SiEUGreen
Sino-European innovative green and smart cities

Sino-European Innovative Green and Smart Cities

Deliverable 1.1

Maps of quantitative and qualitative data for each of the showcase locations - Synthesis report

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The project has received funding from the European Union's Horizon 2020 Research, and Innovation programme, under grant Agreement N 774233 and from the Chinese Ministry of Science and Technology.

Throughout SiEUGreen's implementation, EU and China will share technologies and experiences, thus contributing to the future developments of urban agriculture and urban resilience in both continents.

The project SiEUGreen aspires to enhance the EU-China cooperation in promoting urban agriculture for food security, resource efficiency and smart, resilient cities.

The project contributes to the preparation, deployment and evaluation of showcases in 5 selected European and Chinese urban and peri-urban areas: a previous hospital site in Norway, community gardens in Denmark, previously unused municipal areas with dense refugee population in Turkey, big urban community farms in Beijing and new green urban development in Changsha Central China.

A sustainable business model allowing SiEUGreen to live beyond the project period is planned by joining forces of private investors, governmental policy makers, communities of citizens, academia and technology providers.

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[1] **PU** = Public
PP = Restricted to other programme participants (including the Commission Services)
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Executive Summary

This report presents a synthesis of the maps of quantitative and qualitative data for each of the SiEUGreen showcase locations and outlines a preliminary data collection strategy for the remainder of the SiEUGreen project. It is based on the reports provided by the case study expert for each showcase (Annex 1, 2, 3, 4 & 5), considered in the context of contemporary thinking about urban agriculture (UA) in developed countries. The report is presented in three parts:

- **Part 1** provides an overview of the European and Chinese showcases and outlines the methodology used.
- **Part 2** is the most substantial component and focuses on the four central concepts of the SiEUGreen project - land use, food security, resource efficiency and societal inclusion. It synthesizes data from the case study reports, incorporating academic literature as relevant. Comparative national-level data is also presented for food security and resource efficiency. The analysis is structured around the expected impacts set out in the project proposal, as relevant to each pillar.
- **Part 3** provides a concise summary of the findings from the maps of quantitative and qualitative data for each of the showcase locations before laying out a preliminary data collection strategy to inform the work undertaken in WP1 for the remainder of the SiEUGreen project.

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Part 1. Introduction & Methodology

The showcases

The following sections give a brief explanation about the five SiEUGreen showcases. Three of them are located in Europe (Denmark, Norway and Turkey) and two in China.

The European showcases

The European showcases consist of Aarhus (Denmark), Hatay (Turkey) and Fredrikstad (Norway).

Taste Aarhus

Situated in the Central Denmark Region (Midtjylland), Aarhus is known for its bottom-up initiatives involving UA. The '**Taste Aarhus'** [1] program has been a key driver of the implementation of more than 300 UA initiatives around the city. The program is managed by Aarhus Municipality partially through self-funding (€1 million) and partially through funding provided by Nordea Bank (€1 million, 2015-2018). The main question the program address is '**How can cities create more socially inclusive places and communities when focusing on edible nature and urban farming?**' Taste Aarhus uses urban gardening as a tool to bring people together, activate underutilised spaces around the city and engage people in the practice of growing their own food. Image 1 shows the Green Embassy, which is the headquarters of the Taste Aarhus project, where people can get information about how to start growing food and also about the edible resources in the city.

The SiEUGreen project will sustain and enrich the UA activities in "Taste Aarhus" Program and technical provision. UA-related technologies will be implemented in the Aarhus showcase, including mobile gardens, dry toilet and polytunnels.

[1] http://smagpaaaarhus.dk/

Image 1: The Green Embassy
Source: Aarhus Kommune

Hatay showcase

Hatay is Turkey's seventh-most densely populated province and is located in the southern part of the country. The proximity of Hatay Province to the Syrian border has had a strong influence on population development in recent years, leading to a sharp increase in the number of inhabitants, particularly in border municipalities. The rapidly increasing population places a burden on the Hatay's economy, which largely depends on agriculture. The SiEUGreen project will support Hatay to access to new UA-related technology and knowledge, with the aim of creating job opportunities, increasing food production and resource efficiency.

Currently, the Women's cooperative is the most prominent UA initiative in the region. This cooperative has 250 members that grow food in their backyards (see Image 2).

The SiEUGreen project will support two projects within Hatay Province - the construction of a greenhouse on the Kisecik Expo Zone in the urban fringe of Antakya, the capital of the region, as a demo and pilot case; and the 'Women's Cooperative' (Ureten Eller) initiative.

Image 2: The Women's Cooperative, Hatay Province

Cicignon Park, Fredrikstad

Cicignon Park in Fredrikstad is a showcase for retrofitting and transforming a former hospital complex into a residential and commercial area, called Cicignon Park. The hospital - Østfold Hospital, located in downtown Fredrikstad, has a property portfolio of 55 000 m^2 and a plot area of 35 000 m^2. In December 2014, Nordic Group Development AS bought the hospital and construction of Cicignon Park was expected to commence in April 2018. The private developer's visions for Cicignon Park are (1) high environmental profile, (2) high architectural quality, and (3) high level of satisfaction on a European scale. Significant internal and external resources have already been devoted to study the opportunities, challenges and resources needed for the realisation of these visions. The SiEUGreen project will support intensive testing of innovative UA-related technologies on site. Image 3 shows one of the proposals for the development of Cicignon Park.

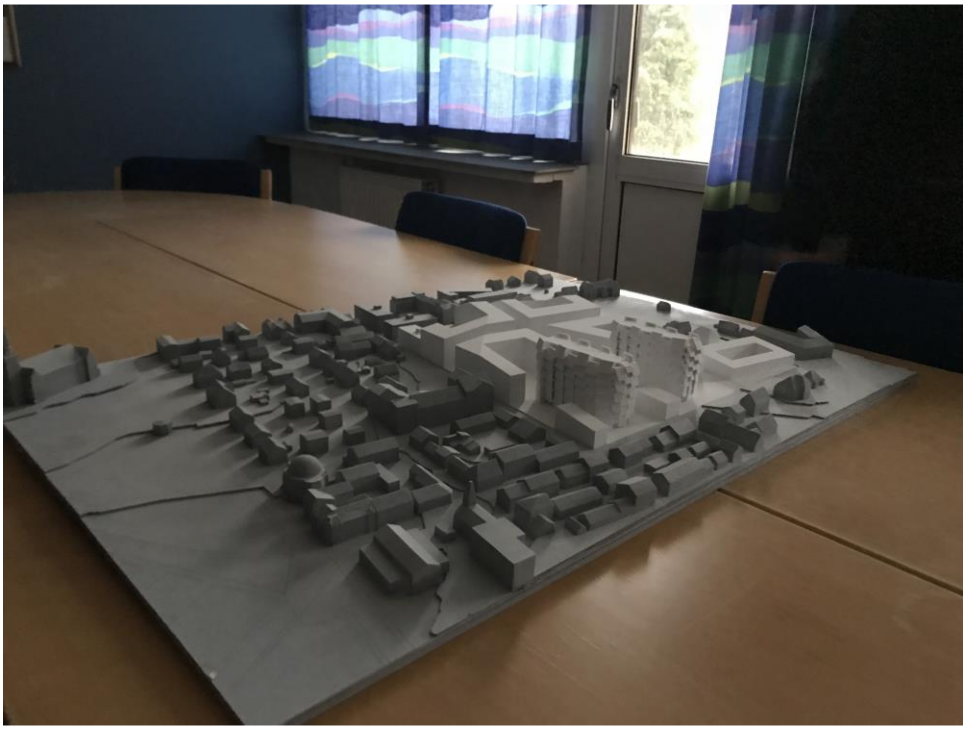

Image 3: Master plan model for Fredrikstad showcase

The Chinese showcases

There are two Chinese showcases, located in Beijing (Sanyuan Farm) and Changsha (Futiancangjun).

Sanyuan Farm, Beijing

Sanyuan Farm is located in Shangzhuang Road, Haidian District, Beijing, northwest of Beijing, about 30 kilometres from the centre of Beijing. Sanyuan Agriculture Co. Ltd. is a modern urban agriculture company under the Beijing Shounong Group. It was established in 2001 and began operating the Citizen Farm Project in 2008 as the first step from traditional agriculture to UA as a leisure activity. The public farms cover a total area of 105 hectares, with a total of more than 1,400 small plots. Image 4 illustrates the overall plan of the farm.

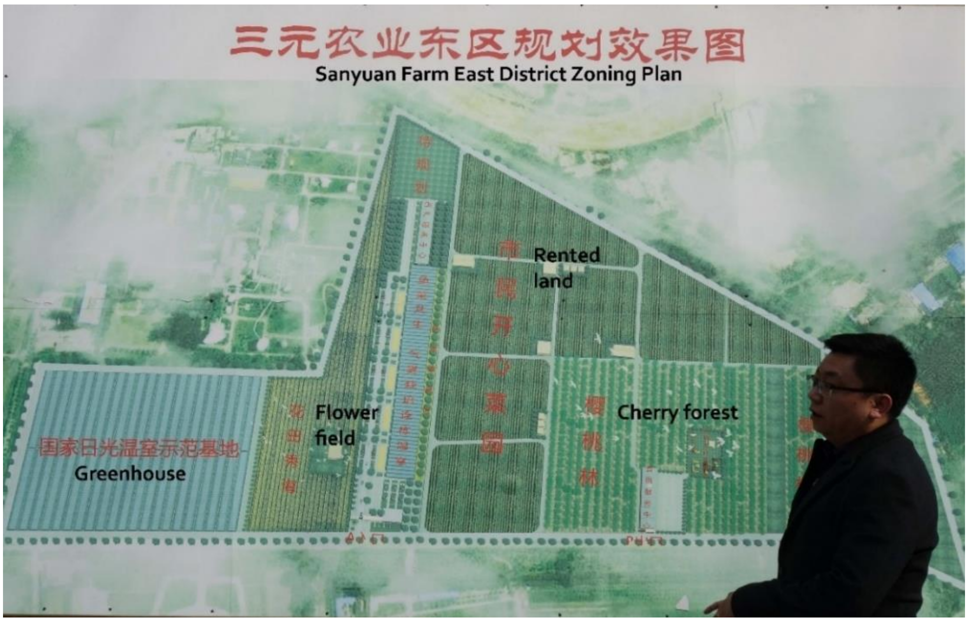

Image 4: Overall plan for Sanyuan Farm East District

The farms rent these plots to the public for an annual fee to meet the urban residents' pursuit of green, natural and environmental protection. Image 5 and Image 6 illustrate the two types of plots available for rent. Currently, around 1300 households are engaged in UA practices in this site.

At present, the farm’s two main activities are production and marketing of green agricultural products and education initiatives which promote farming culture. A greenhouse that showcases different technologies was implemented in 2012. Besides illustrating and providing consultancy to other companies on the potentialities of a soilless and hydroponic technology (see Image 7 and Image 8), the greenhouse also hosts school children, who learn about growing food. The farm also offers the opportunity for tourists to ‘pick’ the food cultivated in the site. Sanyuan Farm’s vision is to demonstrate resource-efficient UA and a healthy happy-life style.

Image 5: Plots of 50 m² of rented land

Image 6: Plots of 80m² of rented land

Image 7: Greenhouse - Sinyuan Farm

Image 8: Hydroponic and aquaponic technology - Sinyuan Farm

Futiancangjun, Changsha

Changsha is the capital of Hunan province, one of the most densely populated provinces in China. As such, it faces an enormous environmental challenge regarding food supply with long transport distance. The real estate project - Futiancangjun, approved by the Changsha Urban and Rural Planning Bureau and located in the Green Controlling Area of the city, will showcase SiEUGreen technologies. The development covers an area of 320 000 m^2 with a total construction area of 700 000 m^2. It consists of schools (kindergarten, primary school and junior school), apartments, mountain park and commercial buildings (see Figure 1and Figure 2). The entire development consists of 35 buildings with 16 to 18 floors each and around 100 apartments per building. This area will become home to 3500 families. Figure 1 illustrates the masterplan for the area with the identification of different phases of development. Phase I is almost completed and 935 apartments will be delivered on June 2019. Phase II is under construction and 1 200 apartments are expected to be delivered to the public in April 2020. Phase III has not started yet, but the remaining 1 000 residential units are planned to be finalised by January 2022.

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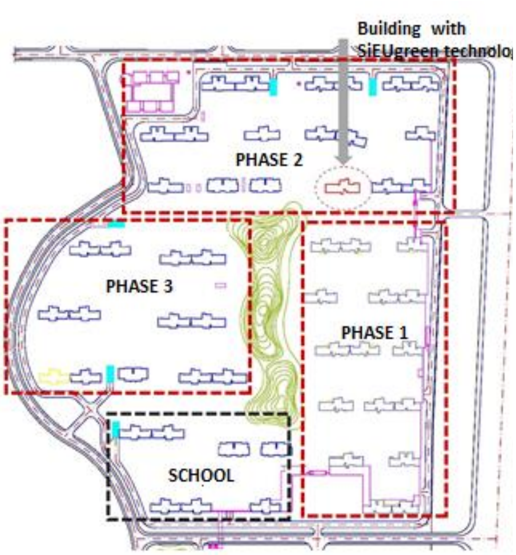

Figure 1: Master plan Futiancangjun

Figure 2: Aerial view of Futiancangjun
Source: Hunan Hengkai Environmental Protection Science & Technology Investment Co. Ltd (Hhepsti)

Technologies implemented through the SiEUGreen project will include recycling of urban sewage and wastewater, water-saving toilets, grey-water treatment, and balcony gardens with soilless cultivation technology, automatic detection of greenhouse temperature and light environment and remote intelligent control technology.

As Image 9 and Image 10 illustrate all the buildings are similar and offer apartments with build-up areas of 70, 100, 120 and 180 m^2..

As Figure 1 shows, SiEUGreen technologies will be implemented in one of the buildings. Some of the toilets will be equipped with technology that lowers the water flow for flushing. This technology will showcase alternative ways of waste treatment and eventually recycled into fertilizers for UA. This building is already under construction and can be seen in Image 10. In relation to UA, 100 devices that enable grow food in balconies will be offered free of charge to residents who want to grow part of their food intake.

This development has ambitious goals of going beyond traditional farming and contributing to producing food locally in an environmentally friendly manner (e.g. zero transport). These goals, however, seem quite difficult to be reached given the scale of the development (build-up area and populational density).

Image 9: Model of Futiancangjun project

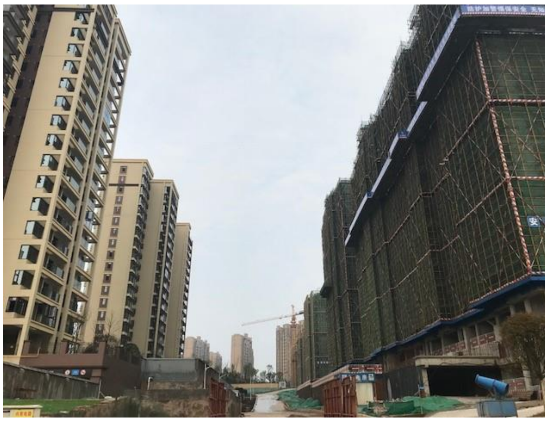

Image 10: Phase I and phase II (in construction)

Having briefly described the SiEUGreen showcases, the section that follows discusses worldwide perspectives on UA and further provides a short overview of how UA is addressed in political and planning systems in the EU and China.

Methodology

The remainder of this report presents a synthesis of the findings of the SiEUGreen case study reports, structured around the four pillars of central interest in the SiEUGreen project: land use; food security; resource efficiency and societal inclusion. These reports were prepared by the research institute responsible for each showcase based on a work plan provided by Nordregio, the work package leader.

In regard to authorship of the study cases reports, Nordregio is responsible for the case study reports of Aarhus and Hatay. Both municipalities – Aarhus and Hatay – provided substantial information to these reports. NMBU and NIBIO are responsible for the case study report of Fredrikstad. CASS is responsible for the case study reports of Beijing and Changsha, the latter had a substantial contribution of Hunan Hengkai.

The work plan prepared by Nordregio was structured by developing goals related to each pillar based on the impact areas identified in the SiEUGreen project proposal. This process is further articulated in the introduction to each pillar and a refined list of the goals is presented in Part 3 of this report. An overview of the data collection methods used in each report is presented in Table 1.

Table 1: Data collection methods for case study reports

Showcase	Desktop research	Interviews	Field study
Aarhus (Nordregio with support from Aarhus Municipality)	- Opendata.dk - Plansystem.dk - Statistics Denmark - Relevant regional and municipal plans - Taste Aarhus website	- 2 x municipal planners - Taste Aarhus Project Manager	- 2 days field trip to Aarhus including visits to 10 gardens
Fredrikstad (NIBIO & NMBU)	- Statistics Norway - Relevant regional and municipal plans - Academic sources and grey literature		- Nordregio introductory visit to the site
Hatay (Nordregio with support from Hatay Municipality)	- Turkish Statistical Institute - Eastern Mediterranean Development Agency (DOĞAKA) - Relevant regional and municipal plans	- Faculty Member in Hatay Mustafa Kemal University, City and Regional Planning Department - Head of the directorate of	- Not possible due to safety concerns

	- Ministry of Food, Agriculture and Livestock	construction affairs in Hatay Municipality - The initiator of the "Ureten Eller Women's Cooperative" in Hatay - Members of the Women's Cooperative - Food engineer, Hatay Municipality	
Sanyuan Farm, Beijing (CASS)	- Academic papers - Research reports - Public data - Statistical yearbooks	- Community residents - Community managers - Event organizer	- Visit Laiyuan, Sanyuan Farm, and urban communities to learn about the promotion of UA. - The Chinese partners visited Oslo in August 29, 2019. This visit was important to investigate the development of UA within the city and realise about the similarities and differences between the Norwegian and Chinese context. - September 20, 2019, Beijing Green Valley Company, understand the process of paper growing vegetables. - September 30-October 1, 2019, Wuyuan County, Hebei Province, Visit to the poor community to explore UA. - October 5, 2019 Visit to the community in downtown Beijing, to understand the promotion of UA in the residential community of the central area of the big city
Futiancangjun, Changsha (CASS)	- Academic papers - Research reports - Public data - Statistical yearbooks	- The company responsible for Chasha showcase—Hunan Hengkai	- Hunan Hengkai visits the site of Futiancangjun quite often as the company is also located in Changsha and plays a substantial role in the development.

As the table shows, data collection methods varied for each of the showcase locations. One major limitation, was the inability to visit the Hatay showcase due to security threats within the region. This was addressed by seeking support from Hatay Municipality in identifying informants that could be interviewed via phone / Skype. In addition, a Turkish speaker with a background in urban planning was employed to both facilitate these interviews and to source and review data and reports not available in English. All participant engagement and data management was conducted in line with SiEUGreen requirements.[2]

Alongside the data from the case study reports, this synthesis report also presents national-level data on food security and resource efficiency for all SiEUGreen showcase countries. The food security data is from the Food and Agriculture Organisation of the United Nations (FAO-UN, 2017). The resource efficiency indicators are mainly based on the European Green City Index (Economist Intelligence Unit & Siemens, 2009), and the EU Resource Efficiency Scoreboard from the European Commission (Eurostat 2016).

A preliminary literature review was conducted to gain a broad understanding of the four pillars in the context of UA and inform the work plan provided to the case study experts. A small sample of this literature is included in this synthesis report to provide context for the empirical material. This literature will be revisited and explored in greater depth for the development of the typology in Deliverable 1.2. Key search terms used in the literature searches can be found in Table 2. In order to capture the full range of academic and grey literature, searches were conducted through academic databases (e.g. Scopus), Google Scholar and Google.

Table 2: Key search terms for a literature review

Research field	Key search terms
Urban agriculture	urban agriculture, urban farming, resilient cities, urban sustainability, urbanisation
Land use	Urban land for agriculture, land security for urban agriculture, including urban agriculture in urban planning
Food security	urban agriculture, food security, food safety, food sovereignty, Europe, global north, developed countries, indicator*, measure*
Resource efficiency	environmental impact, circular economy, waste & wastewater management, green growth, material flow, city metabolism system

[2] D8.1 H – Requirement No. 1; D8.2 H – Requirement No. 2, D8.3 H – Requirement No. 3, D8.4 H – Requirement No. 4 and D8.5 H – Requirement No. 5. from the Work Package 7. 8.1. Identifying/Recruitment of research participants; 8.2. Informed consent procedures for communicating with humans; 8.3 Information sheet and consent forms for stakeholder engagement; 8.4. Data protection requirements for non-European countries; 8.5. Procedures for storage and sharing of data (Personal data)

Societal inclusion	urban agriculture, soci* inclusion, social, indicator*, measure*, Europe

Part 2. The pillars of urban agriculture

Module 1 LAND USE

The land is one of the greatest constraints to the sustainable development of UA. Growing urbanization increases the demand for food, but at the same time, areas suitable for agriculture are diminishing since the need for housing, services and industries is also increasing. As the claim for non-agricultural use grows, land values rise making it even more difficult to access land for agriculture in cities. Thus, competition for land, land availability and security of land lies at the core of debates related to UA (Mubvam & Mushamba, 2006).

From this starting point, this module explores the main issues surrounding the use of urban land for agriculture in the SiEUGreen showcases. It begins by sketching a model through which to explore some of the issues related to using of urban land for agriculture. It then goes on to identify some goals that arise by relating this model to the impacts expected to be attained within the SiEUGreen project. These goals are then used as a framework through which to discuss the different SiEUGreen showcases.

Understanding the use of land for urban agriculture – a basic model

The SiEUGreen project proposal explains that land use for UA will be discussed in relation to institutional, spatial and functional dimensions. Inspired by the work of Mougeot (2000), which describes and discusses UA in relation to urban development, these dimensions – spatial, functional and institutional – are understood as a means to describing how UA could take place in cities in terms of location, mode of occupation of the land and also the legal aspects that regulate land use. These dimensions are explained below:

- **Institutional:** includes the legal aspects of land use exploring questions such as: How land is planned, regulated and used. These aspects thereby touch upon *official and non-official land use for UA.* Besides the legal framework, the political climate is also relevant (e.g. how do governments address or overlook UA in policies?).
- **Spatial:** is related to the location of sites for UA. It can be specified in terms of peri-urban and intra-urban agriculture.

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- *Peri-urban agriculture* takes place in the fringe of cities in less densely populated areas. In this case, more extensive areas are likely to be available for agriculture since the land price might be lower.
- *Intra-urban agriculture* refers to practices of UA within the built environment of the city and as such, takes place in more densely populated areas.

- **Functional:** addresses how land (peri-urban, intra-urban) is used for agriculture. For example, if the cultivation takes place on-plot, off plot (pallets). Functional aspects do not refer only to land, as such, since they also include the potential of the built environment to embrace agriculture (i.e. vertical agriculture – in facades, rooftops, balconies, etc.).

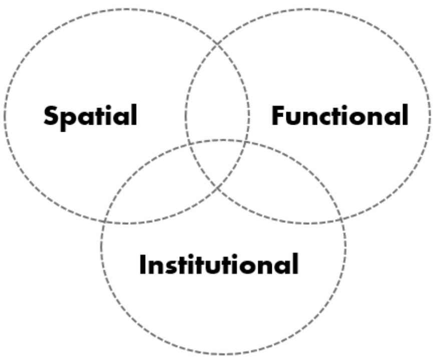

Figure 3: Interrelations between the land-use dimensions

As Figure 3 suggests, these dimensions are interrelated. For example, the land regulations, programs and strategies (institutional) certainly influence the availability of urban land for agriculture (spatial), which also affects how agriculture is performed. For example, the use of pallets for growing food in balconies is a common way of performing agriculture in densely populated urban areas.

These dimensions were used to describe land issues in the SiEUGreen showcases. Nevertheless, while the dimensions above describe the use of urban land for agriculture (How is UA regulated? Where is UA located? and How is UA performed/done?), other aspects, related to particularities of the urban environment in which the UA takes place are also of relevance. Here these aspects are called 'contextual factors' and they can be associated with spatial, economic and cultural aspects that intervene in the production/reproduction of urban areas. Table 3 describes the contextual factors shaping the availability of land for UA.

Table 3: Contextual factors shaping land availability for UA

CONTEXTUAL	SPATIAL	**Availability:** indicates the location of available land for agriculture.
		Accessibility: regards to the distance to reach areas for agriculture.
		Suitability: indicates the aptness of the land for agriculture. May include aspects related to fertility, availability of other resources, such as water, energy, etc.

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	ECONOMIC	**Ownership / lease:** regards to the tenure of land (e.g. public, private, semi-public) and agreements about the use of land for UA (e.g. rental, concession)
		Affordability: addresses to the monetary value of land
	CULTURE	**Lifestyles:** regards to sustainability trends incorporated in an individuals' daily lives (e.g. consumption of organic products)
		Traditions: acknowledges stable values that might be carried out from one generation to another.

The contextual factors and their respective indicators/measures are thus connected to the dimensions of UA. As Figure 4 suggests, the UA dimensions are embedded in the context of the city, which influences how UA is performed.

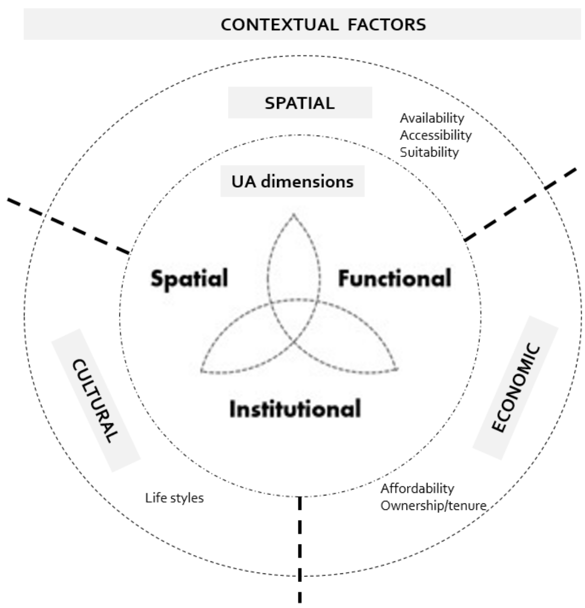

Figure 4: Use of urban land for agriculture: a framework for analysis

This model is the first attempt to systematize the description of UA while identifying aspects of influence. It will be further developed as part of the process of building up a typology for UA in the SiEUGreen Deliverable 1.2.

With the aim of identifying the indicators needed to provide a fair description of showcases, the five SiEUGreen impacts areas highlighted in the project proposal, have been interpreted through the lens of land use. Table 4 lists these impacts and their relationship with the three dimensions of land use outlined above (spatial, functional and institutional).

Table 4: SiEUGreen impacts as related to land use dimensions

	Land use dimensions		
SiEUGreen Impact areas	**Spatial**	**Functional**	**Institutional**
1. Creation of **shorter supply chains** for safe, high-quality food and other horticultural products that reduce European and Chinese cities' ecological footprint by limiting losses and energy in transport and contribute to their food security			secure urban land for agriculture in local planning
2. Resource-efficient low-carbon urban farming systems that: consume low amounts of water, energy, fertilisers, pesticides and space; use waste heat, CO2, waste and rainwater and other waste or by-products from urban source, contributing to the development of the **circular economy (C-E)**; minimise environmental impacts	land availability /accessibility	land efficiency	
3. Improved knowledge of various business models for urban farming, including a thorough understanding of their **potential for development,** performance and impact on urban food systems in economic, environmental and social terms, and success factors or reasons for failures	identify land use conflicts	identify land use conflicts	identify land use conflicts
4. Increased cooperation at the international level, in particular involving exchanges of knowledge and best practices between the EU and China.	Not applicable	Not applicable	Not applicable
5. In the longer term, the results should contribute to a more **sustainable and resilient urban development**, in particular via the provision of ecosystem services (e.g. reduced air pollution, better water retention thus limiting floods, biodiversity, carbon sinks, recreation, greener urban landscapes), social cohesion and jobs creation.	availability of land for UA in cities	create greener urban landscapes through UA	include UA in city development plans

From the analysis of the table, four goals related to the use of urban land for agriculture were identified:

a. Secure land for UA
b. Increase land efficiency for UA
c. Identifying the potential and hindrances for UA
d. Create greener urban landscapes – securing political and institutional support & monitoring

Secure land for UA – institutional aspects

Before addressing issues related to securing land for UA, it is important to characterise the land cover profile of the different showcases. Aarhus Municipality is made up of approximately 35% urbanised areas and 65% other land uses, including green open spaces (Olafsson et al. 2015). The land cover has changed in the last decades with an increase in urbanised areas, forest and water and a decrease in agricultural land. The replacement of agricultural for forest areas in the fringe of the city was a strategy to cease the use of pesticide and other pollutants and thereby safeguarding groundwater. Between 2009 and 2012, 3.2 km^2 of land, most of which previously used for agriculture was afforested. According to the Afforestation Plan 2009-2012, 32 km^2 of new forest areas will be implemented by 2030 (Olafsson et al. 2015).

In comparison to Aarhus, the proportion of urban areas in Hatay is much smaller with only 9.5% urban areas, 39% agricultural areas, 38.5% forest areas, 12.5% coastline. The larger proportion of agricultural areas in relation to the other land uses mirrors the importance of agriculture in the economy of the region.

In Fredrikstad, most of the area of the municipality is covered by forest (around 147.43 km^2). Agriculture is the second most common land use, making up approximately 71.78 km^2 of land cover in the region, approximately half the area occupied by forests. Urban areas account for 33.35 km^2. As data from Agriculture and Forestry in Østfold (2017) shows, between 2000 and 2016 around 8% of the were converted to other land uses such as urban areas.

The Chinese showcases are quite different from the European showcases but also quite different from each other. Beijing covers 1 641 054 hectares and is made up of 16 municipal districts (September 2019). In 2016, cultivated land made up just 13 per cent (216 345 hectares) of Beijing's total land coverage. By the end of 2018, the resident population of Beijing was 21,542 million. Eighty-seven per cent of this population is considered urban and the population density is 1,313 people per square kilometre. In contrast, 84.7% of Changsha's total land area (1,181,946 hectares) is agricultural land (1,001,567 hectares). The resident population is 7 431 800 and the population density is 629 people per square kilometre. To put these numbers into context, the population density in Aarhus Municipality is around 700 people per square kilometre.

It is worth mentioning the substantial difference between the Nordic cases and the Turkish case in relation to the configuration of the urban areas. Aarhus and Fredrikstad are cities with a clear urban core and neighbourhoods. In contrast, considered in the European context, one could say that Hatay's configuration seems more like a region. Hatay includes 15 districts in which only four of them are regarded as urban areas. This difference must be kept in mind when addressing issues related to land security. As mentioned above, issues involving land security for UA are intertwined with many other aspects (e.g. land price, tenure). At this early stage of the project, the analysis of the institutional dimension of UA focuses on the planning systems of the three countries, highlighting if and how urban development plans address UA. Other aspects may be explored at a later stage.

The planning systems of all three European countries – Denmark, Turkey and Norway – follow a common hierarchy: national, regional and local. Despite this, they are quite different from each other, regarding the mechanisms that regulate the linkages between these levels. It is possible, however, to identify similarities between the Danish and the Norwegian planning systems.

In the Nordic countries, the planning system is quite decentralised with substantial power concentrated at the local level at the expense of the regional level. In this political landscape, municipalities are the main body responsible for developing the comprehensive municipal plan, the central spatial planning instrument. This plan generally aims to promote regional and national goals, but municipalities have the autonomy to deliberate about many issues, as well as flexibility in the way they incorporate regional and national goals. The municipal plan includes the overall objectives for development, steers land use, and specifies planning regulations and guidelines for urban and rural land management. This plan also guides the development of detailed plans for specific parts of the city and includes peri-urban and nature management (e.g. water, forests) beyond the urban built-up area.

Another commonality between the Danish and Norwegian planning systems is that they acknowledge public participation as a vital step in the planning process. This means that any plan - no matter the administrative level (municipal, regional or national), should be published and given some time; usually eight weeks, for the public submit their opinions, objections or proposals before it becomes implemented.

The Turkish system, on the other hand, is quite centralised with the national level holding most of the power. The binding document for spatial development is the Environmental Plan which allocates land use (e.g. residential, industrial, agriculture, tourism) and transportation. This plan is informed and guided by different ministries such as Agriculture and Livestock, Science Industry and Technology, Environment and Urban Planning and Culture and Tourism. At the regional level, the Eastern Mediterranean Development Agency (DOĞAKA) is the main responsible authority for regional planning and development.

DOĞAKA is a semi-autonomous public body and primarily works to encourage economic and social development of the region, which includes Hatay and two other municipalities, Kahramanmaraş and Osmaniye. In this context, the municipal plan for Antakya, which is the capital of Hatay, is steered by the strategic planning objectives from DOĞAKA and by the environmental plan formulated at the national level by the different ministries. Municipal planners take part in the process as informers rather than decision-makers.

As in the Turkish context, the majority of the decision-making power within the Chinese planning system is concentrated at the national level. China's spatial planning system is divided into five levels: national, provincial, city-level, county, and township-level. The national land space master plan forms the basis for detailed planning and special planning at the other levels. This national policy provides a general outline for the protection, development, utilisation and restoration of land. It is organised by the Ministry of Natural Resources and relevant departments and issued by the Party Central Committee and the State Council. The provincial-level is responsible for guiding the detailed implementation of the national plan at the city and county levels. Plans are submitted to the State Council for approval after deliberation by the Standing Committee of the same level. The detailed planning is organized by the municipal and county-level natural resources departments and reported to the government at the same level for approval, mainly at the village level.

The Beijing Municipal Government has issued a master plan for land and space, combined with urban industrial development, land nature, and urban construction. Each district (Chaoyang District, Tongzhou District, etc.) prepares specific plans according to the guiding principles of the overall plan. UA is part of suburban agriculture or urban agriculture in Beijing's land space planning and has not received special support. The Changsha Municipal Government has issued a master plan for land and space, combined with urban industrial development, land nature, and urban construction. Each district prepares specific plans according to the guiding principles of the national plan. UA is part of suburban agriculture or urban agriculture in Changsha's land space planning and has not received and special support.

In the European showcases, the visions stated in the planning documents of the different cities shed light on their priorities for development. Aarhus endeavours to become “a good city for all, where there is room for unfolding and diversity, and where we together help those who need it” (Aarhus Municipality, 2018). The municipal master plan of Fredrikstad, through social and spatial guidelines, strives for the vision of being “The small world city” (Fredrikstad Municipality, 2018). Hatay aims to ‘becom[e] a leader in agricultural production not only in Turkey but also in the Middle East” (Hatay Municipality, 2018: 15).

These visions, to some extent, mirror the role of UA in the different cases. Mediated by the Program Taste Aarhus, more than 300 UA initiatives have been flourishing in the City of Aarhus. Despite the success of this program and the green profile of Aarhus Municipality, reflected in the ambitious plans for afforestation, UA is not mentioned in the municipal plan. The head of the strategic planning of Aarhus planning department said that urban agriculture is interesting to activate the land and bring people together in the city, but it has not much to do with planning. In his words ' .. *when you plan, you plan for the future, not for the temporary (…)*'. His perspective unveils a clear divide between short term planning which, in this case, is driven by bottom-up UA initiatives and long-term planning that settles, among other aspects, land use regulations for urban development.

On the other hand, in Hatay, agriculture lies in the core of the policies for land use and is the driver for the economic growth of the region. One of the priorities stated in the regional plan (DOĞAKA) is enhancing the productivity of agriculture in the region. This directive has been taken into consideration in the environmental plan, which identifies and safeguard specific areas for agriculture. The use of sustainable agricultural methods, increasing efficiency in terms of time and process, improving quality of products and the living standards in rural areas while generating competitive prices are some of the aspects mentioned in the plan to attain the vision mentioned above. As the analysis of the environmental plan showed, a significant share of land in the region is secured for agriculture.

In Fredrikstad, the incorporation of UA to a large urban development goes in hand with the popularisation of UA in many cities around the world. A new and green development situated in the Fredrikstad seems to match the vision of becoming 'the small world city'.

Increase land efficiency for UA – spatial and functional aspects

As previously mentioned, land is crucial in the debate about agriculture within urban environments. It is worth noting that, 'efficiency' is not discussed in terms of how productive a piece of land shall be for agriculture but rather how the practice of agriculture in urban spaces can trigger social, environmental and economic efficiency of urban spaces.

The goal of increase land efficiency for UA addresses the question: Where and how UA is performed in the different SiEUGreen showcases? Answering this question implies acknowledging the spatial and functional dimensions of UA. Given the impossibility to fully explore these aspects, at this stage of development of the project, the analysis focuses on accessibility (where the land for UA is located?) and tenure (who owns the land?).

Aarhus is undoubtedly a 'lab' for urban agriculture with peri-urban and intra-urban agriculture implemented extensively in the municipality. Urban agriculture in Aarhus takes place in public, private, semi-private (e.g. between buildings) and restricted access areas (e.g. hospitals, schools, associations). Based on the different applications of UA in the case of Taste Aarhus, draft typologies were developed to describe the use of land within the dense parts of the city (intra-urban) for agriculture. These types - transitional, leftover and between buildings - were useful for understanding the diversity of the practices while helping to draw some considerations about the ownership and leasing of land for UA.

As mentioned above, the concession to use public land for agriculture in cities is a common practice in Aarhus. The use of private land for UA purposes was observed in two UA initiatives: one located in peri-urban areas (Brabrand) and other located close to the city centre (Ø-Haven). The land tenure in both cases is a source of uncertainty about the long-term use of land for agriculture purposes. The land that hosts the peri-urban initiative is out in the market for selling and the displacement of 100 families who grow food is probable. A similar scenario is seen in the case of Ø-Haven, which is a construction site, in the centre of Aarhus. The development is almost concluded, and the threat of displacing the 300 people who currently grow food in the area might become a reality in the short term.

In Hatay, UA is mainly performed in peri-urban areas, and agriculture within urban spaces (intra-urban) is not significant in the region. According to a civil servant in Hatay Municipality who was interviewed for the project, intra-urban agriculture is not common in Hatay. This may be because UA has not gained popularity as it has in other cities around the world. The economy is based heavily on agriculture, with a large amount of land protected for farming in peri-urban and rural areas. The low density of urban centres in the region may also reinforce the association of agriculture to rural or peripheral urban areas. Informants also suggested that agriculture in urban areas is stigmatised and commonly related to low-income groups. In addition, at least some parts of the city have a dense urban structure with small plots, few green public areas and rather narrow streets. This configuration seems not to enhance the development of intra-urban agriculture. In relation to land tenure, both UA initiatives in Hatay are quite distinct from each other. Public land will be used to build the greenhouse in the urban fringe of Antakya. In contrast, the UA initiatives coordinated by the Women's

Cooperative are spread out in different provinces of the region. This cooperative is based on the use of private land for agriculture with on-plot cultivation.

In Fredrikstad, the Nordic Group Development AS is the owner of the .35 km^2 that hosts the Østfold Hospital located in a central area of Fredrikstad. The area was bought from the public sector in 2014, and, as described in the introduction, will become a large residential and commercial area. The development strives to achieve high environmental profile, and UA plays an important role. Regardless of how 'high environmental profile' is interpreted, this initiative differs considerably from a similar development example in Aarhus (Ø-Haven). In Cicignon Park, UA is used by a private stakeholder as a means to green the new development, meaning that the UA is expected to be incorporated into the lifetime of the project. In Ø-Haven, UA is basically a transitory activity. Interestingly, in the Aarhus example, incorporating UA as a transitory activity has led to a greening of the final design, which now plans to incorporate a green axis, making a permanent feature out of the gardens.

In China, UA includes suburban agriculture or urban agriculture. Urban agriculture is generally in the form of small balcony gardens (as planned for Changsha), and suburban agriculture is mainly in the form of citizen gardens or "farms" where land is divided into small plots and leased to urban residents (as in the Beijing showcase). The primary role of both types of UA is as a form of leisure, although they do also provide some agricultural products for urban residents. Notably, these models of UA do not rely on urban land in the same way as, for example, the Taste Aarhus program. At the same time, the accessibility of UA, as well as its capacity to contribute to the urban fabric, is likely to be affected by a scenario where land for UA must be privately owned or leased.

Identifying the potential and hindrances for UA

This goal is quite complex and difficult to fully understand at this initial point of development of SiEUGreen project. It involves many other aspects that could not yet be included in the analysis (e.g. demand / land price/ increased urbanization/ populational growth, migration to cities, etc.). As a starting point, Table 5 summarises some learnings related to potential and hindrances for the three European showcases.

Table 5: UA dimension summary for the SiEUGreen European showcases

	Aarhus	Hatay	Fredrikstad	Beijing	Changsha
Institutional	Public administration assists UA bottom-up	Public administration assists UA bottom-up initiatives	The private sector is the main stakeholder promoting UA	The local government supports Sanyuan Farm	The private sector is the main stakeholder promoting UA

	initiatives (Taste Aarhus)	(Women's cooperative)	in Cicignon Park		in Futiancangjun
	UA is not regarded in land use planning	Peri UA is included and prioritized in development plans	UA is not regarded in land use planning	UA in land use planning does not receive special support	UA in land use planning does not receive special support
Spatial / functional	Peri-urban and intra-urban agriculture	Peri-urban agriculture	Intra-urban agriculture	Peri-urban agriculture	Intra-urban agriculture
	Diverse forms of UA (leftover, transitory, in between buildings, circulation spaces). Green-houses, on-plot, off-plot (pallets)	Greenhouses	Use of different technical solutions for water, sanitation, stormwater and energy; Innovative greenhouse (special insulation); Green roof and green wall	Greenhouses	Use of different technical solutions for water, sanitation
	Public, private and semi-public land	Private land (women's cooperative) and public land (Kisecik greenhouse)	Private land (Cicignon Park)	Public land	Private land

Create greener landscapes – political and institutional support & monitoring for UA

This is a normative goal that implies the conditions of the entire urban system. In the context of the SiEUGreen project, some of the indicators that could be used to understand how UA performs are:

- Green areas per capita
- Percentage of sealed soil in the city: proxy of the ability of the urban system to cope with rainfall and the resilient capacity to recover from flooding
- Percentage of people living within 300m of public green urban areas (> 5000m^2) and public green urban areas of any size;
- New developments: the proportion of brownfield sites, densification in the inner-city or urban cores, green fields;
- Quality of green and blue areas: usability (people behaviour) and environmental qualities (healthy or unhealthy environments, e.g. exposed to pollution, etc.)

- Investments in green infrastructures (e.g. sustainable urban drainage, green rooftops, etc.).

Most of the indicators described above demand quite refined spatial data. The availability of this data will be further investigated in developing the typology for Deliverable 1.2.

Conclusions and recommendations

With regard to land use, the main lesson learnt from the different cases is that assumptions about UA cannot be taken for granted. For example, one can argue that the price of land should influence the availability of land for UA and therefore, areas with high value are unlikely to host urban agriculture. Nevertheless, this relationship does not apply to Cicignon Park, in which UA is expected to play an important role in the new urban development, which is located in the centre of Fredrikstad. Needless to say, that, this is influenced by the increasing popularisation of UA as a label for urban sustainability.

Further work needs to be done to better understand the use of urban land for agriculture in the showcases. Yet, we see great potential in the draft model presented in this chapter which is the first step towards a consistent framework that will allow a detailed description and fruitful 'conversation' between the different showcases. From this process, valuable lessons are expected to be learned, and knowledge exchanged.

Supplementary research on how land is planned, regulated and used is necessary and a thorough exploration of the official and non-official use of land for UA in the showcases. Spatial analysis can be useful to identify accessibility to green areas, percentage of sealed soil, as well as to make cross spatial examination combining data about official use of land (e.g. residential) *versus* land ownership *versus* land price. A careful exploration of land ownership and tenure might also reveal important aspects of the structure of the land in the showcases and municipal budgets allocated to UA can be a proxy about the willingness of public administration to incorporate agriculture into urban environments. Exploring these data may allow to draw a better picture of the potential and hindrances for UA as well as to understand how UA can help create greener landscapes. Still, it is worth to highlight that the feasibility of this examination is dependent on the availability and quality of data in the different showcases.

Module 2 FOOD SECURITY

The aim of this module was to address the question: How will food security be understood and measured throughout the SiEUGreen project? The starting point was to consider food security in the context of the expected impacts of the SiEUGreen project. This led to the identification of the following broad goals:

a. Increase food security in line with the measures provided by the Food and Agriculture Organisation of the United Nations
b. Increase access to high-quality food that is healthy, nutritious and contamination-free
c. Increase understanding of the contribution of UA to the urban food system

These goals made up the framework for data collection in each of the case study reports. This section of the synthesis report summarises these findings, considers them in the context of the existing literature and makes recommendations for how food security can be addressed in the SiEUGreen project going forward.

What is food security?

According to the Food and Agriculture Organisation of the United Nations (FAO-UN), '[f]ood security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life' (FAO-UN, 2006). Although food security is experienced at a household or individual level, the factors that contribute to it are complex and multi-scalar (Pérez-Escamilla & Segall-Corrêa 2008). As depicted in Figure 5, food security is influenced by the availability of food at both the global and national level, with the latter dependent on a country's ability to import and produce food. Even where access to food at the national level is good, households may still experience food insecurity due to inadequate household income.

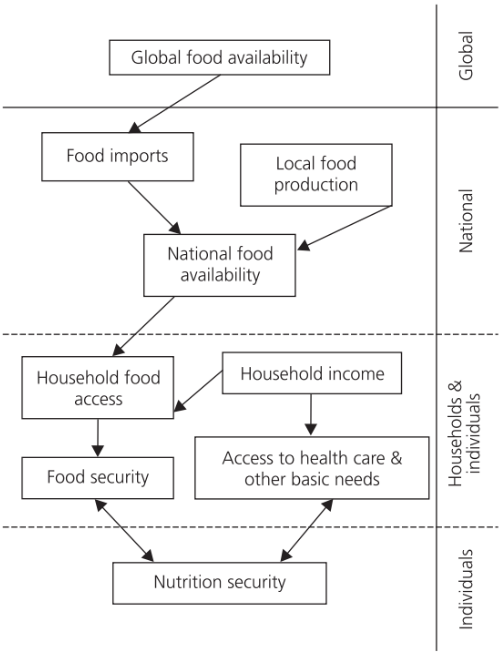

Figure 5. A multi-scalar perspective on food security.
Source: Pérez-Escamilla & Segall-Corrêa (2008)

The urban scale is a notable absence from Figure 5, perhaps a reflection of the long-standing neglect of the food system that has been evident in urban studies (Morgan, 2015). This has shifted recently, with increased interest in both urban food systems, and the role of UA within them (Morgan, 2015; Badami & Ramankutty, 2015). Despite this, there remains little in the way of consensus with regard to how the contributions of urban agriculture to urban food systems should be measured or even conceptualised (Badami & Ramankutty, 2015; Warren et al., 2015). Thus, although food security is a commonly cited benefit of UA, reliable evidence to support this claim is scarce (Badami & Ramankutty, 2015).

Increase food security in line with the measures provided by the FAO-UN

In the project proposal, the FAO-UN food security indicators were proposed as useful in evaluating the impact of the SiEUGreen project with respect to food security. These indicators (shown in Table 6) were chosen based on the recommendations of experts gathered in the Committee on World Food Security Round Table on Hunger Measurement in September 2011 and aimed to enable comparisons across regions and over time. They measure food security at the national level based on a range of indicators organised under four dimensions: availability, access, utilisation and stability. This section provides an overview of the available (national level) data for China, Denmark, Norway and Turkey, examining each dimension of the framework in turn and considering the four showcase countries in relation to each other as well as in a global context. Particular attention is paid to trends over time.

Table 6. UN FAO-UN Food security indicators

<table>
<tr><th colspan="2">FOOD AND AGRICULTURE ORGANISATION OF THE UN
FOOD SECURITY INDICATORS</th></tr>
<tr><td>AVAILABILITY
• Average dietary energy supply adequacy
• The average value of food production
• Share of dietary energy supply derived from cereals, roots and tubers
• Average protein supply
• The average supply of protein of animal origin</td><td>ACCESS
• Rail lines density
• Gross domestic product per capita (in purchasing power equivalent)
• Prevalence of undernourishment
• Prevalence of severe food insecurity in the total population
• Depth of the food deficit</td></tr>
<tr><td>STABILITY
• Cereal import dependency ratio
• Per cent of arable land equipped for irrigation
• Value of food imports over total merchandise exports
• Political stability and absence of violence/terrorism
• Per capita food production variability
• Per capita food supply variability</td><td>UTILISATION
• Access to improved water sources
• Access to improved sanitation facilities
• Percentage of children under 5 years of age affected by wasting
• Percentage of children under 5 years of age who are stunted
• Percentage of children under 5 years of age who are overweight
• Prevalence of obesity in the adult population (18 years and older)
• Prevalence of anaemia among women of reproductive age (15-49 years)
• Prevalence of exclusive breastfeeding among infants 0-5 months of age</td></tr>
<tr><td colspan="2">ADDITIONAL USEFUL STATISTICS
• Total population
• Number of people undernourished
• Number of severely food insecure people
• Minimum Dietary Energy Requirement (MDER)
• Average Dietary Energy Requirement (ADER)
• Coefficient of variation of the habitual caloric consumption distribution
• The skewness of habitual caloric consumption distribution
• Incidence of caloric losses at the retail distribution level
• Dietary Energy Supply (DES)
• Average fat supply</td></tr>
</table>

Availability

> *These indicators address the physical availability of food. This relates the supply of food (e.g. how much food is available) but also the quality of the available food.*

The first indicator in this group, **average dietary energy supply adequacy**, is shown in Figure 6 and expresses the actual energy supply (dietary energy supply) as a portion of recommended energy supply (average dietary energy requirement). In all SiEUGreen showcase countries, this number is (and has been since 1999) above 100 per cent and above the global average. Supply is highest in Turkey and lowest in China. Notably, the greatest increase has also occurred in

China, taking the country from being comparable to the global average in 1999-2001 to approximately 10 percentage points higher in 2014-2016.

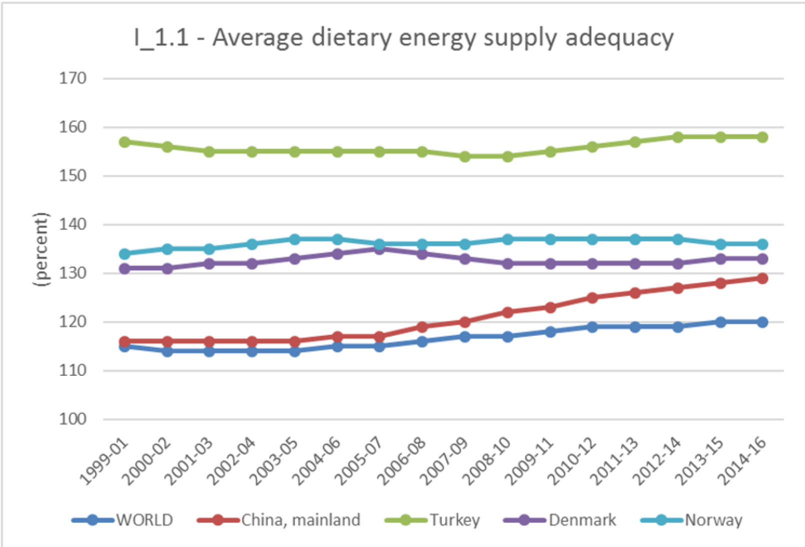

Figure 6: average dietary energy supply adequacy

With respect to **the average value of food production**, Denmark produces by far the highest value[3] (I$1080) in 2012-2014, followed by Turkey (I$480). China (I$371) falls just above the global average (I$309) and Norway just below (I$245). All showcase countries have been relatively stable on this indicator since 1999-2001 with the exception of a steady increase in China and a slight decrease in Norway.

The remaining three indicators in this category relate to the quality of diet based on the sources that make up the daily energy supply. For Norway and Denmark, these indicators have remained fairly stable over time, with the **average protein supply** well above the global average (G[4] = 80 gr/caput/day; DK = 133 gr/caput/day; NO = 150 gr/caput/day); and the **share of dietary energy supply derived from cereals, roots and tubers** substantially below the global average (G = 50%; DK = 28%; NO = 30%). In Turkey and China, greater change is evident, with the share of **dietary energy supply derived from cereals, roots and tubers** steadily decreasing (CN = -20%; TK = -18%), the **average protein supply** steadily increasing (CN = +22%; TK = +20%) between 1999-01 and 2014-16. This increase was even more marked with respect to the **average supply of proteins of animal origin** (CN = +32%; TK = +26%). Perhaps of greatest

[3] The indicator expresses the food net production value (in constant 2004-06 international dollars), as estimated by FAO and published by FAOSTAT, in per capita terms.
[4] G = Global

note is the steady decrease in the gap between the countries on these indicators. For example, Figure 7 shows that, while in 1999-01 the **average daily protein supply** of a person in Norway was almost double (92% greater) that of a person in China, by 2011-13, this figure had reduced by over one third (60% greater).

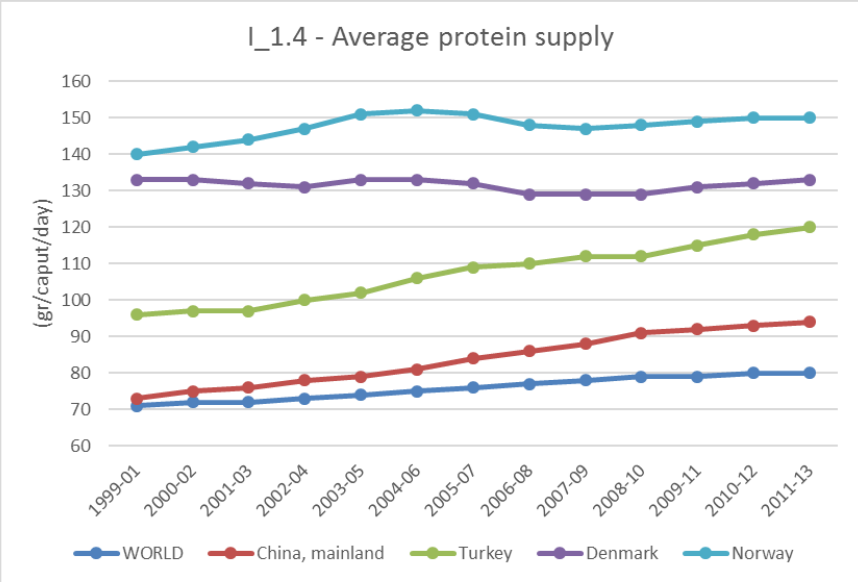

Figure 7: Average protein supply

Access

Includes indicators related to both economic and physical access. A good supply of food at the national level does not necessarily mean that all households have the same access. Some families may have limited access to fresh food within a reasonable distance. Others may lack the economic means to purchase sufficient food of high nutritional value.

Rail lines density (per 100 square km of land area) was highest in Denmark (5) and comparable in the other showcase countries in 2014 (G = 0.9; CN = 0.7; NO = 1.1; TK = 1.3). Global data is patchy on this indicator however available data suggests that, rather than reflecting poor coverage in China, Norway and Turkey, this gap is a result of Denmark's relatively high levels of rail coverage in a global context. With respect to **gross domestic product per capita (in purchasing power equivalent)**, Figure 8 shows that all showcase countries experienced an increase during the measured period (2000-2016). Increases were more marked in Turkey and China, though GDP per capita is still substantially lower in these countries than in Norway and Denmark. Notably, following the increase in China, all showcase countries are now equivalent to or above the global average on this indicator.

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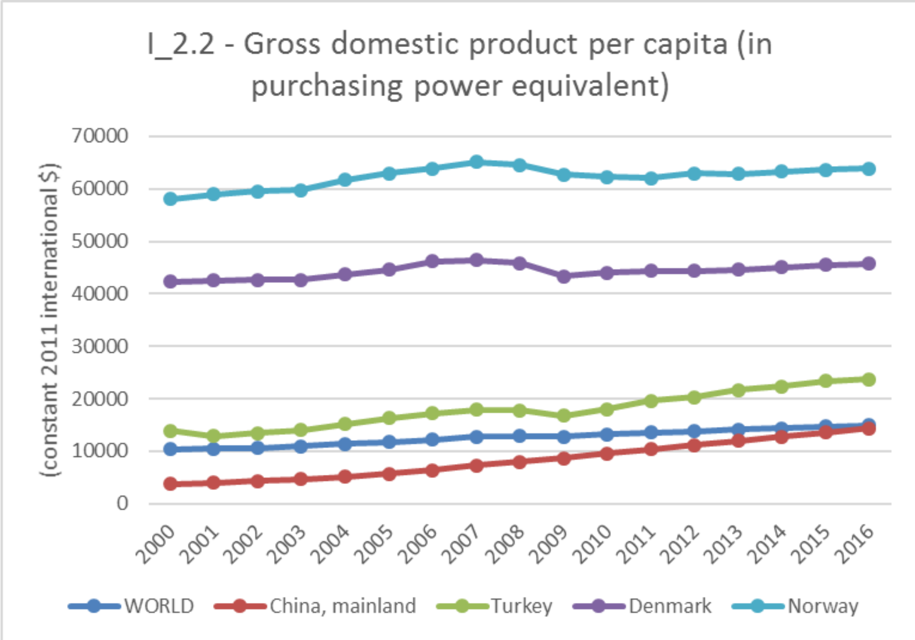

Figure 8: Gross domestic product per capita (in purchasing power equivalent)

China is the only showcase country which exhibited any **prevalence of undernourishment** during the period, with 9.7 per cent of the Chinese population experiencing undernourishment in 2014-16. This is a substantial decrease since 1999-01 (16.1%), taking the percentage of undernourished people in China from 1.3 per cent greater than the global average to one per cent below. Data on the **prevalence of severe food insecurity in the total population** was only available for Denmark (0.77%) and Norway (1.18%).[5]

The **depth of the food deficit** indicates how many calories per capita (based on the entire population) would be required to lift the undernourished from their status, everything else being constant.[6] As demonstrated in Figure 9, the **depth of the food deficit** in Denmark, Norway and Turkey, was close to zero during the period. In China, the depth of the food deficit declined substantially during the period, from 17 per cent higher than the global average in 1999-01 (a deficit of 130 calories per capita per day) to comparable to the global average (a deficit of 77 calories per capita per day) in 2014-16.

[5] Data period: 2014-16

[6] The average intensity of food deprivation of the undernourished, estimated as the difference between the average dietary energy requirement and the average dietary energy consumption of the undernourished population (food-deprived), is multiplied by the number of undernourished to provide an estimate of the total food deficit in the country, which is then normalized by the total population.

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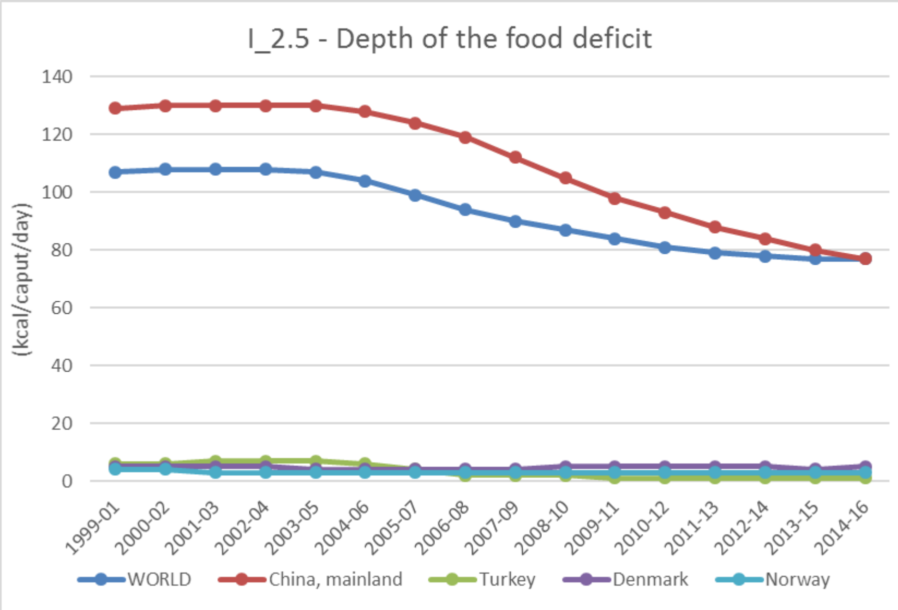

Figure 9: Depth of the food deficit

Utilisation

> *Relates to nutrition levels among individuals in the population. Poor food utilisation may result in malnutrition but is also associated with obesity.*

In both Denmark and Norway 100 per cent of the population has **access to improved water sources** and close to 100 per cent has **access to improved sanitation facilities** (DK = 99.6%; NO = 98.1%). These numbers have been consistent since 2000. Turkey reached total coverage with respect to water since 2014 and 95 per cent coverage with respect to sanitation facilities in 2015. Although still not equivalent to the other showcase countries, the situation in China has improved greatly with respect to these indicators since 2000. Ninety-five per cent of Chinese people had access to improved water sources in 2015 (up from 80.3% in 2000), and 76.5 per cent had access to improved sanitation facilities (up from 58.8% in 2000).

With respect to health outcomes, the **prevalence of obesity in the adult population (18 years and older)** was highest in Turkey (29.3%), Norway (24.8%) and Denmark (20.8%) respectively in 2014. China was the only showcase country with obesity rates in the adult population below the global average in 2014 (8.2%). Figure 10 shows that consistent with the global average, the prevalence of obesity increased in all showcase countries between 2000 and 2014. In absolute terms, the increase between 2000 and 2014 is sharpest in Turkey (9.2 percentage points higher in 2014), and comparable to (China and Denmark), or slightly greater than (Norway), the increase in the global average (4.6 percentage points higher) in the other showcase countries.

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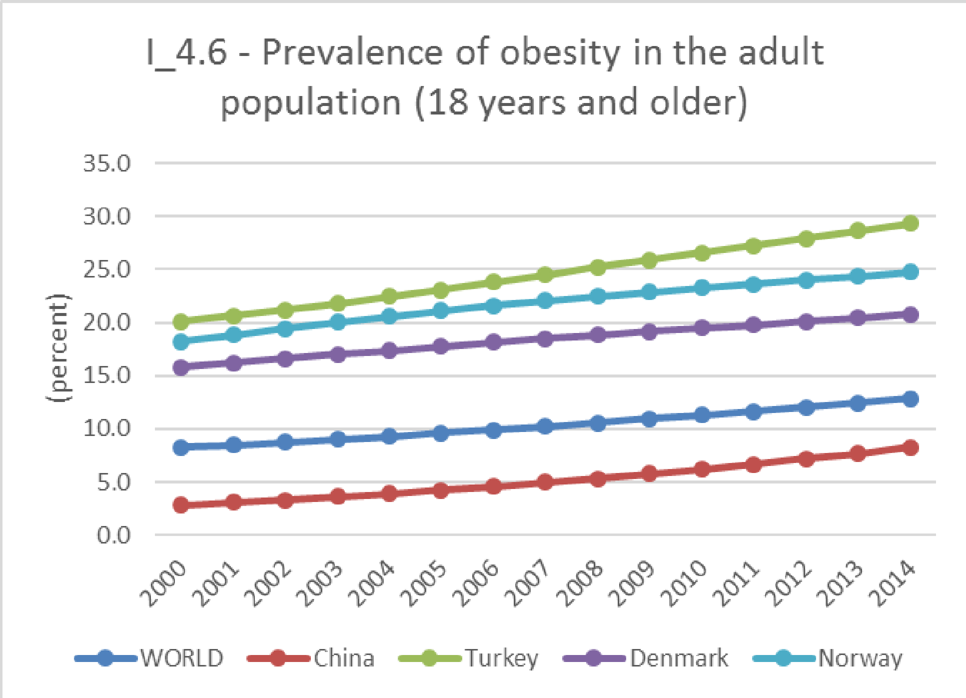

Figure 10: Prevalence of obesity in the adult population (18 years and older)

As Figure 11 demonstrates, the **prevalence of anaemia among women of reproductive age (15-49 years)**, was also highest, though still comparable with the global average (32.8%), in Turkey (30.9% in 2016). Denmark (16.3%) and Norway (15.3%) had the lowest rates and China, though below Turkey, still experienced substantial rates (26.4%). Interestingly, rates in China, Denmark and Norway followed a similar pattern, decreasing or remaining fairly consistent from 2000-2010 before increasing between 2011 and 2016.

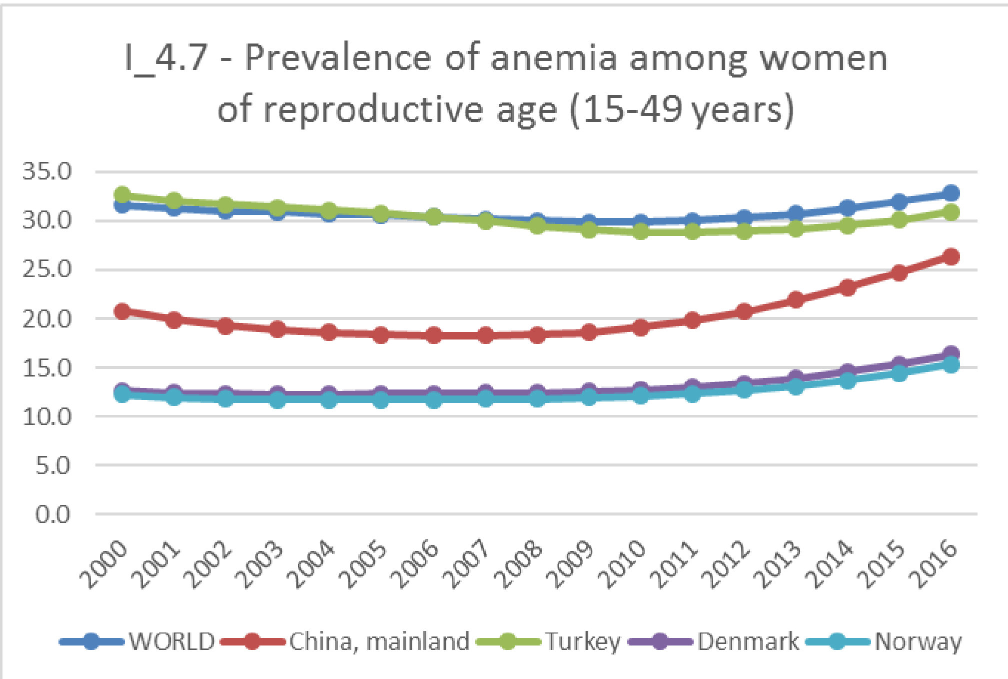

Figure 11: Prevalence of anemia among women of reproductive age (15-49 years)

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There was no data available for the showcase countries for the indicators **percentage of children under 5 years of age affected by wasting**, **percentage of children under 5 years of age who are stunted**, **percentage of children under 5 years of age who are overweight** or **prevalence of exclusive breastfeeding among infants 0-5 months of age**.

Stability

This measure describes the stability of the other three components. Even if a person's food intake is acceptable today, if there is a risk that this will not be the case tomorrow, they cannot be considered food secure. In the context of global climate change, it can be relevant to take a long-term view on the stability of food security. Even countries currently experiencing high levels of food security may be at risk of food insecurity in the long term.

The **cereal imports dependency ratio** indicates how much of the domestic cereal supply has been imported and how much comes from the country's own production. A higher number indicates a greater dependency on other countries for cereals, and a negative number indicates that the country is a net-exporter of cereals. As can be seen in Figure 12, Norway is the showcase country most dependant on cereal imports. Interestingly, the country's cereal dependency also increased substantially (by 71%) between 1999-01 and 2011-13. All other showcase countries have relatively low cereal import dependency ratios, with Denmark a net-exporter of cereals. Denmark and Turkey appear to experience more variable cereal production than China.

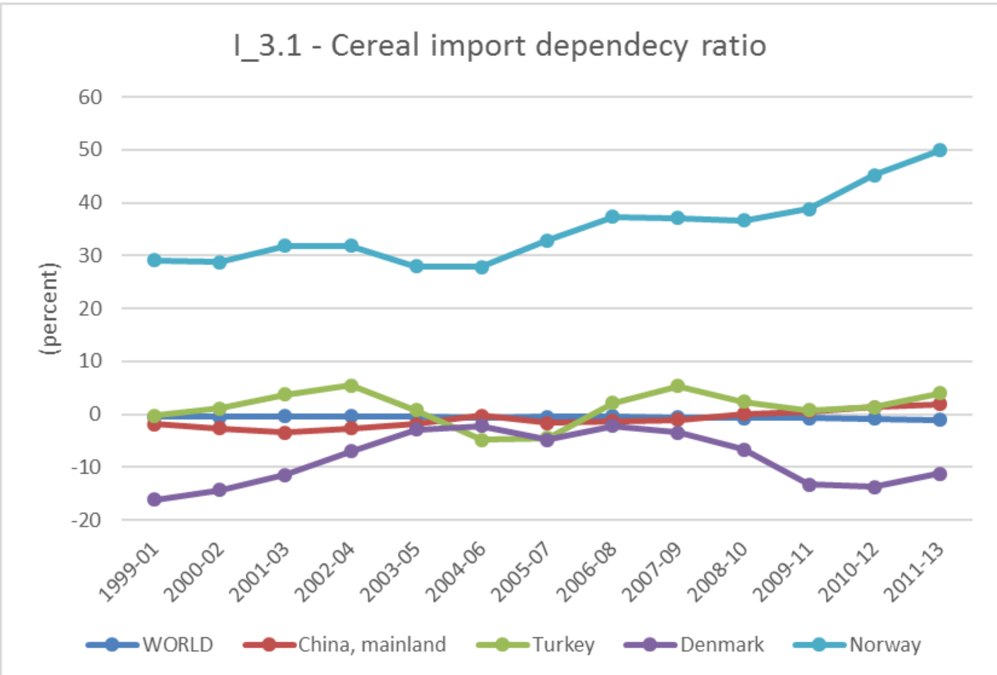

Figure 12: Cereal import dependency ratio

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As Figure 13 demonstrates, China stands out as the showcase with the highest **percentage of arable land equipped for irrigation.**[7] The increase in this type of land in China is also notable, both in comparison to the other showcase countries and in a global context. In both Denmark and Norway, the per cent of arable land equipped for irrigation decreased during the period and in Turkey the increase was slight.

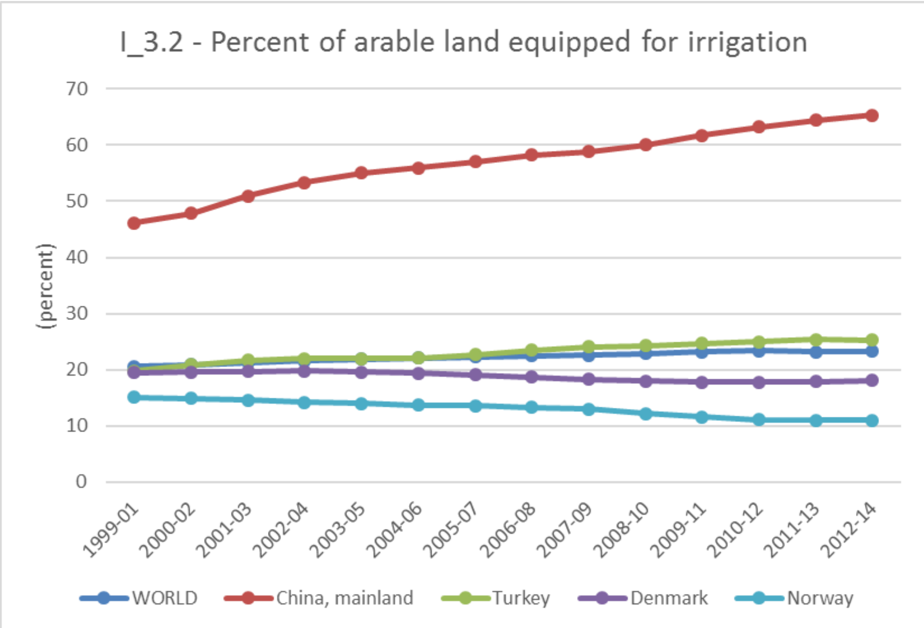

Figure 13: Percent of arable land equipped for irrigation

The **value of food imports over total merchandise exports** captures the adequacy of foreign exchange reserves to pay for food imports. Here we see a similar trend as with the average value of food production. Denmark scored highest (7%) in 2011-2013, Turkey was comparable to the global average (5%), and both China and Norway were below the global average (3% each). With respect to **per capita food production variability**[8], Figure 14 shows that China and Norway have the most stable production but also the lowest value of production (1.6 and 4.7, respectively in 2014). Denmark and Turkey experienced more fluctuation, with Denmark experiencing an overall increase in the value of food production between 2000 and 2014 and

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[7] Arable land is defined as the land under temporary agricultural crops (multiple-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years). The abandoned land resulting from shifting cultivation is not included in this category. Data for arable land are not meant to indicate the amount of land that is potentially cultivable. Total arable land equipped for irrigation is defined as the area equipped to provide water (via irrigation) to the crops. It includes areas equipped for full and partial control irrigation, equipped lowland areas, pastures, and areas equipped for spate irrigation.
[8] Food production variability corresponds to the variability of the "food net per capita production value in constant 2004-2006 international $" as disseminated in FAOSTAT.

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Turkey and overall decrease (-53%). With respect to **per capita food supply variability**[9], fluctuations remained within 10 calories and 50 calories per person, per day between 2000 and 2013 for all showcase countries. To put this into perspective, the global value for the **average dietary energy requirement** in 2016 was 2 355 calories per person, per day.

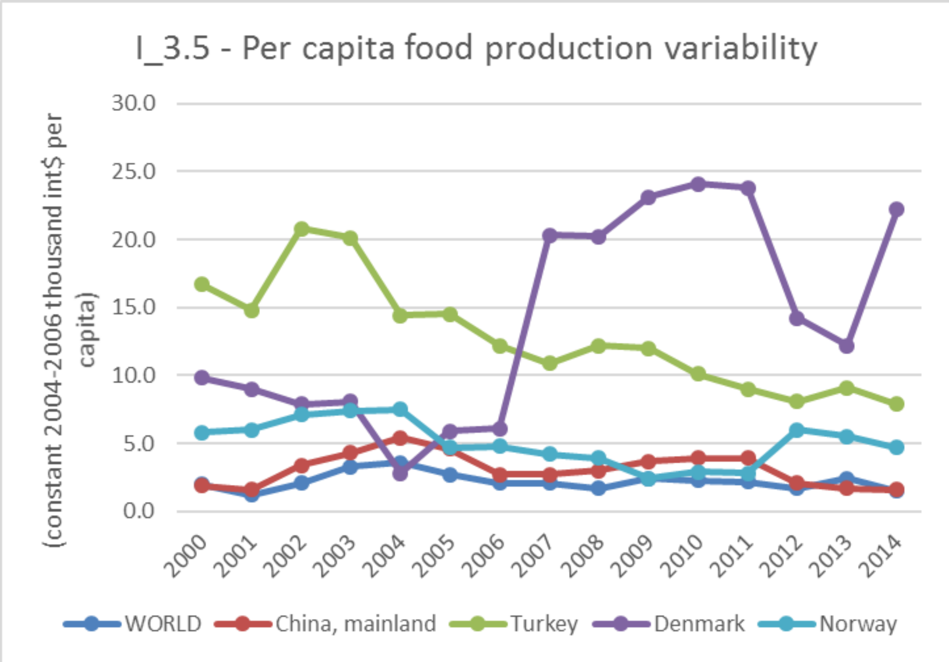

Figure 14: Per capita food production variability

Political stability and absence of violence measures perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. As such, this indicator provides a measure of political shocks that might have implications for national food security. Scores on this indicator fell in all showcase countries between 2000 and 2015, with Turkey's score dropping particularly low by 2015 (-1.28). China's 2015 score was also below zero (-0.56), and Denmark (0.89) and Norway (1.15) were both above. No global average is provided for this indicator but to put these figures into context, it is perhaps useful to note that, in 2015, the country with the lowest score was Syria (-2.94) and the lowest score was found in the independent territory of Greenland (1.92).

[9] Measured as the variability of the "food supply in kcal/caput/day" as disseminated in FAOSTAT.

FAO-UN indicators as a tool for measuring food security at a sub-national level in developed countries

Although data is provided by the FAO-UN for most countries on most indicators at the national level, data for these indicators proved to be difficult to obtain at lower geographical scales. The following (primarily regional level) insights relevant to the FAO-UN indicators can be observed from the case study reports.

Central Denmark Region, the region where Aarhus is situated, contains 30 per cent of Denmark's total utilised agriculture area, more than any other region in the country.[10] Approximately 60 per cent of the region is dedicated to agriculture, divided across a total of 12,840 individual holdings.[11] With respect to UA undertaken through Taste Aarhus, there was no evidence of participation being motivated by a material need nor of growing to alleviate the unmet material need of others in the community. Notably, there were examples in the higher yield gardens of participants meeting all, or at least a substantial part, of their fruit and vegetable needs through their growing. This suggests that participation in certain types of UA project may be useful in providing food security in the event that other sources of food become less stable in the future (e.g. impacts of climate change, disruptions to security).

Hatay Province produces a large portion of its own food. Cultivated areas constitute 51 per cent of the province's total area and food-export rates far exceed food-import rates. The region has a strong agricultural profile and boasts many advantages for agriculture, including a good climate, well-functioning transportation networks (e.g. highways, seaways and airways) and logistical connections, cheap labour, high potential for improved R&D activities and strong domestic purchasing power.

In the Norwegian context, it is important to acknowledge that only three per cent of the land is cultivatable and, of this, only 1.3 per cent is suitable for grain production. In Østfold County, the county where Fredrikstad is situated, the potential is much greater, with 19 per cent of the total land area dedicated to agriculture and 80 per cent of this land used for grain production (Bunger & Smedshaug, 2017). As a result, despite constituting only 1.1 per cent of Norway's total area, Østfold includes seven per cent of the country's agricultural area and is

[10] http://ec.europa.eu/eurostat/statistics-explained/index.php/Agricultural_census_in_Denmark
[11] Source: Eurostat (online data codes: ef_ov_kvaa, ef_kvaareg and FSS 2010)

a major producer of all of Norway's important agricultural products: grain, meat, eggs, milk, vegetables and berries (Bunger & Smedshaug, 2017).

In Beijing, UA functions primarily as a leisure activity. In Sanyuan Farm, urban residents rent a small piece of land, and they can come to the farm to grow crops on weekends. The agricultural products produced are mainly consumed by themselves or given to relatives and friends. Although UA does result in the supply of agricultural products for some families, the demographic of those able to participate in UA initiatives suggests that people are not growing due to material need.

In 2018, the added value of agriculture, forestry, animal husbandry and fishery in Changsha reached 33.721 billion yuan, an increase of 3.5% over the previous year, including 22.928 billion yuan of agricultural added value, an increase of 3.6%. The total area sown to grain was 325,400 hectares, down 5.5% from the previous year, including 293,300 hectares sown to rice, down 7.5%, and 76.8% planted to high-quality rice. The area sown with vegetables was 146,300 hectares, up 2.6%. The oil planting area was 55,100 hectares, down 1.3%.4.3853 million pigs were slaughtered, up 0.4%.

Based on the information gathered for the case study reports, the FAO-UN indicators are thought to be somewhat limited terms of their explanatory power when it comes to understanding food security at the urban level, particularly in the case of countries experiencing high levels of food security. For example, even if it were possible to obtain data on the prevalence of obesity in the adult population in Fredrikstad and track this indicator over the course of the SiEUGreen project it would be difficult, if not impossible, to ascertain the contribution of the Cicignon showcase to any fluctuation observed. As such, despite the usefulness of the FAO-UN indicators in providing the above context for food security within the SiEUGreen showcase countries, they are not recommended as a data collection framework for the remainder of the project. From a theoretical perspective, the model itself should still act as a guide (i.e. the four dimensions and their descriptions).

Increase access to high-quality food that is healthy, nutritious and contamination-free

This goal relates to the type of food that people have access to, the ways in which food is produced and community perceptions and knowledge around food production. Existing data that would help shed light on this goal was scarce for the showcase locations however, the insights provided in the case study reports were useful in shedding some light on potentials for collecting data going forward.

Firstly, it is important to point out that, as evidenced by the FAO-UN data presented above, access to healthy, nutritious food does not appear to be a pressing concern in any of the European showcase locations. All three countries have stringent food safety laws and processes in place and, at the local level, opportunities to access food are many and varied. Østfold County is responsible for a particularly large proportion of total ecological production in Norway, in particular, eggs (43 per cent), vegetables (27 per cent), cereals (24 per cent) and milk (13 per cent) (Bunger & Smedshaug, 2017). Though it is unclear how much of these products are consumed within the local market. In Hatay Province, some concerns have been raised about high levels of pesticide and chemical use; however, it was beyond the scope of this deliverable to investigate these in any depth (Parlakay et al., 2015).

With regard to regulation and oversight of UA specifically, there was little evidence that any of the activities observed in the research for the case study report would be captured under current regulatory structures. One exception can perhaps be found in Hatay, where products that are grown for commercial purposes may be controlled by the municipality when they go to market. Taste Aarhus project participants are not permitted to use any poisons in their gardens; however, there does not appear to be any controls in place around this rule. In Fredrikstad, it was not possible to assess the oversight of UA as no activities are currently occurring.

When it comes to participant motivations, food production was not always at the forefront. In the case of Taste Aarhus, despite being funded under the banner of health and food, the project operates under a definition of health that is more consistent with notions of overall well-being. As a result, participant's motivations are just as likely to be social or leisure related as they are to be about access to food. Nonetheless, it was clear that the food itself was an important motivator for some. This was particularly evident in the larger gardens and greenhouse projects. In Hatay Province, the Women's Cooperative again provides an example of access to healthy food as a by-product of other goals - in this case, the empowerment of women. In the case of the Fredrikstad showcase, it is not possible to comment on participant motivations as UA activities have not yet begun.

Beijing's food safety issues are mainly regulated by government departments. Food is mainly from the wholesale market, and a food safety traceability system is currently being established. As in the European showcases, it is unlikely that any such regulation would effectively capture UA activities. At the same time, it is important to acknowledge that avoiding contamination may perhaps be a more important motivator in the Chinese context than in Europe. As the information above illustrates, available knowledge related to this goal is relatively scarce at this stage in the project. As more people become active in SiEUGreen activities, there will be broader scope to collect data about the role of UA in increasing access to high-quality food that is healthy, nutritious and contamination-free. This data is likely most valuable if collected through questionnaires conducted with participants in different types of initiatives - as opposed to large data sets covering distinct geographical areas (e.g. district or municipal level). Information about the motivations for involvement in the projects, and to what extent these motivations relate to food production would be particularly useful. It would also be interesting to understand the extent to which the knowledge gleaned through participation in the garden projects has equipped participants to meet their dietary needs through their growing in the case that such action should be required.

Increase understanding of the contribution of UA to the urban food system

This goal is concerned with how we understand UA in the context of the urban food system as a whole. This is a particularly interesting aspect of the project from a social science perspective. It is also perhaps the most challenging as it requires intimate knowledge of the local food system that is likely beyond the scope of the SiEUGreen project. As a result, the SiEUGreen project should contribute to a broader understanding of the role of UA in the urban food system in a qualitative sense, rather than seeking to present concrete data on the exact physical contribution. The first step in addressing this goal was to attempt to understand flows of food into the city as well as gain knowledge about the existing presence of locally sourced food in the showcase locations.

In the case of Aarhus, UA appears to account for a very small portion of food consumption. Although several small farmers markets operate on a semi-regular basis and there are farms where it is possible to buy direct from the producer, the majority of food consumed in the municipality is imported by the large supermarkets. Notably, the largest market in Aarhus is a bazar which sells foreign-grown food, most of which is imported from Hamburg. In contrast, Hatay's food system is based to a large extent on local products. The majority of these are produced in rural areas or on the periphery of urban areas however, and thus cannot be considered as UA making a contribution to the urban food system. Intra-urban agriculture is still considered marginal in Hatay Province and is not taken into consideration in planning documents and development strategies. Initial results from the Women's Cooperative suggest a potential for this project to contribute to the urban food system; however, the scale of production is relatively small at this stage. In Fredrikstad, there are two farms offering community supported agriculture as well as the Moon Greenhouse (Månegartneriet) which sells ecological produce as part of the Moon festival (Månefestivalen).

UA also offers the opportunity to make elements of the food production process more visible in the urban context. The Taste Aarhus project provides several examples of promoting access to "open source" food (e.g. edible objects that grow in the wild such as mushrooms and berries). There are also examples of garden projects that incorporate animals and insects in the urban food system (e.g. chickens, hens, bees, edible insects) though these do not make up a substantial component of the urban food system nor even a substantial component of the Taste Aarhus Program. In Fredrikstad, the municipality has established a collaboration with beekeepers to increase the number of town bees by setting out beehives in the centre of the city. The project began in 2015 with 10 beehives and has expanded since. Cicignon is one of the neighbourhoods where the beehives have been placed.[12]

In Beijing, locally produced agricultural products are very limited. Thanks to the development of the agricultural product circulation industry, urban residents can easily buy agricultural products from all over the country in their local supermarkets. Agricultural activities are more prominent in Changsha than in Beijing; however, the majority of agricultural products are mostly imported from other parts of the country and sold by large supermarkets. Weather conditions play an important role in shaping the extent to which UA can become a genuine part of the urban food system. In Aarhus, garden projects are highly seasonal and greenhouses are considered a valuable asset in extending the growing season and increasing the amount of food that can be produced. Fredrikstad experiences even more severe winters than Aarhus; however, it is not clear to what extent and how weather conditions will be taken into account in the Cicignon showcase. In Hatay Province, the climate is much more favourable for UA and for agriculture in general though water scarcity may be more of an issue here (see resource efficiency). Interestingly, greenhouses are still highly valued but in this case more with regards to their ability to increase production (rather than simply making it possible).

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[12] https://www.fredrikstad.kommune.no/tjenester/naringmiljosamfunn/Samfunn/byensbier/

The climate in Beijing is typical of the semi-humid continental monsoon climate in the north temperate zone. It is hot and rainy in summer, cold and dry in winter. Wheat can be grown in summer, and outdoors in spring, summer and autumn. In winter, the temperature is below 0 degrees, and vegetables and fruits can only be grown in the greenhouse. In contrast, Changsha belongs to the subtropical monsoon climate. The climate is mild and very conducive to crop growth with abundant precipitation, simultaneous rain and heat and four distinct seasons.

When it comes to promoting knowledge of the food system among the urban population, it is perhaps too early in the project to say anything conclusive. The Taste Aarhus project has a substantial capacity-building component, as evidenced in the garden initiatives and in the engagement achieved through the green embassy. The Taste Aarhus program also offers opportunities to consider the role of UA in reconnecting people with the food production process. Better understanding the way in which this occurs, alongside its impact on consumption behaviour has the potential to be extremely valuable in unravelling the complexity in the relationship between people and food in the context of contemporary cities.

Conclusions and recommendations

All SiEUGreen countries performed in line with or better than the global average on the majority of the FAO-UN food security indicators. The general trend was a stronger performance from Denmark and Norway, but the greater improvement was evident over time in Turkey and, in particular, China. One exception was the prevalence of obesity in the adult population (18 years and older), where all SiEUGreen countries except China exhibited rates above the global average. Scores on political stability and absence of violence fell in all showcase countries between 2000 and 2015, with the most notable drop evident in Turkey. Data related to the FAO-UN indicators at the regional or local level was difficult to obtain; thus the remainder of the description of food security focused on qualitative data relating to two other intended impact areas of the project: 1) increase access to high-quality food that is healthy, nutritious and contamination-free; and 2) increase understanding of the contribution of UA to the urban food system. With respect to the former, existing evidence suggests that the role of UA in providing access to high-quality food is marginal in the showcase locations at this stage. In Aarhus, the outcomes of UA initiatives appear to be more social in nature and in Hatay, the primary goals are economic. In Fredrikstad, there is not yet significant UA activity to assess. When it comes to the understanding of the contribution of UA to the urban food system, the SiEUGreen showcases offer a potentially rich source of knowledge. Of particular interest is the way that UA may be useful in reconnecting urban dwellers with the food production process.

In the project proposal, the indicators provided by the FAO-UN were proposed as useful in evaluating the impact of the SiEUGreen project with respect to food security. Though these indicators no doubt provide a useful starting point, it is also important to acknowledge the limitations of this data set, particularly when it comes to understanding food security at an urban scale. Perhaps more useful is the rich qualitative data that can be obtained by engaging with participants in SiEUGreen initiatives throughout the life of the project. In addition, further qualitative interviews with professionals, both food related and in the planning sector, would be useful in further understanding the place the food system occupies in contemporary urban thinking.

Module 3 RESOURCE EFFICIENCY

According to the United Nations Environment Programme, "[t]he unstainable use of resources has triggered critical scarcities and caused climate change and widespread environmental degradation – all of which have negative impacts on the well-being of the planet and its people" (UNEP, 2018). Resource efficiency is a mainstream response to this challenge, and it means using the Earth's limited resources in a sustainable manner while minimising impacts on the environment. It allows us to create more with less and to deliver greater value with less input. As part of the Europe 2020 Strategy, the resource-efficient Europe flagship initiative supports the shift towards sustainable growth via a resource-efficient, low carbon economy (European Commission). As depicted in Figure 15, resource efficiency is one basic principle that underpins the entire life cycle of materials and is fundamental to circular economy.

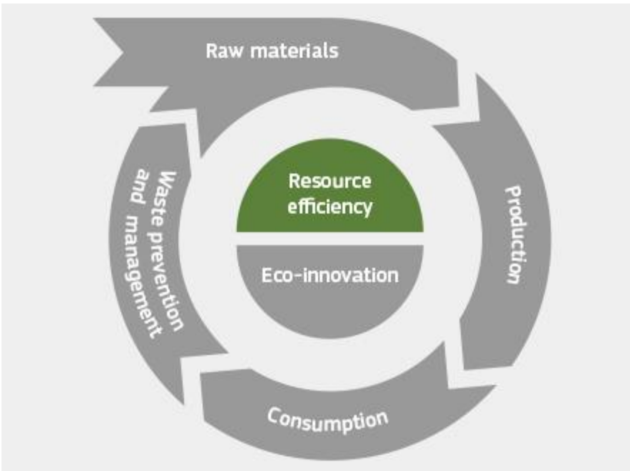

Figure 15. A circular system perspective on resource efficiency. Source: European Commission.

It is a widely held belief that resource efficiency is essential for UA production. This is because the scope of UA production can be expended and sustained by farmers through the efficient use of resources (Umoh, 2006). Large-scale implementation of UA has the potential to be a vital step towards improving urban environmental performance, but claims relating to UA's improved environmental sustainability and resource efficiency relative to conventional agricultural remain premature given the paucity of field verification and quantitative assessment of UA systems (Goldstain, E., Hauschild, M., Fernández, J., Birkved, M., 2016).

Based on the expected impacts of the project, and data collected from the project partners at the SiEUGreen kick-off meeting, the following goals have been identified with relation to resource efficiency in the context of SiEUGreen:

a. Mitigate environmental impacts through UA implementing novel technologies

b. Promote resource efficiency in relation to UA applying quantitative measures
c. Increase understanding of the contribution of UA to circular economy and green growth

The remainder of this section addresses each of these areas, in turn, based on materials collected during the first six months of the project period.

Mitigate environmental impacts through UA implementing novel technologies

Cities, in general, face a set of environmental issues, the most major of which include poor air quality, the urban heat island effect, reduced water quality and excessive stormwater runoff, a lack of ecological biodiversity, an increasing waste stream, and increased carbon emissions. UA appears to be a means to combat the environmental pressure of increasing urbanisation, and four sustainability claims related to urban agriculture have been defined in the pursuit of mitigating environmental impacts, as shown in Table 7 (Goldstain et al., 2016).

Table 7. Sustainability claims related to UA

Sustainability claim	In the context of UA
Building energy	The potential benefits of UA in relation to building energy consumption are some of the best documented due to previous research on green roofing that can reasonably be extrapolated into the realm of UA.
Urban symbiosis	It is UA's potential to leverage proximate urban residual material and energy fluxes as production factors, attenuating urban waste and avoiding virgin material inputs to food production.
Supply chain efficiencies	They are the streamlined needs of UA compared to typical urban food supply chains.
Ecosystem improvement	It outlines beneficial environmental amenities brought to the urban environment by UA.

A wide set of innovative agricultural technologies will be implemented at showcases within SiEUGreen, which are expected to improve resource efficiency and mitigate environmental impacts. Their contribution will mainly be measured and evaluated based on feasible quantitative indicators.

For the three European showcases, the proposed UA-related innovative technologies and their potential contribution are listed in Table 8, organised three categories – green, blue and yellow technology. The green technologies include soil-based traditional plant growing, water-based hydroponic culture (soilless) and aquaponics (fish and plant), paper-based plant growing technology, greenhouse technology. The blue technologies include water and waste management, production of fertilizer and soil amendment from waste, resource recycling. The yellow technologies include biogas production from waste resources, seasonal solar storage, combined heat and power, and photovoltaic generation of electricity.

Among the three European showcases, Fredrikstad (Cicignon Park) is the most technology-intensive as a showcase for retrofitting[13]. With all green, blue and yellow technologies are to be implemented in Cicignon Park, they are deemed to contribute to local food production, solid waste recycling, wastewater treatment, energy and water saving. For Aarhus and Hatay, on the other hand, the technologies to be implemented are focused on green and blue technologies, whose major contribution will be to local food production and waste recycling.

In relation to the Chinese showcases, the main waste from the **Sanyuan Farm** is the stalk, which is recycled and reused in two ways. The first way is to transform it into an enzyme as fertilizer (composting), and the second way is to use it for vermicomposting. The irrigation system is remotely visible and controlled, which enables precision irrigation and contributes to water conservation.

Changsha showcase has a focus on wastewater treatment. The main wastewater from the showcase building is from domestic sewage, which is recycled and reused in different ways. The greywater will be treated by using a Biofilter/Filterbed treatment system or a biomembrane system. The stormwater will be treated by using a wetland/pond system or wetland/infiltration system. The nitrogen and phosphorus will be treated by struvite precipitation.

Table 8. Set of agricultural technologies to be implemented and their contribution to resource efficiency

TECHNOLOGY	Contribution to resource efficiency (ES = energy saving; LFP = local food production; WR = waste recycling; LFodP = Local fodder production; NA = Nutrient availability; WS = water saving; WWR = wastewater recycling; UG = urban greening)				
	Fredrikstad, Norway	Hatay, Turkey	Aarhus, Denmark	Changsha, China	Beijing, China
Green					
Innovative greenhouse technology using special insulation, solar heat storage, and biogas for light CO_2 and heat	ES				
Greenhouse technology, traditional		LFP	LFP		LFP
Polytunnels			LFP		LFP
Mobile gardens			LFP		LFP
Soil-based traditional plant growth	LFP	LFP	LFP	LFP	LFP
Water-based hydroponic culture	LFP	LFP		LFP	
Aquaponic cultures (plant fish fully recycling technology)		LFP			
Paper-based plant growing technology	LFP	LFP	LFP	LFP	LFP
Balcony gardens	LFP		LFP	LFP	LFP
Blue – Processing of waste for recycling					
Biogas production from Antec Biogas pilot-scale reactor	ES + WR				

[13] Retrofitting is initially described as urban re-engineering for sustainability in a socio-technical context.

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Treatment of Biogas digested by biofiltration	NA				
Struvite precipitation from biofilter percolate	NA			NA	
Use of organic waste product for the production of insects in connection with the aquaponic system	WR + LFodP	WR + LFP			
Biofiltration of urine	NA				
Co-composting of organic household waste /green waste and solar dry toilet residue	WR + WS		WR + WS		WR + WS
Blue – Source separation of wastewater					
Vacuum- /low flush toilets	WS			WS	
Urine diverting toilets	WS + WWR				
Solar dry toilet	WR + WS		WR + WS		WR + WS
Greywater treatment using a Biofilter/Filterbed treatment system	WWR			WWR	
Greywater treatment using a biomembrane system	WWR			WWR	
Green wall for greywater treatment	WWR + UG				
Blue – Stormwater handling					
Green roof lightweight aggregate (LWA) for water retention	WS + UG			WS + UG	
Green wall for water retention	WS + UG				
Wetland/pond system for stormwater disposal	WS + UG			WS + UG	
Wetland/infiltration system for stormwater disposal	WS + UG			WS + UG	
Yellow					
Borehole thermal energy storage (BTES)	ES				
Ground source heat pumps (GSHP)	ES				
Photovoltaic panels (PV)	ES			ES	
Solar collectors for heating water	ES			ES	
Combined heat and power (CHP) from biogas	ES				

Promote resource efficiency in relation to UA applying quantitative measures

According to United Nations Environment Programme, sustainable consumption and production (SCP) are essential for promoting resource and energy efficiency, minimising the use of natural resources and toxic materials as well as the emissions of waste and pollutants, while providing basic needs and promoting quality of life (UNEP). Thus, this section will be centred on the consumption and production pattern of the urban system with a specific focus on UA.

The Resource Efficiency Scoreboard presents indicators covering themes and subthemes of the Roadmap to a Resource Efficient Europe. The scoreboard aims to monitor the implementation of the roadmap, to communicate the link between resources and economy and to engage stakeholders. Indicators are arranged in three groups – lead, dashboard and theme-specific indicators. Table 9 shows the selected indicators deemed of greatest potential interest to the project, on the basis of the full suite of resource efficiency indicators as outlined by Eurostat. Data is provided by Eurostat and the OECD at the national level for most countries on most of the indicators. The results on the national level supplemented with the major outcomes on the local level from case study reports are presented below.

Table 9. Selected indicators based on EUROSTAT Resource Efficiency Scoreboard

RESOURCE EFFICIENCY SCOREBOARD INDICATORS		
Indicator	Definition	Unit
LEAD INDICATOR		
Resource productivity	Gross domestic product (GDP) divided by domestic material consumption (DMC)	EUR per kg
DASHBOARD INDICATORS		
Material		
Domestic material consumption	The total amount of materials directly used by an economy	Tonnes per capita
Land		
The productivity of artificial land	The gross domestic product (GDP) of a country divided by its total artificial land	Millions of PPS per km2
Water		
Total freshwater abstraction	The water removed from any freshwater source, either permanently or temporarily.	Million cubic metres
Carbon		
Greenhouse gas emissions per capita	All man-made emissions of the so-called 'Kyoto basket' of greenhouse gases	Tonnes of CO_2 equivalent per capita
Share of renewable energy in gross final energy consumption		%
THEMATIC INDICATORS		
Transforming the economy		
Turning waste into a resource		
Generation of waste excluding major mineral wastes	All waste generated in a country per inhabitant and year (in kg), excluding major mineral wastes, dredging spoils and contaminated soils	Kilograms per capita
Landfill rate of waste excluding major mineral wastes	The rate of waste landfilled (directly or indirectly) in a country per year, excluding major mineral wastes, dredging spoils and contaminated soils	%

As UA is in its infancy in China, it has not yet played a significant resource-saving effect in China. The Changsha demonstration site is currently under construction and experimental stage, and the conservation aspects of water resources remain to be seen. The Beijing Demonstration Point data on resource conservation and utilisation is provided by the Beijing Eco-Creative Alliance.

Lead indicator

Resource productivity

Resource productivity is measured as the Gross Domestic Product (GDP) over the amount of materials used by an economy (Domestic material consumption - DMC), excluding natural *resources such as land/area, water, air, ecosystems, etc. The indicator quantifies the relation between economic growth and the depletion of materials (Eurostat).*

Figure 16 shows the development over time, in which the GDP is expressed as chain-linked volume (which eliminates the effect of inflation) is used. The overall trend of resource productivity for Denmark is towards an increase in material productivity and decoupling of material use from economic growth. The same trend is displayed for Turkey, with a relatively lower level of resource productivity. However, there is no clear trend for Norway. One explanation for this could be the Norwegian economy's high dependence on oil, which means the oil price would influence the resource productivity to a considerable extent (e.g. the oil price crashes in 2008 and in 2014).

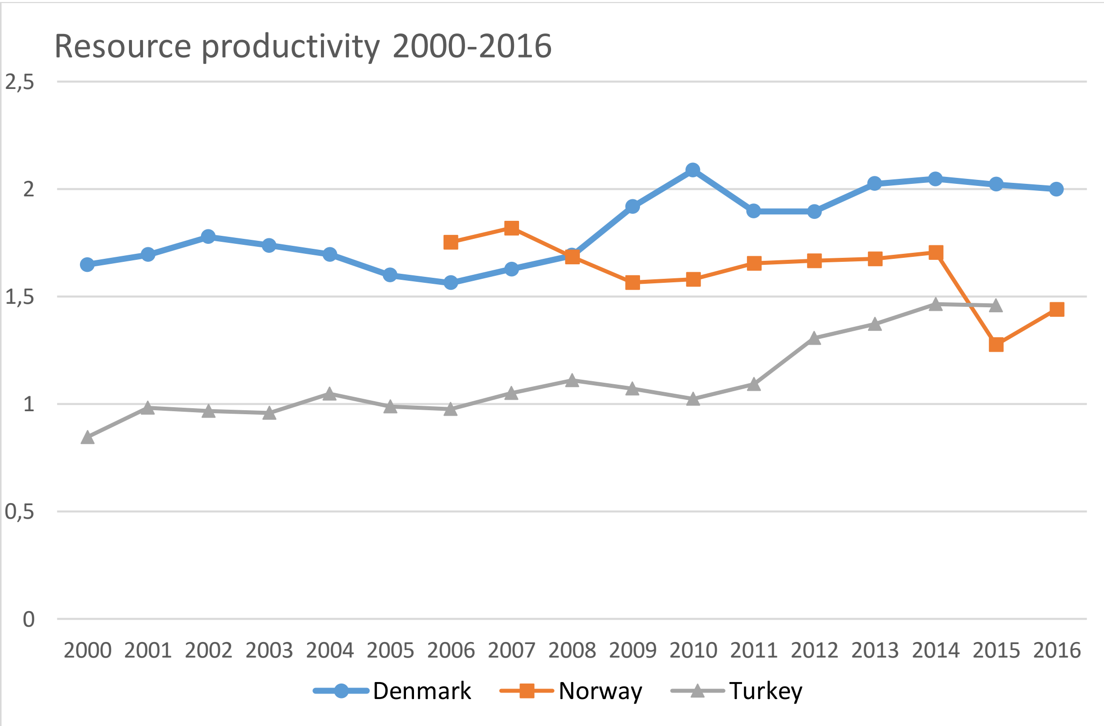

Figure 16. Resource productivity in Euro per kg, chain-linked volumes (2010). Source: Eurostat

Materials

Domestic Material Consumption per capita

The indicator measures the amount of materials directly used by an economy, and thus provides an assessment of the level of material used.

As shown in Figure 17, the material consumed per capita differs among the four countries, both in regards to material quantity and to material group. For Denmark, the total Domestic Material consumption (DMC) per capita decreased slightly during 2000-2016, while in the

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three other countries it increased. China witnessed a dramatic increase in DMC per capita during the same time period. For Turkey, the DMC per capita increased, to a smaller extent during 2000-2015. Norway has also experienced an increase in material consumption per capita since 2010.

The major material consumed domestically for all the four countries is non-metallic minerals (mainly construction minerals), which steadily accounts for approximately half of the total consumption in Denmark and Turkey, and around two-thirds in China during 2000-2016. For Norway, non-metallic other than construction minerals is the major material consumed. Biomass is the second largest material consumed per capita in Denmark, with consumption making up around 30% of the total consumption for the past years. Biomass plays a considerably smaller role in the other three countries. The share of fossil energy carrier's consumption per capita has dropped slightly for all countries, with the exception of China. It accounts for around one-third of the total DMC per capita in Norway, which is the highest share in all four countries.

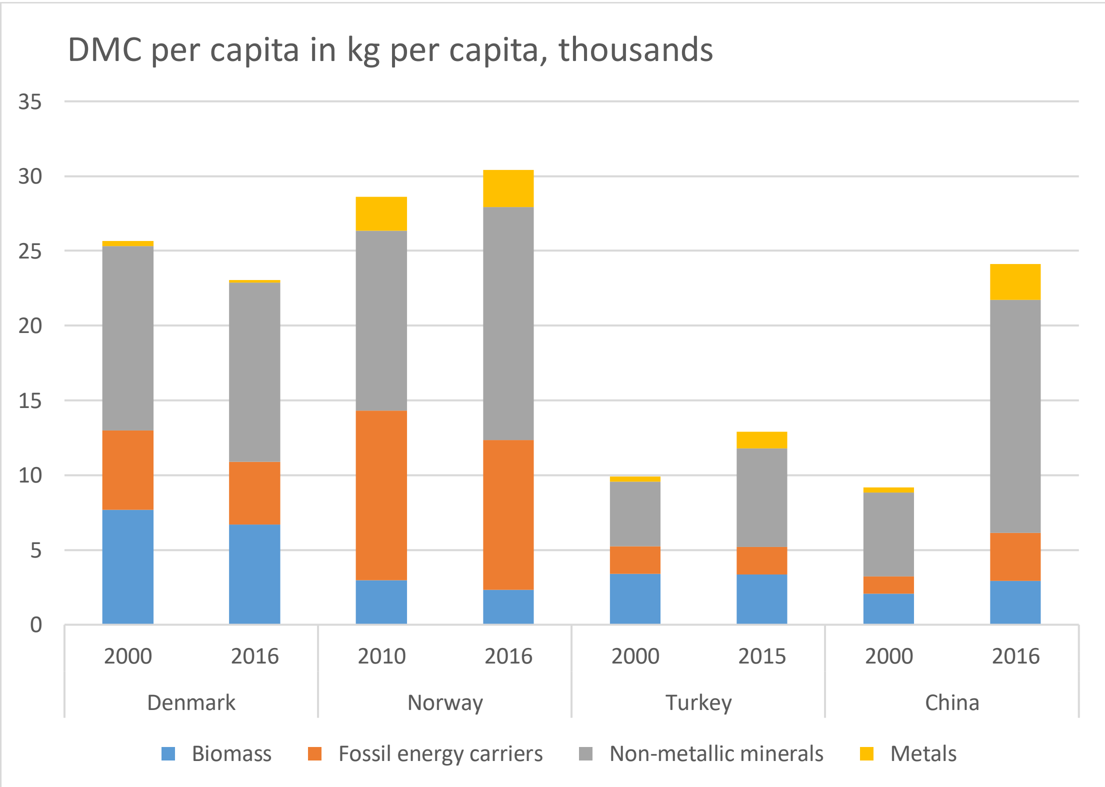

Figure 17. DMC per capita by material category in Denmark.
Source: OECD

Land

The productivity of artificial land

This indicator is defined as the gross domestic product of a country divided by its total artificial land, which consists of built-up areas (areas covered with buildings and greenhouses) and non-built-up areas (streets and sealed surfaces).

The total area of land in a country is a finite resource and is unlikely to be transformed back to a natural environment if used for urban development and infrastructure. However, land needs to be built-up with infrastructure in order to increase the productivity of the economy. It is therefore important to maximize the value of output per unit area of artificial land, which contributes to the long-term goal of decoupling economic growth from the development of artificial land.

The productivity of artificial land in Denmark was 61, 65.9, 70.4 in millions PPS per km^2 in 2009, 2012, and 2015 respectively, (Eurostat). The productivity has increased but is still lower than the EU28 average, which is 80.8 in 2015. There is no data for Norway and Turkey from Eurostat, and productivity of artificial land is not a standard indicator for OECD.

Greenhouses, as a type of built-up areas, is closely related to UA. The UA-related activities in greenhouses take place in urban and peri-urban areas of Aarhus Municipality, which is a way to increase the productivity of idle artificial land. It is the similar case for the small-scale greenhouses planned in the backyards in Hatay Province, which are for the inhabitants living nearby to improve their economic conditions. The large-scale greenhouses to be constructed in the peri-urban area in Hatay are aiming for large food production and efficient energy consumption. In 2006, there are around 740 greenhouse establishments in Norway, and, according to available data, their productivity increased since 1999.

Water

Water abstraction

Water abstractions are a major pressure on freshwater resources, particularly from public water supplies, irrigation, industrial processes and cooling of electric power plants. This has significant implications for issues of quantity and quality of water resources.

As shown in Figure 18, the total freshwater abstraction for Denmark after 2000 ranges from 650 to 750 million cubic metres, with a relatively small abstraction year in 2007 (565.45) and an extremely large abstraction year in 2011 (970.7). Of the total freshwater abstraction, the share of agricultural abstraction varies from 20.8% in 2007 to 36.2% in 2009, with a share of around 30% for most years. Thus, more economical consumption of water in agricultural activities would contribute considerably to the overall water conservation.

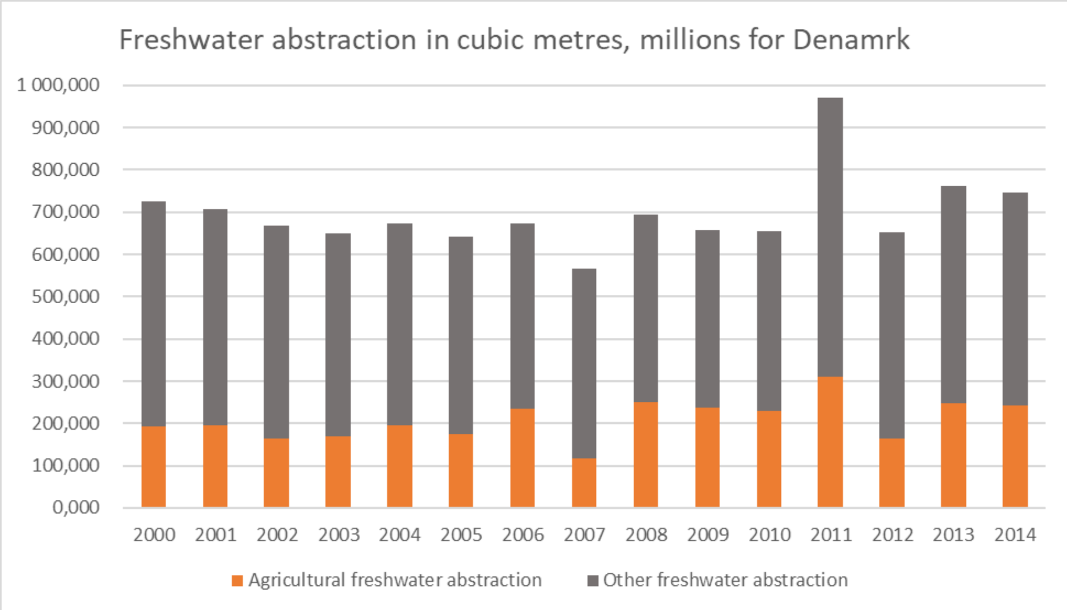

Figure 18. Total and agricultural freshwater abstraction in Denmark.
Source: OECD.

Data on total freshwater abstraction for Norway is only available for a few years, and the most recent data is from 2007. Although the share of agricultural abstraction is around 30% similar to Denmark, the total abstraction amount is 4-6 times higher in Norway than in Denmark. For Turkey, the total freshwater abstraction increased by almost 20% from 2000-2014. China witnessed an increase of almost 10% from 2001-2012. The freshwater abstraction for agricultural activities accounts for over 80% of the total abstraction, which makes more economic use of water in agriculture more crucial. The data on agricultural freshwater abstraction in China is not available.

Wastewater treatment

Wastewater treatment is a process used to convert wastewater into an effluent that can either be used directly or returned to the water cycle with minimal impact on the environment. Wastewater that is discharged to the environment without suitable treatment causes water pollution. In Hatay Province, there is no proper treatment system, which results in the pollution of water bodies by the industrial activities, and as well the pollution of groundwater by domestic and agricultural activities. In contrast, Aarhus Municipality has a relatively systematic sewage system, and most of the inner-urban sewage is treated in one way or another. For Fredrikstad showcase, wastewater treatment is one of the key demonstrations within SiEUGreen. The wastewater is separated into blackwater and greywater and recycled with the application of innovative technologies.

Carbon

Greenhouse gas emissions per capita

Decarbonisation of the economy is an essential development towards a resource-efficient society. The aggregated greenhouse gas emissions are expressed in units of CO^2 equivalents.

Norway and Denmark have a significantly higher level of greenhouse gas emissions per capita, compared to Turkey. However, during the past decade and a half, the difference between Denmark, Norway and Turkey is narrowing, due to the decreasing trend for Norway and Denmark and the increasing trend for Turkey (Figure 19). With regards to the greenhouse gas emissions from agriculture (Figure 20), Norway and Turkey are at a similar level, while Denmark has a much higher emission level per capita. If the agricultural land area is taken into consideration, on average, one Danish person has twice as much land of a Norwegian person, which explains the difference in GHG emissions from agriculture. For Turkey and Denmark, the agricultural land per capita is similar, and the difference in GHG emissions from agriculture may have resulted from levels of agricultural land productivity.

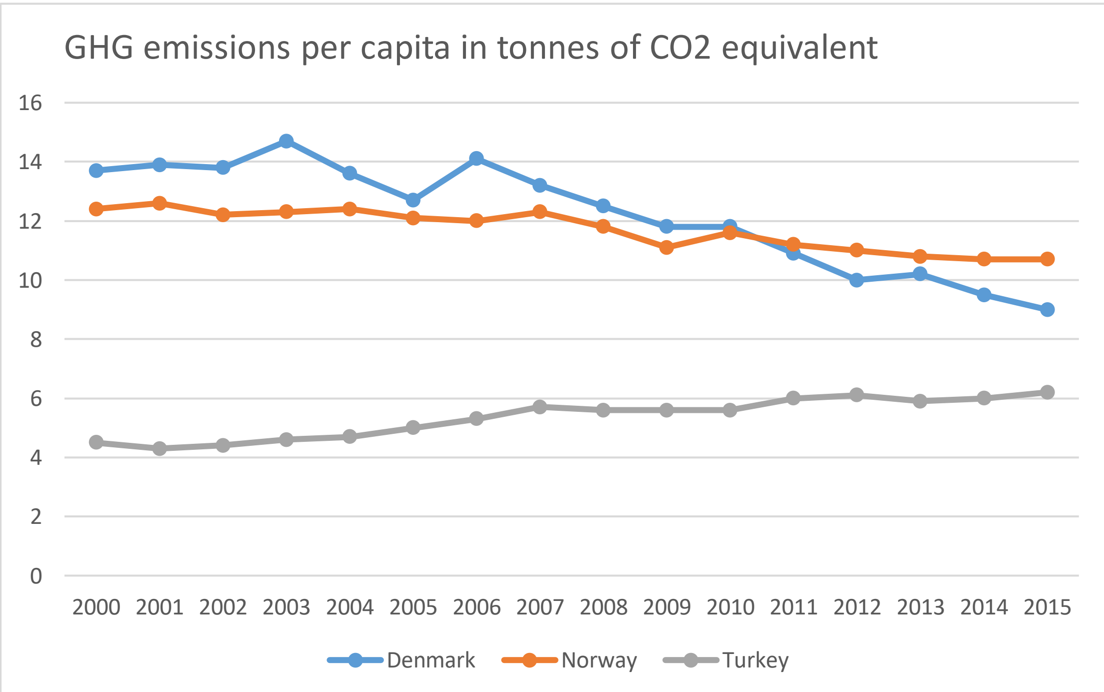

Figure 19. GHG emissions per capita in tonnes of CO2 equivalent in DK, NO, and TU.
Source: Eurostat.

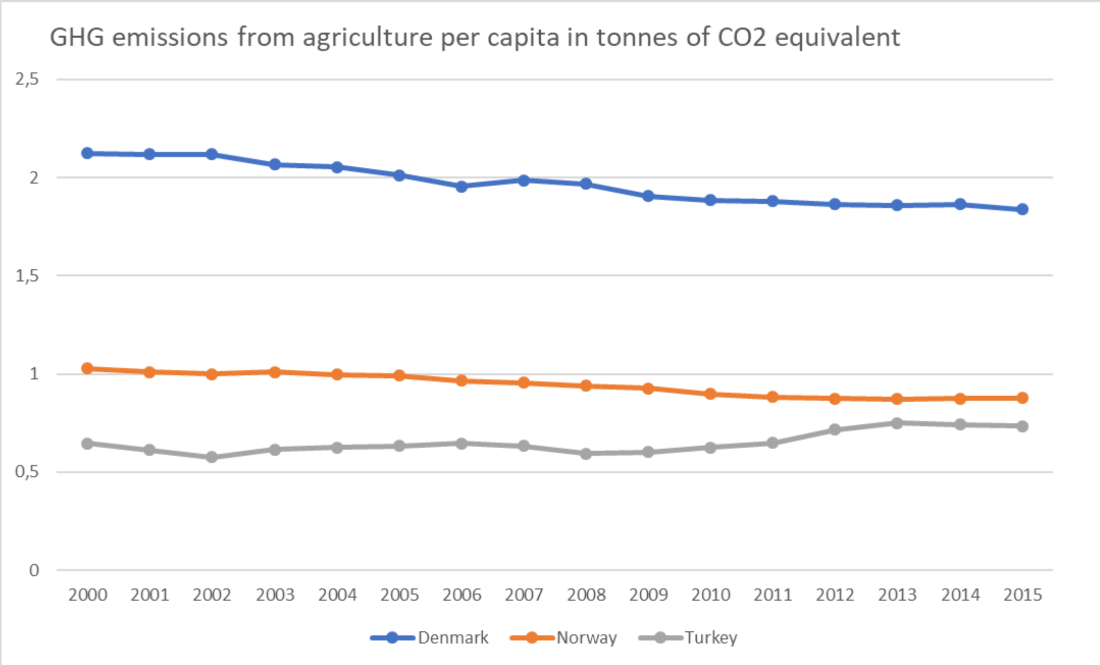

Figure 20. GHG emissions from agriculture per capita in tonnes of CO2 equivalent in DK, NO and TU. Source: OECD.

Share of renewable energy in gross final energy consumption

It measures the gross final consumption of energy from renewable sources divided by final gross energy consumption.

For Denmark, the share of renewable energy in gross final energy consumption increased from 14.9% in 2004 to 32.2% in 2016. In addition, the total final energy consumption for agriculture decreased from 5.37 tonnes of oil equivalent per hectare in 2000 to 4.85 in 2014, while the agricultural land area remained stable. It is obvious that renewable energy is increasingly widely used in Denmark, and at the same time, the total energy consumption in agriculture is dropping.

For Norway, the share of renewable energy in 2004 was already over 50% (58.1%), and its share steadily increased to 69.4% in 2016. Norway's performance with regard to renewable energy far exceeds that of other countries. Eurostat does not provide data on the share of renewable energy for Turkey. Both Norway and Turkey have witnessed increasing total final energy consumption for agriculture during 2000-2014; Norway increased 1.6%, and Turkey increased by 48.2%. The more dramatic increase in the case of Turkey is likely due to the application of modern agricultural machinery and large-scale farming.

Turning waste into a resource

According to European Environment Agency, waste management should be implemented by minimising inputs and outputs by using different approaches such as waste prevention, reusing, recycling, cascading (direct reuse of outputs but at a lower quality) and recovering (energy recovery, extraction of useful materials etc.) (see: Figure 21).

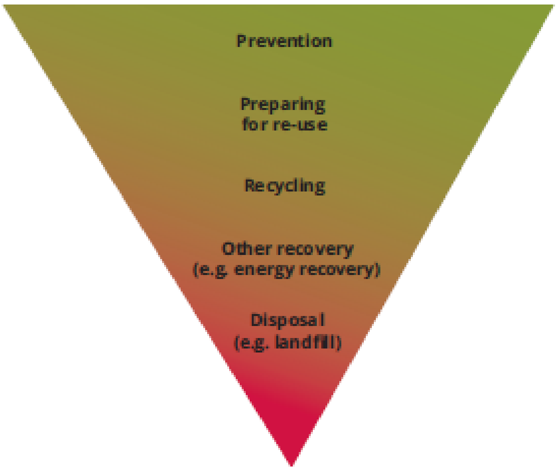

Figure 21. The waste management hierarchy.
Source: European Environment Agency.

Generation of waste excluding major mineral wastes

The indicator presents the amount of waste, excluding major mineral wastes, generated. It covers hazardous and non-hazardous waste from all economic sectors and from households, including waste from waste treatment but excluding most mineral waste.

Figure 22 shows that, in Denmark, mineral and solidified waste makes up the largest share of waste per capita and that its share of the total waste generation increased from 44.9% in 2004 to 56.8% in 2014. Although the volume of recyclable wastes per capita has increased, its share of the total waste generated per capita fluctuates - increasing from 18.1% to 20.8% from 2004-2010 followed by a decrease to 16.8% in 2014.

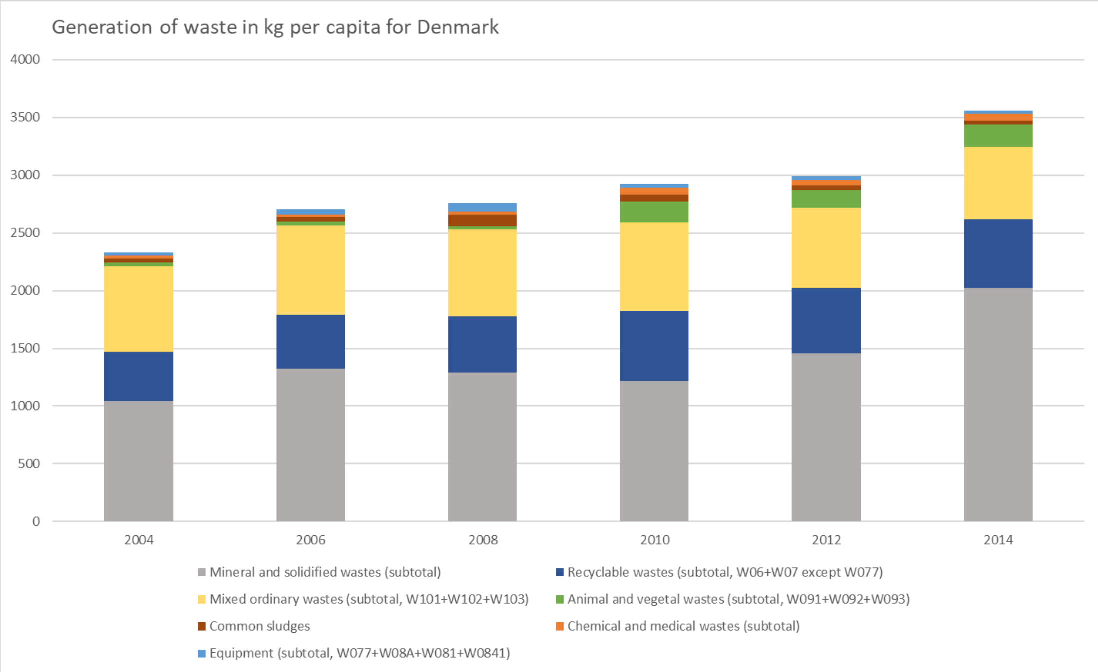

Figure 22. Generation of waste by waste category in Denmark.
Source: Eurostat.

Waste generation for EU28 together with Norway, Denmark, and Turkey is displayed in Figure 23. Denmark generates the most waste per capita among the three European countries, although its value is only half of the EU28 average; Turkey generates the least waste per capita. For Denmark and Turkey, the most common waste category is mineral and solidified wastes; while for Norway, it is mixed ordinary wastes.

On the showcase level, the data on household waste composition collected for Fredrikstad, Aarhus and Hatay, showed that organic waste is the largest waste category in quantity for all three European showcases. Organic waste consists of residuals coming from either a plant or animal, and it is preferred environmentally over items that do not disintegrate, such as plastic waste.

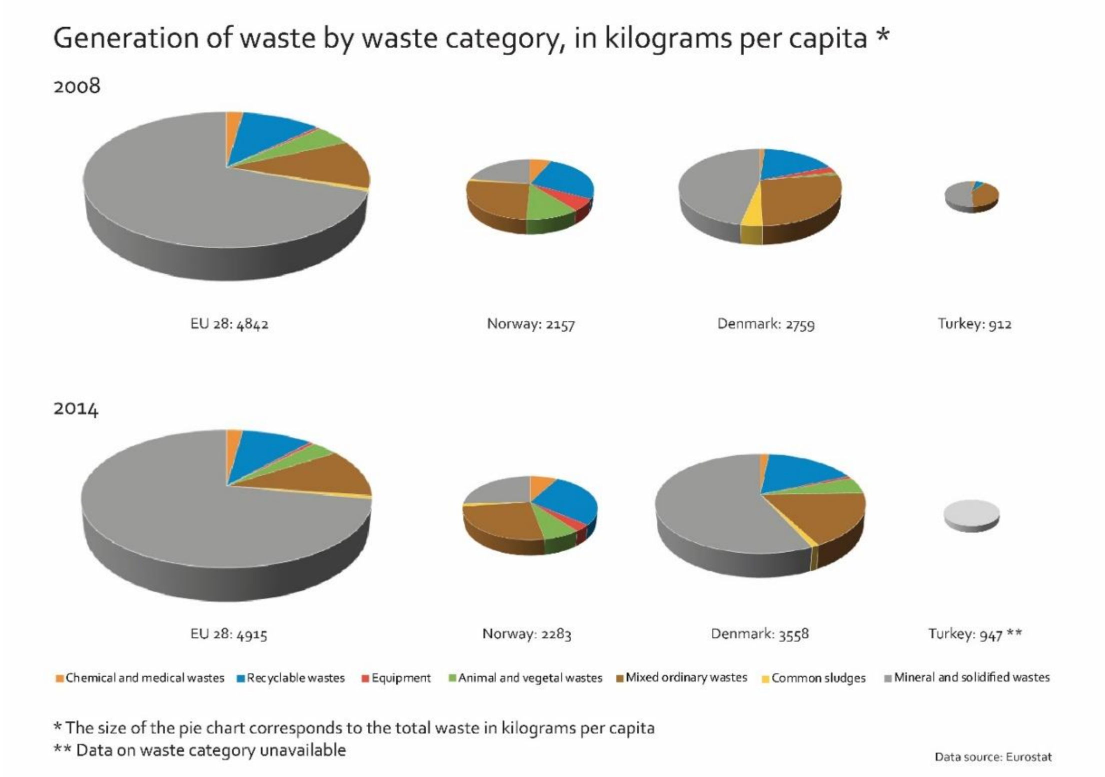

Figure 23. Generation of waste by waste category.
Source: Eurostat.

Landfill rate of waste excluding major mineral wastes

Disposal such as landfill is perceived as the least favoured waste-management approach, as landfilled waste represents an enormous loss of resources in the form of both materials and energy. A resource-efficient economy is, therefore, one which minimises the requirement for landfilling to the extent possible. On the contrary, recycling, including material recycling, composting and anaerobic digestion, has many benefits versus landfilling or incineration.

Figure 24 shows the waste treatment status in Denmark, Norway, Turkey and EU28 as an average in 2014. For Denmark, nearly 60% of the waste was recovered/recycled, and another 20% of the waste was incinerated for energy recovery. The waste that was deposited onto or into land (landfill) accounts for slightly over 20% of the total waste. Norway has a lower recovery/recycling rate and a higher incineration rate for energy recovery than Denmark. Both are performing in a more sustainable way than the EU28 average, with a considerably lower deposit and landfill rate of the waste. Backfilling operations[14] are more prevalent in Norway

[14] “backfilling' means a recovery operation where suitable waste is used for reclamation purposes in excavated areas or for engineering purposes in landscaping and where the waste is a substitute for non-waste materials”. Eurostat

and in the EU28 on average than they are in Denmark and Turkey. For Turkey, the major waste treatment operation is still the traditional disposal onto or into the land, accounting for 70% of the total treated waste.

The situation in Hatay is similar to that of the country as a whole, in that waste management is mainly conducted through solid waste disposal plants, and that waste recycling rate is rather low. In contrast, waste management is more sustainable in Aarhus even compared with the Danish average, with over 80% of the waste from stations recycled.

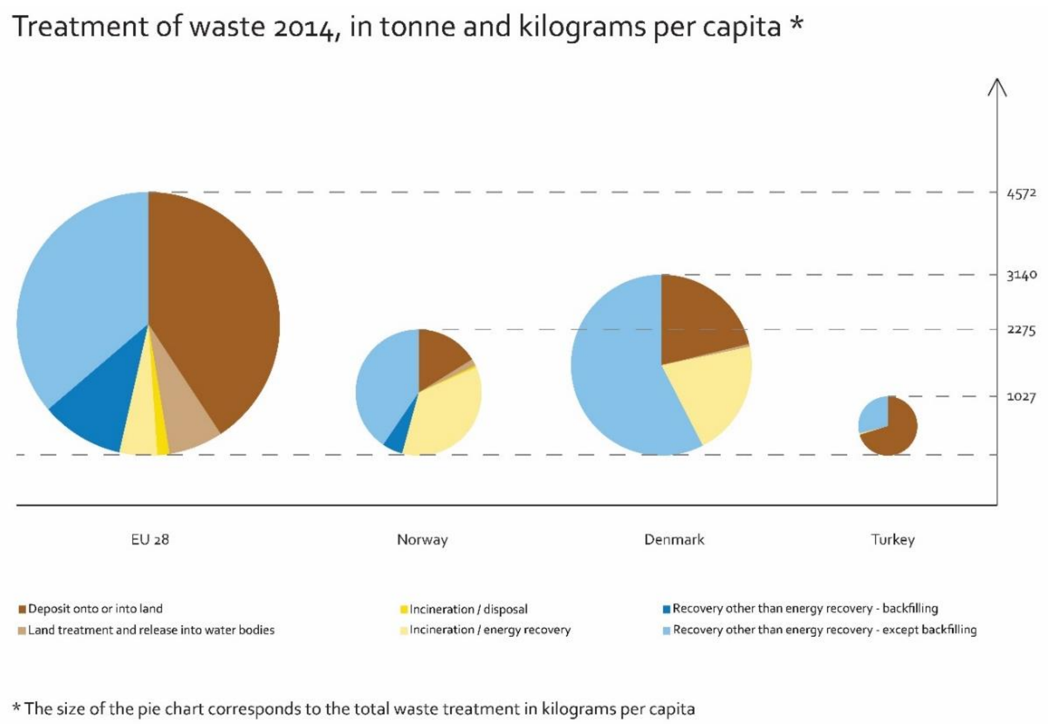

Figure 24. Waste treatment by waste operations in EU28, NO, DK and TK, 2014. Source: Eurostat.

Increase understanding of the contribution of UA to C-E and green growth

While natural ecosystems have a circular, zero-waste metabolism, in the way that the waste from one organism is the food of another. In contrast, urban ecosystems are often inefficient and incomplete. In most cases either the circle is not closed or the model of consumption is linear. Raw materials are extracted outside urban areas, transformed into goods and products and ultimately end up as waste, sewage and emissions beyond the city boundaries. For cities to become more resource-efficient, the loop of urban cycles needs to be closed by applying innovative technologies, changing mindsets, institutional governance and supportive policy. Figure 25 illustrates the circular economy as a closed-loop, which has been achieved/implemented to varying degrees in many industries. The urban metabolism can apply the same rationale, and its material and energy flows can be optimised by integrating all urban activities (industry, utilities, commercial, housing, urban and peri-urban agriculture), by involving all the actors (including investors and city residents) and by working with municipalities beyond the city limits (EEA, 2015).

Cities import large amounts of synthetically produced nutrients embedded within the food that usually end up in waste streams for emission to local water bodies or partial recovery during waste management, which is a traditional linear metabolism. UA enables productive reuse of water and urban waste to provide water, animal fees and fertilizers for the demands of urban agriculture (World Bank, 2013), providing the basis for a closed-loop urban food production system. For example, black-water (toilets) can be leveraged for UA, and household organic solid waste can be used to generate nutrient-rich compost.

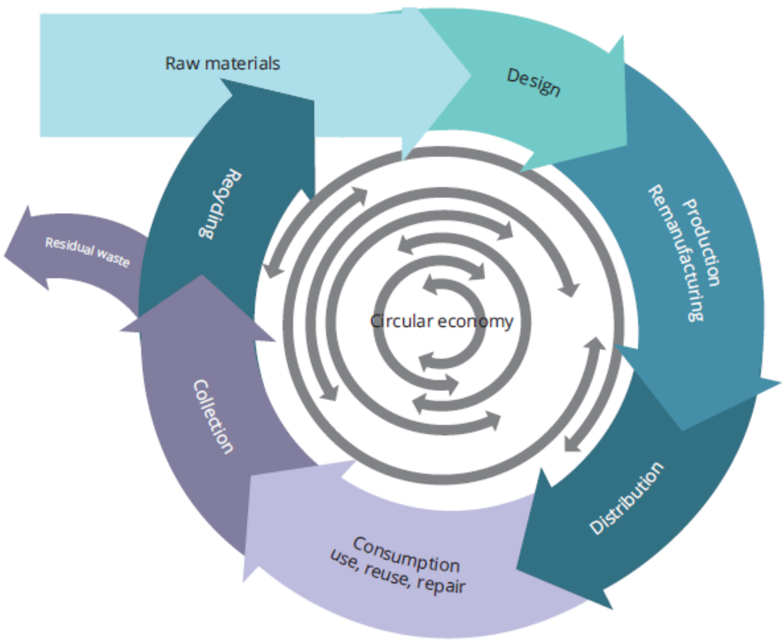

Figure 25. The circular economy.
Source: European Environment Agency.

As organic waste constitutes the largest portion of household waste generated in the European showcases, organic waste is ideal as material for UA activities. Residual waste can be recycled through the composting process, or be reused for the production of insects in connection with the aquaponic system, etc. With the blue technologies processing waste for recycling to be implemented within SiEUGreen, UA will contribute further to circular economy and urban symbiosis in optimising the material and nutrient flows and attenuating urban waste. The other two blue technology categories - source separation of wastewater and stormwater handling, and the yellow technology category mainly focus on ameliorating the energy flux in the linear urban metabolism. Through the attempt to leverage wastewater and collect unutilised energy imported to the urban system, these innovative technologies can generate renewable energy as biogas, allocate or store the energy for other purposes, which to a large extent contributes to close the energy loop.

Conclusions and recommendations

The monitoring indicators suggest that the three European showcases differ considerably with regards to the status of resource efficiency. As the lead indicator, resource productivity indicates that Denmark and Turkey are both moving towards an increase of material productivity and decoupling of material use from economic growth, however, are at different stages in the process. The performance in Norway is more varied and has fluctuated during the past decade. Norway and Denmark consume more materials per capita than Turkey. Denmark is outstanding in terms of the high share of biomass consumption whereas, in contrast, Norway is still much dependent on fossil energy carriers. Greenhouses in Arhus Municipality increase the productivity of artificial idle land and will be constructed in Hatay Province as an implementation of modernised production mode in urban agriculture. The freshwater abstraction for agricultural activities accounts for over 80% of the total abstraction, which makes more economical water use in agriculture more crucial. In Aarhus, awareness of water-saving is relatively high, and wastewater is treated systematically. While in Hatay, the effluent water resource results in uneconomical water usage, with nearly 90% of surface agricultural irrigation and there is a lack of a proper wastewater treatment system. GHG emissions per capita are decreasing in Denmark and Norway, both in total and for agriculture, while Turkey’s emissions are increasing. Denmark and Norway both have recovery and recycling as the main solid waste management; however, disposal is still the prevailing treatment in Turkey.

In the Sanyuan Farm stalk is transform into an enzyme as fertilizer (composting), and used as vermicomposting. Water efficiency is seen in the irrigation system which is remotely controlled, enabling precision irrigation. In Futiancangjun development in Changsha**,** the greywater from some apartments will be treated using a Biofilter/Filterbed treatment system or a biomembrane system. A wetland/pond system will be used to treat the stormwater.

UA appears to be a way to mitigate the environmental impact and move towards a circular economy and green growth, from the perspective of resource efficiency. With the implementation of innovative green technologies within the SiEUGreen project, plant growing will be transformed into a more resource-efficient mode. The blue and yellow technologies will contribute to solid waste recycling, wastewater recovery and energy saving. Despite the fact that technologies implementation varies at different showcases, it is expected from all showcases that the material, nutrient and energy flow will be forming a more closed-loop, and less residual waste as output from the urban metabolism system. The contribution of technology and improvement in resource efficiency will be monitored throughout the project period.

Module 4 SOCIETAL INCLUSION

Social inclusion is one of the benefits commonly claimed to be achieved through UA (Davidson, 2017; Corcoran and Kettle, 2015). Some studies argue that UA has enabled new forms of social engagement and created institutional conditions that can disrupt conventional agri-food systems (Davidson, 2017), others claim that UA has been an arena for challenging stereotypes, exchanging knowledge and dismantling social barriers (Corcoran and Kettle, 2015). Social inclusion is a rather complex and vast matter that is context-dependent and influenced by the constellation of stakeholders who take part in the UA initiative.

Based on the expected impacts of SiEUGreen project, and data collected from the project partners at the kick-off meeting, the following goals have been identified with relation to social inclusion in the context of SiEUGreen:

a. Increase understanding of the social and economic potentials of UA
b. Improve access to recreational activities
c. Increase social cohesion
d. Create jobs
e. Increase knowledge of organic gardening practices
f. Improve the quality of life
g. Improve social, economic and cultural governance of UA
h. Improve children's knowledge of healthy food
i. Increase social capital through UA

Considering these goals, issues related to societal inclusion are explored through the mapping of the relationships between the stakeholders involved in the different UA initiatives. Attempts to exploring how UA can trigger/improve societal inclusion in economic, social and political terms is also made.

Map & analysis of the actors involved in the cases study

Actors analysis is a way of generating information about actors' behaviour, interests, agendas, their influence on decision-making processes (Brugha and Varvasovsky, 2000).

At this early stage of the project, it was not yet feasible to undertake comprehensive mapping the network of actors involved in the showcases. For the time being the focus turns to the basic constellation of actors involved, with the intention of deepening this analysis as the project progresses. In the case of Taste Aarhus, the core program staff consists of just four civil servants; an architect, who manages the program, a specialist in gardening, who acts as a counsellor in many of the initiative, an account, and a communications expert. This small team manages more than 300 UA initiatives in Aarhus by 'sitting on their hands'. This expression was used by the Taste Aarhus manager to describe their work method. It means that the program provides small start-up support (financial and counselling), and that is all. While this perspective might be interpreted as a lack of support, it has proved to be a successful strategy in encouraging participants to take full responsibility for their own gardens.

Any person in the city is eligible to start up an initiative. Only two requirements are necessary; organisation of a democratic structure consisting of a chairperson, treasurer and three other decision-makers and organising two events per year that are open to the public. The latter is a means of giving back to the community for the privilege of using public land.

In Hatay, the Women's cooperative engages 250 women in peri-urban agriculture, offering a rich opportunity for actor-network analysis. The administrative structure of the cooperative consists of a chairwoman who works in cooperation with Hatay Municipality and seven women who are part of the board. As the UA initiatives take place in 13 districts of Hatay, the members of the board are in charge of managing and providing assistance (e.g. meeting and educational activities) to those involved in UA. The board also deliberates on the admission of new members to the cooperative. The reeves, who are males and responsible for different streets or districts of the city, help to identify women interested in becoming members. The reeves are not part of the cooperative, which has women as the primary and only group, but they mediate the communication between these women and the board during the process of selecting new members. Figure 26 below depicts the organisational structure of the Women's Cooperative.

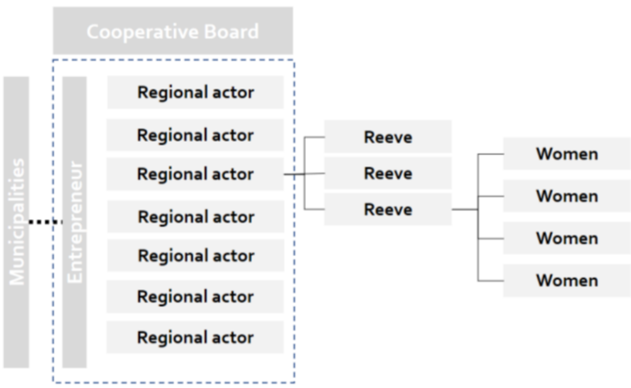

Figure 26: Network of actors involved in the Women's Cooperative

Once engaged in the cooperative, the municipality provides financial and technical support. For example, the municipality delivers material to build up a small greenhouse and seeds to start up the cultivation. The entrepreneur who started up the initiative also invested €2,500 in the start-up phase. Technical support includes monthly visits from an engineer who works at the municipality and give advice (e.g. irrigation, fertilizer).

In Fredrikstad, the development of Cicignon Park is still in an early stage of development; thereby, it is not possible to say much about the network of actors involved in UA. Nevertheless, the developer, Nordic Group Development AS, the NMBU with expertise in technologies for resource-efficiency seem to play an important in this showcase. Similarly, in Futiancangjun development in Changsha showcase, Hunan Hengkai, the property developer, is the primary actor. Here the developer is responsible for building houses in residential communities and then selling them to urban residents, who later act as property managers to provide technical services and guidance to residents.

In the Beijing showcase, the Sanyuan farm rents the farmers' arable land and then transforms it into small pieces and rents them to urban residents (see Figure 27). A number of stakeholders are involved in the implementation and management of Sanyuan Farm. Beijing Sanyuan Agriculture Co., Ltd. is the owner and manager of the farm. Beijing Ecological Creative Agriculture Service Alliance is responsible for the implementation and promotion of greenhouse technology, compost technology and balcony vegetable garden, is responsible for the business model development of UA. Urban dwellers rent small plots of farmland to grow their own vegetables or participate in farm activities. According to the manager of the farm, the plots available for rent attracts mainly highly educated, middle-class people. In sharp contrast with the showcases in Hatay and Aarhus, urban gardeners have no direct influence on the management and decision-making of the farm. Government actors are not directly involved; they have however, issued some policies to support the development of leisure agriculture in the suburbs. For example, the land that is now Sanyuan Farm, originally farmers' land which was nationalised, is allocated to Sanyuan Farm for free. Sanyuan farm can use the land permanently and free of charge. Schools and other educational institutions cooperate with Sanyuan Farm and regularly organise activities on the farm. Overall, the connections between these stakeholders are relatively loose when compared to the European showcases. The relationship between the farm and the participants most closely resembles that of supplier and customer – If the farm service is not good, the participants will choose other farms.

Co-funded by the Horizon 2020 programme of the European Union
Co-funded by the Chinese Ministry of Science and Technology

Figure 27. Actor interaction in the Beijing showcase

Improving societal inclusion

Societal inclusion is commonly understood as having three dimensions: economic, social and political. The economic dimension relates to a person's ability to contribute to the economy and share the benefits of economic growth. This dimension is predominantly relevant to social groups that practice UA as a means of income. The social dimension is largely concerned with the concept of social capital, which can be understood as 'networks together with shared norms, values and understandings that facilitate co-operation within or among groups' (OECD, n.d). Finally, the political dimension concerns the capability of all citizens to participate in making collective decisions about matters that affect their lives - something that varies considerably across contexts. Some critical questions related to this dimension include: How are different societal groups involved in the planning and design of local food systems? (Raja et al. 2017); What opportunities does UA present for new forms of engagement with the political ecology of the city? (Davidson 2017). The remainder of this section explores these dimensions in turn as they relate to the European showcases.

Economic

The economic dimension relates to the ability of UA to empower people to contribute to the economy and share the benefits of growth. This dimension is concerned with questions such as: How does UA provide access to food, and for whom?; Which groups are enjoying the benefits of UA? (Meenar 2017) and; How does UA contribute to (or undermine, e.g. "green gentrification") spatial justice within the city? (Raja et al. 2017).

While the economic dimension of societal inclusion is, of course, relevant to the Aarhus showcase, it was difficult to assess without collecting demographic data about participants in the Taste Aarhus project. There may be potential to collect this type of data at later stages in the project. During the field study, we did not come across any examples of participants in the Taste Aarhus project who were motivated to grow by material need. In addition, there do not appear to be participants who are growing for commercial purposes.

In sharp contrast, enhancing the economic independence of low-income women is the major objective of the Women's Cooperative in Hatay. Working with agriculture provides women with the possibility of additional income, particularly as it can be carried out in addition to their daily jobs. A woman who is a member of the cooperative reported considerable improvement in her economic condition as a result of her participation. As her family get many products from the greenhouse, her costs with food have decreased by approximately 50%. In addition, she also enjoys the benefits of the collective revenues made by the cooperative.

Given its central location and inclusion in a new development, the Fredrikstad showcase offers a unique opportunity to take a more critical perspective and explore the notion of "green gentrification" through UA as raised by Raja et al. (2017). Unfortunately, it is too early in the Cicignon Park development to say much more than that at this stage. There may be potential to explore these ideas, from a planning perspective at least, in the coming months. It is unlikely that this showcase will offer any opportunity to explore UA as a means of income.

The Beijing project demonstration site, Sanyuan Farm, mainly reflects the leisure function brought by urban-suburban agriculture to urban residents. Given urban residents must rent the land they cultivate, this showcase may offer an opportunity to assess the accessibility aspects of UA in the Chinese context (e.g. how does cost effect participation in UA initiatives). The land lease price of Sanyuan Farm is relatively high. The participating urban residents are mainly middle-class families with good economic conditions, and the scope of participants is limited. The farm is also quite far from the urban area, meaning that it may be difficult for some families to access.

Social

This social dimension of inclusion offers an opportunity to explore how different practices of UA enhance different forms of social capital (OECD, n.d) such as:

- **Bonds:** Links to people based on a sense of common identity ("people like us") – such as family, close friends and people who share our culture or ethnicity. For example, UA can strengthen the social bonds of those involved in growing food (community level)
- **Bridges:** Links that stretch beyond a shared sense of identity, for example to distant friends, colleagues and associates. For example, growing food could be a mean to foster social integration of immigrants and marginalized groups

A critical question that underlines the distinction between bonds and bridges is: 'How do UA projects break down barriers between social groups and encourage the creation of new networks?' e.g. "spaces of potential" "shared politics of place" (Corcoran & Kettle, 2015).

The Aarhus showcase offers a rich opportunity to study the social dimension of societal inclusion as an outcome of UA. UA is clearly a valuable tool in enhancing social capital, though the way this occurs appears to vary from garden to garden. In some cases, bonds between acquaintances are strengthened through participation. For example, an underutilised public area that has been 'adopted' by a group of neighbours and has become a space for interaction strengthening the bonds among them. In other cases, new bonds are created between people who were previously strangers. For example, a woman who was inspired by a documentary about urban gardening united with her neighbours to start-up a vibrant and social garden at the back of the churchyard.

Larger gardens appear to bring less proximal people together, but we do not yet have adequate knowledge about the level of interaction between participants in these gardens to assess their contribution to the development of social capital. Understanding of the social and demographic make-up of participants in the gardens is also somewhat limited at this stage, making it difficult to ascertain whether such connections may constitute forms of bridging capital. 'Gardens of the World' offers an important social opportunity in an extremely culturally diverse neighbourhood with people from more than 80 nationalities. In these gardens, residents are encouraged to grow herbs and other plants that have cultural significance for them.

In Hatay, the Woman's cooperative fosters social engagement despite the fact that most women work individually in their own plots. As one member revealed during an interview, the activities sponsored by the cooperative has enriched her social life. Besides the meetings held to discuss issues related to the cooperative, some of the women also meet during their spare time, for example, eat lunch together in each other's greenhouses. This provides a valuable source of social contact with other women. The project has increased the women's capacity to grow their own food and seems to have helped to strengthen the social bonds between them. Nevertheless, since the activity mainly involves women from low-income groups, it has not effectively bridged different social groups. Yet, this initiative has created the opportunity to exchange knowledge and experiences between these women and other actors from other social groups (e.g. civil servants, engineers).

The information on the development of Cicignon Park does not allow inferences about how UA could foster social capital in the development. The visions and goals of the development are quite broad and make it difficult to form any concrete hypothesis about the target group. They are described by the developers as follows:

- *Develop a park-like living area with balconies and with green areas and gardens*
- *Shopping centre with a grocery store, flower shop, hairdresser, doctor, dentist, pharmacy, fitness centre etc.*
- *Social infrastructure. Places to meet, eating places, kindergarten, school etc. Diversity of all age groups.*

Knowledge on the number of residential units, types of apartments (e.g. floor area) may be useful in shedding some light on the profile of the future residents, or at least indicate if the project has been planned and designed for a heterogeneous social group (e.g. families, students, elderly).

At Sanyuan Farm, urban residents can cultivate their own land and produce food for their relatives, friends or neighbours, which can enhance social integration. Sanyuan Farm provides a place for urban residents to entertain and relax so that people from schools and institutions can come here to organise activities and socialise.

When it comes to Futiancangjun development in Changsha, not much can be said as people have not yet moved into the apartments. Nevertheless,it seems that urban agriculture will be practised individually in balconies.

Political

The political dimension of societal inclusion refers to the capability of all people to participate in making collective decisions about matters that affect their lives. Some critical questions related to this dimension include: How are different societal groups involved in the planning and design of local food systems? (Raja et al. 2017); What opportunities does UA present for new forms of engagement with the political ecology of the city? (Davidson 2017).

In Aarhus, there were clear examples of UA presenting opportunities for the new forms of engagement with the political ecology of the city, as Davidson (2017) describes. The fact that the groups need to organize themselves to start up a UA initiative is per se an exercise of that fosters democratic principles. Each group is different in the way that they navigate setting up these structures and deciding how their garden will run but the central commonality is the democratic process. The garden projects also give residents the opportunity to shape the public spaces in their city in ways that they might not have expected. Another significant example of political engagement related to the garden projects was found at Fællesgartneriet, Brabrand. This land is pin-pointed for potential development and there is some talk of it becoming an eco-village. According to the Taste Aarhus project workers, the garden group have been quite successful at making themselves visible, making networks with politicians and raising funds. This paves the way for ensuring that, if these plans do come to fruition, the group and their garden will be a part of them.

In terms of political empowerment, several aspects of the Women's Cooperative in Hatay have been significant. A member of the cooperative who also takes part in the board highlighted the opportunity the cooperative has given her to become politically active. The tasks of managing, deliberating and collaborating with other members has been, in her opinion, a great experience. The Women's Cooperative also challenges the gender conditions of the local labour market, as the female employment rates in Hatay as well as in Turkey is considerably low compared to that of males (see Hatay study case report). The cooperative fosters the involvement of women in the local economy, enabling them to support their households. In this respect, UA seems to be a mean for social and economic empowerment.

At this stage, data relating to political engagement through UA in Fredrikstad is scarce. There does appear to be quite a bit of interest in the development among residents, however, and it would be interesting to explore perceptions of the development in the community (e.g. short interviews with people who live close to the site). A follow-up on the political issues and discussions that surrounds the new development through media material would also be helpful to grasp the political issues that surround the implementation of Cicignon Park. Of particular interest in both cases would be what (if any) influence the "green" elements of the development have had on public perceptions.

No political significance has been found in the Chinese showcases for the time being.

Conclusions and recommendations

The Aarhus showcase offers a rich opportunity to study societal inclusion as an outcome of UA. From a social perspective, UA is clearly a valuable tool in enhancing social capital, though the way this occurs appears to vary from garden to garden. In some cases, bonds between acquaintances are strengthened through participation, and in other cases, new bonds are created between people who were previously strangers. From a political perspective, UA appears to present at least some opportunities for the new forms of engagement with the political ecology of the city. The democratic structure required by the Taste Aarhus project is instrumental here; however the opportunity to use public land also appears to elicit a degree of ownership.

The Women's Cooperative in Hatay promotes the economic empowerment of women while at the same time fostering social interaction and through seminars and meetings. The structures included in the management of the project, while perhaps more hierarchical compared to those of Taste Aarhus, still embody participatory democracy and present an opportunity for political engagement. The fact that the UA activities are spread out in 13 districts also should be noted. In addition, gathering 250 women was an efficient process that took place in a relatively short time.

Although little is known about the social dimension of the Fredrikstad showcase case at this stage, it is clear that the Cicignon Park site offers great potential to learn about the process of integrating UA into a planning process. Interviews with the developers and municipal planners could offer interesting insight about the motivations, enablers and barriers here. In addition, the perspectives of residents could offer insight into the role of the "green" element of the project in shaping public perceptions of development. Finally, though challenging from a methodological perspective, this showcase may offer the opportunity to take a critical perspective on UA and study notions of "green gentrification" even if only in an exploratory fashion.

In the Chinese context, the Beijing showcase offers the opportunity to study the social aspects of UA while the Changsha showcase offers a similar potential to investigate the economic aspects as the Cicignon Park development.

Further development of this module may include a careful analysis of the linkages (flow of information, power, etc.) between the actors. This exercise can provide insight into strategies for engagement that will be further developed within SiEUGreen (i.e. Delivery 1.5) as well as shedding light on the interactions that occur in the showcase locations during the technology implementation phase of the project. This knowledge can be useful in developing strategies to make UA initiatives more resilient to challenges related to the distribution of power among the members.

Part 3. Summary and next steps

Summary of findings

With respect to **land use**, the main lesson learnt from the different cases is that assumptions about UA cannot be taken for granted. The factors shaping the process of securing land for UA appear to be more complex than can be determined through simple quantitative indicators, for example, land price or land availability. The overarching vision of a region or city also plays a role in shaping the perceptions of UA. In the case of Fredrikstad, the pursuit of global recognition in the field of urban sustainability provides motivation to reserve premium land for UA. In Aarhus, the notion of "being a good city for all" is driving the use of land of all shapes, sizes, values and locations for UA. Finally, Hatay with its strong agricultural profile favours peri-urban agriculture with higher yield capacity. Based on these profiles, several draft "types" of UA can be identified including transitional, leftover, between buildings, and fringe.

Institutional aspects appear to play a role in shaping the nature of the vision that will be formulated and thus will affect what types of UA initiatives occur and what land can be efficiently utilised for UA. The high level of power at the municipal level in the Nordic planning systems appears to result in a more urban focus, in contrast with the stronger regional perspective in the case of the more top-down Turkish system. In China, the majority of the power within the planning system is also concentrated at the national level. However, stakeholders at the lower levels play an important role in developing neighbourhood-level plans in line with national priorities.

An interesting finding across all showcases is the way that UA is absent from the formal planning system, albeit in different ways. In Aarhus, UA is considered a temporary "activity" rather than a permanent fixture within the urban fabric. In both Fredrikstad and Changsha, the introduction of UA to the city is led by private developers. In Hatay, agriculture is a vitally important part of the regional economy and thus regional planning; however the urban dimension appears to be lacking. Finally, in Beijing, UA is seen as a leisure activity facilitated through lease agreements with individual families. In none of the showcase locations is UA considered an important aspect of the urban environment from a planning perspective.

Further exploration is required to draw a better picture of the potential and hindrances for UA as well as to understand how UA can help create greener landscapes. This may include smaller-scale spatial analysis in proximity to the showcase locations showing, for example, accessibility to green areas, percentage of sealed soil, official uses of land, land ownership and land price. A careful exploration of land ownership and tenure, with the aim of revealing important aspects of the structure of the land in the showcases and municipal budgets allocated to UA, can be a proxy about the willingness of public administration to incorporate agriculture into urban environments. The feasibility of this work will, of course, be dependent on the availability and quality of data in the different showcases.

Understanding the contributions of UA to **food security** in the context of cities in developed economies is a challenging task. Although there are notable differences, all SiEUGreen showcase countries experience a good level of food security when considered in a global context. When it comes to understanding food security at an urban, or even regional level, a more qualitative approach is required. Based on the evidence available at this early stage of the project, it appears that the role of UA in providing access to high-quality food is marginal in the showcase locations at this stage. In Aarhus and Beijing, the outcomes of UA initiatives appear to be more social in nature and in Hatay, the primary goals are economic. In Fredrikstad and Changsha, there is not yet significant UA activity to assess. When it comes to an understanding the contribution of UA to the urban food system, the SiEUGreen showcases offer a potentially rich source of knowledge. Of particular interest is the way that UA may be useful in reconnecting urban dwellers with the food production process. This is particularly evident in the Aarhus and Beijing showcases.

In the project proposal, the indicators provided by the FAO-UN were proposed as useful in evaluating the impact of the SiEUGreen project with respect to food security. Though these indicators no doubt provide a useful starting point, it is also important to acknowledge the limitations of this data set, particularly when it comes to understanding food security at an urban scale. Perhaps more useful is the rich qualitative data that can be obtained by engaging with participants in SiEUGreen initiatives throughout the life of the project. In particular, it is recommended that information from a sample of participants in each showcase is collected at two or more stages throughout the project using questionnaires. These questionnaires should explore:

- The motivations for involvement in UA projects, and to what extent these motivations relate to food production.

- The extent to which the knowledge gleaned through participation in UA projects has equipped participants to meet their dietary needs through their growing in the case that such action should be required.
- How participation in the UA initiative has affected knowledge and awareness around the quality of food.
- To what extent UA contributes to self-sufficiency (e.g. what portion of food needs are met by growing).
- What (if any) impact participation in UA has on consumption behaviour as related to food.

In addition, further qualitative interviews with professionals, both food related and in the planning sector, would be useful in further understanding the place the food system occupies in contemporary urban thinking.

UA has been proposed as a strategy through which to promote **resource efficiency**, mitigating environmental impacts, promoting green growth and moving towards a circular economy. As a starting point to investigating this claim, we sought to understand the broader context, finding considerable differences between the European showcase locations when it comes to resource efficiency. Denmark and Turkey are both moving, at different speeds, towards decoupling material use from economic growth, while Norway remains somewhat dependent on fossil fuels. Denmark utilises an impressively high share of biomass and is also strong on organic waste recycling, particularly in Aarhus Municipality. Denmark and Norway both have recovery and recycling as the main solid waste management strategy, however, disposal prevails as the primary method in Turkey. Water use is of deep concern, particularly in Hatay where close to 90% of agricultural use is surface irrigation and there is a lack of a proper wastewater treatment system. GHG emissions per capita are decreasing in Denmark and Norway, both in total and for agriculture, while Turkey's emissions are increasing. Greenhouses are an important means of increasing the productivity of artificial idle land in both in Arhus Municipality and Hatay Province. Evidence from China related to resource efficiency was difficult to source, a barrier that can hopefully be overcome before the completion of the project.

Within the SiEUGreen project, the implementation of innovative green technologies will be key to making resource efficiency a reality through UA. Monitoring the contribution of these technologies to the showcases' performances on environmental indicators throughout the SiEUGreen project period will be vital to developing an improved of the resource efficiency component of UA. On-site measurements and small-scale experiments would also be useful in drawing more concrete conclusions.

The diverse nature of the showcases offers a rich opportunity to study **societal inclusion** in the context of UA. From a social perspective, the Aarhus, Hatay and Beijing showcases demonstrate the value of UA as a tool to enhance social capital. In the case of Aarhus, this occurs in a variety of ways, with some gardens strengthening bonds between acquaintances and others creating new bonds between previous strangers. In Hatay, social interaction is fostered through meetings and seminars while the gardens themselves are an individual venture. In Beijing, UA offers valuable recreation time for families. From a political perspective, UA appears to present at least some opportunities for the new forms of engagement with the political ecology of the city. In both Aarhus and Hatay, the democratic structures through which the garden projects (Taste Aarhus) and the Women's Cooperative (Hatay) operate are instrumental in this. In the case of Taste Aarhus, the opportunity to use public land for UA also appears to elicit a degree of ownership that in some cases leads to political engagement.

Further development of this module may include a careful analysis of the linkages (flow of information, power, etc.) between the actors. This exercise can provide insight into strategies for engagement that will be further developed within SiEUGreen (i.e. Delivery 1.5) as well as shedding light on the interactions that occur in the showcase locations during the technology implementation phase of the project. Further investigation into the social dimension of the Fredrikstad and Changsha showcases will also be vital going forward as this case offers great potential to explore the social processes involved in integrating UA into the planning of private development. Interviews with the developers and municipal planners could offer interesting insight about the motivations, enablers and barriers here. In addition, the perspectives of residents could offer insight into the role of the "green" element of the project in shaping public perceptions of development. Finally, though challenging from a methodological perspective, these showcases may offer the opportunity to take a critical perspective on UA and study notions of "green gentrification" even if only in an exploratory fashion.

Even at this early stage, the evidence presented here and in the case study reports provides a surprisingly rich picture of the four central pillars of the SIEUGreen project: land use, food security, resource efficiency and societal inclusion. The data presented here also highlight the most substantial knowledge gaps and the areas where contributions from the SiEUGreen project have the greatest potential value - both to the project partners and to the scientific community more broadly. The next and final section of this report outlines a preliminary data collection strategy that will guide this work going forward.

Data collection strategy

The comprehensive nature of the research undertaken for this delivery has largely exhausted the relevant quantitative data sets available at the national, regional and municipal level for the showcase locations. Thus, further data collection is likely to be more fine-grained, targeting specific geographical areas, or even sites, and engaging in a more meaningful way with stakeholders and participants. This work will support the development of a more nuanced understanding of the four pillars and will feed into the remaining deliveries in WP1 and into the project as a whole. In order to better document the data, a metadata template will be designed, in which essential information will be stored.

The goals identified through D1.1 will continue to guide data collection throughout the SiEUGreen project, though they may, of course, be refined based on new knowledge as it is acquired. Table 10 provides an overview of these goals (as refined based on the findings of D1.1) alongside recommendations for data collection going forward.

Table 10: WP1 data collection framework

Pillar	Related goals	Potential methods
Land use	- Secure land for UA - Increase land efficiency for UA - Identifying the potential and hindrances for UA - Create greener urban landscapes – securing political and institutional support & monitoring	- Detailed spatial analysis targeted at relevant locations - Interviews with planners and other relevant professionals (local level)
Food security	- Increase access to high-quality food that is healthy, nutritious and contamination-free - Increase understanding of the contribution of UA to the urban food system	- Participants surveys - Interviews with planners and other relevant professionals (local level)
Resource efficiency	- Mitigate environmental impacts through UA implementing novel technologies - Promote resource efficiency in relation to UA applying quantitative measures - Increase understanding of the contribution of UA to circular economy and green growth	- Small-scale experiments - On-site measurements - Monitoring of technology implementation
Societal inclusion	- Increase understanding of the social and economic potentials of UA - Improve access to recreational activities - Increase social cohesion - Create jobs - Increase knowledge of organic gardening practices - Improve the quality of life	- Participant surveys and interviews (targeted and longitudinal) - Collection of demographic data from participants accompanying any other data collection - Stakeholder mapping

	- Improve social, economic and cultural governance of UA - Improve children's knowledge of healthy food - Increase social capital through UA	

The initial focus will be on collecting data to inform the next deliverable *D1.2 Baseline study including key indicators and development of a typology*. Here, we see great potential in the draft framework presented under the land use section and shown again in Figure 28. Further work is required to refine the model and integrate the other pillars; however, this model provides a great first step and a framework through which to begin a fruitful conversation between the actors in the different showcases.

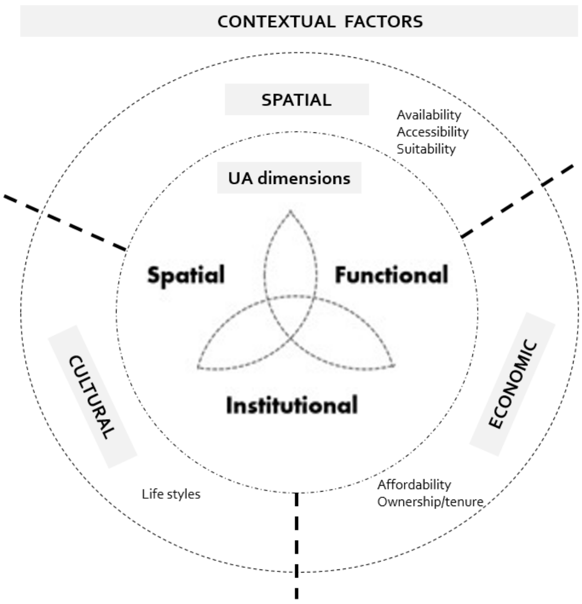

Figure 28: Use of urban land for agriculture: a framework for analysis

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SiEUGreen

Sino-European innovative green and smart cities

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Deliverable 1.1

Maps of quantitative and qualitative data for each of the showcase locations - Annex 1. Aarhus report

Lead Partner: Nordregio
Lead Authors: Luciane Aguiar Borges, Shinan Wang & Linda Randall

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SiEUGreen

The project has received funding from the European Union's Horizon 2020 Research, and Innovation programme, under grant Agreement N 774233 and from the Chinese Ministry of Science and Technology.

Throughout SiEUGreen's implementation, EU and China will share technologies and experiences, thus contributing to the future developments of urban agriculture and urban resilience in both continents.

The project SiEUGreen aspires to enhance the EU-China cooperation in promoting urban agriculture for food security, resource efficiency and smart, resilient cities.

The project contributes to the preparation, deployment and evaluation of showcases in 5 selected European and Chinese urban and peri-urban areas: a previous hospital site in Norway, community gardens in Denmark, previously unused municipal areas with dense refugee population in Turkey, big urban community farms in Beijing and new green urban development in Changsha Central China.

A sustainable business model allowing SiEUGreen to live beyond the project period is planned by joining forces of private investors, governmental policy makers, communities of citizens, academia and technology providers.

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Technical References

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[1] **PU** = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

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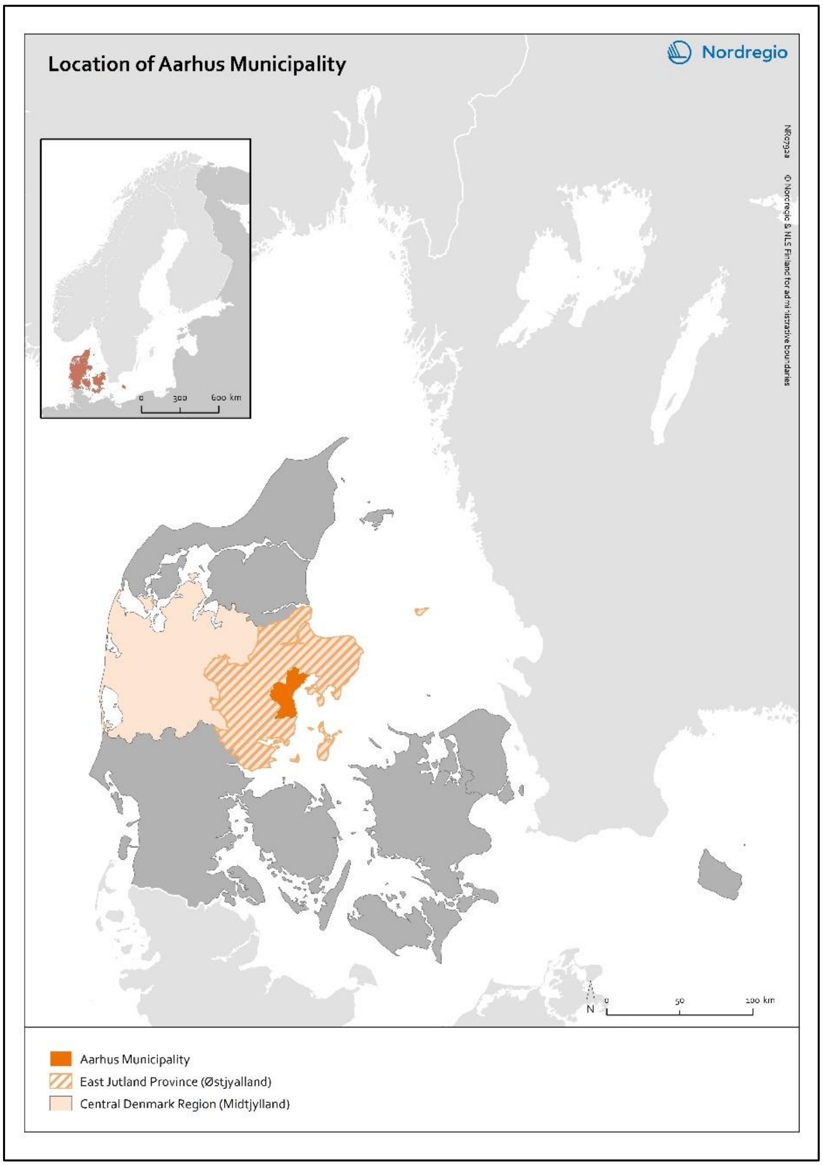
Introduction

Aarhus is the biggest city in the Central Denmark Region (Midtjylland) and the second-largest and oldest city in Denmark. Aarhus municipality is one of 19 administrative units (municipalities) which make up the East Jutland Province (Østjyalland). Central Denmark Region has 1.3 million inhabitants (around 23% of the total Danish population). Aarhus holds around one-fourth of the population of the region, making it the most populous city in the region (Statistics Denmark, 2018).



Map 1. Aarhus Municipality

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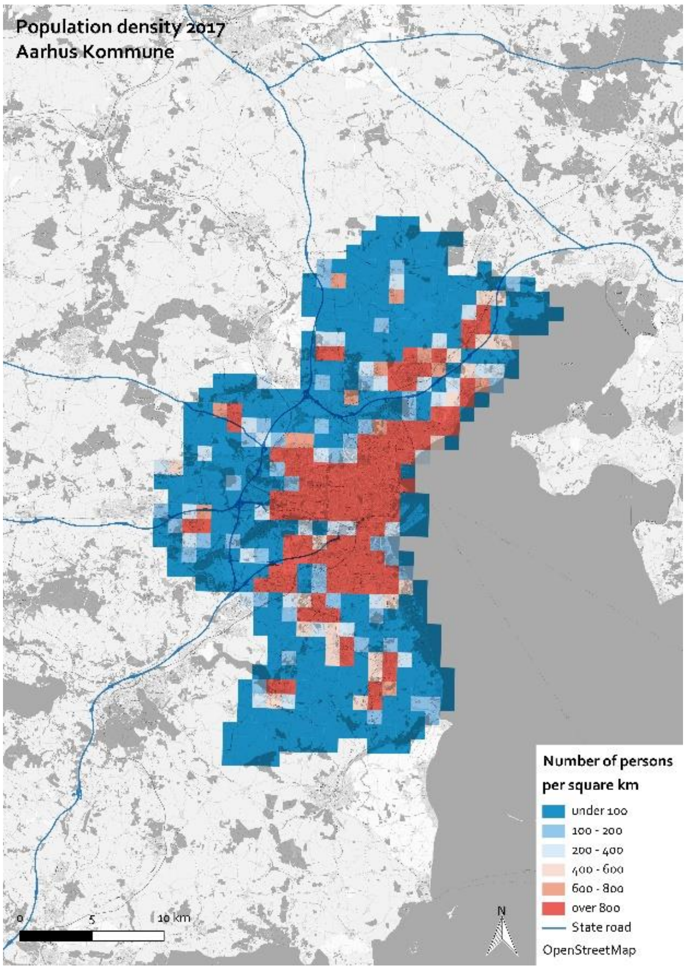
Aarhus has a population of 340,421. The majority of the population live within the urban core (around 93.7%) with the remainder dispersed throughout the municipality. The average population density is around 700[1] inhabitants per km^2 but varies substantially across the municipality - from over 1000 inhabitants per km^2 in the urban core, to under 100 inhabitants per km^2 on the fringes of the city (Map 2).



*Map 2: Population density on 1km*1km grid level in Aarhus Municipality, 2017*

As shown in Figure 1, 25-34 years old is the largest age group in Aarhus Municipality. This is largely due to an abundance of higher education institutions in the municipality (8 in total) (Nordregio, 2016), attracting students and researchers from other regions. In addition, over

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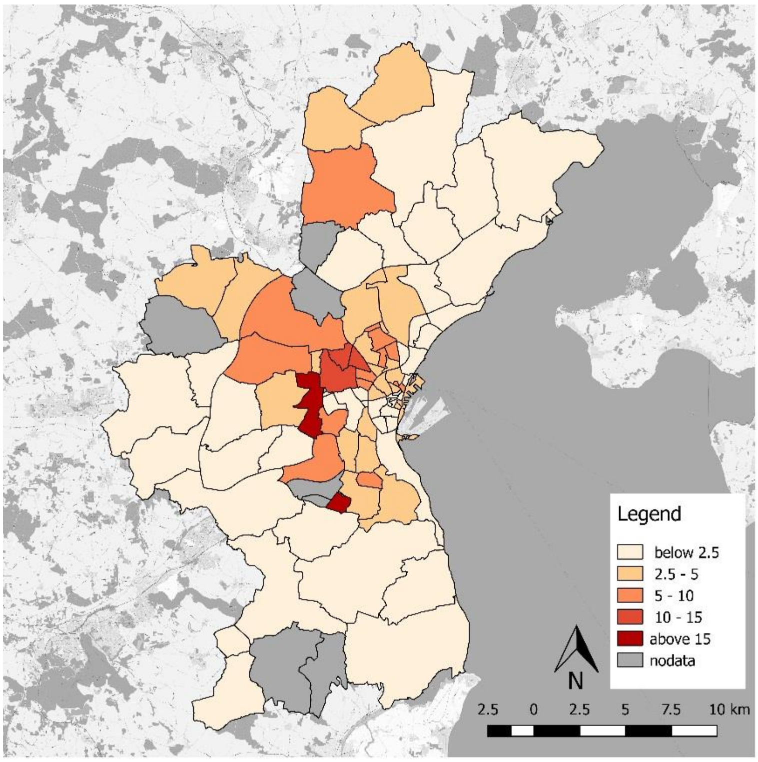
[1] https://ugeo.urbistat.com/AdminStat/en/dk/demografia/dati-sintesi/aarhus/20367515/4

half of the Aarhus population, aged 25-64 years have a tertiary education (51.3%), well above the Danish national average (37.1%).

Figure 1: Age profile for Aarhus Municipality, 2016
Source: Open Data, DK

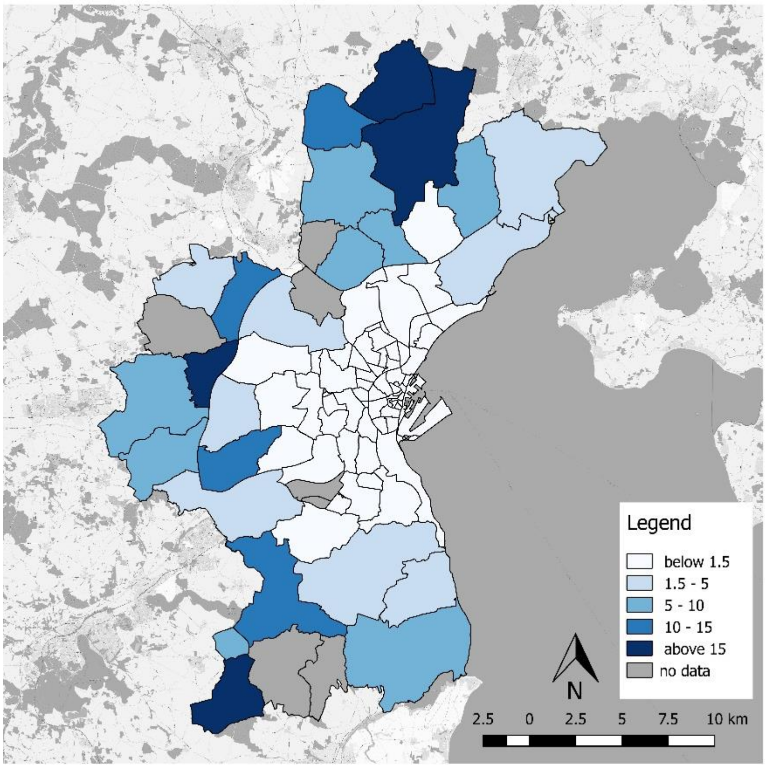
Aarhus is home to 7.7% of the total population of immigrants and direct descendants of immigrants who live in Denmark, which corresponds to 50,616 people (The Ministry of Immigration and Integration,2017) or around 15% of the Aarhus population. As can be seen in Map 3, these migrants are primarily concentrated in districts in the central and northern parts of the municipality.



Map 3. Percentage of the population with non-Western citizenship

The Midtjylland Region accounts for roughly 20% of the total Danish GDP, only after Hovedstaden (Greater Copenhagen Region). In 2015, GRP per capita in the region was 114% of the EU average while in the Capital Region of Copenhagen the GRP per capita was 125% of the EU average. With the exception of slight fluctuations during the economic crisis (especially in 2008-2010), the region's economic performance has been strong, with GRP increasing from €49,903m in 2008 to €55,201m in 2015 (Eurostat, 2017).

In the past, the port and its associated industries have played an important economic role. More recently, Aarhus stands out as a regional trade, research and education centre with a high in-commuting number from large parts of East and Central Jutland (Olafsson et al. 2015). The local economy is quite diverse and relatively spread out through different sectors, with 18% of the business being related to culture, leisure and other services. The sectors of 'trade & transport' and 'business services' account for 16% each of the total share of business in the municipality. It is followed by the sector of public administration, education and health (11%), finance & insurance (8%) and real state (7%). Activities related to agriculture, forestry and fishery contribute with the lowest share accounting for 2% of total business. As can be seen in Map 4, the companies that work with agriculture, forestry and fisheries are primarily located in the urban fringe.



Map 3: Percentage of companies which work with agriculture, forestry or fisheries

With regards to Foreign Direct Investment (FDI), Midtjylland Region witnessed an increase in the total value of investments between 2003-2009 and 2010-2016 while the Capital Region experienced a decrease. This suggests that, although both FDI total value and FDI intensity remain significantly higher in the Capital Region, Midtjylland Region is catching up (Data source: Nordregio and Copenhagen Economics' calculation).

According to the 2016 Labour Force Survey (LFS) data, the employment rate in Aarhus Municipality (70.5%) is below the national average (77.1%), with the gender difference (6.3% lower employment rate among women) slightly smaller than the national average (7.5%). In contrast, the unemployment rate in Aarhus Municipality in 2016 (6.6%) was slightly higher than the national average (6.2%). The share of employment in agriculture, forestry and fishing in Aarhus Municipality in 2016 was 0.46% (Nordregio, 2016), suggesting that agricultural activities are more for leisure for the inhabitants of Aarhus.

Aarhus in SiEUGreen Project

Despite agriculture, forestry and fisheries making only a small contribution to the economy, Aarhus has become known for its bottom-up initiatives involving urban agriculture (UA). The

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Program '**Taste Aarhus'**[2] has been a key driver of the implementation of more than 300 UA initiatives around the city. Taste Aarhus uses urban gardening as a tool to bring people together, activate underutilised spaces around the city and engage people in the practice of growing their own food. The program began in 2015 and is expected to continue until 2023. It is managed by Aarhus Municipality partially through self-funding (€1 million) and partially through funding provided by Nordea Bank (€1 million, 2015-2018). The main question the project addresses is 'How can cities create more socially inclusive places and communities when focusing on edible nature and urban farming'. The project employs a project manager, a gardener, a chef and a communications expert and provides initial financial and human support to those who want to initiate a UA project. Figure 2 shows the different types of initiatives included in the Taste Aarhus project. These three typologies will be discussed in greater depth throughout this report.

Figure 2: Typologies of Initiatives within Taste Aarhus

TASTE AARHUS		
Municipality	**Institutions**	**Community**
Information is provided to residents to support engagement with UA including signposting edible plants found around the city, disseminating information about events run by gardening groups and providing "drop-in" advice on gardening through the Green Embassy.	Gardens are housed within institutions (e.g. NGOs, hospitals, schools) as a mean of empowering vulnerable and marginalised groups (e.g. elderly, hospitals, schools, homeless people, prostitutes, etc.).	Gardens are initiated and run by community members with a small amount of start-up capital and human support provided by the municipality.

[2] http://smagpaaaarhus.dk/

Methodology

The remainder of this report presents an in-depth exploration of the Aarhus showcase, structured around the four pillars of central interest in the SiEUGreen project: Land use; food security; resource efficiency and societal inclusion. Data was collected using the following methods:

1. Desktop research
2. In-depth semi-structured interviews with key informants
3. Two-day field study in Aarhus

This section will describe the steps undertaken in each method, providing insight into the specific sources / informants, the data collection process, the limitations faced and the steps taken to overcome these.

Desktop research

The data products for Aarhus Municipality from Opendata.dk and Plansystem.dk were reviewed, and those relevant to UA were documented and collected (see Appendix I for a complete list of data sets). In addition, Statistics Denmark was used as a supplementary data source. Together, these data sources helped to depict a detailed and comprehensive picture of the municipality with regards to the planning system, the distribution of green infrastructure, land use, waste management, and sewage treatment system. Microsoft Excel and QGIS were used for data analyses and visualisation.

Interviews

Three semi-structured telephone interviews were conducted as well as a number of ad-hoc interviews during the filed study (described below). Two planners, one from Taste Arhus Program and other from the planning department and a manager of a UA initiative, were interviewed by telephone. The interviews were previously arranged by email when the participants received an explanation of the project, and the range of topics to be covered during the interview, and ethical clearance was obtained from them. Since the interviewee did not need to prepare for the interview and with the intention of capturing spontaneous reactions, avoiding rehearsed answers or losing the opportunity to ask new questions that arise from certain replies the questions were not provided in advance the interviews.

During the field study, many face-to-face interviews were carried out. These interviews were not planned since many of the interviewees were people who were working in their gardens and spontaneously approached. These interviewees were the primary means of uncovering the purposes (e.g. leisure, improve income, self-consumption) and meaning behind participation in UA (e.g. strengthen relation with nature, relax, family tradition), techniques used (e.g. nutrients, irrigation) and social networks (how the people got engaged). The interviews generated dialogue regarding the ideologies, concepts and motives for the practising UA.

Field study

In order to gain an intimate insight into the showcase, a two-day field study was organised in Aarhus, hosted by the project partners from Aarhus Municipality. There are over 300 gardens in the Taste Aarhus project and, as such, it was not possible for us to gain a full overview in such a short time. Instead, the teams from Nordregio and Aarhus Municipality collaborated to put together a sample of gardens designed to give as accurate a picture as possible of the full spectrum of community-led garden initiatives in the Taste Aarhus project. These gardens were explored in-depth on-site, including, where possible, interviews with participants (see above). Data was collected using audio recordings and images as well as a small amount of desktop research which occurred before and after the visit. Unless otherwise stated, all images presented in the report were taken by the authors during the field visit.

In addition, general information applicable to all gardens and specific stories of relevance to the deliverable were shared throughout the visit. The continuous dialogue with the two civil servants from Taste Aarhus who hosted our field study was a rich source of understanding. Issues related to how UA is engaged/conceived within the official planning system, the differences and similarities between the different initiatives (e.g. size, number of people involved, purpose), the challenges that the program faces, the benefits of UA for urban development were some of the aspects discussed. The field study also included spending time in The Green Embassy, the headquarters of the Taste Aarhus project. A full list and descriptions of the gardens visited in the field study can be found in Table 1 and their locations in Map 4.

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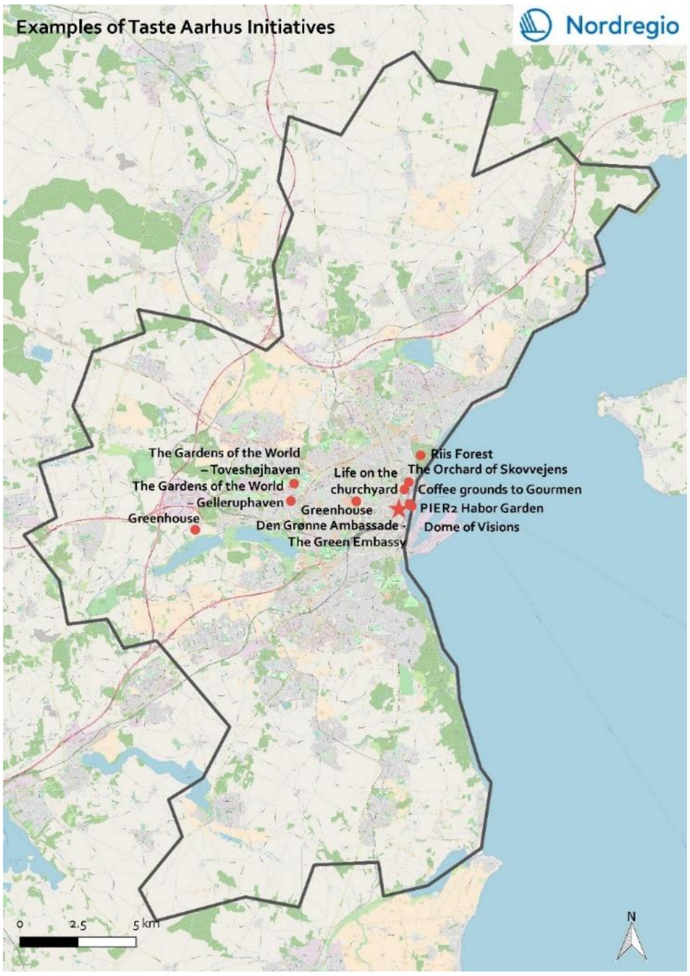


Map 4: Location of the UA initiatives visited

Table 1: Descriptions of Taste Aarhus initiatives included in the field visit

Garden	Description
#1 Pier 2 Harbour Garden Start date: 2017	The community garden PIER2 was formed in 2017 by a group of enthusiastic citizens and consists of approx. 45 small gardens built up of pallet frames. In addition, the community has established pleasant common areas, both for members of the community garden and others who are passing by to Aarhus Harbor. The community garden is temporary as it is located on a building site on Pier 2.
#2 Coffee grounds to Gourmet Start date: 2015	From Coffee grounds to Gourmet is a group, who will create a fungus experiment and grow oyster hats in coffee grounds at Aarhus harbour.
#3 The Dome of Visions Start date: 2015	The Dome of Visions project is about putting action into words and following through on new ideas in construction and urban thinking and planning. The dome is intended specially to inspire and to challenge regarding the solutions for the climate challenges to come.
#4 Riis Forest Start date: 1395 (oldest forest in Aarhus)	In the year of 1395, Her Majesty Queen Margrethe the 1st determined the demarcation of the common field at which the southern part of Riis Forrest (Riis Forest) went to the town of Aarhus. The northern part of the forest was presented to the town by His Majesty King Christian the 3rd in 1542. The main purpose of the forest is still to be a recreative area for the citizens of Aarhus city and the suburbs.

	Visitors are welcome in Riis Forrest 24 hours and all months the year. The forest consists of varied vegetation as well as a good system of paths and smaller roads. The herb ramsløg /rams fills the air and is closely connected to the identification of the City of Aarhus.
#5 The Orchard of Forrestvejen Start date: 2015	A group of neighbours on the Forrestvejen wanted to change an unused piece of land behind their houses. If it was cleaned for scrub and weed, apple trees could be planted for everyone's joy. It happened, and the neighbours have made a small community. They plant trees and take care of them until they grow big enough to give apples to everyone.
#6 Life on the churchyard Start date: 2016	Citizens and the cemetery manager in the municipality of Aarhus, in close dialogue, have established an area that invites the surrounding community to enjoy more edible and inspiring spaces on a sloping area at the backside of the cemetery. The establishment is of course in respect of tombs and other visitors at the cemetery.
#7 Greenhousery Start date: 2017	In the early spring of 2017, 20 people created a nice community garden to grow tomatoes, cucumbers and chilli in this big old greenhouse, which was not used for production anymore. There is room both outside and inside for many kinds of plants and activities. The Greenhousery borrows the greenhouse from the municipality.
#8 Fællesgartneriet Brabrand Start date: 2014	The community garden Brabrand lies in the scenic area of Årslev Engsø approx. 8 km. from Aarhus C. On the open air and in two large greenhouses, 100 families and individuals cultivate everything from marigolds to tomatoes and lemons. Due to the growing of greenhouses, the group can grow all year round and harvest crops several times a year. They have a strong community and hold more annual events of both professional and social nature. SiEUGreen technology to be implemented: Toilets
#9 Søvangens Boligforening Start date: April 2018	This is one of the newest gardens and is going to be a garden community made up of residents on the housing estate.
#10 Verdenshavernes Venner – The Gardens of the World Stat date: pre-dates Taste Aarhus	The Gardens of the World are community gardens in the areas of Gellerupparken and Toveshøj. In all places, herbs, flowers and vegetables are grown for decoration and use. The gardens form a framework for community, not only for those who help to grow but also for the area's other residents. SiEUGreen technology to be implemented: Polytunnels

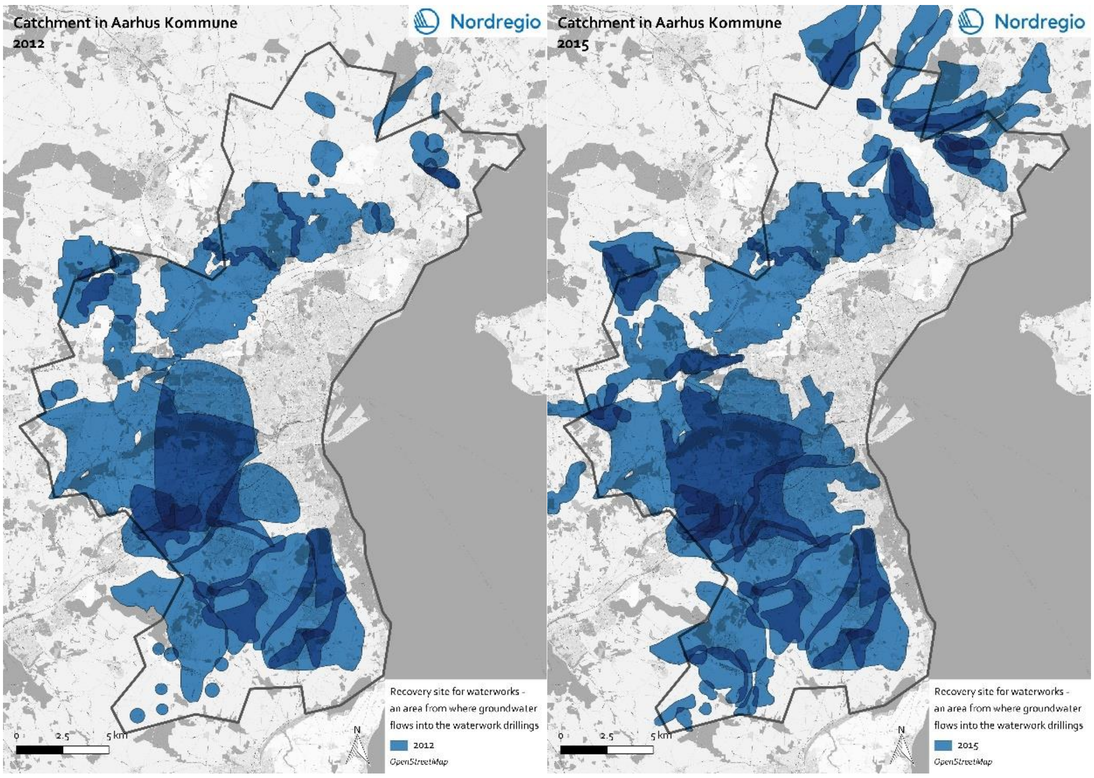
Limitations

As noted above, the large number of gardens in the Taste Aarhus project made it difficult to get a full overview within the first six months of the SiEUGreen project. This limitation has been addressed in several ways. Considerable care was taken in selecting the gardens above to ensure a broad representation of different types of gardens. This pertains to the type of garden, participant group, size of garden and length of time in operation. Considerable time was also spent with the Taste Aarhus team, discussing both the specifics of the selected gardens and general aspects of the program. Drawing on their in-depth knowledge of the project gave context for the gardens that we saw and left us with a good sense of the overall values and aims of the project. The richness of the data we were able to collect by focusing only on selected initiatives is thought to be more valuable in addressing the project aims than surface-level quantitative data addressing a large number of initiatives.

Module 1 LAND USE

Aarhus Municipality is made up of approximately 35% urbanized areas and 65% other land uses, including green open spaces (Olofsson et al., 2015). The land cover has changed in the last decades with an increase in urbanized areas, forest and water and a decrease in agricultural land. The replacement of agricultural areas with forest areas in the fringe of the city was a strategy to cease the use of pesticide and other pollutants and thereby safeguarding groundwater. Between 2009 and 2012, 320 ha of land, most of which previously used for agriculture was afforested (Olafsson et al. 2015).

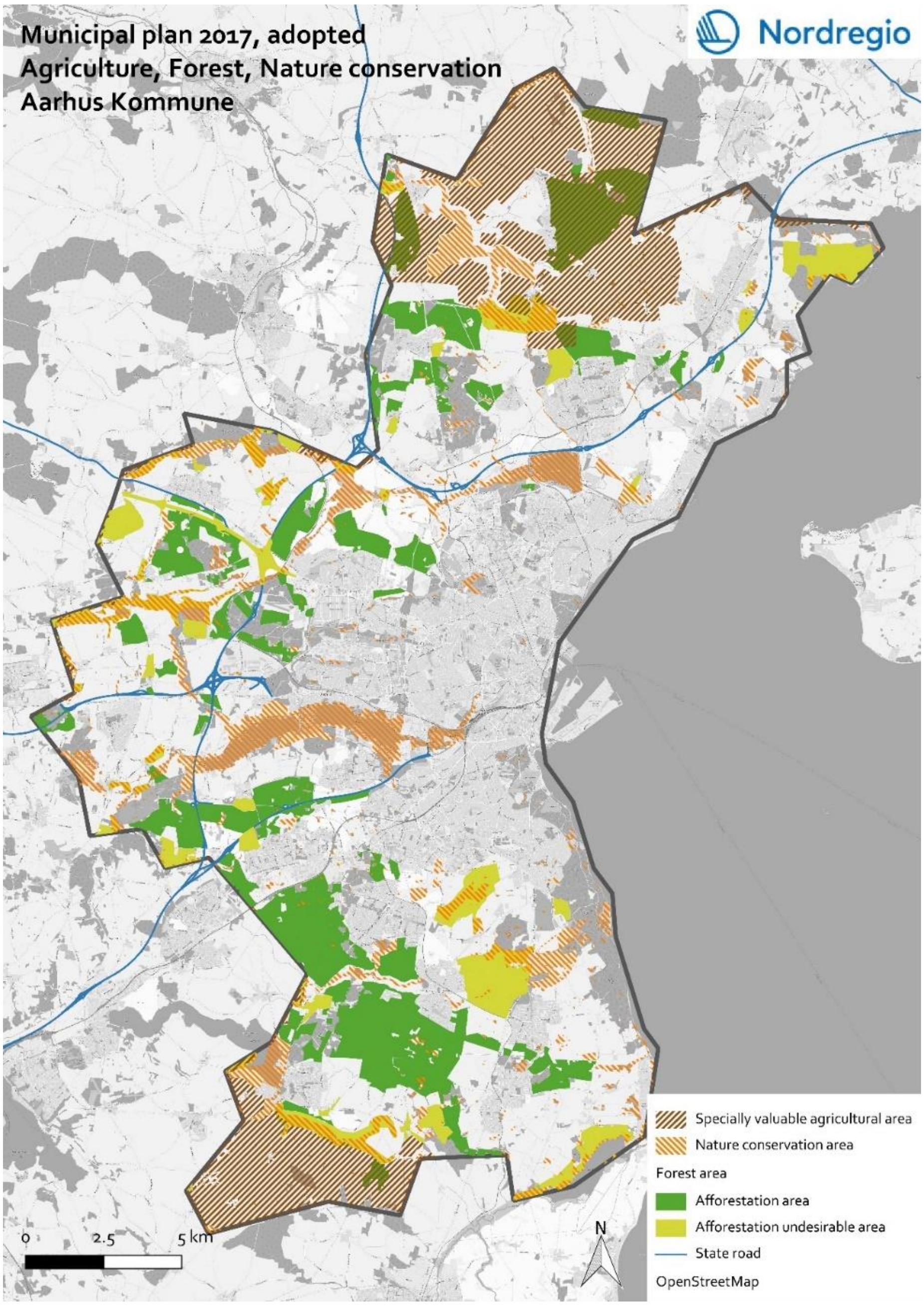
The restoration of the Aarhus River also changed the land cover of the municipality. First, the river was piped during the 1930s for sanitary purposes and to give space for road infrastructure. Then, in 1989, it was resurfaced, primarily to better cope with the increased rainfall expected with climate change. In addition, the presence of the river within the urban structure has helped to revitalize some places that became very attractive for the population. Two meadow lakes (100 ha and 115 ha) have also been established upstream to reduce the leaching of the agricultural surplus of nitrogen and phosphorus into the Bay of Aarhus. The river acts as a green and blue corridor running through the city centre (Olafsson et al. 2015).



Map 5:Catchment areas in 2012 and 2015

The significant increase in the catchment areas between 2012 and 2015 shown in the map reflects the growing amount and intensity of precipitation, and the consequent enlargement of the run-off water flows especially in the southern part of the city.

As can be seen in Map 6 forest areas play an important role in the green structure of the city and afforestation has been a long-term goal supported by the plan *Aarhus surrounded by forest* approved in 1988. According to the Afforestation Plan 2009-2012, 32 km^2 of new forest areas will be implemented by 2030 (Olafsson et al. 2015). Besides delivering clean water for the population, another aim with the afforestation is to increase the absorption of CO^2 in nature zones. The new forests of Aarhus comprise newly raised and public woodlands: Skødstrup Forest, Bærmose Forest, Lisbjerg Forest, Mollerup Forest, Brendstrup Forest, Gjellerup Forest, Tranbjerg Forest, and Solbjerg Forest.



Map 6: Municipal plan on agriculture, forest and nature conservation areas

As can be seen in Map 7, valuable areas for agriculture are planned in the south and north part of the administrative limits of the municipality. Nature conservation areas are scattered located throughout the city with some of them being closely located to the centre. The biggest conservation area extends from the outskirts of the city in direction to the centre reaching high density. The preservation of such great extension reinforces that environmental concerns are high on the agenda for local development. Close to this area, urban parks and allotment areas are placed (see Map 7).

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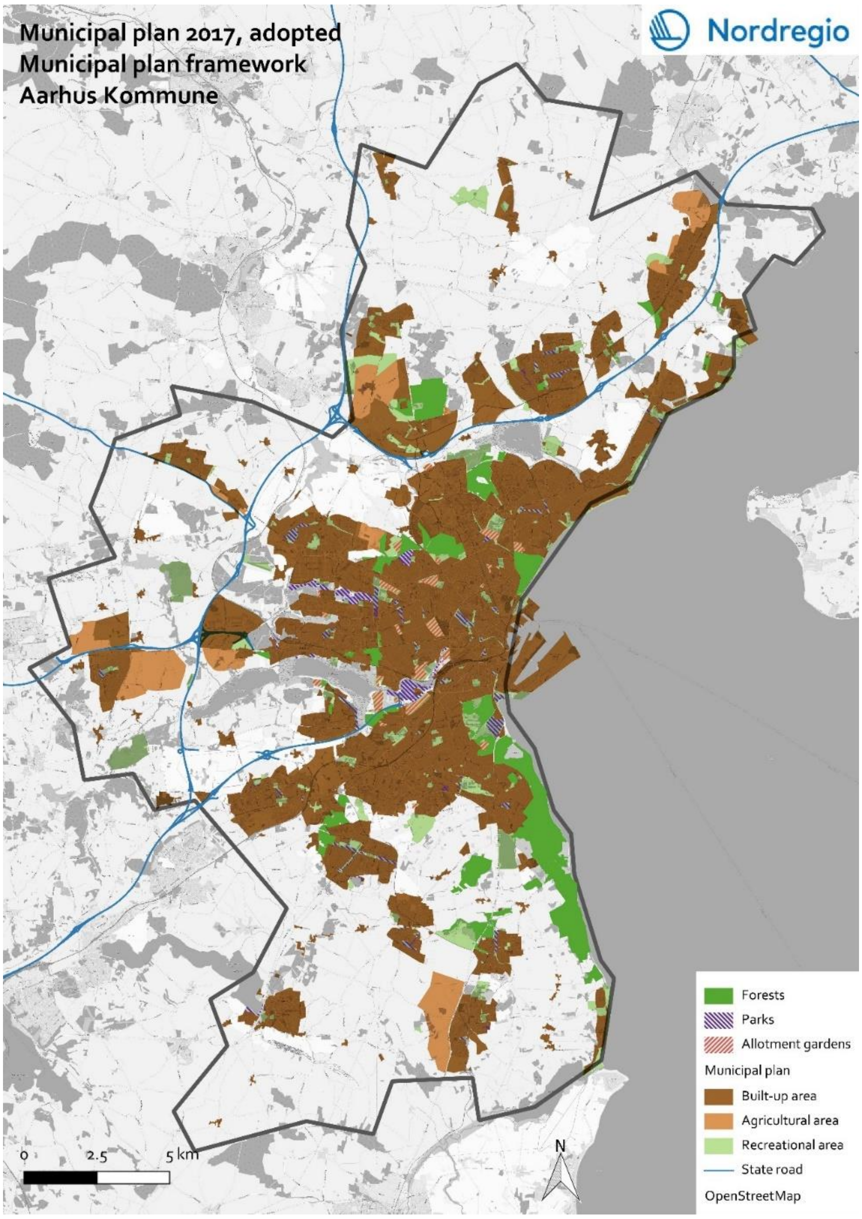

Map 7: Municipal plan, adopted - Municipal plan framework

Looking at the urban morphology of Aarhus, one can locate its origin within the harbour area and liken the pattern of development with a finger. The main roads stretch from the urban core (harbour area) in a finger shape to the adjacent areas. Despite the density of the urban structure, there are a considerable mix of recreational areas, forest and nature conservation areas that make up the relation between green and grey structures. Many of the forests in Aarhus date back to 1800. Marselisborg Forest, which covers around 13 km^2 and extents around seven kilometres along the south coastline of Aarhus, is an example of how forests have been incorporated into city life. It offers many opportunities for leisure (e.g. mountain biking, scouts) as well as hosting other activities such as an amusement park, a stadium and sports arena, a botanical garden, among others.

The presence of allotment gardens in the urban structure of Aarhus is worth highlighting. This follows a tradition that has been established in Denmark since the beginning of the 20th century when the Allotment Garden Union became institutionalised (Jensen, 1996). Usually, the municipality owns the land and rents it out to associations that manage the allocation of the plots to their members. In comparison with the market, the prices are much lower and, thus, the allotments became a viable and popular alternative for people who enjoy growing food within the city.

Despite pressures for urbanised areas due to an increasing population, the city has been maintaining a balanced relationship between green and grey areas. The afforestation program plays an important role in this respect and has been regarded as a good practice in many EU projects (e.g. Green Surge[3] and Naturvation[4]).

Following this brief description of Aarhus urban structure, the subsequent sections give some background about the institutional aspects that guide the land use in Denmark touching upon some particularities of the planning system of Aarhus Municipality. Afterwards, UA initiatives that take place in Aarhus will serve as a base to discuss spatial and functional aspects related to land use for UA.

Institutional aspects

In 2007 the planning system in Denmark went through a significant reform, which reduced the number of municipalities from 271 to 98 and re-arranged the regional political landscape from 14 counties and the Great Copenhagen Authority into five new administrative regions. One of the main objectives of this political re-organisation was to create larger and more efficient administrative units (Danish Ministry of the Environment, 2012)

This reform implied changes to the planning system, with the decentralisation of responsibilities and thus, substantial power gains at the local level at expenses of reducing the

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[3] https://greensurge.eu/
[4] https://naturvation.eu/cities

importance of the regional level. Figure 3 illustrates the structure and list the main documents that are part of the Danish planning system.

As Figure 3 suggests, there is a strong linkage between national and local level, implying that the Minister for the Environment can reject plans, which are not in agreement with national interests. In their somewhat reduced role, the regions are expected to formulate visions, which brings together regional strategies (e.g. business, employment and education, nature and environment, transport) but does not include land use issues.

Figure 3: Spatial Planning in Denmark
Source: Danish Ministry of the Environment (2012:9)

Under the new structure, the municipal level became the main responsible body for developing the comprehensive municipal plan, which is the central spatial planning instrument. This plan includes the overall objectives for development, steers land use, and specifies planning regulations and guidelines for urban and rural land management. This plan also guides the development of detailed plans for specific parts of the city and includes peri-urban areas and nature management (e.g. water, forests) beyond the urban build-up area (Olafsson et al. 2015).

The involvement of the public in the planning process is institutionalised at the national level. It means that any plan - no matter the administrative level it regards (municipal, regional or national), should be published and given at least eight weeks for the public submit their opinions, objections or proposals before it becomes implemented.

A direct linkage between the municipal government and people is strengthened by the subdivision of the municipal area into local community councils. Aarhus municipality area is divided into 28 local community councils. Any decisions related to local areas shall be discussed and examined in collaboration with the relevant Community Council.

Despite the number of initiatives flourishing in the city, UA is not addressed in the municipal plan. In the words of a planner from Aarhus municipality *'Urban agriculture is, at the moment, not a subject that we have in focus in our planning processes. It has not political focus, and therefore, it is not a subject that is included in our municipal plan´* (email from the physical planning chief, 11th April 2018). This perspective was reinforced in an interview carried out with the Head of Strategic Planning who said that UA is interesting to activate the land and bring people together in the city, but it has not much to do with planning. In his words '... *when you plan, you plan for the future not for the temporary (…)*'.

Thereby agriculture is seen as a transitory activity, and as such, it is overlooked in official planning documents. The gap between short and long-term objectives unveils a paradox between the bottom-up initiatives and top-down decisions in planning. The short-term objective of making Aarhus an edible city has engaged many people in 'making the city'. The Taste Aarhus Project Manager suggested that this is due to the fact that the program enables quick action - provided there is willingness, projects can be quickly implemented and the outcomes can also be quickly perceived. In her opinion, participatory processes used in long-term planning can profit a lot from the experiences of UA.

Concluding one could say that despite the green character of Aarhus Municipality, securing land for UA and/or integrating UA in the city planning has not yet been achieved.

Spatial & Functional aspects of UA

Despite pressures on land use in urban areas, the number of UA initiatives continues to grow in the city, largely due to Taste Aarhus' support. The scope of the initiatives varies in terms of location and size (floor area used for UA and the number of people involved).

Peri-urban and intra-urban UA initiatives take place in Aarhus. The location influences the size (floor area) of the UA initiatives. In peri-urban areas where the competition for land is less intense and the price lower, larger areas are available for agriculture. Despite that, the lack of institutional frame for agriculture in cities mirrors the insecurity related to land for agriculture purposes. In this respect, the Brabrand initiative located eight km from the centre of Arhus is worth mentioning. This initiative was driven by an architect who lived in Italy and had a dream to eat and grow fresh food in Denmark. In 2014, her ideas began to receive attention in the media and 20 families joined forces to start up the garden. They rented out an abandoned greenhouse which is privately owned. This initiative has expanded since then and today six hectares, including greenhouses and an open area with a floor area around one hectare are used by more than 100 families to grow food.

Image 1: Greenhouses in Brabrand

This part of the city has been growing significantly with newly built houses. The land that hosts Brabrand greenhouses is currently on the market for sale, so there are many uncertainties about the continuity of UA in the area. Despite the land insecurity, the responsible person seems quite confident and not so worried about the future. In her words:

> *'Maybe we can use this land for only two more years or for more 10 years .. we do not know. But if we get displaced, we will just find some other area in the periphery of the city which has inactive greenhouses, and we will move in.'*

Image 2: UA plots in Brabrand

The intra-urban UA initiatives are quite diverse and take place in different parts of the city. These are depicted in Figure 4.

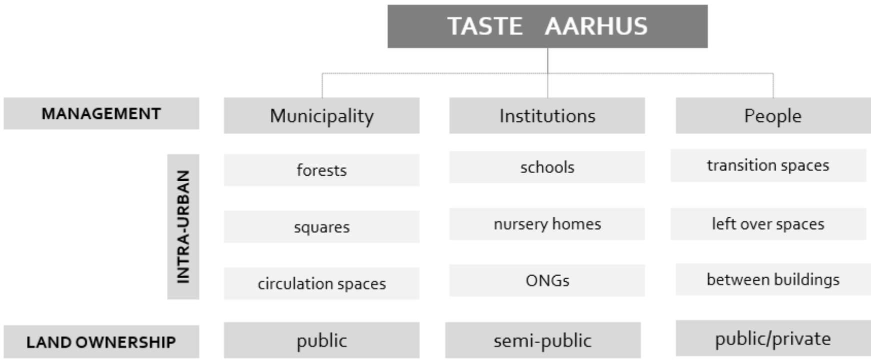

Figure 4: Management of UA initiatives within Taste Aarhus Program:

As part of making Aarhus an edible city, the municipality aims to raise awareness about eatable resources in the city. This includes the distribution of signs identifying herbs and/or vegetables, found in forests, public spaces and beaches, that could be incorporated in daily diets (see Image 3 and 4). Gardening is also used as a strategy to promote behaviour change. In this respect, strawberries were strategically cultivated along cycle paths with the intention to slow down the speed of cycling.

Image 3: Taste Brabrandstien
Source: Aarhus Municipality

Image 4: Åby Park
Source: Aarhus Municipality

Gardening and UA are employed in institutional programmes (e.g. elderly homes, schools) in Aarhus. From a land-use perspective, these initiatives take place in semi-public spaces since the accessibility is restricted to those who are enrolled in these institutions. Nevertheless, using UA as a mean of promoting healthier eating habits, encouraging physical exercise or for social interaction within these institutions can have a positive spin-off effects in the long-run, that can positively influence the use of urban land for agriculture in other parts of the city (e.g. people might be inspired to start their own garden).

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Image 5: Project working with vulnerable women
Source: Aarhus Municipality

Image 6: Nursing Home – Hjortshøj
Source: Aarhus Municipality

Image 7: UA initiative for people with disabilities
Source: Aarhus Municipality

Taste Aarhus supports a variety of UA initiatives that are driven by social groups. While some of them include just a few people (around 6, for example), others have participation from over 300 members. This disparity reflects differences in the way that urban land is used for agriculture. Acknowledging this, and with the aim to systematize the description of such variety, a typology is identified and includes the following types of spaces: ‘transitional’; ‘leftover’ and ‘between buildings’.

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Transitional spaces are those which currently host activities that are not permanent, in other words, when the space in focus is being developed for another purpose (e.g. construction sites), and UA is a temporary activity.

Image 8: Ø-Haven
Source: Aarhus Municipality

One of the largest initiatives that falls in this category is the Ø-Haven located at the harbour of Aarhus. This initiative engages around 300 people who cultivate vegetables and also raise honey bees and poultry (see Image 8). It includes not only pallets but also small greenhouses. Pier 2 Haven is another community garden located in the harbour area. The community consists of 45 members who cultivate vegetables, herbs and flowers in pallet frames (see Image 9).

Image 9: Pier 2

In both initiatives, the land is owned by private investors, and UA is a temporary activity that attracts the surrounding community to the site and, by doing that, popularises the area. This shows the potential of UA to make otherwise unattractive sites a place of social interaction. One could argue that the temporary use of the land for UA might be also beneficial for the investor, who enjoys the status of contributing to 'greening' the city. The urban development close to Ø-Haven is expected to be finalised this year. It will be interesting to follow-up and investigate what will happen with the 300 people who have been performing UA since 2014 in the area. An interviewee who is a civil servant revealed that, despite the temporary character, UA left a trace in the final shape of the urban development, through a green axis that has been incorporated into the design.

Leftover relates to fragments of public spaces that are under-utilised and do not have a clear function. In Aarhus, UA has been used to create value from this sort of spaces. An example is some neighbours who 'adopted' the public area adjacent to their backyards (see Image 10 & 11). Fruit trees were cultivated, and today, it is a common area for the neighbours, who have small backyards.

Image 10: The Orchard of Skovvejen

Image 11: The Orchard of Skovvejen

Image 12: Implementation of a flowerbed in the Churchyard
Source: Aarhus Municipality

Image 13:Flower beds in the Churchyard

Life in the churchyard is a similar initiative, in which a public area was appropriated by neighbours and transformed in a place for social interaction.

The revival of public and open spaces through UA has helped to decrease the public budget with the maintenance of public areas in Aarhus. A similar example is a group of people who took over the maintenance of a rose bed, in the Botanical Garden. The flowerbed was under threat of being demolished due to limited budget (Olafsson et al., 2015)

Since leftover spaces are mainly found in public land, the performance of UA these spaces seem to be more secure than in transitional/temporary spaces.

Nevertheless, the success of these initiatives is highly dependent on the active engagement of people. One can also argue that 'leftover' might mean spaces with limited capacity in terms of size. Thereby these initiatives might be more vulnerable since they are likely including a limited number of people.

As the name reveals **'between buildings'** corresponds to UA that happens in semi-public spaces. The Søvangens Boligforening and World Gardens are examples that fit into this category. Nevertheless, both are quite different in terms of magnitude. The Søvangens Boligforening in one of the newest initiatives supported by Taste Aarhus in which few neighbours are initiating UA in the land owned by the house association (see Image 14 and 15).

Image 14: Early stages of a garden project

Image 15:Selecting the soil

The World Gardens are community gardens in the areas of Gellerupparken and Toveshøj neighbourhoods. These areas are regarded as ghettos, with a high proportion of immigrants from more than 80 nationalities. There are two different types of gardens: one close to the community centre and another one with plots located in between the buildings. While in the backyard of the community centre people cultivate herbs and spices in the open space pallets are used for growing vegetables and flowers (see Image 16 and 17).

Image 16: Pallets close to the community centre in Gelleruphaven
Source: Aarhus Municipality

Image 17: Public area in Galleruphaven
Source: Aarhus Municipality

The community centre plays an important role to bring people together to grow food. The centre offers other services such as counselling. The planner from Taste Aarhus alleged that having a toilet in the centre was an important factor to influence people, especially women, to take part in UA. The plots located in between buildings were implemented more than 30 years ago and form a framework for the community. The UA plots are clearly delimitated with fences, and some of them have a small house to keep the tools or even tables where friends or families who live in the closest buildings gather and eat together. In this specific case, the sense of ownership of the spaces in between the buildings is very strong.

This area is going through significative changes, with the relocation of the great part of the municipal administration to the neighbourhood. The planner from Aarhus said that it is a strategy to lift the area which is defamed. A side effect of this strategy can be the gentrification of the area and/or increasing pressure in the land today used by UA.

Summarising the findings on Land Use

The autonomy and power of local level is certainly an advantage for the success of UA in Aarhus. Nevertheless, there is a clear divide between short term planning which in this case is driven by bottom-up initiatives and long-term planning that settles, among other aspects, land use regulations for urban development. Despite the green profile of the municipality (e.g. ambitious plans of afforestation), UA is not mentioned in the municipal plan. According to the interviews, UA it is a mean to sponsor 'blackspots' in the city and bring people together, but it is considered as a transitory activity. The poor understanding of the importance of introducing UA as part of urban ecosystems and including food systems thinking in urban development may be a product of the large-scale food industry that brings abundant and varied food to cities. The high competition for land within cities may also be a contributing factor.

Aarhus is undoubtedly a 'lab' for UA. Peri-urban and intra-urban agriculture are extensively implemented. In a cold climate, the green-houses play an important role for UA. The draft typologies for the land use for UA (e.g. transitional, leftover and between buildings) were useful to identify the diversity of the practices while drawing some considerations about the ownership and leasing of land for UA. Further investigation into land prices to better map conflicts land for UA might face given growing urbanisation is an important remaining task.

At further stages of development of the project spatial analysis can be useful to identify accessibility to green areas, percentage of sealed soil, as well as make cross-analysis between urban zoning *versus* land ownership *versus* land price. Another indicator that can be used is the share of the municipal budget that is dedicated to UA. As the financing means of the Programme Taste Aarhus suggests, the private sector (e.g. Nordea Bank) is one of the main actors that enabled the implementation of the project.

A deeper understanding of how land is planned, regulated and used is also necessary as well as a thorough exploration of the official and non-official use of land for UA.

Module 2 FOOD SECURITY

Food security is difficult to tackle in the case of Aarhus as, by any measure, all parts of Denmark can be considered to experience high levels of food security. To the best knowledge of the project team, none of the participants in the Taste Aarhus project was motivated to grow food out of material need. It is also worth noting that, despite visiting the garden with the highest yield, we did not come across any examples of people growing for commercial purposes during the field visit. It appears that the majority - if not all - of the food grown in Taste Aarhus gardens is either consumed by the grower or shared with family and friends. Having said this, there were examples in the higher yield gardens (e.g. Fællesgartneriet, Brabrand) of participants meeting all, or at least a substantial part, of their fruit and vegetable needs through their growing.

The project application suggests the food security indicators developed by the Food and Agriculture Organisation of the UN (FAOUN) as potentially useful in guiding the evaluation process with respect to food security. The work carried out in the preparation of this report suggests that data for these indicators is both unattainable and limited in its usefulness at a local level for the Aarhus showcase. As a basic context, it is perhaps useful to note that Central Denmark Region contains 30% of Denmark's total utilised agriculture area, more than any other region in the country (Eurostat, 2012). Approximately 60% of the region is dedicated to agriculture, divided across a total of 12,840 individual holdings (Eurostat, 2012). The national-level FAOUN data for Denmark also provides useful contextual data and is presented in the synthesis report alongside data for the other showcase countries.

The remainder of this section presents the relevant qualitative data from the Aarhus showcase based on two expected impacts of the SiEUGreen project: 1) increase access to high-quality food that is healthy, nutritious and contamination-free; and 2) increase understanding of the contribution of UA to the urban food system. It goes on to provide recommendations about how further data can be collected throughout the life of the SiEUGreen project.

Increase access to high-quality food that is healthy, nutritious and contamination-free

The Taste Aarhus program receives half of its funding from the municipality and half as a grant from Nordea-fonden (The Nordea Fund). The Nordea Fund aims to promote 'good living' in

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Denmark, providing grants under four focus areas: health and food; exercise; nature; and culture (Nordea Fonden, n.d.). Taste Aarhus is funded under the first category: health and food. Nordea's description of this category is as follows:

> *Projects that contribute to creating healthy communities and strengthen public health at all life stages. We prefer projects that keep people healthy for life and projects promoting health through food and meal experiences (Nordea Fonden, n.d.).*

Interestingly, project staff stressed the importance of a definition of health that was broader than physical health. They considered their mandate as promoting overall well-being though all elements of participation in the gardening projects, rather than simply promoting physical health through access to home-grown food. This could be as simple as the physical and mental health benefits of being outdoors but also extended to combat social isolation through the social interaction that happens in the gardens.

It was clear that, although the food itself was an important motivator for some Taste Aarhus participants, this was not the case for all. For many, the social interaction (e.g. connecting with new people or bonding with family and friends) or leisure component (e.g. exercise, being outdoors) was paramount and the food a pleasant by-product. Another interesting motivation was the growing process as an opportunity to reconnect with the food production process, slow down the pace of life and reduce stress. While the food itself is obviously a part of this, these motivations also reveal complexity in the relationship between people and food in the context of cities in highly developed economies. Finally, for some, it appears that urban gardening has become somewhat of a fashion, though, notably, participants with this motivation tend not to spend more than one season within a project.

When it comes to regulation and oversight of UA there are only two strict rules for participants in the Taste Aarhus program: they cannot use poison and, at the conclusion of a project, any non-plant elements of the garden much be removed (e.g. fencing, signs). This does not suggest particularly stringent regulation for UA in Aarhus.

Increase understanding of the contribution of UA to the urban food system

Calculating flows of food into the city and developing a concrete understanding of the existing presence of locally produced food (in terms of quantity and accessibility) in the context of Aarhus is a challenging task, beyond the scope of this initial report. As a general estimation, it is clear that the majority of food consumed in Aarhus is imported by the large supermarkets. Several small farmers markets operate on a semi-regular basis, and there are farms where it is possible to buy direct from the producer. These do not appear to account for a significant portion of food consumption and visitors to the latter often come from outside the municipality. Notably, the largest market in Aarhus is a bazar which sells foreign-grown food, most of which is imported from Hamburg. UA appears to account for a very small portion of food consumption in Aarhus.

The Taste Aarhus project does provide examples of access to “open source” food (e.g. edible objects that grow in the wild such as mushrooms and berries). As noted earlier in this report, signage and online information have been used to highlight edible plants throughout Aarhus. The notion of “fyld hatten” (the filled hat) is used in promotional materials. This is based on the 1241 law stating that one can take from nature as much as they can fit in their hat. This, combined with the signage, is designed to encourage people to take food from around the city to use at home. Recipes for commonly found plants can be accessed on the Taste Aarhus website. As an example of the success of this work, in an area where many of one particular edible plant grows, a sign was placed encouraging people to take a look. In this area, there was evidence of many plants being harvested while another area with the same plant but no sign was left untouched. Examples of the types of edible plants that can be found in Aarhus include rams and different types of fruit.

There are also examples of garden projects that incorporate animals and insects in the urban food system (e.g. chickens, hens, bees, edible insects) though, again, these do not make up a substantial component of the urban food system nor even a substantial component of the Taste Aarhus Program.

Perhaps unsurprisingly, the role of weather conditions in UA (e.g. what can be produced, and when), is substantial in a country like Denmark. The growing season in Aarhus, as in Northern Europe as a whole, is short. As such, projects incorporating greenhouses are particularly popular as they offer an opportunity to extend the growing season. In line with this, there are several examples of projects which utilise otherwise unused greenhouses around the municipality. These projects seem to attract participants who are motivated by the food production element of UA more so that outdoor gardens. Examples of greenhouse projects included in the study visit were Fællesgartneriet, Brabrand (described in detail above) and

'Greenhousery' a project that utilises a greenhouse located on the grounds of the caretakers of the Aarhus Cemetery (see images).


Image 18: Greenhousery


Image 19: Getting an early start

The Taste Aarhus project plays an important role in promoting *knowledge of the food system among the urban population (including children).* Alongside the project manager, the project also employs a gardener, a chef and a communications specialist who are responsible for supporting the community to set-up and get the most out of their gardens. The team are accessible to the public primarily through the 'Green Embassy', a temporary structure located in a prominent position within the city centre (see Image 20). Many participants in the Taste Aarhus program have limited knowledge of gardening, particularly in the beginning. Even one of the more experienced gardeners that we met described learning new things all the time despite having the plot for over five years. Many Taste Aarhus institutional gardens are located in kindergartens, and we saw several examples of grandparents growing with their grandchildren in the public gardens.


Image 20: The Green Embassy
Source: Aarhus Kommune

Summarising the findings on Food Security

Although the Taste Aarhus project is funded under the banner of health and food, the definition of health is more consistent with notions of overall well-being, and participant motivations are just as likely to be social or leisure related. Overall, UA appears to account for a very small portion of food consumption in Aarhus. Despite this, the project offers an important opportunity to recapture elements of the relationship between people and food that are often lost in the urban context. This is evident in the way that the garden projects connect people with the food production process. Initiatives which encourage engagement with edible objects around the city also challenge the relationship between food, people and the city. The Taste Aarhus project plays an important role in promoting knowledge of the food system among the urban population. This is evidenced in the wide range of garden initiatives, both community and institutionally based, and in the engagement achieved through the green embassy.

As the information above illustrates, available knowledge related to the food security goals of the project is qualitative in nature at this stage in the project. Despite this, a large number of active gardens in the Taste Aarhus project presents considerable scope to collect quantitative data through the life of the SiEUGreen project. This data is likely most valuable if collected through questionnaires conducted with participants in different types of initiatives - as opposed to large data sets covering distinct geographical areas (e.g. district or municipal level). Information about the motivations for involvement in the projects, and to what extent these motivations relate to food production would be particularly useful. It would also be interesting to understanding the extent to which the knowledge gleaned through participation in the garden projects has equipped participants to meet their dietary needs through their growing in the case that such action should be required. General knowledge about community awareness about the origins and quality of food would also be valuable, particularly in the case that data collected from a general sample could be compared with data collected from the participant group.

Module 3 RESOURCE EFFICIENCY

Mitigate environmental impacts through UA implementing novel technologies

A wide set of innovative agricultural technologies will be implemented at showcases within SiEUGreen, which are expected to improve resource efficiency and mitigate environmental impacts. Their contribution will mainly be measured and evaluated based on feasible quantitative indicators. For Aarhus showcase, the proposed innovative technologies and their potential contribution are listed in Table 2. The novel technologies for Aarhus showcase mainly fall into the green and blue categories and contribute to sustainability claims of urban symbiosis and supply chain efficiencies. With the application of greenhouse, polytunnels, and balcony gardens in the community/neighbourhood to produce food locally, "food-miles" are reduced – the short distance between producers and consumer. In addition, with the implementation of co-composting of organic household waste and construction of solar dry toilet, the sustainability claim of waste assimilation/urban symbiosis is fulfilled.

Table 2: Set of agricultural technologies to be implemented in Aarhus

TECHNOLOGY	Contribution to resource efficiency / Resource efficiency parameters	How to measure the contribution / Resource efficiency indicators	Sustainable claim
Green			
Greenhouse technology, traditional **Polytunnels** **Mobile gardens** **Soil-based traditional plant growth** **Paper-based plant growing technology** **Balcony gardens**	Local food production	The annual amount of urban food production (types and kg) replacing other food sources per person/family/apartment/building/showcase. In addition, specify production (types and kg) based on recycled nutrients and water resources. Registration and/or calculation.	Supply chain efficiencies; Urban symbiosis
Blue – Processing of waste for recycling			
Co-composting of organic household waste /green waste and solar dry toilet residue	Waste recycling	Annual amount (kg) of the waste fraction (food waste/garden waste/organic waste) taken out of the conventional waste stream per person/family/apartment/building/showcase. Amount of peat soil to be exchanged with compost from organic waste Registration and/or calculation.	Urban symbiosis

	Water-saving	Annual amount (m^3) of drinking water not used for toilet flushing per family/apartment/building/showcase. Registration and/or calculation.	
Blue – Source separation of wastewater			
Solar dry toilet	Waste recycling	Annual amount (kg) of the waste fraction (food waste/garden waste/organic waste) taken out of the conventional waste stream per person/family/apartment/building/showcase. Amount of peat soil to be exchanged with compost from organic waste Registration and/or calculation.	Urban symbiosis
	Water-saving	Annual amount (m^3) of drinking water not used for toilet flushing per family/apartment/building/showcase. Registration and/or calculation.	
Blue – Stormwater handling			
N/A			
Yellow			
N/A			

Promote resource efficiency in relation to UA applying quantitative measures

According to United Nations Environment Programme, sustainable consumption and production (SCP) are essential for promoting resource and energy efficiency, minimizing the use of natural resources and toxic materials as well as the emissions of waste and pollutants, while providing basic needs and bringing a better quality of life (UNEP). Thus, this section will be cantered on the consumption and production pattern of the urban system as it relates to UA activities in Aarhus Municipality. It should be noted that data for many of the indicators included in the Resource Efficiency Scoreboard[5] from Eurostat are only available at the national level and thus not presented here, in particular, those indicators regarding productivity, material and carbon. National-level data for Denmark related to this goal can be found in the synthesis report along with the data from the other showcase countries.

Land

- The productivity of artificial land

[5] *Resource efficiency scoreboard*. (n.d.). Retrieved April 27, 2018, from Eurostat website, http://ec.europa.eu/eurostat/web/environmental-data-centre-on-natural-resources/resource-efficiency-indicators/resource-efficiency-scoreboard

This indicator is defined as the gross domestic product of a country divided by its total artificial land, which consists of built-up areas (areas covered with buildings and greenhouses) and non-built-up areas (streets and sealed surfaces).

Greenhouse, as a type of built-up areas, is closely related to UA. In Denmark, the average coverage of greenhouses was 1.2 square metres per capita in 2015. In reality, however, most inhabitants living in the urban areas do not have access to greenhouses, even though some of them have wished for cultivating in such greenhouses. In Aarhus Municipality, two initiatives through Taste Aarhus have offered possible solutions to this issue. In one initiative (Driveriet - fællesskab i stort drivhus), an old greenhouse previously used for energy production was transformed into a greenhouse available to anyone in the community interested in growing vegetables. In the other initiative, which is located in the peri-urban area near Brabrand (Fællesgartneriet - Større fællesskab), two large greenhouses (700 square meters each) are maintained for inhabitants living nearby to grow organic vegetables during their leisure time. In both cases, land productivity has been increased as these pieces of land would not be in use at all otherwise. This suggests that UA in greenhouses is a way to increase the productivity of idle artificial land.

Water

- Water abstraction

Water abstractions put major pressure on freshwater resources, particularly from public water supplies, irrigation, industrial processes and cooling of electric power plants. It has significant implications for issues of quantity and quality of water resources.

In Aarhus, water usage is metered from every tap, with households, industries, and public facilities paying for water based on their level of consumption. Awareness of the extent of consumption has a resource-saving effect as nobody wishes to pay for wasted water. Although water sources for the urban agricultural initiatives through Taste Aarhus vary, the water-saving awareness appears to be relatively high. For the large-scale peri-urban agricultural greenhouses – Fællesgartneriet, water is conserved by automatic drip irrigation technology, which both monitors water usage and keeps control of leaks.

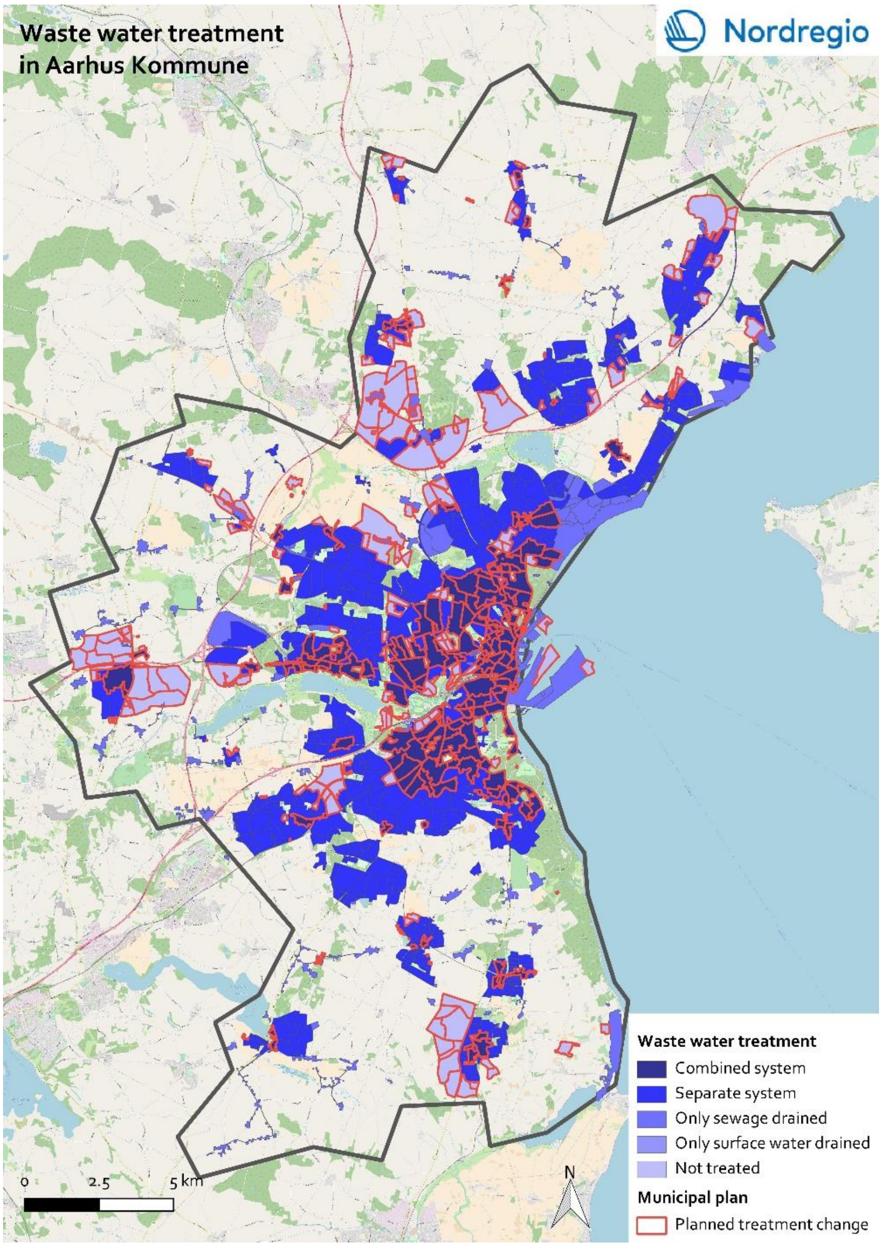
- Wastewater treatment

Wastewater treatment is a process used to convert wastewater into an effluent that can either be used directly or returned to the water cycle with minimal impact on the environment.

Map 8 shows the detailed wastewater treatment in Aarhus Municipality, which depicts the area where wastewater is drained through Aarhus Water's (Aarhus Vand) sewerage network. The treatment is done by the following types of sewers:

- **Combined system**, where wastewater and rainwater/surface water are drained in the same sewer and directed to sewage treatment plants. This sewer type is commonly constructed in the city core;
- **Separated system**, where wastewater and rainwater/surface water are drained in different lines. Wastewater is drained to sewage treatment plants, and the rainwater is drained into the water bodies (watercourse or Aarhus Bay), most often after being contained and cleaned in a rainwater pool. This sewer type can be mostly seen in the urban fringe areas and suburbs;
- **Wastewater draining only**, where the surface water is lowered or otherwise handled locally. This type is mainly located along Aarhus Bay and in rural residential areas;
- **Surface water draining only**, of which there are very few (3 out of 1200), are located alongside road infrastructure where there is almost no sewage from households or industries.

There are still a number of untreated sites spreading out in Aarhus Municipality. According to the adopted municipal plan, all these untreated sites will be connected to other types of sewers, and all the combined sewers will be transformed either to separate sewers or other types. UA, particularly that which utilises household sewage (e.g. balcony gardens), would release the pressure on wastewater treatment network to some extent.



Map 8: Wastewater treatment in Aarhus Municipality
Source: PlansystemDK

Turning waste into a resource

- Generation of waste excluding major mineral wastes

This indicator presents the amount of waste, excluding major mineral wastes, generated. It covers hazardous and non-hazardous waste from all economic sectors and from households, including waste from waste treatment but excluding most mineral waste.

In Aarhus Municipality, a waste analysis on household waste from 6 sites (a total of 10 waste containers) was conducted. Data was collected from empty containers once a week in January

2014, and therefore represents a snapshot of the waste composition. The results are illustrated in Table 3, and it shows that for households of average size from 0.9 to 2.1 in Aarhus, the most waste generated is organic waste (animal and vegetable collected). With the application of UA at the household level (e.g., balcony garden), the organic waste can be reused as fertilizer and soil improver through home composting that is the decomposition process that occurs naturally in the environment, in the presence of the atmospheric oxygen.

Table 3: Household waste analysis in Aarhus Municipality

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Household size	1,5	1,4	1,4	2,1	0,9	1,7
Number of containers	1	2	1	2	2	2
Sorted fractions	kg	kg	kg	kg	kg	kg
Plastic bottles and plastic punch without contents - black items	0	0,14	0	0	0,44	0,14
Plastic bottles and plastic punch without contents - no black items	0,74	2,34	3,64	10,78	3,34	5,94
Plastic bottles and plastic punch with contents	0	2,24	0,94	3,34	0,64	3,64
Plastic bottles and plastic dun with trademark	0,14	1,94	0,24	3,34	0,14	0,54
Empty oil-containing plastic containers (mayonnaise containers, remoulade cream, creams)	0,14	0,54	0,34	1,24	0,94	1,44
Clean / emptied plastic packaging - black items (eg meat trays)	1,44	2,88	2,44	2,34	3,08	3,04
Clean / emptied plastic packaging - no black items	7,24	9,22	6,98	4,74	10,68	10,88
Packaging with residual contents / dirty packages	7,14	9,74	4,44	4,74	5,94	9,74
Plastic foil - clean foils (not rubbish bags, frostbags or the like)	4,78	0,64	0,44	0,24	0,54	2,64
Composite plastic products / materials (plastic and other materials used)	2,14	2,54	2,84	3,14	2,24	1,94
Non-composite plastic products / materials (plastic objects)	0,74	2,74	0	2,14	0,44	1,64
Yogurt and beverage products	5,74	13,58	6,84	14,08	11,28	14,18
Beer / fizzy	1,44	3,54	2,04	2,44	1,04	3,04
Cans	2,04	4,84	2,64	4,64	5,24	4,24
Other metal (metal objects, cups from fireworks etc.)	2,74	1,34	1,04	4,14	2,74	4,84
Newspapers / magazines, other paper and cardboard	8,44	36,98	19,08	43,28	20,68	28,78
Cardboard	8,88	9,28	7,48	7,58	1,34	11,58
Glass bottles and glass of glass	7,44	17,54	13,14	18,44	16,54	16,14
Textiles	6,04	6,24	0,64	14,94	3,84	23,14
Footwear, belts, bags and the like.	1,84	2,34	0	3,04	2,84	2,94
Organic waste (animal and vegetable collected)	78,62	145,44	93,76	132,24	134,76	200
Residual waste (eg diapers, rubbish bags, flamingo, frostbags, pizza trays)	73,3	99,74	51,96	109,48	117,18	127,3
Light sources	0	0,2	0	0,2	0,1	0,3
Electrical and electronic products	1,04	1,3	0	0	0,1	0,8
Environmentally hazardous waste (eg batteries, sprays, medicines, etc.)	1,84	1,3	0,4	0,4	0,4	2,6
Landfill (eg ceramics)	8,44	11,64	0,64	3,64	2,24	1,84

Source: OpenDataDK

- Management of waste

Disposal such as landfill is perceived as the least favoured approach to deal with the waste, as landfilled waste represents an enormous loss of resources in the form of both materials and energy. A resource-efficient economy is, therefore, one which minimizes landfill to the greatest extent possible. Recycling, including material recycling, composting, and anaerobic digestion, has many benefits versus landfilling or incineration.

The following two figures reveal the waste treatment status in Denmark (Figure 5) and in Aarhus Municipality (Figure 6) in 2014. For Denmark, nearly 60% of the waste was recovered/recycled, and another 20% of the waste was incinerated for energy recovery. The waste that was deposited onto or into the land (landfill) accounts for slightly over 20% of the total waste. For Aarhus Municipality, 87% of the waste from recycling stations was recycled, 10.6% was incinerated, and only 2.4% went to landfill. The categorization of waste operations from two data sources differs, which may explain the difference in figures to some extent. Despite this, the figures for “deposit into land” (Denmark) and “disposal, e.g. landfill” (Aarhus Municipality) suggest that the waste in Aarhus Municipality was treated in a more sustainable way compared to that of Denmark as a whole.

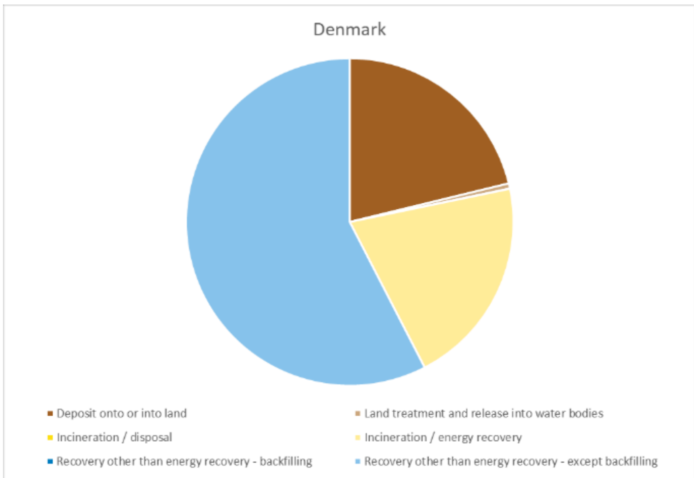


Figure 5: Waste treatment by waste operations in Denmark, 2014
Data source: Eurostat

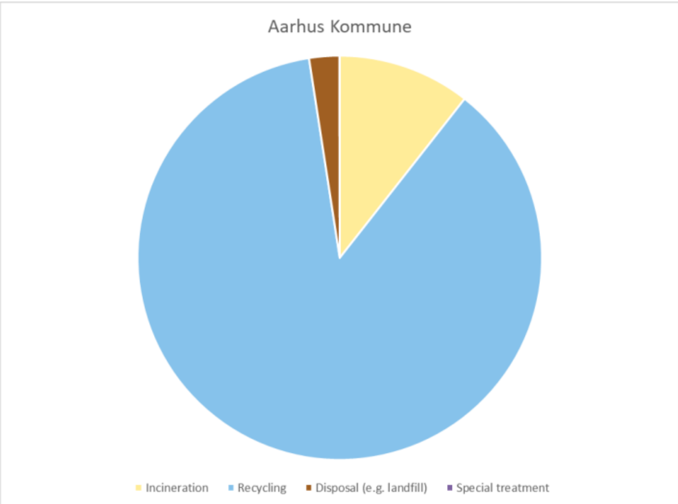


Figure 6: Waste treatment by waste operations from recycling stations, 2014
Data source: Open Data, DK

Map 9 illustrates the location of waste containers in Aarhus Municipality, as well as the location of recycling stations. The majority of waste containers are placed in inner-city and along the coastal line; while in contrast, the six recycling stations are relatively located in peri-urban areas/suburbs.

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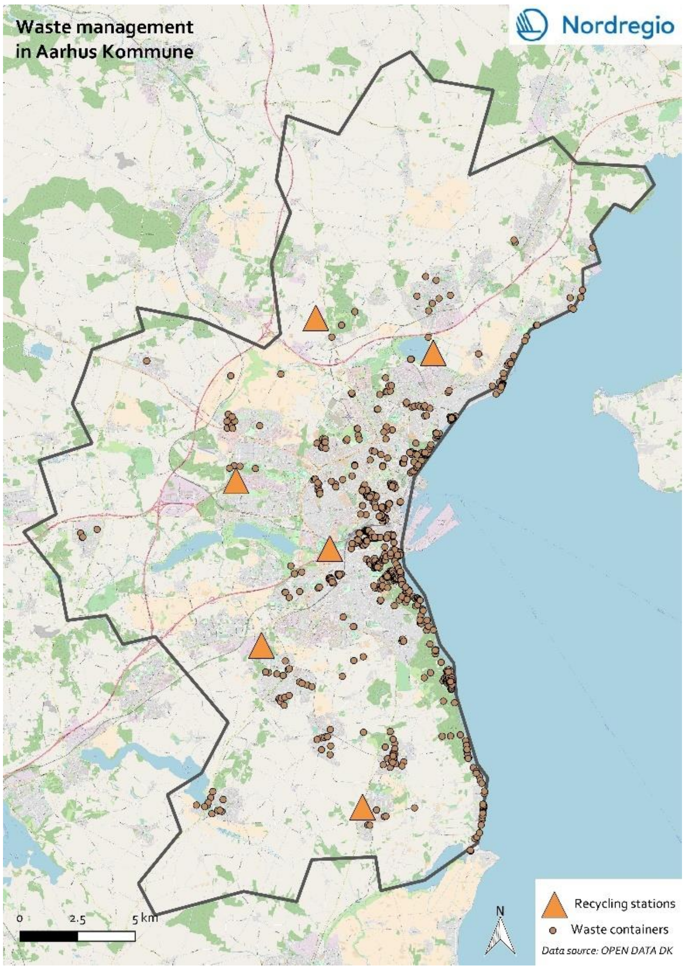

Map 9: Waste management in Aarhus Kommune

Increase understanding of the contribution of UA to C-E and green growth

Figure 7 illustrates the circular economy as a closed-loop, which has been achieved/implemented by many industries. The urban metabolism can apply the same rationale, and its material and energy flows can be optimized by integrating all urban activities (industry, utilities, commercial, housing, urban and peri-urban agriculture), by involving all the actors (including investors and city residents) and by working with municipalities beyond the city limits (EEA, 2015).

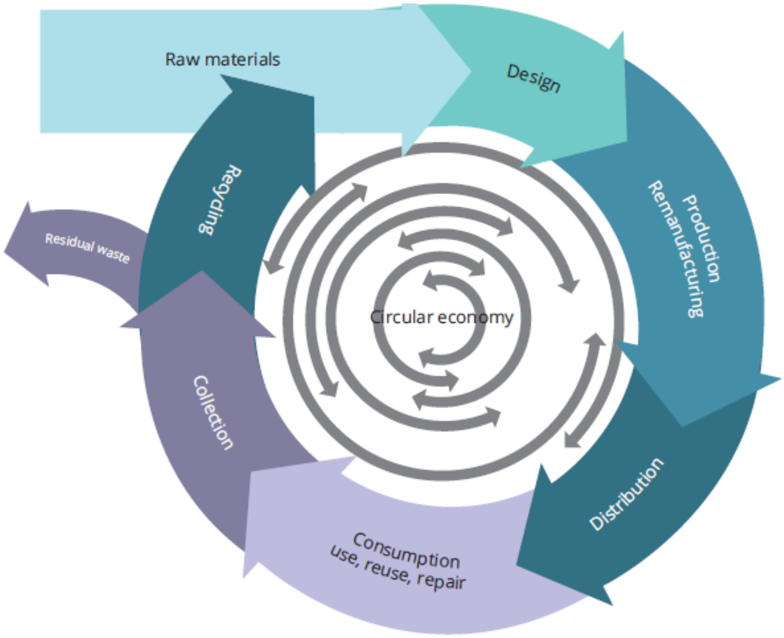

Figure 7: The circular economy
Source: European Environment Agency.

In Aarhus Municipality, the Taste Aarhus project has resulted in 325 urban and peri-urban agriculture initiatives across the municipality. With a small amount of assistance from the municipality, citizens have the opportunity to not only make use of spare land pieces in public areas (e.g. Pier 2, Life in the churchyard) but also take advantage of unused "grey" infrastructure such as old greenhouses (e.g. Greenhousery, Fællesgartneriet Brabrand). The analysis of resource and energy flows in Aarhus highlights the potential synergies between different players (e.g. planners, practitioners and citizens), in the context of UA.

Coffee Grounds to Gourmet is a group who create a fungus experiment and grow oyster hats in coffee grounds at Aarhus harbour. This group collect coffee grounds from around the city and use them to grow mushrooms which they then sell either back to the people who supplied the coffee grounds or to others. It contributes to the circular economy by minimizing residual waste through collection and reuse of the waste from coffee consumption. To some extent, it helps to close the material and nutrient flow and creates a loop of food supply.

Greenhousery, is a community garden for growing vegetables both inside and outside. It is situated in an old greenhouse belonging to Aarhus Municipality, which hasn't been in use since 1976. Then a group of 20 people started UA activities here in 2017, which allows them to have access to open land and cultivatable garden. It is a good practice of taking advantage of abandoned grey infrastructure, and as a result, the land-use efficiency has been improved, and vibrant urban life has been fostered.

Summarising the findings on Resource Efficiency

In Aarhus Municipality, land is used for urban and peri-urban agriculture in an organized way, thanks to the Taste Aarhus program. Urban and peri-urban agriculture takes place in both built-up and non-built-up areas, which contributes to the productivity of idle artificial land. Water, as an important resource for agriculture, is metered and the water-saving awareness appears to be high in Aarhus Municipality. On the other hand, wastewater is collected and treated systematically to a large extent, although some improvements are still needed, and they are already in the planning process. Waste management in Aarhus Municipality is at a relatively high level with 87% of the waste from recycling stations recycled. Organic waste, as the largest waste generated in quantity, is ideal for recycling and used as material for UA.

Within the scope of SiEUGreen, agricultural technologies will be implemented in Aarhus Municipality to increase resource efficiency. These technologies include innovative green technology focused on planting and growing, and blue technology dealing with waste processing and source separation of wastewater for recycling. Their contribution to resource efficiency will be monitored throughout the project period, either by measuring on-site or by estimating based on relevant data from, e.g., small scale experiments.

Module 4 SOCIETAL INCLUSION

As noted in the introduction, Taste Aarhus has a strong focus on social engagement. As such, there is considerable scope for this work provide inspiration to the other showcases as well as contributing in a broader sense to knowledge about the role of UA in facilitating societal inclusion. This section will address the economic, social and political dimensions of societal inclusion, as related to Taste Aarhus, with a primary focus on the gardens visited on the field trip before making recommendations about how societal inclusion can be further explored throughout the project.

Economic dimension

While the economic dimension of societal inclusion is relevant to the Aarhus showcase, it was difficult to assess without collecting demographic data about participants in the Taste Aarhus project. There may be potential to collect this type of data at later stages in the project. As noted above in the module on food security, we did not come across any examples of participants in the Taste Aarhus project who were motivated to grow by material need. In addition, there do not appear to be participants who are growing for commercial purposes.

Social Dimension

There are many examples of enhanced social capital through practices of UA to be found within the Taste Aarhus project. The nature of the investigation undertaken up to this point makes it difficult to make a clear distinction with respect to the form of social capital enhanced, though, on the surface, it appears to be quite varied. There is certainly a substantial scope to explore how practices of UA enhance different forms of social capital throughout the life of the SiEUGreen project. The following is based on a preliminary exploration through the first field trip to Aarhus.

For some gardens, proximity is an important element. 'The Orchard of Forrestvejen', one of the earlier Taste Aarhus projects which began 2015, is an example of this. A group of neighbours (6 or 7 families) sought a common space where they could come together. They approached the municipality about clearing an area that was overgrown with shrubs behind their houses and planting fruit trees in the space (see Image 21). This is a relatively wealthy area, with average house prices around €800,000, and the people coming together for the project obviously had existing relationships. All of the houses have gardens, but they are too small to house fruit trees. Given this, one might expect negligible social capital benefits from this project. In fact, the residents were pleasantly surprised by how much the shared space has brought them together. The children from the houses now play together in the shared space rather than in their own yards. This space (and the fruits) is also available to the public, and several public workshops have been held there about how to plant and care for fruit trees.


Image 21: Houses backing onto the orchard of Skovvejen

'Life on the churchyard' is another example of a gardening community that is based on proximity, but in this case, bonds are being created rather than simply strengthened. Here a resident was inspired by a film about UA and contacted Aarhus Municipality about the possibility of planting fruit trees by the side of the road where she lived. The municipality was hesitant about people picking fruit on such a busy road and instead suggested setting up a space on the backside of the cemetery - on an area separated from the street but still just across the road from where the woman lived. Following this, she approached her neighbours with flyers and was pleasantly surprised by the positive responses she received. Since the group began in autumn 2016, the motivation for its activities has morphed from gardening to be more social in nature. As one of the project workers at Taste Aarhus explained:

> *The goals of the participants are much more social than anything else. I get the impression that they don't care too much if they never eat anything!*

Despite this, the garden itself still plays an important role in bringing people together. For example, on the weekend before our visit, a group member had posted in the Facebook group to say that she would be at the garden on Saturday afternoon with her family to plant some lavender. Two other families turned up to join in the fun, turning a relatively simple task into a whole afternoon of social activity. This garden also provides an interesting example of what Corcoran and Kettle (2015) describe as “spaces of potential”. This point will be addressed in more detail below.

Image 22: View to apartments from the garden ‘Life on the churchyard’.

A third example of a UA project based on proximity but, again, bringing together people who may not otherwise interact can be found in Taste Aarhus’ newest project: Søvangens Boligforening. This garden started as a discussion on the common Facebook group of a housing estate. People felt it would be nice to have a common area where they could grow, as the potential of growing food on the balconies of the apartments was limited. The group is still in the early stages but have already worked together to secure permission from the board of the housing association, made an arrangement with the caretaker for the use of tools and sourced, set up and painted the garden beds. While it is too early to say how successful this project will be in developing bonds between participants, there are already discussions about shared meals and other similar activities based on the food grown together. Common time has been set each week for people who want to come together to work in the garden. As with ‘Life on the churchyard’, the majority of the group do not have a gardening background, though, in the early stages at least, the growing of food appears to be a stronger motivator for this group.

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Image 23: Early stages of a new garden project

There are also examples of gardens which attract a broader demographic, both with respect to where the participants come from and who they are. 'Pier 2', for example, is a garden set up by a construction site in the harbour which came about following a workshop promoting the use of underutilised spaces in the city for gardens. Although participants are generally people who live in the inner city in apartments, their similarities appear to end there. For some people, the garden is a chance to strengthen bonds with family or friends, for example, a place for grandparents to bring their grandchildren. For others, it is a chance to meet new people. Based on the investigation so far it is not possible to ascertain whether the relationships cultivated here equate to bonds made with "people like me" or represent a genuine example of bridging social groups through UA. This would be an interesting area for further exploration.

Image 24: Pier 2

One of the largest projects explored in the visit, and that actually pre-dates the Taste Aarhus project, is Fællesgartneriet, Brabrand (described in detail under land use). The possibility to grow at a large scale and over a longer period in this garden means that it attracts a diverse range of participants from across the city, generally with gardening and food production as the primary motivations. Although not the primary motivation, there is also a strong social component. There are over 100 participants in the garden, and most tend to visit on the weekend. This means getting to know one another and, in some cases, becoming friends. It is as yet unclear whether such connections may constitute forms of bridging capital as not enough is known about the social and demographic make-up of participants.

A final community garden initiative which provides potential to explore the role of UA projects in the production of social capital is 'The Gardens of the World'. The Gardens of the World are community gardens in the areas of Gellerupparken and Toveshøj where herbs, flowers and vegetables are grown for decoration and use. The gardens form a framework for community, not only for those who help to grow but also for the area's other residents, many of whom come from diverse cultural backgrounds. The garden has a project manager for five hours a week employed by the housing association. This is very important in the case of this garden as the residents are quite wary of strangers. Information is presented in different languages (see Image 26), and residents are encouraged to grow herbs and other plants that have cultural significance for them. Polytunnels will be installed at this site as part of the SiEUGreen project.

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Image 25: The World Gardens

Image 26: Signage in a different language is an important inclusion measure

Opportunities to generate social connections are also built into the taste Aarhus project as a whole through the requirements for those who wish to get involved. Each garden is required to provide information and a contact person on the Taste Aarhus website. They should also provide signage at the garden itself as a means of engaging passers-by. Being visible in public space is an important component - people can pass by and see what is going on and get interested. Each garden is also required to provide at least some plants that can be picked by members of the public and to run two public events per year. These can be very simple, for example, "come pick berries and eat them out in the sun". The idea is to encourage the groups to be open to the outside community. Some gardens also set out with the aim of creating links between people who would not otherwise meet. For example, there is a garden located in a park by the university and aims to bring foreign students together with local residents.

Political dimension

Though the political component of the Taste Aarhus program may not be immediately obvious, there were clear examples of UA presenting opportunities for the new forms of engagement with the political ecology of the city, as Davidson (2017) describes. At a very basic level, the garden groups themselves can only become part of the Taste Aarhus program by first instituting a democratic structure consisting of a chairperson, treasurer and three other decision-makers. This structure seems to function well in practice. As an example, in the case of one garden, there was one member who was so driven and enthusiastic that she forgot to bring the group along with her and they lost interest. It was not possible for Taste Aarhus to continue to work with this person due to the condition that there must be a group and they must agree on the direction. In the end, the rest of the group got together and decided to go ahead in another direction. Each group is different in the way that they navigate setting up these structures and deciding how their garden will run, but the central commonality is the democratic process.

The garden projects also give residents the opportunity to shape the public spaces in their city in ways that they might not have expected. The initiator of 'Life in the churchyard' (described above) for example, was positively surprised by how receptive the municipal administration was to her setting up a garden in the public space. This project is particularly interesting as it takes place in a space that might appear to be off-limits to this style of DIY urbanism - a cemetery. Although there was some hesitation to using the space in this way the administration was open to trailing it provided the group were sensitive to the situation, information about the garden was easy to access, and any concerns were dealt with respectfully. Since the garden started, the response has been nothing but positive and the founder describes it as being quite symbolic of bringing life to this place.

Another example of UA shaping the political ecology of the city can be found in the temporary gardens at Pier 2 and Pier 4. With over 300 participants, Pier 4 is one of the bigger projects. It was initiated five years ago by four developers who got together and hired a project manager to set up a garden project by the construction site. The initial motivation was to make the building sites more attractive during the construction phase, thus making the new dwellings more attractive to prospective buyers. When Taste Aarhus joined the project it roughly doubled in size and, alongside the gardens, now has chickens and bees and a kitchen that anyone can use. This is supposed to be the last year of the project, but the developers have decided to keep some of the gardens as a "green line" between the new buildings.

Pier 2 (described above) is a younger garden which was formed in 2017 by a group of enthusiastic citizens. The community garden consists of approximately 45 small gardens built up of pallet frames. In addition, the community has established several pleasant common areas, both for members of the community garden and others who are passing by to Aarhus Harbour. The garden is temporary as it is also located on a building site; however, a dialogue has now started about the potential to make this space into a park. This dialogue was not there before. Prior to the establishment of the garden, the notion of a park was simply not part of the imagination in planning for this space. Together, these examples provide an example of how temporary uses can pave the way for real change. As the Taste Aarhus Project manager explains:

> *You don't get a lot of people to fight for a green area if it has never been there. But if you have had a green area and someone is taking it away from you, then you fight. There is something in there about how you activate people. People are going to fight for something if you take it away from them. They are not going to fight for something that they never had… So, when we remove the garden from, for example, Pier 4, they will want something else in return.*

A final example of political engagement related to the garden projects was found at Fællesgartneriet, Brabrand (described above). This land is pin-pointed for potential development, and there is some talk of it becoming an eco-village. According to the Taste Aarhus project workers, the garden group have been quite successful at making themselves visible, making networks with politicians and raising funds. This paves the way for ensuring that, if these plans do come to fruition, the group and their garden will be a part of them.

Summarising the findings on societal inclusion

The Aarhus showcase offers a rich opportunity to study societal inclusion as an outcome of UA. From a social perspective, UA is clearly a valuable tool in enhancing social capital, though the way this occurs appears to vary from garden to garden. In some cases, bonds between acquaintances are strengthened through participation, and in other cases, new bonds are created between people who were previously strangers. Larger gardens appear to bring less proximal people together, but we do not yet have adequate knowledge about the level of interaction between participants in these gardens to assess their contribution to the development of social capital. Understanding of the social and demographic make-up of participants in the gardens is also somewhat limited at this stage, making it difficult to ascertain whether such connections may constitute forms of bridging capital.

From a political perspective, UA appears to present at least some opportunities for the new forms of engagement with the political ecology of the city. The democratic structure required by the Taste Aarhus project is instrumental here; however, the opportunity to use public land also appears to elicit a degree of ownership. In at least two cases, this ownership has lead participants to take action in seeking to secure permanent changes to the urban structure following engagement with temporary initiatives. More demographic knowledge about participants would be useful in shedding light on the economic dimension of societal inclusion.

Going forward, it will be important that any questionnaires used throughout the project collect socioeconomic data so as to provide context for other findings. Specific research could also be carried out with the aim of better understanding the process through which different types of social capital are developed through UA projects. Here, it could be instructive to include a sample of institutional initiatives as well. Finally, a detailed analysis of the different actors involved, both in specific gardens and in the overall Taste Aarhus ecosystem would be incredibly valuable.

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Appendix I

Data products from Opendata.dk

Original Danish	English translation (google translate)	Files available	Module			
Dataset name	Dataset name		LU	FS	RE	SI
Ejendomme ejet af Aarhus Havn	Properties owned by Aarhus Harbor	GeoJSON; KML	x			
Kolonihaver i Aarhus	Allotment gardens in Aarhus	GeoJSON; KML	x			
Lokalsamfund i Aarhus	Local community in Aarhus	GeoJSON; KML				x
Ejendomme ejet af Region Midtjylland	Properties owned by Region Midtjylland	GeoJSON; KML	x			
Ejendomme ejet af Staten	Properties owned by the State	GeoJSON; KML	x			
Miljødata for den rensede røg	Environmental data for the purified smoke	CSV			x	
Parkeringshuse i Aarhus	Parkhouses in Aarhus	CSV; PDF	x			
BBR-bygninger Aarhus	BBR buildings Aarhus	XLS; PDF; DATA	x			
Tømningsdata, AffaldVarme	Drainage data, Wastewater	CSV			x	
Solcelleanlæg	Solar cell systems	CSV			x	
Befolkningsdata i Aarhus kommune	Population data in Aarhus municipality	CSV				x
CO2-målinger under Aarhus festuge	CO2 measurements during Aarhus feast	CSV			x	
Energiforbrug for idrætsanlæg i Aarhus Kommune 2014	Energy consumption for sports facilities in Aarhus Municipality 2014	XLS; DATA			x	
Trafiktællinger ved Aarhus Kommunes genbrugsstationer	Traffic counts at Aarhus municipality recycling stations	XLS; DATA			x	
Befolkningstal i Aarhus Kommune	Population figures in the municipality of Aarhus	XLS; DATA; HTML				x
Geokoordinater på genbrugsstationer i Aarhus Kommune	Geo coordinates at recycling stations in Aarhus Municipality	XLS; DATA			x	
Legepladser	Playgrounds	GeoJSON; KML	x			
Affaldsanalyse for villaer og etageboliger	Waste analysis for villas and flats	XLS; DATA			x	
Vandreruter	walking trails	GeoJSON; KML	x			
Naturbeskyttede områder med Bilag4 arter 2013	Nature-protected areas with Annex 4 species 2013	GeoJSON; KML; CSV	x			
Indvindingsoplande	Catchment	GeoJSON; KML; CSV	x		x	
OpenStreetMap for Aarhus Kommune [Data Sæt 1]	OpenStreetMap for Aarhus Kommune [Data Sæt 1]	DATA	x			
Kolonihaver i Aarhus 2014	Allotment gardens in Aarhus 2014	GeoJSON; KML; CSV	x			
Data vedr. personale i Aarhus kommune	Data related staff in Aarhus municipality	XLS; PDF; DATA				x
Statsborgerskab og herkomst i Aarhus Kommune, 2013	Citizenship and origin of the municipality of Aarhus, 2013	XLS; HTML; DATA				x
Affaldsbeholdere i Aarhus Kommune	Waste containers in the municipality of Aarhus	KML; XLS; DATA			x	
Skove og parker i Aarhus	Forests and parks in Aarhus	GeoJSON; KML	x			
Hundeskove i Aarhus	Dog forests in Aarhus	GeoJSON; KML	x			
Bålpladser i Aarhus Kommune	Fireplaces in Aarhus Municipality	GeoJSON; KML	x			
Planinformation - Aarhus Kommune	Plan information - Aarhus municipality	HTML; KML; DATA; CSV; GeoJSON	x			
Kloakopland i Aarhus Kommune 2014	Waste water in Aarhus Municipality 2014	KML; CSV; GeoJSON			x	
Aarhus Kommunes areal og afgrøder.	Aarhus Municipality's area and crops.	CSV	x			
Grejbaser ved Aarhus kommune	Outdoor education bases by Aarhus municipality	GeoJSON; KML				x
Miljøzone - Aarhus	Environment Zone - Aarhus	GeoJSON; KML	x		x	
Naturcentre	Nature Center	GeoJSON; KML	x			
Shelters i Aarhus	Shelters in Aarhus	GeoJSON; KML	x			
Naturarealer ved strande	Nature areas at beaches	GeoJSON; KML	x			
Aarhusbolig	Aarhus Housing	XML	x			
Ejendomsfortegnelse	Property List	XLS; DATA	x			
Affald fra genbrugsstationer.	Wastes from recycling stations.	XLS			x	
Vandløb aarhus kommune	Watercourse aarhus municipality	KML; CSV; GeoJSON	x		x	
Batteriindsamling	Battery Collection	XLS; DATA			x	
Datasæt om sammensætningen af affald	Data set on the composition of waste	XLS; DATA			x	
OpenStreetMap for Aarhus Kommune [Datasæt 2]	OpenStreetMap for Aarhus Kommune [Datasæt 2]	DATA	x			
Socioøkonomiske data, Aarhus	Socioeconomic data, Aarhus	XLS				x
Dyr- og naturobservationer	Animal and nature observations	CSV; PDF	x		x	
Træklatring	Tree climbing	GeoJSON; KML	x			x
Aarhus adressedimension	Aarhus address dimension	CSV	x			
Aarhus i tal	Aarhus in numbers	HTML	x	x	x	x
Digitale Bydele	Digital Neighbourhood	JSON				x
Luftforurening	Air pollution	DATA;CVS			x	

Data products from Plansystem.dk

Dataset (Danish and English translation)		Module			
		LU	FS	RE	SI
Dataset 1	Kommuneplan, vedtaget - Kommuneplanrammer	X			
	Municipal plan, adopted - Municipal plan framework				
Dataset 2	Kommuneplan, vedtaget - Detailhandelsstruktur	X			X
	Municipal plan, adopted - Retail structure				
Dataset 3	Kommuneplan, vedtaget - Særlig værdifulde landbrugsområder	X	X		
	Municipal plan, adopted - Specially valuable agricultural areas				
Dataset 4	Kommuneplan, vedtaget - Skovrejsningsområde	X	X		
	Municipal plan, adopted - Forest area				
Dataset 5	Kommuneplan, vedtaget - Naturbeskyttelsesområde	X			X
	Municipal plan, adopted - Nature conservation area				
Dataset 6	Kommuneplan, vedtaget - Økologisk forbindelse		X		
	Municipal plan, adopted - Organic connection				
Dataset 7	Kommuneplan, vedtaget - Værdifuldt kulturmiljø, vedtaget				X
	Municipal plan, adopted - Valuable cultural environment, adopted				
Dataset 8	Kommuneplan, vedtaget - Anvendelse af vandløb, søer og kystvande			X	
	Municipal plan, adopted - Application of streams, lakes and coastal waters				
Dataset 9	Varmeforsyning, vedtaget - Forsyningsområde, vedtaget			X	
	Heat supply, adopted - Supply area, adopted				
Dataset 10	Spildevandsplan, vedtaget - Kloakopland / kloaktype, vedtaget				
	Wastewater plan, adopted - Kloakopland / sewage type, adopted			X	

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SiEUGreen

Sino-European innovative green and smart cities

Sino-European innovative green and smart cities

Sino-European Innovative Green and Smart Cities

Deliverable 1.1

Maps of quantitative and qualitative data for each of the showcase locations – Annex 2. Hatay report

Lead Partner: Nordregio

Lead Authors: Luciane Aguiar Borges, Tuba Kolat, Shinan Wang & Linda Randall

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Throughout SiEUGreen's implementation, EU and China will share technologies and experiences, thus contributing to the future developments of urban agriculture and urban resilience in both continents.

The project SiEUGreen aspires to enhance the EU-China cooperation in promoting urban agriculture for food security, resource efficiency and smart, resilient cities.

The project contributes to the preparation, deployment and evaluation of showcases in 5 selected European and Chinese urban and peri-urban areas: a previous hospital site in Norway, community gardens in Denmark, previously unused municipal areas with dense refugee population in Turkey, big urban community farms in Beijing and new green urban development in Changsha Central China.

A sustainable business model allowing SiEUGreen to live beyond the project period is planned by joining forces of private investors, governmental policy makers, communities of citizens, academia and technology providers.

Co-funded by the Horizon 2020 programme of the European Union
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[1] **PU** = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

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Introduction

Hatay Province is located in the southern part of Turkey. Together with **Kahramanmaraş and Osmaniye,** Hatay Province (TR631, NUTS3) is part of the TR63 (NUTS2) Region based on Statistical Regional Units Classification (NUTS). The region TR63 is one of the 26 established NUTS2 regions in Turkey, occupies 3% of the total surface of the country and is home to 4% of the population of Turkey.

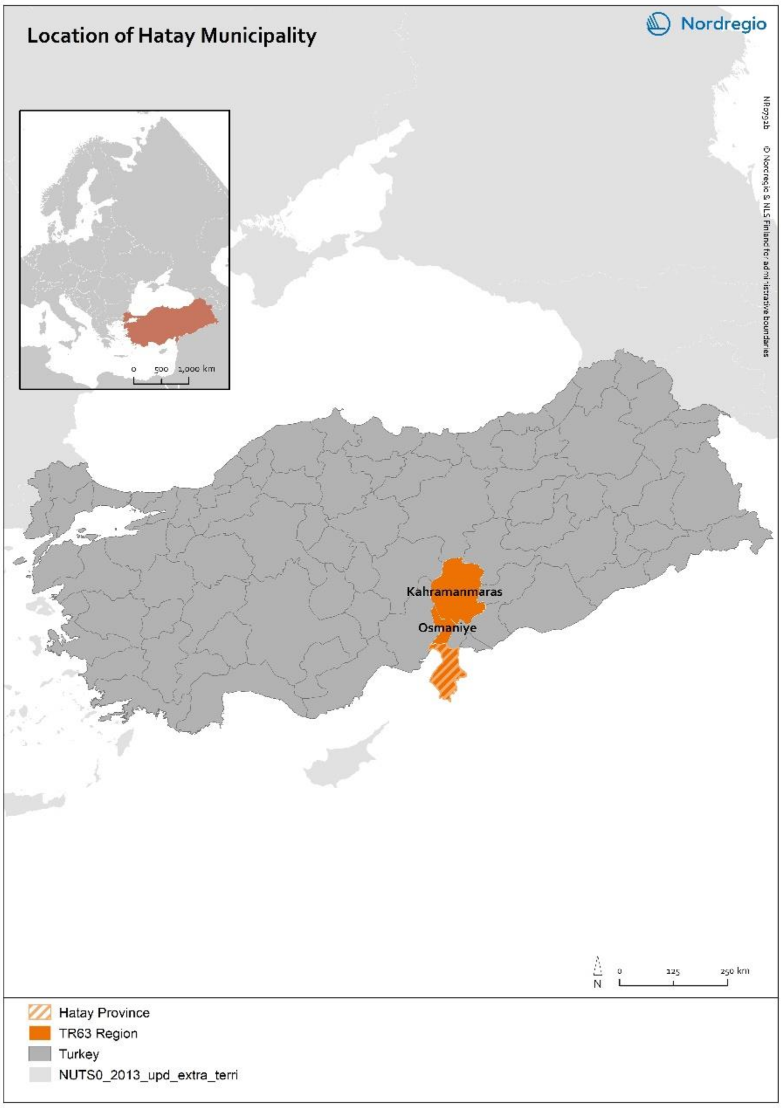


Figure 1: Geographical location of Turkey and Hatay

Hatay province is surrounded by mountains - Mount Amanos in the north, Mount Kel in the south, Mount Habib Neccar in the east and the Amik plain to the north-east; with the Eastern Mediterranean Sea lying to the southwest of the city. It is located 25 km east of the

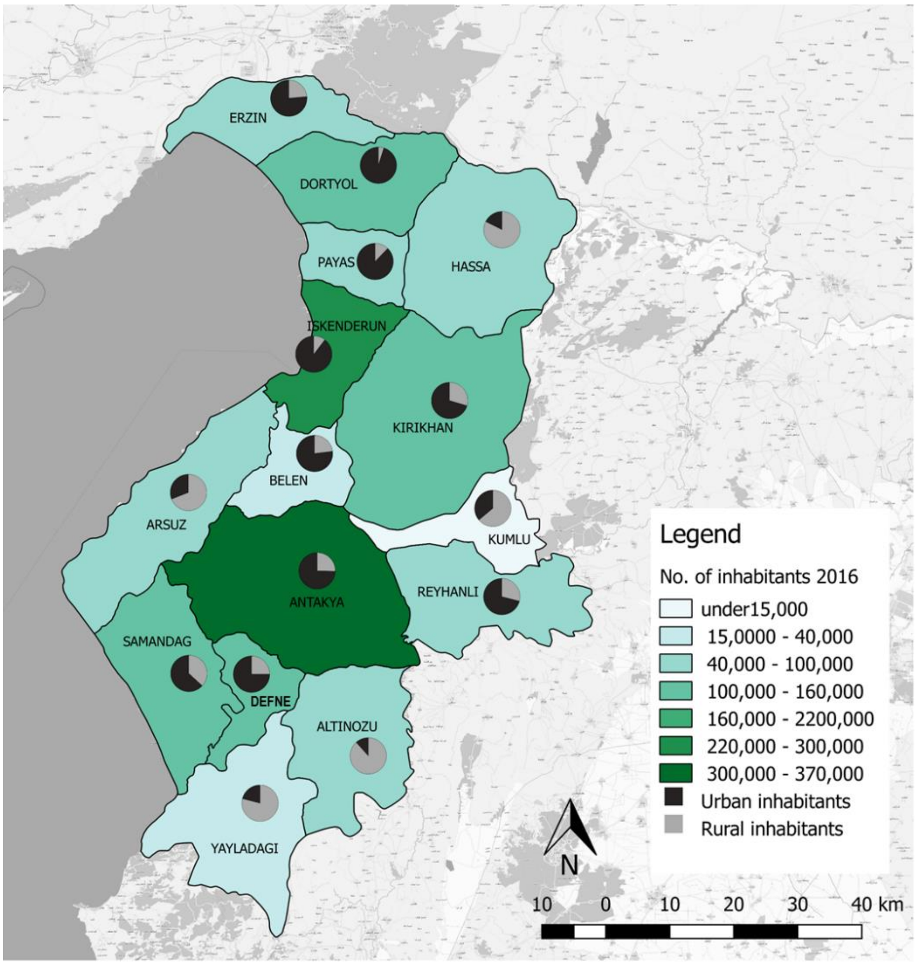
Mediterranean Sea and 20 km northwest of the Syrian border. Mountain Amanos has a strong effect on the way in which the settlements were organised in Hatay Province. It also influences the administrative borders for the 15 municipalities (Antakya, Altınözü, Belen, Dörtyol, Erzin, Hassa, İskenderun, Kırıkhan, Kumlu, Reyhanlı, Samandağ, Yayladağı, Defne, Arsuz, Payas) which are part of Hatay.

Based on the 2023 population projection by the Turkish Institute of Statistics, Hatay Province is the thirteenth largest province by population in Turkey (TR Eastern Mediterranean Development Agency, 2015). In 2012, Hatay became a metropolitan city through approval of a new regulation which declares thirteen provinces as metropolitan cities[1]. This decision has increased Hatay's attractiveness and consequently sped up population growth, from 6.39% between 2011 and 2012 to 12.99% between 2012 and 2013 (TR Eastern Mediterranean Development Agency, 2016). In 2016 the population of Hatay was 1 555 165[2] inhabitants, and the annual population growth was around 14%. This rate is slightly higher than the national average of 13.55% (TUIK, 2016), making Hatay Province the thirty-fourth fastest-growing province in Turkey.

Hatay Province is the seventh most dense province in Turkey, with an average of 267 inhabitants per km2 (TR Eastern Mediterranean Development Agency, 2015). Hatay Environmental Plan (2018) forecasts that the region will have 2 777 000 inhabitants by 2040, being 2 221 600 people living in urban areas, whereas 555 400 people living in rural areas. Map 1 shows the 15 municipalities that makeup Hatay Province. The green shading indicates the size of the population in 2016, with darker colours representing more populous municipalities and lighter colours representing less populous municipalities. The pie charts illustrate the division of the municipal population between urban and rural areas, with the darker colour representing the urban population and the lighter colour representing the rural.

[1] (https://www.tbmm.gov.tr/kanunlar/k6360.html

[2] Data is retrieved from Turkish Statistical Institute



Map 1: Population distribution in Hatay Province, 2016
Source: TR Eastern Mediterranean Development Agency, 2016

As can be seen on the map, the most populous municipalities are Antakya (365 402 inhabitants) and Iskenderun (246 639 inhabitants). Defne, Antakya's neighbouring municipality, is the third most populous (143,176 inhabitants), and together these three municipalities contain the provinces major centres. As such, they are also some of the most urbanised municipalities in the province, with 75% or more of their populations living in urban areas. The smallest populations can be found in Kumlu (13 172), Belen (31 571) and Yaylalagi (28 687). The border municipalities of Kumlu and Yaylalagi are predominantly rural, whereas Belen, neighbouring Antakya, over 75% of the population live in urban areas.

Map 2 sheds further light on population distribution based on the Eurostat typology. Based on this classification only Antakya, Defne, Samandag and İskenderun can be considered urban areas (population density around 5000 inhabitants per km^2), while all other municipalities exhibit some form of rural character (around 300 inhabitants per km^2).

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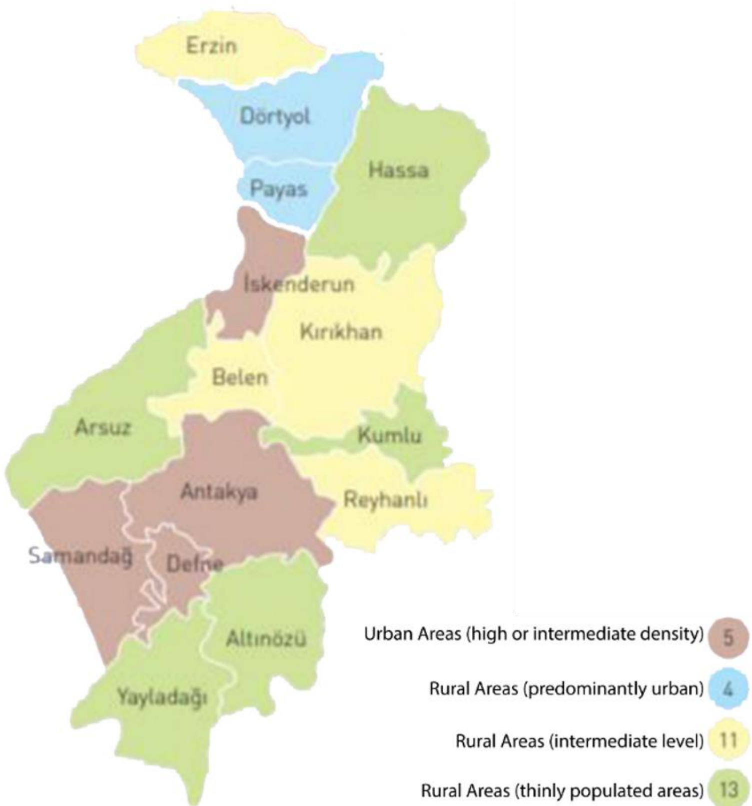
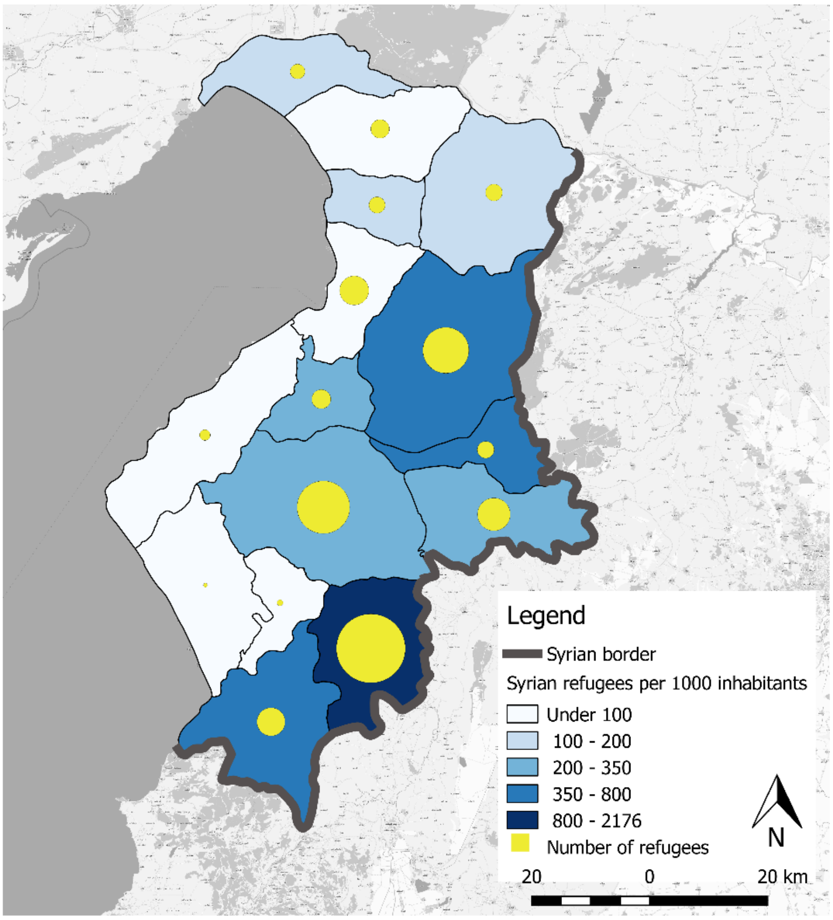


Map 2: Rural and urban areas in TR63
Source: TR Eastern Mediterranean Development Agency, 2015

The proximity of Hatay Province to the Syrian border has had a strong influence on population development in recent years, leading to a sharp increase in the number of inhabitants, particularly in border municipalities. In 2016, the 398,378 Syrian refugees in Hatay Province made up close to a quarter of the total population (24.3%) (DOGAKA, 2017). This accounts for approximately 16% per cent of all Syrian refugees in Turkey, making Hatay the third most common province in Turkey for Syrians to seek refuge (Istatistiklerle Hatay, 2016). Map 3 shows the distribution of Syrian refugees across Hatay Province, including both the absolute number of refugees (yellow circles) and the number of refugees per 1000 inhabitants.



Map 3: Distribution of Syrian Refugees in Hatay
Source: *Eastern Mediterranean Development Agency, 2016*

As can be seen on the map, the by far the largest population of Syrian refugees, both in absolute numbers and as a portion of the population, can be found in the border municipality of Altinozu. In 2016, the 131 789 Syrian refugees in Altinozu made up 69% of the total inhabitants of the municipality. Other municipalities with high numbers of Syrian refugees included Antakya (77 536) and Kirikhan (58 749). The border municipalities of Yaylalagi (22 028) and Kumlu (7 958) both had large populations of Syrian refugees in the context of their relatively small populations, though the absolute numbers were not as large.

Concerning age, just under half the population of Hatay Province are aged from 25-64 years, 45% are aged below 25, and just 7% are over 65 years of age.

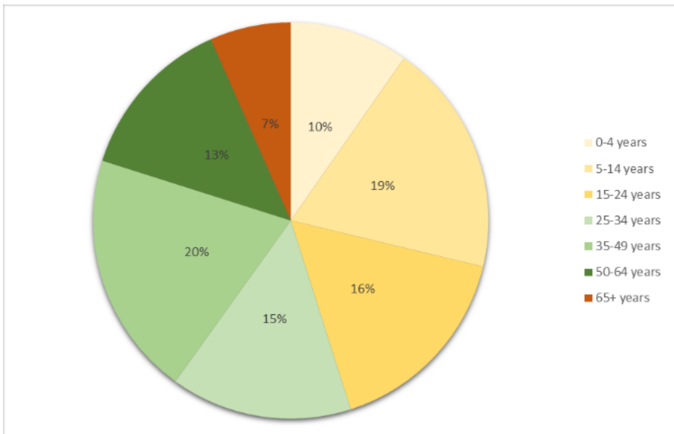


Figure 2: Age structure of Hatay Province, 2015
Source: *TR Eastern Mediterranean Development Agency, 2015*

Hatay is listed twelfth in the ranking of the provinces in Turkey with the highest emigration rates. Between 2010-2016, the emigration rate was 48.346%. The lack of precise data about ethnicity and/or age of the population which leaves the region unable to investigate the reasons that lie behind this pattern of movement. A possible reason for that is the transitory status of the Syrian refugees that might stay in the region for a short while and then look for opportunities in other European countries.

Turning to the economic profile, Hatay is one of the poorest regions in Turkey. In 2017, the GRP per capita was only €9, approximately one third that of Istanbul (€29), the region with the highest GRP (TR Eastern Mediterranean Development Agency, 2016). Agriculture and the metal industry play a key role in the economic profile of the region. For both sectors, the Arabic countries are the most prominent export countries (Dogaka, n.d[3]). As a result, trade with these countries constitutes a significant share of Hatay's economy. Nevertheless, conflicts in these countries have depressed their imports with knock-on effects for Hatay. As pinpointed in a report from OECD (2016), Hatay is among the regions that struggle to diversify the export markets.

This dim view of Hatay's export potential was challenged by a planner from Hatay Municipality, who indicated that agriculture has the potential to drive economic growth. According to this interviewee, a large amount of land has been safeguarded for agriculture. This fact, combined with Hatay's advantage of hosting seaports with access to both the

[3] http://www.investinhatay.com/sectors.asp?S=24&Sector=foreign-trade

Mediterranean Sea and the Middle East raises expectations regarding the potential of agricultural activities and export capacity in Hatay.

Hatay's economic struggles are reflected in the region's high unemployment rate. For the most part, the employment rate in the region has been lower than the national average, while the unemployment rate has been higher than the national average (see Figure 3). An exception was the year 2010 when the regional employment rate was comparable to the national average.

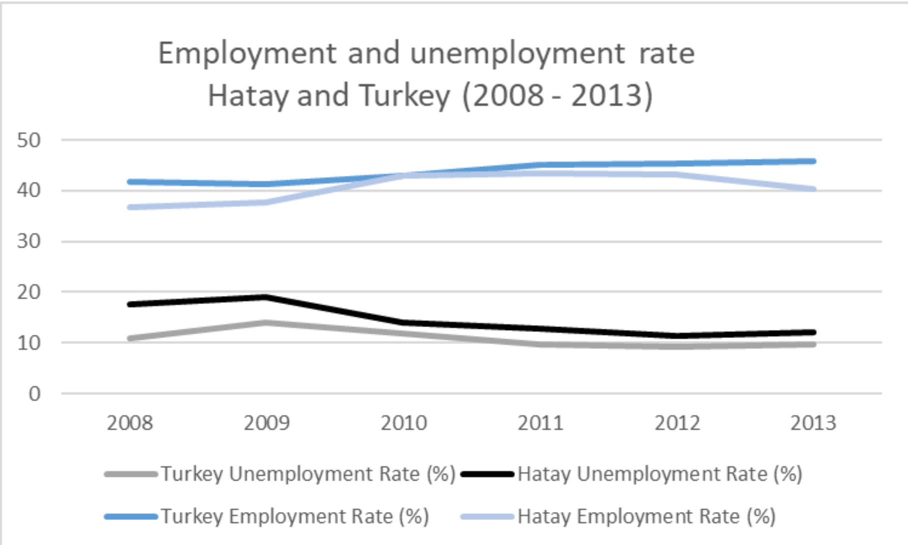


Figure 3: Employment and unemployment rate in Hatay and Turkey, 2008 - 2013

Between 2014 and 2016, a slight increase in the employment rates was registered in Hatay (from 43.3% to 46%). Female employment, which increased from 19.9% to 26% during the same period seems to have been the major influence in this trend. Another significant aspect is the great difference in the employment rate by gender. Data from 2012 shows that in Hatay, the proportion of female employment is three times lower than males. As can be seen in Figure 4, this trend mirrors the national pattern. (TUIK, 2012).

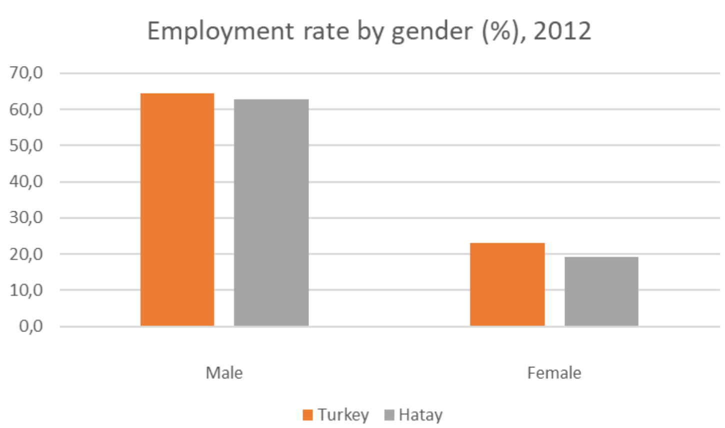


Figure 4: Employment rate by gender

Source: Turkish Statistical Institute (TUIK), 2012

According to the Environmental Plan (Hatay Municipality, 2018), the labour force of the region corresponds to 57% of the total population. Of the total workforce, 63% are employed in the agriculture sector, 29% in the service sector and 9% in the manufacturing industry. Employment projections for 2040 estimate a significant drop (from 57% to 36.5%) of the population working within the agricultural sector, and an increasing number of people occupied in the service sector (37%). The industry sector is expected to maintain a similar proportion of employees (26.5%) (The Municipality of Hatay, 2018)

Concerning education, Table 1 shows a rather bleak picture, with less than one-third of the population completing secondary education and only 8.7% attaining tertiary education. While the literacy rates, despite keeping raising from one generation to another, is still significant.

Table 1: Level of Education of the Population

Level of Education of the Population (2014)	
Illiterate	2,6%
Primary	56,1%
Secondary	31,2%
Tertiary	8,2%
Further Education	0,5%
Unknown	1,5%

Source: TR Eastern Mediterranean Development Agency, 2015

Hatay in SiEUGreen Project

The construction of a greenhouse on the Kisecik Expo zone in the urban fringe of Antakya, the capital of Hatay, and the Women's Cooperative are the initiatives that will receive support from SiEUGreen Project. In the context of Hatay Region's strong agriculture profile, it is hoped that UA may be a means through which to increase the earnings of low-income people as well as to integrate refugees into Turkish society.

The Kisecik greenhouse is expected to become a demo and pilot area to test the potential of aquaponics, hydroponics and vertical gardening systems to produce food in the region. It will showcase the environmental and economic feasibility to further apply these technologies in the UA initiatives in the Women's Cooperative.

The Women's Cooperative (in Turkish Ureten Eller) is an ongoing initiative managed by an entrepreneur with the assistance of Hatay Municipality. The cooperative engages 250 low-income women in peri-urban agriculture activities providing financial assistance to build up a small green-house, seeds to grow flowers and vegetables. The cooperative also runs educational activities.

Within the SiEUGreen project, it is anticipated that hydroponic systems will be implemented in approximately one-quarter of these greenhouses, enabling the diversification of production. The engagement of this initiative in the SiEUGreen project is expected to facilitate the dissemination of new technology, increasing production and providing increased income to participants. Furthermore, urban aquaponics has the potential to help feed low-income earners and refugees and in Hatay. In the future, this system is expected to be extended to the whole community with the long-term goal of attaining local food security and self-sufficiency.

Both initiatives are further explored in the modules on land use, food security, resource efficiency and societal inclusion.

Methodology

The remainder of this report presents an in-depth exploration of the Hatay showcase, structured around the four pillars of central interest in the SiEUGreen project: land use; food security; resource efficiency and societal inclusion. Data was collected using the following methods:

1. Desktop research
2. In-depth semi-structured interviews with key informants

This section will describe the steps undertaken in each method, providing insight into the specific sources/informants, the data collection process, the limitations faced and the steps taken to overcome these.

Desktop research

Information about Hatay Province in English is scarce and, where such information is available, its primary purpose is generally to promote the region. The exception was a few scientific articles, which were used to describe the physical structure of Antakya and to give some insights on the role of the refugees in the economy of the region. Given these limitations, we employed the assistance of a Turkish speaker.

Eurostat and the OECD were the main sources of national-level data. Data on showcase level for Hatay province were obtained mainly through reports, (e.g. Environmental Plan, Energy Sector Report, Hatay Environmental Impact Report) produced by regional and national authorities (e.g. DOGAKA, Ministry of the Environment). The national database of Turkey was also used to gather statistical information. The lack of digital spatial data (e.g. land-use zoning at the municipal level) was partially overcome consulting few scientific articles, published in English. Together these data helped to draw a comprehensive picture of the municipality with regards to the planning system, the distribution of green infrastructure, land use, waste management, and sewage treatment system. Microsoft Excel and QGIS were used for data analyses and visualisation.

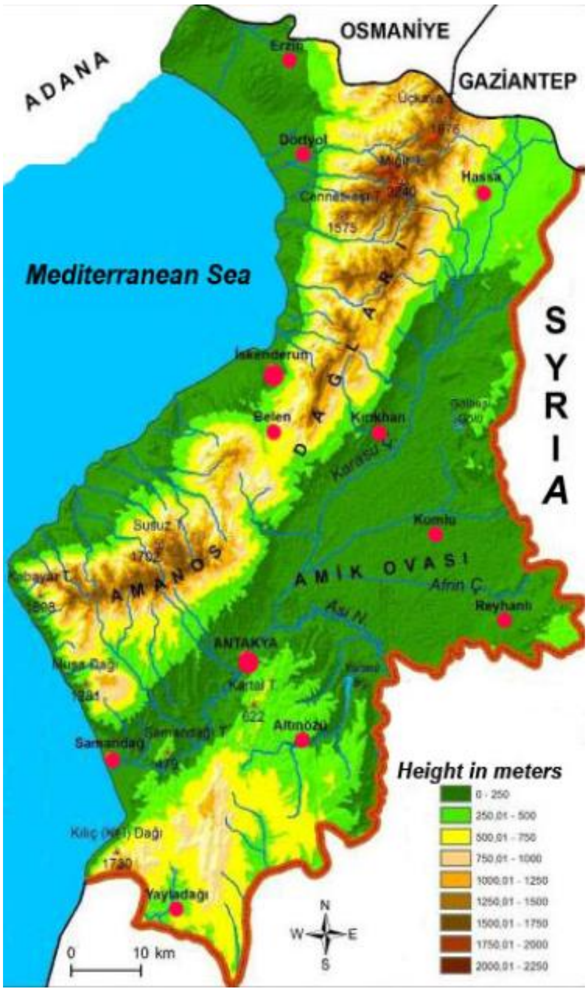
In-depth semi-structured interviews with key informants

Due to the political instability of the region, it was not possible to perform field research in the case of Hatay. As such, interviews played a major role in gaining insights about urban agriculture in Hatay. Before setting up individual interviews, a skype video meeting was organised with representatives of Hatay Municipality. Seven stakeholders (e.g. planners, entrepreneurs) from different sector related to urban agriculture were present. This meeting was an opportunity to understand their expectations of the SiEUGreen project, discuss the availability of data (e.g. digital database at the municipal level) and identify possible interviewees.

Following this meeting, five semi-structured telephone interviews were undertaken with several stakeholders (e.g. planners, entrepreneurs, researcher, food engineer, urban farmer). The interviews were previously arranged by email when the participants received an explanation of the project, and ethical clearance was obtained from them. Given the language barrier a short questionnaire, in English, was handed in before to the interview and Turkish was the language used during in all the interviews. These interviewees were the primary means of uncovering the purposes (e.g. leisure, improve income, self-consumption) and meaning behind participation in UA (e.g. strengthen relation with nature, relax, family tradition), techniques used (e.g. nutrients, irrigation) and social networks (how the people got engaged). The interviews generated dialogue regarding the ideologies, concepts and motives for the practising UA.

Module 1 LAND USE

Hatay Province is constituted of 39% agricultural areas, 38.5% forest areas, 12.5% coastline and 9.5% urban areas (ISIN-ER Planlama, 2011). Its surface area is 5559 km^2 and 46.1% of the land are mountains, 33.5% are plains and 20.4% are plateau.



Map 4: Topography of Hatay Province
Source: Hatay Municipality, presentation of the region during the SiEUGreen kick-off meeting, Oslo 16-17 January 2018

As shown in Map 4, the mountains (Amik Mountains) roughly divide the region into two halves: The East Mediterranean Coast and the West Inland. The north part of the east coast, hosts settlements with high (İskenderun) and intermediate (Payas and Dortyol) population density. The other three important urban centres of the region (Antakya, Defne and Samandag) are located in the inland flat area (Amik). The most fertile soils of the region are also found in this flat. This perhaps explains the rural character of the other provinces that are located in this area.

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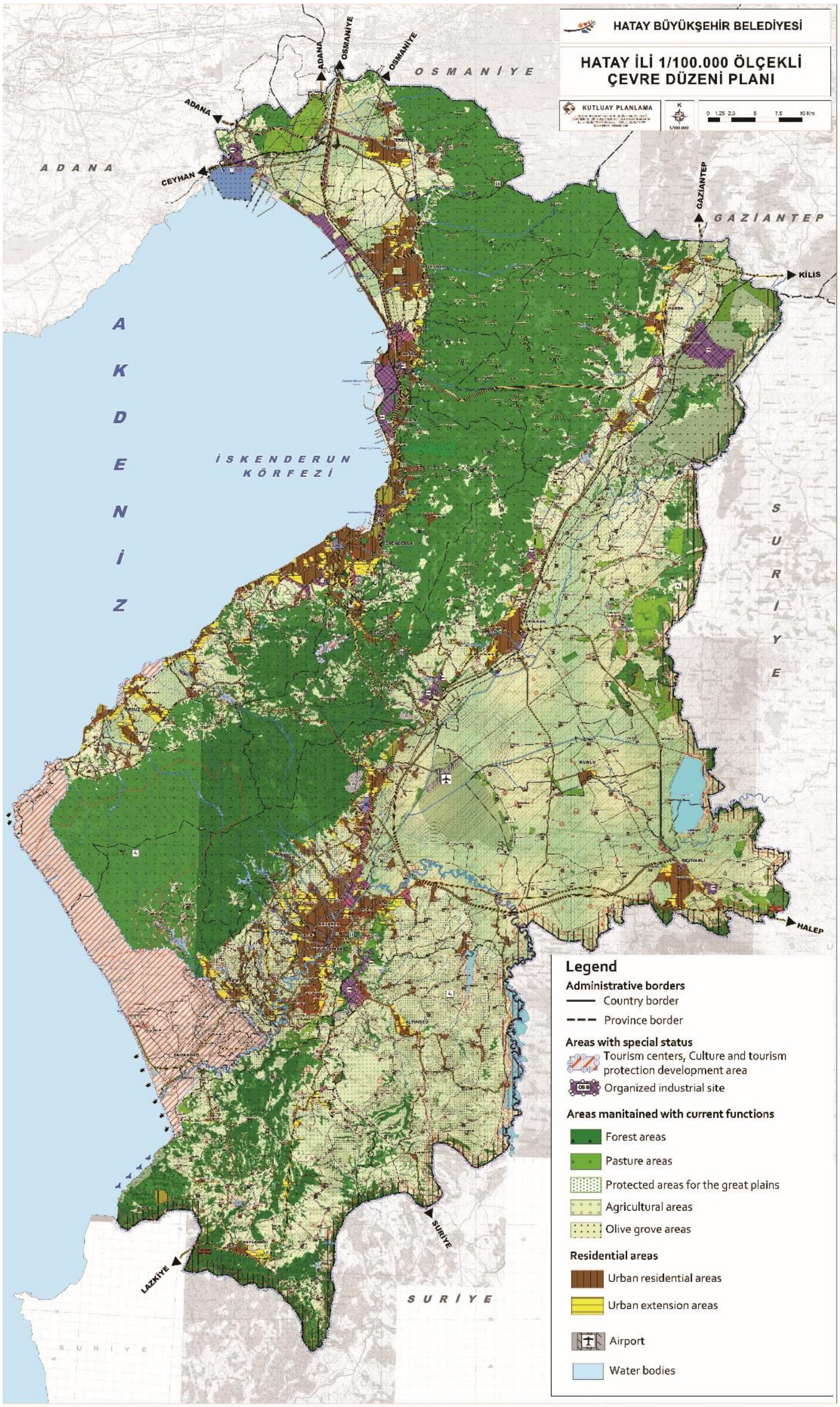
An accurate overview of the land use and the network of urban settlement in the region can be seen in Map 5.



Map 5: Land Use zoning.
Source: Environmental Plan, 2018

As Map 5 shows, the main connection between the East Mediterranean Coast and the West Inland part of the region is made through roads located in Belen Province. As the brown colour shows, the network of cities is scattered with some urban settlements located in the north part of the east coast and others inland. Antakya and Dafne are the largest urban centres in the region. The map also indicates the location of large industrial sites close to Antakya, İskenderun (east coast) and Hassa (north-west). It is also worth noting the significant area on the south-east coast, located in Samandag Province, which is regarded as a tourism and protection area.

In the ongoing Environmental Plan currently being developed by the Ministry of Food Agriculture and Livestock, the prairies of Arsus (on the cost), Erzin and Dortyol (in the north) and Amik (in the centre of the region) have been assigned the status of an agricultural protected area.

Institutional aspects: the planning system

The planning system in Turkey is very centralised. The binding document for spatial development is the Environmental Plan which allocates land use (e.g. residential, industrial, agriculture, tourism) and transportation at the national level. This plan is informed and guided by different ministries, including Agriculture and Livestock, Science Industry and Technology, Environment and Urban Planning and Culture and Tourism. For example, when it comes to decisions about the regulation of land for agriculture the Ministry of Agriculture is consulted and their recommendations must be taken into consideration. Thereby the Environmental Plan for Hatay has been developed with the participation of different ministries. Figure 5 illustrates the hierarchy of the planning system in Turkey.

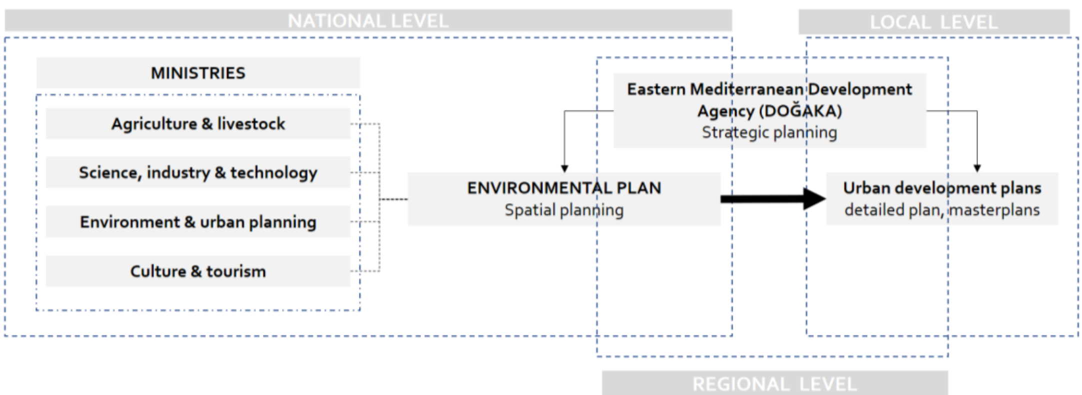


Figure 5: Planning system in Turkey

At the regional level, the Eastern Mediterranean Development Agency (DOĞAKA) is the main actor responsible for regional planning and development in the TR3 Region (Hatay, Kahramanmaraş and Osmaniye). Operational since 2009, DOĞAKA is a semi-autonomous public body and primarily works to encourage economic and social development of the region. One of the agencies main activities is building capacity among stakeholders from the public and private sectors, NGOs and local governments. Guided by the vision to turn TR3 into a leading region in Turkey and the Middle East in Agriculture, Technology, Commerce, Transportations and Tourism, DOĞAKA strives to improve the economic and social conditions of the region while at the same time protecting the cultural and natural environment.

Although DOĞAKA has no substantial power over the development of master plans, environmental plans and spatial plans, any local-level decisions regarding urban development in Hatay Province, must be coherent with the overarching vision, goals and strategies set by DOĞAKA for the three regions (Hatay, Kahramanmaraş and Osmaniye). Thereby the regional development directives formulated by DOĞAKA must be considered by municipalities when designing instruments for local development (e.g. spatial development plans, masterplans).

At the local level, the strategic planning objectives from DOĞAKA and the recommendations concerning land use and transportation from the Environmental Plan form the basis for the development and design of master plans and detailed plans for urban development. An interviewee, who is a planner in the municipality highlighted the limited power of the local level, stating that its role is mostly limited to adjust decisions that are taken at the ministries to the local level. He also mentioned the 'patchy' work that is performed by the different ministries. For example, the Ministry of Food, Agriculture and Livestock make their own agricultural land use plan, the Ministry of Science, Industry and Technology decides the industrial sites and so on.

One of the priorities stated in the regional plan (DOĞAKA) is enhancing the productivity of agriculture in the region. This directive has been taken into consideration in the environmental plan, which identifies and safeguards specific areas for agriculture. Specific measures include the use of sustainable agricultural methods, increasing efficiency in terms of time and process, and improving the quality of products and the living standards in rural areas while generating competitive prices. These measures are expected to support the vision of “Hatay becoming a leader in agricultural production not only in Turkey but also in the Middle East” (The Municipality of Hatay, 2018: 15).

The plan highlights the need to develop branding strategies for olives, olive oil, cotton, citrus and carrots to improve their market value while promoting the region as agricultural and trade centre for these products. According to the plan, around 40.4% of the territorial area of the Hatay region is assigned as agricultural land (2163.53 km^2). In addition, 5.48% of the area of the region, corresponding to 29,310 ha is planned as olive gardens.

The plan also defines the districts of Kirikhan, Kumlu, Reyhanli and Hassa as underdeveloped rural areas, and recommends further investments in agriculture to improve the quality of life in these areas. Antakya and Defne are highlighted as important service centres and should be developed as such. Furthermore, Antakya is also regarded as an important centre for the public sector and industries. The importance of agriculture in the economy of Antakya is also pinpointed, and some peripheral settlements (Pasakoy, Marasbogazi, Arphan and Asagiboga) are highlighted due to their agricultural potential. Infrastructure improvements (e.g. road conditions, irrigation systems and educational support) are planned with the aim of increasing efficiency and profitability in agriculture and fostering the potential of these areas (Agriculture and Livestock, 2018).

Spatial and Functional aspects

As described in the introduction, the SiEUGreen project will support the construction of a greenhouse on the Kisecik Expo Zone in the urban fringe of Antakya and the Women's Cooperative. The greenhouse will be located in the outskirts of Antakya and the UA initiatives related to the Women's Cooperative will take place in thirteen out of the fifteen municipalities of the Hatay Region. Only women from Dorityolt district, located in the north, and İskenderun sited on the west coast will not participate. Table 2 below shows the number of greenhouses implemented in each municipality.

Table 2: Distribution of the greenhouses under the body of the Women's Cooperative.

District	Number of greenhouses
Samandag	43
Antakya	32
Reyhanli	28
Altinozu	26
Yayladagi	26
Kirikhan	20
Defne	17
Arsuz	16
Dortyol	16
Belen	8

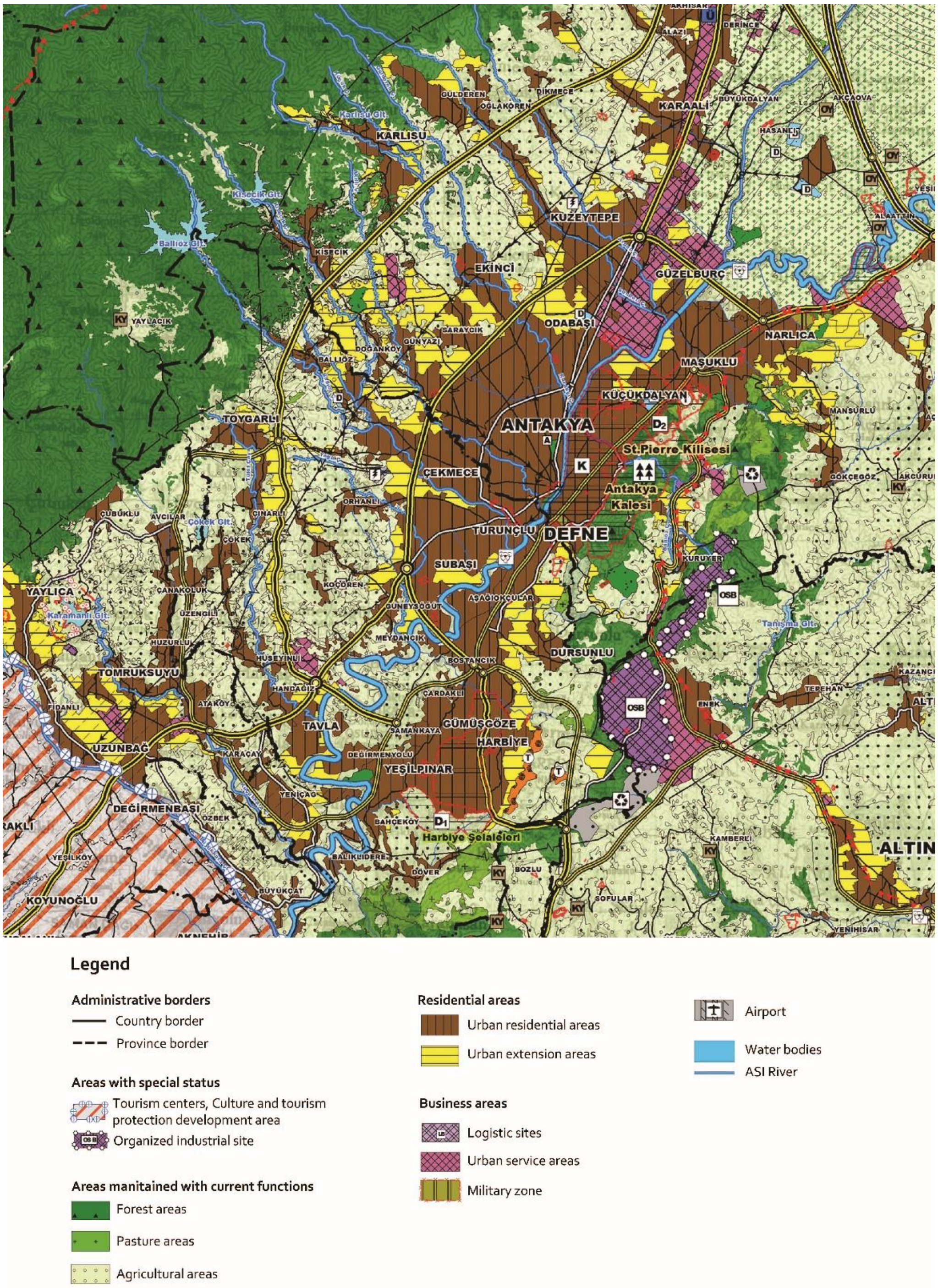
Hassa	8
Kumlu	5
Payas	5
TOTAL	250

Source: Interview with the entrepreneur

In terms of land use, agriculture is performed in peri-urban areas in both initiatives. Given the impossibility of describing land use in all 13 districts, the focus turns to Antakya where the greenhouse to test new technologies will be built and a significant number of middle-size greenhouses have already been implemented through the Women's Cooperative.

Antakya is located 25 km east of the Mediterranean Sea and 20 km northwest of the Syrian border at an altitude of 80 m. The city is surrounded by mountains in the north (Mount Amanos - Nur Mountains) south (Mount Kel - Cebel-i Akra) and east (Mount Habib Neccar - Silpius Mountain). In the northeast of the city lies the Amik plain which contains fertile land appropriate for agriculture. The Eastern Mediterranean Sea lies to the southwest of the city.

As can be seen in Map 7, the Asi River divides Antakya into the Eastern and Western parts. The historic urban core of the city, known as "Old Antakya" (see Image 1) and new areas developed after the first quarter of the 20th century are located in the eastern part. The western part was developed after the mid-19th century and is linked to the eastern part by seven bridges. The main road towards neighbouring regions (e.g. İskenderun, Samandağ. Reyhanlı and Daphne) as well as to Aleppo, Syria, are located in the eastern part of the city (Rifaioğlu, 2014).



Map 6: Antakya land use.
Source: Environmental Plan (2018)

Three archaeological sites are important landmarks in the urban configuration of the Antakya: Tell Tayinat and Tell Açana (Alalah) to the northeast and Seleucia Pieria (Samandağ) to the southwest. In the southern border, the urban structure of Antakya almost merges with the neighbouring city of Defne which is the third municipality of the region in terms of population.

As shown in Map 7, the city is surrounded by agricultural areas and few pastoral areas on the western side. Areas earmarked for urban expansion are sited mostly in the eastern part of the city. Urban service areas (e.g. education, health, economic activities) are placed in the north part of the city. In Hatay, urban service areas are planned for the new urban expansion areas. This strategy aims to respond to the needs of the hinterlands while preserving their rural lifestyle and agricultural assets (Plan Hillsborough, 2015).

Image 1: The Long Bazaar of Antakya
Source: Rifaioğlu (2014)

According to an interviewee who is a civil servant as a food engineer in Hatay Municipality intra-urban agriculture is not common in Hatay. This may be because urban agriculture has not gained popularity as it has in many other cities around the world. The economy is heavily based on agriculture, with large amounts of land protected for farming in peri-urban and rural areas. The low density of urban centres in the region may also reinforce the division between urban and rural. The interviewee also added that agriculture in urban areas is stigmatised and commonly related to low-income groups. In addition, at least some parts of the city have a dense urban structure with small plots, few green public areas and rather narrow streets. This configuration seems not to enhance the development of intra-urban agriculture. The pictures below give a hint about the configuration of public spaces as well as a sample of the typologies of the buildings.

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Image 2: Streets typology in Antakya
Source: Rifaioğlu (2014)

Image 3: Buildings typologies in Antakya.
Source: Rifaioğlu (2014)

The Kisecik Expo Zone is located 6.4 kilometres from Antakya centre. The municipality owns 10000 m^2 of a community garden zone, and a masterplan for the region is under development. Figure 6 shows the approximate location of the park and Image 4 illustrates the landscape.

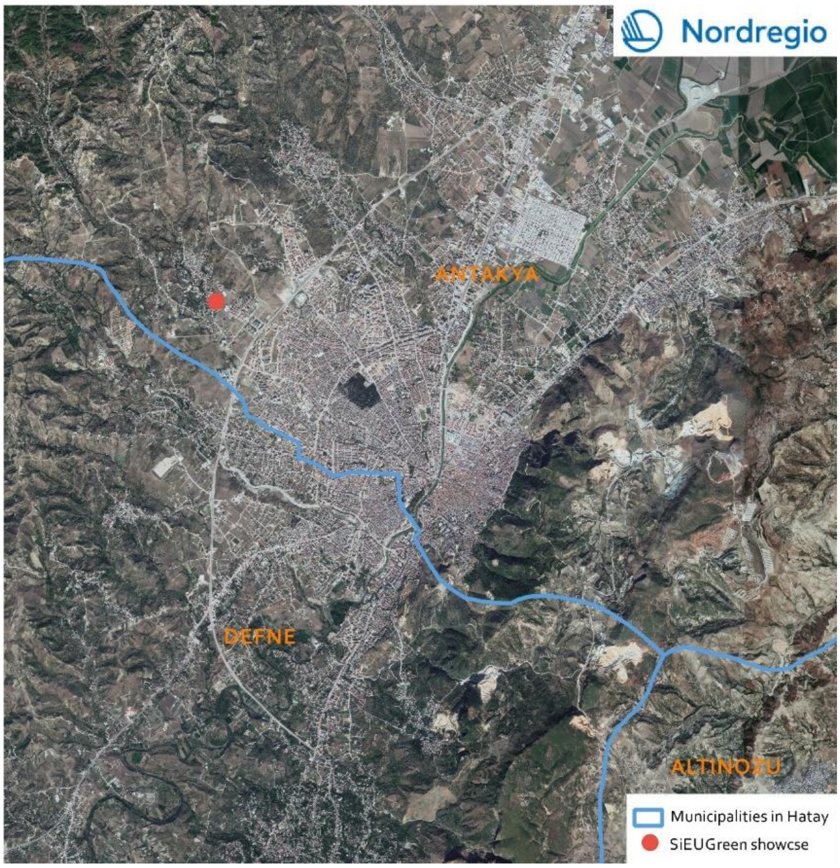

Figure 6: Probable location of a new greenhouse in the SiEUGreen

Image 4: Kisecik Expo zone. Source: Hatay Municipality

The greenhouse that will be built in Kisecik is expected to become a demo and pilot area to test the potential of aquaponics, hydroponics and vertical gardening systems to produce food in the region. It will showcase the environmental and economic feasibility to further apply these technologies in the UA initiatives in the Women's Cooperatives.

In the Women's Cooperative, the land structure is quite different, though the location is also peri-urban. Owning a plot of land with a minimum area of 360 m^2 is one of the conditions to become engaged in the cooperative. Agriculture takes place on the plot where the participant lives or on an area located within walking distance from the place of residence. The cooperative then helps to construct middle-sized greenhouses, usually 6x30 meters, in the backyard of the private houses or in a near area. One reason for that is to avoid costs with transportation and facilitate farming care and maintenance. These greenhouses are built with limited technology, usually with a steel structure covered with plastic (see Picture 5 and Picture 6).

The cooperative also provides seeds. In many cases, flowers are cultivated and used in the parks and squares of the closest urban settlement. The production of vegetables is becoming more popular. Currently, 250 women are part of the cooperative, most of whom have previous experience with farming. Their engagement with the cooperative goes through a selection process that will be further explained under the pillar of social inclusion.

Image 5: Greenhouse women's cooperative

Image 6: Greenhouse women's cooperative

Summarising the findings on land use

As the analysis of the environmental plan showed, a significant share of land in the region is secured for agriculture. Nevertheless, urban agriculture is mainly performed in peri-urban areas and agriculture within urban spaces (intra-urban) is not significant in the region. As an interviewee pointed out UA is stigmatised and associated with low-income groups.

Both UA initiatives in Hatay are quite distinct from each other concerning land use. Public land will be used to build the greenhouse in the urban fringe of Antakya. On the contrary, the Women's Cooperative initiatives are spread out in different provinces of the region and the cooperative is based on the use of private land for agriculture with on-plot cultivation.

Availability of land for agriculture seems not to be a concern for two reasons. First, the region is predominantly rural with few urban settlements. Second, agriculture plays an important role in the economy of the region. Nevertheless, before assuming an urban-rural divide, it is necessary to further investigate the social meaning of agriculture and how it enhances or constrains the practice of UA within cities.

An in-depth examination of land ownership, affordability and structure is also needed to draw a reliable picture of the conflicting issues that may surround the use of urban land for agriculture. Another question that could be explored is around the implications of large scale versus small scale agriculture in the region and how these modes of production are mirrored in the land structure.

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Module 2 Food security

Hatay Province produces a large portion of its own food, with food-export rates far exceeding food-import rates. As can be seen in Table 3, Hatay Province is in the top-five producing provinces in Turkey for 26 food products. It is the number one producer of chard (63%), parsley (39%), dill (30%) and mandarins (29%). Cultivated areas constitute 273,115 hectares or 51 per cent of the provinces total area and, of this, approximately 20 per cent is irrigated and a further 54 per cent is economically viable for irrigation.[4]

Table 3: Agricultural Production Capacity in Hatay

Product	**Production (in tonnes)**		**Prop. of Turkish production (%)**	**Rank in Turkey**
	Hatay	**Turkey**		
Chard	3.9	6.2	63	1
Parsley	22.5	57.6	39	1
Dill	1160.0	3.8	30	1
Mandarin	277.5	942.2	29	1
Grapefruit	25.1	228.8	11	2
Plum	24.6	305.4	8	2
Green Onion	12.1	153.5	8	2
Lettuce (With heart)	15.1	212.2	7	2
Mint	1.0	14.1	7	2
Persimmon	5.6	332.9	2	2
Citrus Fruits	643.5	2,347,904	27	3
Olive (for oil)	139.0	1,286,000	11	3
Carrot	60.3	569.9	11	3
Olive	158.4	1,576,000	10	3
Peas	10.6	107.5	10	3
Squash	15.7	293.7	5	3
Loquat	662.0	12.9	5	3
Orange	302.5	1,781,258	17	4
Cotton (Unginned)	202.8	2,250,000	9	4
Aubergine	57.6	826.9	7	4
Garlic (Fresh)	1.9	27.9	7	4
Garlic (Dried)	6.1	87.1	7	5
Cowpea (Fresh)	1.2	21.3	5	5
Lemon	38.2	726.3	5	5
Cress	186.0	7.4	3	5
Fig	6.3	298.9	2	5

Source: http://www.investinhatay.com/sectors.asp

According to the greenhouse feasibility report by TR Eastern Mediterranean Development Agency in 2017, Hatay province has many advantages for agriculture, including a good climate, its existing status as an agricultural centre, well-functioning transportation networks (e.g. highways, seaways and airways) and logistical connections, cheap labour, high potential for improved R&D activities and strong domestic purchasing power. As a result, the region has a strong agriculture profile and boasts the highest annual revenue from agricultural production in the country. The Region also accounts for 19 per cent of Turkey's total citrus production (TR Eastern Mediterranean Development Agency, 2015), 39 per cent of the national parsley supply (based on Turkish Statistical Institute's data in 2013, cited from Agriculture and Livestock, 2018) and 8.5% of total world production of bay leaves (TR Eastern Mediterranean Development Agency, 2015).

The total agricultural area in Hatay is 2,587,419 km2 and, of this, 1,438,898 km2 is cultivated and 1,102,259 km2 is used for fruit and vegetable gardens. The largest agricultural areas are concentrated around Antakya, Kirikhan, Reyhanli, Altinözu respectively. Dörtyol, Erzin, Samandag and Iskenderun house the highest production of fruit and vegetables (TR Eastern Mediterranean Development Agency, 2014). Increase access to high-quality food that is healthy, nutritious and contamination-free

In the Turkish context, the Ministry for Food, Agriculture and Livestock is the primary actor with respect to food security. Relevant professional organisations and associations also play an important role (e.g. The Chamber of Food Engineers). Municipalities are not part of the policy design process for controlling products which are going to be imported or exported. The research is being carried by the local representatives and in the laboratories under the body of the Ministry of Food, Agriculture and Livestock based on the samples from abroad. As a next step, their feasibility, advantages and disadvantages are discussed together with professional organizations and associations. The decision is made after this process.

The Ministry for Food Agriculture and Livestock is responsible for setting regulations and standards on the level of nutrition, quality and security with respect to all food consumed in Turkey. Food imports are subject to laboratory analysis to ensure that they meet Turkish standards before they are sent to market. The Ministry for Food Agriculture and Livestock is also responsible for approving locally produced products before they are taken the municipally controlled wholesale market. This is true for fresh foods (e.g. fruit and vegetables) and processed foods. Producers are required to declare their production plan to the Ministry of Agriculture, Food and Livestock who then audit the plan and the production facilities, informing the producer of any required changes prior to certification. Following the commencement of production, products are again sent for analysis to ensure that the requested changes have been made and that the food meets the national standards. Products which meet the standards of foreign countries' can also be exported to these countries.

Hatay Municipality also has a department which is responsible for ensuring food security. This department is responsible for checking businesses involved in the production or sales of food (e.g. food production facilities, grocery stores, butchers). Their role is to assure that all such facilities have approval from the ministry of agriculture, food and livestock and that the conditions meet the national standards and food regulations. Their specific role is as "controller who works for the state to ensure the public health and food quality, which is defined through national regulations and standards in the food industry".[5] Hence, their role may or may not extend to urban agriculture depending on the scale and nature of production and distribution.

Industrial food production is being controlled by a specific unit within the Ministry of Food, Agriculture and Livestock. Agricultural products in Hatay are collected in the wholesale market hall and are controlled by the controllers in these market halls. The Municipality of Hatay analyses the locally produced fruits and vegetables to detect if there is any pesticide residue in the products. The products which are suitable for consumption and Turkish Standards Institute are approved for selling. The Municipality of Hatay also has an abattoir where people can bring their animals for slaughter. This facility operates under state control; thus meats produced here are eligible to be sold to the public, in for example, butchers shops and markets.

Usage of pesticide is very common in agriculture as it is an important tool to combat agricultural diseases, insects, rodents, fungus and herbicides. In Hatay, approximately 692-ton pesticides were used in 2012. In Hatay, it has been detected that the usage of pesticides is above the recommended level. Hence, governmental bodies have started to give education to local farmers in Hatay, in order to raise awareness for consequences of over usage of pesticides (Parlakay, Kiziltug, & Celik, 2015). The usage of chemical fertiliser helps to increase efficiency in agricultural production. On the other hand, it causes water contamination due to containing NO, N2O, NO2 as these substances mix in groundwater through irrigation and

[5] Quote from interview with a food engineer at Hatay Municipality.

rinsing. Chemical fertilisers also increase the amount of nitre in green-leaved vegetables which create a threat to human health. The annual consumption of chemical fertiliser in Hatay is around 70 000 ton and the surface which the chemical fertilisers are being used is 292 626 ha. In Hatay, the governmental bodies organise collaborative seminars and educations for industrial facilities and farmers to decrease the usage of the chemical fertilisers (Parlakay, Kiziltug, & Celik, 2015).

A study concerning the feasibility of greenhouse implementation in Hatay province conducted by DOGAKA in 2017 (henceforth referred to as greenhouse feasibility study) classified greenhouses into two groups. First, mid-sized greenhouses employing limited technology that aim to improve the economic conditions of families who live in the rural areas of Hatay Province. Second, greenhouses employing a high amount of technology that aim to contribute to the overall economy of the region through the export of high-quality products. The first use is the most relevant to food security and has the potential to contribute to increased access to high-quality food participating families. The relevance of such greenhouses to the project may be questioned, however, as they target rural, rather than urban, areas. The main product of these greenhouses has been defined as cucumbers, strawberries, tomatoes and roses.

Based on the interview with one of the initiators of the greenhouse implementation project, the ideal location for greenhouse with high-technology is in EXPO area, which can help Hatay's prestige in terms of agricultural production and can attract investors to implement such projects in Hatay by providing a good sample. This would increase and promote agricultural production in Hatay in a more efficient way with higher quality.

Increase understanding of the contribution of UA to the urban food system

As noted above, Hatay's food system is based largely on local products. The majority of these are produced in rural areas or on the periphery of urban areas, however, and thus can be considered as entering the urban food system from the outside. Intra-urban agriculture is still considered marginal is not taken into consideration in planning documents and development strategies.[6]

[6] Interviews with Ihsan Cakar

A participant in the Women Cooperative under the greenhouse implementation project interviewed for this report commented that she had seen a notable improvement in her economic condition since taking ownership of one of the greenhouses. Her total monthly food costs have reduced by approximately 50 per cent (60-70TRY or €12-15). She grows cucumber, beans, tomato, parsley as well as flowers such as viola and velvet. The statement of this participant suggests that UA has the potential to contribute to the urban food system; however, only if the opportunity to participate in such programs was available to a larger number of people. Currently, the number of places in the program is limited to 250 due to a lack of municipal resources and there are many women waiting in the queue to receive a greenhouse.

According to a food engineer with Hatay Municipality, agricultural production in Hatay Province is not confined to large companies. It is very common for people/families to be involved in agricultural production and to sell their own products. Currently, this practice is most common in rural areas, while urban agriculture is a very new phenomenon. Urban dwellers who become engaged in agricultural activities are generally those who become tired with city life and migrate to rural areas. As sustainability and energy efficiency concerns become more widespread, there is an expectation that growing food may also become a popular urban activity as not everyone will have the means, nor the life-circumstances, to allow them to move out of the city.

Mitigate environmental impacts through UA implementing novel technologies

A wide set of innovative agricultural technologies will be implemented at the SiEUGreen showcases, which are expected to improve resource efficiency and mitigate environmental impacts. Their contribution will mainly be measured and evaluated based on feasible quantitative indicators. For Hatay showcase, the proposed innovative technologies and their potential contribution are listed in Table 4. The novel technologies for Hatay showcase mainly fall into the green and blue categories and contribute to sustainability claims of urban symbiosis and supply chain efficiencies. With the application of greenhouse, water-based, paper-based and aquaponic growing technologies in the community/neighbourhood to produce food locally and efficiently, "food-miles" are reduced – reducing the distance between producer and consumer. In addition, by turning organic waste into insect production for the aquaponic system, the sustainability claim of waste assimilation/urban symbiosis is fulfilled.

Table 4: Set of agricultural technologies to be implemented in Hatay

TECHNOLOGY	Contribution to resource efficiency / Resource efficiency parameters	How to measure the contribution / Resource efficiency indicators	Sustainable claim
Green			
Greenhouse technology, traditional	Local food production	The annual amount of urban food production (types and kg) replacing other food sources per person/family/apartment/building/showcase. In addition, specify production (types and kg) based on recycled nutrients and water resources. Registration and/or calculation.	Supply chain efficiencies; Urban symbiosis
Soil-based traditional plant growth			
Water-based hydroponic culture			
Aquaponic cultures (plant fish fully recycling technology)			
Paper-based plant growing technology			
Blue – Processing of waste for recycling			
Use of the organic waste product for the production of insects in connection with the aquaponic system	Waste recycling	Annual amount (kg) of the waste fraction (food waste/garden waste/organic waste) taken out of the conventional waste stream per person/family/apartment/building/showcase. Amount of peat soil to be exchanged with compost from organic waste Registration and/or calculation.	Urban symbiosis; Supply chain efficiencies;

	Local food production	The annual amount of urban food production (types and kg) replacing other food sources per person/family/apartment/building/showcase. In addition, specify production (types and kg) based on recycled nutrients and water resources. Registration and/or calculation.	
Blue – Source separation of wastewater			
N/A			
Blue – Stormwater handling			
N/A			
Yellow			
N/A			

Promote resource efficiency in relation to UA applying quantitative measures

According to United Nations Environment Programme, sustainable consumption and production (SCP) are essential for promoting resource and energy efficiency, minimising the use of natural resources and toxic materials and the emissions of waste and pollutants, while providing basic needs and bringing a better quality of life (UNEP). Thus, this section will focus on the consumption and production pattern of the urban system as it relates to UA activities in Hatay Province and TR63 Region. It should be noted that data for many of the indicators included in the Resource Efficiency Scoreboard[7] from Eurostat are only available at the national level and thus not presented here, in particular, those indicators regarding productivity, material and carbon. National-level data for Turkey related to this goal can be found in the synthesis report along with the data from the other showcase countries.

Energy

Turkey's energy consumption is provided mainly by natural gas (33.3% of total consumption), followed by fossil fuel with (29.7%) (TMMOB Chamber of Mechanical Enginners, 2017).

. Turkey's external energy dependency (petroleum and natural gas) costs the country 54 billion USD and account for 22% of the total import expenditure of Turkey.

[7] *Resource efficiency scoreboard*. (n.d.). Retrieved April 27, 2018, from Eurostat website, http://ec.europa.eu/eurostat/web/environmental-data-centre-on-natural-resources/resource-efficiency-indicators/resource-efficiency-scoreboard

In TR63 region, there are three main resources for energy - two renewable resources and one unrenewable resource. The renewable resources are wind power (plants) and hydropower (hydroelectric centrals); whereas brown coal is being used in thermal energy centrals.

Thermal energy plants:

Thermal energy plants play an important role as an energy provider in the TR63 region, with Kahramanmaras province housing the biggest thermal energy plant in Turkey. According to the plan from the Turkish Energy Market Regulatory Authority, there are two more thermal energy plants planned in Kahramanmaras, two in Osmaniye, and five in Hatay (see Figure 7). The main fuels used will be natural gas and imported coal among others.

These new investments are expected to increase the region's contribution to Turkey's energy production from 11,33% to 16,31%. This is, in turn, expected to increase the region's attractiveness to industry.

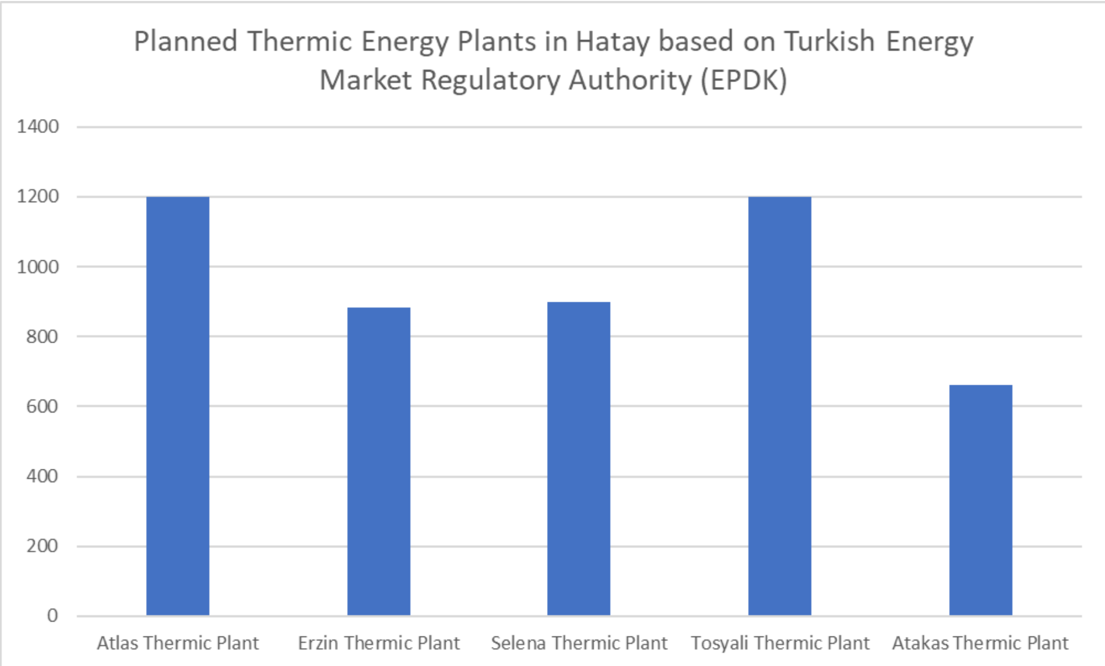

Figure 7: Planned thermal power plants in Hatay with capacity (MW), 2010.
Data source: Energy Sector Report for TR63 Region (TR Eastern Mediterranean Development Agency, 2014)

Wind power plants:

TR63 region is ranked third in the country with respect to wind power plant potential. According to an analysis conducted by the Ministry of Energy and Resources, Hatay Province has the highest potential and advantage in terms of wind power energy in TR63 region (Figure 8). There are five wind power plants in Hatay province with a total capacity of 216 MW – Belen, Sebenoba, Senbuk, Senkoy, Ziyaret, and another five plants are under construction with a total capacity of 97 MW – Antik Belen, Sebenoba, Senduk, Senkoy, Ziyaret (data from 2014). The region's potential contribution to Turkey's supply of wind power will increase from 11.87% to 12.64% following the construction of these plants.

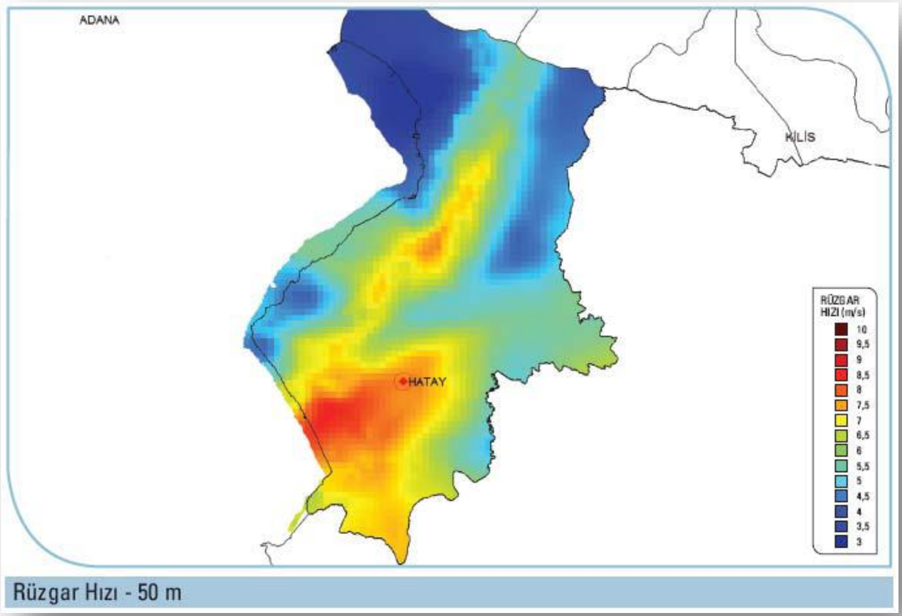

Figure 8: Wind potential in Hatay Province.
Source: Hatay province.

Solar Energy:

In TR63 region, there have not yet been any initiatives for establishing licensed solar power plants. There are, however, initiatives for producing energy through photovoltaic solar plants on rooftops with 500 kW capacity, which does not require an official license. TR63 region is defined as having middle and high-level suitability for solar energy, as illustrated in Figure 9 and Figure 10.

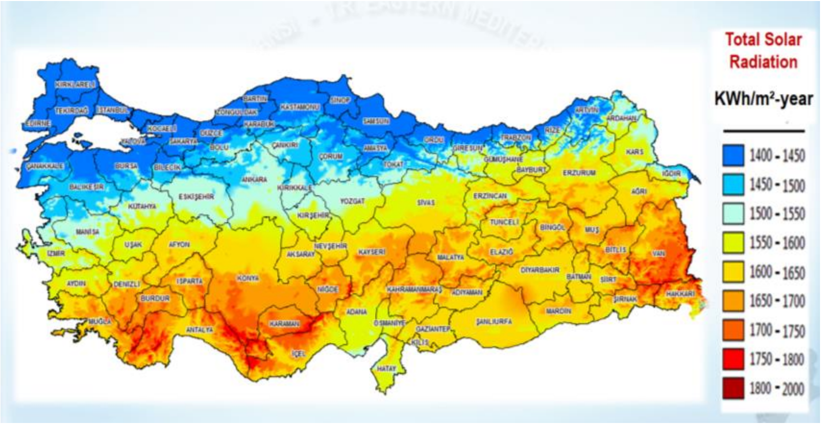

Figure 9: Solar potential in Turkey.
Data source: Hatay province.

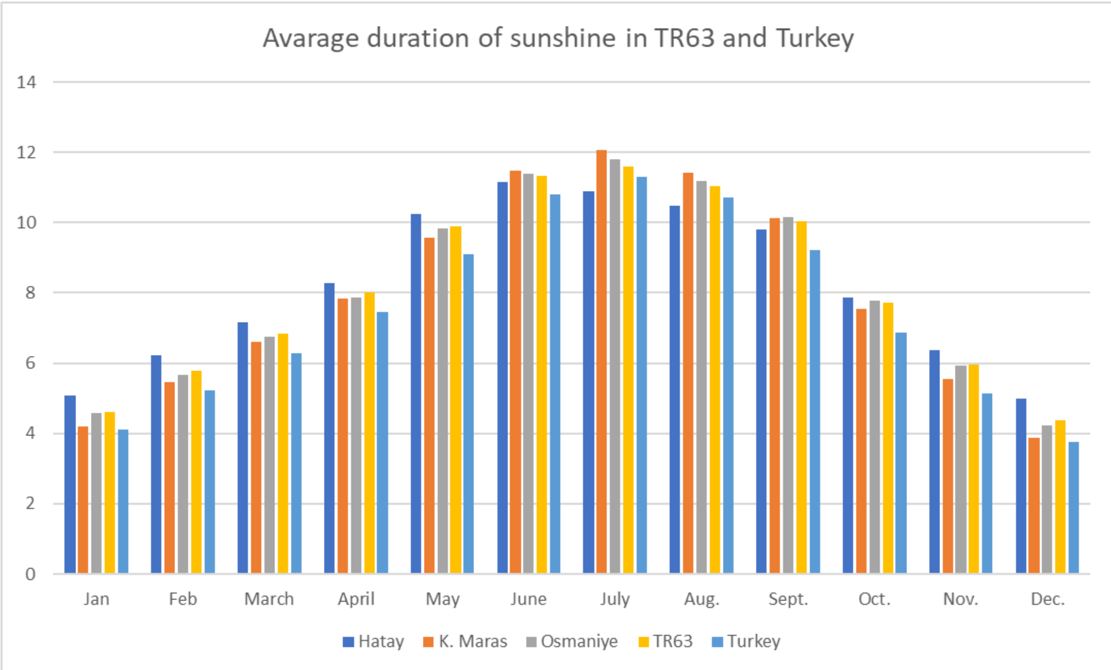

Figure 10: Average duration of sunshine, 2014.
Data source: Energy Sector Report for TR63 Region (TR Eastern Mediterranean Development Agency, 2014)

Geothermic Electric:

The share of geothermal energy in Turkey’s general energy production is 0.32%. Within TR63 region, Hatay Province houses by far the most geothermal energy resources.

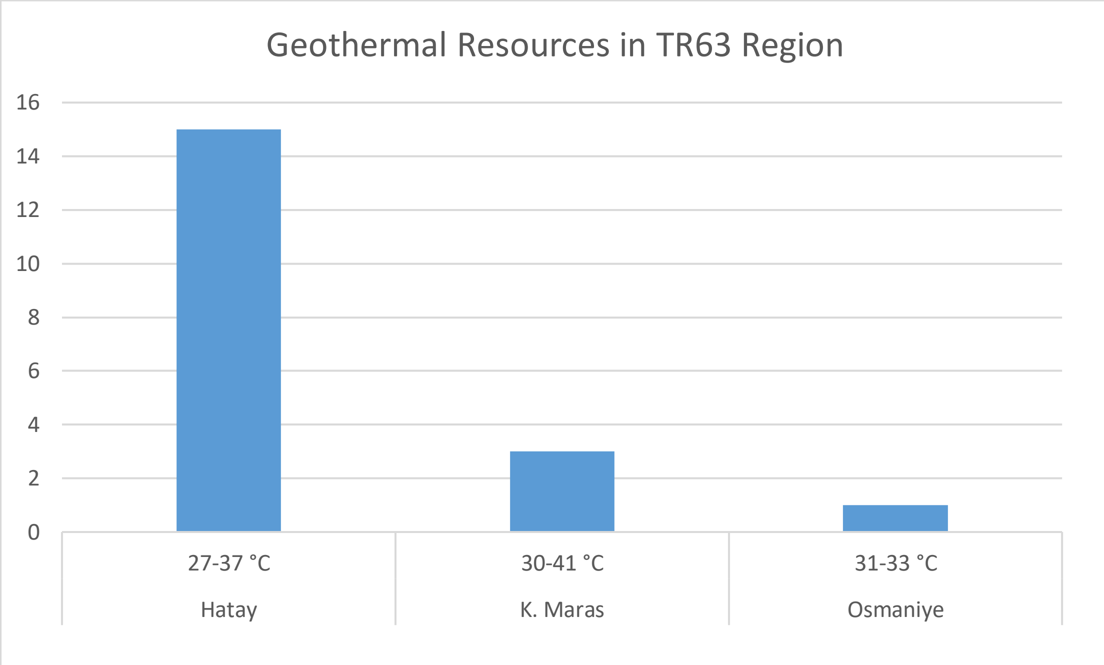

Figure 11: Number of geothermal resources in TR63 region with average heat temperature, 2010.
Data source: Energy Sector Report for TR63 Region (TR Eastern Mediterranean Development Agency, 2014)

Shale Energy:

The TR63 region has a high potential for shale gas. It is estimated that the use of this resource could contribute significantly to reduce the energy dependence of the country.

In terms of electricity generation in Turkey, the largest resource is natural gas (45%), followed by hydropower, brown coal and imported coal (10%), which in total compose nearly 95% of the total generation (see Figure 12). New infrastructure projects for transmitting the energy can create new potentials for Turkey and help to reduce its external dependency in terms of energy. Baku-Tiflis Ceyhan pipeline, Iraq-Turkey pipeline, Nabucco Natural Gas pipeline, Turkey-Greece-Italy Natural Gas pipeline, Samsun-Ceyhan pipeline and Trans Anatolian Natural Gas pipeline constitute strategically the most important energy investments in Turkey. Ceyhan region has been decided as an energy centre and industrial area. Due to its geographic proximity to Ceyhan region, Erzin municipality within Hatay Province has been decided as energy production and storage centre in the new environmental plan of Hatay. Besides, the new investments within the TR63 region show that the region and its surroundings will become an important actor in the energy sector.

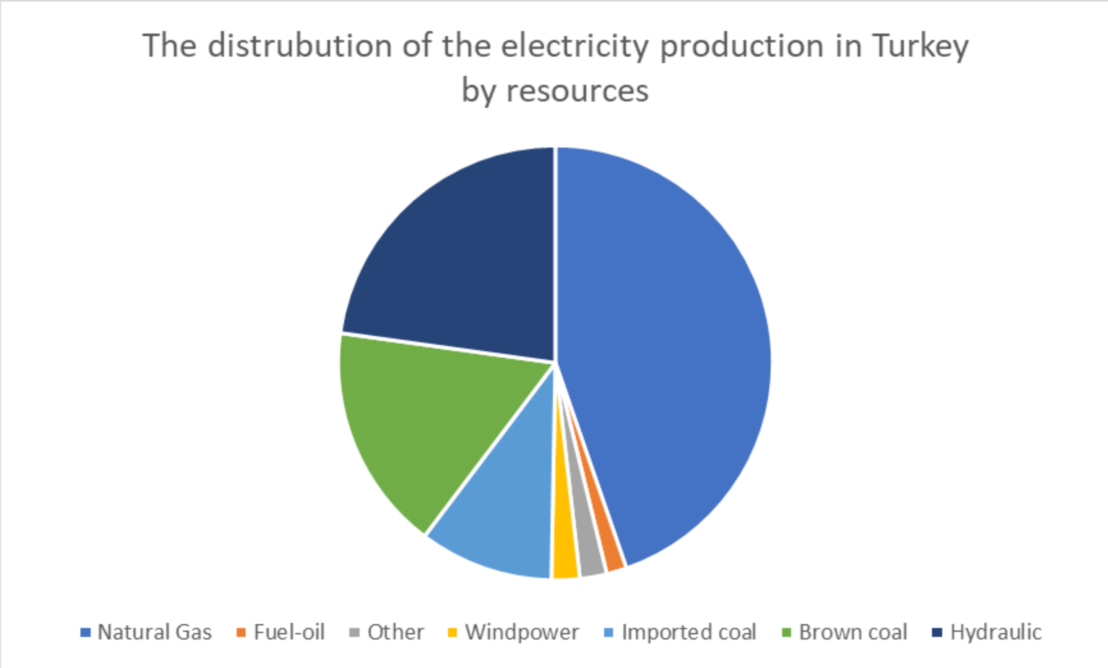

Figure 12: Electricity generation by resources in Turkey, 2011.
Data source: Energy Sector Report for TR63 Region (TR Eastern Mediterranean Development Agency, 2014)

Land

The share of land used for agriculture in TR63 region is 14% which is 9% higher than the national average, indicating the large scope of agricultural activities in the region. The regional plan 2014-2023 for TR63 also has strong emphases on policies to increase production capacity and to widen product range. In addition, there are plans to increase the agricultural capacity of the region through extensive branding operations and new production models. These strategies have the potential to positively impact rural development, particularly in areas where agriculture is the primary economic activity.

Greenhouse cultivation is deemed one of the agricultural production models to be promoted in the region, and it is an important means of implementing urban and peri-urban agriculture initiatives. The strengths, weaknesses and opportunities of greenhouse implementation are summarized in Table 5. The region has favourable climate conditions for greenhouse cultivation, as well as logistic advantages thanks to its location. Being a gate to the Middle East through several ports such as LIMAK, Iskenderun Iron-Steel Operations Port and Boats Port, TR63 Region is competitive in terms of exporting agricultural products. In spite of these advantages, the existing infrastructure in TR63 Region only constitutes 2.1% of the greenhouse cultivation area in Turkey, and the percentage is much smaller than other places such as Antalya and Mersin. Most greenhouses are in Hatay Province. Hence, capacity building for farmers, providing economic and technical support regarding greenhouse cultivation are essential for promoting greenhouse cultivation in TR63 Region, as described in the regional development report.

Table 5: Strengths, weaknesses and opportunities of greenhouse implementation in TR63 region.

Strengths	• Climate • One of Turkey's most important agricultural centres – the region is above the national average in terms of agricultural production, and the region's fresh fruit and vegetable trade is playing an important role in Turkey • Housing important highway and sea networks, having airports • Cheap labour force • Geographic location - proximity to Middle Eastern countries and favourable logistics conditions in export-based agriculture • Regional universities are conducting the R & D work related to agriculture • Large consumption of the domestic market
Weaknesses	• Usage of traditional methods in agricultural activities, as the usage of agricultural technology, creates high costs for small producers • Inadequacy of production infrastructure • Lack of agricultural education • Low organizational capacity among producers • Need for improving marketing activities of the agricultural products
Opportunities	• Agricultural fields suitable for greenhouses and implementing organized greenhouse areas • Potential use of geothermal resources, waste heat from thermal power plants and cogeneration heat in greenhouse heating • Agriculture and Rural Development Support Agency's support for agricultural activities in Hatay province and Kahramanmaras province • Foreseen increase of the agricultural exports in the region in case the political crisis in the Middle East ends • The young and dynamic population • Domestic market and the consumption power • Proximity to the markets where foreign consumption is concentrated (Russia, Middle East)

Data source: Baytorun & Gultekin, 2017

In the feasibility report for greenhouse implementation for TR63 Region, greenhouses have been classified into two types. The first type includes the middle-size greenhouses with limited technology for families who live in rural areas in TR63. This strategy aims at improving the economic conditions of these families. The workforce for these greenhouses will be mainly family members. The second type of greenhouses employ high levels of technology aims at contributing to the overall economy of the region through exporting high-quality agricultural products. The use of renewable energy (geothermic, cogeneration or thermic centrals) will

Co-funded by the Horizon 2020 programme of the European Union
Co-funded by the Chinese Ministry of Science and Technology

increase the profitability rate of these agricultural entities, and the main products have been defined as cucumber, strawberry, tomato and rose in the regional plan. The TR63 region is ranked 6th place in terms of fruit production among NUTS2 regions, and Hatay provides 65% of the entire fruit production within the region. Hatay province has a leading role in cucumber and tomato production within the TR63 region, and within Hatay Dörtyol and Erzin have great importance in citrus cultivation.

Water

Asi Water Basin is one of the 26 river basins in Turkey and is the most important river in Hatay Province. Asi River overflows during the rainy seasons; while during the dry season the river sometimes drains. Hatay also houses many creeks namely Muratpasa, Buyukkaracay, Kucukkaracay, Cokak, Menguliye, Derseden, Cekmece, Kadinlar, Kavasli, Tulel, Harim, Soguksu, Felit, Favar and Duver. In addition, Hatay houses five dams, Kuzuculu, Yesilvadi, Tahtakopru, Yarseli and Yayladag, which are mainly used for irrigation, preventing flood, providing drinking water. They do not provide hydro-electricity.

Groundwater and irrigation:

The groundwater reserve in Hatay is calculated as 310 hm^3[8] per year, of which Asi Plain accounts for nearly half of the reserves with 149 hm^3 per year. As illustrated in Figure 13, the other relatively large reserve is in Dortyol Erzin Plain with 100 hm^3 per year.

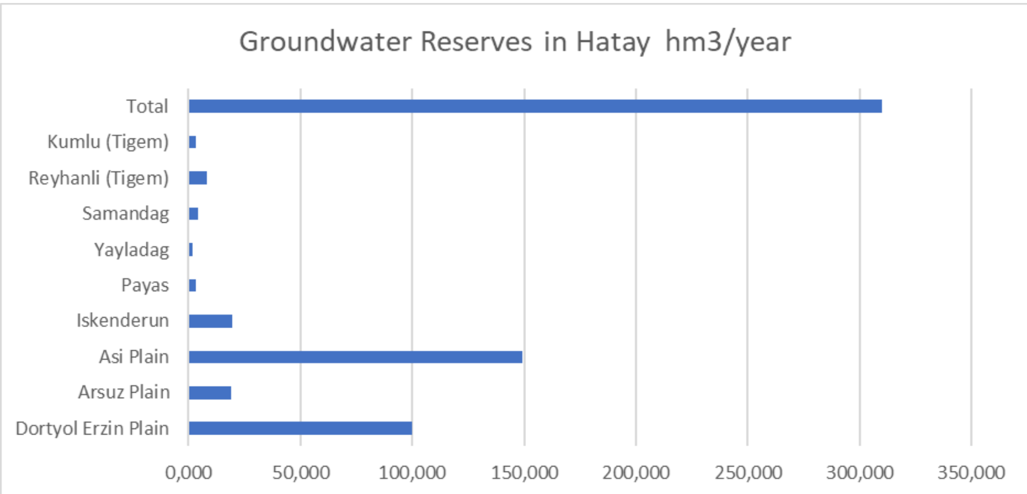

Figure 13: Groundwater reserves in Hatay province, 2013.
Data source: Hatay Environmental Impact Report (Bircan, 2013)

[8] 1 hm3 = 1 000 000 000 l

13,198 ha[9] area in Hatay is irrigated through groundwater. If the projects - Amik-Afrin Dam for irrigation, Büyük Karaçay project for irrigation and drinking water, Asi Dam for irrigation and Gönençay-Tahtaköprü dam for irrigation, planned by General Directorate of State Hydraulic Works (DSI) were to be carried out, the amount of the area irrigated through groundwater would be decreased to 1.295 ha (Environmental Impact Report, The Ministry of Urbanization and Environment, 2014). As well as groundwater, lakes are also used for irrigation in Hatay Province. As shown in Figure 14, six lakes in Hatay are currently used for irrigation, of which the biggest are Samandagi Karamanli, Hassa Demrek and Pulluyazi.

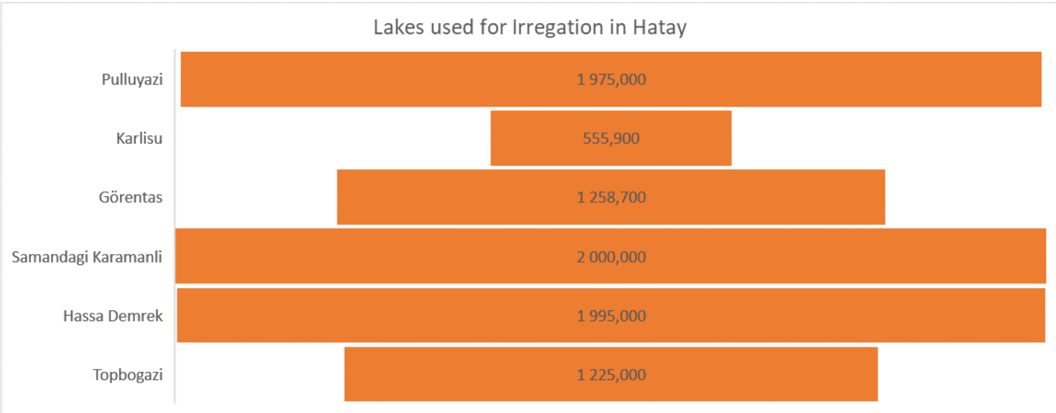

Figure 14: Lakes used for irrigation in Hatay with lakes' volume, 2013.
Data source: General Directorate of State Hydraulic Works (DSI)

Water Usage Based on Sectors and Water Allocation:

Agricultural Irrigation:

In Hatay, 275,578 ha area is identified as suitable for agriculture, of which 206,553 ha area is land suitable for irrigation. Yet, around 85% (176,515 ha) of this irrigation-favourable land is being irrigated (Figure 15). Thus, both irrigated and dry farming exist in Hatay, and there is an ongoing effort to increase the amount of irrigated farming areas in Hatay.

Eighty-eight per cent of the agricultural land in Hatay is irrigated through surface irrigation; whereas 12% of the land is irrigated through sprinkling and drip irrigation. Surface irrigation is still prevalent which causes over usage of water while increasing the production costs. Six per cent of the surface irrigation comes from dams and lakes, 36% comes from rivers and groundwater, and 57% is provided from drew-well (Bircan, 2013).

[9] 1 ha (hectare) = 10 000 m^2

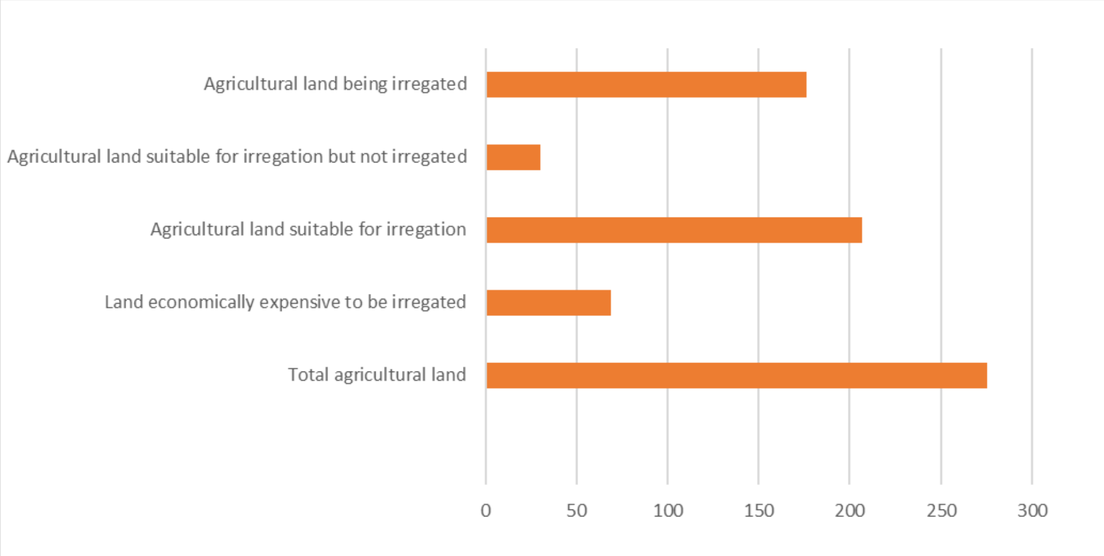

Figure 15: Agricultural land in terms of irrigation in Hatay in ha, 2013.
Data source: Hatay Environmental Impact Report (Bircan, 2013)

Drinking water and water mains:

Seventy-five water mains in Hatay are responsible for providing drinking and tap water. Cevdetiye Regulator, which is located in Iskenderun, is an important source in terms of providing drinking water to Hatay province. One of the important ongoing projects for the provision of irrigation, drinking and mains water as well as energy is Buyukkaracay project. This project is aimed at obtaining 350 hm^3 drinking water per year, whereas this amount is currently 200 hm^3.

Table 6 shows the water supply condition of the villages[10], which are the rural areas of Hatay province. In general, over 95% of the villages in Hatay have sufficient water supply, and there are only a few villages suffering from water scarcity.

Table 6: Water supply condition in Hatay province for villages, 2012.

	Total number of villages	Villages with no water problem	Villages with water scarcity
Centrum	66	63	3
Altinozu	40	40	
Belen	11	9	2
Dortyol	6	5	1
Erzin	10	10	
Hassa	28	27	1

[10] A village (Turkish: köy) is the smallest settlement unit in Turkey. All villages are in the rural areas of the districts.

Iskenderun	37	37	
Kirikhan	56	55	1
Kumlu	13	12	1
Reyhanli	31	30	1
Samandag	31	31	
Yayladagi	33	32	1
Total	362	351	11

Data source: Hatay Environmental Impact Report (Bircan, 2013)

Industry and water pollution:

Eighty-five per cent of the water used by industry is provided from drew-wells, and 15% from rivers. However, the wastewater from industrial zones is transferred to Hatay's sewage system and the sewage system is directly connected to the sea without going through any purification system. The purification plant for the wastewater in Hatay is still under a state tender process.

The districts with a coastline to the sea are Iskenderun, Dortyol, Erzin and Samandag. The main water pollution sources in the Iskenderun gulf are Iskenderun district sub-drain, Isdemir iron industry, Toros fertilizer factory and the ships which come to the gulf for petroleum transfer. The Iskenderun district sub-drain is discharged to the sea without purification process. The storage facilities for petroleum also discharge their waste to the sea due to lack of purification system.

Regarding groundwater pollution, household waste is one of the main pollution sources. Fertilizer and pesticides used in agricultural activities also pollute groundwater. In addition, overexploitation of groundwater causes water pressure difference, which results in seawater intruding into the groundwater system. Hence, the quality of the groundwater is under threat due to careless use over the years.

Waste management

In Turkey, waste management mainly occurs through solid waste disposal plants. In Hatay Province, these plants are in two major associations - Hatay Environmental Protection Association with 50 members and Iskenderun Waste Management Association with 27 members. These associations service around 1.2 million inhabitants in Hatay, which accounts for approximate 75% of the total population. The annual amount of collected waste is almost 400 thousand tons, as listed in Table 7.

Table 7: Waste management associations in Hatay province, 2013.

Hatay Environmental Protection Association			
Settlement	**Number of Members**	**Population served**	**The amount of collected waste (ton/ year)**
District	8	419 124	137 682
Town	42	254 105	83 473
Village			
Total	50	673 229	221 155
Iskenderun Waste Management Association			
Settlement	Number of Members	Population served	The amount of collected waste (ton/ year)
District	4	324 315	106 537
Town	19	161 539	53 065
Village	4	5 468	1 796
Total	27	491 322	161 398
Total population served by the two waste management associations			1 164 551
Total amount of collected waste (kg/year)			382 553

Data source: Hatay Environmental Impact Report (Bircan, 2013)

The recycling rate of collected solid waste is extremely low, with a few districts without any recycling process. For example, the daily amount of solid waste collected in 2013 in Erzin city in Hatay is 25 tons in summer and 45 tons in winter, none of which was recycled. Figure 16 depicts the composition of the solid waste of Erzin, and the organic waste accounts for 70% of the total solid waste collected. Through UA, in particular, household agriculture, the organic waste could be reused for the production of insects in connection with the aquaponic system, which is one of the technologies to be implemented in Hatay. Iskenderun is the largest district in Turkey. The daily collected solid waste in 2013 was 200 tons in summer and 210 tons in winter, the composition of which is displayed in Figure 17. The share of organic waste is less but still more than half (53%), further highlighting the potential for waste recycling through UA.

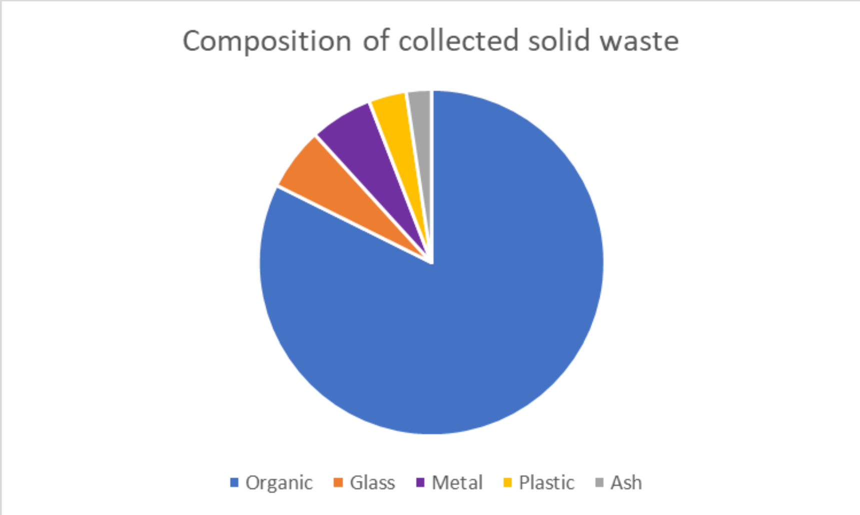

Figure 16: Composition of collected solid waste in Erzin, 2013.
Data source: Hatay Environmental Impact Report (Bircan, 2013)

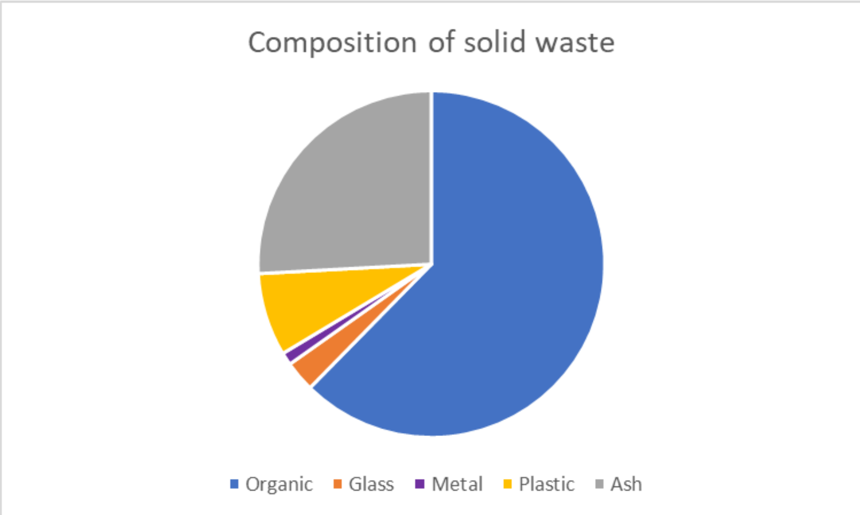

Figure 17: Composition of collected solid waste in Iskenderun, 2013.
Data source: Hatay Environmental Impact Report (Bircan, 2013)

The regional development plan implemented in 2018 – the 1:100 000 Environmental plan, emphasises waste management, and more storage facilities for disposed of solid waste will be set up in the region. In addition, a functional recycling system for the waste will be established and expanded in TR63 region.

Increase understanding of the contribution of UA to C-E and green growth

Figure 18 illustrates the circular economy as a closed-loop, which has been achieved/implemented by many industries. The urban metabolism can apply the same rationale, and its material and energy flows can be optimised by integrating all urban activities (industry, utilities, commercial, housing, urban and peri-urban agriculture), by involving all the actors (including investors and city residents) and by working with municipalities beyond the city limits (EEA, 2015).

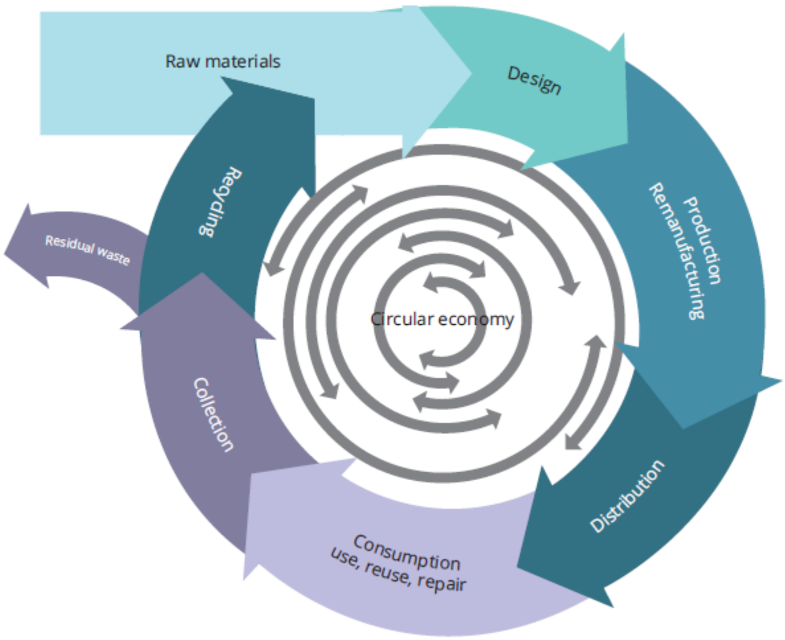

Figure 18: The circular economy.
Source: European Environment Agency.

In Hatay province and TR63 Region, circular economy thinking is yet to prevail, with the traditional linear metabolism dominant. However, the ambition of moving towards a more resource-efficient and environmental-friendly society is evident in the latest regional development plan. There is potential for the SiEUGreen project to be an important part of this process in the coming years through the showcase deployment and technology implementation in Hatay. UA will play an important role in Hatay's transition towards greener economic growth. The greenhouses planned for Hatay will contribute to the land efficiency and energy efficiency, by putting unutilised land to use for food production, and extra energy from other industry sectors will be allocated to these greenhouses. Organic waste can also be recycled and reused proximately to develop urban agriculture at a household level. Thus, UA can contribute to the circular economy by closing the loops of energy, material and nutrition flow.

Summarising the findings on Resource Efficiency

Energy production in TR63 region is dominated by brown coal, wind power and hydropower. The supplementary resources are natural gases and solar energy. Agriculture is an important industry sector in TR63 region. As described in the development plan of the region TR63 the implementation of modern greenhouses will be promoted in the region. These greenhouses will utilise renewable energy, largely as a by-product from industrial processes, to increase energy efficiency. To increase water efficiency, local governments and national bodies for water management should apply sprinkling and drip irrigation more extensively in agriculture instead of being depended on surface irrigation which is currently the dominant model in Hatay Province. Wastewater treatment and solid waste management are two major concerns in Hatay Province and TR63 Region. According to the plan, functioning sewers to separate wastewater and surface water should be set up, and wastewater purified before it is drained into water bodies. In addition, the plan recommends that the recycling rate of the collected solid waste should be increased, and organic waste, as the largest component, can be recycled and reused for UA (e.g., the production of insects in connection of aquaponic system).

Within the scope of SiEUGreen, agricultural technologies will be implemented in Hatay province to increase resource efficiency. These technologies include innovative green technology focused on planting and growing, and blue technology dealing with waste processing for recycling. Their contribution to resource efficiency will be monitored throughout the project period, either by measuring on-site or by estimating based on relevant data from, for example, small scale experiments.

Module 4 SOCIETAL INCLUSION

Social benefits are usually regarded as one of the advantages of UA. It is claimed that UA creates community space that brings the neighbourhood together (Poulsen, 2017), empower people (Hovorka, 2006) and alleviate poverty (Mkwambisi, Fraser , & Dou, 2011). This section investigates at the potential of UA to promote societal inclusion in Hatay. To do that, the focus is placed on the women's cooperative, which is an ongoing initiative. Two interviews are the main source to enlighten issues related to societal inclusion.

Map and analysis of the actors involved in the cases study

Both initiatives planned for SiEUGreen involve different constellations of actors. The construction of the greenhouse outside Antakya will be a large investment with the implementation of technology that is not currently commonly used in the region. One interviewee, an entrepreneur, said that this investment must showcase the possibilities new technologies offer for agriculture (e.g. productivity) and should be seen as an example that could support the fulfilment of the vision for the region becoming the leader in agriculture in Turkey and the Middle East. Thereby the greenhouse should provide a sample and add-value to farmers and investors.

The viability of this initiative is highly dependent on the SiEUGreen project and includes the participation of different actors (SiEUGreen partners, Hatay Municipality, planners, etc.). Mapping the network of stakeholders that will be involved in this initiative was not achievable at this early stage, but will be further investigated as the project progresses. In comparison with the Women's Cooperative, the greenhouse initiative has a top-down character and very different target group.

With the objective of creating employment for women, an entrepreneur who had been working in Hatay for several years started the 'Women's Cooperative'. Before moving to the region in 2010, she lived in Diyarbakir, where she had previous experiences of cooperatives system being applied to agriculture. With the support of Hatay Municipality, in 2016, she established the Women's Cooperative in 13 districts of Hatay. Currently, 250 women, receive help to construct a green-house and are growing food and flowers in their backyards.

The entrepreneur is the chairwomen, and seven other women take part in the board (see Figure 19). Each woman in the board is responsible for the management of UA initiatives in certain provinces of the region. The board decide who will be accepted as a member and also plan and carry out activities with the members (e.g. education activities, support visits). Usually, once a week, the members of the cooperative of their region meet to report the development, needs and to share know-how.

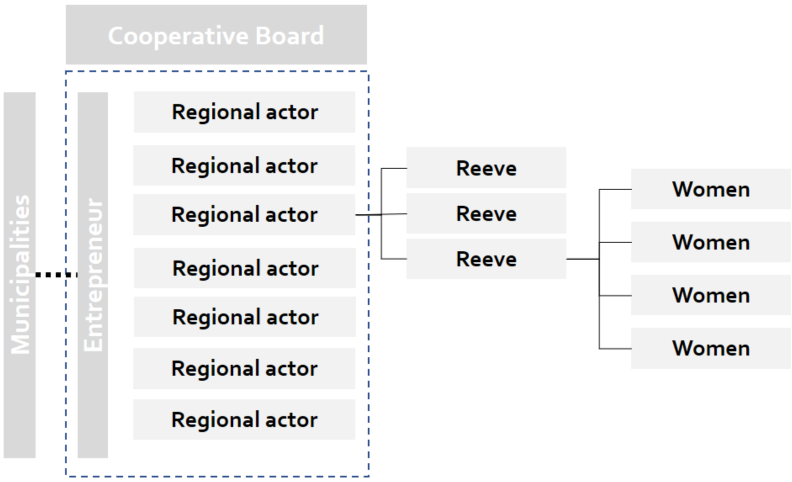

Figure 19: Network of actors involved in the Women Cooperative

The selection of women is mediated, by the so-called "Muhtar" which is similar to a reeve, someone responsible for different streets or districts. This is the usual way of organisation in Turkey. The role of the reeve is to identify women interested in becoming engaged in the cooperative and to mediate the communication between these women and the board during the selection process. To be eligible as a member, two criteria must be fulfilled. First, the woman must own or have access to, a plot of at least 360 m^2 in area. Second, she must have a low income. The priority of membership is given to widows, divorced women and/or those who have children attending school, women whose husbands are unemployed husbands or those who have been abused. So far, 589 reeves have been involved in supporting the interested women to take part in the cooperative.

As part of the selection process, visits are undertaken to check the conditions of the plot and applicants are interviewed. Once engaged in the cooperative, the municipality provides financial and technical support. For example, the municipality provides the material to build up the greenhouse and seeds to start up the cultivation. The entrepreneur has also invested €2,500 to start up the initiative. Technical support includes monthly visits from an engineer who works at the municipality and give bits of advice on technical issues (e.g. irrigation, fertilizer). The cooperative includes activities, for example, seminars for disseminating knowledge about how to grow flowers and vegetables. With the aim of avoiding import seeds from other regions, a common subject in these seminars is to learn about seasonal seedling.

The production harvest from half of the floor area of the greenhouses belongs to the cooperative who takes care of selling the products in the local markets. The communal revenue is primarily used to maintain the initiatives and the remaining profit is divided amongst the women. If the greenhouses cultivate flowers, these are used by the municipality in public spaces (e.g. parks and squares). The production from the other half of the floor area of the greenhouse belongs to the women. Usually, they cultivate vegetables and sell surplus production.

The demand for new greenhouses in Hatay is high, and there are many women on the waiting list. Unfortunately, due to limited resources, the municipality has restricted the program to 250 greenhouses. The entrepreneur also mentioned power conflicts in local politics that have blocked or slowed down the implementation of the initiatives.

Improving societal inclusion

Empowering women, especially by enhancing their economic independency, is the major objective of the cooperative. As such, with the exception of the reeves, males are consciously excluded from the cooperative. Working with agriculture brings the possibility of additional income, particularly as it can be carried out in addition to their daily jobs. During the interview, the entrepreneur revealed that when visiting some of the women who applied to be members, it was common for husbands to try to steer the process. The project team was very clear about the target group, however. As a result of their participation in the project, many women opened a bank account for the first time in their lives.

The description of societal inclusion aspects is based on two interviews: with an entrepreneur who is the chairwomen of the cooperative and with a woman who is part of the board in the cooperative and also grows food. The woman is a housewife with five children; one of her children is studying at the university in another city. Her husband is employed but earns a minimum wage (300.45 Euros).

She reported that her economic condition had improved noticeably since she got engaged in the cooperative. As her family get many products from the greenhouse, her costs with food have decreased by approximately 50 %. She grows cucumber, beans, tomato, parsley and flowers such as viola and velvet. These are bought by the Hatay Municipality, which is currently the only customer of the cooperative in her region. Nevertheless, she says that there is great potential for widening the market. Through the week she works around three hours per day in the greenhouse, but on the weekends her husband helps.

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UA has also enriched her social life. Besides the meetings held to discuss issues related to the cooperative, some of the women also meet during their spare time, for example, eat lunch together in each other's greenhouses. This provides a valuable source of social contact with other women. Furthermore, the cooperative has given her the opportunity to become politically active. The tasks of managing and collaborating with other members have been a great experience. In her opinion, the project has been very successful, and she hopes that the number of greenhouses can be extended to give to other women the same opportunities that she enjoys. Images 7, 8 and 9 illustrate some of the greenhouses.

Image 7: Greenhouses in Hatay

Image 8: Greenhouses in Hatay

Image 9: Greenhouses in Hatay

Summarising the findings in societal inclusion

As highlighted above both initiatives have quite different purposes and involve different constellations of actors. The greenhouse outside Antakya is expected to showcase the potential of using technology (aquaponics, hydroponics) to improve the productivity of agriculture in the region to investors and farmers. The cooperative is already implemented, involves a specific group and has a clear goal of empowering women. The participation in the cooperative has improved the domestic economy, the costs with food have decreased and the greenhouses also provide an income for some of the women.

Despite most of the woman working individually in their own plots, the initiative fosters social engagement, through the meetings and seminars. The project has increased the women's capacity to grow their own food and seems to have helped to strengthen the social bonds between them. Nevertheless, since the activity mainly involves women from low-income groups, it has not effectively bridged different social groups. Yet, this initiative has created the opportunity to exchange knowledge and experiences between these women and other actors from other social groups (e.g. Greenhouses servants, engineers)

In terms of political empowerment, the Women's Cooperative has been quite significant in several aspects. The initiative challenges the structural gender conditions, promoting the involvement of women in the local economy. Besides enabling women to support their households, UA seems to be mean for social and economic empowerment. They are able to establish social networks and thus encouraging community development.

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Deliverable 1.1

Maps of quantitative and qualitative data for each of the showcase locations - Annex 3. Fredrikstad report

Lead Partner:	Nordregio (This report developed by NMBU & NIBIO)
Lead Authors:	Yasir Nadeem from NMBU (module 1 and 3) & Atle Hegnes from NIBIO (module 2 and 4)
Due date:	30/06/2018
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The project has received funding from the European Union's Horizon 2020 Research, and Innovation programme, under grant Agreement N 774233 and from the Chinese Ministry of Science and Technology.

Throughout SiEUGreen's implementation, EU and China will share technologies and experiences, thus contributing to the future developments of urban agriculture and urban resilience in both continents.

The project SiEUGreen aspires to enhance the EU-China cooperation in promoting urban agriculture for food security, resource efficiency and smart, resilient cities.

The project contributes to the preparation, deployment and evaluation of showcases in 5 selected European and Chinese urban and peri-urban areas: a previous hospital site in Norway, community gardens in Denmark, previously unused municipal areas with dense refugee population in Turkey, big urban community farms in Beijing and new green urban development in Changsha Central China.

A sustainable business model allowing SiEUGreen to live beyond the project period is planned by joining forces of private investors, governmental policy makers, communities of citizens, academia and technology providers.

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Technical References

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[1] **PU** = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

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Introduction

The case of Fredrikstad and Cicignon Park can be understood as a case of *Retrofitting*. In the anthology, *Retrofitting Cities* (Hodson, Marvin & Marvin, 2016), retrofitting is initially described as *urban re-engineering for sustainability in a socio-technical context.*

In December 2014 it was decided that Nordic Group Development AS would buy the Østfold Hospital, downtown Fredrikstad. The plan is to turn the former hospital into a project called Cicignon Park. According to the municipal sector plan, this site will be transformed into a residential and commercial area. The hospital has a property portfolio of 55 000 sq. m. and a plot area of 35 000 sq. m. Cicignon carries a long history and with its central location and view of Fredrikstad. In April 2018 it was decided that the building of the Cicignon area could start.

Nordic Group's visions for Cicignon Park are (1) high environmental profile, (2) high architectural quality, and (3) high level of satisfaction on a European scale. Significant internal and external resources have already been devoted to study the opportunities, challenges and resources needed for the realization of these visions.[1]

Master plans of Cicignon Park were drafted in a competition by the architectural firms Snøhetta AS, Niels Torp AS and HRTB. Niels Torp architects won the competition.

Whereas some of the other showcases in SiEuGreen are already established, Cicignon Park is still planned for. This showcase status thus gives a different showcase description compared to the other cases. It is mainly based on documents, literature study and information provided by the municipality.

About Fredrikstad

Frederikstad is a city and municipality in Østfold County, Norway. The administrative centre of the municipality is the city of Fredrikstad. The city of Fredrikstad was founded in 1567 by King Frederick II and established as a municipality on 1 January 1838.

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[1] This section is mainly based on the description given by Nordic Holding on: http://nordic-group.no/?page_id=836&lang=en

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The city was named after the Danish king Frederick II in 1569. The last element stad means "city". Prior to 1877, the name was spelt Frederiksstad, then from 1877–1888 it was written as Fredriksstad, and finally, since 1889 it has been spelt in its current form: Fredrikstad.

The rural municipality of Glemmen was merged with Fredrikstad on 1 January 1964. The rural municipalities of Borge, Onsøy, Kråkerøy, and Rolvsøy were merged with Fredrikstad on 1 January 1994. The city straddles the river Glomma where it meets the Skagerrak. Along with neighbouring Sarpsborg, Fredrikstad forms the fifth largest city in Norway: Fredrikstad/Sarpsborg. As of 1 January 2018, according to Statistics Norway, these two municipalities have a total population of 136,117 with 80,977 in Fredrikstad and 55,140 in Sarpsborg. Fredrikstad was built at the mouth of Glomma as a replacement after Sarpsborg (15 kilometres (9 miles) upstream) was burnt down by the Swedish Army in the 1500s. Some of the citizens stayed behind and rebuilt their old town at its original site and got their city status back in 1839.

The city centre is on the west bank of the Glomma, while the old town on the east bank is Northern Europe's best-preserved fortified town. Fredrikstad used to have a large sawmill industry and was an important harbour for timber export, then later on shipbuilding, until the main yard was closed in 1988. The main industries are currently various chemical plants and other light industry. In 2005, Fredrikstad was the final host port for the Tall Ships' Race, attracting thousands to the city (Fredrikstad Kommune, 2018).

The Østfold Railway/Gothenburg Starting from Oslo, the Østfold railway runs to Halden Sarpsborg and Fredrikstad. Several trains continue to Sweden. The train has frequent departures all day. The Østfold Railway has a Western and an Eastern line. Several of the departures on the Western line continue to Gothenburg in Sweden.[2]

[2] https://www.nsb.no/en/our-destinations/our-regional-railway-lines/ostfoldrailway

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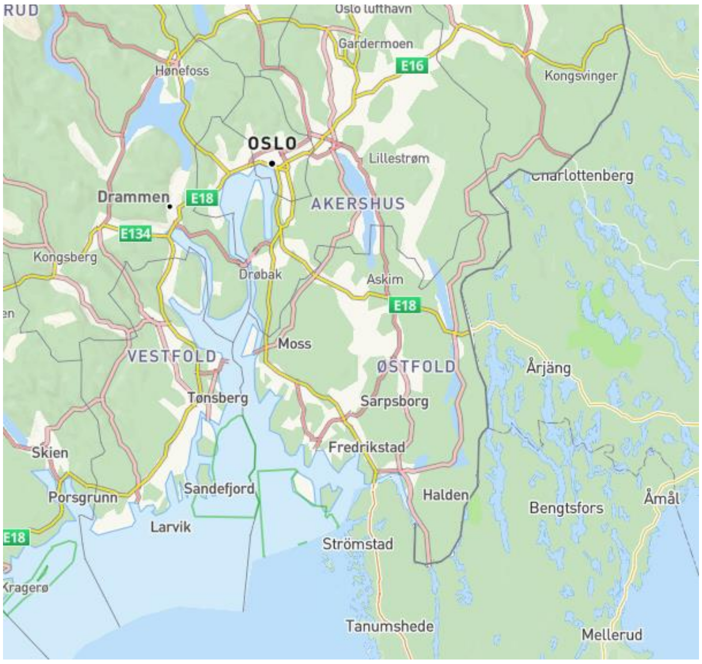

Figure 1: Fredrikstad location
Source: *https://kommunekart.com/*

Region	Østlandet
Province	ØSTFOLD
Sign Province	
Hamlet of the municipality	0
Surface (Km2)	437.44
Population density (Inhabitants/Kmq)	183.2

Figure 2: territorial information
Source: UrbistatAdminstat, 2017

Inhabitants (N.)	80,121
Families (N.)	35,677
Males (%)	49.7
Females (%)	50.3
Foreigners (%)	8.3
Average age (years)	41.0
Average annual variation (2011/2016)	**+1.17**

Figure 3: Demographic Information, 2016
Source: UrbistatAdminstat, 2017

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Inhabitants on 1th Jan.	**78,967**
Births	784
Deaths	738
Balance of nature[1]	**+46**
Registered	4,350
Deleted	3,242
Migration balance[2]	**+1,108**
Total balance[3]	**+1,154**
Inhabitants on 31th Dec.	**80,121**

Figure 4: Demographic Balance, 2016
Source: UrbistatAdminstat, 2017

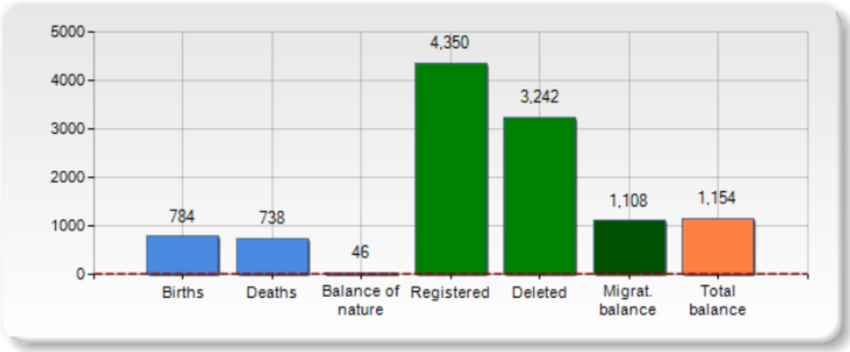

Figure 5: Demographic Balance, 2016
Source: UrbistatAdminstat, 2017

Year	Inhabitants (N.)	Variation % on previous year
2011	75,583	-
2012	76,807	+1.62
2013	77,591	+1.02
2014	78,159	+0.73
2015	78,967	+1.03
2016	80,121	+1.46

Figure 6: Changes in population
Source: UrbistatAdminstat, 2017

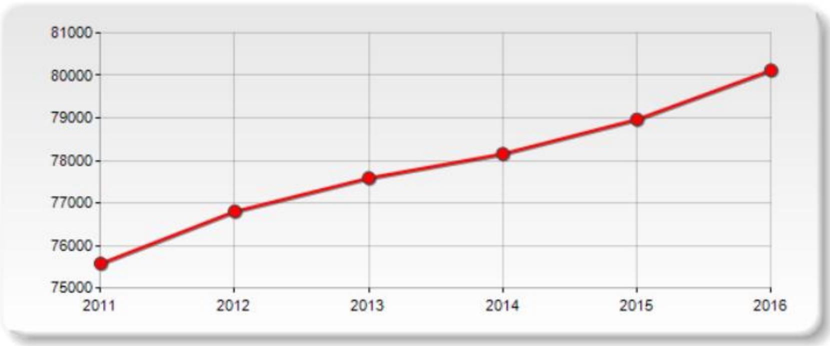

Figure 7: Population trends 2011-2016
Source: UrbistatAdminstat, 2017

	Males		Females		Total	
Classes	(n.)	%	(n.)	%	(n.)	%
0 - 2 age	1,238	3.11	1,161	2.88	2,399	2.99
3 - 5 age	1,307	3.28	1,287	3.20	2,594	3.24
6 - 11 age	3,014	7.56	2,741	6.81	5,755	7.18
12 - 17 age	3,075	7.71	2,832	7.03	5,907	7.37
18 - 24 age	3,758	9.43	3,489	8.67	7,247	9.05
25 - 34 age	4,839	12.14	4,679	11.62	9,518	11.88
35 - 44 age	5,076	12.74	5,122	12.72	10,198	12.73
45 - 54 age	6,034	15.14	5,962	14.81	11,996	14.97
55 - 64 age	5,039	12.64	5,044	12.53	10,083	12.58
65 - 74 age	4,028	10.11	4,318	10.72	8,346	10.42
75 e più	2,450	6.15	3,628	9.01	6,078	7.59
Total	**39,858**	**100.00**	**40,263**	**100.00**	**80,121**	**100.00**

Figure 8: Population – age structure, 2016
Source: UrbistatAdminstat, 20173

Education

There are 13 registered schools offering studies in Fredrikstad, and you can choose from 147 different studies. The following school types are registered in Fredrikstad: Fagskole, Høgskole, Videregående, Folkehøgskole, Friskole (Fredrikstad Kommune, 2018).

	Immigrants and Norwegian-born to immigrant parents								
	2010	2011	2012	2013	2014	2015	2016	2017	2018
0106 Fredrikstad									
Males	4 324	4 756	5 346	5 826	6 066	6 281	6 627	7 083	7 423
Females	4 230	4 532	4 827	5 191	5 511	5 775	6 156	6 630	6 923

Footnotes

The figures are rounded off.

Figure 9: Immigrants and Norwegian-born to immigrant parents, by region, sex, contents and year
Source: Statistics Norway, 2018[4] ()

Municipal planning

The description below of the Norwegian municipal planning is taken from The Norwegian Ministry of Local Government and Modernisation.[5], [6]

[3] https://ugeo.urbistat.com/AdminStat/en/no/demografia/dati-sintesi/fredrikstad/20421993/4
[4] https://www.ssb.no/en/statbank/table/07108/?rxid=4fd48db9-ceaa-4c47-99ff-4303c27e0d5b
[5] https://www.regjeringen.no/en/topics/planning-housing-and-property/plan--og-bygningsloven/planning/engelsk-test---planning-in-norway/engelsk-test----2/id710310/
[6] https://www.regjeringen.no/en/topics/planning-housing-and-property/plan--og-bygningsloven/planning/engelsk-test---planning-in-norway/engelsk-test----5/id710313/

*All municipalities are required to have a **municipal master plan**. The municipal master plan is the municipality's overriding governing document. It provides the framework for the development of the municipal community and management of the land use resources.*

Municipal planning shall promote municipal, regional and national goals, interests and functions. The municipal master plan consists of a land-use element and a social element with an implementation element. The municipal sub-plan is a plan for specific areas, topics or areas of activity and the municipality is free to decide the areas for which it is expedient to make plans. The implementation element shall be revised annually and it shall contain an action programme for the implementation of the social element for the next four budget years. The implementation element shall specify the plan and form the basis for the municipality's prioritisation of resources and planning and cooperation functions.

During the first year of the electoral term, the municipal council shall prepare a municipal planning strategy that concerns strategic choices relating to the development of the municipality and the need for future plans. The main question is whether to revise the municipal master plan in whole or in part and what this revision shall entail. This applies to long-term land use, the sector's activities and an assessment of the municipality's planning needs in the electoral term.

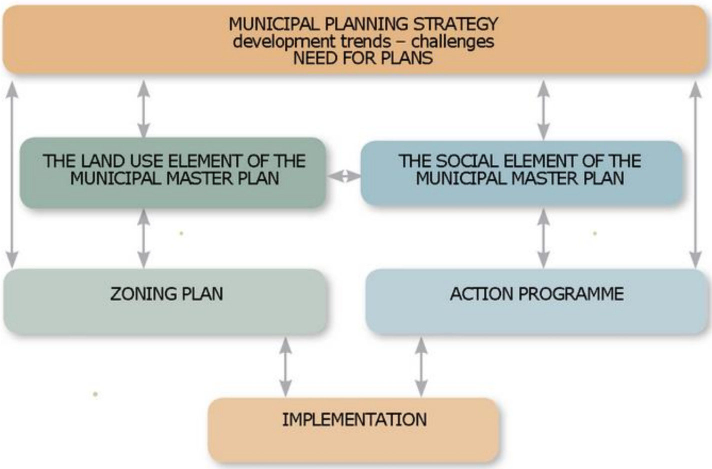

Figure 10: From plan to project – formal possibilities under the law

*The purpose of the **municipal planning strategy** is to clarify what planning functions the municipality should initiate or continue in order to facilitate the desired development in the municipality.*

Then newly elected municipal council shall present its proposal for a municipal planning strategy during the first year of the four-year electoral term. The municipal council shall clarify the municipality's planning needs for the *upcoming municipal planning period, and the further planning work will be based on the planning strategy.*

The planning strategy focuses strongly on planning being needs-based and not being made more comprehensive than necessary. The municipal planning strategy shall help the new municipal council to clarify what planning functions the municipality shall prioritise during the electoral term in order to meet the municipality's needs.

In connection with the adoption of the municipal planning strategy, the new municipal council shall determine whether the municipal master plan shall be revised in whole or in part. The planning strategy can also be used to assess the municipality's planning system, planning resources and the overall planning needs in the electoral term relating to municipal sub-plans.

The municipal planning strategy shall be prepared and adopted no later than one year after the municipal council is constituted. In the same period, the county councils shall adopt a regional planning strategy that shall clarify regional planning needs. This parallel process promotes better coordination of planning functions and improved follow-up of adopted plans across municipal and county borders.

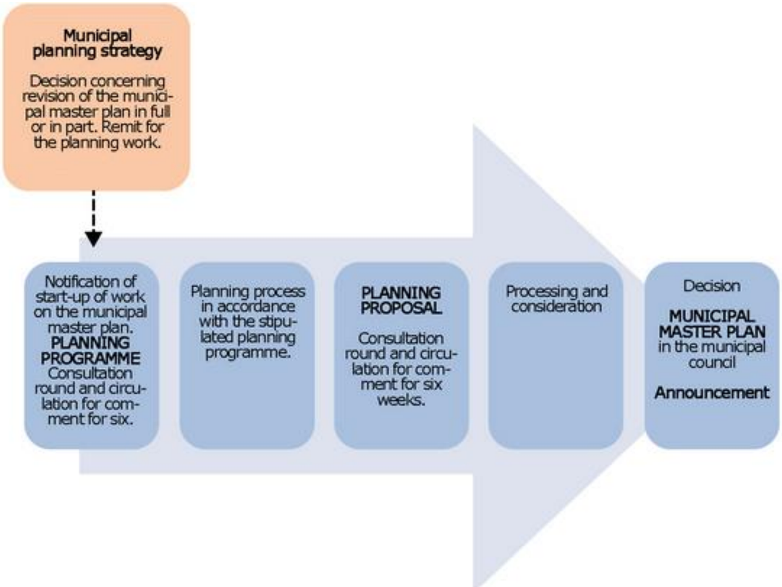

Figure 11: The relationship between municipal planning strategy and municipal planning master plan process

Fredrikstad

The municipal master plan of Fredrikstad consists of a social and land use element to reach the vision of Fredrikstad: "The small world city" (Den lille verdensbyen)

The social element plan:

- https://www.fredrikstad.kommune.no/organisasjon/om-kommunen/planer/kommuneplanen/samfunnsdel/

The land use element plan:

- https://www.fredrikstad.kommune.no/organisasjon/om-kommunen/planer/kommuneplanen/arealdel/

For SiEUGreen, the Fredrikstad strategy for Urban densification will be of special interest.

- https://www.fredrikstad.kommune.no/globalassets/dokumenter/kmb/barekraftig-samfunn/kommuneplanens-arealdel/fortettingsstrategi---hoveddokument.pdf

Module 1 LAND USE

Fredrikstad kommune spokesperson provided land use information. The information is represented below in bar-charts, and the detailed information is given in appendix 1.

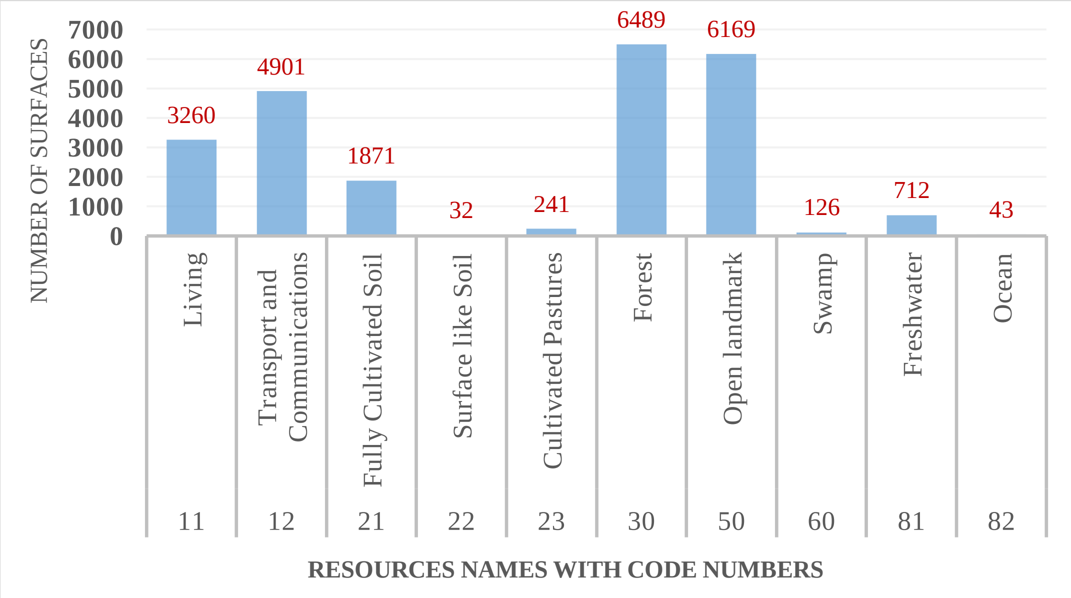

Figure 12: Land Use in Fredrikstad Kommune (a)

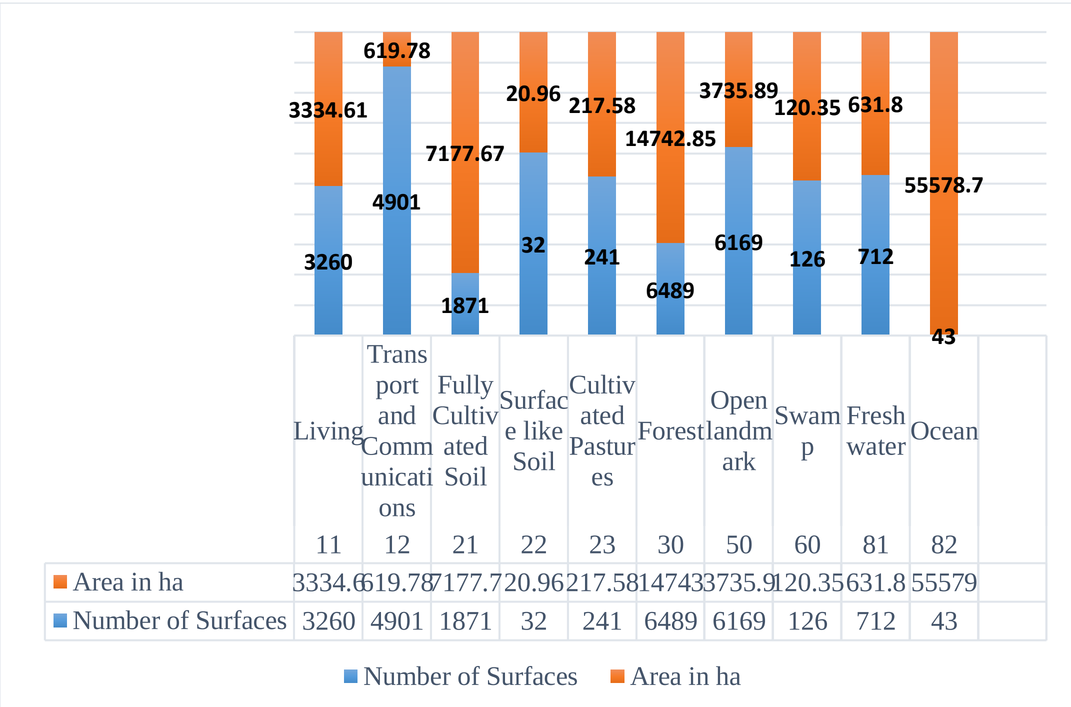

Figure 13: d Use in Fredrikstad Kommune (b)
Source: Information provided by Fredrikstad kommune, 13-06-2018

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Secure Land for UA in proximity to consumption markets

As we saw earlier, the decline in the number of enterprises has gone faster than the decline in the agricultural area. The municipalities with the largest agricultural area are today Rakkestad, Sarpsborg, Eidsberg, Fredrikstad, Trøgstad and Halden. In Halden and Spydeberg, the area of worship has increased since 2000, and Hvaler has an unchanged area with wilderness, while in the others it has gone down. In total, the area of farmland in operation has decreased by 4 per cent from 2000 to 2016 in Østfold.

Since 1999, the lease share has risen from 31 per cent of the total area to 43 per cent of total area in Østfold (the national average is 44 per cent). When land is rented out across municipal boundaries, the rented land in the statistics will be counted in the municipality where the operating centre is located. That is, when a user with a lot of land handles and leases the land to one or more in other municipalities, this will give a big impact on the statistics. This is part of and explains the sharp decline in, among other things. The reduction in the agricultural area may also be due to fermentation and marginal areas have been discontinued. In addition, the redistribution of farmland to other purposes than agriculture. Agricultural area is redistributed to housing and recreation areas, traffic areas and industrial buildings (Agriculture and forestry in Østfold, Report 2017).

		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
0106 Fredrikstad	**Population per 1.1. (persons)**	71 297	71 976	72 760	73 638	74 579	75 583	76 807	77 591	78 159	78 967	80 121	80 977
	Area (km²)	288	288	288	288	288	288	287	287	287	287	293	293
	Land area (km²)	283	283	283	283	283	283	284	284	284	284	284	284
	Population per km² land area	252	254	257	260	263	267	271	273	275	278	282	285

Footnotes

Land area and area: Source: The Norwegian Mapping Authority (1:50 000) and The Norwegian Polar Institute (1: 100 000).

The whole country: The mainland without Svalbard and Jan Mayen

Area total: Fresh water included. Land area: The figures represent mainland Norway, Svalbard and Jan Mayen are not included.

See list over changes in regional classifications (in Norwegian).

Figure 14: Population and area by region, contents and year

Source: Statistics Norway, 2018

			Population			
			2014	2015	2016	2017
0022 Fredrikstad/Sarpsborg	0-5 years	Males	3 821	3 806	3 645	3 637
		Females	3 544	3 517	3 449	3 460
	6-12 years	Males	4 541	4 584	4 786	4 835
		Females	4 304	4 344	4 440	4 469
	13-15 years	Males	2 068	2 091	2 097	2 116
		Females	1 929	1 934	1 921	1 947
	16-19 years	Males	2 868	2 872	2 833	2 902
		Females	2 727	2 774	2 815	2 790
	20-66 years	Males	32 688	32 679	33 100	33 556
		Females	32 550	32 576	32 944	33 281
	67 years or older	Males	7 120	7 442	7 686	7 899
		Females	9 760	10 017	10 191	10 375

Figure 15: Population by age, sex, contents and year (a)
Source: Statistics Norway, 2018

		Persons (number)		
		2015	2016	2017
0 - 66 years	0106 Fredrikstad	66 580	67 459	67 945
Over 13 years	0106 Fredrikstad	67 343	68 418	69 258
15-74 years	0106 Fredrikstad	59 340	60 383	61 092
16-18 years	0106 Fredrikstad	3 039	3 082	3 033
16-66 years	0106 Fredrikstad	52 052	52 861	53 291
18-22 years	0106 Fredrikstad	5 163	5 164	5 146
18-24 years	0106 Fredrikstad	7 140	7 247	7 204
18-66 years	0106 Fredrikstad	50 064	50 804	51 282
Over 18 years	0106 Fredrikstad	62 451	63 466	64 314
19-24 years	0106 Fredrikstad	6 089	6 222	6 180
20-66 years	0106 Fredrikstad	47 956	48 731	49 222
25-66 years	0106 Fredrikstad	42 924	43 557	44 078
67-79 years	0106 Fredrikstad	8 830	9 103	9 378
Over 67 years	0106 Fredrikstad	12 387	12 662	13 032
Over 80 years	0106 Fredrikstad	3 557	3 559	3 654

Footnotes

Population by age, municipalities, KOSTRA municipality groups, country with and without Oslo.

Figure 16: Population by age, sex, contents and year (b)
Source: Statistics Norway, 2018

	2000	2016	Prosentvis endring
Halden	59 914	61 070	2 %
Moss	5 716	3 903	÷32 %
Sarpsborg	79 837	76 074	÷5 %
Fredrikstad	68 843	63 242	÷8 %
Hvaler	3 330	3 314	0 %
Aremark	19 487	19 181	÷2 %
Marker	40 690	39 062	÷4 %
Rømskog	2 941	2 907	÷1 %
Trøgstad	66 672	66 249	÷1 %
Spydeberg	37 365	38 974	4 %
Askim	26 009	23 813	÷8 %
Eidsberg	75 871	70 827	÷7 %
Skiptvet	35 367	29 781	÷16 %
Rakkestad	112 837	112 028	÷1 %
Råde	34 299	32 728	÷5 %
Rygge	26 687	26 024	÷2 %
Våler	35 542	33 905	÷5 %
Hobøl	29 729	27 838	÷6 %
Østfold	761 136	730 920	÷4 %
Norge	10 313 684	9 812 399	÷5 %

Figure 17: Land cultivated (acres), 2000 and 2016
Source: Agriculture and forestry in Østfold, Report 2017

Fredrikstad and Sarpsborg municipality stands out with both large numbers of farms and large numbers of people. Together with Moss and Halden, these are the most populous municipalities in the county.

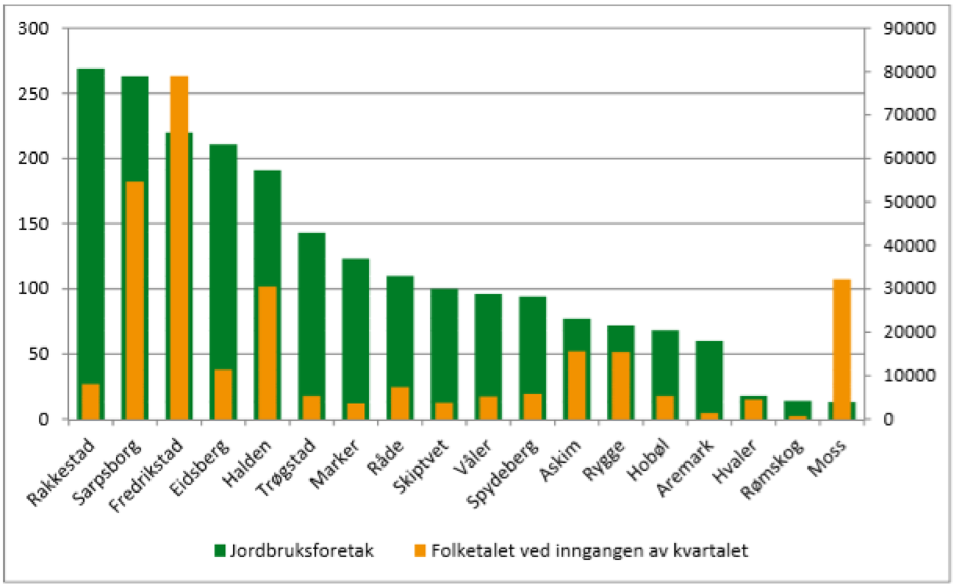

Figure 18: Farms and population per municipality

Farms (left-hand scale) and population numbers per municipality (right-hand scale) in Østfold 2016. Source: Statistics Norway, table 01222 and the Danish Agricultural Directorate.

(**Source**: Agriculture and forestry in Østfold, Report 2017)

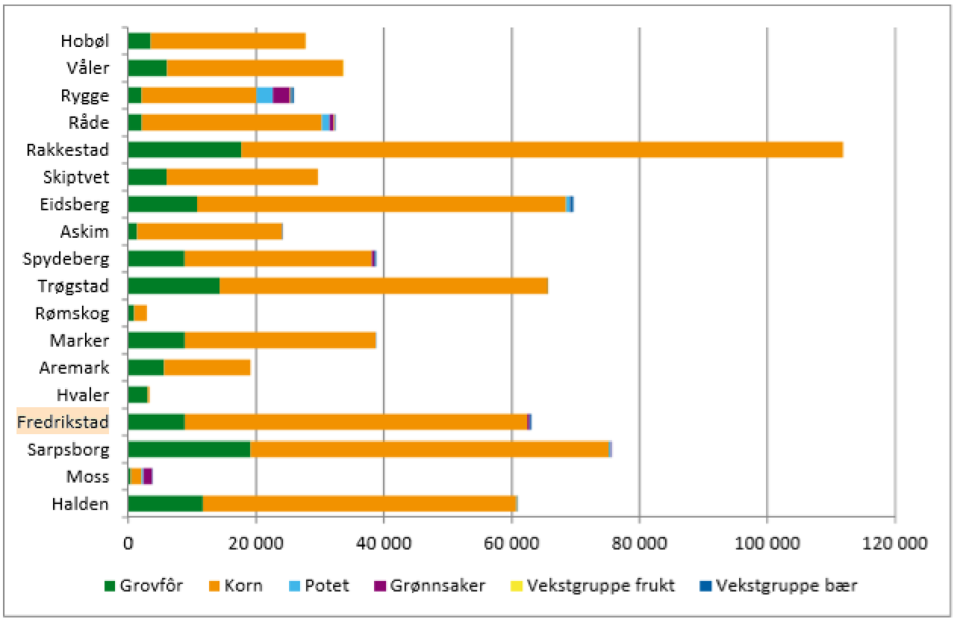

Figure 19: Plant production by municipality in acres, 2016
Source: Agricultural Directorate, 2017.

All municipalities in Østfold have grain areas, but in Hvaler these are very small. Rakkestad stands out as the clearly largest grain-producing municipality, with a total of over 53,000 tons of grain produced. Eidsberg municipality produced over 31,000 tonnes of grain by 2015, and the municipalities of Fredrikstad, Sarpsborg, Trøgstad and Halden produced between 20,000 and 30,000 tonnes of grain by 2015.

Increase Land Efficiency for UA (Less land more food)

Organic farming is a production method that takes particular account of the environment, sustainability and nature's own cycle. Food from organic farming is produced using animal manure and other organic fertilizers and without the use of chemical pesticides. The method is based on best practices in the environmental field and is constantly evolving as new knowledge comes into being. In Norway, the term is ecologically defined through a specific and detailed regulatory framework, which is largely similar to the EU's regulatory framework. Organic farming serves as a cutting edge for the development of more sustainable production methods in agriculture (Fredrikstad Kommune Report, 2018).

Fertile Soil and Climate Conditions

Agricultural areas in Østfold are valuable, and having very good soil protection. Particularly valuable is the best vegetable soil that lies in the areas alongside and outside the south of the county, where both soil and climate are very suitable for vegetables and early produce.

Co-funded by the Horizon 2020 programme of the European Union
Co-funded by the Chinese Ministry of Science and Technology

Also areas suitable for grain production, especially food cereals which are limited in this country. A large proportion of the redistribution in Østfold since 2005 has occurred in these highly productive areas around the breed. However, the decline in cultivated and cultivable land in Østfold has declined in recent years and was less than half as high as in 2005, from 461 acres in 2005 to 219 by 2015. Østfold region is an important vegetable flock, and especially in the areas along the south of the county, both soil and climate are very suitable for vegetables and early produce. The largest and most contiguous areas are in Moss, Rygge and Råde, and that is where the production of potatoes, berries and vegetables is greatest. Vegetable areas have increased by 28 per cent since 2000, but the potential for vegetable cultivation is greater than that.

Fruit and vegetable areas have increased by 141 and 29 %, respectively. Only the last year from 2015 to 2016, the area has increased by 15 and six per cent. The number of enterprises with vegetable production has also increased by three per cent in the last year, while fruit producers have remained unchanged. Although the fruit area has increased a lot in percentage, it still represents a very small proportion of the agricultural area.

Both grain area and the number of grain producers have decreased. But grain areas have also increased in the past year, by 2 %. By 2015, 65 % of the farmers in Østfold region had enterprises under 300 acres, compared to 73 % on a national basis. Østfold farmers are getting bigger enterprises (Agriculture and forestry in Østfold, Report 2017).

Create Greener Landscapes- Political and Institutional support and monitoring for UA

	Agricultural area in use (decares)		
	2015	2016	2017
0106 Fredrikstad	63 905	63 275	63 029

Figure 20: Land use for agriculture in Fredrikstad
Source: Statistics Norway, 2018

	Gross operating expenses to local administration of agricultural areas (NOK 1000)		
	2015	2016	2017
0106 Fredrikstad	3 838	5 134	0

Figure 21: Total Operational Expenses of Agricultural Areas

Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

	Area					
	2011	2013	2014	2015	2016	2017
0106 Fredrikstad						
Residential areas	19.12	19.41	19.41	19.56	19.75	19.76
Recreational facilities	4.58	4.77	4.85	4.88	4.94	4.96
Built-up areas for agriculture and fishing	2.92	3.08	3.09	3.06	3.05	3.06
Industrial, commercial and service areas	5.75	5.88	5.90	6.09	6.14	6.12
Education and day care facilities	0.61	0.64	0.62	0.63	0.65	0.64
Health and social welfare institutions	0.36	0.34	0.35	0.35	0.35	0.35

Footnotes

The statistics are as detailed as possible for each year, but will also reflect that the basedata is getting more complete. Hence theese tables can not be used to detect changes between years.

Figure 22:Land use in Urban Settlement and land cover (km²), by region, area classification, contents and year

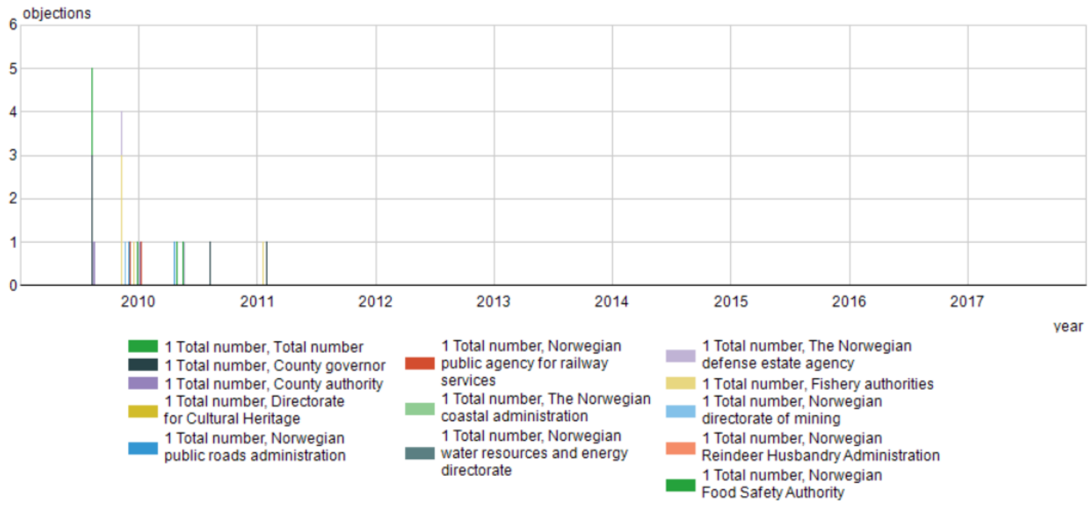

Figure 23: Land- use and Regional planning (a). Number of Objections to Municipal (Sub) plans.
Basic data, by region, argument, authority, contents and year

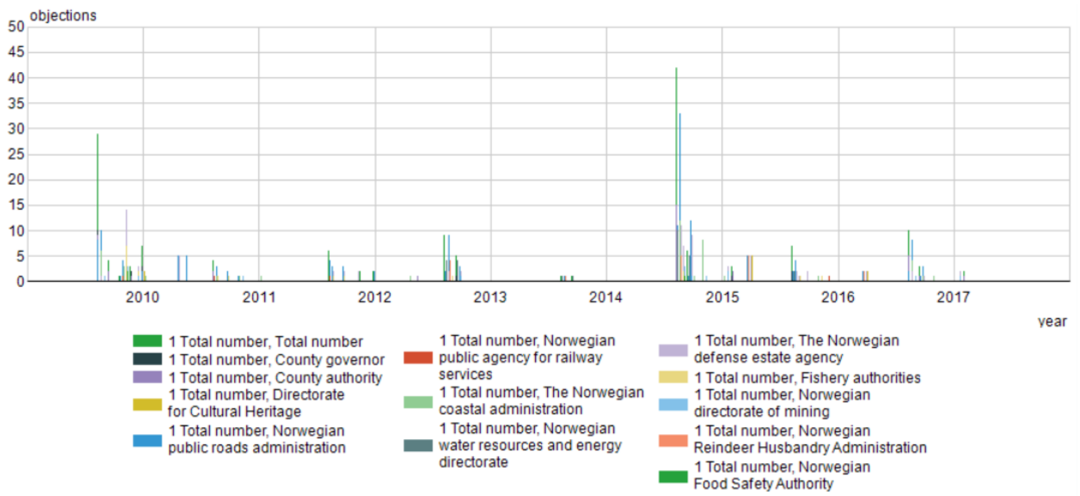

Figure 24: Land- use and Regional planning (b). Number of Objections to Municipal (Sub) plans.
Basic data, by region, argument, authority, contents and year

	Gross operating expenditures to agricultural managemnet and agricultural business												
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
0106 Fredrikstad	..	..	..	2 935	2 935	2 937	3 617	4 130	4 602	4 143	3 838	5 134	5 033

Figure 25: Local administration of agricultural areas: Gross Operational Expenditures
Source: Statistics Norway, 2018

Estimated population growth and population. The whole country and the ten largest municipalities.

The ten largest municipalities	2017			
	Population 1st January. Final figures	Estimated population	Estimated population 31st December	Estimated population growth. Per cent
The whole country	**5 258 317**	**38 478**	**5 296 795**	**0.7**
Oslo	666 759	6 078	672 837	0.9
Bergen	278 556	1 352	279 908	0.5
Trondheim	190 464	2 864	193 328	1.5
Stavanger	132 729	281	133 010	0.2
Bærum	124 008	1 403	125 411	1.1
Kristiansand	89 268	2 318	91 586	2.6
Fredrikstad	80 121	889	81 010	1.1
Sandnes	75 497	830	76 327	1.1
Tromsø	74 541	1 016	75 557	1.4
Drammen	68 363	486	68 849	0.7

Figure 26: Estimated Population Growth of whole Norway and the ten largest municipalities
Source: Statistics Norway, 2018

Qualitative Data: Survey, Interview

		2015	2016
0106 Fredrikstad	Is food included in the municipal rate? (Yes/ No) (yes=1, no=0)	1	1
	Are clothes and shoes included in the municipal rate? (yes=1, no=0)	1	1
	Are expenditures on daily products included in the municipal rate? (yes=1, no=0)	1	1
	Are TV license, newspaper, telephone included in the municipal rate (yes=1, no=0)	1	1
	Are leisure time expenditures included in the municipal rate (yes=1, no=0)	1	1
	Travel expenditures are included in the fixed municipal support rate (yes=1, no=0)	1	1
	Are housing expenditures (rent) incorporated in the municipal fixed support rate (yes=1, no=0)	0	0
	Heating included in the municipal rate (yes=1, no=0)	0	0
	Housing insurance included in the fixed municipal rate (yes=1, no=0)	0	0
	Expenditures on furniture and equipment included in the municipal rate (yes=1, no=0)	1	1
	Are municipal rates based on state (ministerial) guidelines? (yes=1, no=0)	1	1
	Is social assistance paid according to fixed municipal rates? (yes=1, no=0)	1	1
	Child benefits excluded when social assistance is measured out (yes=1, no=0)	0	0
	Children's incomes excluded from the fixed municipal rate (yes=1, no=0)	0	0
	Child benefit allowance excluded when social assistance is measured out (yes=1, no=0)	0	0

Figure 27: Expenditures included in support rate, by region, contents and year

			Amount (number)	
			2015	2016
0106 Fredrikstad	In total	In total	48 416.0	38 910.0
		Recycling	8 879.0	8 620.7
		Incineration	24 705.0	25 663.2
		Landfilling	2 051.0	1 414.1
		Biogas production	0.0	0.0
		Composting	2 872.0	0.0
		Other	9 909.0	3 212.0
	Food- and other wet organic waste	In total	0.0	0.0
		Recycling	0.0	0.0
		Incineration	0.0	0.0
		Landfilling	.	.
		Biogas production	0.0	0.0
		Composting	0.0	0.0
		Other	0.0	0.0

Footnotes

Household waste amounts

. = Category not applicable

Figure 28: Waste production from Households in Fredrikstad: material, treatment, contents and year
Source: Statistics Norway, 2018

Summarizing the findings on Land Use

- The population is growing with the growth rate of 1.1 %
- The number of immigrants is increasing in Fredrikstad kommune
- Fredrikstad soil is highly fertile for fruits and vegetables
- Climate of Østfold region is highly supportive for UA
- Fredrikstad is one of the biggest corn producer municipalities in Norway
- Forest area and open landmark have the highest surface areas as compared to surface soil and cultivated pastures
- Municipality and public seems interested in regional planning
- Municipality wants development planning but also facing public complaints
- Fredrikstad municipality wants to prioritise local food in cases where this is a better climate and environmental choice than alternatives
- Knowledge of food and the environment is increasing in educational institutions through training on practical measures.

Module 2: Food Security

The county context for agriculture and value chains

In 2017 AgriAnalyse reported on the situation for the County that Fredrikstad is situated in, Østfold (Bunger and Smedshaug, 2017). The report addresses the agricultural and forestry industry in Østfold, and the county's strong and diverse value chains. To describe the context of Fredrikstad and Cicignon on County level, we have therefore translated relevant parts of the summary of this Norwegian report:

> *About three per cent of the Norwegian land area is cultivable and only 1.3 per cent is suitable for food grain production. Østfold, which is a small county, constitutes only 1.1 per cent of the total area in Norway but has 7 per cent of the country's agricultural area in operation and 20 per cent of the grain area. Østfold has major productions in all of Norway's important agricultural products: grain, meat, eggs, milk, vegetables and berries. In Østfold, a total of 19 per cent of the area is used for agricultural land. Versatile agriculture in the county also provides the basis for a varied and complex food industry with high processing from all sectors with the exception of milk. Since 2000, the number of farms in Østfold has fallen by 34 per cent, which is a little lower than total in the country (38 per cent). The land use change in agriculture have also been slightly lower than on national level, approx. 4 per cent since the turn of the century, compared with 5 per cent in the country in total. From 2015 to 2016, the agricultural area in Østfold incresed slightly by 0.5 per cent. The areas increased for cereals, potatoes, vegetables and fruits, while the forage areas it decreased by 5 percent. In 2016, 80 per cent of cultivated land in Østfold was used for grain production, and in 2015 the county produced 23 percent of all Norwegian grain. Østfold has, like Norway, never had more grain crops since the beginning of 2013. However, the share of food grain has declined in recent years. Østfold has 19 per cent of Norwegian poultry production, down from 22 per cent in 2006. The situation of pig (7 percent of Norwegian production) and eggs (11 percent of Norwegian production) are more stable. Milk and beef production accounts for 2 per cent of Norway's total production. Ecological Production in the county represents a particularly large proportion of total Norwegian production, especially for eggs (43 percent), vegetables (27 percent), cereals (24 per cent) and milk (13 per cent). The agricultural sector in Østfold is in average more profitable than average nationally in 2014. The average farm has higher debt but also has greater output than the national average. The agricultural sector of Østfold has a total of over 7100 jobs in agriculture, forestry and the farm associated processing industry together.*

Additional to conventional agriculture, there are also other interesting cases that can be related to urban/peri-urban agriculture and food security.

- **The town bees** (Byens bier) - The municipality of Fredrikstad has established collaboration with beekeepers to set out beehives in the centre of the city, to increase the number of town bees. In 2015 a total of 10 beehives were set out within the centre area. The experience after the first season was positive, and the project continued and expanded. The beekeepers own and operate the beehives and the municipality facilitates the project. Cicignon is one of the neighbourhoods where there are beehives.[7]

- **The moon greenhouse** (Månegartneriet) – The Moon Festival (Månefestivalen) is the biggest annual music and culture festival in Østfold. The festival arena is in the Old Town in Fredrikstad, and the festival also has its own market garden. Månegartneriet is located just outside the Old Town and follows ecological principles for production. The market garden is used both as a production and information arena. They produce flowers and plants that are used to decorate the festival areas. In addition, some herbs, vegetables and flowers are also for sale. They also supply products for a café in Gamlebyen Kulturhus. In cooperation with Gudeberg School, a school-garden project is being conducted in the Månegartneriet. 6th graders participate in the work and learn about ecology and how to grow their own food.[8]
- **Fredrikstad central kitchen (Sentralkjøkkenet) –** The central kitchen produces food for about 1000 people daily. The meals are delivered to the elderly in nursing homes, at home or those who use the retirement homes. While all the municipalities previously had their own large kitchens, they were merged in 2004. However, there are still cooks at the individual nursing home. They ensure that the food from the central kitchen keeps good quality and heats the meals before serving. The central kitchen also operates catering and has a cookery course.[9]
- **Community supported agriculture –** Close to Fredrikstad there are two farms offering community supported agriculture: Dale store gård in Gressvik[10] and Nes gård in Fredrikstad.[11]

[7] https://www.fredrikstad.kommune.no/tjenester/naringmiljosamfunn/Samfunn/byensbier/
[8] http://maanefestivalen.no/manegartneriet
[9] https://www.f-b.no/nyheter/jobben-min/naringsliv/her-lages-1-000-middager-hver-dag/s/5-59-695798
[10] http://www.dalestoregard.no/
[11] https://www.nesandelsgaard.no/

Strategy for food and environment

A strategy for food and environment has been developed for the municipality of Fredrikstad. Fredrikstad municipality's food purchases amount to around NOK 45 million annually. There were several reasons why the presidency in 2016 decided that a strategy for food and environment should be developed that looks at the municipality's food service in a comprehensive environmental perspective:

https://www.fredrikstad.kommune.no/globalassets/dokumenter/strategier/strategi-for-mat-og-miljo_vedtatt-i-bystyret-16.11.17_justert-10.01.2018.pdf

Consumption patterns and practices

Relevant studies have been conducted on Environmental Information and Consumption Practices specifically in Fredrikstad. Although the results are more than 10 years old, they may give an impression on consumption patterns. Summary of *Environmental information and consumption practices: A case study in households in Fredrikstad* (Vittersø, 2003):

> *This report discuss the significance of environmental information in changing consumption practices in a more environmentally sound direction. It concludes that information is a necessary, but not sufficient tool for changing household consumption patterns. In general information should be viewed as a long term instrument. However, in the short run information seem most effective when combined with other political measures.*

- *http://www.hioa.no/extension/hioa/design/hioa/images/sifo/files/file48548_fagrapport2003-4.pdf*

Whereas this SIFO report concerns private consumption, a new report from Østfoldforskning has mapped topics such as menus in municipal businesses and food waste:

- *Klimavennlige menyer i kommunale virksomheter Fredrikstad commune*
  https://www.ostfoldforskning.no/media/1795/klimavennlige_menyer_or_0218.pdf
- *Kartlegging av matavfall i serverings-sektoren Fredrikstad og Moss kommune*
- https://www.ostfoldforskning.no/media/1714/or2116-kartlegging-av-matavfall-i-serveringssektoren-fredrikstad-og-moss-kommune.pdf

Share of household income that is spent on food for different income groups

In 2012 the share of household spent on Food and non-alcoholic beverages on Norwegian national level was 11,8%.[12]

Overweight and obesity

National numbers:

- Overweight is a body mass index (BMI) between 25 and 30 kg / m2. Obesity is a BMI of 30 kg / m2 or above. Obesity is primarily associated with increased health risk.
- In total, between 15 and 20 per cent of children are overweight or obese (about 1 in 6 children). There are signs that the trend has levelled out.
- In total, 1 in 4 young people (about 25 per cent) is overweight or obese. There are indications that the proportion is increasing.
- About 1 in 4 men and 1 in 5 women aged between 40-45 years are obese. The proportion has increased in the last 40-50 years. The proportion of overweight comes in addition to the proportion of obesity.
- The combined proportion of overweight and obesity varies by region and education level.
- A high BMI contributes to approximately 2400 annual deaths in Norway and probably many cases of cardiovascular disease, diabetes and other chronic diseases.[13]

[12] https://www.ssb.no/en/inntekt-og-forbruk/statistikker/fbu/aar/2013-12-17
[13] https://www.fhi.no/en/op/hin/risk--protective-factors/overweight-and-obesity-in-norway---/#main-points

Module 3 RESOURCE EFFICIENCY

Introduction

"Resource efficiency means using the Earth's limited resources in a sustainable manner while minimising the impacts on the environment. It allows us to create more with less and to deliver greater value with less input" (European Commission, 2017)[14]. In today's world, **the** Improvement in resource efficiency is among the top priorities as; businesses, governments and civil society are highly concerned about the use of natural resources, environmental impacts, material prices and supply security (**OECD, 2018).** According to the United Nations Environment Programme, "The unsustainable use of resources has triggered critical scarcities and caused climate change and widespread environmental degradation – all of which have negative impacts on the well-being of the planet and its people. At the same time, more than 10 per cent of the world population continues to live in extreme poverty, unable to meet even their most basic needs. Responding to this dual challenge will require innovative policies, redirected investment, environmentally sound technologies, international cooperation, and capacity development to support countries to transition to inclusive green economies. Producers will need to change how they design, source, manufacture and market their products. Consumers will need to incorporate environmental and social concerns into their consumption decisions and adopt sustainable lifestyles" (UNEP)[15].

By using natural resources efficiently, we **can live healthier lives, reduced unemployment by creating jobs, save more money, boost our economy and respect our planetary boundaries**. Economic sense can be generated through resource efficiency. It is one of the important principle which support the entire life cycle of economic strategy and is also basic step towards green growth (European Commission, 2017)[16]

The following figure 1; is showing the resource efficiency loop which main goal is generate less waste and increase economic impact that will ultimately be reduced carbon emissions in

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14 http://ec.europa.eu/environment/resource_efficiency/index_en.htm
15 https://www.unenvironment.org/explore-topics/resource-efficiency/why-does-resource-efficiency-matter
16 http://ec.europa.eu/environment/green-growth/resource-efficiency/index_en.htm

atmosphere. Figure 2 is showing the entire life cycle of materials and its basic principle to circular economy;

Figure 29: Resource efficiency loop.
Source: WRAP (The Waste and Resources Action Programme), 2018

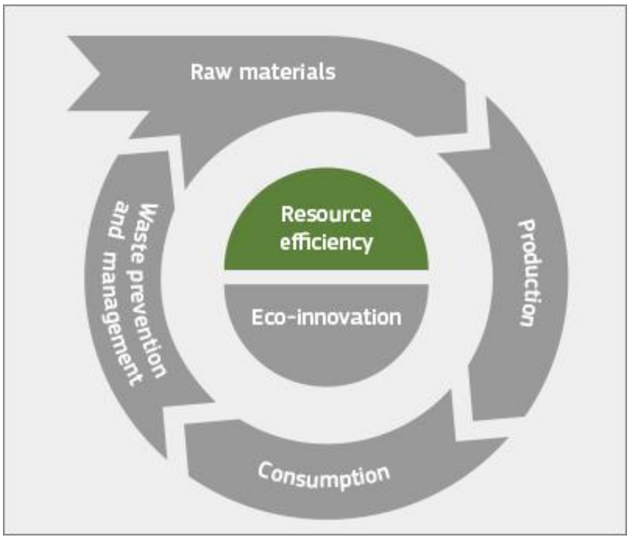

Figure 30: Life-cycle of material in the context of resource efficiency.
Source: European Commission, 2017

It has been accepted that resource efficiency is important for urban agriculture. Because the scope of urban agriculture is to expand the farming activities in the study area and to sustain these activities by farmers through efficient use of resources (Umoh, 2006). Large-scale implementation of UA (Urban Agriculture) may be a vital step towards improving urban environmental performance, but many claims of UA's improved environmental sustainability and resource efficiency relative to conventional agricultural remain premature given the scarcity of field verification and quantitative assessment of UA systems (Goldstein et al., 2016).

Based on the expected impacts of the project (SiEUGreen), and data collected from the project partners, the following objectives have been identified with relation to resource efficiency in the context of SiEUGreen project:

a) Mitigate environmental impacts of UA applying life cycle thinking
b) Improve resource efficiency in UA monitored by the measures provided by the statistical office of the European Union (EUROSTAT)
c) Increase understanding of the contribution of UA to circular economy and green growth
d) Qualitative Data (Survey, interviews)
e) Narrative and representation: Summarizing the findings on Resource Efficiency

Module 3 (Resource Efficiency) addresses each of above-mentioned objective, including clear instructions on how should be approached by the study area Fredrikstad. The material provided is based on grant agreement of SiEUGreen, relevant literature, as well as suggestions collected from the partners at the workshop held at the project kick-off meetings in Oslo.

Resource Efficiency in Fredrikstad

Mitigate environmental impacts of UA applying life cycle thinking

This goal is about "increasing the sustainable management of resources and achieving resource efficiency along with both production and consumption phases of the lifecycle, including resource extraction, the production of intermediate inputs, distribution, marketing, use, waste disposal and re-use of products and services" related to UA (UNEP)[17].

Within the SiEUGreen project scope, a wide set of innovative agricultural technologies are expected to be implemented at study area (Fredrikstad). The case study experts should

[17] https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/sustainable-consumption-and-production-policies

identify which (if any) technologies are/will be most suited to implement at Fredrikstad with the concern of low environmental impacts. Those (to be) implemented technologies should be addressed, visualised and described appropriately. The following table 1; can be used to identify the suitable technology that can be implemented in Fredrikstad in the context of SiEUGreen project.

Table 1: UA technologies and their implementation which can mitigate environmental impacts

Emerging Technologies to Mitigate Environmental Impacts
Green
Innovative greenhouse technology using special insulation, solar heat storage, and biogas for light CO_2 and heat
Greenhouse technology, traditional
Polytunnels
Mobile gardens
Soil-based traditional plan growth
Water-based hydroponic culture
Aquaponic cultures (plant fish fully recycling technology)
Paper-based plant growing technology
Balcony gardens
Blue – Processing of waste for recycling
Biogas production from Antec Biogas pilot-scale reactor
Treatment of Biogas digestate by biofiltration
Struvite precipitation from biofilter percolate
Use of organic waste product for the production of insects in connection with the aquaponic system
Biofiltration of urine
Co-composting of organic household waste /green-waste and solar dry toilet residue
Blue – Source separation of wastewater
Vacuum- /low flush toilets
Urine diverting toilets
Solar dry toilet
Greywater treatment using a Biofilter/Filtered treatment system
Greywater treatment using a biomembrane system
Green wall for greywater treatment
Blue – Stormwater handling
Green roof lightweight aggregate (LWA) for water retention
Green wall for water retention
Wetland/pond system for stormwater disposal
Wetland/infiltration system for stormwater disposal
Yellow
Borehole thermal energy storage (BTES)
Ground source heat pumps (GSHP)
Photovoltaic panels (PV)
Solar collectors for heating water
Combined heat and power (CHP) from biogas

Some of the innovations in UA are considered as win-win potential: production and environmental benefits. For example, Green technologies such as; conservation tillage, Integrated Pest Management (IPM) and precision farming can increase farm profitability and productivity. These technologies can reduce environmental impacts and conserve natural resources as well. Similarly, Precision agriculture can also reduce adverse environmental impacts by using advanced technologies, such as satellite farming, a global positioning system (GPS), to collect data at exact locations and geographical information systems (GIS), to map more accurate fertilisers and pesticides requirement across the field (Hall and Dorai, 2010). In SiEUGreen project, these innovations can be used as a reference to mitigating environmental impacts.

Table 2: Showing approaches greenness by mapping them against environmental challenges

		Environmental Challenges					
	Approach to 'Greenness'	Pollution	Biodiversity Loss	Water Scarcity/ Salinity	Carbon Foot-Print	Soil Degradation/ Nutrient Loss/ Erosion	Natural Resource Depletion
New science and generic technologies with green potential							
1.	Biotech GM/GE Crops	✓	✓	✓		✓	✓
2.	ICT applications		✓	✓			✓
3.	Sustainable Bio Production		✓		✓		✓
Farming system innovations							
4.	Integrated Pest Management (IPM)	✓	✓				
5.	Systems of Rice Intensification (SRI)	✓		✓		✓	
6.	Organic Agriculture	✓	✓		✓	✓	
7.	Conservation Agriculture/ Zero Tillage			✓		✓	
8.	Water Management Systems			✓		✓	
9.	Natural Resource Management		✓	✓	✓		✓
10.	Urban and Peri-Urban Agriculture				✓	✓	
Integrated national green regimes							
10.	Use of Renewable Energies in Agriculture		✓		✓		✓
11.	Biofuels	✓					✓
12	Agri-tourism				✓	✓	

Source: (Hall and Dorai, 2010)

Improve resource efficiency in UA: measures provided by the EU

The resource efficiency scoreboard[18] exhibits indicators covering themes and subthemes of the roadmap to a resource-efficient in Europe. The scoreboard aims to monitor the implementation of the roadmap, to communicate the link between resources and economy and to engage stakeholders. Indicators are arranged in three groups – lead, dashboard and theme-specific indicators, as displayed in the following figure.

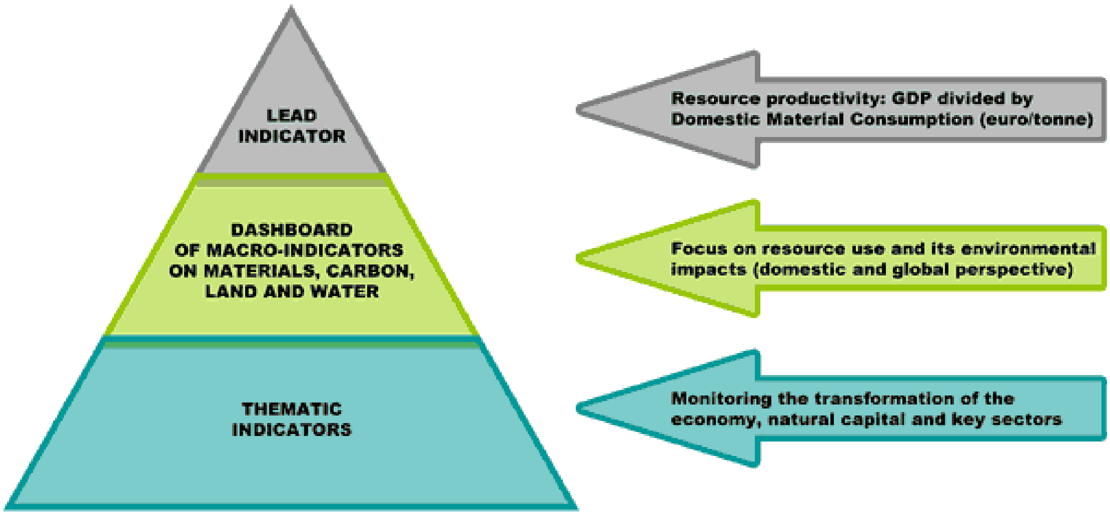

Figure 31: A three-layer approach to resource efficiency
Source: European Commission

Lead indicator: Resource productivity

Resource productivity is measured as the Gross Domestic Product (GDP) at market prices divided by the number of materials used by an economy (Domestic material consumption - DMC), excluding natural resources such as land/area, water, air, ecosystems, etc. The indicator quantifies the relation between economic growth and the depletion of materials (Eurostat, 2018).

[18] http://ec.europa.eu/eurostat/web/europe-2020-indicators/resource-efficient-europe

Table 3: Resource productivity – GDP/DMC of Different Countries Data (2000-16) (Index 2000 = 100)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EU-28	100	101.7	104.4	106.3	103.8	105.0	106.5	106.5	108.0	117.3	123.0	120.4	129.3	132.2	132.6	134.3	138.8
Belgium	100	98.6	102.2	105.7	106.8	107.6	97.2	98.9	99.2	107.5	109.4	104.9	117.3	121.3	126.4	129.5	134.7
Bulgaria	100	97.1	100.8	104.8	99.4	105.0	103.3	107.4	105.6	127.4	130.9	120.5	125.4	131.0	121.4	111.5	128.2
Czech Republic	100	101.8	108.5	109.3	108.0	116.0	120.1	125.0	130.4	136.0	146.5	141.2	157.5	159.2	158.2	159.8	166.2
Denmark	100	102.8	107.9	105.5	102.9	97.1	94.8	98.8	102.6	116.3	126.7	115.1	115.0	122.9	124.2	122.7	121.4
Germany	100	107.6	110.2	110.7	110.4	114.9	116.0	119.8	121.9	120.8	125.7	120.7	125.4	126.9	124.6	131.9	137.2
Estonia	100	111.5	103.0	87.6	99.8	111.5	110.7	98.3	102.4	93.3	94.6	95.4	99.4	95.0	99.8	104.3	116.3
Ireland	100	104.7	110.2	100.4	98.4	103.0	100.9	103.0	111.6	139.3	165.0	180.3	196.4	180.8	204.0	253.3	246.9
Greece	100	98.1	99.2	95.5	102.2	102.6	110.8	82.6	86.7	97.7	103.2	104.3	105.7	110.3	108.0	114.9	119.6
Spain	100	101.0	95.4	93.2	93.4	93.9	93.3	94.6	109.7	129.6	146.0	163.7	199.7	209.2	210.3	209.3	218.2
France	100	106.0	106.6	114.3	106.8	112.0	112.2	110.3	112.9	122.5	127.2	126.0	129.9	130.4	133.2	139.7	145.5
Croatia	100	85.0	77.1	76.7	70.7	76.0	75.1	78.7	70.0	82.6	96.3	96.9	104.0	98.2	107.7	103.7	103.8
Italy	100	104.4	111.9	124.4	117.6	114.9	115.8	123.6	126.4	132.9	143.5	148.9	169.3	188.8	198.1	187.9	185.9
Cyprus	100	103.6	98.7	114.9	107.6	109.2	115.4	105.1	72.5	90.6	98.6	100.7	133.1	173.2	172.1	174.4	151.8
Latvia	100	110.9	111.0	119.6	122.0	121.2	126.3	128.9	147.5	164.2	136.7	131.5	142.1	136.8	140.7	141.4	155.3
Lithuania	100	118.6	105.2	99.1	98.9	102.9	109.8	103.1	99.6	125.8	116.0	113.4	128.4	109.7	121.0	123.5	122.1
Luxembourg	100	100.0	96.6	95.6	94.2	98.1	94.7	105.5	119.1	116.9	121.5	125.0	125.7	124.4	124.8	112.5	115.2
Hungary	100	91.3	99.2	101.8	90.7	82.5	102.4	131.4	118.0	135.1	148.7	151.0	171.6	152.8	123.8	130.2	141.1
Malta	100	104.4	111.9	96.5	95.7	113.8	95.2	120.1	139.8	128.2	154.6	119.4	107.0	126.3	100.3	92.5	95.8
Netherlands	100	103.3	114.7	117.2	113.2	117.9	120.2	118.2	114.7	117.1	119.9	125.0	128.9	135.0	132.6	126.8	146.4
Austria	100	104.3	98.7	104.8	102.8	102.2	102.4	105.2	119.7	121.2	127.4	124.2	127.2	128.4	128.6	131.4	130.5
Poland	100	105.3	112.6	113.2	111.7	113.8	118.4	113.5	115.6	123.8	122.9	104.3	121.6	130.5	135.3	143.0	140.8
Portugal	100	97.0	100.8	112.9	105.6	106.8	98.8	97.5	93.1	100.4	110.0	116.3	121.6	137.9	131.4	132.8	137.3
Romania	100	66.5	73.0	70.7	71.7	68.3	68.5	61.6	51.9	62.1	65.4	59.4	61.7	63.4	63.9	55.6	64.7
Slovenia	100	104.7	104.8	99.6	102.8	110.1	99.9	96.5	113.3	126.4	135.4	151.3	169.9	171.3	164.2	165.4	176.7
Slovakia	100	96.8	96.9	104.8	94.6	92.6	101.3	110.7	106.2	113.9	121.8	123.9	142.1	150.9	140.2	144.4	141.3
Finland	100	100.5	101.9	99.3	102.2	103.1	102.7	106.0	105.4	117.3	112.0	113.5	116.6	102.1	121.6	123.3	121.8
Sweden	100	103.2	103.7	105.5	106.3	100.7	113.4	105.7	105.7	115.9	108.4	105.9	105.3	103.5	104.1	109.1	110.7
United Kingdom	100	101.9	107.5	110.9	109.2	115.5	119.8	123.5	130.9	143.1	149.6	150.3	157.6	158.9	158.1	163.4	171.9
Norway	:	:	:	:	:	:	100	102.8	89.2	93.0	88.8	87.8	85.0	85.6	88.9	70.1	85.5
Switzerland	100	101.3	103.6	107.0	103.4	105.0	106.7	112.9	113.4	110.8	110.9	110.9	115.7	115.0	116.4	124.5	:
Former Yugoslav Republic of Macedonia, the	:	:	:	:	:	:	:	:	:	:	100	93.0	96.6	101.9	104.6	108.4	115.0
Serbia	:	100	100.6	112.2	109.1	113.9	116.6	129.9	128.2	136.2	129.0	129.8	142.1	134.5	140.0	132.7	125.2
Turkey	100	112.8	116.3	118.1	123.7	114.1	106.9	110.0	111.7	109.2	98.8	103.8	121.6	129.7	132.6	130.3	:

(:) not available

(*) GDP in chain-linked volumes, reference year 2010

Source: Eurostat (online data code: env_ac_rp)

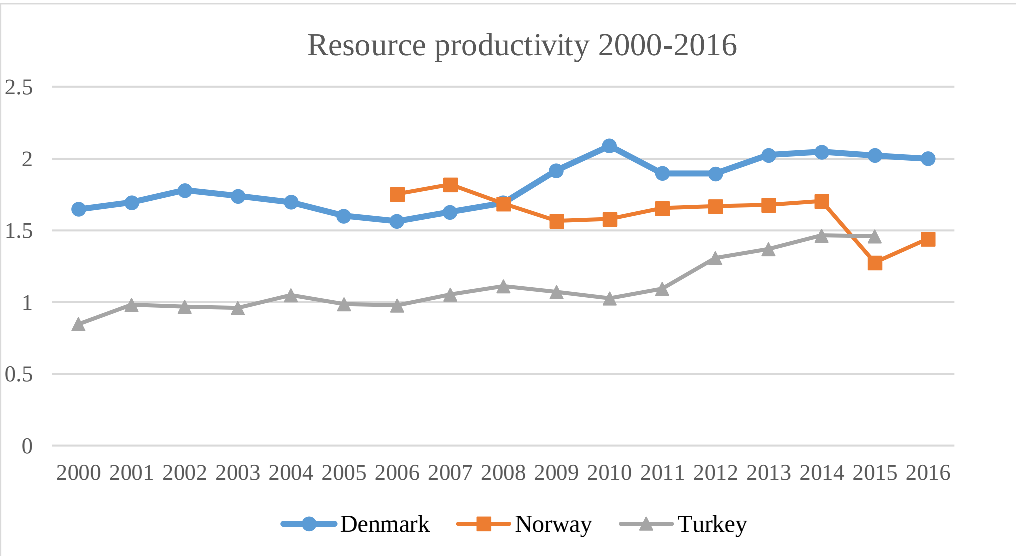

Figure 32: Resource productivity comparison between three countries Denmark, Norway and Turkey
Source: Eurostat, 2018

Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

Table 4: resource productivity, GDP and DMC, by country, 2016

	GDP_{PPS} per capita	DMC per capita	Resource productivity (GDP_{PPS}/DMC)	
	(PPS per capita)	(tonnes per capita)	(PPS per kilogram)	(Index EU-28 = 100)
EU-28	29 181	13.3	2.2	100.0
Belgium	34 192	12.6	2.7	123.8
Bulgaria	14 162	19.4	0.7	33.1
Czech Republic	25 574	15.6	1.6	74.5
Denmark	36 084	22.9	1.6	71.6
Germany	36 021	15.6	2.3	105.1
Estonia	21 890	25.2	0.9	39.5
Ireland	52 540	22.2	2.4	107.5
Greece	19 698	11.6	1.7	77.4
Spain	26 720	8.7	3.1	140.1
France	30 442	10.9	2.8	127.1
Croatia	17 458	10.1	1.7	78.3
Italy	28 247	8.5	3.3	151.0
Cyprus	24 072	16.7	1.4	65.6
Latvia	18 832	20.2	0.9	42.5
Lithuania	21 978	15.7	1.4	63.6
Luxembourg	75 356	25.8	2.9	132.7
Hungary	19 651	12.0	1.6	74.3
Malta	27 485	14.0	2.0	89.4
Netherlands	37 195	9.7	3.8	174.4
Austria	37 182	20.4	1.8	83.0
Poland	20 153	17.7	1.1	51.8
Portugal	22 564	14.8	1.5	69.3
Romania	16 964	24.6	0.7	31.3
Slovenia	24 083	12.8	1.9	85.5
Slovakia	22 418	13.3	1.7	76.4
Finland	31 925	31.5	1.0	46.1
Sweden	35 992	22.7	1.6	72.2
United Kingdom	31 394	8.6	3.6	165.5
Norway	43 281	30.0	1.4	65.5
Switzerland (1)	48 061	11.4	4.2	192.4
FY Rep of Macedonia	10 887	9.0	1.2	55.0
Serbia	10 683	16.9	0.6	28.7
Turkey (1)	18 773	12.9	1.5	66.3
Bosnia and Herzegovina (1)	8 045	9.3	0.9	39.4

Note: GDP in current prices, Purchasing Power Standards (PPS)

(1) 2015 instead of 2016

Source: Eurostat (online data codes: env_ac_mfa, nama_10_gdp, demo_gind)

Source: Eurostat

Dashboard Indicators

Domestic Material consumption

It is "abbreviated as DMC, measures the total amount of materials directly used by an economy and is defined as the annual quantity of raw materials extracted from the domestic territory, plus all physical imports minus all physical exports" (Eurostat, 2017)[19] Facts and Figures (including GDP and DMC) about Norway are given below.

Data collected from; ().

GDP: EUR 378 billion (equivalent to 2.7 % of EU-28 total in 2014)

Per person GDP: EUR 48,900 (in purchasing power standard)
(178 % of EU-28 average per person in 2014)

Use of materials:
145 million tonnes DMC (equivalent to 2.2 % of EU-28 total in 2014)
28.2 tonnes DMC/person (215 % of EU-28 average per person in 2014)
Resource productivity 2.39 EUR/kg (121 % of EU-28 average in 2014)

Structure of the economy:
agriculture: 1.7 %
industry: 38.2 %
services: 60.1 % (2014 est.)

Surface area: 323,800 square kilometres (equivalent to 7.3 % of EU-28 total)

Population: 5.1 million (equivalent to 1.0 % of EU-28 total)

Figure 33: Facts & Figures Norway
Source: Eurostat, European Environmental Agency, Country profile Norway, 201620.

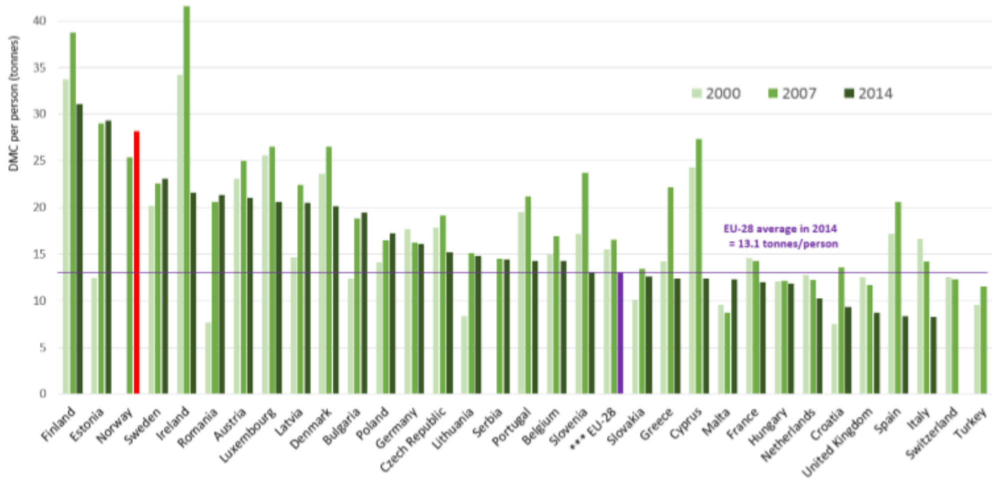

Figure 34: Use of materials (DMC) per person, participating countries and EU-28, 2000, 2007 & 2014

[19] http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Domestic_material_consumption_(DMC)
[20] file:///C:/Users/ynadeem/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/NORWAY%20-%20final%20country%20profile%20for%20web%2022%20May%202016.pdf

Co-funded by the Horizon 2020 programme of the European Union

Co-funded by the Chinese Ministry of Science and Technology

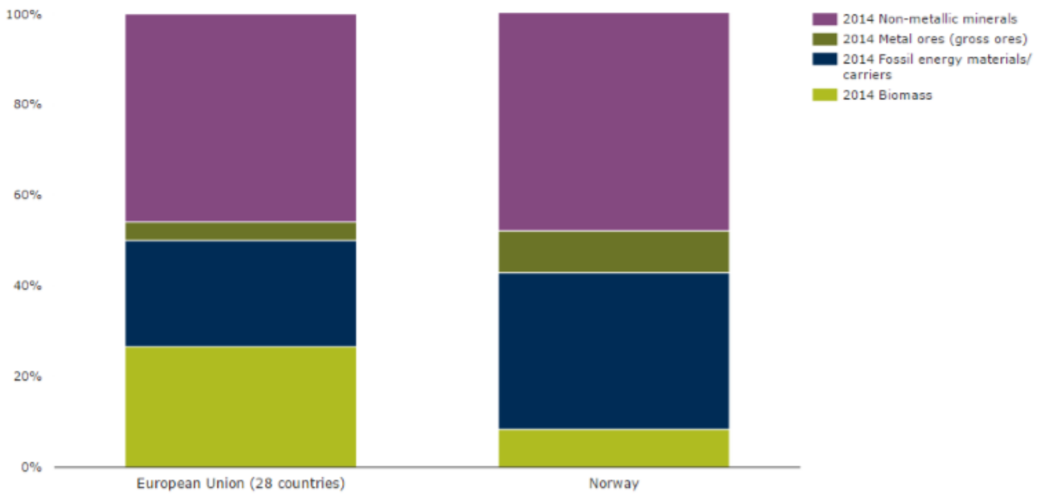

Figure 35: Domestic material Consumption by category, EU-28 average and Norway, 2014

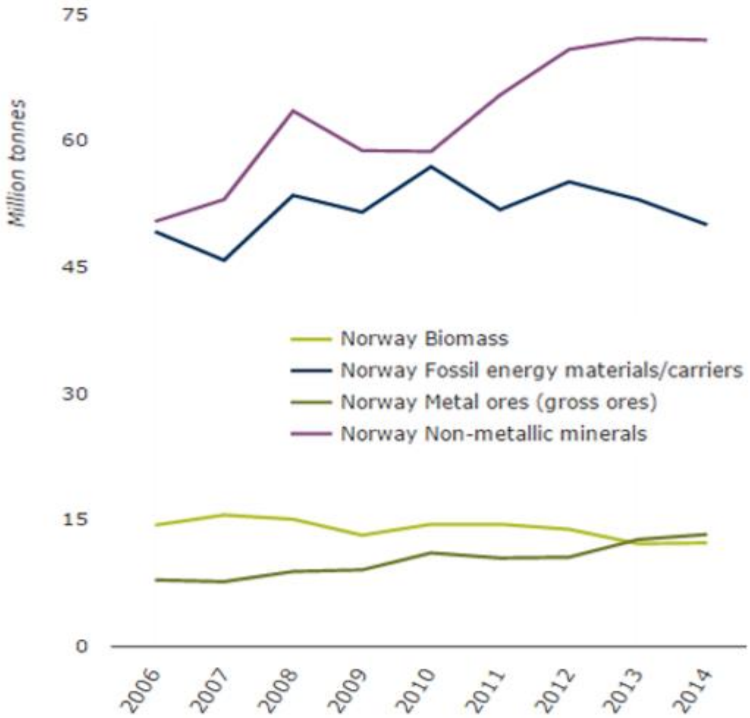

Figure 36: Trends in material consumption, Norway by category, 2006-2014

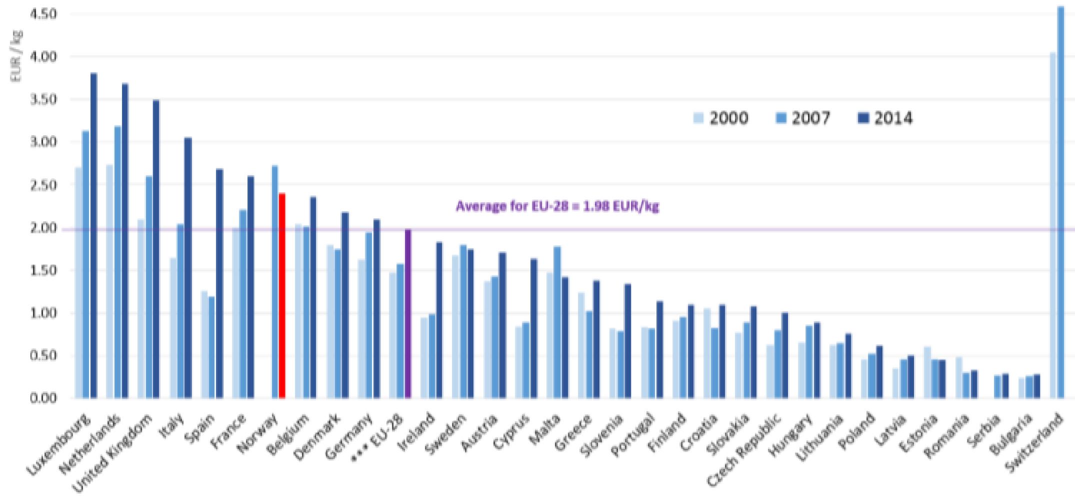

Figure 37: Resource productivity (GDP7DMC), participating countries and EU-28, 2000, 2007 & 2014

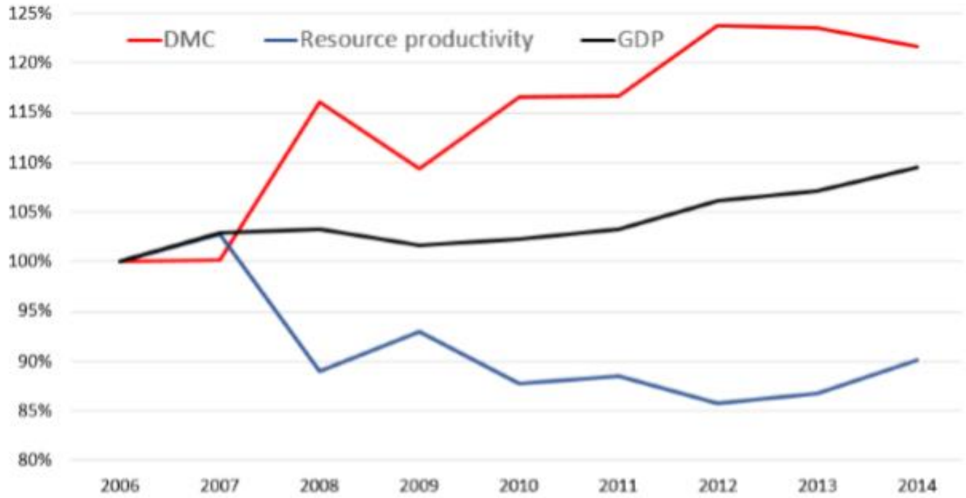

Figure 38: GDP, DMC and resource productivity trends, Norway (2006-2014)

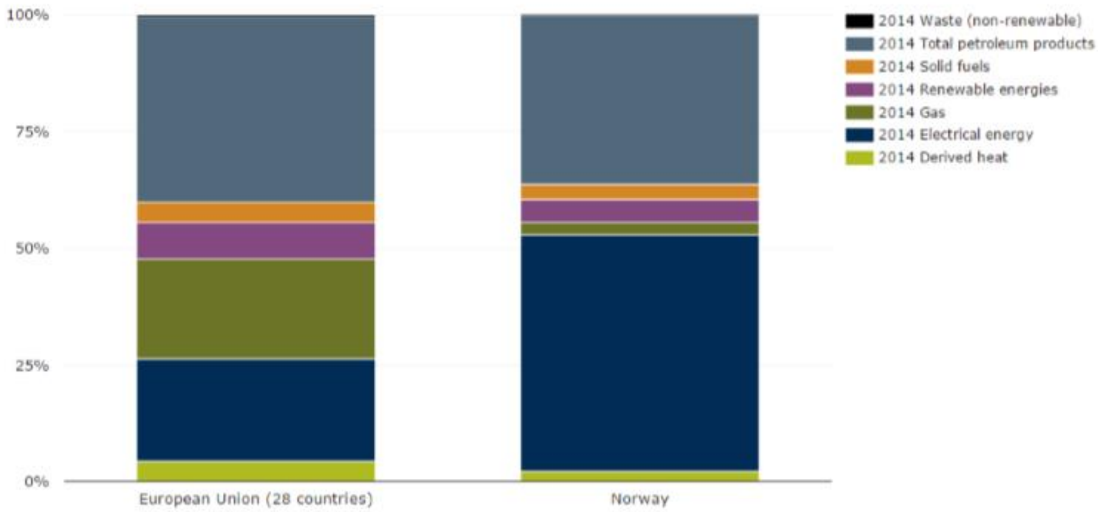

Figure 39: Share of final energy consumption by fuel type, EU-28 and Norway, 2014

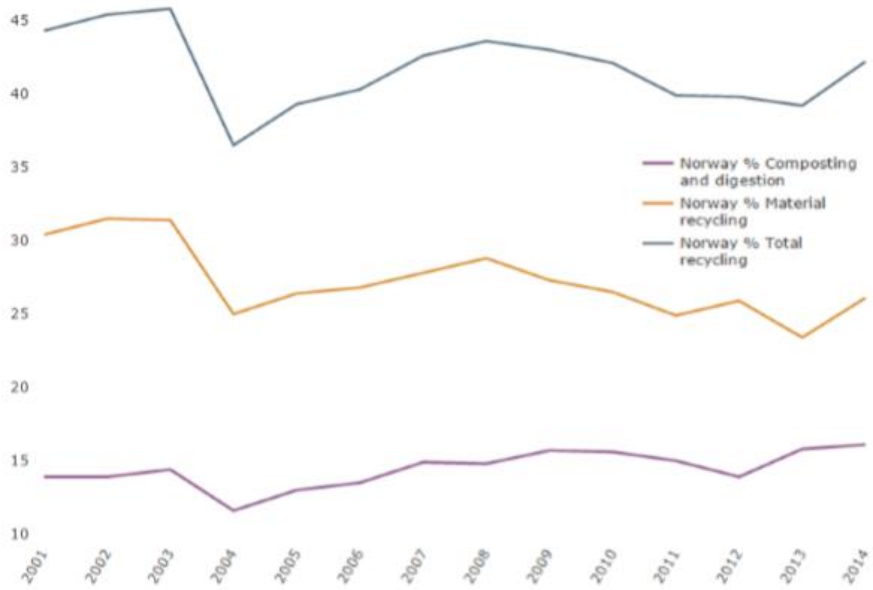

Figure 40: Recycling of municipal waste, Norway, 2001 - 2014

Land

The productivity of artificial land:

> "Productivity of artificial land is defined as the gross domestic product (GDP) of a country divided by its total artificial land. Artificial land consists of built-up areas (areas covered with buildings and greenhouses) and non-built-up areas (streets and sealed surfaces). Artificial land productivity shows whether built-up and non-built-up areas are efficiently used to generate added economic value. Data are available for the years 2009 and 2012. For 2009, the EU aggregate provided regards only 23 countries[21]. The total area of land in a country is a finite resource which provides important habitats and ecosystem services and, if used for urban development and infrastructure, is unlikely to be transformed back to a natural environment. However, land needs to be built up with infrastructure in order to increase the productivity of the economy (represented by *gross domestic product* (GDP)). It is therefore important to maximize the value of output per unit area of artificial land within a country and across the EU, with a long term goal of decoupling economic growth from the development of artificial land"[22] (Eurostat).

Unfortunately, the data on productivity of artificial land in Norway, is not available in Eurostat database system. Greenhouse, as a type of built-up areas, is closely related to urban agriculture. The data about greenhouses and nurseries in Norway are presented below;

"Figures for 2006 show that there are almost 740 greenhouse establishments in Norway. This is a decrease of 23 per cent since the last census in 1999. In the same period, the greenhouse area and production level have increased".

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[21] http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=t2020_rd100&plugin=1
[22] http://ec.europa.eu/eurostat/web/environmental-data-centre-on-natural-resources/resource-efficiency-indicators/resource-efficiency-scoreboard/dashboard-indicators/land

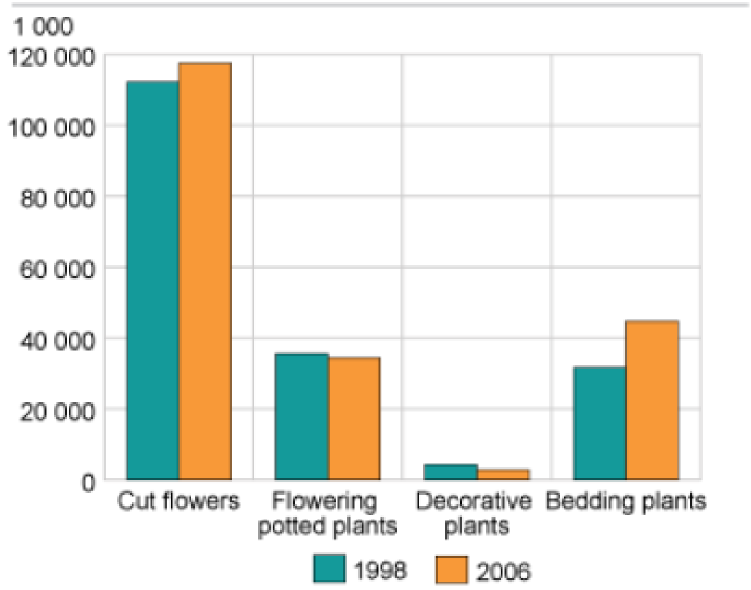


Figure 41: Produced quantity of goods for sale in greenhouses 1998 and 2006 (1000)

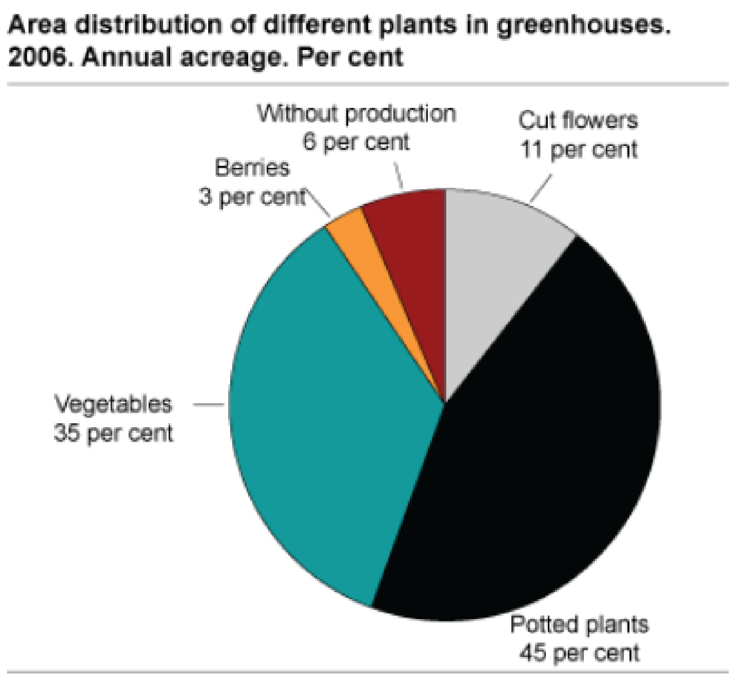


Figure 42: Greenhouses in Norway, 2006
Source: Statistics Norway, 2018

Water

The total area of land and freshwater in Norway is presented below;

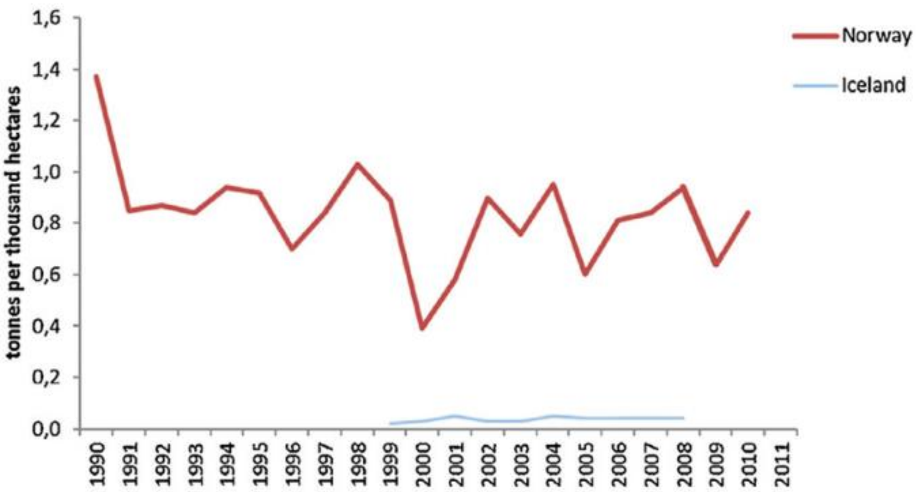
Land and fresh water. Square kilometres [1]			
	2018		
	In all	Land	Fresh water
The kingdom of Norway	**385 208**	**365 108**	**20 100**
The mainland	323 808	304 110	19 698
Svalbard	61 022	60 627	395
Jan Mayen	377	371	6

[1] Source: The Norwegian Mapping Authority (1:50 000) and The Norwegian Polar Institute (1: 100 000).

Figure 43: Total area of land and freshwater
Source: Statistics Norway, 2018

Water abstractions are a major pressure on freshwater resources, particularly from public water supplies, irrigation, industrial processes and cooling of electric power plants. It has significant implications for issues of quantity and quality of water resources.

A comparison between Iceland and Norway-gross water abstraction (1990-2007) is presented below; which is showing that Norway is reducing pressure on water resources by decreasing its abstraction;



Data sources: FAOSTAT (2016a)

Figure 44: Comparison between Iceland and Norway – gross water abstraction, 1990-2007
Source: Cook, D. 2018[23]

Carbon

“The Norwegian emissions of greenhouse gases increased by 2 per cent from 2000 to 2001, and have now reached the highest level ever recorded. The amounts of waste continue to increase, and each Norwegian generates close to 2 tonnes of waste every year. The discharges to water from the petroleum activities have increased significantly since the mid-1990s, but last year’s change was modest. The pressure on the Norwegian nature from

[23] file:///C:/Users/ynadeem/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/PhD_thesis_David_Cook.pdf

acidifying substances is decreasing. The discharges of the plant nutrients phosphorus and nitrogen to sensitive coastal areas have been reduced, but the nitrogen inputs still have to be reduced substantially to reach the reduction target. Norwegian greenhouse gas emissions rose by more than 8 per cent from 1990 - the baseline year of the Kyoto Protocol - to 2001, and are now at the highest level ever. The increase last year was 2 per cent. CO 2 accounted for three-quarters of Norway's aggregate greenhouse gas emissions in 2001. The most important emission sources are road traffic, oil and gas extraction, combustion in manufacturing industries and process emissions in metal production. (Statistics Norway, 2003). A comparative data of Greenhouse gas emissions per capita between Denmark, Norway and Turkey is presented below.

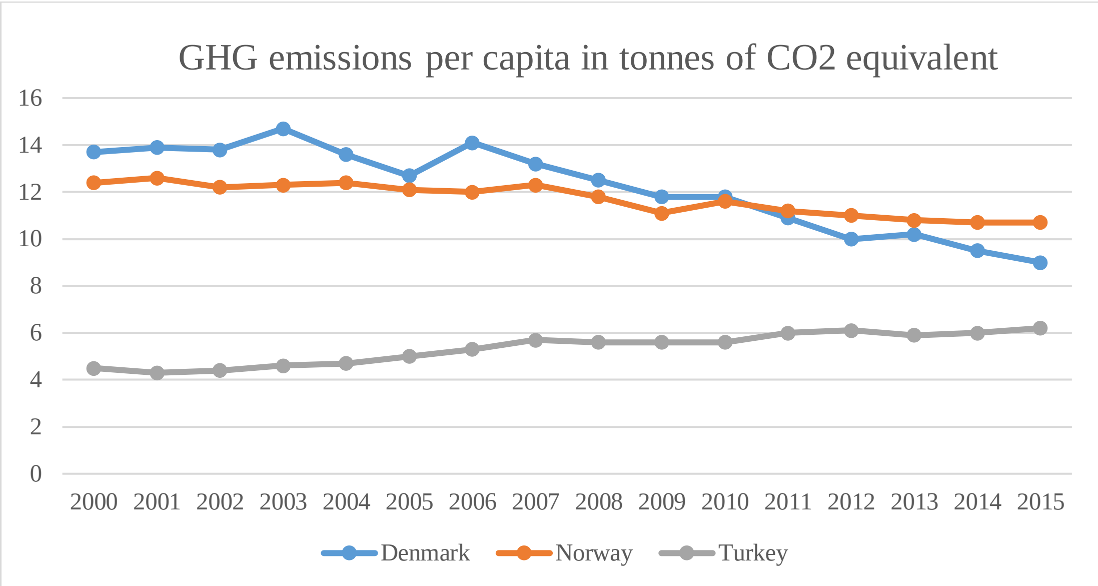


Figure 45: GHC emissions per capita, DK, NO, TK
Source: Eurostat

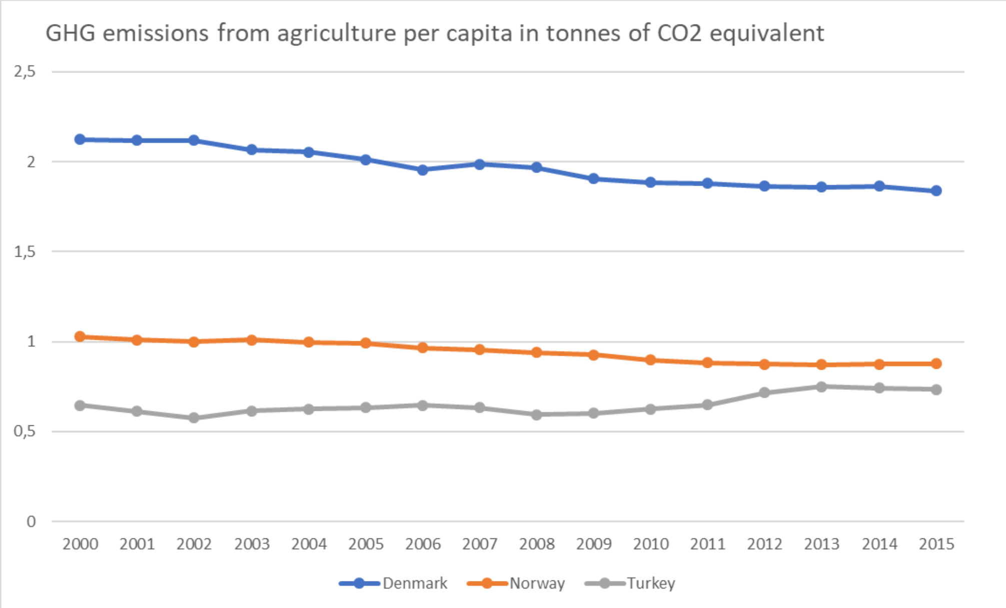


Figure 46: GHG emission from agriculture per capita in tonnes of Co2 equivalent
Source: OECD

Thematic Indicators

These are more or less similar to dashboard indicators. They also contribute to a complete picture on resource use, together with lead indicator. Most of them are indicators that report directly on policy implementation. So maybe used to analyse policy effectiveness. Others further elaborate upon the state of different natural resources, whether the pressures upon them, their status or the extent of impacts (Eurostat)

Thematic indicators “reflect a variety of different elements. One is the management of waste, being relevant to ‘closing the loop' in a circular economy. Another section deals with research and innovation with environmental objectives or outcomes. The allocation of resource to the innovation of this type as well as its outputs is assessed, as indicators of potential growth in the green economy. The indicators within the section titled ‘Getting the prices right' are concerned with the shift in taxation to tax bases with a negative environmental consequence, as a way of directing movement away from these activities” (Eurostat).

Household waste [1]

	Total			Per cent	
	2010	2015	2016	2010 - 2016	2015 - 2016
Total 1 000 tonnes	2 088	2 289	2 277	9	-1
Kg per inhabitant	424	439	433	2	-1
Sent to material recovery. 1000 tonnes. [2]	880	867	868	-1	0
Sent to material recovery. Kg per inhabitant. [2]	179	166	165	-8	-1
Income from fees per inhabitant (NOK)	885	953	993	12	4

[1] The figures have been adjusted to correct for interference of industrial waste in household waste
[2] Sent to material recovery includes composting and fermentation

Figure 47: Household waste production in Norway
Source: Statistics Norway

			Amount (number)		
			2015	**2016**	**2017**
0106 Fredrikstad	**Food- and other wet organic waste**	**In total**	0.0	0.0	0.0
	Hazardous waste	**In total**	1 686.0	461.4	1 130.1
	Other	**In total**	11 960.0	7 968.8	8 376.2
	Residual waste	**In total**	18 639.0	18 121.3	17 987.5
	Plastics	**In total**	290.0	256.8	246.6
	Garden waste	**In total**	2 872.0	1 363.6	773.9
	Metals	**In total**	1 506.0	1 068.5	1 245.1
	Glass	**In total**	681.0	697.7	662.6

Figure 48: Household waste production in Fredrikstad
Source: (Statistics Norway)

Table 5: Waste Treatment in 28 Europen Countries, including IS and NO

	Total (million tonnes)	Landfill	Incineration	Energy recovery (%)	Backfilling	Recycling
EU-28	2 319.5	47.4	1.5	4.7	10.2	36.2
Belgium	42.8	8.2	4.3	13.6	0.0	73.9
Bulgaria	175.7	97.9	0.0	0.1	0.0	2.0
Czech Republic	19.9	17.3	0.4	5.1	29.1	48.1
Denmark	17.7	21.7	0.0	20.7	0.0	57.6
Germany	370.7	19.2	2.3	10.5	25.3	42.7
Estonia	20.7	65.6	0.0	2.5	11.9	20.0
Ireland	10.0	42.6	0.1	7.2	37.4	12.7
Greece	67.1	88.4	0.0	0.2	8.1	3.2
Spain	103.4	47.9	0.0	3.4	12.6	36.1
France	299.7	29.3	2.0	4.5	10.7	53.6
Croatia	3.5	51.1	0.0	1.4	2.0	45.5
Italy	129.2	16.0	5.2	1.6	0.2	76.9
Cyprus	1.8	58.9	0.0	1.7	25.9	13.5
Latvia	1.9	34.8	0.0	8.7	0.9	55.5
Lithuania	4.5	67.6	0.1	4.1	2.5	25.8
Luxembourg	8.5	38.3	0.0	2.5	16.0	43.3
Hungary	13.7	39.4	0.7	8.9	3.7	47.3
Malta	1.6	28.9	0.4	0.0	37.5	33.3
Netherlands	130.6	45.4	1.0	7.9	0.0	45.7
Austria	53.9	38.6	0.2	6.5	20.1	34.7
Poland	182.4	24.9	0.4	2.7	21.5	50.5
Portugal	9.9	31.8	10.0	3.1	0.0	55.0
Romania	172.2	94.4	0.0	1.3	0.6	3.7
Slovenia	5.4	9.2	0.6	4.9	33.5	51.8
Slovakia	7.1	53.8	0.8	4.4	0.0	40.9
Finland	93.3	80.9	0.5	4.8	0.0	13.8
Sweden	163.3	84.4	0.1	4.7	1.6	9.3
United Kingdom	209.0	41.5	3.6	0.9	10.4	43.6
Iceland (¹)	0.5	30.7	0.0	2.7	0.6	66.0
Norway	11.7	17.9	0.5	35.8	5.3	40.5
Montenegro	1.0	98.8	0.0	0.1	0.0	1.0
Former Yugoslav Republic of Macedonia	1.5	98.7	1.3	0.0	0.0	0.0
Albania	1.2	74.8	3.1	0.5	0.0	21.6
Serbia	49.4	97.3	0.0	0.1	0.0	2.6
Turkey	79.3	70.2	0.0	0.7	:	29.0

Source: Eurostat[24]

Waste and Recovery

Increase in waste volumes, but more is recovered

"A total of 11.9 million tonnes of waste was generated in Norway in 2014. This was an increase of 7 per cent from the year before. Industrial waste accounted for 22 per cent of the total waste quantity, while households contributed to 20 percent. Norwegian government has a target which states that the total quantity of waste shall be considerably lower than the growth in the economy. Overall, for the entire period from 1995 to 2014, the quantity of waste grew by 60 per cent, while GDP increased by less than 50 per cent" (Norwegian Environment Agency, 2016).

[24] http://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Waste_treatment,_2014-1.png

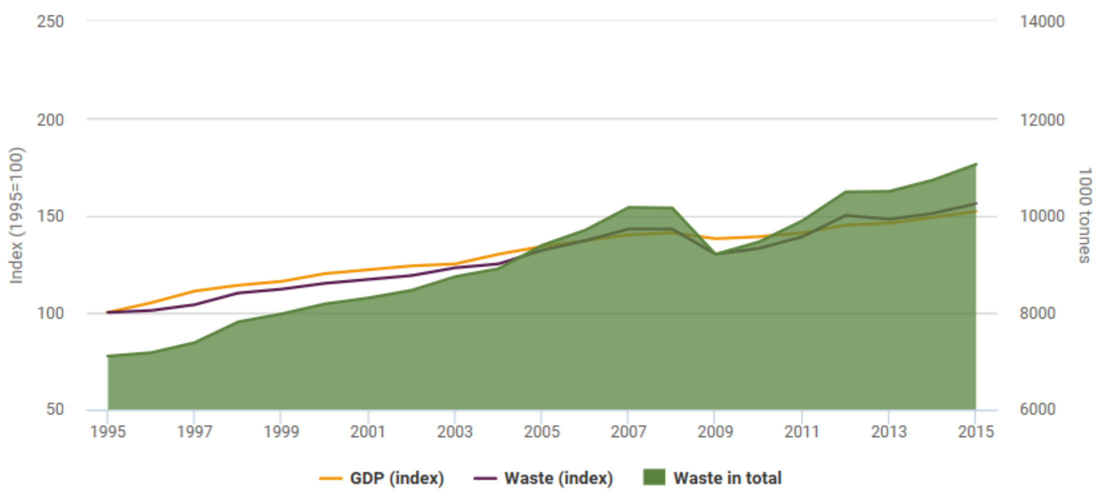


Figure 49: Trends in waste generation and GDP, Norway

"Twenty years ago, it was common to landfill most of the waste in Norway. Since then, the proportion of the waste that is landfilled has decreased, while the proportion that is recovered has increased correspondingly. In 2014, approximately 80 per cent of all waste was recovered. Waste contains resources, both energy and materials, which can be recovered in the recycling process. Material recovery involves using the materials as a raw material in new production of goods and energy is also saved by not using virgin materials. Aluminium recycling is a good example of such practices. If the waste is not landfilled but used to replace fossil fuels, greenhouse gas emissions are further reduced.The following figure shows that material recovery and incineration with energy recovery are the most common treatments today".

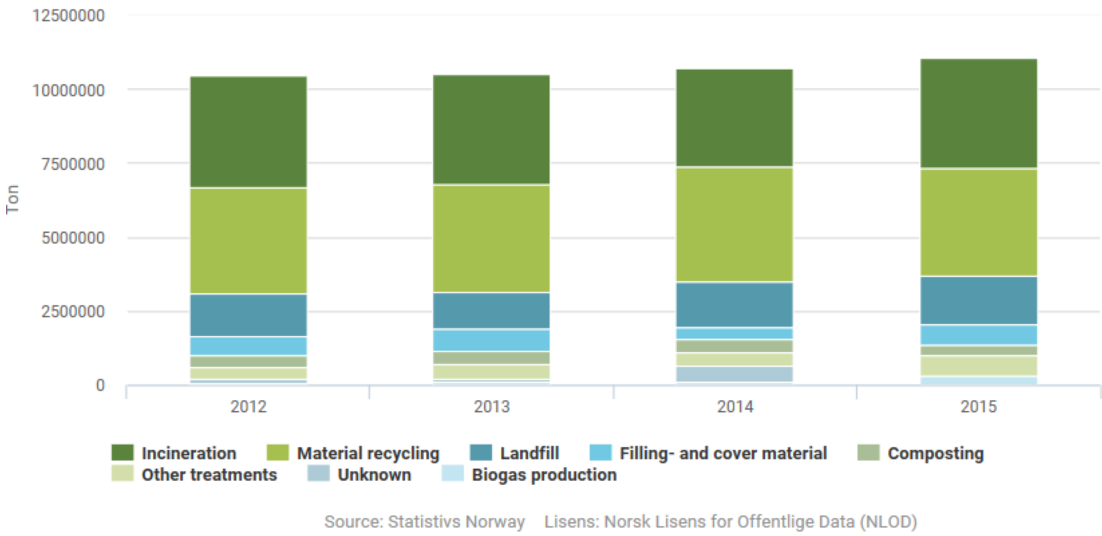


Figure 50: Non Hazardous waste in Norway, by method and Treatment

Waste management

The following figure 7 is showing the waste management hierarchy, which indicates that the waste management shall be implemented by minimizing inputs and outputs by using different approaches such as waste prevention, reusing, recycling, cascading (direct reuse of outputs but at a lower quality) and recovering (energy recovery, extraction of useful materials etc.).

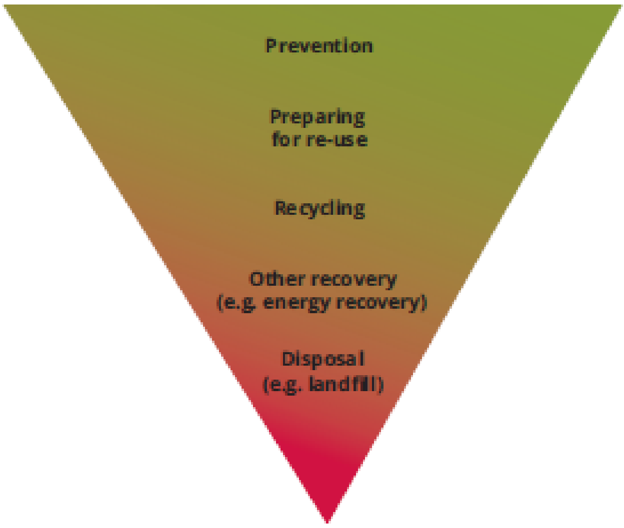


Figure 51:The waste management hierarchy. Source: European Environment Agency.

Increase understanding of the contribution of UA to C-E and green growth

Circular Economy

The circular economy is a popular concept sponsored by the EU, through many governments and many businesses around the world (Korhonen et al. 2018). The term circular economy recently used in sustainable community. However, it has been famous around the world. Although it's practical applications are not widely spreader yet. But we are very close to cross the limits of our natural resources, and our earth capacity to intake waste and pollution is rapidly decreasing. Therefore, to adopt CE concept is the best option for us. Circular economy is a general term. In which the waste concepts does not exists actually. Material circulating continuously through technical and biological cycles. CE system in detail has been explained in the following figure 8;

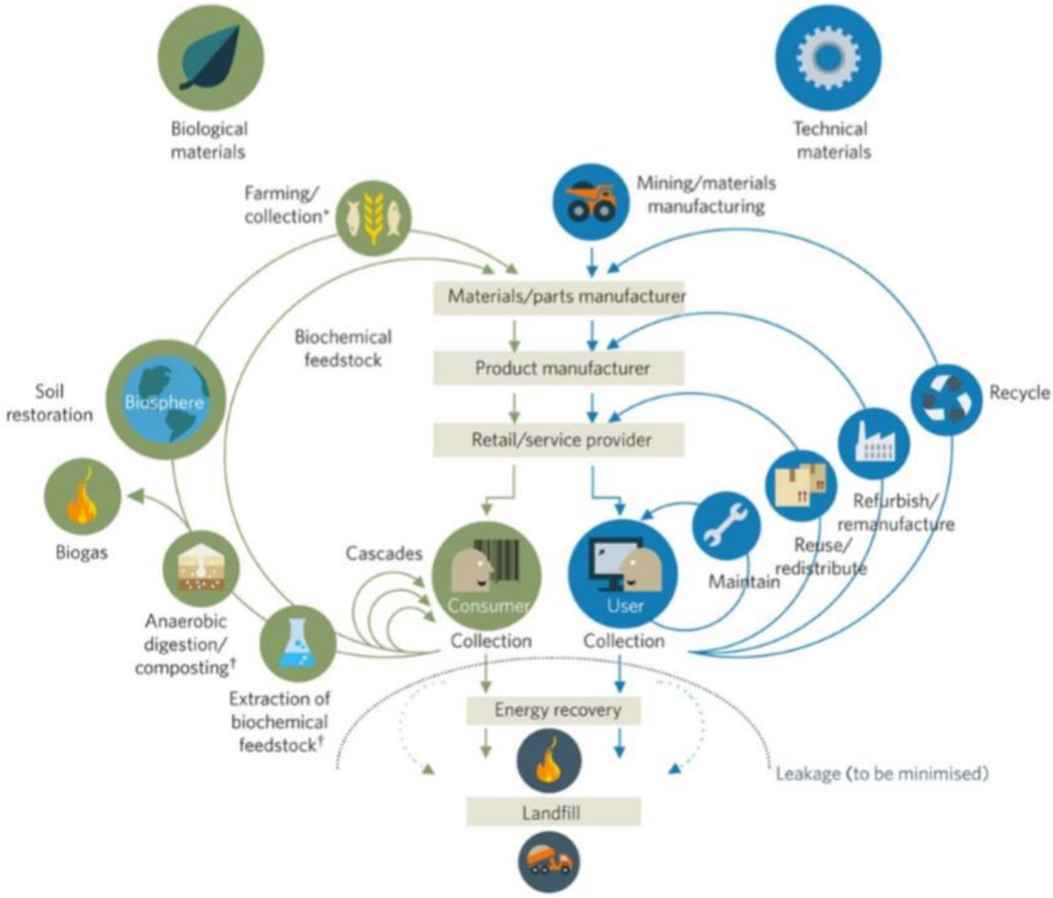


Figure 52: Concept of Circular Economy
Source: Ellen Macarthur Foundation, 2017

There are three principals of circular economy as presented in Ellen Macarthur Foundation website. These principals are as follows;

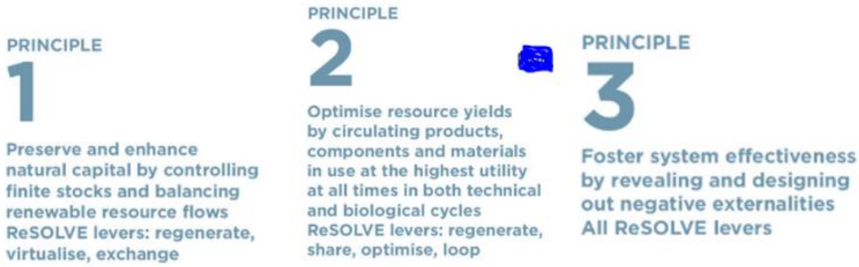


Figure 53: Principles of Circular Economy
Source: Ellen Macarthur Foundation, 2017

Ecosystems have a circular zero-waste metabolism, in the way that the waste from one organism is the food of another. Related to ecosystem, urban metabolism, however, is still far removed from it. As the circulation of flows is inefficient and incomplete, in most cases the circle is not closed, or even the linear model exists instead. Raw materials are extracted outside urban areas, transformed into goods and products and ultimately end up as waste, sewage and emissions beyond the city boundaries. For the cities to become more resource-efficient, the loop of urban cycles needs to be closed by applying innovative technologies, changing mindsets, institutional governance and supportive policy. The following figure 9 illustrates the circular economy as a closed-loop, which has been achieved/implemented by many industries. The urban metabolism can apply the same rationale, and its material and energy flows can be optimised by integrating all urban activities (industry, utilities, commercial, housing, urban and peri-urban agriculture), by involving all the actors (including investors and city residents) and by working with municipalities beyond the city limits (EEA, 2015).

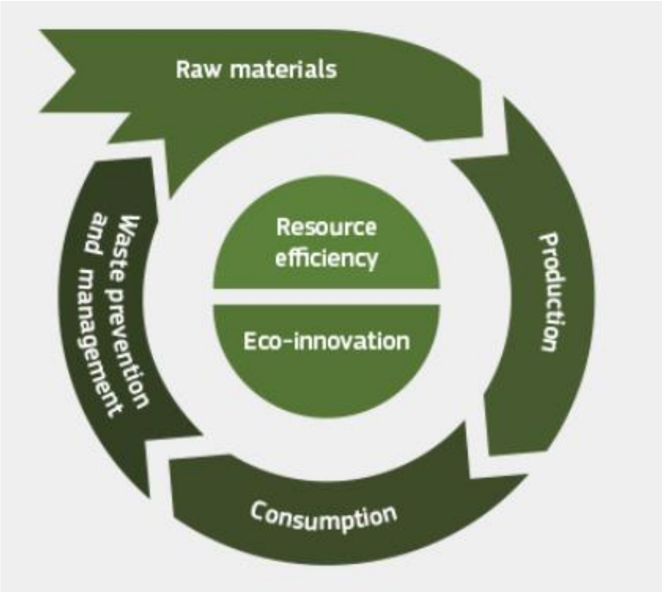


Figure 54: Green Growth and Circular Economy
Source: European Commission, 2017

Qualitative Data

Municipal Waste Production in Norway

"Municipal waste is defined as waste collected and treated by or for municipalities. It covers waste from households, including bulky waste, similar waste from commerce and trade, office buildings, institutions and small businesses, as well as yard and garden waste, street sweepings, the contents of litter containers, and market cleansing waste if managed as household waste. The definition excludes waste from municipal sewage networks and treatment, as well as waste from construction and demolition activities. This indicator is measured in thousand tonnes and kilograms per capita" (OECD, 2018)[25].

[25] https://data.oecd.org/waste/municipal-waste.htm

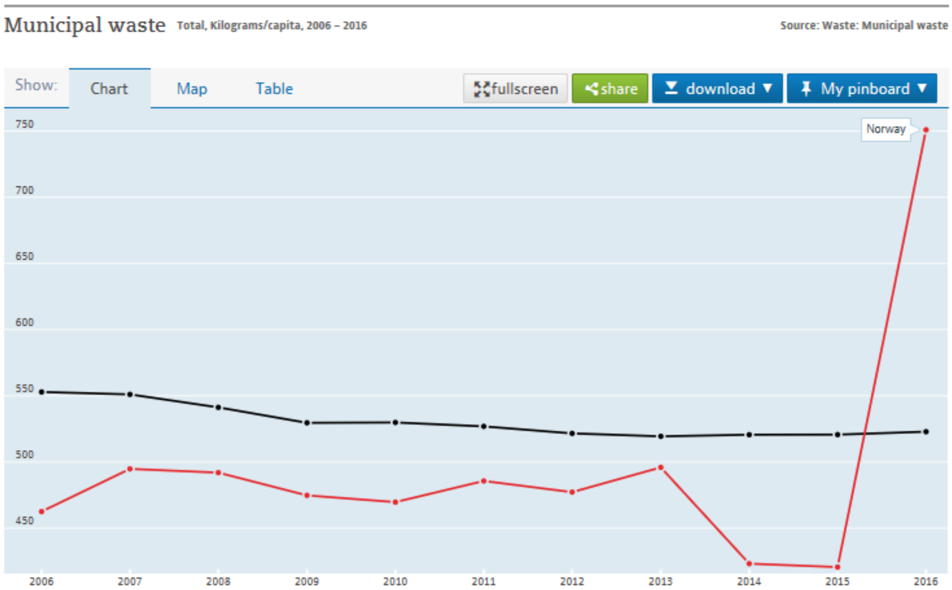


Figure 55: Municipal Waste Production in Norway, Kg per capita, 2006-2016

Table 6: Household waste – Østfold Region

		2015	2016
EKA01 Østfold	**Direct operating expenditures**	226 763	236 657
	Indirect operating expenditures (from form 23)	13 546	12 163
	Operating expenditures(direct operating expenditures + indirect operating expenditures)	240 309	248 821
	Calculated capital interest expenses (from form 23)	1 597	1 502
	Depreciation (form 23)	9 735	10 070
	Capital costs (depreciation + capital interest expenses)	11 332	11 571
	Other income	11 270	13 095
	Fee calculation basis (current costs + capital costs)	240 370	247 297
	Income from fees	246 187	247 892
	Deposition for funds	..	..
	Purchases financed from funds	..	..
	Balance full cost fund per 1 January	..	..
	Opportunity cost by locked-up capital in funds or projection of deficit	..	..
	Balance full cost fund per 31 December	..	..
	Purchases included in own production	35 885	35 209
	Wages	42 089	45 610
	Purchase of goods and services that replace municipal's own production	123 730	130 862
	Årsgebyr for avfallstjenesten - ekskl. mva. (gjelder rapporteringsåret+1)	..	39 117

Footnotes

See list over changes in regional classifications (in Norwegian).

.. = Data not available

Source: (Statistics Norway)

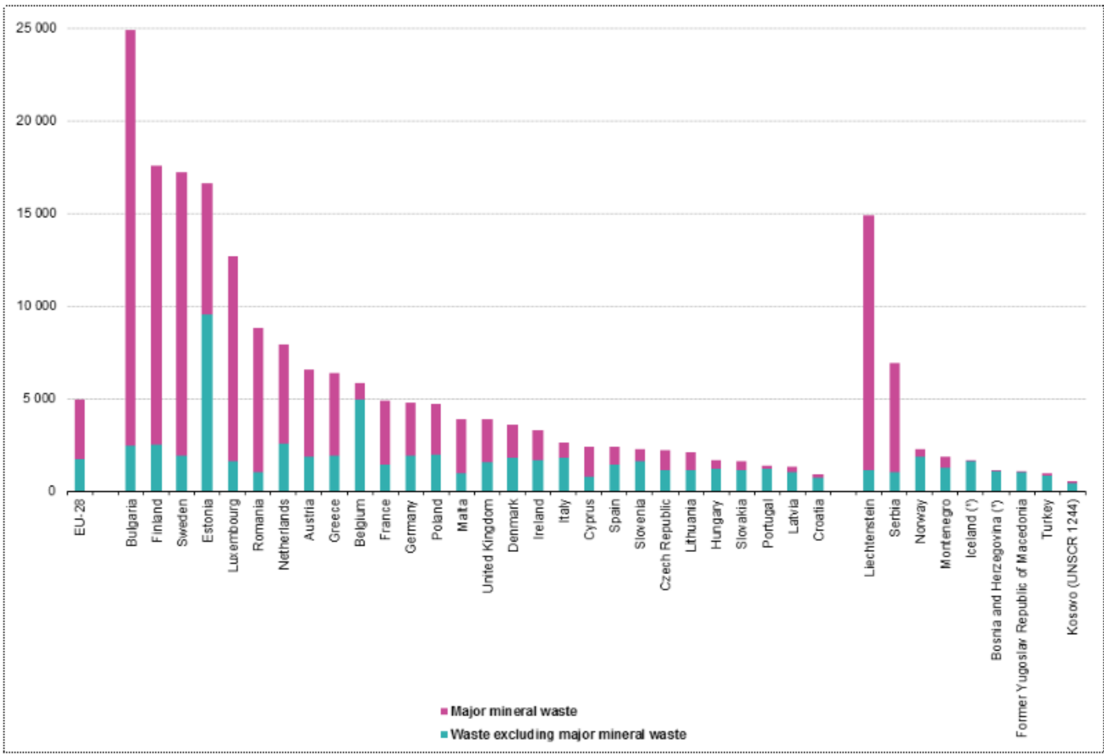


Figure 56: Waste generation in 28 EU and Norway, 2014
Source: Eurostat[26]

Resource efficiency in Fredrikstad

Fredrikstad will exhibit innovative solutions for water sanitation, storm-water and energy. These technologies will reduce water consumption, by using water-saving fixtures as vacuum toilets, facilitate recycling of nutrients to urban and peri-urban agriculture and thus, almost eliminate pollution of surface water. Biogas production from toilet waste (blackwater) and organic household waste (OHW) is a key treatment technology. CO2, heat and power from biogas combustion are utilized together with the nutrient-rich retention in a super-insulated greenhouse for local resource reuse and year around plant production.

In the “Showcase Fredrikstad,” the wastewater is separated into two fractions; toilet waste (blackwater) and greywater. A vacuum system is used for the collection of blackwater and grinded organic household waste and the following technologies are planned for the treatment of wastewater and OHW.

Blackwater and grinded OHW will be collected via a vacuum system and led to a biogas reactor (as shown in Fig. 10). The vacuum toilets will be dual flush and use about 0.5 liter per

[26] http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics

flush in average. In the biogas reactor, waste resources will be hygienized to satisfy the current regulations for use in plant production while producing biogas. The effluent from the biogas reactor must be further processed prior to reuse in urban agriculture. The non-decomposed organic matter is filtered off rendering a nutrient-rich non-smelling liquid. This liquid will be checked for content of harmful substances as microorganisms, heavy metals and pharmaceutical residues. If the content of harmful substances are at an acceptable level according to current regulations and guidelines, the liquid can be used for hydroponic growing in a greenhouse next to the biogas reactor. Production of Struvite (magnesium ammonium phosphate, MAP) will also be tried from the nutrient-rich liquid that comes from the biogas reactor. In principle, most of the nutrients and energy will be taken out on site so that any excess liquid will be hygienically acceptable (*i.e* bathing water quality). Struvite precipitation will provide low nitrogen and phosphorus content. The feasibility of the struvite extraction from the blackwater will be tested at NMBU laboratory at Ås. The project will show if the content is so low that the surplus liquid can be released to the storm-water network or must be added to existing waste water collection systems. Nevertheless, the amount of waste water system will be very small from this system - less than 10 liters per person and day and much lower load of nutrients and organic matter than in normal wastewater. Normal wastewater production is 150 liters per day in Norway.

The biogas will be burned continuously so that no gas is stored. Using a gas turbine this will generate both heat and power. The heat will be used to heat the greenhouse during the cold season and to produce hot water the rest of the year. The power will be used for lights in the greenhouse. The greenhouse will be super-insulated using soap bubbles (a recent Norwegian Dutch invention) so that production throughout the year is possible. CO_2 from combustion will also add to the greenhouse to increase plant production.

The grey water (water washing, kitchen and showers) will be treated locally next to the building where the greywater is generated. The greywater will be treated to good bathing water quality when it comes to indicator organisms. It is expected to achieve drinking water quality for nitrogen and <1ppm for phosphorus. Normally, this water can be released to the storm-water sewer or directly to a river or stream. Laboratory trials will also be performed where the treated greywater is upgraded to drinking water quality using membrane filtration.

Overall, the systems that will be demonstrated in Fredrikstad will lead to a significantly lower discharge regarding both volume and pollutant load than traditional plumbing fixtures. Water consumption can also be expected to be 20-30% lower than usual today.

This opens new possibilities for future development of municipal sewer handling. If new development does not increase the burden on the existing systems (By using systems as described above) the existing collecting sewers and corresponding treatment systems may operate longer without new investments and upgrading. In Fredrikstad today there are plans for upgrading of the sewer networks and treatment systems that will be both very costly and may require increased pumping and consequently energy use.

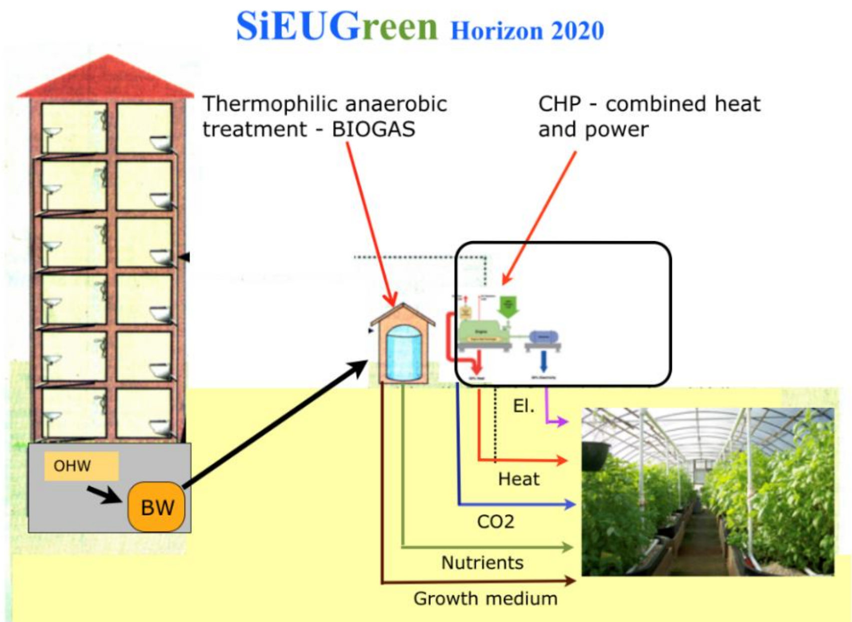


Figure 57: The system handling of toilet waste and organic household waste (OHW) in Fredrikstad

Toilet waste will be collected using vacuum toilets. OHW will be grinded and collected by vacuum. Toilet waste and OHW will be mixed-used as a substrate for biogas production. The gas will be burned and generate heat end power. All resources will be used in a greenhouse adjacent to the biogas reactor.

Summarizing the findings on Resource Efficiency

- Resource efficiency main goal is to generate less waste and increase economic impacts. That will ultimately reduce the emission of carbon into the atmosphere.
- Resource efficiency is important for urban agriculture.
- Emerging green technologies can be used to mitigate environmental impacts
- Resource productivity in Euro per kg of Norway is higher than turkey nut less than Denmark
- The Norwegian emissions of greenhouse gases increased by 2 per cent from 2000 to 2001, and have now reached the highest level ever recorded

- In Norway Greenhouse gas emission per capita is higher than Denmark Turkey (2012-2015)
- In Norway Greenhouse gas emission from agriculture per capita is lower than Denmark but higher than turkey
- A total of 11.9 million tonnes of waste was generated in Norway in 2014. This was an increase of 7 % from the year before
- Overall, for the entire period from 1995 to 2014, the quantity of waste grew by 60 per cent, while GDP increased by less than 50 per cent
- Green growth and Circular economy is the best option for waste management and to reduce the load on natural resources of our planet.

Module 4 Societal inclusion

Two recently published reports discuss the development of the city center of Fredrikstad, from two different perspectives:

The NIBR report *Vitalisering av sentrum. Eksempler fra byene Bodø, Drammen, Fredrikstad og Tromsø* (Vitalizing the city center. Examples from the cities Bodø, Drammen, Fredrikstad og Tromsø), maps and describes beneficial factors and challenges for vitalizing the city centres. http://www.hioa.no/content/download/144873/4072476/file/2018-1.pdf

There exist different design principles for city development, and one of them is related to proximity. The five minute city is described by (Chu & Hong, 2016:360-361):

> *The idea is relatively simple: everything that a person requires on a daily basis should be reachable within a five minute walk from a public transport stop. This normally includes the home, educational facilities, a market or other shopping facilities, a public park or open area, and potentially also the workplace. With the average walking speed of a person calculated to be 5 km/h, the distance an average person will cover in five minutes is 420 m. The Five-Minute City is essentially a spatial module that contains the essential aspects of everyday life, scaled to be walkable, cyclable, and/or easily reachable by public transport, thus promoting at once healthy behaviour and forms of mobility that are low emission and often also more socially equitable. The presupposition of the inclusion of a public transport system, existing or proposed, in the scope of the project indicates a clear reorientation of a city away from the private car toward public forms of transportation. The Five-Minute City principle also promotes multi-functional zoning and transport-oriented development, one that features a mix of housing, commercial, and educational facilities, as well as recreational areas around public transportation nodes, with the goal of fostering a more vibrant and diverse urban life. At the module scale, these elements can remain relatively modest. However, the principle remains that within a five-minute walking radius of any public transport stop, more than simply housing or commerce should be found. Despite its simplicity, this design principle can yield a great variety of solutions. Programming of the daily needs alone varies depending on the society or culture. It can also yield highly distinct urban districts, depending on the parameters of density, plot ratio, lot coverage, and other urban design regulations.*

The report *Case Fredrikstad – Bylaboratorium for nærhetsbyen (2014)* written in collaboration between the Municipality of Fredrikstad and Rodeo architects is inspired by such principles as the five minute city. The development of Cicignon Park is also inspired by this way of planning, but in an even smaller scale. A challenge may be to merge these notions of city planning. This is also illustrated in the social module of the municipal master plan (p.16)

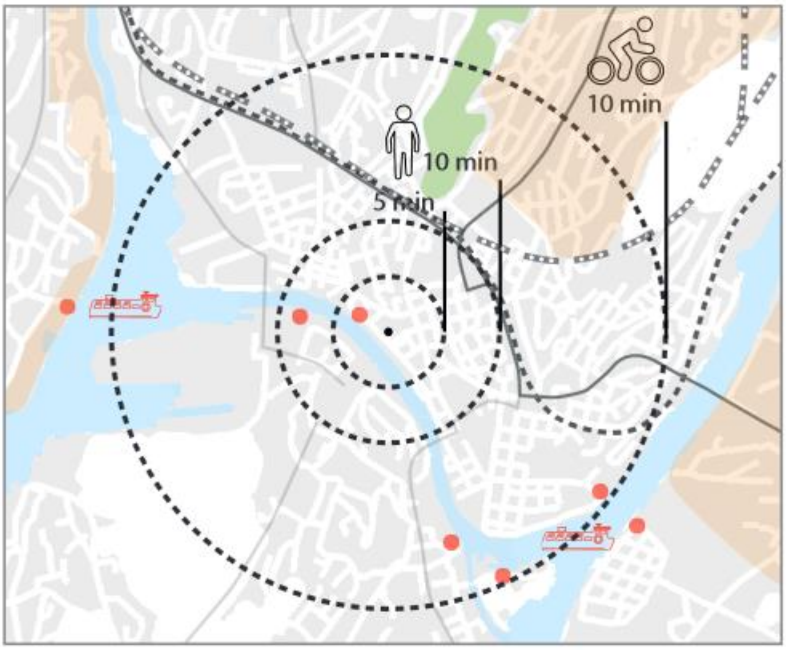


Figure 58: Two-five, ten-fifteen minute city

Social intentions for Cicignon Park

A presentation given by Nordic Group Development AS at the city hall of Fredrikstad 22. April 2015 focused on a vision with three specific dimensions for Cicignon: High level of environmental profile, High level of architectural quality and High level of well-being. The aspect of well- being was further specified in three aims: 1) Attractive living environment 2) High satisfaction 3) Strong identity / belonging. NCs starting point for creating a good living environment was described as:

> *The physical structures that contribute to the development of social life and co-location and walking and cycling distances between the daily errands have impact on health and well-being. The housing environment and area planning shall take into account human needs for security, belonging and activity opportunities. Therefore, we must develop and provide semi-private and semi-public zones related to the homes that allow residents to get to know their neighbors and develop a positive neighborhood.*

To achieve their goals of wellbeing they described the following actions:

- *Develop park-like living area with balconies and with green areas and gardens*
- *Shopping center with grocery store, flower shop, hairdresser, doctor, dentist, pharmacy, fitness center etc.*

- *Social infrastructure. Places to meet, eating places, kindergarten, school etc. Diversity of all age groups*

The architect office that won the competition, Niles Torp, also gave a presentation. They focused on their own competence and described their previous national and international projects. Their presentation of the Fredrikstad case was titled 'Fredrikstad hospital becomes Cicignon Prak'. They focused on: 1) the distance to close and not that close areas in Fredrikstad 2) The connection of the heart of Cicignon within the Cicignon area, and to related areas 3)The buildings as models and 3D 4) The blocks (kvartalene) 5)The design process of the area 6) design process on the tall buildings 7) sun, shadow and view 8) Traffic and public transport 9) apartments 10) School, kindergarten, business, cafe and 10) BREEAM 11) Cicignon park as a Green district.

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WRAP (The Waste and Resources Action Programme), 2018

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Co-funded by the Chinese Ministry of Science and Technology

Appendix 1

Art Type-code	Art type name	Number of Surfaces	Area m2	Area in ha (approx.)
11	Living	3260	33346024.39	3334.61
12	Transport and Communications	4901	6197738.11	619.78
21	Fully Cultivated Soil	1871	71776696.2	7177.67
22	Surface like Soil	32	209599.6674	20.96
23	Cultivated Pastures	241	2175748.647	217.58
30	Forest	6489	147428441.5	14742.85
50	Open landmark	6169	37358854.19	3735.89
60	Swamp	126	1203489.341	120.35
81	Freshwater	712	6317945.792	631.8
82	Ocean	43	555786906.3	55578.7

Information provided by Fredrikstad Kommune spokesperson (13-06-2018)

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Sino-European Innovative Green and Smart Cities

Deliverable 1.1

Maps of quantitative and qualitative data for each of the showcase locations - Annex 4. Beijing report

Lead Partner: CAAS
Lead Authors: Liu Yahui

Due date: 31/01/2020
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Introduction

The total area of Beijing is 16410.54 square kilometres. As of September 2019, Beijing has jurisdiction over 16 municipal districts (see Figure 1). By the end of 2018, the resident population of Beijing was 21.542 million, of which 7.446 million were resident permanent residents, accounting for 35.5% of the resident population. Among the resident population, the urban population is 18.634 million, accounting for 86.5% of the resident population. The resident population density is 1,313 people per square kilometre.

The composition of the three industries in Beijing is 0.4:18.6:81.0, which is 0.4% of the primary industry. There are 1,172 agricultural sightseeing parks in the city, with a total income of 2.73 billion yuan. The actual number of folk tourism operators was 7,783, and the total income was 1.3 billion yuan. Facility agriculture and seed industry realised revenues of 5.17 billion yuan and 1.24 billion yuan, respectively. The total output value of agriculture, forestry, animal husbandry and fishery reached 29.68 billion yuan.

Beijing land supply: The total supply of state-owned construction land for the year is 2273.3 hectares. Among them, residential land is 1149 hectares (including 344 hectares for affordable housing projects), 91.4 hectares for industrial and mining storage, 181.3 hectares for commercial use, and 851.6 hectares for other infrastructure such as infrastructure. The urban green coverage rate is 48.44%.

In 2018, the number of new jobs in urban areas reached 13.61 million, an increase of 100,000 over the same period last year. At the end of 2018, the number of employed people in urban areas was 43.19 million. The urban registered unemployment rate at the end of 2018 was 3.80%.

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Figure 1: Municipalities that are part of Beijing jurisdiction

Beijing showcase in SiEUGreen Project

Beijing Sanyuan Agriculture Co., Ltd. is a modern urban agriculture professional company under the Beijing Shounong Group, covering an area of 1800 acres. Sanyuan Farm is located in Shangzhuang Road, Haidian District, Beijing, northwest of Beijing, about 30 kilometres from the centre of Beijing.

Sanyuan Agriculture Co., Ltd. was established in 2001 and started to operate the Citizen Farm Project in 2008. It has been ten years old. The citizen farm is the first step for Sanyuan agriculture from traditional agriculture to leisure urban agriculture, and it is also the initial business and products of Sanyuan Agriculture. The public farms cover a total area of 260 acres, ranging from 50 square meters to 120 square meters, with a total of more than 1,400 small plots. The farms rent these plots to the public in the form of annual rents to meet the urban residents' pursuit of green, natural and environmental protection. Demand, provide a venue for the public to make farming activities part of the life of urban residents.

Sanyuan Farm takes 500-mu science park and ecological technology multi-storey greenhouse as the activity venue. With the 24 solar terms as the activity background, the park's various formats and products are endowed with cultural connotation and educational significance, and the farming culture is the main subject of education. The four seasons of agriculture are characterized by education, with educational activities such as farming experience, pastoral

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development, agricultural product food processing, agricultural product handicraft processing, and scientific experiments as educational carriers, and educational activities for the majority of primary and middle school students and parent-child families.

Image 1: Group of visitors to Sanyuan Farm

Image 2: The entrance of Sanyuan Farm

Image 3: People growing food on the farm

Image 4: School kids visiting the farm

Image 5: Plot for renting

Image 6: Plot for renting

Methodology

Several methods were employed to develop this report.

- Desktop research: academic papers, research reports, public data, statistical yearbooks;
- Interviews with community residents (to understand their perceptions and needs about UA); with community managers (to understand the basics of the community) and with event organizers of the Sanyuan farm (to understand the promotion and sustainability of UA

- Field studies such as:

    - Visit Laiyuan, Sanyuan Farm, and urban communities to learn about the promotion of urban agriculture.
    - On August 29, 2019, Oslo, to understand the development of urban agriculture within the city.
    - September 20, 2019, Beijing Green Valley Company, understand the progress of paper growing vegetables
    - September 30-October 1, 2019, Wuyuan County, Hebei Province, visited the survey of poor residents' communities to understand the promotion of urban agriculture in poor communities and the improvement of life for the poor.
    - October 5, 2019 Community of residents in downtown Beijing, to understand the promotion of urban agriculture in the residential community of the central area of the big city
    - Information that can be obtained: community residents, poor people, the views of the elderly on urban agriculture, the economic and social benefits of urban agriculture to these people, the development of urban agriculture and the problems they face.

One of the limitations of the study is the lack of interviews and investigations with government authorities

Module 1 LAND USE

Beijing urbanization rate of 86.5% in 2018. The urban green coverage rate in Beijing is 48.44%, and the per capita housing construction area is 32.56 square meters.

At the end of 2017, the area of cultivated land in Beijing was 320,5959.75 mu. In 2017, the agricultural land of Beijing was 1720.08 million mu, including 320.60 million mu of cultivated land, 1,992,200 mu of garden land, 11.1761 million mu of forest land, 0.28 million mu of pasture and grassland, and 833,000 mu of another agricultural land. The construction land is 5,403,100 mu, and the permanent basic farmland is 1,156,400 mu.

The total land supply of state-owned construction land in Beijing is 1922.40 hectares, including 223.49 hectares for industrial and mining storage, 162.74 hectares for commercial use, and 771.13 hectares for residential land. The public administration and public service land are 508.53 hectares, the transportation land is 191.11 hectares, and the water and water conservancy facilities are 65.40 hectares.

In 2017, the comprehensive land price of construction land in Beijing was about 38,673 yuan / square meter, the highest in the country.

The agricultural land in Beijing is mainly distributed in the suburbs, and the agricultural land data of various districts and counties have not yet been collected.

Institutional aspects

China's national land space planning system includes a master plan-detailed plan-special plan, which is divided into five levels, national-provincial-city-level-county-township-level, and the national land space master plan is the basis for detailed planning and special planning.

The national land and space planning is a global arrangement for the national land space. It is the national policy and general outline for the protection, development, utilization and restoration of national land space. It is organized by the Ministry of Natural Resources and relevant departments and is issued by the Party Central Committee and the State Council.

The provincial-level land space planning is the implementation of the national land space planning and guides the city and county to prepare the national land space planning. It is prepared by the provincial government and submitted to the State Council for approval after deliberation by the Standing Committee of the same level.

The urban and rural spatial planning of cities, counties and towns is a detailed implementation and specific arrangement for the higher-level planning. According to the principle of adapting to local conditions, the city, county and township land space planning will be compiled, or it can be compiled in several townships and towns, organized by the local people's government. prepared by.

The detailed planning is organized by the municipal and county-level natural resources departments and reported to the government at the same level for approval, mainly at the village level.

The Beijing Municipal Government has issued a master plan for land and space, combined with urban industrial development, land nature, and urban construction. Each district (Chaoyang District, Tongzhou District, etc.) prepares specific plans according to the guiding principles of the overall plan. UA is part of suburban agriculture or urban agriculture in Beijing's land space planning and has not received special support.

UA generally plays the role of economic benefits of urban agriculture in the planning system, and the government and some agricultural enterprises are promoting the development of urban agriculture. Within the urban community, mainly residents and public welfare agencies are promoting UA.

Spatial & Functional aspects of UA

Urban agriculture in China mainly refers to suburban agriculture or urban agriculture. It provides agricultural products and leisure functions for the residents of the city around the agriculture around the big cities. Followed by a small, small balcony garden inside the residential community.

Suburban agriculture mainly provides leisure and entertainment places for urban residents and provides some agricultural products for urban residents. The main role is to let urban residents experience agriculture, leisure and entertainment.

In the suburbs of Beijing, the UA development model is mainly in the form of a citizen garden. The farm divides the land into small pieces and leases them to urban residents. The city residents can plant vegetables or food on the farm on weekends. They can also entrust the farm to farm and provide farms with residents. Seed, technology and other aspects of help.

Summarising the findings on Land Use

In large cities in China, urban agriculture is mainly distributed around the city in space, and some are leisure farms, which mainly play leisure and experience functions. Family farming within the city, such as balcony agriculture, accounts for a small proportion. The main function is that the elderly pass the time and provide a small number of vegetables for the family.

Module 2 FOOD SECURITY

UA in a big city like the city, especially Beijing, its function is mainly leisure, followed by the supply of agricultural products.

Increase access to high-quality food that is healthy, nutritious and contamination-free

In Sanyuan Farm in Beijing, urban residents rent a small piece of land, and they can come to the farm to grow crops on weekends. The agricultural products produced are mainly consumed by themselves or given to relatives and friends. If urban residents do not have time to cultivate, they can entrust to the farm to plant and harvest the produce on the farm during the harvest season.

Increase understanding of the contribution of UA to the urban food system

The agricultural products around Beijing are mainly from all over the country. These agricultural products are transported from all over the country to the wholesale market of new agricultural products and then purchased by supermarkets or secondary wholesalers. These agricultural products enter community stores or supermarkets, and urban residents go to supermarkets and community stores to purchase.

Only about 5% of the land around agriculture in Beijing is produced, and the agricultural products produced are very limited. Thanks to the development of the agricultural product circulation industry, urban residents can easily buy agricultural products from all over the country.
Unfortunately, it was not possible to get data about the locally produced/sourced food in proportion to all food, neither to the access to "open source" food (e.g. edible objects that grow in the wild such as mushrooms and berries) and to the presence of animals and insects in the urban food system (e.g. chickens, hens, bees, edible insects)

The climate in Beijing is typical of the semi-humid continental monsoon climate in the north temperate zone. It is hot and rainy in summer, cold and dry in winter, and short in spring and autumn. Wheat can be grown in summer, and outdoors in spring, summer and autumn. In

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winter, the temperature is below 0 degrees, and vegetables and fruits can only be grown in the greenhouse.

In Beijing, 98.5% of the daily staple foods are mainly rice and products. The frequency of eating of various staple foods is higher than the average for young people under 14 years old; the vegetables with higher consumption rate are tomatoes (92.4%). Among the fruit foods, apples, watermelons and bananas are the main choices for daily consumption of residents. Meat is mainly pork.

Summarising the findings on Food Security

Beijing's food safety issues are mainly regulated by government departments. Food is mainly from the wholesale market, and a food safety traceability system is currently being established.

Module 3 RESOURCE EFFICIENCY

Mitigate environmental impacts through UA implementing novel technologies

A wide set of innovative agricultural technologies will be implemented at showcases within SiEUGreen, which are expected to improve resource efficiency and mitigate environmental impacts. Their contribution will mainly be measured and evaluated based on feasible quantitative indicators. Table 1 below indicates which technologies will be used in the Beijing showcase

Table 1: Technologies that will be implemented in Beijing showcase

TECHNOLOGY	Will it be implemented on your site? If yes, please elaborate.	How do you measure its contribution to resource efficiency?
Green		
Innovative greenhouse technology using special insulation, solar heat storage, and biogas for light CO_2 and heat		
Greenhouse technology, traditional		
Polytunnels		
Mobile gardens		
Soil-based traditional plan growth		
Water-based hydroponic culture		
Aquaponic cultures (plant fish fully recycling technology)		
Paper-based plant growing technology		
Balcony gardens		
Blue – Processing of waste for recycling		
Biogas production from Antec Biogas pilot-scale reactor		
Treatment of Biogas digestate by biofiltration		
Struvite precipitation from biofilter percolate		
Use of organic waste product for the production of insects in connection of the aquaponic system		
Biofiltration of urine		
Co-composting of organic household waste /green waste and solar dry toilet residue		
Blue – Source separation of wastewater		
Vacuum- /low flush toilets		
Urine diverting toilets		
Solar dry toilet		
Greywater treatment using a Biofilter/Filtered treatment system		
Greywater treatment using a biomembrane system		
Green wall for greywater treatment		
Blue – Stormwater handling		
Green roof lightweight aggregate (LWA) for water retention		
Green wall for water retention		
Wetland/pond system for stormwater disposal		

Wetland/infiltration system for stormwater disposal		
Yellow		
Borehole thermal energy storage (BTES)		
Ground source heat pumps (GSHP)		
Photovoltaic panels (PV)		
Solar collectors for heating water		
Combined heat and power (CHP) from biogas		

Promote resource efficiency in relation to UA applying quantitative measures

Due to the control of Chinese research data, we are not authorized to collect and provide you with the data in the following tables.

RESOURCE EFFICIENCY SCOREBOARD INDICATORS		
Indicator	Definition	Unit
LEAD INDICATOR		
Resource productivity	Gross domestic product (GDP) divided by domestic material consumption (DMC)	EUR per kg
DASHBOARD INDICATORS		
Land		
Productivity of artificial land	The gross domestic product (GDP) of a country divided by its total artificial land	Millions of PPS per km2
Built-up areas	The total built-up area in a country	km2
Water		
Water exploitation index	The annual total freshwater abstraction in a country as a percentage of its long-term annual average available water (LTAA) from renewable freshwater resources (groundwater and surface water)	%
Water productivity	How much economic output is produced per cubic metre of freshwater abstracted	EUR per m3
Carbon		
Greenhouse gas emissions per capita	All man-made emissions of the so-called 'Kyoto basket' of greenhouse gases	Tonnes of CO2 equivalent per capita
Energy dependency	The share of total inland energy needs met by imports from other countries	%
Share of renewable energy in gross final energy consumption		%
THEMATIC INDICATORS		
Transforming the economy		
Turning waste into a resource		
Generation of waste excluding major mineral wastes	All waste generated in a country per inhabitant and year (in kg), excluding major mineral wastes, dredging spoils and contaminated soils	Kilograms per capita
Landfill rate of waste excluding major mineral wastes	The rate of waste landfilled (directly or indirectly) in a country per year, excluding major mineral wastes, dredging spoils and contaminated soils	%
Recycling rate of municipal waste	The share of recycled municipal waste in the total municipal waste generation	%

Recycling rate of e-waste	Waste electrical and electronic equipment (WEEE), also known as e-waste, such as computers, televisions, fridges and mobile phones	%
Getting the prices right		
Energy taxes by paying-sectors - Households		%
Energy taxes		Million EUR
Nature and ecosystems		
Biodiversity		
Area under organic farming	The share of total utilised agricultural area (UAA) occupied by organic farming (existing organically-farmed areas and areas in process of conversion)	%
Land and soils		
Gross nutrient balance on agricultural land - nitrogen	The potential threat to the environment of nitrogen surplus or deficit in agricultural soils	Kilograms per hectare
Gross nutrient balance on agricultural land - phosphorus	The potential threat to the environment of phosphorous surplus or deficit in agricultural soils	Kilograms per hectare
Key areas		
Addressing food		
Daily calorie supply per capita - total		Kilocalories
Improving buildings		
Final energy consumption in households by fuel - total petroleum products	How much electricity and heat every citizen consumes at home without consideration of energy used for transportation	%
Ensuring efficient mobility		
Pollutant emissions from transport - NOx		Index
Modal split of freight transport - by road		% in total inland freight tonne-km

Summarising the findings on Resource Efficiency

As urban agriculture is in its infancy in China, urban agriculture has not yet played a significant resource-saving effect in China. The Changsha demonstration site is currently under construction and experimental stage, and the conservation aspects of water resources remain to be seen. The Beijing Demonstration Point data on resource conservation and utilization is provided by the Beijing Eco-Creative Alliance.

Module 4 SOCIETAL INCLUSION

The Sanyuan farm rents the farmer's arable land and then transforms it into small pieces and rents them to urban residents.

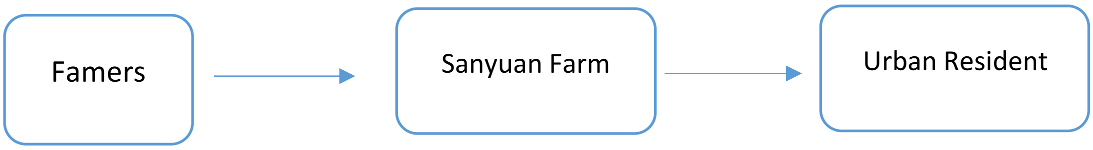

Figure 2: Main stakeholders in Sanyuan Farm

Economic dimension

The Beijing project demonstration site, Sanyuan Farm, mainly reflects the leisure function brought by urban-suburban agriculture to urban residents. At Sanyuan Farm, urban residents can rent a piece of land to cultivate their own, enjoy the fun of their own farming, and at the same time produce safe Food for the family to eat. The farm uses composting technology to turn wastes such as leaves into organic fertilisers.

Social Dimension

At Sanyuan Farm, urban residents can cultivate their own land and produce food for their relatives, friends or neighbours, which can enhance social integration. Sanyuan Farm provides a place for urban residents to entertain and relax so that people from schools and institutions can come here to organise activities and socialise.

Political dimension

No political significance has been found for the time being.

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Deliverable 1.1

Maps of quantitative and qualitative data for each of the showcase locations - Annex 5 Changsha report

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Lead Authors: Wenlian Luo (Hunan Hengkai) and Liu Yahui (CASS)
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Introduction

Changsha is the capital and most populous city of Hunan province in the south central part of the People's Republic of China. It covers 11,819 km2 (4,563 sq mi) and is bordered by Yueyang and Yiyang to the north, Loudi to the west, Xiangtan and Zhuzhou to the south, Yichun and Pingxiang of Jiangxi province to the east. According to the 2010 census, Changsha has 7,044,118 residents, constituting 10.72% of the province's population.

Figure 1: Location of Changsha City in Hunan

Figure 2: Location of the city centre in Hunan

Changsha has an urban population of 7,044,118. A total of 12,966,836 reside in the metropolitan area. The majority of people living in Changsha are Han Chinese. A sizeable population of ethnic minority groups also live in Changsha. The three largest are the Hui, Tujia, and Miao peoples. The 2000 census showed that 48,564 members of ethnic minorities live in Changsha, 0.7% of the population. The other minorities make up a significantly smaller part of the population. Twenty ethnic minorities have fewer than 1,000 members living in the city.

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In changsha, the population aged 0-14 is 955887, accounting for 13.57%; the population aged 15-64 is 5452222, accounting for 77.40%; and the population aged over 65 is 636009, accounting for 9.03%.

Subdivision	Simplified Chinese	Pinyin	Pop. (2010 Census)	Area (km²)	Dens. (/km²)
City Proper					
Furong District	芙蓉区	*Fúróng Qū*	523,730	42	12,470
Tianxin District	天心区	*Tiānxīn Qū*	475,663	74	6,428
Yuelu District	岳麓区	*Yuèlù Qū*	801,861	552	1,453
Kaifu District	开福区	*Kāifú Qū*	567,373	187	3,034
Yuhua District	雨花区	*Yǔhuā Qū*	725,353	114	6,363
Wangcheng District	望城区	*Wàngchéng Qū*	523,489	970	540
Suburban and rural					
Liuyang City	浏阳市	*Liúyáng Shì*	1,278,928	4,999	256
Ningxiang City	宁乡市	*Níngxiāng Shì*	1,168,056	2,906	402
Changsha County	长沙县	*Chángshā Xiàn*	979,665	1,997	491

Figure 3: Population distribution in the municipality of Changsha

Changsha is one of China's 20 most "economically advanced" cities. In 2008, Changsha's nominal GDP was ¥300.1 billion (US$43 billion), a year-on-year growth of 15.1% from the previous year. It is per capita GDP was ¥45,765 (US$6,589). Its GDP grew at an average of 14% per year from 2001 to 2005, compared to the national average of 9% in the period. As of 2005, the service sector generated roughly around 49% of Changsha's GDP, up 112% from 2001 figures, leading to a disposable income for urban residents of 12,343 RMB annually. This growth is expected to continue driving the city's economic growth. The manufacturing and construction sectors have grown relatively steadily, growing 116% during 2001-2005. The primary sector, including agriculture, forestry, animal husbandry, and fishery, has grown slightly over this same period. In addition, the consumer market has grown dramatically along with income levels, with the minimum salary level at 600 RMB per month in comparison to Beijing's at 640 RMB or Shanghai's at 750 RMB per month. Urban residents in 2005 had an average income of about US$1,500, 15% higher than the national average and up 10% from 2001 figures.

In 2018, the added value of agriculture, forestry, animal husbandry and fishery in changsha reached 33.721 billion yuan, an increase of 3.5% over the previous year, including 22.928 billion yuan of agricultural added value, an increase of 3.6%.The added value of forestry was 2.242 billion yuan, up 6.9%;The added value of animal husbandry was 5.659 billion yuan, up 1.3%;Fishery added value was 1.144 billion yuan, up 0.8%;The added value of agriculture, forestry, animal husbandry and fishery services reached 1.848 billion yuan, up 8.1%.

The total area sown to grain was 325,400 hectares, down 5.5% from the previous year, including 293,300 hectares sown to rice, down 7.5%, and 76.8% planted to high-quality rice.The area sown with vegetables was 146,300 hectares, up 2.6%;The oil planting area was 55,100 hectares, down 1.3%.4.3853 million pigs were slaughtered, up 0.4%.

In 2018, the number of employed personnel in the city increased from 2.7774 million in 1986 to 4.8043 million, an increase of 2.02669 million, an increase of 73.0%.In the efforts to expand employment at the same time, the municipal governments at all levels took a variety of measures to strengthen unemployment control; unemployment rate has been effectively controlled.In 2018, the registered urban unemployment rate was 2.67 per cent, 0.83 percentage point lower than that in 2000.

In 2016, there were 1,019,800 agricultural production and operation personnel in the city, among whom 132,100 received professional and technical training.Males accounted for 58.3%, while those aged 36 to 54 accounted for 53.1%.In terms of education level, the junior middle school education level accounted for 54.8%, high school or technical secondary school education level or above accounted for 15.3%.

Changsha showcase in SiEUGreen Project

The showcase is located in Futiancangjun, Changsha, Hunan. The Futiancangjun is approved by the Development and Reform Bureau of Changsha in 2016, which is located in the Green

Controlling Area of the Changsha city. It covers an area of nearly 320000 m^2 with a total construction area of nearly 740000 m^2. It is under construction and consisted of a school, houses and commercial buildings.

Figure 4: Layout of Futiancangjun

The project vision for Changsha showcase is to demonstrate this urban development as resource-efficient, intelligent and sustainable, with reduction, reuse and recycling of waste, suppling secure food and effective utilization of solar energy. In the future, we hope to create Changsha into a water culture, agricultural culture, and social-cultural, sustainable development, circular economy, characteristic green ecological city.

Figure 5: Airscape of Futiancangjun

Changsha will exhibit the comprehensive recycling technology of urban sewage, the recycling technology of nutrients in sewage, and the recycling of urban wastewater. Futiancangjun community-building demonstration in Changsha installed low to flush the toilet, toilet water saving, the sewage are collected in the community and magnesium ammonium phosphate crystallization method to extract the elements such as nitrogen and phosphorus, was established in demonstration building roof rainwater recycling system, biological treatment system on the model family of greywater (water washing with water, the kitchen) and part of the intercept rainfall for processing. In order to improve the living quality of residents, a demonstration of the balcony vegetable garden in Changsha will be conducted by combining soilless cultivation technology, automatic detection of greenhouse temperature and light environment and remote intelligent control technology. According to the available space characteristics of each family balcony, the balcony is equipped with personalized planting equipment, which is used for planting leaf vegetables, fruit vegetables, sprout vegetables, edible fungi and so on.

Methodology

Several methods were employed to develop this report. For example, desktop research of relevant literature (journals, master thesis), some interview with relevant actors from Hunan Hengkai to understand the progress in the development of the Futiancangjun. Three field studies in first quarter 2019 were also conducted with the aim of better understanding the symbiosis of blue/green /yellow technology, comparing the advantages and disadvantages of Changsha technologies through field research, and finally determining the technical solution.

Module 1 LAND USE

Changsha urbanization rate of 79.12% in 2019. As of the end of 2017, the green area of Changsha's built-up areas was 12,584 thousand hectares, and the green area rate, green coverage rate and per capita park green area reached 41.5%, 35.1%, and 11.03 ㎡, ranking the middle level in the country.

In 2015, the total land area of Changsha City was 1,181,946 hectares; of which 1,001,567 hectares were agricultural land, accounting for 84.74% of the total land area, 134,257 hectares were land for construction, 11.36% of the total land area and 46,122 hectares were another land, accounting for 3.90% of the total land area.

Of the construction land, 116,324 hectares of urban and rural construction land, accounting for 9.84% of the total land area; 16,448 hectares of traffic water utilization land, accounting for 1.39% of the total land area; 1485 hectares of another construction land, accounting for 0.13% of the total land area. Among other lands, the water area is 30758 hectares, accounting for 2.60% of the total land area; the natural reserve is 15,365 hectares, accounting for 1.30% of the total land area.

Among agricultural land, 284,503 hectares of arable land, accounting for 24.07% of the total land area, are mainly distributed in the valleys and plains of the Xiang River, Laodao River, Liuyang River, Oushui River, Chu River, Wu River, Jin River, and Daxi River; It occupies 2.58% of the total land area, mainly distributed in river valley plains and hilly mountains; forest land is 591583 hectares, accounting for 50.05% of the total land area, mainly distributed in hilly mountains; river valley plains are distributed less and gradually increase from the city centre to the east and west ends . 13 hectares of pasture grass; 94,93 hectares of another agricultural land, accounting for 8.04% of the total land area.

Institutional aspects

China's national land space planning system includes a master plan-detailed plan-special plan, which is divided into five levels, national-provincial-city-level-county-township-level, and the national land space master plan is the basis for detailed planning and special planning.

The national land and space planning is a global arrangement for the national land space. It is the national policy and general outline for the protection, development, utilization and restoration of national land space. It is organized by the Ministry of Natural Resources and relevant departments and is issued by the Party Central Committee and the State Council.

The provincial-level land space planning is the implementation of the national land space planning and guides the city and county to prepare the national land space planning. It is prepared by the provincial government and submitted to the State Council for approval after deliberation by the Standing Committee of the same level.

The urban and rural spatial planning of cities, counties and towns is a detailed implementation and specific arrangement for the higher-level planning. According to the principle of adapting to local conditions, the city, county and township land space planning will be compiled, or it can be compiled in several townships and towns, organized by the local people's government. prepared by.

The detailed planning is organized by the municipal and county-level natural resources departments and reported to the government at the same level for approval, mainly at the village level.

The Changsha Municipal Government has issued a master plan for land and space, combined with urban industrial development, land nature, and urban construction. Each district prepares specific plans according to the guiding principles of the overall plan. UA is part of suburban agriculture or urban agriculture in Changsha's land space planning and has not received special support.

UA generally plays the role of economic benefits of urban agriculture in the planning system, and the government and some agricultural enterprises are promoting the development of urban agriculture. Within the urban community, mainly residents and public welfare agencies are promoting UA.

Spatial & Functional aspects of UA

Urban agriculture in China mainly refers to suburban agriculture or urban agriculture. It provides agricultural products and leisure functions for the residents of the city around the agriculture around the big cities. Followed by a small, small balcony garden inside the residential community.

Suburban agriculture mainly provides leisure and entertainment places for urban residents and provides some agricultural products for urban residents. The main role is to let urban residents experience agriculture, leisure and entertainment.

Summarising the findings on Land Use

In large cities in China, urban agriculture is mainly distributed around the city in space, and some are leisure farms, which mainly play leisure and experience functions. Family farming within the city, such as balcony agriculture, accounts for a small proportion. The main function is that the elderly pass the time and provide a small amount of vegetables for the family.

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Module 2 FOOD SECURITY

Increase access to high-quality food that is healthy, nutritious and contamination-free

Changsha showcase is expected to be completed in April 2020, and residents will move in September.

Increase understanding of the contribution of UA to the urban food system

The agricultural products around Changsha are mainly from all over the country. These agricultural products are transported from all over the country to the wholesale market of new agricultural products and then purchased by supermarkets or secondary wholesalers. These agricultural products enter community stores or supermarkets, and urban residents go to supermarkets and community stores to purchase.

In 2017, the sown area of grain in Changsha was 369,000 hectares, of which 333,000 hectares were paddy, and the proportion of high-quality rice planted area was 80.0%; the planted area of vegetables was 173,000 hectares; the planted area of oilseeds was 56,000 hectares; 6.749 million pigs were slaughtered

Unfortunately, it was not possible to get data about the locally produced/sourced food in proportion to all food, neither to the access to “open source” food (e.g. edible objects that grow in the wild such as mushrooms and berries) and to the presence of animals and insects in the urban food system (e.g. chickens, hens, bees, edible insects)

Changsha belongs to the subtropical monsoon climate. The climate is characterized by the mild climate, abundant precipitation, simultaneous rain and heat, and four distinct seasons. Very conducive to crop growth

Urban population's knowledge of food systems mainly comes from families,

Module 3 RESOURCE EFFICIENCY

Mitigate environmental impacts through UA implementing novel technologies

Changsha showcase is currently under construction, is expected to be completed in April 2020, and residents will move in September. Demonstration of water treatment and balcony vegetable garden has not yet started.

Summarising the findings on Resource Efficiency

As urban agriculture is in its infancy in China, urban agriculture has not yet played a significant resource-saving effect in China. The Changsha demonstration site is currently under construction and experimental stage, and the conservation aspects of water resources remain to be seen.

Module 4 SOCIETAL INCLUSION

Hunan Hengkai As a developer of Changsha showcase, They are responsible for building houses in residential communities and then selling them to urban residents, who later act as property managers to provide technical services and guidance to residents.

As residents have not moved to Futiancangjun development, the economic social and political dimensions of this showcase have not been demonstrated yet.

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