cover, and being able to access a public green space within 300 meters from home.³⁶ This rule was adopted by the city of Malmö, Sweden, in 2023, and will be part of its new city master plan.

The Urban Forest Master Plan for Birmingham is another good example for how to plan a green city.³⁷

For the Flemish government in Belgium Konijnendijk has recommended four fast fixes to improve the health of the population:

- Increase tree canopy cover!
- Increase the number of pocket parks!
- Increase the number of community gardens (allotment gardens)!
- Green school yards!

Research has found that neither government nor civic organizations organize and collaborate according to how ecosystems hang together and need to be taken care of. This deficiency needs to be taken account of.³⁸

If needed action is to take place, we need a broad social movement to do the job. A tool to engage a large segment of the population of a city, while also having control over the geographical dispersion, is the Stew-Map (short for map of stewardship organizations).³⁹

³⁶ *The 3-30-300 Rule for Urban Forestry and Greener Cities*, Biophilic cities Journal, 2021.

³⁷ <https://birminghamtreepeople.org.uk/about-us/the-urban-forest-master-plan/>

³⁸ Scale-Crossing Brokers and Network Governance of Urban Ecosystem Services: The Case of Stockholm, Henrik Ernstson et al., *Ecology and society*, 2010.

³⁹ <https://www.nrs.fs.fed.us/STEW-MAP/>

Trees – diversity needed!

City trees are the foundation for biodiversity in urban ecosystems. Their below ground interactions with mycorrhizal fungi and above ground interactions with pollinators are central to urban ecosystem planning.⁴⁰

Henrik Sjöman certified that today the importance of trees in cities is well proven by science.

In the last decades research has demonstrated the capacity of trees to capture particles in the air, thereby contributing to better air quality in cities, to absorb storm water, increase biodiversity and much more (see figure 13).

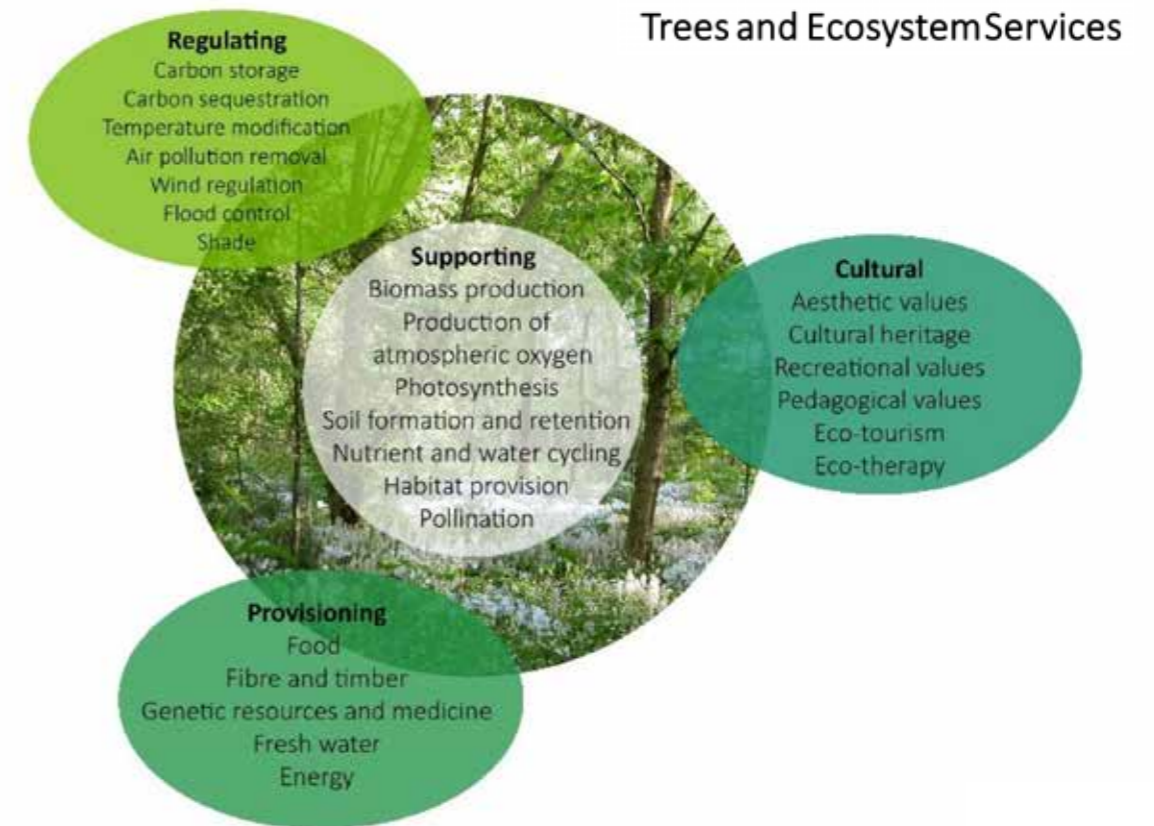


Figure 13. The many ecosystem services of trees.⁴¹

Sjöman has noted that planting is seen as a savior and a general truth held among NGOs, city planners and politicians. Campaigns for planting millions of trees have been initiated (see figure 14!).

⁴⁰ Philip C. Stevenson et al., *The state of the world's urban ecosystems: What can we learn from trees, fungi, and bees?* Plants People Planet PP, 2020.

⁴¹ Henrik Sjöman and Arit Anderson, *The essential tree selection guide for climate resilience, carbon storage, species diversity and other ecosystem benefits*, Filbert Press, 2024.



Figure 14. Tree planting campaign.

This is a dramatic shift, one that has taken place in a few decades. However, the emphasis is too often just on quantity, without consideration of what kind of trees should be planted, or if a variety of species is better than just a few.

Planting new trees, Sjöman claims, is the most important thing that can be done for biodiversity and other ecosystems services in cities. But it must be done with care. 25-40 percent of trees planted in urban settings fail in the US and probably also elsewhere.⁴²

Add to that climate change. Long periods of droughts and more instances of extreme flooding will create quite different circumstances for trees to grow. It all adds up to three challenges that we need to better understand:

- the capacity of different tree species for delivering ecosystem services,
- the ability of different tree species to grow in different habitats and
- untraditional – non-native – species.

Most cities exhibit a low variation of species. Three species often make up half to three quarters of the trees in a city.

⁴² Nowak, D. J., & Greenfield, E. J. *Tree and Impervious Cover Change in U.S. Cities*. Urban Forestry & Urban Greening 2012.

Limited diversity of urban trees

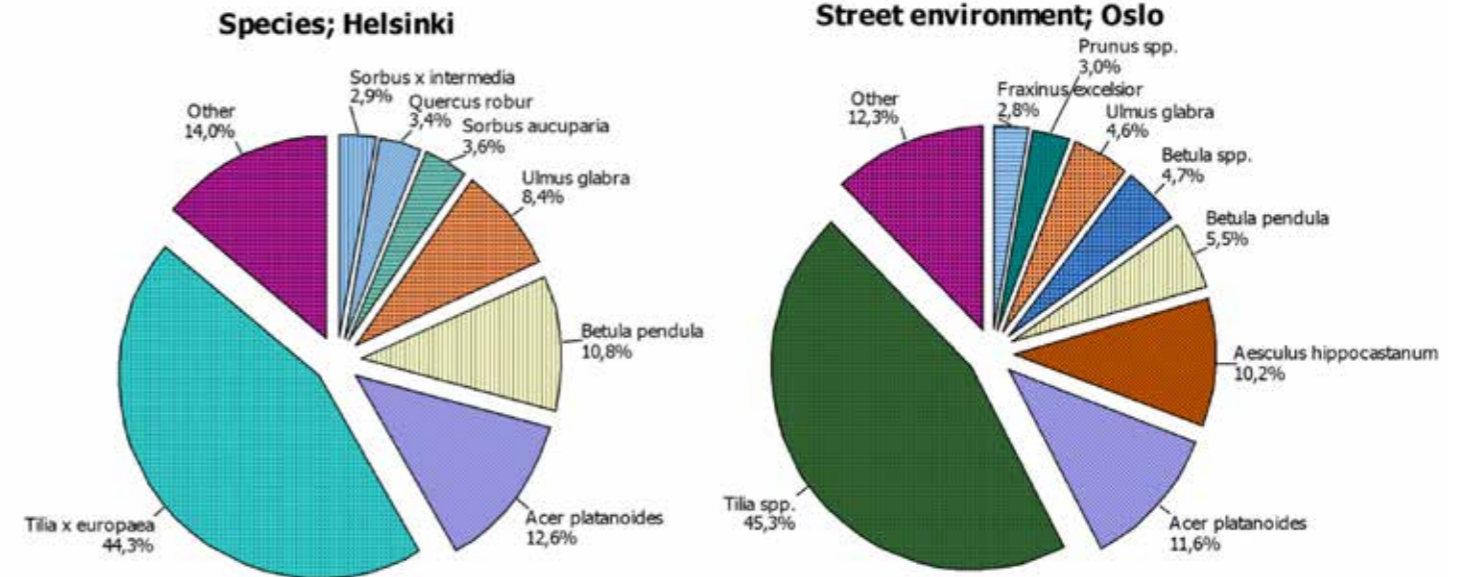


Figure 15. Too few varieties of trees in most cities. Helsinki parks and streets, Oslo just streets.⁴³

In Stockholm 24 percent of the trees are lindens, 19 percent maples, and 8 percent birches. In Copenhagen 25 percent are lindens, 9 percent planes and 8 percent are maples, leaving the rest a more varied set of tree species. There is a great risk that diseases or insects will infest any of these species, like the Dutch elm disease has done, causing the loss of a large segment of the trees in our cities.

A threat that has for some time been observed is the Asian Long-horned Beetle. Unlike other infections or insects it attacks a very large variety of trees. In a realistic scenario, an invasion of Asian Long-horned Beetles might cause the loss of 45 percent of all urban trees, in worst-case scenarios up to 95 percent.

In a simulation of the impact of various types of attacks on trees in Sweden – droughts, diseases, insects, floods – Sjöman forecasts that only four native (broad definition) species out of thirty are likely to survive. The four surviving species are juniper, bird cherry, Swedish whitebeam and common hornbeam. Of the four, only Hornbeam is a large enough tree that will provide shade. His conclusion is therefore that we need to search for non-native species that will be more resilient. For example, conifers of many different varieties are known to be able to grow under very different conditions – humidity, light, temperature, and winds.

Within a specific species there is a wide genetic variation that should also be considered. Individuals of the same species have adapted to and live under very different circumstances. Therefore, we should search for varieties of species that have adapted to live in tough climate conditions, such as that we can expect in the

⁴³ Sjöman, Henrik and Östberg, Johan, *Vulnerability of ten major Nordic cities to potential tree losses caused by longhorned beetles*, Urban Ecosystems, 2019. https://www.researchgate.net/publication/330898242_Vulnerability_of_ten_major_Nordic_cities_to_potential_tree_losses_caused_by_longhorned_beetles

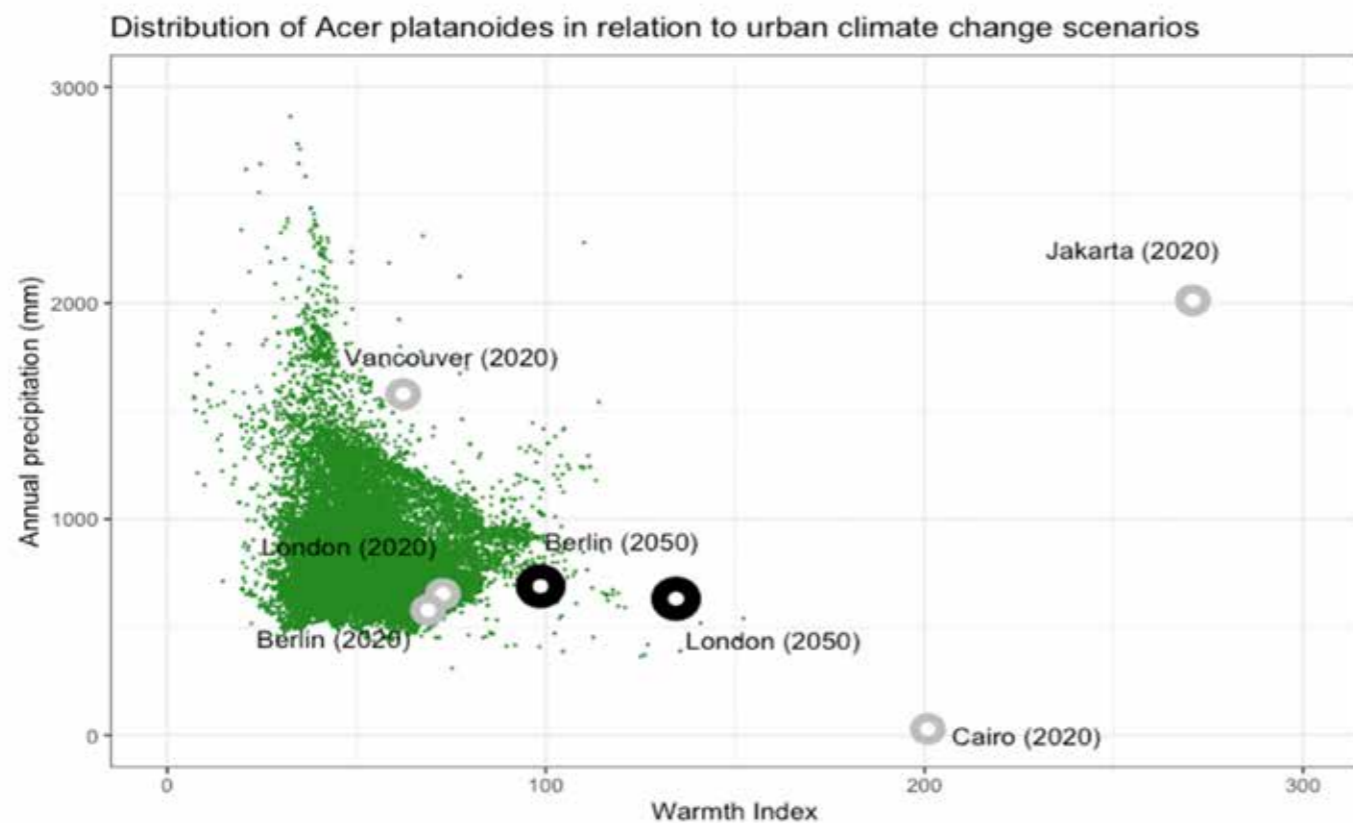


Figure 16. Maples growing under different climate conditions, precipitation and warmth. Each green dot is a maple habitat.⁴⁴

All in all, it means we cannot rule out exotic tree species and need to experiment with species from far off places if we are going to sustain viable tree populations in our cities in the future. We must reckon with that this will require and cause adaption by a great number of other species – fungi, birds, lichens, insects – that make up the ecosystems in our cities.⁴⁵ This calls for human design of nature based on scientific evidence, to speed up evolution.

Sjöman’s general advice is: don’t think species, think habitats! And he points to the allotment garden as the exemplary place of a bountiful of habitats.

Sjöman suggested further reading about the city of Sheffield, UK, and its program for greening the city⁴⁶ and consulting Great Dixter about biodiversity.⁴⁷

⁴⁴ Henrik Sjöman and Harry Watkins, *What do we know about the origin of our urban trees? – A North European perspective*, Urban Forestry & Urban Greening, 2020.

⁴⁵ Henrik Sjöman et al. *Diversification of the urban forest – Can we afford to exclude exotic tree species?* Urban Forestry & Greening, 2016. See Henrik Sjöman and Arit Anderson, 2024.

⁴⁶ <https://www.local.gov.uk/pas/topics/environment/nature-recovery-and-biodiversity-case-studies/how-sheffield-city-council>

⁴⁷ <https://www.greatdixter.co.uk>. Great Dixter is a renowned garden and shop in East Sussex, UK

Be aware of disservices!

Anton Stahl Olafsson brought up potential conflicts of interests in relation to urban green. His message is not to abstain from greening cities but to be aware of disservices and people’s attitudes, positive and negative. To fully reveal the many co-benefits of biodiverse cities, attention and strategies are needed in order to mitigate possible trade-offs, disservices and dilemmas that might arise from a biodiversity transition of Nordic cities.

The many positive ecosystem benefits have been contrasted with urban ecosystem disservices. A list of disservices may look like this⁴⁸ :

- City trees and bushes emit volatile organic compounds (VOCs)
- Trees may blockage views from buildings
- Pollen may cause allergic reactions
- Falling trees and broken branches may cause accidents
- Vegetated areas may be perceived as scary
- Vegetation may break up pavements, sewer systems etc.
- Animals, snakes, insects, rats are considered unpleasant

Humans have many negative nature experiences such as bites, bruises, infections, poisons, scares etc. from snakes, insects, nettles, wolves and so on. This has caused a degree of disconnection from nature. While it is often true that appreciation of nature overtakes these negative experiences for most people, there is a good reason to keep this in mind when planning for urban green.⁴⁹

Cultural norms and disconnection from nature are serious problems to be overcome for the greening of cities to be successful. It has to do not only with individuals’ various phobias but has to do with the way man’s exploitation of nature is built into philosophy, politics, and economic policies. That there is a vicious cycle distancing city dwellers from nature and increasing their alienation is recognized. But so is also its opposite, the good cycle, that by bringing nature closer to people in cities people’s awareness and appreciation of nature can increase.⁵⁰

The overall picture from opinion polls in Copenhagen and Helsinki is that people appreciate urban green but also that there are negative attitudes in connection with such disservices as the ones mentioned above. A general conclusion is that, from

⁴⁸ Gómez-Baggethun, et al. *Urban ecosystem services in Urbanization, biodiversity and ecosystem services: Challenges and opportunities: A global assessment*, Springer, 2013.

⁴⁹ Soga, M., & Gaston, K. J., *The dark side of nature experience: Typology, dynamics and implications of negative sensory interactions with nature*, People and Nature 2022.

⁵⁰ Beery, T., et al. (2023). *Disconnection from nature: Expanding our understanding of human–nature relations*. People and Nature

various perspectives, urban green among city residents (Helsinki) is valued more highly the richer biodiversity that there is, up to a point. Appreciation then diminishes as biodiversity increases still more.

There is also a curious effect of preserving parts of nature. Areas, not protected but rated very highly by experts for their biodiversity, are not recognized as such by residents. But already protected green areas enjoy high appreciation by both experts and residents. It seems that just designating an area as a nature reserve, and, perhaps, informing about it, causes people to appreciate such an area. Is that a way to manage urban green that will eliminate conflicts to some degree, such as fear of wild animals, bats, bugs? Designate it as a protected area and inform the public!

By all accounts, people appreciate being outdoors, having a walk etc. What about biodiversity in itself? Surveys show a very strong support for wild nature in comparison to maintained lawns, flower beds and sports facilities. In a survey about a future Nature Park in Nordhavn (Copenhagen) wild nature was rated positively four times as often as maintained lawns and sports facilities.

To understand inhabitants' views about urban greening Stahl Olafsson recommended Public Participation Geographic Information Systems (PPGIS). PPGIS are surveys taken of residents' evaluation of urban green and different varieties thereof. Such surveys taken in Copenhagen show that "wild" nature is highly appreciated, but so are sports facilities. These are conflicting views and must be accommodated in planning for urban green.

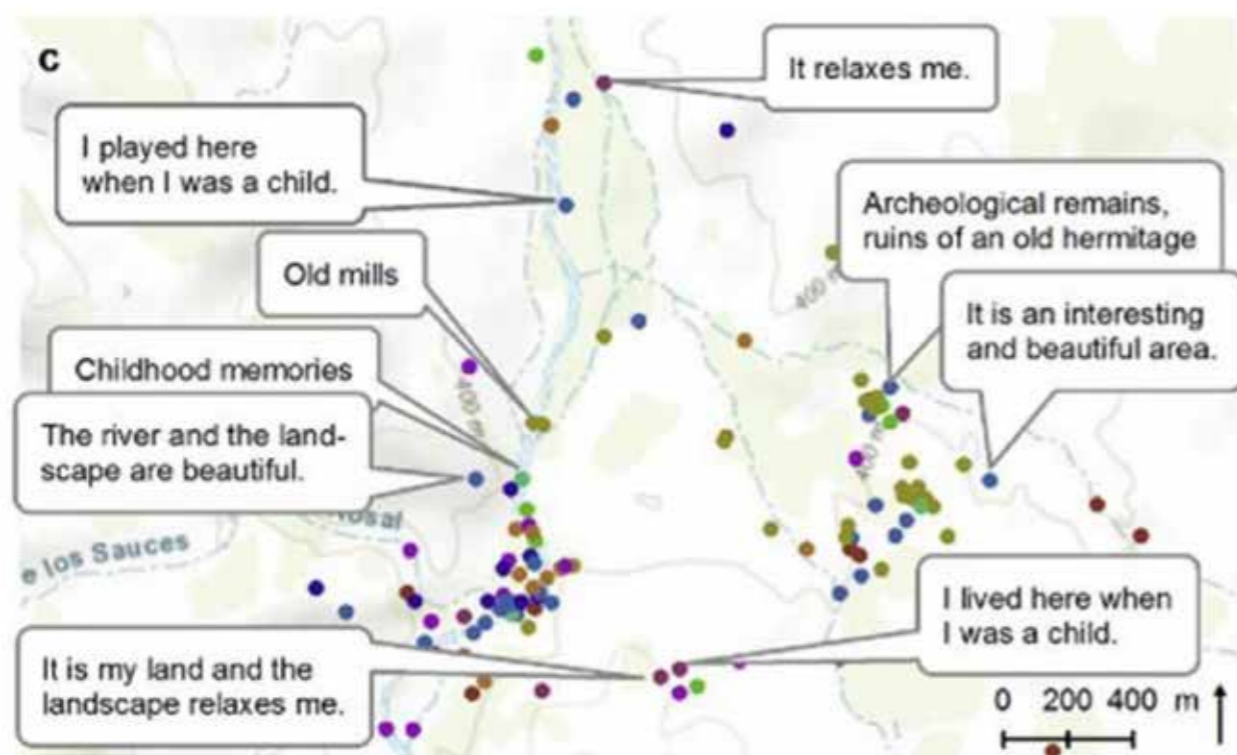


Figure 17. PPGIS map. Credit: Nora Fagerholm.

An example of a conflict between aesthetics, biodiversity and environment is the management of a city lake in Copenhagen. There the great Cormorant inhabiting the lake started to increase in numbers during a general national Cormorant population increase. From a biological point of view, the great Cormorant helped improve the water quality by catching small fish that helped increase the population of larger predatory fishes that again increased the level of zooplankton at the expense of phytoplankton. Thereby better water quality was going to be achieved. However, Cormorants killed the trees on an island in the lake and their guano caused a bad smell, which angered nearby residents.

Light pollution is another example of a conflict. Some people value strong artificial light at night which is harmful for species like birds, bats, and insects – even for nature as a whole, which needs to get some sleep.

Handling conflicts of interests

How to handle conflicts of interest and the disconnectedness from nature? **Stahl Olafsson** recommends creating spots of nature in the urban environment so as to create incidental experiences of nature.⁵¹ **Hedblom** coined the phrase "messy ecosystems in orderly frames" in order to be increase biodiversity in urban environments.

Mapping biodiversity and public appreciation of green areas is a recommended tool to find areas where it will be uncontroversial to protect and promote biodiversity. How to work with areas that are of high concern for biologists but of no interest to the population? Will educational efforts work? Show-casing smaller nature conservation projects is suggested.

Regarding the different views on the type of greenery that is preferred and the kind of activities that people want to undertake outdoors, the conclusion must be that one size does not fit all. There must be a mix of various types of urban green.

Stahl Olafsson sees no general hierarchy of values that should be promoted everywhere but recommends to look at each place in its own context. Cultures differ and there may even be a blend of cultural diversity and biodiversity that can be successful.

Aril Vatn addressed the critical issue of how to reach decisions on highly controversial policies, such as climate and biodiversity. He started by pointing out that the fundamental issue in decision-making is how values are expressed, taken

⁵¹ Beery et al., *Fostering incidental experiences of nature through green infrastructure planning*. *Ambio*, 2017. Barragan-Jason et al, *Human–nature connectedness as a pathway to sustainability: A global meta-analysis*. *Conservation Letters*, 2021. <https://doi.org/10.1111/conl.12852>

notice of, and used for rating alternatives. Commodities can be valued by people's willingness to pay – which is reasonable for an individual assessment and consequent decision. Commodities are valued instrumentally according to usefulness. This is a truly anthropocentric perspective. Values can, however, be of a different kind. There are intrinsic and relational values. Very often this is the case in relation to nature, but also in relation to other phenomena such as people, institutions, art etc. This may still have an anthropocentric aspect, but it may also be based on perspectives disconnected from individual, human appreciation, and instead reflect perspectives based on philosophy, religion or science.

In city building, conventionally, instrumental values tend to dominate. But, since cities also are common (public) goods, intrinsic and especially relational values are very important and should be taken into account. Nature, the whole array of complex ecosystems, is, just the same, an area where intrinsic and relational values apply.

Vatn demonstrates that intrinsic and relational values are poorly handled by markets. Markets are places for individuals. Politics overcomes the limits of markets and may express and act on intrinsic and relational values. So can other collective decision-making processes, like town-hall meetings, cooperatives, unions etc. This does not mean that the individual has no say, but it means that decisions are formed in a dynamic process, with arguments and dialogue and learning, that might end in very different decisions compared with the market. The conclusion is that in matters concerning urban greening and urban biodiversity the public dialogue and consultations with residents are of prime importance.

Vatn contrasts two ways of handling nature values in decision-making – environmental accounting and participatory (deliberative processes) decision-making. Even though there are substantial efforts put into monetizing nature values no economist will claim that all of nature's attributes and aspects can be valued by market prices. Therefore, valuation schemes often result in a combination of monetary and non-monetary values.

In passing, Vatn notes that monetary evaluations have had little impact on decisions taken.⁵²

When it comes to decisions about nature values it is important to consider in what way values should be extracted – is it mainly through individual assessments (could be through questionnaires as well as market evaluation) or through some common decision (after a public discussion).

⁵² Barton, D. N. et al. *Value expression in decision-making* in Methodological Assessment of the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (eds Balvanera, P. et al.), Zenodo, 2022. <https://zenodo.org/record/6522261>

Vatn favors citizens' deliberative process for several reasons:

- It deepens democracy
- It engages people in the issues at stake (climate, biodiversity etc.)
- Participation and deliberation reduce egoism
- Increased focus on long-term
- Reduces the influence of special interests

Such deliberative processes require skill and good will to be conducted well, without manipulation. It is important to realize that people may reveal different values dependent on the institutional context.⁵³ They are time-consuming and there is no guarantee that results will be implemented. Nevertheless, Vatn argues that they are needed to achieve decisions that solve the big environmental problems of today, and doing that in a way which succeeds in attaining wide-spread popular support, which is necessary for a successful implementation. There are several good examples of deliberations around the world:

National examples:

- The Irish citizens' assembly on biodiversity loss (2022)
- The UK people's assembly for nature (2022)
- The French citizens' assembly on the climate (2019)
- The Danish citizens' assembly on climate (2021)
- The first Swedish citizens' assembly on climate policy (2024)

Local examples:

- The citizens' assembly of Dublin – e.g. reports on biodiversity and climate (2022)
- Copenhagen climate citizens' assembly ('klimaborgereting') (2020)
- Tallinn Green Capital Citizens' Assembly (2023)
- People's assembly ('folkepanel'/'folkestemmen') in Larvik Norway (2023)

⁵³ Vatn, A., *Institutions for sustainability—Towards an expanded research program for ecological economics*, Ecological Economics, 2020.

Planning and taking action for urban biodiversity in Nordic and Baltic cities – from regional and city planning to plants

An analysis of green infrastructure planning in 23 Scandinavian cities shows that biodiversity and protection of green spaces plus green corridors or paths is a top priority, however, mostly in conjunction with many other environmental and social aims.⁵⁴ It seems, therefore, as if green infrastructure and nature-based solutions are planned to satisfy several needs, and to avoid conflicts. But it may also be concluded that social aims still dominate the greening of cities. A conclusion, therefore, could be to look for projects with synergies between biodiversity and green space on the one hand and social aims like recreation, health, meeting places, playgrounds, and cultural heritage on the other hand.

National guidelines

The *Swedish Environmental Protection Agency (EPA)*, represented by **Anki Weibull** and **Linn Lagerberg**, underlined that urban biodiversity depends on biodiversity in the rural landscape. It has, therefore, to do with agriculture and forestry around cities. A group of Swedish municipalities have started to manage their forests – usually on the periphery of the urban area – without clear-cutting. Among them are

- Gällivare
- Ulricehamn
- Motala
- Trollhättan
- Ovanåker
- Nordanstig
- Söderhamn

Other cities have set aside costal zones, where exploitation is prohibited. One example is the city of Lomma in southern Sweden.

Green infrastructure planning is not mandated by law in Sweden. However, the government assigned all county administrative boards in 2015 to map, assess and suggest actions for preserving and developing green infrastructure in and around

⁵⁴ Nordh, H., & Olafsson, A. S. *Plans for urban green infrastructure in Scandinavia*, Journal of environmental Planning and management, 2021.

major conurbations in Sweden. This resulted in reports from all county governments in Sweden.⁵⁵

In 2022 The Swedish EPA and the Swedish National Board of Housing, Building and Planning issued guidelines for municipalities in Sweden.⁵⁶ Weibull and Lagerberg described how the guidelines advocate for green infrastructure to be planned on par with other forms of infrastructure. Therefore, a green master plan is essential. Parks and green spaces need to be taken into consideration in the same way as roads and sewage systems. In addition, the two government agencies strongly urge municipalities to make use of nature-based solutions.⁵⁷

A comprehensive green plan should, therefore, comprise several parts. Se figure 18!

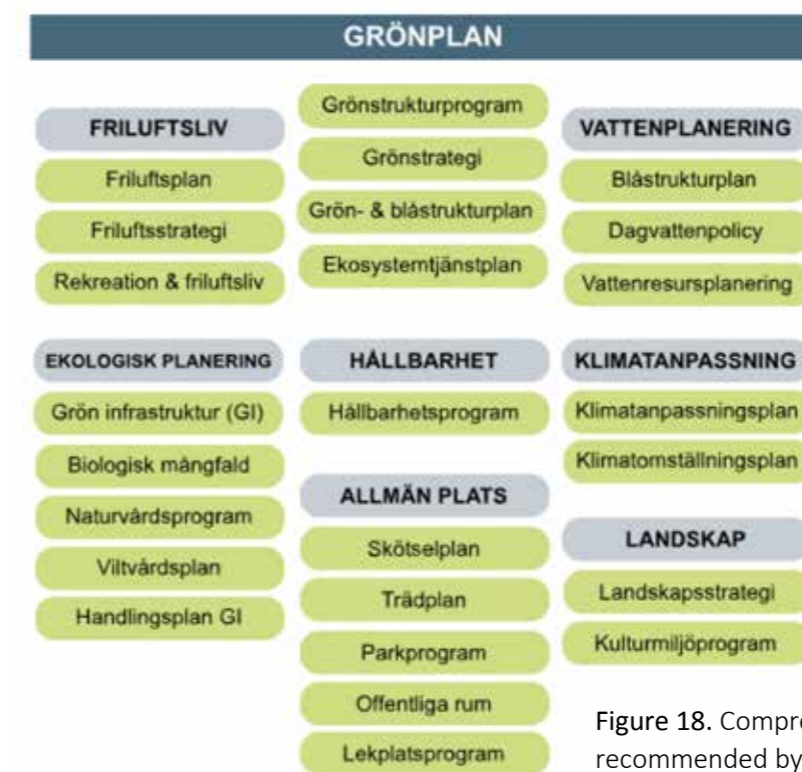


Figure 18. Comprehensive green planning recommended by EPA and the Swedish National Board of Housing, Building and Planning (in Swedish).

EPA recommends the 3-30-300 rule (see above!). Green accessible areas should not be smaller than one hectare.

⁵⁵ An example of these reports is Grön infrastruktur. Regional handlingsplan för Stockholms län, rapport 2019:12, Länsstyrelsen Stockholm (in Swedish) <https://catalog.lansstyrelsen.se/store/39/resource/213>
⁵⁶ www.boverket.se/sv/PBL-kunskapsbanken/teman/gronplan/
www.naturvardsverket.se/vagledning-och-stod/samhallsplanering/gronplanering/
⁵⁷ The Swedish EPA defines nature-based solutions (NBS) as “multifunctional and cost-effective measures to address different societal challenges through protection, enhancement or creation of ecosystems, benefitting both biodiversity and human well-being” (def. based on modified definitions of IUCN, CBD and EU). NBS aims to

- Promote sustainable development
- Enhance biodiversity and ecosystem services
- Create multifunctionality
- Increase resilience and reduce vulnerability

Source: Nature-based solutions. A tool for climate adaption and other societal challenges, Naturvårdsverket 2022. <https://www.naturvardsverket.se/publikationer/7000/978-91-620-7074-8/>

Up to now, half of Swedish municipalities report being well aware of the guidelines. Still, only one reports having initiated a nature-based solution to a local environmental problem.

Start with a regional perspective!

Klara Tullback Rosenström, the County Administrative Board of Stockholm, demonstrated new tools for green infrastructure and biodiversity planning. For over thirty years green wedges have been an important part of regional planning in the Stockholm region.

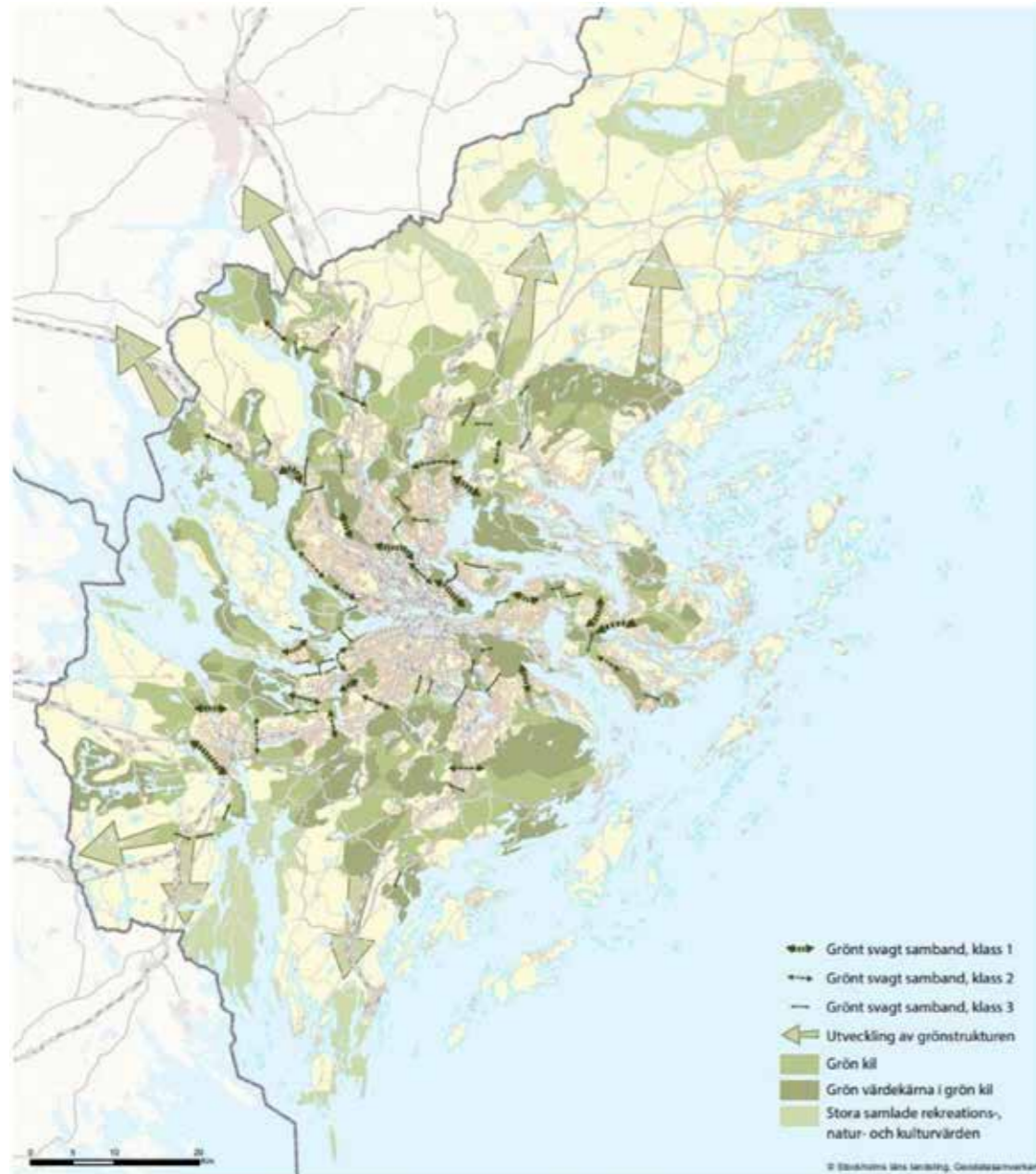


Figure 19. Map showing green structures/green wedges in the Greater Stockholm region. Black arrows show weak connectivity.⁵⁸

⁵⁸ Regional plan, Stockholm County Council.

A modern tool for planning is a biotope map. It is currently being developed, but can already be used, all over the country.⁵⁹ It has a very detailed legend identifying various nature types, including hard surfaces. A guideline for how to order analyses of habitats and connectivity is presently being prepared (in Swedish).⁶⁰ Most the 25 municipalities in the Stockholm County use these maps to plan for green infrastructure. In their masterplans for city development, green plans are as essential as plans for housing, roads etc. Municipalities take account, not only of connectivity deficiencies and needs within their own borders but also between municipalities. At present Tullbäck Rosenström is engaged in a project to develop objectives and indicators for green infrastructure.⁶¹

Oslo

Oslo, as related by **Nicolai Ljøstad Aasen**, is situated in a fertile area, ten rivers crossing it on their way to the Oslo fjord (bay). The microclimate helps to bring about a rich set of species. 32 percent of the built-up zone is covered by parks, forests and green areas. The city is surrounded by forests. According to Norway's Biodiversity Information Centre, Oslo is the most species rich city in Norway. A recent count identified 13,398 species, which is 30 percent more than the next richest. Of those 1,031 are red-listed out of the 4,957 total for Norway as a whole. Black-listed, alien species (introduced in Norway after year 1800, posing a risk for biodiversity) are 757 out of a total of 2,342 for all of Norway.

Oslo is fast growing, one of the top ten fastest growing cities in Europe. By 2050 the population is projected to more than double.

The "Marka Act" separates urban areas from forests and agricultural land surrounding the city. The division was drawn up in 1938 and has been kept since then. "Marka" constitutes 68 percent of the total acreage of Oslo. Within "Marka" no exploitation is permitted. City growth puts great pressure on the built-up zone, in which it becomes even more important to defend biodiversity. In patches of forests – for example a limestone forest – within the city there are examples of a large number of red-listed species.

In 2009 a Nature Diversity act was adopted. It protects several species and habitats. Four of those habitat types exist in Oslo: hollow and large oaks, traditional hay meadows, limestone forests and limestone meadows. The Oslo Master Plan regulates habitats and waterways. Going even further are zoning plans for various districts, a special plan for villa areas ("småhusplanen") which prohibits cutting down

⁵⁹ www.biotop.se

⁶⁰ <https://catalog.lansstyrelsen.se/store/25/resource/287>

⁶¹ <https://catalog.lansstyrelsen.se/store/18/resource/1402>

trees with a larger circumference than 90 cm. A Biodiversity Action plan was decided in the autumn of 2023. It ensures that Oslo works according to the EU Green Deal and the CBD Framework from 2022.

All of Oslo’s urban areas have been mapped for biodiversity. Each area is described by nature type and what kind of species are contained, also invasive. The biodiversity of each area is rated on a scale a, b, c, with a the most important.

The Department of Urban Environment is consulted early in the process of a planned building development by the Department for Planning and Building Services, by instruction as soon as the plan comes closer than 50 meters from species noted. The department for Urban Environment suggests precautions and remedies but does not have the final say.

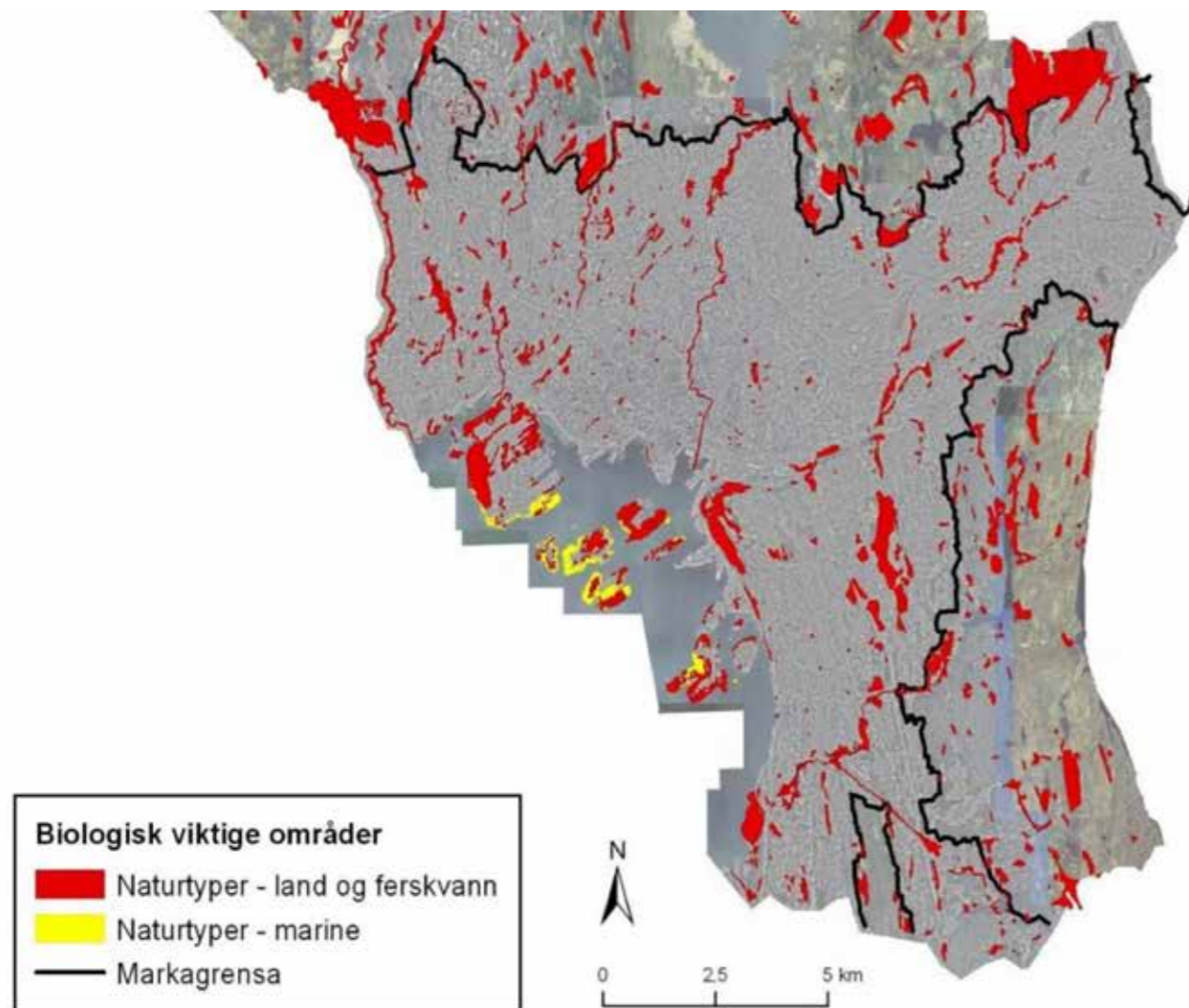


Figure 20. Oslo especially Biologically Valuable Areas, totaling 1,200 areas, according to number of nature types: large old trees (470), park landscapes (33), rich deciduous forests (115), limestone forests (45), limestone meadow (140), hay meadow (32), natural pasture (25) and ponds (80). The black lines show the “Marka Act” border beyond which no exploitation may take place within Oslo municipalities. The map does not show all green areas, parks and forests, just the specific nature types listed.

Copenhagen

What is being done in the City of Copenhagen was presented by **Sabine Zwergius Teilmann** and **Henriette Berggreen Nguessan**.

Greater Copenhagen is made up of 44 municipalities that need to cooperate. For many years, Greater Copenhagen has been guided by the “fingerplan” – a set of green wedges. Efforts are made to uphold this plan.

The city of Copenhagen is lowly situated (2 m above sea level) and has experienced a serious rainstorm a few years ago. Today Copenhagen to 29 percent consists of publicly accessible green areas and 3 percent open freshwater. 8 percent is protected according to the Nature Protection Act. The first biodiversity strategy was adopted in 2015. Now there is a new biodiversity strategy for the years 2022–2050 and an action plan for 2022-2025. The vision is that the decline in biodiversity shall be reversed by 2050 and that all Copenhageners shall have access to nature and nature experiences. By 2050 publicly accessible green areas should increase to 30 percent, protected areas to 10 percent. Total freshwater areas – ponds, streams, ditches, wetlands – shall increase by 10 percent. Through education, knowledge about biodiversity shall be promoted.

The city of Copenhagen is set to grow by 100,000 inhabitants until 2050 – from 650,000 today. Population density is already quite high, 7,200 people/km². Therefore, landfill will play an important role.

This calls for action to protect land from storms.



Figure 21. Copenhagen. Planning for levees (“diger”). Blue have already been put in place, yellow are to come.

In connection with storm surge protection measures biodiversity is to be enhanced, a typical nature-based solution. Stone dams and coastal landscape are designed to stem future sea level rises.

Lynetteholmen is a completely new urban area to be built on a landfill. The idea is that the development of the eastern coast will strengthen the connectivity between the existing green areas along the coast and their relationship to the sea. The total landfill for Lynetteholmen is 271 hectares. Of that, 60 hectares will be coastal park. A new seabed of 17 hectares outside the shore will help to dampen waves. There, a marine park will be established with lots of eel grass planted. This is to compensate for the loss of biodiversity caused by the landfill.



Figure 22. Copenhagen. The green hatched areas are areas within the city where nature and nature experience should be the primary focus – both land and water.

Figure 22 shows nature areas that constitute the green city. In addition, the green city also encompasses cemeteries, parks, trees, and private gardens.

In other parts of the city – the grey city – biodiversity is integrated in conjunction with the city’s other activities such as:

- stormwater management projects
- road rehabilitation projects
- area revitalization and other urban renewal projects

There is also a special program for the blue city – lakes, rivers, ponds, harbor, ditches, and coast.

The strategy follows four themes:

- Existing biodiversity shall be protected and improved. An example is the large nature park, Amager Fælled, which has been established some years ago.⁶²
- New habitats for biodiversity shall also be created. An example is pocket parks replacing asphalt in the gray city. Another example is seaweed planted in the harbor.
- Knowledge and education about nature and biodiversity is to be realized through greening school yards in connection with lectures.
- Voluntary communities for biodiversity with examples of allotment gardens, street gardening and divers clearing shores and sea bottom from scrap will be encouraged.



Figure 23. Copenhagen. Green connections.

Special attention is given to green connections, often across municipal borders. This calls for cooperation between municipalities.

Work is focused on ten species, among them some butterflies and insects, a selection of birds, a bat, the small amphibian salamander, and the hedgehog.

⁶² See Murray, 2021/2022.

The action plan sets out to map existing habitats and biodiversity and will start monitoring biodiversity with a baseline next year. The monitoring will be done every second year in order to capture the development – an assessment of the success of the policy (in competition with other factors). With the action plan comes funding from 2024 for municipal and citizen-focused biodiversity projects.

Stockholm

Ulrika Egerö and **Viveca Jonsson** related how the city of Stockholm is handling biodiversity.

Already in the 2018 master plan for Stockholm it was stated as one of the important aims to have a strong green infrastructure that should be robust, and that a rich biodiversity should be preserved and strengthened. Special attention was to be paid to functions that are of regional importance for biodiversity. Weak parts of the green infrastructure – connectivity that needed to be strengthened – were pointed out. 2018 was the first time this was done in a master plan.

At the same time, it was stated that a very ambitious building program – 140,000 new apartments until 2030 – was taking place and was to be completed.

In 2020 an Action plan for biodiversity in Stockholm was decided.⁶³ It is based on the following strategies:

- Call attention to priority species and nature types.
- Have biodiversity observed in the city’s planning and decision-making processes.
- Undertake actions to strengthen ecosystems.
- Develop knowledge and communication.
- Develop tools for coordination and implementation.

One of the primary tools for biodiversity in city planning, restoration projects and management of parks and protected areas, is a number of different spatial datasets. Among them is a map showing ecologically especially valuable areas (ESBO), pointing out core areas, connectivity corridors and habitats for prioritized species. A project has been to create maps with specific suggestions in specific places in the blue-green infrastructure to strengthen biodiversity. This has been done by aggregating information from these datasets about habitat networks, biotopes, and predominance of certain species.

⁶³ <https://start.stockholm/globalassets/start/om-stockholms-stad/politik-och-demokrati/styrdokument/handlingsplan-for-biologisk-mangfald-i-stockholms-stad.pdf>

For Stockholm it becomes a tricky issue to handle biodiversity under conditions of massive house building. For city districts where a lot of housing is going to be built special district plans are being made (see figure 24).



Figure 24. District plan for Hagsätra-Rågsved, southern Stockholm. New housing (black squares) is placed in some green areas, while at the same time protection is given and measures undertaken to strengthen connectivity. This is based on a detailed map of biotopes, habitats, and connectivity. Legend: dark green (areas not to be exploited), light green (when built, buildings should be fitted in with care), blue ring (extra care should be taken), arrow (connectivity to be strengthened), brown ring (habitats should be strengthened), acorn and pine cones (biotopes to be strengthened), bird (special measures to be undertaken for insects and for tits (“barrskogsmes” in Sw.)).

The focus is on old oak trees, old pine trees, wetlands, and shores. A number of species that are connected with other forms of biodiversity are prioritized, such as crested tit (“tofsmes” Sw.), toad (“padda” Sw.) and insects belonging to old oak trees. In the end there is a compromise between new housing, roads, schools etc. and biodiversity. If new development is to take place in areas of specific interest for biodiversity it is recommended that special care for biodiversity must be taken. Forest areas in the city of Stockholm are, up to 80 percent, of very high biological value. Many developments are bound to take place in such areas.

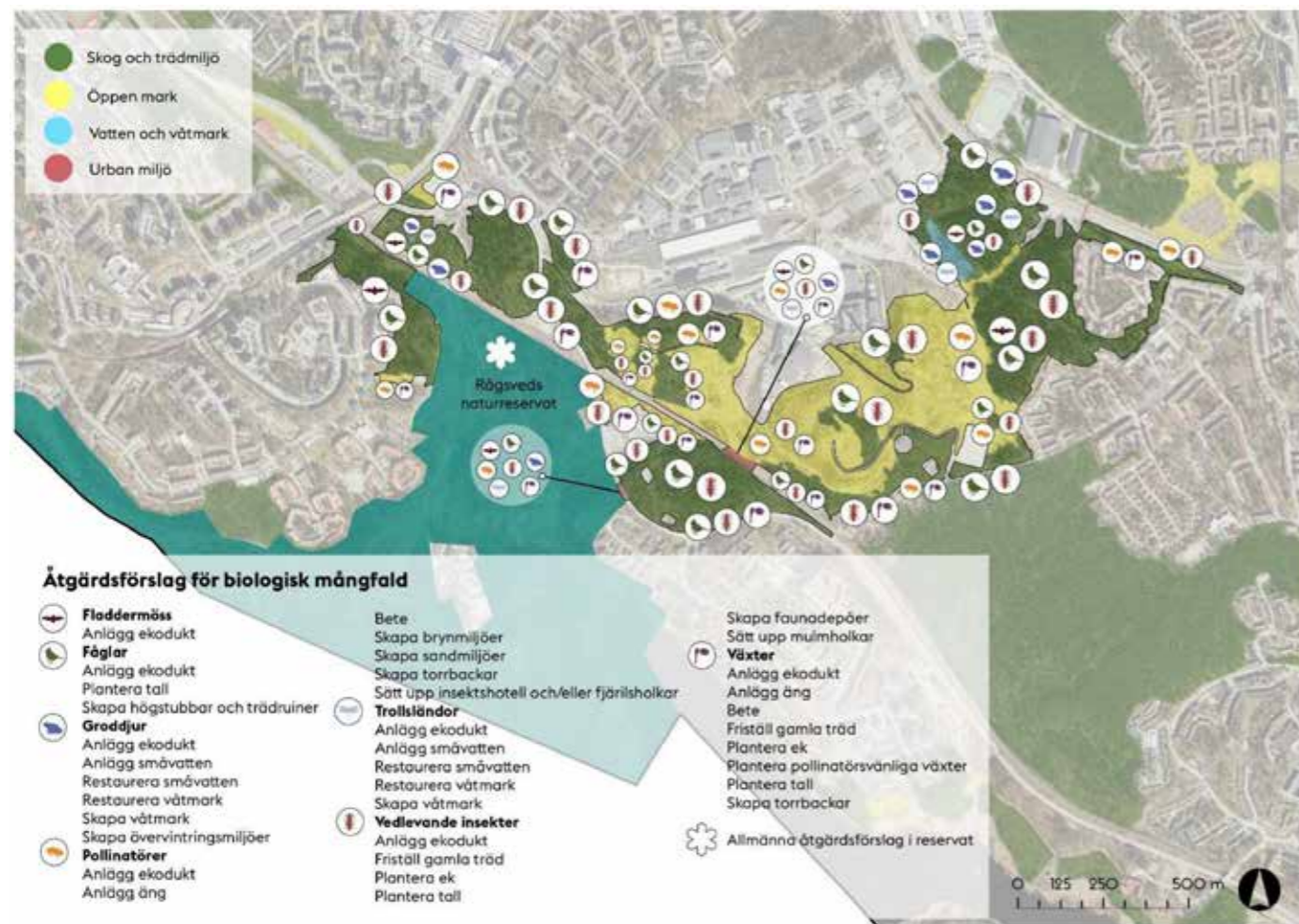


Figure 25. Map showing a district in southern Stockholm where suggestions from the Department for Environment and Health for measures to enhance biodiversity are plotted.

Local areas in Stockholm where specific habitats or connectivity is important have been investigated and measures to promote biodiversity have been suggested by the Department for Environment and Health. Measures include ecodecks, wetlands, tree planting, cutting away asphalt etc.

The general level of knowledge about nature in Stockholm is relatively good. Some money has been allocated to Local Biodiversity Measures and a catalogue of such measures has been produced and circulated. It has stimulated local, municipal administrations to apply for specific projects.

An overall monitoring of biodiversity – insects, birds, toads etc. – will eventually indicate possible progress.



Figure 26. One example of a nature-based solution in a suburb in Stockholm. Instead of concrete slopes, a series of terraces have been proposed, filled with flowers. It will enhance both the aesthetics, lower temperatures, absorb heavy rains and promote biodiversity.

Stockholm monitors a limited number of species – frogs, toads, birds, etc. – in specific places, and has been doing so for several years. Air and water pollution is monitored more closely.

Vilnius

Ramunė Baniulienė told about Vilnius, the capital of Lithuania, that the city works ambitiously with biodiversity, turning the city from brown to green. The city has a population of around 592,400 residents, and spans an area of 401 km², resulting in a population density of approximately 1,480 inhabitants per km². A public campaign – “A Green Wave” – aims at raising people’s awareness and encouraging citizens to green their doorsteps.

Although 61 percent of the city of Vilnius is covered by green areas, which has to do with a peri-urban nature park – Pavilnys Regional Park – stretching right into the midst of Vilnius, it also has brown-field areas that are or will be transformed. Pavilnys Regional Park contains a river with salmon, spined loaches and trout. It is a Natura 2000 area. 1,400 ha in Vilnius are Natura 2000 areas.

Nestled amidst hills in the valley of the Neris river, its Old Town has held UNESCO World Heritage Site status since 1994. Notably, Vilnius boasts substantial green spaces, including parks and the Neris river, which serve as crucial ecological corridors supporting urban biodiversity. Within the city boundaries, there are eight protected nature reserves and 18 Natura 2000 sites housing 19 species and 18 habitat types of European Union significance.

Lithuania faces significant challenges due to climate change, characterized by shifts in temperature, precipitation patterns, and a diminishing snow cover. Despite hurdles, such as a legacy of Soviet industrial areas and a car-centric transportation system, Vilnius abundant green spaces allow for biodiversity preservation and nature-based urban planning.

Major projects address climate change and pollution, like a large storm water pond in the midst of the city, recycling and incinerating garbage and turning streets green. Directly or indirectly, projects like these contribute to biodiversity by increasing the green area and reducing the footprint of the city.

The Master Plan of Vilnius outlines medium- and long-term objectives pertaining to biodiversity, green spaces, and sustainable land use. The master plan maps out important green areas, habitats and connectivity corridors. It emphasizes conserving biodiversity and expanding green areas by establishing connections between surrounding forests and urban green spaces. Furthermore, the plan aims to create a local green network to enhance accessibility for residents and to designate two new protected areas.

Occasional observations indicate that biodiversity seems to be stable. It is recognized that there is a need for more extensive monitoring of biodiversity. A biodiversity monitoring program for all of Vilnius started 2022.

Vilnius has introduced an innovative street standard, highlighting a “trees come first” approach, prioritizing the protection of mature trees in infrastructure projects, and planting new trees. Vilnius has planted over 68,000 trees and 100,000 bushes since 2021. This has added eleven hectares of greenery. The city has tried several varieties of trees to see what works. Conifers are heavily attacked by the bark beetle.

Starting in 2016, the city has been actively constructing 100 kilometers of new bicycle infrastructure, adorning bike trails with a variety of trees and bushes. This not only creates attractive travel routes but also establishes green infrastructure connections and wildlife corridors.

For all urban developments there is a green index standard to be followed, taking account of present natural qualities. A large brownfield area has been transformed into a model for green city development, adding five hectares of green areas. Another five hectares of green are in the making.

Vilnius is a fast-growing city, and green areas, mainly plain lawns, are being built upon. Vilnius reasons that building on lawns with little biodiversity lessens the loss of biodiversity.

National Urban Parks in Finland

Jukka-Pekka Flanders has been responsible at the Ministry of the Environment in Finland for the program *National Urban Parks*. A new land use and building act was enacted, which entered into force on January 1 year 2000. It included provisions for the establishment of national urban parks. The Finnish concept of a national urban park works as a tool to implement integrated and sustainable urban planning. § 68 in the Land Use and Building Act 132/1999 defines the criteria required to establish a National Urban Park (NUP):

“A national urban park may be established to protect and maintain the biodiversity and beauty of the cultural and natural landscape, historical characteristics or related values concerning how the town was created, social, recreational, or other special values of an area.”

Biodiversity was added as a requisite in 2009.

“The National Urban Park must be an integrated urban space with a high cultural and natural environment and part of a wider ecological whole” and must fulfill the following four criteria:

- Breadth and content
- Urban centrality
- Extent and contiguousness
- Ecology and continuity

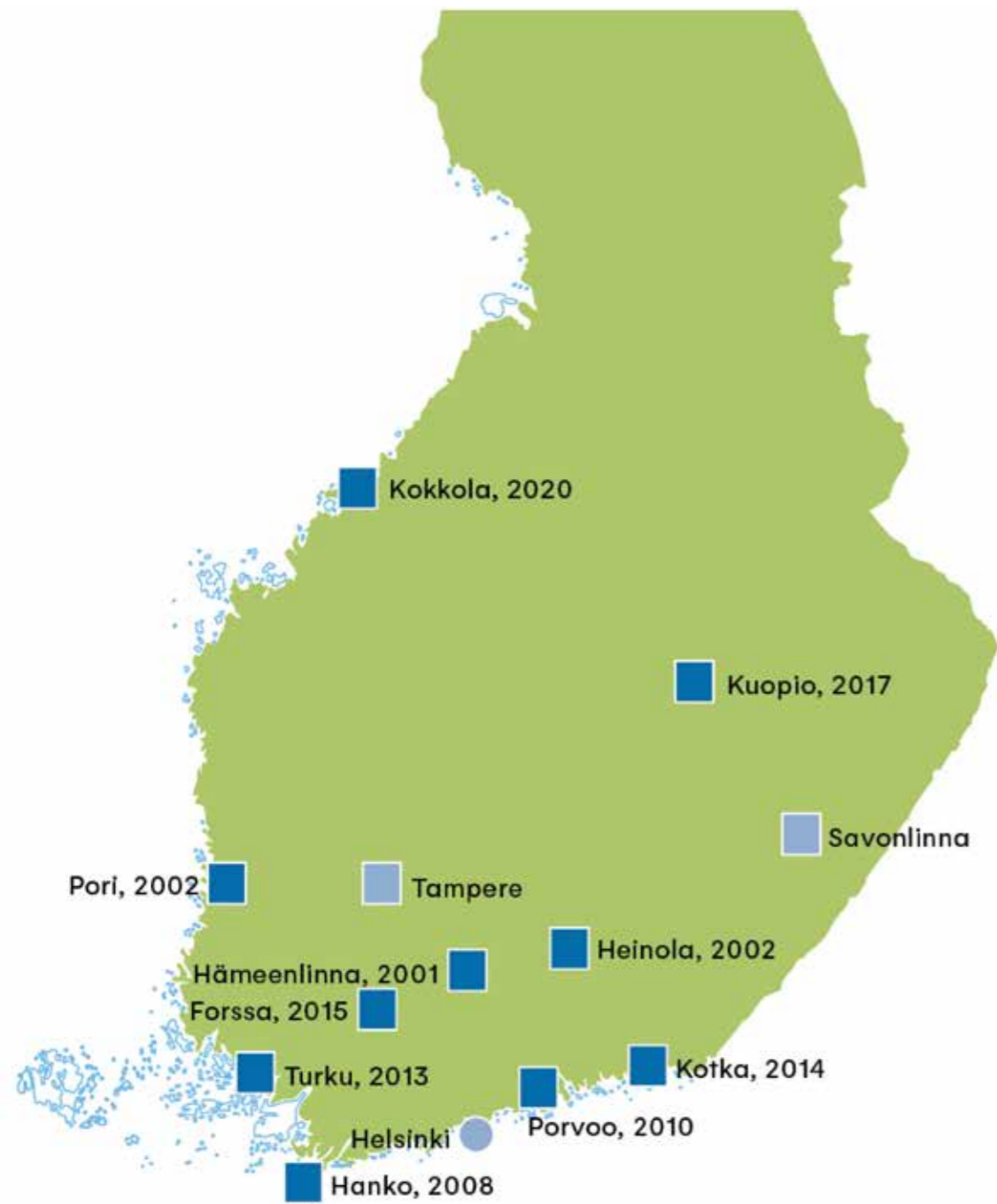


Figure 27. The network of National Urban Parks (NUPs) in Finland in 2023. Dark blue existing, year of founding, light blue squares, application has been sent to the Ministry of the Environment, round light blue, application under preparation.

Cities apply and the Ministry of the Environment decides. From the start in 2000 to today ten national urban parks have been designated. Great emphasis is put on a dialogue with citizens, represented by the civic society of the applicant city. The application must contain a management plan, which has to be approved by the ministry. Management plans may include large transformations of the urban landscape. An example is the oil port of Kotka that was turned into a seaside park. Parts that are wild nature, or parts left to develop on their own, are mandatory.



Figure 28. Former oil port in Kotka.



Figure 29. Seaside park created on the former site of the oil port in Kotka.

After inauguration, a couple of NUPs have been enlarged. This has been done in cooperation between the ministry and the city.

A NUP sets limits on the expansion of the city. It forces development to take place elsewhere and, in that way, promotes regional development of new towns and other regions.

Unfortunately, Flanders tells, there are dark clouds in the sky. Both cities and the central government are selling or reserving land for development by international construction companies at an unprecedented rate. This will significantly affect the possibilities of establishing new national urban parks in the future.

Helsinki

Jarmo Saarikivi advocates a somewhat relativistic view regarding biodiversity and that, therefore, any endeavor to enhance biodiversity must question what kind of ecosystem and what species should be promoted.

In the first place it must be understood that most biotopes in cities, especially those rich with biodiversity, are man-made. Central Park in New York, as well as Central Park in Helsinki, is filled with planted trees, bushes, flowers, grass etc. and the land has been sculptured. Urban nature is not pure, untouched nature, but shaped by human actions over centuries.

Secondly, Saarikivi highlights that connecting corridors may not always be a good thing. Helsinki cares for and defends its green corridors. But if a green corridor attracts prey it may be an easy bite for predators, thus reducing biodiversity.



Figure 30. Green "fingers" of Helsinki.

Thirdly, we should understand that biodiversity may not always be a good measure of the quality of nature. Invasive alien species add to biodiversity, but at the same time may reduce or threaten native species or ecosystems. The same thing holds for clear-cutting forests that temporarily increases biodiversity, but at the same time obliterates existing ecosystems. This means that we must think about what kind of biodiversity we want to protect or increase, not just any biodiversity, for its own sake. This is a real problem in Finland, since in Finnish cities "open" or vacant parts – meadows, fields, brownfields and ruderal land – are rare and, if left to themselves, will become colonized by trees and shrubs. This may look like an increase in biodiversity but is, in fact not, since the open habitats are often rich in biodiversity.



Figure 31. Suburb north of central Helsinki, filled with biodiversity. Here thrive the Siberian flying squirrel, goose hawks and eagle owls.

Wild animals, like the Siberian flying squirrel, flee from industrially grown forests and find a harbor in urban forests that contain a varied assortment of tree species, trees of different ages, old, wounded trees – in short, a varied and rich ecosystem. It is in areas, such as the one depicted in figure 31, that biodiversity peaks. These are areas in between the disturbances of city life and the disturbances of industrial forestry or mono-agriculture on the periphery of the city.

Helsinki is now working on its third Biodiversity Action Plan.⁶⁴ This means that a series of developments of habitats and biodiversity have already taken place. What has happened?

Active monitoring is required by law. There is a separate monitoring plan for Helsinki, by which about 40 indicators are being followed yearly, such as the prevalence of bats, birds, vascular plants etc. The development of biodiversity in the whole city is assessed with a couple of years in between but specific areas are monitored more closely every year. 150-200 thousand euros is spent on monitoring each year. Monitoring shows a dynamic picture: new species appear all the time, others are reduced, but overall, it seems that nature is slowly recuperating. The data is processed for politicians and decision-makers and comparative analyses are performed between different areas within Finland and internationally in such projects as CBI (Singapore Index of Biodiversity) and GCA (Green City Accord).

⁶⁴ <https://julkaisut.hel.fi/en/reports/lumo-programme-city-helsinki-biodiversity-action-plan-2021-2028-abridged-version>

It needs two full-time workers to keep a database on nature, parks, recreation possibilities, biodiversity, projects etc. continuously updated.⁶⁵ But it is considered worth-while doing that. The general public appreciates it, and it is of great value in the communication with politicians and planners.

Reykjavik

Reykjavik already in 2016 approved a biodiversity policy. And in 2017 a 10-year action plan was decided. **Thorolfur Jonsson** underscored that the policy was to be based on knowledge about biodiversity in the city and its weaknesses, the assembly of which was to be done as the first step in the action plan.



Figure 32. Map of green infrastructure in Reykjavik. Legend: Græni trefillinn (The „Green scarf“, green areas around the capital area), Sjór og vatn (sea and lakes), Mikilvæg græn svæði (important green areas), Önnu græn svæði (other green areas), Tenglaðar – grænar tengingar (connecting green corridors), Stofnæðar – grænar tengingar (main green corridors), Tengipunktur við græna trefillinn og önnur sveitarfélög (connection point with the Green scarf and other municipalities)

The goal of the biodiversity policy was to ensure that the status of biodiversity in the city should remain strong. The strategy had as its main pillars to combat the threats against biodiversity in the city, to integrate biodiversity thoroughly into relevant activities and operations of the city and to communicate policy and educate policymakers and citizens about biodiversity.

A strategic approach has been to map and understand the green corridors in the city and their weaknesses (see figure 32).

With policy and action plan in place, Reykjavik has undertaken to conserve important habitats, eradicate invasive plant species and create urban habitats for various species. This has been done in combination with some research projects concerning wildlife in the city and a campaign for public awareness – people often think that areas with rich biodiversity are untidy and prefer short-cut grass lawns. Guidelines have been issued for all neighborhoods and for all densification development plans on how to evaluate the status and value of existing biodiversity and how to plan to benefit biodiversity.

A very important area for biodiversity – especially for birds – is the Tjörnin lake and Vatnsmýri wetland right in the middle of Reykjavik. Lots of work has been done to strengthen this area as a biodiversity hotspot. Canals have been built around Vatnsmýri to hinder hikers through the area during summer – in the winter bridges are provided for pedestrians.

Another big project has been the restoration of Elliðaárdalur valley after the closing of a power plant. The river runs through the southeastern part of the city and three years ago the power plant shut down for economic reasons and the big reservoir was emptied. The power plant was built in the 1920s and the question was whether to preserve it as a building of cultural importance or not. Biodiversity won. Today, salmon can swim up the river and the reservoir basin is now green.

The botanic garden of Reykjavik plays an important role for biodiversity. Collections include the Icelandic flora, alpine and arctic flora, systematic collections, and horticultural collections. A project is undertaken to cultivate wild relatives to farmed crops to be used by plant breeders to improve crops or to have as a reserve in case a crop species is hit by disease. Many wild relatives thrive on ruderal habitats in cities.

It is noted that the salmon now fares better in the Elliðaárdalur valley, where the dam was removed, and that the Tjörnin lake has been cleaned from pollution. Also noted is that, instead of skeptical comments about flowering meadows, politicians now may suggest that lawns are not to be cut.

⁶⁵ <https://www.hel.fi/en/urban-environment-and-traffic/protection-of-the-environment-and-nature>

Trollhättan

Trollhättan, Sweden, **Torbjörn Nilsson** stated, is an industrial town of 60,000 inhabitants in the southwestern part of Sweden. It aims to become the equivalent to the Danish city Hjørring, renowned for its biodiversity. For some years, Trollhättan has had two politically prioritized ecological goals: fighting climate change and promoting ecosystems and biodiversity, in line with UN 2030 sustainability goals. In April 2021, Trollhättan received a state grant for a project to increase biodiversity on land owned by the municipality. All the city administration was engaged: park management, forest management, the public housing, real estate and energy companies, the school administration, ecologists ... In June 2021, it was decided to prioritize biodiversity in the city strategy for Agenda 2030 – and later in the “Target and resource plan”. The aim was to engage the whole community, private companies and real estate owners, school kids and their parents – the public at large. Top scientists were engaged as lecturers, and the position of a biodiversity advisor was instituted. The pillars have been:

- Green school yards
- Greener residential areas
- Education, school kids and teachers, city administration and others
- Green roofs
- Conversion of lawns into meadows
- No clear-cutting of forests (the city owns 1,300 ha, most of it close to the city)
- Combatting light pollution
- Combatting invasive alien species
- Management plans for veteran trees (mostly oak)
- All new public buildings must plan for biodiversity

Trollhättan has started to develop a Green Plan, in order better to preserve valuable green areas and to promote biodiversity.

Tallinn

Meelis Uustal referred to a long history of nature conservation in Tallinn but focused on what has been done in the last four to five years. Tallinn was founded, like many other cities, in a biodiversity hotspot, and therefore has many remnant habitats. Comprehensive studies of the past five years show that Tallinn is still very rich in pollinators, birds, amphibians, reptiles, bats and many mammals. 2,200 out of 16,000 hectares are protected nature. Tallinn has inventoried habitats and species

all around the city. Basic, comprehensive inventories and analyses of habitat status and connectivity for various species have been made after which planning has been done: strategic plans, restoration feasibility studies, species action plans and site management plans. This is followed by implementation, management, and monitoring.

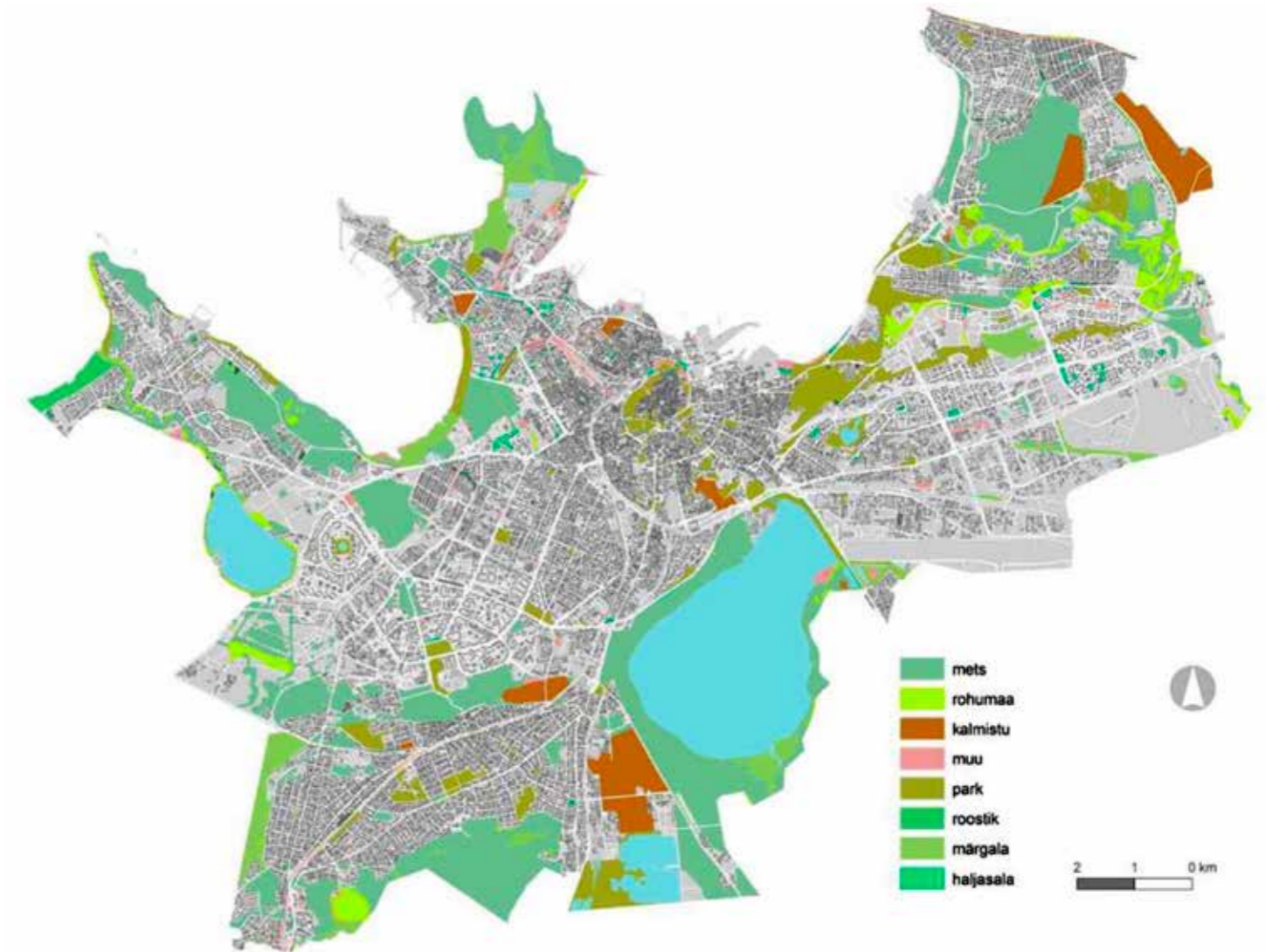


Figure 33. Habitats and biodiversity in Tallinn. Legend: mets (forest), rohumaa (grassland), kalmistu (cemetery), muu (other), park (park), roostik (reedbed), määrgala (wetland), haljasala (lawn). Light blue is lake.

Tallinn has up to now focused on the first steps, realizing that comparatively little was known about biodiversity four to five years ago. This work is halfway and is still ongoing. Tallinn monitors a selection of species as indicators but only every four or five years. The situation for various categories of species is this:

- Bumblebees, solitary bees, and butterflies. Tallinn is one of the richest habitats in Estonia. Meadow restoration, pollinating friendly cutting of grass in core areas, sowing wildflower etc. is undertaken. Droughts and limited cutting of grass have helped Tallinn to bloom.
- The situation found for amphibians is poor. Spawning ponds are muddy and soon dry up, and habitats are fragmented by streets. Ponds need dredging and felling of trees, and amphibian tunnels need to be built. Monitoring shows that the tunnels were used, even by others like reptiles, rodents, other small vertebrates, even birds and cats. During summer nights a special street is closed off for traffic and volunteers help a mass of toads crossing it.
- Mammals. Tallinn is only in the beginning of inventory and planning. The city is rich in mammals the size of weasels, and lots of conflict points have been noted.
- Bats. All species in Estonia are present in Tallinn. Connectivity and habitat analyses will be conducted next year. It has already been observed that the bats use different parks during the summer, one for feeding, another for mating, and one for nesting. Bats must be taught to use nest boxes.

A large-scale project, undertaken in cooperation with volunteers, is to restore peat bogs within the city. The city formerly held seven peat bogs, now two are left that can be restored. Fifty hectares are now in the process of being restored. Some 200 dams are to be built – by hand, since, in the city, people, who have helped to organize the restoration plan, don't want heavy machinery doing it.

Another big project is the restoration of three coastal meadows, covering 100 hectare. For five years, work has been undertaken at the first one, and already the kind of birds that used to occupy the area fifteen years ago have started to return. Highland cattle is set to graze the meadows to keep them open.

In the making is also a 13 km long Pollinator Highway west of the city, on an abandoned embankment. It is made as a linear park for hiking but designed also for pollination. A second linear park is the seven km Limestone Klint park to the east of the city, along a coastline with cliffs of limestone.

Three nature conservation areas are on the way to be established, covering 330 hectare.

Pesticides are only allowed in limited amounts in the botanic garden and for growing roses. This is a regulation for the whole city, even for private gardens.

Examples of strategic biodiversity measures in and around Stockholm

Examples of various measures taken in greater Stockholm was demonstrated during a bus tour. Guides were **Henrik Waldenström, Rikard Dahlén, Peter Nilsson, Ulrika Hamrén, and Richard Murray.**

The National City Park in Stockholm was instituted as a means to protect a 27 km² area in the midst of the Stockholm region. This was done in 1995 with the set aims to promote natural and cultural values, recreation, and biodiversity.



Figure 34. The National City park in Stockholm.

The park constitutes the innermost part of a green wedge (Järva wedge) stretching 30 kilometers outwards in northwesterly direction from the hub of Stockholm.



Figure 35. Järva green wedge (Järvakilen) in Stockholm. Legend from above: total area (light green), silent areas (green hatched), physically untouched areas (grey hatched), forest older than 60 years (green-gray), deep forests (dark green)

In Stockholm wedges have been recognized as important elements of green infrastructure for the last thirty years. But there is no general protection for the ten green wedges of Stockholm.

Since the institution of the National City Park in Stockholm some major infrastructure projects have been affected: part of a ring-road around central

Stockholm to the east of the center of the city is put on hold (possibly for good) and a major part of a bypass west of the metropolitan area is being dug into a tunnel. Also, since the institution of the park an eight-kilometer-long stretch of nature reserves has been established to protect the green Järva wedge just outside the park.

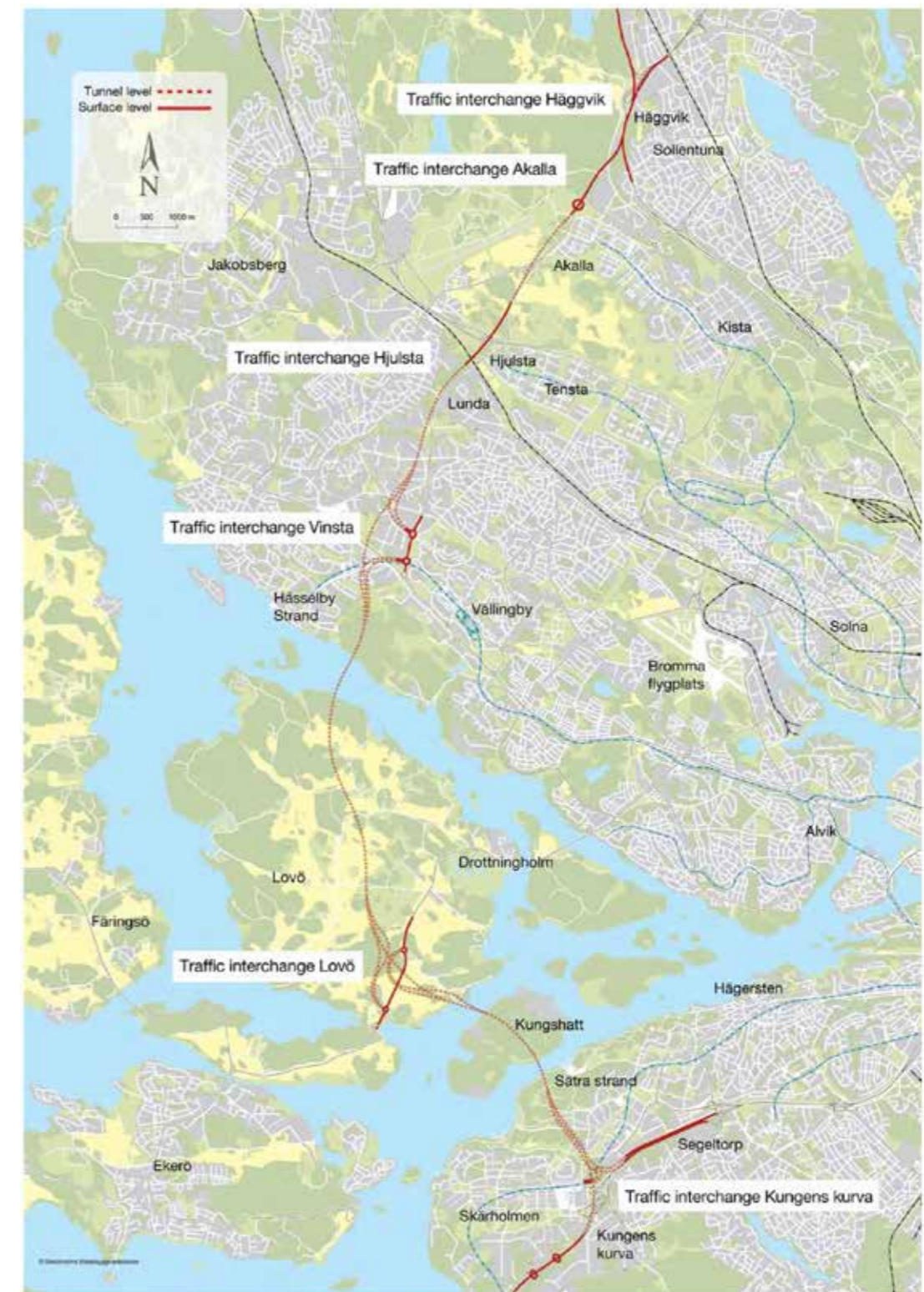


Figure 36. Bypass west of Stockholm built mostly as a tunnel (dotted line). The bypass is about 25 kilometers long.



Figure 37. The bypass is laid in a tunnel not only where it crosses the green wedge of Järva but along most of its 25 kilometer long stretch. Photo: Richard Murray.



Figure 39. Watershed relocated and fortified through newly built Barkarby center, close to the Järva green wedge. Photo: Richard Murray



Figure 38. Restored watershed in a place in the green wedge of Järva that formerly housed a motor-bike racing track. Photo: Ekologigruppen.

Urban expansion is going on around and sometimes even encroaches the green Järva wedge. In a newly developed urban area substantial efforts have been made to handle storm water. This is done so as to promote biodiversity at the same time.

Conclusions

The general picture of what is being done to enhance biodiversity in Nordic and Baltic cities is that there are some front runners but that in most cities and municipalities far too little is yet done to protect and promote biodiversity – especially in the light of what **Alexandre Antonelli** believes is what is needed.⁶⁶

Work to protect, enhance, and develop and add to existing biodiversity has come about quite recently, during the last couple of years. Cities report that 10-15 years ago biodiversity was a non-issue, that greenery mattered for aesthetics and recreation but not for biodiversity.

The cities reporting show that it is possible to start out promoting biodiversity with a number of different, quite simple methods without any comprehensive planning. There are obvious measures to be undertaken such as greening of school yards, planting trees along streets, promoting allotment gardens etc. plus raising the awareness of the general public. There are no reasons for waiting for better and more precise knowledge. Let's go!

⁶⁶Such a verdict is also delivered in the European Environment Agency report 14/2023, *Urban adaption in Europe: what works – Implementing climate action in European Cities*.

In cities with more advanced biodiversity planning, city-planning is still a compromise and biodiversity is often the loser. Question asked: ought not biodiversity be valued twice as much as anything else since it is about the dying out of species, what is done – and not done – is unalterable. Question asked: should there not be more citizens' dialogues and participation – in line with what **Arild Vatn** asks for – to decide the shaping of their urban – and rural – landscapes?

The cities report that on the whole, nowadays there is a friendly discussion with some mutual understanding between ecologists and city planners on the needs for biodiversity, but that city development – which is strong in all the reporting cities – almost always forces compromises to the detriment of biodiversity. However, efforts are done to minimize harm and sometimes to compensate for harms done. There are reports both of adherence to environmental analyses and complete disregard.

Some cities report major nature restoration projects. This ought, in the near future, to become an everyday practice if, in fact, international agreements are to be adhered to.

In all of the reporting cities the knowledge about biodiversity, what needs to be done and how to do it, is both reasonably well developed and well founded. The recording and mapping of nature types, habitats, green corridors, environmental disturbances, and much more is well – sometimes very well – documented and is lucidly presented in connection with city development decisions. Politicians are the ones who decide, and in, for example, Stockholm, they are advised at least four times during the planning process leading up to a building permit about the values lost when building in a green area. Politicians might nevertheless decide to exploit a valuable nature area.

Cities cope with population growth in different ways. Copenhagen extends the area of the city by landfills into the sea. Stockholm sacrifices green areas, just as Vilnius does, but Vilnius takes care to build on such green areas as cut lawns with little biodiversity and Stockholm tries to minimize the harm or undertake compensating measures. Oslo has set a definite limit for the spread of the city a long time ago.

Overall, it seems that the work done in the cities having reported at this conference is, to a large extent, focused on preservation, i.e. preserving existing biodiversity, the type of species and habitats that exist in the city of today. Very little is done to create new habitats and attract new, from an ecosystem point of view, missing species. However, unexpectedly formerly extinguished species unexpectedly return, like the beaver has done in the Stockholm National City Park.

Although some cities have adopted policies for biodiversity a couple of years ago – 2015 and onwards – it seems that mapping and classifying green areas, habitats and biodiversity has not started until quite recently in most cities. Monitoring the development of biodiversity is picked up quite late. Research into old collections, such as at the Swedish Museum of Natural History with its collection of 11 million specimens from hundreds of years ago up to the present, as **Sebastian Kvist** mentioned, may provide earlier baselines for comparisons as well as projections for the future. 60 percent of the collection is from Sweden, a large part from Stockholm.

Cities must act as forerunners when national governments do not. Some cities report problems fighting off big infrastructure projects that are sanctioned by the national government. Some, but far too little, funding for nature preservation is offered by the national governments.

For things to happen, the general public has to push for biodiversity, not only for greenery and parks, but for biodiversity in itself. In some cities, local volunteers have taken action to show the way, and also to help implement biodiversity friendly measures.

Developers have to be educated. **Johanna Alkan Olsson** runs the Bio path project to inspire private companies to work for biodiversity. The project is soon to be extended to municipal and other public agencies. It teaches organizations how to take account of the impact that they have on biodiversity. Hopefully, it will help in the great transformation that is needed, according to **Alexandre Antonelli**.

Cities, when prioritizing habitats and species, often choose a set of indicator species to focus on. These species are thought to represent a wider set of species belonging to an ecosystem. Thereby a wider range of species may be promoted by promoting the indicator species. On what grounds specific species are chosen to focus on seems not to be founded on an overall regional – or global! – analysis of what kind of ecosystems should be promoted and what not.

It appears that cities and municipalities don't cooperate in the field of biodiversity to any important extent. There are cases of civil servants working as ecologists in adjoining municipalities that meet occasionally. On the political level there seems to be no cooperation except in Finland, where the NUPs meet once a year. All the municipalities around Oslo recognize biodiversity and have started to work with it, but there is no cooperation. This is despite the importance of recognizing the regional level, green corridors and supporting habitats. According to **Vicki Lee Wallgren**, there are interesting examples of cooperation and planning on the larger landscape level of the Arctic region, that could be a model for other parts of the world, such as city landscapes.

Widening the issue of how cities impact nature and biodiversity by taking into account the amount of resources that goes into the building and maintenance of a city, and also of life in the city, the impact is grossly increased. The ecological footprints of various activities have been calculated and for modern, large cities, like the Nordic and Baltic capitals, the footprints are very large. What is done today to promote biodiversity, is to try to remedy for the scars that the city has inflicted upon global nature. But that is not enough. Biodiversity in cities is just one part of a the global challenge to mitigate cities' harm to biodiversity.

Further reading

Antonelli, Alexandre, *The Hidden Universe*, Ebury Publishing, 2022.

Konijnendijk van den Bosch, Cecil C., *Rethinking Urban Green Spaces*, Edward Elgar, to be published 2024.

Murray, Richard, *Why Cities Need Large Parks – large parks in large cities*, Medströms/Routledge, 2021/2022.

Sjöman, Henrik and Anderson, Arit, *The essential tree selection guide for climate resilience, carbon storage, species diversity and other ecosystem benefits*, Filbert Press, 2024.

Vatn, Arild, *Environmental Governance. Institutions, Policies and Actions*, Edward Elgar, 2015

Program

4th of October

18:00 Informal get-together – Bistro at Mornington hotel,
Nybrogatan 53, Subway stop Östermalmstorg

5th of October

What do we know about biodiversity in cities?

09:00 Welcome

Richard Murray, Ekoparken Association

Sebastian Kvist, Swedish Museum of Natural History

Vicki Lee Wallgren, World Wide Fund for Nature

09:15 Alexandre Antonelli, professor, director of research Kew Gardens

Think globally, act locally – why urban biodiversity matters

10:15 Thomas Elmqvist, professor in natural resource management, Stockholm

university, **Urban ecosystems – characteristics and potentials**

10:55 Refreshments

11:25 Johanna Alkan Olsson, researcher, dept of biology, Lund University

UN Convention on biodiversity and EU Green deal – are these binding for cities?

12:05 Lunch

13:25 Anki Weibull, Senior expert in Nature Based Solutions and Linn Lagerberg,

Expert in Urban Green Planning, Urban Planning Unit, Swedish Environmental Protection Agency

Building resilient cities – tools for multifunctional green spaces

14:05 Marcus Hedblom, professor, Swedish University of Agriculture

Managing the urban green for biodiversity and human recreation

14:45 Anton Stahl Olafsson, ass. professor, Copenhagen University

Conflicts and dilemmas of biodiversity in multifunctional green spaces: reflections from Copenhagen

15:25 Arild Vatn, professor em., Norwegian University of Life Sciences

How to bring nature values into local decision-making

16:05 General discussion – comments on previous talks, forgotten issues

17:00 End of first day

19:00 Dinner at your own expense. Mornington hotel or some other place



6th of October

Experiences from Nordic and Baltic cities in promoting biodiversity.

09:00 Cecil Konijnendijk van den Bosch, director of Nature Based Solutions Institute, Barcelona-Stockholm

Greening cities around the world

09:40 Panel with city representatives across the Nordic and Baltic countries

How to ensure that biodiversity is treated on par with other forms of infrastructure in regional and city planning

Nicolai Ljøstad Aasen, Oslo

Sabina Zwergius Teilmann, Copenhagen

Klara Tullbäck Rosenström, Stockholm County administration

Ulrika Egerö, Stockholm

Ramunė Baniulienė, Vilnius

Jukka-Pekka Flanders, Finland

TorBjörn Nilsson, Trollhättan municipality

11:40 Refreshments

12:10 Henrik Sjöman, Scientific curator at Gothenburg botanic garden and researcher at Kew Garden, London.

Trees for future challenges – opportunities and limitations

12:50 Lunch

14:00 Panel with city representatives across the Nordic and Baltic countries

Planting, caring and developing green infrastructure and biodiversity in cities

Thorolfur Jonsson, Reykjavik

Viveca Jansson, Stockholm

Ramunė Baniulienė, Vilnius

Anja Hartvi Spork, Copenhagen

Jarmo Saarikivi, Finland

Meelis Uustal, Tallinn

16:00 Refreshments

16:30 General discussion. Summing up

17:30 End of day two

18:30 Åsa Lindhagen, Vice mayor for environment and Climate, City of Stockholm

Informal gathering at Kristinehovs malmgård, Kristinehovsgatan 2.

Buses leave 17 45.

Speakers

7th of October

Excursion – buses start at Nybroplan

Visits to projects aiming at increasing biodiversity in the Royal National City Park and other parts of the Stockholm region.

09:00 Henrik Waldenström, WWF Sweden and Peter Nilsson, Swedish Museum of Natural History – **Royal National City Park and its importance for biodiversity**

12:00 Lunch

13:00 Ulrika Hamrén, Ekologigruppen, Rikard Dahlén and Richard Murray **Wildlife corridors in metropolitan Stockholm**

16:00 End of guided tour and conference. Buses stop at subway station Universitetet



Åsa Lindhagen

Green party, Vice Mayor for Climate and Environment, City of Stockholm



Sebastian Kvist

Director of research at the Swedish Museum of Natural History



Vicki Lee Wallgren

20 years experience in the WWF network, in various positions and offices.



Alexandre Antonelli

Professor, Director of research, Kew Gardens, London



Thomas Elmqvist
Professor, Stockholm resilience
Centre, Stockholm University



Johanna Alkan Olsson
Researcher, Dept of Biology, Lund University



Anton Stahl Olafsson
Ass. Professor, Researcher, Nature, green spaces
and outdoor recreation, Institut for Geovidenskab
og Naturforvaltning, Copenhagen University



Arild Vatn
Professor em., NMBU/Norwegian University
of Life Sciences



Anki Weibull och Linn Lagerberg
Swedish Environmental Protection Agency,
Department for Nature-based solutions



Marcus Hedblom
Professor, Department for urban and
rural development, Swedish University
of Agricultural Sciences



Cecil Konijnendijk
Professor, Director Nature Based Solutions
Institute, Barcelona/Stockholm



Nicolai Ljøstad Aasen
Biologist, Nature and pollution department,
Oslo city



Sabina Zwergius Teilmann

Chief consultant, landscape architect,
City of Copenhagen



Klara Tullback Rosenström

Development manager, Stockholm County
Administration



Jukka-Pekka Flanders

Former director of program for NUP Ministry
of Environment



Torbjörn Nilsson

Sustainability strategist, Trollhättan
municipality, Sweden



Ulrika Egerö

Urban strategist, City of Stockholm



Ramunė Baniuliene

Head of Urban Landscape Division,
city of Vilnius, Lithuania



Henrik Sjöman

Scientific curator at Gothenburg botanic garden
and researcher at Kew Garden, London



Þórólfur Jónsson

Landscape architect, Head of Parks and Nature
at the Department for Environment and Planning,
Reykjavik, Iceland



Viveca Jansson
Project manager and ecologist,
City of Stockholm



Anja Hartvi Spork
Landscape architect,
City of Copenhagen



Jarmo Saarikivi
Researcher at Helsinki Institute
of Sustainability Science



Peter Nilsson
Biologist with a specialty in fungi and insects,
Swedish Museum for Natural History



Ulrika Hamrén
MSc biologist, ecologist, environmental planner
and EIA consultant at Ekologigruppen, Stockholm



Meelis Uustal
Nature conservation specialist, Tallinn Urban
Environment and Public Works Department



Henrik Waldenström
Ornithologist with a long career at WWF,
Sweden, member of the board of the
Ekoparken Association



Rikard Dahlén
Biologist and member of the board of the
Ekoparken Association. Has worked with nature
conservation in the Stockholm area for 40 years



Richard Murray
PhD in political economy, president of
Ekoparken Association

Checklist for anyone working to promote biodiversity in cities

1. Remember that cities are important for global biodiversity – think globally, act locally!
2. When working with biodiversity in cities start with a regional perspective!
3. Cities grow fast – think and plan ahead when creating green infrastructure!
4. Large urban parks and distributed urban green – both are needed
5. Give the Department for Health and Environment a central role in urban planning!
6. Green infrastructure should be planned on par with other forms of infrastructure
7. Integrate biodiversity considerations in all municipal activities!
8. A Green Plan should include not only a plan for biodiversity but also plans for green infrastructure, management plans for urban green, park plan, recreation plan, etc. and be connected to a general plan for the environment
9. Set challenging goals (for tree canopy cover, pollution, species, restoration of nature areas, accessibility ...)!
10. Up-date the Green Plan and connected plans every 3-5 years! Revise goals!
11. Monitor progress and evaluate projects! Inform decision-makers and the public!
12. Inventory urban green (habitats, corridors, species, deficiencies) and make detailed maps for the city and the region!
13. Advocate sustainable production and consumption practices!
14. When conserving, choose the biologically most important areas, not the least costly!
15. Combatting climate change and combatting biodiversity loss go hand in hand
16. Advocate adherence to the UN global biodiversity convention and EU Green Deal!

17. Advocate – with a critical eye for greenwashing – adherence to business standards and certification schemes!
18. More research on urban biodiversity is needed
19. Use cities as biodiversity laboratories!
20. Take into account human perceptions and societal norms!
21. Inform and educate the general public and decision-makers!
22. Don't forget dialogues with the residents!
23. Engage citizenry and business! Secure stewardship in all areas!
24. First step: explore management practices that may benefit biodiversity
25. Advice to gardeners – do less!
26. Look for nature-based-solutions with synergies between biodiversity and ecosystem services!
27. Explore show-cases of wild nature and messy ecosystems in orderly frames!
28. Evaluate the full environmental impact of large scale biodiversity enhancing projects before they get started! Seek simpler, more cost-effective measures!
29. In any city there is plenty of hard surface that can be turned green
30. Let parts of the urban green grow wild!
31. Follow the 3-30-300 rule down on the block!
32. Think habitats rather than species!
33. Connectivity is as essential as habitats
34. City trees are the foundation for biodiversity in urban ecosystems
35. Plant with care – not just quantity!
36. Increase the variety of tree species!
37. Look for genetic varieties from harsh climate zones!
38. Be aware of disservices and conflicting interests!
39. Plan for a variety of urban green areas!
40. Information and experience will increase appreciation of biodiversity over time
41. Monetizing nature values must be complemented by public dialogue
42. Cooperate with surrounding administrative entities!

