COMMISSION STAFF WORKING DOCUMENT

Assessing territorial impacts: Operational guidance on how to assess regional and local impacts within the Commission Impact Assessment System
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Assessing territorial impacts:
Operational guidance on how to assess regional and local impacts within the Commission Impact Assessment System

1. INTRODUCTION

This document explains what it means to assess territorial impacts, why it can be useful, when to use and how to do it.

The Impact Assessment guidelines contain many references to the territorial dimension. For example, the guidelines ask the following questions (emphasis added):

– Will it have a specific impact on certain regions?

– Is there a single Member State, region or sector which is disproportionately affected (so-called ‘outlier’ impact)?

– Does it affect equal access to services and goods?

– Does it affect access to placement services or to services of general economic interest?

– Does the option affect specific localities more than others?

– Does the option have the effect of bringing new areas of land (‘greenfields’) into use for the first time?

– Does it affect land designated as sensitive for ecological reasons?

– Does it lead to a change in land use (for example, the divide between rural and urban, or change in type of agriculture)?

This document provides operational and methodological guidance on how to answer these questions. This guidance only complements the Impact Assessment guidelines and does not create additional reporting requirements. It is a tool that can be helpful to enhance policy coherence of policy proposals.

The objective of assessing territorial impacts is essentially to do an impact assessment with a territorial focus. It is not limited to a specific policy domain. As a result, the assessment of social impacts and competitiveness proofing are entirely compatible with an assessment of territorial impacts.

This type of assessment has become more realistic due to the substantial increase in regional, local and spatial data. This increase in data has many sources, including the use of register

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data, the use of geographical information systems and satellite imagery. The growing awareness of and the interest in the territorial dimension has also helped to boost the production of more sub-national indicators. In addition, the European Commission, with the help of the OECD, has established a wide range of harmonised regional and local typologies, which can be an extremely useful tool for this type of work.

The guidance provided here responds to a request from the Member States, expressed in the debate4 following the 2008 Green Paper on Territorial Cohesion5 and under the Polish EU Presidency in 2011 as part of the Territorial Agenda process6.

Several good examples of Commission impact assessments with a strong territorial dimension can be found on the Impact Assessment website7. In particular, the assessments of the Common Agricultural Policy for 2014-2020 and of the White Paper: Roadmap to a Single European Transport Area include detailed assessments of territorial impacts.

2. **WHAT DOES ASSESSING TERRITORIAL IMPACTS MEAN?**

Assessing territorial impacts helps to identify whether a policy option risks having a *large asymmetric territorial impact*, also known as an 'outlier' impact.

Territorial means primarily using a more spatial approach to analysing the impacts. It refers to a number of different spatial angles:

- Administrative or political levels such as: macro-regional, national, regional or local level
- Types of regions or areas such as: border regions, rural areas, coastal areas …
- Functional areas such as: river basins, labour market areas, service areas …

Asymmetric means that there is highly unbalanced spatial distribution of the costs and benefits. This is important as a large asymmetric impact may reduce support for the policy and can create problems and delays during the implementation.

3. **WHY ASSESS TERRITORIAL IMPACTS?**

Commission policies can benefit from assessing territorial impacts. Before deciding on a particular policy, assessing territorial impacts could show in a quantitative or qualitative manner which areas or regions may face the highest costs or benefits. If these costs are distributed in a highly asymmetric manner, the policy could be adjusted to reduce the costs of the policy on the most affected regions. If the policy itself cannot be adjusted, mitigation measures including the creation of another instrument to reduce the burden on these regions or areas should be investigated.

Three short examples can illustrate the potential regional differentiation of impacts.

1. Reducing the concentrations of an airborne pollutant in cities to uniform level within a single deadline may be more difficult to achieve in some cities than others. Concerns about such difficulties may lead to pressure to allow higher concentrations. Assessing territorial impacts could identify such risks and ensure that the policy grants cities with very high concentrations a longer time frame to reach the necessary quality threshold.
(2) State aid policy also differentiates its approach according to the level of development of a region and to the size of the market. For example, different possibilities to award state aid apply to areas with an abnormally low standard of living, to outermost regions, to regions with low population density.

(3) Growing global trade integrations tends to benefit the EU, but some regions specialised in a sector vulnerable to further trade integration/globalisation may face a high number of redundancies. The European Globalisation Adjustment Fund (EGF) was set up, in part, to address such negative asymmetric impacts. The EGF provides one-off, time-limited individual support geared to helping workers who have suffered redundancy as a result of globalisation\(^8\). A Member State can apply for funding when at least 500 redundancies were caused by globalisation within four months. If the redundancies primarily occur in SMEs, specific sectors or regions, the time frame is extended to 9 months.

Taking into account potential asymmetric impacts can increase the effectiveness and the efficiency of the policy. It can increase political support for a policy, boost the benefits while addressing excessive spatial concentrations of the costs.

4. **WHEN SHOULD AN ASSESSMENT OF TERRITORIAL IMPACTS BE CONSIDERED?**

There are two types of policies for which an assessment of territorial impacts should be considered. The first type explicitly targets or differentiates by specific (type of) regions or areas. This type is easy to identify. The second type addresses issues that are not evenly distributed across the Union. This type is more difficult to identify (see Figure 1).

If the issue (or industry) is spread evenly across the Union and the policy is applied in an identical manner to the entire Union, it is unlikely that some regions or areas will be significantly more affected than others. In these cases, there is no need for a territorial dimension in the impact assessment. In many cases, a territorial impact assessment will not be needed.

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\(^8\) The scope of the EGF was broadened from 1 May 2009 to 30 December 2011 to provide support to workers made redundant as a direct result of the global financial and economic crisis.
4.1. Policies that explicitly focus on specific territories

These policies can be easily identified as the proposal mentions the type of territory. Some policies only apply to one type of area, for example urban or rural areas. Other policies cover a broad issue but differentiate by type of area, for example cohesion policy or state aid policy.

The territories mentioned in the policy can be in one out of four situations. They can be defined by the Commission or by the Member States. The territories can be already defined or still to be defined (see Table 1).

Table 1 - Identification of territories

<table>
<thead>
<tr>
<th>Territories …</th>
<th>Member State</th>
<th>European Commission</th>
</tr>
</thead>
<tbody>
<tr>
<td>… have been identified.</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>… will be identified.</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

Examples of all four situations can be easily found.

- The Air Quality Directive 2008/50⁹ is an example of situation 1. Member States had identified the zones and agglomerations where air quality should be monitored following the adoption of an air quality directive in 1996. This new directive followed the same approach, thus the territories were already identified by the Member States.

- Areas facing natural constraints in the Common Agriculture Policy will be delimited by Member States based on EU common criteria after the adoption of the post-2013 EAFRD regulation. This is an example of situation 2.

- The Baltic Sea region strategy adopted in 2009¹⁰ specified the geographical coverage in relation to the issues to be coordinated. This is an example of situation 3.

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- The draft Cohesion Policy regulation explained the methodology to be used to determine regional eligibility, but the final regional eligibility was not yet known. This is an example of situation 4.

These four situations are ideal types and some situations are a hybrid. For example, in some policies the Commission may determine the territories in a dialogue with a Member State, in others the Member State identifies the territories but based on criteria established by the Commission.

How can an impact assessment deal with the different situations? If the territories have been identified, they can obviously be used in the impact assessment. If the territories are still to be determined, the impact assessment can use territories which are likely to be similar to the final territories. In the case of Cohesion Policy, the regional eligibility criteria were applied to the most recent data available, knowing that the final criteria would be applied to updated indicators. In other words, the most recent data was used as a proxy for the final data.

A wide range of harmonised regional and local typologies are also available to use in impact assessment. These can also be used as a proxy when the final selection of regions or areas is still to be determined. For example, a policy targeting issues in cities could use the harmonised definition of cities. A policy addressing cross border health problems could use the border region definition. For a full list of European harmonised regional and local typologies see Annex 1 and 2.

4.2. Policies that have an asymmetric territorial impact

These policies are less straightforward to identify. Such policies typically deal with issues that are concentrated in space. It is impossible to provide an exhaustive list of issues here, but many policy issues have consequences that mainly impact on particular regions.

In some situation, the issue itself may not be concentrated, but the actors involved in the policy response might be. For example, during the preparation of the policy on the marketing and use of explosives precursors, it became apparent that although the marketing and use of these products occurred throughout the union, the producers of these products were geographically clustered.

In some cases, the risk of asymmetric territorial impact is obvious. In other cases, only experts familiar with the issue can assess the risk of such asymmetric impacts and whether this merits an assessment of territorial impacts.

Some policies will be relevant everywhere, but more so in some regions or areas than in others. For example, the reduction of poverty and social exclusion is a Europe 2020 objective, but it is particular relevant in areas with high levels of poverty or exclusion.

A short number of checks can help to assess the potential of an asymmetric territorial impact:

- Is the problem or driver to be addressed concentrated in some (types of) areas or regions?
- Are the actors involved in the policy response concentrated in some areas or regions?
- Ask stakeholders whether they think the problem or the actors are spatially concentrated (see below).
5. **How to assess territorial impacts?**

This chapter explains the different methods which can be used to assess territorial impacts. It covers qualitative and quantitative methods, specific tools developed to support impact assessments and the consultation process.

Including an overall qualitative assessment of territorial impacts is recommended for all methods (see Figure 2). If the affected regions and areas can be identified and appropriate regional or local data is available, then a quantitative method is also recommended.

**Figure 2: What method to use?**

The qualitative approach relies on a description of the spatial distribution of four items:

1. the main problem or driver,
2. the capacity to respond to the problem / implement the policy
3. the actors involved in the policy response
4. the potential impact, which is a combination of the former issues.

The text should explain the logic linking the problem/driver, the adaptive capacity, the actors and the potential impact.

The example of the impact assessment of the 2009 White Paper: Adapting to climate change may help to highlight these steps. This impact assessment discussed the spatial distribution of climate change (item 1). It identified the Southern Europe and the Mediterranean Basin, mountain areas, in particular the Alps, coastal zones, densely populated floodplains and the Arctic region as the most vulnerable to climate change.

For the capacity to respond (item 2) it covered both ecosystems and human systems. The adaptive capacity of the ecosystems depends on their diversity and health. For human systems, it depends on a wide range of issues including economic wealth, technology and infrastructure, information, knowledge and skills, institutions, equity and social capital.

The document also discussed the actors (item 3), including those at the local and regional level, involved in setting up adaptation strategies. It highlighted the possible lack of funding, information, knowledge and expertise for some of these actors/areas as bottlenecks.
Therefore, the potential territorial impact (item 4) of adapting to climate change depends on the spatial distribution of vulnerability, adaptive capacity and the actors in policy implementation. The assessment highlighted that the climate change will have different spatial effects and strong variability and stressed that EU funds, including Cohesion Policy, could help to address these concentrated spatial impacts.

If the spatial distribution of an issue cannot be measured directly, it can sometimes be derived from case studies or the scientific literature. In some cases, another measure with a similar spatial distribution can be used as a proxy indicator. For example, opening up trade in textile sector may mean that regions with an uncompetitive textile industry will see high redundancies in that sector. If no data is available on the regional competitiveness of the textile industry, regional employment growth in that sector may help to assess which regions could be more vulnerable.

5.1. Statistical description

A description of the issue at stake can be quite helpful. For example, for a policy to improve the labour market integration of people born outside the EU, a map with this target population as a share of total regional population would show which regions are concerned by this and which not at all. The impact assessment of an air quality directive could be supported by a mapping which (urban) areas are exposed to high levels of air pollution.

Sources of sub-national data have increased substantially over the last decade. This has been achieved through a variety of techniques, including using register-based data, creating multi-year averages and remote sensing. As a result, more issues can be measured and described at the sub-national level. A list with sources of sub-national data is included in the Annex (3).

5.2. Projection

If the data allows, a projection would show to what extent this issue is likely to grow in the future. In other words, an assessment should be done of how the situation would develop if relevant policies were left unchanged (so called baseline scenario). For the example above of labour market integration, a projection showing the share of people born outside the EU and their children as a share of the regional population in 2020 and 2030 together with a projection on how this share would change if a policy option was implemented, would be a useful input into the impact assessment.

Other projections with a sub-national component including demographic, economic and land use projections can help to show the likely evolution of the issue at stake. Although these do not show the impact of the different policy alternatives, they can still show how the context of the policy is likely to change.

European wide territorial projections are available from multiple sources.

- Eurostat publishes regional population projections11.

- The Directorate-General for Employment, Social Affairs and Inclusion has a new instrument that can make regional population, education, employment and unemployment rate projections.12

- The RHOMOLO13 economic model can add a regional component to the QUEST's model long term projections (see Annex 5.3).

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11 Eurostat regularly publishes regional population forecasts. Contact: Eurostat, Demography Unit.
– The LUMP model can make land use projections using population and economic projections (see Annex 5.1).

– The CAPRI\textsuperscript{14} model makes ex-ante analyses of the CAP and policies affecting the agricultural sector (see Annex 5.4)

– The European Environmental Agency publishes spatial environmental and climate change past trends and projections.

– ESPON has published several regional population projections as part of the DEMIFER project. (www.espon.eu)

5.3. Modelling interactions

A model can support an impact assessment, especially if the policy addresses a problem driver that is strongly linked to other issues. For example, trade policy can have an impact on the agricultural sector or new transport infrastructure can influence economic growth and land use changes.

The Joint Research Centre has developed six models with a sub-national component. A fiche describing each model can be found in Annex 5.1-6.

For more information on the models, please check: http://intranet.jrc.es/cfapp/models/ (not accessible from outside the Commission).

An interesting overview of regional models used in (national) impact assessments is included in the 2010 report 'Review of Methodologies applied for the assessment of employment and social impacts\textsuperscript{15}.'

5.4. Tools to support the quantitative assessment of territorial impacts

The methods described above can generate a large amount of information about the different policy options and their impact on regions and areas. Two tools have been developed to help summarise this information into an overall impact: ESPON ARTS and QUICKScan.

The ESPON ARTS instrument assesses policy impacts using a vulnerability approach. This approach uses three elements: exposure, sensitivity, and impact (see Annex 4.1):

- 'exposure' identifies the regions which are exposed to a policy option, for example urban areas;
- 'sensitivity' assesses how strong the impact of a policy option could be based on quantitative information or expert judgement; for example number of days with low air quality.
- 'territorial impact' is the combined result of exposure and sensitivity.

This excel-based instrument allows to get a quick impression of the overall impact based on exposure and sensitivity. Different combinations of exposure and sensitivity can easily be tested. In addition, the tool allows multiple territorial impacts to be aggregated.

\textsuperscript{13} This is a regional economic model that can simulate the impact of a number of policies.

\textsuperscript{14} CAPRI is an economic model designed specifically to assess regional impacts of the common agricultural policy and trade policies.

\textsuperscript{15} http://ec.europa.eu/social/main.jsp?catId=760&langId=en
QUICKScan, developed by the EEA and Alterra, is a toolbox similar to ESPON ARTS but uses a geographical information system (GIS) approach. The tool can use GIS layers such as land use, climate or population distribution. The tool is designed to facilitate impact assessments and policy making. It allows the users to combine quantitative information with expert judgement. The estimated impacts can be easily mapped and different options can be compared and tested. (see Annex 4.2).

For a more thorough investigation, a spatial sensitivity analysis can show to what extent the estimated impacts are the result of the underlying data or the assumptions made in the calculations. The Econometric and Applied Statistics Unit in the Joint Research Centre can carry out such analysis.

5.5. **Consultations can help to reveal asymmetric impacts**

The stakeholder consultation process foreseen in the impact assessment can be used to collect data and information about the issue to be addressed and the impact of the policy option from outside the European Commission. Stakeholders may have access to more information and thus be in a good position to judge the risk of an asymmetric impact.

Therefore, the consultation could include a question to check whether the public or the stakeholders expect the policy to have an asymmetric impact. For example:

*Do you expect that this policy will have a disproportionately large impact on certain areas, regions or Member States? If yes, please indicate which ones and why.*

*According to your knowledge and information, is this problem concentrated in certain areas, regions or Member States?*

Under the 'Protocol on Cooperation between the Commission and the Committee Regions' (2012) the 'Commission services may ask for support from the Committee in preparing its assessment'. This may be particularly useful if the consultation investigates asymmetric impacts on regions or local authorities.

6. **CONCLUSION**

This document aims to facilitate the inclusion of a territorial dimension in Commission impact assessments of policies that:

(a) explicitly target some (type of) region or area or

(b) have a high risk of affecting some (type of) regions or areas more than others, i.e. risk having a highly asymmetric territorial impact.

Assessing the territorial impact of a policy can improve the effectiveness and efficiency of the policy. If the territorial impact is highly asymmetric, the policy can be adjusted to reduce this imbalance. Examples of five different types of response to potential asymmetric territorial impacts are provided in this document:

(1) Adjust the policy for the entire Union or some of its parts

(2) Grant more time to implement a policy in some parts of the union

(3) Exempt some parts of the union from the policy

(4) Use existing policies, including Cohesion Policy, to address asymmetric territorial impacts

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(5) Create a new instrument to address asymmetric territorial impacts if/when they arise

Policies which explicitly target some regions or areas should base their impact assessment on these regions or areas (if they have already been identified). If the regions or areas have not been yet been identified, the impact assessment can rely on a) a proxy for the final regions or areas or b) a harmonised definition of a specific type of area.

Assessment of territorial impacts can be carried using both qualitative and quantitative methods based on the intervention logic. The spatial distribution of the problem combined with the regional sensitivity to the policy response can show the territorial impact. For policies that lead to significant amount of interaction between different domains, a modelling approach is recommended.
7. **ANNEX**

This annex provides an overview of regional and local typologies. These typologies have been developed for analytical and statistical purposes. The regional and local typologies are also linked, which ensures greater consistency and data availability. (See section 2 and chapter 14 of the Eurostat 2012 regional yearbook for more detail.)

In addition, the annex provides an overview of sources of sub-national data, tools developed to support impact assessments and models with a sub-national component held by the Joint Research Centre.

1. **DEFINITIONS OF REGIONAL TYPOLOGIES**

All these typologies have been published in a Regional Focus (2011/01) and on the Eurostat website ‘Statistics explained’. These typologies will be updated after each change in the NUTS classifications. Changes in the methodology or in its application will discussed with the relevant services prior to their application. Updates will be published on both websites.

1.1. **Urban-rural typology**

Urban-rural typology of NUTS3 regions

The urban-rural including remoteness typology classifies all NUTS 3 regions according to criteria based on population density and population distribution (urban-rural). This classification is combined with a distinction between areas located close to city centres and areas that are remote. It creates five categories of NUTS 3 regions:

1. predominantly urban regions;
2. intermediate regions, close to a city;

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3. intermediate, remote regions;
4. predominantly rural regions, close to a city;
5. predominantly rural, remote regions.

The classification is completed in four steps: identify rural area population, classify NUTS 3 regions and adjust classification based on the presence of cities. The last step assesses which regions are remote.

**Population in rural areas**

This typology uses a simple two-step approach to identify population in rural areas:

1. rural areas are all areas outside urban clusters;
2. urban clusters are clusters of contiguous\(^{20}\) grid cells of 1 km\(^2\) with a density of at least 300 inhabitants per km\(^2\) and a minimum population of 5 000.

**Regional classification**

NUTS 3 regions are classified on the basis of the share of population in rural areas:

- predominantly rural if the share of population living in rural areas is higher than 50 %;
- intermediate, if the share of population living in rural areas is between 20 % and 50 %;
- predominantly urban, if the share of population living in rural areas is below 20 %.

To resolve the distortion created by extremely small NUTS 3 regions, regions smaller than 500 km\(^2\) are combined for classification purposes with one or more of their neighbours.

**Presence of cities**

In a third step, the size of the urban centres in the region is considered:

- a predominantly rural region which contains an urban centre of more than 200 000 inhabitants representing at least 25 % of the regional population it becomes intermediate;
- an intermediate region which contains an urban centre of more than 500 000 inhabitants representing at least 25 % of the regional population becomes predominantly urban.

*(See also the Eurostat regional yearbook 2010, pp.240-253 or Urban-rural typology).*

**1.2. Urban-rural typology including remoteness**

This typology follows the same approach as above and adds a remoteness dimension to it.

**Remoteness dimension**

All predominantly urban regions are considered close to a city.

\(^{20}\) Contiguity for urban clusters includes the diagonals (i.e. cells with only the corners touching). Gaps in the urban cluster are not filled (i.e. cells surrounded by urban cells).
A predominantly rural or intermediate regions is considered remote if less than half of its residents can drive to the centre of a city of at least 50 000 inhabitants within 45 minutes. If more than half of the regions’ population can reach a city of at least 50 000, it is considered close to a city. For more details on the methodology please consult Regional Focus 01/2008\textsuperscript{21}.

\textsuperscript{21} http://ec.europa.eu/regional_policy/information/focus/index_en.cfm
1.3. Metro regions

Typology of metro regions

The NUTS 3-based typology of metro regions contains groupings of NUTS 3 regions used as approximations of the main metropolitan areas.

The initial methodology for the selection of the NUTS 3 components of the metro regions is based on the Urban Audit definition of Larger Urban Zones (LUZ). These LUZs contain the major cities and their surrounding travel-to-work areas. LUZs are defined as groupings of existing administrative areas (often LAU2 units). Their boundaries do not necessarily coincide with those of NUTS 3 regions. Consequently, NUTS 3 regions in which at least 50% of the regional population lives inside a given LUZ were considered to be the components of the metro region related to that LUZ.

Hence, the quality of the territorial approximation depends on the average size of the NUTS 3 regions concerned.

In cooperation with the OECD, refined versions of the methodology are being tested, using population distribution at a fine level of disaggregation (1 km²) to identify the cores of the metro regions. Census-based local commuting data are then used to define contiguous areas around the cores, where substantial levels of commuting to these cores occur.

This approach has resulted in revised definitions of the extent of several metro regions. The typology distinguishes three types of metro regions:

1. capital city regions;
2. second-tier metro regions;
3. smaller metro regions.

The capital city region is the metro region which includes the national capital.

Second-tier metro regions are the group of largest cities in the country excluding the capital. For this purpose, a fixed population threshold could not be used. As a result, a natural break
served the purpose of distinguishing the second tier from the smaller metro regions. The distinction between second tier and smaller metro regions may be adapted in future to provide a closer match with the distinctions used in, especially national, policy debates.

1.4. Border regions

Cross-border cooperation programme areas (ERDF, IPA and ENPI), 2007-2013

The NUTS 3-based selection of border regions refers to the regions participating in the core areas of cross-border cooperation programmes in the programming period 2007-2013. This includes:

- programme areas of cross-border programmes co-financed by ERDF under the European territorial cooperation objective;

- areas of the cross-border cooperation component of IPA (Instrument for Pre-Accession Assistance);

- areas of the cross-border cooperation programmes within ENPI (European Neighbourhood and Partnership Instrument).

The typology lists regions according to the current NUTS classification (valid from 1/1/2008 to 31/11/2011). Some programme areas have been determined on the basis of a former NUTS classification. Due to NUTS boundary changes, some current NUTS 3 regions are only partly eligible as programme areas.

The typology does not consider areas adjacent to the core programme areas, i.e. the ‘flexibility areas’ referred to in Art. 21(1) of Regulation 1080/2006 of 05/07/2006.

Two main types of border regions can be distinguished:

1. internal border regions – these regions are located on borders between EU Member States and/or European Free Trade Area (EFTA) countries;
2. external borders – these regions participate in programmes involving countries outside both the EU and EFTA.

This typology will be updated to cover the new NUTS classification and the new Cohesion Policy programming period. Mountain regions

Mountain regions at NUTS 3 level are defined as regions in which more than 50% of the surface is covered by topographic mountain areas or in which more than 50% of the regional population lives in these topographic mountain areas.

The study on mountain areas in Europe\(^{22}\) defines topographic mountain areas using the following criteria:

- above 2500m, all areas are included within the mountain delimitation;
- between 1500m and 2500m, only areas with a slope of over two degrees within a 3 km radius are considered mountainous.
- Between 1000m and 1500m, areas had to justify one of two sets of criteria in order to be considered mountainous. The first of these is that the slope within a 3 km radius should exceed five degrees. If the slope is less steep than this, the area can still be considered mountainous if elevations encountered within a radius of 7 km vary by at least 300 meters. If neither of these two sets of criteria is met, the area is considered non-mountainous.
- Between 300m and 1000m, only the latter of the two previous sets of criteria is applied. This means that only areas in which elevations encountered within a radius of 7 km vary by at least 300 meters are considered mountainous.
- Below 300m, the objective was to identify areas with strong local contrasts in topography, such as Scottish and Norwegian fjords and Mediterranean coastal mountain areas. Selecting

areas according to the standard deviation of elevations in the immediate vicinity of each appeared to be the best approach for the inclusion of these types of landscape. For each point of the digital elevation model, the standard deviation from the eight cardinal points surrounding it (North – North-East – East – South-East – South – South-West – West – North-West) was calculated. If this standard deviation is greater than 50 meters, the landscape is sufficiently undulating to be considered mountainous despite its low elevation.

The typology of NUTS 3 mountain regions distinguishes three categories:
1. regions with more than 50% of their population living in mountain areas;
2. regions with more than 50% of their surface covered by mountain areas;
3. regions with more than 50% of their surface covered by mountain areas, and with more than 50% of their population living in mountain areas.

1.5. **Island regions**

Island regions are NUTS 3 regions entirely covered by islands. In this context, islands are defined as territories having:
- a minimum surface of 1 km²;
- a minimum distance between the island and the mainland of 1 km;
- a resident population of more than 50 inhabitants;
- no fixed link (bridge, tunnel, dyke) between the island and the mainland.

NUTS 3 island regions can correspond to a single island, or can be composed of several islands, or can be part of a bigger island containing several NUTS 3 regions.
The typology of NUTS 3 island regions distinguishes five categories, depending on the size of the major island related to the NUTS 3 region:

1. regions where the major island has less than 50 000 inhabitants;
2. regions where the major island has between 50 000 and 100 000 inhabitants;
3. regions where the major island has between 100 000 and 250 000 inhabitants;
4. regions corresponding to an island with 250 000 to 1 million inhabitants, or being part of such an island;
5. regions being part of an island with at least 1 million inhabitants.

1.6. Sparsely-populated regions

Sparsely-populated regions are regions with a population density below a certain threshold. Paragraph 30(b) of the Guidelines on national regional aid for 2007-2013 defines low population density regions as ‘areas made up essentially of NUTS 2 geographic regions with a population density of less than 8 inhabitants per km², or NUTS 3 geographic regions with a population density of less than 12.5 inhabitants per km²’. In the Cohesion Report, the analysis was based on the NUTS 3 regions.

As a result, sparsely-populated areas are defined as NUTS 3 regions with a population density of fewer than 12.5 inhabitants per km².

1.7. Outermost regions

Outermost regions are identified by Article 349 of the Consolidated Treaty on the Functioning of the European Union as Guadeloupe, French Guiana, Martinique, Réunion, Saint-Martin (i.e. the French overseas departments), the Azores, Madeira and the Canary Islands.
2. **DEFINITION OF LOCAL TYPOLOGIES**

This section presents two linked local typologies. They are linked because in both typologies, the cities are defined in an identical manner.

Both local typologies are also linked to regional typologies:

- The rural grid cells used in the degree of urbanisation are also used in the urban-rural regional typology.
- The cities are used to identify regions close to a city.
- The cities and commuting zones are used to identify the metro regions.

2.1. **The degree of urbanisation**

The new degree of urbanisation creates a three-way classification of LAU2s as follows:

(a) Densely populated area: (alternate name: cities or large urban area)
   - At least 50% lives in a city centre

(b) Intermediate density area (alternate name: towns and suburbs or small urban area)
   - Less than 50% of the population lives in rural grid cells and
   - Less than 50% lives in a city centre

(c) Thinly populated area (alternate name: rural area)
– More than 50% of the population lives in rural grid cells.

The set of two images below gives an example of Cork in Ireland.

**Figure 3: Cork, Ireland: Type of cluster and degree of urbanisation**

Definitions:

**City centre (or high-density cluster):**

– Contiguous\(^{23}\) grid cells of 1km\(^2\) with a density of at least 1 500 inhabitants per km\(^2\) and a minimum population of 50 000.

**Urban clusters:**

– clusters of contiguous\(^{24}\) grid cells of 1km\(^2\) with a density of at least 300 inhabitants per km\(^2\) and a minimum population of 5 000.

**Rural grid cells:**

– Grid cells outside urban clusters

Density: Population divided by land area

\(^{23}\) Contiguity does not include the diagonal (i.e. cells with only the corners touching) and gaps in the cluster are filled (i.e. cells surrounded by a majority of high-density cells applied iteratively). For more detail see section 4.5.

\(^{24}\) Contiguity includes the diagonal. For more detail see section 4.5.
Adjustments and validation by national statistical institutes

The application of this methodology was sent to the national statistical institutes (NSI) for adjustments and validation. The NSIs could make two types of adjustments: adjusting city boundaries and adjusting LAU2 classifications.

Adjusting city boundaries

The guidance note highlights that due to the variation of the area size of LAU2s, the match between the high-density cluster and the densely populated LAU2s could be adjusted within certain constraints. In this context, several NSI have requested changes to the densely populated areas to ensure a better match between the appropriate political level and/or a level for which annual data is collected.

Other adjustments

Due to the sources of the population grid and the fairly coarse resolution of the population grid, the classification of a limited number of LAU2s may not correspond to this approach. As a result, National Statistical Institutes (NSI) were invited to critically review this classification and to make, where necessary, adjustments to the classification.

This new definition identified 885 cities with an urban centre of at least 50,000 inhabitants in the EU, Switzerland, Croatia, Iceland and Norway. These cities host about 40% of the EU population. Each city is part of its own commuting zone or a polycentric commuting zone which covers multiple cities.
2.2. **Harmonised definition of a city and its commuting zone**

**How does this definition work?**

This new definition works in four basic steps and is based on the presence of an 'urban centre' - a new spatial concept based on high-density population grid cells.

**Figure 5.1-4 How to define a city**

![High density cells, urban centre and city (Graz)](image)

**Step 1:** All grid cells with a density of more than 1 500 inhabitants per sq. km are selected (map 1.1).

**Step 2:** The contiguous high-density cells are then clustered, gaps are filled and only the clusters with a minimum population of 50 000 inhabitants (map 1.2) are kept as an 'urban centre'.

**Step 3:** All the municipalities (local administrative units level 2 or LAU2) with at least half their population inside the urban centre are selected as candidates to become part of the city (map 1.3).

**Step 4:** The city is defined ensuring that 1) there is a link to the political level, 2) that at least 50% of city the population lives in an urban centre and 3) that at least 75% of the population of the urban centre lives in a city (map 1.4).

In most cases, as for example in Graz, the last step is not necessary as the city consists of a single municipality that covers the entire urban centre and the vast majority of the city residents live in that urban centre.

For 32 cities with an urban centre that stretched far beyond the city, a 'greater city' level was created to improve international comparability.

---

25 Contiguity for high-density clusters does not include the diagonal (i.e. cells with only the corners touching).

26 Gaps in the high-density cluster are filled using the majority rule iteratively. The majority rule means that if at least five out of the eight cells surrounding a cell belong to the same high-density cluster it will be added. This is repeated until no more cells are added.
To ensure that this definition identified all relevant centres, the national statistical institute were consulted and minor adjustments were made where needed and consistent with this approach.

**A Harmonised Definition of a Commuting Zone**

Once all cities have been defined, a commuting zone can be identified based on commuting patterns using the following steps:

1. If 15% of employed persons living in one city work in another city, these cities are combined into a single destination.
2. All municipalities with at least 15% of their employed residents working in a city are identified (image 2)
3. Municipalities surrounded\(^{27}\) by a single functional area are included and non-contiguous municipalities are dropped (image 2.3).

**Figure 6.1-3 How to define a commuting zone**

\(^{27}\) Surrounded is defined as sharing at least 100% of its land border with the functional area.
2012: Urban Audit Cities and Larger Urban Zones

- City
- Larger Urban Zone

© EuroGeographics Association for the administrative boundaries
3. **SUB-NATIONAL DATA SOURCES**

This section provides an overview of the main sources of sub-national data for the European Union.

3.1. **Eurostat**

Eurostat has been expanding its sub national data offer in the recent years in two dimensions, more domains covered and more detailed geographical levels:

- Most indicators are published for the so called NUTS regions (see Table 2 for details).

- Some of these indicators are also calculated for a predefined group of NUTS 3 regions, like rural regions, metropolitan regions, coastal regions, etc.

- The urban-rural characteristics could be also analysed at a lower geographical scale, at the 'local area' (communes, municipalities) level using the degree of urbanization classification. Data is published for the sum of all urban/intermediate/rural local areas of a given country (see Table 3).

- Data is also available for cities. The list of indicators covers most aspects of urban life, e.g. demography, housing, health, the labour market, education, climate, transport and cultural infrastructure.

- The European population 1km² grid dataset provides data for the reference year 2006 combining data from registers, hybrid data from various national data sources and disaggregated data.

- The statistical information listed above can be overlaid with several geographical layers, allowing calculating new indicators, like accessibility of services, share of population living within a certain distance from the coast, etc. (see List 1 below).

For more information please visit the [website dedicated to sub-national statistics](#).
<table>
<thead>
<tr>
<th>Domain</th>
<th>Content</th>
<th>NUTS level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demography</td>
<td>Population by age and by gender; Population change (births, deaths); Life tables (life expectancy, etc.); Infant mortality; Census data (2001)</td>
<td>NUTS 2 or NUTS 3</td>
</tr>
<tr>
<td>Migration</td>
<td>Internal migration (arrivals, departures by sex, origin and destination)</td>
<td>NUTS 2</td>
</tr>
<tr>
<td>Economic accounts</td>
<td>Gross Domestic Product (GDP) indicators; Branch accounts; Household accounts</td>
<td>NUTS 2 or NUTS 3</td>
</tr>
<tr>
<td>Labour Market</td>
<td>Economically active population; Employment and unemployment; Socio-demographic labour force statistics; Labour market disparities; Job vacancy</td>
<td>NUTS 2 or NUTS 3</td>
</tr>
<tr>
<td>Science and Technology</td>
<td>R&amp;D expenditure and staff; Human resources in science and technology; Employment in technology-intensive sectors; European patent applications</td>
<td>NUTS 1 or NUTS 2</td>
</tr>
<tr>
<td>Structural Business</td>
<td>Structural business statistics (Number of local units, persons employed and Wages and salaries by economic activity); Distributive trade statistics (2009)</td>
<td>NUTS 1 or NUTS 2</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Land use/cover; Farm Structure Survey indicators (Area, livestock, labour force and standard output of farms); Animal, milk and crop production; Economic accounts for agriculture; Agri-environmental indicators (for e.g. farmers training level)</td>
<td>NUTS 1, NUTS 2 or NUTS 3</td>
</tr>
<tr>
<td>Health</td>
<td>Causes of death; Health care infrastructure; Health status; Hospital patients</td>
<td>NUTS 1 or NUTS 2</td>
</tr>
<tr>
<td>Tourism</td>
<td>Tourist accommodation, arrivals, nights spent</td>
<td>NUTS 2 or NUTS 3</td>
</tr>
<tr>
<td>Transport</td>
<td>Road, rail, maritime, inland waterways and air transport; Transport infrastructure, stock of vehicles and road accidents</td>
<td>NUTS 2 or NUTS 3</td>
</tr>
<tr>
<td>Education</td>
<td>Number of students by sex, age, education level, orientation; Educational attainment and lifelong learning</td>
<td>NUTS 1 or NUTS 2</td>
</tr>
<tr>
<td>Information Society</td>
<td>Internet access; Computer usage</td>
<td>NUTS 1 or NUTS 2</td>
</tr>
<tr>
<td>Environment</td>
<td>Water resources; Wastewater treatment; Solid waste</td>
<td>NUTS 1 or NUTS 2</td>
</tr>
<tr>
<td>Social policy / income and living conditions</td>
<td>At-risk-of-poverty-or-social-exclusion and its three dimensions</td>
<td>NUTS 0, NUTS 1 or NUTS 2</td>
</tr>
</tbody>
</table>
Table 3 - Statistics by degree of urbanisation

<table>
<thead>
<tr>
<th>Domain</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour Market</td>
<td>Economically active population; Employment and unemployment;</td>
</tr>
<tr>
<td>Education</td>
<td>Participation rate in education; Educational attainment and lifelong learning</td>
</tr>
<tr>
<td>Information Society</td>
<td>Internet access; Computer usage</td>
</tr>
<tr>
<td>Social, income and living conditions</td>
<td>At-risk-of-poverty; Severe material deprivation rate; Household budget characteristics; Housing costs; Distribution of population by dwelling type and income group</td>
</tr>
</tbody>
</table>

List 1 - Geographical Information (Reference topographic layers and Specific thematic layers)

- Administrative and statistical regions (NUTS 0-3, LAU1-2) (source: EuroGeographics)
- Topographic layers (administrative areas and boundaries, hydrography, transport infrastructure, settlements and city areas, points of interest) (source: EuroGeographics)
- Country boundaries (source: UN), Exclusive Economic Zones (EEZ, source: VLIZ), coastline
- Ports, Airports, Maritime routes (under validation), coverage: Europe
- Degree of Urbanisation, coverage: EU27, EFTA
- Urban Audit (SubCity districts, cities, Large Urban Zones)
- Digital Elevation Model, coverage: Europe up to 60° N
- High resolution road network, including detailed network at street level, some points of interest, speed profiles for itinerary and journey time calculation, coverage: EU27 (excl. CY), EFTA, candidate and potential candidate countries
- Data from the LUCAS land use, land cover survey
3.2. JRC

DG JRC develops georeferenced datasets at European and global scale, many of which are relevant for regional or territorial analysis. These datasets cover themes as natural hazards and risk prevention, distribution of species, climate change, agriculture, land cover, soil data, etc.


For Commission services, this inventory can also be searched using the INSPIRE@EC Geoportal:


Additionally, the JRC operates and maintains the INSPIRE geoportal giving access to data and services from Member States: [http://inspire-geoportal.ec.europa.eu/discovery/](http://inspire-geoportal.ec.europa.eu/discovery/)

3.3. EEA

Data sets in this table are organised per EEA Environmental Data Centres that could be consulted for additional information.

Table 4: Data available from the EEA

<table>
<thead>
<tr>
<th>Key data sets</th>
<th>Brief description of the content</th>
<th>Spatial coverage e.g. countries</th>
<th>Spatial resolution e.g. MMU, meters</th>
<th>Update frequency, latest year available</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air pollution</strong>&lt;sup&gt;28&lt;/sup&gt;</td>
<td>Pollutant releases from individual industrial facilities to air, water and soil, and waste transfers</td>
<td>EU-27, IS, LI, NO, CH, RS</td>
<td>Point source data. Geographic coordinates available.</td>
<td>Annual. Data for 2010 available.</td>
</tr>
<tr>
<td>E-PRTR (also used for water)</td>
<td>Spatial emission maps of selected pollutants to air and water from ‘diffuse’ sources e.g. transport, households etc.</td>
<td>Air: EU-27, CH, LI, NO, IS Water: EU-27, NO, CH, LI</td>
<td>Air: 5 km grid Water: River basin district</td>
<td>Air: Periodic updates. 2009 available. Water: Periodic updates. Dataset compiles data from different years</td>
</tr>
<tr>
<td>Large combustion plant emissions</td>
<td>Emissions of NOx, SOx, and dust from individual large combustion plants. Fuel data for the plants where this is not confidential.</td>
<td>EU-27</td>
<td>Point source data. Plant name and address available.</td>
<td>Three yearly updates. Datasets 2004-2006, and 2007-2009 available.</td>
</tr>
<tr>
<td>AirBase</td>
<td>Measurement data and associated meta information delivered under the EoI decision and the set of derived statistics are made publicly available in the European air quality database (AirBase). All products are downloadable (e.g. raw data, calculated statistics, meta data). AirBase covers all EoI pollutants, which amount to 187 different components of which 15 are mandatory.</td>
<td>EEA-32, AL, BA, HR, ME, MK, RS</td>
<td>Geographic coordinates available.</td>
<td>Annual. Data for 2010 available.</td>
</tr>
</tbody>
</table>

### Air Quality Questionnaire

The EU air quality legislation requires EU Member States (MS) to divide their territory into a number of air quality management zones and agglomerations. In these zones and agglomerations, the Member States should annually assess ambient air quality levels against the attainment of air quality standards and objectives (for different pollutants). EEA publishes the related spatial information: [http://www.eea.europa.eu/data-and-maps/data/zones-in-relation-to-eu-air-quality-thresholds-2](http://www.eea.europa.eu/data-and-maps/data/zones-in-relation-to-eu-air-quality-thresholds-2).

<table>
<thead>
<tr>
<th>EU-27, CH, IS, NO</th>
<th>Polygons (zones and agglomerations)</th>
<th>Annual. Data for 2009 available.</th>
</tr>
</thead>
</table>


<table>
<thead>
<tr>
<th><strong>NATURA 2000</strong></th>
<th>The European network of protected sites (Special Protected Areas, Sites of Community Importance and Special Areas of Conservation)</th>
<th>EU27</th>
<th>1:100 000</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CDDA</strong></td>
<td>The European inventory of nationally designated areas holds information about protected sites and about the national legislative instruments, which directly or indirectly create protected areas</td>
<td>EEA39</td>
<td>n/a</td>
<td>2011</td>
</tr>
<tr>
<td><strong>Conservation status of habitat types and species</strong></td>
<td>All Member States are requested by the Habitats Directive (1992 Article 17) to monitor habitat types and species considered to be of Community interest.</td>
<td>EU27</td>
<td>10 km grid (1:10 000 000)</td>
<td>2006 (temporal coverage 2000-2006)</td>
</tr>
<tr>
<td><strong>Biogeographical regions, Europe</strong></td>
<td>The bio-geographic regions dataset contains the official delineations used in the Habitats Directive (92/43/EEC) and for the EMERALD Network set up under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)</td>
<td>EEA39 + ENPI East countries and European part of Russian Federation</td>
<td>varying/a (1:1M to 1:10M)</td>
<td>2011</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th><strong>Urban Audit data</strong></th>
<th>329 variables covering socio-economic and environmental data per city and per LUZ: These are needed to assess urban vulnerability to climate change in Europe (sensitivities and adaptive capacity)</th>
<th>EU27 plus Turkey, Croatia, Switzerland and Norway</th>
<th>Per core city, sub-city districts and per Larger urban Zone</th>
<th>Every 3 years Last: 2004, 2007, 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DEGURBA</strong></td>
<td>Degree of Urbanisation degree of urbanisation based on population densities (1km² population grid) (1)Densely populated area: (2)Intermediate density area (3)Thinly populated area</td>
<td>EU27 plus Turkey, Croatia, Switzerland, Norway, Iceland</td>
<td>LAU 2</td>
<td>2006 Next population updates for 2011, 2014</td>
</tr>
<tr>
<td><strong>European Climate Assessment and</strong></td>
<td>Daily gridded data of surface temperature, precipitation and surface atmospheric pressure. Daily</td>
<td>EEA39 ++</td>
<td>Gridded 25 km resolution</td>
<td>Update 2 times per year, last update April</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Climate change adaptation</strong> (Climate-Adapt platform: <a href="http://climate-adapt.eea.europa.eu">http://climate-adapt.eea.europa.eu</a>)</td>
<td>Interactive maps of various layers from ClimWatAdapt, ESPON Climate, JRC-IES and ENSEMBLES are available through climate-adapt mapviewer *</td>
<td>EU27 Gridded in 25 km spatial resolution or NUTS2 and NUTS 3 level No regular update is foreseen</td>
</tr>
<tr>
<td><strong>Land use</strong>[^31] (Data centre <a href="http://www.eea.europa.eu/themes/landuse/dc">http://www.eea.europa.eu/themes/landuse/dc</a>)</td>
<td>Corine Land Cover Vector land cover map with 44 classes derived from satellite image at scale 1:100 000</td>
<td>EEA39 (38) 25ha (5ha changes) 1990, 2000, 2006</td>
</tr>
<tr>
<td></td>
<td>Imperviousness Raster map on degree of soil sealing 0-100% derived from satellite image</td>
<td>EEA39 100m raster 2006, 2009</td>
</tr>
<tr>
<td></td>
<td>Landscape fragmentation Fragmentation of landscape by urban areas and transport infrastructure calculated as mesh size on unfragmented land</td>
<td>EEA29 1km grid (EEA) 2009</td>
</tr>
<tr>
<td></td>
<td>Urban Atlas (also used for climate change) Vector land cover map of cities with their surroundings at scale 1:10 000</td>
<td>EU27, ca. 300 large urban zones 0.25ha 2006</td>
</tr>
<tr>
<td><strong>Water</strong>[^32] (Data centre <a href="http://www.eea.europa.eu/themes/water/dc">http://www.eea.europa.eu/themes/water/dc</a>)</td>
<td>Waterbase (use WISE viewer to explore) a) Water quantity time series b) Chemical quality of groundwater, characteristics of groundwater bodies and sampling sites c) Physical characteristics of the transitional, coastal and marine water monitoring and flux stations, proxy pressures on the upstream catchment, basin and River Basin District associated with transitional and coastal waters, chemical quality data on nutrients in seawater and hazardous substances in biota, sediment and seawater, as well as data on direct discharges and riverine input loads. d) River Basin Districts (RBDs) and/or their subunits (RBDSUs) e) Lakes: nutrients, organic matter, hazardous substances and other chemical determinands in water, proxy pressure data on the upstream catchments and physical characteristics f) Rivers: data on nutrients, organic matter, hazardous</td>
<td>Varying, but exact country coverage is available for each data category. Example of typical country coverage for a) ‘Water quantity time series’ (in the column to the left): a) Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Hungary, Ireland, Latvia, Liechtenstein, Lithuania, Macedonia the former Yugoslav Republic of, Netherlands, Portugal, a) b) c) e) f) h) point data, geographical coordinates available d) vector data</td>
</tr>
</tbody>
</table>

[^31]: http://www.eea.europa.eu/themes/landuse
[^32]: http://www.eea.europa.eu/themes/water
### 3.4. ESPON

The mission of the ESPON 2013 Programme is to support policy development in relation to the aim of territorial cohesion and a harmonious development of the European territory. Support is being provided, amongst other, by providing comparable information, evidence, analyses and scenarios on territorial dynamics. The ESPON 2013 Database is a core element in making fundamental regional information provided by ESPON projects and EUROSTAT accessible for policy makers and practitioners related to regions, cities and larger territories.

Currently the ESPON 2013 Database contains approximately 1250 socio-economic indicators, covering 60 countries in Europe and in the world, with a main focus to cover the entire European Union plus Switzerland, Norway, Iceland and Liechtenstein (ESPON space). The Database provides access to the following data categories: regional, local, urban, neighbourhood (candidate countries), world, grid and historical data.

The regional and local data and indicators use the Nomenclature of Territorial Units for Statistics (NUTS) references. The other types of data use similar statistical units or grid. The temporal coverage of the data ranges from 1950 to 2050. Most of the datasets and information produced are public available and free accessible.

Some of the data included in the ESPON 2013 Database are further elaborations upon data published by the EEA. For example, in field of climate change and land use, ESPON has completed a number of studies which further analyses and refine data published by the EEA.

| g) | substances and other chemical determinands in water, proxy pressure data on the upstream catchments and physical characteristics emissions of nutrients and hazardous substances to water, aggregated within River Basin Districts (RBDs) data selected from the reporting of Member States as part of the UWWTD implementation | Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom |
| h) | g) |

| Bathing Water Directive - Status of bathing water | The EU Bathing Waters Directive requires Member States to identify bathing places in fresh and coastal waters and monitor them for indicators of microbiological pollution (and other substances) throughout the bathing season which runs from May to September. | EU27, Croatia, Montenegro, Switzerland | Point data. Geographic coordinates available. | 1990-2011 |

E-PRTR data for water | (see section on air pollution) | | | |

---

<table>
<thead>
<tr>
<th><strong>Bathing Water Directive - Status of bathing water</strong></th>
<th>The EU Bathing Waters Directive requires Member States to identify bathing places in fresh and coastal waters and monitor them for indicators of microbiological pollution (and other substances) throughout the bathing season which runs from May to September.</th>
<th>EU27, Croatia, Montenegro, Switzerland</th>
<th>Point data. Geographic coordinates available.</th>
<th>1990-2011</th>
</tr>
</thead>
</table>

E-PRTR data for water | (see section on air pollution) | | | |
Themes covered by the ESPON 2013 Database are related to territorial cohesion and as such very diverse.

They cover:

- demography
- agriculture
- transport
- accessibility
- energy and resources
- climate change
- land use and land cover
- natural hazards and risk prevention
- education
- labour market
- living conditions
- culture
- economy
- employment
- research and innovation
- typologies
- scenarios
- geographical objects.


Direct link to the ESPON 2013 Database: [http://database.espon.eu/data](http://database.espon.eu/data)

4. **TOOLS TO SUPPORT THE ASSESSMENT OF TERRITORIAL IMPACTS**

4.1. **ESPON ARTS**

ESPON ARTS assesses the impact of policy options using a vulnerability approach. It relies on seven steps and is often used in a workshop.

(1) Setting the frame

The first step is to detect the potential effects of a policy option on a territory. In a workshop, the experts draw a picture of the cause-effect relationships.

(2) Considering different types of regions – regional Exposure

A policy may affect only particular regions (e.g. coastal regions, regions with presence of particular productions or facilities like nuclear power plants etc.) or different types of regions could be touched in different ways by a directive. This instrument provides a set of pre-selected types of regions to facilitate the decision if a certain type of region is involved. Moreover it enables to define the exposure differently for different types of regions.

This step should determine:

(a) If a directive affects a certain type of region (according to the preselected types of region) or

(b) Is it necessary to distinguish the exposure resulting from a directive along different types of regions?

(3) Estimating in exposure
The previous step decided if a region was exposed to a policy. In this step, the intensity of the exposure should be defined according to the following classes:

- high positive exposure intensity
- low positive exposure intensity
- no exposure
- low negative exposure intensity
- high negative exposure intensity

(4) Calculating the impact and plausibility checks
Based on the exposure and the regional sensitivity, which can be integrated in preformatted excel file, the territorial impact is calculated automatically. It provides for each thematic field/indicator and for each region the impact of the policy option in a region in 9 classes ranging from very high positive impact to very high negative impact. These should be checked for plausibility.

(5) Mapping the Territorial impact
If the plausibility checks are positive the maps showing the impact along the different indicators can be drawn. Additionally 'summative' impacts of a policy option on each region, considering together all impacts on the different fields can be drawn.

(6) Discussion on policy implications
Based on the maps the discussion on policy implication can be done, focusing on the positive impacts of a directive as well as on negative effects. The host moderates the discussion and writes the minutes.

(7) Writing the minutes
Based on the results of the meeting and the discussion minutes are elaborated according to a common structure.

4.2. QUICKScan
QUICKScan34 is both a framework (Figure 7) and a software tool to be applied in group-processes with policy makers and experts to develop and explore potential policy options and assess likely impacts of those options. The framework addresses five questions:

---

(a) What aspects, in a policy context are relevant with respect to human and ecosystems well-being?

(b) What typical ‘pictures’ of the past and actual condition and trends exist?

(c) What elements and interactions are relevant for the persistence of these patterns, trends and impacts?

(d) Which strategies and options can be devised to preserve, restore, use, improve, mitigate, or adapt?

(e) Which hotspot areas, services or land covers could be identified as targets for policy actions?

**Figure 7 – QUICKScan framework**

The QUICKScan software encompasses a modelling environment with functionalities to do the assessment of societal and environmental conditions, diagnose patterns and interactions, implement alternative responses and evaluate the impacts of those responses.

A typical EEA QUICKScan exercise starts by populating the system with data that the participants find relevant to the policy question. In the next step, participants try to assess the impact of different policy options by defining rules of 'if..then..else' type. The rules can be quantitative or use qualitative typologies. They may also be linked together to form a chain of rules. The system will apply these rules to the data and create derived data. Finally, the derived data can be aggregated (e.g. by administrative unit, biophysical units) and displayed in tables, charts and maps in order to help the policy makers to compare the impact of different policy scenarios.

The EEA QUICKScan toolbox allows combining tacit expert knowledge with available spatial and statistical data. Inevitably, it requires a certain level of knowledge of data

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2012 Mainstreaming the Economics of Nature: Challenges for Science and Implementation, Leipzig, Germany.
availability and Geographic Information Systems. However, with this condition in place, the EEA QUICKScan can help the assessment of policy questions in a relatively short period.

5. **DESCRIPTIONS OF JRC MODELS WITH A SUB-NATIONAL DIMENSION**

The models listed below were developed by the JRC to support the policy needs of different services of the European Commission, such as exploration of future policies and impact assessments of specific policy options.

5.1. **LUMP: Land Use Modelling Platform**

**Non-technical description**

The changes in the cover and use of the surface of the earth depend on natural processes and are, at the same time, shaped by demographic, economic, cultural, political, and technological drivers. The Land Use Modelling Platform (LUMP) can help to understand and interpret the complex interactions between the bio-physical and human factors that influence land use/cover dynamics. In addition, it can be used as a tool to assess environmental consequences of policies with direct or indirect spatial impacts.

The model is based upon the combination of a spatially explicit land use model and its linkages with other modelling activities in thematic fields such as hydrology, agriculture, economy, forestry and so on.

LUMP consists of three modules. The first module formulates the demand for different land uses. The second module allocates the land and it is the core of the model called also EU Clue Scanner. Finally, the third module computes the indicators necessary for the interpretation of the results. These can be related to the use of the land itself (e.g. change in agricultural land abandonment, urban expansion) or thematic such as land cover connectivity potential, soil sealing, river flood risk, urban sprawl and content of organic carbon in soils.

**Areas where the model can be applied**

The LUMP is most suited for ex-ante impact assessment of European policies that influence, directly or indirectly land use/cover change. The forecasted land use/cover changes are not only analysed per se. Land use/cover is an important factor for many ecosystem services such as provision of food; fibre and timber; biodiversity; water flows and climate regulation; carbon sequestration; provision of recreational opportunities; etc. Therefore, LUMP aims at providing relevant input to analyse a growing number of environmental domains that are influenced by land use/cover change.

The modelling framework in LUMP allows the translation of policy questions into alternative scenarios that could be compared through a set of indicators that capture economic, environmental and social issues. To date, LUMP has been applied in the following ex-ante impact assessments:

- Integrated Coastal Zone Management
- Green measures of the Common Agricultural Policy post-2013
- 2012 Blueprint to Safeguard Europe's Waters

Further applications are being prepared in the fields of energy, resource efficiency, bio-economy and the adaptation strategy to climate change.

**Spatial resolution**
The latest version of the model can operate at a resolution of 100 x 100 m which is also the resolution of the most important input map, the CORINE Land Cover 2006, which defines the original state of the land use/cover in Europe. The outputs and indicators of the model can be aggregated to a coarser resolution, e.g. at any NUTS aggregation level.

It can be run also for individual NUTS1 or countries only. It also allows working with irregular regions of interest, composed by any configuration of NUTS1 regions.

**Input and output variables**

LUMP links specialized models and data within a coherent workflow. The model uses input from demographic (EUROPOP 2008, 2010) and economic models (CAPRI, GEM-E3, RHOMOLO) and also from TRANS-TOOLS. The model also requires a number of spatially explicit parameters at different resolutions (1 x 1 km, 100 x 100 m).

The main output of LUMP is a simulated map of the land use/cover for a given year in the future. The allocation module is currently able to simulate land use/cover classes such as urban, industry and commerce, agriculture, forest and semi-natural areas, thus allowing the competition between land uses to be accounted for dynamically in time and space. However, due to its components, functionalities and linkages with other models, the platform goes beyond the simple allocation of land uses and can be considered an integrative platform capable of translating scenarios into physical impacts in a range of environmental domains. LUMP is currently prepared to provide relevant output to the LISFLOOD model, which models river discharge at European level.

**Timeframe**

As currently configured, the model runs from 2006, producing yearly results up to 2030. Under some conditions, the timeframe can be extended by 10 or 20 years.

**Country coverage**

LUMP covers the whole of the EU. The model can be extended to cover new Member States of the European Union or to other neighbour countries of interest for which CORINE Land Cover 2006 (or comparable map) is available.

5.2. **TRANS-TOOLS: a transport network model**

**Non-technical description**

TRANS-TOOLS was tailored specifically to the main priorities of the EU transport policy. It combines, in an integrated manner, advanced modelling techniques in transport generation and assignment, economic activity, trade, logistics, regional development and environmental impacts. It covers the networks of all main modes in both passenger and freight transport.

It can be used in combination with other models and tools (TREMOVE, TRANSVISIONS meta-models, PRIMES, etc.) when required.

**Areas where the model can be applied**

The features of the model have been selected in order to best simulate and analyse the impacts of three types of measures:

- Changes in transport networks, especially TEN-T
- Pricing measures
- Changes in logistics and distribution systems
TRANS-TOOLS is not suited to assess the impact of the selected specific projects, mainly due to its traffic generating equations that were calibrated to minimize aggregate errors across all of Europe, and therefore could produce very erroneous results locally. Whereas this type of error might be acceptable in the evaluation of global policies, in which case such errors could be mutually compensating, it would be unacceptable when looking at individual projects defined over relatively limited areas.

**Spatial resolution**

**NUTS3**

**Input and output variables**

The main input variables are:
- Transport statistics, GDP and demographics, trade statistics (Eurostat)
- Logistics patterns (research projects)
- Price elasticities of transport demand (economic literature and research projects)
- Emission factors and external costs (research projects)

In order to keep consistency with past or parallel policy relevant analyses and projections, the TRANS-TOOLS Reference scenario matches historical data as published by EUROSTAT and DG MOVE, it is consistent with the energy outlook (PRIMES Reference scenario) and it uses the same assumptions concerning population and economic development than the other related policy departments do (e.g. DG ECFIN, DG CLIM, DG ENV).

The model can simulate the impact of changes in accessibility in terms of:
- Demand per mode
- Traffic on the network links
- Transport costs (per Origin-Destination pair, commodity type, specific corridor, etc.)
- Regional GDP
- Travel times
- Emission and accidents

**Timeframe**

Currently runs up to year 2030. Version 2.6 (due late 2012) will run until 2050.

**Country coverage**

EU28 plus neighbouring European countries

5.3. **RHOMOLO: Regional Holistic Model**

**Non-technical description**

The model integrates economic, spatial and social dimensions in a micro-economically founded framework.

RHOMOLO incorporates the following important features:
- Each regional economy is divided into six sectors which are linked through input-output linkages
- Producers (firms) produce goods and services by combining labour, capital, and intermediate inputs
- Consumers (households, governments and firms) purchase goods and services and save the rest of their budget
- Regional governments collect taxes, pay subsidies, consume goods and services and accumulate savings (or make debts)
- Dynamic optimisation of investments
- Regions are linked within the framework of New Economic Geography: inter-regional trade of goods and services are subject to trade costs; the model allows for knowledge spillovers, factor mobility and agglomeration economies

The pattern of inter-regional trade flows depends upon the preferences of consumers for buying goods from particular regions and upon the prices RHOMOLO differ by the type of good transported, the distance between the regions of origin and destination, and the quality/density of the transport infrastructure.

Each NUTS2 region in RHOMOLO consists of three types of economic agents: households, production sectors, and a government. The six activities are differentiated according to the NACE classification. Each activity produces only one type of good or service. Service sectors in RHOMOLO include both market and public sectors.

Labour is not differentiated according to skill/education level, although wages are region-specific and vary according to the differing educational and productivity levels of the regions. Wages take the appropriate level that equalises demand and supply. In addition, RHOMOLO allows also for inter-regional labour migration and positive unemployment in each region and sector.

**Areas where the model can be applied**

RHOMOLO can be used for ex-ante impact assessment of European Cohesion Policy and also for other policy simulations and comparison between policy scenarios. For example, RHOMOLO can be used to analyse the impact of innovation policy through the links between R&D expenditure, TFP growth and spillover effects.

**Spatial resolution**

NUTS2

**Input and output variables**

The input data come mainly from EUROSTAT, WIOD and the National Statistical Offices. The model simulates the impact of changes in exogenous shocks (economic integration, changes in policy regime, etc.

- Gross domestic product (GDP)
- Employment and unemployment
- Public and private savings and investment
- Inter-regional trade
- Inter-regional labour migration, unemployment and wages
- Regional disparities in wealth, poverty, etc.

**Timeframe**

Currently, the time horizon of RHOMOLO is 2030 but it can be extended to a longer time period if combined with DSGE models such as QUEST.

**Country coverage**
EU27 and the rest of the world as one aggregated region

5.4. CAPRI: Common Agricultural Policy Regional Impact Analysis

Non-technical description

CAPRI is a modelling system which consists of specific data bases, a methodology, its software implementation and the researchers involved in their development, maintenance and applications. It is the key model for the Commission reporting on agricultural and agri-environmental policies at the regional level. The model consists of a supply module and a market module, e.g. a spatial, global multi-commodity model for agricultural products including 47 products in 77 countries organized in 40 trade blocks.

Areas where the model can be applied

The objective of CAPRI is to evaluate ex-ante impacts of the Common Agricultural Policy (CAP) and trade policies on production, income, markets, trade and the environment, from global to regional level.

For example, it is able to perform a regional level analysis of specific Common Market Organisations (e.g. sugar, dairies), trade of agricultural goods with the rest of the world (e.g. WTO proposals) and different subsidisation schemes in Europe (e.g. partial decoupling of agricultural subsidies).

Recent examples include the 'greening measures' in the framework of the CAP 2014-2020 and the Mercosur free trade agreement.

Spatial resolution

NUTS0, NUTS1, NUTS2, farm types (within NUTS2) and cluster of 1x1 km grid cells (for environmental impact assessment)

Input and output variables

The model is based on data from EUROSTAT, FAOSTAT, OECD and extractions from the Farm Accounting Data Network (FADN). They cover about 50 agricultural primary and processed products in the EU, from regional to global level including input and output coefficients. Specific modules ensure that the data used in CAPRI are mutually compatible and complete in time and space.

Some exogenous variables like population growth, GDP, exchange rates, oil prices are coming from UN, DG ECFIN or Global Insight.

Output variables:

- Supply, demand, trade flows of agricultural commodities
- Hectares, herd size, yields, input use
- Producer and consumer prices, income indicators
- Environmental indicators, e.g. nutrient balances, GHG
- Welfare effects including the EU budget for the CAP

Timeframe

CAPRI is a static model and therefore compares a scenario (policy change) to a baseline (business as usual) for a specific year in time.

- Medium term : at this moment, one point in time = 2020
- Long term : under development (= 2050)
Country coverage

CAPRI is a global model, covering 77 countries in 40 trade blocks in the EU27, Norway, Turkey and Western Balkans.

5.5. RIAT-CHIMERE: Assessment of regional Air quality scenarios

Non-technical description

The RIAT-CHIMERE is composed of two main elements: (1) RIAT is a Regional Integrated Assessment Tool that brings together data on pollutant sources (emission inventories), their contribution to atmospheric concentrations and human exposure, with information on potential emission reduction measures and their respective implementation costs. (2) CHIMERE is a multi-scale air quality model (developed by the Laboratoire de Meteorologie Dynamique and by INERIS (France)) which is designed to produce daily forecasts of ozone, aerosols and other pollutants and make long-term simulations (entire seasons or years) for emission control scenarios. CHIMERE provides the link between emissions and concentrations within RIAT.

Areas where the model can be applied

RIAT-CHIMERE is well suited to assess the impact of emission reduction strategies on air quality and health at both the urban and regional scales.

RIAT-CHIMERE has not been directly used in impact assessments for the Commission but its CHIMERE component is currently used in projects which aim at providing support to the Commission, e.g. EC4MACS or in the frame of contract services in support to Commission departments (e.g. DG. ENV). RIAT is currently used by several regions (e.g. Lombardy, Emilia-Romagna and Alsace) in the EU to assess the impacts of regional air quality plans.

Spatial resolution

RIAT-CHIMERE runs over a range of spatial scales from the regional (several hundreds kilometres) to the urban (few tens of km) with resolutions from 1-2 Km to 20 Km.

The CHIMERE model has been widely used over Europe, with a spatial resolution as low as 10 km and time period up to full years to assess the impact of urban and regional areas. It can as well be used at higher resolution, with smaller domains or for shorter periods. RIAT is mostly used with resolutions ranging from 2 to 20 km.

Input and output variables

CHIMERE requires meteorological data (from prognostic meteorological model), boundary conditions for pollutant concentration (e.g. from coarser scale models) and land-use information and temporally and spatially defined emissions (both anthropogenic and biogenic). Outputs are gridded three dimensional fields of the selected pollutants (O\textsubscript{3}, aerosol, NO\textsubscript{x}, CO etc.) with an hourly time resolution.

In addition to CHIMERE the RIAT component requires information on technological costs (set to GAINS value by default) and emission-concentrations relationships (from CHIMERE). RIAT provides cost-effective sets of abatement measures together with a spatial distribution of air quality indicators and associated costs.

Timeframe
CHIMERE can be used for both short episodes or for full year simulations. RIAT is mostly used for seasonal or yearly assessments (although based on a hourly resolution) Entire year air quality scenarios can be produced as well to assess pollution trends in future years (e.g. 2020, 2030) based on adequate emission projections.

**Country coverage**

In theory, the model can be applied to any specific area having adequate input data. At present CHIMERE is a well-established and widely used (about 35 modeling groups) air quality model in Europe to assess and/or design future compliance with air quality standards. The RIAT component recently developed requires a more intensive data preparation and is currently applied within a few regional areas in the EU.

5.6. **RURAL EC MOD: Ex ante Spatial Policy Impact Analysis of the rural development policy**

**Non-technical description**

The RURAL EC MOD model allows for a split between urban and rural areas while capturing the economic interactions between the different actors - firms, government and households - in the short and medium run. When implementing policy scenarios, the model captures the responses of all actors to policy changes and indicates the impact on the regional economy but also on rural and urban areas.

**Areas where the model can be applied**

The model can be used for assessing the impact of expenditure-based interventions. The model has been used in the Impact Assessment of the reformed CAP.

**Spatial resolution**

NUTS3

**Input and output variables**

The inputs required:

- Social accounting matrix of a NUTS 3 region
- Assumptions on types of factor markets and macroeconomic balances best define the economy (closure rules)
- Elasticities for structural forms: trade, production, substitution, LES-demand
- Exogenous parameters, e.g. depreciation rate, TFP by sector
- Spending on rural development policy measures at NUTS 3 level
- Pillar 1 by type (e.g. coupled, SFP) and Pillar 2 by measure (e.g. 311)

The output of the model typically includes:

- GDP: total region, urban and rural areas
- Employment levels: activity, skilled/unskilled, urban/rural
- Income: rural/urban, farm households
- Exports: total region, and by sector
- Producer Prices: by sector
- Production: total, by activity: cereals, mining, manufacturing
- Wages: by type of labour, by area: urban/rural

**Timeframe**
Theoretically, the model can be run for a very long period, although in practice, it is better to limit the horizon to a maximum of 25 years (because of uncertainty surrounding the additional data requirement). As an example, previous impact assessments have modelled the impact of rural development policies from 2006 up to 2020.

**Country coverage**

EU