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Delineating mountain areas in Europe: the principles used for the ESPON GEOSPECS project and their foundation in previous research

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Abstract

The ESPON GEOSPECS project looks at mountain areas from the perspective of areas with geographic specificities. These geographic specificities (including mountains, islands, sparsely populated areas and others) are a growing concern in EU Cohesion Policy. Before analysing their situation, a justifiable delineation has to be developed. The GEOSPECS project defines 1 km^2 grid cells as mountainous depending on their altitude, slope and terrain roughness. The grid cells are afterwards approximated to municipal boundaries by defining LAU 2 units with more than 50% mountainous terrain as mountainous. Conversely, mountainous grid cells are not approximated to NUTS 3 units. In this way, the delineation used in GEOSPECS is similar to the approach of previous studies (European Commission 2004; European Environment Agency 2010).

Keywords: geographic specificities, delineation, mountain areas, ESPON

1 The policy context: Why do we need a delineation of mountain areas?

During the second half of the 20th century, different European states developed definitions for the mountain areas on their territories. However, the criteria differed from state to state, with no general agreement on the concept of "mountains" (Price et al. 2004). The first European policy document to address mountains at a supranational scale was in the framework of the Common Agricultural Policy (CAP): the Directive on mountain and hill farming in less favoured areas (LFAs), published in 1975 (Directive 75/269/EEC). The logic of this Directive is to compensate mountain areas for the disadvantages they experience compared to lowland areas (i.e. slopes and climatic conditions that disfavour agricultural production).

At the beginning of the present century, this "agriculture-focussed" view on mountain areas in the EU was extended, when mountain areas were for the first time mentioned in the Cohesion Reports. Within Cohesion Policy, the perspective on mountains is one of areas with "geographic specificities".

For example, the Second Report on Economic and Social Cohesion (2001) recognized mountains as regions with "permanent natural handicaps" – as were island territories and sparsely populated areas. Similarly, the Green Paper on territorial cohesion (European Commission 2008) mentions three types of regions with geographic specificities that face particular development challenges: mountains, islands, and sparsely populated regions. However, it also points out that this list is not exhaustive.

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The most prominent reference to geographic specificities can be found in Article 174 of the Treaty on the Functioning of the European Union (ex article 158 TEC), which has been inserted by the Lisbon Treaty:

"In order to promote its overall harmonious development, the Union shall develop and pursue its actions leading to the strengthening of its economic, social and territorial cohesion.

In particular, the Union shall aim at reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions.

Among the regions concerned, particular attention shall be paid to rural areas, areas affected by industrial transition, and ***regions which suffer from severe and permanent natural or demographic handicaps such as the northernmost regions with very low population density and island, crossborder and mountain regions.****"*

In view of translating this phrase into practice, Members of the European Parliament have set up a parliamentary intergroup, known as the "Intergroup Mountain, Island and Sparsely Populated Regions" or "Intergroup 174".

All these discussions about geographically specific areas need a sound evidence base. This is where the ESPON GEOSPECS ("Geographic specificities and development potentials in Europe") project comes into play. Its goal is to provide a solid assessment of the situation of areas with geographic specificities in Europe: mountain areas, islands, sparsely populated areas, border regions, coastal zones, Outermost Regions and inner peripheries.

While mountain areas are one important focus of GEOSPECS, this research project is not the first that aims to provide an analysis of the situation of mountain areas:

The first report to substantiate the "handicaps" of mountain regions – which was commissioned by DG REGIO after mountain areas had first been mentioned in the Second Cohesion Report – was published in 2004 with the title *Mountain areas in Europe: Analysis of mountain areas in EU Member States, acceding and other European countries* (European Commission 2004).

Subsequently, DG REGIO published a Working Paper entitled *Territories with specific geographical features* (Monfort 2009).

The most recent comprehensive view on mountain areas was provided in a study commissioned by the European Environment Agency in 2010 entitled *Europe's ecological backbone: recognising the true value of our mountains.*

All of these studies offer delineations of mountain areas. The GEOSPECS project follows the reasoning of the 2004 and 2010 reports, while discarding the approach of the 2009 Working Paper. The reasons are set out below.

Last but not least, a consistent delineation of mountain areas has recently come into focus during the discussions on the review of the "Quality Package" on agricultural quality products. In one of its legislative proposals, the Commission recommends to further analyze the "problems faced by producers of mountain products in labelling their products on the market" (European Commission 2010). A commonly accepted definition of mountain areas is a necessary prerequisite if a European "mountain product" label is ever to become reality.

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2 Previous delineations

As noted above, the first European policy document to address mountain areas was the Less Favoured Areas Directive, which has been succeeded by Regulation 1257/1999. Article 18 of this Regulation refers to the limitations for agriculture that derive from altitude, slope, and climatic conditions in mountain areas, but it does not name specific thresholds above which an area should be considered as "mountainous". Instead, it leaves the task of defining criteria and designating portions of territory as mountain areas to the member states. Many states (but not all) have chosen to do so. A comparison of the national criteria shows that the minimum altitude for such designations increases from north to south, which reflects a shorter growing season at higher latitudes. For example, Spain uses a minimum elevation of 1,000 m, whereas Ireland defines all land above 200 m as "mountainous" (Price et al. 2004).

As mentioned before, the first consistent European-wide delineation was attempted in the report "Mountain areas in Europe" (European Commission 2004).

In this report, the delineation was based on the GTOPO30 global digital elevation model (DEM), which records the altitude of every square kilometre of the Earth's land surface, which Kapos et al. (2000) used to develop a global typology of mountain classes on the basis of topographic criteria. The study tested sixteen combinations of topographic criteria (altitude, slope, and local elevation range – or "relief"), which were discussed with experts from the European Commission, interest groups and national experts.

The agreed criteria were then used to define mountainous municipalities (LAU 2 areas, previously called NUTS 5) by considering a municipality as mountainous if at least 50% of its area was mountainous according to the topographic criteria. Furthermore, northerly areas from Fennoscandia were included which are not mountainous in topographic terms but have mountainous climates; not because they are topographically mountainous but because the concept of 'mountain LFA' was extended to these sub-arctic areas in Regulation 1257/1999 after Finland and Sweden had joined the EU. Accordingly, 36% of territory of the study area[1] was identified as mountainous (home to 18% of the population).

In contrast, the 2009 DG REGIO Working Paper "Territories with specific geographical features" defined mountainous regions as NUTS 3 regions with at least 50% of population living in topographic mountain areas (Monfort 2009). In this way, a much smaller proportion of European territory (with only 8% of population) was identified as mountainous – which is logical, seeing that NUTS 3 areas cover a much larger space than LAU 2 areas and that the population tends to be concentrated in the lowland areas.

This approach was strongly opposed by organizations defending the interests of people in mountain areas. For example, the European Association of Elected Representatives of Mountain Regions (AEM) criticized the fact that, on the map provided in the DG REGIO Working Paper "an important part of the Alps, Abruzzos,

[1] The study area of the 2004 report was: the current EU (including those states that were still accession candidates in 2004), as well as Norway and Switzerland

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Carpathians, Greece, Massif Central, Cantabrian Mountains, and Pyrenees simply disappears" (AEM 2010).

Consequently, the 2010 EEA study[2] applied a similar delineation approach to the 2004 report „Mountain areas in Europe". The main difference is that the EEA report only uses topographic criteria and does not apply these to LAU 2 units (municipalities). Also, climatic criteria for areas north of 62° N (i. e. the sub-arctic parts of Finland and Sweden) were not used. This study therefore defined 36% of Europe (including the very mountainous country of Turkey) as mountainous, with 17% of the continent's population. For the EU-27, the proportions are 29% and 13%.

3 Delineation of mountain areas for the ESPON GEOSPECS project

Based on the methodology of the 2004 report of DG REGIO and the 2010 EEA report, the GEOSPECS project uses the following criteria to define a grid cell as mountainous:

- between 0 m and 300 m, the objective is only to include areas with a particularly rough landscape in the mountain delineation. For this purpose, the standard deviation of elevations between each point of the Digital Elevation Model (DEM) and the eight cardinal points surrounding is calculated. If this is greater than 50 m, the landscape is sufficiently rough to be considered as 'mountain' despite the low altitude.
- between 300 m and 1,000 m, areas which either meet the previously mentioned criterion or where altitudes encountered within a radius of 7 km vary by 300 meters or more are considered mountainous.
- between 1,000 m and 1,500 m, all areas which meet any of the previously mentioned criteria are considered mountainous. In addition, areas with a maximum slope of 5° or more between each point (to which value is assigned) and the 8 cardinal points surrounding it are also considered mountainous.
- between 1,500 m and 2,500 m, in addition to all previous criteria, areas with a maximum slope of 2° or more between each point (to which value is assigned) and the 8 cardinal points surrounding are also considered mountainous.
- above 2,500 m, all areas are considered mountain.

This set of grid cells with mountainous topography was approximated to municipal boundaries by defining LAU 2 units with more than 50% mountainous terrain as mountainous. Continuous mountain areas of less than 100 km^2 were then identified, and designated as exclaves which were excluded from the mountain delineation, except on islands of less than 1000 km^2. In this latter case, small mountain areas were deemed to constitute a greater potential constraint for social and economic activities, insofar as the total available land is limited. Similarly, non-mountainous groups of

[2] The study area of the 2010 report was: all European states that are members of the EEA

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LAU2 units of less than 200 km² surrounded by mountain areas were identified as enclaves and included in the mountain delineation (ESPON 2011).

The GEOSPECS consortium did not approximate the "mountain" grid cells to NUTS 3 areas. One reason is that the approximation of mountain areas at the NUTS 3 level generally makes it impossible to analyse mountain-piedmont relations, as these two types of areas are usually included in the same administrative regions. Major components of specific social and economic processes that are specific to mountain areas would therefore be ignored if the consortium were to apply a NUTS 3-based delineation of mountain areas. In addition, a delineation along the border of NUTS 3 areas would deviate substantially from local and regional understandings of "mountain" areas, and thus may not be functional in a project that investigates how identities and geographic specificities interact (ESPON 2011). Mountain areas were then grouped into 15 massifs (see Figure 1).

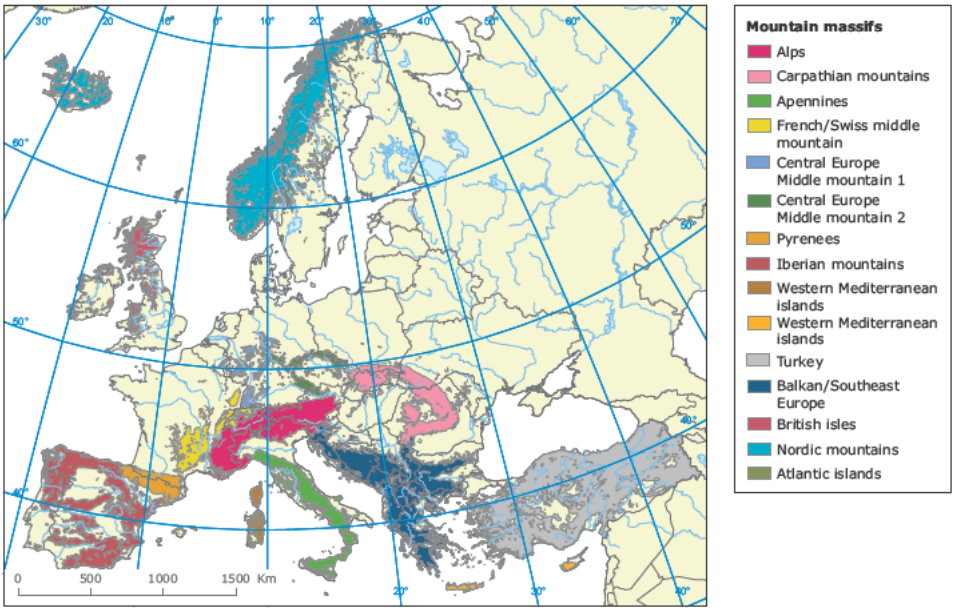

Figure 1: Mountain massifs in Europe (modified). Source: Creator: Gebhard Banko. © European Environment Agency.

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Zeitschrift/Journal: IGF-Forschungsberichte (Instituts für Interdisziplinäre Gebirgsforschung [IGF]) (Institute of Mountain Research)

Jahr/Year: 2011

Band/Volume: 4

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