ESPON

EUROPEAN UNION

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Inspire Policy Making with Territorial Evidence

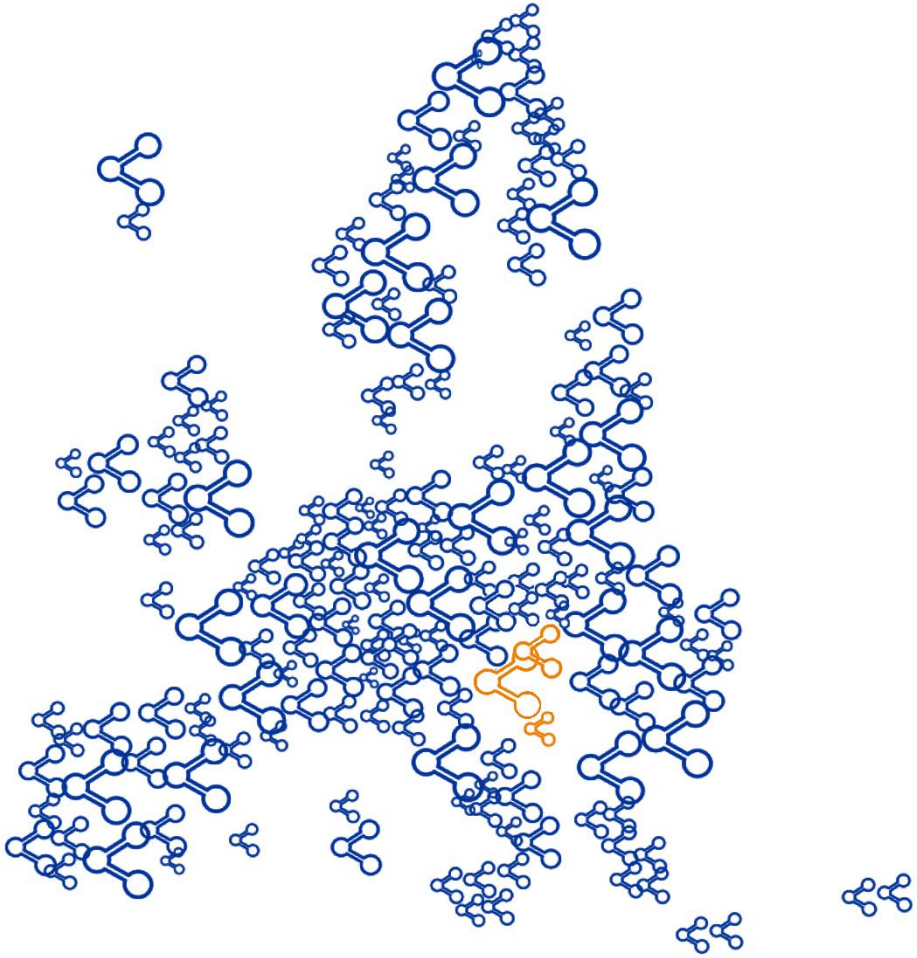
Territorial fiche

Territorial patterns and relations in Croatia

Land use and urbanisation

Climate change

Sustainable use of natural resources



Interactive version: www.espon.eu/croatia

Introductory remarks

The content of the following overview is a summary of research results from different thematic applied research projects under the ESPON 2020 programme. As a consequence, most indicators and analyses are not based on most recent data but represent the data availability at the time when the research was undertaken. Only in a few cases, for some rather basic indicators that could easily be reproduced, more up-to-date information was used.

It is therefore important to note that this overview is mainly a collection of available findings with different time stamps and not an up-to-date, comprehensive analysis. Its main goal is to showcase the wide range of ESPON research and, by zooming-in on a specific country, to raise interest for the scientific results at a more national and even regional scale.

Land use and urbanisation

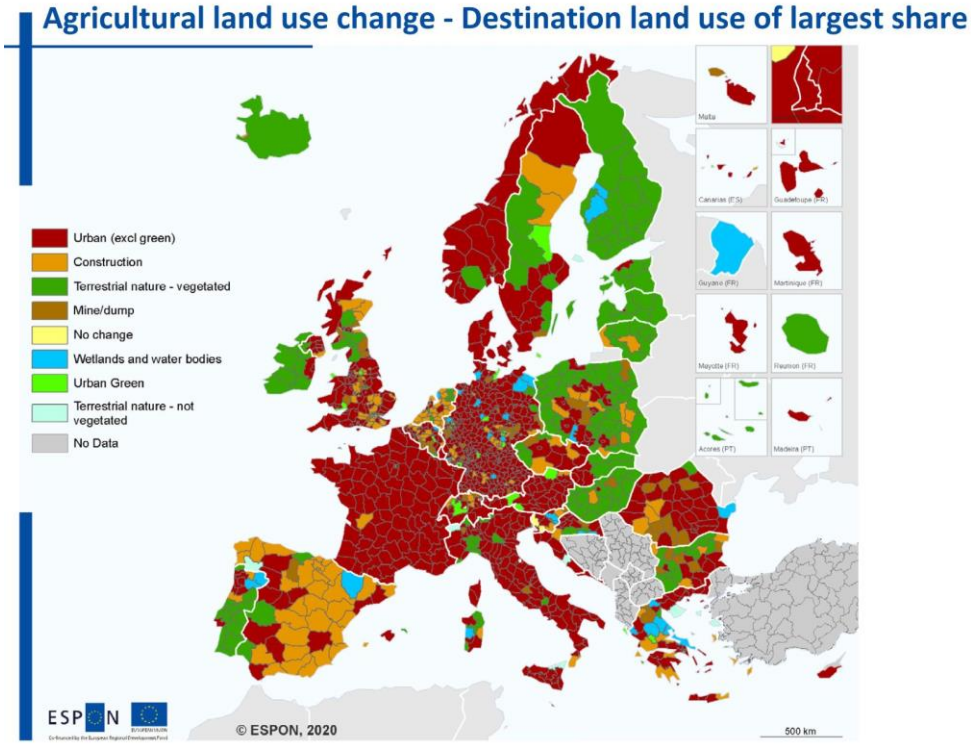
Destination of change in agricultural land-use

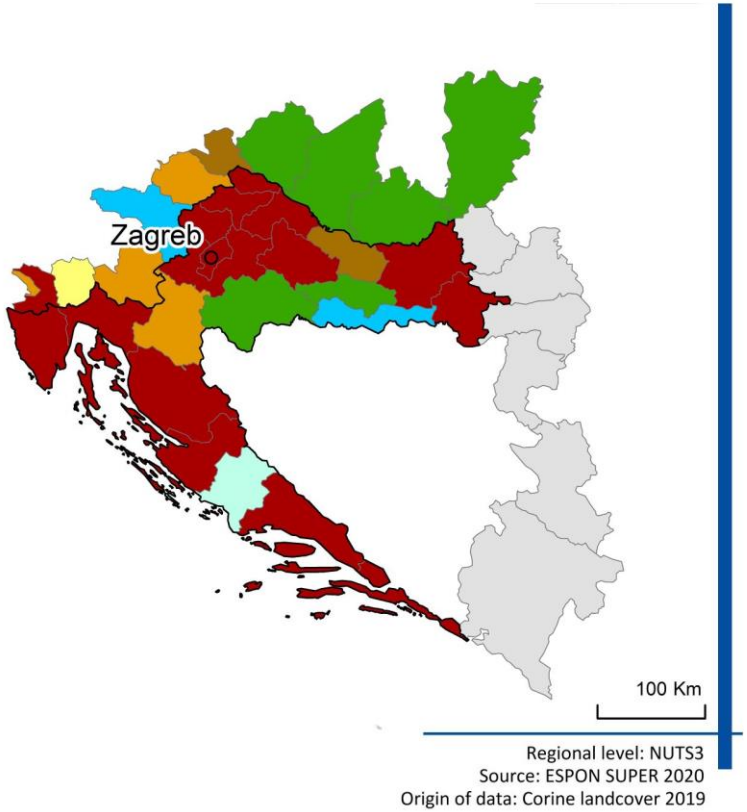
Urbanisation

Urban shrinking

The chapter "Land use and urbanisation" focuses on the change in agricultural land use, urbanisation and urban shrinking. Three maps show the evolution of the situation between 2000 and 2018 in Europe with a focus on Croatia. In Croatia from 2000-2018, as in most other regions of Europe, the predominant trend of change in land use is from agricultural to urban. In the Pannonian Region of Croatia, the predominant reason for this change is the phenomenon of suburbanisation, while along the Adriatic coast the development of tourism is the main focus. The highest urbanisation ratio in Croatia between 2014 and 2018 is found in the southern coastal county of Split-Dalmatia and the north-eastern lowland county Osijek-Baranja.

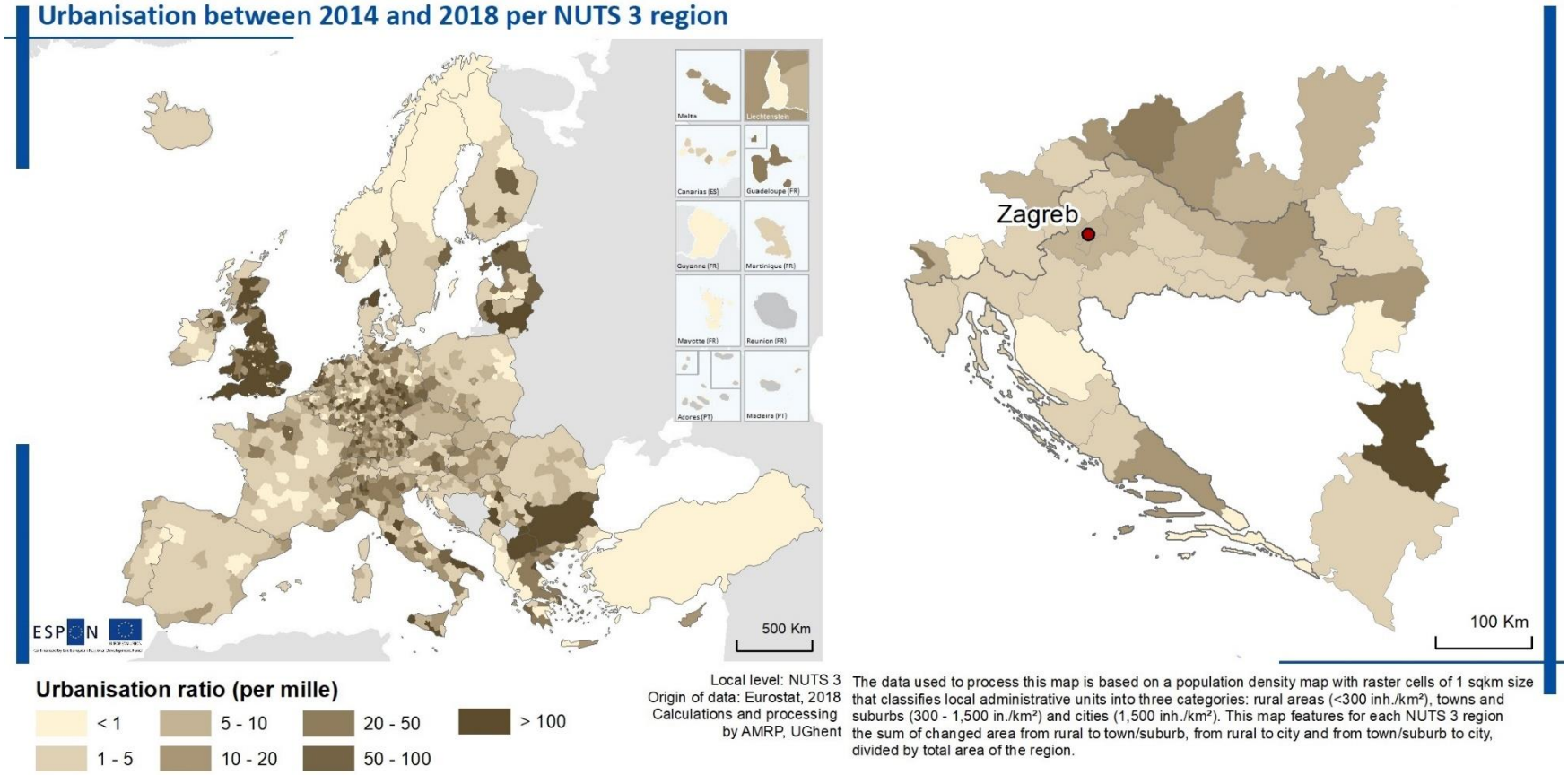
Urban shrinkage in Croatia is a combination of the traditional emigration routes from the mountains to other Croatian regions or abroad, and the new, recently created emigration areas in the lowland - Slavonia. The highest urban shrinking ratio in Croatia between 2014 and 2018 is found in the counties Brod-Posavina (98), Dubrovnik-Neretva (96), Lika-Senj (84), and Sisak-Moslavina (34).





This map shows agricultural land use change in Europe between 2000 and 2018. Agricultural land is more frequently abandoned in Finland, Estonia, Latvia, Lithuania, Poland, Slovakia, Hungary, Bulgaria, Portugal, Ireland, and Iceland. In almost everywhere else, agricultural land is mostly urbanised. Change from agricultural to urban land use is predominant in Norway, France, Germany, Austria, Italy, Croatia, and Romania. A significant proportion of the land converted from agricultural land use to (currently unused) construction areas is characteristic of Spain and the Netherlands. Land use change to industrial land use and mineral extraction or dump sites account for a much smaller share of land in Europe.

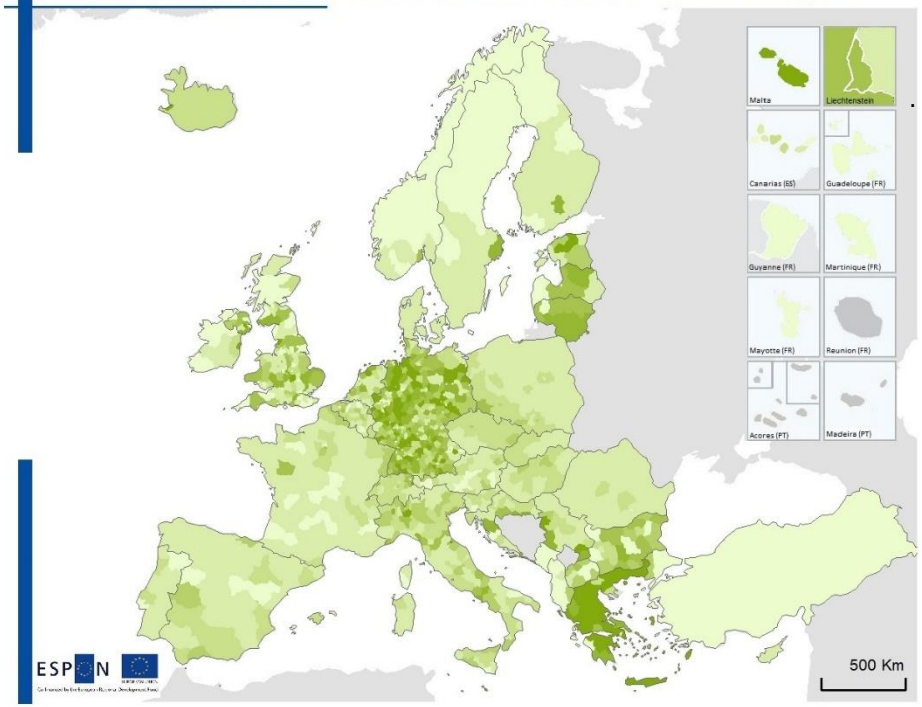
The predominant trend of agricultural land use change in Croatia is towards urbanisation. Croatia has a higher urbanisation rate of agricultural land than its neighbouring regions in Hungary and Slovenia. In contrast to the Pannonian inland region of Croatia, where the reason for the land use change from agricultural to urban use is the suburbanisation process, the main driving force of urbanisation along the Adriatic coast is tourism development. Agricultural land is abandoned in the inner periphery of the counties Sisak-Moslavina (southeast of Zagreb) and Požega-Slavonia in Central Slavonia and has changed into wetlands and water bodies along the Sava River in the county Brod-Posavina. Other agricultural land use changes include mineral extraction or dump sites (in the county Virovitica-Podravina (in the north-east of Croatia)), construction sites (Karlovac County) and change to natural areas (terrestrial nature) for the coastal Šibenik-Knin County.

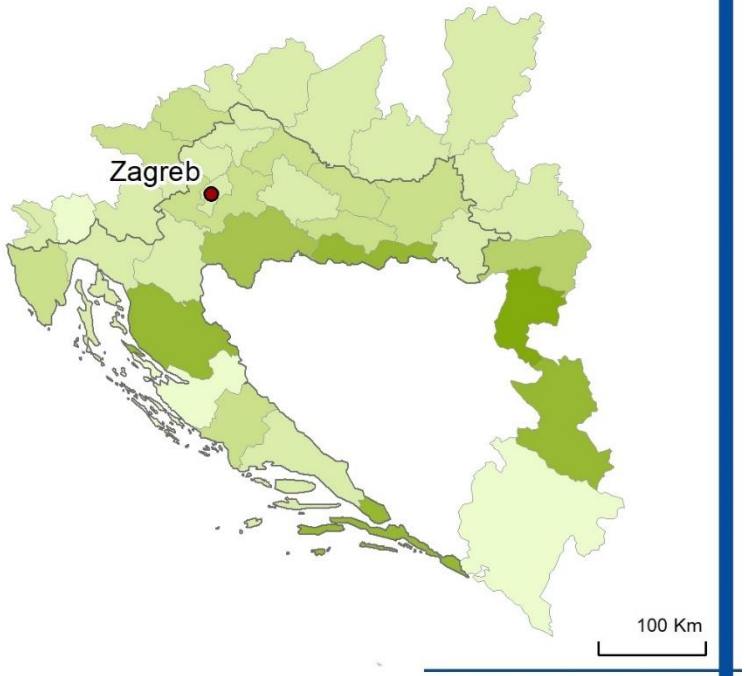


Final report of the ESPON SUPER project outlines residential development as one of the main drivers of urbanisation. Another driver is economic growth. More economic growth creates demand for more industrial areas, warehouse space, shops and offices. This development can be independent of population development and follows a different logic in terms of the location and space requirements. The speed of urbanisation is related to the composition of urban land use, which differs from region to region and from country to country. Although almost all forms of urban land use (urban fabric, industrial/commercial, infrastructure, urban green, construction sites) are present everywhere, their compositions vary.

The urbanisation ratio in the Croatian border regions is generally similar to that of neighbouring regions in Slovenia, Hungary and Serbia. The highest urbanisation ratio in Croatia (10-20 km² per 1000 km²) is found in the coastal county Split-Dalmatia (13) and in the lowland county Osijek-Baranja (11). In the second class (5-10) are 6 continental lowland counties in the north of Croatia: Međimirje (6,9), the city of Zagreb (6,3), Koprivnica-Križevci (6,1), Vukovar-Srijem (5,9), the county of Zagreb (5,4) and Virovitica-Podravina (5,1). 11 counties are in the 3rd class (1-5). Counties Dubrovnik-Neretva and Lika-Senj both have urbanisation ratio 0.

Urban shrinking between 2014 and 2018 per NUTS 3 region





Urban shrinking ratio (per mille)

< 1	5 - 10	20 - 50	> 100
1 - 5	10 - 20	50 - 100	

Local level: NUTS 3
Origin of data: Eurostat, 2018
Calculations and processing by AMRP, UGhent

The data used to process this map is based on a population density map with raster cells of 1 sqkm size that classifies local administrative units into three categories: rural areas (<300 inh./km²), towns and suburbs (300 - 1,500 in./km²) and cities (1,500 inh./km²). This map features for each NUTS 3 region the sum of changed area from city to town/suburb, from city to rural and from town/suburb to rural, divided by total area of the region.

Urban shrinkage has become a widespread phenomenon across Europe, posing new challenges to traditionally growth-oriented spatial planning. Some densely populated urban areas face significant population losses over a long period of time. Five main drivers are found, often in a combination: economic transformation (decline of uncompetitive areas), suburbanisation (migration of people and jobs to the suburbs, hollowing out of the core city), demographic change (falling birth rates, migration to rural areas), structural upheaval (collapse of a political system, unrest, resettlement) and environmental pollution. High urban shrinkage is characteristic of Greece, Bulgaria, Lithuania, Latvia, parts of Estonia, Germany, the UK, Croatia, and Serbia.

The urban shrinking ratio in the Croatian border regions is generally similar to that of Italy, Slovenia, Hungary, and Serbia. The highest urban shrinking ratio in Croatia (50-100 km² per 1000 km²) is found in the counties Brod-Posavina (98), Dubrovnik-Neretva (96) and Lika-Senj (84). In the second class (20-50) they are followed by the Sisak-Moslavina (34). In the third class (5-10) are 7 counties, in the fourth class (1-5) 9 counties. Zadar (0.6) in fifth class has the lowest urban shrinking ratio in Croatia. Urban shrinkage in Croatia is the combination of traditional emigration from the mountainous to other regions or abroad and the new, recently created areas of emigration in the lowlands (Slavonia). Other mountainous regions had already experienced high emigration before, so there is not much left to show urban shrinkage.

Climate change

Aggregate potential impact

Potential cultural impact

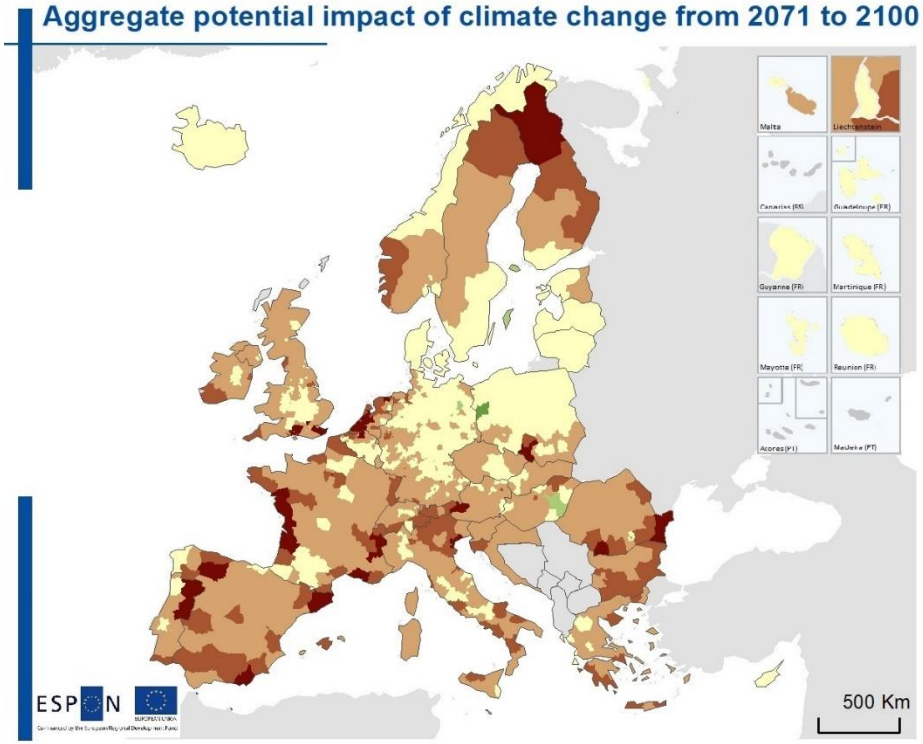
Potential environmental impact

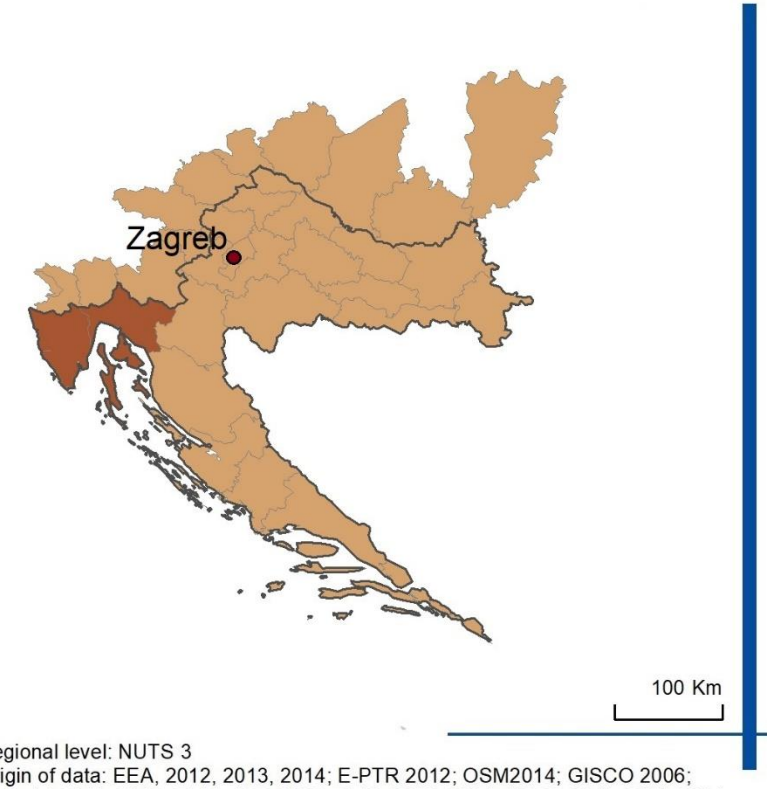
Potential economic impact

Potential physical impact

Potential social impact

The chapter "Climate change" focuses on aggregated potential impacts: cultural, environmental, economic, physical and social impacts. Six maps show the potential situation between 2071 and 2100 in Europe with a focus on Croatia. Like most of Europe, the majority of Croatia will suffer from a low level of aggregated negative potential impacts of climate change. The highest (medium) level is predicted for the western counties of Istria and Primorje-Gorski Kotar.
The characteristics in terms of population, socio-economic development, topography and urban structures of each region have a determining influence on the type of climate change impact. For instance, regions with a high potential of peak temperature in combination with an important rate of elderly or other vulnerable population groups will undergo a high social climate change impact. The cultural impact focuses on World heritage sites and museum, while the environmental and economic impact are dependent of the ecological and economic resilience of regions. Finally, the potential physical impact takes into consideration the state of the infrastructure, such as roads, railways and settlements.





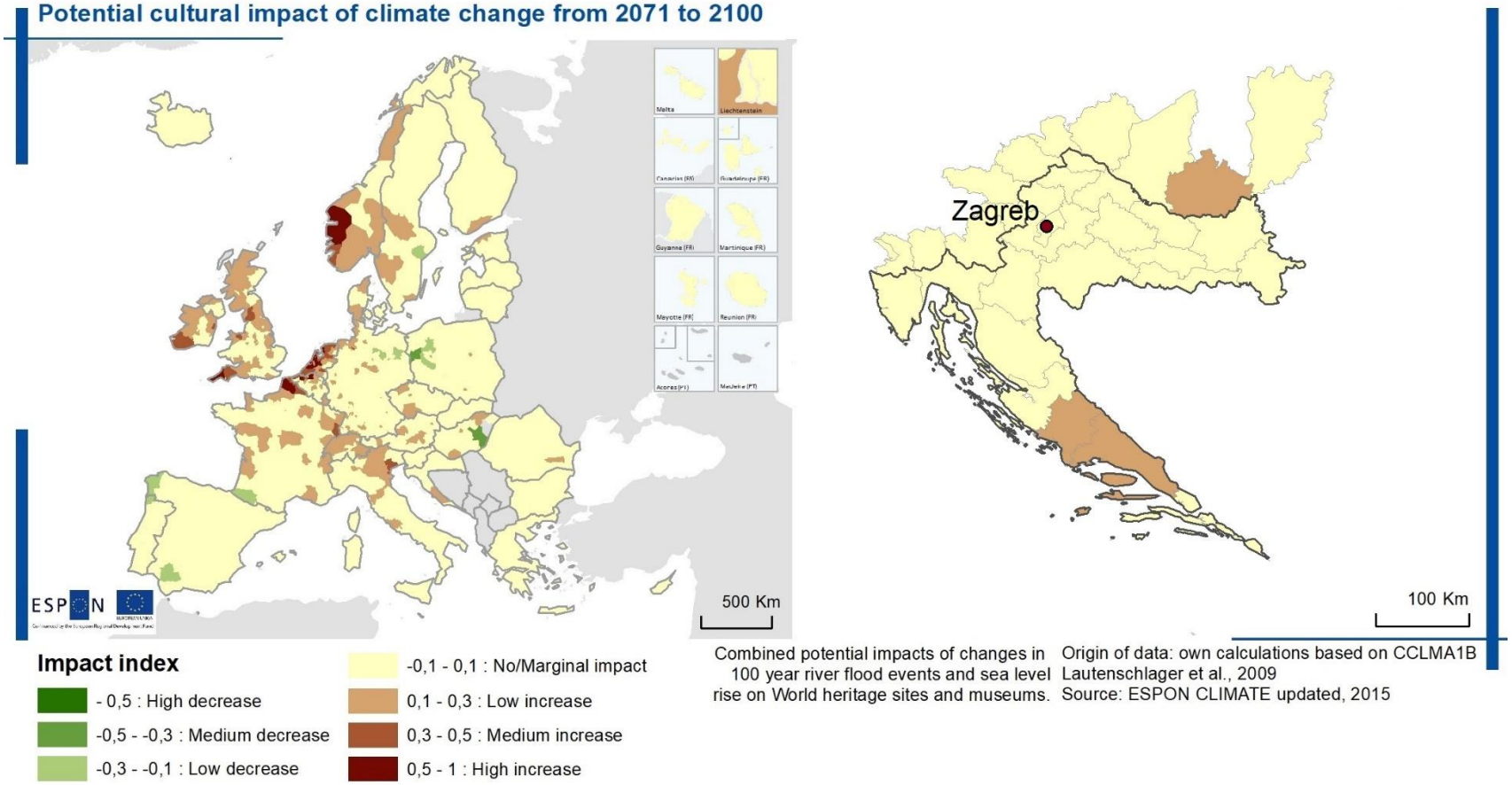
Aggregate potential impact of climate change

- Medium positive impact (-0,5 - -0,3)
- Low positive impact (-0,3 - -0,1)
- No/Marginal impact (-0.1 - 0.1)
- Low negative impact (0.1 - 0.3)
- Medium negative impact (0.3 - 0.5)
- High negative impact (> 0.5)

Regional level: NUTS 3
Origin of data: EEA, 2012, 2013, 2014; E-PTR 2012; OSM2014; GISCO 2006; Eurostat 2011, 2013, 2014; JRC 2006, 2012, 2013, 2014; USGS 2011, DIVA 2004, ATSR2014; Statistics Iceland 2011; Bundesamt fur statistik 2011, 2014; Amt fur Statistik Liechtenstein 2014; HESTA 2014.
Source: ESPON CLIMATE updated, 2015

Climate change impacts the majority of European regions and there are differences in the capacity to respond to these changes through mitigation, adaptation and resilience measures. The potential impact of climate change is aggregated according to the degree of exposure (the exposure to natural hazards or the effects of climate change), the sensitivity of the region (the potential for economic, social and ecological damage) and its response capacity (the ability to react to and mitigate). The impact of climate change concentrates mainly along regions with natural borders (rivers, mountains, coastal regions). Most of Europe will have a low negative impact. Medium and high negative impacts are expected for Northern Finland and Sweden, most coastal areas, some river valleys, the Alps and the Rhodope Mountains. In the area around the Baltic Sea, Poland, Germany, Denmark, Norway, and Iceland no, or only marginal, impacts are expected.

In Croatia, the potential negative impact of climate change is highest in the western counties of Istria and Primorje-Gorski Kotar. In these areas, a medium level of potential negative impact of climate change is predicted. The rest of Croatia has a low level of negative potential impact of climate change - similar to all other nearby regions in Hungary, Slovenia, Austria and Italy.

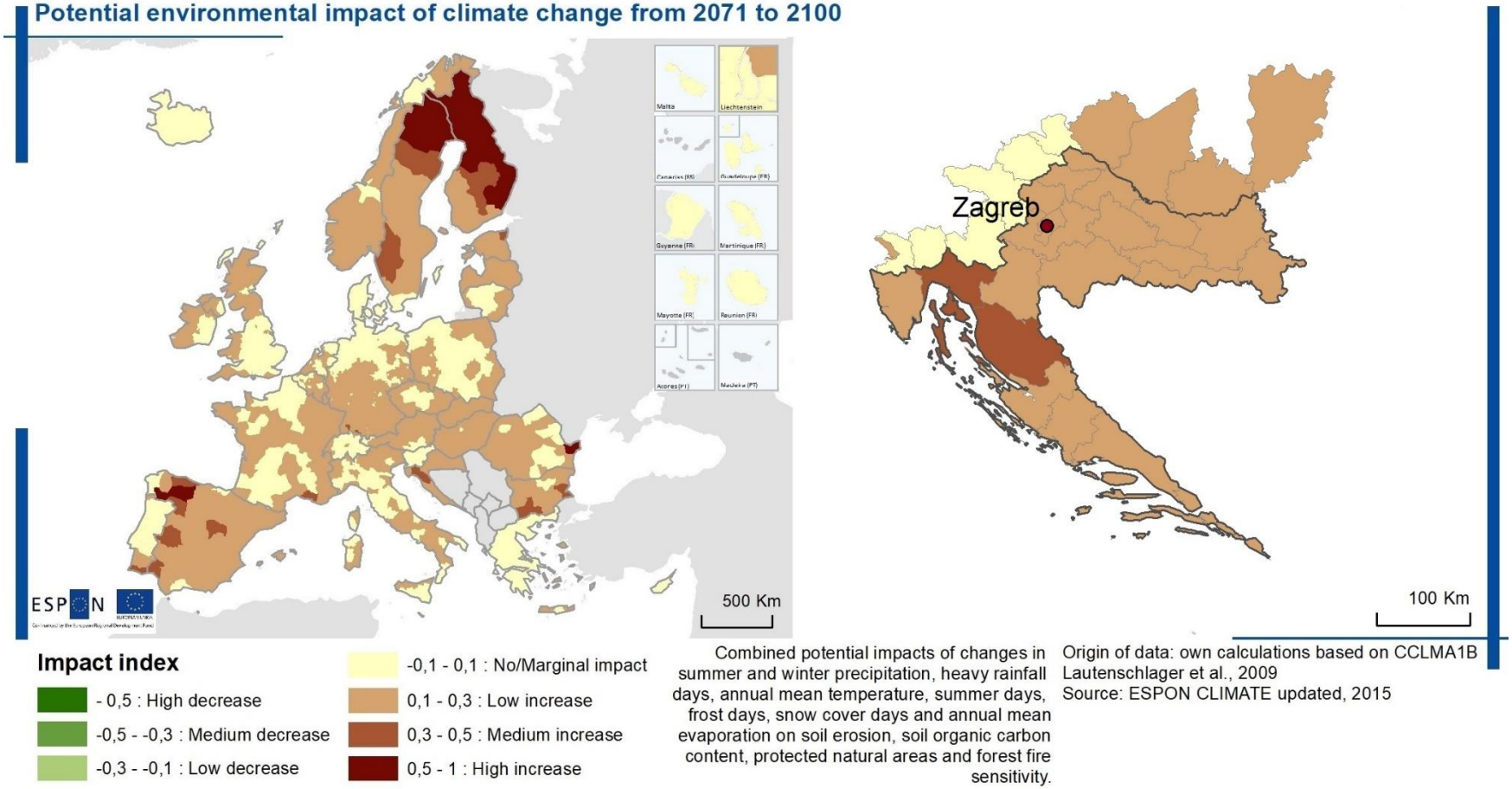


Combined potential impacts of changes in 100 year river flood events and sea level rise on World heritage sites and museums.

Origin of data: own calculations based on CCLMA1B Lautenschlager et al., 2009
Source: ESPON CLIMATE updated, 2015

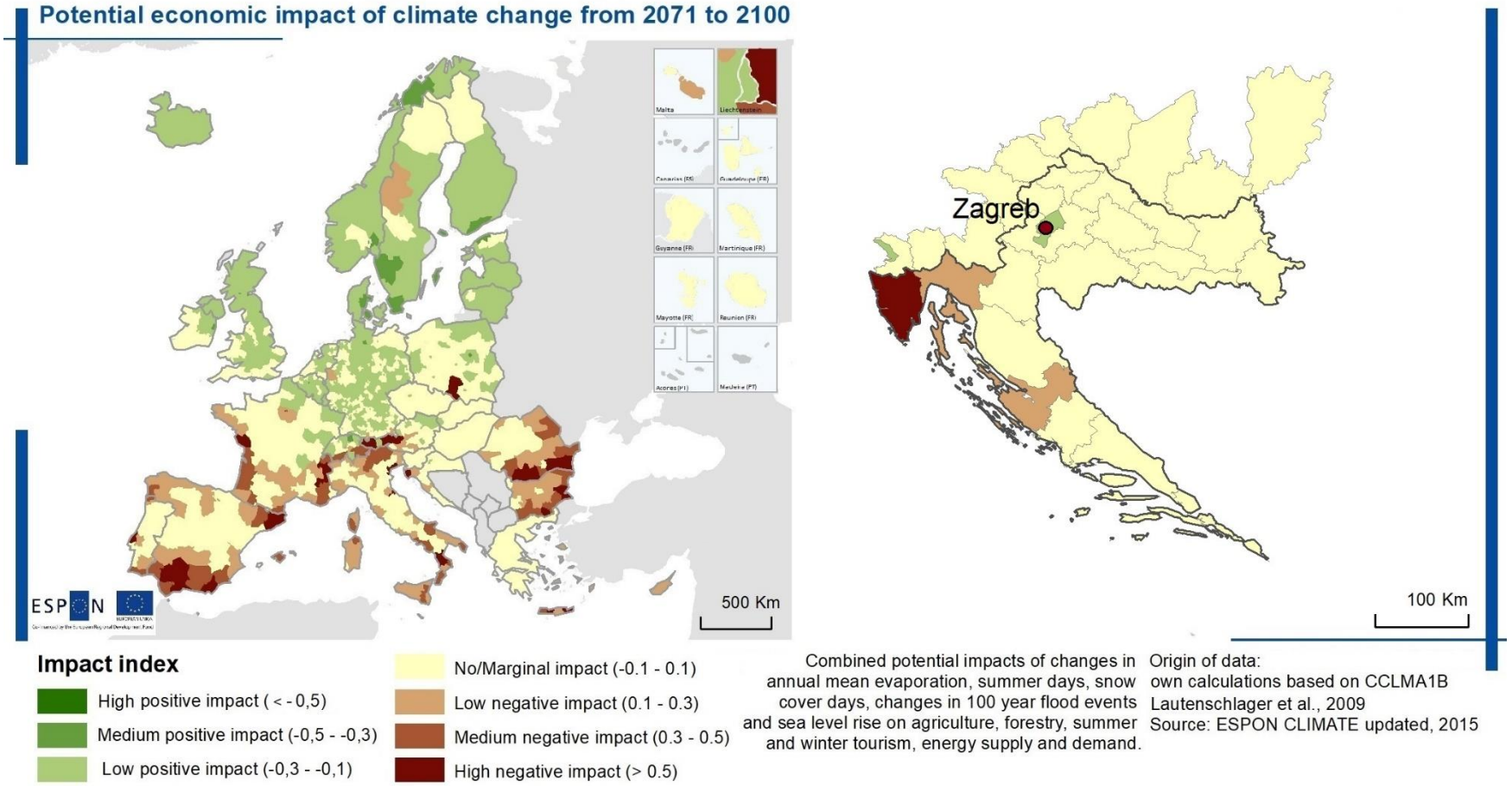
The potential impact of climate change on cultural assets is an issue for few European regions. These arise mainly from changes in the frequency and scale of extreme events to which cultural heritage sites and museums are sensitive. Creeping changes in temperature and precipitation will not play significant roles. The impacted regions in northern Europe include cultural sites and museums and are most affected by an extreme increase in risk of flooding. The impacted regions in France and Italy are due to the predicted increase in the risk of flooding combined with the density of cultural heritage sites The risk of extreme weather events may pose a particular threat to cultural assets. This also helps to illustrate the distribution of areas in Europe with an expected increase in the cultural impact of climate change. Most of Europe will experience a minimal effect. River deltas, valleys and some coastal areas are particularly at risk.

Most of Croatia will experience no or only a marginal cultural impact of climate change, comparable to the nearby regions of Hungary and Slovenia. A low increase is expected for the two counties at the Adriatic coast. Šibenik-Knin and Split-Dalmatia have a higher density of cultural heritage sites.



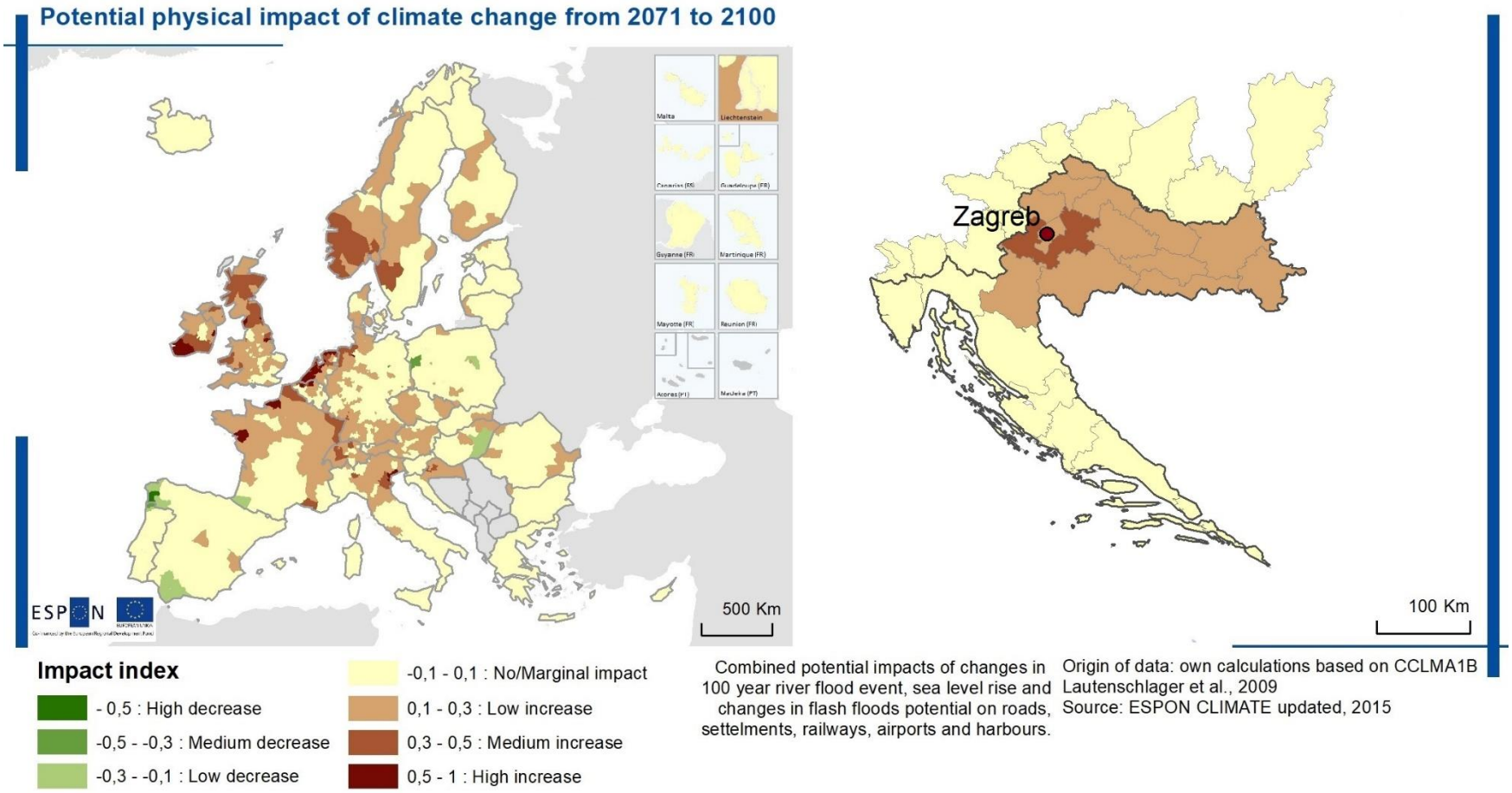
Climate change will affect all parts of nature. Many plants and animals will adapt to it, while some protected natural areas, soils or forests may be more sensitive to the changes. It is expected that the potential environmental impact of climate change will increase, particularly in southern and northern Europe. The severe impacts in northern Europe are partly due to its very large protected areas. The predicted warmer and wetter climate will have a negative impact on the protected ecosystems. In the Mediterranean region, the drier and hotter climate increases the risk of forest fires. For Finland, Sweden, Spain, Croatia, Bulgaria, and Romania a high increase in potential environmental impacts is expected. Large parts of the rest of Europe will experience either a low increase or marginal/no impact. Factors determining the severity of this impact are steep mountain slopes and associated soil erosion, the risk of forest fires, soils in river deltas and sensitive northern ecosystems.

Most of Croatia will experience a low increase in the potential environmental impact of climate change. This is similar to nearby regions in Hungary and Italy, but higher than Slovenia. One impact hotspot is the area of two mountainous Croatian counties on the Adriatic coast; Primorje-Gorski Kotar and Lika-Senj will experience a medium increase in potential environmental impact. The sensitive ecosystems in the mountains of Gorski Kotar and Velebit will also be affected.



Some economic sectors are more sensitive to climate change than others. The sectors most affected are agriculture, forestry, tourism, and energy. In terms of potential economic impact, there is a North-South divide in Europe. Due to improved environmental conditions for agriculture and reduced heating needs, the North is expected to have no, only a marginal increase, or even a decline in potential economic impact. For the South, the economic impact is expected to increase due to worsened conditions for agriculture, tourism and enhanced energy demand due to increased cooling needs. Most southern regions are economically dependent on summer tourism and agriculture. Both are projected to be affected by the increase in temperature and the decrease in precipitation. The economic impact in south-eastern Europe is a consequence of the impact on agriculture. The Alps are a hotspot due to the predicted decrease of snow cover.

A high negative potential economic impact is predicted for Istria, the most developed tourist region in Croatia. A low negative impact is predicted for Primorje-Gorski Kotar and Zadar. A low positive impact is predicted for the city of Zagreb. The rest of Croatia will experience no or only a marginal economic impact of climate change.

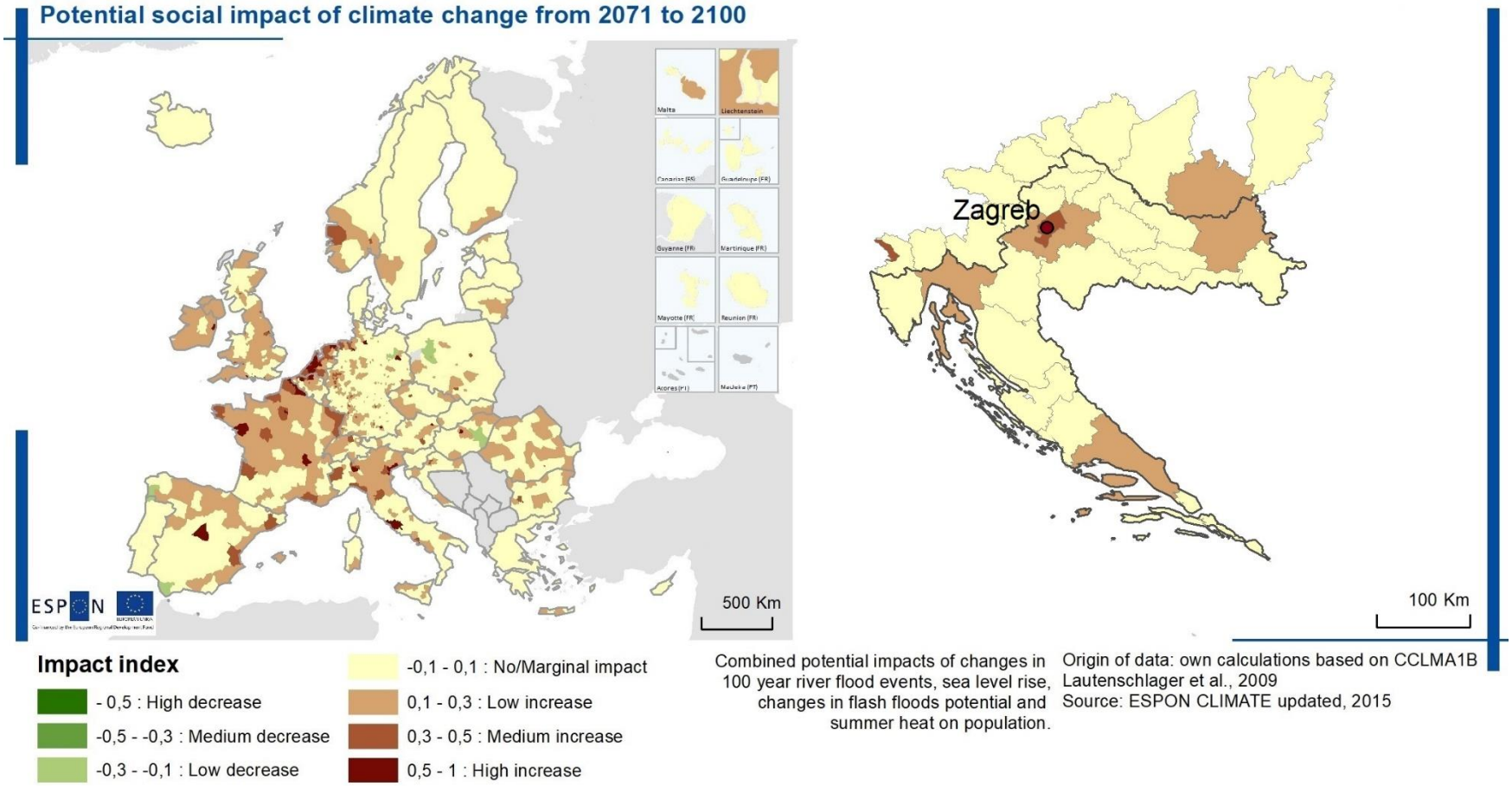


Combined potential impacts of changes in 100 year river flood event, sea level rise and changes in flash floods potential on roads, settelments, railways, airports and harbours.

Origin of data: own calculations based on CCLMA1B Lautenschlager et al., 2009
Source: ESPON CLIMATE updated, 2015

A number of physical human artefacts are important for territorial development and may be affected by climate change. These include settlements and transport infrastructure (roads, railways, airports, harbours…). They can be sensitive to extreme weather events, such as floods and storms, which are expected to increase in many areas. The north-western European regions along the coast of Atlantic Ocean may face a rise in sea level and a predicted increase in river flooding. Other small hotspots can be found in the regions in and around the Alps, at the outlet of the Rhone, in the Po Valley, in Venice and in some parts of central-eastern Europe. Most river valleys in Europe may be vulnerable to river flooding, but this is not the case for Eastern Europe due to decreasing precipitation. For the rest of Europe only marginal effects are expected.

Due to intensive suburbanisation and high infrastructure density, the highest increase in potential physical impact of climate change is predicted for the Zagreb County around the Croatian capital. For the rest of continental Croatia a small increase in the potential physical impacts of climate change is expected. For the coastal areas of Croatia it is predicted that there will be only marginal or no impact due to the general mitigating effects of karst. It is believed that this carbonate rich topographic formation will have a stabilizing effect in the changing climate.



Combined potential impacts of changes in 100 year river flood events, sea level rise, changes in flash floods potential and summer heat on population.

Origin of data: own calculations based on CCLMA1B Lautenschlager et al., 2009
Source: ESPON CLIMATE updated, 2015

The human population may itself be affected by climate change in terms of public health and personal mobility, for example. This implies attention to river and coastal flooding, flash floods and heat islands in urban areas threatening senior citizens. The potential social impact of climate change is projected to increase in many parts of Europe. The highest increase is expected for western regions, coastal areas, river basins and agglomerations. Large parts, particularly in northern, central and southern Europe, will experience no, or only marginal, effects.

The potential social impact of climate change will affect four macro-regional urban centres in Croatia: Zagreb, Split, Rijeka and Osijek. The potential social impact of climate change in Croatia is predicted to be highest in the city of Zagreb, the capital of Croatia, where it will reach medium rate, reflecting the situation in other urban areas of similar size in Europe. Low increase is expected for Zagreb County around the capital, the counties of Osijek-Baranja, Primorje-Gorski Kotar and Split-Dalmatia. The rest of Croatia is expected to have no, or only a marginal, social impact of climate change.

Sustainable use of resources

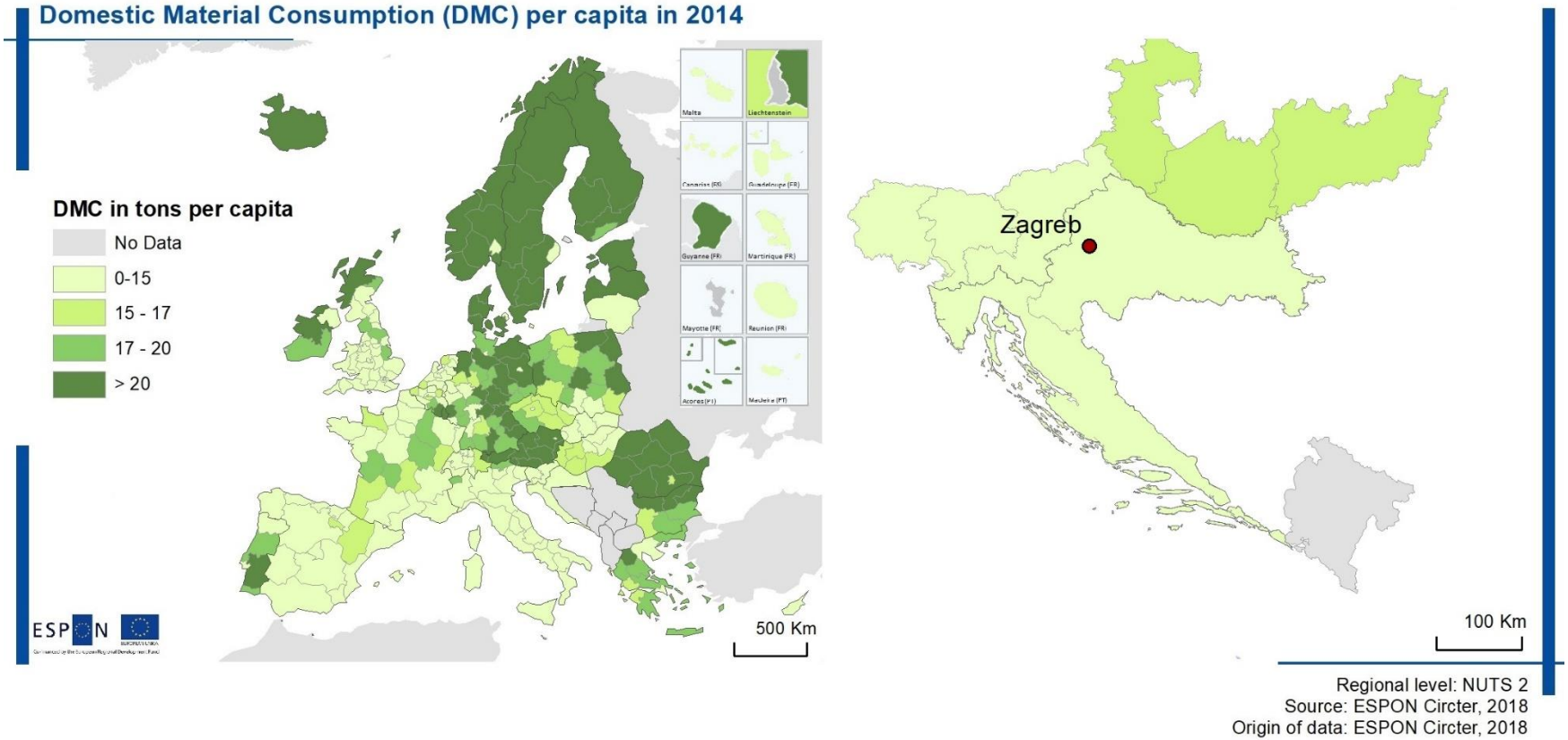
Domestic Material Consumption
Turnover growth
Green Infrastructure

Share of protected areas
Solar energy potential
Wind energy potential

The chapter "Sustainable use of resources" focuses on domestic material consumption (DMC), turnover growth, green infrastructure, the share of protected areas, solar energy potential and wind energy potential. Six maps show the situation between 2010 and 2019 in Europe with a focus on Croatia. In 2014, Croatia had low DMC per capita. Between 2010 and 2015, inland Croatia was well positioned in Europe with a growth rate of 20-30% in turnover per person employed while the coastal areas had a lower growth rate of up to 10%.

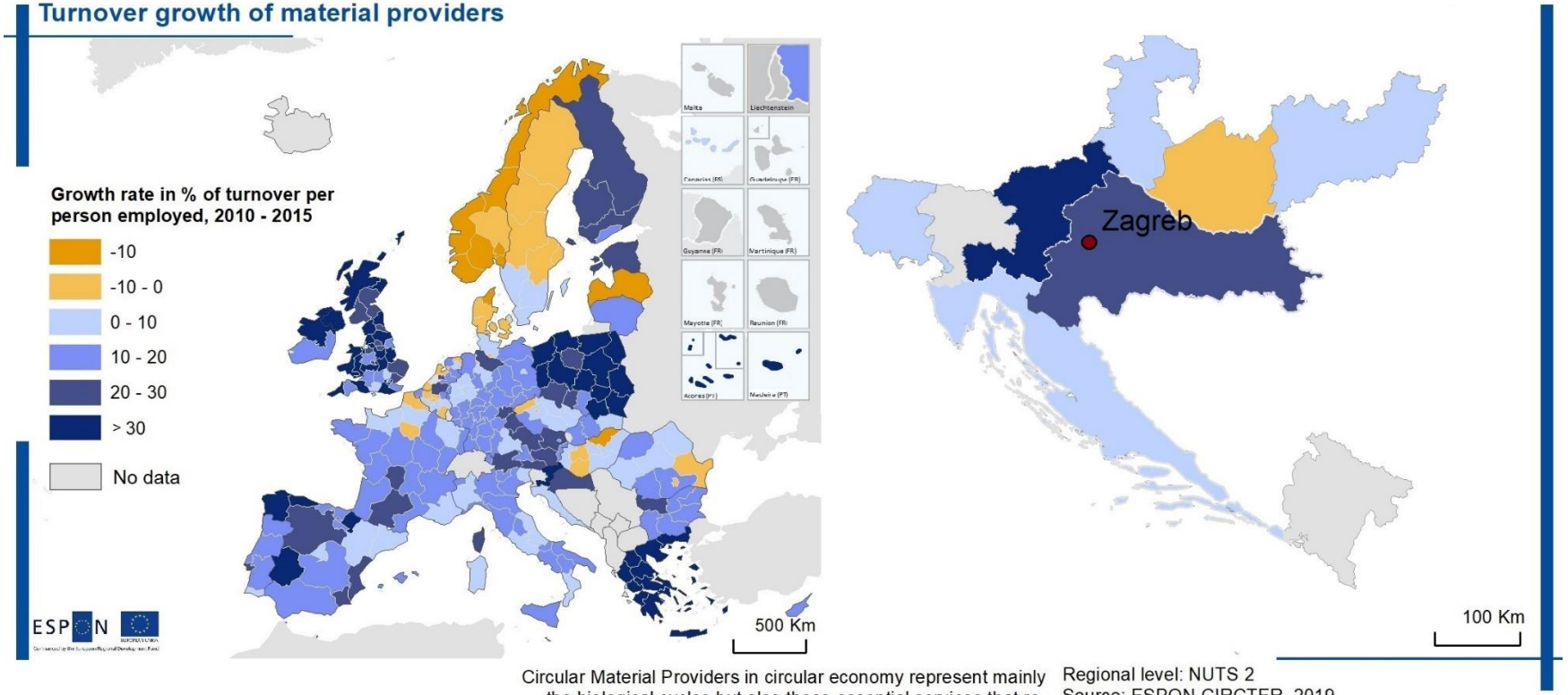
Croatia has a high share of green infrastructure. Coastal regions have a share of over 80% coverage, while the share of inland regions is between 60% and 80%. Croatia is an ecological corridor to Slovenia and the Alps for many animal species. The country has a long tradition of protected areas, many of which are also at sea. The oldest national park Plitvice Lakes was established in 1949 and in 1979 it was added to the UNESCO World Heritage List. Croatia has the second highest share of protected areas in the EU. The highest share in Croatia (50-100%) is located in the four mountainous coastal counties Primorje-Gorski Kotar, Lika-Senj, Zadar and Dubrovnik-Neretva.

When compared to the average photovoltaic energy potential in Europe (most counties having a potential of over 400 megawatt hours per km^2) Croatia has average potential. Inland Croatia generally has a higher photovoltaic potential than the coastal part of the country. Croatia has a higher onshore wind energy potential than neighbouring countries. The highest potential is on the Adriatic coast between the towns of Rijeka and Šibenik. In 2015, 11.4% of total Croatian consumption was generated by wind power.



In order to be able to discuss circular economy potentials, material resource use can be measured in terms of domestic material consumption (DMC) in tons per capita. This indicator only takes into account the actual mass of imported and exported goods when crossing international boundaries. The lower the DMC per capita value, the less primary material input is expected to flow into the system. There are some differences in Europe with high consumption in the Nordic countries, Estonia, Latvia, Austria, Romania, and parts of Germany, Poland, Portugal, and Greece. High consumption is often related to the use of natural resources (e.g. forestry, mining and agriculture) or to less densely populated areas (e.g. because building materials and infrastructure are distributed among fewer people). There is a trend towards lower consumption rates in metropolitan and capital city regions.

For 2014 Croatia has low DMC per capita, similar to nearby regions in Hungary, Slovenia, and Italy. The whole country is in the 0-15 tons per capita class of DMC.

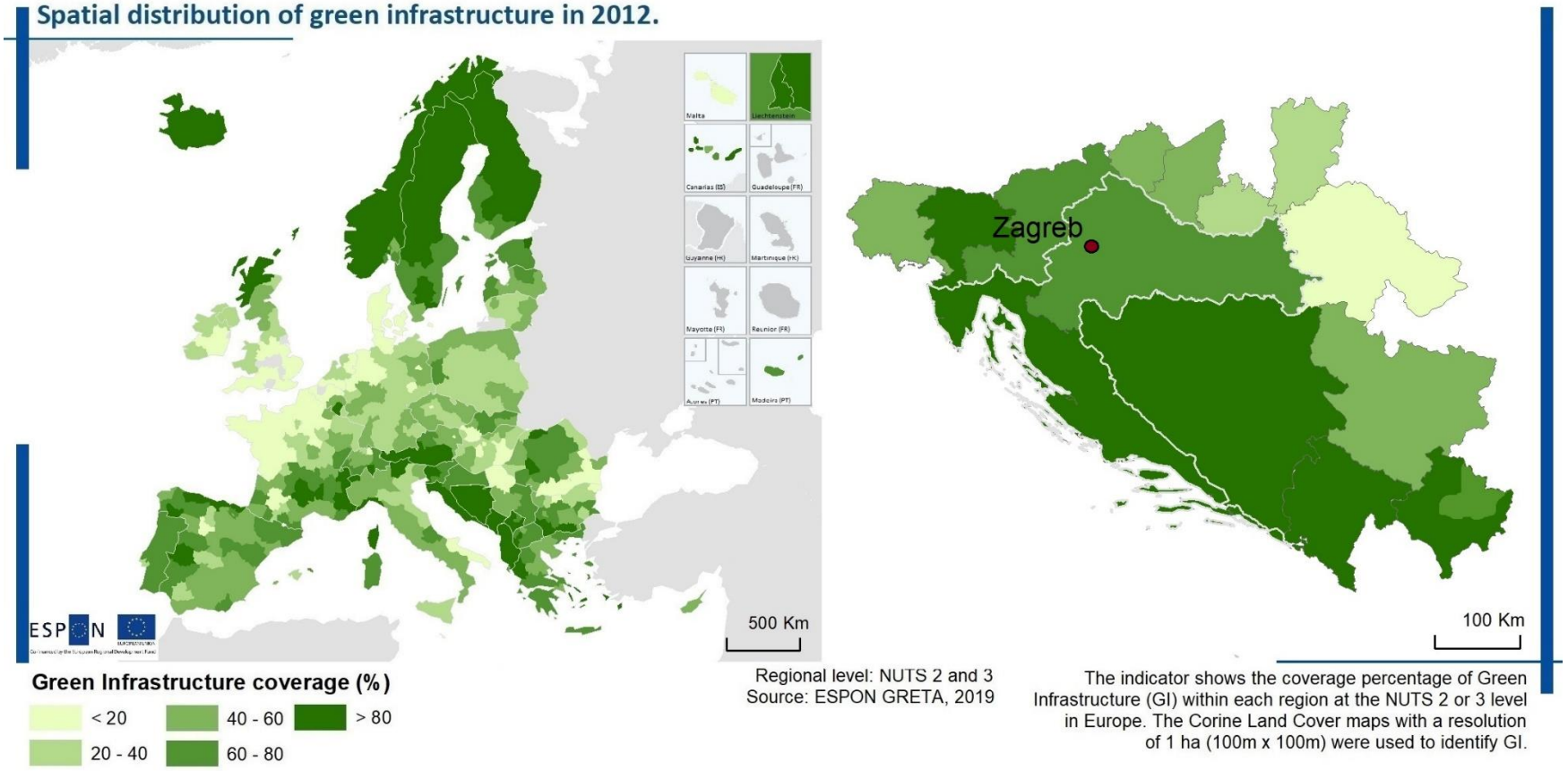


Circular Material Providers in circular economy represent mainly the biological cycles but also those essential services that re-introduce wastes as resource into existing value chains. They provide materials comprised of renewable and recycled materials.

Regional level: NUTS 2
Source: ESPON CIRCTER, 2019
Origin of data: Eurostat, 2019, calculated by Prognos AG.

The map shows the growth rate of the turnover of material providers per person employed from 2010-2015. Specific indicators have been developed and used on the basis of the ESPON CIRCTER project. Organic farming, sustainable forestry and the provision of wood materials, waste collection and recycling services are examples of the circular economy material providers sector. Circular economy providers make an important contribution to the economic structure of the regions with up to 13% of employment in some European areas. Sustainable agricultural and forestry activities play an important role, especially in rural areas. The map also shows the mechanisation, intensification, and specialisation of forestry and agriculture. Finland, Estonia, Poland, Austria, the UK, and some regions in Spain show above-average turnover growth of material providers.

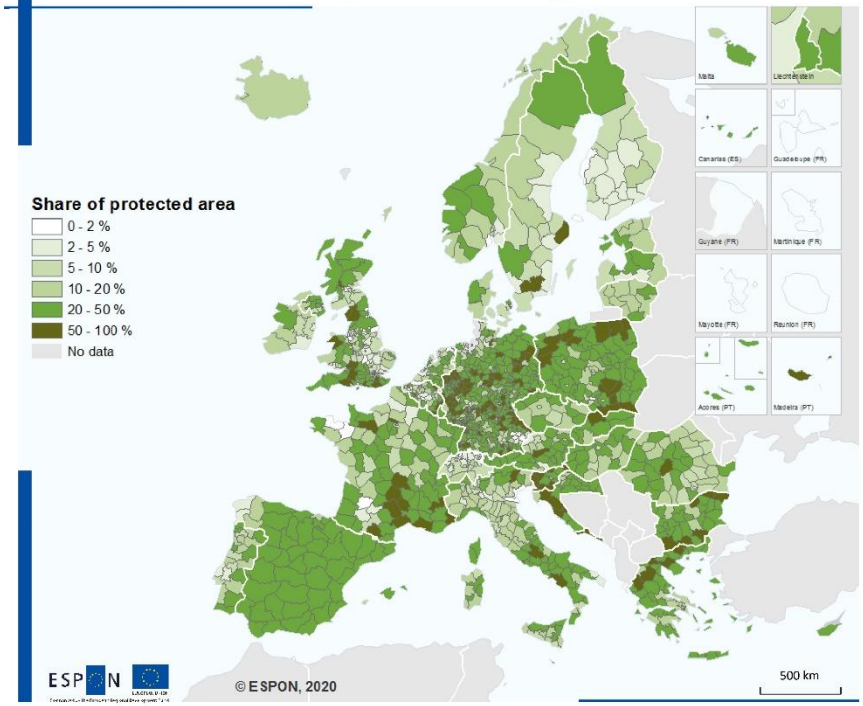
With a 20-30% growth rate of turnover per person employed in the period between 2010 and 2015, the continental part of Croatia is well positioned compared to the nearby regions in Hungary, while it is lower than the nearby region in Slovenia. The coastal part of Croatia is similar to the nearby Italian region with a growth rate of up to 10% turnover per person.

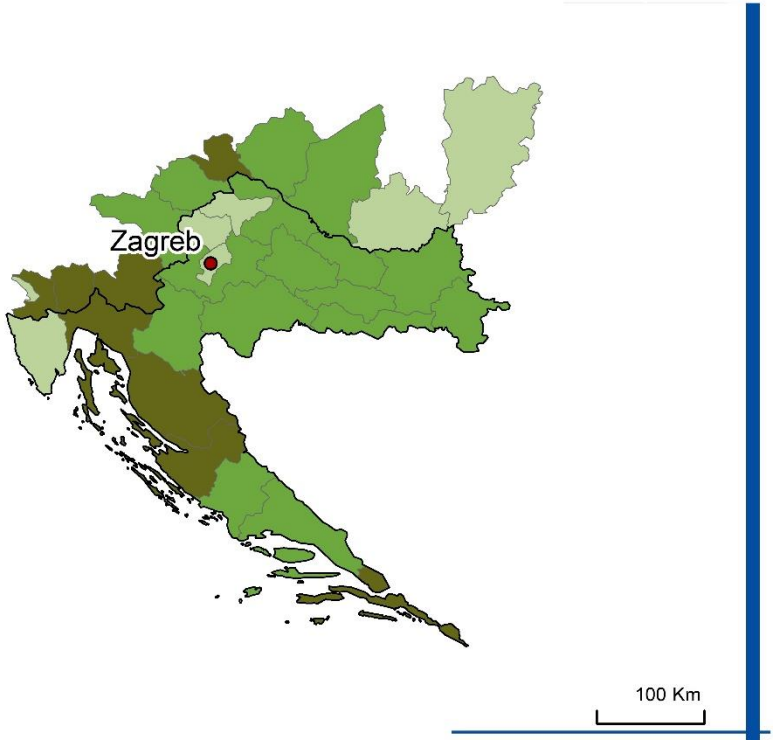


Green infrastructure (GI) is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to provide a wide range of ecosystem services. It includes green spaces, or blue in the case of aquatic ecosystems, and other physical features in terrestrial and marine areas. The spatial distribution of GI has been calculated using maps with an accuracy of 1 hectare and reflects population density, infrastructure development, climatic and topographical conditions, and the distribution of agricultural areas within the territory of the EU. In 2012, the coverage of GI was highest in the Nordic countries, the Balkan countries, especially along Adriatic Sea, the Eastern Alpine region, the French Alps, and the Spanish coast of the Bay of Biscay. Regions in Southern Europe have a high percentage of green infrastructure. The regions with the lowest coverage are north-west France, Belgium and Germany, the south-east of the UK, Ireland, and Denmark.

From a European perspective, Croatia has a high share of GI. The areas along the coast of Croatian Adriatic have more than 80% of green infrastructure coverage, similar to the neighbouring regions in Bosnia and Herzegovina, Montenegro, and Slovenia. Continental Croatia has between 60% and 80% GI coverage, which is less than the neighbouring regions in Bosnia and Herzegovina, similar to Slovenia and much more than in Hungary and Serbia. Croatia is a corridor for brown bears to Slovenia, from where some of them are resettled in protected areas in the Alps and Pyrenees.

Share of protected areas in NUTS3 regions

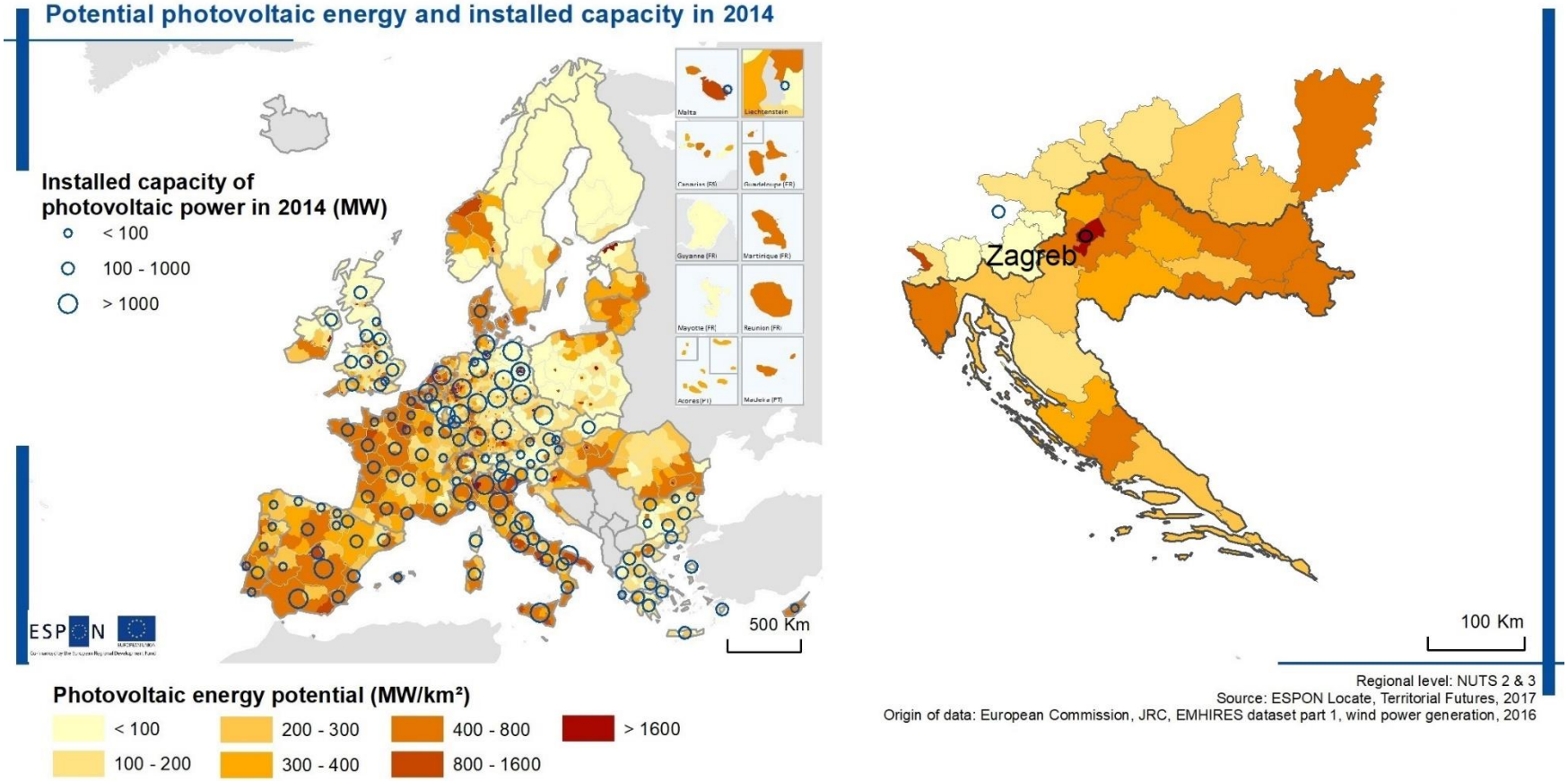




Regional level: NUTS 3
Source: ESPON SUPER 2020
Origin of the data: Corine landcover 2019, Eurostat

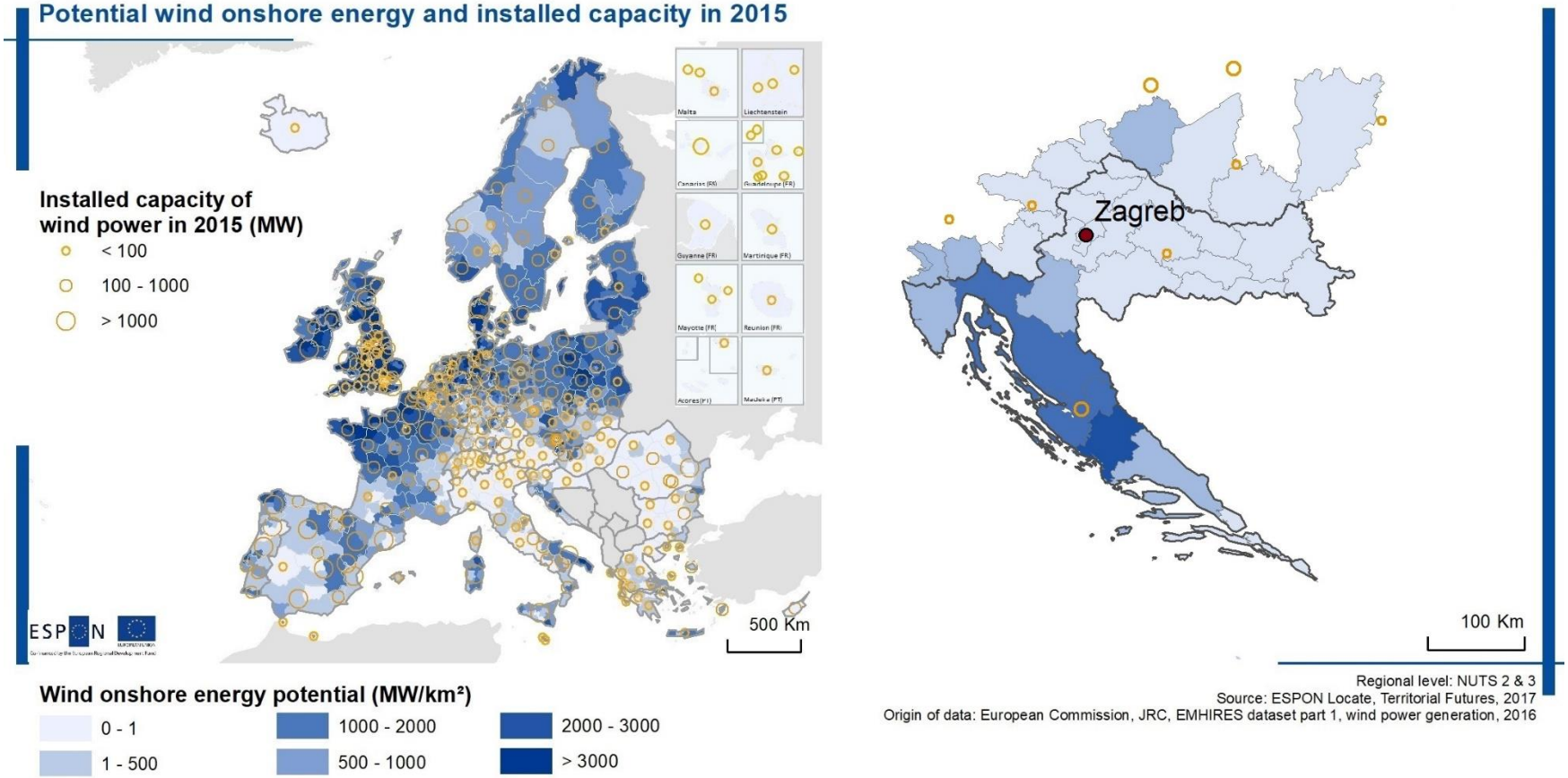
In the past, aesthetics was the main criterion for the creation of protected areas. They usually appeared first in mountainous areas. Recently, biodiversity also became an important criterion. Slovenia (38%) and Croatia (37%) have the highest share of protected areas in the EU. Denmark (8%) and the UK (9%) have the lowest share. In Western Europe, the increase in the size of family farms on a market basis has allowed agriculture to intensify. In most of the former socialist countries of Eastern Europe, the intensification of agriculture has been made possible by state or collective farming enterprises. Some exceptions were Poland, Romania and Yugoslavia. The latter allowed private farming up to a maximum of 10ha of arable land. With small fragmented farms it was more difficult to organise intensive agriculture. The preserved traditional agricultural landscape was more favourable for the preservation of biodiversity. Therefore, after the accession of Slovenia and Croatia to the EU on the basis of the criteria of Natura 2000 areas, the share of their protected areas increased significantly.

The highest share of protected areas in Croatia (50-100%) is located in the 4 mountainous coastal counties. Since 1949, about 444 natural zones have received the status of protected green areas based on national legal standars, in some cases supported by international standards. Croatia has a total of 8 national parks , 2 strict reserves and 11 nature parks. Many of these areas are located along the coast in the karst areas. Karst is a particular topographic form made from carbonates that is characterised by sinkholes and caves. These particularities generally confer particular nature and ecological values to karst areas. Other yet significant areas are located inland consist of mountain ranges, hills and wetlands.



The potential of photovoltaic energy is higher in southern and western Europe than in northern and some parts of central-eastern Europe. Finland, Sweden, Poland, the Czech Republic, Slovakia, Austria, and the UK have the lowest photovoltaic energy potential with less than 100-megawatt hours per km² in most regions. The highest potential for photovoltaic energy is around Mediterranean Sea, on the Iberian and Apennine Peninsulas, and in western and southern France with over 800-megawatt hours per km².

Croatia has an average photovoltaic energy potential. Most counties in Croatia have a potential of over 400-megawatt hours per km². It has a much higher potential than the neighbouring regions in Hungary and Slovenia. The continental part of Croatia generally has a higher photovoltaic potential than the coastal part of the country. The highest potential is in the city of Zagreb, due to the high density of potential rooftop use, with more than 1600-megawatt hours per km² (MW/km^2). The second group (between 400 and 800 MW/km²) contains the Pannonian counties of Zagreb, Varaždin, Međimurje, Koprivnica-Križevci, Virovitica-Podravina, Osijek-Baranja, Vukovar-Srijem, Brod-Posavina and the two coastal counties of Istria and Šibenik-Knin. The county Lika-Senj has the lowest photovoltaic potential, followed by Karlovac, Primorje-Gorski Kotar, Split-Dalmatia and the county of Požega-Slavonia.



Wind power is currently the second most important renewable energy source in the EU. The potential for wind energy depends strongly on average wind speeds and the availability of land for wind power installations. Europe has a high potential for wind energy, but socio-environmental concerns often need to be taken into account. The highest potential for wind energy is found around North Sea and Baltic Sea, along the Norwegian and Irish coasts, in north-western France, in Poland and in certain parts of southern Europe. High offshore potentials generally exist in northern and western Europe. North Sea-facing countries and Spain are the largest onshore producers, while the UK and Denmark have the largest offshore production.

Croatia has a higher onshore wind energy potential than the neighbouring regions of Hungary, Slovenia and Italy. The highest potential is on the Adriatic coast between the towns of Rijeka and Šibenik. The county of Šibenik-Knin has the highest wind onshore energy potential with 2278 MW/km². The second most favourable class of onshore wind energy potential includes the counties of Zadar (1806 MW/km²), Lika-Senj (1388 MW/km²), Primorje-Gorski Kotar (1080 MW/km²). The county of Split-Dalmatia has the potential of 429 MW/km². In the period between 2010 and 2016, wind power production in Croatia has increased by a factor of 15, which is partly due to high state financial incentives. In 2015, 11.4% of total Croatian consumption was generated by wind power.

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