STEEP SLOPES IN THE SUDETES
TECTONIC AND ROCK CONTROL AT WORK

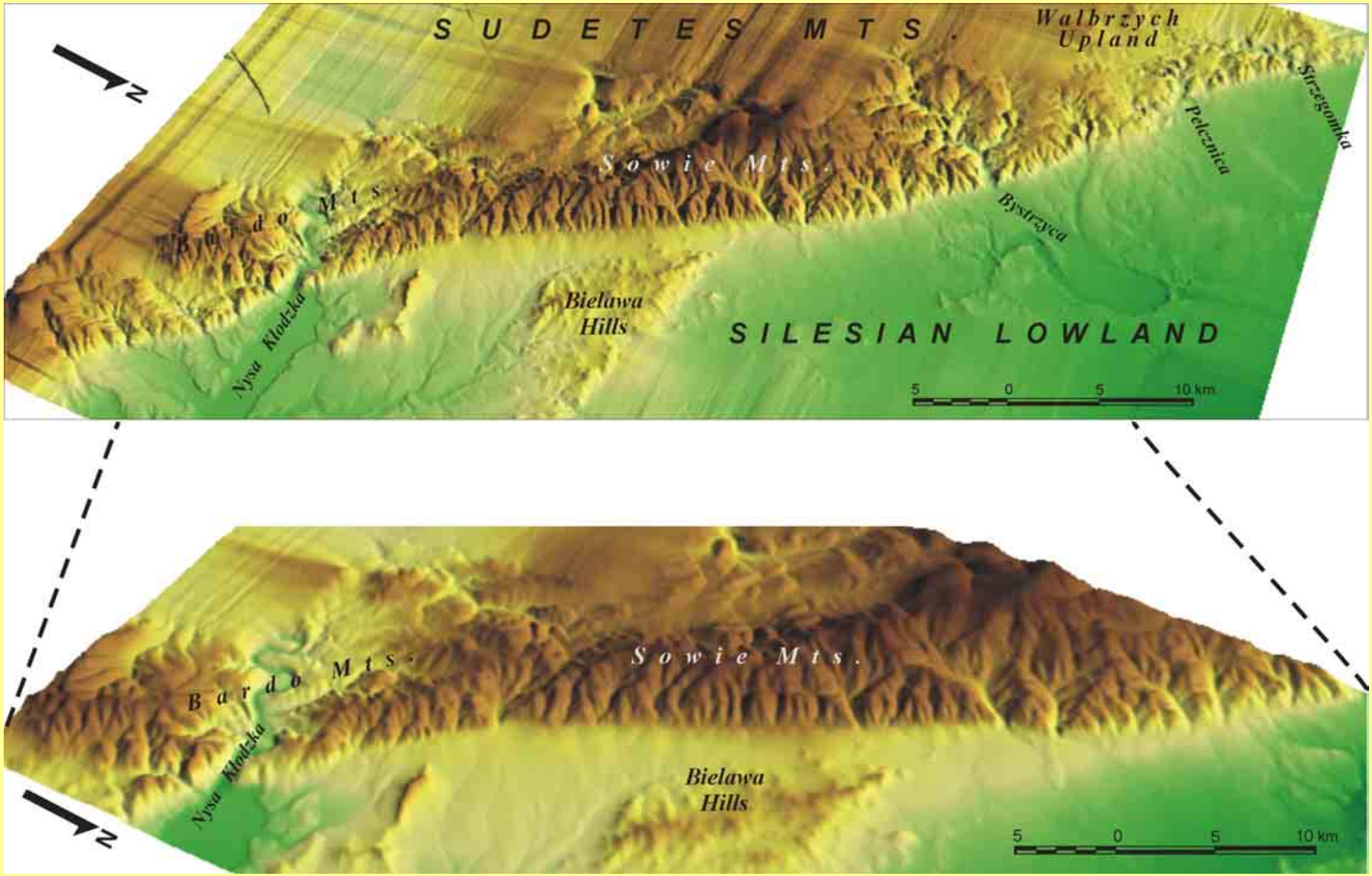
Piotr Migoń, Wiesława Żyszkowska, Agnieszka Placek
Department of Geography and Regional Development
University of Wrocław, pl. Uniwersytecki 1, 50-137 Wrocław

Rationale:

1. Steep slopes are possible indicators of the lack of balance between surface uplift and denudation, with the rates of uplift exceeding the rates of slope lowering. Hence, the distribution of steep slopes may serve as a tool to recognize geodynamically active area.
2. However, rock strength is a modifying factor and steep slopes may also reflect varying resistance of rock complexes. Likewise, low resistance may account for low gradients, even if the rate of uplift is relatively high

Outline of the presentation:

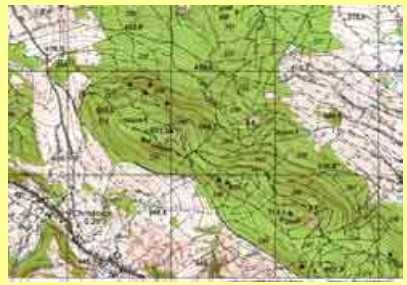
1. Introduction – morphometry for morphotectonics
2. Problem and procedures
3. Slope maps for the Sudetes
4. High gradients – interpretation
5. Rock strength as a modifier
6. Conclusions



(from Badura et al.., 2003)

DEM for the Sudetes Mountains in *ArcGIS*

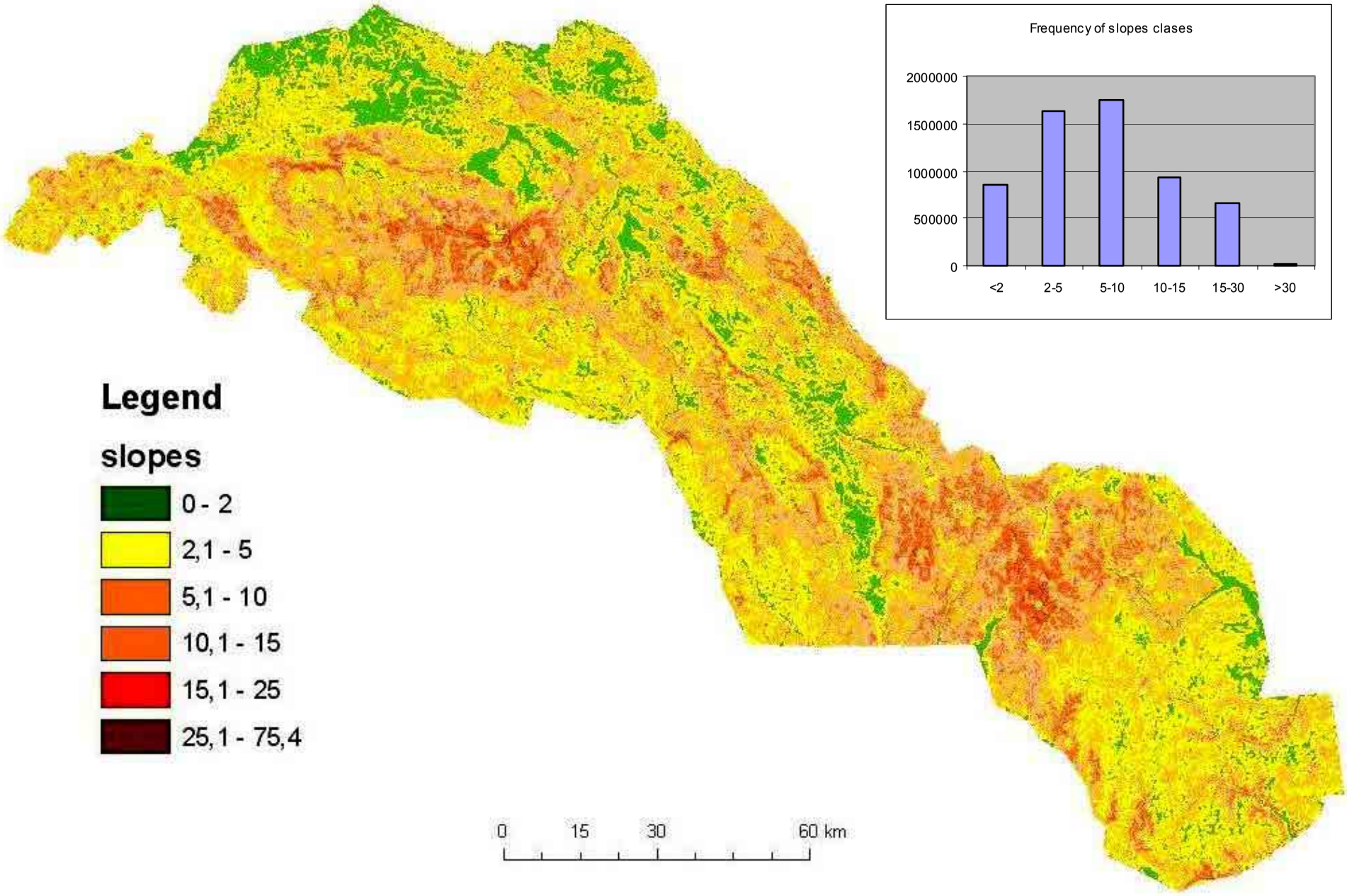
1. Topographic maps 1:25 000 → *Vectorization*

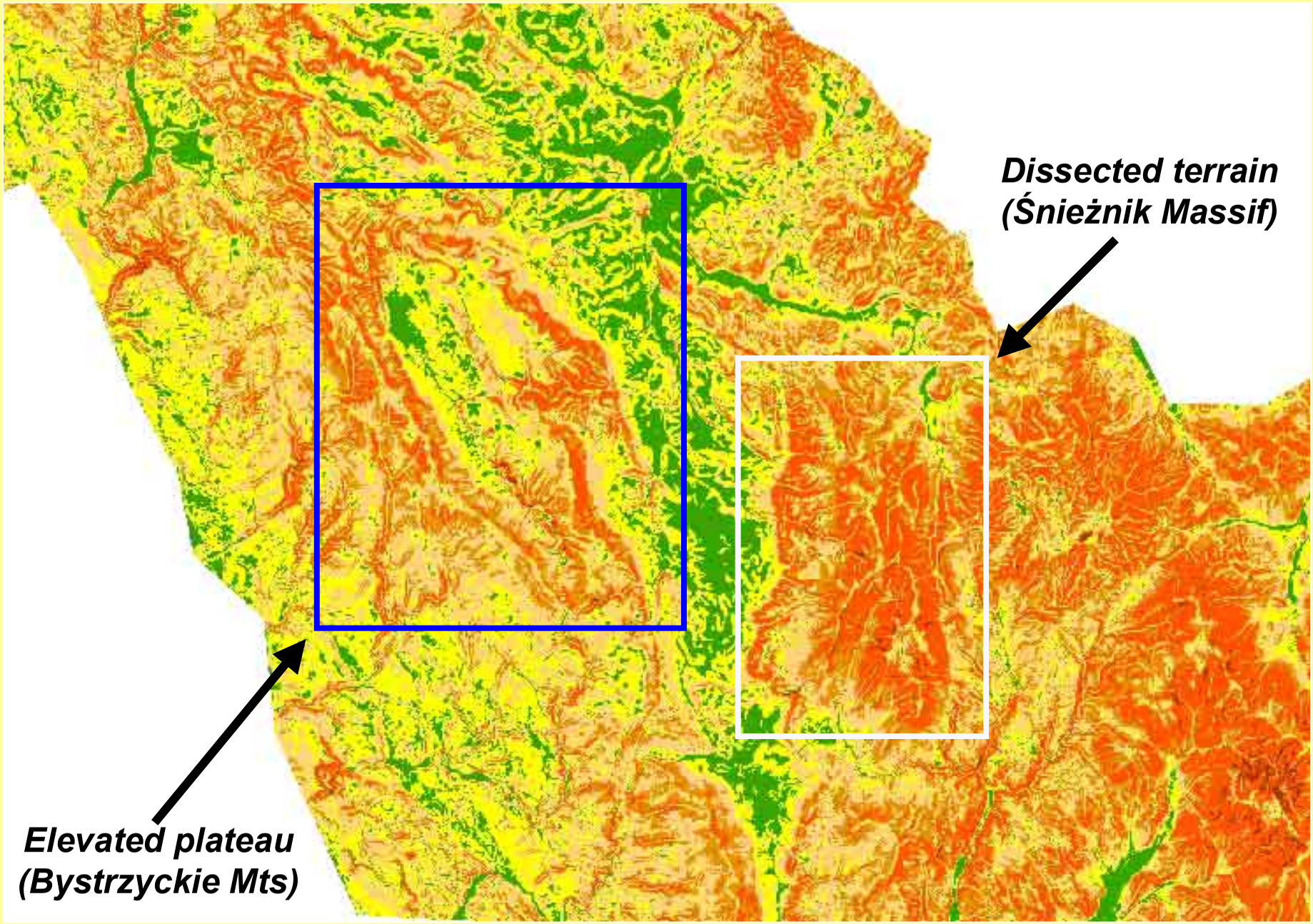


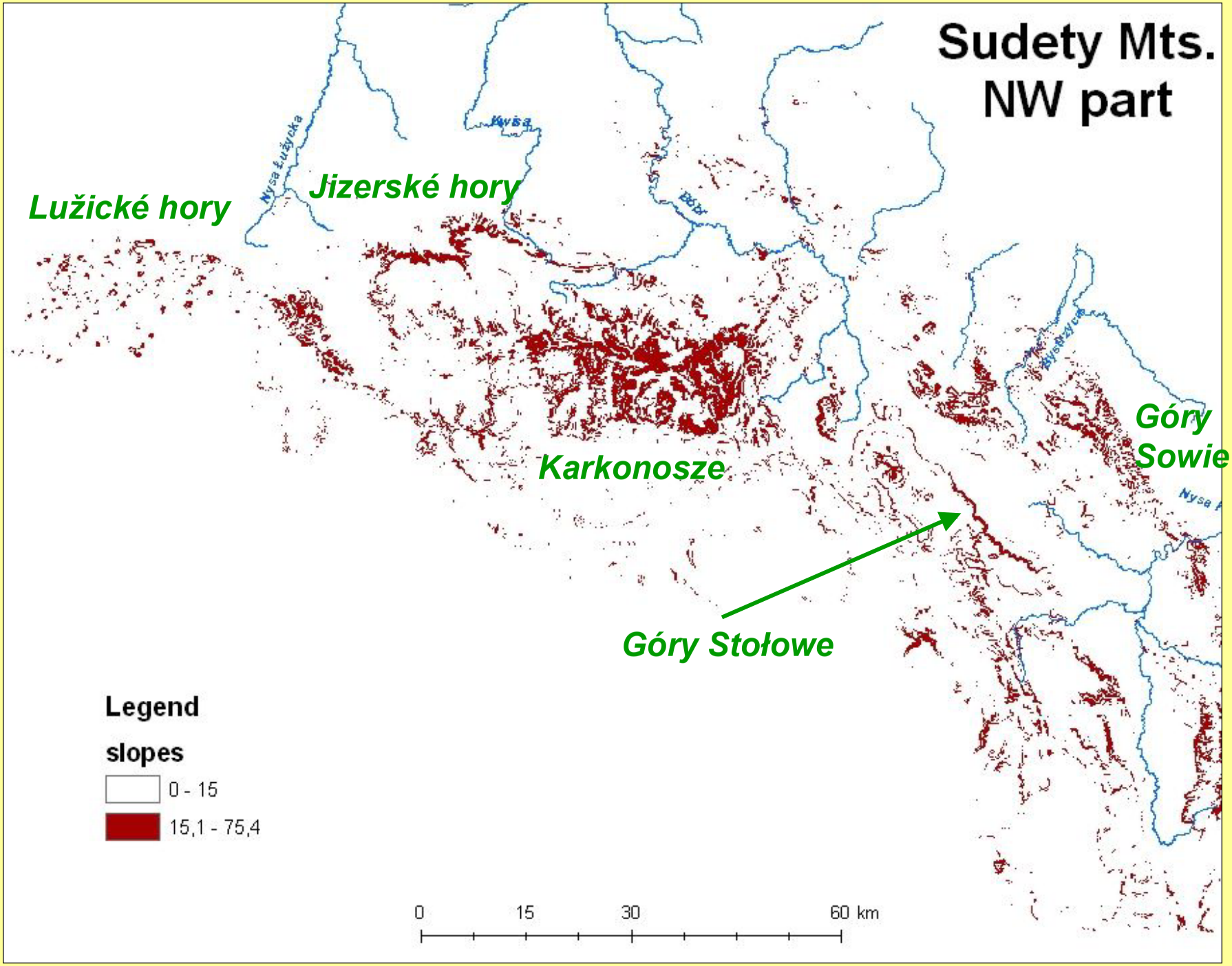
2. 25 m contours → *Topo to Raster*

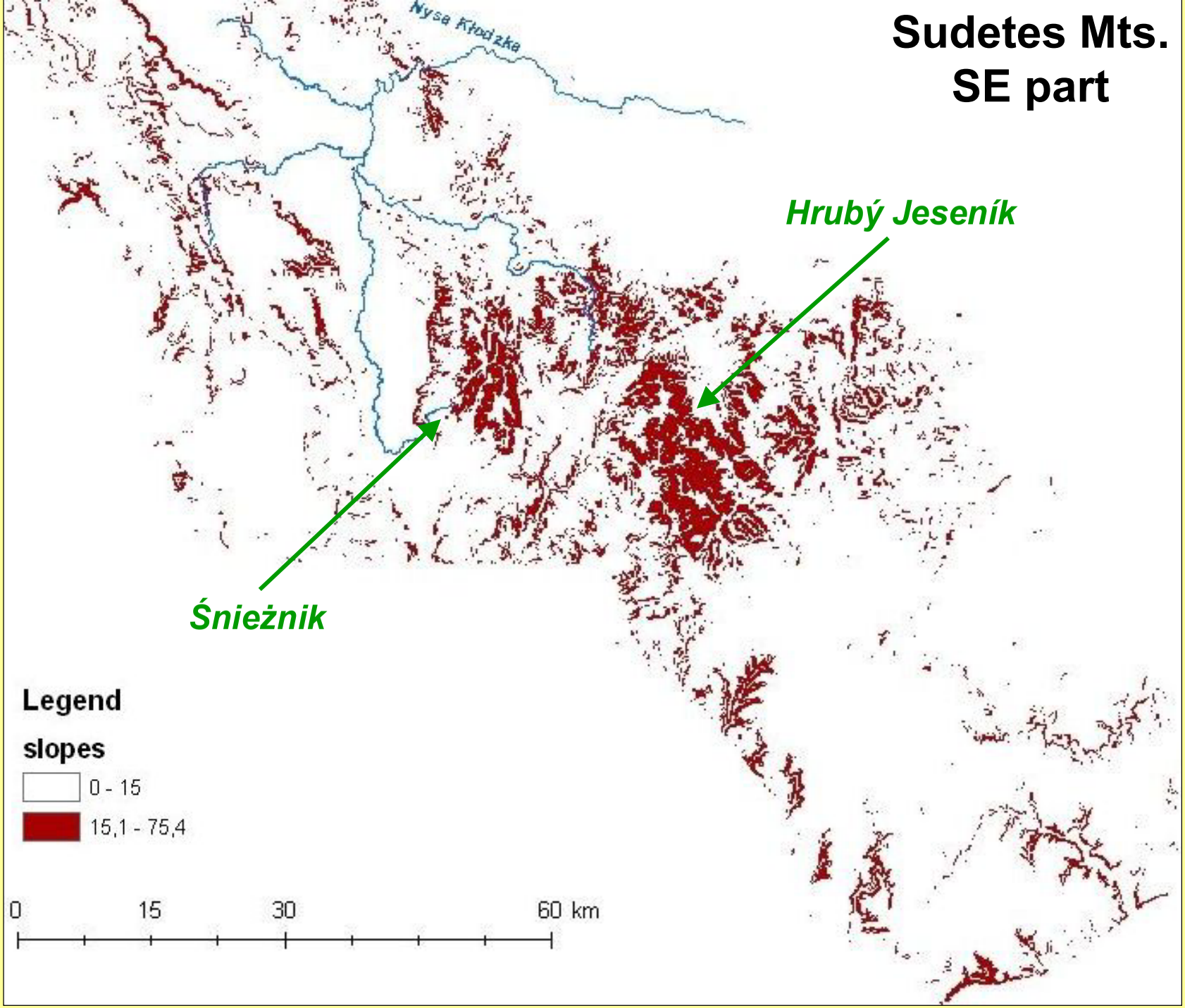
3. DEM for the Polish part
   DTED for the Czech part → *Merge*

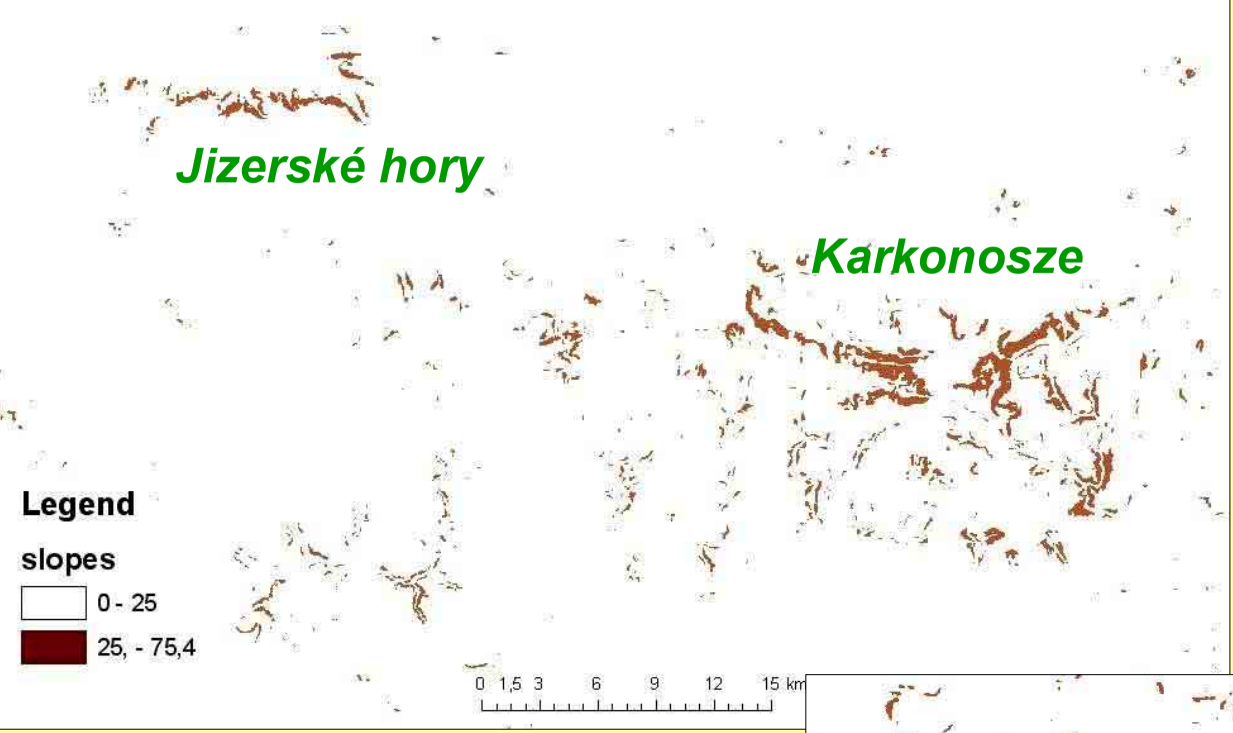
4. DEM of the Sudetes Mts → *Spatial Analysis*

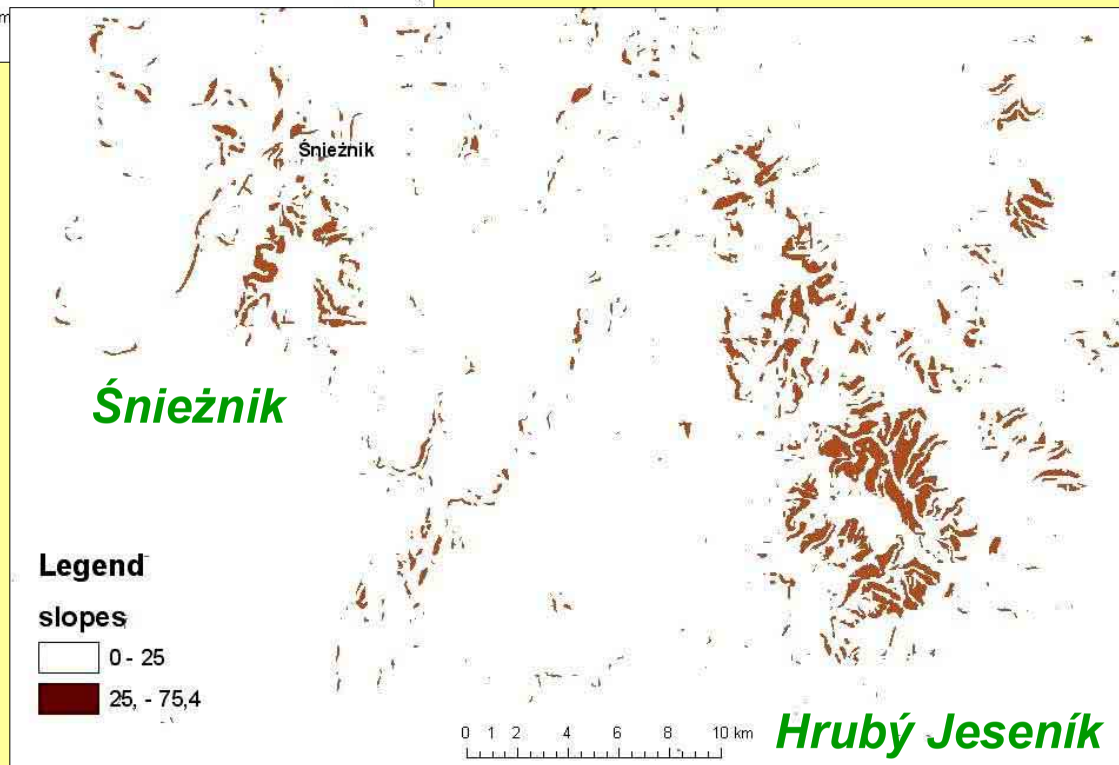

Frequency of slopes clases
2000000
1500000
1000000
500000
0
<2
2-5
5-10
10-15
15-30
>30
Legend
slopes
0 - 2
2,1 - 5
5,1 - 10
10,1 - 15
15,1 - 25
25,1 - 75,4
0
15
30
60 km


Dissected terrain
(Śnieżnik Massif)
Elevated plateau
(Bystrzyckie Mts)

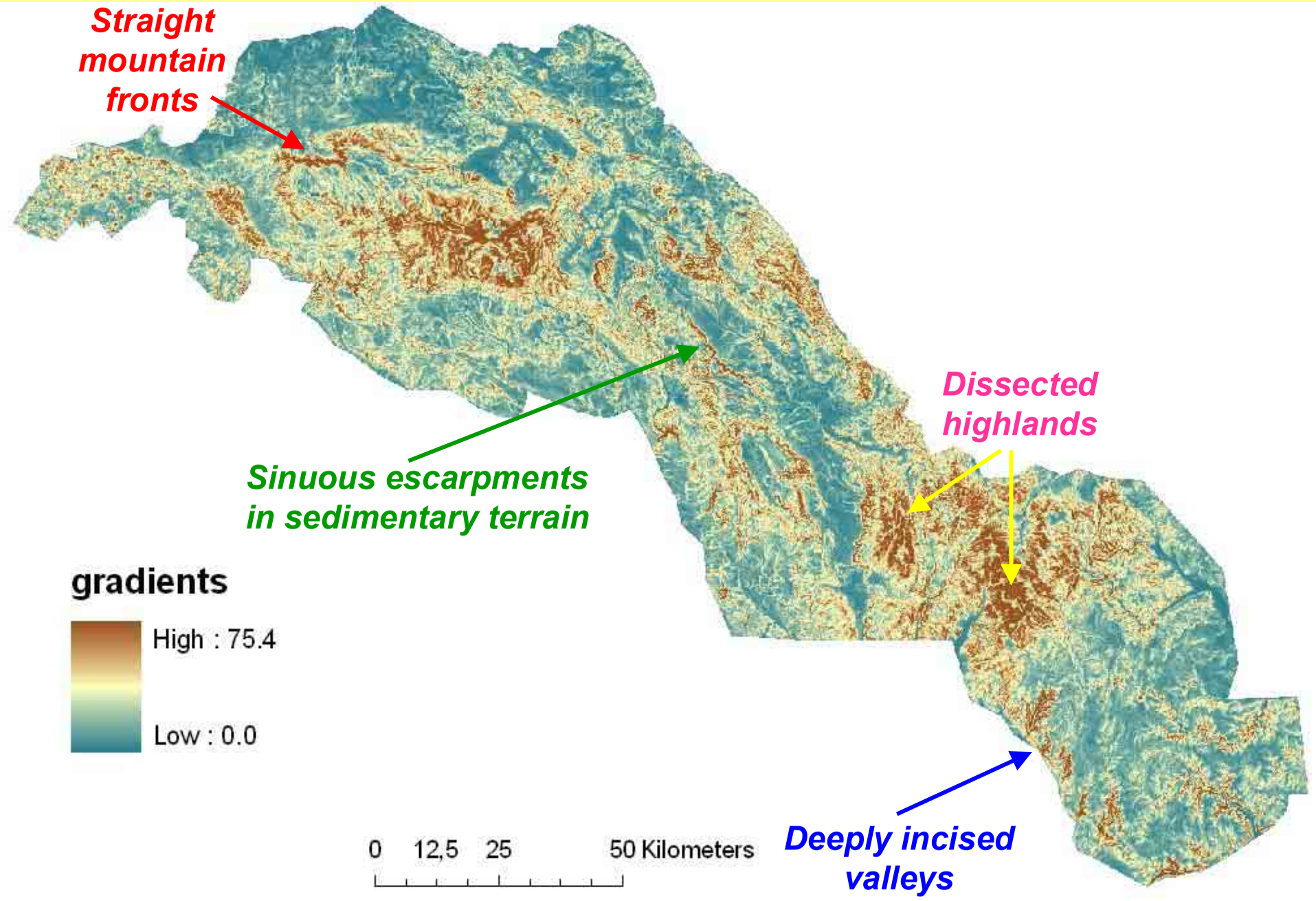

Sudety Mts.
NW part
Lužické hory
Jizerské hory
Karkonosze
Góry Sowie
Góry Stołowe
Nysa Łużycka
Nysa
Bóbr
Legend
slopes
0 - 15
15,1 - 75,4
0
15
30
60 km

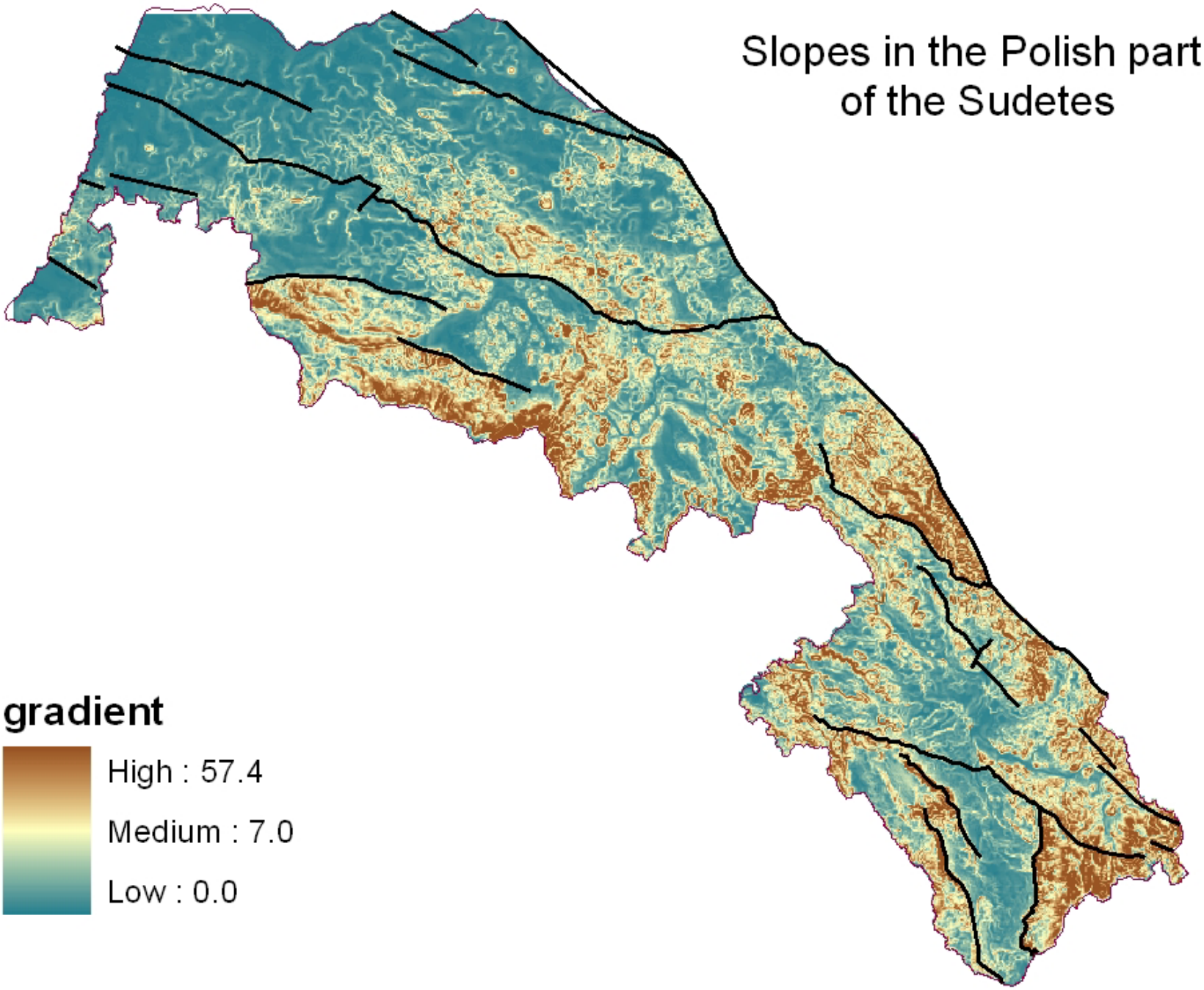

Sudetes Mts.
SE part
Nysa Kłodzka
Hrubý Jeseník
Śnieżnik
Legend
slopes
0 - 15
15,1 - 75,4
0
15
30
60 km


Jizerské hory
Karkonosze
Legend
slopes
0 - 25
25, - 75,4
0 1,5 3 6 9 12 15 km

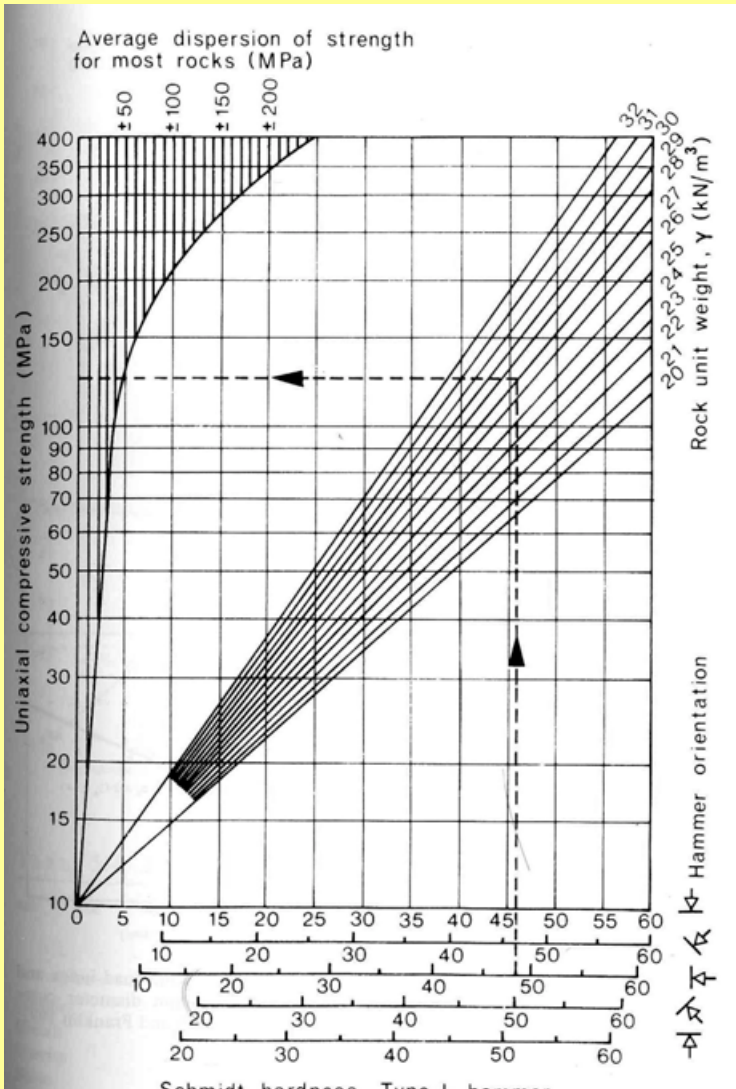

Śnieżnik
Śnieżnik
Legend
slopes
0 - 25
25, - 75,4
0 1 2 4 6 8 10 km
Hrubý Jeseník

Steep slopes – topographic and morphotectonic setting

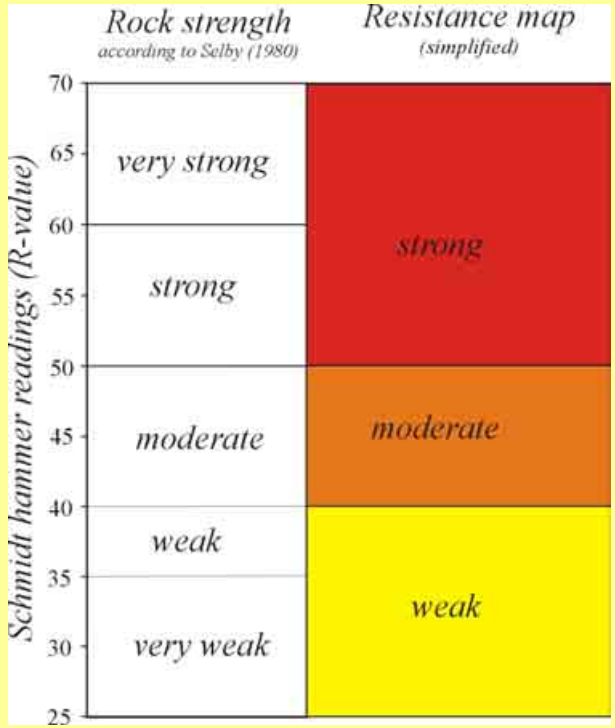



Slopes in the Polish part
of the Sudetes
gradient
High : 57.4
Medium : 7.0
Low : 0.0

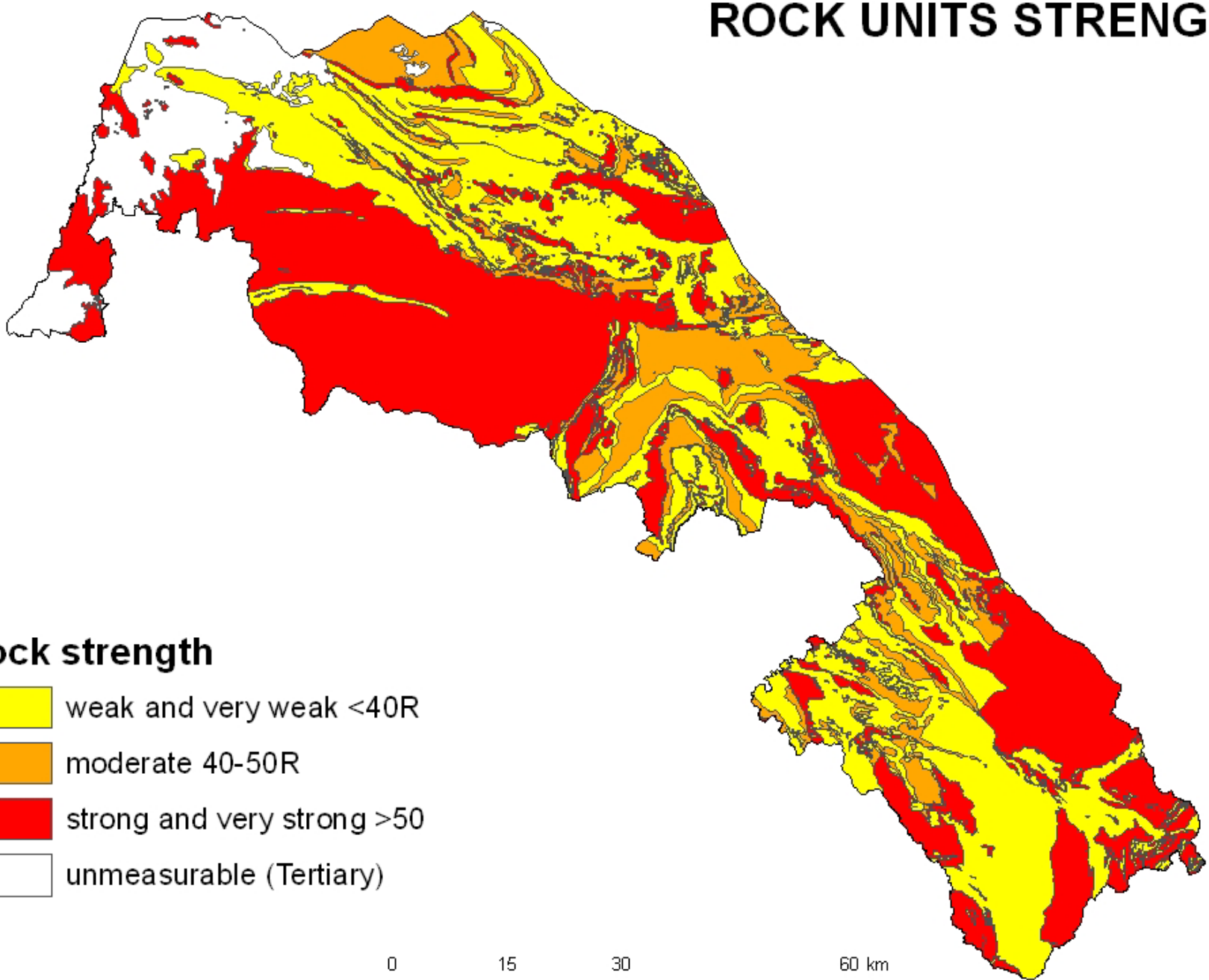
- **Rock hardness** has been measured in the field by means of Schmidt hammer at 589 sites in the Polish part of the Sudetes
- **Schmidt hammer** readings correlate well with uniaxial compressive strength of rock

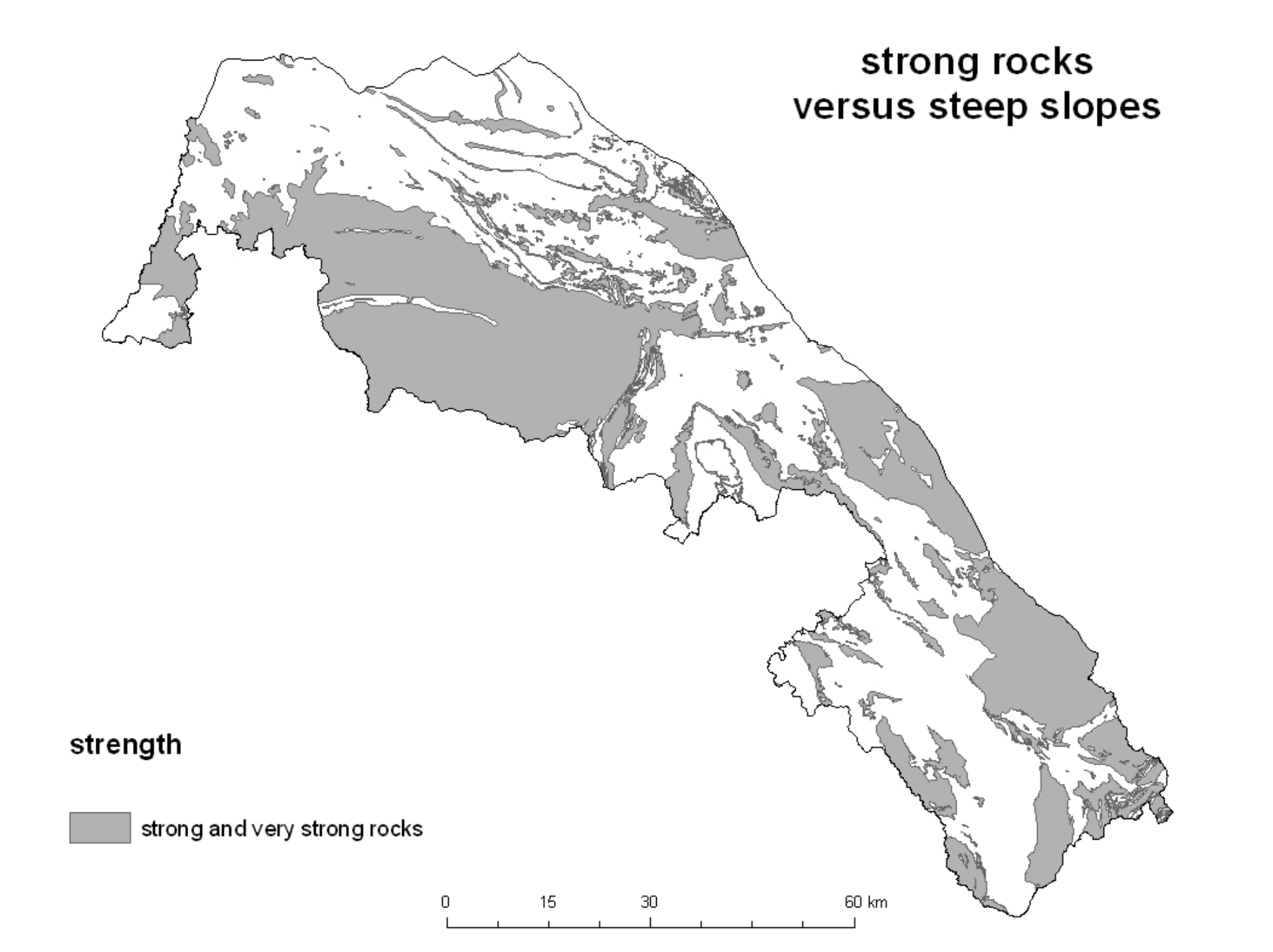


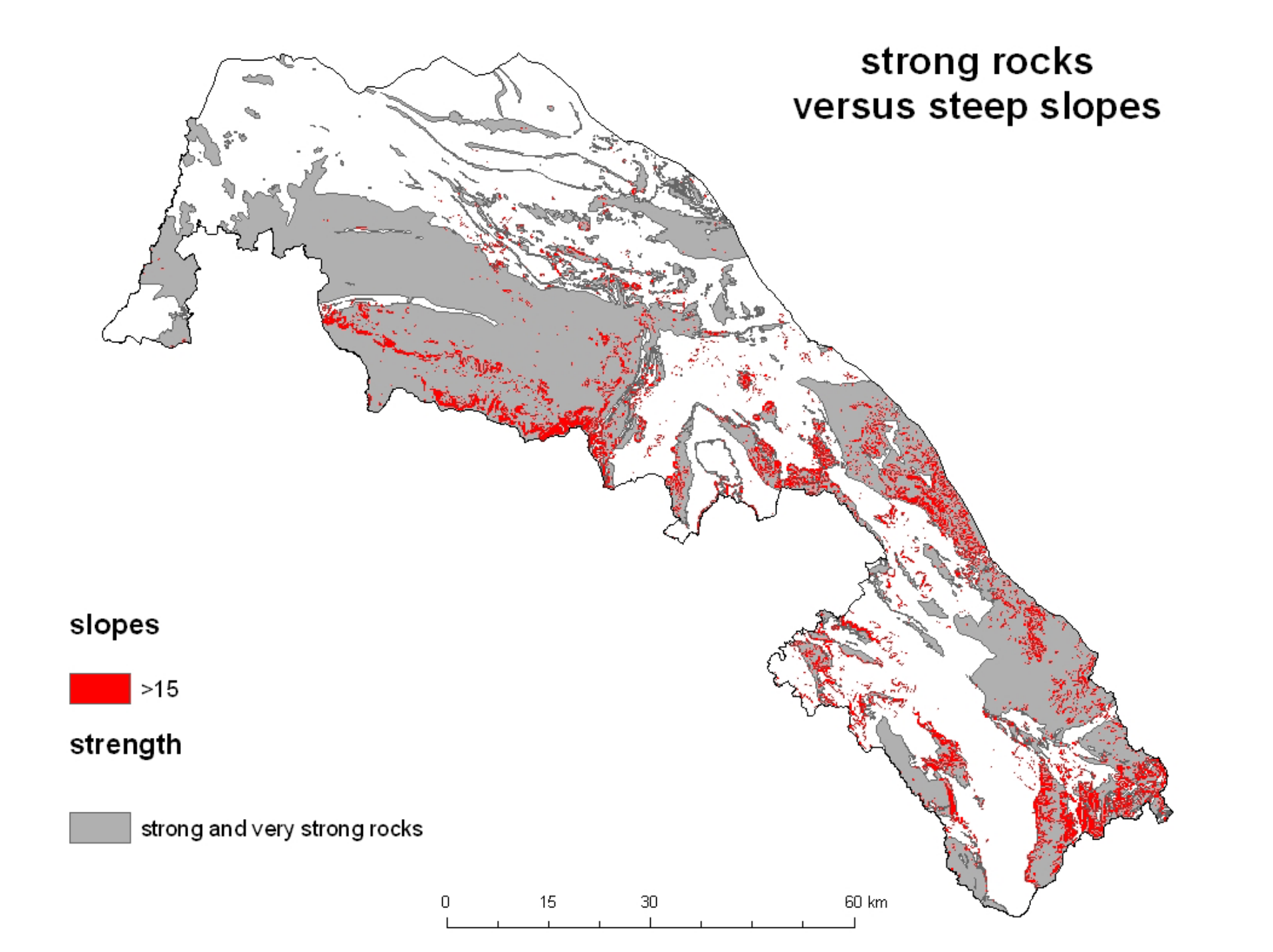
- Rock units were divided into 5 classes according to their mechanical strength (scale proposed by Selby, 1980)
- The map image simplified to 3 classes

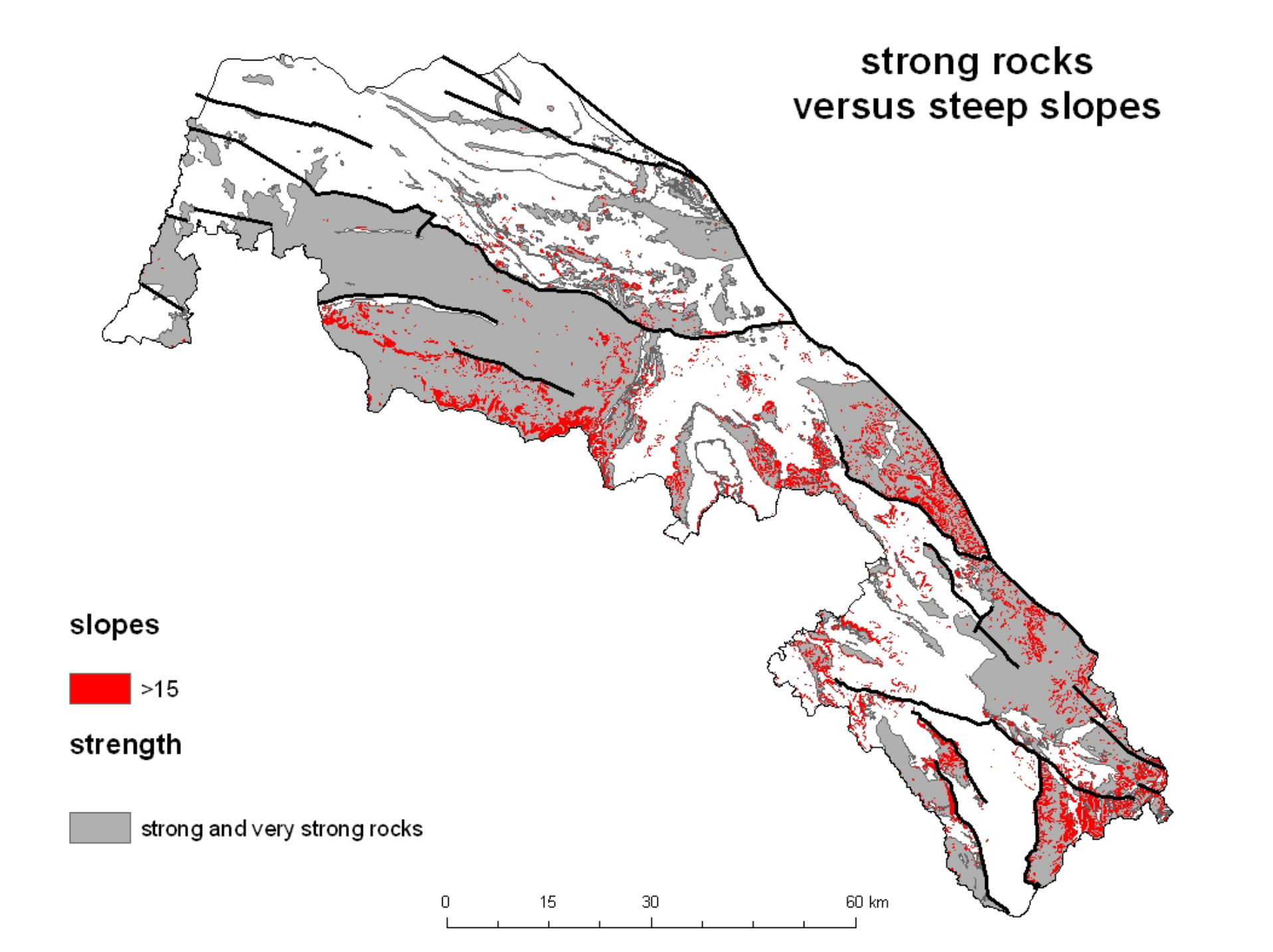


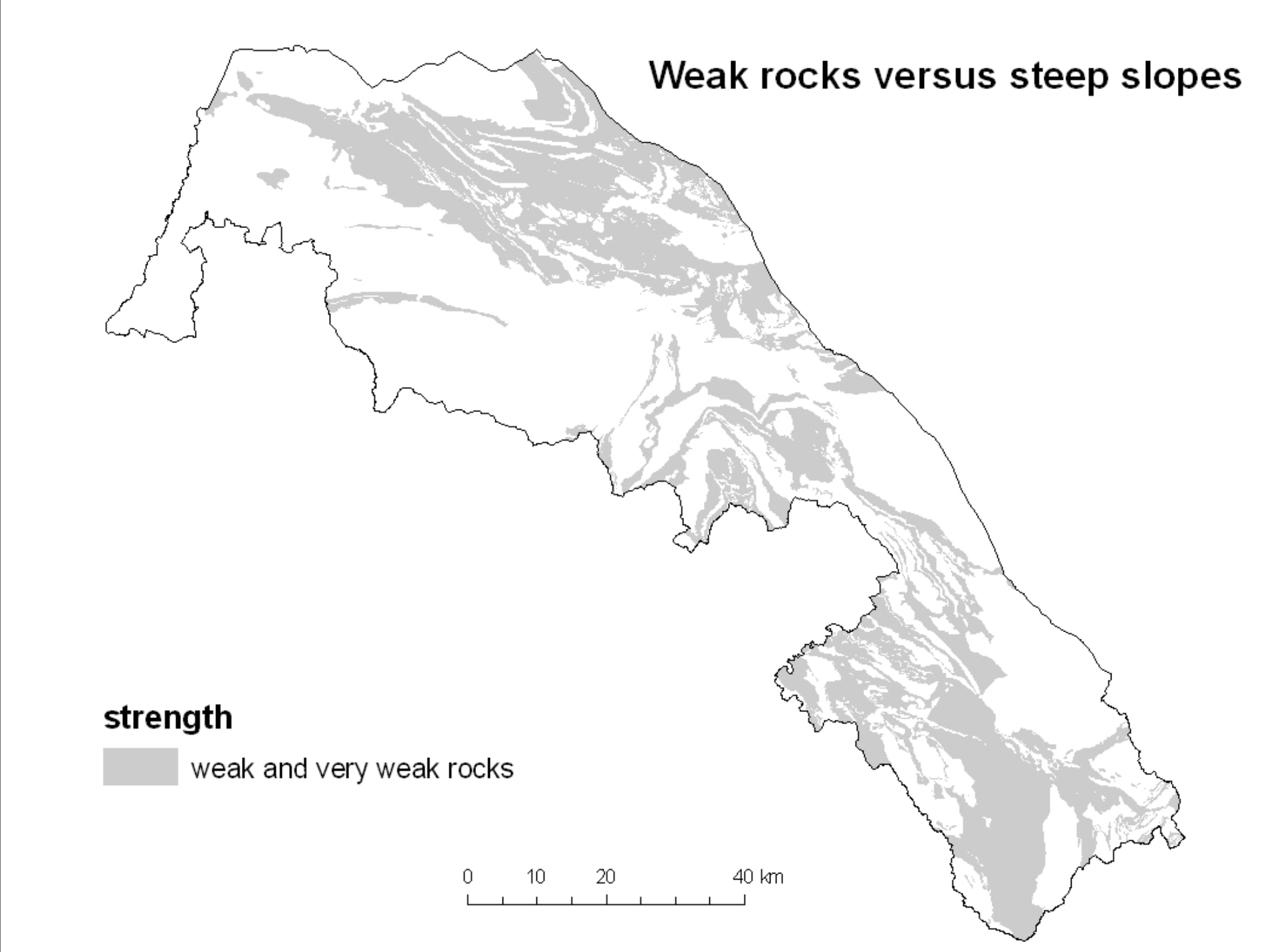
ROCK UNITS STRENGTH

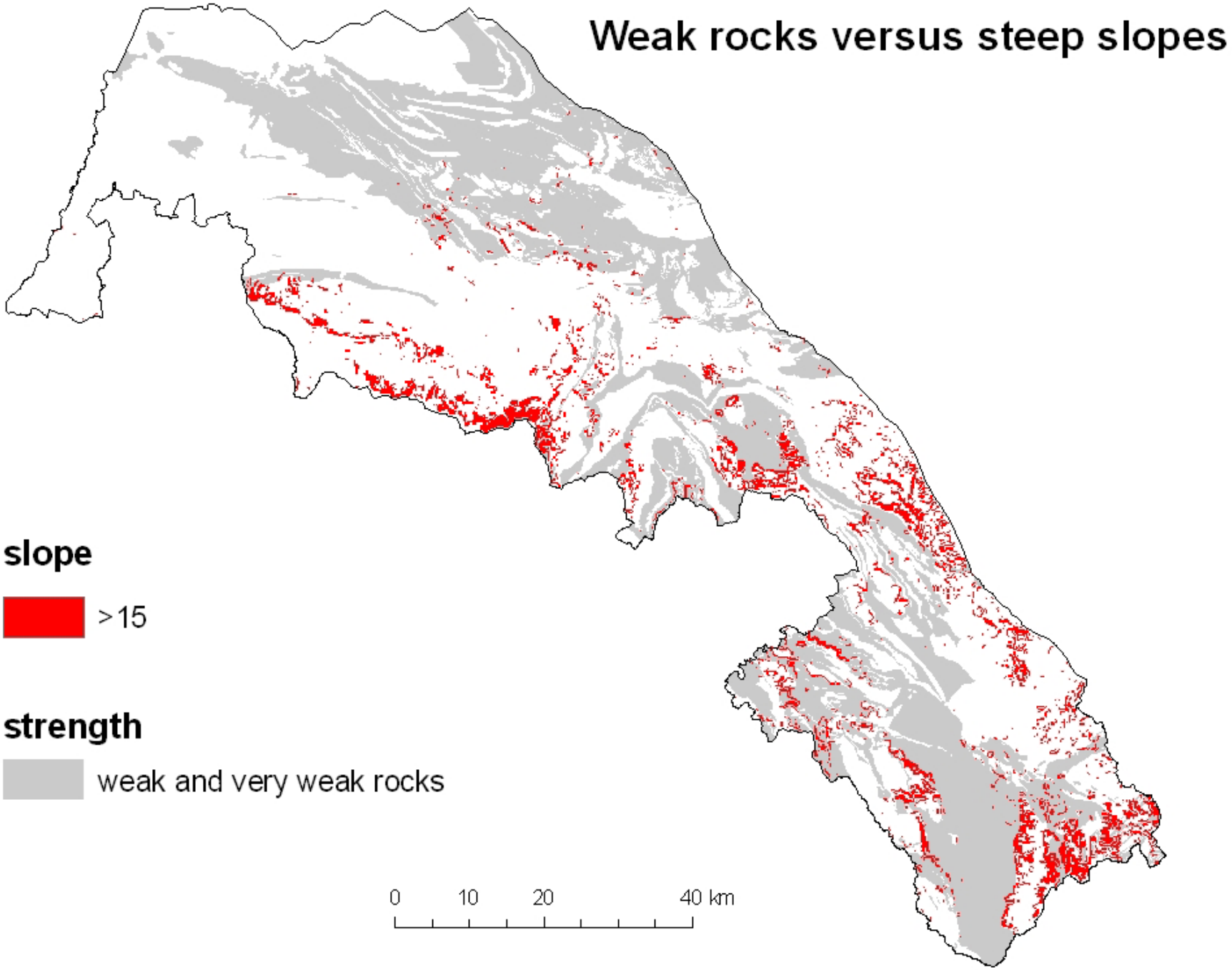


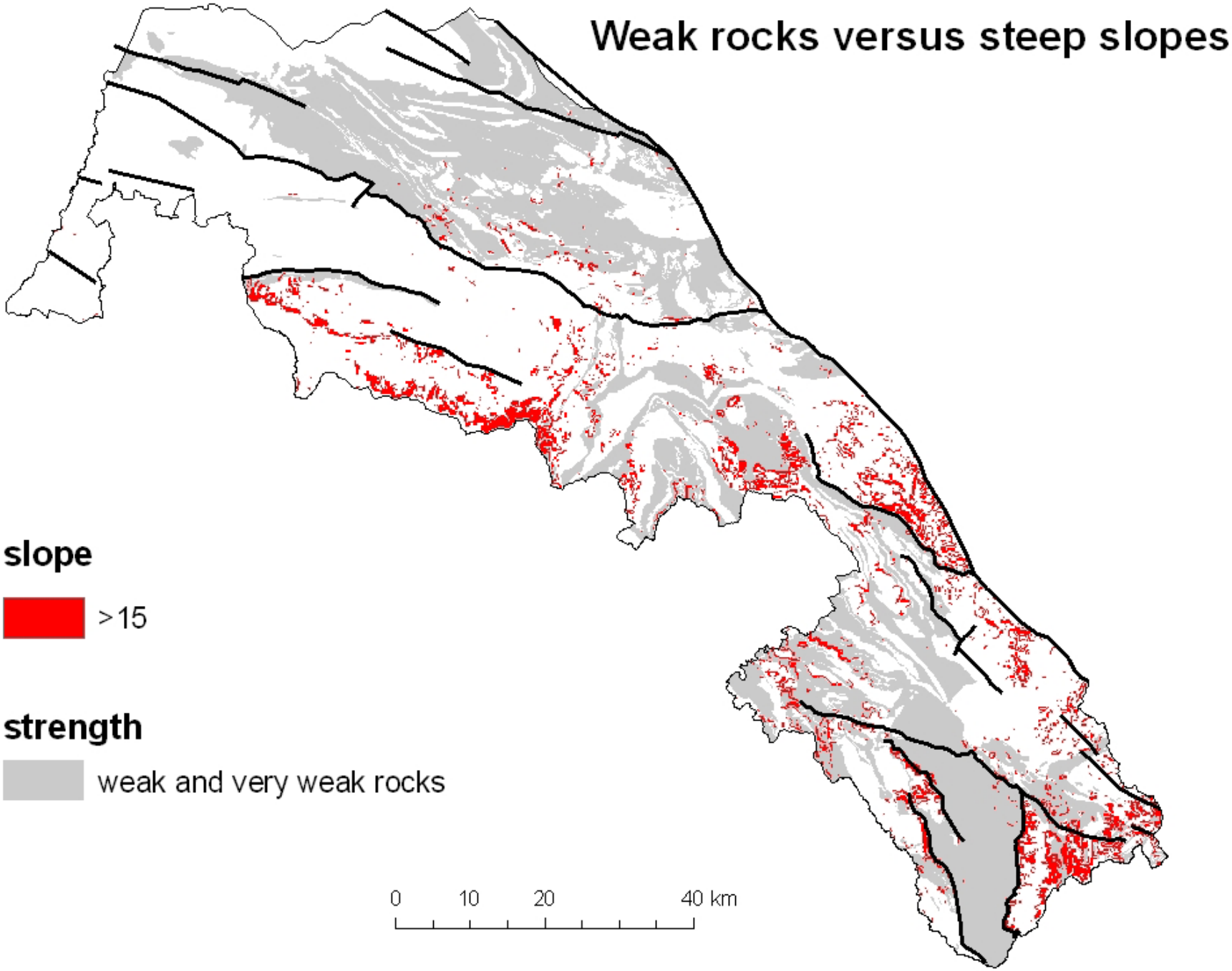

strong rocks
versus steep slopes
strength
strong and very strong rocks
0
15
30
60 km


strong rocks
versus steep slopes
slopes
>15
strength
strong and very strong rocks
0
15
30
60 km


strong rocks
versus steep slopes
slopes
>15
strength
strong and very strong rocks
0
15
30
60 km


Weak rocks versus steep slopes
strength
weak and very weak rocks
0
10
20
40 km


Weak rocks versus steep slopes
slope
>15
strength
weak and very weak rocks
0
10
20
40 km


Weak rocks versus steep slopes
slope
>15
strength
weak and very weak rocks
0
10
20
40 km

Conclusions:

1. Slope map is a useful tool to characterize the diversity of mountain relief and offers an opportunity to provide a quantitative dimension to DEM analysis.
2. The meaning of high gradient areas varies. Tectonics, rock control, and active fluvial erosion are among the factors contributing to the steepness of the terrain.
3. Mountain fronts show up rather poorly on the slope map. Elevated and dissected mountain massifs are the areas of the highest mean gradients.
4. Poor image of many tectonic lines may be explained by the mechanical weakness of the rock building the footwall.
5. The association of the majority of tectonically-induced steep slopes with the most resistant rocks suggests that the intensity of recent uplift – compared with the rate of denudation – is rather low.