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GEO-GNOME Global Mountain Explorer

Visualizing and comparing commonly applied mountain definitions

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Background

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- GEO-GNOME: **G**roup on **E**arth **O**bservations – **G**lobal **N**etwork for **O**bservations and **I**nformation in **M**ountain **E**nvironments

- GEO Work Programme Initiative 2017-2019

- Leadership
  - Mountain Research Initiative (Carolina Adler)
  - Institute of Atmospheric Sciences and Climate (Elisa Palazzi)

- Community
  - Scientific & non-scientific organizations
  - Divers competences & topics

Background

- Mountains are globally distributed
- Mountains provide societal benefits
- Mountains are home to many exposed human populations
- Mountain regions are sensitive to global change
- Important to monitor mountain environment & response to drivers
- Important to improve policies and practices

Aims

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- Facilitate access to fragmented data (past / present / future) to support examination of drivers, conditions & trends at different scales
- Improve understanding of mountain regions & ability to provide policy and investment-relevant advice
- Create & foster capacity and know-how to combine data across globally distributed environments to meet emerging policy needs
- Focus on science & policy

Tasks

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- Accurately delineate mountain regions using best available data
- Compile data that quantify ecosystem services, socio-economic measures and drivers
- Improve understanding & foresight through focused campaigns
- Develop indicator capacity that responds to future policy needs
- Report periodically on State of the World's Mountains
- Obvious need for data & data infrastructure

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GLOBAL MOUNTAIN EXPLORER

Methods: Data & layers

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- 3 widely used mountain definitions
  - K1 – Kapos et al. 2000: proposed for developing a map of the world's mountain forests
  - K2 – Körner et al. 2011: proposed for biodiversity research and biogeography
  - K3 – Karagulle et al. 2017: Ecological Land Units (ELUs) proposed for multiple applications, not mountain-specific

Methods: K1

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> 6 classes based on ruggedness & elevation

Class	Elevation (m)	Slope (%)	Relative Relief (m)	Global Area (10^6 km^2)	Global Area (%)
1	>4500	Not used	Not used	1.8	1.2
2	3500 - 4499	Not used	Not used	2.7	1.8
3	2500 - 3499	Not used	Not used	6.9	4.7
4	1500 - 2499	> 3.5	Not used	5.3	3.6
5	1000 -1499	> 8.75 **(OR)**	> 300	6.2	4.2
6	300 - 999	Not used	>300	13.0	8.8
			Global Totals	35.9	24.3

Methods: K2

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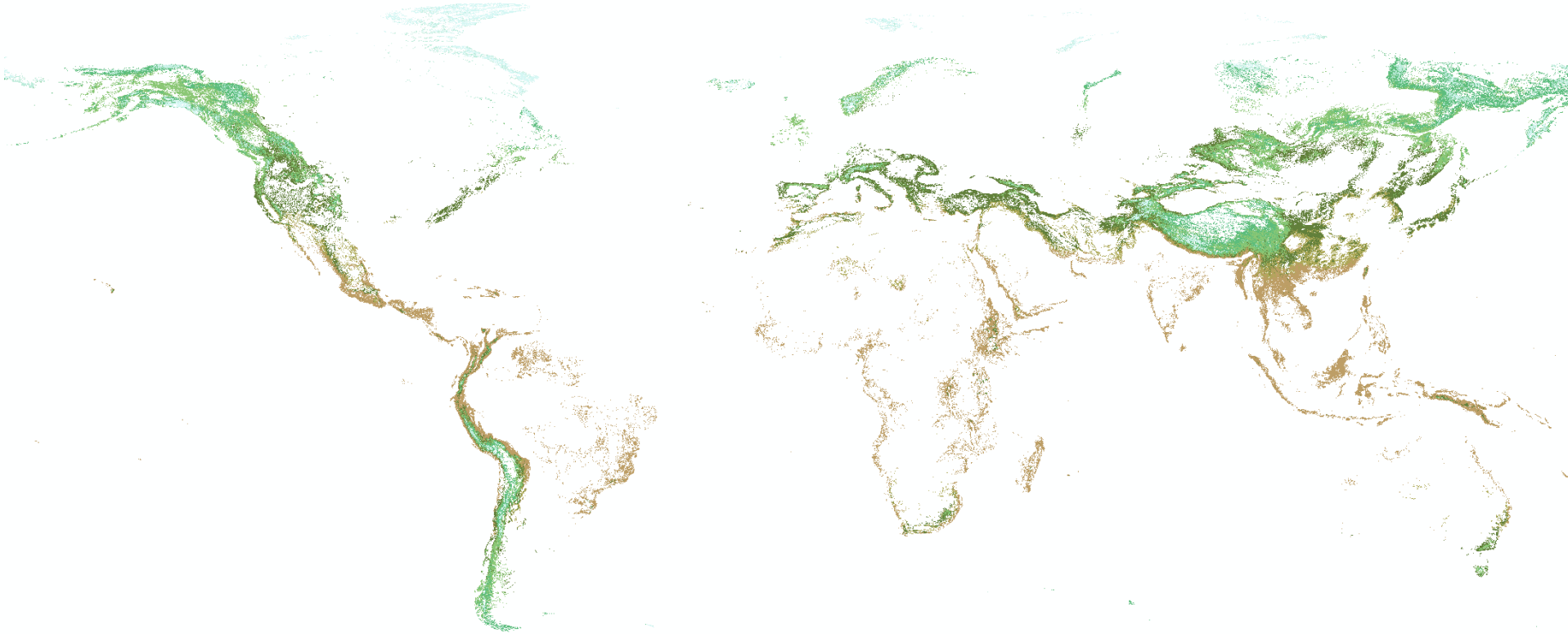
- 7 classes based on ruggedness only & associated with thermal belts

Thermal belts	Area (Mio km^2)	M (%)
1. Nival (<3.5°C, GS < 10 days)	0.53	3.24
2. Upper alpine (<3.5 °C, GS > 10 days < 54 days)	0.75	4.53
3. Lower alpine <6.4°C, GS < 94 days)	2.27	13.74
The treeline		
4. Upper montane (>6.4 ≤10 °C)	3.39	20.53
5. Lower montane (>10 ≤15 °C)	3.74	22.64
6. Remaining mountain area with frost (>15°C)	1.34	8.11
7. Remaining mountain area without frost (>15°C)	4.49	27.22
Total	16.51	100.00

Methods: K2



Methods: K3

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> 4 classes based on slope, relative relief, and profile

Mountain Class	Slope Class (%)	Relative Relief (m)	Profile (%)	Global Area (km^2)	Global Area (%)
High Mountains	81 -100	> 900	Not used	12,579,032	9.4
	51 - 80	> 900	> 50% of all cells in the NAW are high slope		
Scattered High Mountains	51 - 80	> 900	≤ 50% of lowland cells in the NAW are high slope	2,563,661	1.9
Low Mountains	81 - 100	301 – 900	Not used	12,519,699	9.3
	51 - 80	301 - 900	> 50% of all cells in the NAW are high slope		
Scattered Low Mountains	51 - 80	301 - 900	≤ 50% of lowland cells in the NAW are high slope	13,208,399	9.8
			Global Totals	40,869,376	30.5

Methods: K1 – K2 – K3

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- 3 widely used mountain definitions

Global Mountain Characterization	Total Global Land Surface Area (10^3 km^2), Excluding Antarctica	Total Area (10^3 km^2) of Global Land Surface Occupied by Mountains	Total Percent (%) of Global Land Surface Occupied by Mountains
K1	133,724	35,238	26.4
K2	133,724	16,434	12.3
K3	134,088	40,869	30.5

- Large differences are important in the context of sustainable mountain development and policies!

Methods: online tool

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- Individual layer visualization
- Comparative layer visualization
- Query of individual pixels
- Layers available for unrestricted download
  - GME website
  - University of Bern server
  - Caucasus GeoNode
- Additional resources
  - GMBA mountain inventory

Contributors & partners

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