GMBA mountain definition_V1.0

Version: V1.0
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Background

We offer a quantitative mountain definition that can be used for mountain-specific data retrieval of all space-based research . A mountain can neither be defined by elevation nor by climate, the only common feature of mountains is their steepness, for which ruggedness can be used as a proxi. Ruggedness is taken as the vertical amplitude within a pre-defined space and therefore corresponds to the geometrical slope between the lowest and the highest grid point in a specific area.

In 2011, Körner and al.[1] proposed a new definition of mountains based on ruggedness only, as opposed to ruggedness and elevation (Kapos et al., 2000) [2], and generated the current dataset of ruggedness values for individual pixels. Ruggedness calculations are based on the digital elevation model (DEM) used by WorldClim. Elevation of every cell in a 30 arc-seconds grid (c. 0.9 km at the equator) is compared with elevation of its eight neighboring cells. If the difference between the lowest and highest elevation of these nine 30 arc-seconds grid cells exceeds 200 m, the central cell is assigned as 'rugged' i.e. belonging to mountain terrain, as a matter of convention. The dataset is subsequently reduced to a resolution of 2.5 arc minutes (by using every 5th 30 arc-seconds cell in latitude and longitude) for the final calculation of ruggedness, mainly because WorldClim Climate data are on a 2.5 arc minute grid only.

Each mountain pixel is also attributed to one of the seven climatic belts described in Körner et al. (2011), i.e., the nival and two alpine belt above and the three montane belts below the potential bioclimatic treeline (Paulsen and Körner, 2014)[3]. The latter enables biodiversity experts to place their assessments in a meaningful bioclimatic context, irrespective of elevation and latitude.

The GMBA mountain definition dataset can be used to identify mountains worldwide based on the Körner et al., 2011 definition. This dataset is freely available. When using the GMBA ruggedness and or thermal belt data, please cite: Körner C, Paulsen J, Spehn E (2011) A definition of mountains and their bioclimatic belts for global comparisons of biodiversity data. Alpine Botany 121(2): 73-78 and the DOI number of the dataset.

[1]Körner C, Paulsen J, Spehn E (2011) A definition of mountains and their bioclimatic belts for global comparisons of biodiversity data. Alpine Botany 121(2): 73-78. DOI: 10.1007/s00035-011-0094-4.

[2]Kapos V, Rhind J, Edwards M, Price M F and Ravilious, C 2000 Developing a map of the world's mountain forests. In: Price, M F and Butt, N (eds) Forests in sustainable mountain development: A report for 2000. CAB International, Wallingford, p 4-9. DOI: 10.1079/9780851994468.0004

[3]Paulsen, J and Körner, C 2014 A climate-based model to predict potential treeline position around the globe. Alpine Botany 124:1-12. DOI: 0.1007/s00035-014-0124-0.

Data content in GMBA mountain definition_V1.0.txt

Latitude: latitude of grid cell in degrees and decimal fractions of degrees

Longitude: longitude of grid cell: in degrees and decimal fractions of degrees

Ruggedness: maximal elevational difference among neighboring grid points (Koerner et al., 2011).

tvzcode: label for "thermic vegetation zone"

-9: not available

1: nival, season length <= 10 days

2: upper alpine zone; season length between 10 and 59 days or season longer and season mean < 3.5 degrees C

3: lower alpine zone; season length < 94 or season mean < 6.4 degrees C

4: upper montane zone; season length >= 94 days and season mean between 6.4 and 10.0 degrees C

5: lower montane zone; season length >= 94 days and season mean between 10.0 and 15.0 degrees C

6: warm zone with possible freezing; season length >= 94 days and season mean >= 15.0 degrees C

Grid cell size: 0.04166666 decimal degrees (2.5 Arc minute; 2 minutes 30 seconds)

Data content in GMBA mountain defintition_V1.0: all data available (GIS data, ASCII data, reference publication, general information)

Data content in GMBA mountain defintition_V1.0(GIS): ruggedness data for geographic information system (GIS) software (.dbf, .prj, .shp, .shx).