ESPON

EUROPEAN UNION

Co-financed by the European Regional Development Fund

Inspire Policy Making with Territorial Evidence

APPLIED RESEARCH //

Main Report

SUPER – Sustainable Urbanization and land-use Practices in European Regions

Main Report // November 2020

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Authors
David Evers, Maarten van Schie, Lia van den Broek, Kersten Nabielek, Jan Ritsema van Eck, Frank van Rijn, Ries van der Wouden, PBL - Netherlands Environmental Assessment Agency (Netherlands), Volker Schmidt-Seiwert, Anna Hellings, Regine Binot, Lukas Kiel, supported by Jonathan Terschanski, BBSR - Federal Institute for Research on Building, Urban Affairs and Spatial Development (Germany), Giancarlo Cotella, Umberto Janin Rivolin, Alys Solly, Erblin Berisha, Donato Casavola, Politecnico di Torino (Italy),Ivana Katurić, Mario Gregar, Sven Simov, Katarina Pavlek, Ranko Lipovac, URBANEX (Croatia), Joaquín Farinós-Dasí, Albert Llausàs, Carmen Zornoza-Gallego, University of Valencia (Spain), Dorota Celinska-Janowicz, Adam Ploszaj, Katarzyna Wojnar, University of Warsaw, Centre for European Regional and Local Studies - EUROREG (Poland), Mailin Gaupp-Berghausen, Erich Dallhammer, Bernd Schuh, Ursula Mollay, Roland Gaugitsch, Liudmila Slivinskaya, ÖIR GmbH - Austrian Institute for Regional Studies (Austria), Tristan Claus, University of Ghent (Belgium)

Advisory group
Project Support Team: Isabelle Loris, Flanders Department of Environment (Belgium), Tamara Slobodova, Ministry of Transport and Construction (Slovakia), Harald Noreik, Ministry of Local Government and Modernisation, (Norway), Frederick-Christoph Richters, Ministry of Energy and Spatial Planning (Luxembourg), ESPON EGTC: Marjan van Herwijnen (project expert), György Alfoldy (financial expert).

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Contact: info@espon.eu

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Abbreviations

AQD	Air Quality Directive
BBSR	Federal Institute for Research on Building, Urban Affairs and Spatial Development
CAP	Common Agriculture Policy
CF	Cohesion Fund
CLLD	Community Led Local Development
CO	Carbon Monoxide
CO2	Carbon Dioxide
CoR	Committee of the Regions
DG ENV	Directorate-General for Environment
DG REGIO	Directorate-General for Regional and Urban Policy
DG RTD	Directorate-General for Research and Innovation
EAFRD	European Agricultural Fund for Rural Development
EAGF	European Agricultural Guarantee Fund
EAP	Environment Action Programme
EC	European Commission
EEA	European Environmental Agency
EESC	European Economic and Social Committee
EHS	Environmentally Harmful Subsidies
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMFF	European Maritime and Fisheries Fund
END	Environmental Noise Directive
EP	European Parliament
ERDF	European Regional Development Fund
ESDP	European Spatial Development Perspective
ESCT	The European Sustainable Cities and Towns conferences
ESPON	European Territorial Observatory Network
ESPON EGTC	ESPON European Grouping of Territorial Cooperation
ESIF	European Structural Investment Funds
ETSCT	European Sustainable Cities & Towns Campaign
EU	European Union
FRAMPs	Flood Risk Management Plans
FUA	Functional Urban Area
GDP	Gross Domestic Product
GES	Good Environmental Status
GNI	Gross National Income
GPP	Green Public Procurement
ICT	Information and Communications Technology
ITI	Integrated Territorial Investments
IZCM	Integrated Coastal Zone Management
JRC	EU Joint Research Centre
LAU	Local Administrative Units
LEADER	Liaison entre actions de développement de l'économie rurale
MS	Members State
MSFD	Marine Strategy Framework Directive
NGO	Non-Governmental Organization
NO2	Nitrogen Oxide
NUTS	Nomenclature of Territorial Units for Statistics
O3	Ozone
OIR	Austrian Institute for Regional Studies
Pb	Lead (plumbum)
PBL	Netherlands Environmental Assessment Agency

PCI's	Projects of Common Interest
PM	Particulate Matter
POLITO	Politecnico di Torino
PoMs	Programme of Measure
R&D	Research and Development
REFIT	Regulatory Fitness and Performance Initiative
RMBPs	River Basin Management Plans
SEA	Strategic Environmental Assessment
SECAP	Sustainable Energy and Climate Action Plan
SDG	Sustainable Development Goal
SO2	Sulphur Dioxide
SPAs	Special Protection Areas
SUL_NBS	Sustainable Use of Land and Nature-Based Solutions
SUPER	ESPON Sustainable Urbanization and Land Use Practices in European Regions
TA2020	Territorial Agenda of the European Union 2020
TIA	Territorial Impact Assessment
TEN-E	Trans-European Networks for Energy
TEN-T	Trans-European Transport Network
UA	Urban Agenda
UN	United Nations
YEI	Youth Employment Initiative
WFD	Water Framework Directive

Executive summary

The aim of the ESPON Sustainable Urbanization and land use Practices in European Regions (SUPER) project is to provide evidence and recommendations on how sustainable land use can be promoted and how unsustainable urbanization can be avoided, reduced and/or compensated in Europe, its cities and regions. This summary to the main report will first briefly describe the approach and methods, provide a sampling of the evidence, and finally present conclusions and recommendations.

The SUPER approach

The basic philosophy of the project is couched within its acronym. It has emphatically chosen to use terminology that is as neutral as possible and which has an affinity with territorial governance and spatial planning, rather than environmental discourse.

- **Sustainability**: we take a very broad view of this term, looking at both the temporal aspect (e.g. carrying capacity, generational justice) as well as its thematic aspect (balance between economic, ecological and social dimensions). We add an institutional aspect as well (longevity of interventions, good governance).

- **Urbanization** and land use: when describing the conversion of land to urban uses we eschew normative terms such as ‘urban sprawl’ and ‘land take’ and opt for the more neutral ‘urbanization’. In general, we describe urban form in terms of compact, polycentric or diffuse development.

- **Practices**: land use is socially constructed in that the conversion of land from one use to another is a human activity, often involving a spatial planning system. Practices refer to the way land-use decisions are commonly made.

- **European Regions**: the forces of urbanization generally manifest themselves at the regional level. The territorial diversity of European regions is considerable, a fact which affects the urbanization pressures as well as the feasibility of interventions.

Evidence base

The SUPER project used an interdisciplinary approach to understand land-use change in Europe and the capacity for interventions to affect it. This resulted in the following insights:

- **On urbanization and land-use developments** the SUPER project combined state of the art demographic, economic and land use data at the NUTS 3 level into a single database. Based on this database, the project provides an overview of the most important land-use developments in the 2000-2018 period using maps, figures and tables. It found that urbanization is generally unidirectional and geographically asymmetrical: some regions are in fact experiencing deurbanization. The analysis demonstrates the importance of drivers such as economic development and demography, but also of phenomena such as second homes and tourism. Finally, the analysis illustrates dilemmas and trade-offs with respect to sustainability.

- **On interventions and their effects**: using various data collection methods, the SUPER project compiled a database of interventions in Europe that affect, or try to affect, urbanization and land use. This database was analysed to distil factors for success and sustainability. The analysis revealed that these were highly context dependent: one type of intervention (e.g. a growth boundary) could be successful in one region and unsuccessful somewhere else. Although the SUPER project did not discover guaranteed recipes for success, the many examples of interventions and their

accomplishments can provide inspiration to policymakers. The analysis also revealed that EU policies can and do have an impact on urbanization and land use, and therefore can potentially be deployed towards sustainability.

- **On development practices**: the SUPER project completed eleven case studies to understand land-use practices in context. The cases were selected to maximize diversity: scales, problems, intervention types and successes were all varied. Given this, the case studies were conducted according to a strict protocol to enhance comparability. Each case studied the prevailing development practice and how a given intervention sought to influence this. The effectiveness of the intervention was assessed by means of in-depth interviews with stakeholders and secondary sources. The results show that respondents were cautiously optimistic about the capacity of interventions to influence development practices.

- **On future development pathways**: the SUPER project also produced three scenarios to combine the evidence it produced into storylines based on compact, polycentric and diffuse modes of urbanization. Each scenario contains a description of drivers informed by the analysis of developments and a policy package derived from the analysis of interventions and case studies. Outcomes of each scenario were computed using the LUISETTA land-allocation model, and the impacts of these outcomes discussed using the sustainability assessment framework drawn up from a review of the scientific literature.

Main messages

The conclusions of the SUPER project are a result of discussions within the project team and the ESPON sounding board. Unfortunately, the planned activities with stakeholders to validate these results were cancelled due to the COVID-19 pandemic. Bearing this in mind, we have five points we would like to put on the agenda for discussion and welcome all feedback and suggestions.

- **Learn from the past and the future:** urbanization can largely be explained by population and socio-economic development. Still, this pressure is always mediated by local development practices. In the case studies, we have often seen that interventions are reactions to developments or practices deemed undesirable or unsustainable. Given this, the foreseen economic crisis following the COVID-19 pandemic should also resonate in future land-use decisions, ultimately changing the map of Europe. Depending on how the pandemic has affected public opinion, we could also see radically new housing and business location preferences, which would shift urbanization pressure to unexpected types of locations. This underlines the importance of making and using policy scenarios such as those drawn up in the SUPER project to explore the advantages and disadvantages of different developmental trajectories (e.g. compact, polycentric and diffuse). It also provides a basis for discussion on the synergies and trade-offs with respect to sustainability.

- **Interventions can and do affect urbanization and land use:** the SUPER project found that it is possible to design interventions that adjust the payoffs or orientation of stakeholders, and thus their behaviour in the development process, to more sustainable ends using a combination of carrots, sticks and sermons. The intervention database is replete with examples that raise costs associated with greenfield development or lower them for regeneration and infill. Even though it is impossible to measure the impact of such interventions on land-use developments (there is no control group to tell us what would have happened otherwise), the case studies do provide insight into this matter: stakeholders involved in the development process overwhelmingly asserted that interventions had an impact on standard development practices.

- **European policies can support or undermine sustainability:** despite having no formal competence for spatial planning, there is substantial evidence that EU policies impact urbanization and land use substantially. We can therefore posit that if the EU wishes to prioritize sustainable land use, it should seek to align its own policies to this end. For example, the EU could reduce the land

consumption of the structural funds; sustainable land use could be made a precondition for financial support. A step further would be for the EU to help member states develop more sustainable urbanization and land use practices, for example by offering information about best practices. A first step in this direction is the SUPER *Guide to sustainable urbanization and land use* published in parallel with this report.

- **Territorial differentiation needed:** it is difficult to make overall judgements about sustainability at the pan-European level because the distribution of developments is highly heterogeneous. For example, we observe signs of agricultural intensification in some parts of Europe and agricultural abandonment in others. We see strong urban growth in some parts of Europe, and decline in others. In addition, the effects of these developments are highly heterogeneous, and often entail a local trade-off between different dimensions of sustainability. For example, an increase of urban fabric per capita suggests more living space and improved housing affordability (social sustainability) but less efficiency in terms of land consumption (environmental sustainability). Similarly, the analysis of interventions shows very little regularity in terms of what works and why. Successful interventions in some regions fail in others. This suggests that generic targets or one-size-fits-all regulations have only limited value for steering urbanization and land use.

- **Proactive long-term holistic thinking aids short-term implementation:** for electoral reasons, it is often tempting for politicians to focus on quick-fix solutions to concrete and urgent problems rather than addressing complex long-term issues that require a more holistic approach. The case studies signalled a clear need for interventions to be embedded into a clear and comprehensive strategy or vision that covers all relevant topics and involves all relevant stakeholders. A vision can allow the intervention to be viewed as part of a wider strategy where land-use decisions are not made on the basis of opportunism, expedience or jurisdictional politics. Instead, they are viewed as optimizing land uses in terms of thematic sustainability and leading to a better future (temporal sustainability). Broad-based interventions, if they are successful in achieving their goal, seem to have the best chance to be sustainable in all three dimensions.

1 Introduction

The COVID-19 crisis has forced us to rethink *how and where we should live our lives*. Moreover, with the land development system now on hold in most parts of Europe, a unique window of opportunity has opened up to question whether this system is capable of delivering the natural and built environment we want for ourselves and for our children. Do we need as many carparks, airports, or holiday resorts as we once thought? Would we rather live in walkable compact cities, small-town transit communities, or diffuse urban regions with spacious homes and gardens? The decisions we make about urban development and land use today will impact our physical environment for decades or even centuries to come. And given that land-use conversion is socially determined – it is, after all, the outcome of conscious decisions made by human beings – it is also something that can be affected by conscious human interventions. Policies and practices matter. Now is the time to act.

This window of opportunity is a long time in the making. Recent years have seen several high-level studies on urban sprawl (EEA & FOEN, 2016; OECD, 2018) and EU policy initiatives (European Commission, 2011, 2012; European Commission & Joint Commission Resources, 2019; Urban Agenda, 2018). The European Parliament's declaration of a climate emergency in November 2019 can be seen as a rallying cry to fast-track planning efforts that address land-use sustainability goals (European Parliament, 2019). On the other hand, there is only so much that the EU can do. It is mainly national territorial governance and spatial planning systems that steer, or attempt to steer, land use through a variety of policy interventions and to varying degrees of success. Given that these interventions take on different guises in different national contexts, serve divergent goals and are implemented at various levels of scale, the European policy context is highly heterogeneous and fragmented (Couch et al., 2008). If Europe wishes to promote sustainable urbanization and land use in its regions, more insight is needed in how this occurs, and what interventions can effectively alter prevailing land development practices.

1.1 Aim and ambition

The primary aim of the ESPON SUPER project is to provide evidence and recommendations on how sustainable land use can be promoted and how unsustainable urbanization can be avoided, reduced and/or compensated in Europe, its cities and regions. Specifically, it:

1. provides a straightforward conceptual framework to understand urbanization and land-use dynamics;
2. gathers and analyses evidence on urbanization and land-use developments within the ESPON space over the 2000-2018 period;
3. gathers and analyses evidence on policy interventions, including EU policies, and their relative success and sustainability;
4. gathers and analyses evidence on how interventions affect land-use practices through case study research within a wide diversity of territorial contexts;
5. draws up a holistic sustainability assessment framework and applies this to three urbanization scenarios for 2050 (compact, polycentric and diffuse);

The five points above correspond to the first five chapters of this main report. Chapter 6 pulls the evidence together by providing conclusions and recommendations for decisionmakers (politicians), policymakers (officials) and other professionals involved in urbanization and land use dynamics. The impact of the SUPER project will be further realized in the way the research outputs find their way into policy practice. To facilitate this, the handbook *A Guide to Sustainable Urbanization and Land Use* was produced concurrently to this main report (see Annex 5).

1.2 Key terms and working definitions

Given the lack of a specific EU policy devoted to 'sustainable land use' and the fragmented literature and policy response described above, we feel that one of our first tasks is to be clear about terminology. Contained within the SUPER title 'Sustainable Urbanization and land-use Practices in European Regions' lies the key conceptual building blocks of our approach.

1.2.1 Sustainability

The most traditional definition of sustainability regards a *temporal balance*, that is the ability to 'sustain' the quality of life on the planet, which ties into notions of generational justice. Various temporal measures of sustainability exist. These often use the notion of 'carrying capacity' to assess whether resource consumption exceeds the recovery rate (Neuman & Churchill, 2015). One could argue that land, as a finite resource, can never be sustainably 'consumed' by definition – something implicitly suggested by the term 'land take'. We reject this view, positing that urban (re)development can enhance sustainability if it creates a more future-proof urban form. A final consideration with respect to temporal sustainability is the durability of policies (e.g. stability of funding, vulnerability to political/economic cycles) and governance quality and capacity to effectively steer long-term processes such as urbanization. We call this institutional sustainability.

Another common conceptualization of sustainability regards a *thematic balance* between three dimensions, commonly referred to as the 'three Es' (economy, ecology, equity) or the 'three Ps' (people, planet, profit). Sustainable development, therefore, advances one or more of these dimensions without sacrificing the other. Urban planning and urban design often try to achieve advances in all three dimensions of sustainability simultaneously (Campbell 2016).

1.2.2 Urbanization and land use

We emphatically employ the term 'urbanization' above 'land take' or 'sprawl' because we feel it to be a more neutral way to describe the phenomenon of conversion of land to more urban uses. In our conceptualization, urbanization does not merely denote the movement of population to cities or the expansion of the built-up area, but *all physical urban developments*. Many variations of urbanization can be distinguished in Europe, even de-urbanization (conversion of urban land to natural or rural uses). Obviously, some forms of urbanization will be more sustainable than others. Given the diversity of Europe and the increased importance of taking a place-based approach, urbanization as a concept is also more consistent with and amenable to territorial governance and spatial planning traditions.

To facilitate various analyses, the SUPER project has identified three main urban forms: compact (usually walkable large dense cities that are dominant in their regions), polycentric (clustered development, usually well-served by public transport) and diffuse (low density car-oriented scattered development). These can also be used to describe developments.

1.2.3 Practices

The conversion of rural to urban land use can be an exceedingly lucrative practice, and property development is a major driver of local, regional or even national economies. Any attempt to make urbanization practices more sustainable will require insight into how the system of land development is organized and how various parties earn money through urbanization. The 'game of urban development' (Lord, 2012; United Nations Human Settlements Programme, 2016) is structured by formal (e.g. property rights and land use regulation) and informal institutions (e.g. how municipalities and developers interact). Governments play a key role in setting the rules of the game through for example taxation, subsidy schemes and drawing up land-use plans. And in some cases, they are active participants.

Territorial governance and spatial planning systems intervene in these land-use development practices. In addition to wielding sticks (e.g. regulations, zoning) and providing carrots (e.g. subsidies or incentives), they rely heavily on the power of persuasion, often taking the form of visions or strategies (Hood & Margetts, 2007). All these actions we call interventions. Especially relevant are the (un)intended consequences of EU-policies and conscious interventions via territorial governance and spatial planning at various levels.

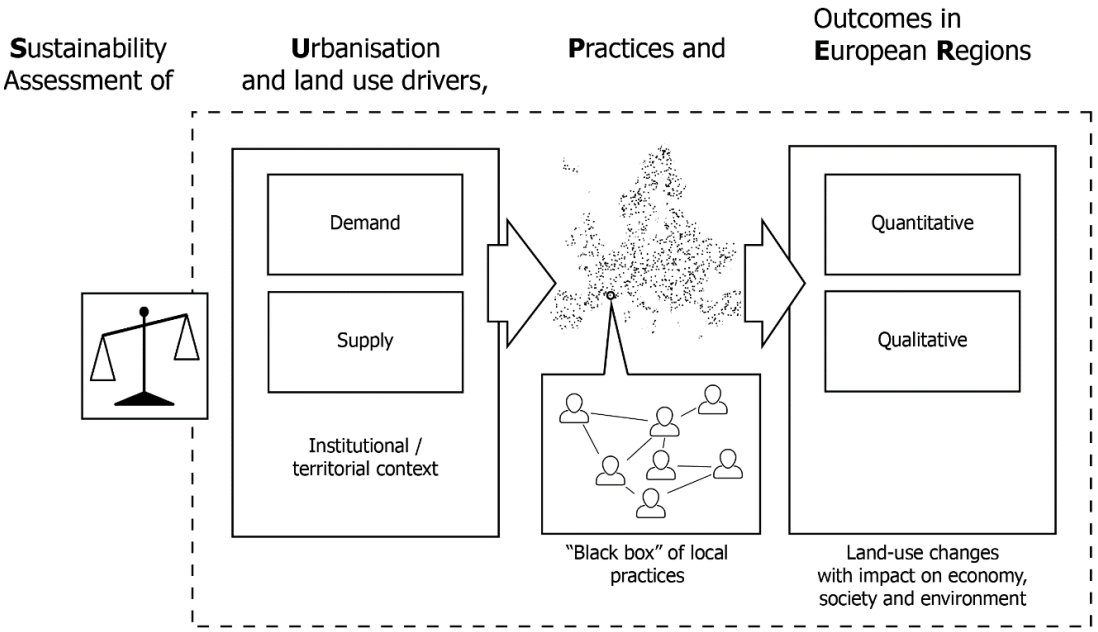
1.2.4 European Regions

We posit that the forces of urbanization generally express themselves at the regional level, or at least the level of labour and housing markets and commuting zones. As an illustration of this diversity, we note that not all European cities experience the same urbanization pressures at the same time (Dembski et al., 2019). The placement of a European region within its development trajectory has important ramifications for the level of urbanization pressure it experiences as well as the feasibility of interventions intended to deal with it.

1.3 Conceptual framework

The concepts discussed in the previous section have been reordered to provide a guide for carrying out the necessary research. This conceptual framework is grounded in own research (Dallhammer et al., 2012; ESPON, 2013, 2018; Evers & Tennekes, 2016; Farinós Dasí, 2018) and recent academic literature (e.g. Colsaet et al., 2018; Pagliarin & De Decker, 2018) and illustrates the main relevant cause-effect relationships governing urbanization and land-use change. This is indicated within the dotted area in *Figure 1.1*.

Figure 1.1: Conceptual framework



1.3.1 Urbanization and land-use drivers

Much research, particularly quantitative data-driven research (e.g. EEA & FOEN, 2016; OECD, 2018), attempts to explain urbanization patterns (sprawl) on the basis of key demand-side drivers. Some examples are outlined below. Annex 1 contains a fuller explanation and analysis of the relative force of these kinds of drivers.

- **Demographic drivers**: population growth, household size and migration dynamics are seen as factors that determine the demand for urban space.

- **Economic drivers**: growth in GDP/GVA (especially regarding commercial space), macroeconomic trends, access to credit and level of household savings, welfare-state regimes, vitality and agricultural sector consolidation and accessibility.

- **Societal and technological drivers**: housing preferences (apartment versus detached), tenure preferences, transport preferences, social norms regarding cohabitation and second homes.

Urbanization is not determined by demand alone. Supply-side factors also play a role, such as the profitability of land-use conversion (Couch et al., 2008), strategic land ownership and legal rights to develop (Buitelaar & Leinfelder, 2020). Fiscal aspects also play a role, such as the level of municipal reliance on local property taxes (Rothenberg, 1977) as does the level of consolidation or fragmentation of government (Evers & de Vries, 2013). Although these supply side drivers are less studied, they can be quite significant. Moreover, there are other factors that determine the shape, intensity and direction of land-use change. Physical barriers (e.g. mountains, water bodies) is an obvious structuring element. Policy is another: the designation of a site as a floodplain, natural habitat or industrial zone affects the prospects for development. Given that every legal development requires some form of planning approval from a public authority, a further understanding of how this occurs is of uttermost importance.

1.3.2 Practices governing land-use decisions

Most studies on urbanization and land use focus either on global drivers (input) or global outcomes (output). The crucial decision to convert a site from a non-urban use to an urban use largely remains a black box. Following Lord (2012), this black box can be opened by considering the payoffs and interests of the actors involved in urban development. This usually requires in-depth local knowledge. The SUPER project includes 11 case studies at various territorial contexts and scales which examine how a particular intervention to promote sustainable land use affected development practices.

1.3.3 Outcomes in European Regions

The physical outcome of land-use decisions is readily measurable thanks to the availability of increasingly accurate data based on satellite imagery. The Corine Land Cover (CLC) dataset, based on this imagery, allows us to 'see' the changing landscape of Europe over the past 18 years with a reasonable level of accuracy. It is therefore possible to make aggregate analyses of how the land is being converted in Europe. Corine combined with other sources allows for more sophisticated analyses, such as identifying 'hotspots' of urbanization in Europe, creating morphological typologies and carrying out cluster analyses to discover common types of urban areas and their evolution. This is the topic of the next chapter.

1.3.4 Sustainability assessment

Finally, using our broad definition of sustainability, we can then evaluate whether particular interventions, practices or outcomes (e.g. compact versus diffuse urban form) are sustainable in a nuanced way. This analysis will enable the identification of potential synergies or inherent trade-offs, and therefore provides a springboard towards policy conclusions and recommendations.

2 Urbanization and land-use development in Europe

The SUPER project has profited from an unprecedented availability of high-quality data. In particular, Corine Land Cover (CLC) data provided by Copernicus and coordinated and managed by the European Commission in partnership with the European Space Agency (ESA), comprises the most important basis for our analysis of physical developments. This dataset enables the monitoring of land use with a reasonable level of accuracy (minimal mapping units of 25 ha). For more detailed analyses, the Corine land cover change database (CHA) provides information at a minimal mapping unit of 5 hectares. In addition to Corine, the German Aerospace Centre's Global Urban Footprint (GUF) and the EU Joint Research Centre's Global Human Settlement Layer (GHSL) were used. This allows analyses at finer scales and therefore a more nuanced understanding on changing urbanization and land-uses in Europe.

To perform analyses combining information on land use with potential drivers of land use change, the SUPER project created a database that combines socioeconomic, environmental and land-cover data into a single Excel spreadsheet to ensure maximum comparability, compatibility and ease of use. As far as possible, all data was collected at or converted into NUTS 3 (2016 boundaries) for the four Corine Land Cover measurement dates (2000, 2006, 2012 and 2018). The database has been adapted to allow for user-generated queries via the pivot table function and will be made publicly available.

2.1 Overview of changes 2000-2018

The CHA dataset allows us to track changes in land use across the ESPON territory over the 2000-2018 period. During this time, a little under 2.87 million hectares of land changed from one main category to another (see Table 2.1) or about 0.6% of the surface area of ESPON space. Almost half (1.26 million ha or 44%), concerned a conversion to urban land. As a result, artificial land cover increased from 19.2 million to 22.6 million hectares, the vast majority of which (18.5 million in 2000 and 21.8 million in 2018) concerned uses such as homes, businesses and infrastructure; the rest regarded mineral extraction and dump sites.

Table 2.1 Sum of land-use change (ha) in ESPON countries between 2000 to 2018

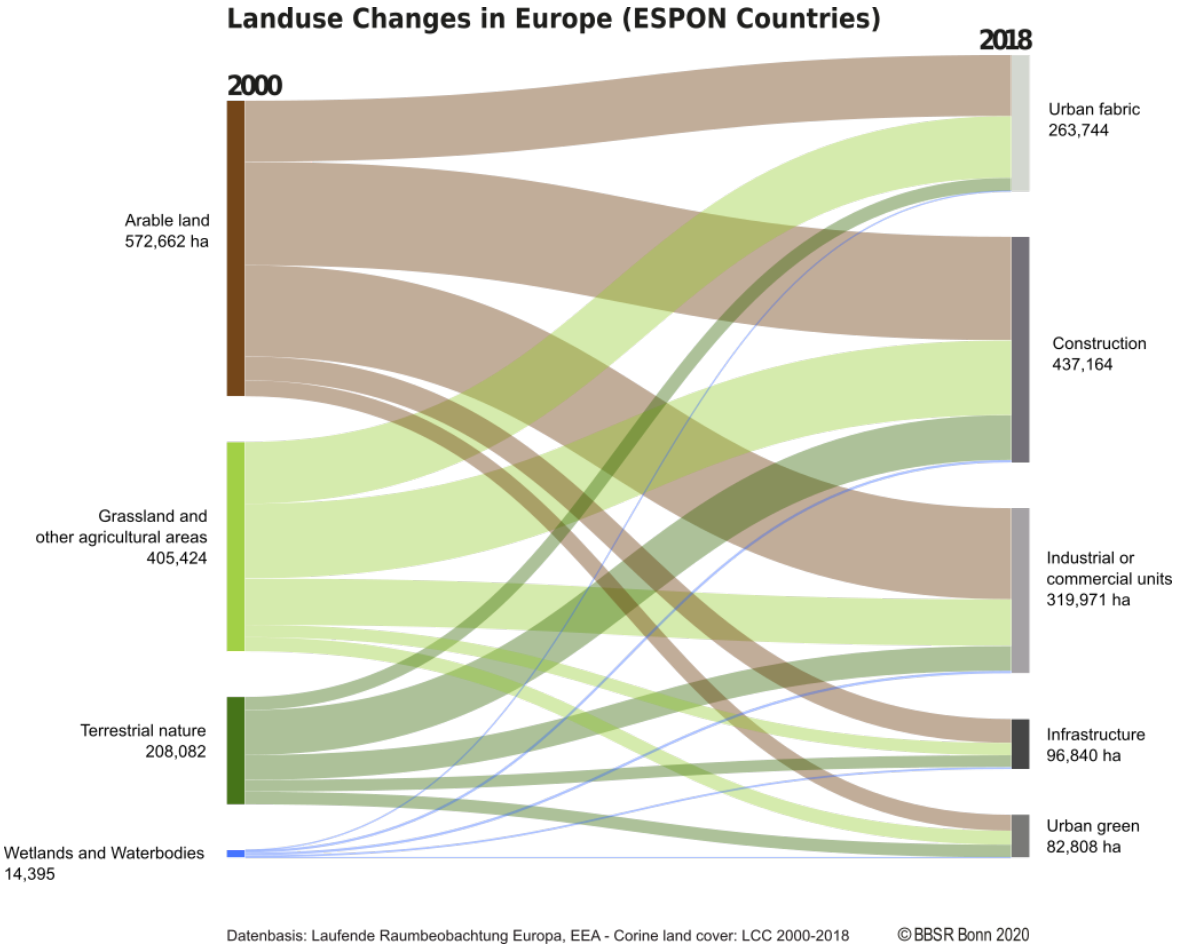
To / From	Urban	Artificial (not urban)	Agricultural	Terrestrial nature	Wetlands and water bodies	Total*
Urban		3,040	33,000	12,120	9,030	57,2190
Artificial (not urban)	8,760		52,400	50,030	19,8120	131,010
Agricultural	990,540	162,330		456,680	97,320	1,706,860
Terrestrial nature	246,970	97,800	325,140		125,900	795,820
Wetlands & water bodies	16,300	4,620	45,130	111,500		177,550
Grand Total*	1,262,570	267,790	455,680	630,320	252,070	2,868,440

*Totals may not add up exactly due to a rounding to the nearest 10 ha.

2.1.1 Urbanization

As stated, about 1.26 million hectares of land were converted to urban use in the 2000-2018 period. If we subtract the land already registered as construction sites (450 thousand ha) and add the land converted from construction sites to urban (350 thousand ha) we get a total urbanization figure of 1,166,000 ha in the ESPON space. Of this, 35% became urban fabric (predominantly residential), 37% industrial (including business parks, shopping centres and offices), 17% infrastructure (including airports) and 11% urban green. Urban development mainly occurred on agricultural land (78%), although in Scandinavian countries (except Denmark), Croatia, Greece, Iceland, and Portugal this came more at the expense of terrestrial nature (see also *Map 2.7*). Some NUTS 3 in Austria and the UK (Scotland) also saw a majority of new urban land coming from natural areas. *Figure 2.1* visualizes how land use shifted towards urban uses.

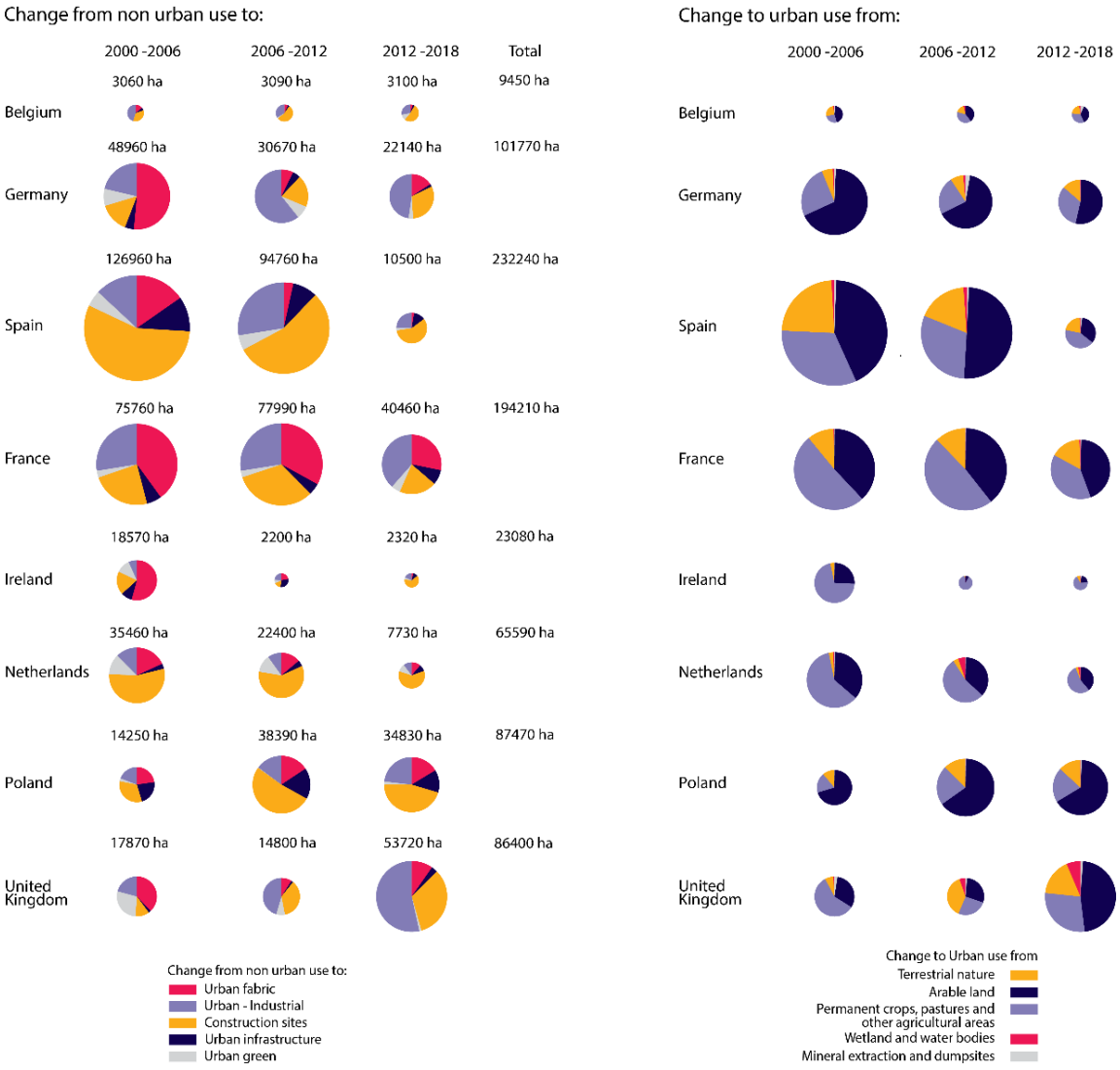
Figure 2.1: Changes to urban land use in the ESPON territory (2000-2018)



Of the approximately 176,000 ha of deurbanising land in the total ESPON space, the majority (69%) concerned transitions away from 'artificial land' like mines and dump sites. This land was converted in equal proportions to agriculture and terrestrial nature, and a smaller part to water-related nature. Over half of these conversions took place in four countries: Germany (21%), Spain (15%), the UK (10%) and Poland (9%). In total, 8.6 times more land was converted to urban/artificial use than vice versa. Only in Romania (-0.8%) and Bulgaria (-0.1%) did the share of urban land decrease between 2000 and 2018 as a whole.

The content and pace of urban land conversion also varied in Europe. *Figure 2.2* displays, for a select number of countries, the magnitude of urban conversion by urban land use (left) as well as the previous land use (right). In this sense, it territorializes *Figure 2.1*.

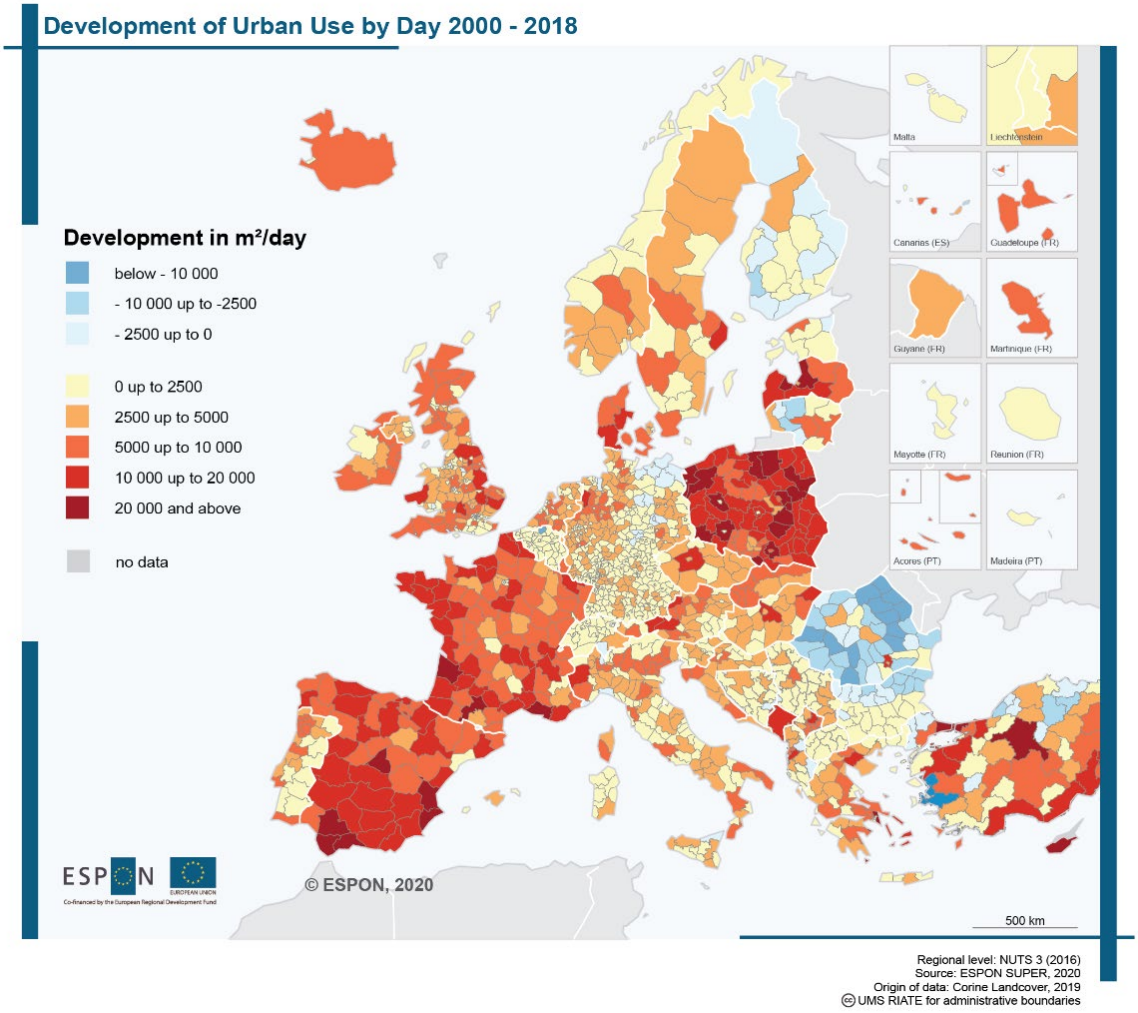
Figure 2.2: Changes to urban land use for selected countries in the ESPON territory (2000-2018)



Reflecting on this figure, it appears that land-use changes seem closely tied to socioeconomic and political developments. For example, far less land changed function in the years following the financial and economic crisis, especially in Spain and Ireland (where this was acutely felt). On the other hand, urbanization in Poland almost tripled in the years following its EU accession. Between 2000 and 2018 nearly 20% of all Europe's urbanization occurred in Spain, followed by France with 15%. In the last period from 2012 to 2018, the UK took the lead; over one fifth of all changes were registered here, followed by France with again 15% and Poland with approximately 13%.

Finally, there is significant regional variation in the rate of urbanization. Map 2.1 shows the changes at the NUTS 3 level per day, revealing high conversion rates in Poland, France, Spain, and Turkey. Suburbanization is also perceptible by observing relatively high rates of development surrounding cities such as Prague, Budapest and various Polish cities. The map also reveals a few regions of net deurbanization in the 2000-2018 period.

Map 2.1: Daily rate of urbanization in the 2000-2018 period



As useful as the CLC database is for its wide geographic coverage, its resolution is too coarse to capture very small-scale urban development well. For example, the Corine database reports an urbanization rate for Belgium several times lower than higher-resolution data collected nationally. To explore this matter further, we combined the CLC data for 2012 with the Global Urban Footprint (GUF) database, which measures built-up areas at a very high resolution (12m) for 2011. The overlay of these two datasets is presented in *Figure 2.3* (Liège). Black areas in the map represent individual buildings (GUF) and red areas (CLC) urban land cover. Red areas with little black inside are designated by CLC as urban but have a modest urban footprint. This can be readily observed to the east and south of Liège. Consequently, the ribbon development to the east of the city could easily continue along the same roads without being noticed by Corine as new urban land cover. When combined with population data this could result in an erroneous finding that urbanization is highly efficient and sustainable because it makes use of existing built-up areas. In fact, homes are still being built, just not registered. Rather than urban containment, diffusion is occurring.

Spurious conclusions can also be drawn when built-up areas are too small to be coded as urban in Corine, as the example of Warsaw shows (*Figure 2.4*). To the east of the city, urban form in Corine seems more compact than it really is because very diffuse development is still being registered as agricultural. When combined with population data, this could give the impression that Csie is a vital rural area, where in fact it may be losing its function (in this case, it is). Moreover, construction of buildings in this rural area – even if they were devoted to agricultural use – still has implications for soil sealing, water retention, and hence sustainability.

Figure 2.3: CLC-GUF comparison for Liège and environs. GUF: black, CLC: urban (red), industry/commerce (purple), infrastructure (grey), agriculture (yellow), nature (green), water (blue).

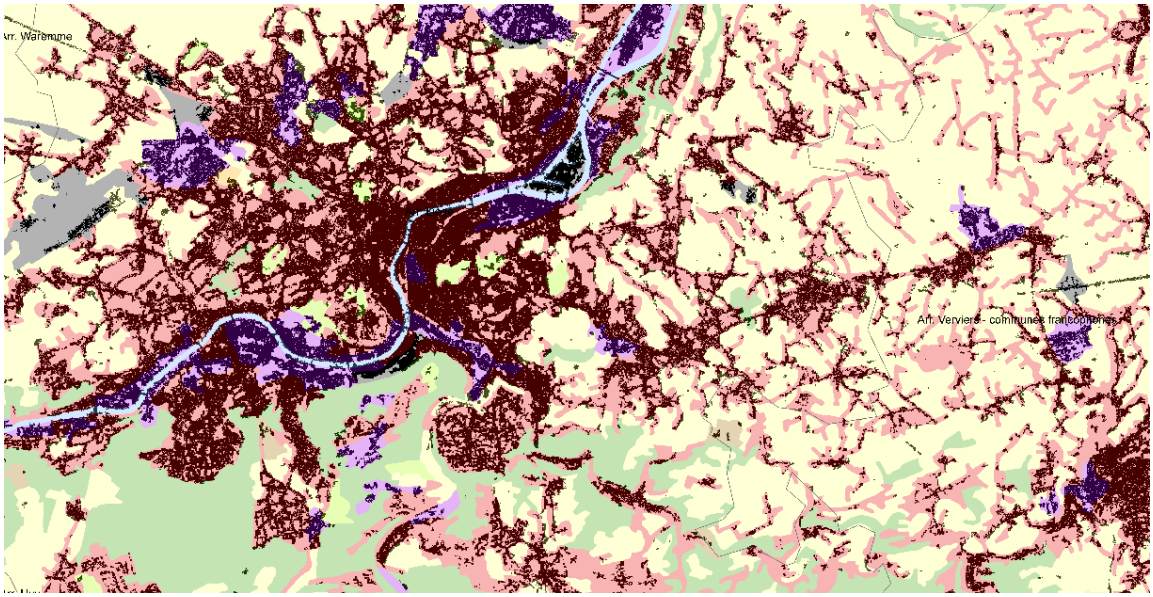
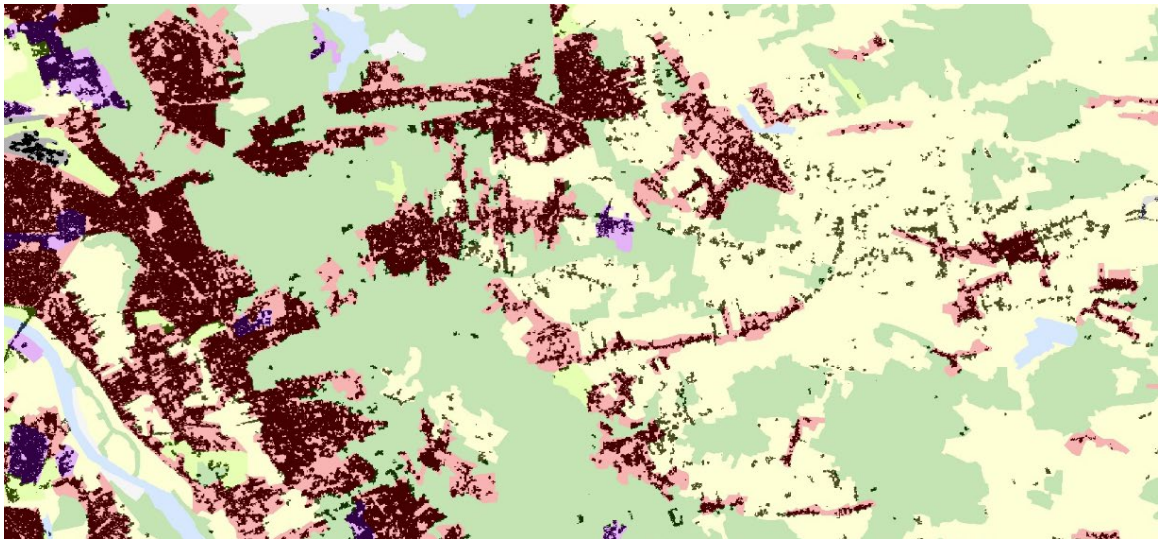


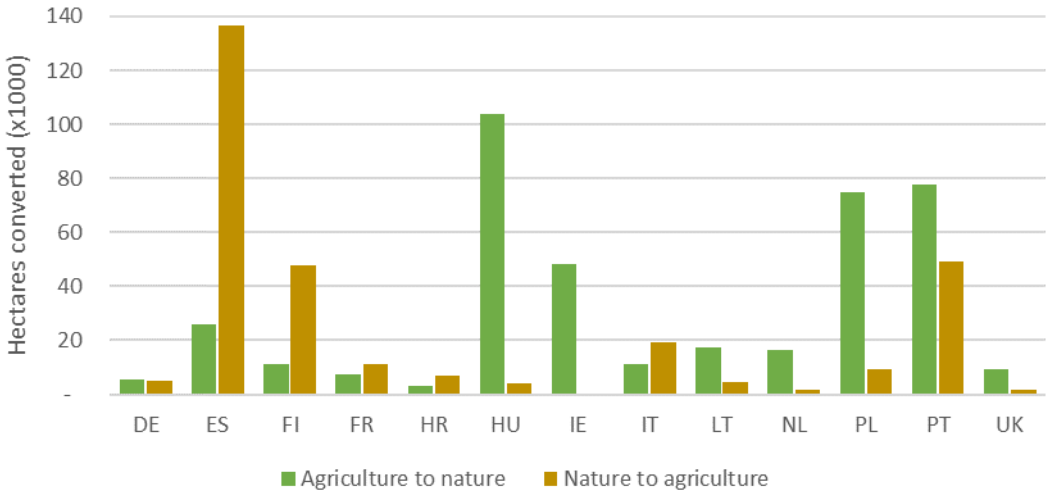
Figure 2.4: CLC-GUF comparison for eastern Warsaw and environs. GUF: black, CLC: urban (red), industry/commerce (purple), infrastructure (grey), agriculture (yellow), nature (green), water (blue).



2.1.2 Non-urban land use change

Finally, with regard to non-urban land cover, the biggest source for new agricultural land was terrestrial nature (71%) and the biggest source for new terrestrial nature was agriculture (72%), although 1.4 times more agricultural land was converted to terrestrial nature than vice versa. As a result, agricultural areas decreased from 208.8 million to 202.7 million hectares while natural areas remained largely stable (233.2 million hectares in 2000 and 234.0 million hectares in 2018). Other major non-urban conversions included agriculture to mineral extraction (150 thousand ha), terrestrial nature to mineral extraction (84 thousand ha) and agriculture to wet natural areas (97 thousand ha).

Figure 2.5 Conversion of agriculture to nature and vice versa per country in the 2000-2018 period (for countries with a total conversion of more than 10.000 ha)



From Figure 2.5, we see that the relatively stable balance between agriculture and nature at the European level belies significant territorial differences. Most of the dynamics occurred in just a handful of member states: Spain, Hungary, Poland and Portugal. Moreover, the dynamics were one-way in several cases: Spain (and to a lesser degree, Finland) showed a significant shift from nature to agriculture, whereas this was the opposite in Hungary and Ireland. Finally, significant changes occurred within non-urban categories. For example, many areas coded as agriculture saw shifts between arable land (crop production) and land devoted to pastures and permanent crops (e.g. orchards).

2.1.3 Urban typology

Every region has its own unique composition of land uses and challenges. One way to reduce the inherent complexity of territorial differentiation is to create typologies according to a particular indicator or set of indicators. We can group European regions according to their economic structure, geographic specificities, population development and, more relevant for this study, the urban/rural typology based on population density. The latter is however rather unidimensional, and given the wealth of land-use data currently available, more sophisticated analyses are possible. For example, can we make a grouping of regions according to their urban characteristics?

To answer this question, we performed a cluster analysis of NUTS 3 regions based on the composition of their artificial land use classes (urban fabric, industrial/commercial, infrastructure, urban green, construction and mineral extraction/dump sites) as well as their population density and proportion of jobs in agriculture, industry, construction and services. A complete discussion of methodology and results is provided in Annex 1 to this report. The analysis generated the following seven clusters:

1. **Standard industrial cities (StInd)**. Cluster 1 is characterized by a large proportion urban fabric and a large industrial sector, albeit with a small proportion industrial and commercial areas. Because this cluster is in many respects close to the average for all European regions, and because it is the most abundant type, we refer to it as ‘Standard’, with the addition of ‘industrial’ to distinguish it from cluster 2. This type is dominant in central and eastern Europe.

2. **Standard service-oriented cities (StSer)**. Cluster 2 is quite similar to cluster 1 with respect to urban land use, which is why we also refer to it as ‘Standard’. It differs from cluster 1 in that is has a large service sector and an above average proportion of infrastructure. This is the dominant type in France, Belgium, parts of southern Europe and northern Norway.

3. **Cities with extensive work areas (Work).** Cluster 3 is characterized by a high proportion of land devoted to Industrial and commercial areas; it also has a large industrial sector. We find this type in western Germany, northern Italy, parts of Spain, Bulgaria and Latvia.

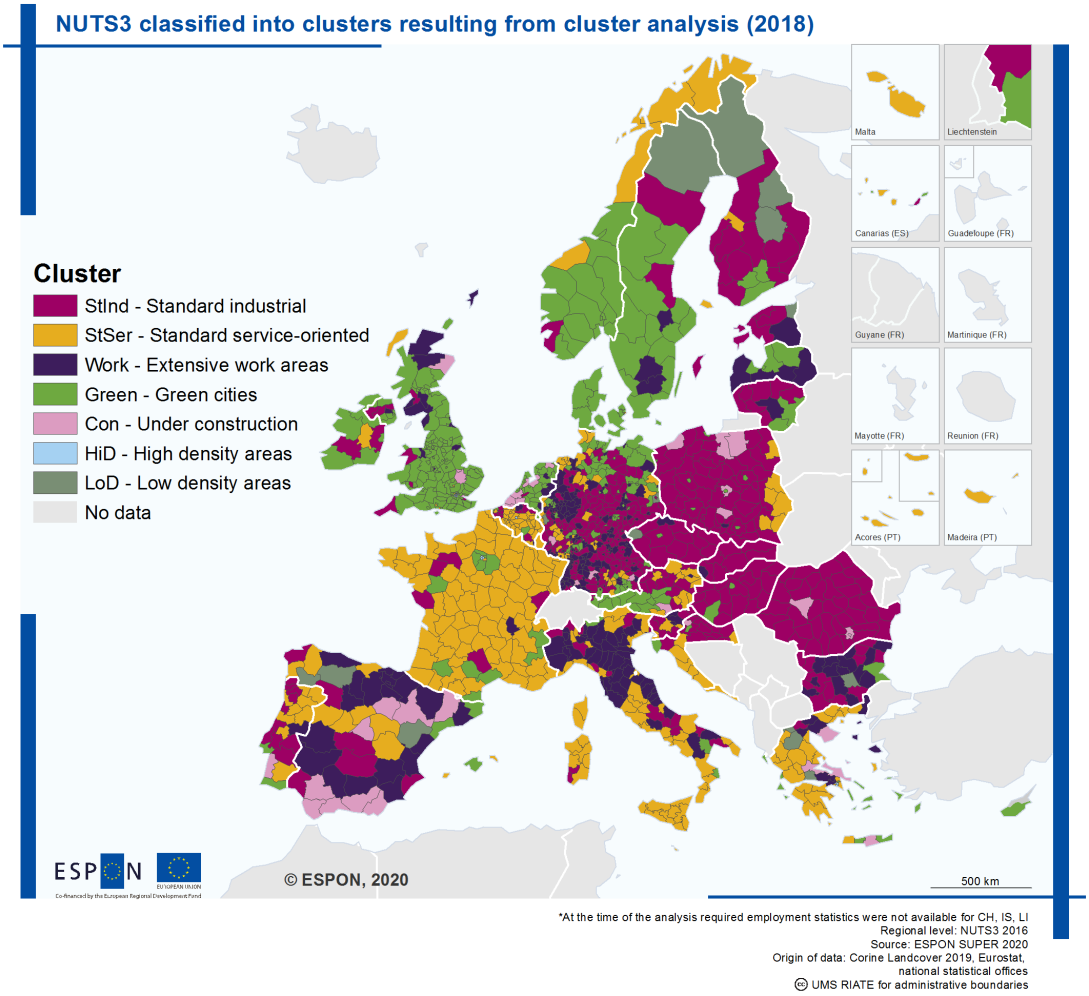
4. **Green cities (Green).** Cluster 4 is characterized by a high proportion of urban green and a large service sector. This is the dominant type in north-western Europe, and in parts of Austria.

5. **Cities under construction (Con).** Cluster 5 is characterized by high proportions of construction areas and infrastructure. This is the dominant type in Southern Spain.

6. **High density areas (HiD).** Cluster 6 is made up of 15 small, highly urbanized NUTS3 regions, and is therefore difficult to spot on the map. These have by far the highest densities of population and employment, the highest proportion urban fabric as well as the largest service sector. We find these areas in the metropolitan areas of London, Paris, Brussels and Athens. The fact that they occur here, and not in other metropolitan areas, may be an artefact of the different sizes of metropolitan NUTS3 regions in different countries.

7. **Low density regions (LoD).** Cluster 7 is characterized by the highest proportions of mineral extraction and dump sites and the lowest densities of population and employment and a relatively large industrial sector. It consists of 16 regions, 4 of which are located in northern Scandinavia.

Map 2.2 NUTS 3 regions classified into the clusters resulting from cluster analysis



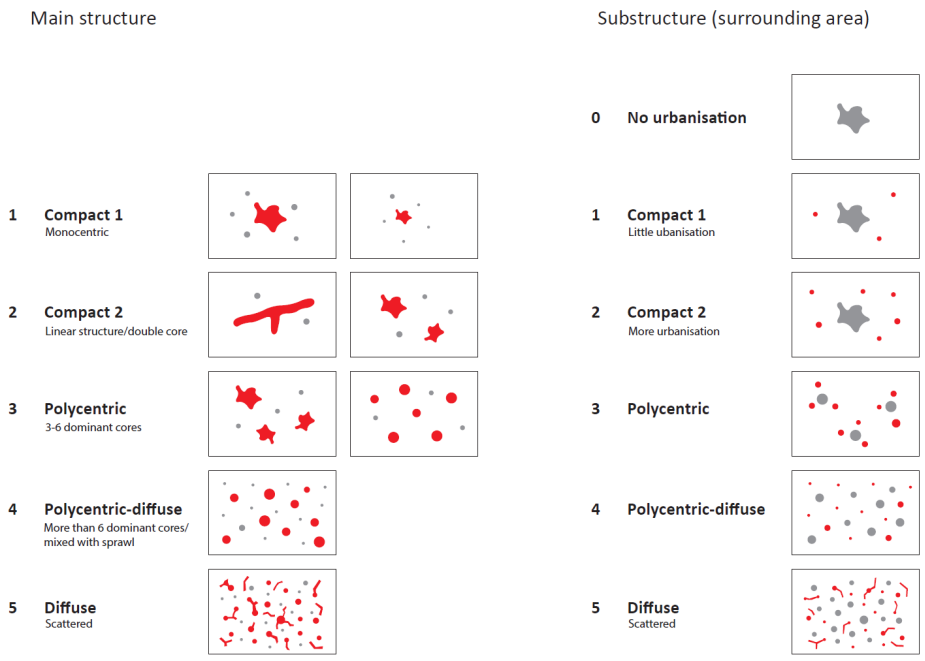
Map 2.2 shows the geographical distribution of the clusters. The first four clusters are the most significant: together they contain around 90% of the land mass, population, and economic activity of the NUTS 3 regions included in the analysis. The largest land area and the largest artificial land area are occupied by the cluster Standard industrial, whereas the largest population, most jobs and the largest share of GDP are found in the cluster Urban Green. The other three clusters relate to very specific types of land use. The cluster High Density is remarkable because it occupies only 0.02% of the total land mass (0.4% of all urban land), but still houses 2% of the population and over 3% of all jobs, and produces ca. 6% of the total GDP in the study area. The small NUTS 3 areas make it virtually impossible to detect these clusters on the map. Construction indicates either stalled construction or areas in flux. The Low density cluster has large amounts of artificial areas that are not directly related to urban land use, with by far the lowest population and job densities of all clusters.

Our understanding of the structure of European urban space is further enhanced when we compare this typology to others. If we look at the primacy rate (i.e. the population of the most populous LAU 2 area as a proportion of the total population of the NUTS 3) we see that all clusters are predominantly polycentric, although the two Standard clusters have an equal number of monocentric regions. The Extensive work areas cluster has an above average proportion of polycentric regions, which corresponds to the observation that many have their origin in the rapid development of mining and industry during the industrial revolution (Freeman & Snodgrass, 1975). Finally, none of the regions in the Low density cluster have a clear major municipality.

2.1.4 Morphological analysis

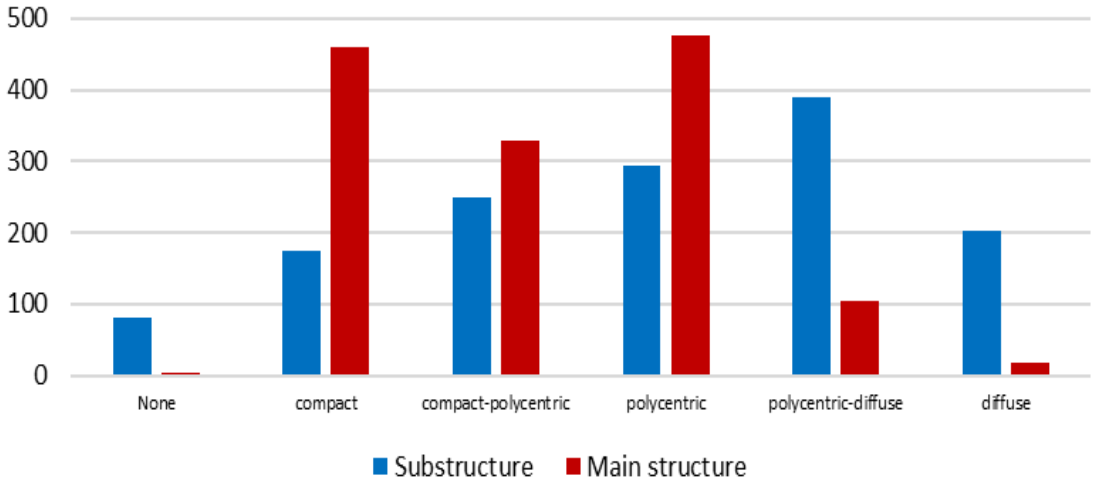
Much of the literature on sustainability of urban morphology makes a distinction between a relatively sustainable compact urban form versus unsustainable urban sprawl. This cannot be readily deduced from statistics on areas of land use type or population density, however. To contribute to this debate, the SUPER project manually classified NUTS 3 regions in terms of their urban form. The classification of compact, polycentric and diffuse was maintained as a starting point in order to link up to the sustainability assessment framework (See Annex 4).

Figure 2.6: Urban form evaluation guide



The basic philosophy of the method employed is similar to the book *A Field Guide to Sprawl*, which uses visual information – aerial photography – to identify urban forms (Hayden, 2004). The methodology employed was to manually assess the urban form from images of NUTS 3 regions using expert judgement. An important distinction is between is the predominant visual element, which is generally larger urban areas (main structure) and the composition of the remaining space (substructure). For example, it is possible to have a region with a compact monocentric city surrounded by a diffuse hinterland (substructure). The evaluation framework is displayed in *Figure 2.6*. This experimental and unorthodox methodology should be considered indicative and preliminary.

Figure 2.7: Frequency of main and substructure scores



This section provides a summary of the results; a fuller description including all maps and figures is provided in Annex 1. A first indication of the data can be obtained by making a frequency distribution of the scores. This is presented in Figure 2.7. Here it is clear that, not surprisingly, main structures were judged to be more compact than substructures. Polycentric-diffuse was the most prevalent substructure, while the most common main structures were compact and polycentric. For 84 regions no urban form could be identified, usually in the substructure (n=80), because of extremely compact development or tight NUTS3 boundaries.

Figure 2.8: Type of change of main class per main class

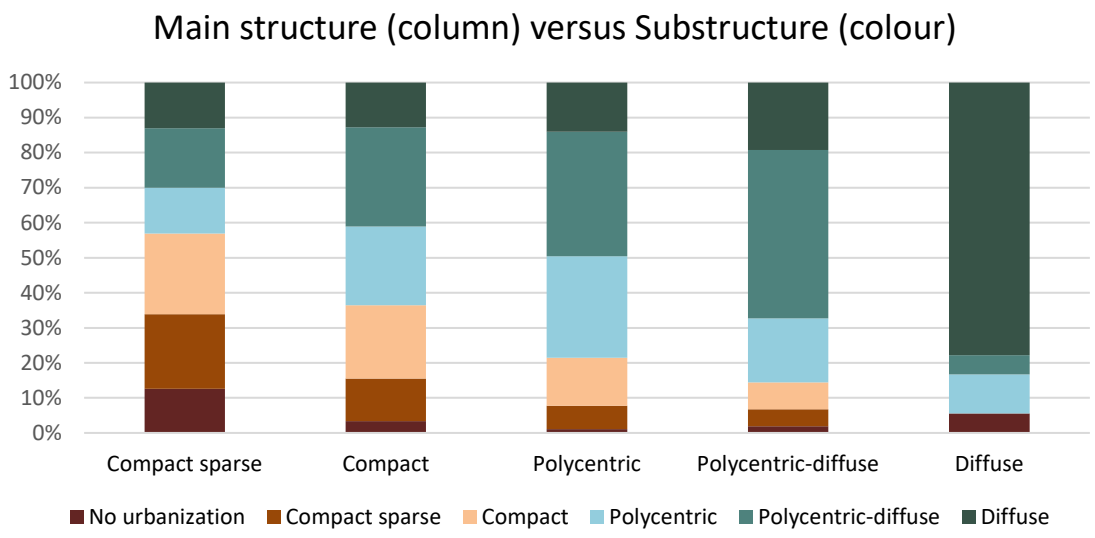
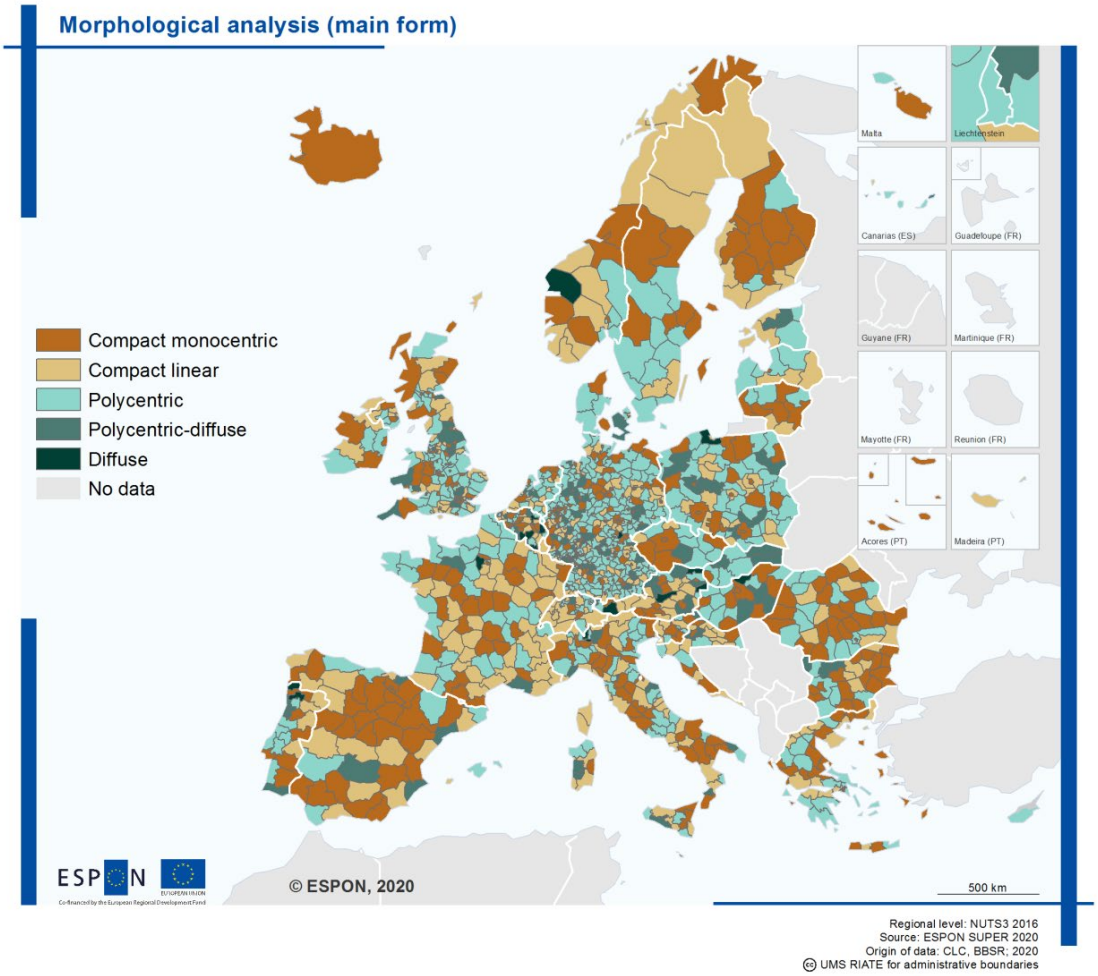


Figure *2.8* shows how the two structures interrelate, revealing that more diffuse substructures – often labelled as urban sprawl – most often occur when the main structure is also diffuse. Interestingly, the other main categories show roughly equal levels of diffuse substructures. In other words, the chance that a compact (monocentric or dual/linear structure) region has a diffuse substructure is roughly the same as that for polycentric regions. For example, there were monocentric regions with very compact or no development outside the core city (e.g. Oslo, Berlin, Coventry and Budapest: sometimes explained by tight NUTS3 borders) as well as ones with very diffuse development (e.g. Gliwicki, Milan and Braşov). Still, outside this relatively small diffuse category, we clearly see a pattern where, as the main structure becomes more diffuse, so too becomes the substructure.

More insight is obtained when the two structures are mapped out at the NUTS3 level, the scale at which the morphological analysis was carried out. Examining Map 2.3, national differences can be observed in the main structure, with Iceland, Norway, Finland and Spain generally having compact main structures and the Netherlands, Germany, Denmark and the Slovak Republic being more polycentric. Still, the differences within countries is marked. France, Romania, Bulgaria, Belgium, Italy, and Poland are all quite heterogeneous. Sweden is divided between a compact north and polycentric south while Portugal and the Czech Republic have an east/west divide. These results challenge the conventional wisdom of a traditional compact Mediterranean urban form versus dispersed development in the more northern regions, or stereotypes of idyllic compact Italian cities versus urban sprawl in Belgium. According to this analysis, the distribution of main urban form is quite diverse across the ESPON space.

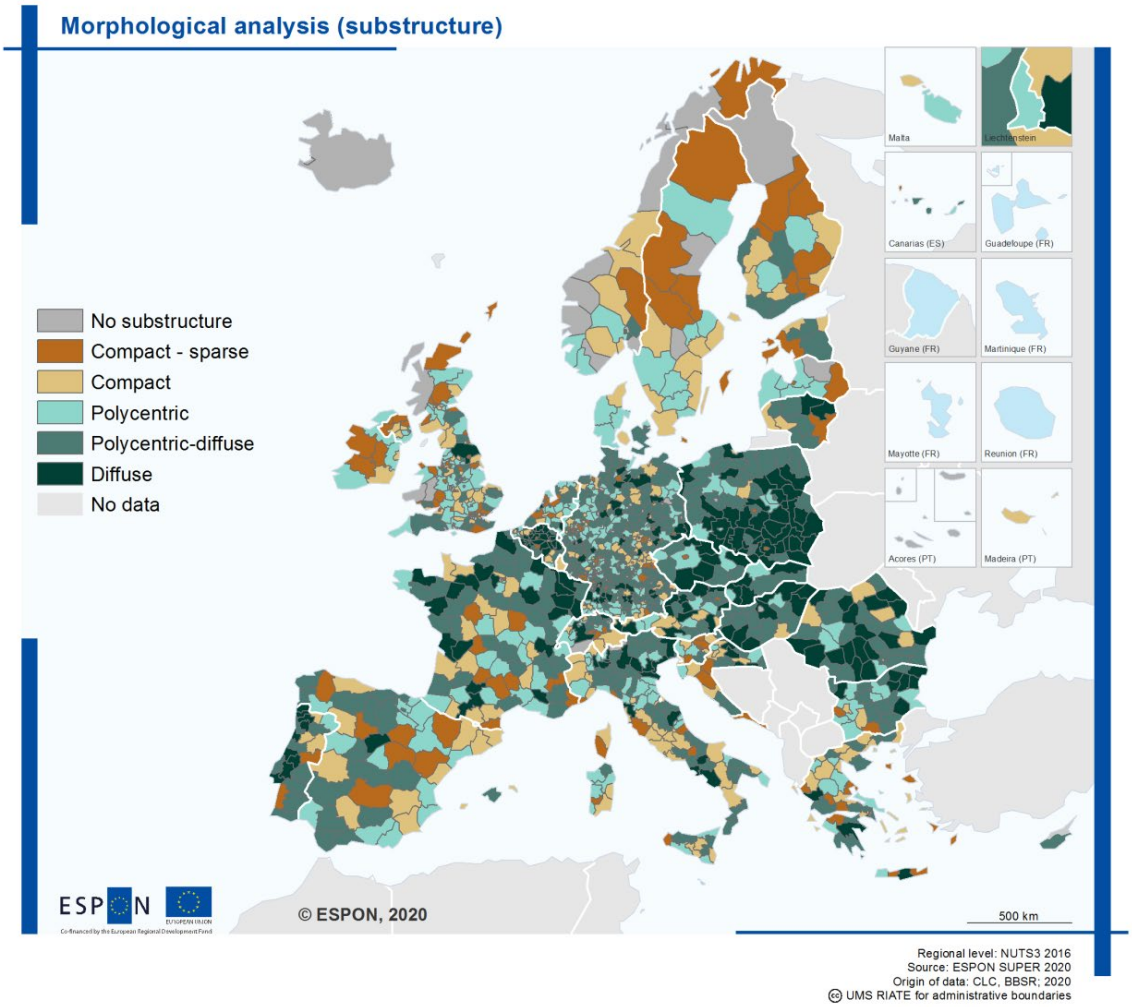
Map 2.3: Morphology of main structure at NUTS3



The diversity of Europe is still apparent, but less so, when examining the distribution of substructures in *Map 2.4*. The observation at the European level that the substructure is more diffuse than the main structure is immediately apparent in the large share of polycentric-diffuse and diffuse categories. Northern France, northern Italy, Ireland, much of central and eastern Europe (particularly Poland, Hungary and the Czech and Slovak Republic) have comparably diffuse substructures. More compact substructures are found in Spain, central France, Croatia, central Italy, the Netherlands, and northern Scandinavia. As noted in the sustainability assessment framework (see Annex 4), urban form has distinct but complex implications for sustainability given inherent trade-offs. On the other hand, it is also something that has gradually evolved over a long period of time and is difficult to manage; much of Europe's current urban structure is the result of seeds planted hundreds, if not thousands, of years ago. This has implications for the capacity of certain territories to become more sustainable.

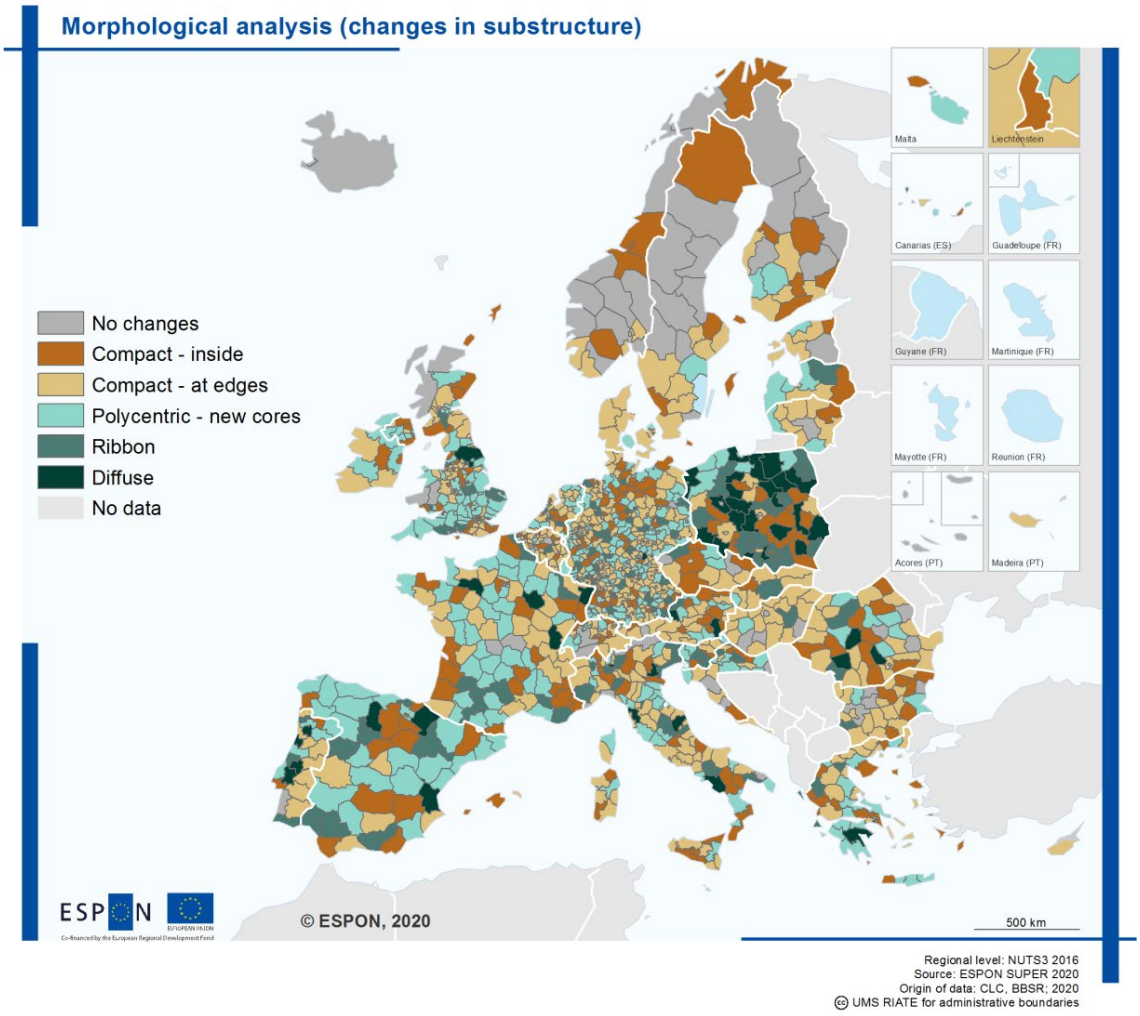
Urbanization is a dynamic phenomenon and measuring changes in urban form over time provides insight into sustainability. With respect to the main structure, it was found that the predominant kind of urbanization is contiguous: either close by or on the urban fringe. Development at a distance or diffuse was less frequent. Still, contiguous development in a diffuse main structure is not likely to create a more compact structure, but instead reproduce fragmentation. When mapped out, few spatial patterns are immediately apparent, especially at the national level: almost all countries had regions developing more compactly and less compactly. Interestingly, Spain which has the most urban development in absolute terms, urbanizes in a comparatively compact way. This is also the case in the Netherlands, Bulgaria and Sweden.

Map 2.4: Morphology of substructure at NUTS3



Finally, given that much of urban development occurs in the substructure, and that this is where the sprawl debate is generally focussed, this was analysed with interest. From the analysis we see more compact substructures growing in slightly more compact ways: infill or contiguous development constituted over 90% of urbanization in the 2000-2018 period. Diffuse development only really occurred in already diffuse substructures, although the line is quite blurry between this category and polycentric new areas (scattered development). As with the main structure, if new development in relatively diffuse substructures occurs contiguously, this does not necessarily imply that a more compact structure is being created.

Map 2.5: Change in substructure (2000-2018)



Map 2.5 shows that most countries have a region where the substructure is urbanizing in a diffuse way (either scattered or along roadways). Scandinavia and the Baltic states seem to be an exception to this rule. It is also worth noting that some countries such as Hungary and the Czech and Slovak republics that had fairly diffuse substructures are urbanizing in more compact ways, while Poland is not. If nothing else, this finding reveals that 'urban sprawl' is a very complex phenomenon and not necessarily path dependent. This suggests that targeted interventions could be effective in redirecting developmental trajectories towards more sustainable urbanization.

2.2 Sustainability of developments

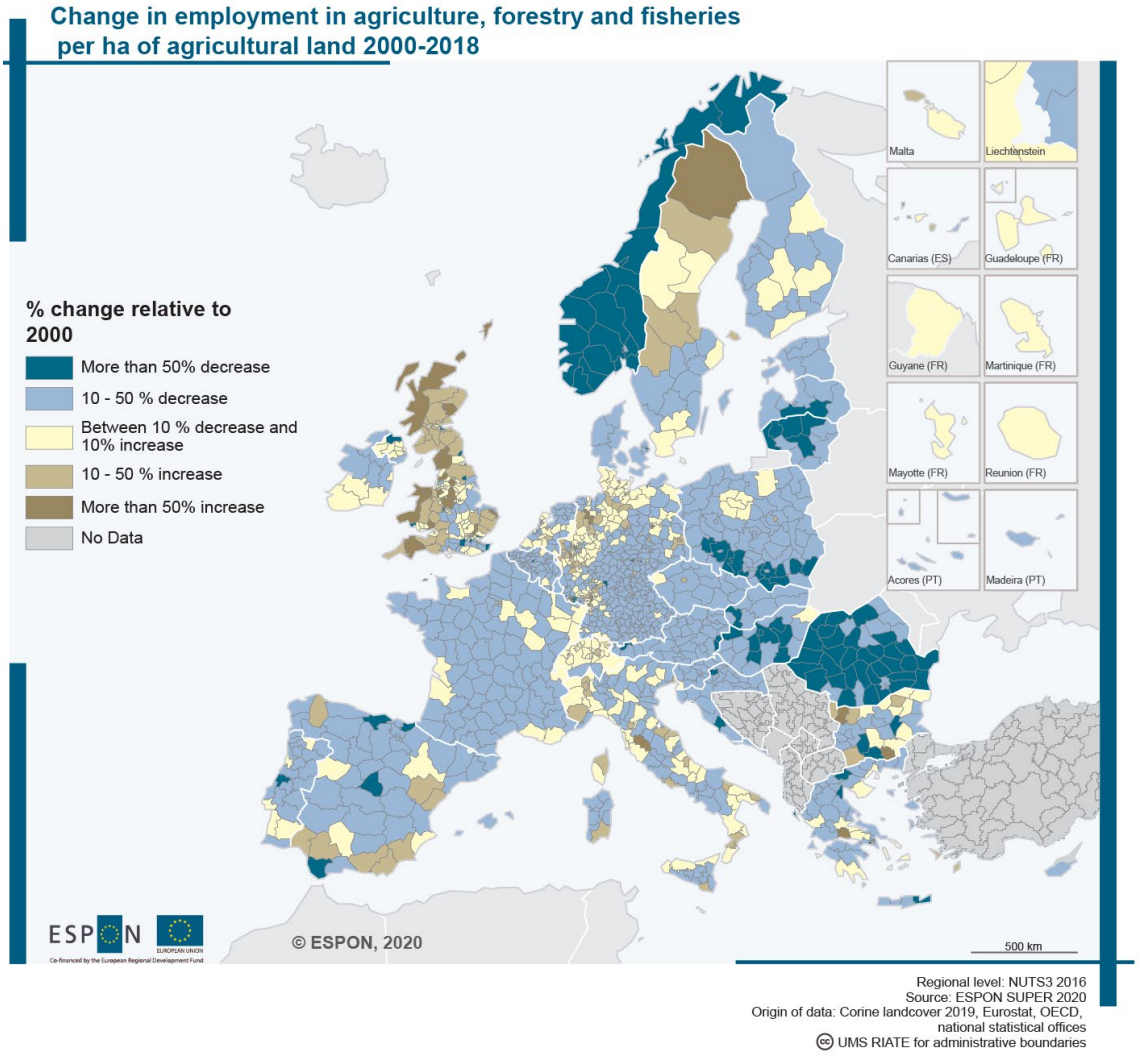
It is challenging to assess the divergent developments presented in this chapter in terms of sustainability. According to our broad conceptualization (see Section 1.2.1), sustainability has both a temporal as well as

a thematic aspect. Regarding the first, we can ask ourselves if land use in Europe in 2018 is more sustainable than it was in 2000. To do that, we will approach this matter by considering the three thematic dimensions of sustainability: economic, social and environmental.

2.2.1 Economic sustainability of land-use developments

Putting land to economically productive use is an important driver of land use change. Sometimes economic value is derived from location (e.g. urban cores offering proximity to consumers and other businesses). Sometimes economic value is derived from the land use itself. These functions can be intensive in terms of jobs/ha or GVA/ha (e.g. offices) or extensive in terms of resource extraction (e.g. agriculture or surface mining).[1]

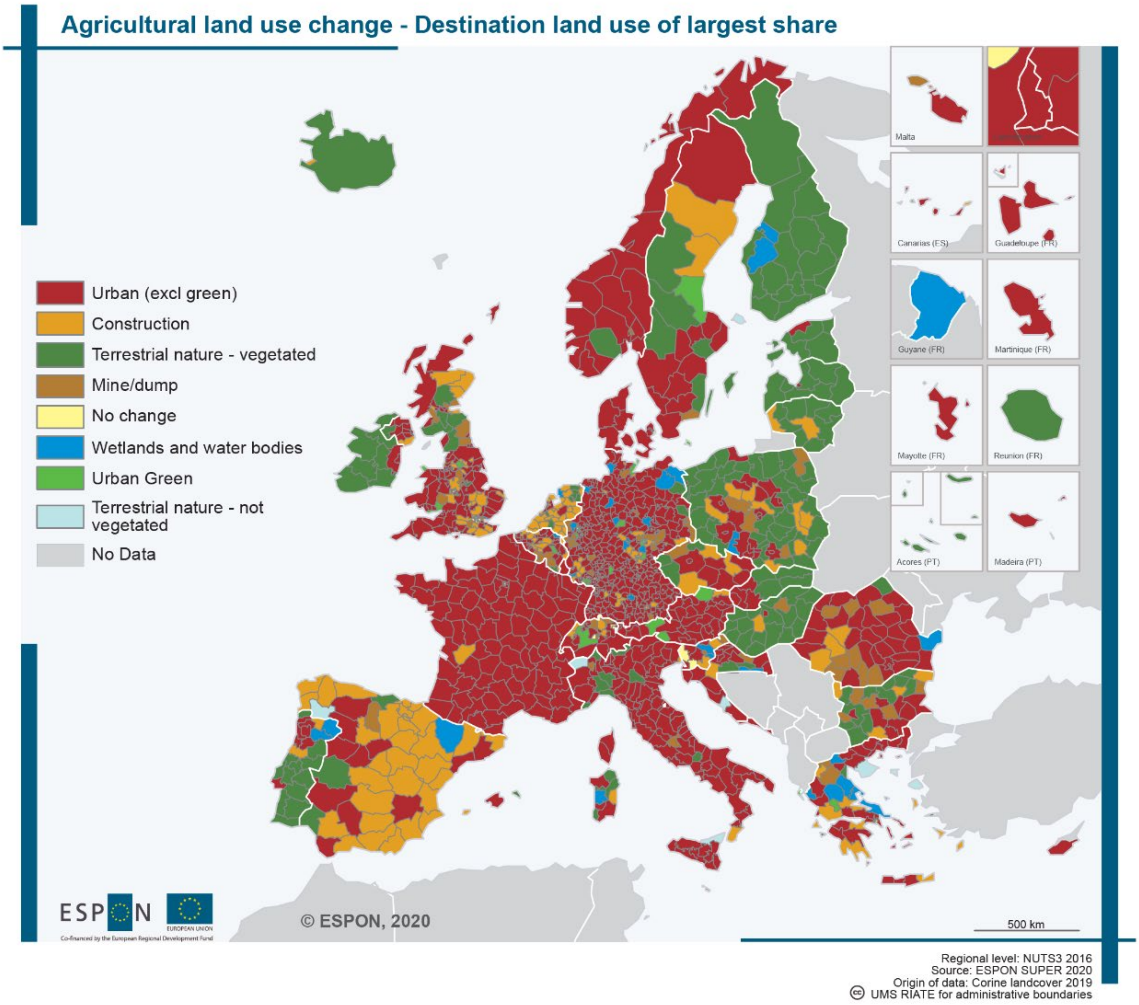
Map 2.6: Employment change in agriculture, forestry and fisheries per ha agricultural land (2000-2018)



[1] In Corine, commercial and industrial land use is grouped (CLC class 121) even though this combination contains land uses that differ significantly – at the extremes, this puts an oil refinery or seaport into the same land-use category as a central business district.

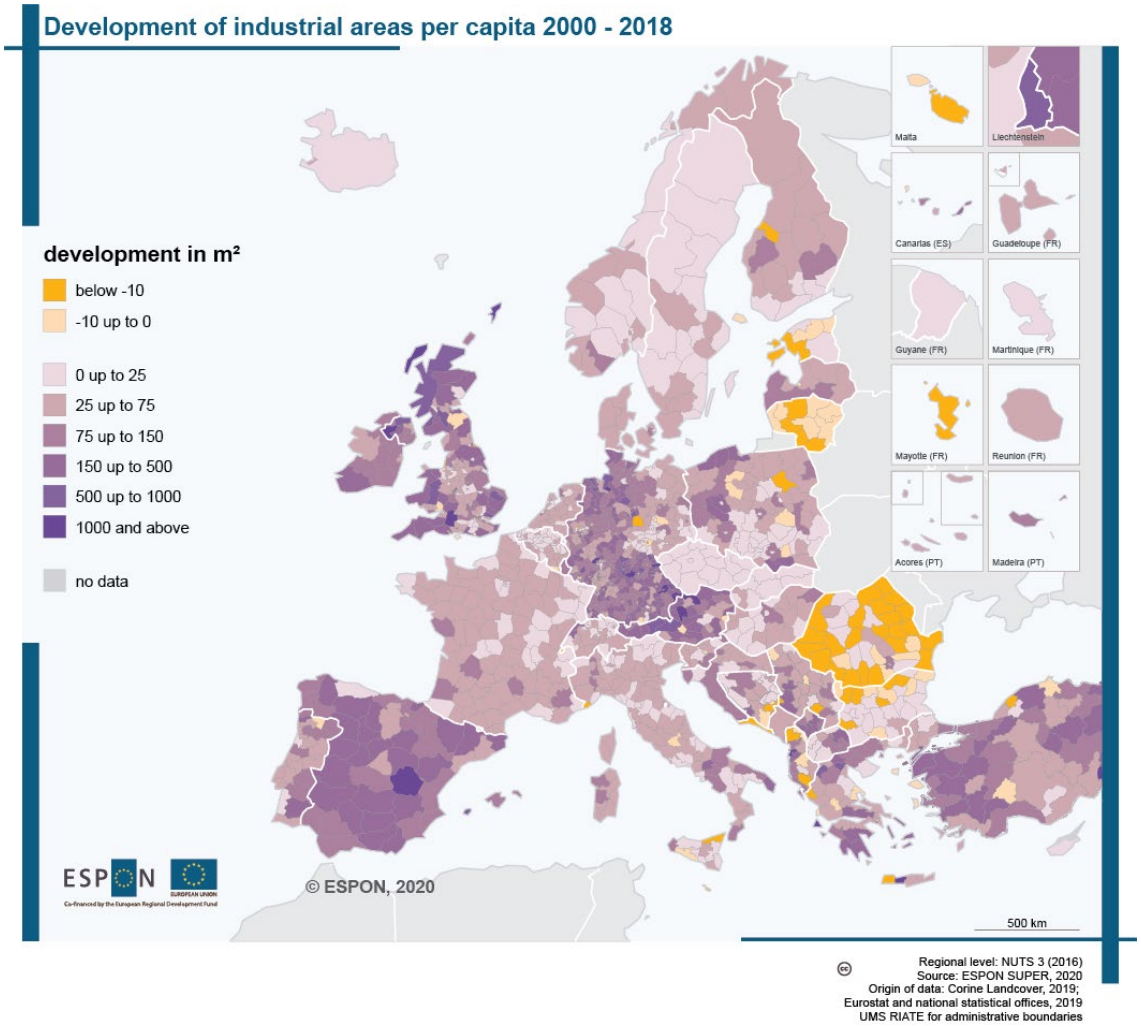
By far the largest share of land put to economic use regards agriculture. It covers 43% of the total land mass studied, although national figures range from 75% in Denmark to 3% in Iceland. The relationship between agriculture and sustainable land use deserves closer scrutiny. *Map 2.6* displays the ratio of agricultural land to jobs over time, which is a proxy for intensification. On the one hand, intensification can concentrate environmental damage beyond the recovery rate, but it also points to high efficiency, allowing land elsewhere to be retained. Of further note with respect to agricultural land-use change is what happens to agriculatural land that is converted, as illustrated in *Map 2.7*. We see that in Portugal, Poland, Slovakia, Hungary, Ireland, and Iceland this land is more frequently abandoned. Almost everywhere else this land is predominantly urbanized.

Map 2.7: Agricultural land use change: destination land use of largest share (2000-2018)



Industrial land use and mineral extraction/dump sites cover a much lower proportion of land: respectively 0.6% and 0.2% of the total European land area. These numbers can vary significantly from region to region however: Seine-Saint-Denis, extending in the north-east of Paris from the Périphérique to the Charles de Gaulle airport, has 18.5% of its total land devoted to commercial/industrial purposes. Generally, however, even in areas where the proportion of artificial land use is relatively high, commercial/industrial land cover is typically less than 2% of the total NUTS 3 surface area (but typically 10-25% of urban land use). Overall, the period 2000-2018 has seen the largest increase in industrial areas per capita in the UK, Spain, Germany, Austria, Western Poland, the Western Balkans, Greece and Turkey; and a decrease in only a few regions but including most of Lithuania and Romania (see *Map 2.8*). This development can be related to developments in employment.

Map 2.8: Development of industrial area per capita (2000-2018)

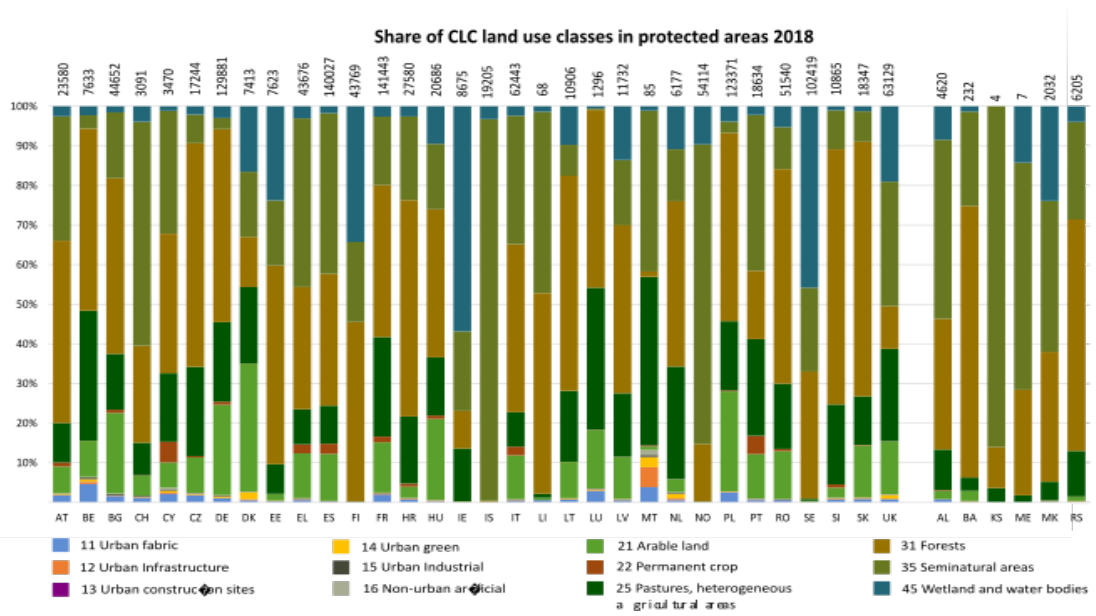


2.2.2 Environmental sustainability of land-use developments

Approximately 1.16 million ha were urbanized in the 2000-2018 period, or about 177 ha per day. From this, it appears that urbanization in Europe is decelerating as a computation for the 1990-2006 period resulted in a figure of 275 ha per day (Prokop et al., 2011). Whether or not the current rate is sustainable is highly debatable. On the one hand, it would be rash to label the entirety of this transformation 'land take' and hence unsustainable. Environmental sustainability should pertain to how land is being used beyond carrying capacity. For example, the sustainability of agriculture versus urban is fraught with complexities pertaining to the availability of habitat for flora and fauna, use of pesticides, displacement of livelihoods when intensification is required to retain profitability, and so on. Most of this is beyond the scope of the SUPER project.

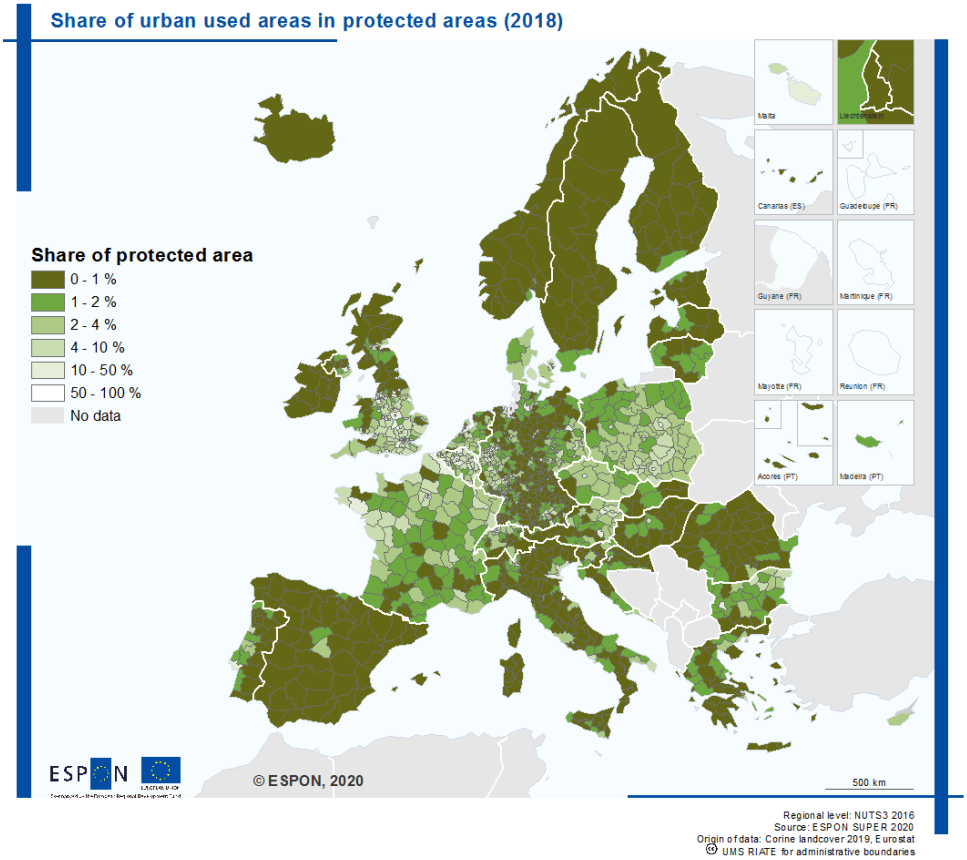
Finally, agriculture can have widely different environmental sustainability consequences. A clear intensification of agricultural land use is visible in this CLC data: from 2012 to 2018, about 65% of changes were from grassland and pastures to arable land, which corresponds to an area of over 300,000 ha. This intensification may have ecological consequences: in addition to the loss of biodiversity there is an increased risk of soil erosion, loss of retention areas, and higher pollution by pesticides and fertilizers (especially nitrate) in soil and groundwater.

Figure 2.9: Share of CLC land use classes in protected areas per country in 2018, and total area in km2



Given the data constraints, we start by examining changing land use within protected nature areas, as we assume that these are most important for biodiversity. We find that although urban and agricultural uses within protected areas are significantly lower than those in the surrounding areas at national level, there are isolated regions in which the share of use is 50% and higher (see *Figure 2.9*).

Map 2.9: Share of urban use areas in protected areas (2018)

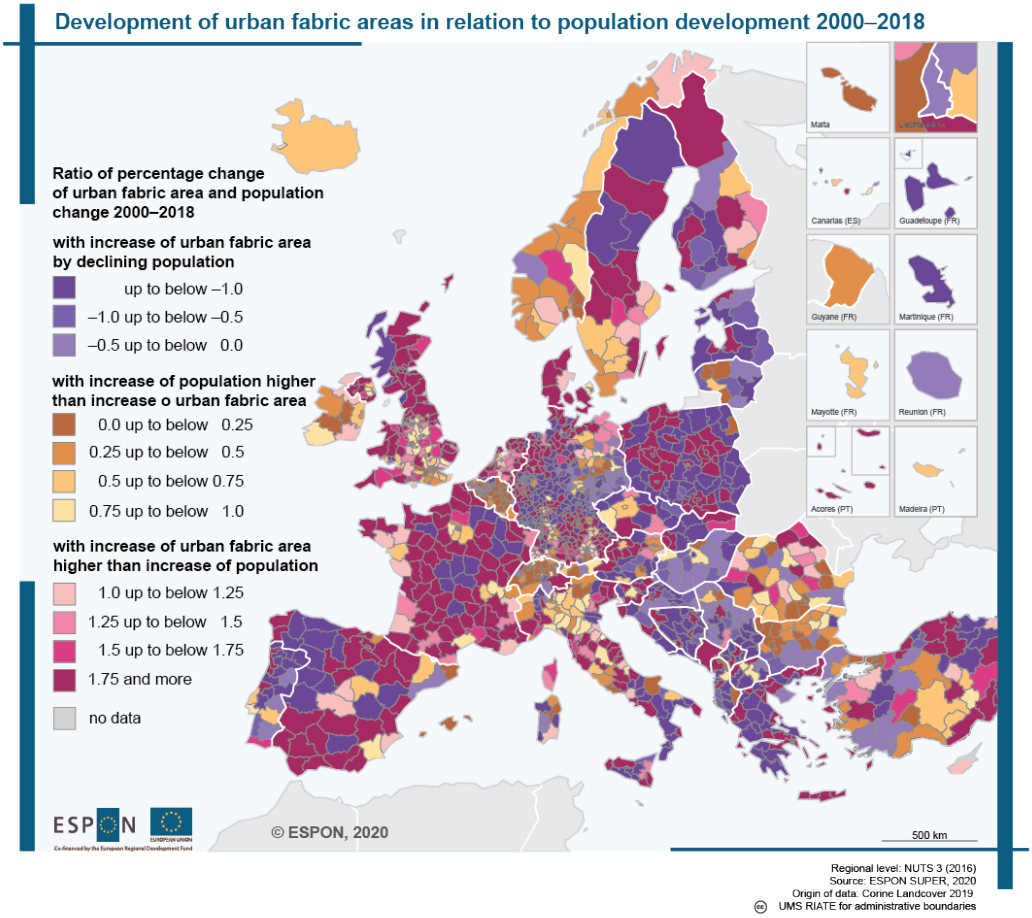


2.2.3 Social sustainability of land-use developments

Land-use changes related to housing is a paramount social concern, both in terms of providing enough housing that fits people's preferences and budgets. Urban and suburban development is driven and counterbalanced by household income and developments of rents, interest rates, and land and house prices. Exploring the kinds of data to create an evidence base on these elements at the European level reveals a potpourri of unharmonized regional level data with great gaps. Given this, simple proxies will need to suffice.

Urban areas and, more specifically urban fabric (primarily housing), can be measured in relation to population growth in the 2000-2018 period, which directly relates to the SDG indicator 11.3.1, (UN-GGIM Europe, 2019). The resulting map reveals regions with housing markets under pressure (see *Map 2.10*). According to this calculation, a value of one indicates a balanced development in which settlement developments follow the development of population. A value of 0.5 the percentage change of population is twice that of urban development (increasing density, oranges) and vice versa for a value of 2.0 (decreasing density, reds). Finally, there are regions with declining population, yet growing urban fabric (decreasing density, purples). The number of NUTS 3 regions where population grew faster than urban fabric is especially noticeable in regions around large cities. The capital cities in Eastern Europe show the strongest differences, with the exception of Poland where the relative increase of urban fabric indicates suburbanization processes.

Map 2.10: Development of urban fabric in relation to population development in 2000-2018



The development of cities and their environs shows that in many countries, the pressure of population growth has reached the suburbs. The development of prices should then follow suit. This could indicate a socially unbalanced movement to the inner-suburbs and an increased pressure on inner-city property. This particularly affects parts of the population depending on affordable housing. Furthermore, this could spur urban development beyond the suburbs.

3 Interventions and their effects

Suggestions abound on interventions to promote sustainable urbanization and land use, as witnessed by myriad declarations and manifestos on good spatial planning practices ranging from the New Urbanism movement in North America to, in Europe, the European Spatial Development Perspective, the Territorial Agenda of the European Union, the Leipzig Charter on Sustainable Cities, the Charter of European Planning and others. Many suggestions are theoretical, rather than based on actual practice. In order to give account of the variety of ways in which public-sector activities affect urbanization and land use in Europe, the SUPER project carried out a survey of interventions actually being implemented in 39 European countries. In addition, data was collected on the impacts of EU policies affecting land use. These two levels of scale – European and (sub)national – will be treated separately in this section.

3.1 Overview of interventions

Any intervention influencing the distribution of development and land-use rights or inducing land-use conversion potentially falls into the scope of the SUPER project. Five methods of data collection were employed to create a database of interventions (1) inputs provided directly by the SUPER consortium partners, (2) an analysis of the ESPON COMPASS (2018) project reports, (3) the development and distribution of an online questionnaire, (4) a literature review and (5) targeted searching. The third method provided the highest number of results, while the fourth and fifth were largely used to fill in gaps. Importantly, the database underwent a quality control and was fine-tuned and improved accordingly.

More in detail, the preliminary step concerned the provision of direct inputs by the SUPER consortium partners, and partially overlapped with the project case studies. Each project partner was required to identify between five and ten interventions that could have constituted a potential case study for the project, which generated 48 interventions. These were the first entries of the database.

With respect to the analysis of the ESPON COMPASS project reports, this was carried out by searching the Phase II Country Questionnaires developed by the project experts for potential interventions affecting urbanization or land-use. This exercise resulted in the identification of only 5 examples, mainly because the examples cited in the ESPON COMPASS project were collected following a different rationale and, even in the cases when they could have fit the scope, they were often too recent to be appropriate for an analysis of impacts.

In order to collect more relevant examples of interventions all around Europe, the research team designed, distributed and analysed an online questionnaire. This was launched on 14 March 2019 and circulated throughout a number of channels for several months, in order to ensure that experts from all the countries that compose the ESPON space were reached, as well as experts from the EU Candidate Countries (i.e. Albania, North Macedonia, Montenegro, Serbia and Turkey) and the other countries of the Western Balkans (i.e. Bosnia and Herzegovina and Kosovo under UN Security Council Resolution 1244). In particular, the survey reached out to the ESPON Contact points and Monitoring Committee Members, and to the members of a number of academic and professional associations: the Association of European Schools of Planning (AESOP), the European Council of Spatial Planners (ECTP-CEU); the International Society of Cities and Regional Planners (ISOCARP). It was also circulated through a number of expert channels, as ResearchGate and the ESPON and AESOP newsletter. The complete set of questions of the online survey is available in Annex 2.

The survey generated a little over 160 responses, subsequently compiled into a preliminary list together with those deriving from the previous data collection exercises. The quality of the list was checked for overlaps and errors. The list was then complemented by all members of the research team through targeted searching to fill geographical gaps. At the same time, relevant academic books and journal articles were screened for

more examples. The combination of these two activities resulted in the inclusion into the list of 42 additional interventions, for a total of 227 that, in one way or another, affect land use and thus influence its sustainability in one or more countries in Europe.

Each of the collected interventions was further explored by reviewing available online documentation, and all this information was systematically compiled into an intervention database. Each intervention was described using the fields on basic information, characteristics of the intervention, and effects. The database will be made publicly available on the ESPON website.

The list was submitted as an annex to the project Interim report. Following the comments received by the members of the ESPON MC and PST, three additional, complementary activities were undertaken. First, the database underwent a thorough quality control, that allowed (i) to spot and eliminate uninteresting, scant or irrelevant entries (for a total of 34) and (ii) to fill and/or complete the information gaps. Moreover, selected members of the ESPON Monitoring Committee and ESPON Contact Points were contacted with the request to indicate additional interventions for underrepresented countries. Finally, an additional targeted screening of the literature was performed in relation to these countries. These two last activities produced 10 and 31 new interventions respectively, which were entered into the quality-enhanced database (together with the case study concerning Switzerland, as agreed in the context of the SUPER project spin-off), for a total of 235 interventions (see Annex 2).

Although all the 39 countries under scrutiny are represented in the database, their distribution is quantitatively uneven, with a prevalence of interventions located in the home countries of the consortium partners. Moreover, as shown in Table 3.1., the identified sample is rather heterogeneous in relation to the different variables adopted for the analysis (i.e. scale of interests, type of territory, type of interventions and type of instrument. Finally, for each category of the chosen variable, the interventions show varying degrees of success.

Table 3.1: Number of interventions per analytical category

Scale of interest			Type of territory			Type of intervention			Type of instrument		
Scale	**n.**		**Territory**	**n.**		**Type**	**n.**		**Instrument**	**n.**	
NUTS0	112		Urban	141		Densification	33		Legal device	75	
NUTS1	9		Rural	69		Containment	72		Land use regulation	45	
NUTS2	23		Functional	33		Regeneration	32		Strategy	58	
NUTS 3	39		Coastal	16		Governance	57		Program and subsidy	23	
LAU 1	39		Mountain	12		Spatial quality	25		Project	40	
LAU 2	35		Peripheral	29		Transport	11				
Other	2		Cross-border	14		Environment	14		Other	1	
			Scarcely populated	17		Rural development	4				
			Other (national)	60		Other	11				
Total	259*		Total	391*		Total	259*		Total	242*	

*The total varies because each intervention may be classified in more than one category.

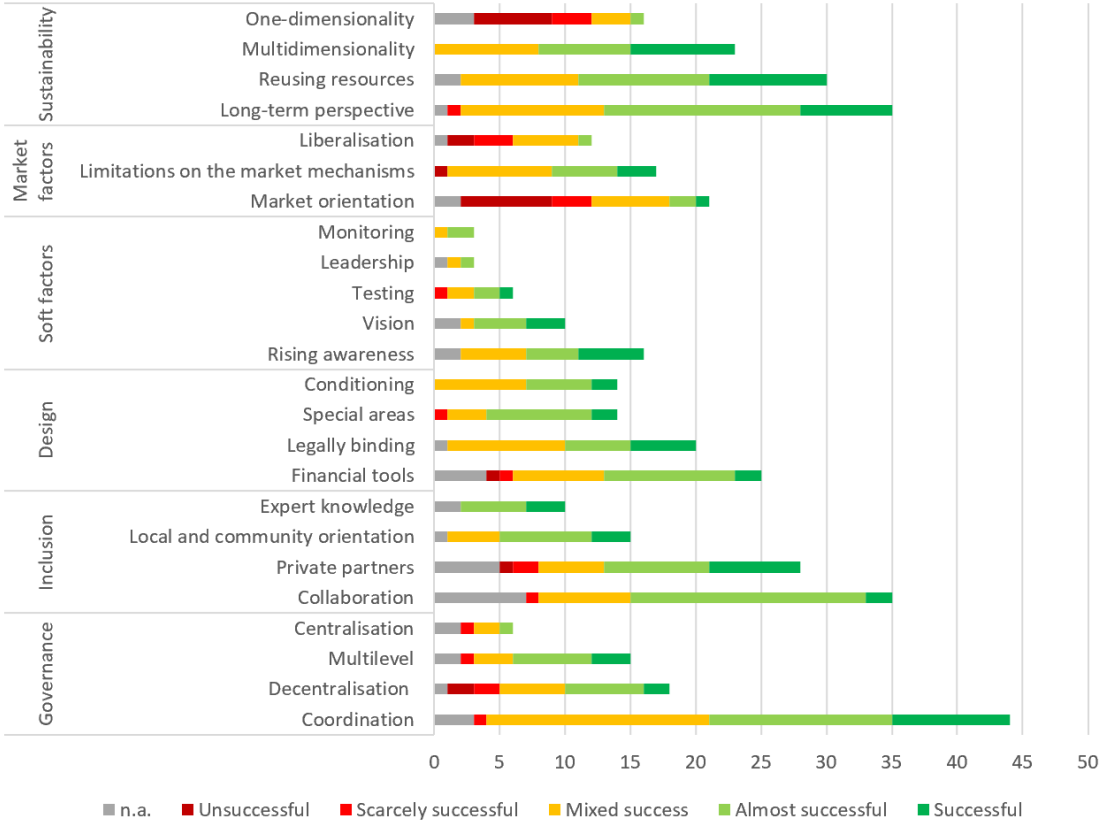
3.2 Effects of interventions

The SUPER project conducted extensive empirical research to ascertain the relative success of the collected interventions in terms of sustainable land-use goals. A qualitative analysis was performed on the 235 interventions of the Intervention Database as of Spring 2020 counting how many times certain explanations –

factors – were given for success or failure of a given intervention with respect to (1) the intervention's own goals and (2) sustainability. In the end, 41 factors, grouped into seven categories were identified.

As can be seen in Figure 3.1, the most commonly mentioned success factors regarding own goals were coordination, collaboration, long-term perspective, reusing resources and private partners. From the analysis, it quickly became apparent that no universal set of factors guarantee success: the same factor may play a positive role in one case and a negative role in another. Overall, coordination, collaboration, long term perspective, reusing resources and inclusion of private partners are the most frequently cited positive factors, while market orientation, liberalization, neglecting local context and one-dimensionality are the most negative.

Figure 3.1: number of interventions by cited success factor



Similar results were found with respect to sustainable land-use goals. Here, coordination also topped the list (successful/almost successful). The next factors were somewhat different however: long-term perspective, reusing resources, collaboration, inclusion of private partners and multidimensionality, which fits the aims of sustainability.

Interestingly, centralization and decentralization received an equal number of positive and negative scores on sustainability, indicating either complete disagreement or that in some contexts, centralization is an advantage, but in just as many other contexts, a disadvantage. The information in the database suggests that decentralization (mentioned more frequently than centralization) is sensitive to the local context, circumstances and needs, provides flexibility, and can increase commitment to achieve sustainable land-use goals. On the other hand, the flexibility achieved by decentralization may be also viewed as a pathway towards deregulation/liberalization, and in specific political cultures where little political or institutional support exists for sustainability, it may lead to non-implementation, corruption and sacrificing environmental and social goals for economic gain. A full explanation of all the factors and how they correlate to each other as well as how as their contribution (either positively or negatively) to success and sustainable land use is provided in Annex 2.

As stated, interventions seeking to promote sustainable urbanization fell into various types. Although five were identified, for the sake of brevity, this main report will concentrate on three of these: (1) those encouraging densification of cities (e.g. up-zoning, financial incentives, information), (2) those seeking to regenerate problematic areas (e.g. brownfields, deprived neighbourhoods) and (3) those seeking to contain urban expansion (e.g. growth boundaries, restrictions on out-of-town retail development, revitalizing rural areas). It was not always easy to classify interventions, especially when they concerned plans with many objectives and measures. This section presents the most salient success factors for each intervention type along with a few illustrative examples. A more extensive overview is available in Annex 2 as well as an analysis on the relative success of the instruments used for interventions.

The most frequent factor cited in successful **densification** interventions was 'legally binding' (n=5), followed by inclusion of 'private partners' (4), 'multidimensionality' (4), and conditioning (3). There was also a large degree of overlap with the category 'design'.

A brief sampling of densification interventions:

- A 2018 national decision in Malta allows for the construction of additional floors of buildings, overriding local plan provisions. Although the rule is too recent to measure results, the expectation is that this will be a mixed success in terms of sustainability. While conceivably reducing demand for greenfield sites (ecological sustainability), it could overheat the urban property market and create oversupply (negative economic sustainability) and inconvenience residents and motorists (social sustainability) from the nuisance caused by construction (DeBono, 2016).

- Luxemburg's 2014 National Infill Programme (*Nationales Baulückenprogramm*) identifies suitable inner-city lots for building and informs landowners about how they could contribute to accommodating housing demand (Ministère du Logement, 2016). No financial incentives or legal requirements are involved: it is purely voluntary. Consequently, the effectiveness and impact on sustainability remains to be seen.

- In the city of Reggio Emilia, the municipal operative plan was employed to reduce the number of areas that had once been zoned for urban uses but remained unbuilt. Since landowners pay taxes on the value of the zoned land, stripping development rights confers a direct financial benefit. Since 2015, over 200 ha of potential urban land was downzoned to rural. This intervention is regarded as a success by all parties and as a boon for sustainability.

- The German mandatory land readjustment rule has existed for over 100 years and allows for the exchange of plots for urban development in towns and villages. At the same time, it respects the rights of property owners by increasing total values through densification and a subsequent redistribution of surplus value. The procedure allows for a prudent use of land from an ecological point of view via the land-use planning system (Kötter, 2018).

- Italian fiscal rules inadvertently helped promote densification. Paragraph 669 of Article 1 of Law 147/2013 (*Legge di stabilità 2014*) levies a real-estate tax on buildings and construction sites. This led to a reduction of urbanization pressure, as developers became aware of the financial risk of fallow construction sites or under-occupied buildings. Since farmers were exempt, there was also less incentive for them to sell their land to developers. However, some parties have tried to sidestep this rule by registering construction sites as agricultural areas (Croci, 2013).

- Estonia explicitly attempted to foster densification using fiscal rules. The 1993 Land Value Tax shifted the tax base from the value of buildings to the value of the plot, thus encouraging landowners to maximize the use of their land within the scope of planning regulations (Thiel & Wenner, 2018).

- As may be expected, 'reusing resources' was the most frequent factor for successful interventions classified as **regeneration** (n=13). More revealing were the factors 'multidimensionality' (6), 'coordination' (5), 'private partners' (5), as well as 'long-term perspective' (5). The most frequent governance factor was 'collaboration' (7). For successful spatial quality interventions, 'financial tools' (4) were cited while for sector-policy interventions correlated with 'long-term perspective' (3).

A brief sampling of regeneration interventions:

- In Rotterdam, houses in deprived neighbourhoods were bought up by the municipality and given away for free to anyone willing to invest a certain amount in renovation and promising to live there for at least 5 years (Snel et al., 2011). This state-led gentrification campaign was seen as a success in economic and ecological terms, as it brought in residents who may otherwise had opted for suburban housing, and in some ways, it was seen as improving social sustainability, given improved liveability and services.

- Berlin sought to regenerate problematic sites in the core city. To do this, a state-owned company Grün Berlin GmbH, successfully promoted the reconversion of problematic areas into attractive parks and vibrant public spaces (*Grün Berlin, About Us*, 2020; Oppla, 2019).

- The United Kingdom focused on regeneration and densification under the banner of an 'urban renaissance' in the 1990s (Shaw & Robinson, 2010). It set a nationwide target of 60% of new housing to be built on brownfield sites by 2008, implemented as a legal requirement. The outcomes surpassed the intervention's goals (approximately 80%). It can be seen as ecologically and economically sustainable as it revitalized existing urban areas (Schulze Bäing & Wong, 2012). However, the socio-economic improvement concerned the influx of high-income groups rather than upward mobility, and housing affordability declined (ibid., pp. 3004-3005).

- In the early 1990s, the City of Plzeň (Czech Republic) embarked on regenerating the Industrial Park Borská Pole. The strategy began informally but was soon transformed into official municipal policies and binding planning documents. The outcome was deemed successful as the objectives were fully achieved. It also can be considered ecologically successful in that no greenfield land was used.

- Latvia sought to revitalize areas via its EU-funded regional development programme. Support is given to aid construction/renovation of buildings and equipment (Republic of Latvia, 2015). This has been deemed relatively successful in both its own aims (creation of jobs in these areas) as well as sustainability.

- For **containment** interventions the most common success factor was 'coordination' (11 interventions), and, thereafter, 'long-term perspective' (9), 'collaboration' (7), 'expert knowledge (6), 'multidimensionality' (6), 'limitations on the market mechanisms' (6) and 'local and community orientation' (5). In short, process-oriented and governance factors seemed to head the list of success factors.

A brief sampling of containment interventions:

- The 2000 French Law of Solidarity and Urban Renewal contains provisions to control urbanization by coordinating public-transport infrastructure and social housing provision. It is seen as a mixed success as far as containment is concerned (Aubert, 2007; Guet, 2005).

- The 2014 Physical Planning Act of Croatia contains restrictions on building outside of settlement borders, regulates terms and conditions on the expansion of the settlements and protects sensitive

areas (Vidan, 2014). It is considered relatively successful in its aims, which are generally aligned to sustainability.

- The Czech Republic raised the bar on greenfield building by requiring a proof-of-need. When zoning for new urban development, the need for new land (and, formerly, the impossibility of using currently zoned urban land) needs formal approval. This intervention has been integrated into the EIA process. Its success is mixed: it is aligned to sustainability but has been criticized for burdening the planning process.

- In 1980, the Andalusia region in Spain introduced urbanization caps for medium and large municipalities (40% of the previously existing urban land or 30% of the previously existing population within eight years) as well as the coordination of management systems for protected natural areas. It was singled out as a European best practice to limit, mitigate or compensate soil sealing (European Commission, 2012).

- Austria introduced a non-coercive containment measure based on information provision. The federal planning authority of Lower Austria offered municipalities an Infrastructural Cost Calculator in 2012 to help them assess infrastructural costs versus tax revenues for new urban developments. Given that diffuse development generally requires more public investment per capita than compact development, it could potentially affect local decision making (Humer et al., 2019).

- In 1997, Denmark placed restrictions on the construction of large shops and shopping centres on greenfield sites outside the largest cities and promoted small retailers in small and medium-sized towns. This intervention was identified as a best practice (European Commission, 2012). It was not uncontroversial but leadership and political will at the national level proved decisive (Reimer, 2014).

3.3 EU policies and their effects

To explore the impact of EU policies on urbanization and land-use, the SUPER project team collected and reviewed EU policies across sectors with respect to their potential to substantially influence urbanization or land use. Policies which met this criterion were transferred to a comprehensive data matrix. Factsheets were then created for each identified policy using a standard layout; these are presented in full in Annex 2. The information in the factsheets was then analysed to identify patterns and craft recommendations. The 59 identified EU policies fell into 10 policy areas and four instrument types. These are displayed in *Table 3.1* below:

Table 3.1: Overview of identified policy measures at European level by policy area

Legislation (directives, regulations)	Funding Instruments and Corresponding Programmes	Binding Strategies, Documents and Policy Guidelines	Non-binding Agreements, Agenda and Discourse
Environment / Climate Action Water Framework Directive (#2) EIA Directive (#12) SEA Directive (#13) Natura 2000 (#14) Birds Directive (#15) Floods Directive (#16) Landfill Directive (#17) Waste Framework Directive (#18) Environmental Noise Directive (#32) Air Quality Directive (#33) Seveso III Directive (#34) **Agriculture and Rural Development** Rural Development Plans (#47) **Energy** Renewable Energy Directive (#35) Energy Efficiency Directive (#36) TEN-E strategy (#37) **Procurement** Public procurement for a better environment (#31) Public Procurement Directive (#38) Directive on procurement by entities operating in the water, energy, transport and postal services sectors (#39) **Maritime** Marine Spatial Planning Directive (#40) Marine strategy framework Directive (#41)	**Transport** TEN-T Guidelines (#1) **Cohesion Policy / Funding** ESI – Fund (#5) ERDF (#6) Cohesion Fund (CF) (#7) ESF (#8) URBACT III (#26) INTERREG (A) (#43) INTERREG (B) (#44) INTERREG (C) (#45) Macro-regional strategies (#46) Integrated territorial investment (#55) ESPON (#59) **Agriculture / Rural Development** EAFRD (#19) CAP (#20 / #56) **Urban Development** Urban Innovative Actions Initiative (#30) **Maritime** European Maritime and Fisheries Fund (EMFF) (#42)	**Regional Development / Sustainability** Roadmap to a Resource Efficient Europe (#11) EUROPE 2020 (#28) **Transport** White Paper - Roadmap to a Single European Transport Area (#25) **Energy** Energy 2020 (#29) **Environment** EU Biodiversity strategy to 2020 (#57)	**Regional Development / Sustainability** European Spatial Development Perspective (ESDP) (#3) Territorial Agenda of the European Union 2020 (TA2020) (#4) **Urban Development** Urban Agenda for the EU (#9) SUL_NBS Partnership (#10) Toledo Declaration (#27) Basque Declaration (#48) Aalborg Charter (#49) Aalborg Commitments (#50) The European Sustainable Cities and Towns conferences (ESCT) (#51) **Sustainable Land Use/ Soil Protection** The Soil Thematic Strategy (#23) European Landscape Convention (#58) **Environment / Climate Action** A new EU Forest Strategy (#21) Environment Action Programme to 2020 (#22) Soil Sealing Guidelines (#24) EU Adaptation Strategy (#52) Covenant of Mayors (#53) **Cohesion Policy** Seventh Cohesion Report (#54)

#number – refers to the factsheet number in Annex 2.

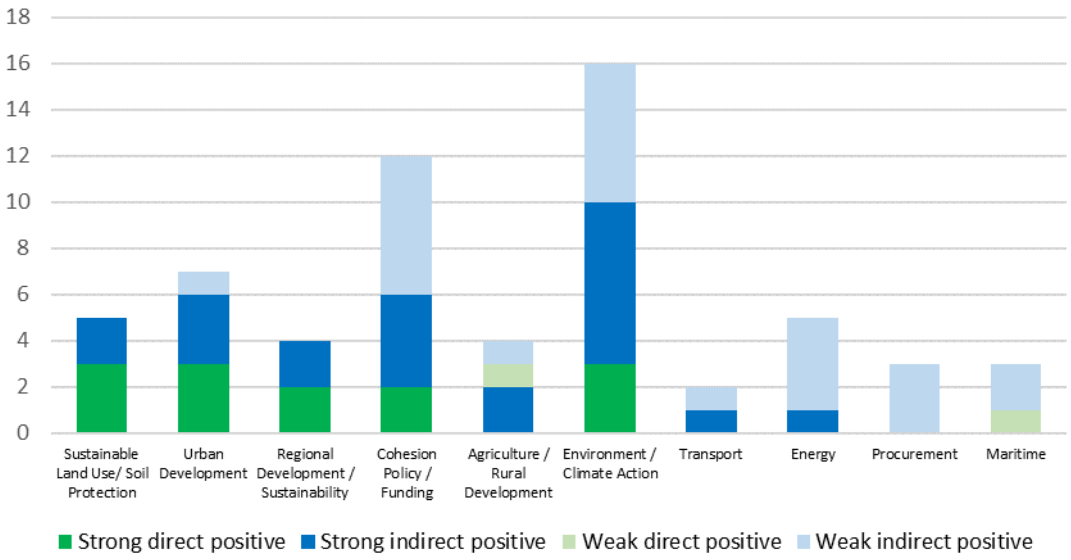
The policies were analysed further with respect to how they – potentially – impacted urbanization and land use with respect to sustainability. Four categories were used for this:

- A **strong direct positive impact** is attributed to policies with provisions directly targeting land use / soil, having sustainable urbanization as its objective or directly supporting projects aimed at one of these topics.
- A **strong indirect positive impact** is attributed to policies from closely related sectors such as transport, environment, agriculture/rural development, which promote sustainable development in their own fields.
- A **weak direct positive impact** is attributed to policies containing few provisions or just general statements on land use, soil or sustainable urbanization or which have limited territorial impact.
- A **weak indirect positive impact** is attributed to policies from other sectors targeting other aspects of sustainable development, such as social integration, etc.
- Finally, potentially negative effects may occur for each policy regardless of its direct or indirect character, so this is set as a flag in addition to the 4 categories above.

The classification was made using expert judgement. It was not always easy to determine the impact of EU policies, especially given that they often overlap with national policies. For example, a study on the effect of the Flood Directive in France found that it only had a limited impact given the strong role of national policy (Larrue et al., 2016), whereas in Poland implementation of this directive proved more challenging but – partly for that reason – had a larger and positive potential impact (Kundzewicz, 2014).

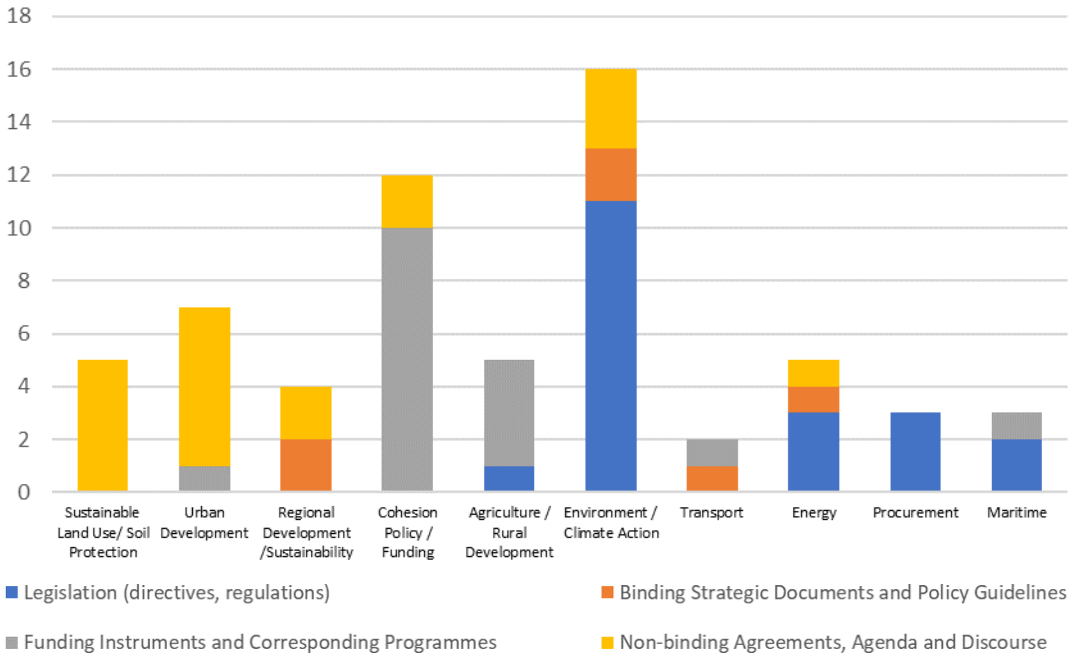
Figure *3.2* presents the findings on the potentially beneficial effects of EU policies (for the sake of readability, potentially negative effects were excluded). Here it is revealing that the highest ranking category was environment and climate action. Even so, problems were signalled regarding implementation of, for instance, the EIA and SEA directives (Bruhn-Tysk & Eklund, 2002; De Montis et al., 2016). Interestingly, the most strong and direct policies in both relative and absolute terms were 'sustainable land use and soil protection' and 'urban development' – not surprising given their focus – which indicates that these are particularly well-suited to be deployed as EU-level interventions.

Figure 3.2: number of EU policies according to policy area and potential impact on sustainability



If the same figure is modified to display types of instrument (see Figure 3.3), however, we see that these same strong and direct policies are generally much more discretionary (mostly non-binding agreements) than environmental policies, which are backed by hard legislation. Additionally, it is cohesion policy and agriculture that have the most potential to contribute to sustainable urbanization and land use goals in monetary terms, even though their direct contribution is comparatively indirect and weak (and sometimes negative). With respect to the Common Agricultural Policy, for example, it was found in Poland that this had only a weak effect on land values, and therefore did not significantly alter the incentive for farmers to sell to developers (Milczarek-Andrzejewska et al., 2018). Annex 2 provides a more comprehensive discussion of individual EU policy effects in the member states.

Figure 3.3: number of EU policies according to instrument and potential impact on sustainability



4 Understanding practices in context: case studies

As stated in Chapter 1, a conceptual 'black box' exists between generic drivers of urbanization and land-use change, such as demography and macroeconomic trends, and the actual manifestations on the ground in the form of buildings, roads, forests, and fields. The contents of this black box are the developmental practices in which stakeholders interact and arrive at land-use decisions, such as place-based investments or planning permission. Because these matters require in-depth knowledge of the local situation, case studies are the most appropriate method to approach this. The SUPER project carried out 11 case studies at various territorial contexts and scales, which are summarized in Table 4.1.

Table 4.1. Shorthand titles and basic characteristics of the 11 case studies.

ID	Case study	Year	Scale
AT-Vorarlberg	"Vision Rheintal" (Vorarlberg)	2004	LAU 1
	In the Austrian federal state of Vorarlberg, the valley of the Rhine has undergone massive change over the past 50 years. Once separated villages and small towns have become an almost closed band of settlements. In 2004, Vision Rheintal was put in place as a coordinated strategy of 29 municipalities to consider the region as a whole and tackle spatial planning challenges jointly across the communities.		
BE-Flanders	Integrated Policy Planning in Ghent & Flemish Decree on Spatial Planning	1996	NUTS1
	In 1996, a Flemish decree on spatial planning obliged municipal governments to draw up their own spatial structure plans, with urban development as the spearhead. Some years later, in 2003, the structure plan of Ghent used this framework to address urban sprawl without explicitly mentioning it.		
CH-CantonAargau	Revision of the Swiss Spatial Planning Law (RPG)	2014	NUTS3
	Urban sprawl and land-take have been considered major problems in Switzerland. With the revision of the Spatial Planning Law, the Federal Council and parliament sought to put an end to uncontrolled land consumption and eliminate implementation deficits. The intervention under scrutiny is the Revision of the Swiss Spatial Planning Law (RPG 1 and RPG 2) and its implications for the Canton of Aargau.		
DE-30ha	German Land Take Reduction Target	2002	NUTS0
	The target to reduce land take to less than 30 ha per day of land for settlements and transport infrastructure by 2030 is an integral part of the 2002 German sustainability strategy. It is a threshold for the country as a whole, but is taken up at various administrative levels, such as the spatial development plans of different Länder.		
ES-Valencia	Huerta de Valencia Spatial Plan	2018	LAU 1
	Demands for the protection of the traditional Huerta (vegetable cultivation) landscape started at the turn of the Century, but the initiative was only approved in 2018. In the meantime, the initial vision transformed from a Green Infrastructure planning approach to a more comprehensive intervention, combining the protection of rural areas with support for agrarian activities.		

ID	Case study	Year	Scale
HR-Coastal	Protected Coastal Area Within the Physical Planning Act in Croatia	2004	NUTS2
	The Croatian Physical Planning Act defines a protected coastal area that encompasses a large area of coastal self-governing units. For the purpose of protection and sustainability of development, the restricted area covers the 1000 m wide continental belt (both on terrestrial part and islands) and the 300 m wide sea belt measured from coastal line. Certain limitations are prescribed for planning and use of the restricted area.		
IT-BassaRomagna	Municipal Structural Plan	2009	LAU 1
	A Municipal Structural Plan was jointly adopted by ten Municipalities grouped on the Union of Municipality of Bassa Romagna. The plan had two main objectives: counter urban sprawl and support sustainable development. This case study investigates the efficiency of intermunicipal plans in dealing with sustainable land use.		
NL-Ladder	Sustainable urbanization procedure	2012	NUTS0
	The Ladder for Sustainable Urbanization is a rule requiring all zoning plans enabling urbanization to first argue (1) the need for this development (2) why, if on a greenfield, it could not be accommodated in existing areas and (3) if on a greenfield, if it is multi-modal accessible. It was adopted at the national level in 2012 to promote compact development and prevent oversupply. Citizens can challenge plans in court on these grounds.		
PL-ITI	Integrated Territorial Investment	2014	LAU 1
	The Integrated Territorial Investments (ITI) instrument was implemented in 24 functional areas in Poland, including 17 areas surrounding regional capitals and 7 functional areas of sub-regional cities. A total of around EUR 6.2 billion is earmarked for ITI implementation in the period 2014-2020 (the total includes national operational programs—under which support for the so-called 'complementary projects' are provided).		
RO-Constanta	Densification along the Black Sea Littoral Area	1991	NUTS 3
	The spatial planning system in Eastern Europe's post-communist countries was a major departure from centralized decision-making practices. In the coastal region of Constanta, by the Romanian Black Sea, that framework has facilitated great economic development and the growth of tourism resorts that are an economic engine but also increasingly recognized as threats to ecological sustainability.		
SE-Stockholm	Stockholm Urban Containment Strategy	2017	LAU 2
	The Stockholm Urban Containment Strategy focuses on containing urban expansion by adopting a comprehensive perspective that gives consideration to economic, social and ecological dimensions. It gives specific consideration to rural land and the provision of affordable housing.		

Each case study described the prevailing land-use practices (i.e. how decisions are traditionally made to develop land, including obtaining planning permission), how each selected intervention sought to affect these practices, how it was implemented and how it actually performed in terms of land-use sustainability. In addition to consulting relevant written material, each case study is based on the collection of everyday experiences by those individuals most involved with the interventions or affected by them. Generally, this involved about 10 in-depth interviews.

Read individually, the case study reports enable a case-by-case assessment of the factors that led to positive and negative results in each context, providing valuable lessons to the respective local, regional and/or national practitioners and decision-makers (see Annexes 3.2 to 3.12). Because the case studies followed a rigorous methodological framework (see Annex 3.1) a scientifically sound cross-comparative analysis of the outputs was also possible (see Annex 3.13). Given the limited space in this main report, this chapter will present only the highlights of the synthetic analysis.

4.1 Intervening in development practices

When comparing case study results, it must be appreciated that the studied interventions took place under widely divergent state structures and planning cultures. These range from regulatory federal systems (AT-Vorarlberg, CH-CantonAargau, BE-Flanders, DE-30ha), centralized systems (HR-Coastal, RO-Constanta), systems focusing on regional economic development (ES-Valencia, PL-ITI) and systems evolving towards integration (IT-BassaRomagna). Before drawing conclusions about success factors and sustainability, it is therefore necessary to bear in mind the contextual factors affecting land-use decisions.

4.1.1 Contextual factors

The analysis of the institutional context produced findings that challenge traditionally held beliefs about what is commonly regarded as 'good planning' (i.e. north-west European style) versus often-maligned practices (i.e. Mediterranean regulative urbanism). A key question is whether land-use development responds to a demonstrable demand or not. Supply-oriented systems such as those of ES-Valencia, HR-Coastal, RO-Constanta conceive development as a business opportunity to stimulate economies suffering from a lack of diversification. Even in the case of healthier economies, supply-side factors are present when urbanization is understood as an economic engine (DE-30ha) or where land development is instrumental to sustain municipal budgets (DE-30ha, ES-Valencia, HR-Coastal, IT-BassaRomagna, NL-Ladder, PL-ITI, RO-Constanta). In the case studies, we find that these divergent socio-political contexts lead to different practices, but some commonalities have also been observed.

- **The status of spatial planning is rising and falling**. While DE-30ha, HR-Coastal, NL-Ladder and RO-Constanta show a declining influence, AT-Vorarlberg, CH-CantonAargau, IT-BassaRomagna and ES-Valencia give evidence to the contrary.

- **Simplistic regulatory instruments are gaining in popularity**. This can have side-effects such as inadequate horizontal coordination mechanisms with other policy sectors (DE-30ha), or are contradictory (DE-30ha, HR-Coastal), while others fall short in terms of vertical (multi-level) coordination (DE-30ha, ES-Valencia, HR-Coastal, RO-Constanta).

- There are indications of a **trend towards delegating spatial planning responsibilities** to consultants (BE-Flanders, ES-Valencia, NL-Ladder, RO-Constanta, SE-Stockholm) and decisions to courts (NL-Ladder).

4.1.2 Factors influencing decision-making on interventions

A systematic evaluation of the factors that led to more or less successful interventions provides insight into the opportunities and pitfalls of drafting interventions beyond the conclusions of the intervention analysis presented in Chapter 3. These insights should be of particular value for decision makers because they are backed by in-depth research.

4.1.2.1 Knowledge, data and technical capacity

Previous research and the existing scientific literature on institutional innovations demonstrate that technical capability (Wong, 2006) is important for successful decision-making. Our analysis found that sufficient technical capability exists in most case study areas. However, it was also noted that when land development

occurs as an economic driver, this affected the demand for technical capability in spatial planning, and that the crisis reduced this demand. Given that development practices have returned to pre-crisis dynamics in some countries, this finding should serve as a warning with respect to the COVID-19 pandemic if the expected economic crisis materializes.

Regarding data and information, availability was broadly considered sufficient (and excellent in CH-CantonAargau and SE-Stockholm), with a few exceptions (HR-Coastal, RO-Constanta). Some cases were critical about the utility of the available information for decision-making and public participation (DE-30ha, HR-Coastal, NL-Ladder). More tailor-made information and indicators would make it easier to design, implement and monitor initiatives.

4.1.2.2 Public participation and visions

Public participation in EU member states is regulated by the Strategic Environmental Assessment Directive (SEA). The case study analysis clearly shows an emergence of a standardized 'formal' participation according to EU rules. In traditionally participatory cultures, public participation dynamics remained stable (CH-CantonAargau, DE-30ha, SE-Stockholm), were re-oriented to embrace greater pluralism (NL-Ladder) or even enhanced (AT-Vorarlberg). Other cases apply just the formal SEA requirements (ES-Valencia, IT-BassaRomagna), although in some cases its utility and public acceptance is contested (HR-Coastal, RO-Constanta).

Public support is also needed when drawing up long-term visions. The case studies revealed that a common understanding about the initial situation (i.e. the right problem definition), based on clear evidence helps parties to agree on a strategic vision. Although a strategic vision was present in almost all cases, there were differences in its status. In some cases, the vision had a hard/regulative nature (CH-CantonAargau, DE-30ha, ES-Valencia, HR-Coastal, RO-Constanta), while other case study areas had adopted a softer vision (AT-Vorarlberg, IT-BassaRomagna, PL-ITI). The cases of BE-Flanders, NL-Ladder and SE-Stockholm presented an intermediate situation.

4.1.2.3 Institutional leadership and stakeholder relations

According to a stakeholder map analysis developed for each case study, two typical situations arose. Some interventions were implemented under strong leadership (AT-Vorarlberg, BE-Flanders, CH-CantonAargau, IT-BassaRomagna) while others were developed as a collective effort (DE-30ha, NL-Ladder, SE-Stockholm, PL-ITI). The stakeholder analysis also measured the density of relationships between stakeholders on a scale from 0 to 1 (Table 4.2). The results indicate that the presence or absence of strong leaders correlates poorly with the construction of denser or sparser social networks. Constructive interactions (cooperation and negotiation) dominate in AT-Vorarlberg, IT-BassaRomagna, HR-Coastal, and SE-Stockholm, whereas CH-CantonAargau, DE-30ha and ES-Valencia proved to be the least cohesive.

Table 4.2. Density of relationships by type: High (green) - Medium (yellow)- Low (red).

Relations	AT	BE	CH	DE	ES	HR	IT	NL	PL	RO	SE
Cooperation	0.41	0.37	0.32	0.26	0.30	0.56	0.41	0.35	0.41	0.39	0.56
Negotiation	0.47	0.23	0.11	0.13	0.08	0.14	0.37	0.12	0.06	0.07	0.08
Conflict-Pressure	0.00	0.18	0.00	0.16	0.12	0.02	0.03	0.17	0.00	0.21	0.07
None	0.12	0.23	0.57	0.45	0.50	0.27	0.19	0.37	0.54	0.34	0.29

4.2 Sustainability assessment of interventions

This section contains two parts. The first reports on the sustainability assessment on the goals of the intervention, largely the result of desk research and expert judgement on the part of the researchers. The second part reports on the sustainability assessment on the outcomes of the intervention, which was taken from the in-depth interviews with participants and relevant literature such as third-party evaluations. A summary of the outcomes can be found at the end of the section in Table 4.3

4.2.1 Sustainability assessment of goals

All 11 studied interventions dealt with sustainability issues in their formulation of regulations, plans, strategies, programs or initiatives. Most of them did so explicitly, as they recognized the need to address economic, ecological and social dynamics in a balanced way. References to sustainability are more implicit in RO-Constanta and BE-Flanders, particularly in older documents when sustainability discourse was less developed. This suggests that the emergent sustainability paradigm has had great influence on the formulation of land-use management and planning instruments. Moreover, the temporal and institutional aspects of sustainability are manifestly evident in most interventions since they aspire to produce long-lasting effects (AT-Vorarlberg, CH-CantonAargau, ES-Valencia, PL-ITI, SE-Stockholm), have concern for future generations (CH-CantonAargau, HR-Coastal, IT-BassaRomagna, RO-Constanta), address climate change (ES-Valencia, HR-Coastal, PL-ITI, SE-Stockholm), set land-use targets (BE-Flanders, DE-30ha, IT-BassaRomagna) and include a calendar for mandatory revision and update (ES-Valencia, RO-Constanta). Nevertheless, despite expressed intentions to achieve a good equilibrium between the three aspects of sustainability and to sustain this over time, it is clear that each dimension is not given equal attention.

Economic sustainability is always present as a goal, but the way it is treated varies enormously between the case studies. Generally, there are two main approaches:

- **Good economic performance as a key target**. In RO-Constanta, economic growth is encouraged across all the sectors of the economy, with the tourism sector signalled as the main priority. Land development to support this should occur “within the limits of environmental protection", but these limits are not made explicit and it is admitted that development will lead to “the devaluation of the natural potential”. This shows that an intervention that strives towards economic targets cannot automatically be assumed to strive towards economically sustainable land use as well. In the case of NL-Ladder, economic performance is not explicitly mentioned in the intervention itself, but the regulation does seek to correct a market failure by preventing oversupply of real estate. Therefore, it can be seen as promoting sustainable economic development.

- **Equitable distribution of economic growth**. The few economic considerations in DE-30ha and IT-BassaRomagna (the main focus is environmental) relate to affordable housing. In ES-Valencia the viability of agricultural activity in the metropolitan area was the main issue, particularly support for local products to boost employment and incomes of struggling small-scale family operations.

The remaining case studies use economic discourses that mix both approaches. By including often-overlooked social groups in the circle of interventions’ potential beneficiaries of economic goals, interventions can broaden their base of support. This can indirectly contribute to social sustainability objectives as well.

With respect to **ecological sustainability**, the case studies vary according to geographical scale and territory. Well-established urban planning approaches such as containment, densification, compactness and redevelopment of brownfield areas are the preferred options in AT-Vorarlberg, BE-Flanders, CH-CantonAargau, DE-30ha, ES-Valencia, IT-BassaRomagna, NL-Ladder, SE-Stockholm, NL-Ladder and PL-ITI. Rural interventions usually have two ingredients: (1) a recognition of intrinsic values and ecosystem services (e.g. AT-Vorarlberg, BE-Flanders, CH-CantonAargau, DE-30ha, ES-Valencia, HR-Coastal and SE-Stockholm) and (2) a desire to preserve and enhance these values (AT-Vorarlberg, BE-Flanders, ES-Valencia, HR-Coastal, IT-BassaRomagna, PL-ITI, RO-Constanta and SE-Stockholm). This analysis illustrates how, in most cases, ecological sustainability is, at least on paper, the backbone of most case study interventions. By strengthening ecological sustainability, their advocates often expect to synergistically enhance economic and social dimensions of sustainability as well.

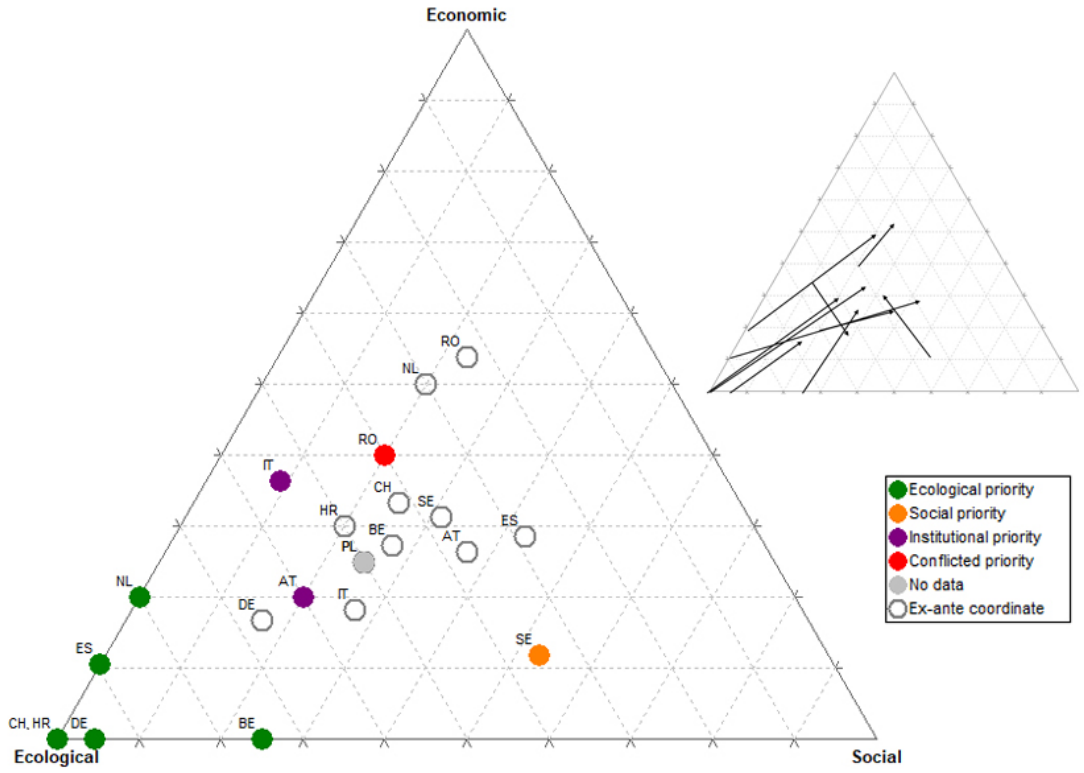
All 11 interventions contain some mention of **social sustainability** indicators, but to widely differing degrees. AT-Vorarlberg, BE-Flanders, ES-Valencia, RO-Constanta and SE-Stockholm pledge to reduce inequality

between neighbourhoods, towns and social groups in their respective territories. Despite rhetoric on social sustainability, responsibility, equity, fairness and justice, the explicitness and concreteness of measures generally lags behind the other two dimensions of sustainability. CH-CantonAargau reflects a concern for the fair distribution of land development opportunities at the national level, as a previous citizen-led initiative aiming to completely stop land-take was considered unfair on equity terms.

In summary, while none of the cases is exclusively focussed on one dimension and blind to the others, it is remarkable how most interventions lean towards ecological sustainability aims. Only two (NL-Ladder and RO-Constanta), put the onus on economic aspects, and only the AT-Vorarlberg, ES-Valencia and SE-Stockholm interventions grant one third or more of their attention to social aspects (see

Figure *4.1*). Of course, no recommendation can be given on how an intervention chooses to prioritize sustainability dimensions because this depends on the type of problem that it wants to tackle or the improvements one wants to deliver. Still, the results reveal that, as a general rule, what the 100+ interviewed stakeholders overwhelmingly expected and demanded from the land-use interventions was action towards ecological goals (usually in response to perceived environmental sustainability problems), but the interventions that were actually drafted were more holistic.

Figure 4.1. Sustainability assessment of intervention goals



Explanation of figure: the ternary plot on the left depicts (1) the indicative position of the issue that was expected to be addressed, measured as the sum of all values from all interviewees per case and (2) the location of the character of each case-study intervention (empty circles) across the three dimensions of sustainability based on close reading. The colours indicate the main character of the intervention. The accompanying ternary plot on the top right shows the distance between (1) and (2) for each case study, indicating the degree to which the intervention matched expectations and needs.

The results on temporal sustainability suggest that public authorities tend to be slow in detecting or giving adequate consideration to land-use sustainability challenges and are not proactive enough in implementing early responses. Notwithstanding, decision-makers should be reassured by the finding that most stakeholders in most cases approved of the measures put into place, once they were put into place.

4.2.2 Sustainability assessment of outcomes

Two data sources provide evidence for assessing the sustainability performance of the interventions: land-use change maps and graphs on the one hand, and feedback from the involved stakeholders on the other. As in the previous section, the results follow the three-dimensional conceptualization of sustainability.

Given that only two out of the 11 interventions focussed on **economic priorities** and, even in these cases, they were paired with other concerns, it is not surprising that almost all interviewees struggled to find objective and reliable indicators of positive or negative impacts on the economy and/or economic sustainability. Under these conditions, stakeholders were only able to estimate the economic effects of the relevant intervention or suggested proxy indicators. With these limitations in mind, the following points were made:

- An optimized distribution of land uses and an efficient use of land (through redevelopment, regeneration, etc.) were seen as generating **indirect economic gains** by reducing the need for car infrastructure, enhancing proximity, creating synergetic areas of industrial and innovative specialization, balancing markets by facilitating conversion of offices into homes and vice-versa, and even tax optimization opportunities. In fact, there are indications that, even in the case of RO-Constanta, the practice of greenfield development as the main way to extract value is increasingly being contested.

- Companies and investors in advanced economies regarded the quantity and quality of green infrastructure, public services and housing opportunities as valuable assets for **attracting skilled and talented workers**. Some global sectors (IT, finance, etc.) viewed land-use strategies capable of delivering these ingredients favourably.

- Interventions in CH-CantonAargau, ES-Valencia and HR-Coastal supported traditional rural activities as a way to **increase the value of agricultural land** and, in this way, protect it from urbanization. In ES-Valencia, even the property development sector admitted that new opportunities had opened up to them as a result – the views over the traditional landscape offered by some properties allowed them to be sold at a premium.

- Experiences in AT-Vorarlberg and IT-BassaRomagna signify a shift in developmental culture, from being driven by a competitive urge among municipalities to attract jobs in a zero-sum manner, to a **more cooperative approach** that guarantees a fairer distribution of public costs and tax revenue. The new culture is also built on the idea that activities should be located in optimal locations according to the three dimensions of sustainability.

The case studies also revealed some negative impacts of the interventions on economic sustainability, expressed as an increasingly unaffordable housing market (SE-Stockholm), a surplus of unused but developable land (BE-Flanders), political interests affecting the distribution of land uses (AT-Vorarlberg, IT-BassaRomagna), an increasingly uneven distribution of development profits (IT-BassaRomagna, RO-Constanta) and an increase in bureaucratic workloads (NL-Ladder, RO-Constanta).

Overall, the findings in this subsection support the contention that land-use interventions, if adequately implemented, are recognized by stakeholders as contributing to long-term economic sustainability. In many cases the benefits in terms of long-term economic sustainability are perceived as exceeding the costs.

The effects of the interventions on the **ecological dimension** of sustainability can be classified, according to the collected data, into three main categories.

- **Conservation of open space** is one of the most tangible and measurable results and, therefore, many consulted stakeholders referred to data and indicators attesting to this achievement in their areas. In AT-Vorarlberg, BE-Flanders, CH-CantonAargau, ES-Valencia, HR-Coastal and SE-Stockholm, the delineation of protected areas by the intervention offered objective evidence of the impact on ecological sustainability while in other instances (IT-BassaRomagna and, in addition in

the cases of CH-CantonAargau and ES-Valencia), the proof came in the form of de-zoned extensions. DE-30ha data showed a deceleration of urbanization whereas in NL-Ladder, respondents cited specific initiatives that had been denied planning permission as a direct result of the intervention.

- For interventions mainly focusing on urban settings, ecological sustainability was fostered indirectly via **sustainable urban development and mobility**. AT-Vorarlberg, BE-Flanders, CH-CantonAargau, IT-BassaRomagna, NL-Ladder, SE-Stockholm and some municipalities in RO-Constanta successfully concentrated growth in or nearby existing built-up areas, thus promoting compactness. Respondents noted additional benefits such as lower emissions, healthier lifestyles via active mobility, greater contact with nature and energy efficiency (AT-Vorarlberg, BE-Flanders, ES-Valencia, IT-BassaRomagna and SE-Stockholm).

- Intangible as may be, **cultural change and environmental awareness** were found to have intensified among stakeholders and the rest of society thanks to the pedagogic and demonstrative effects of the respective interventions. In AT-Vorarlberg, the process alerted participants about the scarcity of remaining open land, in BE-Flanders it raised the level of ambition of conservation goals, in CH-CantonAargau it made lower tiers of the administration co-responsible for environmental protection, in DE-30ha it raised awareness among the political class, in ES-Valencia it revived an appreciation for the traditional landscape, in HR-Coastal it emphasized the public interest of long-term conservation of coastal areas, in IT-BassaRomagna it forged a desire for territorial resilience, in NL-Ladder it helped convince private stakeholders of the need for sustainable growth, in RO-Constanta it sparked a reaction by environmental movements and in SE-Stockholm it vindicated a culture that sees environmental improvement as a precondition for socioeconomic development.

When the impressions from interviewed stakeholders are compared to the maps, tables and plots quantifying the evolution of urbanization in the respective territories, it is difficult to establish a strong correlation between the qualitative and quantitative data (see Figure 3.4 in Annex 3.13). More specifically, it is difficult to find empirical backing for the broadly positive feedback received in relation to the ecological dimension of sustainability cited above. Some interviewees in ES-Valencia, IT-BassaRomagna and NL-Ladder (where the data seems to match most closely) argued that the far more significant impacts of the global financial crisis of 2008 made it impossible to accurately assess the impact of the interventions on land-use change.

The apparent contradiction between qualitative interview-based data and quantitative remote sensing-based data does not necessarily put into question the reliability of the sources; it simply states that all the ecological advancements brought by so-called successful interventions did not eradicate unsustainable land-use changes or, in many instances, even change the trajectory of development. One would be tempted to conclude that land-use planning efforts were ineffective, and these efforts should be stepped up to address the environmental crisis (or that completely different measures are called for). On the other hand, the positive assessment of the stakeholders regarding the impacts also suggests that without the intervention, developments would have been even more unsustainable.

The **social impacts** of the interventions are generally the least visible and elaborated by stakeholders across all case studies. This might validate the hypothesis that social goals in the interventions might be rhetorical or pro-forma add-ons to interventions and do not enjoy the same status of economic and, particularly, environmental priorities. It is also possible that social impacts are secondary to or side-effects of the primary concerns addressed in other areas. Indeed, some indications in the cases BE-Flanders, CH-CantonAargau, ES-Valencia, HR-Coastal, NL-Ladder and RO-Constanta support this contention. The most visible social outputs regard the following:

- **Affordable housing.** SE-Stockholm is particularly significant because the housing shortage was one of the main concerns that triggered the only intervention in the sample that put social goals slightly ahead of other dimensions. Despite this, housing costs still increased. This was partly attributed to building restrictions that limited the supply of land for development. In BE-Flanders the social housing triggered by the intervention still did not meet the total demand and a vulnerable

population remains in a precarious situation. Stakeholders in DE-30ha openly admitted that the apparently inevitable consequence of development restrictions will be increased housing prices.

- **Quality of life**. The vast majority of stakeholders considered that the environmental and economic improvements brought by many interventions had contributed to improving the quality of life for most people, either by increasing recreational opportunities, contributing to the walkable and cyclable city model, providing social services, facilitating contact with nature or maintaining the vitality of the social fabric in urban centres. Finally, the interventions were seen as a means to maintain local identity and social cohesion in AT-Vorarlberg, DE-30ha, ES-Valencia and HR-Coastal.

In conclusion, the assessment of social sustainability impacts confirms what was observed elsewhere: the social dimension remains underdeveloped. On the other hand, more investment in policies such as social housing production may be a small price to pay for the benefits that sustainable land-use interventions can produce for the quality of life and social cohesion of local communities. Communication strategies should capitalize on these advantages to garner public support and increase stakeholder engagement as a first step for delivering on social sustainability promises, now often generically pursued but rarely materialized.

Table 4.3. Overview of case study results.

		AT-Vorarl-berg	BE-Flanders	CH-CantonAar-gau	DE-30ha	ES-Valencia	HR-Coastal	IT-BassaRo-magna	NL-Ladder	PL-ITI	RO-Con-stanta	SE-Stock-holm
CASE STUDY CHARACTERI-SATION	Geographical scale	LAU1	NUTS1	NUTS3	NUTS0	LAU1	NUTS2	LAU1	NUTS0	LAU1	NUTS3	LAU2
	Starting year	2004	1996	2014	2002	2018	2004	2009	2012	2014	1991	2017
	Type of territory	Urban Rural	Urban Rural	Urban Rural	Mixed	Urban Rural	Coastal and is-lands	Urban	Mixed	Functional area Cross-border	Urban Coastal	Urban
	Urban typology	Polycentric	Monocentric	Polycentric	Mixed	Monocentric	Polycentric	Polycentric	Mixed	Mixed	Mixed	Monocen-tric
	Type of instrument	Strategy	Strategy	Legal device	Legal device	Land use regu-lation	Land use regula-tion	Strategy	Legal device	Programme	Land use regulation	Strategy
INTERVENTION PERFORMANCE (EX POST SUSTAINABILITY ASSESSMENT)	Indicators of economic performance											
	Attractiveness for investment	+	+			+			+		+	+
	Business support		+			+						
	Ease of measurement	-	-	-	-	-	-	-	-	-	+	+
	Economic culture change	+			+	+		+			+	
	Economy priority					+	+		+	+	+	
	Even distribution of costs/benefits	+						+				
	Optimization	+	+		+				+			+
	Indicators of ecological performance											
	Climate change mitigation			+								
	Culture - awareness	+	+	+	+	+	+	+	+		+	+
	Densification - infill - regeneration	+	+		+			+	+	- +	- +	+
	Mobility	+	+			+		+			-	+
	Open space conservation		- +	+	+	+	+	+	+		-	+
	Persistence	- +	- +	- +	+	- +	-	+		+	-	+
	Slower / less land conversion		+	+	+	+	+		- +			
	Indicators of social performance											
	Community involvement					+			+			
	Avoid distributional dysfunctions							-		+	-	-
	Avoid gentrification	-	-	-	-						-	-
	Identity	+			+	+						
	Mixed communities		+		+					+		
	Persistence	+						+	- +			
	Quality of life		+	+	+				+		-	- +
	Social housing	+	+		-			- +		- +		- +

4.3 Conclusion and reflection

To a greater or lesser degree, all case study interventions transformed the way in which land-use planning is perceived and practiced, both among institutional stakeholders and the public. This suggests that the interventions can and do affect urbanization and land-use practices. Both successful and less successful experiences offer valuable lessons. The transformations observed in the planning and development culture fall into two general categories: a change in mentality and innovative instruments and practices. These will be discussed in turn.

4.3.1 Interventions as catalysts for cultural change

Even though changing the planning and development culture in the studied territories was not an explicit goal of any of the addressed interventions, many stakeholders recognized it as a distinct by-product. Of all the case studies, only SE-Stockholm was deemed by local stakeholders as having no effect in this regard since the intervention fit the existing political and planning culture and was widely viewed a continuation of previous strategies. Changes in mindset included the following:

- One of the most common changes was the abandonment of competitive individualistic decision-making in land development in favour of more **cooperative strategies** involving combinations of public administrations, institutional stakeholders and private sector groups as well as common citizens.

- A shift from a top-down tradition towards a more **open decision-making process** was a fundamental pillar in the cases of AT-Vorarlberg, ES-Valencia and IT-BassaRomagna. The plan in ES-Valencia is illustrative of a similar shift, from a planning tradition based on an urbanist regulative approach imposed by closed administrative departments with little communication between them and strong ties to political interests to a comprehensive approach involving departments of different administrations and an ambitious public participation campaign.

- All interventions affected **public awareness and involvement in land-use planning** and development. This can be observed in the way stakeholders internalized rather specialized vocabulary and arguments into their everyday practices and discourses (AT-Vorarlberg, CH-CantonAargau, ES-Valencia, HR-Coastal, IT-BassaRomagna, NL-Ladder and RO-Constanta).

4.3.2 Interventions as innovations

In many cases, the interventions can be considered innovative. They not only sought to intervene in physical developments, but also created novelty in developmental practices. Sometimes this was done by the introduction of new instruments, and sometimes by creating new routines and interaction.

In general, the case studies illustrate a certain rejection of conventional spatial planning approaches relying on the imposition of binding norms and regulations and embrace, instead, more discretionary, comprehensive and participatory interventions. In other instances, a basic set of binding norms was deemed essential by stakeholders. IT-BassaRomagna provides an example of an ambitious regulatory practice, with nine municipalities committing to the introduction of a common set of zoning and building norms to support the implementation of the strategy. ES-Valencia made creative use of urbanistic regulations to de-zone areas slated for development. In BE-Flanders, some groups demanded that the administration announcing the land-take target should also develop the regulations to carry it out. In RO-Constanta, the characteristically laissez-faire approach to planning is being increasingly contested, with the argument that it fails to address environmental and social impacts.

- The NL-Ladder represented a significant departure from the Dutch spatial planning tradition at least in two aspects. First, it was an attempt to **indirectly regulate by obliging developers and municipalities to justify their plans** in terms of sustainable urbanization rather than directly regulating development. It was expected that this soft approach would reduce inter-municipal competition while raising awareness about the need to preserve open land. This aspect was generally viewed favourably. The second innovative feature of the NL-Ladder was that enforcement was delegated

to civil society **by allowing plans to be challenged in court**. In practice, this was largely judged to be a failure as it caused a proliferation of litigation and the judicialization of planning.

- Compliance with the intervention was a **source of legitimacy** for the relevant public administrations in AT-Vorarlberg and IT-BassaRomagna, whereas poor compliance led to criticism in HR-Coastal and RO-Constanta. Ironically, the interventions of NL-Ladder and RO-Constanta, recognizable for being the most aligned to liberal planning principles, were also the most accused for increasing red tape. This may call into question the alleged advantages of deregulation and minimal state intervention in planning. When dogmatically applied, these principles may increase risks of reproducing some of the costs and inefficiencies of highly bureaucratic systems.

- Innovative instruments eschewing piecemeal project development in favour of cooperative action based on a collective vision seemed more successful overall. The case studies provide three valuable examples. AT-Vorarlberg introduced a **financial compensation** scheme to evenly distribute the costs and benefits of industrial development in certain locations. IT-BassaRomagna introduced redistributive schemes to compensate for lost revenues of municipalities that chose to preserve open space. The agricultural land bank in ES-Valencia attempted to distribute land use rights so that non-farmer owners and businesses without generational succession could have their land cultivated, while allowing smaller operations to increase their long-term viability.

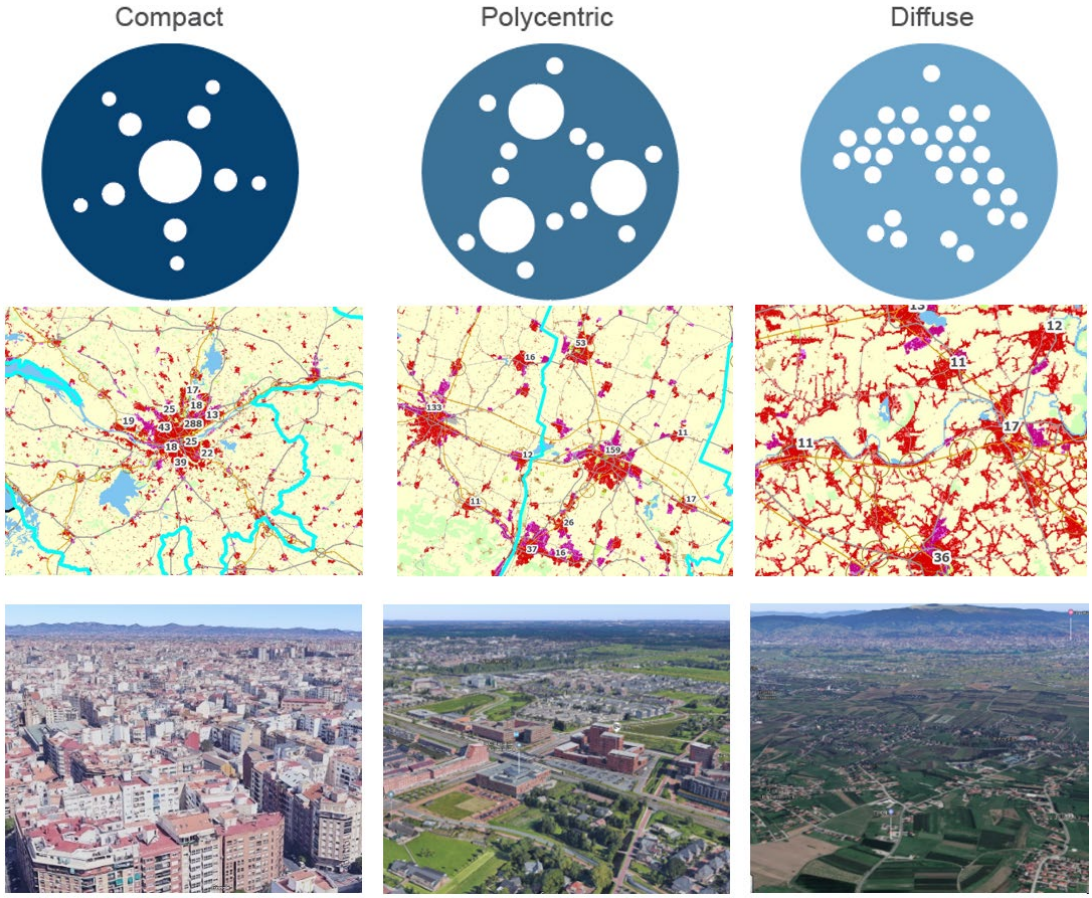
- Many cases were **influenced by the EU**, either explicitly because they were born of a communitarian mandate or in a less direct way through EU directives, principles, ideals, etc. RO-Constanta, together with ES-Valencia and PL-ITI, show that EU policies might have the greatest effect on local spatial planning practices in countries that recently accessed the EU or are major beneficiaries of EU funding. Furthermore, it might indicate that EU standards for public participation, environmental protection and institutional accountability could be a positive stimulus in new member states.

As a concluding remark, it is clear that the studied interventions have left an enduring mark on the planning and development cultures of each territory. It would be rash for planners and decision-makers to imitate innovations that worked elsewhere or outrightly reject initiatives that did not produce desired results without critically assessing the location and time-specific context. While this can be read as a warning against uncritical transplantation of ‘best practices’, it also testifies to the value of experience-based learning, and it should be interpreted as an invitation for planners and decision-makers across Europe to continue sharing knowledge.

5 Imagining future urbanization and land-use pathways

The purpose of this chapter is to pull together the empirical evidence presented in the previous three chapters and synthesize it into integrated storylines about possible future development. More specifically, we borrowed from the morphological analysis and our understanding of urbanization mechanisms from Chapter 2 as a starting point to draw up three scenarios: compact, polycentric and diffuse. The first, compact, scenario has an affinity with the ambition to achieve 'zero net land take' and compact-city discourse that extols the virtues – including sustainability – of large metropolises (E. Glaeser, 2011; Jacobs, 1961). The polycentric scenario has an affinity with literature that seeks an optimal balance between urban and rural areas by clustering development into mid-size liveable communities, usually garden cities or 'new urbanist' transit-oriented neighbourhoods (Howard, 1902; Park et al., 2020) as well as notions of post-territorialism that view functional urban areas or regions as the most important units of economic development, housing markets and cultural identity (Faludi, 2018). The diffuse scenario is associated with individual choice, affordable spacious surroundings and right to privacy, articulated in the works of Frank Lloyd Wright among others (Bruegmann, 2006; Fishman, 1987).

Figure 5.1: compact, polycentric and diffuse urban form illustrated



Source: Maps produced from Corine Land Cover (CLC) depicting Loire (F), Modena, (IT), Flanders (BE); Photos: Google Maps 3D views of Valencia (ES), Leidschenveen (NL), Zagreb (HR)

Each scenario begins with a description of the predominant attitudes towards urban growth. Then scenario-specific packages of interventions are applied starting in 2020 that determine which land is converted to urban use by 2050. Afterwards, the impacts on the three dimensions of sustainability are presented for each scenario, including maps produced by the LUISETTA land-allocation model. These scenarios then function as a springboard towards the conclusions and recommendations of the SUPER project presented in the next chapter.

5.1 Scenario logic and setup

Creating narratives about future development is a common spatial planning tool, particularly for strategic decision-making (Albrechts et al., 2003; Throgmorton, 1996; Zonneveld, 2007). The purpose of a scenario is to explore possible future pathways where the level of uncertainty is too high to warrant a prognosis, but high enough to avoid speculation (Dammers et al., 2013). In general, one can distinguish two types of scenarios: those that hold policies constant except for a set number of external variables on which there is a high level of uncertainty regarding drivers (environmental scenarios) and those that vary according to decisions (policy scenarios) on which there is a high level of ambiguity regarding beliefs. The SUPER scenarios are of the latter type; they seek to explore how three different policy orientations could result in divergent urbanization and land use trajectories, and hence sustainability. Given the *policy scenario* nature, all external variables such as demographic and macroeconomic development, technology and climate change are held constant. Differing societal attitudes comprise the scenario-specific variables, which result in the adoption of a plausible policy package in that scenario.

Table 5.1: Key elements of the scenario storylines

Elements	Compact	Polycentric	Diffuse
Constants			
Demographic development	Slowdown in EU population growth and ageing. Regional differentiation following prognoses.		
Macroeconomic development	Low to medium growth in EU, regional variation		
Technological advancement	Transport and information innovations		
Climate change	More extreme weather events, heat island		
Variables			
Attitudes on mobility	Walkability	Multimodal	Private car
Attitudes on density	Positive	Mixed	Negative
Attitudes on governance	Collectivist	Interdependence	Independence

Each scenario storyline consists of three parts. The first concerns the **rationale**, which serves as a general introduction and is linked to the LUISETTA model input. It consists of a provocative, but not entirely implausible, piece of fiction to make it clear that these stories are not about making predictions, but about describing possible and divergent futures. The storytelling contains common elements, such as identical sentences on the variables held constant (e.g. demography and climate change). As the reactions to these common drivers differ in each scenario, the rationale section explains how societal attitudes create different kinds of preferences for urban space (e.g. the magnitude of ageing is the same in all scenarios, but the housing preference of elderly people varies).

The second part presents the scenario **policy package**. It begins with a brief description of policy aims to establish a plausible link between the societal attitudes described in the rationale and the instruments chosen to influence urbanization and land use accordingly. This package of interventions is directly drawn from the intervention database (see Chapter 2) and case studies (see Chapter 3).

The last part discusses the scenario **impacts**, based on the LUISETTA model output and the SUPER sustainability assessment framework (see Annex 4). It starts with a reflection on the land-use changes using the 2050 image (e.g. a description of the kinds of areas which saw the most urbanization and changes in density). This is followed by a description of impacts in each scenario using the three dimensions of sustainability, supported by specific references to the scientific literature.

5.2 Scenario storylines

5.2.1 Compact

Starting in 2020, a prudent policy of urban containment was promoted throughout Europe to avoid the wasteful, haphazard urbanization which had resulted in the destruction of natural resources, exacerbated land consumption, and undermined the vitality of cities. A selection was made from sustainable urban development policies that had proved successful in the past plus some innovations. The result was that urbanization occurred in or near existing cities. By 2050, redevelopment, regeneration or infill development had become the norm.

Looking back, there were various reasons behind this course of action. Attitudes regarding where and how to live had changed considerably. The generation that had grown up with the Twentieth Century ideal of a single-family home and private car had passed on. The notion that people would willingly commute for hours to a large home in a sprawling suburb or remote village and waste their weekend mowing lawns and taxiing children back and forth to dispersed activities, seemed by 2050 as alien as it was anachronistic – a tiny apartment at a good location was preferable. In short, a change in mindset had occurred in which people preferred convenience and flexibility to size and luxury in their housing decisions.

Many factors influenced this change. One was increased environmental awareness of citizens as the effects of climate change became increasingly unavoidable; compact urban living was widely praised for its sustainability. Moreover, the demographic pressure in Europe had stabilized and the population had aged significantly; there was a greater need to be close to healthcare and sheltered-housing facilities in case of sudden illness. Digital connections had become so pervasive and sophisticated that cyberspace was as important as physical space. This was reflected in new attitudes towards mobility and proximity: being used to the convenience of the online world, physical amenities should also be close at hand. Europe's great cities, with their mixed uses, walkability and excellent public transportation was an ideal counterpart to the online world. As a result, the pressure for new homes, especially those distant from the amenities and services in urban centres, waned whereas large cities thrived.

The millennials decided to reinvent urban areas to suit their needs. In order to produce urban areas large enough to provide the quality they demanded – especially given the demographic developments – an ambitious containment programme was introduced. Various policies enacted in the 2000-2020 period provided inspiration for policy packages throughout Europe. These were territorially differentiated for maximum impact and an overall objective was set that **half of all demand** for urban land use be accommodated within the existing urban fabric.

In urban areas, especially metropolitan regions, various options were available. The most obvious is to restrict urban expansion by imposing legal boundaries, thus increasing densities and creating a more compact urban form and retain traditional rural land (Millward, 2006). One of the most studied containment strategies is the Urban Growth Boundary in Portland, Oregon (USA), but in Europe we also find London's Green Belt, Corona Verde in Torino, Grüner Ring in Leipzig and the Metropolitan Cork Green Belt. Similar strategies include regulations capping urbanization (e.g. the zero-growth plan of the municipality of Cassinetta di Lugagnano), or legal devices that address sustainable land use issues (e.g. in Tuscany, the 2014 regional law on soil consumption n.65/2014). These interventions are sometimes called 'outside game' strategies because they concern limiting outward expansion (Rusk, 1999). These were supplemented with interventions oriented to the 'inside game' that promote inner-city development. Inspiration was found in interventions transforming underutilized areas (e.g. Reinventing Paris), enhancing the quality of existing urban spaces (e.g. BENE – Berlin Programme on Sustainable Development) or regenerating brownfield areas (e.g. Dublin Docklands and the Royal Seaport eco-district in the City of Stockholm).

In rural areas, the focus was on limiting building in the countryside. Examples include swiss anti-sprawl measures, German and Belgium caps on land take, regeneration schemes and farmland protection regulations such as in Valencia. Some countries possess transfer of development rights schemes (e.g. the Dutch 'red for green' or the Portuguese *Perequação* policy), which make planning permission for new buildings conditional on the demolition of old ones. Finally, measures such as community-led regeneration processes were considered such as the regeneration of abandoned areas in Casoria (Italy).

By 2050, the decades of consistent policy decisions on urbanization and land-use could be read in the physical landscape. Green areas bordering large cities were sacrificed for urban development, while those further afield (e.g. within a green belt) remained untouched. Some large polycentric regions such as the Randstad and Ruhr area coalesced, whereas the scattered suburban development around cities like Milan and Warsaw filled in. Within cities, unbuilt spaces became scarcer and population densities higher as buildings increased in height and as apartments were subdivided. Rural areas retained their rural character. Some reflected on this development positively, while others were more sceptical about the sustainability of this policy course. Did it serve the long-term economic, ecological and social goals it aspired to?

Figure 5.2: Sample of compact scenario 2050 output for five selected regions

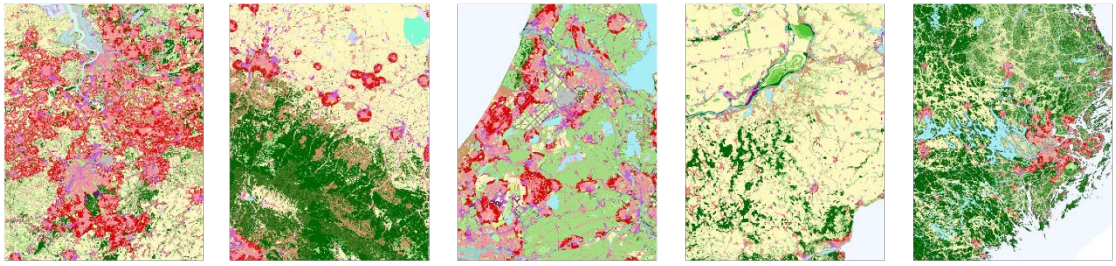
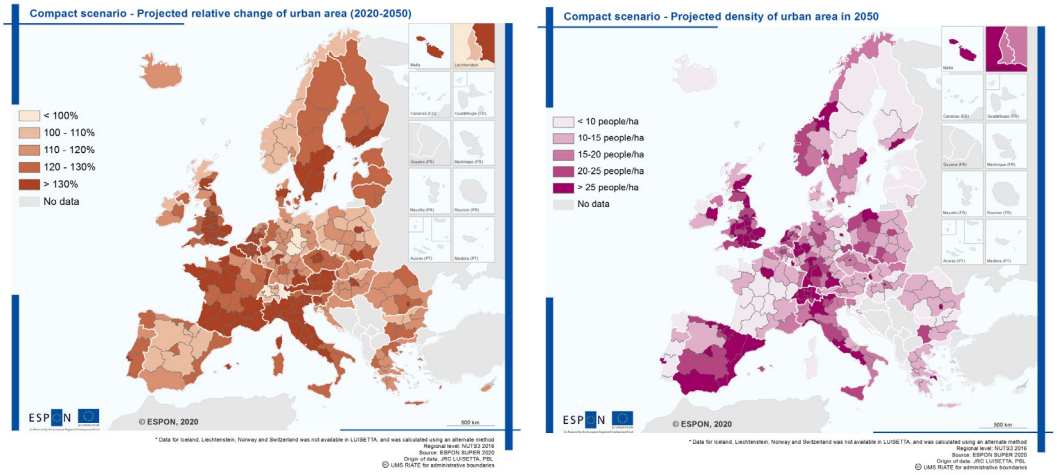


Figure 5.2 displays the typical urbanization pattern produced by the compact scenario by 2050 in the LUISETTA model. The dark red regions show the new urban fabric; the light red areas were already built-up at the beginning of the scenario period. Here we can see that new development clings to existing urban areas, generally the larger cities. Some large polycentric regions such as the Randstad and Ruhrgebiet coalesced, whereas the scattered suburban development around cities like Milan and Warsaw had filled in. In Belgium, we see Brussels filling in towards the south, as well as the spaces between Charleroi and Mons. In the area between Bologna and Ravenna in Italy, development only occurred around a few large cities. The same is true for Stockholm, where the main centre attracted most urbanisation. This tendency was less evident in Constantia (Romania) due to the low development pressure overall.

As Map 5.1 illustrates, the compact scenario produces urbanization in areas with large urban centres, and many of the biggest cities can be discerned in the figure as the areas gaining the most built-up area. Still, not every area gaining population gained the same amount of extra urban space. Due to lower attractiveness or transaction costs regarding building locations, some areas were not able to produce enough space to keep up with demand. In these situations, there was further densification in the existing urban fabric – for example, by redevelopments replacing single-family homes with apartments, adding floors to existing buildings or subdividing homes into smaller (studio) units, sometimes to sublet. As displayed in Map 5.2, we can see this densification in more areas than just large cities: also large parts of Spain, Italy and southern Germany show more people living per hectare of urban fabric.

As regards **economic sustainability**, there were some clear advantages. Real estate values increased considerably, as predicted (e.g. Nelson et al., 2012, p. 107; Nilsson & Delmelle, 2018) and urban economies flourished from the opportunities provided by brownfield redevelopment (Hall, 2014). The proximity afforded by high densities allowed companies to decrease transport costs and facilitate communication between firms (Anas et al., 1998; Nelson et al., 2012). The compact city structure created inner-city jobs, aided the development of central business districts and resulted in higher energy efficiency, because, among other things, heat exchange between buildings is greater in compact cities (Boyko & Cooper, 2011; Naess, 2006; OECD, 2012, p. 61). Less materials was needed for buildings and road infrastructure due to efficiency gains (Naess, 2006). However, some argued that the land-use controls might have resulted in a net welfare loss if the slowed growth outside the main cities is taken into account (Cheshire et al., 2018). Finally, with respect to transportation, the compact city structure made high-quality transport connections more viable, but also increased the risk of congestion and overcrowded public transportation (de Nazelle et al., 2010; Litman, 2019).

Map 5.1: (left) Compact scenario - change in urban area relative to starting year (2020-2050)
Map 5.2: (right) Compact scenario - density in population per ha of urban fabric (2050)



As regards **ecological sustainability**, the sparing of non-built space outside the city boundaries was viewed positively by many (Soga et al., 2014; Sushinsky et al., 2013). Lower land consumption rates also gave flexibility with respect to future ecological planning (Van Der Waals, 2000; Westerink et al., 2013). The policies proved effective in curbing 'exurban' development, defined as highly car dependent urbanization which is too diffuse to be viably served by water or sewer infrastructure (Nelson et al., 2012, p.49). Given that urban form influences the choice between walking, public transport and private vehicle (Owen, 2009; Pooley & Turnbull, 2000; Rajamani et al., 2003), private car use decreased. Innovations such as green roofs, vertical gardens and tiny urban forests provided much-needed ecological services in compact urban areas. Nevertheless, development in compact cities usually came at the expense of urban green areas, as had happened in Helsinki (Hautamäki, 2019) and Amsterdam (Giezen et al., 2018) in the early part of the century.[2] Finally, it proved increasingly difficult to find space for renewable energy in the compact city (Marco Broekman et al., 2017).

As regards **social sustainability**, the compact scenario had some disadvantages. Housing prices tended to rise, and where no vigorous affordable housing policy was implemented, lower-income households became priced out (see Annex 3.11). In some places, this manifested itself in discriminatory practices, such as against immigrants. As feared, contagious diseases can spread more rapidly in densely populated areas. In addition, there are increased nuisances such as noise and pollution as well as diminished access to green spaces (Giezen et al., 2018). Inhabitants of compact cities are potentially healthier because they walk and cycle more (OECD, 2012), but are simultaneously exposed to more air pollution unless this is also reduced by other measures. In addition, the shorter distances reduced car dependency, thus lowering social segregation and improving access to local services, jobs and recreational spaces (Nelson et al., 2012). Finally, smaller physical distance between people increases interaction between different social classes and origins, tradition, custom and culture (Jacobs, 1961).

5.2.2 Polycentric

Starting in 2020, a policy of urban clustering had been promoted throughout Europe to avoid both the disadvantages of haphazard urbanization, which deplete natural resources and undermine of the vitality of

[2] Given the fact that the new development in this scenario is at a higher density, this trade-off should be positive on balance in quantitative terms. Qualitatively it can be debated whether a hectare of community garden, park or football field in a city is more valuable in terms of sustainability than a distant hectare of agricultural land. In fact, sacrificing these kinds of green spaces can aggravate local pollution concentrations (E. L. Glaeser & Kahn, 2010), urban heat island effects and vulnerability to natural hazards (Burby et al., 2001).

cities, and the disadvantages of urban containment which can run counter to the housing preferences of many citizens. A careful selection was made from sustainable urban development policies that had proved successful in the past plus some innovations. The result was to encourage urbanization in and around midsize towns, preferably near rail stations. By 2050, a more polycentric pattern of development began to emerge.

Looking back, there were various reasons behind this course of action. Attitudes regarding where and how to live had consistently shown that people appreciated urban lifestyles with amenities nearby, but also wished to live somewhere where the open countryside was within arm's reach and avoided big-city problems like traffic congestion and noise and air pollution. In the wake of faceless globalization, pandemics, climate change and other external threats, the security and human scale of a healthy midsize community was appealing to many. So, despite bold predictions of grand revolutions in urban development heralded by new technologies and rapid societal change, the desired city structure in 2050 followed the ancient polycentric pattern of towns in Europe (Servillo et al., 2017).

Many factors influenced this change. Rebelling against the populist revolt of previous generations, interdependence was embraced: the theory of neo-medievalism and post-territorialism which had seemed absurd in 2020, gradually became accepted as functional relationships superseded jurisdictions – even national borders. Environmental awareness of citizens increased as the effects of climate change became increasingly unavoidable; the reaction to extreme weather events demanded cross-border cooperation. The demographic pressure in Europe had stabilized and the population aged significantly; many elderly people sought out the familiarity of traditional town structures and appreciated the comfort and sociality of collective transport. Digital connections had become so pervasive and sophisticated that cyberspace was as important as physical space. This became reflected in new pragmatic attitudes towards mobility and proximity: good connections and ease was prized above cars as status symbols.

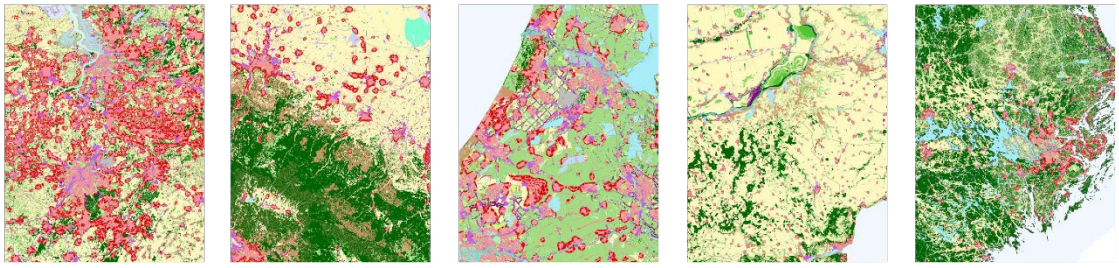
The millennials decided to reinvent urban areas to suit their needs. A policy package was devised to promote 'smart' polycentric growth that struck a balance between economic, environmental, and social aspects of planning and development while making efficient land-use decisions (Daniels & Lapping, 2005). New compact neighbourhoods with excellent public transport infrastructure were well-regarded, as was intensifying development in existing medium-sized towns. A number of interventions introduced in the 2000-2020 period provided inspiration for policy packages throughout Europe. These were territorially differentiated for maximum impact and an overall objective was set that **one-third of all demand** for urban land use be accommodated within the existing urban fabric.

With respect to urban areas, the concept of transit-oriented development was embraced, either by densifying within one kilometre from a rail station or by building light-rail connections in midsize towns (Bertolini et al., 2012; Enrica Papa & Bertolini, 2015). One of the most prominent examples of this was Ørestad, Copenhagen's linear new town built around elevated light-rail stations, but also the Dutch *stedenbaan* project and the countless densification schemes near S-Bahn stations in Germany. Other urban plans that promote a polycentric urban structure and low-density expansion included the 2007 General Urban Development Plan of the City of Sofia and the City of Stockholm which integrated land use, housing and transport planning was pursued (Paulsson, 2020). Finally, the Helsinki region introduced agreements on land use, housing and transport to great effect.

The same philosophy was applied in more rural areas, by encouraging new development around rail stations in small towns and villages, or at least contiguous to current buildings. At the regional level, the general development plan of the City of Stara Zagora encouraged a new polycentric urban model for the future development of the city and its surroundings and the Tri-City metropolitan area in Poland promoted harmonious development of the metropolitan area by giving public transport an important role.

By 2050, the decades of sustained policy decisions on urbanization and land-use could be read in the physical landscape. Some green areas near medium-sized towns and cities had been sacrificed for urban development, but others remained largely intact. Large cities spawned new settlements along infrastructure routes, particularly at train stations, like a string of beads. This allowed those living in these clusters to enjoy the surrounding rural area, while at the same time having access to high-quality urban amenities via the rail line. Some reflected on this development positively, while others were more sceptical about the sustainability of this policy course. Did it serve the long-term economic, ecological and social goals it aspired to?

Figure 5.3: Sample of polycentric scenario 2050 output for five selected regions



Bruxelles-Antwerp region, Belgium | Bologna-Ravenna region, Italy | Randstad region, Netherlands | Constanța region, Romania | Stockholm region, Sweden

Figure *5.3* displays the typical urbanization pattern produced by the polycentric scenario by 2050 in the LUISETTA model. The dark red regions show the new urban fabric; the light red areas were already built-up at the beginning of the scenario period. Here we can see that smaller towns are preferred locations for new development. In the Randstad region and Bologna-Ravenna region, it accentuated the already polycentric urban structure but sometimes resulted in towns growing into each other. Similar tendencies were apparent in the case of the, the Constantia region in Romania, but were dampened by the low growth overall. Stockholm which already had polycentricity as a long-term planning strategy saw development continue on the 'fingers' stretching outwards from the core city.

The aggregated model output for the polycentric scenario regarding urban development shows that conversion to urban land use occurred mainly in more populated regions (

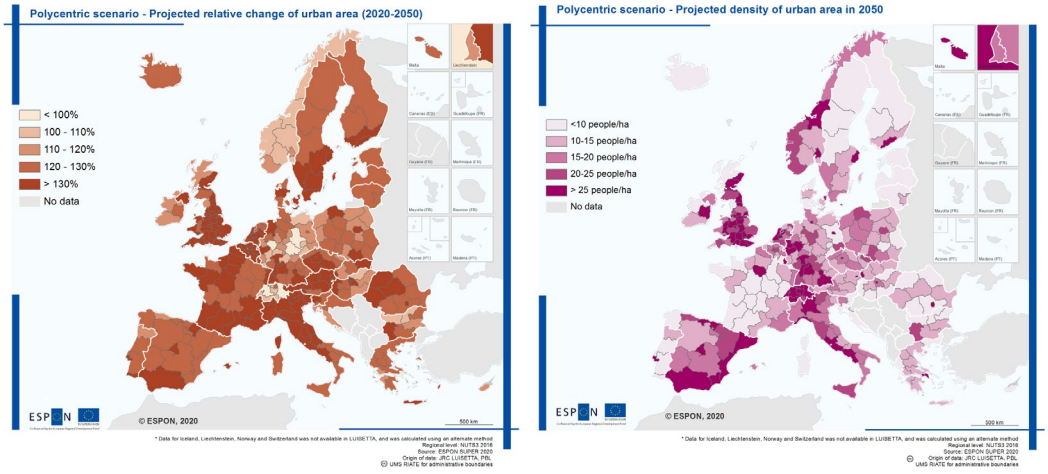
Map *5.3*). Partly for this reason, some countries show internal divisions such as France, Germany and Italy, while others are more homogeneous (Belgium). The polycentric scenario also produced increased densities (Map 5.4). The main cities gained more population than urban fabric, but this tendency was also visible many regions, particularly along the Mediterranean coast. In areas with less development pressure like rural France or Scandinavia or Romania, this was less pronounced.

The polycentric scenario clearly had a positive impact on **economic sustainability**. The polycentric model created space for businesses which relieved pressure from existing employment centres (Knowles, 2012). Clustering also allowed businesses to profit from agglomeration economies (Rosenthal & Strange, 2008; Storper & Venables, 2004) . Moreover, many towns benefitted from each other via 'borrowed size' by reducing travel times, while others continued to compete with each other undermining this synergistic effect (Balz & Schrijnen, 2016; Meijers, 2005). Transit-oriented development improved the accessibility of services and jobs of many residential areas as a whole, while the increased real estate values were deployed to improve the quality of amenities (Cervero & Murakami, 2009). The polycentric scenario provided housing supply for both low income and high-income households (Bartholomew & Ewing, 2011).

This scenario had mostly positive impacts on **ecological sustainability**. In many towns, dense, walkable zones and good public transport connections reduced parking problems, car congestion and emissions (Sider et al., 2013). Because of the polycentric spatial pattern, residential areas were often close to open green spaces, either parks and recreational space or the open countryside (D. Lierop et al., 2017; E. Papa & Bertolini, 2015), while more space was available for future uses, including climate adaptation (e.g. water retention) and renewable energy production (Kenworthy, 2006; Van Der Waals, 2000; Westerink et al.,

2013). On the other hand, some communities still did not have enough space to become energy self-sufficient (Marco Broekman et al., 2017). Also, the polycentric scenario led to a reduction of biodiversity near new construction (Weller et al., 2019).

Map 5.3: (left) Polycentric scenario - change in urban area relative to starting year (2020-2050)
Map 5.4: (right) Polycentric scenario - density in population per ha of urban fabric (2050)



Regarding **social sustainability**, both positive and negative effects were noted. Affordable housing was an important pillar of most clustering strategies. However, enhanced accessibility also drove up housing prices in some cases (Nilsson & Delmelle, 2018). The impact of segregation was mixed: some projects deliberately built mixed residential areas, but others did not. Often the quality of life in residential areas increased by the provision of green public and recreational spaces (Knowles, 2012; Pojani & Stead, 2015; Dea van Lierop et al., 2017) and by the walkable neighbourhood design (Guthrie & Fan, 2016). In some residential areas, noise pollution grew because of the proximity of railway tracks (Pojani & Stead, 2015).

5.2.3 Diffuse

Starting in 2020, a bold policy of urban diffusion was embarked upon to allow and encourage Europeans to enjoy the pleasures of countryside living. It was felt that citizens should have more control over where and how they wanted to live. Why should hard-working people be forced by government bureaucrats to live in crowded cities when there was ample space outside to enjoy the fruits of their labour? The increased demand for housing in a natural environment was facilitated by planners. Urban design concentrated on granting as much privacy and green space to individuals as possible through large-lot zoning and long driveways. Given the low densities, public services and infrastructure were minimal: new developments – mostly as detached family homes or second homes – were built on existing roadways and were often self-sufficient. By 2050, low-density urban functions had displaced agriculture in high-growth regions and most families in Europe revelled in the comforts of a spacious home with an even more spacious yard and vacationing in a second home.

Looking back, there were various reasons behind this course of action. Attitudes regarding where and how to live had become increasingly individualistic rather than collective. Since 2020 a countermovement of 'unplugging' gained in popularity as tranquillity and privacy became luxuries; ideally this should occur in a somewhat remote setting, where the hum of delivery drones was less intrusive. After the COVID-19 pandemic of 2020, the prospect of being quarantined to a large house with a garden was seen as far preferable to being confined to a tiny apartment, to say nothing of the enhanced risk of contagion in dense urban areas.

Many factors influenced this change. One was increased environmental awareness of citizens as the effects of climate change became increasingly unavoidable. Many sought high ground in order to avoid the flooding after extreme weather events. Urban heat island effects further increased the popularity of building a home in an attractive, green environment. Moreover, the demographic pressure in Europe had stabilized and the

population aged significantly. This meant there was enough space to spread out, and many desired to spend their retirement years in spacious, more rural, surroundings. Many coveted the ideal of off-the-grid living in remote eco-communities. Digital connections had become so pervasive and sophisticated that cyberspace was as important as physical space. This could be seen in changing attitudes towards mobility and proximity. It was perfectly feasible to work, visit family, shop or play together at any distance. If necessary, one could travel physically in a personal solar-powered self-driving vehicle (equipped with full VR capability) which would skilfully navigate the traffic on the roads or, if in a hurry, order a lift from a transport drone.

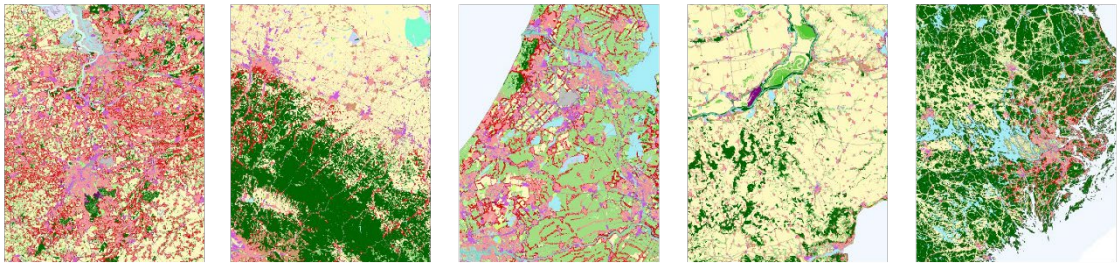
The millennials reinvented urban areas to suit their needs. Government policy was called on to make it feasible to claim a stake in the good life in the countryside. Diffuse development is, after all, not unplanned but originates from local planning and development practices that facilitate it (Burriel de Orueta, 2009; Pagliarin, 2018). To achieve diffusion, planning departments were made leaner, and land-use decisions streamlined and simplified. Self-empowerment was stimulated by generous fiscal arrangements for home-building, private transport and energy independence. More importantly, restrictive measures at higher governmental tiers regarding conservation of landscapes, natural areas and the like were abolished or relaxed. A number of policies enacted in the 2000-2020 period provided inspiration for policy packages throughout Europe. These were territorially differentiated for maximum impact. Needless to say, **no densification** objective was set.

In urban areas, governments prioritized the building of eco-villages and promoted self-sufficiency of the new inhabitants. One example is the Oosterwold area in the Netherlands which suspends most planning restrictions, allowing landowners to build whatever they want, provided they do so in coordination with their neighbours and that they pay all infrastructure and service costs (Cozzolino et al., 2017; Jansma et al., 2013). Similarly, the Belgian tradition of allowing new homes if built along existing roads was viewed as a way to save on public costs and spur diffuse development. As cities became emptier, more extensive use of them became feasible; the Parckfarm project in Brussels on urban agriculture pointed a way forward to fill up abandoned urban land.

In rural areas, it was decided to cordon off the most valuable natural areas (Natura 2000) and make the rest open to development, thus maximizing the opportunity for people to realize their dream of a house in the country. Policy can also directly support this, by providing fiscal incentives for housing outside urban areas, as was done in Lithuania to combat the depopulation of rural areas. Finally, following countries like Croatia, amnesty could be granted for illegal second-home development.

Urbanization largely occurred piecemeal: first areas near existing urban areas were built up, and gradually development radiated outwards into more rural and natural areas. **By 2050**, these areas had absorbed a significant portion of the urban population, resulting in an absolute decline within cities, heralding the beginning of a post-urban era. Meanwhile, the countryside surrounding urban areas assumed first exurban, and then increasingly suburban characteristics. Some reflected on this development positively, while others were more sceptical about the sustainability of this policy course. Did it serve the long-term economic, ecological and social goals it aspired to?

Figure 5.4: Sample of diffuse scenario 2050 output for five selected regions

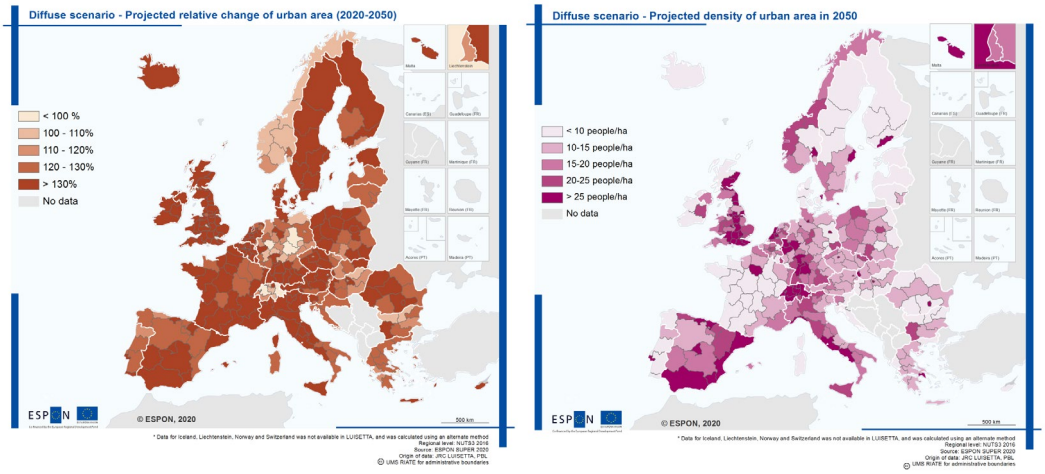


Bruxelles-Antwerp region, Belgium | Bologna-Ravenna region, Italy | Randstad region, Netherlands | Constanța region, Romania | Stockholm region, Sweden

Figure 5.4 displays the typical urbanization pattern produced by the diffuse scenario by 2050 in the LUISETTA model. The dark red regions show the new urban fabric; the light red areas were already built-up at the beginning of the scenario period. The diffusion of low-density urbanization along roadways was visible throughout the European territory. The Brussels-Antwerp area become even more amorphous than before and the scattered development in Romania became slightly more pronounced. On the other hand, the Randstad exhibits extensive ribbon development, which is uncharacteristic for the Netherlands. Not only agricultural land was consumed: in the Bologna and Ravenna region as well as in Stockholm, hills and protected natural areas progressively succumbed to development pressure.

Aggregated to the regional level, the diffuse scenario shows the most net increase in urbanization of the three scenarios; there is a 120-140% increase or more across the majority of the territory modelled, making it difficult to discern hotspots (see Map 5.5). Areas which show less urban growth include parts of Germany, Bulgaria, Switzerland, and Norway (although the latter two were calculated using a slightly different method). Despite the local diffusion and reduction of densities, at the regional level many areas increased their density (see Map 5.6). This is most pronounced in high-growth urban regions which comprise the 'Blue Banana' stretching from the UK to Italy and along the Spanish coast.

Map 5.5: (left) Diffuse scenario - change in urban are relative to starting year (2020-2050)
Map 5.6: (right) Diffuse scenario - density in population per ha of urban fabric (2050)



The diffuse scenario had positive as well as negative impacts on **economic sustainability**. The allocation of urban land followed the rules of the market. Building and development on greenfield were usually much cheaper than the regeneration of brownfields (Bruegmann, 2006), resulting in lower prices for industrial buildings, offices, and housing. Low land prices stimulated housing demand and job growth (Oueslati et al., 2015). Since many locations in the dispersed urban pattern could not be connected to public transport, travelling by car became even more the default transportation mode. Accordingly, transportation costs increased (EEA & FOEN, 2016; Longley et al., 2002) as did traffic congestion and the cry for expanding road infrastructure (Cinyabuguma & McConnell, 2013; EEA & FOEN, 2016; Hortas-Rico & Solé-Ollé, 2010; Klug & Hayashi, 2012). Marginal costs rose for local public services such as police, fire, waste collection, sanitation, road cleaning, and public lighting (Gielen et al., 2019) often to the point where they were no longer provided, and private-sector solutions had to be found. Furthermore, low-density living increased energy consumption, and therefore costs, per person (Couch et al., 2008; EEA & FOEN, 2016; Newman & Kenworthy, 1999).

Regarding **ecological sustainability**, this scenario had mostly negative impacts. Emissions levels as a whole increased due to enhanced use of cars and less regulation (E. L. Glaeser & Kahn, 2010; Norman et al., 2006). On the other hand, pollution was less concentrated given the more extensive use of space. Problems of higher noise and light pollution were also observed (Bennie et al., 2014), but also dispersed over a larger area. Because of the extensive land use, there was significant loss of agricultural land and open space, resulting in a decrease of biodiversity of species dependent on this kind of land use. On the other hand, the greater number of green and open urban spaces (e.g. unbuilt plots, large backyards, parks)

provided other species with a new habitat. Regarding climate change, this scenario had negative as well as positive impacts. Transition to more sustainable energy sources proved difficult due to higher land-consumption rates, and the dispersed spatial pattern increased the surface area of urban 'heat islands' (EEA & FOEN, 2016; Stone et al., 2010). However, some diffuse projects provided more land for buildings and outdoor activities, including urban green space (Wolch et al., 2014) and allowed for better climate adaptation strategies (e.g. space for water retention).

Regarding **social sustainability**, the diffuse scenario had positive as well as negative impacts. Because of low housing prices, people could easily move to low-density suburbs, which offered a desirable place to live for most people (García-Coll & López-Villanueva, 2018), with privacy and large gardens (Longley et al., 2002). For many inhabitants, living close to nature reduced stress and provided a feeling of well-being. But there were also negative impacts, especially regarding social equity and transport justice (Kenyon, 2011; Montgomery, 2013; Morency et al., 2011). In many urban areas, segregation was much more prominent than in the other scenarios (Antoniucci & Marella, 2018). Moreover, in some urban areas dispersion led to inner-city decline, disadvantaging those who chose to remain (Xie et al., 2018).

5.3 Reflection on sustainability

The three scenarios elaborated in this chapter are not intended as predictions nor as a scientifically valid ex-ante assessment of policy choices. Instead, they offer a structured way to reflect on the inestimable complexity and diversity of Europe and the various trade-offs and synergies inherent in land-use decisions. They are also intended to drive home the fact that the direction urbanization takes is the result of human decision-making, and therefore can be influenced by concerted action. In short, the scenarios need not be likely or realistic as long as they are plausible enough to stimulate a discussion on the advantages and disadvantages of policy directions with respect to sustainability.

The outcomes of the scenarios were not based on fantasy alone. They were derived from an extensive review of North American and European scientific literature, mostly from planning and environmental disciplines, which explains the large number of citations.[3] This literature review was created by collecting sources that – directly or indirectly – addressed the impacts of one or more of the three urbanization forms. These were then cross-tabulated with indicators on the three dimensions of sustainability. For each indicator, the scientific evidence was assessed on a five-point scale as to whether it suggested a (strong) positive or negative relationship. In some cases, the literature was inconclusive, contradictory, or revealed internal tensions. Compact development may reduce pollution overall, for example, but increase the exposure of humans to this pollution. Another complication is territorial diversity: study results could be the outcome of local characteristics. Given this multiplicity and divergence, the scenarios were not scored on their 'net' sustainability. The outcome of the analysis is presented in Table 5.2. Annex 4 contains an elaborated version of this table including references to the literature.

Table 5.2 reveals that none of the three scenarios is a clear 'winner' in terms of sustainability. Even diffuse development, usually labelled as sprawl, is not negative on all counts. The wide variety of results and the futility of trying to balance fundamentally different values (e.g. health, jobs, biodiversity) in a scientific manner means that one cannot tally the results to obtain a net sustainability score, even within individual dimensions. Moreover, the large number of ambiguous results (+/-) confirms that such aggregation would lead to unfounded conclusions anyway. Most importantly, the scores were given on the basis of best judgement of

[3] Although urban form differs between the two continents, the richness of the literature on urban containment and transit-oriented development in North America proved helpful in assessing the different aspects of sustainability. Most findings were found to be generic enough to be applicable to both contexts (e.g. walkability affecting obesity or containment affecting home prices).

researchers, and do not reflect actual preferences of elected officials who are charged with actually making the decisions in a particular territory. The weight given to indicators is ultimately a political choice.

Table 5.2: Sustainability of different urbanization types

	Compact	Polycentric	Diffuse
Economic sustainability			
GDP, wealth	+/-	++	+
Public finance	+ +	+	-
Jobs	+ +	++	+/-
Accessibility	+/-	++	+/-
Business areas	++	++	+/-
Housing demand	-	+	+
Transportation costs	+/-	+	- -
Energy consumption	+	+	- -
Ecological sustainability			
Reducing mobility (by car)	+ +	+ +	- -
Reducing pollution, including CO2	+ +	+	- -
Green urban areas	-	+	-/+
Biodiversity	+/-	+/-	--
Land consumption	+	+	- -
Natural hazards	-	+	+/-
Climate change	+/-	+	+/-
Consumption of resources	+/-	+	-
Renewable energy	+/-	+/-	+/-
Space for future water retention	+	+	+
Circular economy	+	+	-
Social sustainability			
Health	+/-	+/-	+/-
Affordable housing	+/-	+/-	+ +
Equity/inclusion	+/-	+	- -
Public and recreational space	+/-	+	+/-
Variety (high-rise, suburban, etc.)	+	+	+
Mixed-use areas	+	++	-
Satisfaction with home environment	+/-	+	+

Looking closer at the economic dimension, a disciplinary bias might be present. The few economic and 'sprawl apologist' studies consulted argue that diffuse development is closest to market distribution, hence efficient and wealth-producing. Most of the other collected sources disagree due to missed agglomeration effects, externalities, high energy and transportation costs as well as the strain on public finance. The compact and polycentric scenarios score roughly equally but in different categories. Regions suffering from stagnant housing production may look more favourably on polycentric, for example, whereas those with severely limited budgets may gravitate towards compact urbanization.

The ecological dimension presents a similar overall picture but is riddled with internal dilemmas and feedback. For example, the lower overall pollution levels in compact and polycentric is offset by higher concentrations. To make an educated policy decision, it is therefore necessary to assess this trade off with respect to the local situation, for example, if unhealthy concentrations have already been reached. Similarly, the ecological benefit of conserving land through density in the compact and polycentric scenarios also implies less space for ecological services and renewable energy. Which route is most attractive or favourable will again depend on local policy objectives. The diffuse scenario is generally negative on all environmental indicators except space for water retention.

The social dimension, finally, presents a much different picture. Here, the diffuse scenario does not lag behind the others, showing some clear advantages over the other two in terms of individualistic indicators such as housing affordability and satisfaction with the residential environment. It fares less positively in terms

of mixed-use areas and social inclusion. Although urban containment should drive up housing prices, such policies are generally implemented alongside affordable housing policies, which offsets this impact. Interestingly, given the heightened interest in health with respect to COVID-19 pandemic, the results were too mixed to offer any real guidance on this matter.

In conclusion, the scenarios and the assessment framework provide a way for decision-makers and policymakers to talk about urbanization and land-use decisions. It opens up a space for policymakers, and indeed everyone, to reflect on fundamental choices without becoming mired in the minutiae of everyday struggles or notions of plausibility or feasibility. As such it provides a structured forum for discussion, which can promote a common understanding of long-term issues, find common ground, and pave the way to commitment to strategic collective action.

6 Conclusions and recommendations

The last task and ultimate purpose of the SUPER project is to provide relevant, feasible and appropriate recommendations to decision-makers and policymakers. The evidence presented in the previous chapters comprise the basis for formulating conclusions and recommendations. In the first section, we highlight several key observations from the previous chapters. Next, we present more normative messages suggested by the evidence, which can be construed as recommendations. Finally, we identify future research needs.

Importantly, guidance and recommendations for decision-makers and policymakers emanating from the SUPER project is provided in a more extensive manner in the *Guide to Sustainable Urbanization and Land Use* (Annex 5), a handbook supporting stakeholders setting up policy measures at local, regional and national levels. Specific guidance is provided to:

- local and subnational decision-makers on the main types of interventions available (i.e. containment, densification, regeneration, governance and sectoral policies in the field of transport, environment and rural development);
- local and subnational policymakers on the types of instruments available (i.e. visions and strategies, legal devices, land use regulations, incentives programmes and projects);
- national level actors on different policy options, the trade-offs they present in relation to the different dimensions of sustainability, and the instruments through which they can be achieved;
- EU level actors on the types of instruments available for promoting sustainable urbanization and land use (i.e. legislation, funding instruments and strategic documents, with particular attention devoted to the EU Urban Agenda SLU_NBS partnership).

It includes examples of effective policy interventions, place-based approaches, enhanced territorial cooperation and tailor-made solutions. It also provides warnings regarding pitfalls and barriers to achieving sustainable urbanization and land use, usually related to side-effects or transferability problems. Additionally, eleven textboxes, each focussing on one of the project's case studies, are placed throughout the text which show readers how interventions affect development practices in context.

6.1 Wrap-up of analyses

The analysis of land-use **developments** in 2000-2018 show a strong, but not perfect, correlation between drivers and land use changes. Urbanization is a multifaceted phenomenon, allowing various typologies to be drawn up (e.g. composition of urban fabric and morphology); the binary distinction between 'no net land take' and 'sprawl' is too simplistic and should be avoided in the policy discussion. The sustainability of these developments can be expressed in terms of efficiency on each of the three dimensions (i.e. economy, ecology, society), but the analysis reveals inherent trade-offs between dimensions as well as synergies. This underscores that achieving all sustainability aspects simultaneously is a complex undertaking.

The analysis of the 235 collected **interventions** revealed that the most relevant EU policies aiming at sustainable urbanization were mainly soft in nature; more powerful policies in terms of funding and binding legislation had a more indirect impact on land-use. The (sub)national intervention analysis identified over 40 relevant success factors. Coordination, collaboration, a long-term perspective, reusing resources and inclusion of private partners were viewed as the most important, whereas opinions were evenly split on the merits of centralization/decentralization.

The analysis of **practices** provided in-depth insight into the degrees to which interventions affect urbanization practices, and – importantly – under what conditions. The cases reveal successful strategies for

garnering and sustaining political support for interventions, recall implementation accomplishments and mishaps, and reflect on the relative contribution to sustainable land use.

Finally, the **scenarios** pull together the previous analyses and project them onto three plausible yet distinct developmental pathways (compact, polycentric and diffuse) for 2050. The outcomes provided by the land-allocation model and the application of the sustainability assessment framework reveals distinct advantages and disadvantages of each pathway as well as different synergies and trade-offs within the dimensions of sustainability. In this sense, the conclusions to the analysis of the future mirrors that of past developments.

6.2 Policy messages and recommendations

This section provides the main policy messages and recommendations of the SUPER project. These are the product of an internal discussion within the SUPER project team and with the ESPON Project Support Team. Workshops with relevant stakeholders to discuss the policy relevance and usefulness of preliminary recommendations were unfortunately cancelled due to the COVID-19 pandemic. Therefore, validation will have to take place beyond the project period.

6.2.1 Learn from the past and the future

The evolution of European land use occurs gradually and in a piecemeal fashion. In the 2000-2018 period, we saw slightly more than half of one percent of the surface area under investigation change its function (0.6%). Much of this regarded an exchange between agricultural and natural land or changes within categories. Urbanization, which accounted for almost half of this land-use change, is particularly significant because it is so unidirectional: over eight times of land is converted to urban use than back. This aspect of irreversibility justifies policy attention.

This policy discussion should bear in mind the nuanced lessons drawn from the analysis of land-use developments in the 2000-2018 period. In general, we find that it is difficult to make blanket judgements about sustainability at the pan-European level because:

- The **distribution of developments** is highly heterogeneous. For example, we see signs of agricultural intensification in some parts of Europe and agricultural abandonment in others. We see strong urban growth in some parts of Europe, slower development in others and even deurbanization in some instances. We see sharp rises in infrastructural land-use in some areas (also per capita), whereas others remain stable. We see some monocentric cities expanding by means of contiguous or clustered development while others display profound urban diffusion. Finally, we see that some regions shifted from one urban type to the other as their urban composition changed.

- The **effects of developments** are highly heterogeneous. In many cases, a development signals a trade-off between different dimensions of sustainability. For example, an increase of urban fabric per capita suggests more living space and improved housing affordability (social sustainability) but less efficiency in terms of land consumption (environmental sustainability). There are even tensions within dimensions: intensification of agricultural activities points to more efficient land-use and conceivably more room for nature, but also a higher concentration of pollution, which can damage nearby habitats.

Despite this differentiation, we have also noted some general correlations. For example, we observed that urbanization can largely be explained by drivers such as population and socio-economic development, particularly the 2008 crisis. Given this, the probable economic crisis following the COVID-19 pandemic should also resonate in future land-use decisions, ultimately changing the map of Europe. Depending on how the pandemic has affected public opinion, we could also see radically new housing and business location preferences, which would shift urbanization pressure to different types of locations. This underlines the importance of making and using policy scenarios such as those drawn up in the SUPER project for 2050 to explore the advantages and disadvantages of different developmental trajectories (e.g. compact, polycentric

and diffuse). It also provides a basis for discussion on the synergies and trade-offs with respect to sustainability.

6.2.2 Interventions can and do affect urbanization and land use

Even though drivers create pressure for land conversion, practices still determine the actual land-use developments. These practices depend on the incentives, power structures, and interaction of various stakeholders within an arena framed by the prevailing territorial governance and spatial planning system and sectoral policies in place.

The SUPER project has found that it is possible to design interventions that adjust the payoffs or orientation of stakeholders – and thus their behaviour in the development process – to more sustainable ends using a combination of carrots, sticks and sermons. The database is replete with examples that raise costs associated with greenfield development or lower them for regeneration and infill. In some cases, interventions prohibit building in certain areas (e.g. restrictive zoning) or sanction it (e.g. permit zoning at higher densities) via the land-use planning system. Information, such as on underutilized urban sites or the costs of infrastructure provision, can also be used as an intervention to promote sustainability.

Even though it is impossible to measure the impact of such interventions on land-use developments (there is no control group to tell us what would have happened otherwise), the case studies do provide insight into this matter. Stakeholders involved in the development process overwhelmingly asserted that the interventions had an impact on standard development practices. Moreover, thanks to the pedagogic and demonstrative effects of the studied interventions, cultural change and environmental awareness had intensified. On the other hand, the case studies also showed that impact was often inhibited by factors such as lack of political will and inefficient institutional mechanisms.

On balance, it could be argued that even though interventions may not always be able to alter macro-developments producing demand for certain land uses, they can affect the spatial allocation of this demand. Since some configurations or land-use combinations are more sustainable than others, this provides perspective to policymakers.

6.2.3 European policies can support or undermine sustainability

The analysis of EU policies has shown that, despite having no formal competence for spatial planning, there is substantial evidence showing it has a substantial impact on territorial governance and spatial planning systems and hence, urbanization and land use. While most EU-policies were assessed as supportive of sustainable urbanization and land-use, some have effects that potentially run counter to this aim. Usually, the impact is indirect or a side-effect (e.g. cohesion policy, competition policy) while other times spatial planning systems in member states are specifically called on for the implementation of EU policies (e.g. Seveso directive). Many interventions (15%) included in the SUPER database were found to be EU-inspired or EU-funded. Some EU policies even address urbanization and land use matters specifically (e.g. European Spatial Development Perspective), but these tend to take the form of non-binding agreements. A particularly relevant EU initiative is the Partnership on Sustainable Use of Land and Nature-based Solutions (SUL_NBS) under the Urban Agenda. As a multi-level stakeholder platform, SUL_NBS could build on the insights of the SUPER project and its own experiences to promote sustainable urbanization and land use.

Given this de facto impact, we can posit that if the EU wishes to prioritize sustainable land-use, it should at least seek to align its own policies to this end. For example, the EU could reduce the land consumption of structural funds by making sustainable land use a precondition for support. Land use considerations could also be included in efforts to ‘green’ the common agricultural policy. For legislative proposals, it is advisable to integrate sustainable land use into ex-ante impact assessments. Finally, further research should be carried out identifying the most significant conflicts between existing policies.

6.2.4 Territorial differentiation needed

The analysis of interventions shows initially very little regularity in terms of what works and why. The investigated interventions are very heterogeneous in terms of goals, scales, soft or binding instruments, and in their degree of success in terms of own goals and sustainability. Successful interventions in some regions are seen failing in others. The SUPER project was able to extract scores of factors that condition and influence the level of success of interventions. These include socio-economic conditions, spatial planning regulations, and the urbanization structures and processes, but also not-so-obvious elements as cultural factors or the level of trust towards public authorities. These highly contextual factors can hinder the transfer of even the most successful interventions from one territory to the other (as also highlighted by the results of the ESPON TANGO and ESPON ReSSI projects).

The analysis of interventions moreover suggests that it is difficult to be successful to the same extent in all aspects of sustainability simultaneously; sustainability includes divergent forces and mechanisms that are hard to reconcile. Moreover, what might be considered sustainable in one region may be unsustainable in another. One can posit that each region has its own imbalance between the three dimensions of sustainability. For example, a region struggling with housing affordability may need to prioritize social sustainability to achieve a better balance, whereas a heavily polluted region may need to prioritize environmental sustainability for the same reason. Synergies are also present, but also territorially differentiated: several case studies showed how, for instance, the conservation of a particular open area (environmental sustainability) offered an opportunity for public uses (social sustainability) and profit (economic sustainability). The analysis also found that cultural perceptions and interests play a major role in shaping land-use practices. Hence, in order to create more sustainable practices, consciousness-raising and mobilization are important first steps.

All this suggests that generic targets or one-size-fits-all regulations have only limited value. The Roadmap to a Resource Efficient Europe, for example, sets a target of zero net land take by 2050. Although such targets can be appealing for their clarity and are relatively straightforward to monitor, they also neglect the importance of territorial context, such as the state of the local economy, ecology or society. As such, they can fail to gain the commitment of those entrusted to make local land-use decisions. Another danger is that less quantifiable targets would take a back seat; various stakeholders indicated that environmental considerations often enjoyed a privileged position vis-à-vis social issues.

6.2.5 Proactive long-term holistic thinking aids short-term implementation

For electoral reasons, it is tempting for politicians to focus on quick-fix solutions to concrete and urgent problems rather than addressing complex long-term issues that require a more holistic approach. Sustainable urbanization and land use often lack political immediacy, especially when it requires a change in culture. On the other hand, the case studies reveal that most interventions were supported by a widespread perception that urbanization practices had become unsustainable. This suggests that public authorities should provide leadership in crafting long-term holistic strategies or visions in which to embed operational interventions. Decision-makers should be reassured by our finding that most stakeholders in most cases approved of the measures finally put into place.

The case studies suggest that interventions should be embedded into a clear, inclusive and comprehensive strategy or vision. The interviewed stakeholders often lamented the lack of adequate long-term visions, speculating that if their intervention had been supported by such a vision, it would have been easier to implement. Moreover, it can allow interventions to be viewed as part of a wider strategy where land-use decisions are made according to optimising the thematic dimensions of sustainability which leads to a better future (temporal sustainability), rather than on the basis of opportunism, expedience or jurisdictional politics. Taken together, we can say that visions enhance the institutional sustainability of interventions. And this institutional sustainability, in turn, helps the interventions to (1) succeed in its immediate goal and (2) produce long-term effects through cultural change, consciousness raising, and new governance practices.

In general, a higher level of scale is needed to transcend parochial interests and strike a balance between the three dimensions of sustainability. It is also helpful if the level at which a vision is made has legislative authority (e.g. national governments or federal states). The analysis of (sub)national interventions showed that unidimensional interventions at the local level had a lower success/sustainability rate. Interestingly, most case-study interventions at lower tiers of government tended to be more comprehensive and those at the national level more specific, suggesting that more work is needed to coordinate policy areas at higher tiers. Tensions can also occur between sustainability at different levels of scale, implying a need for better multi-level governance.

6.3 Recommendations for future research

Considering its geographical and substantive breadth, the SUPER project was carried out in a very short time frame. It has rapidly unearthed a large amount of information and produced extensive, yet rather preliminary, analyses using a wide range of methodologies, some of which are quite novel. During the project, significant knowledge gaps were identified which could not be adequately addressed within the scope of the project. Given the large amount of work that remains undone, many of the conclusions and recommendations here require further substantiation and investigation. In this section we highlight the most salient future activities that are needed to verify or challenge the findings of the SUPER project.

6.3.1 On land-use developments

More research is needed about what the Corine database can and cannot tell us about urbanization. Exploration of this vast dataset and its capabilities and drawbacks – partly revealed only when compared to other datasets – could only be performed in a superficial manner given the time constraints. For sustainable urbanization, finding a solution to the problem of how diffuse development is registered is of paramount importance because these measurements, when used to underpin analyses on efficiency and sustainability, can result in spurious findings and untenable recommendations.

Finally, more relevant data should be linked to the SUPER database for analysis, particularly environmental indicators in order to enhance the link with sustainability or explore the applicability of indexes such as the Human Wellbeing Index and Ecosystem Wellbeing Index (Shaker, 2015). The ESPON project on quality of life indicators, which ran parallel to SUPER project, is an obvious choice. In addition, pan-European data on the location of public services and facilities (e.g. schools, hospitals) developed in the PROFECY project will allow for more sophisticated analyses (Kompil et al., 2019). In addition, if any reliable pan-European data becomes on secondary homes, this could be integrated in the analysis of urbanization drivers.

The SUPER project was able to create two new typologies of urban regions, one on the basis of composition (cluster analysis) and the other on urban form (morphological analysis), but could not take the next step of using these typologies analytically. A logical next step would be to explore how these types relate to sustainability indicators, for example. In addition, it would be interesting to compare the morphological analysis to other methods attempting to measure European urban form and explore whether a shift to grid cells rather than NUTS3 regions would product substantially different and better results.

6.3.2 On interventions

To our knowledge, the survey and analysis of interventions in the SUPER project have provided the best evidence base available on this topic. Still, the compiled database was largely based on an online questionnaire sent to ESPON relations and associations involved in spatial planning and territorial governance. The responses therefore have a bias as they likely reflect the professional values of the respondents and some countries are clearly underrepresented. A wider disciplinary focus would enhance the rigour of the database. More desk research on the impact of the interventions would help counteract some of this bias.

The SUPER project identified success factors mostly on the basis of relatively cursory information in the database, but with clear examples. More in-depth empirical research in relation to a sample of interventions would provide insight into the workings of these factors in determining success and failure of interventions. Similarly, targeted research on how EU policy (particularly cohesion policy) can promote sustainable urbanization and land use is a logical next step to the general findings signalled in this project.

The fact that the urban partnership on Sustainable Land Use and Nature Based Solutions ran parallel to the SUPER project meant that both activities could at most support each other with exchange of basic information and experiences, something which was also compromised by the COVID-19 pandemic. More exploration of how network-based research programmes such as ESPON can support network governance such as the urban partnerships is warranted since the latter seems to becoming more commonplace (Evers et al., 2020).

6.3.3 On practices

The case studies have provided a rich empirical base which has only superficially been probed in the context of this project. Given the strong methodological base, it is possible to explore various hypotheses in more depth regarding the extent to which interventions can alter practices. These could be explicitly researched/tested in future policy-oriented studies and contrasted to the burgeoning comparative institutional literature on land development practices (Buitelaar & Leinfelder, 2020; Gerber et al., 2018; Tennekes et al., 2015).

In addition, the case studies in the new member states in particular raised the issue of the impact of the European union on development practices. The Polish case study regarded an EU policy explicitly, while Croatia's intervention was influenced by European policy and the Romanian experience chronicled increasing Europeanization. These case studies add a multi-level governance aspect to the study of sustainable urbanization, which should be explored further to understand how the EU is affecting this phenomenon both explicitly and implicitly.

6.3.4 On policy directions

The LUISETTA model used in this project is state-of-the-art but, partly for this reason, there are numerous issues which still need to be ironed out in order for it to generate more reliable results. Within the scope of this project, it was possible to produce outputs that roughly corresponded with each scenario storyline, but the level of confidence is rather low – the maps produced are remotely plausible at best. Given the purposes of this project (initiating a discussion with stakeholders on the desirability of divergent development models), LUISETTA was sufficient. But as a tool for land-use impact assessments, more refinement is necessary, and more insight needed in the mechanisms of especially the demand module. The model in its current form has some nontrivial drawbacks for modelling possible future urban development, such as limited information about existing planning policies at the (sub)national level, the inability to have development occur as large projects rather than piecemeal and, perhaps most importantly, the inability to simulate infill or densification (or even regeneration given the amalgamation of office and industrial land use categories).

In addition, more research is needed on land management issues related to fiscal components, ownership rights and urbanization process. Many drivers like these could not be addressed within the SUPER project due to data constraints. Also more targeted research on the interface between elements of the spatial planning system and (un)sustainable outcomes is needed, such as how land is zoned or granted development rights, how much unbuilt land possesses development rights and the political, legal and financial costs of reducing such rights.

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