UNIVERSITY OF COPENHAGEN
DEPARTMENT OF GEOSCIENCES AND NATURAL
RESOURCE MANAGEMENT

Urban Forests in a European Perspective: what can the National Forest Inventory tell us

Workshop for Practitioners and Researchers held on March 15, Brussels
Summary of workshop results

Natalie Marie Gulsrud, Anders Busse Nielsen, Annemarie Bastrup-Birk, Anton Stahl Olafsson, Markus Lier, Christoph Fischer, Remigijus Zalkauskas, Marcus Hedblom, Tuija Sievanen, Helena Nordh, Jonas Dahlgren, Gintaras Kulbokas, Clive Davies, Heino Polley

IGN Report
April 2018

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Citation
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Publisher
Department of Geosciences and Natural Resource Management
University of Copenhagen
Rolighedsvej 23
DK-1958 Frederiksberg C
www.ign.ku.dk

Responsible under press law
Claus Beier

ISBN
978-87-7903-788-5

Cover layout
Jette Alsing Larsen

The report is available electronically from
www.ign.ku.dk > Outreach > Publications

Indholdsfortegnelse

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Introduction

Most Europeans live in urban areas, and even more of our children will live in urban areas. By 2050 it is expected that 90% of Europeans and the citizens of other developed countries will reside in urban areas. The effect this will have upon humans, ecosystems and the total earth climate system is one of the biggest challenges for sustainable development across the world, and the European continent is no exception to this. In this context, a 'city' that feels and functions like a forest is increasingly being proposed as a vision for future sustainable cities. Green infrastructure is widely proposed (e.g. by the European Commission) as being a comparably inexpensive - and thus a realistic - strategy for delivering (i) nature-based solutions, that support (ii) climate adaptation capacity and (iii) sustainable development in Europe's urban areas. Examples of the components of urban green infrastructure include green roofs, permeable vegetated surfaces, street trees, public parks, community gardens, cemeteries, wetlands and not least forests. Forests , understood as wooded areas with uncultivated ground) in urban and peri-urban areas are the focus of this green paper.

While the word 'forest' has historically been regarded as the opposite of 'urban' research has shown that forested environs are becoming ever more urban and are increasingly a key ecosystem service provider in most European cities. Already during 19th century industrialisation, many larger cities acquired so called "city forests". As urbanisation accelerated during the 20th century, these woodland landscapes were often protected due to their multiple social and environmental values. Today we use the ecosystem service as an umbrella term for these multiple benefits. Forest areas were also absorbed or fragmented by urban sprawl to such an extent that remnant areas, along with new forest patches constitute the most frequent type of green (in terms of green land cover) in many European cities. While trees are important in parks and along streets, forest environs are generally more multipurpose and able to sustain many uses simultaneously by providing a wide range of ecosystem services such as biodiversity conservation, recreation, drinking water protection, carbon storage, sustainable raw materials, mitigating urban heat island effects etc. Due to their quantity and quality, forest environs located in and around European urban areas are therefore foremost in providing the back-bone of urban green infrastructure.

However, data to quantify and characterise areas of forest located in and around European urban areas have so far been either lacking or fragmentary.

Key terms

National Forest Inventory: The National Forest Inventory (NFI) is a rolling program designed to provide accurate information about the size, distribution, composition and condition of forests as they have developed through time (often following the FAO definition of forest being areas of more than 0.5 ha in size with tree cover of minimum 10% and uncultivated ground vegetation). NFI methods reflect the country-specific conditions in terms of forest types, topographies, climates and interests in forests. Currently, efforts are made across Europe to harmonize NFI definitions and data collection however, with the aim of providing comparable reporting for decision-making processes. This harmonization work is coordinated by the European Network of National Forest Inventories (**ENFIN**) supported by research conducted in the project "Distributed, Integrated and Harmonised Forest Information for Bioeconomy Outlooks" (**DIABOLO**), funded from the European Union's Horizon 2020 research and innovation programme.
Read more:
http://enfin.info/
http://diabolo-project.eu/

In this regard, an expansion of the domain of multipurpose forest inventories like National Forest Inventories (NFIs) towards urban forests would be desirable. Critically, NFIs represent comprehensive, reliable, nation-wide monitoring systems focusing on forest resources, land-use classes, biodiversity in forests, carbon sequestration etc. By combining forest data collected by National Forest Inventories (NFI) with an urban focus, an SNS and EFINORD supported network has pioneered work and prepared the ground for the expansion of the professional and political relevance of the NFI to the sustainable urban development agenda at both the national and EU level.

An expansion of the NFI to include and report specifically on forests in urban areas will be a major step forward in the integration and recognition of urban forests in national and international policy and decision making. This is also in line with the evolution of forest inventories as multi-purpose resource surveys, broadening their scope to include new variables and components.

Policy outreach workshop

On the 15th March, 2018, 35 researchers, policy makers, and practitioners from nine European countries attended the SNS-EFINORD funded workshop on "Urban Forests in a European Perspective: what can the National Forest Inventory tell us?" The objectives of the workshop were to share cutting-edge data and a harmonised methodology for data extraction on urban forests gathered through the National Forest Inventory (NFI) and identify its applications to nature-based solutions for urban societies. Those attending aimed to identify and discuss how NFI data could support integrated solutions for the use, management, and governance of urban forests at the local, national, and European policy level, and to provide a cross-sectoral platform for knowledge sharing and networking between researchers and practitioners.

Annemarie Bastrup-Birk from the European Environment Agency (EEA) framed the workshop by introducing the relevant European environmental policies and the existing knowledge base.

Professor Anders Busse Nielsen from the University of Copenhagen then presented the results of a year-long pilot study based on 'urban' NFI data from eight (8) European countries. His presentation outlined:

Forest: The Food and Agricultural Organization (FAO) of the United Nations (UN) definition sets a single threshold for canopy cover (10%), height (5 m) and minimum area (0.5 ha). Countries frequently adapt this definition to suit their own circumstances. However, parties are required to justify in their NFI reporting that such values are consistent with the information that has been reported historically to FAO or other international bodies and. The FAO definition specifically excludes orchards, agroforestry and urban forests.
Read more:
http://www.fao.org/docrep/006/ad665e/ad665e06.htm

Urban forest: The FAO defines urban forests as networks or systems comprising all woodlands, groups of trees, and individual trees located in urban and peri-urban areas; they include, therefore, forests, street trees, trees in parks and gardens, and trees in derelict corners.
Read more:
http://www.fao.org/forestry/urbanforestry/86946/en/

SNS/EFINORD: The Nordic region has a long tradition of co-operation within forest research via the Nordic Forest Research Cooperation Committee, SNS (SamNordisk Skogforskning), under The Nordic Council of Ministers, and is one of Northern European Regional Office of the European Forest Institute (EFINORD) core partners. The cooperation aims to improve contact between the forest research communities in the Nordic, Baltic Sea and the North Atlantic regions, and add a European dimension into the well-established Nordic forest research co-operation.
Read More:
http://nordicforestresearch.org/
http://www.efinord.efi.int/portal/

- a new harmonised methodology for applying NFI data to the urban agenda, which is applicable in all European countries
- illustrated for the first time how existing NFI data can quantify and characterize the existing urban forest resource on a national level
- drew perspectives on how NFI data can support the quantification of urban forest ecosystem services and qualify their governance at the local, national and EU level.

DEGURBA: Degree of urbanization (DEGURBA) The Degree of urbanisation classifies local administrative units as cities, towns and suburbs, or rural areas based on a combination of geographical contiguity and minimum population thresholds applied to 1 km² population grid cells. This definition is applied by Eurostat, responsible for providing statistical information to the institutions of the European Union (EU) and to promote the harmonisation of statistical methods across its member states. Read more: http://ec.europa.eu/regional_policy/da/information/publications/working-papers/2014/a-harmonised-definition-of-cities-and-rural-areas-the-new-degree-of-urbanisation

Main findings of the Pilot study

The pilot study has been conducted as a joint taskforce including both NFI and urban forestry affiliates from Denmark, Finland, Germany, Lithuania, Norway, Sweden, Switzerland and the UK. Combining the Degree of Urbanisation data (DEGURBA) and NFI data enabled upscaling from existing case studies of individual large cities to all urban clusters with a minimum population of 5.000 and their fringes where within which local demands for everyday forest recreation is concentrated (< 2 km). In all eight countries, more than half of the total population resides in urban area with more than 5.000 inhabitants and their fringes. In the densely populated (> 200 capita/km2) countries of Switzerland, Germany and the UK the number is in fact more than three quarters of the population (Fig. 1). Below, the key findings of the pilot study are summarized:

Forest in urban areas is not a "niche“

Extraction and separate analysis of NFI field data from forest located within urban clusters and their fringes revealed that these forests constitute much more than a "niche" for the forestry sector as well as for the urban agenda. In the densely populated countries about one fifth of the total forest area is located within or less than 2 km from urban clusters (Fig. 1). In the sparsely populated (< 50 capita/km2) Finland, Lithuania, Norway and Sweden the share of the national forest cover located inside and less than 2 km from urban clusters is markedly lower, but estimated to host up to 180 times more forest visits per area unit compared to rural forests (Fig. 1). The latter underlies the key role played by these urban forest patches for the health and well-being of the majority of the population, even in these countries.

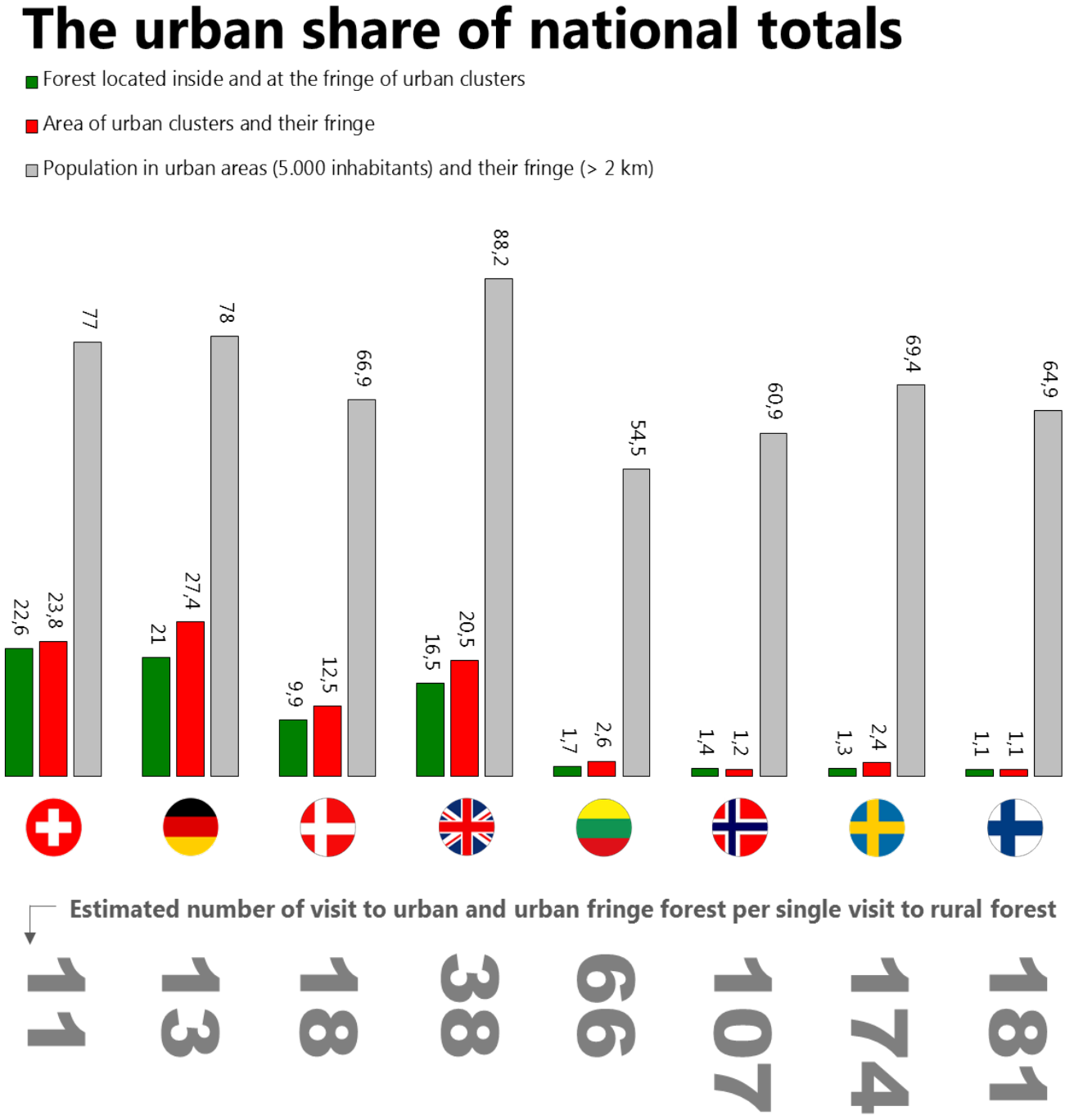

Figure 1. The percentage share of national forest (green bar), land (read bar) and population in and less than 2 km from urban clusters; i.e. clusters of contiguous grid cells of 1 km2 with a density of at least 300 inhabitants per km2 and a minimum population of 5.000 (sensu DEGURBA). Estimated numbers of visits to urban and urban fringe forests per single visit to rural forests are based on the assumption that 1) everyday forest visits of both rural and urban residents are concentrated to forest located less than 2 km from their home, and 2) rural and urban residents visit forest with the same frequency.

Urban areas with forested fringes.

Percentage forest coverage at the fringe of urban clusters is comparable to that found in rural areas in UK, DK, DE and LT, and even surpasses national averages in CH and NO, while being markedly lower than national averages in SE and FI. The high forest cover reaching all the way to the borders of urban clusters is a physical footprint of decades of intentional legislation and land use planning across policy domains, protecting existing and establishing new forests in urban areas. The latter is especially the case in Denmark and the UK, where public afforestation is deliberately targeting urban areas.´

Urban forests have much more wood and many veteran trees.

Standing volume (m3/ha) differs markedly between the countries, decreasing the further North the country is located. Yet despite these differences, a general pattern occurs across the countries where standing volume in forest located in and less than 2 km from urban clusters is notably higher compared to rural forests. As such the urban forests are contributing more per area unit to the sequestration of CO_2 than forests in general. When zooming to the diameter distribution, much of the difference in standing volume across the urban-rural gradient is explained by urban and urban fringe forests harbouring many more veteran trees (i.e. trees > 60 cm DBH; > 40 cm DBH in FI, NO, SE) compared to rural forests. The much higher frequency of old-growth trees in urban and urban fringe forests witness the success of decades of intentional multiple forest management, where old-growth trees is a win-win for recreation and biodiversity.

Forest ownership changes along the urban-rural gradient.

The share of the forest in public holding varies markedly between the countries. Also the relative location of public forest holdings across the urban-rural gradient varies. When combining these variations, the countries form three groups:

- Countries where public forest holdings are limited in urban clusters and their fringes; NO and UK. In these countries public authorities can mainly influence overall urban forest provision and characteristics through policy and governance.

- Countries where public forest holding is extensive and rather evenly distributed across the urban-rural gradient; CH, DE, LT.

In these countries public authorities have extensive possibilities to influence forest provision and characteristics in both rural and urban areas

- Countries where public forest holdings are concentrated in and dominate urban clusters (and their fringes); DK, FI, SE. In these countries, public authorities are important forest providers especially in urban areas with extensive possibilities to influence the overall provision and characteristics of urban forests

Representative of European countries

The eight countries included in the pilot study more or less represent the span among EU member countries with respect to country size, forest cover and population density (Fig. 2). As such, the results of the pilot study might provide a window for European countries in general, where the combination of DEGURBA and NFI data provides a harmonised methodology that enables:

Upscaling from case study level (e.g. urban Atlas) to national levels and a comparison across countries at European level

Detailing data provision on urban forests from being based largely on remote sensing (e.g. CORINE, COPERNICUS) to the comprehensive field based monitoring collected in the NFIs.

Quantifying. The many attributes and data parameters included in NFI field monitoring schemes can provide data input that enables quantifying the multiple ecosystem services - beyond carbon sequestration - provided by forest located within and less than 2 km from urban areas, and potentially estimating the monetary value of these services.

Qualifying. Extraction and separate analysis of NFI data on forests located in and at the fringe of all Europe's urban clusters with a minimum of 5.000 inhabitants can be leveraged to fill key knowledge gaps regarding the quantity and quality of urban forests at the national level and across Europe, and as such qualify policy and decision making.

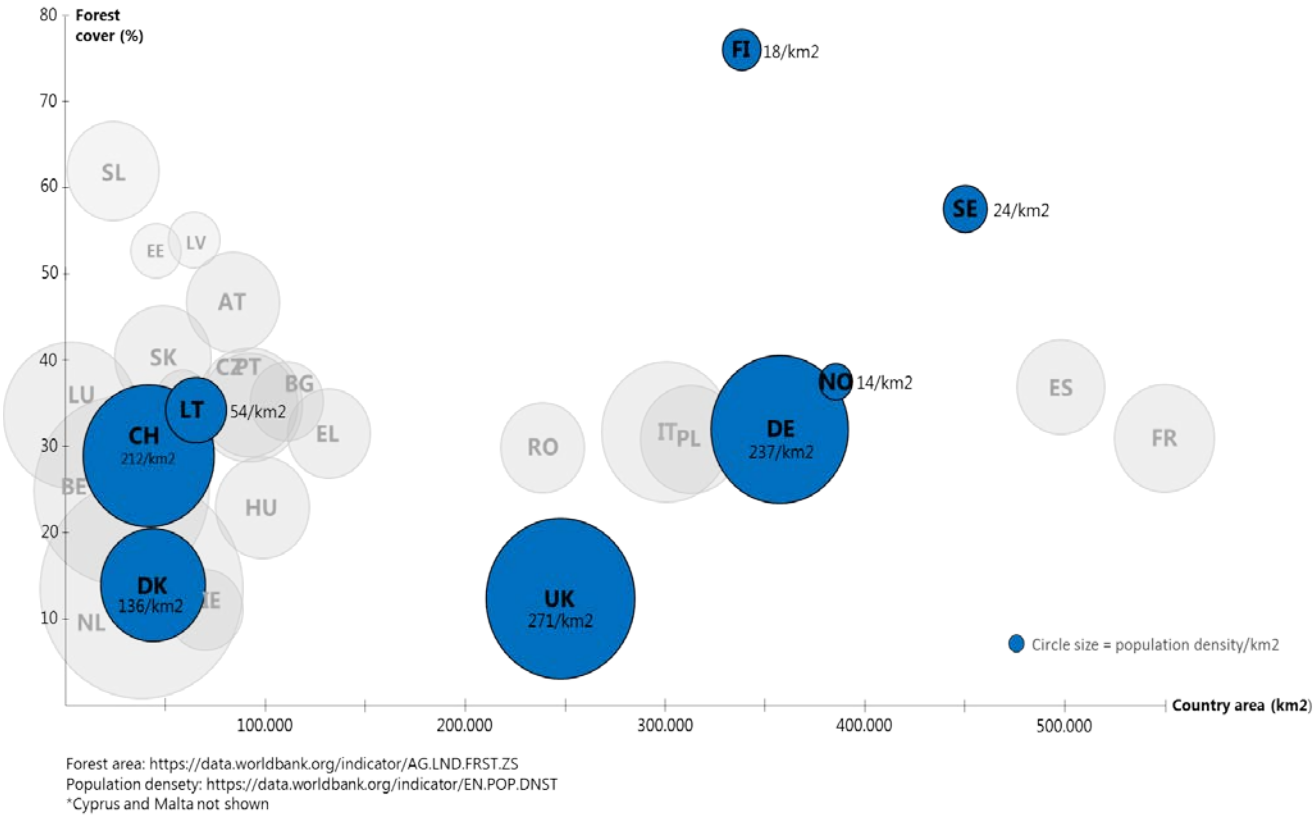

Figure. 2 The eight countries included in the pilot study (Blue circles) and remaining EU member countries (grey circles) where the size of the circle reflects population density. In terms of forest cover (y-axis), the eight countries, include two of the least forested (< 15%) countries in Europe (DK and UK) and two of the most forested (> 50%), being FI and SE. The remaining four countries (CH, DE, LT, NO) have about 30% forest cover, being close to the average of EU member states on 38% forest coverage. In terms of country size (x-axis), DK, CH, LT represent the many small EU member countries, UK represent a medium size country while DE, FI, NO and SE are among the largest countries in Europe. In terms of population density (size of circle), CH represent small and densely populated EU member countries, while UK and DE represent medium respectively large and densely populated European countries. Denmark represents the many small and medium densely populated countries. LT represent the sparely populated small countries while FI, NO and SE constitute their own group of very large and very sparsely populated countries.

Overview of workshop results

The presentations guided a creative workshop activity that involved three groups focused on three separate key questions:

- How can NFI data contribute to quantify and valuate ecosystem services provided by forested urban areas and the scoping of nature-based solutions?
- How can the NFI data be used to identify and discuss integrated solutions for the use, management, and governance of urban forests at the local, national, and European policy level?
- How do we create a cross-sectoral platform for knowledge sharing and networking between researchers and practitioners?

Each group was asked to present their findings to the wider group regarding the key challenges and opportunities. This report presents a summary of each group's findings.

Data

The pilot study demonstrates the potential of the NFI to provide valid and detailed characteristics of forest in urban areas. In the workshop participants identified the potential of NFI data to provide a national level of information of 'what we have' (i.e. the current urban forest resource) and input for quantifications and valuations of the multiple ecosystem services these resources are providing for urban societies. It emerged that there is great potential for working with sub-sets of ecosystem services by matching NFI data up with other data sources, indicators (e.g. indicators for biodiversity and human health and well-being) and modelling tools (e.g. i-Tree).

Biodiversity: NFI can be the data input for assessments of biodiversity performance of forests located inside and at the fringe of urban clusters using the indicators from the EU biodiversity strategy.

Regulating Ecosystem services: Matching up NFI data with modelling tools like i-Tree Europe (to be released during spring 2018) provides an opportunity for expanding the power of NFI data to also support nationwide quantification and economic valuation of the regulating ecosystem services urban areas receive from forests located in and at their fringes.

Cultural ecosystem services: Combining NFI data with (i) Data on nature preferences, (ii) studies of user patterns and frequency, and (iii) well-being and health data, provides an opportunity to estimate and quantify the contribution of urban forests to liveable cities and human well-being. This, however, requires that these are translated into NFI data parameters; e.g. structural attributes or accessibility measurements. Many countries already have data available, but expert work is needed to synthesise the data to identify the links to NFI data variables. This work is currently pioneered in the DIABOLO project (WP3), and the results from this workshop provide clear synergies with the lines of inquiry currently under development in their project.

Many challenges also are apparent before NFI data can be used as a trustful data source for the quantification of ecosystem services of the entire urban forest resource. Good existing data sources are available but there is a need for further research to link the different data sources for enabling integrated approaches (DIABLO will not cover all of this).

Ecosystem services are defined as the benefits that people derive from ecosystems and are broken down into four broad categories:

- Provisioning Services are ecosystem services that describe the material or energy outputs from ecosystems. They include food, water and other resourcesRegulating:
- Regulating Services are the services that ecosystems provide by acting as regulators eg. regulating the quality of air and soil or by providing flood and disease control.
- Supporting services make it possible for the ecosystems to provide food supply, flood regulation, and water purification. These include services such as nutrient recycling, primary production and soil formation.
- Cultural ecosystem services are the non-material benefits people obtain from ecosystems. They include aesthetic inspiration, cultural identity, sense of home, and spiritual experience related to the natural environment.

Read more: https://www.millenniumassessment.org/documents/document.356.aspx.pdf

i-Tree is a state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban and rural forestry analysis and benefits assessment tools. The i-Tree tools can help strengthen forest management and advocacy efforts by quantifying forest structure and the environmental benefits that trees provide. i-Tree provides baseline data that you can use to demonstrate value and set priorities for more effective decision-making.
Read more: https://www.itreetools.org/.

While biodiversity indicators have been harmonised and linked to NFI data reporting, such work remains to be done in order to link NFI data more directly to the quantification of regulating ecosystem services (other than CO_2 sequestration) in the urban context, and particularly bridging to human health and well-being data.

Governance

NFI data on urban forests can be leveraged to fill key knowledge gaps regarding the quantity and quality of urban forests at the national level and across Europe, providing the political weight and efficacy sorely needed to lift urban forests on the urban sustainability agenda.

Key opportunities exist at various policy levels to use existing NFI data to inform decision and policy making in urban forest management and governance. NFI data provides a unique opportunity to monetise the ecosystem services of forest areas located in and at the fringe of urban areas at the national level, thereby illustrating the benefits to society of cleaner air, storm water management, bio-economy, human health, wellness and livelihood. For municipal or state forest holdings, such clear and measurable indicators could provide justification for their investment and stewardship. For privately-owned urban forests such data could provide incentives for government tax reductions and management supporting schemes if performance indicators were upheld.

Additionally, drawing on NFI data about urban forests would promote cross-sectoral partnerships and policy making. For example, NFI data on dead-wood in urban forests would support collaboration between urban biodiversity advocates and citizen groups and national and local government agencies. Private forest owners might be motivated to alter their urban forest management schemes based on potential user groups. By combining NFI data with urban clusters, we can show how many potential urban users could access any given urban forest. Such data modeling provides further potential for collaboration with key sectors such as the health sector, food industry, agriculture sector, tourism sector and many more to ultimately raise the political profile of urban forests.

This pilot project has shown that interesting results can be achieved based on existing inventories. The important thing is that the methodology is applied in parrallel to NFI with the same principle approach, enabling the linkage of information. Yet many challenges also are apparent to such an integrated governance approach.

Cross-sectoral knowledge platform

Based on the workshop, we have identified the potential to change the view of civil society towards urban forests by combining (i) NFI-sourced information with (ii) expert knowledge on the challenges urban societies face.

Figure 3: Telling the urban NFI story

To achieve this synthesis of knowledge, we propose that National Forest Inventories should begin telling the story of Urban Forests based on existing data. To expand on this, a knowledge exchange platform is required to take the existing NFI knowledge (which tells us what we have and characterizes the resource) and combine it with data from the health sector, the conservation sector and the climate change adaptation sectors to tell the story of what forests do for urban society, including quantification and validation of their ESS.

To facilitate the knowledge platform, resources are required:

- Time for researchers, communications experts and policy advisors to contribute their insights and knowledge through collaboration.

- Funding to pay for the time and expenses of those above
- Platform integration into an appropriate trustworthy long-term observatory such as an EU institution or international university.

Achieving the above could fuel the power of civil society to inspire decision makers. This can then be done by using appropriate media including e.g. video content, newsprint and respected commentators. The information needs to be easy to understand and non-technical in its presentation but based on the hard evidence that the combined knowledge platform provides.

Final perspectives, emerging knowledge gaps, and synergies

This pilot project demonstrates that the NFI data, in combination with the DEGURBA approach, provides existing data on European urban forests. Now that we know what we have, there is potential to quantify and qualify the state and trends of European urban forests. Moving forward we can draw on existing policies and concepts such as ecosystem services to model what urban forests can give back to us. Existing EU policy strategies, such as green infrastructure and the biodiversity strategy, provide common policy platforms to build upon and link to urban forests. Such platforms can be used to develop common indicators for further development of the NFI, integrating new biodiversity and green infrastructure indicators into the NFI. I-Tree will be launched in Europe in spring 2018 and will provide a common set of indicators and data streams for urban ecosystem services.

These data protocols could potentially be integrated into the routine measurements of the NFI to enhance current data collection and make links to tree-specific data. In a concrete sense, such data could be applied to the management and planning of urban forests connected with e.g. infrastructure plans. Further steps could be taken to collect and model ecosystem services based on national forest preference and use studies. Additional potential exists to draw on national health data to model the human health and well-being outcomes of European urban forests.

This workshop further outlined large knowledge gaps that demand further exploration to fully realise the potential of what NFI data can tell us about European urban forests. Key questions arise concerning the basic definition of a forest.

Nature-based solutions deliver climate resilience with a strong focus on the benefits to people and the environment itself. In this regard, nature-based solutions move beyond traditional conservation and biodiversity management principles by refocusing the solution on human well-being and socio-economic development.
Read more here for a European application:
https://ec.europa.eu/research/environment/index.cfm?pg=nbs

SDGs: The 2030 United Nation's agenda for sustainable development outlines 17 sustainable development goals (SDGs) that aim to eliminate poverty, increase human health and well-being, human rights of all, and to achieve gender equality and the empowerment of all women and girls. The SDGs provide integrated solutions based in the three dimensions of sustainable development: the economic, social and environmental.
Read more:
http://www.un.org/sustainabledevelopment/sustainable-development-goals/

Habitat III new urban agenda: This vision for cities as sites of environmental solutions was formulated at the 2016 United Nations Conference on Housing and Sustainable Urban Development in collaboration with diverse stakeholders from across the globe. In combination with the UN SDGs, this vision establishes cities as sites not only of environmental degradation but also environmental innovation and draws on a community-based framework for urban governance.
Read more:
http://habitat3.org/the-new-urban-agenda/

The current pilot study has been based on different national or the UN FAO definition of forest, which does not include tree resources in urban streets, parks, cemeteries, garden etc. This means that when NFI data is analyzed, we are lacking data from smaller tree covered patches which are numerous and valuable in the urban context. This part of the urban forest green infrastructure is based in municipal or community tree and park management schemes. Long-term opportunities include linking NFI with municipal inventories of trees in streets, parks and other green spaces, thereby creating a more holistic data-base of tree resources in urban areas; i.e. an Urban Forest Inventory (UFI) as an extension of the National Forest inventory. Therefore, moving towards a UFI there would be a need to explore how NFI data could be combined with i-Tree or other urban forest inventory systems to account for tree-specific level data.

The work pioneered by this SNS-EFINORD network outlines the significance of the European urban forest and this research should be continued to support sustainable urban futures. With mounting pressure from urbanisation and overall challenges of climate resilience, cities have been elevated to the top of the global political agenda. The UN 2030 sustainability goals, in tandem with the Habitat III New Urban Agenda, outline cities not only as sites of environmental challenges but also as critical sites of environmental solutions. Along these lines, trans-national political bodies have called for landscape planners and managers to develop nature-based solutions to urban climate resilience with a focus on an integrated approach balancing ecological, social, and digital methods. Urban forests are at the forefront of these discussions, as many have underlined the multi-functional ecological and social benefits they provide to urban landscapes. There is a clear disconnect however between the demand for solutions from urban forests and the current data parameters on urban forests.

Appendix: List of workshop participants

First Name	Last Name	EU and other international level
Anne Marie	Bastrup-Birk	European Environmental Agency
Peter	Loeffler	European Commission, DG Environment
Hugo	Poleman	European Commission, DG Regional and Urban Policy
Maila	Puolamaa	European Commission, DG Internal market, Industry, Entrepreneurship and SMEs
Constanze	Veeh	European Commission, DG Internal market, Industry, Entrepreneurship and SMEs
Alexander	Wendlandt	European Federation of Forest-Owning Communities
Rik	De Vereese	European Forest Institute
Barbara	Anton	ICLEI, Local Governments for Sustainability
Clive	Davies	European Forum on Urban Forestry, University of Oxford, Bari University
Naomi	Zurcher	European Forum on Urban Forestry, Switzerland
Alan	Simson	European Forum on Urban Forestry, School of Landscape Architecture, University of Leeds, UK
Veronika	Docekalova	International Union for the Conservation of Nature
		National and local level
John	Parker	Transportation London - tree officer
Renate	Spaet	Ministerium für Umwelt, Landwirtschaft, Deutschland
Pernille	Karlog	Ministry og Environment and Food, Denmark
Algis	Gaižutis	Forest Owners Association of Lithuania
Martin	Schneekloth	Danish delegation to the EU/Ministry of foreign affairs
Sointu	Räisänen	East and North Finland regions
Niall	Williams	Landscape Institute Board of Trustees, Tree Charter Board of directors, UK
		Research and educational institutions
Paloma	Cariñanos	Faculty of Pharmacy Universidad de Granada/ University of Granada, Spain
Marcus	Hedblom	Swedish University of Agricultural Sciences
Helena	Nordh	Norwegian University of Life Sciences
Ian	Whitehead	RWTH Aachen University, Germany
		SNS-EFINORD network members
Gintaras	Kulbokas	National Forest inventory, Lithuania
Anders	Busse Nielsen	University of Copenhagen, Denmark
Natalie Marie	Gulsrud	University of Copenhagen, Denmark
Tuija	Sievanen	Natural Resource Institute (LUKE), Finland
Christoph	Fischer	Swiss Federal Research Institute WSL
Heino	Polley	Thünen-Institut für Waldökosysteme, Germany
Remigijus	Zalkauskas	Aleksandras Stulginskis University, Lithuania
Markus	Lier	Natural Resource Institute (LUKE), Finland
Jonas	Dahlgren	Swedish University of Agricultural Sciences, Swedish NFI

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