ESPON

EUROPEAN UNION

Co-financed by the European Regional Development Fund

Inspire policy making by territorial evidence

GRETA - “GReen infrastructure: Enhancing biodiversity and ecosysTem services for territoriAl development”

Applied Research

Greater Copenhagen and Scania

Version 30/07/2019

This applied research activity is conducted within the framework of the ESPON 2020 Cooperation Programme, partly financed by the European Regional Development Fund.

The ESPON EGTC is the Single Beneficiary of the ESPON 2020 Cooperation Programme. The Single Operation within the programme is implemented by the ESPON EGTC and co-financed by the European Regional Development Fund, the EU Member States and the Partner States, Iceland, Liechtenstein, Norway and Switzerland.

This delivery does not necessarily reflect the opinion of the members of the ESPON 2020 Monitoring Committee.

Authors
Elin Slätmo, Kjell Nilsson and Eeva Turunen, Nordregio (research institute under Nordic Council of Ministers, www.nordregio.org) (Sweden)

Co- authors
Hugo Carrao, Mirko Gregor - space4environment (Luxembourg)
Jaume Fons, Raquel Ubach, Roger Milego, Anna Marín UAB (Spain)
Katherine Irvine, Jessica Maxwell, Laure Kuhfuss, Scott Herrett The James Hutton Institute (UK)
Gemma-Garcia Blanco TECNALIA (Spain)

Advisory Group
Project Support Team: Blanka Bartol (Slovenia), Kristine Kedo (Latvia), Julie Delcroix (EC, DG Research & Innovation), Josef Morkus (Czech Republic)
ESPON EGTC: Michaela Gensheimer (Senior Project Expert), Laurent Frideres (Head of Unit Evidence and Outreach), Akos Szabo (Financial Expert).

Acknowledgements
We would like to thank the stakeholders in Greater Copenhagen and Scania - among others technical experts and officials in the city of Malmö and the city of Copenhagen, Region Skåne, the Business authority in Denmark - who generously collaborated with GRETA research and shared their insight into green infrastructure throught the online consultations, phone interviews and meetings.
We would also like to thank the Members of ESPON Contact Points and the Members of ESPON Monitoring Committee for their support.

Information on ESPON and its projects can be found on www.espon.eu.

The web site provides the possibility to download and examine the most recent documents produced by finalised and ongoing ESPON projects.

This delivery exists only in an electronic version.

Contact: info@espon.eu
ISBN 978-99959-55-36-6

GRETA - “GReen infrastructure: Enhancing biodiversity and ecosysTem services for territoriAl development”

Table of contents

1 Introduction 1
2 (Geographic) description of Greater Copenhagen and Scania 4
2.1 Case study outline 4
2.2 Territorial challenges 6
3 The GI network and its potentials for territorial development in Greater Copenhagen and Scania 7
3.1 What is the approach to GI and ES in Greater Copenhagen and Scania 7
3.2 Strategic approach – priorities and benefits of GI and ES 8
3.2.1 Scania 8
3.2.2 Greater Copenhagen 9
3.3 Spatial analysis of GI potentialities 11
3.4 Resources 13
3.4.1 Economic evaluation - benefits 13
3.4.2 Economic evaluation - costs 14
4 Capacity of GI network in Greater Copenhagen and Scania to meet the demand of ES 15
4.1 What do GRETA analysis on ES supply and demand reveal? 15
4.1.1 Analysis of supply and demand for Flood Regulation in Greater Copenhagen and Scania 17
4.1.2 Analysis of supply and demand for Reducing Soil Erosion in Greater Copenhagen and Scania 18
4.1.3 Analysis of supply and demand for Water Purification in Greater Copenhagen and Scania 19
4.1.4 Analysis of supply and demand for Recreation in Greater Copenhagen and Scania 20
5 Governance practices, policy and planning instruments to implement GI and enhance ecosystem services in Greater Copenhagen and Scania 21
5.1 Governance models - roles and responsibilities 21
5.1.1 Scania 21
5.1.2 Greater Copenhagen 22
5.2 Existing policies, planning instruments and initiatives 22
5.2.1 Scania 22
5.2.2 Greater Copenhagen 24
5.3 Threats and conflicts 25
5.3.1 Scania 25
5.3.2 Greater Copenhagen 26
5.4 Cooordination and cooperation 27
5.4.1 Scania 27
5.4.2 Greater Copenhagen 28
6 Lessons learned and good practice examples from the Greater Copenhagen and Scania 29
6.1.1 Challenges for further GI development in Greater Copenhagen and Scania 29
6.1.2 Opportunitites for GI through Cross-border Cooperation 29
6.1.3 Achievements in GI implementation in Greater Copenhagen and Scania 30
7 Policy messages and recommendations in Greater Copenhagen and Scania 30

7.1 Policy messages 30
7.2 Policy recommendations 31
8 Apendix 32
References 37

List of Maps

Map 1. ESPON GRETA selected case studies 1

Map 2. Greater Copenhagen and Scania 4

Map 3. Map over Greater Copenhagen and Scania GRETA case study. Overview map on potential GI serving multiple policies (e.g biodiversity policy, water management policies, climate change adaptation and mitigation policies) (reference: GRETA analyses by UAB and S4e). 11

Map 4 Balancing Supply and Demand for Flood Regulation in Greater Copenhagen and Scania. 18

Map 5. Balancing Supply and Demand for Soil Erosion in Greater Copenhagen and Scania 19

Map 6. Balancing Supply and Demand for Water Purification in Greater Copenhagen and Scania 20

Map 7. Balancing Supply and Demand for Recreation in Greater Copenhagen and Scania . 21

List of Tables

Table 1. Potentialities for GI network in Greater Copenhagen and Scania based on GIS-analysis by UAB 11

Table 2 Relation between benefits provided by ES supply and the corresponding ES demand definitions and operationalisation approaches. Adapted from: Villamagna et al., 2013 and Wolff et al., 2015. 15

List of Figures

Figure 1. Population by age group and sex in Scania, Sweden (reference: Nordregio analyses based on Statistics Sweden, 2017a) 6

Figure 2. Population by age group and sex in Byen Köpenhamn, Köbenhavn omegn and Sjælland (reference: Nordregio analyses based on Statistics Denmark, 2017a) 6

Figure 3 Map with the green structure in Scania (green) and its development opportunities (red). The green structure is based on several layers of maps that have been analysed using the Matrix Green tool for ArcGIS. The layers are regionally important forested land, grass lands (seminatural and grazed pastures and meadows) and waters and wetlands (Region Skåne,

2012, p.99). At the County Administrative Board in Skåne this green structure is integrated in the ongoing action plan for GI (Länsstyrelsen Skåne, 2018). 23

Figure 4 Maps showing the Fingerplans' development pattern of land and water use in Greater Copenhagen. The map to the left show the capital region of Copenhagen with the four main land use types. The map to right show the capital region of Copenhagen with the existing and planned new green wedges. (Ehrversstyrelsen, 2017, p. 14 & 15)..... 25

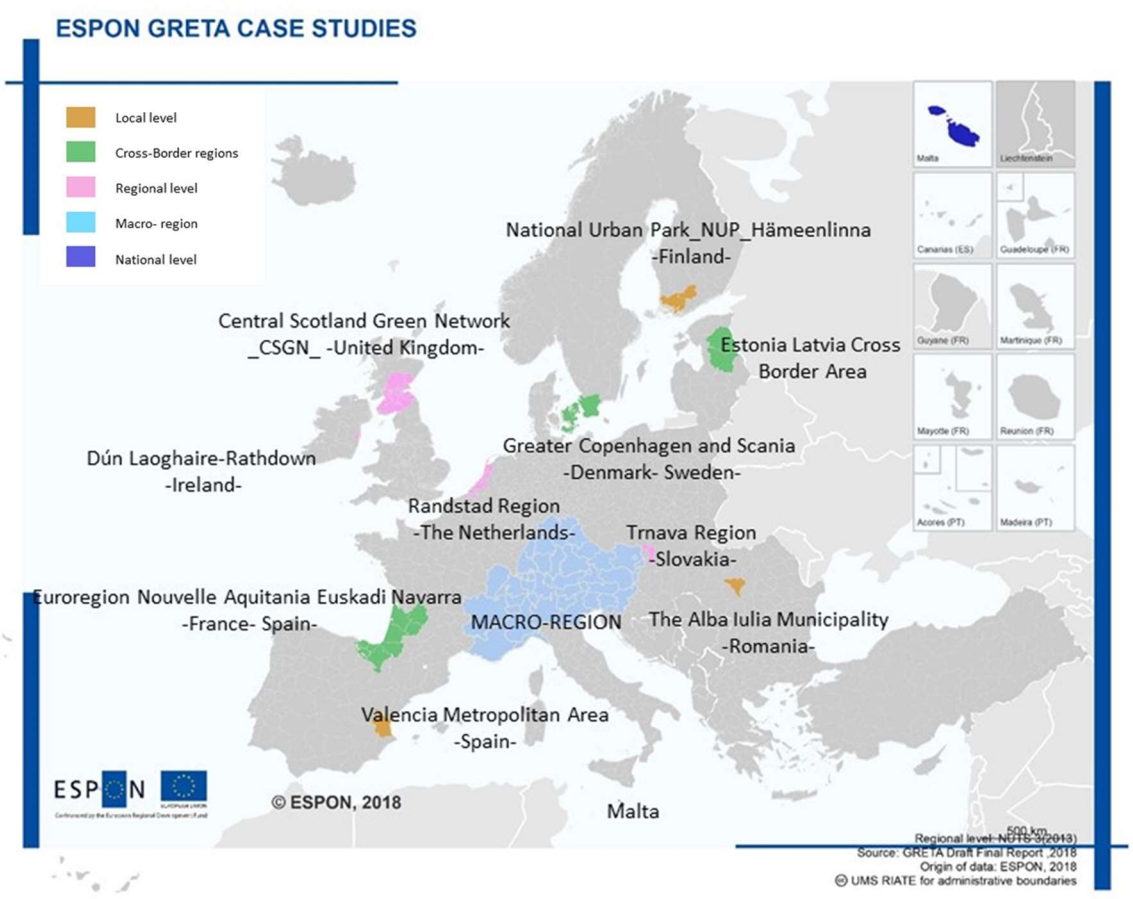
Abbreviations

EC	European Commission
ES	Ecosystem Services
ESPON	European Territorial Observatory Network
EU	European Union
GI	Green Infrastructure
NUTS	Nomenclature of Territorial Units for Statistics

1 Introduction

GRETA investigated 12 case studies that represented different spatial, institutional and governance settings and that ranged from urban centres to rural countryside. The case studies served to:

i. gain knowledge on implementation factors, drivers and constraints in different planning systems and territorial realities;
ii. gain insights on the use and applicability of economic methods in decision making; and
iii. gather knowledge for policy and practice as input and inspiration for the policy recommendations.



Map 1. ESPON GRETA selected case studies

Method

The activities undertaken at the case study level incorporated a combination of desk-based analysis alongside online questionnaires and pre-structured interviews to key actors in each of the case study areas, including: (i) decision and policy making representatives; and (ii) those involved in designing, planning, implementing and managing green infrastructure (GI).

A series of three consultations were developed to gather relevant information from case studies on different aspects of GI spatial analysis, policies, planning and implementation. The consultation process was seen as a combined approach of an online survey and or a telephone interview (which used the survey questions as the basis) with stakeholders to facilitate getting good engagement and to address any clarifications needed.

Consultation A – Economic Valuation

The questionnaire included 20 questions structured in 2 main parts. The first part aimed at understanding the current use and awareness of valuation methods by respondents while the second part aimed at identifying their perceived barriers and interest of using such methods. We used a mix of open-ended and closed-ended questions to combine comparable results as well as qualitative material; respondents also had the possibility to comment on their responses. Analysis of Consultation A is described in Annex III-C.

Access to Consultation A

https://survey.tecnalia.com/limesurvey/index.php/214247?lang=en

Consultation B – Characterising green infrastructure and ecosystem services characterisation

The objective of this consultation was to identify good practice guidelines, opportunities and challenges that could be useful for a variety of regions and cities. Responses to Consultation B were used to assess the usefulness of the GRETA methodology, a methodology specifically developed to delineate and map the main green infrastructure (GI) elements and their multifunctionality, as well as identifying their capacity to support three main policy domains: Biodiversity, Climate Change and Disaster Risk Reduction, and Water Management.. Questions in Consultation B were designed to help us gain further insight into the enabling factors that exist in different regions and cities. We also sought to gather information on the challenges and barriers that may compromise the implementation of GI. The final set of questions focused on identifying the general benefits and potential synergies and trade-offs associated with GI projects.

The maps produced for Consultation B in the GRETA project were intended to provide a starting point for discussion about the applicability of the GRETA methodology from European to local application. As such they did not aim to be a substitute for the maps or other planning material that already exist at local case study level nor were they aiming to characterize the GI on regional or local level. They were not developed to be used as an output from case study levels.

The landscape elements in the maps are produced based on standardized European data sets with a minimum mapping unit of 25ha (i.e. CORINE Land Cover 2012) – smaller geographical features are not depicted. The Consultation B aimed at finding the gaps between datasets produced at the European level and any other data sets produced at regional and local scales.

Access to Consultation B

https://survey.tecnalia.com/limesurvey/index.php/614564?lang=en

Consultation C - Analysis of governance, policy and financial frameworks

The successful implementation of green infrastructure (GI) projects requires a combination of governance structures, integrated policies and financial support. This consultation therefore aimed to investigate the governance systems in place in each case study area in order to determine how policies and policy makers enable the implementation of GI projects in the case study areas.

Responses to Consultation C aimed to help us identify: (i) how much funding (money and personnel) is currently used for GI in the case study regions; (ii) if this funding is sufficient for implementing and maintaining GI; and (iii) the main sources of funding (public tax-based funds, private investments, NGOs or others). Consultation C also examined whether policies compliment or conflict with GI and assesses policy makers' knowledge needs for making full use of GI development potential.

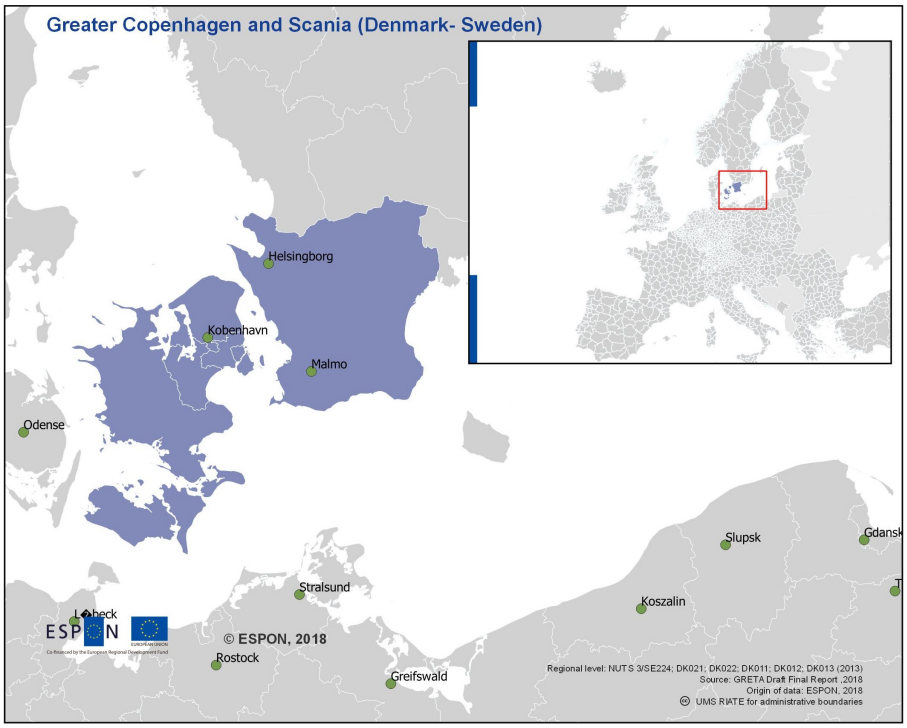
Access to Consultation C

https://survey.tecnalia.com/limesurvey/index.php/129674?lang=en

The content in this report is based on a mixed-method approach. The results presented are interpretations of semi-structured interviews, responses to a questionnaire on national policy and planning, responses to three consultations (Consultation A, B and C) via email, document analysis of plans and strategies (via desk-based analysis), and statistics.and spatial analysis using GIS resulting from the GRETA project. For all case studies, telephone conversations (and for some cases face-to-face meetings i.e. Copenhagen and Scania, Alpine region, Euroregion Aquitania- Euskadi-Navarra) allowed the completion of the consultations B and C.

The respondents that have contributed to this study are persons working on different institutional levels in public administration, private land and business owners, researchers, politicans aswell as persons engaged in civil society organisations in both Denmark and Sweden.

2 (Geographic) description of Greater Copenhagen and Scania



Map 2. Greater Copenhagen and Scania

2.1 Case study outline

Region/Area (French: Nomenclature des unités territoriales statistiques (NUTS) Classification of Territorial Units for Statistics).		For the purpose of this study the cross-border region Greater Copenhagen and Scania include areas both in Denmark and Sweden. These areas are Byen København, København omegn, Sjælland and Skåne (Nuts 3 codes: SE224, DK011, DK012, DK013, DK021, DK022). The Greater Copenhagen and Scania case study is a cross boarder area, which incorporates parts of eastern Denmark, the Danish capital region Copenhagen, and Scania in southern Sweden.	
Geographical features **Case study area in km²** **Bioclimatic region**		From the green infrastructure (GI) perspective, the region is dominantly characterised by built-up (urban) land surrounded by commercially in use waters and agriculture land. Zooming in on different parts of the region, however, provides more nuances both in terms of use of land and access to green space for the public. 20 495 km² (Eurostat, 2018c) Boreal.	
Demographic figures		**Socio-economic characteristics**	
Total population	In total 3.9 million (2017)	GDP per capita in PPP (2015)	In 2017, the annual average unemployment rate was 8.2 % in

in the case study area	For the Danish part of the region: 2.6 million inhabitants. For the Swedish part of the region: 1.3 million inhabitants. For figures by age group and sex see below. (Statistics Denmark, 2017a, Statistics Sweden, 2017a)	**Denmark:** Byen København 51 670 Københavns omegn 57 235 Nordsjælland 29 464 Østsjælland 25 789 Vest- og Sydsjælland 24 921 **Sweden:** Scania/Skåne 30 344 (State of the Nordic Region, 2018).	Sweden and 9.6 % in Denmark (Eurostat, 2018a). In 2016, the annual average unemployment rate was 6-8.5 % for the Danish part of the region (NUTS2): Köbenhavn 6.7 % & Sjaelland 6.4 %. For the Swedish part of the region, it was 8.4 %. (State of the Nordic Region, 2018)
Population density-average in the case study area	For the Danish part of the region: 282.7 persons in km^2 For Scania:120.8 persons in km^2 (Statistics Denmark, 2017b, Statistics Sweden, 2017b)	**Self-perceived health in 2016 in the level of very good (16-year or over):** **Denmark** Total: 26.5% Male: 27.9% Female: 25.1% **Sweden:** Total: 29.0% Male: 30.2% Female:27.8% (Eurostat, 2018b)	
Percentage of the population living in urban and rural areas	**Denmark (national level):** Urban: 72.89% Rural: 21.11% **Scania region:** Urban: 80.24% Rural: 19.76% (State of the Nordic Region, 2018)		

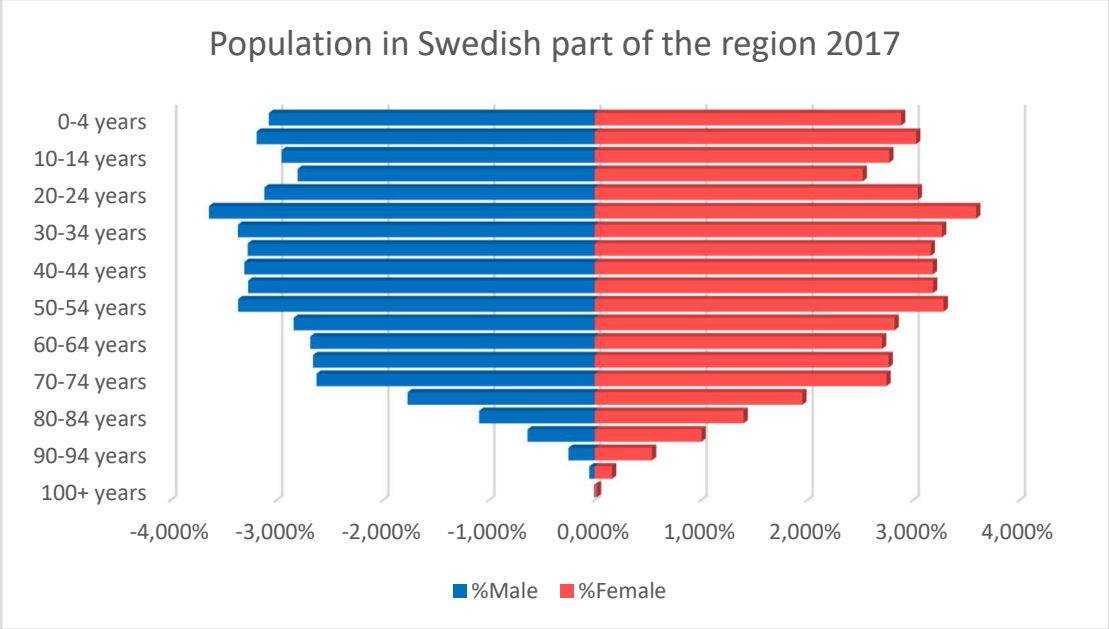


Figure 1. Population by age group and sex in Scania, Sweden (reference: Nordregio analyses based on Statistics Sweden, 2017a)

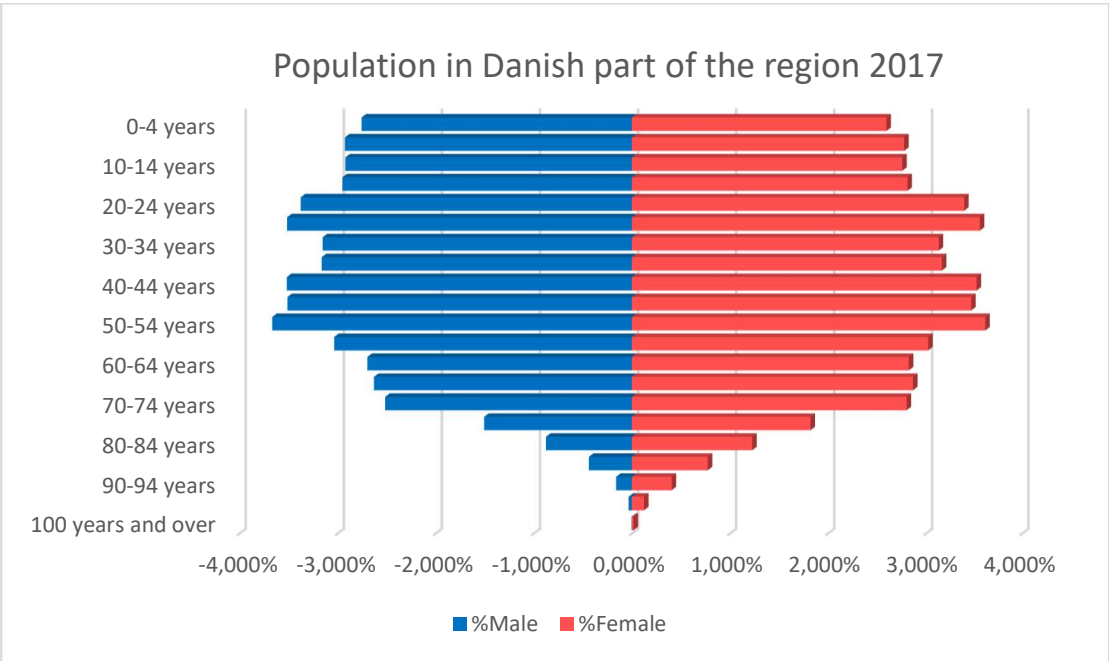


Figure 2. Population by age group and sex in Byen Köpenhamn, København omegn and Sjælland (reference: Nordregio analyses based on Statistics Denmark, 2017a)

2.2 Territorial challenges

The region has a strongly interlinked ICT and transport infrastructure, with ports, roads, railroads and airports. Furthermore, a bridge and regular ferry traffic are linking the region together. The region has a cross-boarder homepage adapted for commuters from Denmark to Sweden, from Sweden to Denmark, or from any other EU-country to Sweden or Denmark respectively (Öresunddirekt homepage, 2018).

The Swedish side of the Greater Copenhagen and Skåne Region is among the top 20 regions with the largest number of cross-border commuter outflows (Eurostat, 2015). The 19 100 cross-border commuters are almost exclusively working in the Danish Capital Region. This commuter flow has only developed in recent years and has been driven by the opening of the Øresund bridge in 2000 (Hasselgren and Lundgren, 2016). Other aspects also influencing the commuting pattern are lower real estate prices and living costs in Sweden, and a relatively high number of job vacancies in the Danish capital (Eurostat, 2015).

The Financial Times (2018) rank Greater Copenhagen first in the mid-sized region category for its success in welcoming major international investors. In turn, according to Greater Copenhagen Investments (2018) there are six larger ongoing infrastructural development projects in the region and 20 urban development areas that seek investors, many of them near the city centre of the Danish capital Copenhagen. These developments are positive for the economic growth and business. However, it is also a potential challenge for preserving green and blue areas, and their qualities. The risk of urban sprawl and the degradation of ecosystem services (ES) due to these developments is a threat for enhancing the green infrastructure (GI). Another challenge due to the region's character mentioned by stakeholders in both Scania and Greater Copenhagen is the transition of agricultural businesses into more industrial forms, with green houses and animal stables, as these developments seal soils under asphalt and concrete.

The territorial and spatial planning in itself is by some stakeholders acknowledged as a challenge. This as the regulations and governance networks are constantly changing, and that plans and decisions are constantly challenged by actors that do not agree on what have been decided.The decisions are challenged both by actors that do not believe that the decisions taken are progressive enough to preserve GI and by actors that believe the decisions taken are too focused on conservation. This is further elaborated in chapter 4.3.

3 The GI network and its potentials for territorial development in Greater Copenhagen and Scania

3.1 What is the approach to GI and ES in Greater Copenhagen and Scania

The approach to GI and ES in the region is including it in public-private-people partnerships to spatial and territorial planning. There is a cross-boarder cooperation committee working with cross-border solutions for the Greater Copenhagen and Scania region since 2000 (Däckfors et al. 2011). The committee counts 46 Danish municipalities and 33 Swedish. According to the Greater Copenhagen and Skåne Committee's homepage (2018) *"The Greater Copenhagen & Skåne Committee is aiming to eliminate the cross-border barriers that prevent economic growth and business development in the region – trying to connect people across countries and cultures."*

The focus of the cross boarder committee is mainly on solving workrelated issues for people living in one country but working in the other, such as mobility, taxes and pensions. It also

entails collaborations for enhanced exchange in innovation, trade, education, culture, sports and leisure time activities. So far it does not include any cross-border territorial planning.

In the Danish part of the region the green infrastructure is called green wedges and in the Swedish part green structures. Despite the different names and jurisdictions due to the different countries, the motivations for ensuring green infrastructure via spatial planning is very similar. This is optimistic for the prospects for future cross-boarder GI-planning cooperation.

3.2 Strategic approach – priorities and benefits of GI and ES

3.2.1 Scania

In Region Skåne they put people in focus, i.e. recreational areas for health, attractivity, outdoor recreation, tourism, but they also emphasize ecosystem services and rural development through environmentally driven businesses. There is also an ambition to develop coherent, sustainable physical structures – to avoid competition between the municipalities – and to grow efficiently with a balanced an sustainable use of land.

"The Scanian nature with coastline, meadows and grazing lands, waterways and dense forest environments provides great variation that comprises an important part of Skåne's appeal. The green areas and water environments provide room for recreation and leisure activities. They are also environments that can manage and reduce the impact of climate change, such as increased precipitation and higher average temperatures. The green and blue structures support broad biological diversity and contribute with valuable ecosystem services, such as pollination, water purification and carbon dioxide sinks." (Region Skåne, 2012, p. 33)

The citation above refer to the overall ambitions as they are referred to in Structural picture for Scania. The green infrastructure related priorities are found in the report *Grönstruktur i Skåne.* They are described as economic, social, ecological and cultural historical values.

The Regional Action Plan for Green Infrastructure (Länsstyrelsen, 2018) stresses the fact that Scania has much less publicly accessible land (*allemansrättslig mark)* compared to the rest of the country, 55.6% and 92.8 % respectively. However, the variation in Scania is large. There are municipalities, such as Osby, which has more than 90%, and others with less than 10%, e.g. Staffanstorp. In terms of available land per inhabitant, the national average is 4.4 ha per inhabitant, while the average in Scania is only 0.6 ha. Within Scania, the availability varies between approx. 3 ha/inhabitants in Osby to approx.10 ha/inhabitant in the southwestern parts.

It also stresses Scania's importance for the protection of flora and fauna. In Scania there is a species richness of animals, plants and fungi that is unparalleled elsewhere in Sweden. Of 4273 red-listed species in Sweden, almost half (46%) are found in Scania. More than every tenth of these species has its only Swedish presence in Scania.

In summary, the main motivations for planning for 'green structures' in Scania (Sweden) are:

- Biodiversity protection and maintainance of ES
- Cultural services as the green structure contribute to a common identity in the region

- Economic as the green structure contribute to strengthen the regions attractiveness and competitiveness
- Wellbeing and health as the green structure ensure areas for recreation (this is formally done by linking public transport to the green infrastructure, via an ongoing cooperation between the region Scania and public transport company)
- The green structures are also valued for contributing to a reduced climate impact
- Rural development through environmentally driven businesses.

3.2.2 Greater Copenhagen

The strategic approaches are in prioritized order: People's access to green areas, biodiversity, air quality, increased property value. The capital region's competitiveness towards other metropolitan regions in Europe is also important. The green wedges create quality of life, which is an advantage for the region. Furthermore, adaptation to climate change is also high on the agenda, especially in Copenhagen municipality with its cloudburst protection plan *(skybrudsplan)* wherein green areas play an important role for climate change adaptation and mitigation aswell for water management.

On the Greater Copenhagen level they have common spatial and territorial planning. The plans are since 1947 called 'The Fingerplan': *"The first Fingerplan was developed in 1947. It proposed a future urban development of the metropolitan area of Copenhagen along five suburban railroads. The areas between them should be kept free of buildings, forming green wedges and supplying the urban population with close recreational areas. Although the plan was only a report and never close by legally binding, it had great influence on later regional plans and infra-structure development in the region."* (Fertner et al. 2011, p.7)

In the 2013 plan, inner city wedges *(indre bykiler*), i.e. some larger urban parks were added for the first time. These include: "*Kastellet, Østre Anlæg, Botanisk Have, H.C. Ørstedparken, Tivoli, Christianshavns Voldanlæg, Søerne, Kløvermarken, Grøndalsparken, Nørrebroparken, Assistens Kirkegård, Bispebjerg-Ryvangforløbet, Emdrup Sø, Kongens Have, Fælledparken, Valbyparken og Kastrup Forst (all Københavns Kommune), Frederiksberg Have og Søndermarken (Frederiksberg Kommune), Bellevue Strandpark, Bernstorffsparken, charlottenlund Skov, Fort og Strandpark, Gentofte Sø og Brobæk Mose (Gentofte Kommune) samt Skaftet og Trekanten (Tårnby Kommune)."* (Ehrvervsstyrelsen, 2017, Kap. 3 stk 7)

There are also ideas about extension of the green wedges, especially towards Køge and Roskilde, but the municipalities cannot reach an agreement. The Outdoor Council (*Friluftsrådet)* suggested a new, third, ring of green areas which was adopted in 2013 and is also included in the plan of 2017 (Ehrvervsstyrelsen, 2017). But they *(Friluftsrådet)* are not satisfied yet, they want to broaden it spatially, to make room also for trees, plants and other organisms.

Outside the wedges there are excursion landscapes (*udflugtslandskaber*), e.g. Kongernes Nordsjælland, a national park mainly consisting of agricultural land. Afforestation is high on the

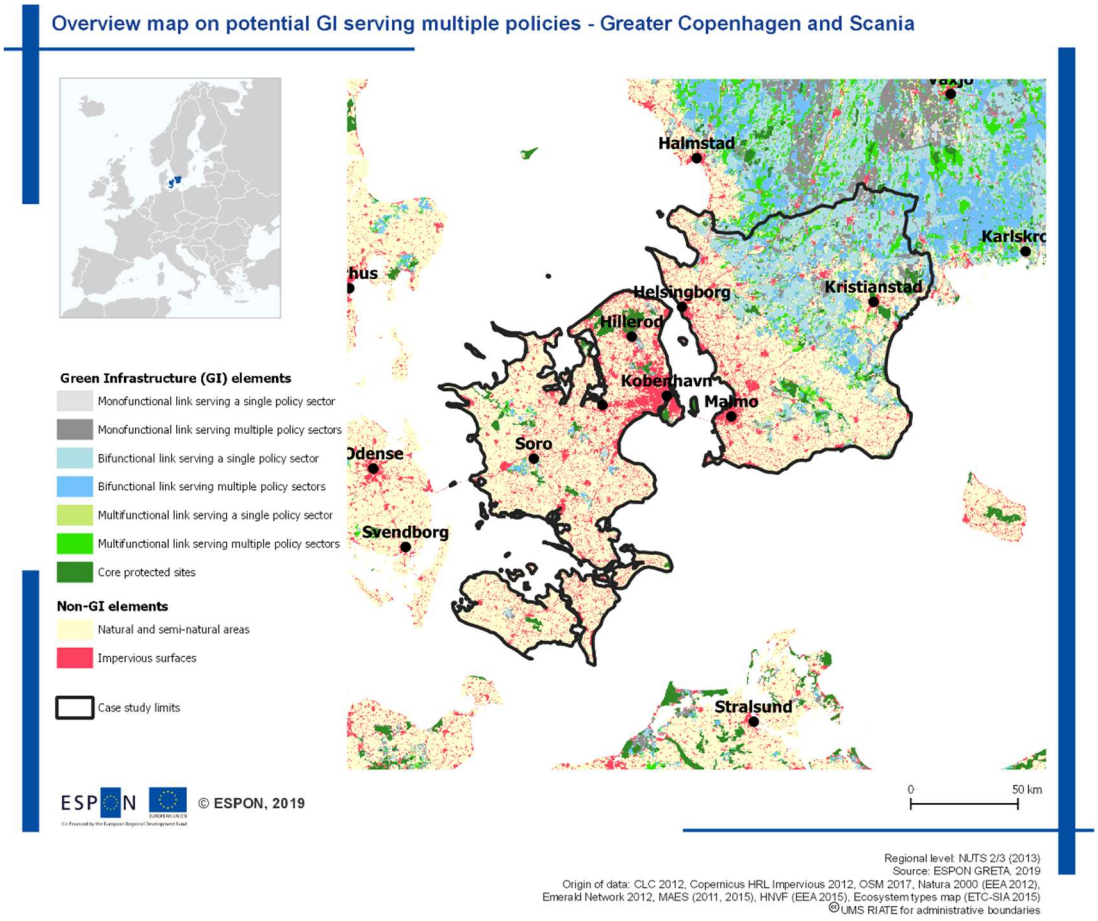
political agenda. During the last ten years 3000 hectars new state-owned forest has been established in Denmark. An extensive documentation of valuable nature is available through the web portal Green Map of Denmark hosted by The Ministry of Environment and Food.

In summary, the main motivations for include the green wedges in the spatial planning in Greater Copenhagen are:

- Biodiversity protection and ensuring ES
- Cultural services as the green areas ease the creation of a common identity in the region
- Economic as the green areas strengthen the attractiveness and competitiveness of the region and increasing property values
- Wellbeing and health as the green wedges ensure areas for outdoor recreation and noise-free areas
- The non-built up land is also valued for ensuring climate adaptation
- Possibilities for continued agricultural use.

3.3 Spatial analysis of GI potentialities

This section describes the potential GI network as delineated by GRETA, analyses the identified synergies and trade-offs between the ES provided by the GI network and its potential for serving several policy objectives, and provides a relative analysis of the region with the general EU patterns.



Map 3. Map over Greater Copenhagen and Scania GRETA case study. Overview map on potential GI serving multiple policies (e.g biodiversity policy, water management policies, climate change adaptation and mitigation policies) (reference: GRETA analyses by UAB and S4e).

Table 1. Potentialities for GI network in Greater Copenhagen and Scania based on GIS-analysis by UAB

Questions related to maps	**Description of phenomena in the case study**	**Implication for management**
Extent of GI	Potential GI covers less than 10% on the Danish part, resulting in highly fragmented spots. On the Swedish part, potential GI covers about 43% of the region, although there is a clear divide, concentrating most	About 2/3 of the Greater Copenhagen region has a very low coverage and highly fragmented GI, leading to differential accessibility depending on the cities. Agricultural areas, currently not included in the potential GI, could play an important role increasing the connectivity and availability of GI at landscape level. This would

	of the GI on the NE part of the region.	require appropriate agricultural practices, and land management, to have such a role on improving connectivity of GI. Moreover, better integration of agricultural areas could enhance connectivity of existing natural and semi-natural areas currently not part of the GI given its isolation.
Integration of protected areas	Given the low coverage and high fragmentation of the GI, some protected areas in Denmark are not integrated on the network, i.e. they remain isolated. On the Swedish part there is a better integration. However, most of the GI is structured around not protected areas (connectors).	The potential GI is not ensuring the connectivity of protected areas, mainly on Denmark. Therefore, the efforts should focuss on connecting these isolated spots and consolidating areas not protected that already contribute to the GI.
Support to policies related to: Biodiversity, Climate Change and Disaster Risk Reduction, and Water Management	The potential GI, and related ES, have a limited capacity to support the three policies. It is remarkable that the links, which conform most of the GI, are capable to provide good support to biodiversity. One would expect that the low contribution of protected areas to GI would result in reduced capacity to support biodiversity. On the other side, GI does not provide the best conditions to support climate change and disaster risk reduction, neither water management policies (water retention capacity is particularly low).	Multifunctionality is very limited since most of the area is only capable to support one or two policy objectives. The existing capacity to support biodiversity should be consolidated, indicating future actions to integrate other natural and semi-natural areas. More detailed information, at local level, would be required to confirm where specific ecosystem services could be improved by appropriate management.
Synergies and trade-offs	Most of the ES have a neutral relationship, i.e. there is no interaction or no influence between ES.	There are no spatial issues related to synergies or trade-offs. It is not expected that improving certain conditions would have side effects on other ES.
City level	There is a clear difference between Copenhagen and the	The relatively high share of GI on the peri-urban area should be taken as an opportunity to better

(Copenhagen, Malmö, Helsinborg)	rest of cities. Copenhagen has relatively low share of green urban areas (26%) compared with the other cities on the region (80% on average). This is compensated with larger coverage on the peri-urban are (76%), although clearly below to the average of the other cities (95%). However, Copenhagen has the highest percentage of protected areas (10%). Green urban areas have remained stable in all cities during the period 2006-2012.	integrate with GI at landscape level. In case of Copenhagen, the lower green urban areas would require appropriate management to increase it, if feasible, and to ensure its accessibility.

Feedback on the above spatial analysis: The respondents in Greater Copenhagen and Scania agree that the policies of 1) Biodiversity, 2) Climate Change and Disaster Risk Reduction (CC&DRR); and 3) Water Management (WFD) are relevant for the GI of the region. However, the spatial analyses and assessments of the GI in the GRETA-project does not match the physical distribution of the GI in neither Greater Copenhagen and Scania. The maps and the assessments done in the research project are based on European regional data sets, which results in maps illustrating much too coarse maps over the potential GI in both the Swedish and Danish part of the region. More detailed spatial data and local knowledge of the benefits of GI, and its potential links and hubs, is available on the national, regional and local spatial planning levels. This is further elaborated in chapter 4.

3.4 Resources

Both Scania (Region Skåne and the County Administrative Board in Scania) and the national Danish agencies (Erhvervsstyrelsen and Naturstyrelsen) have open access via homepage to reports, planning tools, data and maps.

3.4.1 Economic evaluation - benefits

In both the Danish and Swedish part of the region Cost-Benefit Analyses (CBA) have been used to some extent in the decision-making process when deciding about best ways to manage or invest in Green Infrastructure. In the local planning authority of Malmö municipality (Sweden) ex-ante CBA for flood mitigation have been used before the Green Infrastructure intervention. In this CBA, socio-economic information on the benefits in monetary terms was included. The technical expert at the local planning authority in Malmö stated that the reason for why they used this CBA-method was because it suited the purposes to provide a decision support. The technical expert at the regional planning authority in Scania stated that even though they heard about 3 of the 6 different economic valutation methods included in the questionnaire, they did not use them in decision making as they did not suite the objectives.

In planning for the Danish part of the case study region ex-post CBA for recreation have been used as a way to evaluate the results achieved for GI planning. In this CBA, socio-economic information on the benefits in both non-monetary and monetary terms was included. One of the informations included in the CBA was the benefits generated by the Green Infrastructure in terms of effects on prices of real estate. The results from the CBA was used for political and public debates on the future of green wedges in Greater Copenhagen.

The technical expert at the planning authority in Denmark stated that the reason for why they used this CBA-method was in order to present decision makers with some measure of the quantitative, monetary value of the green wedges in the Fingerplan area. The technical expert at the local planning authority in Copenhagen in Denmark stated that it is difficult to say with certainty why these methods are not used more often: *"I think in general that our politicians at the present place put more emphasis on the political process than on technical/economic analyses. In general there is a fairly high level of awareness of the importance of green infrastructure politically."*

In an interview with the Danish planning authority an official said that even aware of economic valuation methods, they mostly argued to preserve and enhance GI with other arguments than economic. Further, the respondent stated three main reasons for why the economic valuation methods are not used as a regular practice in the spatial planning: a) Considerable methodological problems in regard to measurement of effects on real estate prices. b) Moral concerns in regard to making a monetary valuation of green wedges. c) Concerns in regard to the choice of effects on real estate prices as the only focus.

The official at the planning authority also explained that even though aware of its existance, they rarely use economic research on GI in the governance process. The economic research in use are mainly focused on green areas importance to health and property values. Which can help convincing those who do not listen to other arguments.

2 of the 4 respondents to the online consultation on economic valuation methods in Greater Copenhagen and Scania would find the use of the economic valuation methods helpful to better inform the planning and decision-making around Green Infrastructure. To further implement economic valuation methods for GI in their respective organsiations increased competence on the methods and/or increased access to such studies could be useful.

3.4.2 Economic evaluation - costs

The 290 local authorities (municipalities) in Sweden, invested around 4952 million SEK (approx. 495 million Euro) in management of GI in 2017 (Statistics Sweden, 2018). The planning for or construction of new green areas is not included in this sum. Zooming in on the local authorities (municipalities) in Scania, they invested 471 million SEK (approx. 47 million Euro) in management of GI in 2017 (SALAR, 2018; no data for Helsingborg and Malmö). The planning for or construction of new green areas is not included in this sum, neither are nature reserves with a clear nature conservation profile as these are under other budget posts.

The 98 local authorities (municipalities) in Denmark, invested around 1073 million DKK (approx. 107 million Euro) in management of GI in 2017 (Statistics Denmark, 2018). The planning for or construction of new green areas is not included in this sum. Zooming in on the local authorities in the Danish part of the case study region (Region Hovedstaden and Region Sjælland) the municipalities invested 5164 million DKK (approx. 516 million Euro) in management of GI in 2017 (Statistics Denmark, 2018). The planning for or construction of new green areas is not included in this sum as these are under other budget posts.

4 Capacity of GI network in Greater Copenhagen and Scania to meet the demand of ES

4.1 What do GRETA analysis on ES supply and demand reveal?

GRETA have explored the capacity of GI network to meet the demand of ES where:

ES supply is defined as the capacity of ecosystems to provide ES, irrespective of them being used.

ES demand can be defined as the amount of a service required or desired by society in a given location and time. This demand depends on several factors such as socio-economic conditions, cultural/behavioural norms, technological innovations, availability of alternatives, among others.

	ES Supply – benefits provided	ES Demand -specific definitions	Approaches to quantify Demand
Regulating services	Benefits are provided by maintaining desirable environmental conditions	Amount of regulation needed to meet target conditions	Reduction of risk
Cultural services	Benefits are provided by experiencing the natural environment	Desired total use (if rival service) or individual use (if nonrival service)	Preference and values // direct use
Provisioning services	Benefits are derived from consumption of final goods	Amount of goods obtained per unit of space and time or per capita	Direct use // Consumption

Table 2 Relation between benefits provided by ES supply and the corresponding ES demand definitions and operationalisation approaches. Adapted from: Villamagna et al., 2013 and Wolff et al., 2015.

Demand for **regulating services** can be defined as the amount of those environmental conditions that ensure the provision of a desired regulation level. A reduction of risk approach has been usually applied to quantify demands for these services. Vulnerability to potential changes in regulating services may provide valuable insight into society's needs capturing main linkages from the socio-ecological system.

Demand for **cultural services** has been mostly assessed by preferences and values for attributes of certain landscapes, ecosystems or heritage sites. Preferences may be either quantified through stated preferences that relate to the desired level of services, or through revealed preferences (a proxy for the actual use of the service). Demand for cultural services

has also been assessed by the direct use of a specific ecosystem, e.g. for recreation. This can be quantified by total visitor days per year or the number of fishing/hunting licenses, the presence of tourists or accounting the accessibility or proximity to recreational areas.

Demand for **provisioning services** has been quantified based on direct use and consumption of final. It is worthy to note that there is normally a spatial mismatch between the area where the service is provided and the area where the service is consumed, especially true for provisioning services. For this reason, interregional linkages have to be considered in order to properly identify faraway dependencies and assess magnitude of potential impacts

Following the proposed conceptual framework, we have combined demand and supply for each of the selected ES. The focus of this approach was to highlight those areas where there is a high demand and a low supply, i.e. those areas where GI is unable to cover the ES demand. It should be noted that these results are of a more exploratory nature in the whole GRETA project considering the following limitations:

- This is a research area still under development;
- There is need for a higher resolution of the data sources given the nature of the phenomena analysed;
- Balance between supply and demand is semiquantitative; and
- In some cases, a more sophisticated modelling would be required to have an appropriate quantitative balance.

Therefore, these results should be seen as illustration on how this demand and balance could be approached.

4.1.1 Analysis of supply and demand for Flood Regulation in Greater Copenhagen and Scania

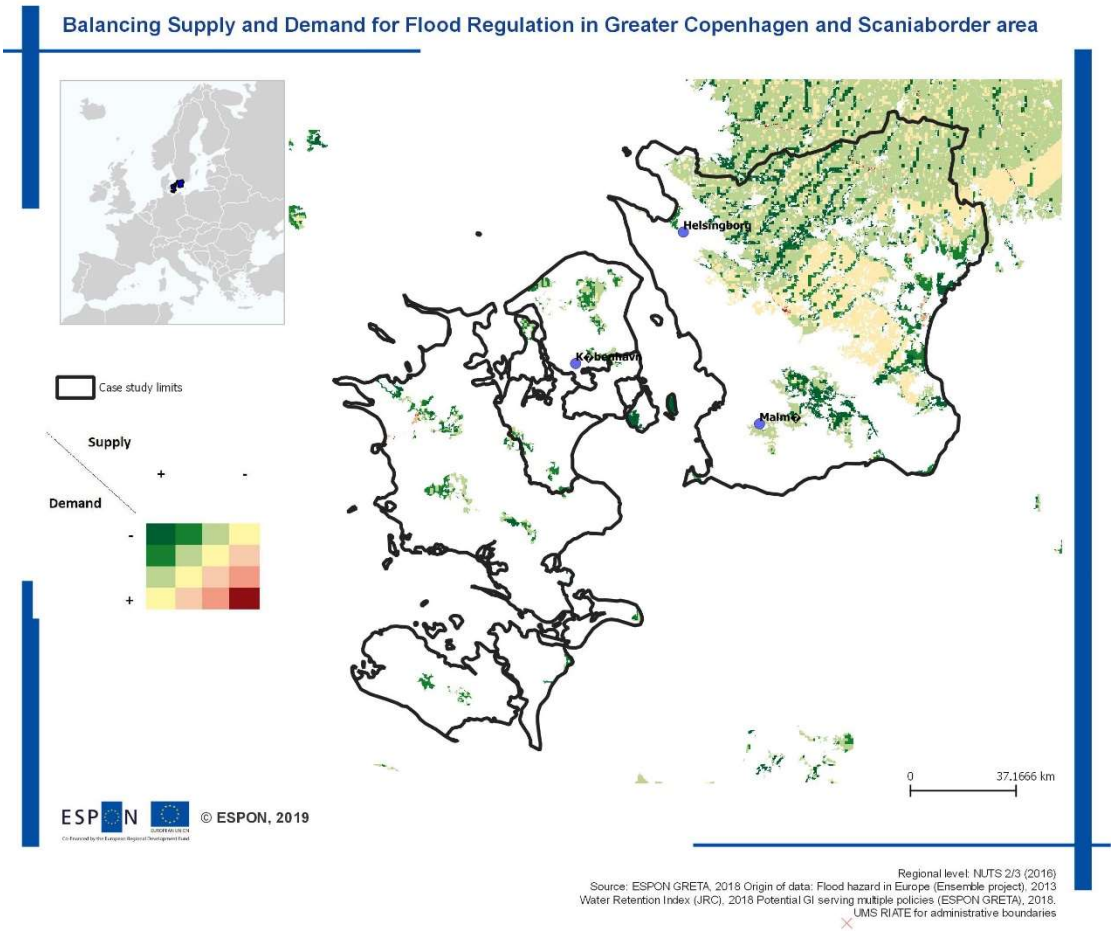
We have quantified demand for flood regulation based on the potential flood hazard. Exposure is described by the projected potential flooding risk[1]. On the other hand, benefits are provided by the water storage capacity of land to regulate floods. The supply for flood regulation is quantified by the Water Retention Index, which assesses the capacity of landscape to retain and regulate water passing through. This index is dimensionless and considers the role of interception by vegetation, the water-holding capacity of the soil, and the relative capacity of both the soil and the bedrock to allow percolation of water. The influence of soil sealing and slope gradient are additionally considered.

Map 4 presents a semi-quantitative analysis of the balance between supply and demand for flood regulation in Greater Copenhagen and Scania. Dark green areas are those with maximum capacity of supply and demand is very low. These conditions are met in core protected areas The other parts of the area that are still green could be considered areas where the balance tend to be positive, in the sense that the supply is slightly higher than the demand.

The areas in yellow in the north east of Scania show balanced in supply, partly explained due to the limited multifuncionality of the area, since most of the area is only capable to support one or two policy objectives.

In practical terms improving or reinforcing GI with the objective of water retention will still have a substantial benefit in the study area.

[1] for the period 2011-2044 that results after applying the LISFLOOD model from the ENSEMBLES project



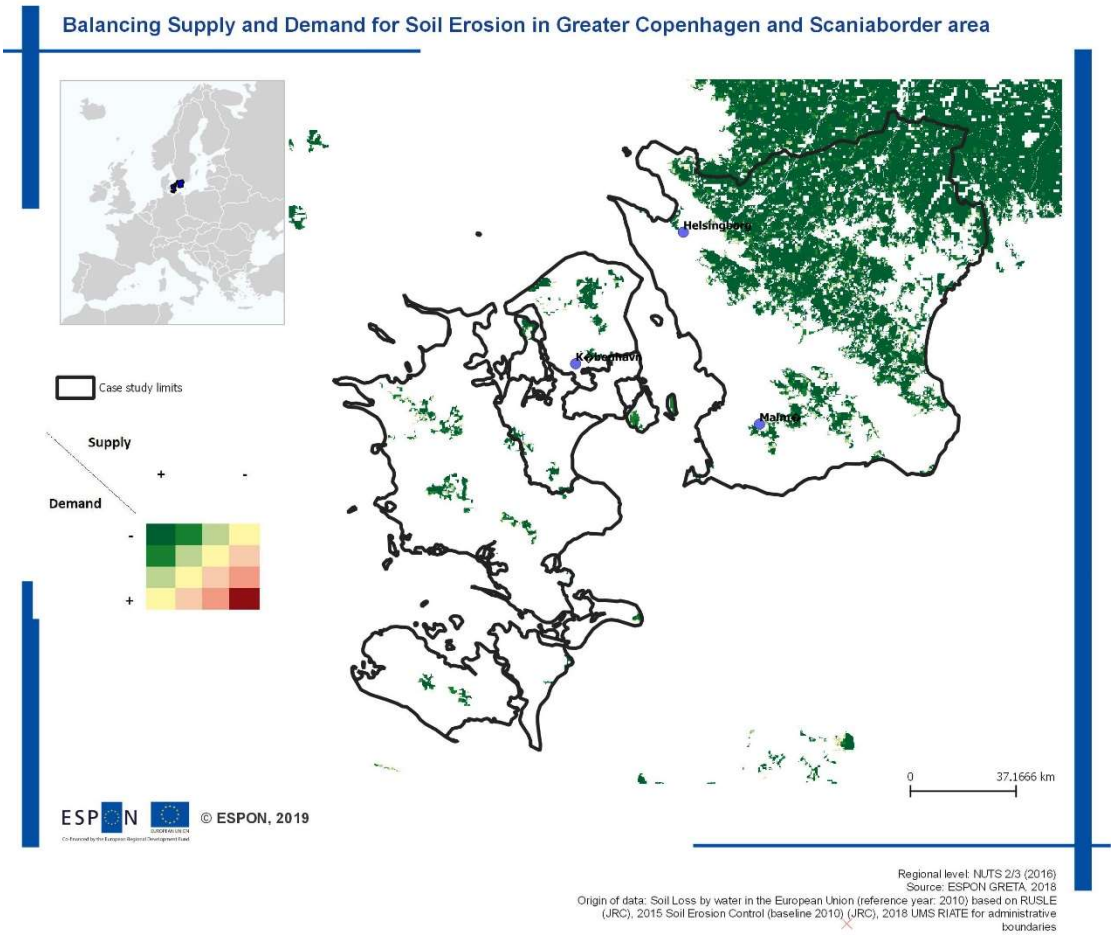
Map 4 Balancing Supply and Demand for Flood Regulation in Greater Copenhagen and Scania.

4.1.2 Analysis of supply and demand for Reducing Soil Erosion in Greater Copenhagen and Scania

We have assessed the demand for the reduction of soil erosion by water producing a negative impact on several ES; in particular to the ones related to crop production, drinking water and carbon stocks. Soil erosion by water is mainly affected by precipitation, soil type, topography, land use and land management. Exposure is described by the soil loss rate[2] (t ha^{-1} yr^{-1}). Benefits are provided by the capacity of vegetation to control or reduce erosion rates. The supply is quantified by the Soil Erosion Control dataset (JRC) that describes the capacity of ecosystems to avoid soil erosion.

From the resulting Map 5, we can observe a clear positive balance pattern showing maximun capacity of vegetation to reduce erosion rates in the whole area.

[2] as estimated by the modified version of the Revised Universal Soil Loss Equation (RUSLE) model



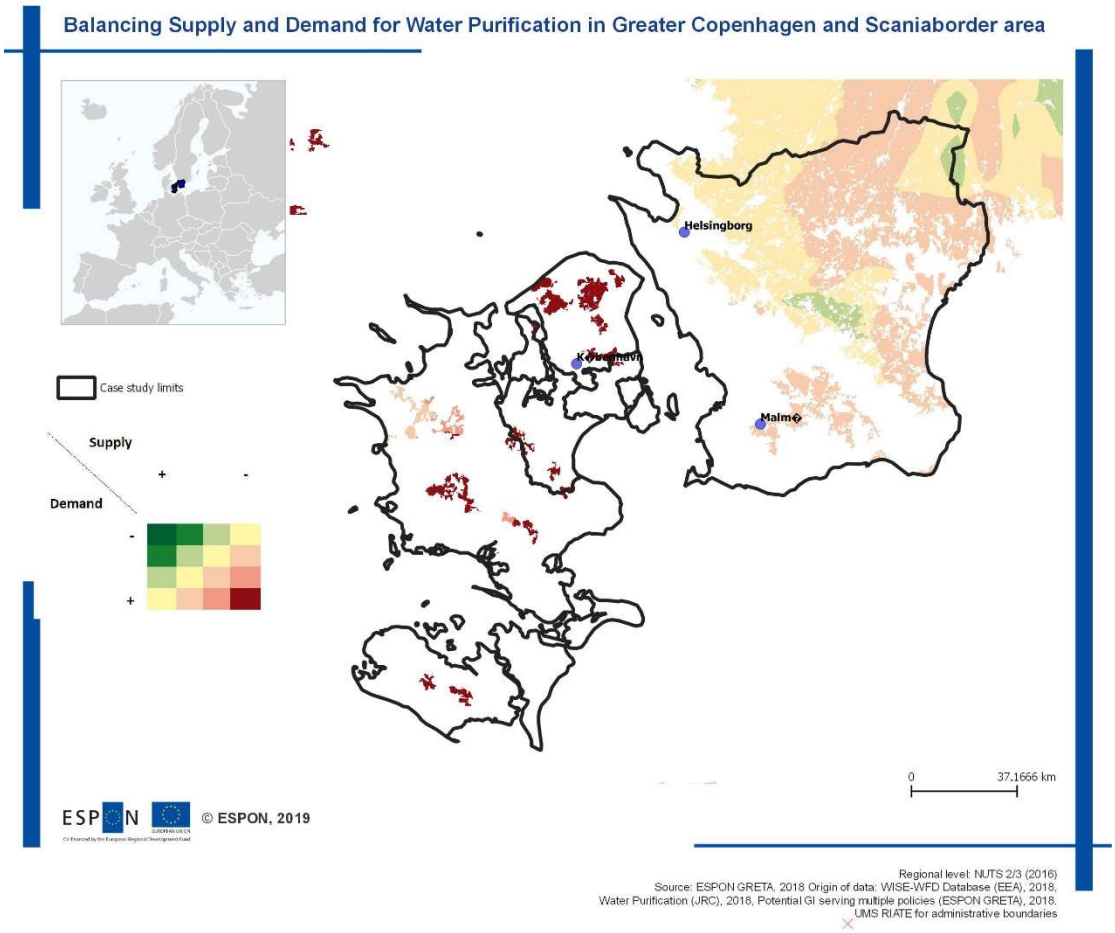
Map 5. Balancing Supply and Demand for Soil Erosion in Greater Copenhagen and Scania

4.1.3 Analysis of supply and demand for Water Purification in Greater Copenhagen and Scania

We have quantified demand for water purification based on the level of pollutants emitted to freshwater ecosystems by polluting sectors, primarily agriculture and waste water treatment discharges from industry and households. Exposure is described by mean annual concentration of nitrates in water [3]. The supply is quantified by the Water Purification dataset (JRC) that assesses the in-stream retention efficiency of ecosystems to dilute or degrade nutrients.

Resulting Map 6 shows that water pollution is still a big challenge and substantial increase on the provision of water purification is still required under current status in most of the area, with particular emphasis in the Danish part of the region.

[3] tonne per year, captured in monitoring stations and aggregated by rivers (the WISE-WFD database)

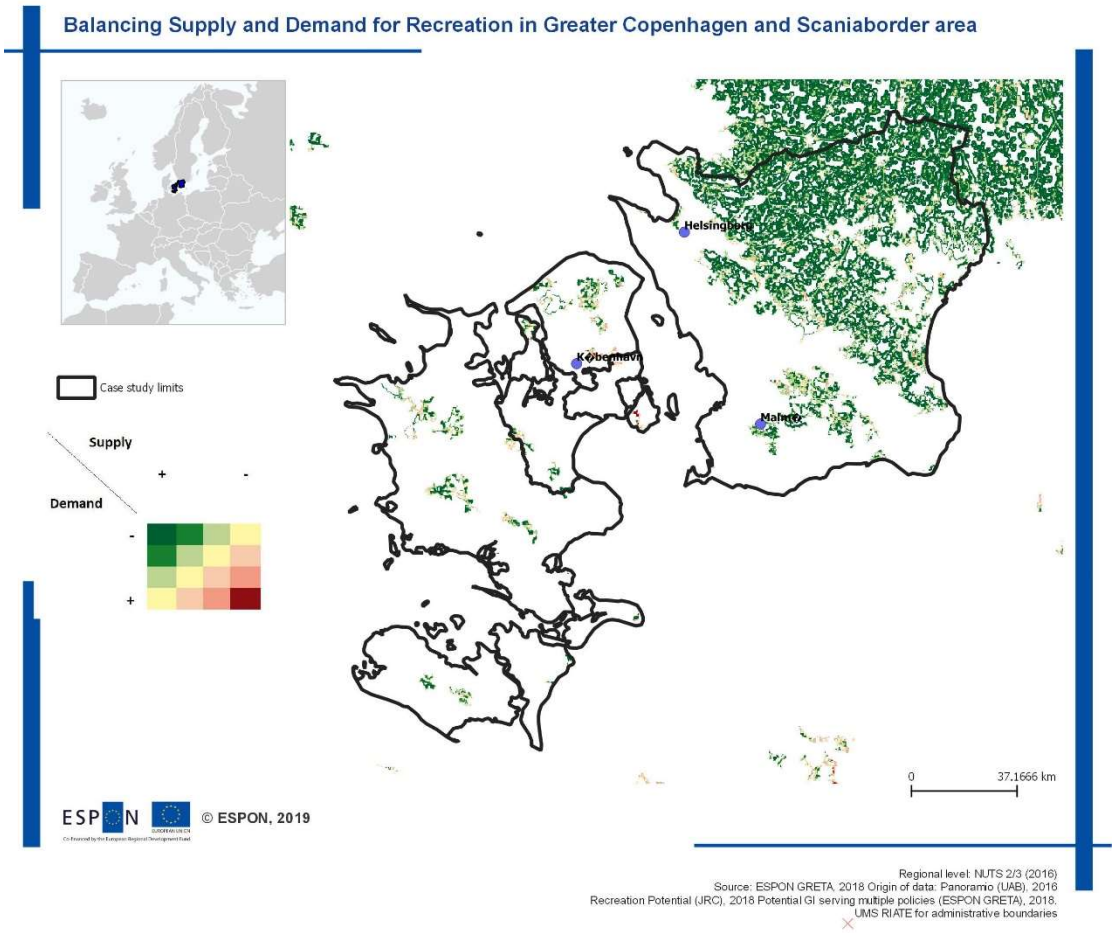


Map 6. Balancing Supply and Demand for Water Purification in Greater Copenhagen and Scania

4.1.4 Analysis of supply and demand for Recreation in Greater Copenhagen and Scania

We have described demand for recreation by means of a proxy for visitation. Recreation and tourism are important elements for national and local economies, that also contribute to other intangible benefits. Recreation directly depends on environmental attributes like species richness, diversity of habitats, and climate. The usability of crowd-sourced information by means of location photographs has already been shown to be as a reliable proxy for visitation rates to recreational sites. We have used the location of photographs in Panoramio as a proxy for landscape attractiveness for visitors. Demand is quantified by the number of pictures per square km. On the other hand, supply is described by the Recreation Potential dataset (JRC) that quantifies the potential for citizens for outdoor recreation.

The resulting Map 7 does show a clear positive pattern in the Greater Copenhagen and Scania.



Map 7. Balancing Supply and Demand for Recreation in Greater Copenhagen and Scania

5 Governance practices, policy and planning instruments to implement GI and enhance ecosystem services in Greater Copenhagen and Scania

5.1 Governance models - roles and responsibilities

5.1.1 Scania

In Sweden, the municipalities are responsible for physical planning through the so-called municipal planning monopoly. The state's role is to identify areas of national interest for certain purposes such as cultural heritage, nature conservation and outdoor recreation but also secure that resources for important societal functions, e.g. communications, mineral resources and energy resources are guaranteed. Through the County Board, which is the national authority at regional level, the state can control that municipalities live up to the national interests in their comprehensive plans.

"Laws and regulations are formulated at national level. Funds for, among other things, infrastructure investments, public transport, healthcare facilities and culture are distributed at regional level while the municipalities have most influence over investments in and the shaping of the physical environment." (Region Skåne, 2013, p.14)

Regarding management of the urban green infrastructure, the municipalities are, in general, responsible for the maintenance of urban parks and other types of public urban greenery but also other managers, such as parishes are responsible for the maintenance of cemeteries, housing companies and private homeowners responsible for their gardens, are important green managers.

Management of the rural green infrastructure is in Scania shared between private landowners and regional authorities, where the County Administrative Board (*Länsstyrelsen*) takes care of nature reserves and national parks while the County Council (e.g. Region Skåne), and the Scania District of the National Forest Agency provide recreational areas.

5.1.2 Greater Copenhagen

At the national level, the responsibility for the spatial planning in Denmark is located at the Business Authority under the Minister of Industry, Business and Financial Affairs. Since a reform in 2007, the responsibility of the spatial planning is no longer at the regional level, but instead the responsibility is shared by the national and municipal governance levels.

This change, decided by the then new government in 2015 is a proof of the willingness to increase the growth and business perspective in the spatial planning. Around 40 spatial planners, moved from the ministry of environment to the ministry of business by that time.

There is a clear role distribution. The state (*Erhvervsstyrelsen*) administers the Finger Plan Law where all included areas are listed by cadastral numbers ("matrikelnummer"). The municipalities have to include them in their comprehensive plans and are responsible for maintenance of public areas.

Regarding management of the urban green infrastructure, as well as in Scania, the municipalities are primarily responsible for the maintenance of urban parks and other types of public urban greenery but also other managers, such as parishes responsible for the maintenance of cemeteries, housing companies, farmers and private homeowners responsible for their gardens, are important green managers.

Management of the rural green infrastructure is in Greater Copenhagen shared between private landowners and the local districts of the National Nature Agency, which in the whole country is responsible for 110,000 hectares of state-owned forests and 90,000 hectare of other nature types.

5.2 Existing policies, planning instruments and initiatives

5.2.1 Scania

The most important documents at regional level are *Det öppna Skåne 2030 (*regional development strategy), *Strategi för ett hållbart transportsystem i Skåne 2050* (strategy for a sustainable transport system), and *Strukturbild för Skåne* (Structural picture for Scania, which aims at connecting the regional development strategy *RUFS* with the municipal comprehensive plans – *översiktsplaner ÖP)*.

The idea of a Structural Picture for Scania was first put forward almost ten years ago, based on a desire for a deeper discussion on planning and urban development at a regional level. Region Skåne started with small steps towards establishing trust between them and the municipalities by building a common knowledge base and starting with less controversial issues and – a process that takes time. When it comes to the coordination of the regional development strategy and the municipal comprehensive plans decisions are taken by a steering group consisting of regional politicians representing Region Skåne and local politicians representing the municipalities from “the four corners”. The cooperation with the municipalities is built on trust, may not be perceived as a threat to the municipal planning monopoly.

A central document in the dialogue between Region Skåne and the municipalities regarding green infrastructure is the report *Grönstruktur i Skåne* (Green structure in Scania; Region Skåne, 2012), which shows (i) potential ecological corridors, (ii) strategic localisation of new green corridors, (iii) valuable urban green areas. The aim of the report is to show develop potentials for the green infrastructure and to be an inspiration for the municipalities (figure 3).

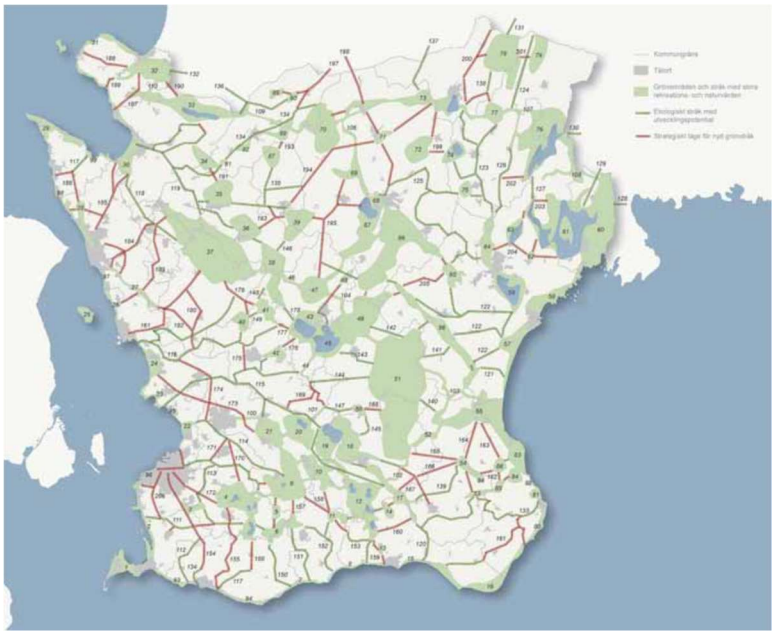


Figure 3 Map with the green structure in Scania (green) and its development opportunities (red). The green structure is based on several layers of maps that have been analysed using the Matrix Green tool for ArcGIS. The layers are regionally important forested land, grass lands (seminatural and grazed pastures and meadows) and waters and wetlands (Region Skåne, 2012, p.99). At the County Administrative Board in Skåne this green structure is integrated in the ongoing action plan for GI (Länsstyrelsen Skåne, 2018).

Region Skåne does not have the same legal mandate as the County Administrative Board. The County Administrative Board has, on behalf of the government, developed a regional action plan for green infrastructure. An important purpose of the action plan is to provide a basis for increased consideration for landscape ecology when different types of land use decisions are taken (Länsstyrelsen Skåne, 2018, draft version of Action plan). The regional action plan from

the County Administrative Board is based on a conservative approach where virtually all social development and change are in vain and that the main strategy is conservation in terms of area protection for core values *(värdekärnor)* and value areas *(värdetrakter)*.

5.2.2 Greater Copenhagen

Since 2017 there is a new Planning and Building Act in place. The currently in force Fingerplan for the capital region was established in June 2017, and is legally binding[4]. This mean that the municipalities are obliged to follow it strict in their spatial planning. The Fingerplan area covers 34 municipalities. The preservation of the green areas (in Danish: "grønne kiler" - green wedges) has its own chapter ("hovedstadskapitlet") in the Danish Planning Law.

The framework has been developed through "*a dialogue between the state and the municipalities within the strict limits of the legislation*". 25 years' of voluntary cooperation through a so-called regional development council ("egnsudviklingsråd") chaired by the state and with a secretariat with up to 30 employees. In 1973/74 came the law on regional planning in the capital area. In 1989 HUR ("Hovedstadsrådet") was established, which was closed down in connection with the administrative reform in 2005. In 2007 the law came which gave the state responsibility for regional planning in the capital region.

From a historical perspective the Fingerplan history goes back to the 1930s, which is quite late compared to other European metropolitan regions, where modern city planning started in the late 1800s, early 1900s. This is because Copenhagen was quite late urbanized in the capital region. The agriculture sector was strongly influencing the economy by that time, and the urban development was localized to several smaller towns rather than just around the capital. During the 1930s, however, the need for a plan for the capital region was started to be the discussed. The second world war came and interrupted the process, but the first plan was decided in 1947. The green wedges and green areas was included already by that time. Due to the agrarian history of Denmark, the green wedges include agricultural land as green areas.

The first plan, which was only a sketch and not legally binding as today, had inspiration from the garden city movement in the UK; that people, living close to each other in social communities should have close access to nature and green areas. Also city models from Germany and the US; where they did not want to build cities circular from one city centre, but instead to build concentrated in one area and in long radially fingers. This, in order to connect the city center to more distanced, smaller centers, approximately 23 kilometers from the city centre. In Copenhagen this meant to allow for new development in 'fingers' out from the 'palm of the hand'. In the 'fingers' the city was, and still is, to be built with garden city inspiration. In between the fingers, it should be green and/or blue areas for good quality of life and health.

[4] Since this study was executed (December 2017-March 2019) a new legally binding plan have been established (March 2019), see Ehrvervsstyrelsen, 2019.

Without this plan the compactness of people, cars, industries and so forth would, over time, have degraded the living environment of Copenhagen (Vejre, 2017).

The current plan (Ehrversstyrelsen, 2017) is based on the same thoughts and motives as its predecessor in 1947. This although the social democrats, which have had a strong hold in Denmark previously is no longer that big, but there is a political consensus of the value of keeping the green wedges intact. Most researchers and practitioners consider the Fingerplan as being a success (cf. Fertner et al. 2011; Vejre, 2017) . This for instance for the continuity in the planning process, a general acceptance of overall steering, respect for the protection instrument, ad-hoc solutions, and constant renewal of the green wedges concept (Vejre, 2017). Although some holes in wedges have slipped through the protection web, the overall ideas of the 1947 plan are still steering the urban development in Greater Copenhagen (figure 4).

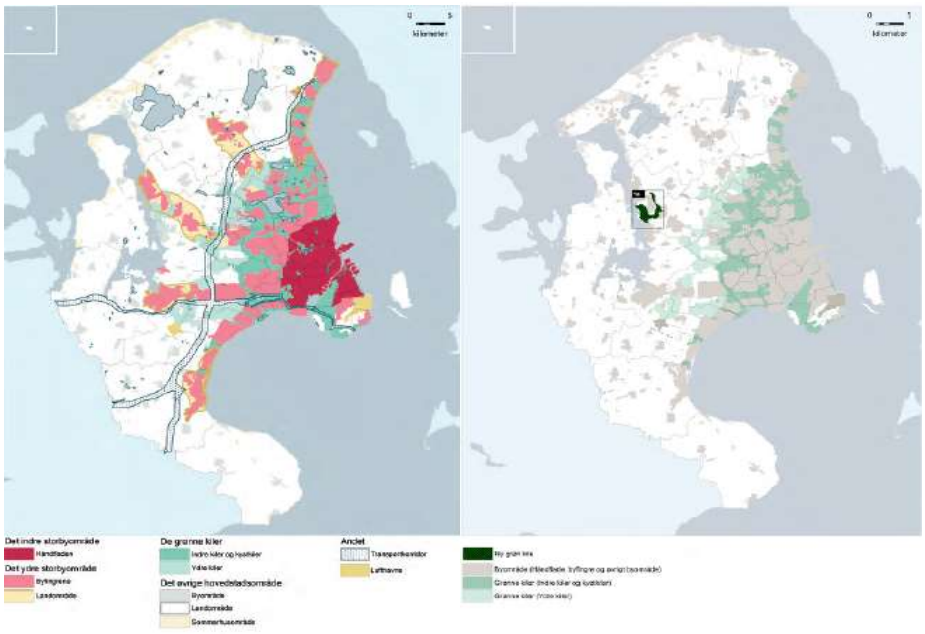


Figure 4 Maps showing the Fingerplans' development pattern of land and water use in Greater Copenhagen. The map to the left show the capital region of Copenhagen with the four main land use types. The map to right show the capital region of Copenhagen with the existing and planned new green wedges. (Ehrversstyrelsen, 2017, p. 14 & 15)

5.3 Threats and conflicts

5.3.1 Scania

Urban sprawl is a threat to productive agricultural land, while densification is a threat to urban greening. Barriers such as technical infrastructure, i.e. highways and railways, are threats to the green infrastructure since they fragmentize the landscape. There can also be conflicts with private landowners because of the right of public access.

"*Contiguous settlements also entail Skåne taking responsibility for wisely managing valuable land, as Skåne has large areas of Europe's best farmland and valuable natural surroundings.*

(…) large parts of Skåne has very limited access to green structure and public land, as large areas comprise agricultural land, while other parts have good access to forests and natural surroundings." (Region Skåne, 2013, p.11)

"*Skåne is a region that is growing, in terms of population and employment opportunities. Growth is good for Skåne and ensures that the region develops. At the same time, growth creates additional pressure on land use due to the need for new housing, business premises, infrastructure and so on, which places demands on the physical planning. Balanced and sustainable land use is crucial for Skåne's attractiveness and sustainable development*." (Region Skåne, 2013, p. 33)

The County Administrative Board's regional action plan for green infrastructure (Länsstyrelsen Skåne, 2018) identifies 5 major threats:

1. Less and fewer areas
2. Changed land and water use
3. Climate change
4. Invasive alien species
5. Water and air pollution

5.3.2 Greater Copenhagen

According to a former regional planner in Greater Copenhagen the most severe threat to the green infrastructure is represented by the desire to develop new housing, roads and other constructions in the 34 municipalities covered by the Fingerplan. This is also reflected in the public media debate. On the one hand, there are voices representing the municipalities arguing that the rules in the Fingerplan are too strict. The opposite opinion is represented by organisations like The Outdoor Council *(Friluftsrådet)* and The Danish Society for Nature Protection *(Danmarks Naturfredningsforening),* arguing that the nature is under severe pressure (see for instance: Altinget, 2018a; 2018b).

Another important threat is structural changes in the agricultural landscape which reduces attractiveness and accessibility of the green wedges. For example, the right of public access to the landscape is granted within the green wedges, which is criticized by the farmers who want to set up fences. The green wedges include industrial agriculture, and ongoing food production. As the legislation in the plan is putting up restrictions on ongoing land use it is a challenge from the agriculture business side, to expand or make any new establishments. Agriculture could be in synergy by establishing pastures and grazing areas that could be used for outdoor recreation and semi-natural pastures are important hot spots for biodiversity, but the industrial farmers are mostly focusing on production and profits.

A third challenge is that in the north/northwest of the capital region there are many old estates and castles in the green wedges. These are important to keep intact for cultural heritage. But it is a similar challenge as for agriculture, to afford keeping the estates and castles in a good condition they need to be developed and renovated. At the same time the legislation in the plan are putting up restrictions for that.

A fourth challenge is that further migration to Copenhagen is expected (approx. 220 000 new inhabitants until 2030). This mean further needs for built up land in terms of houses, child care, schools, sport facilities, public transports, roads etc. and new green areas in relation to the housing areas. It is an ongoing discussion around the possibilities to take land from private and public land owners, mostly agriculture, and turn into housing and recreational areas.

A fifth challenge is climate change, the need for us to adapt to the sea level rises that climate change impose. Copenhagen is located along the coast. The green wedges are part of the climate adaptation, but more work is needed on building housing and other new premises more adopted to sea level rises.

Finally, there are some conflicts with transportation infrastructure, e.g. the Frederiksund railway and highway, and urban development. Every new road that is constructed cuts up the green areas or the green wedges in the finger plan.

5.4 Cooordination and cooperation

5.4.1 Scania

Region Skåne's relation to the County Administrative Board is limited to a dialogue on strategic level, through the housing network and regarding rural development. The relation to municipalities is much further developed. The idea behind The Structural Picture of Skåne is based on the idea of *"a cooperative Skåne, players and levels alike, that enables Skåne to act as a single entity.*" (Region Skåne, 2013) The work is conducted by Region Skåne and Skåne's 33 municipalities together. It started as a project in 2006 and became part of Region Skåne's normal operations in 2011, with the Department of Planning and Urban Development as lead. "The aim is to link the regional development work with the municipalities' land-use planning."

The Structural picture of Skåne was formulated based on an integrative participatory process. Among the approx.100 local, regional and national stakeholders involved in the process formulating the structural picture, is also stakeholders from the Danish side of the cross-boarder region. These types of interactions is linked to the Strategy area 5: Strengthen Skåne's relations within the Öresund Region, Southern Sweden and the Southern Baltic Sea: *"Together Malmö/Lund and Copenhagen form an international growth engine in Northern Europe and are of major importance to Skåne's development. That these cities enjoy good cooperation is a strength for the entire region."* (Region Skåne, 2013, p. 51).

At a seminar on land owners' rights to their land (in Stockholm, May 2018) representatives from the National Farming Union (NFU) in Sweden (both representatives for NFU Forestry and NFU Farming) expressed concerns about the national authority's and county administrative board's conservationist approach to land use, governance and GI implementation. Although proud of their land and the values it contains the perceived risk of getting their land taken for conservation make some farmers and foresters not always report on the biodiversity values that they have on their lands. Some land owners even expressed a willingness to sue 'the state' (e.g. public authoririties on municipal, regional and/or national levels) for taking land from them

and turning it into nature reserves or biotope preservations. Further, a representative from NFU Farming stated that inviting the farmers to the public authorities' planning processes is of fundamental importance for legitimising the process. This as the land owners can be a bit reluctant for others deciding over their use of land.

5.4.2 Greater Copenhagen

Today, spatial planning is constituted by both formal and informal processes. Formally, the draft for new plans are sent out to hearing. For the Fingerplan 2017, it was done via a web portal. All planning documents, the basis for the draft were put on the web portal for all to read and see. As prescribed in the law, the plan is also sent for hearing to a long list of authorities. All the comments from the hearing authorities, including the NGOs and the private actors concerned, are shared on the web platform. After the deadline for the hearing, the planning authority goes through all the comments, and compare them to the draft for the plan. The suggested changes are discussed with the responsible minister and some alteration might be done based on the comments. In any case, all comments that have been received get an answer to acknowledge that their concerns have been considered[5].

Denmark's Outdoor Council *(Friluftsrådet*), established in 1942, and The Danish Society for Nature Conservation *(Danmarks Naturfredningsforening*), established in 1911, have played very active roles in the planning in Greater Copenhagen. Friluftsrådet is an umbrella organization for around 90 different civil society organizations all over Denmark. They have a broad view on outdoor recreation, including organisations working both with nature preservation and outdoor recreation. Since the 1960s they have had collaboration with The Society for Nature Conservation around multifunctional use of green areas. One representative from the Denmark's Outdoor Council state that they are grateful for the inclusive planning process, which is democratic and mostly transparent. This despite they *(Friluftsrådet*) are not necessary always happy with the results in the plan: *"It is a democratic and transparent planning process, although not all our members understand what land use planning is really about. To balance growth and green areas, and find space for all land use interests must be challenging for the planning authorities."*

[5] The same procedure is in place in Sweden, but on municipal level.

6 Lessons learned and good practice examples from the Greater Copenhagen and Scania

6.1.1 Challenges for further GI development in Greater Copenhagen and Scania

In summary, the development of new highways and railways, housing and other constructions on non-built up land (e.g. urban sprawl) and the industrial-like agricultural development are negative for the ES that the non-built up areas entail. Combined it constitutes a potential challenge to fulfil the goal of 'no net land take' by 2030 in European Union (EC, 2013) and the enhancement of biodiversity and ES for territorial planning in the region. Moreover, the study shows that plans and decisions are constantly challenged by actors that do not agree on what have been decided. This is, however, a challenge in any democratic society. The role for the public authorities to balance different interests and put up frames for how the land and water should be used with a long term perspective in mind is functioning in both Greater Copenhagen and Scania.

6.1.2 Opportunitites for GI through Cross-border Cooperation

Today the cross-border cooperation mainly takes place in projects. One example is the "Öresund class room". It was, initially, two Interreg-projects initiated by Lund University, Malmö University, and the municipalities of Lund, Malmö and Copenhagen. The focus was on learning in the Öresund region, to see the whole Öresund as a class room, in order to enhance student participation, democracy, learning for climate adaptation and sustainable development. The initiatives have been picked up on the political arena. For instance, it is in the Malmö-Copenhagen strategy 2025 from 2014 (Sydsvenskan, 2014).

Two of the green wedges in the Fingerplan are coastal. Both Bellevue Strandpark and Amager Strandpark are examples were the state bought private property in order to secure people's access to the sea. And through the Öresund Bridge, the Greater Copenhagen has become much closer to Scania, not only in terms of the labor and residential markets but also for recreation and outdoor life. The right of public access and the high availability of nature in Sweden make it particularly attractive for residents in the Copenhagen area to seek out Scania for nature experiences. Therefore, planning and development of the green infrastructure in Scania should take into account the metropolitan area of Copenhagen, and the planning of Greater Copenhagen should take into account Scania.

One opportunity is The Greater Copenhagen and Skåne Committee which is the formal political cooperation between the 79 municipalities and 3 regions of the Öresund region. Today the cooperation includes projects dealing with food production, research (ESS), life science, tourism, branding, investments, lighting and infrastructure. So far, the last project is only focusing on public transport but it would be an opportunity to extend the cross-border cooperation by including green infrastructure to make the region even more integrated.

6.1.3 Achievements in GI implementation in Greater Copenhagen and Scania

- High accessibility to georeferenced data, tools, plans, hearing process documentation.
- High awareness of the GI among politicans and planners.
- Although different jurisdictions, plans are used as common agreements on future land and water use in Sweden and Denmark respectively. These plans include green structure and green wedges.
- Inclusive process for planning for GI, public-private-people partnerships.
- Well established cross-boarder committee, which could develop their work by including green infrastructure planning and management of ecosystem services in their activities.

7 Policy messages and recommendations in Greater Copenhagen and Scania

7.1 Policy messages

The case study work have three main policy messages.

First, it is not a lack of knowledge about GI in the case study. Rather, it is continuous governance processes that ensure and further connect GI in Denmark and Sweden respectively. GI is included in spatial planning in both Greater Copenhagen and Scania. As presented in chapter 2.2 the GI is motivated by a range of social, environmental and economic benefits. The success factor to reach a high implementation level and common agreements in the spatial planning (chapter 4) is to focus on the social aspects of GI. This to ensure inhabitants access to recreation areas. Although it is acknowledged that GI is multifunctional, the social focus enable a basis for spatial planning beyond municipal territories.

Second, GI in Sweden and Denmark are geographically broader than protected areas. Due to the agrarian history of Denmark, the green wedges in Greater Copenhagen include agricultural land. In Scania the green structure include only what in Europe is called High Nature Farm land (e.g. semi-natural pastures and meadows). To be further discussed is if all non-built up land (such as parks, agricultural land and forested land) should be perceived as part of the GI. Should for instance agriculture land farmed with organic practices, and/or commercially in use certified forests be part of GI on European level? This especially considering the multifunctional ES that these land use areas entails.

Third, and related to the first policy message; to further the work on ecosystem based territorial planning for GI is a potential issue to bring further at the cross-boarder committee. This to ensure one of the committees stated cooperation goals; enhanced exchange in leisure time activities (Greater Copenhagen Committees homepage, 2018). Although there are different juridictions for spatial planning, in Denmark a formal top-down approach and in Sweden a formal bottom-up approach, such collaborations would certainly enhance the possibilities for the inhabitants' possibilities to access and use the green and blue areas.

7.2 Policy recommendations

When it comes to policy recommendations the researchers behind this report can conclude with six main recommendations:

First, to enhance the implementation of GI (to further links and hubs) it is important to involve the private land and property owners, and business actors, in the planning process. This by explaining that planning for GI does not necessarily mean that more land will be turned into protected areas. Instead, it is a way to have a dialogue with the private landowners to use the land and waters with more care. Such recommendations on more sustainable land use could be coupled with subsidies (CAP and national subsidies) in order to encourage land owners to change their farming (e.g. into organic farming with no pesticides and low level of nutrient input), forestry (e.g. into certified forests which set off 10 % of the tilled land or 10 trees/ha to nature conservation) and other commercial businesses (e.g. to compensate negative impacts).

Second, another recommendation is that public authorities could further work to make private actors to compensate negative environmental impacts. This for instance by using the in force EU-directive Environmental Impact Assessments (EIA) and Strategic Impact Assessments (SIA) stricter. The method of compensating one negative environmental impact in one area, by a positive in another is one suggestion of a practice in place that can be furthered. One example of how this can be incorporated in planning is the green area factor, developed in Malmö, Scania. When the western harbour was developed to the housing area *Västra hamnen* in the early 2000, a green area factor was used to ensure compensation. Thanks to the political support this iniative has been developed into a method for the planning and building practice in Malmö, Scania, Sweden. In 2018, this initiative was acknowledged, together with two other in-practice methods for biotope calculations (in Göteborg and Stockholm), as a recommendation for ecosystem based planning by The Swedish National Board of Housing, Building and Planning. A tool box, online educations, arguments and handbooks for integrating GI and ES in planning are also available online at the The Swedish National Board of Housing, Building and Planning (2018).

Third, regarding climate change adaptation and water management public authorities could compensate private actors for investing in water management systems to take care of rain water and sewage on their own properties. This to decrease the risk of floodings and polluting drink water. These types of measures are especially important in coastal areas where effects of climate change is most severe (in terms of risks of flooding and coastal erosion). A measure to adapt to climate change effects of this kind is in place on municipal local authority level in Denmark, for instance in Copenhagen. In Copenhagen private property owners can apply for compensation for investing in water management on their own properties (Klimatilpasning af GF Kløverbladet, 2018).

Fourth, indications from Greater Copenhagen is that stakeholders have tried to induce a climate adaptation and mitigation fund within which private actors whom are allowed building permits are forced to compensate for future domestic investments. To further the work which such a

fund would be frutitful for both Greater Copenhagen and Scania due to the coastal location of the region.

Fifth, to further the work with GI implementation in Scania it seem fruitful for the County Administrative Board (Länsstyrelsen) to consider the work that have been done within the Region Skåne (the county council) in their further work with the Action plan. This in order to balance growth and preservation, and get all private and public actors involved.

Sixth, to further the work with GI implementation within the Fingerplan process in Greater Copenhagen it seems fruitful to further involve farmers in the process.

8 Apendix

The below table give an overview of the stakeholder engagement.

Type of stakeholder	**Workplace**	**Part of Greater Copenhagen region**	**Type of interaction**	**Date**
Technical expert	Local level public authority, planning department	Malmö, Sweden	Online questionnaire, E-mail	2018-08-23
Technical expert	Local level public authority, environmental department	Malmö, Sweden	Phone interview, E-mails	2018-04-11, 2018-04-27
Technical expert	Local level public authority, planning department	Copenhagen, Denmark	Online questionnaire	No record on date on online database
Technical expert	Regional level public authority	Scania, Sweden	Phone interview, E-mails	2018-02-14
Technical expert	National and regional level public authority	Sjaelland & Hovedstaden, Denmark	Phone interview, face to face interview, online questionnaire and follow up via phone and E-mails.	2018-03-07, 2018-04-20, followed up in

				May and August 2018.
Former decision maker and technical expert	National level public authority	Denmark	Face to face meeting at the researchers work place in Stockholm. Followed up via phone call.	2018-02-15,2018-02-28.
Civil society organisation	Friluftsrådet/The Outdoor Council	Denmark	E-mails, face to face interview.	2018-04-20, and email correspondence during April 2018.
Other input				
Technical Expert	National level, senior consultant, Environmental Protection Agency	Denmark	Online questionnaire about GI policy and planning for National Policy Factsheets	2018-03-07
Technical Expert	National level, senior Scientific Officer at the Swedish Environmental Protection Agency	Sweden	Online questionnaire about GI policy and planning for National Policy Factsheets	2018-01-26
Technical Expert	National level, Senior Advisor responsible for biodiversity at the Swedish	Sweden	Online questionnaire about GI policy and planning for National Policy Factsheets	2018-02-26

	Transportation Agency			
Private land and business owners, representatives from public authrorites, politicans, civili society organisations and research	Seminar on land owners rights to land arranged by Royal Swedish Academy of Forest and Agriculture. During this seminar around 98 persons discussed themes important for GI implementation: laws and regulations, compensation for nature biotope protections, and the balance between public and private interests on lands in Sweden.	Sweden	One of the researcher actively attended seminar. More information about this seminar can be found here http://www.ksla.se/aktivitet/ratten-att-aga-och-bruka-sin-mark/	2018-05-31

Consultation A with stakeholders on Economic valuation methods

For the Greater Copenhagen case the questionnaire for consultation A got four responses on the online platform These stakeholders are 1 technical expert from local planning authority in Malmö, Sweden. 1 technical expert from regional planning authority in Region Skåne, Sweden.

1 technical expert from local planning authority in Copenhagen, Denmark. 1 technical expert from national planning authority, Denmark.

In addition to these four responses the research team included the questions for the Consultation A during the 2 face to face interviews in Copenhagen 2018-04-20. The interviewed stakeholders are 1 respondent from the national planning authority Ehrversstyrelsen (the Business authority) whom are a key planner in regional planning and 1 person from the civil society organisation Friluftsrådet.

Consultation B with stakeholders on GI distribution in physical sense

For the Greater Copenhagen case the questionnaire for consultation B got one response on the online platform. This respondent is a technical expert from local planning authority in Malmö, Sweden.

In addition to this response the team got feedback on the information pack maps and questionnaire via email and phone calls from 1 technical expert from national planning authority in Denmark.

Consultation C with stakeholders- on policy and planning for GI in region

For the Greater Copenhagen case the questionnaire for consultation C got one response on the online platform. The online questionnaire about GI policy and planning for National Policy Factsheets got 5 responses (2 for Denmark and 3 for Sweden). These respondents are all listed in the above table. In addition to this the research team included similar questions for the Consultation A during 5 interviews (see Annex 4 below).

Interviews and site visits logbook

Denmark

Interview with 1 technical expert at national planning authority Ehrversstyrelsen (the Business authority) whom are a key planner in regional planning via phone call 2018-03-07, face to face meeting at the repondents work place in Copenhagen 2018-04-20, and follow up via phone calls and email correspondence during May and August 2018.

Interview with 1 former decision maker and technical expert for Danish part of the region via face to face meeting at the researchers work place in Stockholm 2018-02-15 and follow up via phone call 2018-02-28.

Interview with 1 civil society organisation via face to face meeting at the repondents work place in Copenhagen 2018-04-20, and email correspondence during April 2018.

Sweden

Phone interview with 1 technical expert at regional planning authority in Scania 2018-02-14, and follow up email correspondence during March 2018.

Phone interview with 1 technical expert at local authority Malmö, one of the municipalities in Scania 2018-04-27.

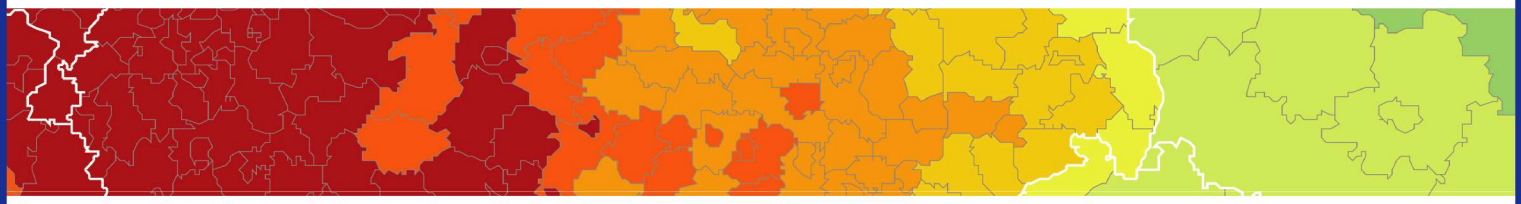
Active attendance at seminar on land owners rights to land 2018-05-31 arranged by Royal Swedish Academy of Forest and Agriculture. During this seminar around 98 persons (private land and business owners, representatives from public authrorites, politicans, civili society organisations and research) discussed themes important for GI implementation: laws and regulations, compensation for nature biotope protections, and the balance between public and private interests on lands in Sweden. More information about this seminar can be found here http://www.ksla.se/aktivitet/ratten-att-aga-och-bruka-sin-mark/

Field visits in Greater Copenhagen was done 2018-04-18 – 2018-04-20

References

- Altinget, 2018a; https://www.altinget.dk/miljoe/artikel/kommuner-fingerplanens-groenne-krav-er-for-strikse
- Altinget, 2018b: https://www.altinget.dk/miljoe/artikel/naturfredningsforening-og-friluftsraadet-hovedstadens-natur-er-truet
- Andersson, Therese; Åhnberg, Moa; Sellers, Inger; Hellsten, Johanna; Sörvik, Veronika; Utzon-Frank, Tine (2013). Strategies for the polycentric Skåne. Structural picture of Skåne. Department for Planning and Development, Region Skåne.
- Blomberg, Per; Åhnberg, Moa; Sellers, Inger; Andersson, Therese; Hellsten, Johanna; Sörvik, Johanna; Utzon-Frank, Tine (2012). Grönstruktur i Skåne – Strategier för en utvecklad grön struktur. Avdelningen för regional utveckling, Region Skåne.
- Däckfors, J. , Mårtensson S. and Melin, M. (2011). Öresundsmodellen en förebild i Europa. pp.26-27 in Gränsöverskridande samarbeten i Norden - 11 projekt som har förändrat sin region. Nordregio och Nordiska ministerrådet. http://www.nordregio.org/wp-content/uploads/2018/02/11-projekt_sve.pdf, accessed 2018-10-03
- Ehrvervsstyrelsen (2017) ”Fingerplan 2017 Landsplandirektiv for hovedstadsområdets planlægning”. Planlægning og Byudvikling. https://planinfo.erhvervsstyrelsen.dk/fingerplan-2017
- Ehrvervsstyrelsen (2019) ”Fingerplan 2019 Landsplandirektiv for hovedstadsområdets planlægning” https://planinfo.erhvervsstyrelsen.dk/sites/default/files/media/publikation/fingerplan_2019.pdf
- European Commission. (2013). Decision No. 1386/2013/EU of the European Parliament and of the Council of 20 November 2013 on a General Union Environment Action Programme to 2020 ‘Living well, within the limits of our planet’. Retrieved from: http://eur-lex.europa.eu/legal-content/EN/TXT/ PDF/?uri=CELEX:32013D1386&from=EN.
- Eurostat (2018a). Unemployment rates by sex, age, citizenship and degree of urbanisation [lfst_r_lfur2ganu] Last update: 04-10-2018
- Eurostat (2018b). Self-perceived health by sex, age and degree of urbanisation [hlth_silc_18] Last update: 08-10-2018
- Eurostat (2018c) Area by NUTS 3 region [demo_r_d3area] Last update: 25-09-2018
- Eurostat (2015). Statistics on commuting pattern on regional level. https://ec.europa.eu/eurostat/statistics-explained/index.php/Statistics_on_commuting_patterns_at_regional_level#undefined, accessed 2018-10-03
- Fertner, Christian; Jørgensen, Gertrud; Nielsen, Thomas Alexander Sick (2011). Land use scenarios for greater Copenhagen – modelling the impact of the Fingerplan. Working paper no. 59/2011, Forest & Landscape, University of Copenhagen.
- Financial Times (2018). fDi European Cities and Regions of the Future 2018/19. With Europe in flux, which regions have investement potential fror the long haul? Published February/March 2018. http://redit.skane.com/sites/default/files/media/document/fdi_european_cities_and_regions_of_the_future_2018_19.pdf
- Greater Copenhagen Committees homepage (2018) *http://www.greatercph.com/about, accessed 2018-10-03*
- Greater Copenhagen Investments (2018) Homepage http://www.investcph.com/projects/development, accessed 2018-10-03
- Hasselgren, B. and Lundgren, A. (2016) Gränsöverskridande transportplanering i Norden. Utvärdering av det nordiska samarbetet kring transporter och transportinfrastruktur.

Nordiska rådet. https://norden.diva-portal.org/smash/get/diva2:952678/FULLTEXT03.pdf, accessed 2018-10-03
- Klimatilpasning af GF Kløverbladet (2018) https://arcg.is/1amOP0
- Länsstyrelsen Skåne (2018). Regional handlingsplan för grön infrastruktur. Arbetsmaterial från Miljöavdelningen. https://www.lansstyrelsen.se/download/18.2e0f9f621636c84402715632/1527599075895/Nulagesbeskrivning_av_Skanes_grona_infrastruktur_v.2.pdf
- Nordmap (2018). http://nordmap.se/
- Region Skåne, Avdelningen för samhällsplanering (2013) Strategier för det flerkärniga Skåne. www.skane.se/strukturbild
- Region Skåne, Avdelningen för regional utveckling (2012) Grönstruktur i Skåne – Strategier för en utvecklad grön struktur. https://utveckling.skane.se/siteassets/publikationer_dokument/gronstruktur_i_skane.pdf
- SALAR (2018) Data sent via personal communication with Peter Sjöquist 2018-10-16.
- State of the Nordic Region (2018). Edited by Grunfelder, J., Rispling, L. and Norlén, G. Nordic Council of Ministers.
- Statistics Denmark (2018). REGK31: KOMMUNALE REGNSKABER (1000 KR.) EFTER OMRÅDE, FUNKTION, DRANST OG ART. http://statistikbanken.dk/regk31, accessed 2018-10-16. Via personal communication with Kevin Vejrup.
- Statistics Denmark (2017a). Population at the first day of the quarter by citizenship, time, age, sex and region.
- Statistics Denmark (2017b). Area 1. January by time and region
- Statistics Sweden (2018). Data sent via personal communication with Jacob Pelgander 2018-10-16.
- Statistics Sweden (2017a). Population 1 November by region, age, year and sex.
- Statistics Sweden (2017b) Population density per sq. km by region, observations, year and sex.
- Swedish National Board of Housing, Building and Planning (2018). https://www.boverket.se/sv/PBL-kunskapsbanken/teman/ekosystemtjanster/verktyg/gronytefaktor/kvartersmark/ and https://www.boverket.se/sv/PBL-kunskapsbanken/teman/ekosystemtjanster/
- Sydsvenskan (2014). https://www.sydsvenskan.se/2014-05-06/den-nya-strategi-vi-presenterar-idag-copenhagen-malmo-2025-kan-losa-regionens-
- Vejre, Henrik (2017). Et århundrede med planlægning af grønne områder i Storkøbenhavn. Kraks Fond Byforskning, København.
- Öresunddirekt homepage (2018) https://www.oresunddirekt.com/, accessed 2018-10-03



ESPON 2020 – More information

ESPON EGTC
4 rue Erasme, L-1468 Luxembourg - Grand Duchy of Luxembourg
Phone: +352 20 600 280
Email: **info@espon.eu**
www.espon.eu, **Twitter**, **LinkedIn**, **YouTube**

The ESPON EGTC is the Single Beneficiary of the ESPON 2020 Cooperation Programme. The Single Operation within the programme is implemented by the ESPON EGTC and co-financed by the European Regional Development Fund, the EU Member States and the Partner States, Iceland, Liechtenstein, Norway and Switzerland.