



# City meadows

Vitality from a living heritage



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Back cover photo: Next to the Tervasilta bridge on the western shore of the Jaaninoja river in Turku, there is a representative patch of meadow that has been maintained through mowing and raking carried out as voluntary work. The following species associated with traditional landscapes are represented in the area: lady's bedstraw (*Galium verum*), maiden pink (*Dianthus deltoides*), dropwort (*Filipendula vulgaris*), Downy alpine oatgrass (*Avenula pubescens*), Alpine cinquefoil (*Potentilla crantzii*) and absinthium (*Artemisia absinthium*), a notable species traditionally accompanying human habitation. Himalayan balsam (*Impatiens glandulifera*), an invasive species, also grows on the sides of Jaaninoja. The main measure used to combat the species is weeding. Jaaninoja is also important as collector and filterer of rainwater in the city. *Photo: Hannu Klemola.*

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# Preface

This publication is produced as part of the Natureship project (2009–2013) coordinated and partly financed by the Centre for Economic Development, Transport and the Environment (CEDTE) for Southwest Finland. Natureship is an international project including members from Estonia, Finland and Sweden. It is funded by Central Baltic Interreg IV A Programme together with national financiers. There are eleven project partners: CEDTE for Southwest Finland, University of Turku Department of Geography and Geology, Forest and Park Service (Metsähallitus), cities of Hamina, Raisio, and Salo, municipality of Vihti, Norrtälje Nature Conservation Foundation, County Administrative Board of Gotland, Estonian Environmental Board and University of Tartu Pärnu College.

The goal of the project is to increase national and international cooperation in nature management and water protection in Finland, Sweden and Estonia. The project aims to carry out shore planning according to the principles of sustainable development, and by means of which, all partners in cooperation try to find the best cost-effective methods of promoting water protection and biodiversity. During the project Natureship partners test different planning methods in shore areas by combining geographic information data (GIS) with historical material, make innovative management experiments and recommendations, and study the indicator species of traditional biotopes. In addition, this project examines ecosystem services, i.e. all the material and immaterial benefits, which are supplied for people by natural ecosystems.

The main outcome of the project is a series of six nature management publications. All the publications can be downloaded from Natureship web pages, [www.ymparisto.fi/natureship](http://www.ymparisto.fi/natureship).

In Turku 21.12.2012

***Anna Haapaniemi, Mika Orjala  
and Annastina Sarlin***

Coordinators of the Natureship project



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**Anu Onjukka** has worked as a research assistant in the Natureship project studying landscape changes in the coastal zone of the city of Pärnu. The research results offered also a basis for her thesis done for the Department of Geography and Geology at the University of Turku.

**Hannu Klemola**, M.Soc.Sc., works as Environmental Consultant and Regional Manager at the Finnish Association for Nature Conservation, where his areas of responsibility include traditional landscapes and the Nordic Day of Wild Flowers.

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### **Magnus Bergström**

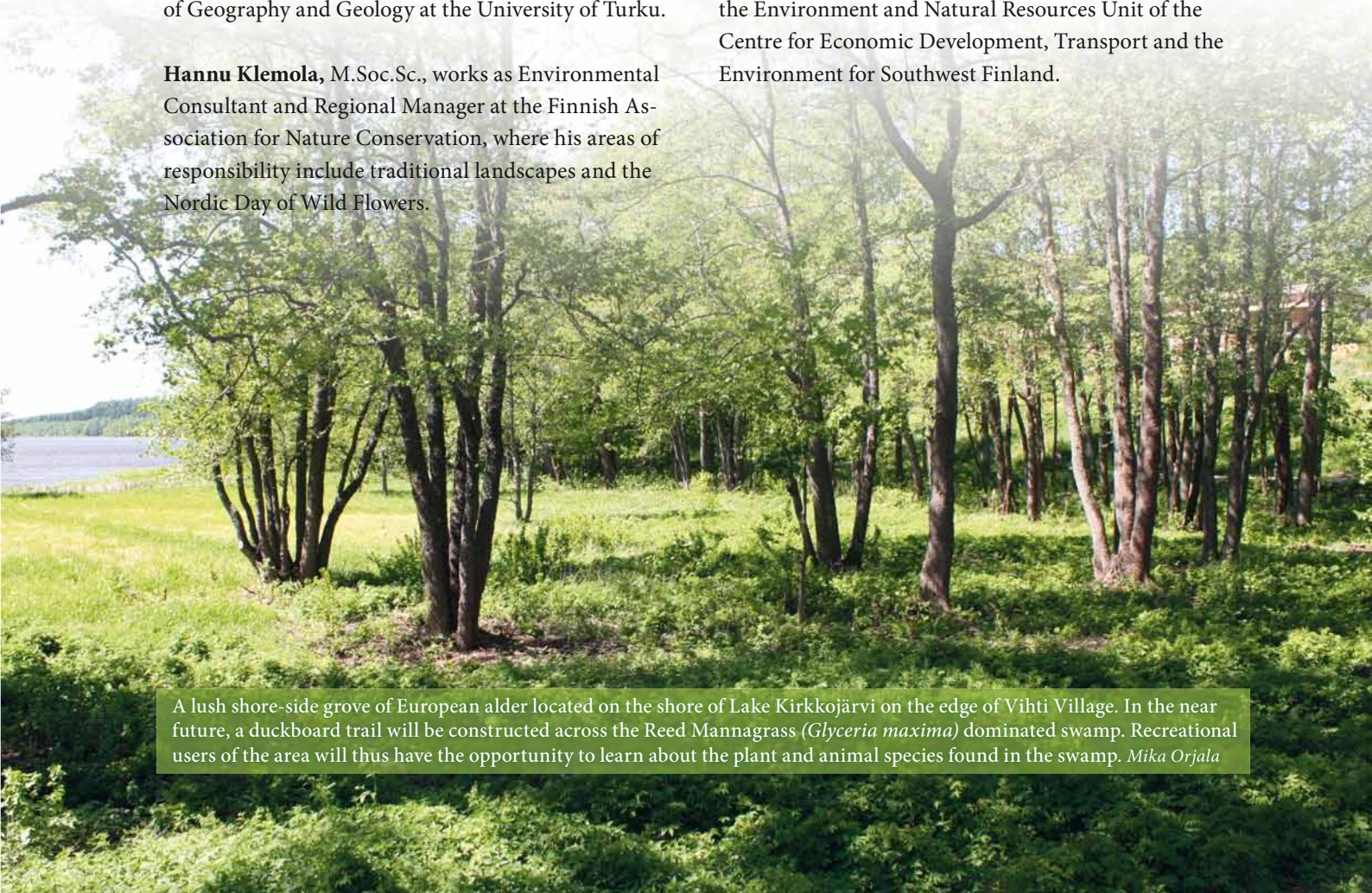
The author has worked as an ecologist in the municipality of Norrtälje and CEO of Norrtälje Nature Conservation Foundation, specializing in the restoration and management of meadows and pastures. The author is currently working on issues related to nature conservation at the Department of the Environment in the Swedish Government Offices.

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A lush shore-side grove of European alder located on the shore of Lake Kirkkojärvi on the edge of Vihti Village. In the near future, a duckboard trail will be constructed across the Reed Mannagrass (*Glyceria maxima*) dominated swamp. Recreational users of the area will thus have the opportunity to learn about the plant and animal species found in the swamp. *Mika Orjala*

# Introduction

## Ecosystem services for the marketing of green areas

The background to ecosystem services is the *Millennium Ecosystem Assessment* (MA), which was started on an initiative by UN Secretary-General *Kofi Annan* in 2001. It established a basis for evaluating ecosystem services and for raising awareness of the effects of the changes taking place in them. The process was also influenced by the international agreements *Convention on Biological Diversity* (CBD) and *Convention to Combat Desertification* (CCD) as well as the *Intergovernmental Panel on Climate Change* (IPCC). The European Union has underlined the importance of ecosystem services in its adoption of the strategy to halt the loss of biodiversity and ecosystem services by 2020. The aim too is to rebuild ecosystem services.

What do we mean by ecosystem services? To put it briefly, the purpose is to identify the services that are produced by nature and attempt to discern their monetary value in a situation in which they have become disrupted by human activity and have to be artificially replaced. Ecosystem services can be divided into *provisioning services* (gifts of nature, farming products, fresh water, energy and raw materials), *regulating services* (regulation of climate, disease and erosion, control of flood waters, groundwater formation, water purification and pollination), *cultural services* (science, art, education, livelihood, recreation, well-being), and *supporting services* (genetic diversity, diversity of species and habitat, nutrient binding and cycling, soil formation, water cycling, photosynthesis, carbon sequestration).

Ecosystem services are critically important for life and are the basis of well-being. We do not even notice most of what we get from ecosystem services, even though they provide us with both tangible and intangible benefits. Nevertheless, the accelerating loss of biodiversity has attracted less attention than, say, climate change. Monoculture reduces nature's ability to produce services and recover from disruptions. It would often be cheaper to retain and use natural services than to produce them using artificial alternatives. For example, water purification and flood prevention should be accomplished by conserving nature, which produces these services.



Bee beetle (*Trichius fasciatus*) on an oxeye daisy (*Leucanthemum vulgare*). Hannu Klemola

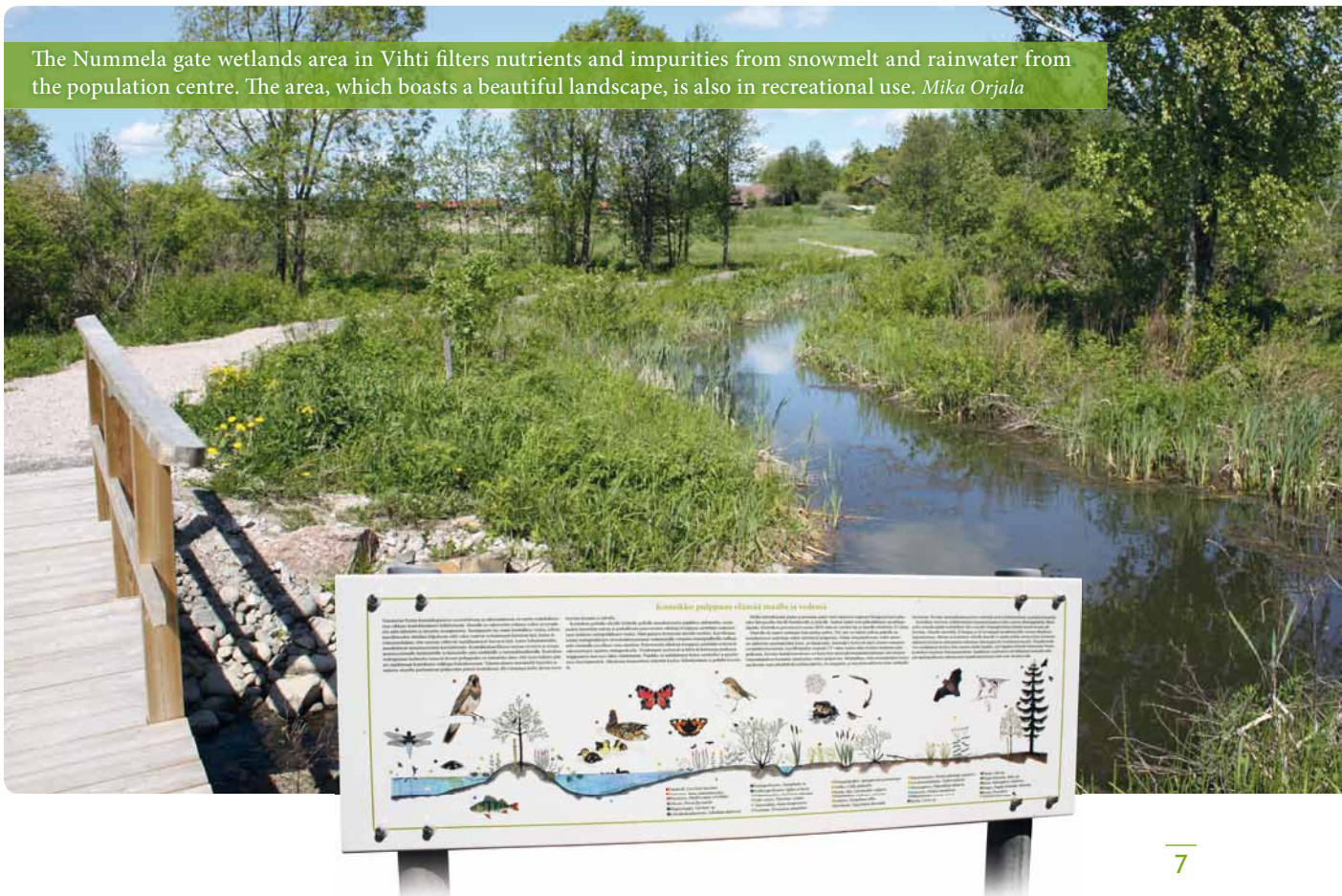


## City meadows as an ecosystem service

City meadows are a reminder of how surprisingly close in time our rural culture is to us. In the urban environment, they are important for filtering rainwater, for their floral splendour, as a habitat for threatened species, and for being part of the green area network and network of ecological corridors. In other words, city meadows and other green areas are an ecosystem service, and the services that they provide (such as their impact on biodiversity and the health of local residents) are described in this publication. A total of 23.3 % of our threatened species live either in their traditional environment or in other environments that have been changed by man. Traditional landscape species in decline mainly live in meadows, fields and pastures, the total surface area of which has fallen dramatically in past decades. Meadow maintenance or the creation of wetlands are measures that need planning and investment in the early stages, but their upkeep is cheap or even free. For example, the Public Works department in Viikki, Helsinki, refurbished the brook at Viikinoja as a green construction project as part of the project to raise the profile of the Eko-Viikki ecological suburb, with excellent results. The spotted crane (*Porzana porzana*) was seen in wetlands the very next summer.

Ecosystem services and, for example, the city meadow network can be protected by means of town and land-use planning. Successful planning needs first-rate surveys to be carried out, something that *Heli Jutila* writes about in this publication. The aim is to safeguard the operation of the green network, i.e., permit the movement and introduction of species in built environments. Often these same links also function as green corridors for the movement of people. The sites and networks must also be considered in green area programmes and maintenance plans with reference to their character. *Hannele Partanen's* article describes the need and benefits of a revised classification of green area management and how that classification would be an excellent tool for conserving and allocating resources. The quality requirements of open green space management should take account local residents, biodiversity, the protection of waters, the landscape and the work itself. This is about integrating perspectives of ecosystem services and evaluating the areas concerned, which also helps in the allocation of resources and with the cost-effectiveness of nature management projects.

The Nummela gate wetlands area in Vihti filters nutrients and impurities from snowmelt and rainwater from the population centre. The area, which boasts a beautiful landscape, is also in recreational use. *Mika Orjala*



## Nature promotes health and quality of life where people live

There is much traditional knowledge of nature's effects on health. Furthermore, the results of new studies support the notion that nature has a healing effect on anxiety, stress, attention restoration and perceived health. One way to bring nature to the cities is with ordinary green roofs, already to be seen in the world's major cities. They provide greenery amid the concrete and the tarmac, and they clean the air and bind carbon dioxide. Roof gardens also absorb the water that would otherwise overload the city's drains. They also even out urban temperatures, with energy savings being made in direct proportion to a reduction in the use of air-conditioning. Here *Ferenc Vilisics* and *Susanna Lehvävirta* write about the construction of green roofs and the ecosystem services that the roofs provide. Finland's largest green roof can be found at the Porttipuisto Shopping Centre in Vantaa. On the roof of the arts centre in Helsinki known as the Cable Factory, useful plants are being grown. Even many threatened species thrive on rooftops. Perhaps it is not such a big step from ancient peat roofing to urban green roofs, though it could be a slippery one!

We have also focused on the importance of nature and ecosystem services for human health. For example, the work done by Professor *Ilkka Hanski's* research team has shown that microbial diversity reduces the allergy propensity in humans. It has also been found that hospital patients with a view of a natural landscape get better more quickly than other patients in the hospital for the same reason who do not have such a view. Even only images of nature in a hospital can cheer up patients. This has been tried out in Kristiinankaupunki. Furthermore, the threshold for exercise is definitely lower if there is an inviting view of the countryside from a window. *Eeva Karjalainen* has also studied the importance of the number and quality of green areas for the health of local residents. Local green spaces also encourage social contact: you meet other people in parks and play areas or while walking the dog, in bird-watching towers or on ski trails. Nature has a positive effect on the mind and on the body, too. There may be considerable financial advantages to public health, and research work is needed to examine this connection.

When the importance of ecosystem services is recognised, they are accorded a value in policymaking. A good tool at the local level is residents' walkabouts and evenings, where local people can air their views on the upkeep of the area.

For example, on the *Nordic Day of Wild Flowers*, all over Finland there are guided tours of the local flora that anyone can go on. At the same time, the importance of city meadows as an ecosystem service can be naturally introduced. Resident's evenings are an opportunity for people to plan measures together and to give and receive advice on the long-term management of ecosystem services. The hopes and concerns of local people may relate to road safety, plot cultivation or the eradication of invasive species, or example. The knowledge capital of relevant actors should be exploited to consider such issues. The turnover of residents means that things need to be repeated. The management of meadow areas may also be channelled, for example, through resident associations, and it could become an annual tradition where people get together to work on a voluntary basis.



The splendour of wild flowers on a dry-meadow bed of violets (*Viola tricolor*). *Keijo Luoto*



## The landscape as a source of identity and inspiration

The landscape has a powerful communicative dimension as a shaper of identity. Understanding the uniqueness of a landscape is a basis for its appreciation. The Internet and online social networks can easily use images and maps to bring sites to the awareness of the public, recruit volunteers or advertise events. Nor should we forget the roles played by association newsletters, articles in the press and stories on the radio.

Finland has signed the European Landscape Convention, which promotes the protection, management and planning of European landscapes. Every year the Ministry of the Environment organises a competition to choose Finland's best landscape project. The Finnish Nature Conservation Act makes possible the establishment of a landscape conservation area in order to preserve and manage a natural or cultural landscape of outstanding beauty, historical interest or other special value. A landscape conservation area differs from the nature conservation areas inasmuch as conservation does not mean restrictions on human activities, but the way that the values are to be preserved have to be decided for each site individually. Instead of, or in addition to, regulations, landscape values management can also be based on guidelines and recommendations. This little-used tool is especially suited to large and significant traditional landscapes.

The cultural services that nature provides have been given less attention. A stunning view, a soundscape, fragrances and recreational facilities boost enjoyment of life, health and the value of property. There are also legends associated with the landscape and its details. Even the seasons can be regarded as a cultural service provided by nature. Nature inspires artists, musicians, writers and filmmakers. A work of art entitled 'Veden taika' (*The Magic of Water*) was realised in the Halikonlahti Green Art project in Salo. This is an ecological and community environmental work of art by Jackie Brook. The floating islands later provided a nesting site for the black-headed gull (*Larus ridibundus*), colonies of which give protection to many water birds in wetlands.

## The end of the beginning

This approach to ecosystem services provides a basis for the collection of data on human dependence on biodiversity and ecosystems and the limits to the exploitation of natural resources. The concept can help us see the reasons for the problematic effects of the use of natural resources and land and succeed in helping developing practices that enable us to make use of the services and strengthen them. At the same time, we can strike a better balance between using and protecting nature. Nature management makes us able to make ecosystem services stronger automatically, with a little initial input and a minimum of maintenance. An ecosystem is viable if it can regenerate itself. More information is needed about the services, however, and there must be more training and guidelines to aid environmental impact assessments of projects. This publication serves this purpose.

The protection of natural values also brings with it money and jobs. Set to benefit are the cities and local authorities, hiking and travel companies, and those that deliver catering and accommodation services. The ecologically sustainable use of ecosystem services such as cultivated trees or reed beds saves the environment and is important for an area's identity, economy and tourism. Moreover, the management of nature sites and traditional landscapes in itself is a source of employment.

People and nature come together in cities, built-up areas, parks and the countryside. More than half the world's population now live in cities, and there are no signs that this urban trend is slowing down. Nature, however, is astonishingly rich, even in the heart of cities. City meadows and other green spaces are hugely important for people's well-being. We who live on the shores of the Baltic Sea can still enjoy our diverse city meadows, which supply us with many types of ecosystem services. But our meadows need care and attention. Investment in the restoration of coastal and city meadows has brought visible results in the landscape and the variety of species that exist, and this is the greatest reward and incentive for keeping up the good work. ■

# Ecological corridors and green area networks in cities and towns

*Heli Jutila*

Even though the priority in town planning is often on the location of settlements, traffic, networks, business and other activities, there are specific arguments for the reservation of urban green areas to ensure recreational opportunities for people and to conserve nature's biodiversity. The best way to create a functional green area network is by maintaining sufficient connectivity between the green areas. In the Helsinki metropolitan area, the aim for many years now has been to create a so-called green belt.

The maintenance or non-maintenance of green areas has an effect on how human beings and nature can utilize these areas. The more intensive the maintenance, the less space is left for nature. On the other hand, a completely untended space does not satisfy requirements for recreational use. A proposal has been presented to the effect that controlled non-maintenance would provide a good starting point for the management of urban green spaces.

## Concepts

An ecological corridor or eco-corridor may be defined as a natural green connection that enables the dispersal of native species (Haila et al. 2010). Species can move from one area to another along ecological corridors or they can colonize new areas. The concept originally emerged in connection with nature conservation, from the standpoint of individual protection zones, applied to island biogeography. For the last few decades, the fragmentation and connectivity of habitats have been a subject of ecological research (Hanski 1999, 2005, 2007). From the perspective of metapopulation theory, the essential fact is the connectivity between patches, that is, the network of ecological links and the temporal dynamics of the network. One might ask in which way the patches should be connected and what the ecological corridors should be like to be functional.

The definition of a green corridor is generally approached from a human viewpoint: namely, it is a corridor used by people for going outdoors and for recreational activities as well as for moving from one place to another. Correspondingly, a green network is a network made of these green corridors.



## Factors that affect the functionality of ecological connections

The necessity and functionality of eco-corridors is linked to the species and natural habitats of the area. The starting point for all planning is adequate habitat surveys that include the charting of species and natural habitats. The habitat of the species to be conserved and the time scale have a great bearing on the importance of an ecological corridor.

Ecological corridors may consist of long, uninterrupted vegetation belts such as hedges, strips of forest or plant life on river banks. Like stepping stones, they can also consist of small habitats that are separated from each other and where an organism can look for shelter, food and a resting place. Wide ecological connections are formed of diverse landscape elements and offer a protected option to move from one core area to another.

The functional width of eco-corridors depends on the species intended to use them. Eco-corridors that are too narrow are wholly edge-influenced, and species that require more protection cannot settle on them. For frogs and small mammals, the width recommended in Central Europe is 250 metres, and for bigger mammals, a width of more than 250 metres is recommended. Deer need a width of 400 to 1000 metres. From the standpoint of forest plants, a height of three full-grown trees is regarded as the minimum. A forest edge offers protection to its core parts from wind, insolation and wear.

Very few rare plant species can be found on the narrow protection strips for fields, but in wider protection zones these can be found much more readily (Tarmi et al. 2011). The phenomena can be explained by the strong influence of fertilizers and pesticides in the narrow protection strip. On the other hand, even narrow strips on field margins have been found important for certain insect species, and in Great Britain it has been shown that, in addition to their importance for the landscape, narrow hedges also have protective value for species.

Certain species have specifically adapted to marginal zones: of these, the most typical are the species on the margin of land and water – the shore species. The marginal zone or ecotone can thus consist of many

species, but the species composition varies from one place to another less than that of the species of the core habitat. A narrow eco-corridor depends on species coming from elsewhere, whereas a wider island of urban green also allows the functioning of the local population.

In addition, connectivity between the urban green islands is of central importance. The separateness of habitat islands makes it difficult for some plants and animals to disperse from one area to another, but certain species can also advance along narrow strips. For example, streams are strip-like habitats and springs are point-like. Dispersal capacity varies by biotic groups and species. For a hedgehog, frogs and reptiles, moving from one island to another is difficult, whereas for birds it is easy. The passage routes for small and slow animals, such as hedgehogs and frogs – over or under streets, roads, railways and waterways – can be protected by building underpasses, green bridges and stepping stones. Eco-corridors have proved suitable for increasing migration between habitat patches for day and night butterflies, for small mammals and for birds, among others.

Among species with poor dispersal characteristics, separate sub-populations can form as the built-up area expands. These small populations are more likely to become extinct. In general, one should be aware that protection of key biotopes that are confined to small areas and aimed for the protection of threatened species is quite laborious. For small populations, the risk of becoming extinct is great. The smaller the population, the greater the risk of becoming extinct. Certain kinds of species are successful in a network of habitat patches, but even these need places to disperse.

Ecological corridors are often naturally created along waterways. Earlier, shores that were inundated remained beyond human use. Today, especially small rivulets and principal ditches are important ecological links. We have also awakened to notice the nature, landscape and recreation values of urban rivulets. They also function as detention and treatment areas for rain water carried from wide, covered surfaces. Conserving adequate amounts of green areas, even when the urban structure is getting more dense, is important to preserve the water balance and to moderate inundations.

The importance of individual city trees as air purifiers is not that great, but nevertheless, wider green areas may still have a certain influence. On the other hand, the aesthetic significance of green areas is undoubtedly great. For example, stress and blood pressure diseases decrease if there are green areas in the vicinity.

Areas where the green area network does not meet the users' wishes may form as the city expands and areas of single-family houses appear on the outskirts. Economic pressures on municipalities have led to more efficient planning of society's structures, many times at the cost of green areas. Residents may lose previously valuable outdoors areas without this being acknowledged in the town planning.

## Maintenance of green areas

The intensity of human activity affects the quality and location of urban green areas. When moving from the maintained parks of the central city area to the outskirts of the town, the intensity of the maintenance of green areas decreases and one will find urban green also outside the actual green areas. Municipalities in Finland have drawn up green area programmes outlining the maintenance of parks and other recreation areas. On the basis of its intensity, usually three maintenance classes are distinguished (Nuotio 2007) from environmentally constructed parks to naturally maintained green areas and urban forests.

The priorities in Hämeenlinna's green area programme until 2015 (Vertainen & Lappalainen 2005) included conservation of historical parks by renovation, preservation of shores for general recreational use and continuation of the shore route, organization of green area services for new residential areas, and development of a national urban park according to the management plan. The aim is to promote the biodiversity and integrity of the route network, especially on the Vanajavesi lake shore. Controlled non-maintenance could be utilized more than is being done now because it has been found to be a form of maintenance that is just right in meeting the requirements of many species of cultural meadows.

The quality of urban green can be improved and the species increased, for example by leaving ecological corridors between green areas, conserving different natural habitats as well as favouring controlled non-maintenance and the naturalness of habitats. For example, by postponing the mowing of roadsides, flowering plants are given time to produce seeds and the roadsides will start thriving and producing multiple species. The conditions for the fauna can be improved and, at the same time, its traffic mortality reduced by guiding fauna with fences and tunnels.



Figure 1. The core of Hämeenlinna National City Park and the shore route along the shores of Vanajavesi. The area continues to the north to the area of Aulanko.

Base map: A false colour picture of the city of Hämeenlinna taken in 2010 and ortho image material of the National Land Survey of Finland 11/2012.

Natural diversity of built parks is often far too limited. It could be increased by conforming to and adapting the list drawn up by the Tampere Nature Conservation Society, as follows:

- 1) By reducing the number of times that lawns are cut, which would also yield economic savings.
- 2) By saving lawns when cutting the occurrences of flowering herbaceous plants, which should be cut only after their flowering is over. In Hämeenlinna, this is the exact method of application to yellow wood anemones that flower near the railway station in springtime. It is worthwhile to increase flowering lawn plant species by sowing seeds and by planting bulbs.
- 3) By changing lawn areas into diversified meadows in places where they have mainly landscape value. In Hämeenlinna, apart from the shore route, there is the dry and sandy field edge of Ahvenisto, which has been maintained as a meadow. Money can be saved in the maintenance of meadows. Pori serves as a good example.
- 4) In the city's flower plantations, it pays to use butterfly plants and other insect plants. That will increase the diversity of predatory birds and bats. The butterfly park found in Riihimäki could serve as an example for many other parks.
- 5) By preserving the use of herbicides for fighting only harmful exotic species such as the giant hogweed.
- 6) By saving tall and valuable old trees in parks and on streets for as long as possible. Many large deciduous trees rot from within. When the trees must finally be removed, they should be transported to the city's forests to decay.
- 7) By leaving some rotted trees in parks, either standing or on the ground. Wild lime, Norway maple, oak and birch trees could be cut at the height of 4–6 metres and left standing to rot. This would provide the city with statuette elements of rotting trees that emphasize the parks' dignity and diversity. Helsinki and Tampere have gained experience in placing rotting trees in maintained parks.

- 8) By favouring several different tree species in an all-round way in the city's tree plantations.
- 9) By increasing the number of bushes because they increase shelter in the parks and offer opportunities for nature. It is worthwhile to favour berry bushes, which provide nutrition for birds and mammals.
- 10) By hanging nest boxes for birds, bats and flying squirrels in the city's parks.

According to the nature conservation organizations in the Helsinki metropolitan area, the handling of recreational forests in municipalities is too rough and useless. Treatment of strands lessens the diversity of the forest structure. It can even increase wear damage and make it more difficult for the stands to grow again. Natural obstacles, brushwood and scrub guide wanderers in the forest. In the forest, this creates areas that are protected from wear, and the flora can grow again (Susanna Lehvävirta).

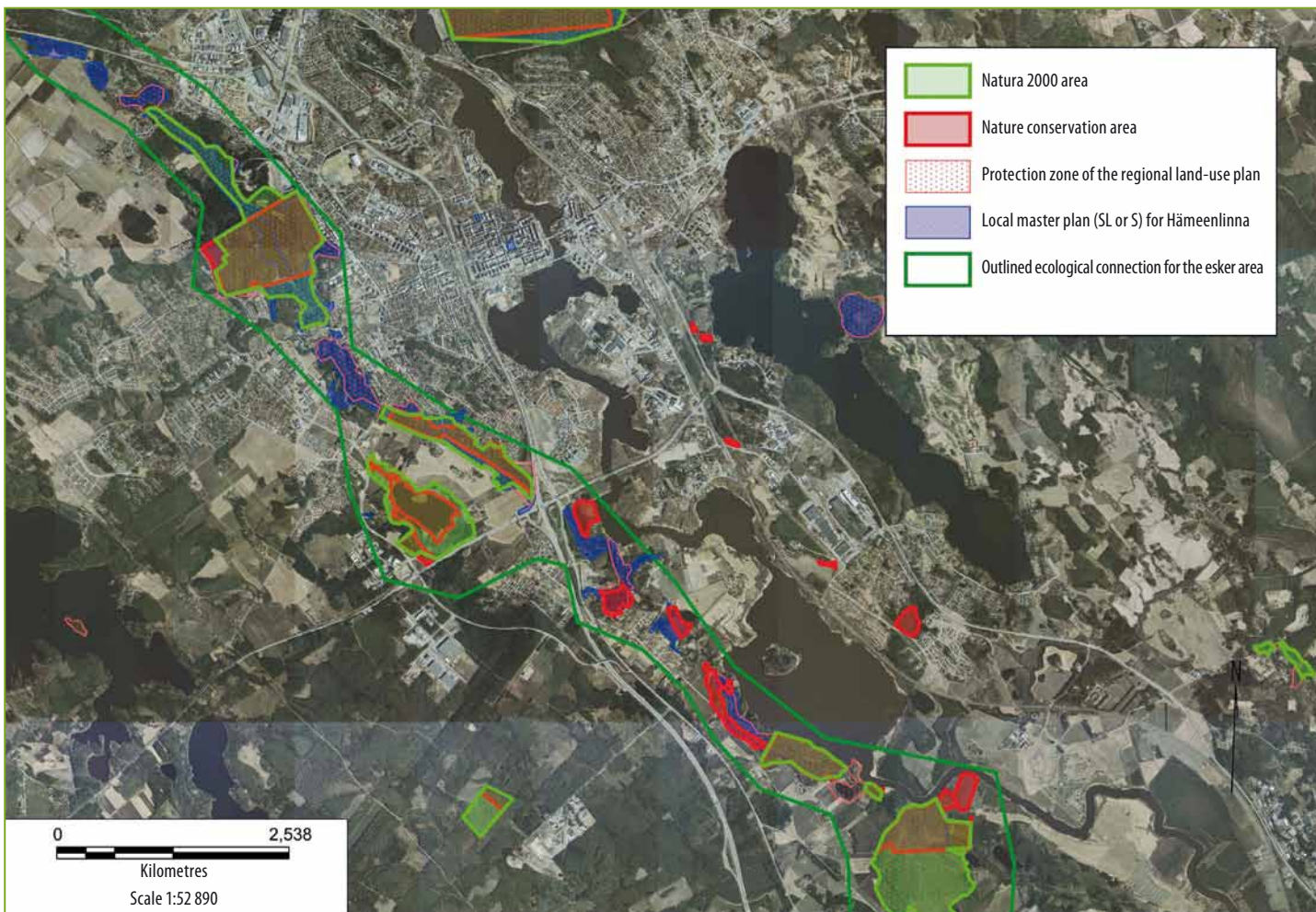
Forest edges with dense growth protect the forest core. Brushwood offers protection for sapling stands and a substrate for species that depend on dead wood. On the other hand, users of green areas may consider thickets, dead standing trees and brushwood as repellent, unclean and increasing insecurity. Regrettably, workers who are responsible for maintenance often appeal to security issues. Clearance and removal of scrub has just as strong a hold.

Rotten trees could be used more than now in the structures of green areas. This is important because, according to estimates, every fourth species living in a forest habitat depends in some way on the existence of rotting wood.

### **Eskers and Vanajavesi as one of the backbones of ecological connections in the Hämeenlinna city centre**

In Hämeenlinna, ecologically significant connections have remained on the northwest–southeast area of esker ridges, where several nature conservation and Natura areas have been established (*Figure 1*). In the 1990s, the esker part of the partial local master





**Figure 2.** The location of Natura areas, nature conservation areas and the protection zones of the regional land-use plan and the local master plan for an area formed by the Miemalanharju–Hattelmanharju–Ahvenistonharju ridge of eskers and, together with their buffers, the ecological connection they form. The conservation reservations of the local master plan (SL or S) are not up-to-date except as far as the esker area is concerned. *Base map: Ortho image material of the National Land Survey of Finland 11/2012.*

plan ensured the conservation of the green zone structure for the ridge area and took it into account in forest management. The connection from the Raimansuo and Miemalanharju nature conservation area continues to the Norjanmäki nature conservation area and the Hakovuori nature conservation and historical monuments area. The esker cut by a motorway continues through the Hattelmanharju nature conservation and Natura areas protected as a herb-rich forest along an esker, which is reserved as a recreation area, to Ahvenistonharju, which is also a part of the nature conservation area and the Natura area continuing to Vuoreharju. This esker continues forested to the Parola military site in Hattula and finally as Ruskeakärki up to the Vanajanselkä lake shore. The flora of herb-rich woods, grove-like areas and sunny slopes is diverse: the rarest species there include cutleaf anemone (*Pulsatilla patens*) and hawk-beard (*Crepis praemorsa*). This backbone of eskers forms the base which provides the city of Hämeenlinna with an opportunity to extend its present national urban park that extends to the shores of Vanajavesi.

The first national urban park of Finland, which was established on 10 January 2001 in Hämeenlinna, protects the urban green in the city core on the shore areas of Vanajavesi and includes Häme Castle, the manor house of Ojoiste, the City Park, Aulanko, the side of the railway and the Varikonniemi areas (*Figure 2*). The so-called shore route that goes along the eastern shore of Vanajavesi to the railway bridge and back has become very popular among residents and visitors to the municipality. The flora along the railway has been known for quite a while to be composed of multiple species. The importance of the area as an ecological corridor for meadow flora clearly increased with the creation of the shore routes. At that time, it was decided that the park planning for the side of the railway would be serve the requirements of nature. By the side of the railway, a single much larger meadow area was established to be sown with meadow flora. Otherwise, the side of the railway remained natural to a large extent. Benches, viewing structures, footbridges and a fireplace were placed along the route.



During summer, the route remains lush (Figure 6), which attracts butterflies and hymenoptera. Apart from the herbaceous exotic meadows and the shore species of Vanajavesi, the area has earlier sown meadows, and the flora includes the maiden pink (*Dianthus deltoideus*), the brown knapweed (*Centaurea jacea*), the giant scabious (*Cephalaria gigantea*), the common chickory (*Cichorium intybus*), the blueweed (*Echium vulgare*), broad-leaved thyme (*Thymus pulegioides*), the haresfoot clover (*Trifolium arvense*) and the hoary plantain (*Plantago media*). For the most part, a single mowing once each summer has proved sufficient for the maintenance of the meadows, but recently lupine (*Lupinus polyphyllus*) has increased alarmingly. Thus, a strong emphasis must be put on its future prevention to preserve the lushness of the meadows. In Varikonniemi, there is still quite a collection of exotic plant species, such as the blue-sow-thistle (*Cicerbita macrophylla* ssp. *uralensis*), the Chinese ragwort (*Sinacalia tangutica*) and the yellow oxeye (*Telekia speciosa*). The specialties of the Vanajavesi shore forest are the European white elm (*Ulmus laevis*) and the foxtail willow (*Salix x alopecuroides*).

Vanajavesi provides the habitat for many other nutrient-rich water species, such as water insects, molluscs and fish. Pigeons, jackdaws and crows have been accompanied by seagulls and terns nesting on roofs in Hämeenlinna.

## Paying attention to ecological networks in town planning

Ecological connections should be taken into account at all levels of town and country planning by creating contiguous green area networks and green corridors through the areas in question. Even those involved in the European Union talk about green infrastructure, regarding the Natura 2000 network as its base. The aim is an ecologically coherent whole that will secure species' genetic exchange in the long run. There is no national plan in Finland, but ecological connections have been examined on the national level, e.g. in the "State of the Parks in Finland" report by Metsähallitus (Heinonen 2007). Our nature conservation law talks about the recommended protection level. Ecological connections are especially important in adapting to climate change.

Wide ecological connections could be taken into account in the regional land-use plan. In the Central Finland region, ecologically valuable zones and sub-areas as well as important areas for recreational use were surveyed between 2003 and 2005 at the initiative of the Finnish Association for Nature Conservation (Uusitalo 2006). An ecological network survey has been also made in eastern Uusimaa (Väre 2002).

The aerial photograph of Tavastia Proper clearly outlines the forests and lakes of the Tammela upland area, the swamps in the direction of Renko, the forests in the areas on the eastern side of Katumajärvi and, apart from these, wide forests in the area of Evo in the east. In the regional land-use plan of Tavastia Proper, ecological connections are not shown as land reservations to any particular extent. In the vicinity of towns and cities, green area reservations have been indicated, but there hasn't been much sign of protecting them in the countryside. Only the conservation reservation of Evo's large regional land-use plan draws attention to its extent. Ecological connections between forest areas are cut in the Vanajavesi valley, for example by settlements and agriculture, and currently more and more by traffic connections. The regional land-use plan indicates some tunnels reserved for the passage of animals underneath the motorway.

The local master plan is quite suitable for examining the green area network and connections, and for this reason, Jyväskylä has drawn up a partial local master plan for the green areas. It is worthwhile to define the ecological connections on the local master plan level and also try to preserve them in the detailed plan.

## Considering ecological corridors in the planning of Hämeenlinna: examples

In Hämeenlinna, the aim has been to preserve green corridors or ecological corridors in local master plan maps, even though they are not actually mentioned in the plan report or plan maps. The partial local master plan for the eastern part of Katumajärvi (decision 2006/confirmation 2008) shows green connections mainly by means of recreation area markings (VL), but the plan report does not mention ecological connections, and even the green connection comes up only a couple of times (Figure 3).

With the local detailed plan of Siiri II, it was found that the background studies for the partial local master plan were not comprehensive enough. It turned out that Siiri has an herb-rich forest and herb-rich heath, which was evaluated in the nature survey as valuable to the locale and should perhaps be conserved (Kyheröinen & Honkala 2008) (Figure 4). In later studies (Heli Jutila), it was found that the target was more valuable and includes herb-rich forest mire, which is particularly threatened. The herb-rich spruce forest referred to is also suitable for flying squirrels, and signs of their existence were found there. The nature survey also proposed the saving of an ecological corridor on the edge of a field, assuming the preservation of the herb-rich forest turns out to be successful. It would ensure a protected route of passage for mammals and birds as well as predation

environments and passage routes suited for bats. The foundation for the local detailed plan, a main traffic route passing through the herb-rich forest, was not altered during the preparations, even though additional information about the natural values of the target was obtained and the target could clearly be regarded as valuable. As a result of an appeal concerning the plan, the Administrative Court of Hämeenlinna ordered by its decision (23 January, 2012) that the Siiri II local detailed plan approved by the city council (12 December, 2011) would go into effect but would not include the herb-rich forest. In its final decision, the court pointed out that the Siiri II local detailed plan did not adequately pay attention to the fostering of natural values, and thus the decision of the city council regarding the disputed part was unlawful.

The Äikäälä area lies in the southern section of the partial local master plan for the eastern side of Katumajärvi. At an early phase of its detailed planning, it was noticed that the green connections shown in the local master plan were not based on natural values; rather, they were based on the idea about where people could move around. In connection with the Äikäälä nature survey (Jutila & Metsänen), it was found that the locally valuable herb-rich forest on the eastern side of Päivölä needed protection. The area forms an ecological corridor as well as a passage and a suitable range for bats and flying squirrels (Figure 5).

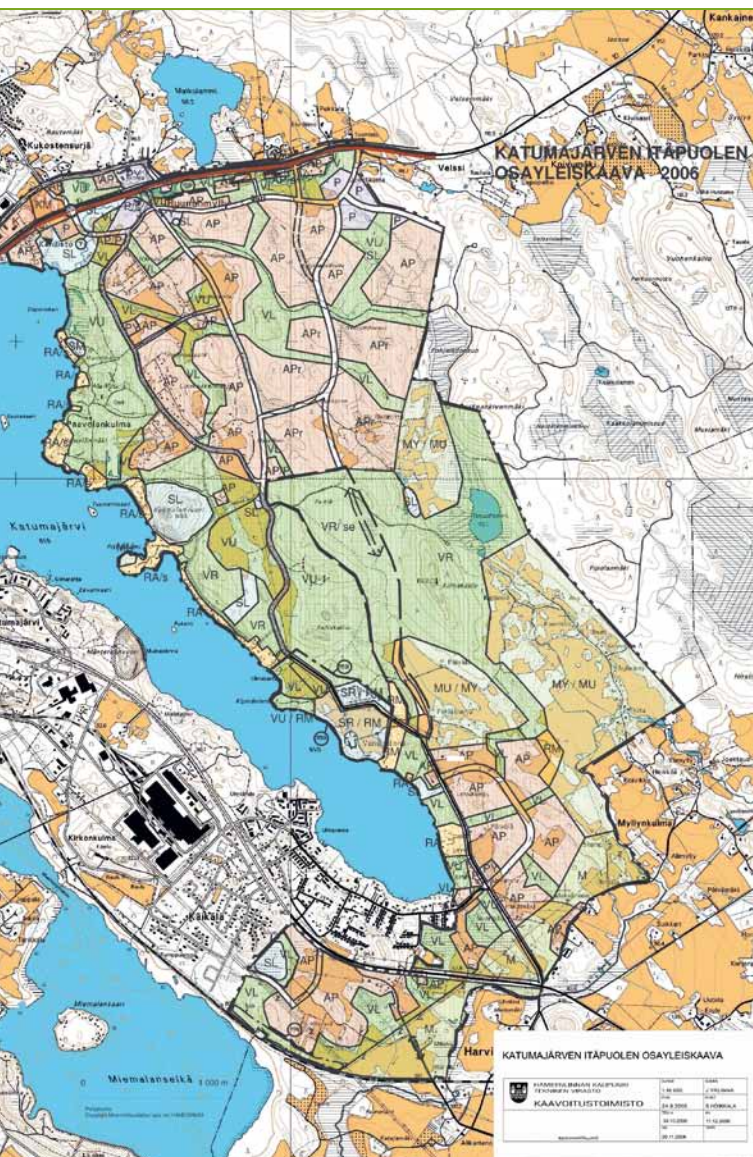
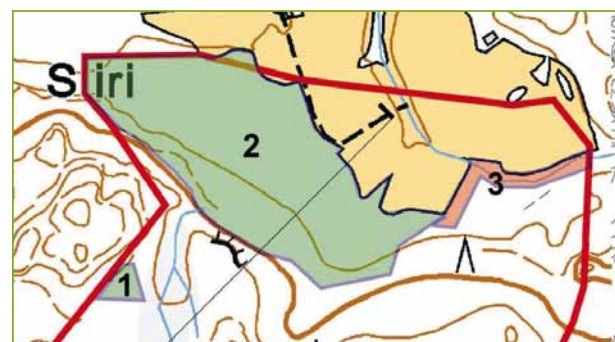


Figure 3. Green connections in the partial local master plan for the eastern part of Katumajärvi (decision 2006/confirmation 2008). Planning Officer Jaakko Välimaa. Map copyright: City of Hämeenlinna.

Figure 4. Siiri II's notable targets by their ecological value. 1 = Old pine trees, 2 = Herb-rich forest and herb-rich heath, 3 = Proposed ecological corridor. Source: Kyheröinen & Honkala 2008. Base map: Base raster map of the National Survey of Finland 11/2012.





The drafts of the Sampo–Alajärvi partial local master plan show the recreational connection (which is also included in the regional land-use plan) between Ahvenisto and Tervaniemi. The plan states that the valuable nature destination of the area on the northern side of the Loimalahdentie road as well as the side of the Sammonoja rivulet and the natural gas line provide good starting points for the planning of recreational routes. A nature survey (Jutila 2010) was carried out during the planning of the Sampo III area, where herb-rich forests and small water bodies were found. Most of the zoning area consisted of fields and was earmarked for residential settlements.

A northern, woody ecological corridor separated the already existent residential area from a new one and became wider near the ponds. An open or half-open green corridor took shape in the south. It is suitable mainly for meadow or water organisms, at least in the initial phase of succession. The deepening and planning of the Sammonoja rivulet as a green connection was already carried out with the earlier local detailed plans of the Sampo area. Today, there is a frequently used and praised green connection along Sammonoja, although the hoped-for resources for its maintenance have been lacking.



Figure 5.

Äikäälä areas of natural value and connections based on plant life, flying squirrel and bat surveys. Source: Jutila & Metsänen 2011. Base map: Ortho image material of the National Land Survey of Finland 11/2012.



## Paying more attention to ecological connections in town and country planning

More information, education and guidance about ecological connections are needed to be able to better take them into account in town and country planning. In the short attention spans in our present culture, we expect that the plans will materialize in a few years. Often the local master plan trails the detailed local plan, and the detailed local plan trails building permit approvals or deviation decisions. When small token areas are planned in a city structure, the whole is not perceived and the significance of ecological connections and the needs of recreational users are forgotten. Zoning is often looked at from the perspective of construction and development, and for this reason, plans with a protective approach are much rarer.

More attention should be paid to ecological networks in planning surveys. The importance of green and recreational areas should be evaluated from the perspective of threatened and directive species and from the perspective of threatened natural habitats. As the management of green areas often has a central role in conserving species and habitats, it is sometimes necessary to issue plan regulations, with which management measures can be better defined. A local recreation area marking (VL) or a camping area marking (VR) does not always guarantee that forest management would enable an efficient functioning of the area as an ecological connection. According to the Land Use and Building Act, a landscape work permit is required for local detailed plan area activities that significantly alter the landscape. Also the local master plan may require it separately. A landscape work permit makes it possible to intervene in a more detailed way in the management of the areas based on the given plan regulations. The requirement of a landscape work permit for different management measures, however, varies from one municipality to another, and often that kind of permit has not been required for the thinning of forests. ■

Figure 6.

Sticky catchfly (*Lychnis viscaria*) thrives along the shore route at the Hämeenlinna National City Park. *Heli Jutila 11th June, 2012.*











Residents enjoy the abundance of vegetation on meadows and landscape fields. *Riikka Söyrinki*



# City meadows and landscape fields

*Hannele Partanen*

## **Meadows and landscape fields popular among residents**

*The appreciation of open spaces, such as fields and meadows, as maintained green areas is increasing in municipalities and parishes. Meadows and landscape fields are also popular among residents, and their maintenance thus constitutes an interesting future prospect for the green sector.*

An increasing amount of feedback is obtained from citizens of municipalities regarding more widespread maintenance of such areas. These areas provide opportunities for recreational use by inhabitants of population centres, and their variable landscapes may function as a calling card for the municipality. When maintained, they offer opportunities for enjoying the diversity of nature and the openness of landscape.

Areas awaiting planning or construction and unbuilt green areas are often forgotten and become untended wasteland. Yet when maintained, these areas contribute to the quality of the environment and the enjoyment provided by it in a significant way and should thus be managed at least by mowing. The areas may exist for long periods of time with no actual purpose to them, in which case a landscape meadow, for example, may lend completely new value to the location.

From the viewpoint of the maintenance of open areas in the landscape, it is important that the areas are included in all plans pertaining to the use of green areas in the municipality, from planning to the green area programme and, finally, to the maintenance plans of the areas.

## **Maintenance classification of open areas renewed**

The national maintenance classification for green areas was published in 2007. The most significant change with reference to the old maintenance classes concerned open areas or maintenance class B. Their number increased from two to five. The maintenance classes are:

- B1 Landscape fields
- B2 Meadows for outdoor activities
- B3 Landscape meadows and pastures
- B4 Open area and open view
- B5 Meadows of important value



## Maintenance classification for green areas

### B1 Landscape fields

Plants cultivated in landscape fields are crops and flowering plants contributing to the beauty of the landscape. Visitors can be guided to a walkway at the edge of the field or on protective zones around waterways.

### B2 Meadows for outdoor activities

Meadows for outdoor activities are open or half open green areas. They provide different opportunities for exercise and spending time outdoors. Meadows for outdoor activities can be part of a recreational area or park.

### B3 Landscape meadows and pastures

- **Landscape meadows**

Landscape meadows are maintained to preserve an open landscape. Visitors are guided to pathways or meadow paths. Landscape meadows are important from the viewpoint of the diversity of nature and the maintenance of cultural landscapes.

- **Pasture**

Pastures are meadows and other half-open areas that are tended by grazing. They can also be used for recreational purposes and outdoor activities to some extent. The care of the animals and any use of the area must comply with the maintenance plan.

### B4 Open area and open view

Open areas and open views are commonly located next to roads and other routes leading to the population centre. These include small openings in the woods, overgrown fields and areas beneath power lines. They may also include views to river and lake landscapes and sites that are significant from the viewpoint of nature or landscape. The maintenance of open areas and open views increases citizen's enjoyment of the areas and they are considered to become safer.

### B5 Meadows of important value

Meadows of important value are meadows defined as important from the viewpoint of cultural heritage, landscape or biodiversity or they hold other value to the residents. Their management is based on site-specific maintenance plan.

As the maintenance classes were renewed, new criteria and guidelines for the maintenance work were also required. The maintenance of the areas can only be started properly when it is known what type of work will be requested and what requirements must be met by the finished work.

The criteria and guidelines emphasise the requirement of diversity. In the maintenance of the areas, in addition to finishing the work requested, it is necessary to account for factors such as inhabitants of the area, biodiversity, the protection of waterways and values associated with the landscape. Instead of strict step-by-step instructions, the guidelines focus the quality of the maintenance work when completed. The criteria and guidelines for the work are outlined in the publication *"Niityt ja maisemapellot" (Meadows and landscape fields)* by the Finnish Association of Landscape Industries.

## Residents should be informed about the following

Municipalities have different goals for the development of open areas, such as obtaining yield from a corn field and improving recreational opportunities in meadows for outdoor activities. The objective of maintenance in unbuilt plots can be maintaining an open landscape or preventing the growth and spread bushes.

A common aspect of the maintenance of the areas is that local residents need to be informed of the work carried out. Channels used in the communication can include the websites of municipalities, press releases on the implementation of the work and guide posts installed in the areas.

Listening to the opinions residents is important both when planning and when implementing the work. For example, the residents may request an earlier mowing of the vegetation due to allergies caused by the plants. In such case, hay allergies and the efforts to prevent the spread of mugwort may impact the timing of the mowing. Some areas may also be affected by mites, particularly problematic for dog-owners, in which case the residents may propose a second mowing of the area.

## Low-cost maintenance

Open areas, also known as B areas, can be maintained more easily and at lower cost than lawns. The funds available for the maintenance of green areas do not increase, even though the general cost level continues to creep up. In order to make sure the management is as cost efficient as possible, it is necessary to consider the alternative management methods closely and from different perspectives.

The maintenance costs of fields and meadows are calculated to be about one fifth compared to a built park. Once the basic improvements have been carried out on the areas to be taken under maintenance, systematic maintenance work using machinery is enabled. It is necessary to take into account, however, that the basic costs will be more elevated for the initial 1 to 5 years, for example, when greater effort is placed in the improvement and management of the areas.

The costs from landscape fields are no greater than those from arable farming in traditional agriculture. When perennial plants are cultivated in the fields in addition to annual ones, the greater seed and management costs of the first year are evened out in the following years. The management work of a landscape field can, however, be slow if proper foundation has not been laid for the field or the field is irregular in shape.

In grazing, the initial costs may be relatively high, but the annual maintenance costs remain fairly low. Compared to the maintenance of a lawn or repeated

clearance works, grazing is a low-cost method of environmental maintenance. The costs vary from case to case, and they generated though activities such as the construction of an enclosure, and the transportation, care and control of animals. For further information on the costs of grazing, see [www.laidunpankki.fi](http://www.laidunpankki.fi).

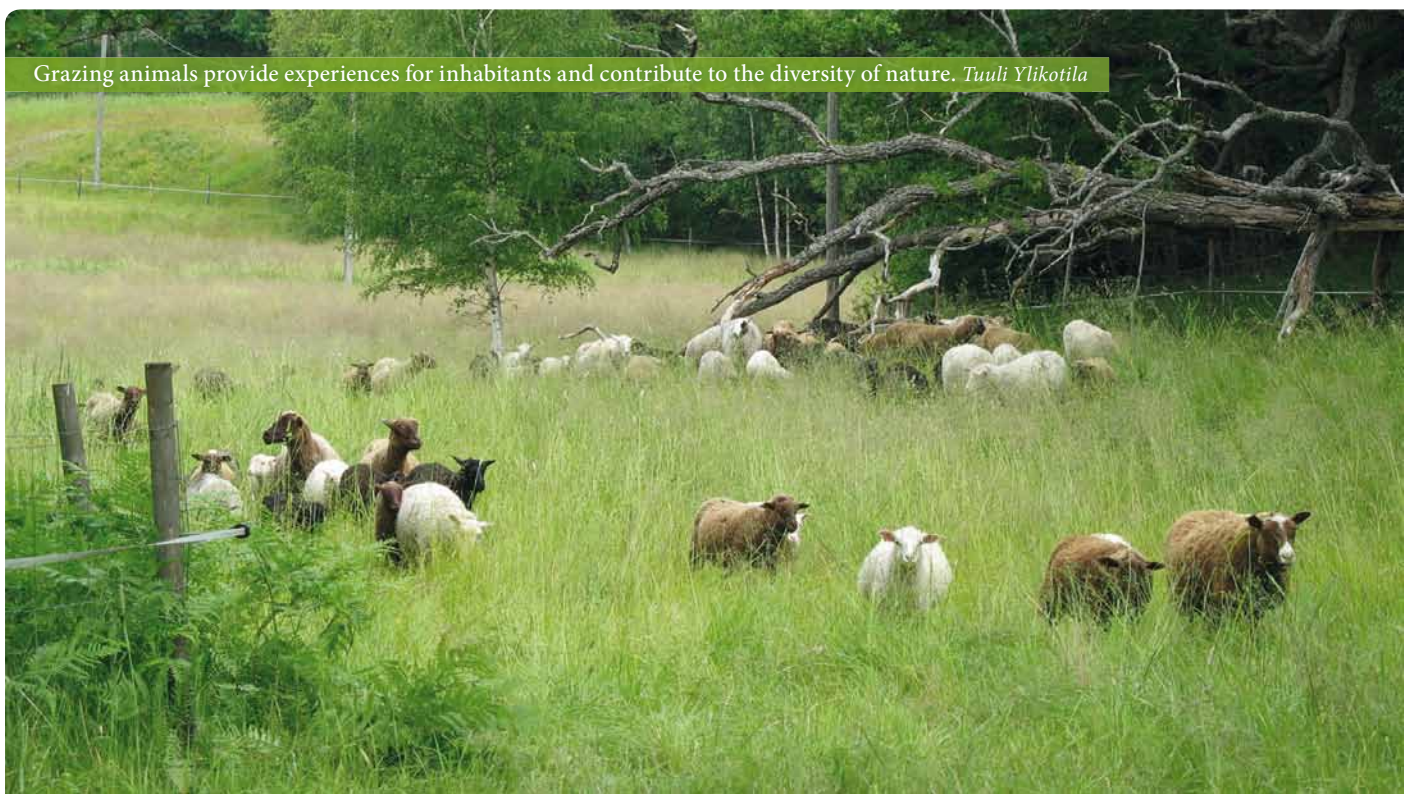
Grazing based on an agreement is one option for the management of vast rural landscapes by municipalities. Grazing based on agreement must be financially profitable for farmers in order to provide sufficient incentive for becoming involved.

## Long-term maintenance agreements

The management of meadows should be considered in the long term. Long-term agreements provide incentive for restoring the areas in a fashion that enables easy management. At an early stage, the costs may be greater due to the expenses related to the establishment of the site. On the other hand, attention to detail at the restoration stage is likely to generate savings in the years to come, for example through quicker mowing and shorter driving journeys.

In addition to the clearance of trees, shrubs and bushes, it is necessary to grind out tree stumps and remove stones. The clearance work must be accounted for in the costing, as it is often the most costly aspect of the management of the areas. Evening out the land is often worthwhile, as it enables the use of machines in the maintenance work. For example, old

Grazing animals provide experiences for inhabitants and contribute to the diversity of nature. *Tuuli Ylikotila*







field ditches create an uneven surface, meaning that the contractor is forced to drive slowly while carrying out maintenance work.

Interest shown by residents in the time of mowing and the blooming of plants may function to slow down the mowing. It is necessary to bear in mind, however, that the involvement of residents is a positive thing and part of how things are done in the contemporary society. Possible downsides may include rubbish left at the site that may prevent the work or cause the machinery to break thus leading to the need to organise additional transfer of machinery, for example.

### **The mapping of meadows provides information on the status of nearby areas**

The mapping of meadows and fields produces an overall picture of open green areas in municipalities and opportunities for their development. Mapping and the planning of maintenance creates savings in both time and money. The mapping also supports the planning of the management of planned green areas and unbuilt areas. The organisation of work and cooperation between different departments is improved. At the same time, we also obtain basic information about the areas for use by public authorities and citizens of the municipality.

In 2010 to 2011, the City of Tampere mapped a total of 170 open B areas located in planned areas. Some years

ago, the municipal authorities in Tampere realised that unless something is done to open B areas, they will disappear for good. The City of Tampere uses less than one per cent of the appropriations for the maintenance of green areas for the management of B areas.

There has been no regular maintenance – the areas have been managed through occasional visits. Only some of the areas have been thoroughly managed, and the resources for maintenance have been directed mainly to A areas, the combined area of which is approximately 450 hectares. In B areas, ditches have been blocked, culverts are no longer functional and there has been no regular mowing.

The working group determined and defined the content of the work and the areas to be mapped. The targets are mostly small and located in different parts of the city. Once the areas have been mapped, they can be managed in a planned fashion and in a way that also generates savings in costs.

Rural Women's Advisory Organisation Pirkanmaa/ProAgria was selected as consultant for the work, and the practical implementation was carried out by landscape architect Riikka Söyrinki. The consultant was responsible for the mapping of the areas as well as tasks such as the updating of maintenance classes and produced a plan for the basic maintenance work. The consultant was provided with maps including the locations of the open areas. She was also provided with environmental information on the sites, based on entries in the city's location data system.

As information on the areas was collected at the sites, a picture was formed as to what would be a suitable maintenance class for each area. In addition to the basic information, the choice of maintenance class was influenced by the location of the area and, for example, whether it was part of a recreational area or whether the area was mostly viewed from the road.

### **Thorough planning of maintenance is worthwhile**

In areas near population centres, thorough planning of the maintenance works is required. In the planning work, it is also necessary to consider the choice of priorities with reference to aims such as diversity of nature, landscape values and safety considerations introduced by residents.

It is necessary to plan the maintenance in a way that accounts for values associated with the diversity of nature and landscape. The very edges of meadows and fields are part of what constitutes an open landscape. If the areas surrounding the meadows are not managed, overgrown willow, for example, may block the view to the meadow and also prevent the use of the area.

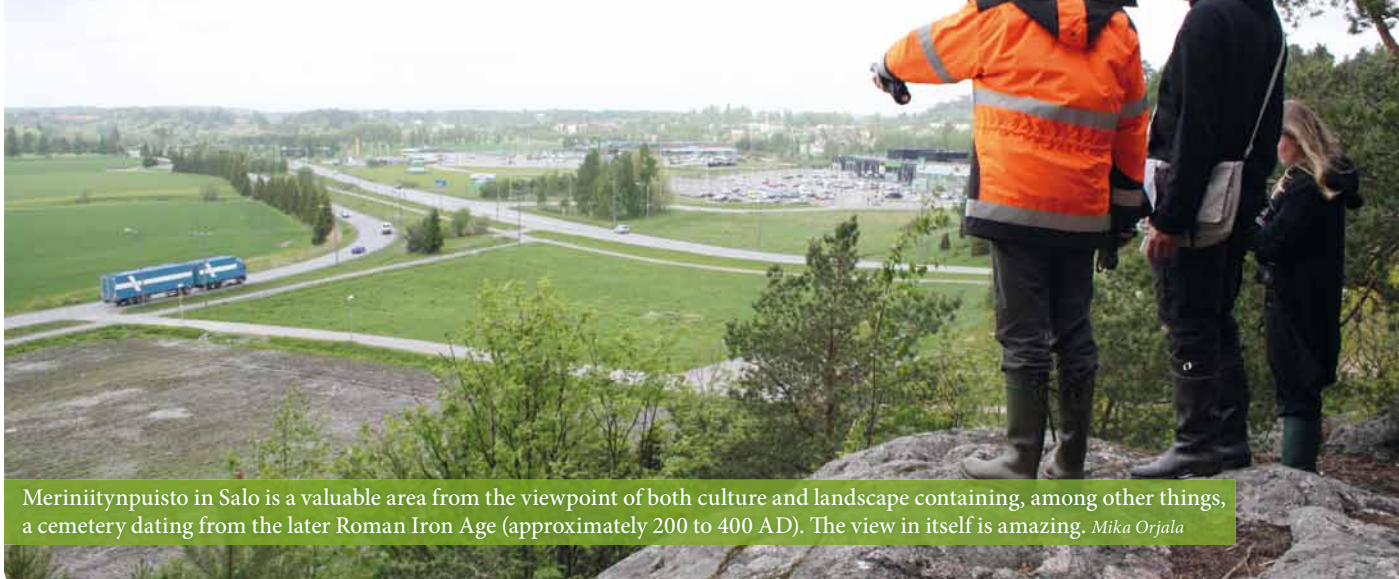
Fields and meadows can be maintained through mowing, clearance and grazing. These measures often also involve the collection, transport and chipping of clearance waste or the collection and transport of mowing waste. Maintenance activities carried out in special sites may include tasks such as the mowing and collection of water plants or the milling of field that has overgrown with bushes and shrubs.

The traditional method of meadow maintenance has been mowing, which also constitutes an excellent form of management for roadsides, wasteland and various traditional landscapes. The objective of mowing is a pleasant environment and possibly reducing problem plants and the amount of nutrients in the growth location. Mowing also functions to protect the diversity of nature by preserving vegetation found in open areas.

Grazing is a natural and traditional way to manage a landscape and prevent the growth and spread of bushes in the environment. The objective of grazing is a pleasant and open landscape. For example, animals grazing after the clearance of an area function to prevent the growth of brushes and to ensure that the area will remain open also in the future.

Clearance works open up the landscape, increase the amount of light and remove unwanted trees and tree species from the area. The objective of vegetation clearance works is an open and pleasant environment and sometimes the achievement of greater financial gain from forestry.

In case ancient sites are located in a population centre, specific criteria apply to their management. For more information on the maintenance of such sites, visit the website of the National Board of Antiquities, [www.nba.fi](http://www.nba.fi) > *Archaeological Heritage* > *Maintenance*.



Meriniitynpuisto in Salo is a valuable area from the viewpoint of both culture and landscape containing, among other things, a cemetery dating from the later Roman Iron Age (approximately 200 to 400 AD). The view in itself is amazing. *Mika Orjala*



## Learning about the areas to be maintained

When planning the areas, it is necessary to take into account from an early stage that some of the areas will be maintained using large farming machinery. The meadows and fields in population areas are often located at relatively great distances from one another, and their conditions may vary greatly. Accessing the areas with large machinery may be difficult, so transport routes to the areas should be planned in advance. Similarly, transferring from one area to the next using large machinery requires advance planning.

In the first year of maintenance, the commissioner and contractor learn about the areas to be managed and the related routes together. They visit the targets and inspect aspects such as bridges, junctions and humidity conditions in the area. In order to take part in the farming or maintenance plan of the area, it is also necessary to learn about the condition of the area. In subsequent years, it can be agreed that the contractor conducts the inspection independently.

The maintenance plan does not necessarily contain all the information needed. For example, access to the green areas may be restricted by locked gates in order to prevent traffic. The locations of wells and other structures, such as low electrical enclosures, are determined onsite.

The areas to be maintained can also be small individual areas, when the moving of equipment and the organisation of work requires accurate planning in order to create savings in both time and costs.

The shape of the fields is another factor affecting the use of large machinery. Small wedge-like shapes are difficult to manage using large machinery. When, for example, a flowering landscape field is very small and of an awkward shape, maintenance with a large machine may not be a feasible option.

## Landscape fields provide opportunities for a range of different activities

On landscape fields, it is possible to allow for public harvesting, in which case the fields should be in locations that are easily accessible to citizens. When planning locations for fields open for public harvesting, it is important to consider the flow of traffic and the opportunities for parking. The harvesting may not create unreasonable disruption to traffic, supervision and the surrounding nature. The fields for public harvesting should also not be located in the immediate vicinity of houses in order to prevent disturbance to inhabitants.

Communications are an important element of the farming of functional landscape fields, too. The harvesting of landscape plants may get out of hand, in case sufficient instructions are not provided. Proper guidelines and carefully marked areas prevent the fields from becoming trodden and losing their natural beauty.

It is also possible to organise different events in the areas, built around the varieties cultivated and the methods used in the maintenance of the fields. For example in cities, traditional haymaking work parties have been very popular. Threshing work parties, collecting flowers and making sheaves of rye are further examples of the great number of possibilities entailed in this type of activities. ■



A view to the Halinen city meadow in Turku containing such noteworthy species typical of traditional biotopes as dropwort (*Filipendula vulgaris*) and the Nottingham catchfly (*Silene nutans*). Hannu Klemola

# Rooftop meadows: green roofs in urban areas

*Ferenc Vilisics  
Susanna Lehvavirta*

Contemporary vegetated roofs are a result of a combination of modern technologies and plant life. Some of them thrive more or less untended while others require a regular maintenance. Either way, green roofs indicate a great deal of care for the environment from the local urbanites and authorities.

Vegetated roofs serve as a unique green element. Establishing mosses, herbs, grasses, succulents and even woody plants on top of buildings is becoming a popular and widely applied way to improve the urban environment, and sometimes even to regain some of the previously lost biodiversity and ecosystem services provided by green spaces within cities. Along with their aesthetic values, green roofs can provide the owner, the neighborhood, and the city with a multitude of services: storm water retention, energy efficiency, improvement of microclimate, noise abatement, prolonged life of the roof and habitat for wildlife, and better health for people.

It is important to note, however, that green roofs cannot replace ground-level habitats, such as forests, streams and bogs. They are artificial construct, and their design sets the limits as regards the ecosystem services provided by the roofs.

## Green roofs in cities: wildlife and conservation

Our knowledge on green roof design (size, shape, substrate depth, etc.) and its relationship to wildlife is not complete. Often disconnected from other green spaces, green roofs are relatively small in size and provide very special habitat conditions as regards the amount of substrate and available water, for example. In other words, green roofs are often extremely harsh in their conditions as exposed to wind and sun without shade, prone to dry out in the summer and fill with water during rainy periods. However isolated the roof is, and despite the harsh conditions, we always find life on them. Plants, animals, fungi and other organisms start arriving as soon as the roof is installed. Surveys on Finnish green roofs showed a rich variety of plants thriving on green roofs, from lichens and mosses to succulents, grasses, herbs and even woody plants. The most important factor influencing plant richness was substrate depth. Even rare

### Glossary

**Green, Eco or Living roof:** a roof on top of a building that was planned to allow growth of vegetation. It has a specific structure, often including technical layers that act as a root barrier, provide drainage, retain water and provide substrate.

**Substrate:** the growing medium, "soil". Various kinds of substrates are used from local site soil to artificially engineered substances. Common attributes are low organic matter content, light weight and good moisture absorbing capacity.



and threatened plant species were found growing on roofs. The survey also proved that invertebrates, such as earthworms, spiders, mites, insects and snails often arrive with the substrate and prefabricated vegetation mats, and more organisms arrive later flying, climbing or carried by wind. The roofs mainly hosted invertebrates of dry meadows: a variety of soil, litter and herb-dwelling insects (ants, aphids, beetles, gnats, land bugs, leafhoppers, mites, snails, spiders, springtails, thrips) and occasionally visiting pollinators (bumblebees, honey bees and flies).

Among vertebrates, birds are unquestionably the most frequent visitors on the roofs. While some common urban birds (magpies, crows, robins, fieldfares) choose to rest on the edge of green roofs, others go there to feed or nest. As such, white wagtail (*Motacilla alba*) is probably the most common bird in Finland, often seen on roofs chasing insects. Although we don't know instances of bird nests on Finnish green roofs, different bird species are known to nest on such roofs elsewhere in Europe. In Switzerland, for instance, white wagtail, house sparrow (*Passer domesticus*), lapwings (*Vanellus vanellus*) and little ringed plovers (*Charadrius dubius*) are recorded to nest on green roofs.

The current biodiversity crisis highlights the potential conservation value of green roofs; however, many of the recent commercial products are controversial as they contain exotic species from all over the world. For example, many *Sedum* species are recorded in early warning lists of aggressive invasive species in areas where they are not indigenous. Alternatively, if wisely planned, green roofs may – when constructed – help mitigate the loss of biodiversity in urban areas by creating habitats for species that are in decline. Species of rocky meadows, for instance, are expected to survive well on green roofs.

For conservation purposes the emergence of "wildlife" or "biodiversity" roofs is an interesting trend. Such roofs are created to harbor a selection of valuable species, or to support a wide spectrum of local, native biota. Roofs with such function can already be found in Helsinki (see Fig. 1), designed and built by the owners.



Figure 1.

Biodiversity roofs in Viikki.  
Niina Ala-Fossi



Figure 2.

*Left:* Plug plants help understanding the requirements of plant species under various conditions.

*Below:* Experimental green roof with various treatments in Vantaa.

*Niina Ala-Fossi*



The University of Helsinki is leading a research program, *The Fifth Dimension – Green roofs in Urban Areas* that explores the optimal green roof solutions for northern conditions (Fig. 2). The ideas presented in this chapter are based on both prevailing global practices and the knowledge developed in this program. We present here the best current understanding, but the modern green roof technology develops rapidly, and an evolution of roof systems (from the current forms towards ever more sustainable solutions) is a process happening right before our eyes.

### The success of green roofs

Manmade vegetated roofs have a long history in architecture: ziggurats in ancient Mesopotamia, medieval abbeys in France, hovels in Tanzania and Norwegian farmhouses are examples of the wide use of vegetation on rooftops. Increased heat insulation and better water proofing were the main benefits of such constructions. Scandinavian and North American sod roofs helped insulating the house during the long cold periods, while in warmer climates rooftop vegetation provided efficient cooling.

The modern-day popularization of green structures is triggered by the alarming decline in ecosystem services in urban areas of developed countries. Glo-

bal population growth and urban development go hand in hand, and although urbanization brings habitat destruction, scientific expertise, with proper regulation, can offer some solutions to mitigate the unwanted effects of urbanization.

Despite of the long history in many countries, modern urban green roofs had a long way of development before they reached the current standards allowing for a global green roof industry. The rise of green roof businesses is facilitated by new developments in low maintenance vegetation systems such as root barriers, light-weight fire-free substrates, recycled materials, and the availability of plant material as seeds, plug plants, prefabricated mats and trays.

On top of the normal carrying capacity, including snow, the structure of a building has to support the weight of the plants and 5–20 cm of substrate for a meadow like vegetation, which occasionally fills with water, and this can be a significant additional weight (ca 100–400 kg/m<sup>2</sup>). The combination of the stronger structure and the green roof material itself raise the costs of the building on the short run. On the long



run, however, green roofs can help saving energy, and prolong the expected life of the roofing layers by 20 years by protecting it from ultra violet radiation, excessive heat, extreme temperature fluctuation, and during snow removal from stabbing by a shovel.

Canada, Denmark, Germany and Switzerland are among the leading countries in green roof installations while USA, Japan, Korea, Sweden, Finland and many more are showing a rapid increase both in interest and commercial activity concerning green roofs.

### Installation and management of roof meadows

Many of the principles here can be generalized to other kinds of green roofs as well; however, the focus here is on meadows. The most important things to consider when installing a rooftop meadow are the substrate depth, water availability and drainage. However artificial it is, a green roof is a living system: nutrient availability, substrate depth and pH will dictate which plants will flourish there.

Green roofs change over time as an effect of interacting biotic and abiotic processes. For instance, decomposers fragment and mineralize dead plant matter releasing nutrients to the substrate. This may allow for soil enrichment and thus provide suitable conditions to new plant species, which eventually serve

as food source to new insects. However, at the same time leaching and erosion may play a significant role, decreasing the amount of substrate and the nutrient content of it. This impoverishment can lead to a change from herb-rich meadow towards a grassy, succulent rich, or even a moss-dominated community.

Spontaneously growing plants, if accepted by people, can provide valuable habitat to the local fauna, as well as provide many of the ecosystem services that commercial plants do, e.g. balance the hydrological cycle, provide greenery, protect the roofing layers, and decrease in-house heat during hot weather. On the other hand, a yearly monitoring is recommendable as several plant species may be unwanted due to their fire load (high grasses), allergenic features (mugwort, *Artemisia vulgaris*), or heavy weight (woody plants will be too heavy if the roof is not planned to support them). However, the maintenance can be kept to a minimum if the roof is planned so as to allow for periodical draught that will kill the above-mentioned kinds of plants.



Figure 3.

Low maintenance roof of prefabricated *Sedum* mats in full bloom (Arabianranta).  
Niina Ala-Fossi

## Construction guidelines

In this chapter we provide suggestions how to make ecologically sustainable green roofs. When planning a sustainable green roof some rules of thumb are advisable to consider: recycled materials and site soil have a lower ecological footprint than virgin materials brought from far away countries.

The weight may often be a limiting factor, and the material should not burn easily. Based on these considerations, drainage and water holding layers made out of rags, recycled plastic or other recycled material are a good option. Similarly, for the substrate, crushed brick, a side product, is a better solution than expanded clay aggregates that require energy intensive processes, and compost mull is better than fertilizers. Irrigation is not an optimal solution, but when needed, a system based on rainwater is better than a system based on tap water.

There are several ways to establish a meadow on a roof, however, a tentative list of necessary components can be given:

- 1) Make sure there are proper root barriers, i.e. layers that prevent the plant roots from reaching the building below the green roof. Several products are readily available from many companies.
- 2) Drainage is needed if the roof is larger than a few square meters and if the slope is less than 2-3 degrees. It can be provided by specific products offered by all green roof companies, or by gravel plus a filter cloth on top of the gravel.
- 3) A water holding layer can be used under the substrate to provide extra moisture for plants. The layer must be double checked before installing it on the roof. The drainage layer can do both jobs if it has a honeycombed structure. There are also different kinds of water holding layers on the market. However, this layer is not necessary if the substrate can retain enough water. Carefully choose the substrate, as water retention capacity needs to support the meadow vegetation.
- 4) For meadow vegetation, 6 to 20 cm of substrate is needed, depending on what species are wanted, what kinds of water retention layers are used and how sunny and windy the place is. Extra nutrients should not be added to the substrate if there is a chance for leakage to the waterways.
- 5) Finally, the plants can be brought onto the roof in several ways, which can also be used in combination. One option is to provide the above layers and just wait for the plants to come. The result is not predictable however, and this may take time, thus it cannot be used on roofs with a slope or in areas with strong winds as under these conditions erosion of the substrate may occur. Sowing plant seeds is similarly restricted. However, the above two ways can be combined with planting plug plants, thus allowing for a more rapid coverage by vegetation. For roofs with a steep slope or high probability of wind erosion, pregrown vegetation mats or trays can be used. With these, however, one should be careful as to avoid exotic species, as some of them may turn out to be aggressive invasive species.

The success of a green roof is almost unavoidable in one form or another. Even if the original set of plant species does not thrive on the roof, other plants will get there as seeds carried by wind or birds, even within the densest urban settlement – we just have to wait. And with and after plants, other life will arrive.

## Green roof strategy and legislation

In most developed countries it is widely agreed that widespread application of urban green roofs provide an array of economic benefits. Some leading countries and several major cities have already identified



the interest of encouraging green roofs and added recommendations to their environmental strategies. Denmark, Germany, Switzerland, the UK (in Europe), China, Japan and Singapore (Asia), Canada and the USA (North America) and Australia are prominent in promoting green roofs. We will give a few examples of current policies below.

Germany can be considered a flagship in green roof legislation and developments. With decades of development, the German roofing industry has set quality standards and created guidelines followed by the rest of the world. Various associations provide technical support for builders and lobby for green roofs at different levels of the government. A number of cities subsidize developers to use green roofs. Several German cities provide aid to private projects, based on the estimated costs green roofs help to avoid. Cities also select zones where a given percentage of flat roofs must be vegetated.

In Canada the City of Toronto has a green roof strategy that contains new green roofs on the City buildings, establishing a grant program, green roof encouragement and an increased publicity. After thorough consultations with building owners, architects, landscape architects, developers, green roof designers, installers, roofing contractors and manufacturers, industry associations and other stakeholders, Toronto adopted the Green Roof Bylaw to govern the construction of green roofs in the City of Toronto in 2009. Other Canadian cities (e.g. Winnipeg) have undertaken thorough studies on the benefits and costs of green roofs, too.

Although green roofs are often not directly targeted in the United States, federal legislation through the US Green Building Council (USGBC) and the Environmental Protection Agency (EPA) certainly encourage the implementation of green roofs. New federal buildings and substantial renovations require an upgraded LEED (Leadership in Energy and Environmental Design) certificate (developed by USGBC), while EPA has proposed new storm water regulations. Therefore, Chicago, Copenhagen, Toronto and all the leading cities in green roof constructions have web pages with a vast online material to those seeking for information or wishing to build a green roof.

Requiring special expertise, a good deal of promotion and initial investment, green roofs are not evenly distributed in the world. A few cities in some low-income countries and desert kingdoms are also becoming aware of the benefits green roofs offer, and so rooftop greening slowly begins.

As poor urbanites are particularly vulnerable to food prices, gardening is the priority when it comes to involvement of rooftops. Cairo, capital of Egypt and home to ca 10 million, is leading in developments of urban greening and gardening within the Arab world. As cultivated lands at the Nile delta are shrinking to urban sprawl, agriculture scientists, NGO-s and politicians work together to popularize rooftop gardens as a safe solution for food production. Rooftop gardens reduce cooling and heating costs and simple dripping systems result in significantly less irrigation than ground level cultivations. The resistance is strong. Besides the lack of safe access to rooftops and the relatively high initial costs, urbanites at certain districts regard gardening as a lower class activity. Women, however, are more eager to invest in gardening equipments, so women's education can be the key for the success.

Vegetable gardens on rooftops are not considered as meadows, but provide similar services and hold the potential to generate interest for "classic" green roofs. Following the international trend, Dubai in the United Arab Emirates has impressive plans installing vast green roofs on newly constructed buildings. Although the system is not widely used, rooftop vegetation in arid climates has great cooling effects as already seen in desert cities as Las Vegas and Phoenix in USA.

## **Green roofs are becoming an essential part of city greening**

Rooftop greening is gaining in popularity all over the world, from arid to rainy regions, and from poor to rich countries. It is commonly agreed that the multiple ecosystem services the roofs can provide are so valuable that it is worth investing in roof greenery.

Meadows are one form of appropriate roof-top vegetation, but food production on the roofs, restorative gardens, or many other kinds of solutions are possible as well. Hybrid roofs combine different kinds of uses and plant systems, allowing for biodiversity solutions to be combined with e.g. growing edibles. For example, roof edges can be greened with dry meadow low-maintenance vegetation, while the center of the roof can be designed into a pot garden. On large buildings (e.g. industrial and commercial), dry meadow-like vegetation offers a low-maintenance solution that can be used to enhance local biodiversity, decrease the probability of flooding, and give aesthetic delight if seen from the road, a café, or the surrounding buildings.

The emergence of rooftop meadows and vegetable gardens are shaping modern cities right before our eyes. While every city would benefit from them, without education, sufficient funds, affordable solutions and political support green roofs remain the symbols of wealthy cities. ■



Silver-washed fritillary (*Argynnis paphia*). Ari Kuusela



# The impact of changes in land use and of the management of coastal habitats on wetland meadows in Pärnu

*Mati Kose  
Anu Onjukka*

## Introduction

Changes in land use and the expansion of urban areas are features that are common to cities both around the Baltic Sea and elsewhere. Urbanisation and the concentration of population frequently result in a loss of biodiversity as well as conflict between economic development, on the one hand, and green infrastructure and considerations of conservation, on the other. It is very important to strike a sustainable balance between these objectives. Furthermore, lessons need to be learned from past and present experience.

This article analyses the changes in land use in the city of Pärnu, in Estonia, and their effects on meadows in their natural state in the city's environs. Pärnu's expansion and changes in the local socio-economic profile are described in brief, as is the impact of expansion on natural and partly natural habitats. The article describes the development of the cultural and natural environment and considers the experiences gained from planning city meadow restoration and the practical work involved.

## Significant events in the history of Pärnu

Pärnu is a city on the southwest coast of Estonia, on the Pärnu River estuary and Pärnu Bay (*Fig. 1*). Its population in 2012 was just under 40,000. The city's location has shaped its economic development and has had an impact on land use. Its strategically important position made it a centre for transport and logistics back in the times of the Hanseatic League, and it continues to be a logistically important centre in Estonia. Its sandy beaches and seawater, so quick to warm up in the spring, have been crucially important for the area's development as a spa and seaside resort.

The first mention of settlement in the area is in 1251 (*Table 1*). The oldest map of the Pärnu area dates back to the start of the 18th century. Then it was a fairly small Swedish stronghold. There were natural wetland meadows surrounding the small area covered by the town, as well as bog and dune forest. After Russia occupied Estonia in the Great Northern War, the importance of the town as a port and shipbuilding centre increased considerably. Its role as a military stronghold also grew. The city area only expanded in

a fairly limited way, however, because Pärnu was a fortress town under the Russian Empire from 1711 to 1864. After that, the city's development and expansion speeded up. While Pärnu started to develop as a spa resort and wellness centre, the first changes were also made to the use to which the coastal land was put. The first spa was built in 1838 near to the coastline - Pärnu was expanding into the area of natural coastal meadows for the first time. Breakwaters two kilometres long were completed in 1864. The coastal infrastructure was built to prevent shipping channels from silting up and to safeguard the port's economic activities. The breakwaters constructed in the coastal waters were later to have a substantial impact on processes along Pärnu's seashore.

The seashore and estuary located next to the town centre were no longer sites for wetland meadows and instead became a beach park from 1882. The spa and seashore buildings were refurbished, and new residential blocks of villas and cottages were built. Although the seaside resort developed fast, the change focused mainly on Pärnu city centre. In the eastern districts of the city and on one side of the river (Vana-Pärnu/Old Pärnu), the wet coastal meadows continued to be preserved as large, untouched areas. The meadows were mainly used for livestock grazing, and, to a smaller extent, for fishing and shipbuilding. Following World War I and the establishment of the Republic of Estonia, the boundaries between urban areas and areas in their natural state in practice remained intact until the end of World War II. There were some ambitious plans put forward to extend the

beach park and lagoons for recreational purposes, but they were never realised, for lack of funds and because World War II had broken out. During the time of the Republic of Estonia, farming and small-scale rearing were a major source of income for the residents of the city's outskirts. These city pastures, which were common land owned by the local authority, were clearly marked 'town pastures' on maps of the city at the time (Fig. 1).

A significant part of the centre of Pärnu was reduced to ruins in the Second World War, so the priority for several decades was the city's reconstruction. But the Soviet Army set aside some areas along the coast between the city centre and its southern districts for construction. The construction of the new city district (known as Mai), with its huge apartment blocks, did not begin until the 1970s. By the start of the 1980s, urban expansion was minimal, and that situation continued until Estonia regained its independence. Since 1997, the expansion of the port, several new health spas, roads and other construction projects have greatly altered the balance between urban areas and areas in their natural state. The economic crisis that began in 2008 halted the development projects that aimed to make the wetland meadows and flood meadows parts of the city. Instead, the coastal meadows became a state nature reserve. Now the city's policymakers are interested in treating the natural meadows as green infrastructure, contributing to the promotion of Pärnu's competitiveness among other seaside resorts in the Baltic Sea area.



Figure 1. Map of Pärnu from 1932. 'Town pastures' ('Linna Karjamaa') to the left and right of the green coastal area refers to pasture land owned by the local authority at the time.



## Impact of urban expansion on coastal meadow biodiversity

The coastal habitats in the Pärnu area form a mosaic of wetland meadows, low sand dunes and coastal lagoons. Sea water floods the very low-lying coastal area almost entirely during the autumn and winter storms. Natural flooding makes the meadows even wetter and introduces fertilising nutrients into the sandy soil. The boreal Baltic coastal meadows in western Estonia have formed in conditions such as these. The shoreline wetlands of Estonia have traditionally only been suited to use as pasture. Formerly, such un-

demanding management was sufficient to keep the grass in coastal meadows short and the landscape uncluttered. Wet and managed coastal meadows are important habitats on account of their diversity. Some of the most important species are rare wetland meadow plants, such as *Dactylorhiza baltica*, a species of orchid, *Thalictrum lucidum* (shining meadow rue), and *Angelica archangelica* (garden angelica). The waders found there include *Calidris alpina schinzii* (Baltic dunlin), *Philomachus pugnax* (ruff), *Limosa limosa* (black-tailed godwit), *Tringa totanus* (common redshank). Among the amphibians that thrive there is the *Bufo calamnita* (natterjack toad).

Year/period	Notable events	Impact on coastal meadows
1251	The city of Pärnu is mentioned for the first time	Slight and limited impact on the natural environment
14-15th century	City joins Hanseatic League and enjoys trading privileges	See above
16-17th century	Swedish stronghold and port; 1699–1710, University of Academia Gustaviana in Pärnu during the Great Northern War	See above
1711–1864	Fortress town and military port under the Russian Empire	Pärnu centre could not be built on, and the shoreline remained pasture land
1838	First construction of a spa; development as a seaside resort starts	Urbanisation of coastal areas
1862–1864	Stone breakwaters two kilometres long constructed on both sides of the estuary	Major impact on the movement of sediment and coastal development dynamics
1882–1940	Establishment and construction of the beach park	Key part of the coastal area is converted into a leisure park
1918–1940	Period of the Republic of Estonia. Extension of the beach park and new buildings in the beach area central park. Most of the coastal area is pasture land owned by the local authority	Plans for new parks and a recreational area on the coast do not go ahead due to lack of funds and the outbreak of World War II
1944–1970	Construction mainly to repair the damage caused to the city centre in the War	Fewest changes in coastal areas; continue to be used as pasture land
1971–1983	Construction of the district known as Mai, with many apartment blocks	Part of the older shoreline is put to use, with additional pressure on nearby coastal areas
1980	Construction of sewage treatment plant in meadow in Old Pärnu	Some of the coastal meadows are lost, but the impact on local biodiversity is minimal
1983–1991	Use of land for pasture gradually becomes prohibited	Some initial signs of loss of coastal meadow biodiversity
1991–2008	Economic growth, building of the port infrastructure and properties at the expense of coastal habitats	Rapid and very harmful changes in coastal meadows; difficult to stop the construction process from destroying important biodiversity
2007	Conservation laws governing nature reserves in Pärnu's coastal meadows are passed	Takes quite some time to ratify legal protection: 1998–2007. Economic pressures make the project challenging, and many diversity-related values are lost
2009	Nature reserve management plan drawn up	Legal framework for preserving coastal meadows
2011	Approach to the preservation and restoration of coastal meadows based on green infrastructure and competitive advantage	Political support and backing from city authorities for the preservation of meadows
2012	Urban Cows LIFE+ project gets under way	Restoration of meadows and other conservation measures get under way

Table 1. Pärnu's main historical events and periods of development, and their impact on coastal meadow biodiversity.

Using the coastal pasture as land where cattle could graze was a traditional way to exploit the wetland meadows around Pärnu for a long time, meanwhile promoting their diversity. Agriculture had an important role in the economy in the period 1920–1944; certain older residents say that as many as 475 head of cattle were grazing in the meadows at the time (Naaber, 2009). The low-lying pastures were managed by using them for grazing until the beginning of the 1970s. After that, the number of cattle began to fall, and at the end of the 1970s, the city prohibited the practice in key parts of the coastline at Pärnu, saying they were concerned about water quality and public health. The decision was something of an emotional reaction to the fact that water quality in Pärnu Bay had deteriorated. So ended centuries of grazing on the coastal meadows. The city authorities tried to manage the meadows by mowing them, but, for technical and financial reasons, the managed areas continued to shrink in size. In 2009, just 12 % of the coastal habitats were being managed, and that figure went down over the following years (Kose, 2009).

The end of management and grazing combined with eutrophication in the Baltic Sea has dramatically changed the plant communities and habitats along the Pärnu shoreline over the past 20–30 years. Most remarkable has been the spread of *Phragmites australis* (common reed). As recently as in the 1920s, the species was so rare on the coast at Pärnu that it was given a separate mention in a national phytogeographical survey. A small clump of it grew in the mud used for spa treatments and preserved in a small lagoon close to the largest spa in the beach area in the centre (Vilberg, 1930 via Kukk, 1998). Now it is a predominant species, and most of the coastline is covered with the common reed. This plant, which grows up to three metres high, along with the sedges, bushes and long stem grasses, has completely altered the low-lying meadow habitat. The most sensitive meadow plant species have already disappeared and some are struggling to survive. The meadows in the centre of Pärnu were estimated to contain as many as 7,000 individual *Dactylorhiza baltica* plants in an inventory made in 1998, making this the country's largest population of the species (Kukk, 1998). In an inventory carried out 11 years later, just 107 individual plants were discovered (Kose and Kuusk, 2009).

The city's coastal area has changed in many different ways over the years. New roads have broken up habitats, roadblocks, ditches and drains and sewers have altered the area's hydrogeology, human beings and pets running about freely disturb bird life, etc. For that reason, preserving the city meadows and restoring their conservation value are huge challenges. The success of this work will depend on a profound understanding of the threats and the implementation of the necessary conservation measures.

A case study on Old Pärnu also involved a detailed survey of changes in biodiversity and human impacts (Kose, 2009). A restricted area of just 140 hectares of coastal meadowland lying between the Pärnu and Sauga Rivers, Pärnu Bay and the Old Pärnu city area was investigated (Fig. 2). The area had been local authority grazing land for livestock, and the city had been responsible for mowing the meadows for decades. Thanks to the management of the land, its biodiversity values have been better preserved than in other coastal meadow areas of the city. The habitats began to decline in the 1980s, when a sewage treatment plant was built, though the rest of the area remained untouched until 1998. Despite opposition from conservationists, the expansion of the city's port and the construction of its service road network got under way, causing a major quantitative and qualitative decline in the coastal meadow habitats. It is in the meadows of Old Pärnu that all the greatest categories of habitat loss and decline can be observed (Fig. 2.) The number of habitats of protected plant species has largely fallen by 50 %, or even more, in the past 11 years (Table 2) (Kose 2009).

Bird enthusiasts have counted the number of birds nesting in the area four times in the last 22 years (Kose 2009). The Baltic dunlin and the ruff have disappeared altogether. The common redshank and lapwing populations have diminished drastically (Fig. 3). These species, which nest in low-growing grass, are very sensitive to changes in the quality of their habitats. They are also sensitive to changes in water quality, but especially to the increased traffic that results from urban development and the disruption caused by humans and pets. Because the results of breeding among waders were very poor, it is assumed that crows, gulls and mammals also prey on the



young in large numbers (Kose 2009). The requirements for improving habitat quality and the need for open and undisturbed wetland meadows mean that the preservation and restoration of wader populations are both immensely challenging.

Although land uplift and the formation of new areas compensate quite well for the loss of natural and partly natural coastal habitats, the gradual decline in the traditional use of the land for grazing – eventually coming to a complete end – has turned the low-lying meadows into dense reed beds.

### Back to grazing – planning the restoration and management of Pärnu’s valuable city meadows

The passing of laws on the nature reserve area in 2007 and the start of the economic crisis meant that plans to use the coastal areas for golf courses, beaches for swimming and hotels have been shelved indefinitely.

At the same time, the nature conservation sector has had time to convince ordinary citizens and policy-makers that Pärnu’s valuable city meadows must be saved. The Pärnu meadows are hugely important in terms of their biodiversity. For example, Estonia’s largest *Dactylorhiza baltica* and marsh helleborine populations are to be found here. A management plan was drawn up to assess the current need for protection and to draft a biodiversity rescue plan. The Environmental Committee approved the plan in 2010 (Kose 2009).

Before the restoration and management plans are produced, it needs to be established how the city meadow approach can be applied in an economically and ecologically sustainable manner. The results of research suggest that the best way to improve protection is through cooperation with the city’s policymakers and inhabitants, with the aim of striking the best possible balance between the need for conservation and the needs of the city. The restoration of the coastal meadows and the technical and socio-



**Figure 2.** Map of a meadow in Old Pärnu, giving the current situation and details of ecological harm. The nature reserve is marked with a thick red line. The numbers on the map indicate the following problems: 1= loss of habitat due to construction, 2 = noise, air, soil and water pollution, 3 = desiccation of wetland habitat, 4 = habitat fragmentation due to roads and paths, 5 = choking of the natural flood system, 6 = illegal dumping of waste, 7 = sand mining, 8 = eutrophication of water, 9 = damage caused by pets, 10 = inadequate management of meadows, 11 = decline in habitat types and the habitats of species through the planting of trees.

Table 2. Changes in the number of the habitats of protected plant species in a meadow in Old Pärnu

Species (ENG/EST/LAT)	Number of habitats		Percentage of remaining habitats
	1998	2009	
Fen orchid, Soohilakas <i>Liparis loeselii</i>	2	0	0 %
Common spotted orchid, Kahkjaspunane sõrmkäpp <i>Dactylorhiza fuchsii</i>	40	6	15 %
Baltic orchid, Balti sõrmkäpp <i>Dactylorhiza baltica</i>	58	16	28 %
Garden angelica, Emaputk <i>Angelica archangelica</i>	71	27	38 %
Musk orchid, Harilik muguljuur <i>Herminium monorchis</i>	18	7	39 %
Marsh helleborine, Soo-neiuvaip <i>Epipactis palustris</i>	11	5	45 %
Soft hornwort, Sile kardhein <i>Ceratophyllum submersum</i>	2	1	50 %
Shining meadow rue, Ahtalehine ängelhein <i>Thalictrum lucidum</i>	17	17	100 %
Woolly butterbur, Villane katkujuur <i>Petasites spurius</i>	3	5	167 %

economic considerations associated with protection have also been major causes for concern in Pärnu. Having cattle graze once again in the surroundings of the city was seen to cause problems, though estimates suggest that the benefits derived from grazing are significantly greater than those associated with the mechanical mowing of the meadows (Fig. 4).

Although cattle grazing is the best management option to get rid of the reeds and to protect important plant habitats, mowing is also needed. The protection

of both birds and plants in the same area makes restoration and management more difficult, because the number of cattle required for the low-lying habitats may be too great for those habitats where soft stem and tall plant species grow. Because of this, the management recommendations have been gone over in detail by referring to the experiences gained from similar areas (Table 3). The management plan charts give a description of the management measures and the extent of the meadow habitats to be restored for birds and plants.

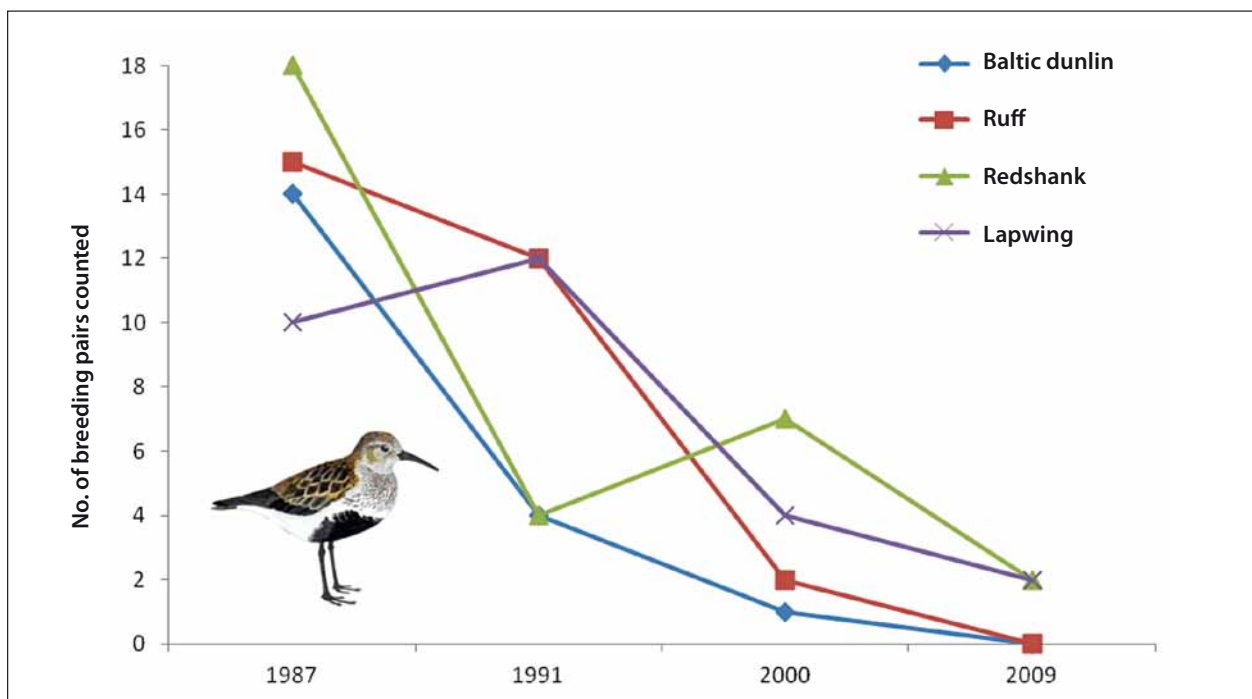


Figure 3. Changes in typical wader populations in the coastal meadows of Old Pärnu (Kose 2009).



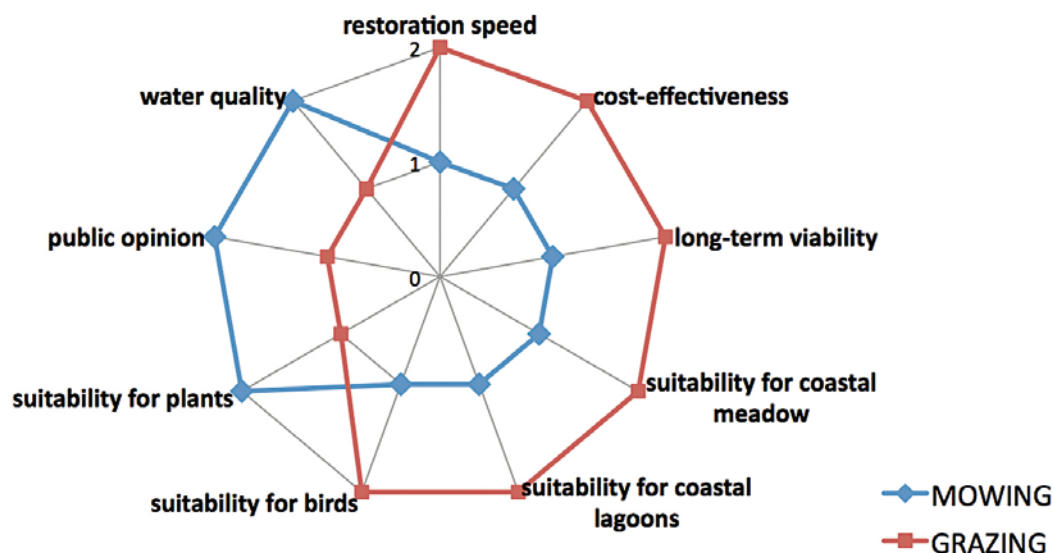


Figure 4.

Comparative assessment of nine different considerations associated with grazing and mowing to restore and preserve the conservation values of Pärnu’s coastal meadows. (Updated, Kose 2009). The individual results are based on estimates made by experts. The scores mean the following: 2 = the management option meets the requirements best; 1 = the management measure meets the requirements to some extent.

As the residents of the city also use the coastline area for recreation, the city authorities required access to the area and an improvement to its recreational values. The management plan consequently incorporates the promotion of sustainable recreational use and the prevention of damage to habitats. Earlier plans to extend the promenade and the cycling and walking route over the protected meadow have been scrapped in favour of a more sustainable approach. The walkway in the recreation area will skirt the conservation area. A new nature path for educational purposes is to be built in the area, with minimal adverse impact on the meadow’s habitats and species (Fig. 5). Access to the seashore will still be via the present roads and walking routes. Improvements to the area as a recreational one and one in which to observe nature will partly come about through the establishment of natural areas of grass and with the construction of bird towers and signboards.

Thanks to successful lobbying, the city authorities are now interested in the idea of using the city meadows as a unique area of green infrastructure. The meadows will help promote Pärnu’s competitiveness among other seaside resorts on the Baltic Sea. The public hearing held while the management plan was being drawn up helped to discover public opinion and made people more aware of the benefits of the restoration and management of the coastal meadows. The EU LIFE+ project *URBAN COWS* was drawn up to implement the management plan and to finance the measures involved. The project got under way at the beginning of 2012. Now EU funds can be used for meadow and lagoon restoration, the commencement of sustainable nature trekking, recreational structures and information and publicity. The restoration of the coastal meadows was begun using public funding in a meadow in the Mai-Papiniidu area of the city back in 2011. The meadow was cleared of rubbish and

	Low-lying meadows (protection of birds)	Plant conservation areas	Restoration of meadows and removal of dense reed beds
<b>Beginning of grazing</b>	May 25	July 20	May 15
<b>Grazing intensity</b>	1,2 LU/ha 150–170 LU/D ha/yr	Ca. 50–75 LU/D ha/yr	1,5 LU/ha 200–300 LU/D ha/yr
<b>Start of mowing</b>		July 20	July 1
<b>Recurrent mowing</b>			September 1

Table 3. Management guidelines by habitat type for different protection needs. LU = cattle unit; ha = hectare, surface area unit; LU/D ha/yr – total number of grazing days in relation to cattle units in one hectare during the harvest season. This figure provides a more realistic picture of the number of cattle during the harvest season than just the number of cattle per area of grazing land.



**Figure 5.** Reconciling considerations of urban development with the need to conserve nature in coastal city areas. When the Terviseparadiis Spa Hotel (a complex in the centre of town) was opened in 2004, a significant part of the natural coastline was lost. The narrow strip between the spa and the beach and the larger natural meadow (left) are badly overgrown with reeds. The establishment of the conservation area prevents additional expansion of the city area, and the Life+ project will help remove the reeds from the meadow. The narrow strip of meadow and the coastal lagoon are being restored and a nature path is to be constructed there. This part of the meadow, where biodiversity value is at its lowest, will provide a route through the area and be used to present the project. Consequently, the larger intact area of meadow will remain undisturbed.

waste from the sea by local residents acting as volunteers. Some of the meadows were fenced off and a small herd of Highland cattle was introduced for grazing (*Fig. 6*). This was a pilot scheme to test the attitude of local residents to cattle grazing, but there had been no cause for worry, as local people and the media took a favourable view. In fact, the animals became a popular attraction, as they are a joy to behold when out walking by the sea. There is now much greater confidence in the restoration of the meadows as a worthwhile project. The purpose is to restore the historic city meadows, the habitats that are so valuable for diversity, and the high quality landscapes for use as recreational areas by both tourists and local residents. ■



**Figure 6.**

The pilot project's cattle grazing in a meadow in Pärnu in 2011.



# Geospatial analysis of the development of land use in Pärnu

Anu Onjukka

By investigating and analysing the history of land use and land cover, valuable information can be obtained about a region's landscape development. This can also be utilised as a basis for the current decisions and actions related to land use. Changes taken place in land cover history of the Pärnu urban area were examined over a space of time of 160 years, spanning from 1844 to 2008. The investigation focused particularly on the changes at the coastal area and on the changes between the urban structure and the coastal area. The investigation was carried out based on historical and modern cartographic material and utilizing geographical information programs and methods. Five different time intersections (1844, 1923, 1948, 1973 and 2008) were used in the investigation. A uniform land cover classification was created, and the changes that had taken place in the landscape were investigated by comparing the time sections to each other.

According to the results of the investigation, the biggest landscape changes in the area occurred between 1844 and 1923 with the first significant extension of the urban structure. Most of this development took place at the cost of natural coastal areas (Figure 1). During the period between 1923 and 1973, the advance of the urban structure to the coastal areas was less, but it again increased

between 1973 and 2008. Of other trends concerning the coastal area, a mention should be made of the increase of forested land cover close to the boundaries of some urban and coastal areas between 1973 and 2008.

Apart from the extension of the urban structure, also the changes in the position of the coastline have had their impact on the landscape of the Pärnu region. The coastal area of Pärnu is very dynamic, and the position of the coastline in the area has varied sometimes quite significantly between the different time sections. According to the results of the investigation, on the whole there has been a significant advance of the coastline towards the sea over a period of 160 years (Figure 2). Most of today's coastal area has appeared after 1973 (Figure 3).

To sum up, it can be said the change of the coastal area of Pärnu has been affected both by the urban sprawl to the coastal areas as well as by the appearance of new coastal areas resulting from land uplift. The rise of the land has enabled construction of new buildings on the moist coastal areas, but, on the other hand, the new coastal areas have proportioned the viability of coastal habitats towards other forms of land use.

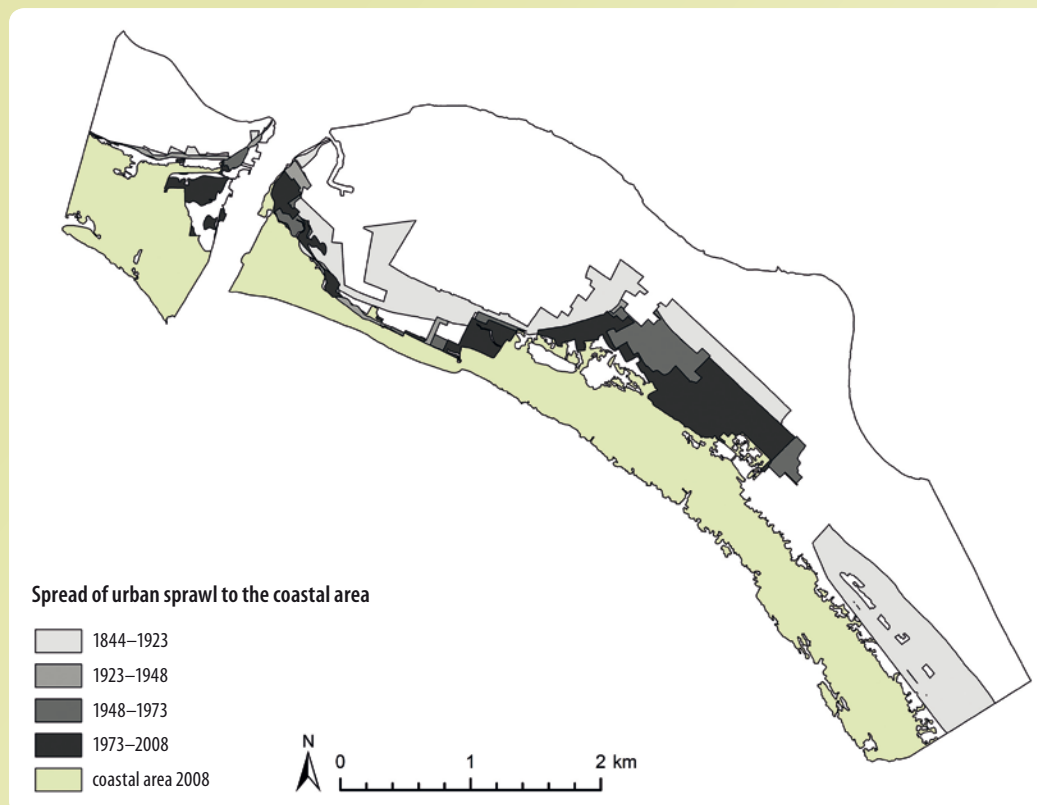


Figure 1.

Spread of urban sprawl to the coastal area during different time periods.

When drawing up restoration and management plans for coastal areas, their historical development stages can provide valuable information for the targeting of the plans and selection of applicable methods. For example, figure 3 shows a narrow strip of a coastal habitat, which has been preserved from 1844 to our times. If other forms of land

use still keep on spreading to the coastal area, there is a danger that this valuable strip of land may disappear because it is located on the margin of the coastal area, in the immediate vicinity of other land use forms. Therefore, special attention could be paid to this area to preserve its natural assets also in the future. ■

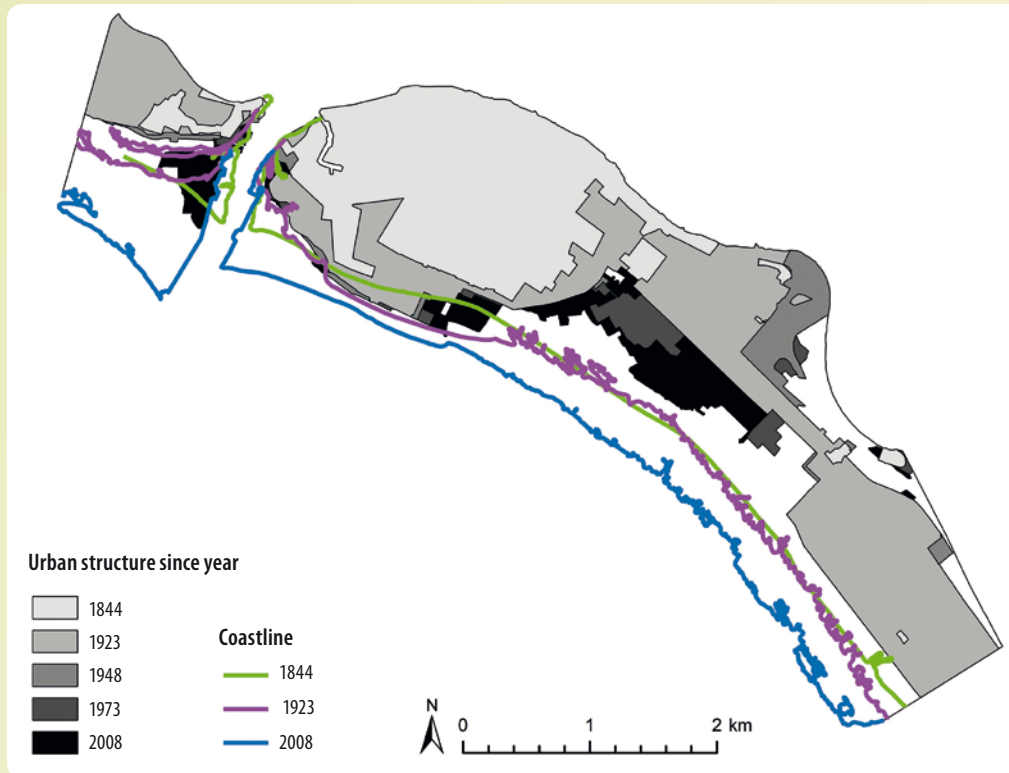


Figure 2.

Advance of the coastline and extension of the urban structure in Pärnu between 1844 and 2008. To add clarity to the figure, only the coastlines of three time sections are shown on the map (1844, 1923 and 2008).

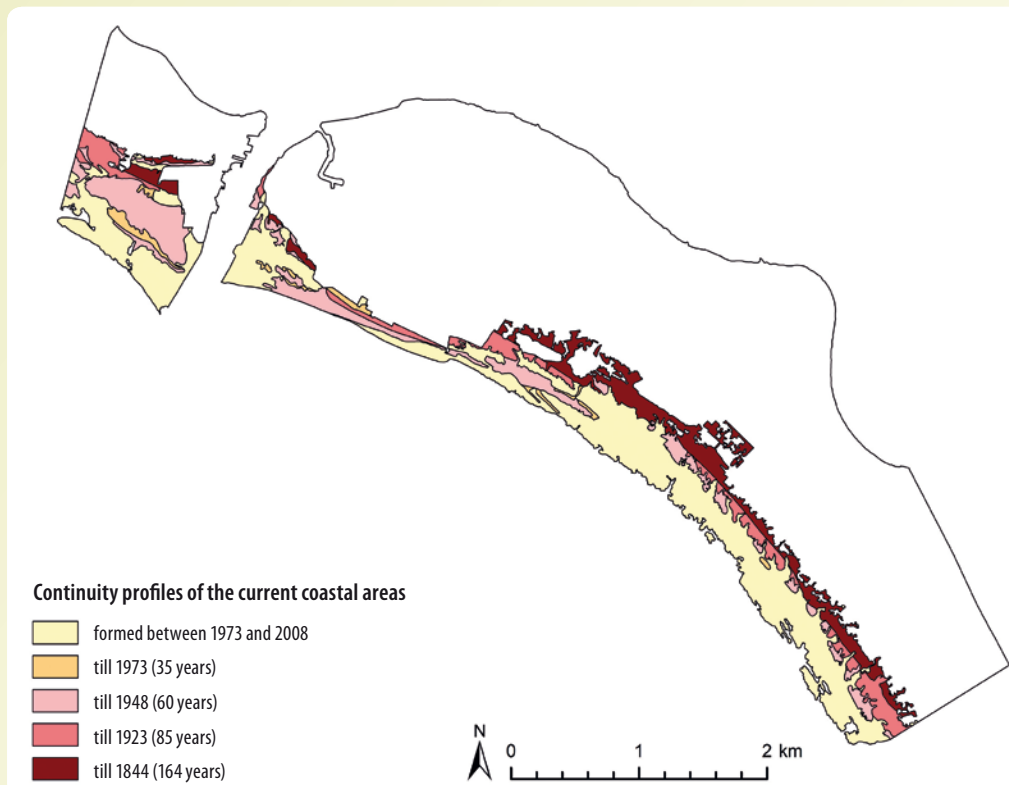


Figure 3.

Continuity profiles of the current coastal areas.



# Time gone by never comes back – or does it?

## The change to city coastal meadows from the ornithological perspective

Many birdwatchers hiking in the 1970s and 1980s recall how in practice Finland no longer had any coastal meadows used for grazing. The views over what had been pastureland were fairly limited. You could just make out the bays between the trees. There were no bird towers, duckboards, parking areas or signs. There was little local information on birdlife. There were only a few birds anyway, and nesting birds were fewer in number than migratory birds in the overgrown meadows. We city boys had to go all the way to the archipelago to see birds. The conversations among older twitchers were full of memories of the post-war years, when flocks of lesser white-fronted geese rested in the bays and dunlins nested in the coastal meadows.

After Finland joined the European Union, the Life projects started. These contributed to an effort to clear the coastal meadows that were hidden away amid the urban sprawl. Brand new urban panoramas opened up for birds and those who enjoyed the outdoors, with pastures, meadows and open shorelines seething with birds. At the same time, service structures were put in place and management plans drawn up. There were management projects for the habitats of water birds in Pirkanmaa, the Gulf of Finland (in bays on flyways), in urban Natura 2000

areas in southwest Finland, in wetlands that were valuable in terms of bird life in central Finland, on the lake at Siikalahti, in Parikkala, in the precious wetlands of southwestern Finland, in Vanhankaupunki Bay in Viikki, Helsinki, in the Natura areas of Yyterinniemi, in Pori, and in the wetlands of the Liminka Bay. Millions of euros were spent and the results are visible. Liminka has a new Visitor Centre, which at the same time is Finland's first and only wetlands centre in the area covered by the Nordic countries and the Baltic Sea. The centre is open to the public throughout the year, and when it was built, special attention was paid to children. The exhibition there is intended for members of the general public who are not actually nature lovers in a big way. The exhibition focuses on birds mainly, but it will incorporate other aspects of wetland wildlife and ecosystem services. The centre is run by Metsähallitus Natural Heritage Services.

Land set aside for purposes of conservation continued to be acquired and the areas became protected under the law. The new projects and landscapes meant that the birds found their old nesting and resting sites. The bird enthusiasts started to arrive, and they were followed by hikers, families and schools. The projects have also resulted in more knowledge about cost-effective management. Management plans have been produced, especially for protected species. Agri-environmental support meant that the management of sites that had started in projects could continue. The hunting of small predators has brought results and the commitment of hunters to the management of the areas in question. Good water bird habitats even provide prey for hunters, even if hunting is banned in the coastal meadows being managed.

Today there are books, birdwatcher's guides and articles in the press about local birdlife in many areas. All over Finland there are excellent, well managed sea bays and inlets, with pasture land and meadows bordered by forest. Fields and meadows frequently border on bays and lakes, and this boosts bird diversity. Management plans

The yellow wagtail (*Motacilla flava*) benefits from coastal meadow management. Ari Kuusela



are being drawn up for sites, a recent example being the Raisiolahti Management Plan 2012 in association with the Natureship project financed under the Central Baltic Interreg IV A Programme 2007–2013. The plan is based on previous management plans. The results of management are even evident at Raisionlahti now: waders, gulls and aquatic birds can be seen on the harrowed shoreline.

The number of birds whose habitat is wetlands and which are under threat has increased, according to the 2010 Red List. That is a matter for concern. The coastal meadows that have been managed in the Baltic region provide a habitat for species that have adapted to fluctuations in water levels and brackish water. The animals grazing in meadows that have been managed for a long time now keep the shoreline growth short and diverse in terms of its plant species. The pastures and their bordering areas serve as habitats for a wide range

of species. In the holes left by ungulates are to be found the water mudwort (*Limosella aquatica*), for example, and the combination of reed beds and varied seashore provides nesting sites for a diverse range of birds. The communities of submerged plants, reed islets, mouths of streams and open, warm pools to be found in the coastal meadows all seethe with life and provide many species with nutrition, including dragonflies, frogs and spawning fish. Eutrophication in the Baltic Sea has caused serious problems for coastal meadows. There is much demand for clearing work, grazing and reed cutting. These are also ways to get rid of harmful nutrients. The work is off to a good start, but needs to continue. Many previous coastal meadows, made familiar by black and white photographs, still lack plans, inventories, hiking structures, management and landscaping. ■



The Enäjärvi coastal zone in Vihti is a water meadow habitat. Visible in the photo is the Ridalinlahti wetland, which is one of the lushest parts of the lake. The wetland area of Nummela is also close by.

Mika Orjala



# Sheep for summer duties on city meadows

*Riikka Söyrinki*

Laidunpankki ([www.laidunpankki.fi](http://www.laidunpankki.fi)), or pasture database, is an Internet service through which it is possible to find additional pastureland and locate animals for the purpose of landscape management. The aim is to make the demand and offer for grazing animals and pasture to meet in order to create cooperation that will benefit both parties. Natural pastures offer affordable feed; grazing, at the same time, is an excellent way of taking care of the environment. Landscapes expand, and the nature's biodiversity increases.

The Laidunpankki internet service was launched in 2005 as a result of cooperation between two development projects. The bank has experienced two large reforms, the most recent of which took place in the beginning of 2012. Currently, the service is maintained by ProAgria of Southern Finland. Laidunpankki is free of cost for its users. The service is maintained by funding from the ads placed in the internet service.

The number of users for the service was fairly low for the first few years, but during the last couple of years the service has reached a relatively large audience. In 2012, the average number of visits the users have made to the service has been 925 per month, and thus should amount to over 11,000 visits per year. The average number of ads is well over 100, of which a half is landowners' ads and the rest ads of animal owners. Sheep, cattle or horses can be offered as grazing animals. The number of ads from different parts of the country varies a lot: in some places traditional grapevine still functions so effectively that the network service is not seen as necessary.

The Laidunpankki service is perhaps the only of its kind, at least in the area of Europe. Tapio Heikkilä from the Ministry of the Environment tells that in 2006 the new service was brought up at an EU-organised seminar in Poland, where the agenda consisted of CAP, biodiversity and High Nature Value areas. Elina Nikkola, the representative of Finland's Ministry of Agriculture and Forestry, already at that time brought up Laidunpankki as an aid to conserve traditional landscapes. For other participant countries this was a brand new issue and aroused positive interest.



## Common ground rules from Laidunpankki

In addition to an animal and pasture search service, a wealth of information on grazing and agreement models concerning pasture cooperation and land leasing can be found in Laidunpankki. Basically, pasture cooperation always requires a written agreement in which the distribution of work and responsibilities as well as monetary compensation is agreed on. Grazing is a chargeable environment maintenance service: it does not pay to take the animals to new summer pastures on the "free grub" principle only. Unless the question is, for example, about taking care of traditional biotope, for which it is possible to apply for special environmental support for agriculture.

To be successful from the viewpoints of both landscape maintenance and animal wellbeing, grazing requires planning and cooperation among herders and land owners. It is best to do the planning in good time beforehand, preferably already during the previous year, so that the grazing can start immediately in early summer. From the viewpoint of the end result, it is important that the animals can get to the pastures when the grass growth is at its strongest.

The most sought-after landscape carers are sheep because they are found friendly and easy to approach. The benefit of having sheep is also that a small flock of sheep can manage on a pasture of even less than a

hectare. Cattle and horses need bigger areas, which are quite often not necessarily found in city environments. All grazing animals create positive image about agriculture and increase the interaction between country and city. In built-up areas, establishing a pasture requires a notification or permission from the authority; this also has to do with the opinions of neighbours. Permission practices vary slightly from one municipality to another.

## Case: The city of Nokia: Hätilännotko greenbelt

One of the planning objectives selected for the Pro-Agria's Profitable Environmental Entrepreneurship project was the Hätilännotko green area in Nokia. Hätilännotko is the city's landscape meadow, and it is difficult to maintain it with machinery because the terrain in the area is both damp and stony. The area is traversed by power lines so the cooperation includes also two electricity network companies, Fingrid and Vattenfall.

In Hätilännotko, there was willingness to try grazing, which would offer adventurous experiences to city dwellers while being a new way of looking after power line areas. Grazing started in summer 2010. The sheep arrived for their summer employment from the neighbouring municipality of Hämeenkyrö, from a distance of 50 km approximately. A written



Hätilännotko is situated in the immediate vicinity of a human settlement. *Riikka Söyrinki*



agreement was drawn up in accordance with Laidunpankki's model agreement. A person tending the sheep would be responsible for shepherding during the transport and would get a monetary recompense for the landscape maintenance work performed by the sheep. The city put the building of sheep fence out to tender, and the person who tended the animals was selected for it also. The city carries the responsibility for the maintenance of the fence.

Hättilännotko is situated alongside a road surrounded by a residential area. There was a risk of vandalism in the area; nevertheless, that risk was seen as a minor one. The pasture or the animals were not subjected to any mischief. An important factor in this is that the youth of the AC Nokia sports club committed themselves for daily monitoring of the animals. Eventually, the animals became a popular destination to visit, both for the residents of the area as well as for the groups from kindergartens and schools.

Grazing maintains the city meadow openness and increases the area's biodiversity. The most important result of three years' grazing is the disappearance of the exotic species known as the large-leaved lupine (*Lupinus polyphyllus* Lindl.) from the area. Harebell (*Campanula rotundifolia*) and other meadow plants are gradually increasing in the area. As a whole, the cooperation has functioned well: the same partners are still carrying out landscape grazing in that area.

*"In our opinion, the project in the area of Hättilännotko was a success. The landscape has changed more meadow-like, and for example not one lupine has appeared whereas in summer 2010 there were great many of them. Willow thickets remain low. The sheep flock was balanced, funny and of suitable size. There was a regular daily audience to greet the sheep, and the public feedback has been completely positive."*

*-Minna Kotiranta-Koivunen, AC Nokia-*



The residents feel pleased about the new landscape maintainers. *Riikka Söyrinki*

HÄTILÄNNOTKO GREEN AREA, NOKIA		
Land ownership	City of Nokia	Area 2.1 hectares
Zoning and planning situation	Local recreation area Conservation area, where the environment is conserved (spring).	
General description	The target is a meadow-like power line area. The main part of the area is in a depression; the soil type is clayish. In the middle of the area, there is a small mound where handsome junipers grow. Vegetation in the area is mainly fresh, lush meadow. The mound is drier and stony; in the neighbourhood of the shore and by a rivulet it is very moist. Alongside the edge of the open area, there is a rivulet the surroundings of which have turned into bush. On the western side of the rivulet there is a small, wooded built-in area.	
Landscape values	Open landscape, lake view. Central location in a residential area, visibility in a road landscape.	
Structures	Big power lines, a pumping shed. At the side, there is a carpet washing place and mooring for boats.	
Maintenance objective	Maintenance class: B3 landscape meadow and grazing area. A maintenance and use plan has been drawn up for the area.	
Effects of maintenance	Conservation of open landscape space and a lake view, promotion of nature's biodiversity, prevention of large-leaved lupine, visiting destination especially for children, social and environmental education impacts.	

## Costs of grazing

Also the costs of the landscape grazing were followed up in Hätälännotko. Based on two years' cost monitoring, the yearly grazing costs are on average € 0.21/sq.m. In Nokia's zoned area, the average cost of the maintenance of green areas (inc. maintenance classes

A, B and C) is € 0.66/sq.m. Thus the grazing proved an economical way to take care of the environment. The assumption here is that the grazing continues for five years, which is the average time of duration for a fenced grazing plot.

Realized acts of maintenance and their costs (2.10 ha)	Cost in euros (VAT 0 %) <b>2010</b>	Cost in euros (VAT 0 %) <b>2011</b>	Cost estimation based on the above maintenance for the period of <b>2010-2014</b>
Maintenance plan by the project			
Fence construction	4033	0	4033
Clearance	see further information	see further information	see further information
Guide posts	549	0	700
Animal shed	1800	0	1800
Animal hire	1000	922	6000
Animal monitoring	2040	1228	8540
Fence maintenance	49	75	750
Other possible costs	see further information	0	0
Total cost	9471	2225	21823
Total cost/sq.m/year	0,45	0,11	0,21
Total cost/ha/year	4510	1060	2078
Further information	As the city's own work: clearance of the fence line and the bush, levelling of the terrain, building of the bridges, mowing the lupine (in 2010).		



## Challenges of landscape grazing

The most important requirements for landscape maintenance are animal wellbeing, maintained landscape and economic profitability. The activity must be profitable for the entrepreneur and, on the other hand, of good quality for the customer as well as sufficiently cost efficient. Usually, the owner of the animals cannot take care of daily monitoring of the animals; also a third party is needed to cooperate, for example, some local association or resident who will take care of the monitoring. A written agreement concerning the cooperation must be signed between all the parties.

Successful practical examples are the best marketing for landscape grazing. Grazing for pasture management is an alternative to be reckoned with also for many city meadows. It should, however, be remembered that there are many conditions attached to grazing and animal wellbeing, and these conditions should be taken into account with a careful prior planning. City inhabitants are fairly often quite estranged from animals; thus, a lot of informative communication is needed so that the coexistence with animals would work properly. The future will show how we will succeed in utilizing this opportunity in order to create a more diverse and pleasant environment.



Sheep arrive in Hätilännotko in May 2010. *Riikka Söyrinki*

# Experiences from city meadow management in the municipality of Norrtälje, Sweden

*Magnus Bergström*

Norrtälje city is the capital of the municipality of Norrtälje, which forms the northern third of the county of Stockholm. The municipality consists largely of coastal land and the archipelago, but forest land and rural areas with farms also exist. The municipality has about 56,000 inhabitants, of whom about 18,000 live in the city of Norrtälje. Besides Norrtälje, there are some smaller towns, for example Rimbo. Since the early 1990s, the municipality of Norrtälje<sup>1</sup> and the Norrtälje Conservation Foundation<sup>2</sup> have worked to restore, manage and develop city meadows near Norrtälje city and other urban areas. The city meadows are attractive meadows and pastures with a rich flora and fauna, which are managed by mowing and grazing. The aim of the work is to conserve biodiversity and to develop the area as a destination for local residents and visitors. In all areas, it is important to give visitors information about plant and animal life and how the area is managed. The cost of restoration and annual management of the city meadows is shared between the municipality of Norrtälje, funds from the Swedish Environmental Protection Agency, and funds from the Swedish Agri-Environmental Support Scheme.

## **Björnö birch pasture**

Björnö birch pasture is located just southeast of the city of Norrtälje on the seashore. The area covers 8.8 hectares and is now grazed by sheep. In the pasture, hundreds of birches give a beautiful character to the area. Older ashes, maples and elms also grow in the pasture. In the open parts, there is rich vegetation, including common mountain everlasting (*Antennaria dioica*) and common rock-rose (*Helianthemum nummularium*). The old trees have a rich moss and lichen flora. The Björnö birch pasture has been grazed since at least 1665. Grazing continued until the 1970s; the end of grazing resulted in an overgrowth. The area was restored during 2005 to 2009. Trees and brushwood were cleared away. The pasture was fenced in and sheep began grazing. Recurring clearings have been made to combat brushwood and ferns. The total cost for the restoration amounted to about 40,000 €. The annual cost for grazing is about 1,200 €. The pasture is a popular recreation area, and more people will visit the area in the future because a new city district is planned nearby.



## Libbersmora oak meadow

Libbersmora oak meadow is beautifully situated on the northern shore of Lake Syningen, close to Rimbo. The meadow is covered with centuries-old oaks and covers 2.0 hectares. Many oaks have a radius of 3 to 4 metres; the largest being 6.5 meters in circumference. On the old oaks grow several endangered species, such as the lichen *Lobaria pulmonaria* and the fungi *Fistulina hepatica* and *Xylobolus frustulatus*. The area was used as a meadow at least since the early 1700s and until the end of the 1800s. After that the meadow was grazed until about 1970, and then the overgrowing started. The area was restored during 2005 to 2009 at a cost of about 20,000 €<sup>4</sup>. Trees and shrubs were felled, especially those which pushed the old oaks. Branches were collected and the whole meadow was raked on old leaves. The meadow is now managed annually by mowing with small machines and raking. The annual cost of management is about 2,400 €.

## Karby oak pasture

Karby oak pasture is located on the opposite shore of Lake Syningen in a recreation area near Rimbo. The area covers 4.4 hectares and consists of a somewhat rocky pasture overgrown with oak trees. Maple,



linden, aspen, birch and hazel bushes also grow in the area. Some parts are more open, and there is a relatively rich turf including milkwort (*Polygala vulgaris*) and dropwort (*Filipendula vulgaris*). The pasture has long continuity as pasture and the use can be traced back to the beginning of the 1700s. Grazing continued until the 1980s; after it ceased, the pasture started overgrowing. The area was restored by the removal of certain trees and shrubs, especially around oaks. The area was fenced in with oak poles made from oak trees that were felled in the area. The total cost for the restoration amounted to about 21,000 €<sup>5</sup>. The pasture is grazed annually by sheep and the cost is about 900 €.







Karby oaks. MagnusBergström

## Carlberg hay meadow

The croft Carlberg is situated in the forest landscape north of Rimbo. A hay meadow lies just besides the croft and covers 1.6 hectares. The hay meadow is located on calcareous soils and has a high biodiversity, with about 20 endangered species of vascular plants, fungus, butterflies and molluscs, for example the field gentian (*Gentianella campestris*), the waxcap (*Hygrocybe punicea*), the moth *Nemophora cupriacella* and the land snail *Vertigo geyeri*. The restoration started in 1991 by logging trees and clearing weeds in the overgrown meadow. The area was cleaned carefully of branches, twigs and leaves. The meadow is now annually managed with mowing by small-scale equipment and raking. The project has created one of the county's most species-rich meadows. The meadow is now protected as a Natura 2000 site. The total cost for the restoration and management during the period 1991–2012 is about 80,000 €. Today the cost for annual management is 3,000 €. A short distance from Carlberg is Västra Kornakärret, where a newly restored moist-wet meadow covering 2.0 hectares is situated. All trees, shrubs and stumps were removed, and the meadow is now managed with mowing each year. The total cost for the restoration during the period 2006–2010 is about 21,000 €. The annual cost is about 4,500 €.

## Vigelsjö nature reserve

The major urban recreation area in Norrtälje city is the Vigelsjö nature reserve, which was established by the municipality in 1998. The reserve covers 69 hectares, mainly with forests. Several areas covering about 11 hectares are also managed by mowing and grazing. The elder-flowered orchid (*Dactylorhiza sambucina*) grows in some of the meadows. In the reserve there are lighted trails and walking paths, which are used for visitors and nearby schools<sup>6</sup>. The meadows are managed with small-scale technologies such as using an old horse mower attached to a modern ATV. The annual cost for mowing and grazing is about 2,400 €. Very close to the reserve is Lake Ludden, which was restored during 2001–2006. The lake has been dredged, reed has been dug away and beach forest has been harvested. Subsequently, the shore meadows have been fenced and grazed by cattle to achieve open, well-managed meadows. An accessible low observation tower has been erected and footbridges around the lake have been repaired, which will increase the number of visitors even further. The cost for restoring Lake Ludden and its shore meadows is about 180,000 €, and the annual cost for grazing the shore meadows is about 900 €.



Vigelsjö orchids. MagnusBergström

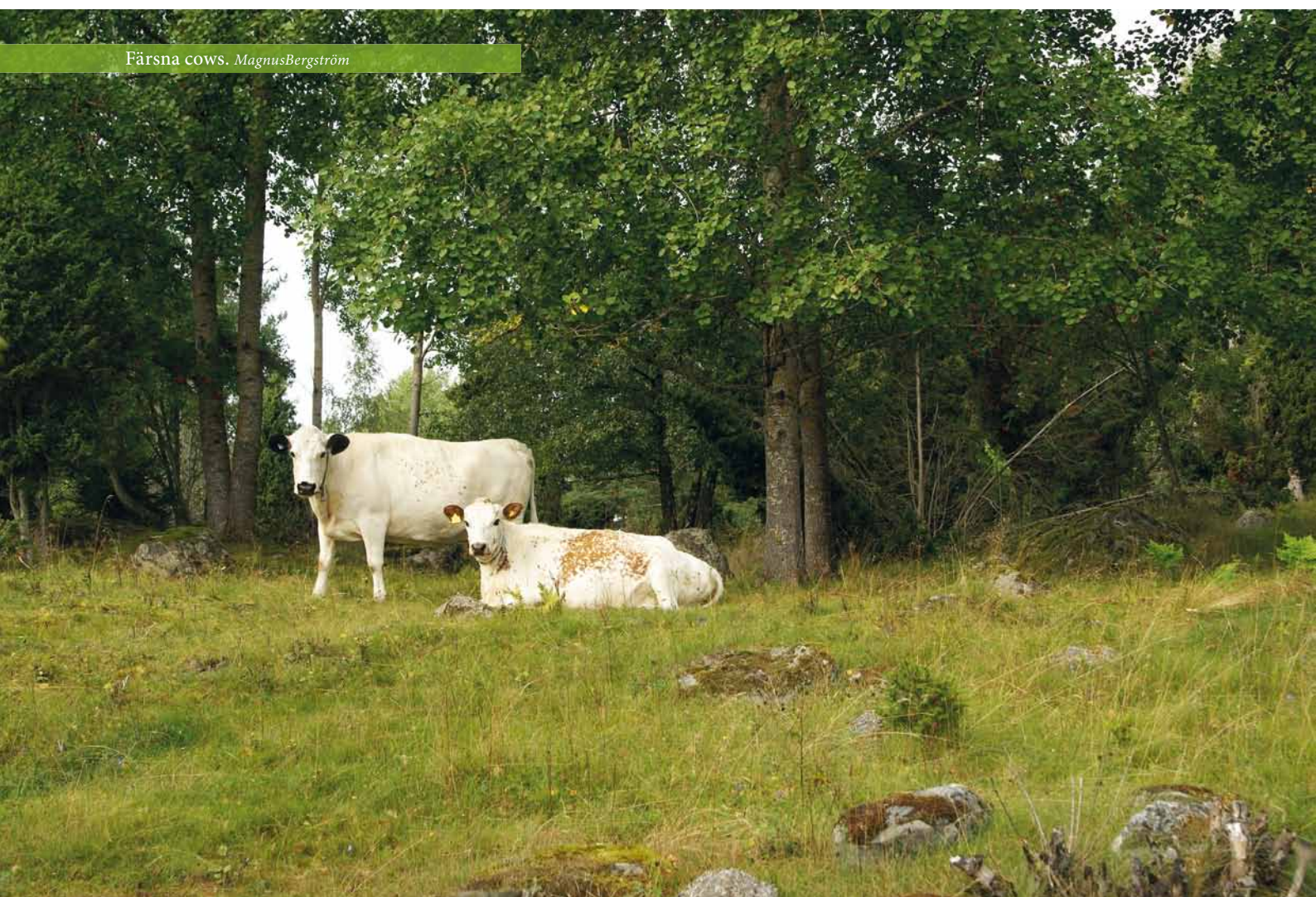


## Färsna farm

The Norrtälje Conservation Foundation has established a Nature Centre<sup>7</sup> at Färsna farm, which is located within walking distance of the city of Norrtälje. The Nature Centre aims to be a centre for nature conservation, practical nature management, recreation and nature education. Each year, thousands of children and youths participate in the foundation's programs. At the farm there are species-rich pastures covering 11 hectares with sticky catchfly (*Lychnis viscaria*) and mountain clover (*Trifolium*

*montanum*), which are grazed by the foundation's cows and sheep. The foundation participated in the Interreg IV A project Natureship, aiming to increase awareness of the meadows in the municipality<sup>8</sup>. In a new project, the foundation will raise further awareness and knowledge of biological and cultural values in the landscape and how these can be managed with older management methods. The aim is also to restore three old meadow areas totalling 1.6 hectares. The budget is about 20,000 €. ■

Färsna cows. MagnusBergström



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- 6) [http://www.norrtalje.se/Bygga-bo-och-miljo/Naturvard/Skyddad-natur/Kommunala\\_naturreservat/Vigelsjo-naturreservat](http://www.norrtalje.se/Bygga-bo-och-miljo/Naturvard/Skyddad-natur/Kommunala_naturreservat/Vigelsjo-naturreservat)
- 7) <http://www.farsnagard.se>
- 8) <http://www.ymparisto.fi/default.asp?node=25688&lan=en>



# Meadows located near urban areas

*Iiro Ikonen and Mika Orjala*

One of the goals of the Natureship project (2009–2013) was to identify cost-effective ways to maintain traditional landscapes, wooded pastures and meadows in urban areas. Funding from the Centre for Economic Development, Transport and the Environment for Southwest Finland and so-called national funding from the municipalities of Vihti, Salo, Raisio and Hamina were used to produce maintenance plans for traditional landscapes, implement basic restoration of wooded pastures and shoreline meadows, and analyse bottlenecks for initiating and continuing the maintenance work. The planning work was allocated based on a competitive tendering process. A total of fifteen maintenance plans for urban meadows were completed during the project. The aim was to impoverish the soil in urban areas and on the interfaces of urban and rural areas, thus promoting the diversity of traditional landscapes and creating pleasant green

networks. It was also important to direct the activities to areas where they were needed most.

The areas chosen as planning targets differed widely: urban meadows located at the heart of population centres, conservation areas, traditional rural biotopes, bushes in their natural state and even old industrial areas. One thing remains common to all of these areas: thorough studies on the natural values represented by the areas and opportunities for their future development were lacking. The urban meadows chosen for the Natureship project and their planning and maintenance costs are presented in a condensed fashion in the table on the next spread. The maintenance plans described in the table can be downloaded in their entirety from the website of the Natureship project at <http://www.ymparisto.fi/natureship>.



Sheep filling their stomachs while maintaining the green area on Pappilansaari Island in Hamina. *Mika Orjala*



Alue	Area (ha)	General features of urban meadows	General description of the maintenance of the area	Total costs
Hamina, Pappilansaari conservation area	5,3 ha	Wooded conservation area, with representative shoreline meadows and rock meadows in shore areas.	Meadow vegetation is improved through grazing, mowing of specific areas, control of invasive species and thinning of forest. This creates half-open spaces, reminiscent of wooded pastures.	Basic restoration approximately €2,000; continued maintenance approximately €350/yr, cost of grazing €1,400/yr.
Hamina, Pappilansaari meadow	5,3 ha	Open shoreline meadow rich in plant and insect species, with three wooded islands and an herb-rich wooded slope.	Two maintenance options: 1. restorative grazing, 2. preservative mowing. Grazing would be the most beneficial option for the meadows in the area.	Basic restoration through grazing approximately €400, and continued site maintenance approximately €100/yr. Construction and material costs for grazing enclosure €3,400.
Hamina, Savilahti shoreline park	4,7 ha	Green area in the vicinity of the centre of Hamina, consisting of both maintained park areas and dry meadow-like wasteland.	The goal is the preservation and strengthening of valuable plant species, while simultaneously improving the recreational values of the area.	No need for basic restoration, continued maintenance in accordance with the plan costs approximately €3,900/yr.
Raisio, lhalantie rock meadows	1,2 ha	In addition to rock meadows, juniper meadows, meadow zones and forest zone can also be found in the area.	Invasive species are removed and the thinning of trees is carried out to make room for actual meadow species. The area is maintained by mowing, once or twice every summer. The area is also suitable for grazing.	Basic restoration through mowing and clearing of trees approximately €7,340. Continued maintenance through mowing and clearing of trees using machinery approximately €5,840/yr.
Raisio, pine island	0,3 ha	Wooded pasture with pine trees: a traditional biotope dominated by old shield-bark pines and junipers.	Overgrown area is opened through effective thinning of trees and annual mowing. Use of grazing is also recommended.	Basic restoration, consisting mainly of the clearing of trees, approximately €2,270 in total. Continued maintenance through mowing and clearing of trees using machinery approximately €2,910/yr.
Raisio, Raisionlahti bay	ca. 39 ha	Valuable birdlife conservation area that is also used as pasture for grazing animals. The size of the area used for grazing is approximately 28 ha. The diversity of birdlife on the shores has improved with the maintenance.	The goal of maintenance by grazing is to prevent the overgrowth of reeds in the bay and the eutrophication of the bay. The amount of open shoreline and meadow areas is increased so that the occurrence of shoreline fowl is improved.	Grazing costs approximately €510/ha/yr; mowing of reed beds approximately €6,000–10,000/yr; harrowing of shoreline to create the right environment for waders approximately €4,000–6,000/yr; clearing of paths €170/yr.
Raisio, Tuulila meadow	0,4 ha	A wooded pasture that was restored to a meadow in the 2000s by the Raisionjokilaakso conservation association.	The meadow area is maintained with annual mowing, twice per summer if necessary. The goal of the maintenance work is the prevention of eutrophication and the maintenance of meadow species.	Maintenance work including mowing and clearing of trees using machinery approximately €1,815/yr.
Salo, Kylälapsenpuisto park	1,9 ha	A rocky mound surrounded by meadows, located in the midst of an old rural environment with field ditches. Diverse range of plant species, dominated by archaeophytes. An herb-rich forest with ash trees can also be found in the area.	The area is maintained by mowing and the removal of brush once or twice per summer, depending on need. Some bird cherries and alders are removed from the small herb-rich forest with ash trees. No other maintenance work is carried out in this endangered habitat – the trees are allowed to grow densely and with a broad age spectrum.	Basic restoration through mowing and clearing of trees approximately €2,450/1st yr and approximately €1,850/2nd yr. Continued maintenance in accordance with the plan approximately €2,600/yr.
Salo, Matildedal horse pasture area	4,0 ha	A mature and robust herb-rich forest including a hardwood forest dominated by oak trees and overgrown patches of meadow. Special features of the area include old root cellars and an ironworks milieu of cultural and historical value.	The maintenance measures account for the special natural and cultural/historical features of the area and create a “recreational area of oak forest by the ironworks” that respects these values. The old structures are preserved, and the herb-rich forest with oak trees is left to develop at a natural pace. Invasive species are removed and trails are improved. Potentially, a playground will be built on a wooded meadow.	Initial costs for the playground approximately €11,570; initial costs for new recreational trails approximately €5,190; basic restoration of meadow areas approximately €2,345; basic restoration of hardwood forest and herb-rich forest by the shoreline approximately €875 in total, continued maintenance of herb-rich forest approximately €480/yr.

**Table 1.** Maintenance plans for urban meadows produced in the Natureship project (Abbreviations used: 1st yr = in the first year, 2nd yr = in the second year, €/yr = annual cost.)

<b>Salo, Meriniitynpuisto park</b>	16,1 ha	A recreational area with traditional landscape, representative meadow vegetation and a long history of agricultural activity. Signs of human activity dating back to the Iron Age have been identified in the area.	Maintenance work aims at a multi-purpose recreational area with a traditional landscape where vegetation associated with a traditional landscape and traditional rural biotopes are preserved. Meadows affected by eutrophication are maintained by mowing, and overgrown forest areas similar to wooded pastures are cleared.	Basic restoration through grazing approximately €6,500/1st yr and approximately €2,650/2nd yr; continued maintenance through grazing approximately €3,900/yr. Basic restoration through mowing and clearing of trees using machinery approximately €8,050/1st yr and approximately €2,650 /2nd yr; cost of continued maintenance approximately €5,450/yr.
<b>Salo, Vartsala timber yard area</b>	8,0 ha	The area, used as timber yard as late as the 1960s, has developed a forest of deciduous trees on top of the timber waste. Among other things, the area has developed vegetation characteristic of a moist herb-rich forest. As a moist area affected by floods and containing a high level of biodiversity, it has the potential to become significant from the species perspective.	The area will be turned into an environment rich in landscape and recreational opportunities, an "herb-rich forest with birdsong". Due to its history, the forest area cannot be rendered open and traversable; instead, the current recreational paths will be restored. The goal is to create a mosaic of open and freely overgrowing herb-rich areas.	Basic restoration of a recreational path approximately €1,580, construction of new paths approximately €4,030 in total; removal of invasive species approximately €680/1st yr and later €108/yr; clearing of trees and bushes €1,080/yr; potential costs from constructing a wetlands area approximately €14,530 in total.
<b>Salo, Viurilanlahti bay</b>		The Viurilanlahti bay Natura 2000 area at the northern part of Halikonlahti is part of the national protection programme for wetlands important for birds as an internationally valuable target and part of the national wetlands protection programme. In addition, the area has the status of Special Protection Area (SPA) granted to significant bird habitats.	The conservation and biodiversity of bird habitats is maintained through the grazing and/or mowing of shoreline areas, the management of fish stocks and the hunting of small predators. In addition, the aim is to promote hiking and recreational use while also accounting for natural values.	The maintenance plan did not contain a budget for the maintenance work.
<b>Vihti, Ridal shoreline area</b>	2,4 ha	Moist field meadow and wasteland area in the immediate vicinity of the Nummela gate wetlands area significant for birdlife.	The area will be turned into a recreational area for local residents. The target is developed in a way that preserves the valuable shoreline swamp located next to it.	Basic restoration approximately €2,800/1st yr and approximately €550/2nd yr; continued maintenance approximately €1,400/yr. A bird watching platform is also planned in the area, with initial costs estimated at €7,000 to €11,000.
<b>Vihti, Tyynelä meadow</b>	5,3 ha	Overgrown field meadow located between residential areas. The area is in active recreational use and contains extensive path networks.	Overgrown meadow areas are cleared; the aim is to turn some parts of the area into a birch forest reminiscent of a wooded pasture and others into a partly treeless natural meadow. Wooded brookside important for birdlife and its buffer zone are maintained in their natural state.	Basic restoration approximately €4,000/1st yr and approximately €3,050/2nd yr; continued maintenance approximately €3,200/yr.
<b>Vihti, central boat dock area</b>	1,1 ha	A robust herb-rich forest with <i>Alnus glutinosa</i> and a <i>Glyceria maxima</i> swamp next to a residential area with detached houses. The area is in active recreational use.	A valuable <i>Alnus glutinosa</i> dominated herb-rich forest by the shoreline is left to develop in its natural state; lake scenery is opened up with careful clearing of bushes and shrubs. A duckboard trail across the swamp will be constructed for educational and recreational use.	No need for basic restoration. Continued maintenance approximately €50/yr. Length of the duckboard trail to be constructed approximately 166 m, total cost estimate €8,300.

What measures, then, should be taken to promote the maintenance of urban meadows? In larger towns and cities, cooperation teams for traditional landscapes and other green areas should be established among experts in environmental protection from the state and the municipalities, the National Board of Antiquities and associations interested in the matter. Measures to control invasive species should also be addressed in

these groups. Moreover, the use of green roofs should be enhanced. Green roofs function to preserve ecosystem services (Halonen 2010); they also constitute one means to maintain green networks in urban areas. Residents and municipal-level decision-makers should be provided with information on the value of urban meadows and the benefits obtained from their maintenance to serve as background information for



planning work. More municipal employees should be involved in the management of valuable areas. For example, summer workers could maintain traditional landscape areas and carry out the removal of invasive species in addition to the maintenance of green areas. By making use of the maintenance classification green areas described in the publication *Viheralueiden hoitoluokitus*, it is possible to create areas that are original, diverse and recreationally interesting in population centres. An example of three-way cooperation between municipalities, nature conservation authorities and associations is Norrtälje in Sweden, where careful planning and restoration of the most valuable sites have been carried out with the support of various financing bodies. Also in Southwest Finland, several urban areas in locations such as Turku, Salo, and Piikkiö in Kaarina benefit from the work of active associations that manage valuable traditional landscapes through mowing, clearing of trees and/or organised grazing.

Since 2005, the best funding instrument for the maintenance of traditional landscapes in the Central Baltic area has been the agri-environmental aid that has been available for the purpose of preventing the deterioration of traditional landscapes in Finland, Estonia and Sweden. In Finland, associations have been eligible for the agri-environmental aid since 2007. Large areas benefiting from the aid can also be found near city centres, including Friskalanlahti bay and Ruissalo in Turku. Maintenance aid for cultural heritage sites adopted recently by the National Board of Antiquities offers new opportunities for the maintenance of areas



In moist shoreline areas, it is sometimes necessary to cut or crush reeds using machinery, for example in situations where grazing animals have not been able to access the area due to difficult soil conditions. Photo taken in the Raisionlahti bay after the crushing of common reed in November 2011. *Mika Orjala*

significant from the viewpoint of cultural history in Finland. During 2014–2020, the emphasis of the rural development activities implemented through the Leader programme in the Central Baltic area will, at least in certain areas, shift to small towns, which may contribute to the opportunities for the maintenance of traditional landscapes in these towns. Various more extensive projects implemented with national funding and so-called turnkey maintenance projects carried out with EU funding will continue to hold a key position in the future. For example in Estonia, basic restoration of reed beds in the immediate vicinity of public beaches and their maintenance through grazing has been enhanced through the LIFE project, *Urban Cows*.

Individual – even small – meadows may constitute important recreational areas locally, but at best the networks of urban meadows may become tourist attractions where it is possible to organise “landscape walks”. Areas with diverse birdlife and special bird-watching towers may function as tourist attractions on an international level. For example the municipality of Vihti, which was involved in the Natureship project, will use its own funding to construct and maintain a bird-watching platform in the vicinity of the species-rich Nummela gate in the Ridal shoreline area.

It is important to bear in mind that not all benefits of the traditional landscape can be easily converted into euros; these include the protection and maintenance of biodiversity, the old cultural landscape, and cultural heritage. The urban green networks provide for the recreational needs of the residents in a versatile manner and create a beautiful network of habitats that is also conducive to the health of the residents. According to recent studies, an ongoing connection with traditional landscapes also reduces the incidence of allergies. The maintenance of flowering meadows can be carried out with little funds, but the benefits obtained from them are diverse. Urban meadows are worth investing in. ■

# Combatting invasive plant species maintains diversity in Turku

*Liisa Rantala*

The idea behind the National Strategy on Invasive Alien Species drawn up in April 2012 is to prevent harm and risks posed to Finnish nature caused by such species, as well as for the sustainable use of natural resources, livelihoods, and social and human well-being.

The City of Turku started to wage war on invasive species in 2009 as part of the *Jättiputki kuriin Varsinais-Suomessa (Fight Hogweed in Southwest Finland)* project coordinated by the Centre for Economic Development, Transport and the Environment for the region. Sightings had been recorded the previous summer (2008) when the local nature conservation society made a survey of the occurrences of alien species through a questionnaire distributed throughout Southwest Finland. The society has also collected sightings and sent them to the Centre for Economic Development, Transport and the Environment for Southwest Finland for the period 2009–2012. In summer 2009, reports of sightings by local residents were verified in the countryside, and an invasive species register was produced, based on the survey. Several hectares of hogweed were discovered, some of which were in the immediate vicinity of rivers, lakes or the sea, and threatening to spread even further. The register was used the following year to focus the operation efficiently to control the problem of invasive species.

The practical work of controlling alien species took the form of a collaboration on projects between the Municipal Property Corporation, the Green Area Corporation, the Environmental Protection Office and what is now the Centre for Economic Development, Transport and the Environment for Southwest Finland (*Fight Hogweed in Southwest Finland*) and as a follow-up project, *Vieraslajit kuriin kummitoiminnalla (Control of Alien Species: Assigning an Active Role to Local Residents)*. Juha Hukka from the Green Area Corporation, the person in charge of the work, headed a special team consisting of students from environmental studies and horticultural colleges, summer workers and people doing community service as a sentence imposed by the Criminal Sanctions Agency. For the first three years, the prevention work was organised by Natalia Räikkönen, coordinator of the invasive species projects at the Centre for Economic Development, Transport and the Environment. When the projects were over in spring 2012,



the City of Turku became responsible for the control of hogweed in the local area and at separately agreed sites in the town of Kaarina. The Centre for Economic Development, however, was still involved, providing funds for the student plant control team and maintaining the invasive species register.

Turku has mainly concentrated on eradicating hogweed, owing to the enormous harm it causes to nature, to the environment and to people. With respect to other harmful species, management has focused only on plants that pose an immediate threat to nature conservation areas. However, Turku has many large areas where Himalayan balsam thrives, and its control is proving difficult, as the resources needed increase from year to year because the sites in question are not being managed properly. The involvement of various associations, clubs and local residents is therefore needed, in addition to that of the authorities. For example, the Turku branch of the Association for Nature Conservation has organised voluntary teams to control the spread of Himalayan balsam in Muhkuri. Voluntary work to combat hogweed in Koroinen has also featured the participation of the Botany Club of the Zoological and Botanical Society of Turku.

## Methods for combatting hogweed

It is a difficult and laborious process to destroy hogweed. The plant's seeds are viable for five to ten years and they form a large soil seed bank. The perennial forms a strong root system that helps it survive the winter and grow new shoots the following spring.

The prevention method is selected for a site based on its location, size and stage of development. The actual methods used include mechanical removal of the plant, covering it in plastic that is impervious to light, and treatment with a pesticide. Pesticide treatment is not undertaken close to bodies of water or in a groundwater area.

For each occurrence, a hogweed monitoring form is completed, with details of the precise location, the growth site, the area of growth and the size of the occurrence. The action taken and dates are recorded. The same form is used for one site from one year to the next, making it easy to monitor the effectiveness of the prevention methods selected and to ensure that a site is monitored for a sufficiently long period.

The herbicide used is glyphosate, which has achieved good results, as the substance travels down from the plant's leaves to the roots. Glyphosate, however, is associated with environmental conservation issues. It degrades relatively slowly in the conditions that tend to be found in Finland and can accumulate in the soil. The required safety distance from water prevents its use in many large areas where invasive species occur. For these reasons, a pesticide to take its place is constantly being sought. For example, a birch distillate that has been trialled only proved effective at a certain stage of growth and was not as deadly as glyphosate. In 2013, the intention in Turku is to experiment with the new, more environmentally friendly Foamstream weed control method, which it is hoped will replace glyphosate. With the Foamstream method, invasive plant species are eliminated by means of a combination of hot water, steam and natural foam. A future method to try to reduce the use of herbicides involves the destruction of large areas of Himalayan balsam by burning seedlings early in the spring.

The most cost-effective way to control these plants is to prevent the formation of seed banks. If there is no seed bank, it reduces the time spent on control and



Hogweed (front). Hannu Klemola



Lesser periwinkle is a popular garden plant that spreads in herb-rich forests suppressing their natural underbrush. *Liisa Rantala*



monitoring by several years. Costs are also saved by destroying seedlings early on in the spring. The waste generated barely incurs any costs, and individual plants are easy to eliminate amid the rest of the vegetation. Later monitoring ensures good results.

Work is still being done to find the best treatment for various invasive plant species. Many of them differ slightly from one to another, depending on where they grow and the ways in which they reproduce. The aim is to halt their spread, with the total eradication of some species in Finland. The solutions need to be not only effective but also cost-effective, where possible, and which take into account people and the environment.

Detailed instructions for controlling invasive species can be found at: [www.ymparisto.fi/vieraslajit](http://www.ymparisto.fi/vieraslajit).

## The challenges

A fundamental challenge in the control process is the lack of knowledge. The residents of cities continue to plant species that spread quickly to the surroundings. This is partly due to ignorance of the ecological impact of plants, and partly because these harmful species are still for sale and may even be recommended because they are easy to look after and they grow fast and have good coverage. But it is just these

characteristics that make them robust and effective competitors of those plants that are native to Finland.

However, basic knowledge is not enough, and the control of invasive plant species will not succeed without an awareness of just how harmful they are. This fact needs to be internalised at all levels and among all actors. A frustrating example of the lack of understanding in Turku is the number of cases where Japanese rose (*Rosa rugosa*) has been removed from certain green spaces in the city and planted in others at the same time.

### Invasive species and garden flowers gone wild

**Japanese rose** (*Rosa rugosa*) is often seen growing both as a cultivated plant and in the wild in coastal areas and islands. The popular **lesser periwinkle** (*Vinca minor*), a ground cover plant for gardens and backyards, is found in many groves, where it chokes the natural undergrowth, causing significant damage to biodiversity and the aesthetics of the surroundings. The **hedge bindweed** (*Calystegia sepium*) is a problem in many places and is especially bothersome when it spreads to oak forests. There are also difficulties with many other species, the best known of which is probably the **large-leaved lupine** (*Lupinus polyphyllus*).



Combatting hogweed by covering it with plastic. *Veli-Pekka Ojala*



Those who plan green spaces have a major role to play in the successful management of invasive alien species. In addition to avoiding plants that are known to be harmful, they should adhere to the precautionary principle when choosing new plants to cultivate. In place of fast-growing plants that spread aggressively, alternatives should be sought, and plants that are native to the country should take priority. However, there is insufficient knowledge concerning plants that are potentially harmful.

Another challenge to the control of invasive plant species is earth that is moved. This can contain the seeds of harmful species, such as hogweed. As the movement of earth is a common phenomenon and hogweed seeds remain viable for a long time, the challenge arises as to how to store and transfer knowledge between actors. Because of the problems from the movement of earth, invasive species should also be included in the city's street and green space register.

Another possible challenge with hogweed is the toxic furanocoumarins contained in the sap, which cause painful skin damage similar to burns caused by the sun's ultraviolet radiation. This can scare off private landowners and make it hard to solve the problem and organise proper management.

## Results

At sites where there are only a few plants, prevention has worked very well because seed banks have not had time to form. Over small areas, hogweed has been entirely eradicated simply by weeding, especially where there is other vegetation providing shade. Over larger areas, however, the plant needs to be controlled several times during the growing season over a period of many years. It is therefore very cost-effective to deal with the problem immediately when occurrences of the invasive plant reach the attention of the authorities.

In the worst cases, there have been thousands of hogweed plants spread over an area of several hectares. As the seed bank continues to produce new seedlings for a period of just under ten years, it is a major task to eliminate the plant. However, the size of the occurrences in managed hogweed areas has substantially diminished in most cases, and some small sites have been declared clean now, after a four-year battle. Even in the worst cases, the weed has been prevented from spreading.

New sites appear constantly and old ones have to be protected and monitored for years. Some of the most



challenging are large areas of weeds on the river banks and lake shores. At individual sites, and regardless of species, results are best achieved by getting the local residents involved. A good example of this is the Jaaninoja, a small ditch in Turku where Himalayan balsam was eradicated in a demarcated section of the park next to the brook, thanks to active monitoring afterwards by local residents and the removal of individual flowers that had penetrated the soil. It is therefore possible to completely eradicate invasive plant species on the river banks and next to lakes as long as the problem is also dealt with upstream and the site is monitored regularly for a long enough period.

The success of efforts to control the problem calls for cooperation, and the problem will not be solved by merely relying on the authorities. Everyone's input is needed to successfully prevent the spread of invasive alien species.

## Costs and funding

Funding for the problem of invasive species has mainly come from the City of Turku and the Centre for Economic Development, Transport and the Environment for Southwest Finland. Summer workers from the University of Turku have been recruited for the work. The local nature conservation society in Southwest Finland has given their time to devote to the work, and the Turku branch of the Association for Nature Conservation has organised voluntary work. Residents and residents' associations in some areas have also gotten involved in the control of invasive species in their local area.

The work to control hogweed cost around EUR 40,000 in 2012. The costs associated with control of Himalayan balsam were roughly EUR 10,000. The costs of controlling other invasive species were just a



Large-leaved lupine (*Lupinus polyphyllus*) is an invasive plant species. Hannu Klemola



few hundred euros, on account of the small amount of work involved. Altogether, the costs of the project amounted to EUR 50,000, of which the city contributed EUR 37,200. The recruitment of students for the work kept the costs down significantly. The prevention work that has begun will have been a waste of resources very soon, however, unless the control and monitoring processes are kept up. In the worst-case scenario, one large hogweed that has gone to seed can produce up to 100,000 seeds and form a seed bank for almost ten years.

The management of invasive species requires a long-term commitment to the work and should be a part of budgetary planning, as, for example, repair work due to vandalism is. A GIS database of the places where invasive species grow is needed and should be constantly updated and made available to all actors. The National Strategy on Invasive Alien Species, commercial gardens, and raising awareness among local residents all mean that, in the future, the costs of managing invasive species will decrease as long as adequate resources are guaranteed to immediately address problems associated with new occurrences. Sightings of invasive species can be reported to the city or municipal environmental office, the Centre for Economic Development, Transport and the Environment for the region, or the local nature conservation society. They may also be recorded in the Hatikka nature observation database, which everyone has access to and which is maintained by the Finnish Museum of Natural History ([www.hatikka.fi](http://www.hatikka.fi)). ■

### National Strategy on Invasive Alien Species

Finland is committed to the objectives of the European Union's biodiversity strategy to prevent harmful invasive species and their adverse effects within a specific timeframe. The Finnish Government has therefore adopted a Resolution on a National Strategy on Invasive Alien Species. The work group responsible for drafting it included a large number of Finnish specialists. The subsequent report can be found at: <http://www.mmm.fi/attachments/ymparisto/vieraslajiseminaari9.12.2009/67MLG2Hn1/Vieraslajistrategia.pdf>.

Interview on the community project to prevent the spread of invasive species (Anna Haapaniemi)

## How did our weeder begin this activity?

Several years ago, a Helsinki resident, who actively took part in preventing the spread of invasive species, became interested in this activity. The weeding work kicked off after our weeder noted that the Himalayan balsam (*Impatiens glandulifera*), which grew in her local area, had begun to take space away from other plants. She had been able to identify the plant before this, but she also remembers seeing a newspaper article on the importance of this subject. As weeding the Himalayan balsam is quite simple, it is easy



Himalayan balsam (*Impatiens glandulifera*) in bloom.  
Southwest Finland Centre for Economic Development, Transport and the Environment, Project "Vieraslajit kuriin kummitoiminnalla Lounais-Suomessa"

## How can we facilitate the local fight against invasive species?

### Experiences of an independent, self-reliant, Helsinki-based Himalayan Balsam weeder

to start doing so independently, and there was no need to seek involvement from an organisation or an authority. When making the decision to start this work, the most important factors are that one is aware of the subject and one shows initiative.

#### What is the best way to facilitate this work?

According to the weeder, no money is required for initiation of this work. Instead, she believes that the best way to facilitate independent efforts to prevent the spread of invasive species is to actively provide information on the topic. Campaigns should be run more often than they are now, at least once a year. She believes that free newspapers distributed to mailboxes are the best channel of communication because they reach most locals. In addition to providing information, providing an example can inspire locals. The Himalayan balsam weeder has noted that some spaces in her local area have been weeded by others, who possibly got the idea to do so after seeing the results of another weeder's work. Thus far, no one has come to ask why plants have been weeded, and all feedback has been positive.

There is also interest in volunteer work organised by the city's Public Works Department, which would include other forms of conservation work in addition to weeding. Our weeder believes that it is important to have many options available for those interested in participating. Some will probably feel that it is easier to get involved in conservation work and get an idea underway if volunteer work involves a large group of people. However, it is our weeder's experience that the best part of this work is that there is no need to officially commit to it and people can choose how much time they spend taking part in it.

#### What is most rewarding about participating in this work?

It is nice to see the results of weeding work that has lasted many years. This is also an enjoyable way to spend one's spare time. "Once you try it, you will realise how enjoyable an activity it really is!"

#### Nature conservation associations in Helsinki and Turku have also taken part in the volunteer effort to destroy the Himalayan balsam

For years, in addition to traditional voluntary meadow and field management days, local nature conservation associations have organised events at which volunteers can take part in preventing the spread of invasive species. "These associations have requested that the public and other associations take part in destroying invasive species," says *Hannu Klemola* from The Finnish Association for Nature Conservation. "For example, work to destroy the Himalayan balsam is a long-term effort, but a rewarding one, as the results are visible quite quickly. The plants in natural meadows will also benefit from this work," continued Mr Klemola.

Additional information on invasive species and volunteer efforts:

<http://www.sll.fi/mita-me-teemme/lajit/vieraslajit>.



# Development needs and conclusions

## City meadows – a vibrant and useful history of land use

The Natureship project has shown how the boundaries between urban areas and their surrounding countryside, and areas in their natural state and those that have been managed, are often blurred, and even artificial. However, within the project's area of operation, the Central Baltic, there are traces of human activity in the coastal areas that date back to prehistory, with the result that the interaction between nature and man in the region has in many respects made great advances, forming networks that are interdependent in many ways. Many settlement clusters began close to bodies of water, and for that reason, city meadows and fields are also frequently located right next to rivers, lakes or the sea. The importance of meadows and other unbuilt-on land is especially evident in connection with water protection: they are needed for absorbing rain and flood water and for generally filtering water – tasks where they offer us the most cost-effective way to alleviate problems of disruption. A good example of this is the city meadow management plan realised during the Natureship project at Ridalinlahti, in Vihti.

City meadows are part of the multi-layered cultural milieu, the age-old battleground for man and nature. *Lasse Pettersson* describes one highly significant historical site in Sweden in the management plan, and how the moats at Visby are now an imaginative play area for children. At the same time, the area's ancient old stone structures provide a refuge for bats, for example. In Finland too, prehistoric sites and valuable city meadows are often located in one and the same place, such as Koroinen, in Turku, and Meriniitynpuisto, the park in Salo. The archaeophytes at these sites, such as dropwort (*Filipendula vulgaris*), betray the existence of an ancient settlement.

Today, city meadows have often formed islands or ribbons within towns and cities, as residential areas have spread further from urban centres. But species travel or are carried through bodies of water and green networks between the centres of towns and cities and the surrounding countryside. They sometimes include invasive species that threaten biodiversity, as *Liisa Rantala* stated in her article. Even small meadows and fields can be very important in the



Highland cattle busy with landscape maintenance at Viurilanlahti bay in Salo. Hannu Klemola

green space network, both for organisms and for humans. We like to explore meadows and forests. Paths that lead from paved roads to green areas are easy to find in cities, but accessibility to green spaces for different population groups, whether on foot, by bicycle or by public transport, is often a challenge in town planning.

We Europeans share a concern for the conservation of our traditional landscapes. In her article, *Riikka Söyrinki* describes how the Finnish Laidunpankki pasture database, which makes possible contact between sites and those who manage them, has awakened interest elsewhere in Europe. The cattle that manage the landscape in cities usually come from elsewhere, but a local resident or association, for example, is paid to supervise the process. A network of actors is required to maintain city meadows and aquatic environments: rural entrepreneurs, local authority street and green space departments, colleges, environment agencies, other authorities, landowners, associations, trusts, specialists and local residents.

Grazing in a natural environment is one of the few food production methods that improves biodiversity. The production of grass-fed meat benefits traditional environments: the animals can graze freely, the pro-

ducer can obtain a better price for his meat, and the consumer can choose a product that has a positive impact on the environment. The criteria for grass-fed meat in Finland are currently being debated, while certified grass-fed meat has been available on the Swedish market for ten years.

At the third National Landscape Symposium on 5 November 2012, Minister for the Environment *Ville Niinistö* mentioned that the meadows and sheep pastures around the churches in the municipality of Keminmaa were one of the area's attractions. Young people from the local 4H organisation ran a summer café in the area, and a course on how to make traditional fences was also held there. The animals, café and events are a tourist attraction that continues a long tradition of cultural history but also promotes habitats for threatened plant species.

## Benefits from investment

All around the world there are examples of how proximity to green spaces is reflected in house prices. A survey conducted in Philadelphia suggests that an overwhelming majority of the financial benefits from urban green spaces came from a rise in house prices. Many agencies and associations in the huge and polluted metropolis of Jakarta have moved out to the green city of Bogor, in the mountains, where the air quality is better. In Finland too, studies show that proximity to the coast and wide-open spaces is greatly valued, and that we are prepared to pay for that in the form of high house prices. This phenomenon is also a familiar one in the municipality of Vihti, which is one of the partners of the Natureship project. The area's neglect and business traffic routes have reduced property values.



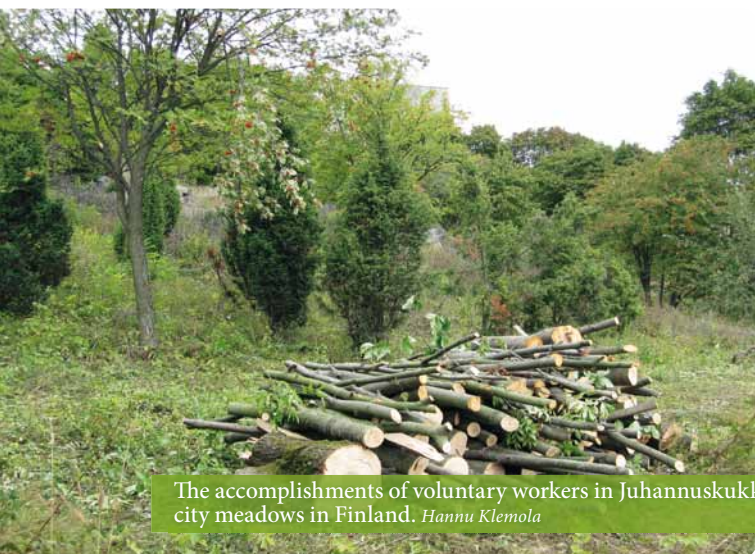
The vulnerable clouded apollo (*Parnassius mnemosyne*). Ari Kausela



A scheme similar to the classification of green space management has also been drawn up for green areas surrounding railway stations. Areas of grass that need fertilising and watering can often be replaced by natural meadows. Roadside meadows are a pleasant sight and valuable species thrive in them. The sunflowers that grow in the fields in Salo and Ruissalo (in Turku) are there for the townsfolk to pick and for the birds to feed on. When cared for, city meadows save money because they control the spread of harmful invasive species and mugwort, which causes allergies. In addition, natural sites close to schools and day care centres are important for the well-being of children, creativity, concentration and the development of a relationship with nature. Green spaces make suitable places for exercise and outdoor and after-school activities. Fortunately, children in cities are once again seeing cattle, as the project at Raisio-lahti shows.

## New practices

It is a challenge to know how to use ecological data and information based on the experiences of local residents in town planning. What is the value of nature, and how should it be made visible in land-use planning? How much would you pay for a square metre of maiden pink or cat's foot? Townsfolk in the Nordic countries have close ties to the natural world and a whole range of residential and environmental preferences. The protection of biodiversity, the natural landscape and ecosystem services means the safeguarding of high-quality habitats.



The accomplishments of voluntary workers in Juhannuskukkula in Turku, one of the most valuable city meadows in Finland. Hannu Klemola

The dissemination of cost-effective practices is a continuous process between different actors. The Natureship project and the *City Meadows* publication are part of this mission. Cooperation furthermore commits local residents and actors to long-term care of their environment. An example is the support for voluntary work by associations in the management of city meadows and the fight against invasive species. Uusimaa's Traditional Landscape Group has adopted a meadow in Porvoo's Stensböl Natura area. The threatened clouded apollo (*Parnassius mnemosyne*) butterfly has been successfully transferred to Stensböl. The Turku branch of the Association for Nature Conservation, by contrast, is planning to adopt an area of water. Hunting has been successfully combined with nature management in the Viurilanlahti Natura area near the town of Salo. Hunters are a natural partner too in the shooting of small predators and in the construction of wetlands, for example. Metsähallitus, the Finnish forest administrative authority, has considered other approaches to the effective use of volunteers to manage traditional landscapes, for example by running courses or special events on the subject of shepherding, organising international work camps, introducing island management schemes and offering farmhand courses. City meadows can also be looked after by hiring unemployed people specifically to do the work, of which there has been some experience already in the fight against invasive species.

The same is true for the management and the controlled neglect of land as it is for managed sites – we need different approaches. We learn best management practices from one another, but we also learn to avoid mistakes and to find shortcuts and partners. The national city parks and management and land-use plans for Natura areas in Finland are good ways to protect and enhance ecosystem services. Knowledge exchange between experts is accomplished through information technology at the push of a button or at meetings like the seminars, field trips and workshops organised during the Natureship project, in which specialists, officials, and other interested parties participated.



Meeting a member of landscape maintenance staff in Ruissalo, Turku. Hannu Klemola

Raisionlahti is an example of the restoration of coastal meadows under severe threat. The common reeds in the area were undisturbed for a long time and were allowed to occupy former meadows and pasture land, but clearing, ploughing and grazing have meant that the shores have opened up and the birds have found places to feed and rest. In addition, the Habitat Restoration and Nature Management steering group set up by Metsähallitus and its experts have developed guides for the restoration of habitats and their management. Restoration sites are also instructive for students of environmental science.

Magnus Bergström relates how the Norrtälje Nature Conservation Foundation and the municipality of Norrtälje in Sweden, both involved in the Natureship project, have been renovating city meadows that are valuable in terms of the species that have thrived there for 20 years. The area's ancient forests and limy soil are the habitat of many rare species. The sites have been cleared, pollarding has taken place, the areas have been mowed, and cattle pens have been constructed. The sites may have a grazing history going back hundreds of years, and they make popular recreational areas. The work has been carried out to help Hartman's sedge (*Carex hartmanii*), among other species, whose population declined as a result of overgrowth after there was less grazing in the area. Certain species are good indicators in the selection of areas for restoration. Sweden also has a tradition of exchanging experiences of traditional landscape management and practices and of the commitment

of landowners to long-term projects. In addition to open meadowland, traditional wooded landscapes, fenced-off land and forest pastures in Finland should also be managed and restored. This is what is hoped will take place under the METSO Programme, which is intended for the acquisition of wooded traditional biotypes as privately protected areas.

Those who commission nature surveys must, when planning land-use, ask consultants not only to identify sites but also make recommendations for management. All meadowland in Finland is under threat and faces problems caused by overgrowth, construction and wear and tear. Meadow overgrowth poses a serious threat, especially to our butterflies. This management work is described in the publication 'Turun kaupunkiniityt' (*Turku's city meadows*). Not all meadows or fields can be managed or restored, and meadows reverting to forest can have their own value in an urban structure, for example, as woodland that provides shelter. There is also a need to combine the control of invasive species with other forms of landscape management. Liisa Rantala's article and the City Meadow Management Plans for Vihti and Hamina give an excellent description of the contemporary problem of invasive alien species. New alien species are regularly being found established in meadows and bodies of water, and the work to control them is expensive. Finland's first National Strategy on Invasive Alien Species was completed in spring 2012.



Rattle grasshopper (*Psophus stridulus*). Ari Kuusela



Many traditional landscape species have found refuge in landfill sites, under power lines and alongside traffic routes. One such example is the rattle grasshopper (*Psophus stridulus*), found next to a cycle/pedestrian path in Kakskerta, Turku. Examples of the management of the rattle grasshopper's habitat can be found in Nokia, in Nynäs in Södermanland (Sweden), and in the meadows at Bräcken in Dalsland (Sweden). Management methods include clearing and mowing, followed by grazing. Students at the Department of Biology at the University of Turku have considered starting commencing management of a site in Turku. According to a study by MTT Agrifood Research Finland, 'built meadows' are also of major importance for biodiversity, as management of traditional natural meadows is not enough to preserve species. Alongside traditional land use in the form of agriculture, there is a need for new habitats and channels for the spread of species that are dealt with in different ways and which vary in terms of their soil.

Although, as a result of the neglect of nature values, there is a danger of habitat fragmentation and that native species will be replaced by expansive invasive species, urbanisation does not necessarily mean less diversity. Garden suburbs can even increase it. An

example of this is the Siberian flying squirrel (*Pteromys volans*), which occurs in coniferous woodland, and which has been in swift decline, particularly in commercial forests. As a consequence, it has almost become an urban species, which survives best in built-up environments if large areas of mixed woodland are protected in urban planning and forest management and if consideration is given to the fact that this species needs an ecological network to prevent the isolation of populations. Like the Siberian flying squirrel, frogs and many mammals are dependent on ecological networks, and they may be more able to travel from one place to another if there are tunnels and fences in the immediate area.

There are many types of important environmental action. Traffic signs can warn motorists of the presence of hedgehogs, roadside mowing can be undertaken only after flowering plants have run to seed, and city parks could favour flowers that attract butterflies and bushes that produce berries. To celebrate its status as European Capital of Culture, the City of Turku acquired nest boxes for its parks and a delightful surprise was that most of them were inhabited by the following summer. Feeding birds in the winter is a popular pastime that gives joy and contentment.



Life on the meadows was explored during a dragonfly excursion in Salo. Emma Kosonen



Studies from the UK suggest that gardens with a feeding place are better protected from aphids, as visiting birds feed on garden pests – yet gain, an ecosystem service in action.

## Challenges and the future

The report describes examples of ecosystem services provided by green space networks. Crucial to the preservation, management or even the establishment of these networks must be resources, but important too is the current situation with respect to land use, mirroring its history, the protection of species, cultural values and landscape management. Management is part of a continuum in which the work of past generations is visible.

Nature management is something that affects many people, and one of the challenges of organising it is the participation of local residents, both in the work itself and in the policymaking process. Ideas and feedback are invaluable for specialist nature management planners. Crucial to the structuring of this type of interaction is access to information in plain language on different areas. But it is just as important to furnish the experts with the resources to take into account the view of local residents – and often this is

restricted because of time pressures. This is important because conflict can be prevented through greater interaction. The experts have no exclusive right to decide what constitutes a good city, and they are not infallible in town planning that applies ecological knowledge, even if researchers and scientists should generally be given more say in decision-making. Furthermore, it is to be hoped that any initial difficulties would not discourage those carrying out the work, and effective knowledge exchange is therefore also vitally important.

An attempt has been made to address these challenges, particularly with regard to the system for drawing up management and land-use plans. What is essential here is to try to achieve a dialogue between the various actors, to take into account the different purposes that areas serve, and also to find the widest possible consensus between those involved. Meadow sites, especially in urban areas, are also often popular for recreational activities and hiking. Some of the managed sites become important nature sites for tourists, and they provide employment and make money. Examples are Liminganlahti, Tåkern, in Sweden, and Matsalu, in Estonia. Around the world, nature tourism is a growing industry, and the Baltic Sea region is still in its infancy in this respect.



The mission poses a challenge. We need practical measures, information and announcements, education and training, guidance and continuity. Actors suffer from a lack of resources, both in terms of cash and manpower. Societies and associations often depend on just a few activists. The administrative difficulties associated with projects are also well-known. Many structures, such as paths, towers and signposts are established by means of projects, but their upkeep is left to the local authorities. A threat is also posed by the poorer prospects for funding under the EU's new programming periods. Cultural environments are certainly not going to be the last place where savings will be sought.

One message coming out of traditional landscape management is that results are achieved through environmental aid for agriculture. The EU's common agricultural policy is turning green: the quality of the environment and animal welfare are more important than ever. Organic production is on the increase. Farmers are being encouraged to promote biodiversity and offer environmental services. The practice of agriculture alone does not necessarily guarantee a satisfactory level of outcome. Today, even associations can apply for specific environmental aid. But landscape management entrepreneurs should also be able to receive aid. Cities can learn a lesson from agricultural practices when it comes to environmental management and the maintenance of green space networks. The need for natural heritage and landscape services is growing. The Rural Women's Advisory Organisation has published a guide to landscape services as a business. Public money is needed to finance the management of traditional biotypes to manage sites that are not covered under specific aid.

Finally, there is the matter of how the value of city meadows as producers of ecosystem services can be shown. A sense of appreciation and the desire to look after the environment are born from the positive experiences people have of the landscape, animals grazing, facilities for outdoor activities and the interesting signposts that people see in their immediate environment. Hopefully, even reading this publication will be part of the experience. A positive message can be sent by local residents to officials and policymakers. The European Union, the state, and the local authorities must provide guidance for such a

determined approach and also influence legislation. A managed, varied and historically diverse environment is valuable for the establishment of identity and social well-being. But it has to be remembered that the right of enjoyment cannot exist without environmental responsibility. If we invest in ecosystem services, we will surely receive a good return on our investment. ■





Broad-bodied chaser (*Libellula depressa*). Ari Kuusela



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In the middle of the hustle and bustle of a city, you may find a city meadow. A city meadow refers to a green area situated in an urban setting, the management of which aims at maintaining meadow species and facilitating outdoor recreation for city residents. Some of these green areas situated in cities are managed in a detailed and planned manner, while others have been left untended and are now wild, overgrown and in some cases impenetrable. However, all these meadows share one similarity: they play an important role in producing ecosystem services. What, then, is meant by ecosystem services? The multitude of flowers that bloom during summer, recreational opportunities, maintaining nature's diversity, as well as filtering urban runoff are some of the everyday "services" that city meadows provide for the urban environment and its residents.

This publication covers several different points of view by numerous experts on the importance of green areas in cities. The message is clear: management of city meadows improves both natural and cultural environments in a cost-effective manner. City meadows also help improve the health and enjoyment of city residents. When a green area is well-managed, the reputation and image of the surrounding properties and neighbourhood will also improve, as will their financial value!



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