

# JPI URBAN EUROPE: POLICY PAPER

A Screening of Urban Megatrends







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# Executive Summary

Since Europe's future depends greatly on its cities and metropolitan regions, it is essential to understand and address the challenges urban areas across Europe are going to be faced in the decades to come. Several studies have already been published analysing the complexity of the urban future and demanding a new urban model and a transformation of our cities. The Joint Programming Initiative Urban Europe has been set up with the ambition to establish a large scale, long term, multidisciplinary and transnational research and innovation programme dedicated to urban development to increase understanding of urban complexity and provide new solutions and evidence for future policy making,

For setting the scene for this endeavour, this policy paper aims at screening urban megatrends, investigating the impact selected megatrends have on European cities and identifying needs for action for research as well as policy to address the corresponding urban challenges. Emphasis is given in particular to megatrends such as demographic development, economic development and climate change.

Data on population change, economic development, climate change and changes in household structure was used to identify the consequences these megatrends have in the different European regions. Results clearly indicate that cities throughout Europe are affected in different ways by the various trends.

To further investigate this, a qualitative analysis was performed in 6 countries to highlight major challenges in the different regions of Europe. These case studies underline that megatrends cause different need for action across Europe that vary according to the local historical, political, demographical, social and other circumstances of each city. However, joint efforts are needed to tackle these challenges and enhance our understanding on urban dynamics and new ways of urban development.

The Joint Programming Initiative Urban Europe aims at addressing these issues in its research and innovation programme. According to the identified need for action an in-depth analysis of urban trends has been performed by the Scientific Advisory Board of JPI Urban Europe and a framework for research and innovation is proposed which is summarized in the Scientific Background Paper.





# Content

<b>3</b>	<b>Executive Summary</b>
<b>5</b>	<b>Introduction</b>
5	Preface and Disambiguation
6	Motivation
<b>7</b>	<b>Methodology and Work Process</b>
7	Desk Research on Global Urban Development Trends
8	Quantitative Analysis of Urban Megatrends
9	Qualitative Analysis
<b>10</b>	<b>The Global Perspective: Geopolitics, World Economy and Global Urbanisation</b>
10	Global Economic Development and the Diffusion of Power
11	Middle Classes in Developing and Emerging Countries
11	Overview of Global Urbanisation: Patterns, Today's Situation and Prospects for the Future
12	Conclusion on Global Trends on the Economy, Power Shift and Urbanisation
<b>15</b>	<b>Similar Megatrends. Different Effects.</b>
15	Delineating Urban Regions – Background and Method
28	European Urbanisation Patterns
19	<i>Present, Recent and Projected Population Dynamics</i>
25	<i>Future Settlement Area Dynamics</i>
27	Societal Trends
27	<i>Changes in Age Structure</i>
28	<i>Changes in Household Structure</i>
30	<i>Economic State and Dynamics</i>
31	The Effects of Climate Change
31	<i>The Effects of Temperature Increase</i>
34	<i>Effects of Extreme Events Triggered by Heavy Rainfall</i>
35	Summary of Trends
<b>37</b>	<b>The Challenges of Urban Megatrends in European Cities</b>
38	Thematic Challenge Categories
39	Developing National Urban Storylines
39	<i>An Austrian Storyline</i>
42	<i>A Danish Storyline</i>
45	<i>An Italian Storyline</i>
46	<i>A Finnish Storyline</i>
48	<i>A Dutch Storyline</i>
50	<i>Input from Norway</i>
52	Conclusion: Megatrends and Challenges to European Urban Areas
<b>55</b>	<b>Bibliography</b>

# Introduction

One of the JPI Urban Europe's central action lines within the pilot phase and the first step towards a research and innovation agenda was to research on how megatrends affect the urban development of European cities. For a long-term, interdisciplinary and integrated research and innovation initiative, a systematic analysis of the driving factors and impacts of the structural trends affecting urban dynamics is absolutely essential.-

Cities are “maybe one of the most complex systems in the universe,”<sup>1</sup> combining issues from many different academic disciplines. However, until recently, urban studies have been mainly treated by single disciplinary research approaches. It was not until recently that the necessity of integrated and multidisciplinary research across national boundaries was acknowledged.

Studying cities is a fascinating yet elusive endeavour, which requires a holistic and integrated approach to contribute to the development of a knowledge base on how cities actually work. This paper thus aims to:

- Identify the **challenges** stemming from **megatrends** faced by **urban areas**.
- Create a **differentiated perspective** of challenges to the urban areas of Europe that takes **national** and **regional diversity** into account.
- Highlight the **complex connections** between the challenges and megatrends in the long-term.
- Determine need for action requiring **research** and **innovation**.

The results of this policy paper on urban megatrends are the starting point for the development of the **Strategic Research and Innovation Agenda (SRIA)** of JPI Urban Europe, and thus contribute to

the long-term strategy of the initiative. In addition to the paper's relevance to the long-term focus of the initiative, findings will also be used to identify short-term research topics and needs that can be covered in the upcoming joint calls.

While the policy paper aims at describing the overall picture and drawing first conclusions for the orientation of the research and innovation programme, a more in-depth analysis of the various trends is needed to elaborate a framework for the research initiative. This has been covered by the Scientific Background Paper which has been elaborated by the Scientific Advisory Board of JPI Urban Europe.

## PREFACE AND DISAMBIGUATION

In order to understand and differentiate the terminology used within this paper, it is necessary to briefly explain and define the terms used.

### Megatrends:

According to the Oxford Dictionary<sup>2</sup>, a trend can be defined as “a general direction in which something is developing or changing” while the prefix *mega* designates something “very large; huge”. Therefore, a *megatrend* brings large, epochal changes that have a long-term impact. Megatrends are responsible for immense social, economic and environmental change. Megatrends are expected to occur in all scenarios and significantly influence how the world “works” (National Intelligence Council, 2012). Megatrends will shape our future considerably and are therefore essential factors in studies of the future.

### Challenges:

In contrast to megatrends, *challenges* are of a smaller scale. They can be understood as difficult tasks which must be overcome by taking suitable action. In this paper, the term *challenge* is used for concrete and comprehensive problems, tasks or

<sup>1</sup> Geoffrey West, physicist at the Santa Fe Institute, cited in *Scientific American*, December 7, 2012

<sup>2</sup> <http://oxforddictionaries.com/>

needs stemming from the structural changes brought about by megatrends. Urban challenges are highly dependent on local circumstances such as history, governmental policy, urban planning, geography, demographic composition, etc. Thus, certain challenges may be relevant for all cities in Europe and other challenges may only occur in cities that share similar characteristics. According to our definition, challenges are the site-specific manifestations of the effects of urban megatrends throughout Europe. A central characteristic of these challenges is that they are not independent, but interconnected. These connections must be carefully taken into account when addressing challenges through research and policy, since tackling one challenge could potentially affect other challenges.

### Challenge categories:

*Challenge categories* are thematic groupings of the challenges that stem from urban megatrends. The challenge categories were used to generate a differentiated perspective of Europe.

### Driver:

In the Oxford Dictionary<sup>3</sup>, a driver is defined as “a factor which causes a particular phenomenon to happen or develop”. In this paper, the term *driver* is used to describe the factors causing a specific set of challenges.

## MOTIVATION

Prior to working on this paper, a screening of urban foresight documents was conducted. The aim of screening urban foresight studies (Kubeczko et. al, 2011) was to support the development of European urban foresight topics and to provide an overview of the challenges, trends and drivers addressed by recent foresight research with a time horizon exceeding 30 years.

The findings of the screening clearly indicated a deficiency of foresight studies on urban megatrends and their consequences on urban areas in Europe. Since the urban areas of Europe are highly diverse, a differentiated perspective is indispensable. The following conclusions were drawn from the screening of urban foresight documents:

- The majority of the foresights screened address the following crucial challenges: urban expansion, climate change adaptation and mitigation, natural disasters (heat waves, flooding, etc.), resource availability (energy, water, food), globalisation and urbanisation, demographic change, migration and security. However, concrete opportunities and threats differ significantly between countries and global regions.
- Turbulence is increasingly expected due to the financial crisis, energy price fluctuations, and climate change effects becoming more evident. Therefore, governance systems in and of urban regions must be adapted to better cope with uncertainty and risk.
- Given global competition and the emergence of global and regional networks of megacities (for example, in China), questions arise about the interaction between these cities and between megacities and the clusters of cities connected to megacities, and possible consequences for European city networks.
- The growing global importance of the emerging economies is associated with high levels of uncertainty for Europe. Opportunities for and threats to European urban regions are matters of long-term strategic interest. Some of the most challenging urban issues are seen in cities on the European periphery, such as Istanbul and St. Petersburg.

# Methodology and Work Process

Both quantitative and qualitative methods were used in the work process of this report. Quantitative methods were used to generate a differentiated perspective on how megatrends manifest in metropolitan areas throughout Europe and this, in turn, was utilised to create a collective understanding and as a baseline for the qualitative analyses. The qualitative analysis provided a more differentiated view of the consequences that megatrends have on urban areas, and of the concrete challenges posed by them.

The vast majority of input for this paper was generated by a quantitative analysis of datasets for urban regions across Europe, and by a second qualitative analysis taking into account regional and national characteristics. Combined, the quantitative and qualitative studies create a differentiated perspective on the effects of megatrends in European cities and also identify crucial interdependencies between the different challenges posed by different megatrends. Workshops and meetings for gathering expert were also organised to reflect the outcome of the quantitative analysis and for comparing national and regional consequences.

The core team conducting the qualitative part of the paper consisted of participants from Austria, Belgium, Denmark, Finland, Italy and the Netherlands. This group of experts brought in a strong knowledge base of national issues and challenges.

## DESK RESEARCH ON GLOBAL URBAN DEVELOPMENT TRENDS

To analyse global urbanisation patterns and geopolitical transformations, desk research was conducted to analyse a number of relevant foresight documents published by the National Intelligence Council (2012), the World Bank (2011) and the European Commission (2009; 2012). The aim was to highlight the effects that global development and urbanisation in other parts of the world have on European cities, and what European knowledge of cities can contribute to research and policy on a global scale.

Since several related studies have been carried out in the last years, it was considered essential to build upon this. The following documents were used as a starting point and for building a common basis for developing the report:

**APEC Secretary (2000).** *The Future of APEC Megacities: A Foresight Approach.* APEC.

**European Commission (2011).** *Cities of Tomorrow. Challenges, Visions, Ways Forward.* Brussels: European Commission.

**Kubeczko, K., Ravetz, J., Van der Giessen, A., & Weber, M. (2011).** *Screening Urban Foresights and Studies Supporting Forward Looking Activities - What can we learn for a JPI-Urban Europe 2050+ Foresight?.* EFP-Report, European Foresight Platform.

**National Intelligence Council (2012).** *Global Trends 2030: Alternative Worlds.* NIC.

3 <http://oxforddictionaries.com/>

## QUANTITATIVE ANALYSIS OF URBAN MEGATRENDS

A quantitative study of urban megatrends was conducted to generate a shared understanding and foundation for further investigations. The data analysis illustrates the Europe-wide trends and challenges that will influence urban areas in the decades to come. A subset of regions delineated by the PLUREL<sup>4</sup> project (Piorr et al., 2011) was used for the quantitative section of the study. Urban regions with an urban population greater than 250,000 inhabitants in the functional metropolitan area were taken into account. In total, 148 city regions were included in the analysis. Data from EUROSTAT was used for the baseline, projection data from International Institute for Applied Systems Analysis (IIASA) for demographics, the University of Paris 1 for economics, the University of Edinburgh for land use and from the Austrian Institute of Technology (AIT) for intraregional distribution of urban regions. Data gathered within the PLUREL project and other European Observation Network, Territorial Development and Cohesion (ESPON) projects (ESPON Climate, 2011; ESPON FOCI, 2010) were applied to these analyses. The study is based mainly on the statistical data available for NUTS3 and NUTS2<sup>5</sup> regions detailing the current state, past dynamics and projected future dynamics.

The objective of this analysis is to explore and discuss the different challenges arising from megatrends in all EU-27 countries. The results clearly show that megatrends manifest uniquely in different areas and underline the importance of taking regional context into account when carrying out urban research on a European scale.

Fig. 1 illustrates the 148 urban regions that have been included in the quantitative study according to their geographical category (left). On the right, the urban fabric of the cities is clustered according to primary form of appearance.

To identify regional differences and obtain a better comparison between the regions, the 148 city regions have been grouped into five clusters according to their geographical location. The grouping was adopted for the quantitative and part of the qualitative analysis of this study. Fig. 1 shows the geographical clusters:

- Northwestern Europe
- Eastern Continental
- Scandinavia and the Baltic
- Mediterranean Area and Atlantic Coast
- Greater Alpine Area

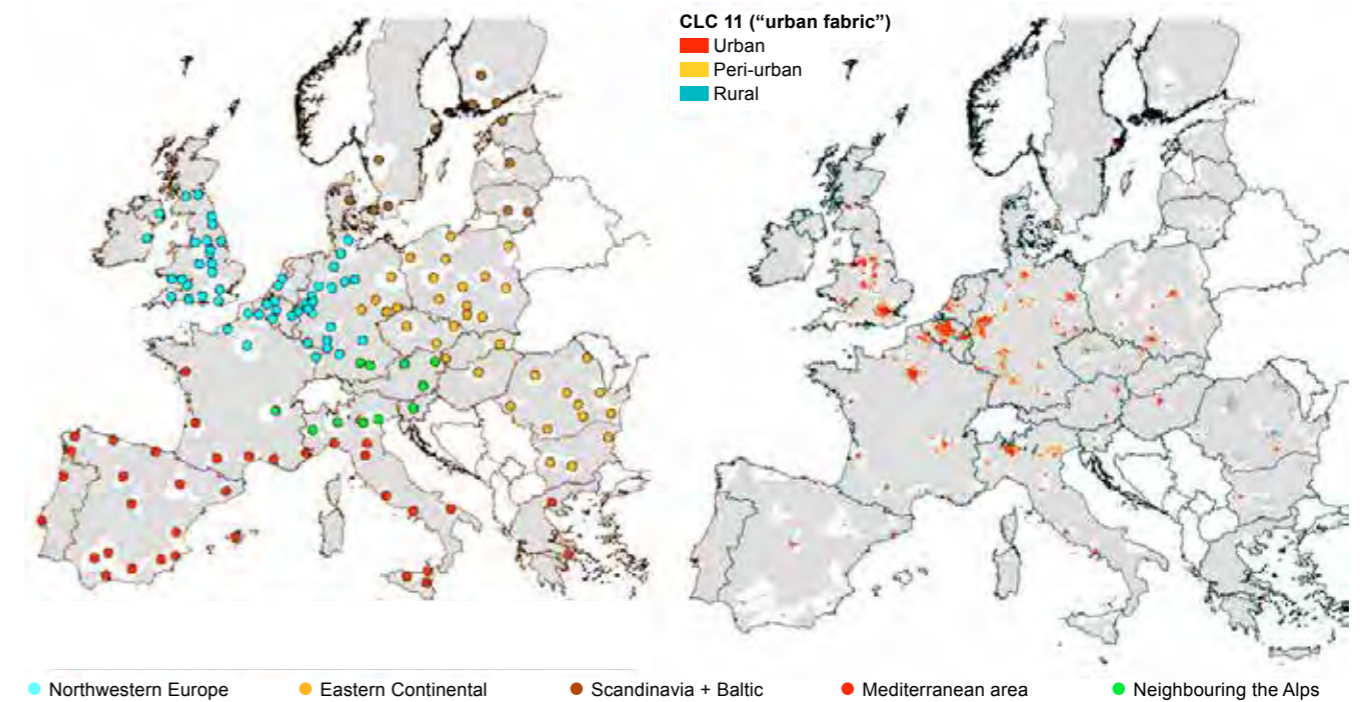


Figure 1: Categorisation of urban regions > 250,000 inhabitants  
Data source: PLUREL project 2007-2010. Population numbers: EUROSTAT. Population distribution and morphology exploration: AIT.

## QUALITATIVE ANALYSIS

Based on the results of the quantitative analysis, a more detailed analysis was performed by six countries (Austria, Belgium, Denmark, Finland, Italy and the Netherlands) working together on case studies and to highlight regional differences. In three workshops, the transnational team identified, compared and elaborated on the national challenges stemming from megatrends and the quantitative analyses. A **standardized format** was developed in order to gather comparable information on national perspectives from national foresight documents, interviews, reports and statistical analyses.

The members of the core group were asked to develop projected **storylines** describing main causal relationships between challenges in urban areas until 2050. The primary aim of this exercise was to create thought-provoking yet plausible scenarios based on a shared framework that assumes *laissez-fair* policies and a moderate climate. Developing storylines for urban megatrends and challenges in the partici-

pating countries contributed significantly to creating a differentiated perspective of the effects and events caused by megatrends in European urban areas, and highlighted the connections between challenges. Finally the results have been validated with municipal representatives from cities in participating countries. The aim was to enrich and challenge preliminary results from the stakeholder's perspective, helping to further specify differences in the distribution of challenges throughout European cities, and to identify research and innovation needs from the perspective of city representatives.

Part of the study focused on the connections and interdependencies between challenges with the aim of investigating the influences that challenges driven by one challenge category have on other trends, and how they manifest in urban space. This enabled the generation of a set of concrete interdependencies of the various types of city regions in Europe, ensuring a holistic view of the challenges posed by urban megatrends.

<sup>4</sup> PLUREL was an EC-funded FP6 project addressing peri-urban land use relationships and strategies and sustainability assessment tools for urban-urial linkages that ran from 01/2007 – 03/2011: [www.plurel.net](http://www.plurel.net).

<sup>5</sup> NUTS3 regions are the smallest administrative entities with statistical data available in all of Europe. Forecast data for population and GDP were first developed on the more general NUTS2 scale and then disaggregated to the NUTS3 regions mainly based on population percentages.



# The Global Perspective: Geopolitics, World Economy and Global Urbanisation

Although, in the case of geopolitical and economic development, predicting the future can be deemed impossible, we know that global economic and political conditions are undergoing significant changes. Since cities around the world act as nodes in a global economic network (Sassen, 2001), changes in these conditions significantly influence the living conditions, performance, liveability, etc. of urban areas. Europe is already highly urbanised today and, with 83.8% of the population living in urban areas by 2050 (UN-Habitat, 2010), cities are only going to gain in importance.

Analysing geopolitical developments and transformations on a global scale is important for a number of reasons. For long-term, Europe-wide research programs on cities, such as JPI Urban Europe, global development is crucial to foreseeing urbanisation trends in Europe. Changes are underway, and these broad transformations will significantly influence Europe's economic, social, and geopolitical position and international relations. Furthermore, these large-scale developments will have concrete effects and consequences for European cities on a very local scale: "glocalisation" – where global development meets local space.

## GLOBAL ECONOMIC DEVELOPMENT AND THE DIFFUSION OF POWER

With the continuous growth of developing and transition nations, the world economy will be increasingly multipolar. All documents examined for this study underline this trend. As the World Bank (2011:13) notes, "The Global Economy of 2025 is likely to look

significantly different from that of 2011." By 2025, the real output of China, India, Russia, Indonesia, Brazil and South Korea combined will likely outnumber European performance. Global economic growth will be driven by emerging powerhouses such as India and China.

The hegemony of single countries or continents will shift towards a more diffuse global economic distribution of power. The six major emerging countries (Brazil, China, India, Indonesia, the Republic of Korea and the Russian Federation) are expected to contribute more than half of all global economic growth by 2025 (World Bank, 2011). Furthermore, second-order player countries such as Colombia, Indonesia, Nigeria, South Africa, Turkey and others will gain in importance for the global economy and will, as a collective group, outnumber Europe, Japan and Russia in global power (National Intelligence Council, 2012).

Furthermore, the National Intelligence Council (2012) foresees that by 2030, instead of a single hegemonic country, state and non-state actors will likely be joined together in networks that significantly influence world politics. Communication technologies will be the significant influence in the shift towards these multifaceted networks. Thus, far-reaching changes are underway, inducing action on a national and global scale.

As the economic power of emerging and developing countries increases, Western countries will find it harder to set the international agenda. It is therefore expected that international affairs will be tested by different worldviews (European Commission, 2012).

## MIDDLE CLASSES IN DEVELOPING AND EMERGING COUNTRIES

With economic growth in developing countries, more and more people are entering the middle classes. A rise in GDP brings with it significant personal lifestyle changes. People with access to capital become a vital part of economic growth.

In most cases, globalisation and rising exports have paved the way to high growth rates. However, increasing wealth in a society stimulates domestic consumption. Consumption by the growing middle classes in India and China will significantly shape the economic performances of these countries. With growing domestic consumer expenditure, economies are strengthened and become more resilient to global economic disturbance. An increase in income is also strongly connected to changing lifestyle patterns. A growing number of people can afford individual modes of transport, their own houses, or living in a larger apartment. How Asian urban areas are going to manage the problems connected with increased income and wealth is of great importance on a global scale, since there is a risk that highly unsustainable urban developments (urban sprawl, significant increases in private transport, etc.) will contribute to climate change (World Bank, 2011).

Looking at social aspects, societies in China and other Asian cities are expected to become more polarised. Income inequality is expected to rise (European Commission, 2009) and the risk of social tension to increase.

## OVERVIEW OF GLOBAL URBANISATION: PATTERNS, TODAY'S SITUATION AND PROSPECTS FOR THE FUTURE

In order to understand global urbanisation and the developments taking place within Europe, taking a close look at current trends in urbanisation in other regions of the world is indispensable. Although urbanisation is a worldwide phenomenon that is not expected to stop in upcoming decades, potential development paths,

manifestations and accompanying challenges vary greatly. For an initiative such as JPI Urban Europe, it is important to keep urban development on the global scale in mind for number of reasons: to better comprehend the big picture of urbanisation, to collaborate and exchange knowledge with other world regions and to understand different urban directories.

The 21<sup>st</sup> century is the urban century. In 2008, for the first time in human history, over 50% of the world population lived in cities. In 1950, only 30% of people worldwide lived in cities. This trend is not expected to halt any time soon and it is expected that by 2050, 70% of the global population will be urbanised. Asian and African cities are expected to show the highest urbanisation growth rates, due to high population growth and a currently comparatively low rate of urbanised population UN-Habitat (2010).

By 2050, 86% of people in the developed world and 67% of the population in developing countries will be living in urban areas UN-Habitat (2010). Although urbanisation rates are already very high today, the years leading up to 2050 will be marked by a continuing trend towards global cities with a wide range of urban development patterns.

Today, half of the global urban population lives in Asian cities and 7 of the 10 largest cities in the world are located in Asian countries. However, since Asia is a highly polarised continent, with economic powerhouses such as China and India located alongside very poor countries, urbanisation patterns are by no means homogeneous. By 2020, Asia is expected to be home to five metacities, urban areas with a population of more than 20 million: Shanghai, Delhi, Beijing, Dhaka and Mumbai (UN-Habitat, 2012). By 2050, half of the Asian population will be living in cities. This is mainly due to the very high urban population rates of China, a country where the connection between urbanisation and economic growth can be clearly witnessed. As a result, it is projected that 70% of the population will live in an urban area by 2050. India, another rapidly developing country, is expected to face slower urbanisation rates compared to China. However, 900 million people, or 55% of the total population, will be living in urban areas by 2050. The

massive growth of Asian cities will have a tremendous environmental, economic and socio-economic impact throughout the world. For example, it is projected that China's cities will double their energy consumption by 2030, thus consuming 20% of global energy used UN-Habitat (2010).

Today, Latin America is the most urbanised region of the world. According to UN-Habitat (2012), 80% of the population lives in cities. Urbanisation started in the 1940s and peaked in the 1960s, when urbanisation mainly took place in primary cities. In the year 2000, 25% of the population lived in cities with more than 5 million inhabitants. In the future, the larger cities will show only slow growth, while small and mid-sized Latin American cities are expected to grow at a much faster pace. Although the urban population rate is already very high, over the next two decades cities will continue to grow, resulting in an urbanisation rate of 85% (UN-Habitat, 2008). South America, a sub region of Latin America, is expected to be the region with the highest proportion of urbanised population, reaching 91.4% by 2050 (UN-Habitat, 2010).

In Africa, the proportion of urban population is expected to grow from 40% in 2008 to 61.8% in 2050 (UN-Habitat, 2010). With 1.2 billion people living in cities, Africa will then house a third of all urban dwellers worldwide. Today, the urbanisation rate in Africa is relatively low, while the fertility rates are high, indicating a significant growth in urbanisation in decades to come. The pattern of urbanisation in Africa is very particular: people and investment capital are almost exclusively drawn to the largest city, which is in the most cases the capital city. However, urbanisation is also strongly connected with slum formation. As of 2010, 62% of the African urban population lived in slums. According to Randers (2012, p. 202), rising urbanisation in Africa will continue to drive slum formation due to slow GDP growth, increasing income disparity and political dysfunction.

In Europe, the proportion of urbanised population was 72.6% in 2010, and is expected to reach 86% by 2050. With a projected 90.7%, northern Europe will be one of the sub-regions with the highest proportion of urbanised population by 2050.

70% of Europe's population now lives in relatively small cities of 500,000 or fewer inhabitants. This means that the characteristics of urbanisation are highly different from in the U.S., where cities with more than 5 million inhabitants house one third of the countries urban population UN-Habitat (2010). In terms of pace and proportion, urbanisation in Europe and North America differs greatly from the urbanisation trends of Asia and Africa.

The 21<sup>st</sup> century can undoubtedly be coined "the urban century", with growing rates of urban population on all continents. However, the greatest net growth of urban population will occur in Asia and Africa. Since urbanisation is closely linked to economic growth, urbanisation patterns, pace and characteristics will vary according to specific local characteristics and circumstances. The following table summarises 2010 world region urbanisation levels, rates projected for 2050 and the year of the urban *tipping point*, the point at which urban populations outnumber rural ones.

## CONCLUSION ON GLOBAL TRENDS ON THE ECONOMY, POWER SHIFT AND URBANISATION

Significant shifts and global changes in (economic) power structures, on-going urbanisation and the rise of a new middle class are going to influence urban areas worldwide. The U.S. has been the hegemonic power since the First World War, however, power structures are on the brink of changing to more dispersed configurations. With the rising economies of Asia and South-America, especially by the BRIC countries, increased military spending, continuing population growth and rising wealth, the national power relations of today are expected to be change significantly. China is projected to be largest economy by 2030. The resulting increase in the middle classes and the higher consumption levels that go with this is expected to impact the environment on a global scale. The hegemonic shift and the rise of transition and developing countries will strongly shape the future of Europe.

Urbanisation will continue to grow globally. However, due to very diverse characteristics, levels of urban-

Region	Tipping Point	2010 urban %	2050 urban %	Difference in urban population 2010-2050 %
<b>World</b>		50.6	70.0	19.4
<b>Europe</b>	Before 1950	72.6	83.8	11.2
Eastern Europe	1963	68.8	80.0	11.2
Northern Europe	Before 1950	84.4	90.7	6.3
Southern Europe	1960	67.5	81.2	13.7
Western Europe	Before 1950	77.0	86.5	9.5
<b>Africa</b>	~ 2003	40.0	61.8	21.8
Sub-Saharan Africa	~ 2032	37.3	60.5	23.2
Eastern Africa		23.7	47.6	23.9
Northern Africa	2005	52.0	72.0	20
Southern Africa	1993	58.8	77.6	18.8
Western Africa	~ 2020	44.6	68.0	23.4
<b>Asia</b>	~ 2023	42.5	66.2	23.7
Eastern Asia	~ 2013	48.5	74.1	25.6
South-Central Asia	~ 2040	32.2	57.2	25.0
South-Eastern Asia	~ 2013	48.2	73.3	25.1
Western Asia	1980	66.3	79.3	13.0
<b>Latin America and the Caribbean</b>	1962	79.4	88.7	9.3
Central America	1965	71.7	83.3	11.6
South America	1960	83.7	91.4	7.7
<b>Rest of the World</b>				
North America	Before 1950	82.1	90.2	8.1
Oceania	Before 1950	70.6	76.4	5.8

Table 1: Urbanisation level per region and tipping point (urban vs. rural population).  
Source: UN-Habitat (2010). Editing: Johannes Riegler.



isation, economic performance, etc., the ways that urbanisation manifests will be highly different. By 2050, African and Asian cities will show the highest growth rates.

As the middle classes grow, consumption levels rise and urbanisation continues, one of the central questions is that of how Chinese and Indian cities are going to deal with these altered circumstances. There is a risk that the failures of European and U.S. urban management will be repeated: suburbanisation, exorbitant growth in personal transport, urban sprawl and unsustainable consumption habits. These changes in lifestyle and urban forms would have negative environmental impacts on a global scale.

Europe and its cities can help prevent harmful consumption habits on a global scale. It can contribute by helping cities to develop and transition countries to find adequate methods of governance, implementing innovation, seeing complex urban systems from an integrated, multidisciplinary perspective and managing it accordingly. Europe therefore has an important role to play by making knowledge and know-how available to developing regions for mutual learning. From today's viewpoint, economic growth in Europe will be at a slower pace in decades to come than in the boom years, while some developing and transition countries and regions are projected to have high growth rates. However, due to this fact, more cities, especially in Asia, are going to reach a level of development where they will compete with Western cities for investments in technology and services, as well as for a skilled and highly educated workforce.

In this light, this chapter aims at being a starting point for exchange and mutual learning with partners outside of Europe. European expertise on urbanisation and urban development can be a crucial part of finding answers to today's challenges, and to preventing the repetition of detrimental choices and failures made in other parts of the world. Reacting accordingly has the potential to improve urban areas on a global scale. However, when bringing European expertise to cities in other world regions, local circumstances must be taken into account. As shown above, the different forms and characteristics of urbanisation vary greatly and may not be comparable to the European situation. Therefore, knowledge, expertise and best practice examples must not be bluntly applied to other regions, but must instead be adapted to the local conditions, challenges, characteristics and framework. Furthermore, local knowledge must be incorporated.

## Similar Megatrends. Different Effects.

This chapter highlights the different manifestations and effects megatrends have on cities across Europe. For a definition of the terminology used, please see Chapter 1.

Based on data on megatrends in demographic development, economic development and climate change, the projected effects on urban areas have been analysed up to 2025 and (climate change until 2070). The results clearly show that although all urban areas in Europe will be affected by these megatrends, the intensity and resulting challenges are going to be diverse depending on the geographical location and political, historical and other circumstances.

Urban development is one of the most pertinent research fields today. A growing percentage of people living in urbanized regions is affected by the various pressures and impacts that result from changing social and economic conditions. Thus, new challenges for urban development and urban governance are on the rise. Urbanisation affects not only the urban region itself, but also the surrounding peri-urban and rural areas and their populations, the related infrastructure and, finally, the overall environmental and economic framework and conditions.

The objective of the quantitative part of the study is to explore and discuss urban megatrends within EU27 cities and city regions.

Urban regions are delineated according various ways. It is thus not always easy to gather data to analyse current and future trends in urban regions. Some of the data used in this study is derived from the results of the integrated research project "PLUREL". Within the PLUREL project, the authors of this chapter focused on the development of urban region typologies, and the spatial analysis and modelling of impacts on landscape and population through urbanisation.

To analyse the megatrends, a subset was applied to the regions delineated in PLUREL. All urban regions with more than 250,000 inhabitants were taken into account. The study is based mainly on statistical data available for NUTS-3 and NUTS-2 regions describing the current state and possible future dynamics.

### DELINEATING URBAN REGIONS – BACKGROUND AND METHOD

A city is not an isolated entity. In fact, there are many interdependencies between core cities and their surroundings. Therefore, functional relationships between the core city and its surroundings are defined by social and economic interaction. The OECD (2002, p.11) defines a Functional Urban Region (FUR) as "a territorial unit resulting from the organisation of social and economic relations within that. Its boundaries do not reflect geographical particularities or historical events. It is thus a functional sub-division of territories."

A functional urban region represents a common area for labour and housing as well as intra-regional trade. Within the European and global networks, urban agglomerations obtain competitive advantages from their role as centres and gateways for social and economic development, innovation and creativity, transportation and communication (Anderson, 2000). The larger the core cities, the larger and more complex the urban regions are. In times of urban growth, sub-centres with their own sub-structure of neighbouring cities grow together to form a common agglomeration. Both growth patterns result in the formation of metropolitan areas with diverse urban and non-urban functions and heterogeneous settlement structures.

A typology of urban regions is required to describe urbanisation trends based on statistical data. Various

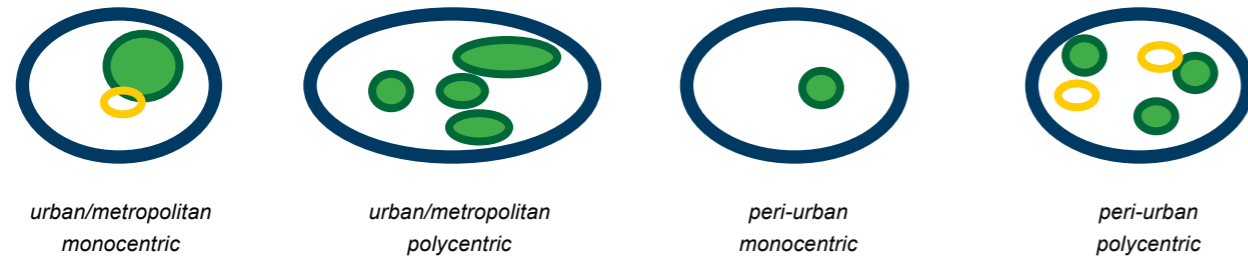


Figure 2: General urban region types based on urban morphology (Source: Loibl et al., 2010)

typologies can be identified. Referring to the PLUREL project, we deal with morphology by considering the size, number and distribution of urban settlements within an urban region (see Fig. 2)

The various growth dynamics are determined by past planning policies. These morphologies assume that different dynamics and growth patterns will be observed in the future. Different morphologies also lead to diverse environmental pressures in the peri-urban hinterland. Spatial typologies are always a matter of purpose, and thus scale. Here, the purpose of the applied typology was to explore the interrelations of cities and catchment areas, and their effects on the environment and land use.

A typology of urban regions requires spatial delineation. Delineating city regions is easy if data on the spatial interaction of people and goods is available. Unfortunately, this is not the case throughout Europe, where often only data sets for various regions are available, and not for the whole of Europe. The main data set available on a European scale describe land cover (CORINE Land Cover – CLC 2000<sup>6</sup> for 100x100m raster cells) and population (for NUTS-3 regions). More recent data on urban population come from Urban Audit (EUROSTAT) and from STEU (GISCO) for point locations and related population numbers of settlement zones (SMZ) with more than 10,000 inhabitants (except for Germany and the Netherlands, where the threshold is 20,000).

Urbanised zones were formed using on the CLC 2000 data. Settlement size and distribution within

a city region (mono vs. polycentric) was extracted based on STEU points and population numbers. Settlements with more than 50,000 inhabitants were defined as urban centres. The further delineation of the extent of the urban regions was calculated through GIS-functions by taking the core city's population numbers as proxy: Circular influence zones were generated whose radii were calculated by a logarithmic function of the core cities' population to mark the related commuting and recreation catchment areas. Those NUTS-3 regions were then clustered into city regions significantly affected by the influence circles. Below, Fig. 3 shows the generated influence radii of core cities, the underlying NUTS-3 entities (left) and the resulting rural and urban regions (right) for a sample area in Germany and the Czech Republic.

Many NUTS3 regions are part of a city region, combining a core city, peri-urban surroundings and a rural hinterland. Depending on the core city's population and the distribution of additional urban cores, the city region will be metropolitan, monocentric or polycentric. In the case of polycentric regions with overlapping urban influence spheres covering several NUTS3 regions, they were merged into one region. If a city is significantly larger than several small ones within the city region (e.g. London) then it is still defined as monocentric, while more or less equal cities form a polycentric region. NUTS-3 entities without any larger centre were classified as rural regions, shown in green in Fig. 3. The left map of Fig. 3 illustrates the result of this re-classification, with 904 NUTS-3 region clusters (rural-urban-regions, or RURs) emerging from the original 1278

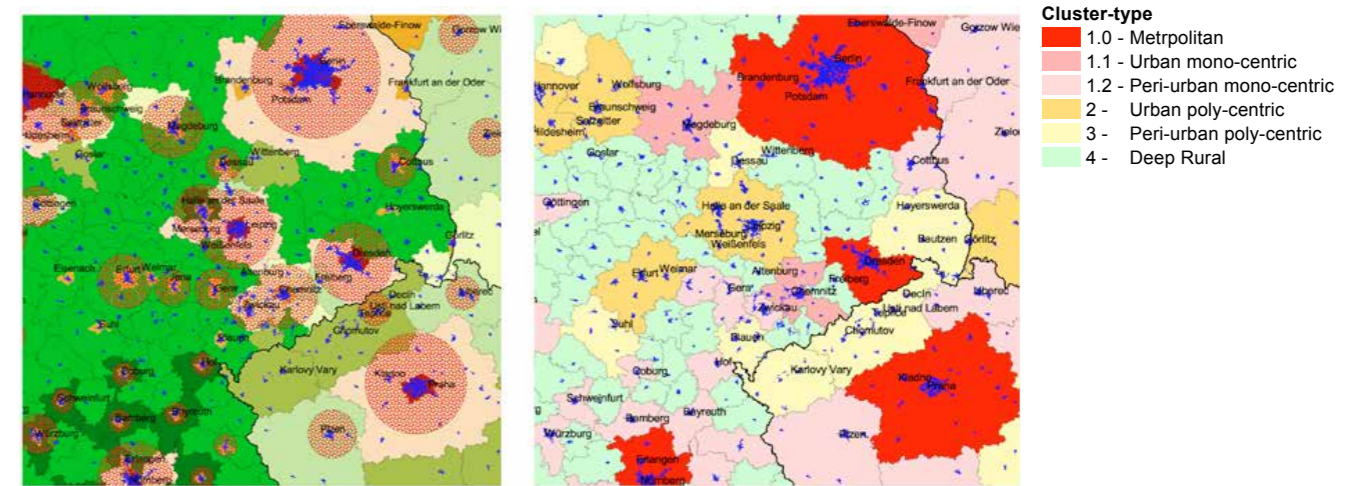


Figure 3: Urban settlements and city influence sphere extraction (left), urban region classification based on NUTS3 entities (right) (Source: Loibl et al., 2010)

NUTS-3 entities of the EU27. Within each region cluster, a further sub-delineation based mainly on population density was performed in order to identify urban, peri-urban and rural areas. The right map depicts these three major land use categories based on the CLC 2000 class "urban fabric" grouped as urban, peri-urban or rural settlements (red, orange and green).

As one can easily see in Fig. 4, there are major differences in the settlement morphology of the EU27: from rural countrysides with only a few urban centres in the Balkans, to almost continuously urbanised landscapes in the UK, Belgium, some areas of the Netherlands and northwest Germany. In general, western Germany, northern Italy and the western part of Poland show a high degree of

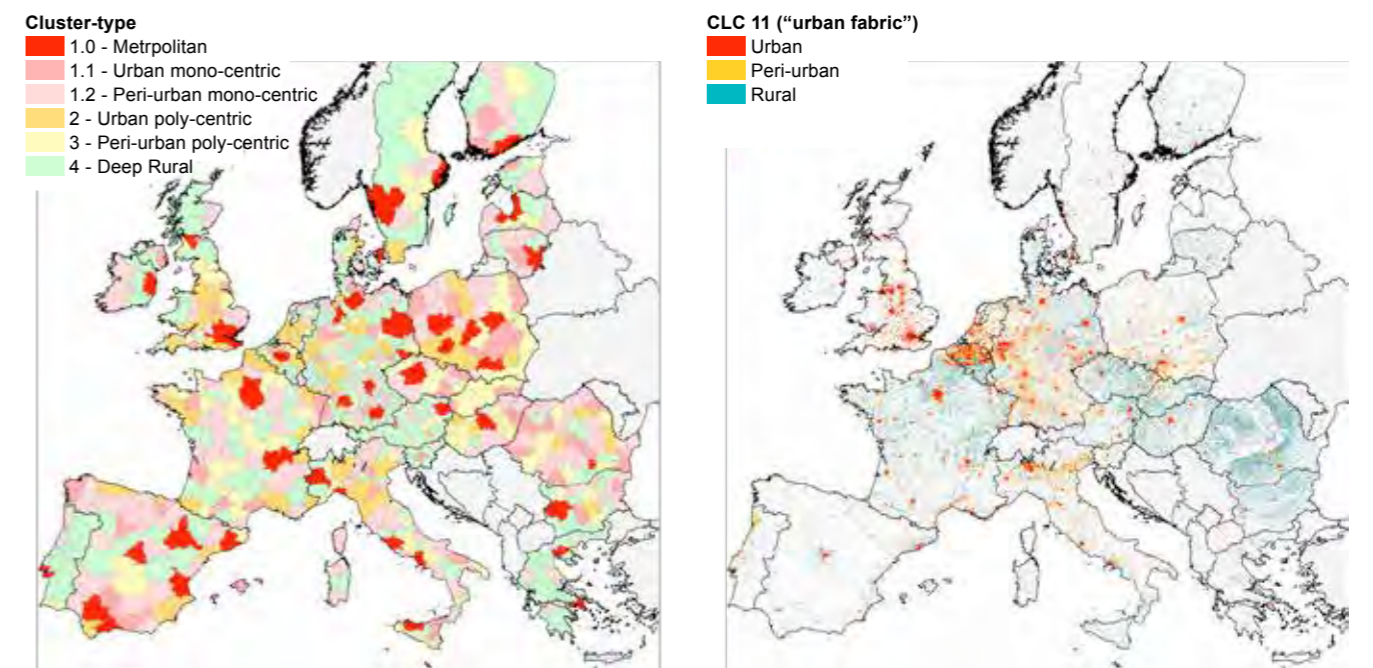


Figure 4: Rural and urban region (RUR) typology based on settlement morphology (left); type of CLC urban fabric (right) (Source: Loibl et al., 2010)

6 <http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2000-clc2000-100-m-version-12-2009>



peri-urban settlements. Additionally, one can see the different patterns of the number, size and distribution of settlements – from the numerous and scattered small settlements in the east, such as in Romania, to medium density in central Europe, to comparatively low densities in Spain and Scandinavia.

The above-mentioned criterion of a minimum of 250,000 inhabitants as the threshold defining a large European urban region produced 148 municipal areas with 182 core cities, the result of polycentric regions. These selected city regions are shown in the left map of Fig. 5. The right map shows the urbanised area within each city region in red.

### EUROPEAN URBANISATION PATTERNS

The share of urban and peri-urban areas within a city region varies greatly depending on landscape, size, economic conditions and, in particular, whether or not a significant portion of the region is utilised for agricultural purposes (c.f. Zasada et al., 2011). Fig. 6 depicts the ratio of urban and peri-urban sub-regions as a rough indicator for urban sprawl and peri-urbanisation.

sation. (The ratios refer to the total size of the NUTS-3 clusters that constitute a city region.)

Both maps show differences in urbanisation between the city regions. The highest rates of urbanisation in core cities can be observed in northwestern Europe in the UK, parts of Belgium and the Netherlands, and western Germany (particularly in the Rhine-Ruhr). As already seen in Fig. 5, regions often encompass more than one core city. The city regions in other countries still show various open spaces within their core cities, reducing the density of the urban fabric.

The greatest peri-urbanisation effects are also observed in northwestern Europe, followed by parts of Italy and Poland. Again, these regions are mostly polycentric regions, especially in the UK and northern Italy. Less urbanized core cities and peri-urban areas are observed in Spain, France, the Baltics, Scandinavia and the eastern continental countries. A special case is Poland, where the city regions show relatively high peri-urbanisation with a rather low number of urban areas: The core cities seem to be very compact and surrounded by small to medium-sized settlements, but hardly any rural settlements (see Fig. 4, right map). Of course, these results depend

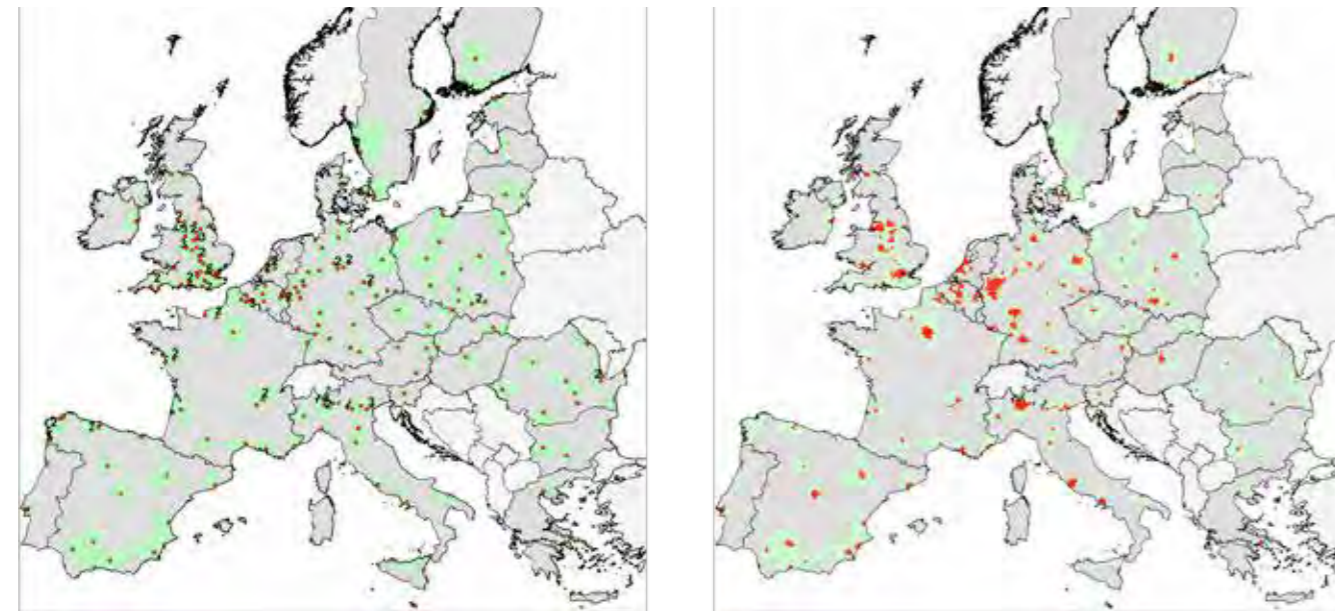


Figure 5: City regions with an urban population of > 250,000. Left: regions and number of urban centres per region (points). Right: regions and urbanised sub-regions (in red).

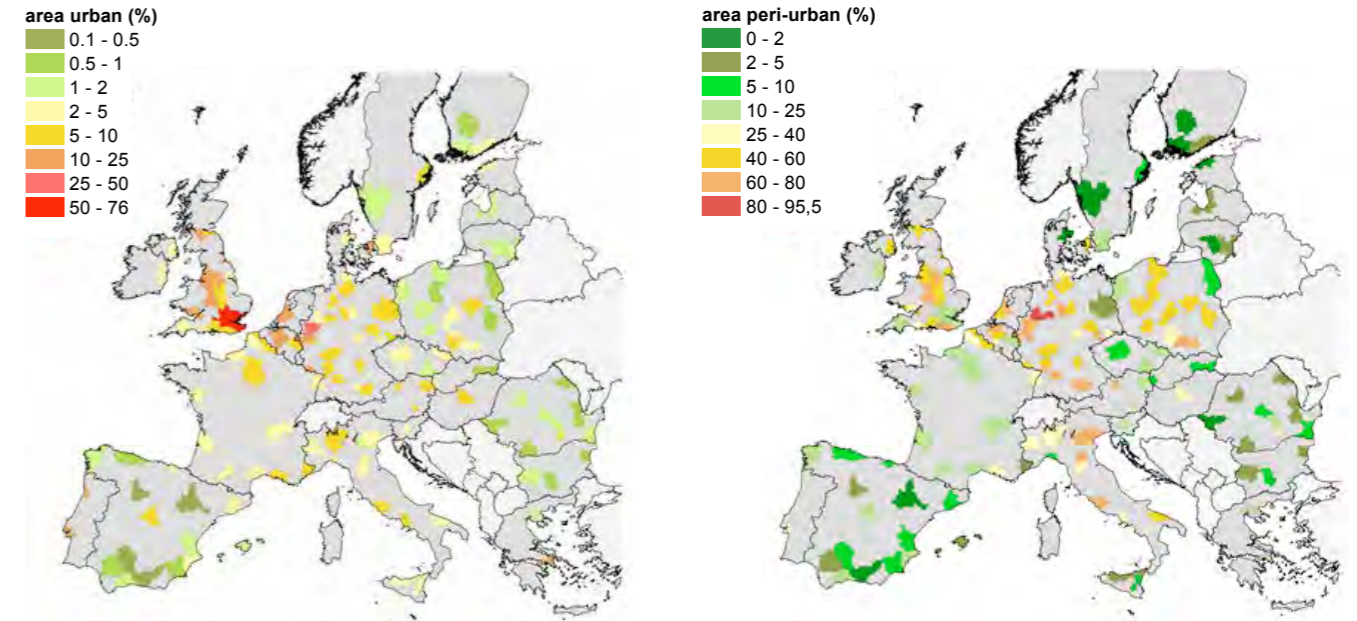


Figure 6: Ratio of urban and peri-urban areas (Data: PLUREL Project, CLC2000, population distribution EUROSTAT, AIT)

not only on urbanisation itself but also on the size of the NUTS3-based region delineation.

The degree of urbanisation can also be calculated with less influence of the region size, by using population figures and urban population ratios. Fig. 7 shows these indicators: The largest cities are Lon-

don and Paris, global metropolitan areas, followed by Berlin, Madrid, the Milan agglomeration and the polycentric Manchester-Liverpool region. The highest urban population rates can be observed in the cities mentioned above, in almost all capital city regions, as well as in Lyon, the Rhine-Ruhr area in Germany, the entire Randstad area in the Netherlands and in

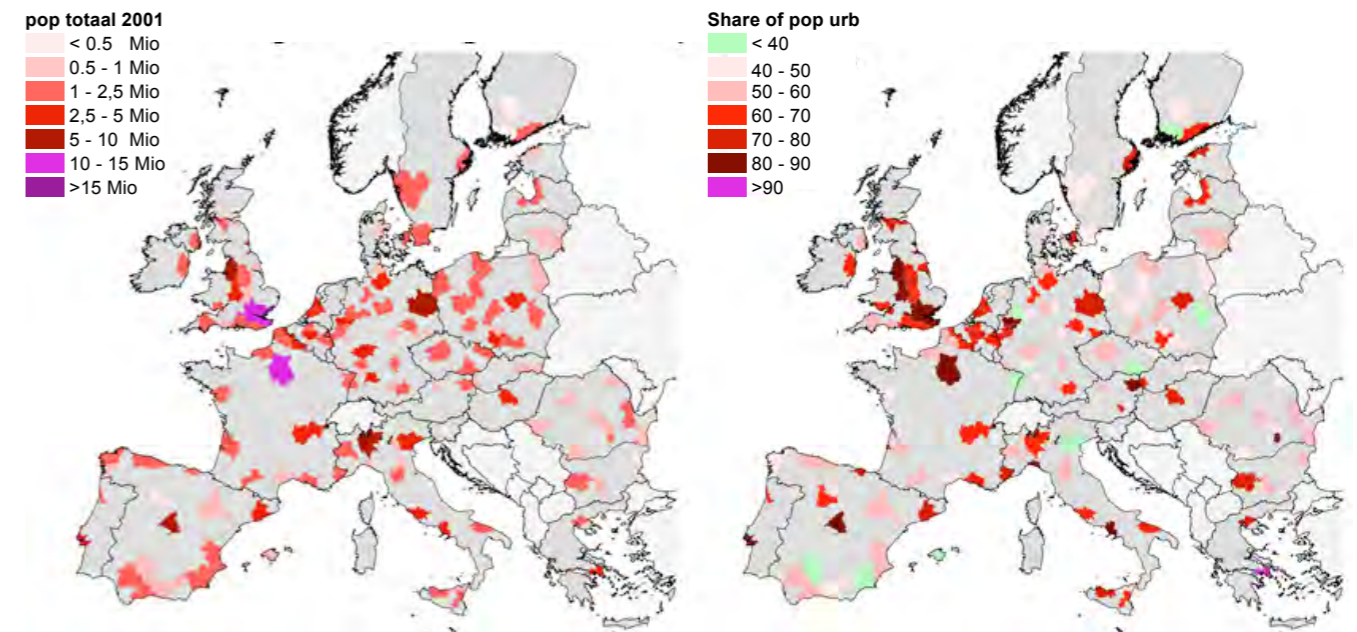


Figure 7: Number of inhabitants and percentage of urban population in 2001 (Data: PLUREL Project, CLC2000, population distribution by EUROSTAT, AIT)



various harbour cities along the Atlantic (such as Bordeaux, Bilbao and Porto) and Mediterranean coasts (including Barcelona, Marseille, Nice, Torino, Naples and Thessalonica).

### Present, Recent and Projected Population Dynamics

There are various sources for future trends, all of which start with a similar assumption (e.g. ESPON FOCI, 2010). In this study, we take the PLUREL scenarios into consideration (Botier et al., 2008; Piorr et al., 2011), which refer to a certain degree on the IPCC Special Report on Emissions Scenarios (IPCC, 2000) as used in the 4<sup>th</sup> ICCP Assessment Report 2007 (IPCC, 2007), which focuses on Europe and thus enables spatially explicit statements. Applied to economic, demographic and land use models extended with a series of “shocks” (i.e. accelerated changes), four medium-term future scenarios are outlined, summarized here in Fig. 8.

Following the IPCC scenarios, the PLUREL scenarios refer to similar assumptions, but with more differentiation dependent upon the prevalence of global or local dynamics (the vertical axis), and upon the frequency of developments triggered by public, social and environmental values or the more economic (technology driven) tendencies indicated on the horizontal axis. The characterised scenarios are: **A1-Hyper Tech** assumes rapid developments in information and communication technologies that lead to reduced commuting and transport needs; **A2-Extreme Water** assumes climate change leading to crucial impacts including rapid sea level rise, flooding and water resource constraints; **B1-Peak Oil** sees an energy price shock leading to rapidly increasing energy and transport costs and subsequent changes in mobility and trade flows; and finally **B2-(Social) Fragmentation** envisions a pandemic disease leading to population declines and behavioural shifts within society (Boitier et al., 2008, Piorr et al., 2011).

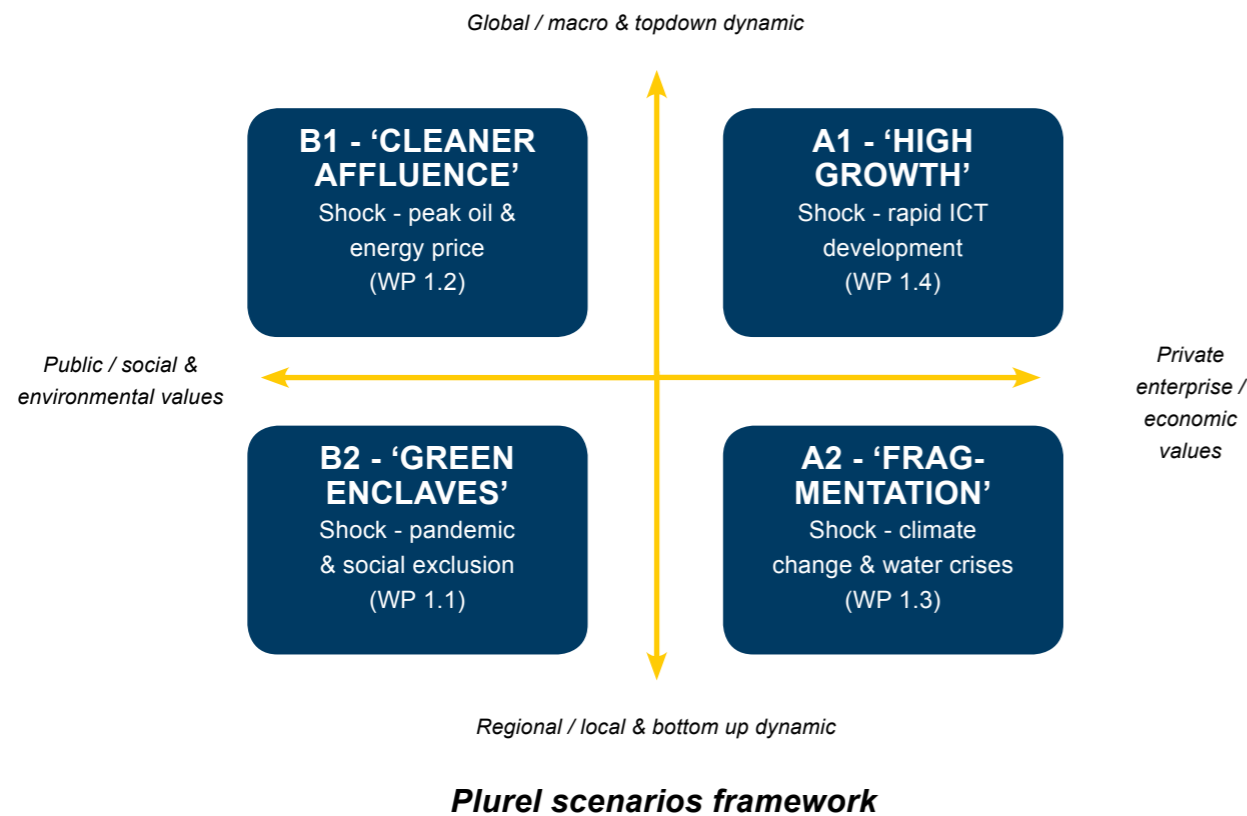


Figure 8: Overview of PLUREL scenarios (Boitier et al., 2008; Piorr et al., 2011).

The underlying numbers for the scenarios are taken from economic projections at the national and NUTS-2 levels, and taking oil price and population projections to in turn create economic projections. The basis for all scenarios are assumptions about the main economic drivers of the NEMESIS model, a macro-economic model for the EU-27 (excepting Cyprus and Bulgaria) and Norway. Details on the generation of the scenarios, the main drivers for each scenario and economic results at national and NUTS-2 scales can be found in Boitier et al. (2008). For more information about the NEMESIS model see [www.erasme.ecp.fr/nemesis](http://www.erasme.ecp.fr/nemesis).

The diagrams (Fig. 9) depict estimated GDP growth rates and population forecasts (Skirbekk et al., 2007) for the four scenarios listed above, disaggregated for NUTS-2 regions. In this study, we refer to the contrasting outcomes of the optimistic, technology driven scenario results of A1 and to the pessimistic B2 scenario to show a possible range of differences for the future. The projections were carried out in 2007-2008, prior to the mortgage and subsequent national budget crises. Today, both A scenarios have turned out to be overly optimistic. Nevertheless, we will still use A1 as a reference point, since the economy is expected to show recovery in the 2<sup>nd</sup> half of the 2011-2020 decade, leading to a brief delay of the assumed scenario. The B scenarios, on the other hand, reflect in some ways the consequences of the current crisis, although possibly with an overly pessimistic growth rate after 2020.

For scenario A1, the European GDP growth rate is assumed to be a little bit lower (around 2.5% per annum) than for A2 for the years 2012-2016. In the following years, a rise in growth rates up to 3% until 2020 and 4% after 2020 is expected. Scenario B2 shows a dramatic decline of the growth rate down to 1.7% after 2010 and a 2.5% recovery of the growth rate by 2025. The peak in population for Europe is projected to occur around 2030. Scenario A1 expects an increase of 15 million inhabitants in Europe, compared to today, and by 2050 quite the same numbers as today. The pessimistic scenario expects an increase of 5 million inhabitants by 2025 and a decrease of 30 million by 2050, which would be a

decline of 6% from current population numbers (c.f. Boitier et al., 2008, Skirbekk et al., 2007).

It must be said that from today's viewpoint the economic growth expectations seem too high. The current expectations are quite in line with the numbers in PLUREL, based on 2007 projections. The figure below shows the GDP growth rates for different European regions based on data from the International Monetary Fund (IMF). In 2007, the EC growth rate was around 3.5% p.a., while the growth rate in Central and Eastern Europe in transitioning sub-regions was around 5% p.a. For 2013, projections are around 1.3% p.a. for the EC and 2.9% for Eastern Europe. Current estimates for 2017 foresee growth rates of 2.1% in the EU and 4% in Eastern Continental Europe. The NEMESIS model estimates from 2007, extrapolated to 2017, range between 3% (scenario A1) and 1.7% (scenario B2) throughout Europe. These projections are within the range of the IMF world economic outlook estimates of 2.1 to 4% after recovering from the 2009-2012 recession years. The assumed GDP growth rates of around 1.8% p.a. for wealthy European EURO states are also in line with

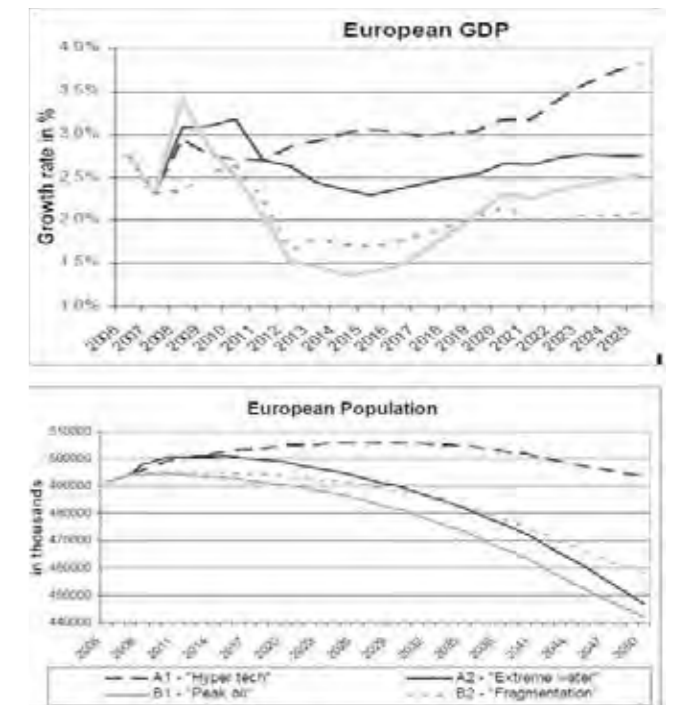


Figure 9: PLUREL scenario assumptions – economic and population development (Boitier et al., 2008)



Austrian projections (calculated until 2046) of growth rates ranging between 1.5 and 2% (c.f. Schiman & Orischnig, 2012). Thus, overall trends and differences between the city sub-groups estimated through NEMESIS can be evaluated as still valid.

As mentioned above, projections for European GDPs (NEMESIS model) and for population (IIASA model) are the only spatially disaggregated ones available only on the rather rough NUTS-2 level. To study the city region levels, the data was disaggregated to NUTS-3 and then re-aggregated to the city regions within the PLUREL project.

To evaluate future trends on this great of a spatial scale, the authors have analysed **present and recent populations** according to data provided by EUROSTAT (Loibl et al., 2010). Unfortunately, due to changes in the categorisation of territorial units for statistics in the middle of the last decade (in Poland and Denmark in particular, but sporadically in other countries as well), no continuous data was available for 2000–2010. Therefore, in accordance with CLC 2000, the years 2001–2005, a time not affected by recent economic crises, were selected as a comparison period. The illustration below (Fig. 9) shows the population dynamics of this period, for entire city regions (left) as well as for urban vs. peri/non-urban sub-regions (right).

When differentiated by core city and surrounding areas, the population dynamics of urban regions during the last decade show an overall division between west (population increase) and east (population decrease), with only a few exceptions, even before the start of the economic crisis around 2008 and long after the fall of communism. Growth and decline usually took place in similar ways in both urban and non-urban areas. For example, in Romania (except Craiova) both core city and hinterland show a decrease of population (sometimes even leading to high total population losses, such as in Brasov with a drop of 5.2%). In France, the UK, northern Italy, the BEN-ELUX and most city regions of western Germany, increases in both urban and non-urban sub-regions can be observed. All these regions are economically more prosperous. However, in some city regions, such as in Poland, Hungary (Budapest), Slovenia (Ljubljana) and southern Italy (mostly in Sicily), core city decline has been accompanied by suburban growth. On the other hand, in some of the non-Mediterranean regions of Spain (e.g. Bilbao, Asturias and Saragossa), inner-urban growth can be observed in conjunction with suburban decline.

Of course, there are many reasons for these different city core and hinterland trends that cannot be analysed on a broad European scale. Nevertheless,

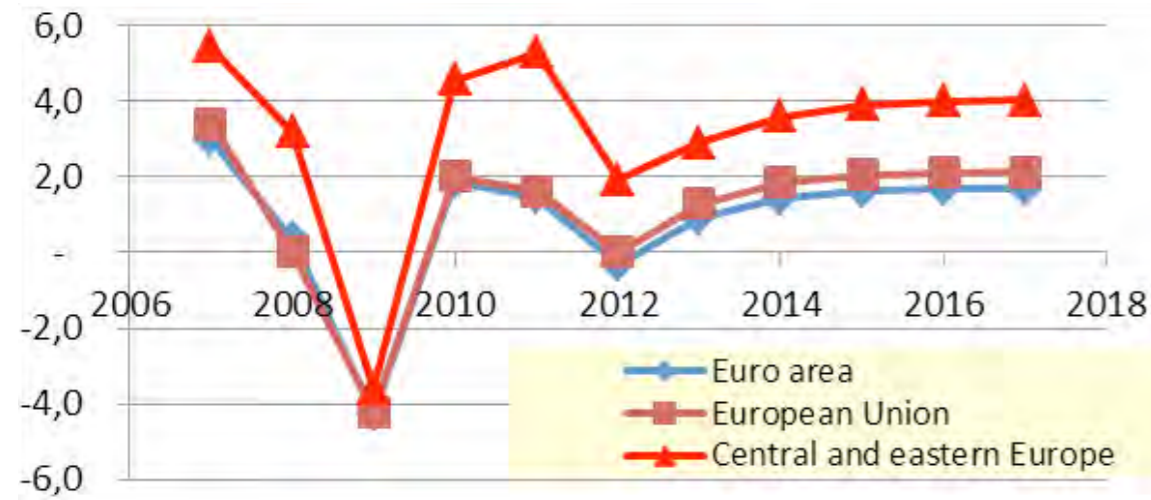


Figure 10: Past and projected annual GDP change rates for specific European sub-regions. (International Monetary Fund, World Economic Outlook Database, April 2012, <http://www.imf.org/external/pubs/ft/weo/2012/01/weodata/>)

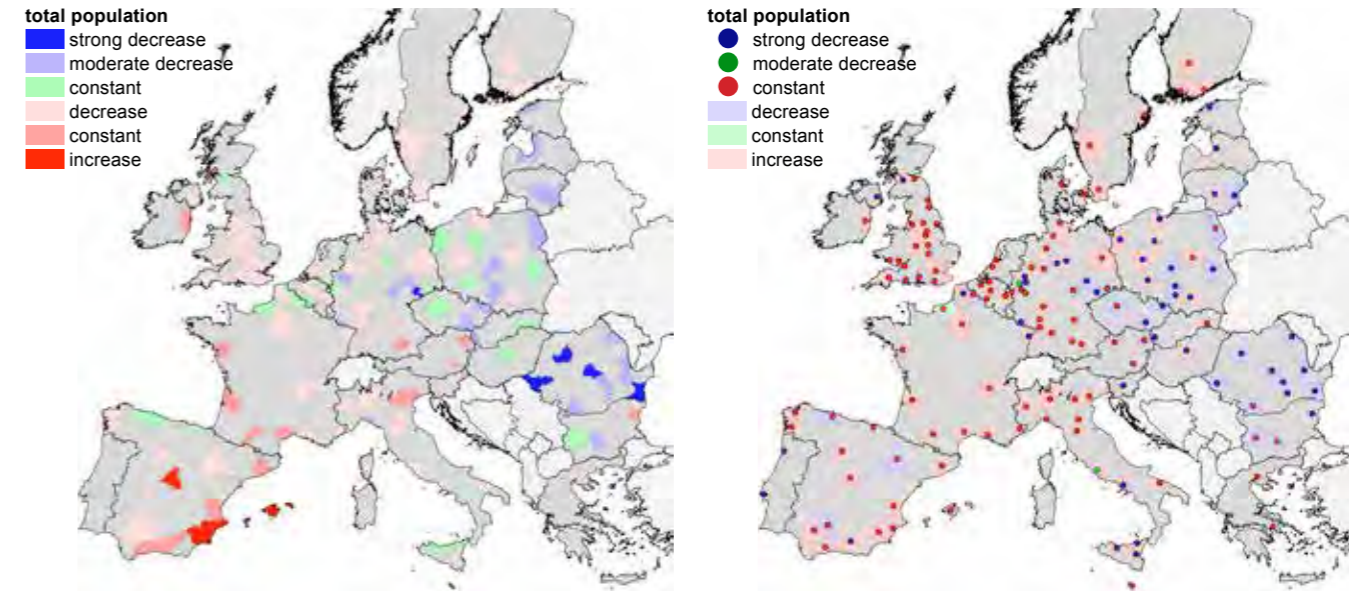


Figure 11: Total versus urban/non-urban population dynamics from 2000-2005/2006 (Data: EUROSTAT; AIT, based on various further sources)

many tendencies can be explained by the specific economic situation of an area. In Spanish Mediterranean regions, for example, distinct increases occurred in the non-urban hinterland, apparently a consequence of the last housing bubble. (Both maps show relative changes, thus, in densely populated regions, high absolute urban population changes result in a rather small relative change. On the other hand, in small regions with low populations, the relative change is higher).

For a better comparison, several regions have been grouped geographically as shown in the left map of Fig. 12. In the right diagram, the average population change from 2001 to 2005 is shown in relation to the total population of 2001. (Consider the log scale for the population numbers in the scattergrams. Stretching the population of the small to medium sized regions allows better comparison). London and Paris, the largest city regions, show moderate to low relative growth rates due to their already high absolute population numbers. The highest growth rates occur in Mediterranean & Atlantic coastal regions, with population numbers of around 1 to 2 million. Moderately high growth rates can be seen in southern France, Greece, in city regions along the Alps and in Dublin (all of which show pre-crisis

conditions!). In all these regions, relative growth is stronger in peri-urban sub-regions. Growth in urban sub-regions, combined with decline in the peri-urban surroundings, occurs frequently along the English Channel coast and in Bulgaria. The opposite trend, i.e. strong growth in non-urban areas and decline in urban city regions, can be observed in Slovenia, Hungary and in southwest Europe. In some parts of Poland and in southern Italy, growth in peri-urban sub-regions is accompanied by declining urban cores, leading to generally constant or slightly positive population dynamics. An overall decline in both urban and non-urban sub-regions is expected in Romania, Poland, the Baltics and eastern Germany (except Berlin).

These **future population** numbers have been projected by IIASA based on a probabilistic population growth model (Skirbekk et al., 2007). The original NUTS-2 results were disaggregated by AIT and the University of Edinburgh to NUTS-3 using artificial surface dynamics as a proxy. Here, they have been re-aggregated to the city regions. As shown in Fig. 13, the projections for all scenarios show quite similar trends: Western regions show overall growth; most Eastern city regions display



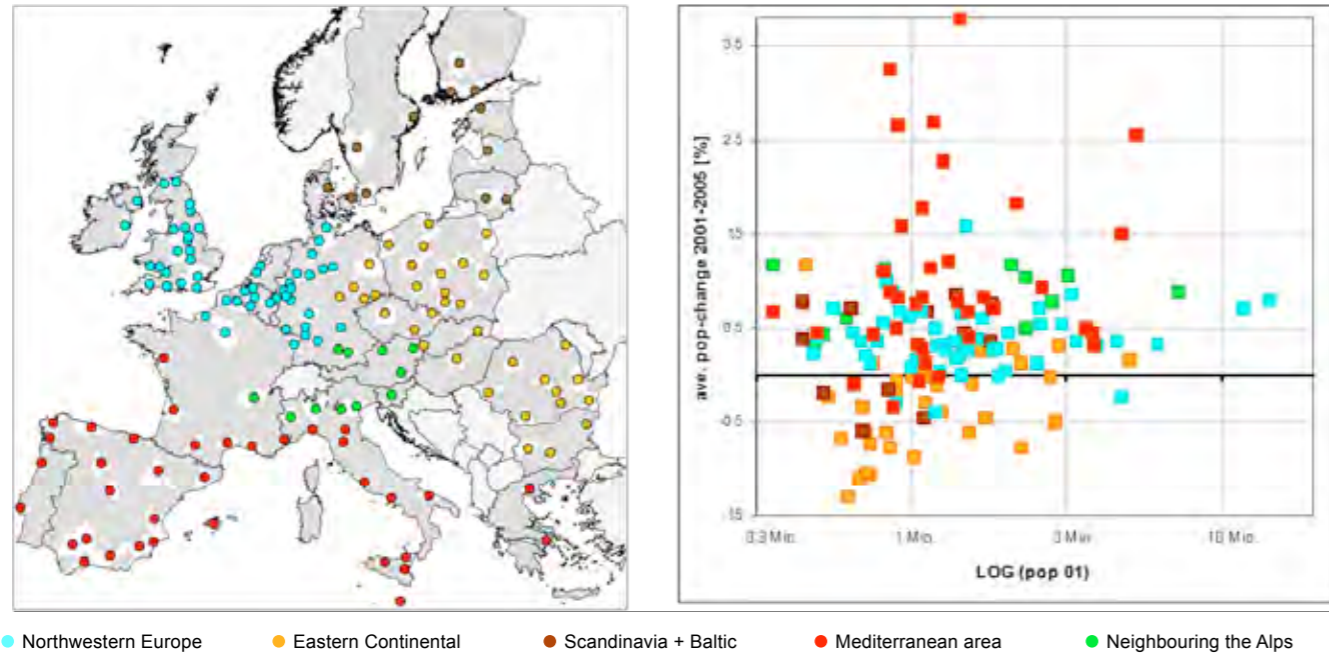


Figure 12: City region groupings (left); population dynamics 2001/05 relative to a function of initial population 2001. Diagram: Population 2001 on a log scale (Data: EUROSTAT; AIT, based on various further sources).

significant decline. Lower economic growth and decline in the East cause increasing population decline or decreased population growth due to emigration to more prosperous regions of Europe. Scenario B2

foresees higher decline in some Eastern city regions, and little or no differences in Western city regions in comparison to the A1 scenario. Overall, both scenarios show similar tendencies compared to the years

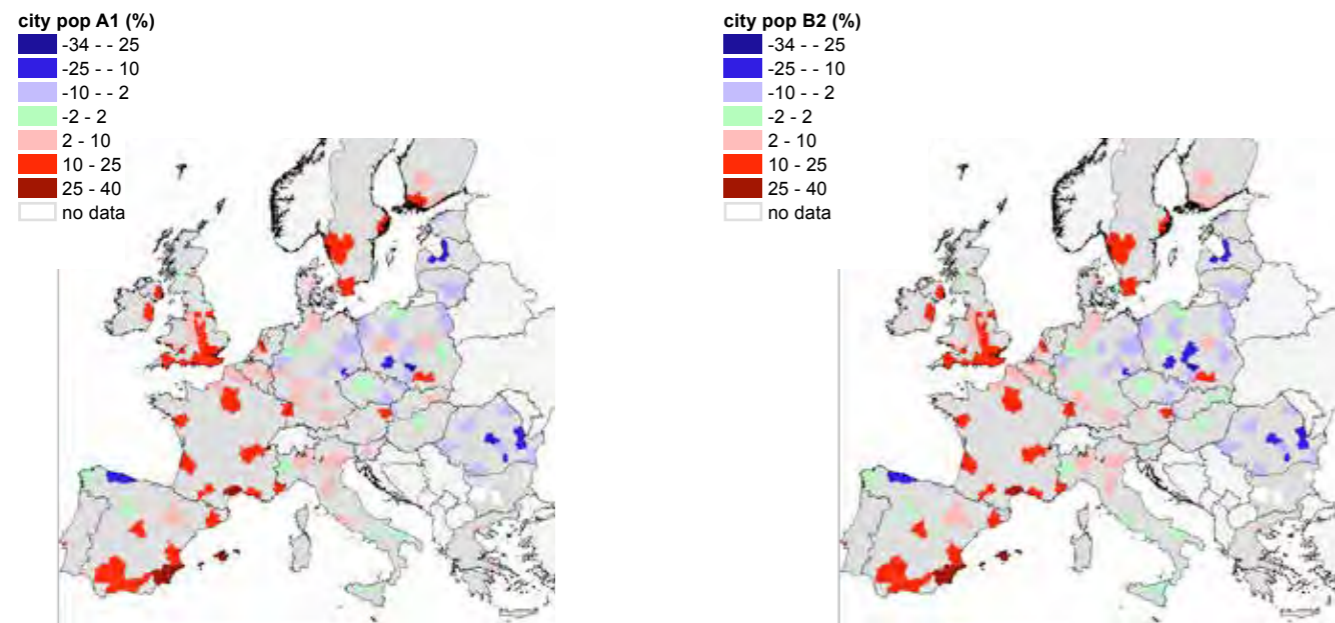


Figure 13: City regions' future population dynamics – 2025 relative change of population since 2001 – Scenarios A1 and B2 – maps. (Data: PLUREL project, IIASA, Univ. Edinburgh, AIT)

2001-2005/06. In general, the dependency between economic development and population dynamics is more visible in smaller Eastern city regions where low absolute population losses lead to higher relative population losses due to smaller population totals.

Fig. 14 shows the dynamics of the A1 and B2 scenario broken down into annual rates of change for better comparison with the left side diagram in Fig. 13 (Population numbers are again shown on a log scale).

Again, Eastern continental city regions show the lowest growth rates (or even a decline), while the highest growth rates are expected to occur in the Mediterranean, especially in medium-sized city regions located in southern Europe (Spain and France) with populations of around 1 to 2 million. Most noticeable in both scenarios is that the average annual change rates from 2001-2025 are expected to be considerably lower than those of the period 2001-2005. The reason for this is the disaggregation method used for the IIASA scenarios: NUTS-2 regions include urbanised as well as entirely rural NUTS-3 regions. Urban and non-urban regions will have different future popula-

tion dynamics, however, it is not possible to take this into consideration through the data disaggregation process. It thus appears that rural regions will benefit too much from projected population growth, and urban regions receive too little population surplus.

Comparing both economic scenarios, the differences in population change seem low but add up to considerable absolute numbers: one can expect differences in annual change rates of between +/- 0.2%. Positive deviations is expected in the coastal and western areas, while negative deviations are projected for Eastern and Baltic areas. Northwestern European city regions are only mildly affected by the different scenarios, and are projected to remain stable.

### Future Settlement Area Dynamics

Settlement area growth will be triggered by population growth and by economic growth as long as the demand matches the supply, controlled by planning guidelines. On the other hand, shrinking populations and economies are not causing a decrease of built environment. In fact, the opposite is the case. Changes in population numbers are, to a certain extent,

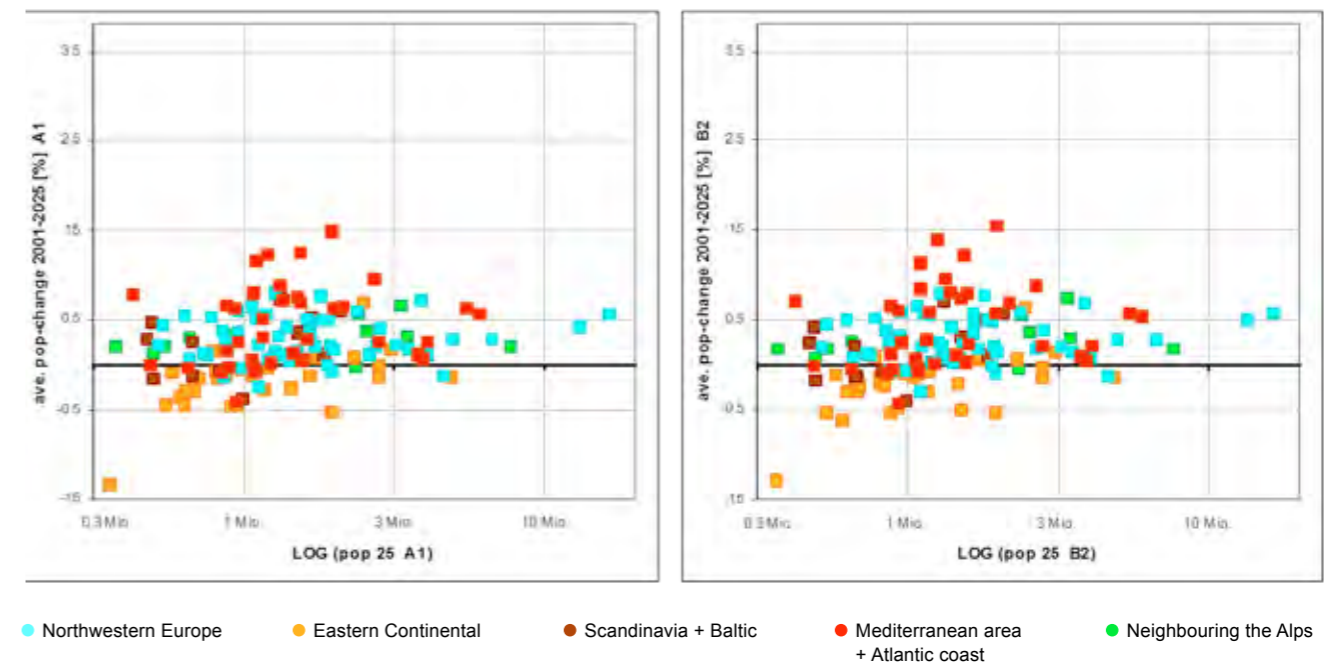


Figure 14: City regions' future population dynamics – 2025 relative change of population since 2001 – Scenarios A1 and B2 (vertical axis) by city size (horizontal axis – population numbers in a log scale). (Data: PLUREL Project, IIASA, AIT)



decoupled from the growth of built environment. The built environment frequently remains the same, or even grow. Experience shows that new buildings are often constructed on new building land instead of using brownfields for redevelopment.

As mentioned above, the University of Edinburgh has modelled urban growth, growth of the “artificial surface”, using a 1x1 km raster cell resolution. The model is based on the current artificial surface derived from CLC 2000 classes (developing areas but also traffic infrastructure areas), projected economic and population dynamics and, to some extent, urban morphology (c.f. Piorr et al., 2011). The area of artificial surface cannot decline. Data was available for all of the EU27 except for Bulgaria, therefore no projections for Bulgaria could be made.

Fig. 15 shows the artificial surface area in 2001 (CLC 2000 data) and the Scenario A1 projected artificial surface area in 2025, in absolute numbers. (In Scenario B2, the artificial surface areas show no distinct deviation from those in Scenario A1). As can be seen, the London and Paris megacity regions have the highest degree of built environment, which will

continue to grow significantly. The artificial surface areas of other city regions will also show growth, but to a smaller extent. Some city regions, especially in Spain, Poland, southern Italy and Romania, show a relatively low degree of artificial surface area, although the regions themselves have reasonable population numbers. This indicates that these regions have somewhat compact and dense cities.

In Fig. 16, the relative change of artificial surface area is set in relation to projected relative population change. As one can see, there are no negative artificial surface change rates, while population change can be both positive and negative.

Artificial surface area growth shows little correlation to population change. In Spain, continuous population growth has led to stronger tendencies for built environment. In the more prosperous regions of the UK, along the Alpine ridge and, to a lesser extent, in Scandinavia and the ESPON “blue banana” regions, a strong growth of artificial surface area is expected, although only moderate population growth is foreseen. This is especially true for Scenario A1. In Scenario B2, expected growth is generally lower, with a growth range of 30-40%.

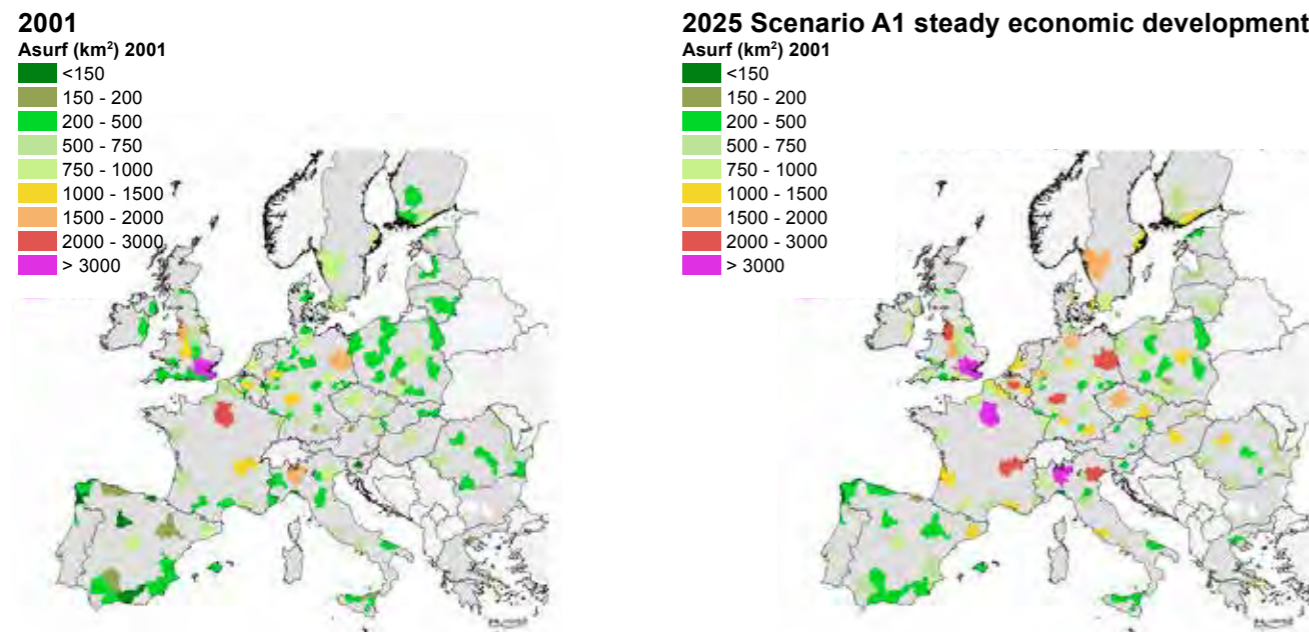
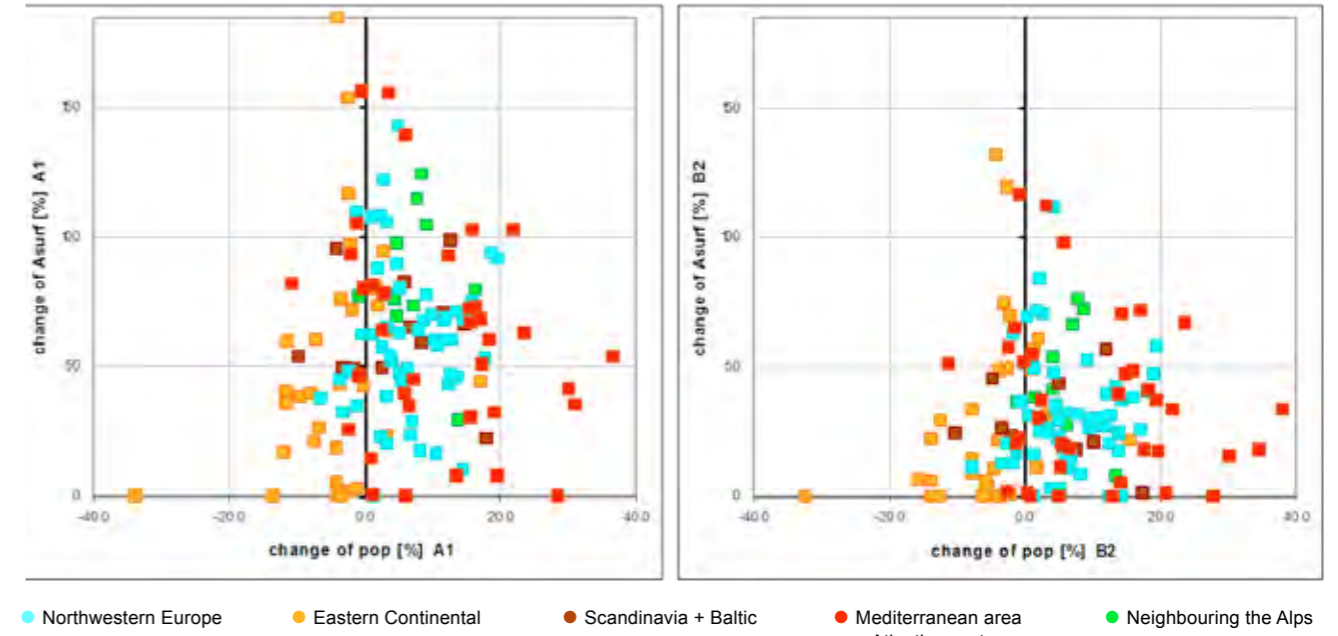


Figure 15: City regions’ artificial surface area – recent past (2001) and 2025 scenario A1; area in km². (Data: PLUREL Project, IIASA, University of Edinburgh, AIT)



In Figure 16: City regions’ future population dynamics (vertical axis) compared to artificial surface area change – 2025 (horizontal scale – relative change since 2001 – Scenarios A1 and B2. (Data: PLUREL Project, IIASA, University of Edinburgh, AIT).

Due to the limitations of the growth model arising from the accuracy of explanatory data, high growth rates for artificial surface areas in relation to increases in population is an indicator of urban sprawl and an increasing peri-urban area.

## SOCIETAL TRENDS

Two societal trends have been included in the study: changes in age structure and changes in household structure.

### Changes in Age Structure

In addition to densification in city centres and urban sprawl in the outskirts, ageing will be – and in some cases already is – a major challenge for future societies. Especially in the eastern and southern parts of Europe, the percentage of elderly in the population will see strong increases because of current demographic structures, low birth rates and emigration of better educated youths heading for more prosperous regions. The economic decline seen since 2008 could reinforce this tendency, but could also mitigate the

trend when these same young people return to their home regions when workplaces become scarce in formerly prosperous target regions. However, economically prosperous regions also show a significant growth of the elderly population. The percentage of people over 60 years of age has been selected as an indicator for ageing.

Fig. 17 illustrates this demographic parameter at the beginning of the analysis period (left map) and the projected percentage of the population over 60 years of age in 2025 (right map). As there are hardly any differences between the different future scenarios, we present here only the results of Scenario A1. Fig. 18 depicts the number of people over 60 as a fraction of the total population in the respective city regions.

The highest growth rates for 60+ populations are expected in eastern continental city regions: e.g. Germany (changing from 10-15% to 25-30%, and in some cases up to 40%). Northwest European, Scandinavian and Alpine city regions with already high elderly populations are expected to change from 15-30% to 25 -35%.



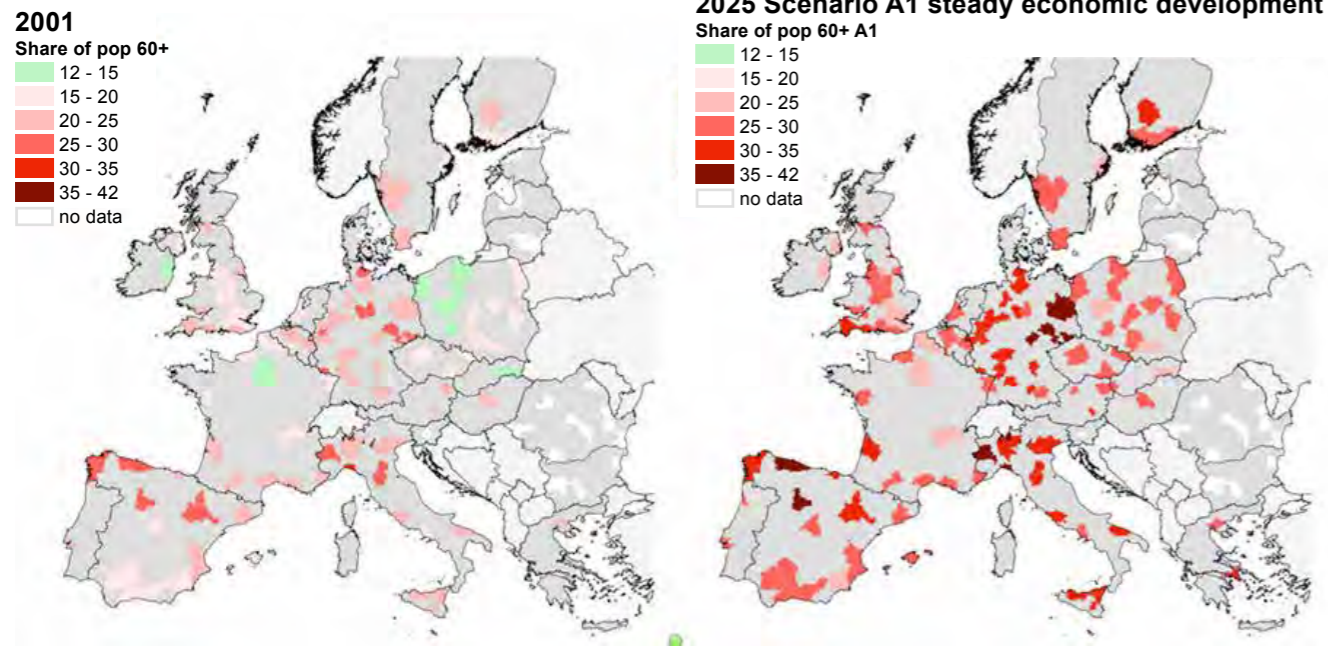


Figure 17: City regions' share of the 60+ age group in 2001 and 2025 (Scenario A1). (Data: PLUREL Project, EUROSTAT, IIASA, AIT).

The share of elderly people tends to remain smaller in the larger cities because of the influx of younger people, while small and medium city regions tend in general to significant over-ageing: Only 4 of the top 15 city regions with the highest 60+ ratios show population numbers over one million: Katowice and Lodz in Poland (both with diminishing populations), Athens and Berlin.

### Changes in Household Structure

As discussed above, population decline does not bring a decrease in the built environment along with it. A major reason for this is the sinking of average household size. Households in countries with current larger household sizes are expected to decay in the future.

As shown in Fig. 19, and even more distinctly in Fig. 20, recent household sizes in eastern and southern city regions are still larger than in the west and north due to economic conditions more frequently obliging families to live together in multi-generational households. Religion and culture may be another reason, since many of these regions have catholic and orthodox populations with rural roots, with families tending to have more children, increasing the average household size. This will be the same in 2025

for most of these regions, especially in the south. However, in 2025, the pattern is expected to change somewhat: the smallest household sizes are projected not in western city regions but in eastern ones. In 2025, there will still be some regions with an average household size of more than 3: in Romania, in southern Spain, in Dublin, Naples (Scenario B2) and some eastern city regions. (Several city regions are shown in white due to data missing either for the past or for the future due to a lack of data to estimate changes).

The diagrams in Fig. 20 provide a better comparison over time and between scenarios. Households in cities in the south and east are larger. The future decline of household size is expected to be less in Scenario B2, due to lower economic prosperity. The smallest household sizes can be found in Scandinavia and the Netherlands, with a correlating high artificial surface area per capita and GDP. In the economically prosperous regions of the west, north and Alpine region, the rather pessimistic Scenario B2 also projects a decline in household size. In Scenario A1, the smallest household sizes may be found in city regions in Poland and the Czech Republic, followed by ones in Scandinavia and the UK. In Scenario B2, city regions in Scandinavia and the Netherlands show the smallest household sizes,

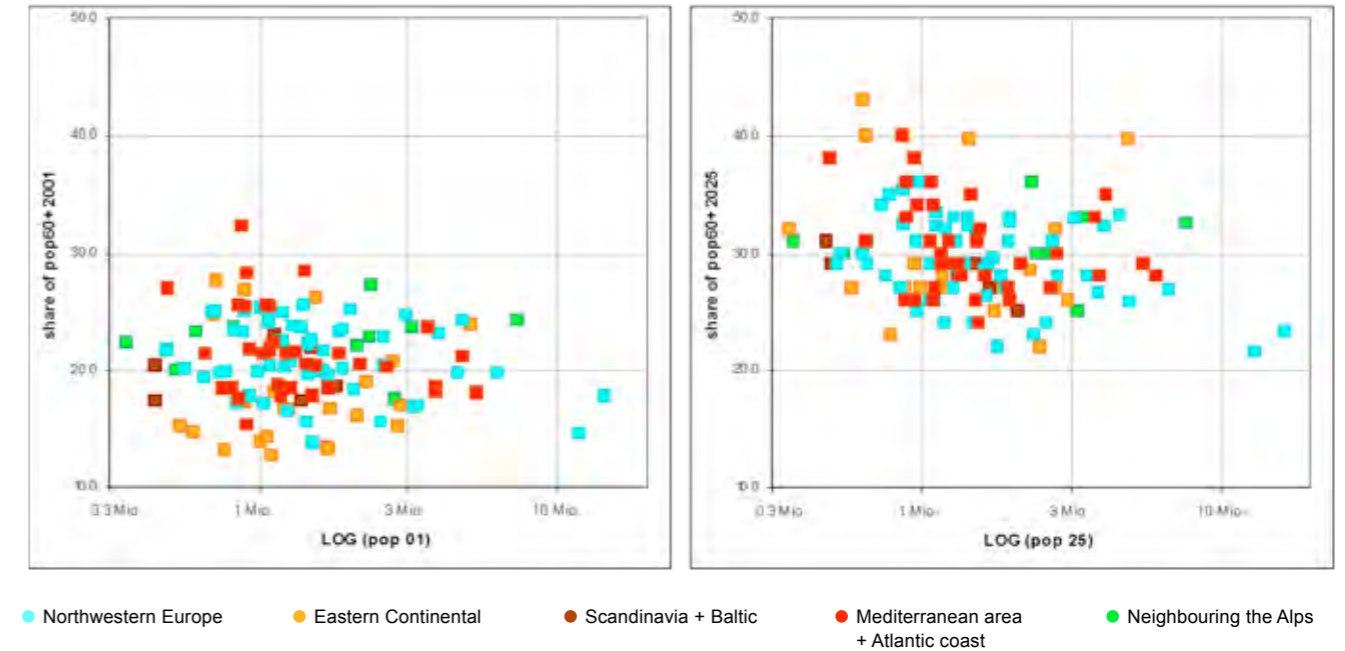


Figure 18: City regions' share of the 60+ age group in 2001 and 2025 (Scenario A1). (vertical axis for city size, horizontal axis for population numbers on a log scale. (Data: PLUREL Project, EUROSTAT, IIASA, AIT)

while the eastern regions retain their larger household sizes due to lower economic prosperity. A major reason for declining average household sizes is the increase in single-person households. This is a significant indicator for urbanisation and is connected to both changing

lifestyles and ageing. The maps shown in Fig. 22 show the situation in the recent past and in Scenario A1. In Scenario B2, the percentage of single person households is smaller due to economic restrictions, which fosters multi-generational households.

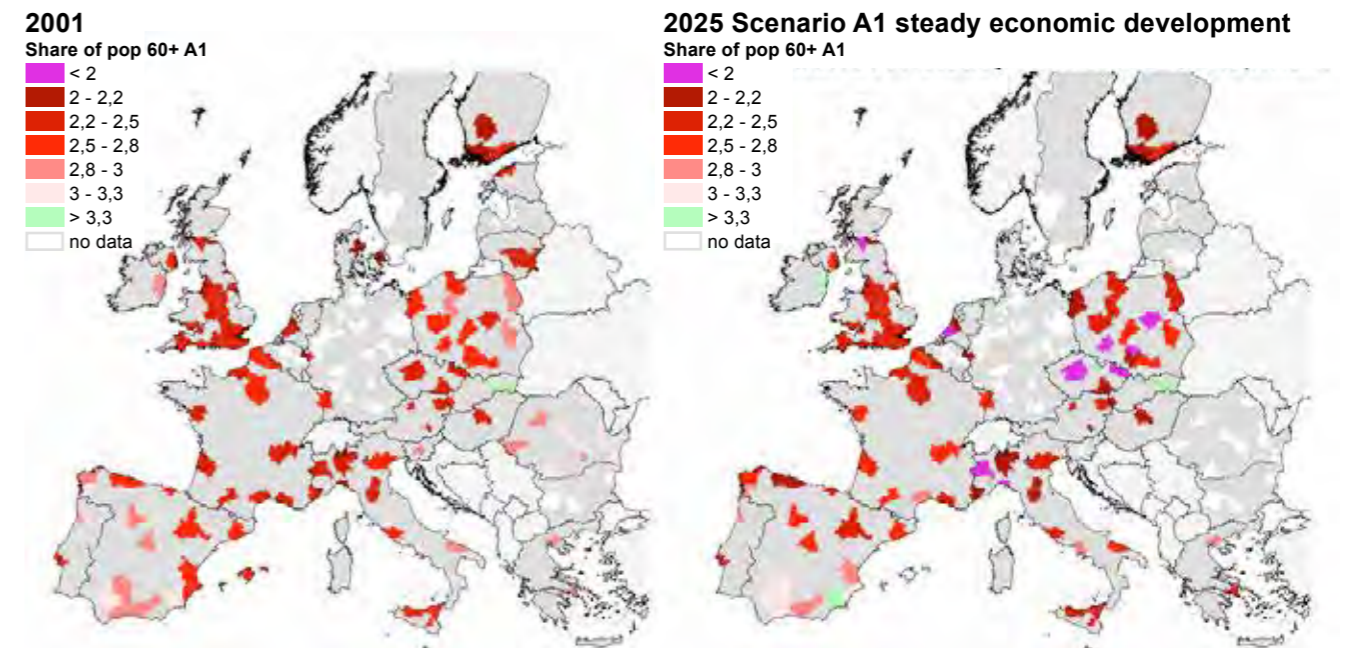


Figure 19: City regions' household sizes (persons per household 2001 and 2025, Scenario A1) (Data: PLUREL Project, EUROSTAT, AIT).



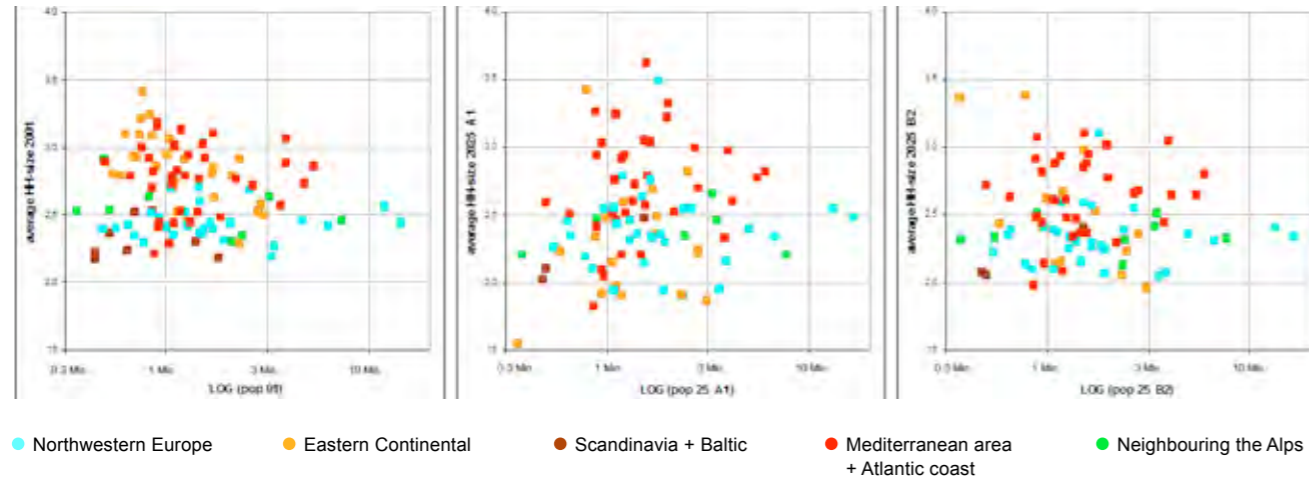


Figure 20: City regions' household size (Vertical axis: persons per household) in 2001 and 2025 by city size (Horizontal axis: log scale), Scenarios A1 and B2 (Data: PLUREL Project, EUROSTAT, AIT).

### Economic State and Dynamics

As mentioned earlier, economic growth is an important driver for built environment (due to the construction of new buildings and traffic networks), as well as for smaller household sizes (due to higher incomes), thus it leads to urban sprawl and peri-urbanisation. Fig. 22 depicts the GDP per capita for city regions in the recent past (2001) and the projection for 2025 (Scenario A1).

The GDP per capita shows a distinct tendency to increase from east to west and south to north. This is expected to remain so until 2025, when the slopes are projected to become even steeper! The GDP per capita is, to some extent, related to city size, but regional effects do overlap. London has the highest absolute GDP per capita, an indicator of London's role as a global financial marketplace. The ranking of the large city regions remains more or less the same

in both future scenarios, with only small alterations being observed.

Absolute increases of GDP per capita are highest in cities in northwestern Europe, Scandinavia, the UK and in cities in the Alpine region. In these city regions, GDP grows from 20,000-40,000 to 30,000-60,000 EUR per capita in Scenario A1 and to 20,000-50,000 EUR per capita in Scenario B2 (Fig. 23). The GDP per capita is to some extent related to city size, however, regional effects do overlap. Within the European regions, city size follows a low to high regional GDP gradient, with some exceptions. The east and the south start to catch up, but still remain behind wealthier northern regions, and in some cases the differences may even increase.

As stated earlier, economic growth expectations must be reduced due to the 2008 and 2012 recession years requiring some recovery, nonetheless the projected dynamics are not greatly different. The NEMESIS model estimates, as extracted for 2017, range between 3% (Scenario A1) and 1.7% (Scenario B2), which is in line with the IMF world economic outlook estimates ranging between 2.1% and 4% for European Union and Central and Eastern European growth rates.

### THE EFFECTS OF CLIMATE CHANGE

Together with population dynamics, urban sprawl and peri-urbanisation, projected changes in urban climate conditions are crucial to the development of city regions. For urban areas and their populations, it is not changes in median temperatures or precipitation totals that are important but instead change in extreme events.

#### The Effects of Temperature Increase

Regarding temperature, the number of days and nights with extreme heat characteristics is a severe issue that affects climate comfort, health and work efficiency as well as summer tourism.

Fig. 24 shows a steady increase in the number of heat days (days with a maximum temperature above 25°C) and tropical nights (nights with a minimum temperature above 20°C) per year (as averages for 30 year periods).

The heat day pattern of the current climate in the northern Mediterranean cities with 60 to 120 days (green to yellow) is expected to be the case in south-

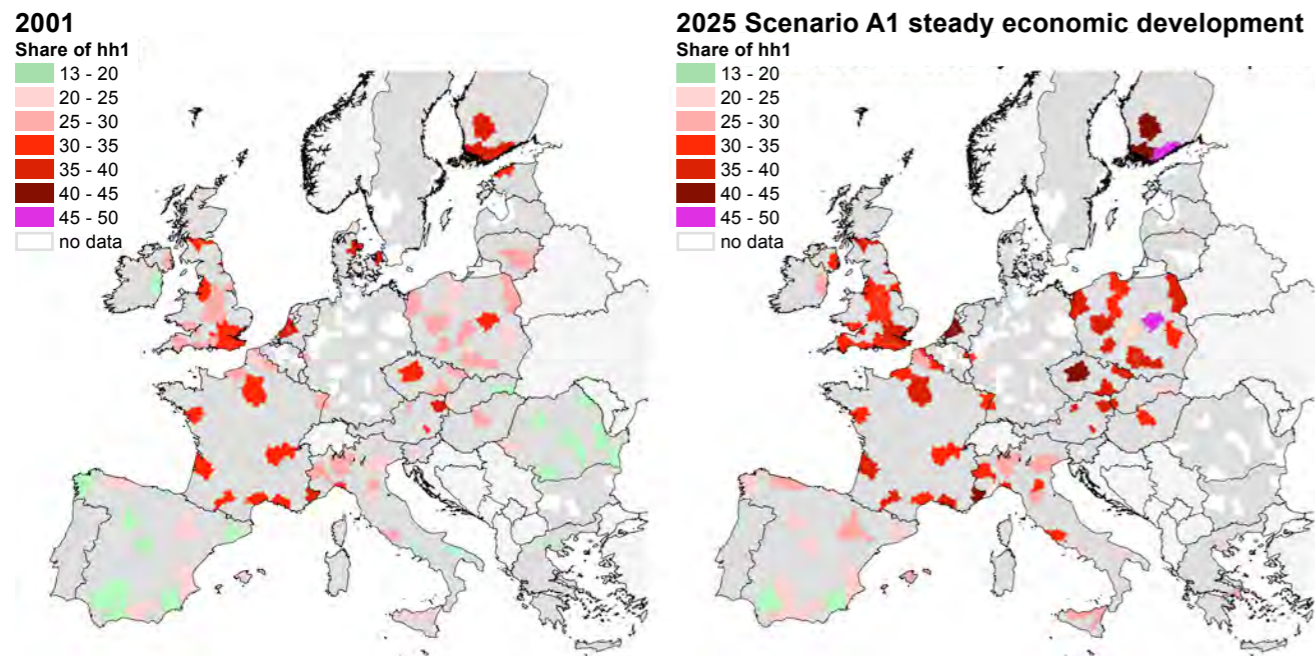


Figure 21: City regions' share of single-person households in 2001 and 2025, Scenario A1. (Data: PLUREL Project, EUROSTAT, AIT).

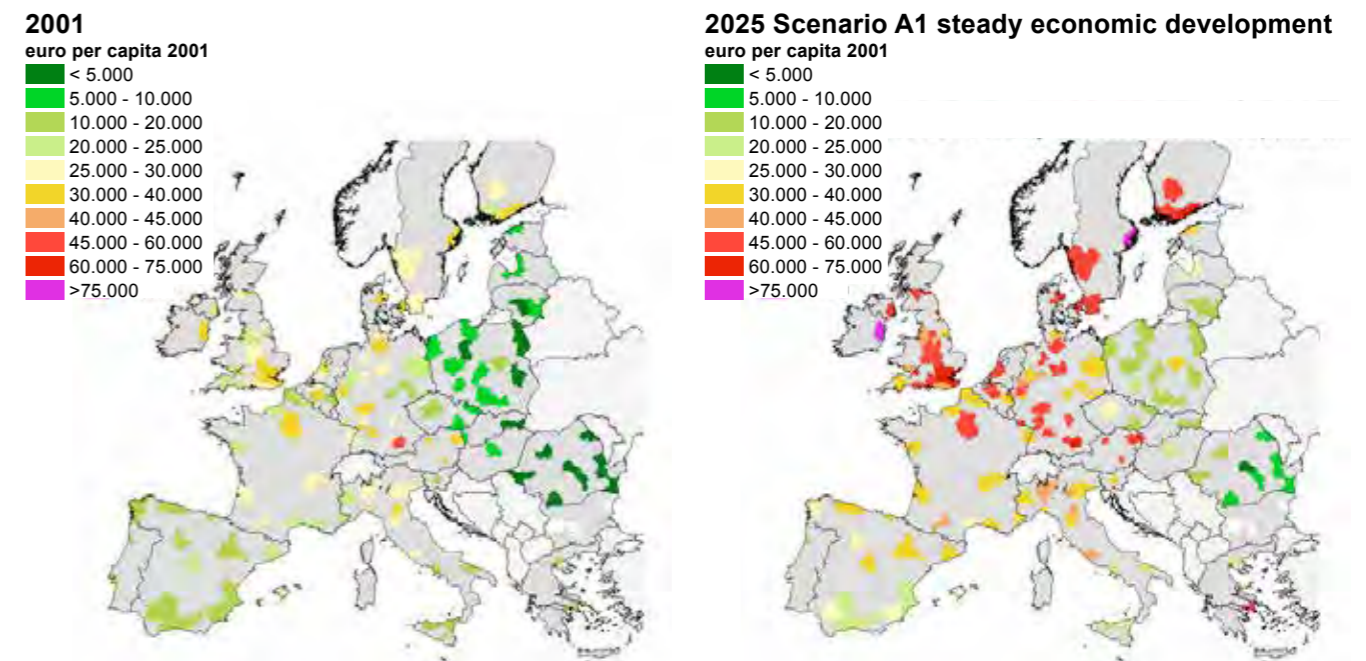


Figure 22: City regions' GDP per capita in euros, 2001 and 2025 (Scenario A1). (Data: PLUREL Project, EUROSTAT, Boitier et al., AIT).



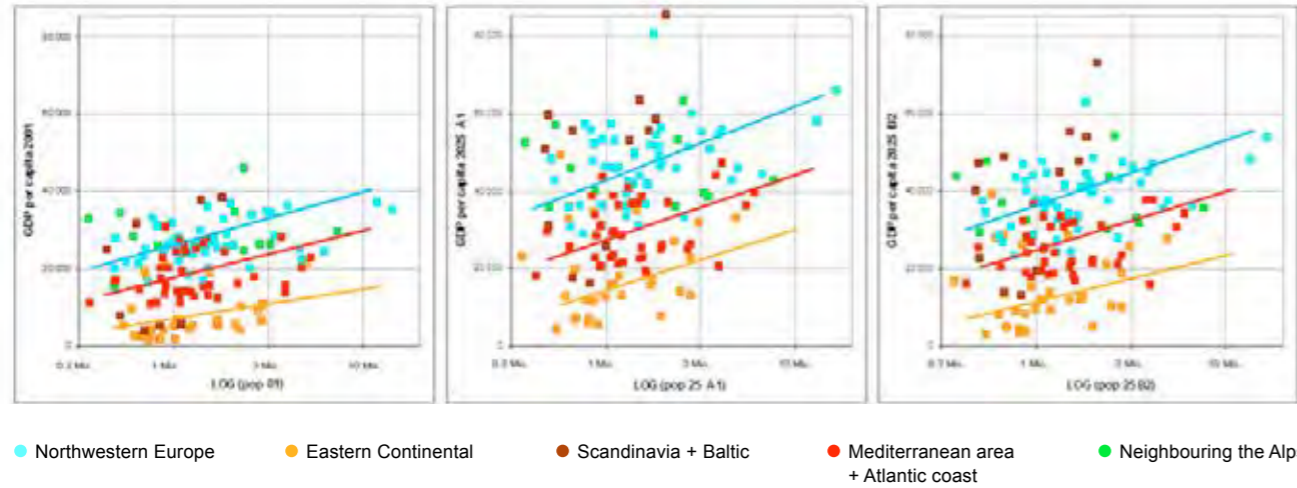


Figure 23: City regions' GDP per capita (vertical axis) by city size (horizontal axis, log scale) in 2001 and 2025 (Scenarios A1 and B2). Lines represent estimated trends for the Eastern Continental, Mediterranean and northwestern sub-groups. (Data: PLUREL Project, EUROSTAT, Boitier).

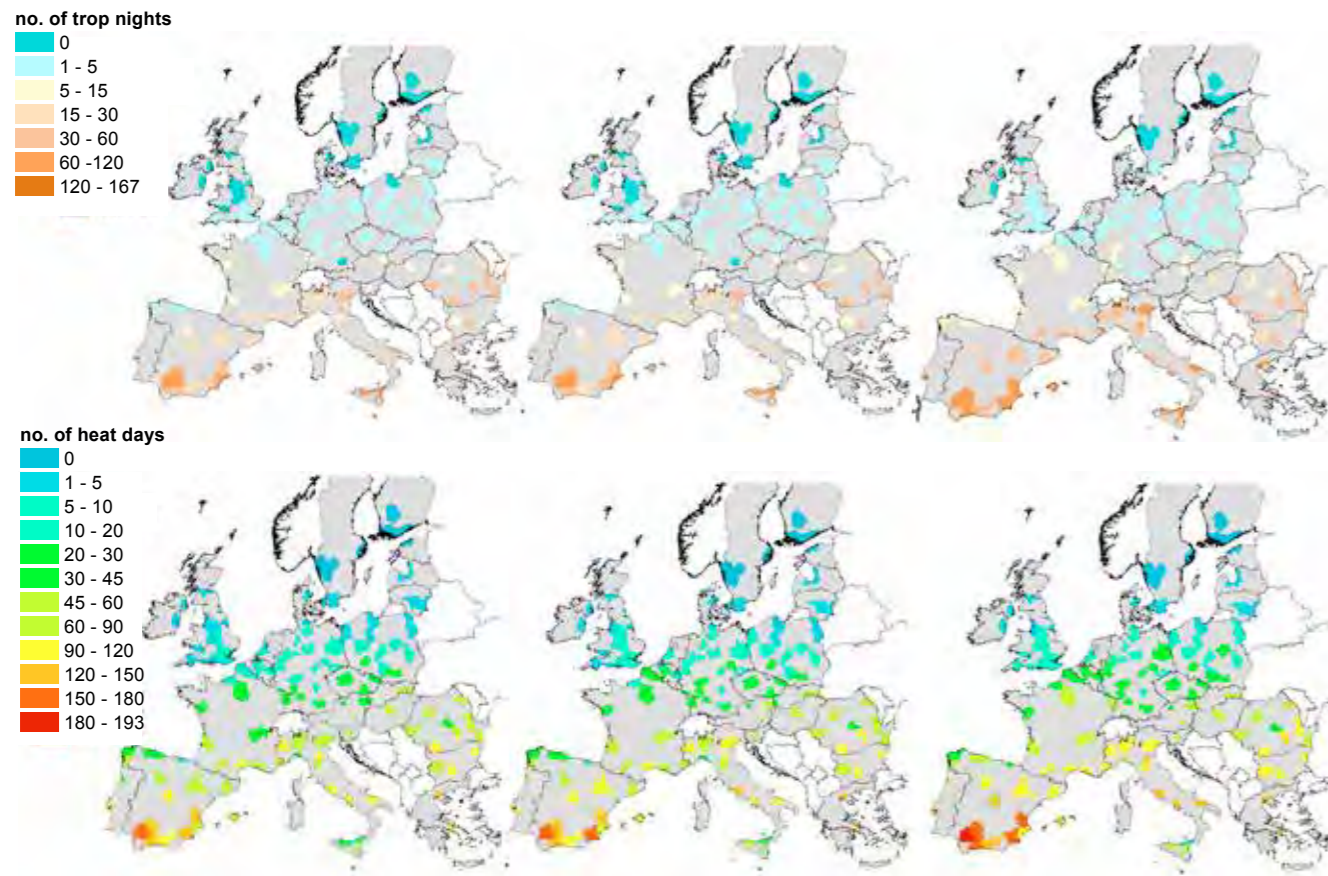


Figure 24: Number of heat days (days with  $T_{max} > 25^{\circ}\text{C}$ ): averages for the 30-year periods 1971-2000, 2011-2040 and 2041-2070 (top row). Number of tropical nights (nights with  $T_{min} > 20^{\circ}\text{C}$ ): averages for the 30-year periods 1971-2000, 2011-2040 and 2041-2070 (bottom row).

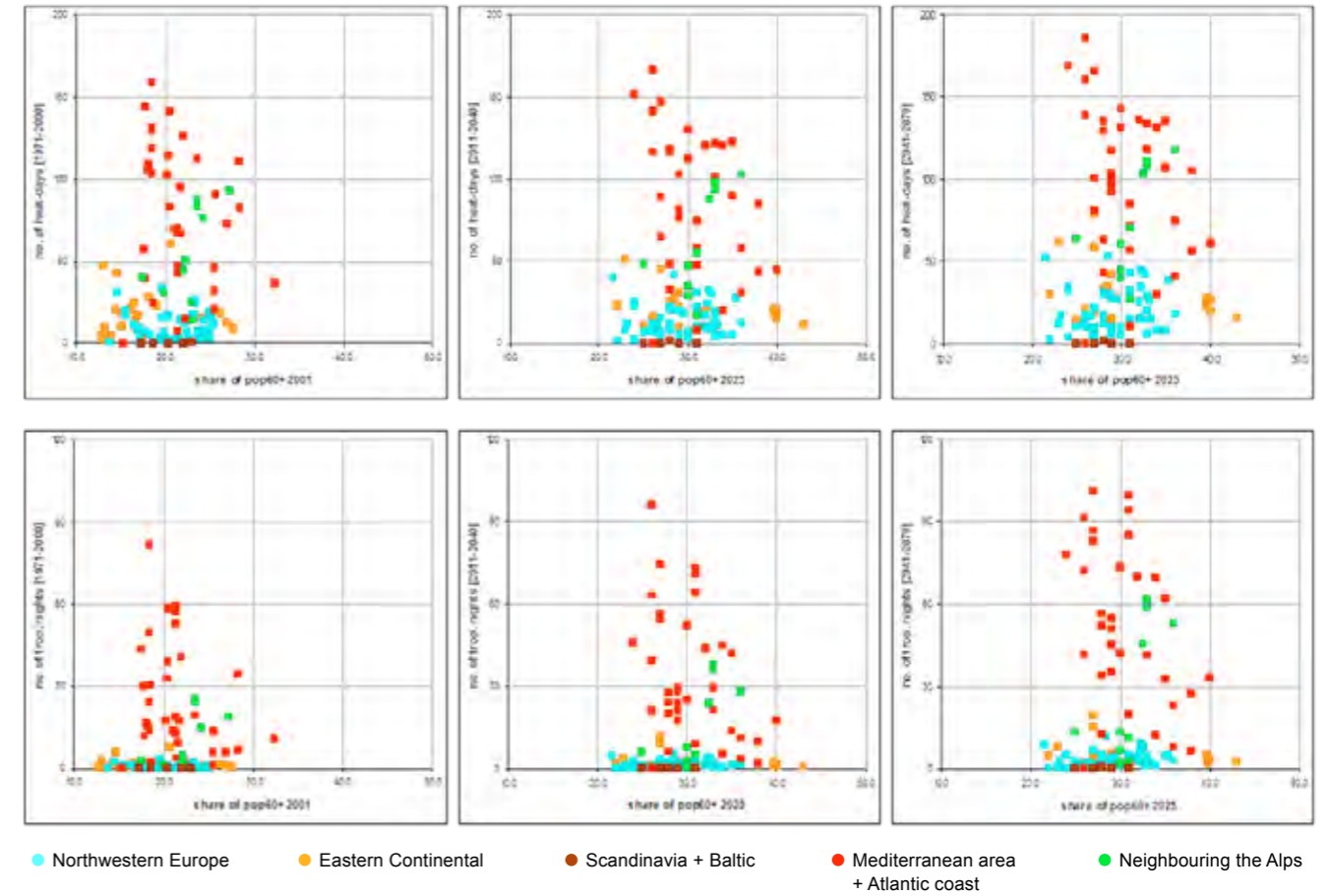


Figure 25: No. of heat days and tropical nights 1971-2000, 2011-2040 and 2041-2070 (vertical axis) and percent of population 60+ in 2001 and 2025 (horizontal axis). (Population data: EUROSTAT, IIASA, AIT. Climate simulation data: Consortial runs - A1B climate scenario).

ern and southeastern continental regions of Europe by the 2020s (on average from 2011-2040). By the 2050s, this climate is also expected in North Central and North Eastern Europe. City regions in southern Europe are projected to have 120 to 180 heat days per year by the 2050s.

The pattern for tropical nights shows a similar trend. Thus, southern European and eastern Continental cities, as well as cities to the south and east of the Alps will be most affected. The number of tropical nights as projected according to the current climate will gradually rise towards the north. By the 2020s, the number of measured tropical nights in south central Europe is expected to be the same as in some of the Mediterranean cities today (5 to 15 tropical nights per year). The lower ranges of climate change effects in cities in north-western and north central Europe

cannot be studied in detail due to the low numbers of extreme event days.

In terms of age, populations in Mediterranean cities will be most affected by heat days and tropical nights, as shown in Fig. 25. The greatest changes in extreme temperature days show increases from 45 to 90 heat days (left top diagram) and from 150 to 180 heat days (right top diagrams). These substantial shifts are concentrated in southern European cities and cities to the south of the Alps (120 heat days). The increase in tropical nights follows the same trend: in city regions of southern Europe, projected increases are from 15 to 60 tropical nights per year (left bottom diagram) and up to 60 to 90 tropical nights or more (right bottom diagrams). Again, the southern cities of the Alps also show high numbers, rising from 45 to 60 tropical nights. The eastern conti-



nental cities remain well below, with heat day numbers increasing from 10 to 25 days, 15 to 45 (2021-2050) and 20 to 55 days (2071-2100). Since the 60+ population rates are projected to continue growing from around 20% to up to an average of 30% by 2025, the number of people suffering from extreme heat events will increase.

**Effects of Extreme Events Triggered by Heavy Rainfall**

Heavy rainfall has local and even continental impact, depending on the extent of the event. The frequency and magnitude of heavy rainfall days will increase throughout Europe. The wind speed of peak events will also increase, especially in the North Sea, Scandinavia, Alpine areas, eastern Continental Europe, and southern Mediterranean. The projected changes depicted in Fig. 26 were derived from comparisons of the 1961-1990 and 2071-2100 climate projections carried out in the CCLM model for the IPCC A1B Scenario (ESPON Climate, 2011).

Mean annual summer precipitation amounts exhibit a distinct southwest to northeast rising trend throughout Europe, with a strong decline in south-western areas and strong increases in Scandinavia, the Scottish

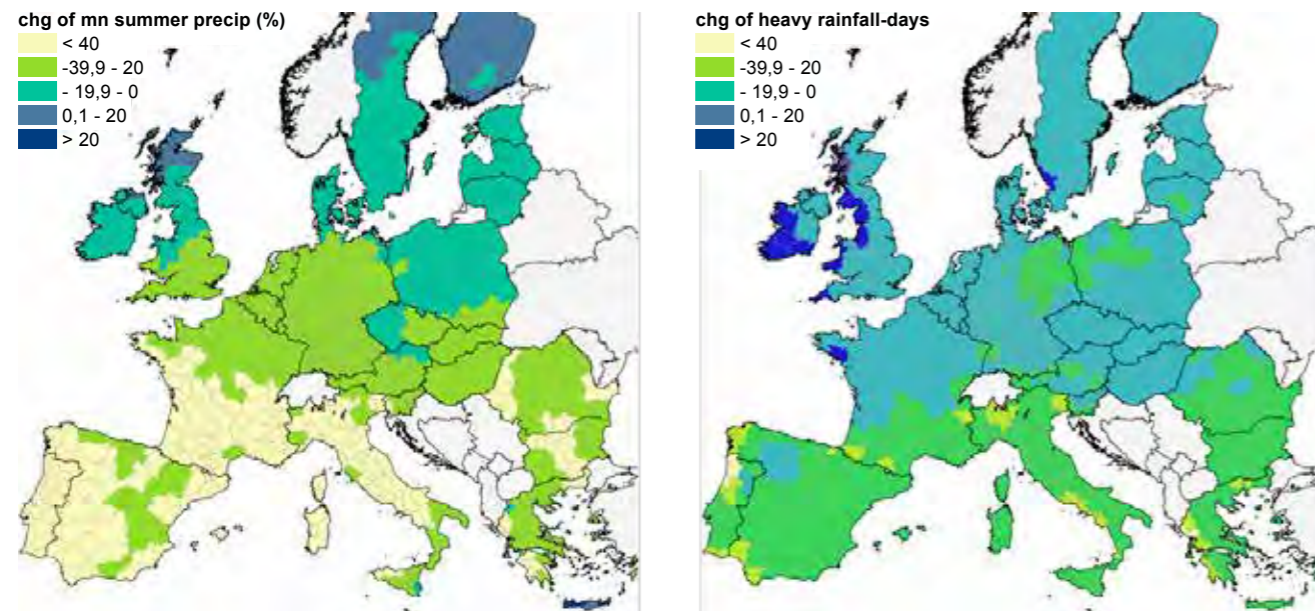


Figure 26: Exposure to heavy precipitation: relative change of annual mean precipitation in summer months (left), change of annual number of days with heavy rainfall > 20 mm/m² (right). (Data: ESPON Climate Project, 2011, adapted by AIT).

Highlands and parts of Northern Ireland. A strong increase of summer precipitation is also expected in Crete. The frequency of heavy rainfall days shows similar tendencies, but on a north-south gradient. In the Mediterranean and the Balkans, as well as in eastern Germany and western Poland, an overall slight decline is projected.

Based on Prudence climate simulation results (Beniston et al., 2007), an increase of high wind speed peaks and storm events is expected in the regions along the North Sea and the English Channel (up to 10%), in northern Scandinavia, in some parts of the Alpine region, and to some extent in eastern continental Europe. Contrasting this, peak wind speeds are expected to decline by 10% in the Mediterranean.

The risk of coastal flooding will increase along the Atlantic coast, especially along the North Sea and to a lesser extent on the Mediterranean. River flooding risk increase is projected throughout the continent along the Danube (Hungary, Romania and Bulgaria), Vistula (Poland), Oder, Elbe (Poland, Germany), Po (Italy), Rhone (France), Umea (Sweden), Kemi and Oulu rivers (Finland), but only a few city regions are expected to be affected by higher flood risk (see Fig. 27, right).

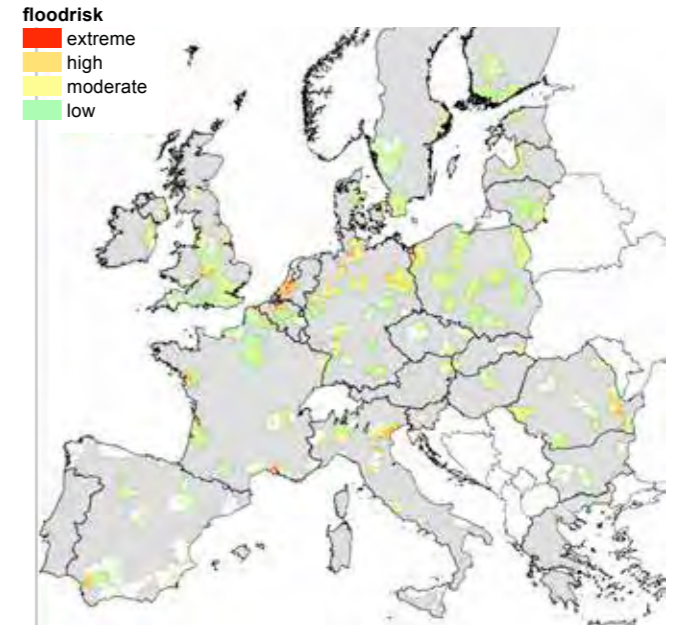
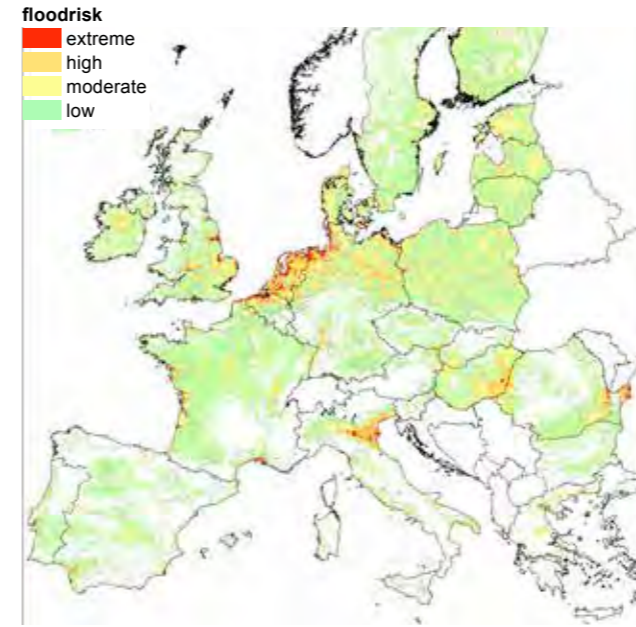


Figure 27: Projected risks due to coastal and river flooding in the EU27 and 148 city regions (Source: AIT, based on JRC's potential flood hazard map of Europe (De Roo, 2007; extracted and correlated by the AIT).

Higher flood risk is expected mainly due to rising sea levels and increases in heavy precipitation. On the European scale, larger cities are less affected by flood risk because of control measures (e.g. reservoirs and dykes), but smaller cities, for example in and around the Alpine region, are expected to be at a higher risk of flooding. The number of extreme precipitation events per year is expected to increase to 2-5 events in the inner Alpine area (Loibl et al., 2011). The current event frequency shows a high variation depending on the region, ranging from 3-5 in the lower eastern and western Alps, 5-15 in the central Alps and up to 15-25 events in the southern Alps, e.g. Ticino (Plaut et al., 2001). Flooding depends on the intensity, volume and timing of precipitation events, river basin conditions (e.g. soil wetness, snowpack and ice cover), morphology and land use, which limits possibilities for long term predictions. The Peseta Project shows, in most European areas, a relative change in river discharge for 100-year floods by 2100 of 5-10% along larger rivers, 10-20% along smaller rivers and a 10-20% decline in 100-year discharge in some areas of Finland, Spain, Romania and Germany.

**SUMMARY OF TRENDS**

**Distribution of Medium and Large Cities:**

City regions are evenly distributed throughout Europe, although the largest city regions are located in the north-western part of Europe, an area referred to as the Blue Banana (© ESPON). This area is a corridor of urbanisation stretching from England (Leeds, Sheffield, Liverpool, Birmingham and London), across the BENELUX countries, France (Lille and Strasbourg), Germany (Rhine-Ruhr, Munich and Nuremberg) and the whole of Switzerland towards the north of Italy (Turin, Milan and Venice). This area shows some of the highest concentrations of capital, population and industry. The most frequent occurrence of polycentric cities in Europe can be found in the UK.

**Population Dynamics**

With some exceptions, a division of the patterns of future population dynamics can be observed. Most city regions in the west will have growing populations, while in the east they are expected to lose inhabitants. This trend is highly dependent on economic growth. Therefore, the (south-)east will still lose young, well-educated members of its population

to migrating to the (north-)west. Ageing will increase rapidly due to current age distribution, birth rates and life expectancies, especially in the east. In most cities located within the Blue Banana, the number of inhabitants living in urban and peri-urban areas will increase. A decline in urban and increase in peri-urban populations is projected for cities in Poland, Hungary, Slovenia and in southern Italy, especially Sicily. Large cities are less prone to ageing because of the in-migration of young populations. Contrasting this, small and medium sized cities are expected to be more affected by ageing trends: of the 15 cities with the highest percentages of 60+, only four have populations of more than 1 million. Three of these cities are located in the Eastern Continental region.

**City Structures, Economy and Growth Dynamics**

The cities in the south are usually compact and have high population densities, whereas urban regions in the north-west, Scandinavia and eastern continental areas display the highest land consumption rates. Relative to economic growth, land consumption rates are expected to continue increasing. However, the very largest cities have the highest population densities, and are expected to show less expansion. Although the GDP per capita is expected to rise in all city regions across Europe by 2025, the distinct east-west and south-north upward gradient will persist, with polarisation even being expected to increase. Analysis has clearly shown that GDP per capita is connected to city size. However, geographical effects do overlap and depend on the economic performance of the city.

**The Effects of Climate Change**

When analysing the consequences of climate change in urban areas, increases in median temperature and precipitation are not of great relevance, while increases in extreme weather events are. In the decades to come, the number of heat days and

tropical nights will increase rapidly with high concentrations in the southern and eastern continental regions and those along the Alps. Summers are expected to be drier and water scarcity will have effects on the water supply. Since the supply of water from mountain headwaters is becoming limited in some regions, the importance of local groundwater is projected to increase. Extremely high temperatures in urban areas will require innovations in urban design and cooling infrastructure. Shading, green space irrigation, building shading, ventilation, etc. are expected to become necessities. The highly vulnerable population group of those over 60 will suffer most from temperature increases. Another effect of climate change will be heavy rainfall, especially in the northern parts of Europe and the Alpine region. The risk of large-scale flooding may increase along some rivers and smaller floods along minor streams are expected to become more frequent. Heavier storm surges and coastal floods are expected along the North Sea coast.

These results underscore the necessity of differentiated perspectives for transnational research, development and innovation activities. Although the megatrends analysed have significant consequences for urban systems, the way they occur and the concrete challenges they may bring to European cities vary greatly depending on the local circumstances. The heterogeneity of European cities is well reflected in the data analysis results. The results underline that, in many cases, there is no “one-size-fits-all” solution to urban challenges in an integrated and multidisciplinary research initiative, but that the local characteristics and individuality of cities must be closely examined to be able to work towards a holistic model of future urbanisation.

# The Challenges of Urban Megatrends in European Cities

The previous chapter emphasised that megatrends occur in different forms depending on the characteristics of urban regions. Starting with the megatrends of demographical development, economic development and climate change, the different forms of manifestation of these trends in urban areas across Europe have been identified. For a visualisation and better understanding of the interdependencies, this chapter focuses on the concrete effects that these megatrends have on city regions and what challenges they bring about. Therefore, a qualitative analysis was conducted in six countries for highlighting the major challenges in European urban areas. The six

countries have been treated as case studies in order to identify the different developments in European urban regions. In order to gain an understanding of what these effects mean for cities throughout Europe, the focus here is on a more local level.

The challenges resulting from megatrends in urban areas, and the causal connections among them, were analysed in a brief exercise during a workshop on qualitative analysis. The results highlight the fact that urban issues can hardly be addressed by looking only at one specific aspect, or one discipline and research field, since the interrelations are complex indeed.

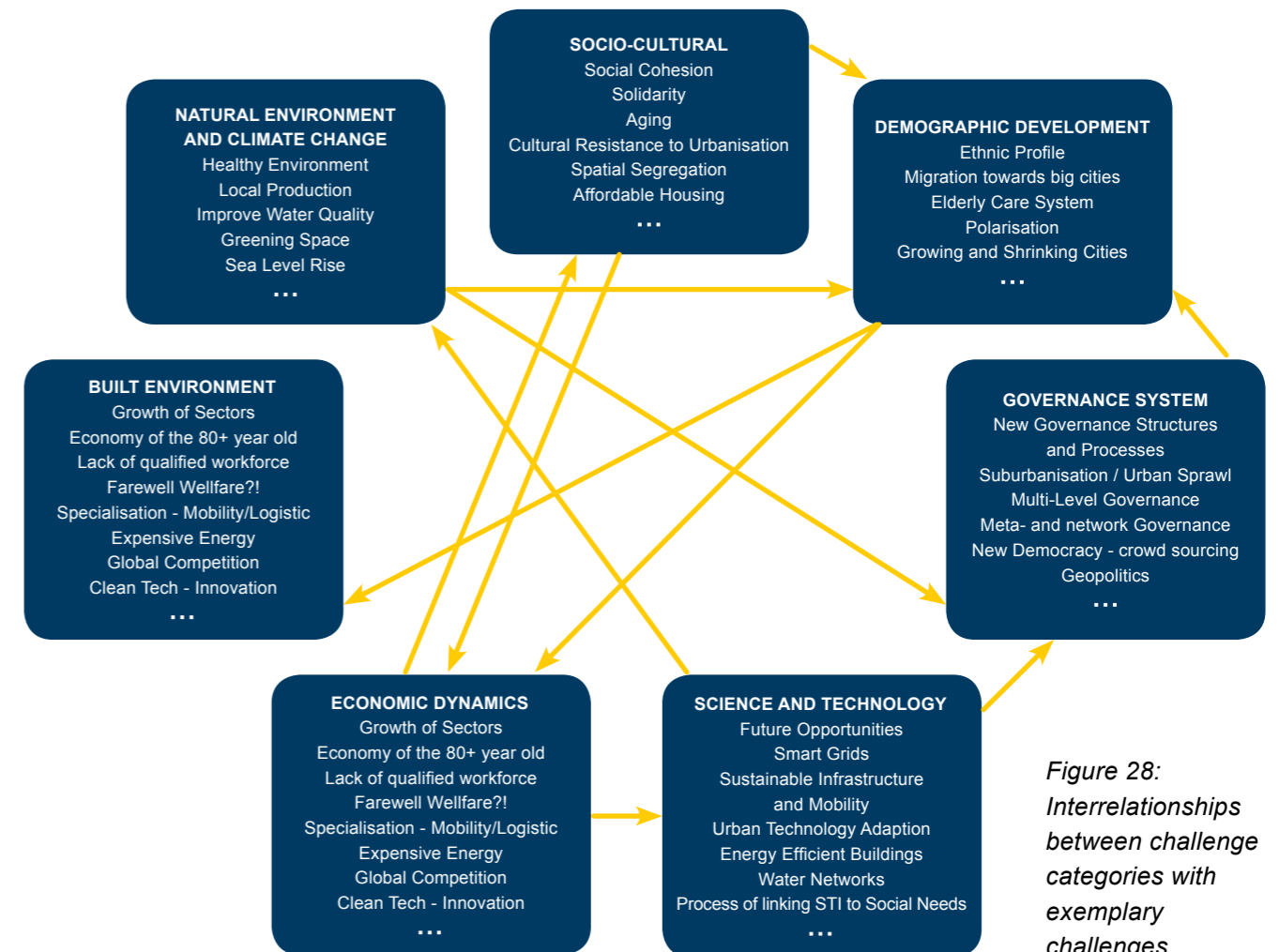


Figure 28: Interrelationships between challenge categories with exemplary challenges.



In addition to the regional differences in how megatrends affect urban areas across Europe, the dependencies among the challenge categories were also analysed. As can be seen in Fig. 28 the individual categories cannot be seen as independent but as being interlinked. Therefore, finding adequate answers to the various challenges requires integrated research and policies that reflect the complexity of urban areas. The challenges listed in the chart are examples used for the purpose of illustrating complexity. Due to the interrelationships and causal connections, challenges deriving from one megatrend may influence developments in another, and/or may bring about other challenges. Therefore, measures and actions taken to tackle one challenge may have unintended effects on issues related to other megatrends. Again, these interactions are highly dependent on local circumstances, but are of great importance and must be taken into account when developing a strategic research and innovation agenda. The results clearly show that within the long-term focus of JPI Urban Europe, the interrelations between challenges must be integrated in order to create a holistic approach towards urban research, and to advance our understanding of the complexity of urban areas as a whole.

## THEMATIC CHALLENGE CATEGORIES

In the on-going discussion on challenges caused by urban megatrends, a thematic clustering has been conducted based on shared characteristics. Six thematic categories have been identified. However, as previously pointed out, urban challenges and issues have a high causal connection and, in some cases, a concrete challenge may be categorised in two different groups. This chapter aims at structuring the challenges into thematic categories.

### Natural Environment

The natural environment provides urban areas with essential features. Green areas, forests and environmentally intact areas are important for recreation purposes and for the liveability of urban spaces. Furthermore, cities must adapt to the changing

climate by providing measures to soften the impact of rising temperatures, the risk of storm floods and providing efficient public infrastructure and services. Although cities are great sources of emissions and the production of waste, it is also within urban areas that resource cycles can be limited and, in the best of cases, even closed. The metabolism of cities must therefore be understood better than ever before.

### Demographic Development

Urban areas have constantly fluctuating population numbers. Cities throughout Europe show different development paths: growing and shrinking. The increase of residential populations bears great challenges for urban areas, including additional housing demand, rising housing costs, the providing of services, urban sprawl, etc. On the other hand, managing shrinking cities is also no easy task. Demographic developments influence all kinds of urban aspects: local economies, social cohesion, socio-economic stratification and socio-cultural issues. In addition to migration, ageing will also significantly influence urban areas.

### Social and Cultural Issues

Cities are an assembly of people from different backgrounds, socio-economic classes and cultures. Cities are places where all kinds of differences can be found, some of which may lead to challenges. Social balance and cohesion are centred on the distribution of opportunity. Cities are places where complex societal problems meet and are manifested spatially. The diversity of cities can be facilitated to create social innovation and to foster entrepreneurial spirit.

### Built Environments and Infrastructure

Built environments and infrastructure play a significant role in efforts to cut CO<sub>2</sub> emissions, move towards a sustainable use of resources and create a secure supply of public services. Sustainable building technologies, the retrofitting of houses and the financing of such are important aspects of creating more sustainable cities and meeting CO<sub>2</sub> emission targets. Transport and mobility infrastructure and the connection to planning are essential to attaining desired urban habitats and securing compact urban development. However, although infrastructure and

the built environment are the backbones of cities, social aspects must not be forgotten.

### Economic Development

Urban areas are exposed to a multitude of economic challenges on various scales. As more than two-thirds of the European workforce lives in cities, generating and securing jobs is a top importance. While attracting international firms and companies to urban areas is one of the essential elements of success in the global competition among cities, effects on local urban space and the consequences of strategies aiming at attracting investments must be taken into account. Furthermore, global economic development also undergoes variations, and cities are faced by arising challenges on a local scale.

### Science and Technological Development

Science and technology not only have the potential to increase energy efficiency, but also to find answers and solutions to meeting societal needs. Information and communications technology (ICT) can be facilitated to become central tools for governance processes and public participation. Furthermore, ICT is an enabler for ways of cooperation and for transforming business and urban living. Living labs where new technologies are applied within a real urban area and in an open innovation eco-system can be used as test beds for co-creating innovation. With the amount of data collected today, an understanding of how urban areas work and how practises and urban functions interact can be generated. Therefore, Big Data is important for the future of cities.

### Urban Governance and Democracy

In many European cities, municipal boundaries do not reflect the urban reality. Therefore, poor cooperation in planning often results in scattered and sprawling urban fabrics. New concepts for public participation in decision-making processes are also greatly needed. To create liveable cities, new concepts for lived urban democracy must be elaborated.

Within these categories, a diverse set of challenges can be identified, comprising social, economic, environmental, governance and technological issues.

## DEVELOPING NATIONAL URBAN STORYLINES

After identifying the challenges and key drivers stemming from megatrends in urban areas, national experts were asked to develop storylines for cities in their countries. The aim was to link the effects of megatrends and the resulting challenges for urban regions identified in the previous workshops on the historical, political, social, demographic and other characteristics of the countries involved in this study. The storyline exercise helps detect different kinds of challenges relevant to transnational research on a local scale for urban regions in Europe by linking quantitative and qualitative research. Creating thought-provoking, evidence-based storylines is an applicable method for gaining comparative and complementary material and distinguished and faceted results for the work process. The storylines have been developed following a “*laissez-faire*” scenario: urban development was thought to continue along the current development paths. Another aim of this exercise is to describe the most important dynamics expected to influence urban development up to and after the year 2050. The storylines developed by the national experts are introduced below.

### An Austrian Storyline

#### Demographic Development

The number of inhabitants in urban regions in Austria will increase significantly by 2050, mainly due to in-migration. Although urban regions are less affected than rural areas and towns, due to migration to cities from other regions in Austria and from abroad, the ageing of society is expected to define a number of challenges and changes. Urban design must be adapted to the needs of all citizens. The accessibility of public space and public services must be improved to meet the needs of an ageing society. Methods to include all groups of people in the city life and in democratic processes should be developed.

Population growth in urban areas (Vienna: +21.6%, Graz: +20.0%, Linz: +15.1%) (ÖROK, 2011). will have a great impact on the built environment, social and cultural composition and issues and technological development by 2050.

By 2050, the number of households is expected to have increased by 21,9% compared to 2009 (ÖROK, 2011). This will be due on the one hand to the growing population, and on the other to the fact that the percentage of single-person households has increased for almost all age groups. Only the 90+ group shows constant numbers.

Although life in densely built urban environments will be more desirable than it was in the 20<sup>th</sup> century, due to programmes to increase liveability, urban sprawl and suburbanisation continues because of a lack of political policy reform and a growing need for housing. Therefore, large amounts must be invested to expand services, infrastructure and public transport in the areas around city centres.

#### Urban Governance and Democracy

In Austria a transformation from managing administrative urban areas to functional urban areas still has to take place. The public debate on restructuring and regrouping municipalities is expected to spill over to city regions. Concepts for reform already developed in the 2010s, however, it will take years or decades to fully implement this process. For all Austrian city regions, strategic development plans are necessary to regulate the development of the urban fabric as a whole. This is especially true for Vienna, since economic development and cooperation with Bratislava is expected to grow and become stronger. In order to strategically develop the region, a cross-border focus should be incorporated into the local master plans of both cities to ensure coordinated development.

Compared to other urban regions in Europe, the privatisation of public utilities and infrastructure is expected to be limited, underscoring the relatively strong role of the public administration. Furthermore, it is not anticipated that the social and public housing stock will be privatised, which will thus continue to have a significant impact on the housing market.

In all urban regions in Austria, public participation in the planning process is likely to be enhanced. Public administration must find adequate methods and tools to actively involve bottom-up initiatives, academia, civil society, businesses and stakeholders, allowing

them to contribute to urban development. However, due to the historic developments of public entities, which carry great weight in Austria, deregulation will not be as strong as in other cities in Europe and the public body will remain very influential.

#### Social and Cultural Issues

Population numbers will increase in all urban areas addressed by this study, and social and cultural composition is thus expected to change by 2050. As more people move to urban areas, rent prices will rise, amplifying segregation tendencies. Depending on the urban dynamic within the cities, gentrification is expected to spread across the city from central locations to more remote neighbourhoods. This will increase pressure on the housing market and push lower income families and people into affordable neighbourhoods at the edge of the city and, in some cases, outside the city.

Although the stock of social and public housing in Austria will most likely not have been privatised, and will still have a significant influence on the housing market, due to lack of public spending, especially in subsidised housing, the construction of social and public housing will not have matched the pace of the rapid increase in population.

While core cities will pull residents and become more attractive for living, suburbanisation continues having an impact on mobility, administration and the built environment into 2050.

Although the immigration of both low-skilled and high-skilled workers will continue, integration is expected to improve due to measures introduced in the early 2000s.

Within all Austrian cities, people are expected to become increasingly active in various urban issues. This is mainly due to the shift from government to governance, the increased wealth of the population and to the changing perception of public authorities that local knowledge is valuable and must be taken into account in when planning and making decisions. Urban democracy is expected to enhance.

Changes in social practices and social innovation must be taken into account in technological developments and the product and innovation process. This means that the combination of social science, humanities and technology is inevitable. Living labs will now be frequently used for optimising processes.

#### Built Environment & Infrastructure

Until administrative reform has been implemented, urban sprawl will increase, leading to the sealing of surfaces around the cities. However, focus must be put on densifying the old suburbs in order to create more residences for the growing urban population. They need to become fully functioning neighbourhoods. Infrastructure and public transport in these areas must be improved to make reaching the city centre without personal transport easier and more comfortable. This will decrease the dependency of urban outskirts on the city centres.

Furthermore, in inner-urban areas, creating mixed uses should be fostered by developing strategies for incorporating the various functions of a city in the same area. Besides locally supplying the population such policies for the mixed use of streets and neighbourhoods increases safety levels, reduces the need for personal transport and increases the liveability of urban areas.

Increase of energy efficiency is high on the agenda of the Austrian politics, cities, and municipalities. Energy efficient buildings, electric mobility and smart grids are expected to be implemented through public and private efforts, first measures are already ongoing. Several cities already started to develop strategies and policies to increase energy efficiency and decrease CO2 emissions. It is expected that these efforts will increase in the next years and decades.

#### Science and Technological Developments and Innovation

Starting in the early 2000s, the Austrian government began to invest in technological developments to build-up a solid knowledge base and support innovation in particular in the areas of energy efficiency, new energy and mobility technologies, ambient assisted living and smart cities. It is therefore the

ambition that, by 2050, Austrian cities will be at the forefront of innovative and green technologies. On the other hand, Austria's knowhow in these fields will become an economic asset, as some enterprises become global players in exporting this knowledge and technology.

By successfully implementing sensor devices and social media in urban space, data is generated which, in 2050, is automatically implemented to impact the physical world. Analysing the big data according very broadly contributes to understanding how Austrian cities function.

#### Economy

With the urban population growth in Austria, urban areas are becoming more and more important for the national economy. By increasing their liveability, Austrian cities are expected to attract highly skilled people important for maintaining Austria's economic performance. However, in the next 40 years, the economy is expected to grow only slowly.

#### Environmental Issues

By 2050, the climate in Austrian cities will be different. The cities are going to face climates once measured in southern European areas in the 2000s. For example, it is expected that Vienna will be faced with a climate formally found in Bologna. However, in urban regions, the changes are expected to be moderate.

Due to climate change, urban space and the built environment must be adapted. Urban design is becoming more important and public spaces must be adapted to the changes in temperature to provide shading and natural air circulation.

The heat island effect will become a problem during summer days in particular, and can only be solved by adapting the urban fabric accordingly. Due to their geographical location, most urban areas are exposed to air circulation (wind), which increases and supports air circulation in urban areas.

The increased occurrence of heavy rainfalls and local floods means that urban infrastructure must also be



adapted. The insurance and maintenance of infrastructure is expected to become more expensive.

### A Danish Storyline

There are hardly any future studies on the state of Denmark in 2050; the Statistical Office has only even made a population projection on an aggregated level. The current crisis has triggered a number of reforms to improve competitiveness and efficiency in terms of public services, provision of labour and to reduce the consequences of climate change. However, at the same time, there is a strong trend toward deregulation and market-driven development, which accelerates energy consumption, land use, etc.

#### Demographic Development

The population is expected to increase at a moderate rate (about 10%) towards 2050, where the natural population growth will cease and only migration will be able to increase the size of the population.

Overall, changes in the population are relatively robust; however, the estimated immigration and emigration figures are, of course, much more uncertain than birth and death rates, as they are strongly influenced by political policy. This forecast estimates a minor increase in the number of births and a higher number of deaths as a natural effect of the changing age composition of the population. While 2012 population growth is still based on natural increases as well as immigration surplus, by 2050, growth will stem solely from immigration (see Table 3).

The much-debated elderly boom will be relatively mod-

erate in Denmark. Having increased from 1.1 million to 1.5 million, people over 65 years of age will make up just under a quarter of the population by 2050 (24%), compared to one-fifth in 2012 (20%). The most marked change in the relative size of age groups is the growth of the 80+ group, from 230,000 to 591,000, or from 4% to nearly 10% of the population.

Migration to the largest cities is strong, making the periphery of the country lose an expected average of 10% of its population, and in some municipalities 25%. The large cities, Copenhagen, Aarhus, Aalborg and Odense, are expected to grow by 30, 20, 10 and 10% respectively. Moreover, this growth will involve a major migration of young people searching for education, jobs and other opportunities, leave their former residential areas as places with mostly elderly people, while the cities become very young localities.

Nearly half of all Danish households are single person; less so in peripheral districts and more in big cities, thus reflecting the age composition of the different parts of the country. The general welfare growth in the last century has triggered a huge increase in housing consumption and more people than ever before can afford to live independently of each other. There is, then, good reason to assume that the average household size will continue to decrease and more people will live alone.

#### Urban Governance & Democracy

Difficult budget situations have long ago forced local governments to rethink their policies, and many have

now made experiences with the privatization of public services. Some of these experiences were good; others more negative. However, most had no marked consequences. The general trend is towards more free market and less public involvement as far as the “big” economic questions go (i.e. infrastructure investment, labour market regulation, social security and so on), while very local questions such as the refurbishment of a neighbourhood, running a kindergarten and other such issues often includes users and other stakeholders in the decision-making process. The current governmental structure reflects the duality of present urban politics: major strategic questions are barely debated publicly, while minor questions are presented as a true democracy. As stakeholder involvement becomes more over-used, the open access to debate and influence becomes reserved to a select few.

All attempts at making the handling of urban challenges, especially in Copenhagen, more simple and efficient have been neatly blocked by other local governments and by national politicians. In the Copenhagen region, the existence of more than thirty local governments has promoted strongly local, biased policies, which gives overall economic strategies that would benefit the region low priority compared to local issues. This is a pattern that has existed since WWII. A local government reform in 2007 reduced the number of municipalities, thus increasing their average size, and this seems to have reduced public involvement in local politics. This trend is likely to continue and will challenge existing public participation and thus the state of democracy.

#### Social and Cultural Issues

Segregation and polarisation were much discussed in the late 1990s and onwards; however, while inequality has increased since then, overall inequality levels are relatively low compared to other European countries. Segregation appeared in public debate around 1990 as a result of the influx of large groups of immigrants and refugees from third world countries. They have settled in non-profit housing around the largest cities, with some estates housing up to 90% non-Danish citizens. Shortly thereafter, a number of studies confirmed the establishment of concentrations of people excluded from the labour market, with

little or no education, low incomes, etc. A new urban policy was launched in the late 1990s to cope with these emerging “ghettoes” and, since then, the issue of segregation has been a priority in politics. There is little sign that these challenges will be solved in the near future and, with a projected inflow of people from outside Europe, the issue will most likely continue to exist in 2050. Segregation is mostly related to housing type, i.e. segmentation of the housing market. These large, non-profit housing estates from the 1970s have become containers for the excluded, while the prospering middle class lives in owner-occupied houses in suburbia or expensive condominiums in the central parts of the largest cities. This is, of course, also related to gentrification, which has changed formerly run-down working class areas near the city centres into attractive middle class neighbourhoods. The social segregation effects of rapidly rising property prices came to an end by 2008, when the property bubble collapsed.

The most negative outcome of the ghettoes has been the exclusion of youngsters with little or no skills relevant to the labour market and often unable to speak Danish, i.e., even the unskilled jobs are not available, since they cannot communicate with the majority population. Their participation in education is often minimal, and they constitute the largest portion of dropouts. These youngsters have created local problems such as the burning of cars, criminal activities, etc. However, the extent is limited.

The current crisis has excluded a growing number of people from the labour market, which has triggered an increase in social welfare costs and a decrease in tax revenue. Unskilled workers, young people and immigrants from the third world have particularly suffered from decreases in employment.

#### The Built Environment

The existing Danish towns have a relatively low density due to the large portion of detached housing, mostly a suburban phenomenon. During the last few decades, still more arguments and attempts have made attempts to increase the density in order to reduce expansion of the urban zone, protect natural environment, lower the need for cars and energy and

	2012	2050	Difference
<b>Population primo</b>	5580516	6158633	578117
<b>Live births</b>	59226	67452	8226
<b>Deaths</b>	52489	66839	14350
<b>Immigrated</b>	56438	55949	-489
<b>Emigrated</b>	41265	46833	5568
<b>Population increase</b>	21910	9730	-12180

Table 3: Denmark: Projected population 2012 – 2050.



provide the preconditions for real “urban life”. Nevertheless, the vast majority of the population strives to become homeowners, especially of detached houses. While more peripheral parts of the country have started to lose inhabitants in the last two decades, the differences in terms of living conditions are rather minimal. However, smaller towns in the periphery seem to stagnate or decline, while larger and more centralised towns and cities are growing. Suburbanisation was a major issue from 1920 to 1980, but has partly been replaced by central city developments (former harbour, rail or manufacturing land) and by exurbanisation, i.e. low-density suburban developments in the countryside (cf. *Zwischenstadt*).

The inner cities were transformed during the 1970s, 1980s and 1990s through regeneration schemes, the more recent cases of which promoted a social upgrading of the population. There are a number of on-going schemes in disadvantaged neighbourhoods. They manage to keep housing standards up-to-date and prevent damage and decay. But they have not successfully been able to provide education and employment to tenants. The dominant share of newer housing units constructed in central parts of Copenhagen and other larger cities have been ownership housing and, to some degree, cooperative housing. Private rental housing has become rare.

Infrastructure investments continued after the urban expansion ceased in the early 1980s. Today, a large portion of investment is in peripheral regions and central parts of large cities. The former is mostly related to highways, high speed internet and heating systems, while the big cities invest in public transport as well, for example, trams in the provincial cities and a new metro ring in central Copenhagen. The large number of cyclists will be a dominant feature of street life in Copenhagen and the largest cities; better biking lanes, the right to bring bikes on board trains and reduced speed for cars help to bolster ambitions for more cyclists in the future.

### Science and Technological Developments and Innovation

There is a long list of initiatives at work and local governments plan for e-services to be the main

interface between population and the public sector. This is planned to be in operation starting in 2014. However, more than half the 65+ are unable to communicate via web (simply because many do not have a computer or smartphone). E-medicine is in operation and in the visions, of course, able to replace locally based medical doctors. Similarly, a number of test projects have tried to provide employment at a distance via tele- or e-working. So far, the effects have been limited, but more are on their way. Smart grids are being tested as a way to harness the electrical surplus of windmills and solar panels and use it for transport (battery-driven cars). It remains a test project at the moment, but is expected to expand massively during the decades to come.

### Economy

The public sector plays a major role in Denmark and employs approximately one-third of the labour force. This is the result of the growth of the welfare state, which has managed to include women in the labour market. However, due to external competition, the costs of labour and tax-financed welfare are now under severe pressure and a number of reforms have been launched during recent years. Today, nearly 80% of the population in their active years is at work, with a slightly higher rate for males than females. The vast majority of the labour force is employed in public and private services (around 80%), while manufacturing and construction make up 17% and agriculture, fishery, mining etc. the remaining 3%. High-tech, knowledge-intensive business services (KIBS), the media and other knowledge-based industries have received strong exposure in government reports and research. The creative sector in particular has attracted great interest as a sign of the rise of a new urban culture. However, the current crisis has somewhat reduced trust in this. Both at central and local government levels, major efforts are being made to prepare for the next generation of high-value manufacturing industries. Research and development is increasingly related to the needs of commercial production (manufacturing and services), just as the educational system is trimmed to support competitive strategies.

### Environmental Issues

At a national level, the development of alternative energy sources receives much attention, just as do measures to reduce energy consumption, i.e. improved building insulation, district heating, etc. Local energy sources (wind mills and various sorts of test constructions) have also received much attention and financial support. The overall goal is to achieve a zero-energy building standard by 2050. This requires major changes in building codes and will most likely be passed. However, the weak point is the existing stock of buildings. It is not likely that they will be upgraded, despite economic incentives. The transport sector has been similarly resistant to demands for lower energy use, and automobiles remain the main means of transportation, even in the highest density areas of the largest cities. CO<sub>2</sub> emissions are strongly related to transport and the heating of buildings, but are also an issue in the manufacturing industry. The government has opted to aim for a 40% reduction of CO<sub>2</sub> emissions by 2020 (compared to 1990).

However, protection of endangered species and clean water has been less successful in recent decades, despite European directives for the conservation of water (groundwater, lakes, rivers and coastal sea areas). Intensive agriculture bears a major part of responsibility for this, yet has managed to avoid any real restrictions on production and land use.

Climate changes will most likely bring no major changes. Neither extreme cold nor hot and dry summers are foreseen, and precipitation is expected to increase at only a modest level. However, the rise of the sea level will have a serious impact on many low-lying areas, especially sparsely populated islands and countryside districts, as they are not financially valuable enough to protect using expensive dykes. The Danish part of the Wadden Sea is expected to be hit by more storms and thus lead either to large investments in protection or abandonment of the low-lying districts in southern Jutland.

### An Italian Storyline

#### Demographic Development

The United Nations (February 2008) foresaw that Italy is going to be one of the countries with the greatest

demographic decline by 2050. In particular, populations living in urban areas with fewer than 500,000 inhabitants are expected to increase, while that of larger agglomerations (Rome, Milan, Naples, Turin and Palermo) will remain stable.

According to the United Nations Population Division, demographic decline and ageing of the population can only be softened by international migration to Italy.

However, in addition to the populations of urban areas, it is also necessary to take into account the informal population of urban agglomerations. Informal settlements have developed in many cities, such as along the Via Emilia, along the Adriatic Sea or the one formed by the south-eastern Veneto. The numbers of people using Italian cities without being registered leads to a mismatch between official population numbers and the amount of people using the urban spaces.

After 2010, the decline of the population will be drastic, which will have far-reaching effects on the demographic structure of the population. Italy will be faced with an ageing society and thus a drastic reduction of the workforce and an increase in the number of economically inactive people. An ageing society brings with it demands for access to public space and public services to serve the needs of elderly people.

The ageing index is a number that indicates the ratio of the 65+ population to the population between 0 and 14 years of age. In 2011, the number for Italy was 114.5 points, while for 2050 it is estimated to reach 256.3 points. The southern regions have the greatest increases in aging index values: by 2050, it is estimated to reach 170 points in southern Italy, 156.8 points in the Island, 73.3 points the northwest, and 86.9 points in the northeast. This means that a significant north-south gradient can be observed in Italy.

By 2050, the Italian population will have decreased from 57 million in the year 2000 to around 40 million. Therefore, the number of inhabitants will be lower than in the 1950s. To soften the effects of this and

prevent enormous damage to the national economy and the welfare system, at least 350,000 people need to migrate to Italy each year.

### Urban Governance & Democracy

By 2050, programs and strategic planning are expected to no longer be the responsibilities of local authorities. This has much in common with a deliberative democracy and respecting the visions and expectations of all stakeholders and citizens. Urban development and a vision for the city shared by the different actors and stakeholders is therefore a key ingredient for strategic planning. By taking into account the opinions and visions of a wide range of stakeholders, the development of local economies is strengthened. Local economies are a social capital that strengthens territorial confidence and network alliances.

### The Built Environment & Infrastructure

In the built environment and infrastructures, the focus is climate change issues (energy-efficient buildings, urban transport, etc.), nature conservation and biodiversity (reducing soil sealing, recovery of abandoned industrial areas, distribution and abundance of individual species populations, etc.), quality of life and comfort (reduction of air and noise pollution, etc.), sustainability, reducing, reusing and recycling.

In Italy, 14 million people commute each day from surrounding areas to city centres. The reasons behind these high numbers are increasing rent prices and the changing uses of city centres.

### Science and Technology

There are many initiatives, on both local and national levels, that are currently planning and working towards e-services becoming the main interface between people, the public and the working sector. This means that from 2015-2017, Italy will have a great number of applications for smart technologies at city a city level, which could strongly influence the scenarios already developed.

Technological innovation is a strategic factor that can enable new solutions in vehicle traffic and the development of smart grids and information technology applied to mobility to provide solutions to economic and

territorial development, environmental sustainability and freedom of movement. In Italy, although there is an absence of a national support program, there are several on-going pilot projects and experiments implementing new technologies in urban space.

### A Finnish Storyline

To develop the Finnish storyline, we used statistical population data, newly published governmental foresight scenarios for 2030 and the Smart Cities Initiative material from Tekes. A great amount of crowdsourcing has been involved in the foresight and initiative preparation processes, which facilitated the recognition of important development paths to enable sustainable growth and welfare in Finland.

Finland is a relatively young, small nation with a current population of 5.4 million. Population growth is around 23,000 citizens annually, over half of which is derived from immigration. Population density is relatively low, with only 17 people per square kilometre. Most of the Finnish population lives close to the coast in the south and southwest. More than 1 million people live in the capital area. Finland currently has five main growth centres (Helsinki, pop. 600,000; Tampere, pop. 217,000; Turku, pop. 180,000; Oulu, pop. 191,000; and Jyväskylä, pop. 133,000) where both the population and investment activities have grown remarkably in the past decades. Over a third of the area of Finland is above the polar circle, where the population density is extremely low (less than 1 person per square kilometre). Finland became urbanized relatively late, which could be an indicator that the continuing urbanization towards growth centres will continue in the forthcoming decades. Finland has been an independent nation for almost 100 years, but has a long common eastern borderline with Russia and has been strongly influenced by global developments since its independence. Global economic and political developments will heavily influence how Finland will look in 2050, but the following development paths have been recognized to be enablers of sustainable welfare in Finland in the future:

**Government as an Enabler:** Regulations should not kill innovation. As an example, in the 90s, Finland pulled out of the recession mostly because of its suc-

cessful electronic industry and the Nokia corporation. The government played an important enabler role in the creation of this success. A successful government helps and supports its citizens and companies to succeed and conquer new markets. ICT helps make government mechanisms open and efficient. Fast and flexible companies are absolutely necessary in tightly competitive marketplaces. Modern networked companies purchase know-how, production capacity and find the right partners to conquer markets. Governments compete for the capabilities to provide the best functioning environments to frontrunner companies. Finland can succeed by successfully managing value networks in carefully chosen fields.

**Citizen Participation and Welfare:** In order to create value, each person must feel important and needed. Changes in world economic structure and the global division of labour favour the relatively high levels of education in Finland (37% of the Finnish population over 15 years of age has completed secondary school, 25% has a university degree and 0.4% has doctoral degree). However, high education levels are not enough. The focus of this small nation will be on the parts of value chains where the most value can be created by specific know-how. Modern ICT enables new ways to participate in value creation through, for example, crowdsourcing and new, mobile ways of working.

**Union of Work and Life-long Learning:** The working environment needs a workforce that is capable of learning. We learn our whole life long. We learn in school and by doing. Work life should bring better interrelationships to learning processes in very early phases, in order to produce true professionals with practical capabilities. Society will be structured so that resources are always in being used productively, not unemployed or employed with no real need. The focus will be on individuals, on motivating them and increase their possibilities of finding the next job. ICT enables global working in local communities, which can be independent of global resource crises such as food scarcity.

**New Northern Geography:** The importance of the Arctic region is growing because of its rich raw

material resources, tourism and the melting of ice around the pole. Northeast passage and connections to the ocean are increasing Finland's logistic importance to European countries and creating many new business opportunities for northern Finland. Finland will be successful in, for example, sustainable mining technology, sea, ice and cold know-how and arctic construction.

**New Opportunities from Scarcity:** Energy know-how and material efficiency is important to Finland. There are strong internal markets here for new clean-tech innovations, such as in the built environment, that support developments towards successful global businesses. The focus of construction is expanded to the entire life cycle for all projects. Smart electric grids save and store energy. Private and public transport is efficient and functions seamlessly. Food production is resource-efficient, local, independent and healthy.

**Experimental Pioneer:** Traditional ways of doing research are slow. The growth of experimental culture boosts innovation to the speed levels required for global success.

**Cities as Integrators of Research and Innovation:** Cities are leaders and owners of urban systems. R&D&I projects are funded, and demonstrations are an essential part of each project – urban living labs. Comprehensiveness (the integration of technologies, processes and services) enables large-scale business activities and everyday test bests. The safety and security of the living environment and health services make good use of digital systems. Robotics are increasingly being used for routine tasks.

### Finland: Scenario 2050+

By 2050+, the population of Finland has increased to 10 million. Immigration has been increasing. Many professionals have moved to Finland with their jobs and to have a good salary level and high quality of life. Finland is famous of its new growth centres near areas with tens of thousands of lakes and beautiful rivers that offer fresh pure nature experiences and world-class, energy-efficient physical and ICT infrastructures. Based on real-life testing, new clean-tech



ideas are rapidly transformed into new clean-tech products and concepts, and exported as specialized know-how. The sea level has been rising slowly in recent decades and floating construction has increased in the coastal areas of Finland, where the majority of citizens still live. Smart floating constructions can produce most of the energy consumed by those on top of them. Finland has finished new nuclear power plant projects, but because of new energy-efficient infrastructures, most of the energy can be sold abroad.

Finland is one of the frontrunner countries, and has successfully implemented a new school system to support life-long learning and work life. Students in comprehensive schools can already start working and gain practical experience to help find the right career path for them. Even after retirement, old people are happy to be able to contribute to society and live a meaningful life.

Other new growth centres are located in northern Finland, where international mining companies have joint ventures with Finnish clean-tech companies. Raw materials from the underground mines and fresh drinking water are transported to Europe and northern oceans following the new arctic region logistics. Cargo ships operating along the Northeast Passage have been mainly designed in Finland, based on their special know-how of ice breaking technologies.

### A Dutch Storyline

This text briefly summarises the recent dynamics of urban areas in the Netherlands, and explores how these areas will evolve in the decades to come. It has been based on outlooks and forecasts from the Netherlands Environmental Assessment Agency (PBL) in the field of demography, economy, land use and other areas (PBL, 2011; Jong and Duin, 2013, Borsboom et al., 2012), a land use scenario jointly developed by PBL, Free University Amsterdam and Deltares (Dekkers et al., 2012), and prognoses from Netherlands Statistics (CBS, 2012). These materials generally assume a time horizon of 2040, which can be easily extended to 2050. The main findings of these outlooks have been linked to the megatrends as identified during workshops held in Antwerpen and Vienna. The focus here is on demography, spatial dynamics, climate and energy.

### Before 2010

Population growth and household division led to a substantial increase in residential land use from 1990 to 2010. The Dutch population rose from 14.9 to 16.6 million, while average household size dropped from 2.42 to 2.23 persons. The total number of households increased in this period by 20.7%, to more than 7 million. Strong economic growth up to 2008 and increased labour participation propelled the development of new business locations. In addition, economic growth drove up net income, thereby changing residential preferences and stimulating demand for more expensive and spacious housing. As a result, built environment, especially in the vicinity of large and medium-sized cities, expanded considerably: about 1% per year.

### Demographic Development by 2040 and 2060

After these decades of considerable growth, the Netherlands are moving forward to a more stable demographic situation. In CBS (2012), it is expected that the Dutch population will increase from nearly 16.8 million inhabitants in 2013 to 17.8 inhabitants in 2040 and 17.9 inhabitants in 2060. This is for the large part due to higher life expectancies, which is also reflected in the increasing share of elderly in the population: from 16% in 2013 to around 26% in 2040 and 2060 (CBS, 2012). In the coming decades, this acceleration of ageing will put pressure on the welfare state, facilities such as health care and intergenerational solidarity, for example with respect to pensions.

Apart from that, it is clear that although the population number is still growing by about 50,000 persons per year, this growth is gradually slowing down. Fertility rates are slowly decreasing and, in recent years, emigration has sometimes exceeded immigration. In general, net migration amounts to approximately 20,000 persons per year. After 2035, it is expected that mortality rates will be higher than fertility rates, which leads to a more or less stable population where net migration will largely determine total population growth or decline.

The number of households will increase by approximately 20% by 2040 as a consequence of ageing

and individualisation, which will have an impact on the housing market and type of housing provided by the housing stock.

However, there is tremendous regional variation within the Netherlands where demographic developments are concerned. While growth will be predominantly concentrated in the Randstad conurbation (Amsterdam, Rotterdam, The Hague and Utrecht), in larger parts of the more rural provinces in the east, north and south populations are expected to become stable or decline in number (Jong and Duin, 2013). Specific regions have been delineated where demographic shrinkage is expected in the near future or long term. In these regions, experiments for coping with demographic (and usually also economic) shrinkage are being carried out and monitored to develop new adequate policies aimed at preparing a soft landing for the impact of shrinkage. Growth regions are mainly located in the Randstad conurbation and a number of medium-sized cities. There are a variety of reasons responsible for this: urban-oriented immigration patterns related to the labour market and family and kinship ties, young people migrating to the cities for employment and education, and vital elderly who want to be located near cultural and leisure facilities.

### Urban Spatial Dynamics 2040

One of the main challenges of the Coalition Agreement of a previous Dutch Government in 2007 was to bring about social cohesion, while creating conditions for more sustainable development. The primary focus was on integrating the social (people), ecological (planet) and economic (profit) dimensions. In addition, motions in the Dutch Upper House in 2005 asked the Minister of Housing, Spatial Planning and the Environment to prepare a more integrated, long-term investment strategy for spatial planning. This strategy needed to pay more attention to the effects of climate change and make provisions for the further development of the Randstad conurbation and Schiphol Amsterdam Airport.

In response to the request of the Dutch government and the motions in the Upper House, the “The Netherlands in the Future” study was initiated as part of the Second Sustainability Outlook by PBL. It focused

on the most probable spatial dynamics and their impact by elaborating a baseline scenario exploring the most probable land use patterns, reflecting a policy neutral extrapolation of current trends and policies and, from this low-policy perspective, the demand for land was given a moderate economic and demographic growth with the Land Use Scanner, according to past patterns of spatial development. In this study, average demographic and economic growth was projected up to 2040: more precisely, economic growth of 1.7% per year and population growth from 16.6 to 17.1 million by 2040. The Baseline Scenario thus represents average spatial pressure. Because it was felt that the assumptions about economic and demographic growth were possibly too conservative, a second version of a policy neutral scenario was developed, namely the High Development Pressure Scenario, which assumes annual economic growth of 2.1% and population growth from 16.6 to more than 20 million in 2040. This scenario was used to check whether the key policy messages were sensitive to the differences in future socio-economic developments affecting land use, such as economy and demography.

The maps of future land use in the Baseline and High Development Pressure Scenarios for the year 2040 are shown in Fig. 29.

Interpreting these maps tells us that this kind of enormous urban sprawl would have a huge impact on congestion, vulnerability to climate change (growth centres below sea level), cultural landscapes and biodiversity, urban environmental quality, water management and attractiveness of the urban living environment. It was pleaded to take a more stepwise approach taking preconditions into account.

However, at the moment the austerity measures in response to the economic and financial Eurozone crisis and the more strict financial regulations for owner-occupiers led to a collapse of the housing market, an enormous drop in location (re)development and a decline in people moving up the housing ladder. To make it worse, overcapacity of office and retail floor space is estimated at between 15% and 30%. Urban expansion is piecemeal and better use

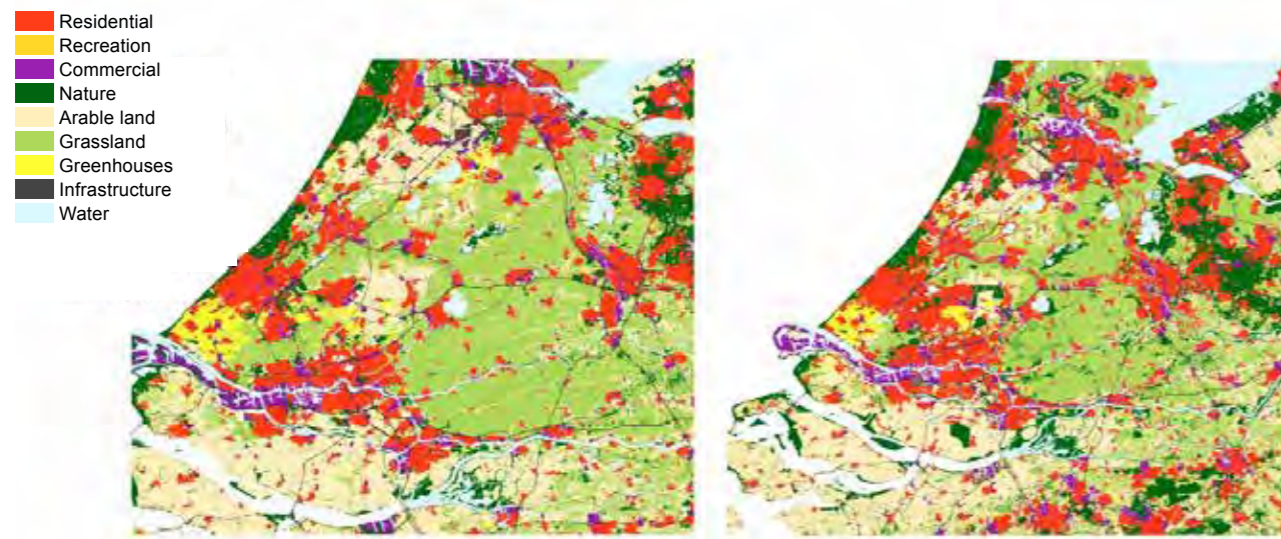


Figure 29: Land use in the base year 2000 and in 2040 according to the Baseline Scenario (Source: PBL 2007).

of the current urban fabric is high on the urban stakeholder's agenda. The future demand for urban land for housing, infrastructure and employment is very uncertain (PBL, 2011).

### Conclusion: The Dutch Storyline

It is clear that after decades of growth, the Netherlands must adapt to a new, more stable situation and to deal with increasing interregional and interurban polarization in terms of demographic and economic development. It is expected that regional and local authorities are better equipped for this, and that more responsibility for the execution of specific tasks, such as the allocation of health care budgets for the elderly, will lead to a more tailor-made approach to dealing with the effects of demographic change in urban areas.

The large cities are currently developing plans for the densification of the built environment. The question is thus how to conduct this densification in a smart way (see Tillie, et al. 2012). Apart from the geographical inertia inherent to urban buildings and energy infrastructures, and the huge costs required to make them sustainable, a main issue of the urban energy tran-

sition is that citizens do not know what to do where, and how to react accordingly. Energy efficiency is crucial to the built environment of the future. Additionally, because of the Netherlands' geographical location, the rising sea level is a big challenge, and a huge programme is currently dedicated to this issue (Delta Programme). Scenario-based projections of future land use contributed to the knowledge base for the Knowledge for Climate Program (Dekkers, et al., 2012). Other issues related to adaptation are extreme weather events, heat stress and the epidemiological consequences of rising temperatures.

### Input from Norway

Since Norway did not participate in the qualitative part of this study, a workshop was held at the Oslo Green Forum 2013, on June 6<sup>th</sup>, 2013. The methodology was slightly different, since participants were asked for their opinion on what the most important urban challenges in the thematic RDI areas for Norwegian cities are. However, for the continuous working process of the study and adequate documentation, the outcomes of the workshop can be taken into account here for the interpretation and drawing of conclusions on the storylines.

### Economic Vitality

The challenge in Norwegian cities is to attract and to keep talent. People come to Norway to study and tend to leave after graduation. For the Norwegian economy, it is important to keep these skilled people in the country.

Small knowledge environments and clusters around universities and research institutions are important to gaining competitiveness. Small knowledge environments need to be fostered. Furthermore, more cooperation between research environments, businesses, universities, industry and government is important.

Meeting points in the urban structure are seen as important nodes for "urbanising" the Norwegian people, to foster encounters and the exchange of knowledge and to "socialise" people.

Research shows that living close together is conducive to attaining a higher BNP. Due to the low population density throughout the country, Norway has a great potential for a higher BNP by increasing the population density.

Transport systems must be expanded and improved in order to help people come together.

The Norwegian economy is dependant on the oil industry.

### Social Inclusion and Urban Democracy

Segregation is an issue in Norwegian cities. The phenomenon is strongly connected to rising rents and the lack of affordable housing. Furthermore, the ration of rented and owned apartments must be balanced.

Social housing estates contribute to segregation. Democracy and governance must be enhanced on the local level.

### Urban Environment and Ecosystem Services

The quality of urban space must be high and include green areas. Furthermore, clean air and a healthy living environment are essential. Noise pollution is an issue as well.

Acceptance for denser built environments must be fostered. This could, for example, be achieved by multifunctional green structures not just for playing and recreation. However, green space is essential to accepting a denser living environment.

Since Norway is economically dependent on the oil industry, there is a lack of pressure for action. The oil has become a "cushion", leading to inaction towards more sustainable urban development.

Sufficient water management and the combination of green and blue structures are essential.

There is pressure on green areas to be developed and built upon.

### Sustainable Infrastructure and Networks

Sustainable modes of transport and housing must be combined with high-quality urban space.

Urban areas must be mixed in terms of activities and people. For example, urban life should be made it attractive for young families to stay in the city centres. Urban structure is an essential element thereof and should provide small shops, schools, parks, cultural institutions, etc. within short distances.

Transportation networks are important on many levels, including inner urban and regional. Urban networks must be adapted to the mobility needs of people. The current system is organised in sectors with many governance levels.

Pedestrian and bicycle transport needs to be promoted. At the moment, at least in Oslo, the share of cyclists is relatively low compared to other Scandinavian cities such as Copenhagen and Stockholm.

New technologies need new use incentives. Environmentally friendly modes of transport are important for sustainability on a large scale, as well as for a liveable environment and for contributing to public health.

### Urban Adaptability and Dynamics

Norwegian policy is rather rural. However, the towns



in the countryside and broad parts of northern Norway are now shrinking, except for a few towns in the north that are located close to oil production areas in the Barents Sea.

Cities should be built denser, yet avoid losing any quality of life.

The social mix and the mix of urban functions and uses should be enhanced.

In many cases, there is a political mismatch on several levels. Due to strong rural policies and rural political decisions, many decisions made on a national scale contradict good policies on a city scale. It is very important to take a close look at urban dynamics on a local scale. Furthermore, it is important to take into account the interests of the different stakeholders.

## CONCLUSION: MEGATRENDS AND CHALLENGES TO EUROPEAN URBAN AREAS

In the following, the combined key outcomes of the quantitative and qualitative sections of the paper are given. The different perspectives and diverse paths of the future are underlined in order to highlight the diversity of urban development. Analyses of the prospect data and the national perspectives of participating countries have led to this conclusion. A collection of the main challenges identified by the study, clustered according to the defined challenge categories, is provided in Table 2.

Urban regions throughout Europe will be affected by challenges resulting from megatrends in diverse ways, depending on the urban characteristics. Geography, political settings, historic developments, demographic composition and distribution, etc. therefore play a significant role.

Most cities in eastern continental Europe will be faced by population losses, lower GDP growth rates compared to the rest of Europe and the far-reaching consequences of climate change causing the number of extreme weather events such as heat days, tropical nights and storm floods to rise significantly. Furthermore, urban regions in the south and eastern continental Europe are highly exposed to uncertain externalities. Possible global economic disruptions are expected to hit these regions hard, and would have a great impact on the urban development of these areas. In this case, vulnerability would be high. At the same time, qualitative research showed that in Eastern European regions the focus has not yet been put on climate change mitigation because of a lack of financial means, which are being used to answer other pressing challenges. Therefore, priorities for answering urban challenges are set differently. Eastern continental urban regions will be most affected by megatrends. The combination of diminishing populations, slow economic growth, high exposure to climate change and the lack of public financial means, among other things, creates a delicate mix of challenges. The need for action and innovation is most pressing in the eastern regions of Europe. Unfortunately, no central eastern European country has taken part in JPI Urban Europe activities to date. Therefore, the qualitative part of this study lacks the comprehensive contribution of a local expert. The study would have benefitted from a broader CEE perspective.

Urban regions in southern Europe will also be exposed to a number of far-reaching challenges in the future. The most pressing issue will be ageing. Especially in cities in the south of Italy, ageing will be a big problem. Young and trained people will continue to migrate to economically more prosperous countries in the future. Combined with low birth rates and high life expectancy, the percentage of retired people is going to increase. Therefore, urban region in southern Europe are expected to face a widespread

lack of (skilled) workforce members, making them dependant on immigration. The number of heat days and tropical nights will increase rapidly in southern regions.

Cities neighbouring the Alps are expected to be less challenged than those in southern and eastern continental regions. Although exposed to global economic dynamics, the exposure is expected to be less fierce than in other regions. Most urban regions are expected to grow, putting pressure on land use and bearing the risk of massive urban sprawl and non-coherent urban development on urban fringes. Although the climate is changing and temperatures are expected to rise, the increase will be moderate. However, heavy rainfall and storm floods will be issues here in the future.

While central eastern Europe is expected to be hit by challenges resulting from megatrends, urban regions in the north are less prone to suffer hardships from global economic developments in upcoming decades. The big challenge is how to cut CO<sub>2</sub> emissions. However, finding appropriate channels for public participation is needed. Too often, minor questions are presented to citizens as “real” participation in decision-making processes, while important, far-reaching issues are not discussed with the public. However, although the level of the welfare state is still high, more and more public aspects are being outsourced in these current times of tight budgets, which is expected to have effects on urban development and services. The age structure of the cities is relatively young, as they have become desired places to live. A side effect is the rising pressure on the housing market. Housing prices are increasing, making it difficult for groups with low socio-economic power to find adequate apartments. If this trend continues, it is expected to become much harder to find affordable housing to buy or rent, even for young professionals. Beside the social aspects that this development brings up, this trend could also influence the competitiveness of cities (see Glaser (2011) in the long

term. Connected to the issue of rising rents is segregation, which is intensified in many cities by the lack of social integration in social housing estates. Due to misleading policies in the past, and the high level of housing costs, many cities in Scandinavia are struggling with concentrated areas of poverty that are resulting in “lost” generations of poorly educated youths. In the future, this could lead to far-reaching social and economic problems. Urban regions in the north will not be hit hard by increasing temperatures. Nevertheless, for coastal cities, rising sea levels and storm floods will be a major challenge.

In urban areas in the northwest, economic development is expected to continue at a relatively high level. The exposure to externalities is projected as being moderate. As in cities along the Alps and in the north, the number of households will increase while the number of people per dwelling will decrease. In the Netherlands, some urban areas will be prone to shrinking in population as well as economically in the short and long term. However, there are pilot projects looking at how to find adequate policies to address these circumstances. In the case of the Netherlands, although most urban areas are expected to grow in the near future, demographic development will be more stable in the long term.

This study highlights a number of issues and questions requiring further research in studies, analyses and topics. Since the threshold for cities to be included in the quantitative analyses was defined as an agglomeration population of at least 250,000 inhabitants, smaller cities were not analysed. However, since Europe is characterised by relatively small urban areas compared to US and Asian cities, they are of great importance. Analysing the urban dynamics of small and medium size towns may reveal different developments. Especially in countries with only one large primary city and second and third tier cities with significantly smaller populations, analysing the development of cities within the country seems relevant (e.g. Austria). Furthermore, in countries like Finland,

7 National decisions often support rural areas more than the urban ones. This strong rural policy is due to several reasons, some of them historical. Another reason is that most of the population has lived in rural areas until only recently. The political system underpins this, because the mandates are distributed by area and by size of population. This means that some mandates represent large areas with few inhabitants. Since more and more people move to the cities, the representation has become increasingly unbalanced in recent years.

Sweden and Norway (unfortunately no analysis data was available for Norwegian cities), the large size of the countries combined with very low population densities means that small and medium sized cities play important roles in the regions. This holds especially true for cities further north in the countries, as most larger urban centres are located in the south of the Scandinavian countries.

European urban areas are heterogeneous. Nevertheless, most of the challenges identified are relevant to cities throughout Europe. However, concrete manifestations in space are highly influenced by local characteristics (geography, demographic composition, economic structure, urban fabric and political development). Therefore, the same challenges may have different spatial manifestations throughout Europe.

The interrelation between challenges must be better understood and considered for future urban policy. Furthermore, the results of the study have shown that the identified challenges require different scales to address them. While some challenges are relevant to urban areas throughout Europe, others should be dealt with multi- or bilaterally. Some challenges stem a distinct urban feature (e.g. coastal cities, industrial cities), apply only to certain city types or to a certain

city size. Bi- and multilateral transnational research activities on such selective issues are efficient ways to addressing these challenges. Europe-wide research activities on urban issues are of great importance in order to foster environmentally sustainable, socially balanced and economically vibrant forms of urban development.

Since European urban areas share the vast majority of challenges identified throughout this study, joint research in the field of urban development with a focus on multidisciplinary, integrated and comparative work is highly needed. Transnational research offers opportunities to highlight, analyse, compare and understand the various manifestations of challenges in each city in a more detailed manner while being able to conduct effective and profound research.

JPI Urban Europe has the ambition to address these issues within its Research and Innovation programme to support urban transformation across Europe.

Based on the findings of this policy paper, a more in depth analysis of urban trends on global and European level was performed and lead to a framework for the research and innovation programme which summarises in the scientific background paper. Accordingly to the proposed framework, the Research and Innovation Agenda will be elaborated.

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# JPI URBAN EUROPE: POLICY PAPER

A Screening of Urban Megatrends

