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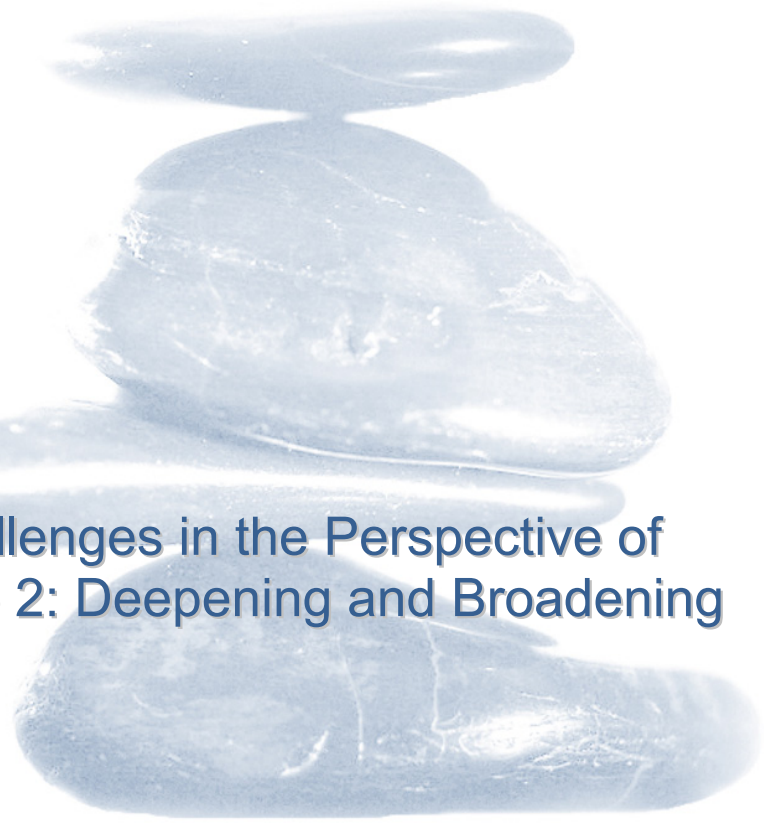

Contract Study

Regional Challenges in the Perspective of 2020 – Phase 2: Deepening and Broadening the Analysis

Final report: Annexes

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Annex 1: Methodology

The theoretical approach of regional vulnerability

Vulnerability is a complex issue to be developed, especially as there are no fully elaborated approaches to apply this concept in the context of the development of regions. One major challenge when depicting vulnerability is to translate this complex analytical model into a manageable and presentable format, which allows on the one hand to pay tribute to the fact that linear aggregation of the parameters (impact and adaptive capacity) will not be feasible and on the other hand to take into account that a clear cut formalistic "translation" of the relations between the parameters will not be possible either. Therefore we have constructed a synthetic approach, which allows an aggregation without getting into conflict with the uncertainty of the underlying systemic syntax of the relations between the parameters of vulnerability.

Mathematically the model can be described by the following structure:

(2) $V(t) = f(IM(t), AC(t))$ *V(t) = ƒ(IM(t),AC(t))*

with

(3) *IM(t) = g(E(t – 1),S(t – 1))* $IM(t) = g(E(t-1), S(t-1))$ and

(4) *AC(t) = h(SC(t – 1),INV(t – 1),INV(t – 2), …)*

where

V = Vulnerability	*S* = Sensitivity
IM = Impacts	*SC* = Social Capital
AC = Adaptive Capacity	*INV* = Investments
E = Exposure	*(t)* = index of time (2020), (t-1) = 2010

In brief this model starts with the general definition of vulnerability expressed as a function *f* of impacts and adaptive capacity at specific points in time *(t)*, with impacts being a function *g* of exposure and sensitivity at a time *t-1* thus building one causal chain to the vulnerability of the region. Adaptive capacity may be seen as function *h* of the social capital in a region at a given time *t-1* and the cumulated investments (private and public) over time. It builds the second causal chain to vulnerability.

The indicators describing the single elements of the concept will therefore have to be able to cover these variables of the model. An important fact is that we still do not know how the functions (*f, g, h*) are actually mathematically described as a linear or exponential relation is not to be assumed.

A possible extension to the model may be to define sensitivity as:

(5) *S(t) = j(INV(t – 1),INV(t – 2), ...)*

In this case we assume that different investments should go into *S(t)* and *AC(t)*. It allows for a better clarification of sensitivity – however it is bought at the expense of difficulties with splitting up investments into regions (public and private) into the two categories sensitivity and adaptive capacity, which may be difficult as the counter effects of investments vis-à-vis the regional vulnerability will have to be known. From the perspective of minimizing the loss of information from the real world it would be the better option, as investments may indeed increase the impact of any challenge (e.g. increasing social disparities) and not only serve as increase of adaptive capacities in a region.

Another alternative to the model with regard to the specification of sensitivity following the train of thought of the previous paragraph would be to define sensitivity as:

(6) *S(t) = k(AC(t))*

In this case vulnerability is only a function of *IM* directly. It could be argued that indirectly the original definition of vulnerability appears in this reduced form with time lags, so in principle no change in the approach is needed, but it might help to clarify operations.

The model operates for the calculation of potential impacts, adaptive capacities per key issue and for one challenge as well as for multiple challenges.

Combination of indicators for the maps

z-Transform

Sometimes one has the problem to make two samples comparable, i.e. to compare measured values of a sample with respect to their (relative) position in the distribution. An often used aid is the z-transform which converts the values of a sample into z-scores:

$z_i = (x_i - x')/s$

with

z_i ... z-transformed sample observations
x_i ... original values of the sample
x'... sample mean
s ... standard deviation of the sample

The z-transform is also called standardization or auto-scaling. z-Scores become comparable by measuring the observations in multiples of the standard deviation of that sample. The mean of a z-transformed sample is always zero. If the original distribution is a normal one, the z-transformed data belong to a standard normal distribution (m=0, s=1).

Aggregation inside the vulnerability dimensions

The most pragmatic way of doing this is the use of logical disjunctions and conjunctions. In logic, a conjunction is a compound sentence formed by using the word AND to join two simple facts. A disjunction is a compound sentence formed by using the word OR to join two simple facts. The assumption behind this is that the exposure/sensitivity/adaptive capacity of a region is dependent from either one indicator OR another or the exposure/sensitivity/adaptive capacity is dependent on both; i.e. one indicator AND another.

It was decided for this draft to use disjunction for aggregating within one dimension of vulnerability and conjunction to combine sensitivity and exposure. In most cases, this would result in the most meaningful results.

An example: exposure in key issue C1 biomass production is expressed by *the interannual variety of crop yields* and the danger of *forest fire hazards*. No matter whether it is high variability or many fire hazards, the region gets will be exposed the decline in biomass production anyway. Sensitivity is expressed by the *employment in agriculture and forestry* and the *share of agriculture and forestry in GVA*. A high share in both of theses describes the same thing, i.e. a high sensitivity of agriculture in this region, no matter if by which of the two it is measured (in fact there are relatively interchangeable). When it comes to aggregating exposure and sensitivity, the conjunction (arithmetic mean in practice) is the appropriate method: if a region has a high exposure but a low sensitivity, the impact will be medium.

For adaptive capacities, for many there are only second best solutions (such as GDP or qualitative data) and the data situation is less reliable which is why it was chosen to not aggregate it into the vulnerability but integrate it as a separate layer of information.

Generally, disjunction requires a relatively low number of indicators as it tends to produce very overall higher values the more indicators there are. It would be sufficient, for instance, if only one exposure indicator out of ten would be very high to make the region very highly exposed in total. If this one indicator is of very minor significance, it may be better to drop it or to use a conjunction. Therefore the use of disjunctions has to be carefully considered. That is to say, in some key issues the strict logical framework for the aggregation of did not prove to be appropriate. There are types of indicators that are not interchangeable why it is more useful to use a logical conjunction, i.e. to calculate an arithmetic mean. For instance, in the key issue G3 accessibility it did not prove to be reasonable to calculate the accessibility by different means of transport as these are not able to substitute each other. A high exposure to air traffic accessibility does not necessarily mean that a region is badly accessible, as long as there is a low exposure to road traffic accessibility is negligible. In this case, it would probably make more sense to use a logical conjunction for air and rail and a disjunction for the most important means of transport, road traffic.

For these reasons, some of the vulnerability maps still have to be reworked in this respect. The logical conjunction to combine exposure and sensitivity proved to be very reasonable, however, for the single dimensions, all indicator sets for exposure and sensitivity will be tested for the final maps following the subsequent scheme:

- There is only one indicator for exposure/sensitivity/adaptive capacity -> no logical junction required
- All individual indicators for exposure/sensitivity/adaptive capacity by themselves cause discrete and comparable levels of exposure/sensitivity/adaptive capacity -> logical disjunction (one OR the other indicator has to be

high to have an overall high level of exposure or sensitivity)

- The entirety of indicators for exposure/sensitivity/adaptive capacity causes higher levels of exposure/sensitivity/adaptive capacity than the individual indicators by themselves -> *logical conjunction* (one AND the other indicator has to be high to have an overall high level of exposure/sensitivity).

Functions used

Either all indicators in one of the dimensions add up to the z-transformed total level of exposure $Ex_{im(z)}$ (conjunction in the form of the average value):

$Ex_{im(z)} = \sum (Ex_{1(z)}, Ex_{2(z)}, Ex_{n(z)})/n$

Or the level of exposure of one of the indicators overrules the others (disjunction in the form of the minimum value, i.e. the worst score):

$Ex_{im(z)} = \min (Ex_{1(z)}, Ex_{2(z)}, Ex_{n(z)})$

Combinations are possible, eg. if the sum of exposure indicators one and two are of the same importance for the level of exposure as indicator three:

$Ex_{im(z)} = \max (\sum (Ex_{1(z)}, Ex_{2(z)})/2), Ex_{3(z)})$

For **sensitivity**, the indicators are normalised and combined in exactly the same way:

$Se_{im(z)} = f (Se_{1(z)}, Se_{2(z)}, Se_{n(z)})$

For the total **impact** in quintiles as a part of vulnerability $Im_{vu(z)}$, exposure and sensitivity are weighted equally (conjunction in the form of the average value):

$Im_{vu(z)} = \sum (Ex_{im(z)}, Se_{im(z)})/2$

At this stage, the indicators get classified using an five-part ordinal scale based on mean value (always 0 for the z-transformed indicators) and shares of standard deviation. In our case we used:

- Highly below average: normalised indicator is equal to or below negative standard deviation.
- Below average: normalised indicator is above negative standard deviation but below 1/3 negative standard deviation
- Average: normalised indicator is above 1/3 negative standard deviation and below 1/3 positive standard deviation
- Above average: normalised indicator is above 1/3 standard deviation but below total positive standard deviation
- Highly above average: normalised indicator is equal to or above positive standard deviation.

For **adaptive capacity** in quintiles as a part of vulnerability $Ac_{vu(z)}$, the indicators are normalised and combined in the same way as for exposure and sensitivity, either using a conjunction, a disjunction or a combination:

$Ac_{vu(z)} = f (Ac_{1(z)}, Ac_{2(z)}, Ac_{n(z)})$

Again, these values get classified for the impact maps.

For the total **vulnerability** $Vu_{(z)}$, impact and adaptive capacity are again weighted equally (conjunction):

$Vu_{(z)} = \sum (Im_{vu(z)}, Ac_{vu(z)})/2$

In the final maps, the vulnerability is not pictured but rather adaptive capacity layed over the impact, for a maximum of information. Aditionally, a different type of combination is used (see methodological remarks chapter).

Assumptions taken for the development of scenarios

Globalisation

	Sustainable recovery scenario	Sluggish recovery	Lost decade
Europe and external investors	Accelerating integration of markets: Greater exchanges with other high growth areas and with European neighbourhood – increasing global interest in European services and products Mergers among transnational corporations: Concentration of power to a narrowing number of global cities		Europe less interesting to external investors, and less able to invest in emerging markets Isolated, losing market shares
Traffic volumes and CO2	Increased traffic volumes: higher CO2 emissions that cannot be compensated through technological advances on the short and medium term	Traffic volumes increasing more slowly: Time delay in transport increases offers possibility for technical innovation to advance and cushion the environmental effects Technological advances may significantly reduce overall emission levels	traffic volumes hardly increasing, or possibly decreasing on the short term Net reduction in CO2 emissions, but limited means to develop long term solutions and alternative technologies
international demand	Increased international demand for goods and services	increasing more slowly:	stagnating, or possibly decreasing on the short term
	Sustainable recovery scenario	Sluggish recovery	Lost decade
demographic polarization	Demographic polarization: towards cities with higher education opportunities, especially as students find job opportunities where they happen to be when they get their degree, towards regions of old Member States, as they attract workers from New Member States and from outside Europe Effect on regional demographic trends, ageing and population decline in remote areas, increase in the proportion of active population and demographic increase in regions with high GDP	Relatively slower Higher rate of return migration after the end of higher education Relatively more modest work-related migrations from Old to New Member States Net flows from rural to urban in New Member Statesslowed down Possibility of exploiting this situation to promote more balanced territorial development, drawing from the competencies and entrepreneurship of inhabitants of each region	Demographic situation stabilized or, in some cases, inversed Birth rates dropping in areas where the economic situation is uncertain or in crisis High rate of return migration after the end of higher education Modest work-related migrations from Old to New member states Return migration from urban to rural areas in the NMS with the lowest levels of economic performance Difficult to exploit this situation to promote more balanced territorial development, because the economic means to draw advantages from what could be a potentially favourable context are missing Risk for a growing brain drain out of Europe higher rates of persons taking higher education in countries with generous public support systems Accentuated difference between European countries in terms of higher education levels
investment in R&D	High levels, Europe facing up to the intense global competition in this respect.	Lower overall levels of investment in R&D, higher share of public investments in this sector greater possibility of steering the orientation of R&D, but risk of insufficient overall R&D effort	Low private and public levels of investment in R&D Europe losing falling behind in the international competition

Demographic change

	Sustainable recovery scenario	Sluggish recovery	Lost decade
Migration flows	Backflow of work seeker in countries and regions recovering first depending on the degree of the crisis – change in direction and target regions Migration from 2007 Accession countries will increase after the establishment of full free movement of persons in 2014	Backflow of workers will be limited in size to a selected range of target regions recovering after crisis the fastest Different speed of recovering will deepen disparities of the regions Manifold crisis regions will start lagging behind – possible migration flows from regions not yet or in the present no longer recognised as source regions of migration	Ongoing crisis will increase regional disparities in broader range of the territory Countries in economic difficulties might develop to out migration regions in a wider scale
Natural development	Catch-up effect of temporary short break-off of births	Catch-up effect of temporary short break-off of births will be delayed in time	Catch-up effect of temporary short break-off of births will be postponed

Climate change

	Sustainable recovery scenario	Sluggish recovery	Lost decade
	High investments in all sectors that support decoupling of economic growth and resource use e.g. energy efficiency, renewable energies, education Decreasing GHG emissions and reduced dependency on fossil fuels More sustainable use of water as one important aspect of more sustainable resource use Development of flexible, highly adaptive structures in the energy, as well as in economic and social systems Coordinated and collective European policies to support the European headline targets, in particular the reduction of GHG emissions Implementation of existing innovative directives insofar as they support the EU climate policy for 2050 (water framework directive, floods directive, habitat directive, energy efficiency, soil thematic strategy, soil framework directive, agricultural policy, water scarcity and drought policy, transport policy, renewable energies, marine and coastal policy, marine strategy framework directive, strategic environmental assessment, regulatory impact assessment) and the formulation of new ones necessary to acieve the ambitious goals. Mutual support among the member states concerning innovative climate change adaptation measures (e.g. Climate Change Adaptation Clearing House) Health improvements (physical and mental well-being) due to increased emphasis on quality of life	Modest investments in all sectors that support decoupling of economic growth and resource use e.g. energy efficiency, renewable energies, education Increasing GHG emissions in many regions and continued (partial) dependency on fossil fuels Increase in sustainable use of resources, however a lack of coherent policy Patchwork development of flexible, adaptive structures in energy, economic and social systems Slow and uncoordinated European policies to support the attainment of Europe's headline targets, in particular the reduction of GHG emissions, and inefficient implementation of existing directives. Increasing transportation costs without a corresponding increase in disposable income will reduce tourism. In tourism climate change itself might trigger additional changes. Due to increased biomass use as a consequence of rising fossil fuel prices, agriculture and forestry will face the challenge of providing food, feed, fiber and fuel in a sustainable manner, however, the missing positive incentives due to investments in renewable energy delay changes. Increased transport costs will increase demand for locally produced products. Adaptation measures and climate proofing of infrastructure will require intelligent solutions and enhanced education. Even the more modest investments in these fields could provide new integrated job opportunities in all regions in urban as well as rural areas.	Minimal investment in all sectors that support decoupling of economic growth and resource use e.g. energy efficiency, renewable energies, education Slowing of the growth of GHG emissions due to slow economic growth rather than to a decoupling of economic growth and resource use. Continued dependency on fossil fuels. Slow and uncoordinated European policies to support the attainment of Europe's headline targets, in particular the reduction of GHG emissions, and inefficient implementation of existing directives. Patchwork solutions in water management and climate change adaptation measures responding to case specific needs rather than far-sighted policies. Reduction of public expenditures on social and health programs in an effort to boost economy in many regions will lead to an increase in health and sanitation problems. Increasing transportation costs without a corresponding increase in disposable income will reduce tourism significantly. In tourism climate change itself might trigger additional changes. Due to increased biomass use as a consequence of rising fossil fuel prices, agriculture and forestry will face the challenge of providing food, feed, fiber and fuel in a sustainable manner. Increased transport costs will increase demand for locally produced products.

	Sustainable recovery scenario	Sluggish recovery	Lost decade
	Adaptation measures and climate proofing of infrastructure will require intelligent solutions and enhanced education and will provide new integrated job opportunities in all regions in urban as well as rural areas. Dramatic change in mobility due to rapid reduction of fossil fuel use and therefore also changes in temporal and spatial patterns of tourism (fewer trips and closer to home). In tourism climate change itself might trigger additional changes (on the push and the pull side). Due to increased biomass use as part of the drive towards renewable resources, agriculture and forestry will face the challenge of providing food, feed, fiber and fuel in a sustainable manner. Increased transport costs will increase demand for locally produced products.		

Secure, sustainable and competitive energy

	Sustainable recovery scenario	Sluggish recovery	Lost decade
energy import price	Slight increase to 61.1 $/bbl in 2020	High energy import prices of 84.4 $/bbl in 2020	Increasing (71.9 $/bbl in 2020)
Primary energy consumption, energy mix and energy import dependency	Primary energy consumption is increasing, but energy growth rates become smaller over time with consumption almost stabilising towards 2020. Energy intensity (i.e. ratio between primary energy consumption and GDP) improves increase will be mainly met by renewables and natural gas, which are the only energy sources that increase their market shares	Decreasing primary energy consumption decreasing energy intensity, Renewable energy is the only energy carrier with increasing share in primary energy. However, RES 2020 targets of the EC are not met. Increasing energy import dependency due to decrease in own production of fossil and solid fuels as well as increasing net imports of renewable.	Total primary energy consumption is increasing due to insufficient investments in energy efficiency. Decoupling of energy intensity from GDP continues. Growing share of renewable energy covering mainly the growth in primary energy consumption. Total consumption of other fuels (fossil, solid and nuclear) is remaining stable. Growing energy import dependency mainly for oil and gas as well as a slight increase of imported renewable energy.
Energy related CO2 emissions	continue to increase as on account of the nuclear phase-out becoming effective and the ensuing replacement of nuclear with coal, which is not sufficiently compensated by the further penetration of renewables	decreasing as on the account of the slower economic growth and growing share of renewables	Energy related CO2 emissions remain stable with a slightly decreasing tendency above all sectors
	Decreasing share of nuclear energy as a result of political decisions in certain old Member-States and the closure of plants with safety concerns in some new Member States.	Economic recovery package promotes renewable energy and carbon capture and storage (CCS). In addition, new additional national policies and measures are implemented with the aim to meet the EU 2020 targets	Due to few additional policies and measures on energy efficiency and renewable energy, the EU 27 remain far below the RES 2020 target.

Social polarisation

	Sustainable recovery scenario	Sluggish recovery	Lost decade
Social security system	Due to its wealth Europe will be able to stick to its strong social net and even improve it. Benefits of growth will be widely shared and people experiencing poverty and social exclusion are enabled to live in dignity and take an active part in society.	After some consolidation cuts in the first years after the crisis, the social security system will somehow stabilise with higher GDP levels. However, a number of newly emerging social issues cannot be addressed appropriately to really mitigate social polarisation challenges before 2020.	The economic pressures and the hole they break into Europe's social net will steadily increase social polarisation. Unemployment goes up, many young and older people will be jobless.
income inequalities	get lower but not to a major extent, the steady growth and generally rising income levels do not call for action in changing the distribution of income and additionally, prices for consumables will rise by trend.	not really change. To remain competitive, income levels will not rise to a major extent.	steadily rise as many people are jobless and social transfers have to be reduced in countries that had a stronger redistribution system.
labour market transformations	labour market transformations as we know them will slow down because due to its rising share in the global economy Europe will be able to keep itself attractive also for industries at risk of offshoring	carry on to an extent as could be examined during recent years, the global competitiveness still forces many companies to offshore their activities towards lower income level countries.	increase rapidly as global competitiveness for Europe can only be achieved by offshoring to low-cost countries and automation of processes.
youth unemployment	decrease as the strong growth will induce investments into new capacities, new jobs will be created. However, high education levels will remain a major requirement for young job seekers.	stay about the same as no major changes in education levels and the labour force structure can be noticed.	increase by trend as older workers are trying to stay in the working process due to the unstable situation by all means which makes it difficult for younger people to enter the labour market.
access to SGEIs	remain the same in already well equipped regions and will increase in less equipped regions. The structural reforms of service provision will not take place as the rising growth does increase the income of the service providers.	decrease by trend but not severely because it will be necessary to reduce costs in some regions.	decrease on the one hand because it will be necessary to cut down infrastructures in some regions, on the other hand efficiency will increase due to the severe cost pressure so that well equipped regions will not face major cuts.

The methodological approach of clustering

In a first analytical step the correlation between indicators were calculated in order to avoid overlaps in the capacity to depict qualities of the regions or biases through the inherent weighting of specific aspects of the overall balanced picture. These correlation matrixes were calculated by Pearson and Spearman-Rho. Both correlation matrixes show no significant correlation between single indicators. This means that no indicator is “overlapping” with another indicator or depending on another one – thus putting a misleading emphasis on one single aspect of the analysis of the vulnerability of regions.

In terms of methodology (see Hans-Friedrich Eckey, Multivariate Statistik; unpublished script) the following approach has been used:

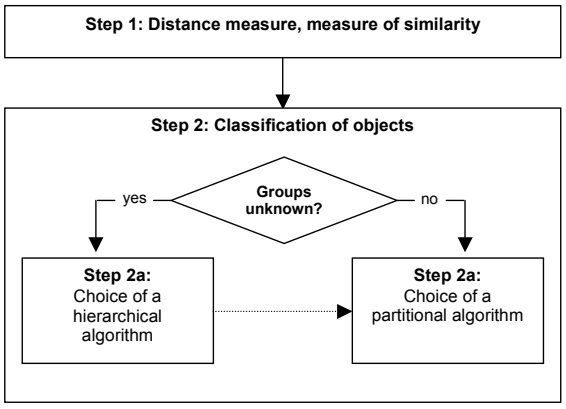
By means of cluster analysis, the regions were classified in several clusters which on the one hand should be in itself as similar as possible (homogeneous) and which on the other hand should be as different as possible (heterogeneous) among each other.

Clustering is the classification of objects into different groups, or more precisely, the partitioning of a data set into subsets (clusters), so that the data in each subset (ideally) share some common trait – often proximity according to some defined distance measure.

The data clustering was executed by means of two different processes (see 0 below). Due to the fact that firstly no groups (clusters) were known, a hierarchical algorithm had to be chosen.

The (hierarchical) clustering could finally be improved by a partitional algorithm (k-means clustering).

Figure A.1 Clustering process by combining (hierarchical) clustering and partitional algorithm



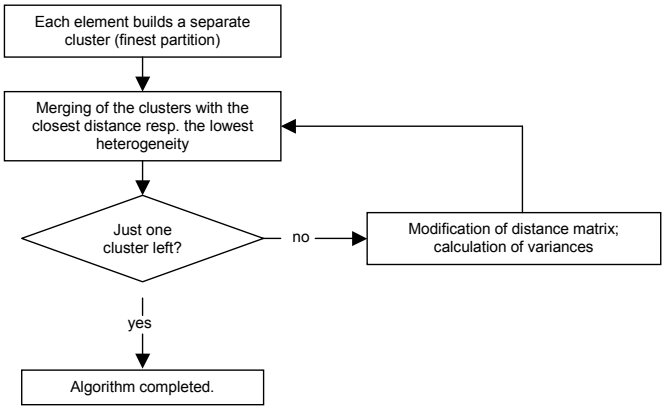
Hierarchical algorithms find successive clusters using previously established clusters, whereas partitional algorithms determine all clusters at once.

The hierarchical algorithm calculates as follows (see also Figure A.2 below):

- First each element builds a separate cluster (finest partition – no object belongs to more than one cluster).
- The two clusters which are closest (according to the chosen distance) resp. which merging causes the lowest increase in intra-class variance get merged.
- The distance matrix gets modified resp. the intra-class variances get re-calculated.
- The algorithm can be (theoretically) continued until just one cluster remains.

Clustering gets stopped either when the clusters are too far apart to be merged (distance criterion) or when there is a sufficiently small number of clusters (number criterion).

Figure A.2 Hierarchical algorithm process of calculation



Due to the fact that firstly no groups (clusters) were known, the hierarchical algorithm was chosen. To get groups in clusters which are as homogeneous as possible, the Ward method was used. The aim of the Ward method is to unify groups in such way that the variation inside these groups does not increase too drastically.

When variance-oriented algorithms are used, the squared Euclidean distance must be used as distance function. Thereby the Euclidean distance – the "ordinary" distance between two points in the two-dimensional space – gets squared.

When Ward linkage method is used for clustering, all variables have to be measured on a metric scale. All used variables meet this condition.

$$QED(i,j) = \sum_{k=1}^{m} \left(z_{ik} - z_{jk}\right)^2$$

Ward's Method

Ward's method is one possible approach for performing cluster analysis. Basically, it looks at cluster analysis as an analysis of variance problem, instead of using distance metrics or measures of association.

To calculate the mean of the g^{th} cluster for the k^{th} Variable all n_g objects of this cluster are used:

$$\bar{z}_{gk} = \frac{1}{n_g} \sum_{i \in C_g}^{n_g} z_{ik}$$

So the sum of the square deviations of the single values of this variable in cluster g can be calculated:

$$\sum_{i \in C_g}^{n_g} \left(z_{ik} - \bar{z}_{gk} \right)^2$$

The adding over all m variables shows the variation within cluster g:

$$V_g = \sum_{k=1}^{m} \sum_{i \in C_g}^{n_g} \left(z_{ik} - \bar{z}_{gk} \right)^2$$

The adding of the V_gs over all clusters shows the error sum of squares of a special partition:

By every fusion the variance within the clusters increases.

The clusters should be as homogeneous as possible, that means the variance within the clusters should be as small as possible. Using Ward's method two clusters get merged if the fusion causes the smallest increase of the variance within the clusters and for this reason causes a growth of heterogeneity within the clusters which is as small as possible.

The increase of the term V in case of merging the clusters C_g and C_h can be determined by the expression:

$$\Delta V\left(C_g \cup C_h\right) = \frac{n_g \cdot n_h}{n_g + n_h} \sum_{k=1}^{m} \left(\bar{z}_{gk} - \bar{z}_{hk} \right)^2$$

Within the classification process the growth ΔV has to be calculated for all pairs of clusters. The two clusters with the smallest value of ΔV get merged.

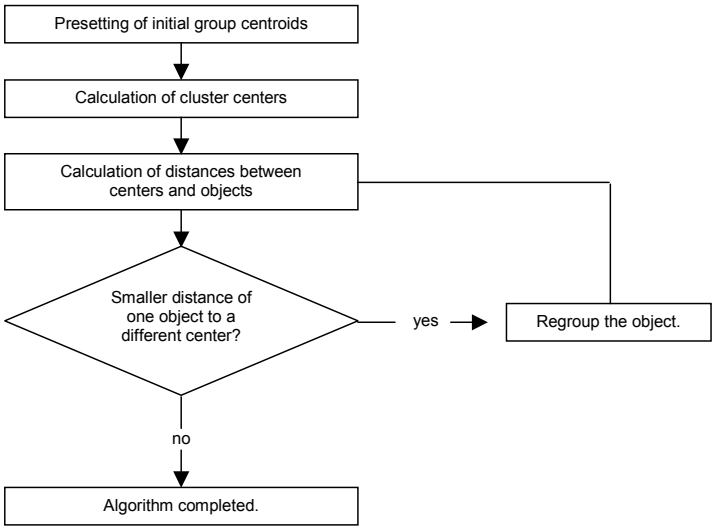
To optimize the cluster solution calculated with the hierarchical algorithm, finally a partitional algorithm was used. Thereby an initial partition based on the results of the hierarchical algorithm was employed.

K-means clustering (partitional algorithm)

The procedure (see 0 below) follows a simple and easy way to classify a given data set through a certain number of clusters (assume k clusters) fixed a priori. The K-means algorithm assigns each point to the cluster whose centre (also called centroid) is nearest. The centre is the average of all the points in the cluster – its coordinates are the arithmetic mean for each dimension separately over all the points in the cluster. For all objects the squared Euclidean distance to all cluster centres is calculated. Then each object gets assigned to the group that has the closest centroid.

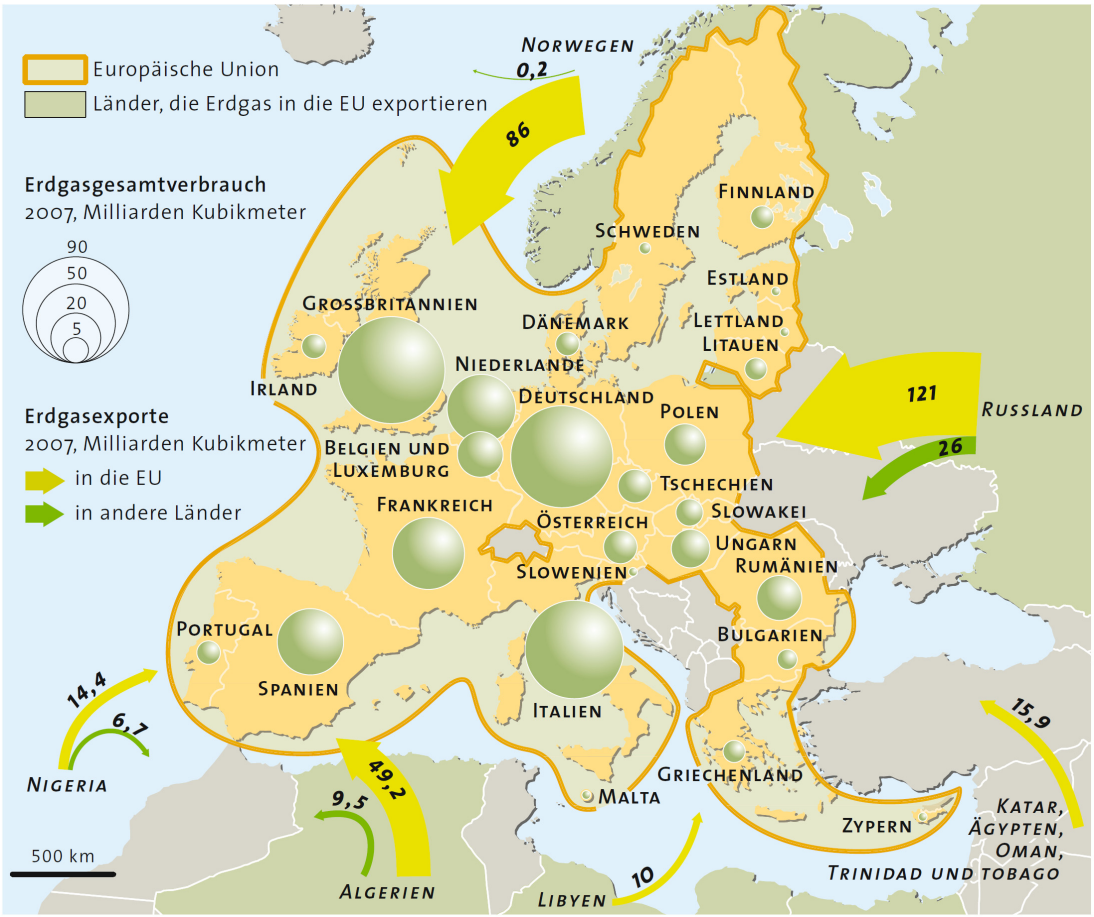
At this point k new centroids as barycentres of the clusters resulting from the previous step get re-calculated. The two steps are repeated until all objects have the minimal distance to their centres.

Figure A.3 K-means clustering (partitional algorithm)



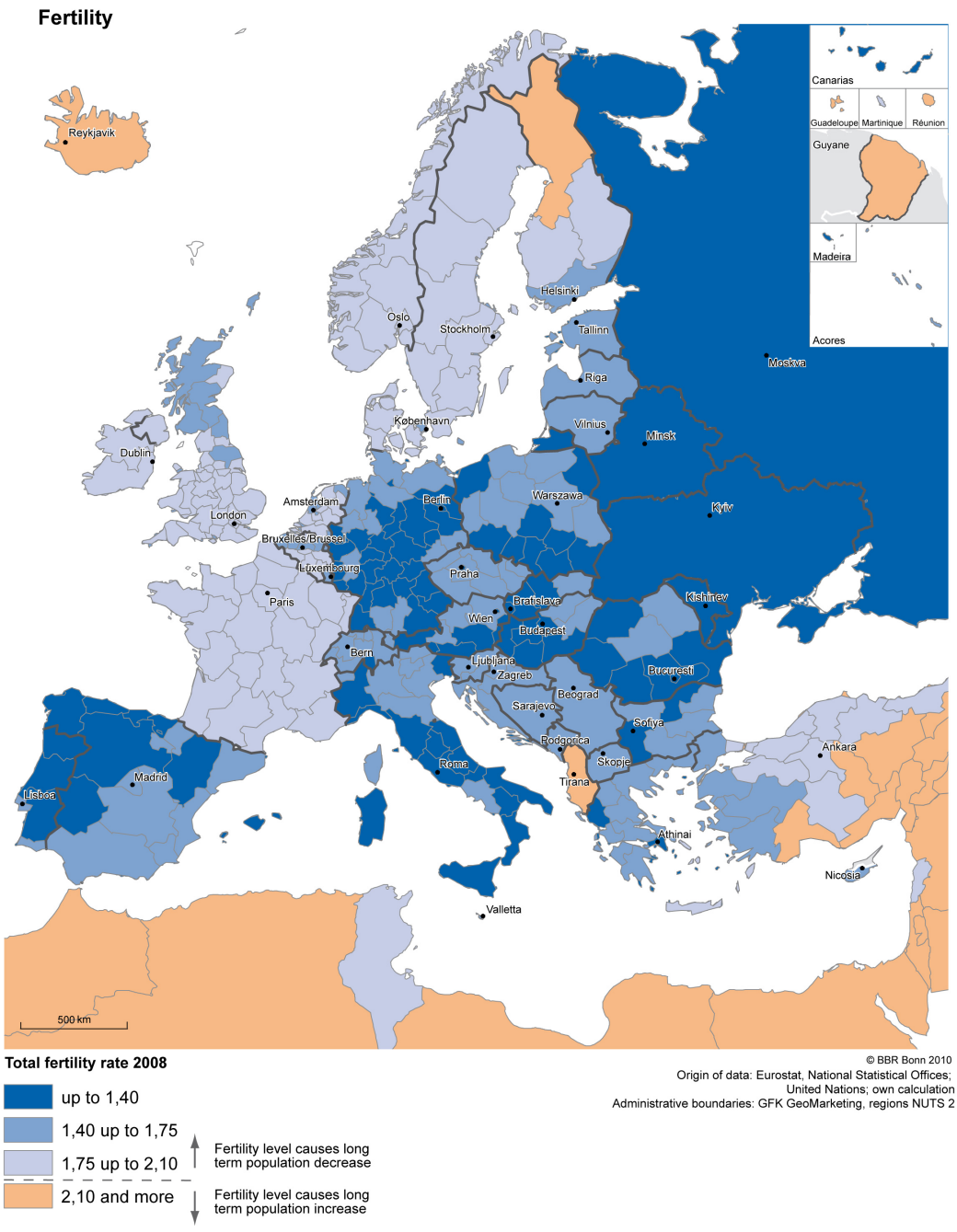
Annex 2: Additional maps

Map A.1 Natural gas demand and export

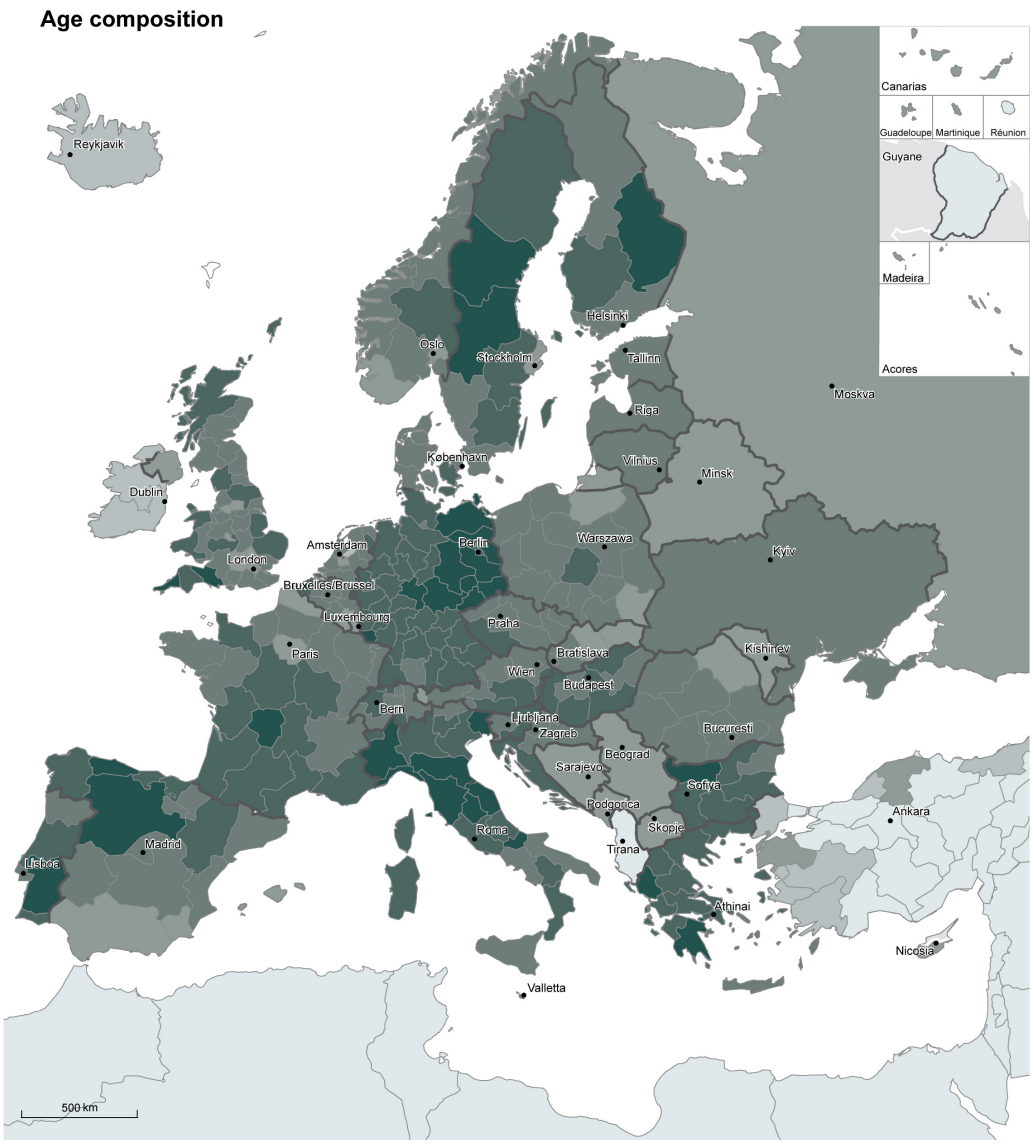


Source: Le Monde diplomatique (2009: 82)

Map A.2 Fertility



Map A.3 Age composition



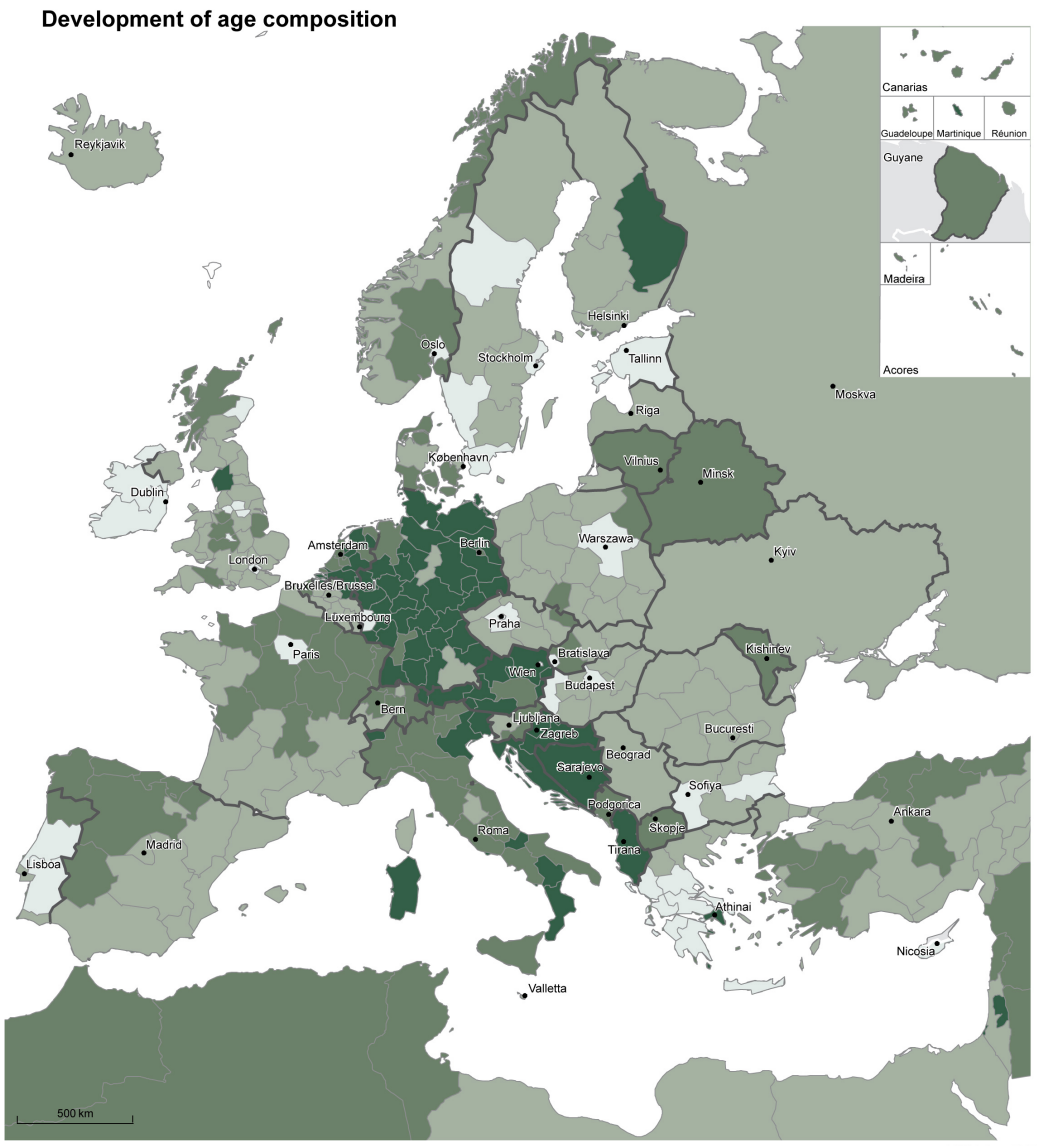
Age composition of the population expressed by the Billeter Index* in 2008 **

- to below -0,60
- -0,60 to below -0,45
- -0,45 to below -0,30
- -0,30 to below 0,15
- 0,15 to below 0,00
- 0,00 and more

Origin of data: Eurostat, National Statistical Offices; United Nations; own calculation
Administrative boundaries: GFK GeoMarketing, regions NUTS 2

*** population below 15 - population 50 and over / population 15 - 50**
**** Neighbouring countries 2005**

Map A.4 Change of age composition in time



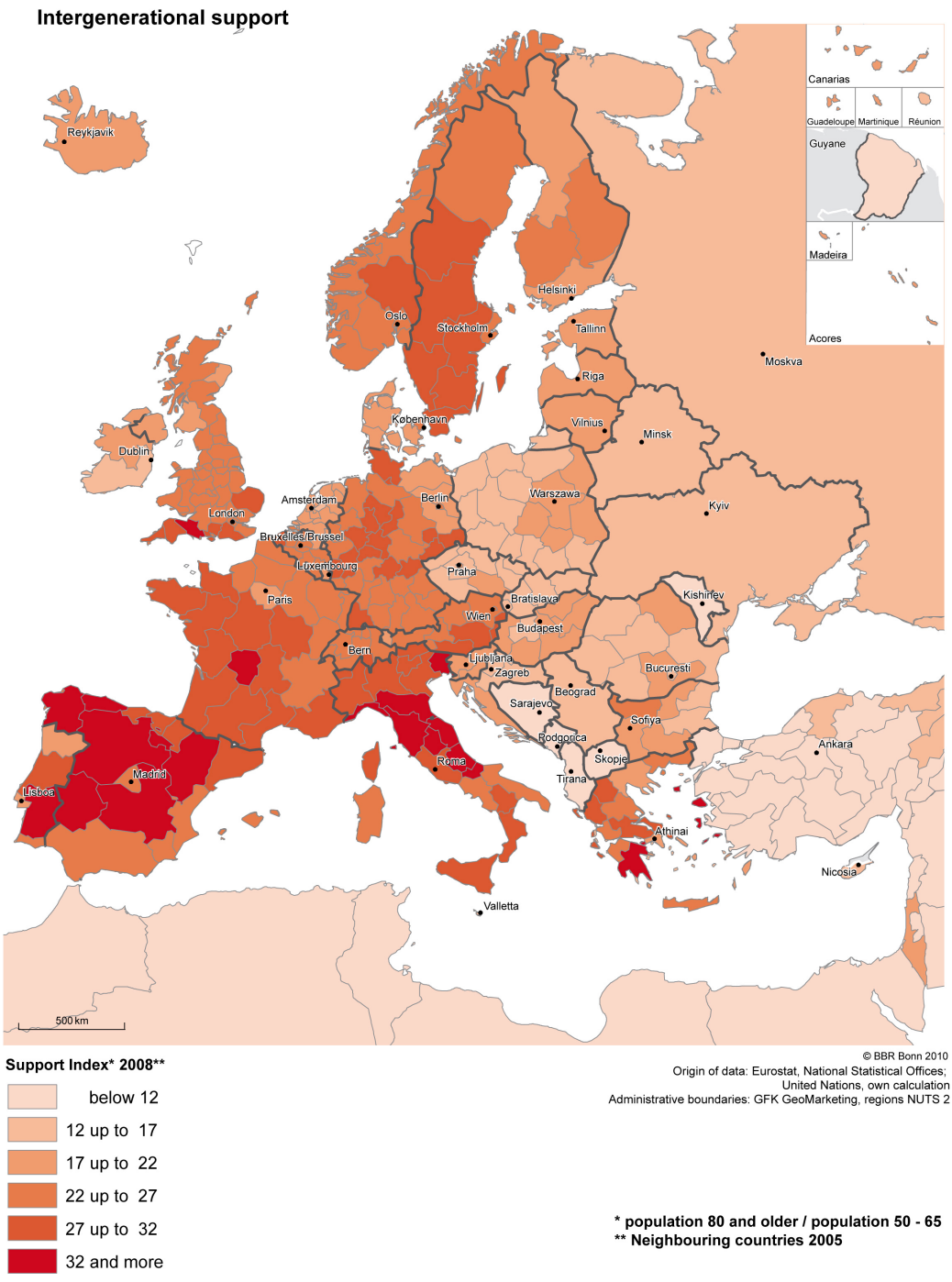
Change of age composition of the population expressed by the Billeter Index* 2020 compared to 2008 **

- up to -0,24
- -0,24 up to -0,16
- -0,16 up to -0,08
- -0,08 and more

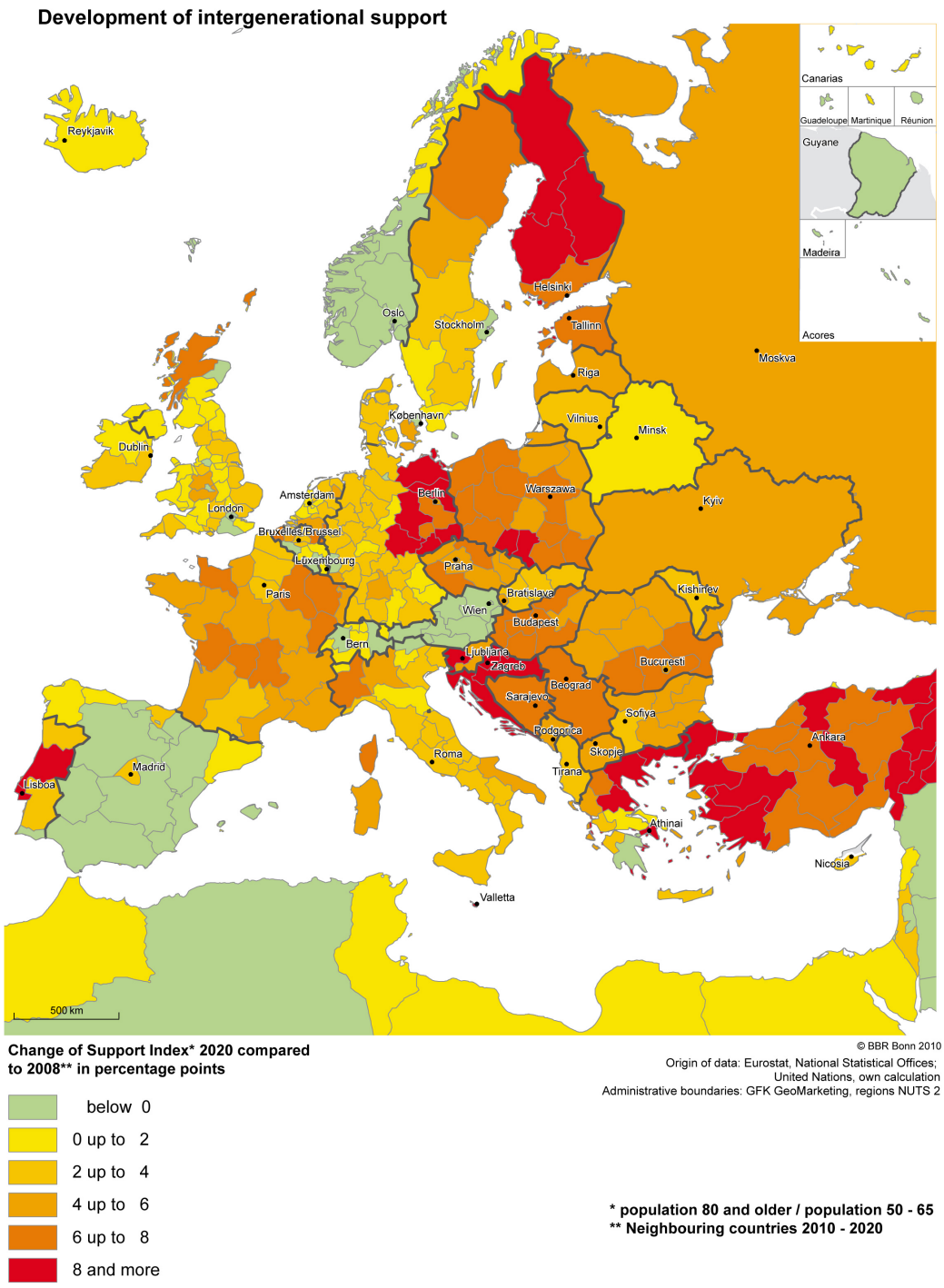
Origin of data: Eurostat, National Statistical Offices; United Nations; own calculation
Administrative boundaries: GFK GeoMarketing, regions NUTS 2

*** population below 15 - population 50 and over / population 15 - 50**
**** Neighbouring countries 2010 - 2020**

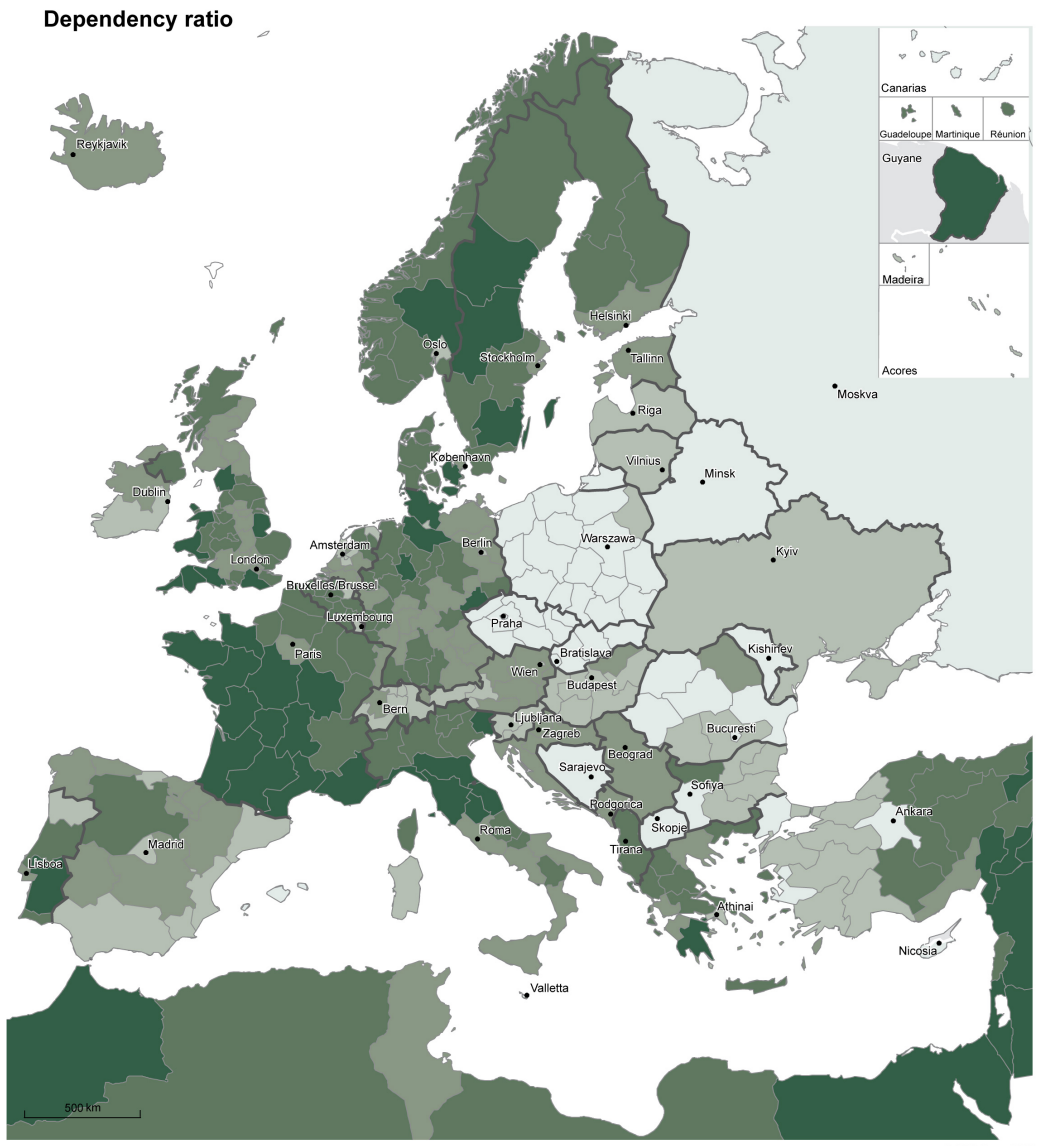
Map A.5 Intergenerational support



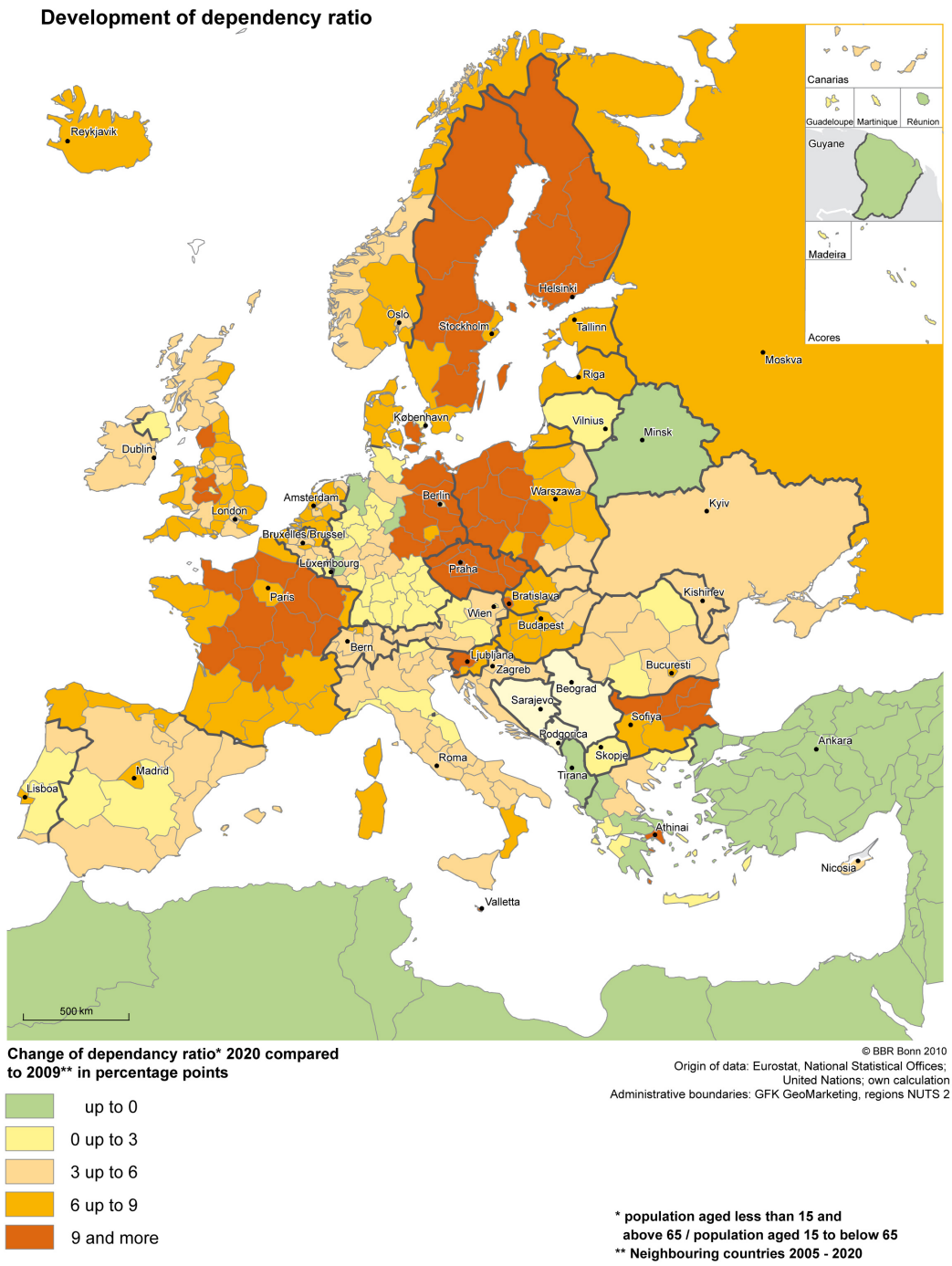
Map A.6 Change of Intergenerational support in time



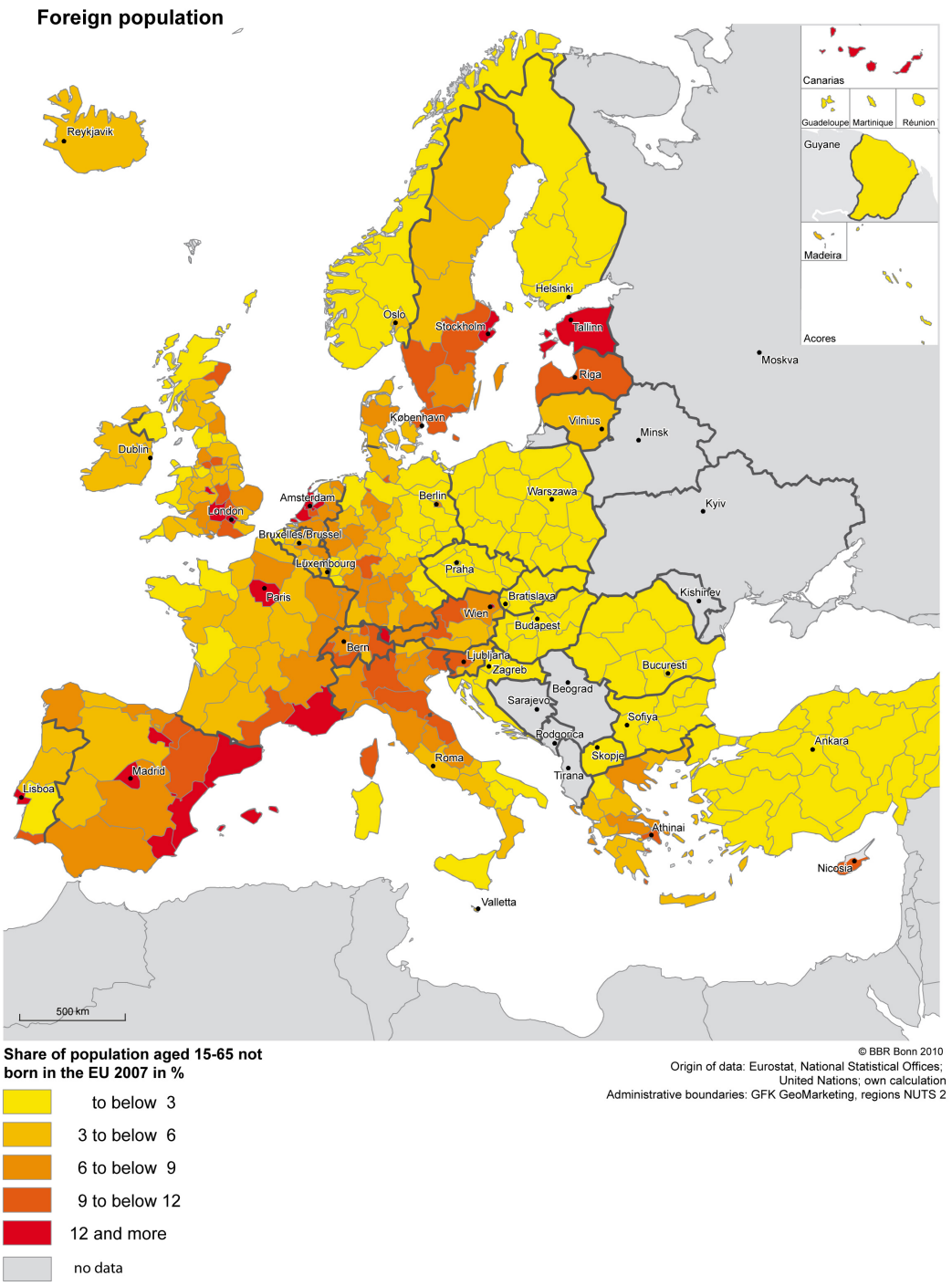
Map A.7 Dependency ratio



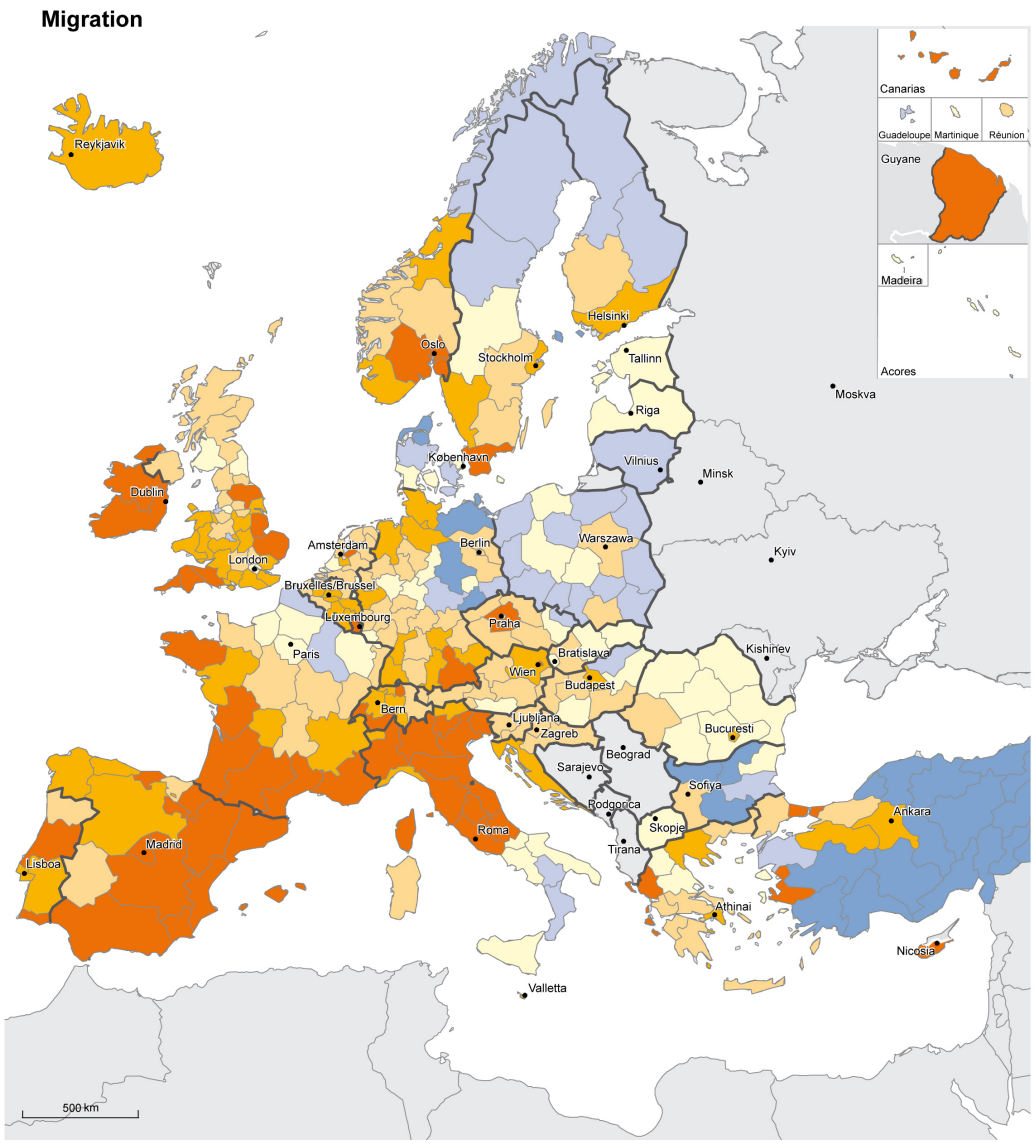
Map A.8 Development of dependency ratio



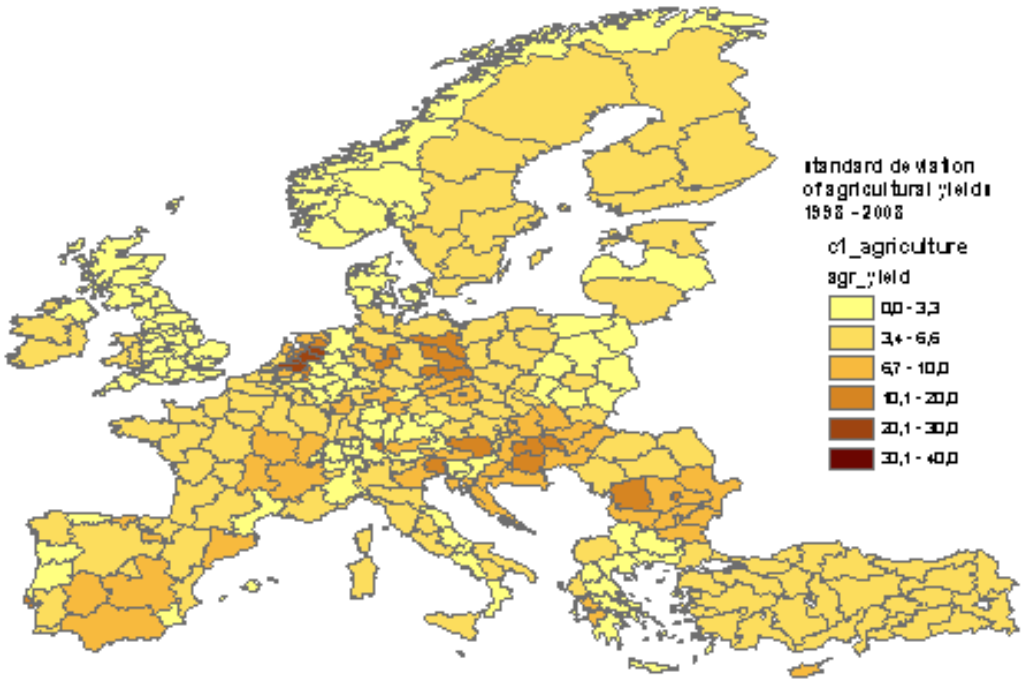
Map A.9 Foreign population



Map A.10 Migration

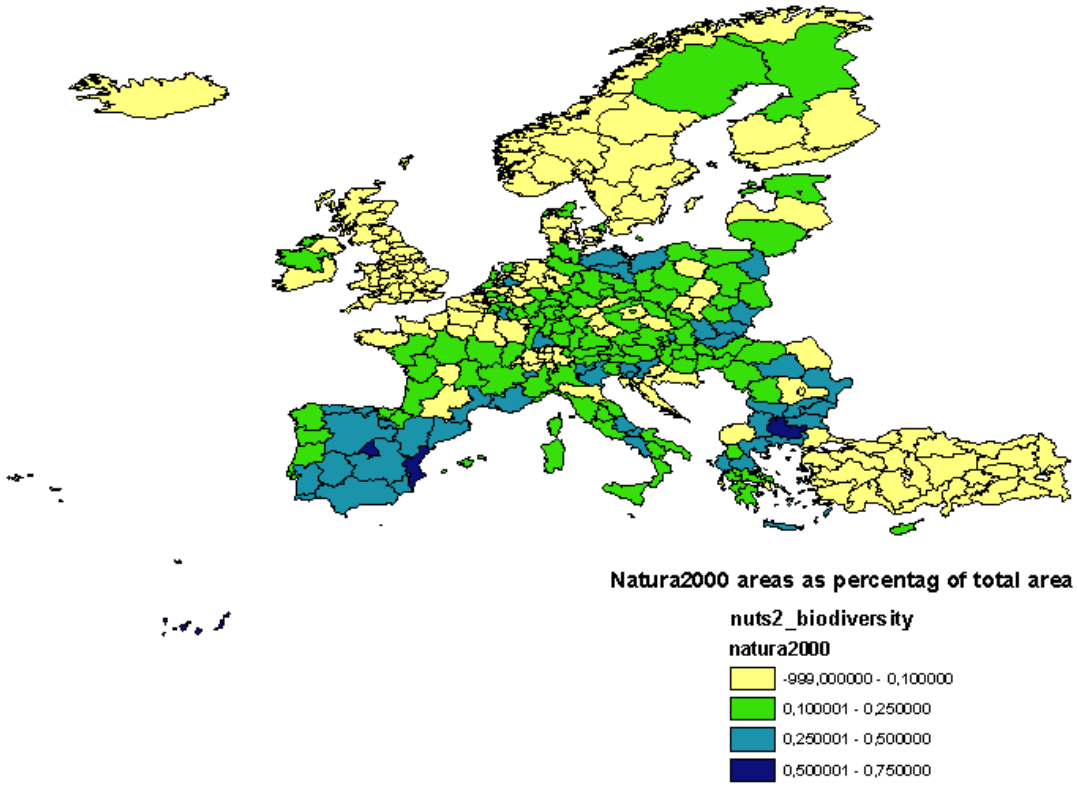


Map A.11 Variability of agricultural yields (Eurostat)

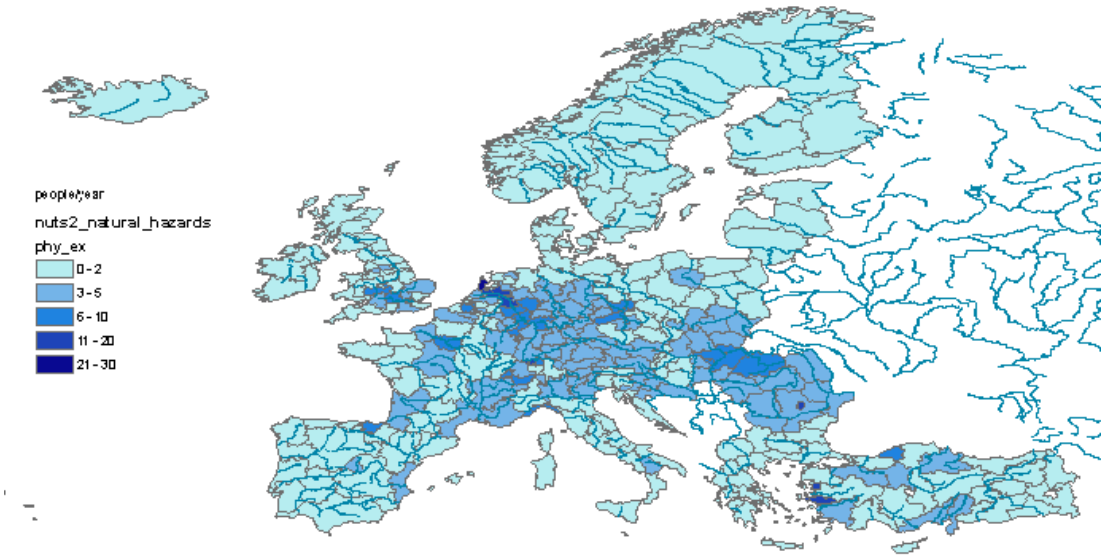


Source: Eurostat

Map A.12 Natura 2000 areas as percentage of total area

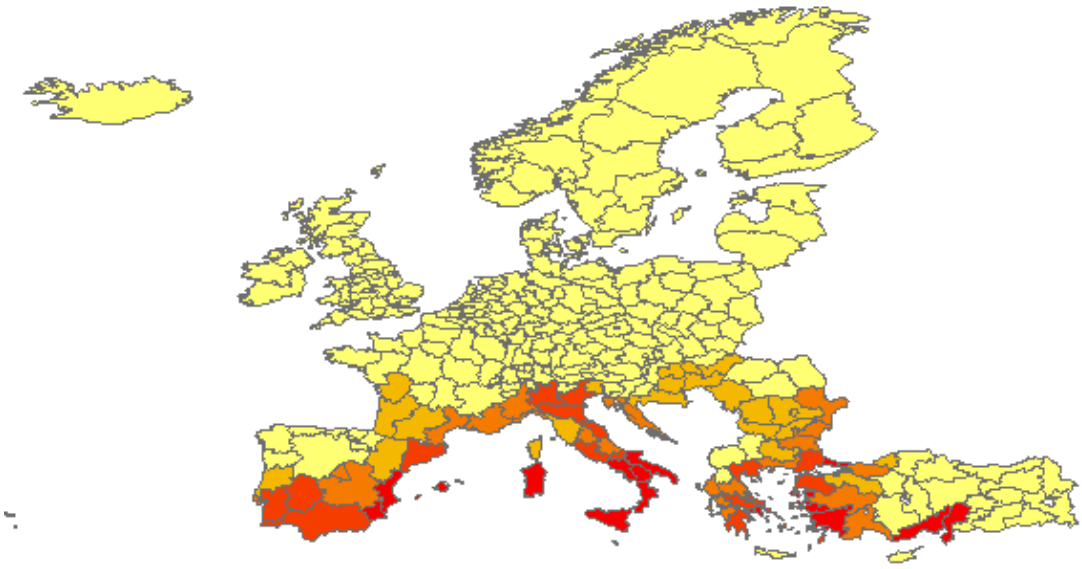


Map A.13 Physical exposure to floods



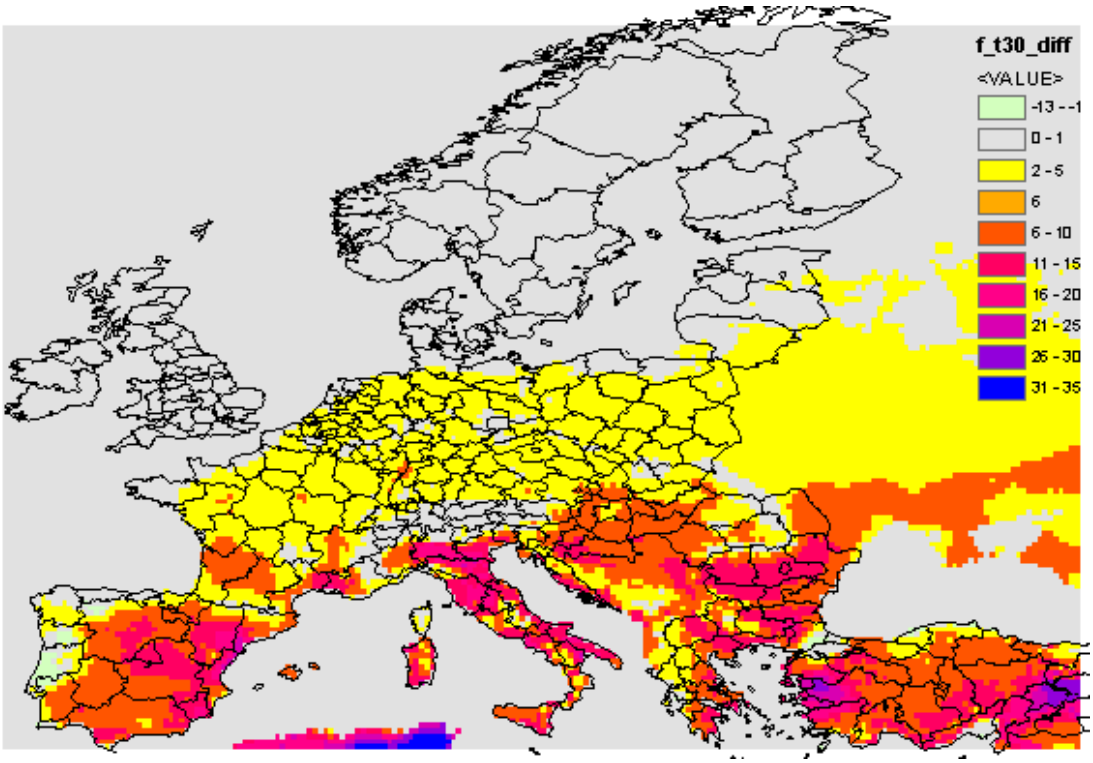
Source: UNEP 2009

Map A.14 Tropical nights (Tmin>20°C) – Status quo (E-OBS)

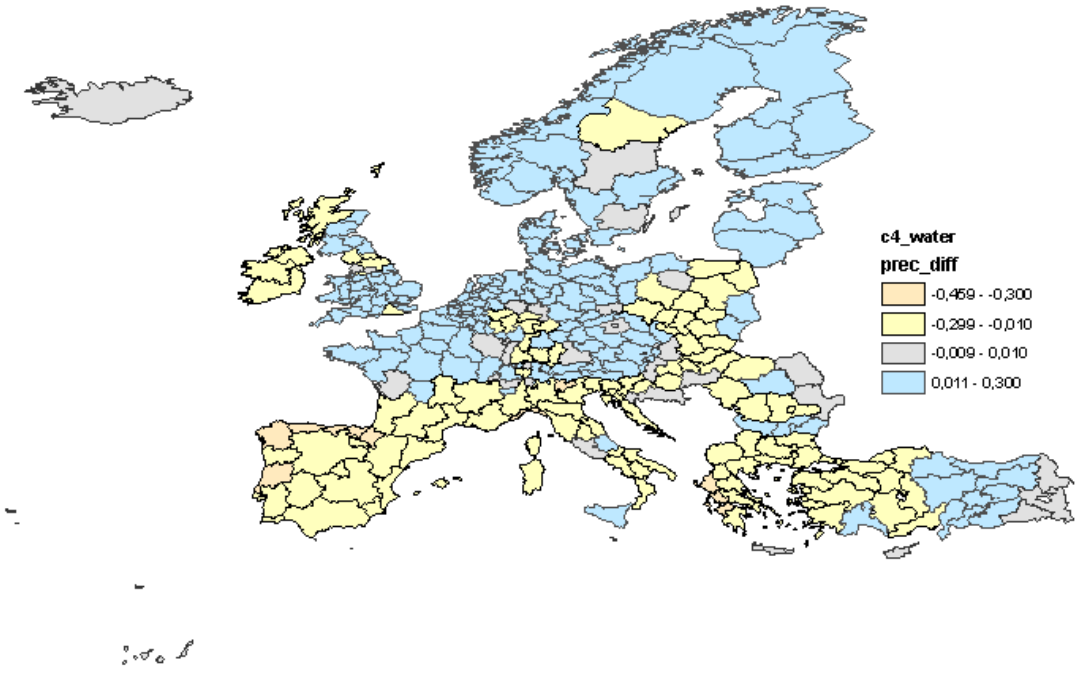


Source: UNEP 2009

Map A.15 Heat days (Tmax>30°C) difference 1961 – 2009

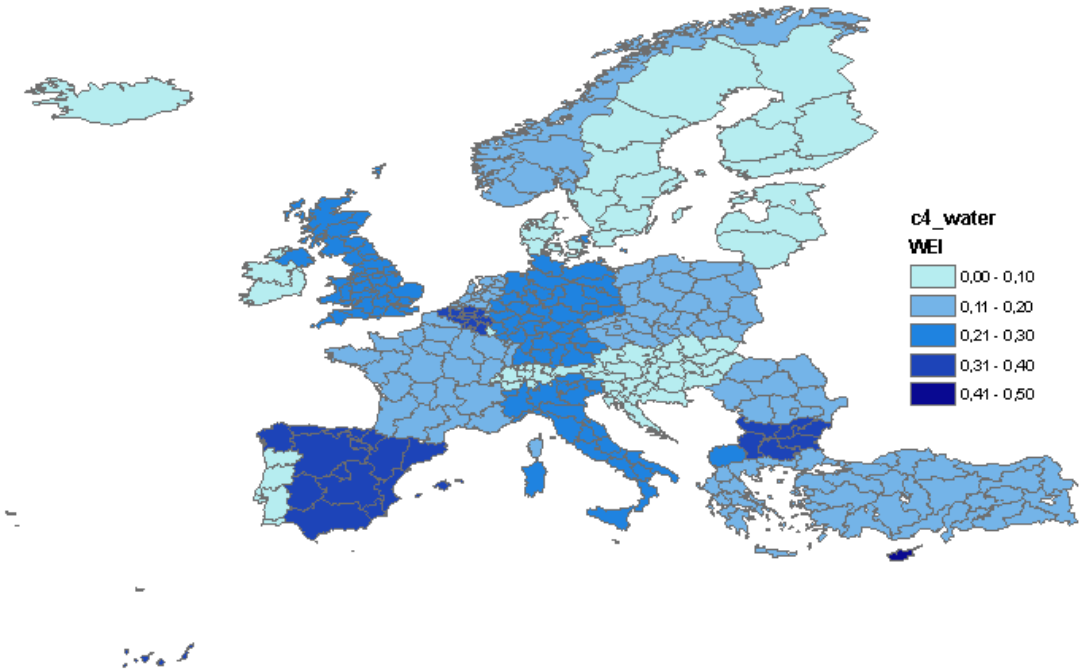


Map A.16 Annual precipitation difference 1961 – 2009 (E-OBS)



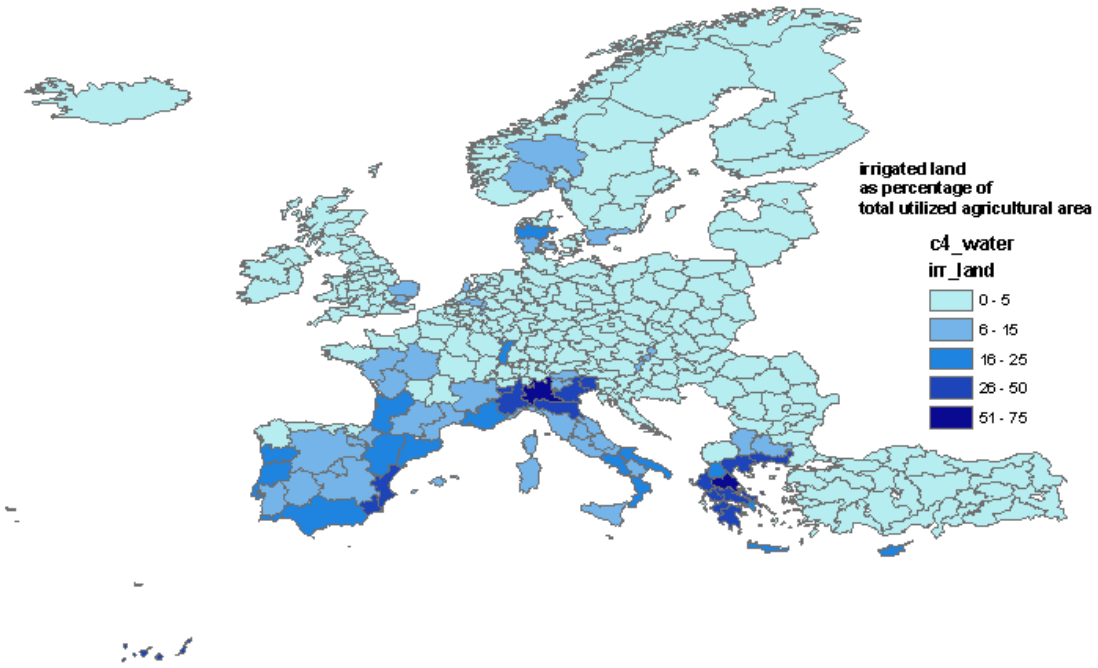
Source: E-OBS

Map A.17 Water exploitation index



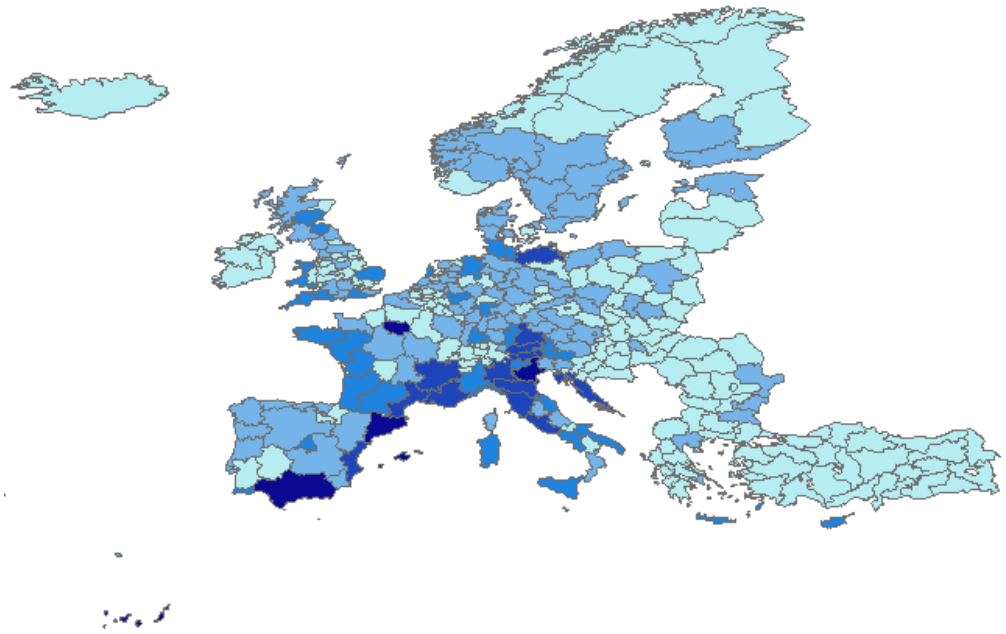
Source: EEA 2002

Map A.18 Irrigated land 2005



Source: Eurostat

Map A.19 Overnight stays 2008



Source: Eurostat

Annex 3: Additional tables

Table A.1 Changes in production and employment by activity

	volume index of production*				persons employed			
	Percentage change q/q-4 (NSA)							
	2007Q4	2008Q4	2009Q4	2010Q1	2007Q4	2008Q4	2009Q4	2010Q1
Mining and quarrying	6.39	-9.43	-9.02	-4.63	-4.48	-0.89	-4.13	-3.86
Manufacture of food products	1.67	-2.58	-0.94	1.87	0.44	-0.67	-1.96	-0.86
Manufacture of beverages	-1.26	-3.97	0.02	-0.78	0.51	-3.89	-4.96	-2.83
Manufacture of tobacco products	-2.33	-15.48	-5.77	-1.32	-7.85	-5.68	-6.99	-4.89
Manufacture of textiles	-4.72	-17.59	-5.38	5.58	-5.96	-9.03	-12.3	:
Manufacture of wearing apparel	0.42	-2.82	-10.67	-2.11	-6.46	-7.99	-12.29	-13.39
Manufacture of leather and related products	-5.86	-9.91	-5.43	-1.09	-4.46	-8.45	-9.55	-6.93
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	-3.77	-14.4	-6.89	1.33	0.33	-4.77	-11.5	-8.57
Manufacture of paper and paper products	0.97	-9.17	-1.45	7.41	-1.53	-2.04	-5.69	-5.34
Printing and reproduction of recorded media	0.37	-6.39	-6.59	-4.39	-0.1	-3	-6.65	:
Manufacture of coke and refined petroleum products	-1.82	1.89	-6.56	-3.36	0.99	-0.36	-3.63	-4.03
Manufacture of chemicals and chemical products	1.68	-13.51	3.81	14.97	-0.59	-2.16	-4.67	-3.93
Manufacture of basic pharmaceutical products and pharmaceutical preparations	2.9	1.51	1.66	4.62	-0.14	-1.95	-1.16	0.74
Manufacture of rubber and plastic products	2.49	-14.33	-0.57	8.74	1.66	-1.09	-6.86	-4.46
Manufacture of other non-metallic mineral products	-1.99	-13.51	-12.63	-3.87	1.39	-4.81	-12.88	-11.54
Manufacture of basic metals	-1.1	-17.5	-7.33	17.93	-0.02	-2.06	-10.22	-9.58
Manufacture of fabricated metal products, except machinery and equipment	2.79	-11.4	-13.48	0.68	3.35	0.55	-10.02	-9.72
Manufacture of computer, electronic and optical products	10.08	-4.6	-12.95	5.08	1.13	-3.09	-9.49	-6.25
Manufacture of electrical equipment	1.95	-8.12	-12.06	3.63	2.19	-0.14	-9.05	-6.14
Manufacture of machinery and equipment n.e.c.	6.36	-5.39	-22.86	-5.54	3.5	1.14	-8.39	-9.03
Manufacture of motor vehicles, trailers and semi-trailers	6.67	-24.89	1.74	27.84	0.41	-1.17	-9.33	-5.69
Manufacture of other transport equipment	2.28	3.66	-12.6	-3.37	3.04	0.73	-7.64	-6.94
Manufacture of furniture	-0.59	-11.63	-10.65	-4.26	-0.26	-4.98	-9.84	-10.47
Other manufacturing	-1.13	-2.19	-3.35	5.32	0.15	-0.21	-4.96	-4.29
Repair and installation of machinery and equipment	2.66	2.01	-7.48	-2.31	1.94	1.72	-3.74	-3.59
Electricity, gas, steam and air conditioning supply	5.8	-4.78	-4.01	2.26	-0.9	-0.45	-0.48	-1.89
Water collection, treatment and supply	:	:	:	:	-2.24	1.05	-0.47	1.12
Construction	-0.72	-7.62	-6.29	-7.27	3.42	-4.22	-7.69	-8.36
Wholesale and retail trade; repair of motor vehicles and motorcycles	6.3	-3.25	-3.38	1.15	2.43	0.33	-3.01	-2.72
Transportation and storage	9.6	-1.07	-6.91	1.16	2.33	-0.54	-3.07	-2.44
Accommodation and food service activities	4.02	-1.56	-5.96	-2.31	3.32	-0.04	-2.08	:
Information and communication	4.39	2	-3.29	-1.62	3.08	1.18	-2	-1.07

* volume index of turnover in service activities
Source: Eurostat Short-term business statistics

Table A.2 Growth rates of GDP in volume (based on seasonally adjusted* data)

	Percentage change compared with the previous quarter				Percentage change compared with the same quarter of the previous year			
	2009	2010			2009	2010		
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
EA16	0.2	0.4	1.0	**0.4**	-2.0	0.8	2.0	**1.9**
EU27	0.3	0.4	1.0	**0.5**	-2.2	0.7	2.0	**2.2**
Member States								
Belgium	0.4	0.1	1.0	**0.5**	-0.1	1.7	2.6	**2.1**
Bulgaria	-0.2	-0.5	0.5	**0.3**	-6.7	-0.8	-0.3	**0.2**
Czech Republic	0.5	0.5	0.9	**1.1**	-3.2	1.1	2.5	**3.0**
Denmark	0.5	0.6	1.3	**0.7**	-3.1	-0.9	3.0	**3.1**
Germany	0.3	0.6	2.3	**0.7**	-2.0	2.1	3.9	**3.9**
Estonia**	1.4	1.1	1.9	**0.5**	-8.8	-2.6	3.1	**4.7**
Ireland	-2.5	2.2	-1.2	**:**	-5.6	-0.7	-1.8	**:**
Greece	-1.1	-0.6	-1.7	**-1.1**	-3.2	-2.7	-4.0	**-4.5**
Spain	-0.2	0.1	0.3	**0.0**	-3.0	-1.4	0.0	**0.2**
France	0.6	0.2	0.7	**0.4**	-0.5	1.1	1.6	**1.8**
Italy	-0.1	0.4	0.5	**0.2**	-2.8	0.5	1.3	**1.0**
Cyprus	-0.1	0.4	0.5	**0.6**	-2.7	-1.2	0.2	**1.5**
Latvia	-1.2	0.9	0.8	**0.8**	-16.8	-5.1	-2.9	**2.4**
Lithuania	-0.2	-0.1	0.5	**0.6**	-14.0	-0.6	-0.3	**0.8**
Luxembourg	1.3	0.8	-0.3	**:**	2.1	2.9	5.3	**:**
Hungary	0.0	1.0	0.4	**0.8**	-5.2	-1.1	0.5	**2.1**
Malta	1.0	1.4	0.1	**:**	0.1	3.5	3.7	**:**
Netherlands**	0.6	0.5	0.9	**-0.1**	-2.2	0.6	2.2	**1.8**
Austria	0.4	0.0	1.2	**0.9**	-1.9	0.1	2.2	**2.5**
Poland	1.4	0.7	1.2	**1.3**	2.8	3.1	3.8	**4.7**
Portugal	-0.2	1.1	0.2	**0.4**	-1.0	1.7	1.4	**1.5**
Romania	-1.5	-0.3	0.3	**-0.7**	-6.9	-3.2	-1.5	**-2.2**
Slovenia	0.1	-0.1	1.0	**0.3**	-6.1	-0.2	1.4	**1.3**
Slovakia	1.3	0.8	1.0	**1.0**	-4.2	4.6	4.4	**4.2**
Finland	0.3	0.1	1.9	**1.3**	-5.2	0.6	3.4	**3.6**
Sweden	0.9	1.7	2.0	**2.1**	-1.6	2.8	4.5	**6.8**
United Kingdom	0.4	0.4	1.2	**0.8**	-3.0	-0.3	1.7	**2.8**
EFTA countries								
Iceland	-0.3	-1.2	-3.1	**:**	-7.6	-6.5	-8.6	**:**
Norway	-0.2	0.5	-0.2	**-1.6**	-1.1	-0.1	0.8	**-1.4**
Switzerland	0.7	0.9	0.8	**0.7**	-0.2	1.7	3.0	**3.1**
Main economic partners								
United States	1.2	0.9	0.4	**0.6**	0.2	2.4	3.0	**3.2**
Japan	1.0	1.6	0.4	**0.9**	-1.3	4.7	2.7	**4.1**

: Data not available

* The seasonal adjustment includes a working-day correction for the following Member States: Belgium, the Czech Republic, Germany, Estonia, Spain, France, Italy, Cyprus, Latvia, Lithuania, Hungary, Malta, the Netherlands, Austria, Poland, Slovenia, Slovakia, Finland, Sweden and the United Kingdom.

** Percentage change compared to the same quarter of the previous year calculated from non-seasonally adjusted data

Source: Eurostat Selected Principal European Economic Indicators

Table A.3 Budgetary dimension of EERP crisis measures in 2009 and 2010, in % of GDP

	Fiscal policy											
	Discretionary stimulus in 2009					Consolidation measures in 2009	Discretionary stimulus in 2010					Consolidation measures in 2010
	Overall (gross terms)	Out of which,					Overall (gross terms)	Out of which,				
		measures aimed at households	increased spending on labour market	measures aimed at businesses	increased investment expenditure			measures aimed at households	increased spending on labour market	measures aimed at businesses	increased investment expenditure	
	in % of GDP	in % of GDP	in % of GDP	in % of GDP	in % of GDP	in % of GDP	in % of GDP	in % of GDP	in % of GDP	in % of GDP	in % of GDP	in % of GDP
BE	1.1	0.5	0.2	0.2	0.2	0.0	1.1	0.3	0.5	0.1	0.1	-0.9
BG	0.3	0.0	0.0	0.0	0.2	-3.3	1.0	0.4	0.6	0.0	0.0	-3.3
CZ	2.3	0.1	1.1	0.7	0.4	0.0	1.2	0.0	0.5	0.6	0.1	-1.1
DK	0.7	0.0	0.3	0.1	0.3	0.0	1.5	0.0	1.0	0.0	0.5	0.0
DE	1.7	0.5	0.4	0.5	0.4	0.0	2.4	1.1	0.4	0.4	0.4	0.0
EE	0.0	0.0	0.0	0.0	0.0	-9.2	1.2	0.0	0.0	0.0	1.2	-10.7
IE	0.7	0.4	0.1	0.2	0.0	-5.4	1.0	0.6	0.2	0.2	0.0	-10.2
EL	0.6	0.5	0.1	0.0	0.0	-1.0	0.0	0.0	0.0	0.0	0.0	-1.8
ES	2.4	0.5	0.1	0.8	0.9	-0.3	0.8	0.2	0.0	0.1	0.5	-0.9
FR	1.6	0.3	0.1	0.9	0.3	0.0	1.4	0.3	0.0	1.0	0.1	-0.1
IT	0.8	0.2	0.1	0.3	0.2	-0.9	0.8	0.1	0.2	0.3	0.1	-0.8
CY	2.7	0.9	0.1	0.3	1.4	0.0	2.4	0.7	0.1	0.6	1.1	0.0
LV	1.5	1.4	0.0	0.0	0.0	-4.5	0.1	-0.1	0.0	0.2	0.0	-11.7
LT	0.0	0.0	0.0	0.0	0.0	-7.6	0.0	0.0	-0.1	0.1	0.0	-12.5
LU	3.4	1.6	0.3	0.3	1.1	0.0	2.2	1.4	0.0	0.5	0.3	0.0
HU	0.5	0.0	0.5	0.0	0.0	-2.2	2.1	0.0	2.1	0.0	0.0	-5.5
MT	0.7	0.2	0.0	0.2	0.2	-1.7	1.1	0.6	0.0	0.2	0.3	-2.2
NL	0.9	0.2	0.1	0.3	0.2	-0.2	1.0	0.2	0.1	0.3	0.4	-0.1
AT	1.5	1.1	0.3	0.0	0.1	0.0	1.8	1.3	0.3	0.1	0.0	0.0
PL	1.6	0.8	0.0	0.2	0.5	-0.6	3.2	0.9	0.1	0.2	2.0	-0.5
PT	1.1	0.2	0.2	0.3	0.4	0.0	0.6	0.2	0.3	0.1	0.0	0.0
RO	0.2	0.0	0.1	0.1	0.0	-0.6	0.3	0.0	0.1	0.2	0.0	-2.7
SI	1.5	0.1	0.1	0.8	0.4	-1.0	1.8	0.1	0.3	1.0	0.4	-1.7
SK	0.4	0.2	0.1	0.0	0.1	-0.5	0.5	0.3	0.1	0.1	0.1	-1.1
FI	1.6	1.0	0.0	0.2	0.3	0.0	2.7	1.7	0.1	0.5	0.4	-0.4
SE	1.7	0.2	1.3	0.0	0.2	0.0	2.7	0.9	1.6	0.0	0.2	0.0
UK	1.9	1.3	0.1	0.3	0.2	-0.2	0.5	0.4	0.2	0.1	-0.1	-0.6
EU27	1.5	0.5	0.2	0.4	0.3	-0.4	1.4	0.5	0.3	0.4	0.3	-0.7

Notes: The numbers refer to the sum of the budgetary amounts of the expansionary stimulus measures, taken or planned to be taken over 2009/2010, compared to 2008, in response to the crisis and in line with the EERP. Fiscal consolidation measures being implemented in various countries at the same time are abstracted from.

Source: Commission services (taken from: EC 2010-4)

Table A.4 EU public interventions in the banking sector as of end-May 2009 (in % of GDP)

	Capital injections		Guarantees on bank liabilities		Relief of impaired asset		Liquidity and bank funding support		Total for all approved measures	Total effective for all measures	Deposit guarantee scheme (in € unless indicated)
	Total approved measures	Effective capital injections	Total approved measures	Guaran-tees granted	Total approved measures	Effective asset relief	Total approved measures	Effective liquidity intervent.			
AT	5.0	1.7	27.3	5.1	0.4	0.4	27.3	1.5	60.1	8.7	100%
BE	4.2	5.7	70.8	16.3	5.7	5.0	NA	NR	74.6	35.3	100,000
BG	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50,000
CY	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100,000
CZ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50,000
DK	6.1	0.3	253.0	NR	0.0	0.0	NA	NR	243.8	0.5	100%
EE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	50,000
FI	0.0	0.0	27.7	0.0	0.0	0.0	0.0	0.0	27.7	0.0	50,000
FR	1.2	0.8	16.6	3.1	2.3	0.3	0.0	0.0	20.2	4.2	70,000
DE	4.2	1.6	18.6	7.3	3.6	0.4	0.0	NR	26.4	6.3	100%
EL	2.0	0.0	6.1	0.4	0.0	0.0	3.3	1.7	11.4	2.2	100%
HU	1.1	0.1	5.9	0.0	0.0	0.0	0.0	0.0	7.0	0.1	100%
IE	5.1	2.1	225.2	225.2	0.0	0.0	0.0	0.0	230.3	227.3	100%
IT	1.3	0.0	NA	0.0	0.0	0.0	0.0	0.0	1.2	0.0	~300,000
LV	1.4	0.0	10.9	2.8	0.0	0.0	10.9	6.1	23.1	8.9	50,000
LT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100,000
LU	6.9	7.9	12.4	NR	0.0	0.0	0.0	0.0	19.3	18.5	100,000
MT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100,000
NL	7.9	7.9	34.3	5.7	0.0	4.9	0.0	5.8	42.2	24.4	100,000
PL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50,000
PT	2.4	0.0	12.5	3.0	0.0	0.0	0.0	0.0	14.9	3.0	100,000
RO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50,000
SK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100%
SI	0.0	0.0	32.8	0.0	0.0	0.0	0.0	0.0	32.8	0.0	100%
ES	0.0	0.0	9.3	2.8	0.0	0.0	2.8	1.8	12.1	4.6	100,000
SE	1.6	0.2	48.5	8.8	0.0	0.0	0.1	0.0	50.2	8.9	50,000
UK	3.5	2.6	21.7	9.5	0.0	0.0	25.1	18.7	50.3	30.8	~57,000
EU 27	2.6	1.5	24.7	7.8	12.0	0.5	4.3	3.0	43.6	12.8	
EA 16	2.6	1.4	20.6	8.3	12.0	0.7	1.3	0.7	36.5	11.1	

Notes: NA: Not available indicates that the amount is not available in the state aid decision. NR: Not reported indicates that the amount was not reported by the Member State in its reply to the EFC questionnaire.

Source: European Commission, Directorate-General for Economic and Financial Affairs: Public Finances in EMU 2009.

Complete selection of branches for manufacturing sensitivity

NACE 2.0 codes: DB17 – Manufacture of textiles, DB18 – Manufacture of wearing apparel; dressing; dyeing of fur, DC19 – Tanning, dressing of leather; manufacture of luggage, DD20 – Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials, DH25 – Manufacture of rubber and plastic products, DI26 – Manufacture of other non-metallic mineral products, DJ – Manufacture of basic metals and fabricated metal products, DK29 – Manufacture of machinery and equipment n.e.c., DL – Manufacture of electrical and optical equipment, DM – Manufacture of transport equipment, DN36 – Manufacture of furniture; manufacturing n.e.c..

Annex 4: Vulnerability indicator tables

code	C1								
key vulnerability	Agriculture and forestry conditions								
subtitle	Climate change as a challenge for food, feed, fibre and biomass energy in European regions								
vulnerability dimension	indicator	indicator name	geographical	measuring unit	reference year(s)	source	polarisation	logic operation for	justification for the logic operation
Exposure	1_EX1	interannual variability of crop yield	NUTS 0		1998 - 2008	Eurostat	+		
Exposure	1_EX2	probability of forest fire hazard	NUTS 2		1997-2003	Espon 1.3.1,	+		
Exposure	1_EXIM	total exposure	NUTS 2				+	disjunction	Regions are exposed if there is a high variability, no matter if
Sensitivity	1_SE1	share of employment in agriculture and forestry	NUTS 2	% of people	2007	Regions2020	+		
Sensitivity	1_SE2	share of agriculture and forestry in GVA	NUTS 2	% of GVA	2007	Regions2020	+		
Sensitivity	1_SE3	biomass energy production	NUTS 0	% of total energy	2010	Primes	+		
Sensitivity	1_SEIM	total sensitivity	NUTS 2				+	conjunction	biomass production would overrule SE_1 and SE_2 in many
Impact	1_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a
Adaptive capacity	1_AC1	farmers with other gainful activity	NUTS 2	% of farmers	2005-2008	Eurostat	-	none	
Adaptive capacity	1_ACVU	total adaptive capacity	NUTS 2				-	none	only one indicator
Vulnerability	1_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a

code	C2								
key vulnerability	Natural and seminatural ecosystems								
subtitle	Climate change as a challenge for ecosystems and biodiversity in European regions								
vulnerability dimension	indicator	indicator name	geographical	measuring unit	reference year(s)	source	polarisation	logic operation for	justification for the logic operation
Exposure	2_EX1	difference of summer to annual precipiation ratio	NUTS 2	°C	1961 - 2009	E_OBS	-		
Exposure	2_EX2	vegetation days change	NUTS 2	°C	1961 - 2009	E_OBS	+		
Exposure	2_EX3	annual mean temperature difference	NUTS 2	°C	1961 - 2009	E_OBS	+		
Exposure	2_EX4	loss of natural, extensive to artificial, intensive area	NUTS 2	% of country	2000 - 2006	Corine	+		
Exposure	2_EX5	loss of vegetated surface	NUTS 2	% of country	2000 - 2006	Corine	+		
Exposure	2_EXIM	total exposure	NUTS 2				+	conjunction	The Exposure indicators are very heterogeneous in their
Sensitivity	2_SE1	share of Natura 2000 areas	NUTS 2	% of country	2009	DG ENV	+	none	:
Sensitivity	2_SEIM	total sensitivity	NUTS 2				+	none	only one indicator
Impact	2_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a
Adaptive capacity	2_AC1	sufficiency index	NUTS 0	status of reaching	2008	DG ENV	-		
Adaptive capacity	2_ACVU	total adaptive capacity	NUTS 2				-	none	only one indicator
Vulnerability	2_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a

code	C3								
key vulnerability	Natural hazards and coastal threats								
subtitle	Excessive climate events challenging European regions								
vulnerability dimension	indicator	indicator name	geographical	measuring unit	reference year(s)	source	polarisation	logic operation for	justification for the logic operation
Exposure	3_EX1	winter and tropical storm hazard potential	NUTS 2		2003	Espon project	+		
Exposure	3_EX2	phyiscal exposure to floods	NUTS 2		1999 - 2007	UNEP,	+		
Exposure	3_EX3	occurrence of landslides	NUTS 2		2004	Espon project	+		
Exposure	3_EX4	occurrence of storm surges	NUTS 2		2005	Espon project	+		
Exposure	3_EXIM	total exposure	NUTS 2				+	disjunction	Either one of the disasters would have a high impact no
Sensitivity	3_SE1	existing coastal protection measurements	NUTS2		2004	Eurosion	-		
Sensitivity	3_SEIM	total sensitivity	NUTS 2				+	conjunction	Both indicators are important and cannot be substituted
Impact	3_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a
Adaptive capacity	3_AC1	disposable income of households, net (uses)	NUTS 2	EUR	2007	Eurostat	-		
Adaptive capacity	3_AC2	regional GDP	NUTS2			Eurostat	-		
Adaptive capacity	3_ACVU	total adaptive capacity	NUTS 2				-	conjunction	Both indicators are important and cannot be substituted
Vulnerability	3_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a

code	C4								
key vulnerability	Health and heat waves								
subtitle	Climate change as a challenge for human health in European regions								
vulnerability dimension	indicator	indicator name	geographical	measuring unit	reference year(s)	source	polarisation	logic operation for	justification for the logic operation
Exposure	4_EX1	days over 30°C per year	NUTS 2		1995	E_OBS	+		
Exposure	4_EX2	tropical nights per year	NUTS 2		1995	E_OBS	+		
Exposure	4_EXIM	total exposure					+	conjunction	
Sensitivity	4_SE1	population density	NUTS 2		2008/2009	Demography	+		
Sensitivity	4_SE2	share of population over 65y	NUTS 2		2008/2009	Demography	+		
Sensitivity	4_SEIM	total sensitivity					+	conjunction	
Impact	4_IMVU	impact					+	conjunction	Highly exposed regions that are only lowly sensitive have a
Adaptive capacity	4_AC1	physicians or doctors per 100.000 capita	NUTS 2		2007	Eurostat	-		
Adaptive capacity	4_AC2	health care expenditures	NUTS 0		2007	Eurostat	-		
Adaptive capacity	4_ACVU						-	conjunction	:
Vulnerability	4_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a

code	C5								
key vulnerability	Water dependency								
subtitle	Climate change as a challenge for water intensive sectors								
vulnerability dimension	indicator	indicator name	geographical	measuring unit	reference year(s)	source	polarisation	logic operation for	justification for the logic operation
Exposure	5_EX1	annual precipitation difference	NUTS 2		1961 - 2009	E_OBS	-		
Exposure	5_EX2	water exploitation index	NUTS 0		latest year	EEA	+		
Exposure	5_EXIM	total exposure					+	conjunction	
Sensitivity	5_SE1	irrigated land	NUTS 0	% of country	2005	Eurostat	+		
Sensitivity	5_SE2	industry share of GVA	NUTS 2	% of GVA	2007	Eurostat	+		
Sensitivity	5_SE3	hydropower production	NUTS 0	% of total energy	2010	Primes	+		
Sensitivity	5_SEIM	total sensitivity					+	disjunction	
Impact	5_IMVU	impact					+	conjunction	Highly exposed regions that are only lowly sensitive have a
Adaptive capacity	5_AC1	implementation of Water Framework Directive 1	NUTS 0		2009	DG Envi	+		
Adaptive capacity	5_AC2	implementation of Water Framework Directive 2	NUTS 0		2010	DG Envi	+		
Adaptive capacity	5_ACVU						-	conjunction	:
Vulnerability	5_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a

code	C6								
key vulnerability	Summer tourism climate								
subtitle	Climate change challenging summer tourism in the European regions								
vulnerability dimension	indicator	indicator name	geographical	measuring unit	reference year(s)	source	polarisation	logic operation for	justification for the logic operation
Exposure	6_EX1	Tourism Climate Index 1970	NUTS 2		1970	Peseta	-	AND (conjunction)	
Exposure	6_EX2	Tourism Climate Index difference	NUTS 2		1970 - 2020	Peseta	-	AND (conjunction)	
Exposure	6_EX3	quality of coastal bathing water	NUTS 0		2006	DG Envi	-	OR (disjunction)	
Exposure	6_EX4	quality of inland bathing water	NUTS 0		2006	DG Envi	-	OR (disjunction)	
Exposure	6_EXIM	total exposure					+	special calculation partly conjunction, partly disjuction	
Sensitivity	6_SE1	overnight stays	NUTS 2		2008(UK2007)	Eurostat	+		
Sensitivity	6_SE2	people occupied in tourism	NUTS 2	% of people	2007	Regions2020	+		
Sensitivity	6_SEIM	total sensitivity					+	conjunction	
Impact	6_IMVU	impact					+	conjunction	Highly exposed regions that are only lowly sensitive have a
Adaptive capacity	6_AC1	disposable income	NUTS 2	EUR	2007	Eurostat	-	conjunction	
Adaptive capacity	6_AC2	regional GDP	NUTS 2			Eurostat	-		
Adaptive capacity	6_ACVU						-	conjunction	:
Vulnerability	6_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a

code	D1								
key vulnerability	Ageing population								
subtitle	The growing share of elderly people as a challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	1_EX1	mean age	NUTS 2	years		BBSR	+	conjunction	
Exposure	1_EX2	life expectancy at birth	NUTS 2	years		BBSR	+	conjunction	
Exposure	1_EXIM	total exposure	NUTS 2				+	conjunction	
Sensitivity	1_SE1	dependency ratio	NUTS 2	-		BBSR	+	conjunction	
Sensitivity	1_SE2	Billeter index	NUTS 2	-		BBSR	-	conjunction	
Sensitivity	1_SE3	healthy life expectancy at birth	NUTS 2	years		BBSR	-	conjunction	
Sensitivity	1_SEIM	total sensitivity	NUTS 2				+	conjunction	
Impact	1_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	1_AC1	employment replacement ratio	NUTS 2	-		BBSR	-	conjunction	
Adaptive capacity	1_AC2	social support index	NUTS 2	-		BBSR	-	conjunction	
Adaptive capacity	1_ACVU	total adaptive capacity	NUTS 2				-	conjunction	
Vulnerability	1_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	D2								
key vulnerability	Shrinking regions								
subtitle	Population decline as a challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	2_EX1	population development 1998-2008 in %	NUTS 2	%		BBSR	-	none	
Exposure	2_EXIM	total exposure	NUTS 2				+	none	
Sensitivity	2_SE1	population density	NUTS 2			Eurostat	-	conjunction	
	2_SE2	share of third level education employment	NUTS 2	%		Eurostat	-		
	2_SE3	share of population with third level qualification	NUTS 2	%		Eurostat	+		
Sensitivity	2_SEIM		NUTS 2				+	conjunction	
Impact	2_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	2_AC1	disposable income of households, net (uses)	NUTS 2	€	2008	Eurostat	-	conjunction	
Adaptive capacity	2_AC2	labour costs	NUTS 2	€		Eurostat	+	conjunction	
Adaptive capacity	2_ACVU	total adaptive capacity	NUTS 2				-	conjunction	
Vulnerability	2_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code key vulnerability subtitle	D3 Migration and Integration in-migration as a challenge for integration efforts in European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	3_EX1	accumulated migration 1998-2008	NUTS 2	1000 persons		BBSR	+	none	
Exposure	3_EXIM	total exposure	NUTS 2				+	none	
Sensitivity	3_SE1	population in working age born outside of the EU	NUTS 2	%		BBSR	+	none	
Sensitivity	3_SEIM	total sensitivity	NUTS 2				+	none	
Impact	3_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	3_AC1	innovation performance	NUTS 2			regional innovation scoreboard	-	none	
Adaptive capacity	3_ACVU	total adaptive capacity	NUTS 2				-	none	
Vulnerability	3_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	E1								
key vulnerability	Energy capacities								
subtitle	Insufficient investments in new capacities as a challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	1_EX1	Average load factor	NUTS 2		2005	PRIMES	-	conjunction	
Exposure	1_EX2	Flexibility margin	NUTS 2		2005	PRIMES	-	conjunction	
Exposure	1_EXIM	total exposure	NUTS 2				+	conjunction	
Sensitivity	1_SE1	Share of electricity in total final energy consumption	NUTS 0	%	2005	Eurostat	+	conjunction	
Sensitivity	1_SE2	Share of wind in net generation capacity	NUTS 0	%	2005	Eurostat	+	conjunction	
Sensitivity	1_SE3	Electricity Market Price (Domestic)	NUTS 0	€	2010	Europe's Energy Portal	+	conjunction	
Sensitivity	1_SE4	Electricity Market Price (Industry)	NUTS 0	€	2010	Europe's Energy Portal	+	conjunction	
Sensitivity	1_SEIM	total sensitivity	NUTS 2				+	conjunction	
Impact	1_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	1_AC1	Electricity Intensity Index	NUTS 2		2005	Eurostat	-	conjunction	
Adaptive capacity	1_AC2	GDP per capita	NUTS 2			Eurostat	-	conjunction	
Adaptive capacity	1_ACVU	total adaptive capacity	NUTS 2				-	conjunction	only one indicator
Vulnerability	1_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	E2								
key vulnerability	Fossile energy supply shortfall								
subtitle	Supply shortfall associated with resource concentration as a challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	2_EX1	Resource Concentration Price Indicator fossile fuels	NUTS 2			Ecofys	+	conjunction	
Exposure	2_EX2	Resource Concentration Physical Availability Indicator gas	NUTS 2			Ecofys	+	conjunction	
Exposure	2_EXIM	total exposure	NUTS 2				+	conjunction	
Sensitivity	2_SE1	Share of oil and gas imports	NUTS 0	%		Eurostat	+	conjunction	
Sensitivity	2_SE2	Share of renewable sources in final energy demand	NUTS 0	%		Eurostat	-	conjunction	
Sensitivity	2_SE3	Gas Price (Domestic)	NUTS 0	€		Europe's Energy Portal	-	conjunction	
Sensitivity	2_SEIM	total sensitivity	NUTS 2				+	conjunction	
Impact	2_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	2_AC1	Energy Intensity	NUTS 0			Eurostat	-	conjunction	
Adaptive capacity	2_AC2	GDP per capita	NUTS 2			Eurostat	-	conjunction	
Adaptive capacity	2_ACVU	total adaptive capacity	NUTS 2				-	conjunction	
Vulnerability	2_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	E3								
key vulnerability	Peak energy demand								
subtitle	Extreme events as an energy supply challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	3_EX1	Cooling Degree Days	NUTS 2				+	conjunction	
Exposure	3_EX2	Heating Degree Days	NUTS 2				+	conjunction	
Exposure	3_EXIM	total exposure	NUTS 2				+	conjunction	
Sensitivity	3_SE1	De-rated electricity peak capacity margin	NUTS 2			Ecofys	+	conjunction	
Sensitivity	3_SE2	Share of electricity in total final energy consumption	NUTS 0			Ecofys	+	conjunction	
Sensitivity	3_SEIM	total sensitivity	NUTS 2				+	conjunction	
Impact	3_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	3_AC1	Electricity Intensity	NUTS 2			Eurostat	-	conjunction	
Adaptive capacity	3_AC2	GDP per capita	NUTS 2			Eurostat	-	conjunction	
Adaptive capacity	3_ACVU	total adaptive capacity	NUTS 2				-	conjunction	
Vulnerability	3_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	G1								
key vulnerability	Global players								
subtitle	Concentration of global economic activities as a challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	1_EX1	population density	NUTS 2		2009	Eurostat	-	conjunction	
Exposure	1_EX2	total flight passengers (embarked/disembarked)	NUTS 2		2008	Eurostat	-	conjunction	
Exposure	1_EX3	employment in banking and	NUTS 2		2008	Eurostat	-	conjunction	
Exposure	1_EXIM	total exposure	NUTS 2				+	conjunction	Both exposures are comparable indicators for the level of agglomeration. However, population alone cannot guarantee for a low exposure of population, why all three indicators have to be counted.
Sensitivity	1_SE1	GDP per capita	NUTS 2		2007	Eurostat	-	none	
Sensitivity	1_SEIM	total sensitivity	NUTS 2				+	none	only one indicator
Impact	1_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	1_AC1	number of transnational headquarters per 1000 jobs			2005	Fortune	-	disjunction	
Adaptive capacity	1_AC2	R&D expenditures in % of GDP	NUTS 2		2007	Eurostat	-	disjunction	
Adaptive capacity	1_ACVU	total adaptive capacity	NUTS 2				-	disjunction	A region negatively exposed to agglomeration economies can mitigate by either attracting transnational headquarters or investing into R&D, although in many cases both will go hand in hand.
Vulnerability	1_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	G2								
key vulnerability	Mobility of persons and goods								
subtitle	Booming global trade flows and dislocations as a challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	2_EX1	total air cargo handled at airports	NUTS 2		2008	Eurostat	-	conjunction	
Exposure	2_EX2	total flight passengers	NUTS 2		2008	Eurostat	-	conjunction	
Exposure	2_EX3	total sea cargo	NUTS 2		2008	Eurostat	-	conjunction	
Exposure	2_EXIM	total exposure	NUTS 2				+	conjunction	To describe the mobility of people AND goods, all three indicators have to be summed up.
Sensitivity	2_SE1	share of employment in trade, transport, hotels and restaurants			2007	Eurostat	+	disjunction	:
Sensitivity	2_SE2	share of GDP in trade, transport, hotels and restaurant s			2007	Eurostat	+	disjunction	:
Sensitivity	2_SEIM	total sensitivity	NUTS 2				+	disjunction	
Impact	2_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	2_AC1	motorway density	NUTS 2		2007	Eurostat	-	none	
Adaptive capacity	2_ACVU	total adaptive capacity	NUTS 2				-	conjunction	-
Vulnerability	2_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	G3								
key vulnerability	Accessibility								
subtitle	Increasing global exchange as a challenge for European (peripheral) regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	3_EX1	potential road acessibility	NUTS 2		2007	ESPON 1.2.1	-	conjunction	
Exposure	3_EX2	potential rail acessibility	NUTS 2		2007	ESPON 1.2.1	-	conjunction	
Exposure	3_EX3	potential air accessibility	NUTS 2		2007	ESPON 1.2.1	-	conjunction	
Exposure	3_EXIM	total exposure	NUTS 2				+	conjunction	Road traffic is by far the most important means of transport for intermediate and rural regions, air accessibility is crucial for globalised competition. Rail accessibility is a cheap means of transport for a number of industries. All are nonexchangeable.
Sensitivity	3_SE1	Labour costs per employee in representative sectors	NUTS 1		2004	Eurostat	-	disjunction	Regions with high labour costs and tourist regions are both sensitive to accessibility exposure separately.
Sensitivity	3_SE2	nights spent in collective tourism accomodation per 1000 capita	NUTS 2		2006-2008	Eurostat	-	disjunction	
Sensitivity	3_SEIM	total sensitivity	NUTS 2				+	disjunction	
Impact	3_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	3_AC1	share of households with broadband access	NUTS 1-2		2008	Eurostat	-	conjunction	
Adaptive capacity	3_AC2	patent applications per 1 mio.	NUTS 2		2006	Eurostat	-	conjunction	
Adaptive capacity	3_ACVU	total adaptive capacity	NUTS 2				-	conjunction	Both indicators are nonexchangeable – broadband access alone cannot substitute innovation activities.
Vulnerability	3_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	G4								
key vulnerability	Knowledge and know-how								
subtitle	The challenges of global information society for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	4_EX1	share of employment in manufacturing	NUTS 2		2008	Eurostat	+	conjunction	
Exposure	4_EX2	share of employment in agriculture	NUTS 2		2008	Eurostat	+	conjunction	
Exposure	4_EXIM	total exposure	NUTS 2				+	conjunction	All three are indicating specific types of exposure and cannot be substituted
Sensitivity	4_SE1	productivity in agriculture	NUTS 2		2005		-	conjunction	:
Sensitivity	4_SE2	productivity in industries	NUTS 2		2005	Politecnico di Milano	-		
Sensitivity	4_SEIM	total sensitivity	NUTS 2				+	conjunction	
Impact	4_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	4_AC1	total productivity	NUTS 2		2004	Politecnico di Milano	-	conjunction	
Adaptive capacity	4_AC2	R&D personnel in % of active population	NUTS 2		2008	Eurostat	-	conjunction	
Adaptive capacity	4_ACVU	total adaptive capacity	NUTS 2				-	conjunction	All four are indicating specific types of adaptive capacity and cannot be substituted
Vulnerability	4_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	S1								
key vulnerability	Income distibution								
subtitle	The distribution of income as a social challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	1_EX1	inequality of income distribution (Gini coefficient)	NUTS 0		2008		+	none	
Exposure	1_EXIM	total exposure	NUTS 2				+	none	The Gini coefficient influences the distribution of disposable income directly. Apart from that, the Gini coefficient is only available on national level and would erase intranational disparities if using a disjunction.
Sensitivity	1_SE1	disposable income of households, net (uses)	NUTS 2		2000 - 2007		-	none	
Sensitivity	1_SEIM	total sensitivity	NUTS 2				+	none	only one indicator
Impact	1_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	1_AC1	disposable income of private households as % of primary income	NUTS 2		2007		-	conjunction	
Adaptive capacity	1_AC2	GDP per head in Purchasing Power Parities	NUTS 2		2007		-	conjunction	
Adaptive capacity	1_ACVU	total adaptive capacity	NUTS 2				-	conjunction	
Vulnerability	1_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	S2								
key vulnerability	Labour market transformations								
subtitle	Rising demands on jobholders as a challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	2_EX1	unemployment rate, 15y and over (%)	NUTS 2		2000-2007	Eurostat	+	none	
Exposure	2_EXIM	total exposure	NUTS 2				+	none	
Sensitivity	2_SE1	share of people with maximum education ISCED Level 2	NUTS 2		2007		+	conjunction	
Sensitivity	2_SE2	share of employees in selected sectors at risk of offshoring	NUTS 2		2007		+	conjunction	
Sensitivity	2_SEIM	total sensitivity	NUTS 2				+	conjunction	
Impact	2_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	2_AC1	share of people aged 25-64y participating in life long learning courses	NUTS 2		2007		-	conjunction	
Adaptive capacity	2_AC2	total intramural R&D expenditure per GDP	NUTS 2		2007		-	conjunction	
Adaptive capacity	2_ACVU	total adaptive capacity	NUTS 2				-	conjunction	Both capcities are important and noneexchangeable
Vulnerability	2_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	S3								
key vulnerability	Youth unemployment								
subtitle	The prospects of the young generation as a challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	3_EX1	unemployment rate of people aged 15-24y	NUTS 2		2002-2007		+	none	
Exposure	3_EXIM	total exposure	NUTS 2				+	none	
Sensitivity	3_SE1	percentage of the population aged 18-24y with at most lower secondary education and not in further education or training	NUTS 0				+	conjunction	
Sensitivity	3_SEIM	total sensitivity	NUTS 2				+	conjunction	Early school leavers are only available at NUTS 0 level and therefore have to be attached to a regional indicator (total students). Students in higher education are especially important for youth employment which is why they have to be added to the overall score.
Impact	3_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	3_AC1	Students in tertiary education, as percentage of the population aged 20 to 24 years old	NUTS 2		2007		-	none	
Adaptive capacity	3_AC2	Students at upper secondary and post-secondary non-tertiary education, as percentage of the population aged 15 to 24	NUTS 2		2008		-	conjunction	
Adaptive capacity	3_ACVU	total adaptive capacity	NUTS 2				-	none	
Vulnerability	3_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

code	S4								
key vulnerability	Access to SGEIs								
subtitle	The diminution of regional infrastructure endowment as a challenge for European regions								
vulnerability dimension	indicator code	indicator name	geographical level	measuring unit	reference year(s)	source	polarisation towards vulnerability	logic operation for aggregated vulnerability dimensions	justification for the logic operation
Exposure	4_EX1	hospital beds per 100.000 capita	NUTS 2				-	conjunction	
Exposure	4_EX2	physicians or doctors per 100.000 capita	NUTS 2				-	conjunction	
Exposure	4_EX3	expenditures for elderly care in % of GDP	NUTS 0				-	conjunction	
Exposure	4_EX4	road density	NUTS 2	road km per area km^2			-	conjunction	
Exposure	4_EX5	children in pre-primary education	NUTS 2				-	conjunction	
Exposure	4_EXIM	total exposure	NUTS 2				+	conjunction	All indicators are noneexchangeble regional endowments.
Sensitivity	4_SE1	population development	NUTS 2		2001-2007		+	none	:
Sensitivity	4_SEIM	total sensitivity	NUTS 2				+	none	only one indicator
Impact	4_IMVU	impact	NUTS 2				+	conjunction	Highly exposed regions that are only lowly sensitive have a medium impact in total.
Adaptive capacity	4_AC1	health care expenditures per capita	NUTS 0				-	conjunction	
Adaptive capacity	4_AC2	GDP per head	NUTS 2		2007		-	conjunction	
Adaptive capacity	4_ACVU	total adaptive capacity	NUTS 2				-	conjunction	ESF expenditures are just a proxy for any social expentitures, therefore they only serve as an auxiliary indicator to health care expenditure.
Vulnerability	4_VU	vulnerability	NUTS 2				+	conjunction	High impact regions that have high adaptive capacity have a medium vulnerability in total.

Annex 5: Index tables and mapping tool

The aggregate indices for exposure, sensitivity, impact, adaptive capacity and overall vulnerability together with the membership of all NUTS 2 regions to their respective clusters are available as a separate excel file.

There is also a mapping tool available with which all these indices can be visualised online.

Please visit http://ec.europa.eu/regional_policy for more information!