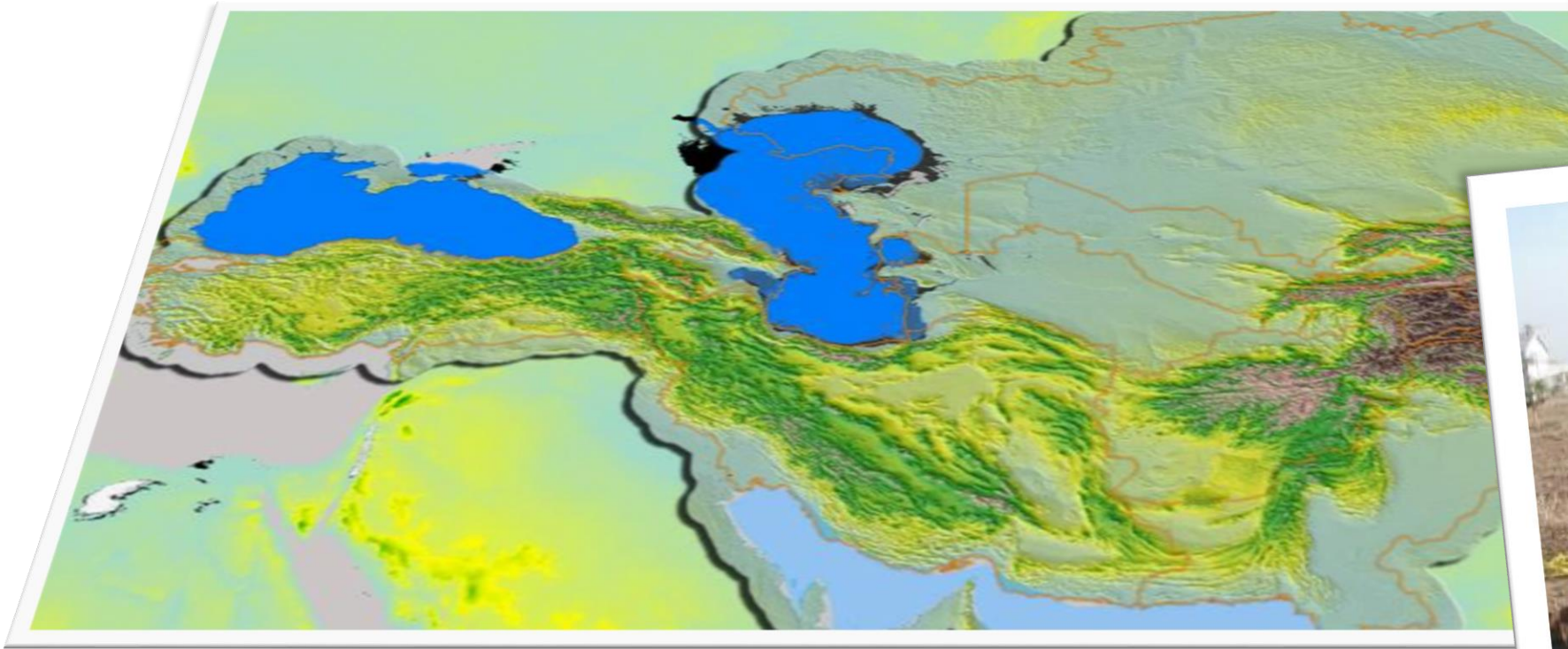


Preparing Environmental Quality Index Map of ECO Member State Region (ECO- EQI)





Brief project profile

Project Code: EME/Minerals/Project 2017

Project title	Project: “Preparing Eco-Environmental Quality Index (EQI) Map of ECO Member States Region (ECO-EQI)”	Department of Energy, Mineral, Environment (EME)
Presented	6 th ECO Mineral Expert meeting in Tabriz (October 2016)	
Accepted	7 th ECO Mineral Expert meeting in Sanandaj (August 2018)	

Team:

- Parisa Piroozfar (Project Manager)
- Omid Ardebili
- Azra Hassanlou
- Noushin Aghababazadeh
- Mahasa Roostaei

Financing Sources

- | | |
|------------------------|---|
| ECO Secretariat | (1) FGPF to support Consultancy Service (US\$ 3,000)
(2.) Project implementation (US\$ 50,000) |
|------------------------|---|

Member States	GSI of Iran
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Co-financing (amount)	US\$ 250,000
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Total:	Project cost (US\$ 300,000)
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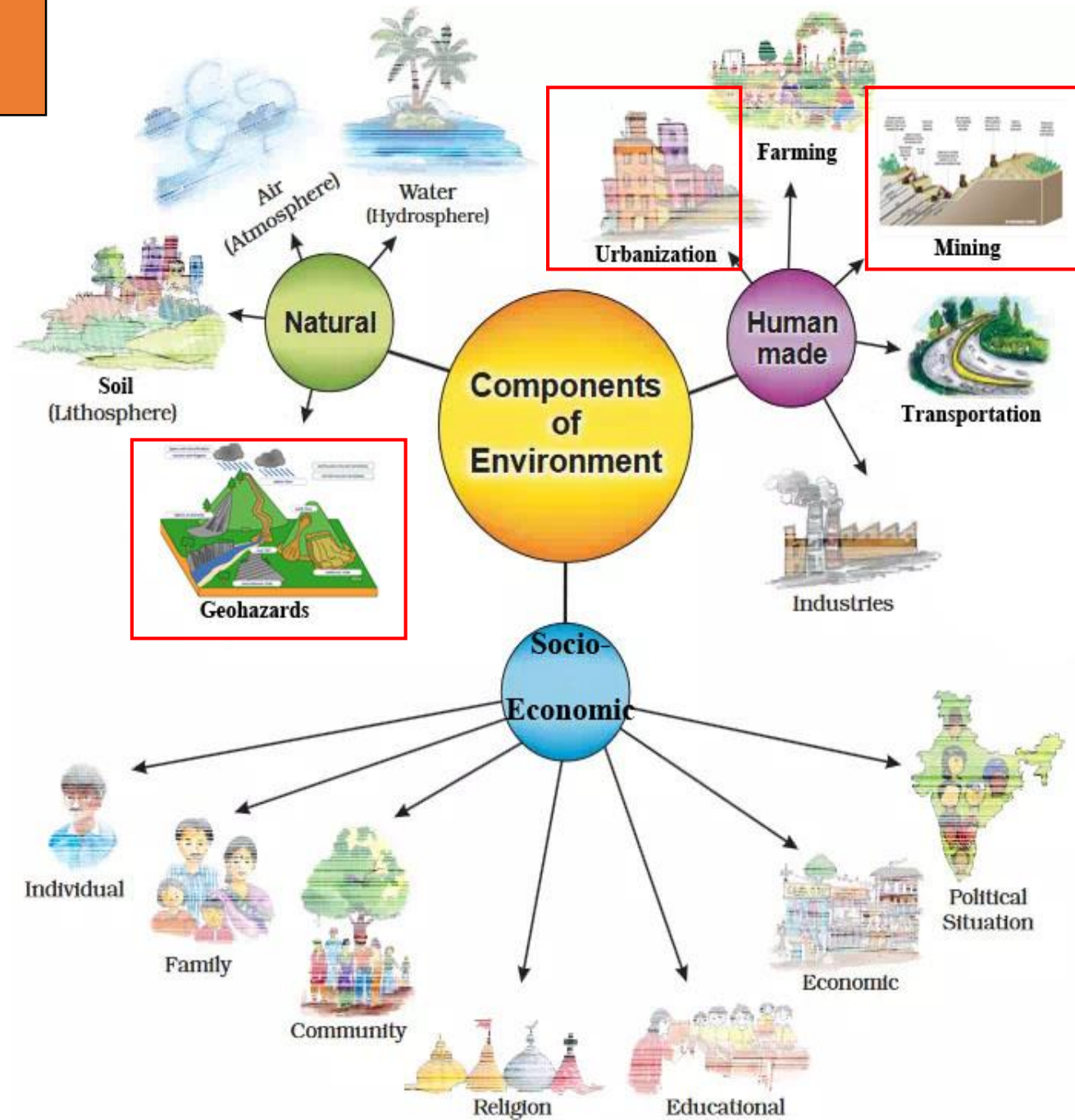


How to define Environmental Quality?

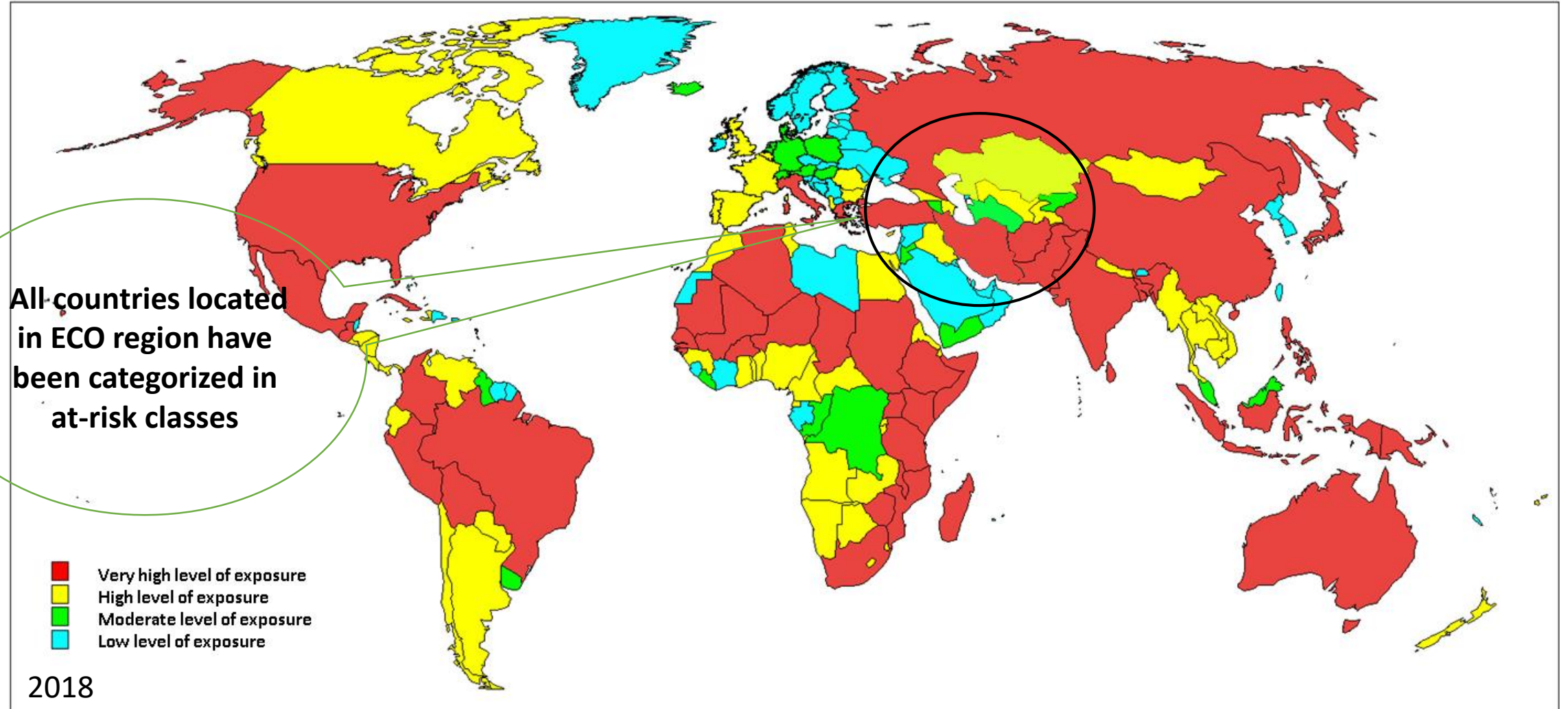
"**Environmental Quality**" is a set of properties and characteristics of the environment which effects on human beings and other organisms.

The components are categorized in 3 classes:

- ❑ Natural: the quality of soil, air and geo-hazards
- ❑ Man- made: mining, urbanization, transportation, farming and industries
- ❑ Socio-/economic: economic, education, religion and so on.

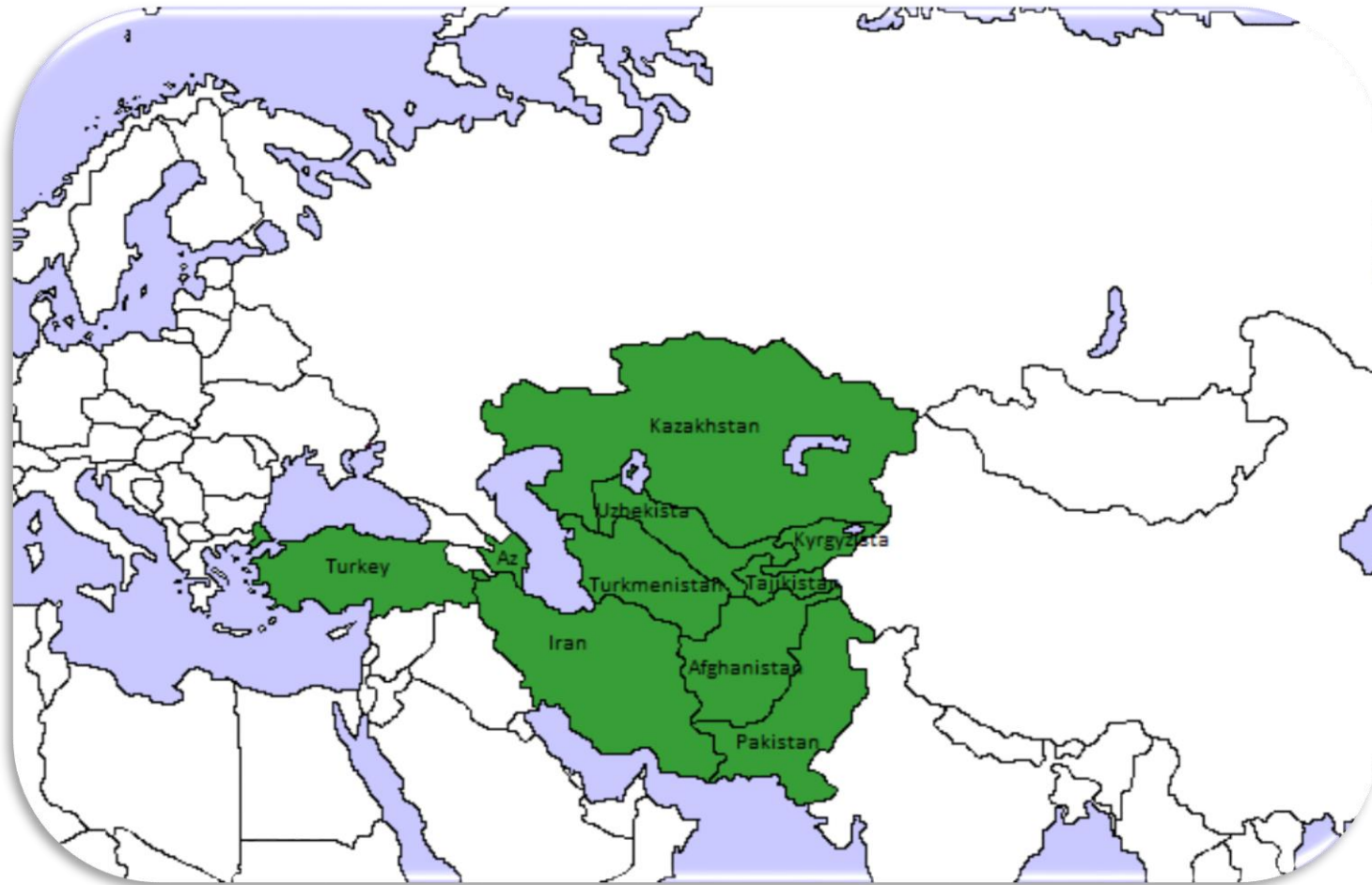


Map estimating the levels of exposure of the different countries to natural hazards

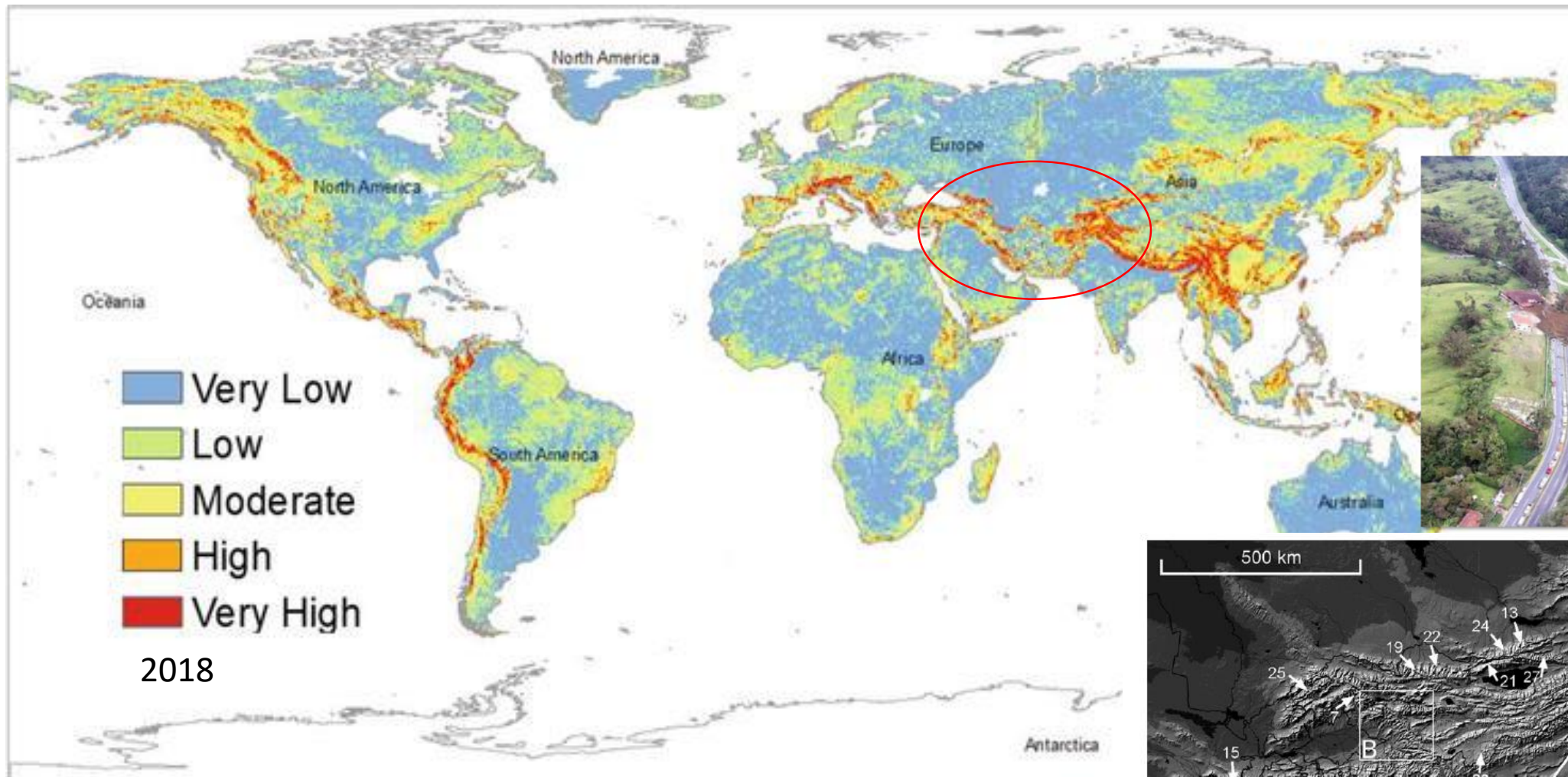


Geo-hazards in ECO Member State Region

The ECO Region is one of the most disaster prone regions in the world and faces various types of natural and man-made hazards and disasters.

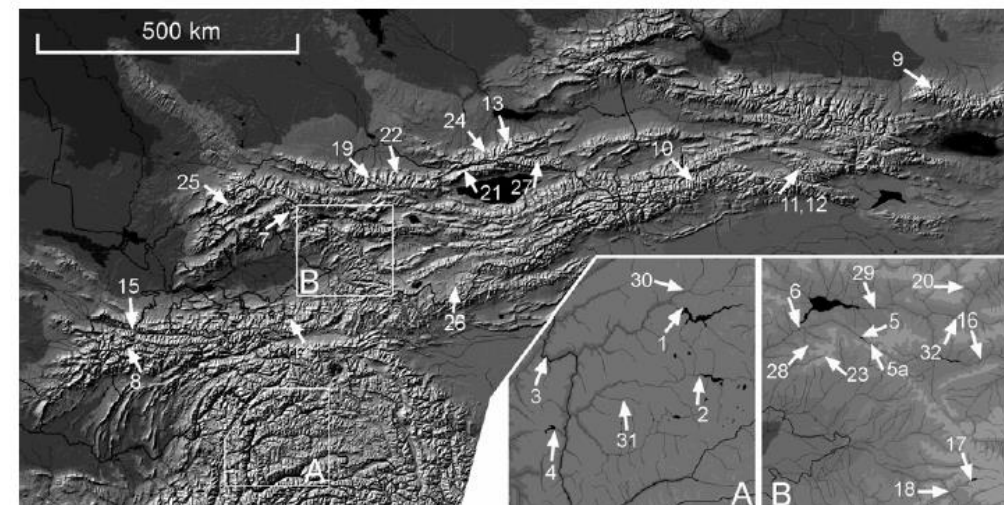


Landslides Susceptibility Map



2018

www.ourworldindata.org

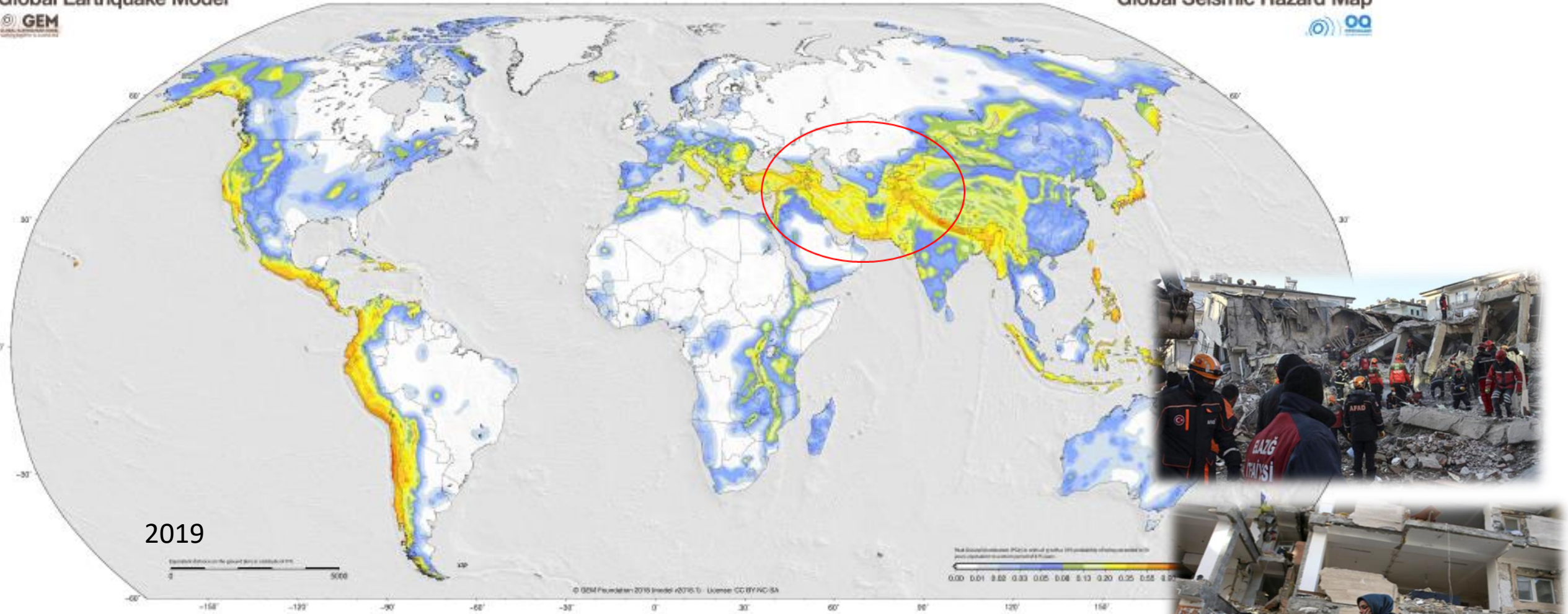


Global Seismic Hazard Map

Global Earthquake Model

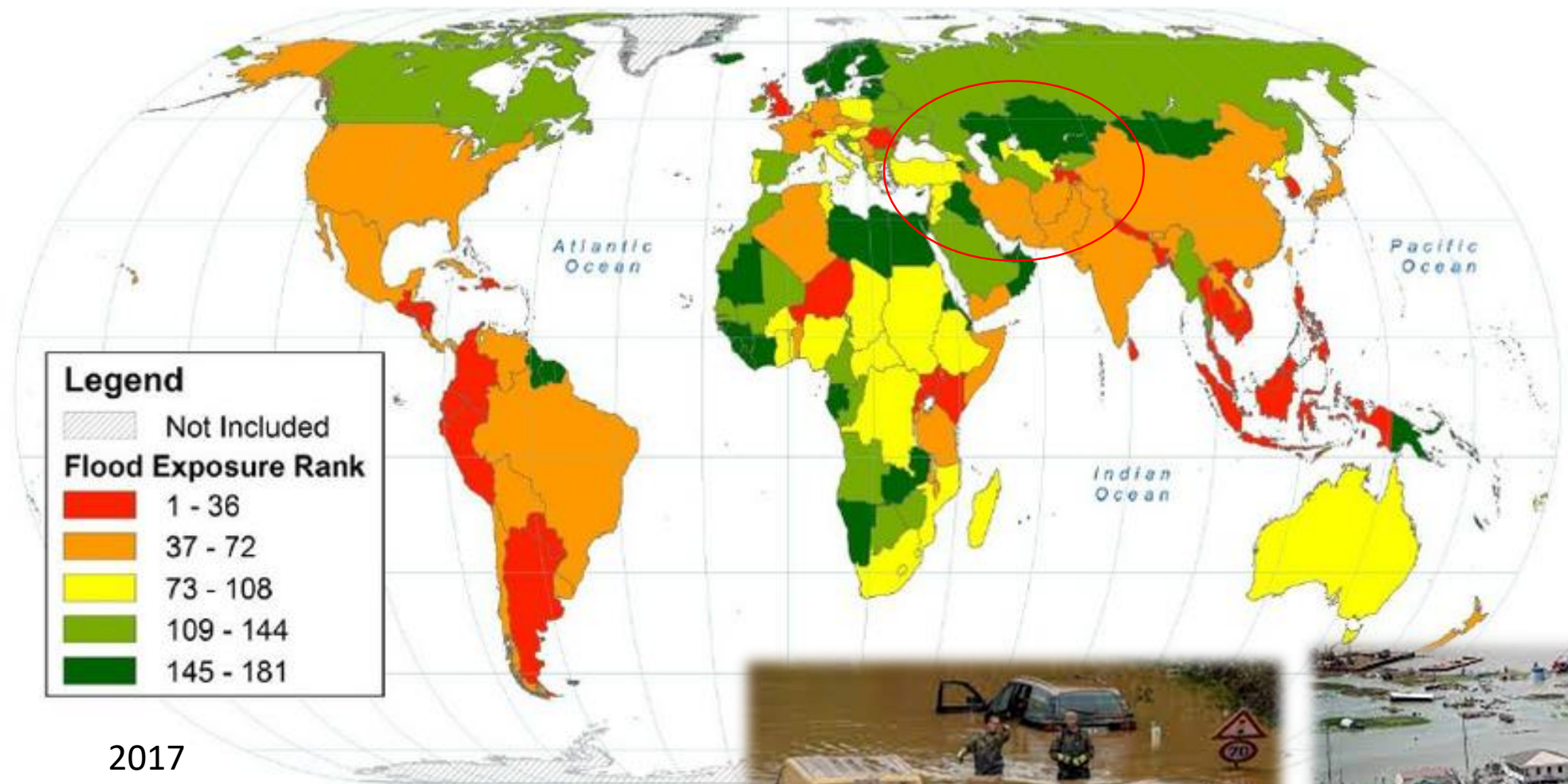


Global Seismic Hazard Map

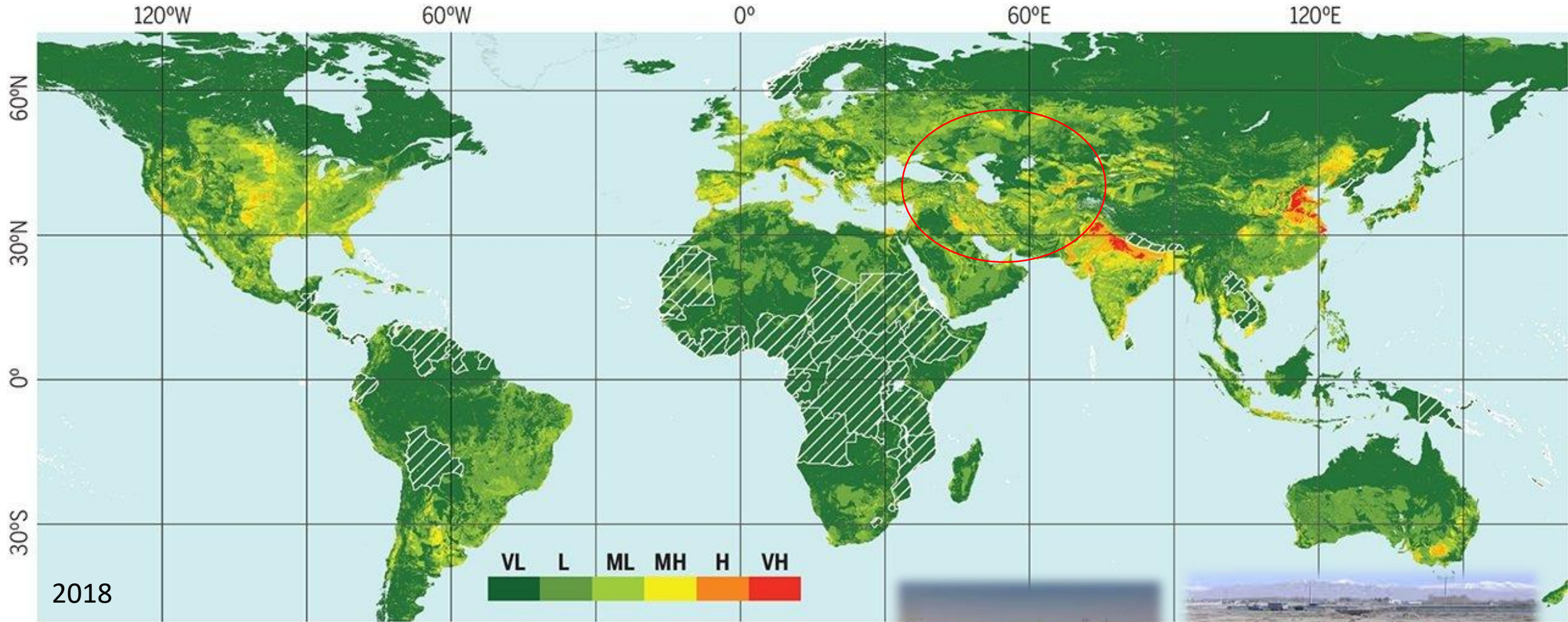


<https://www.atlas-mag.net/en/article/natural-catastrophes>

Flood Exposure Map



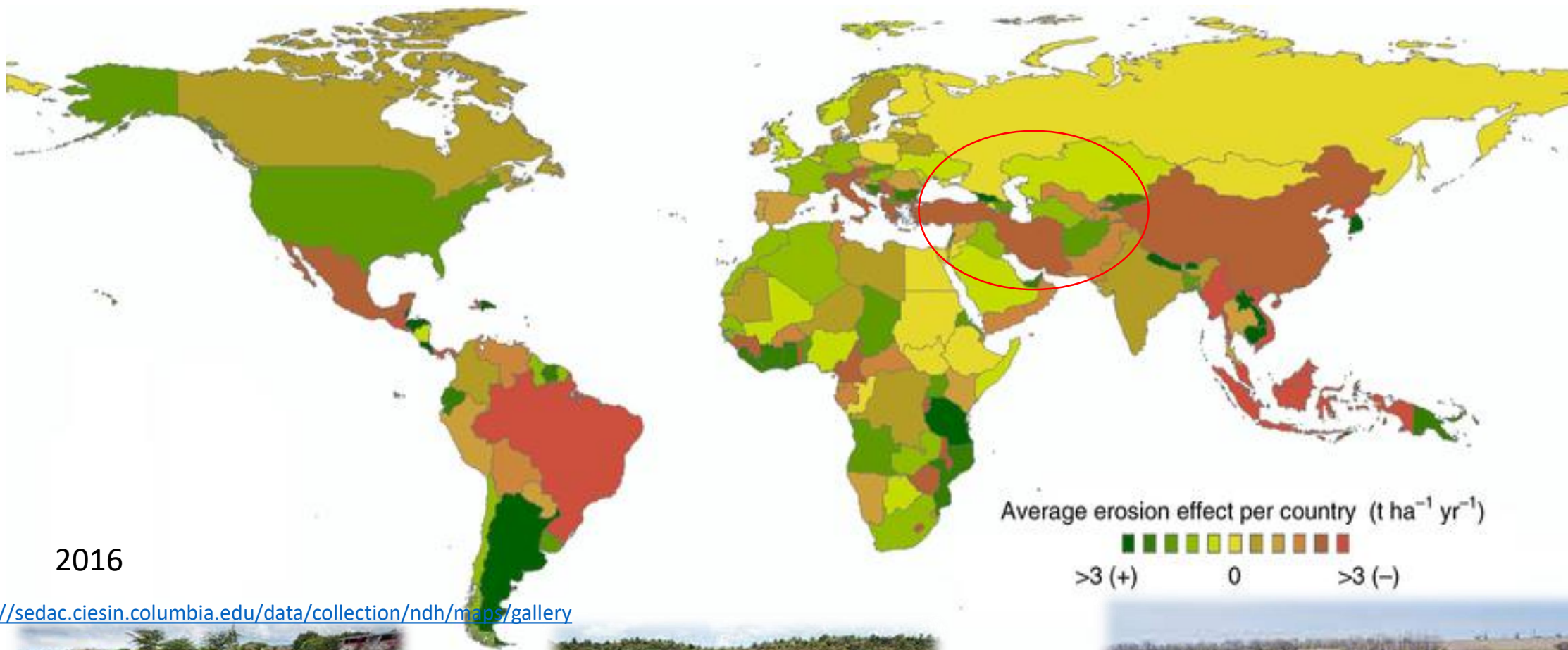
Global Land Subsidence Susceptibility Map



<https://www.atlas-mag.net/en/article/natural-catastrophes>



Soil Erosion Map

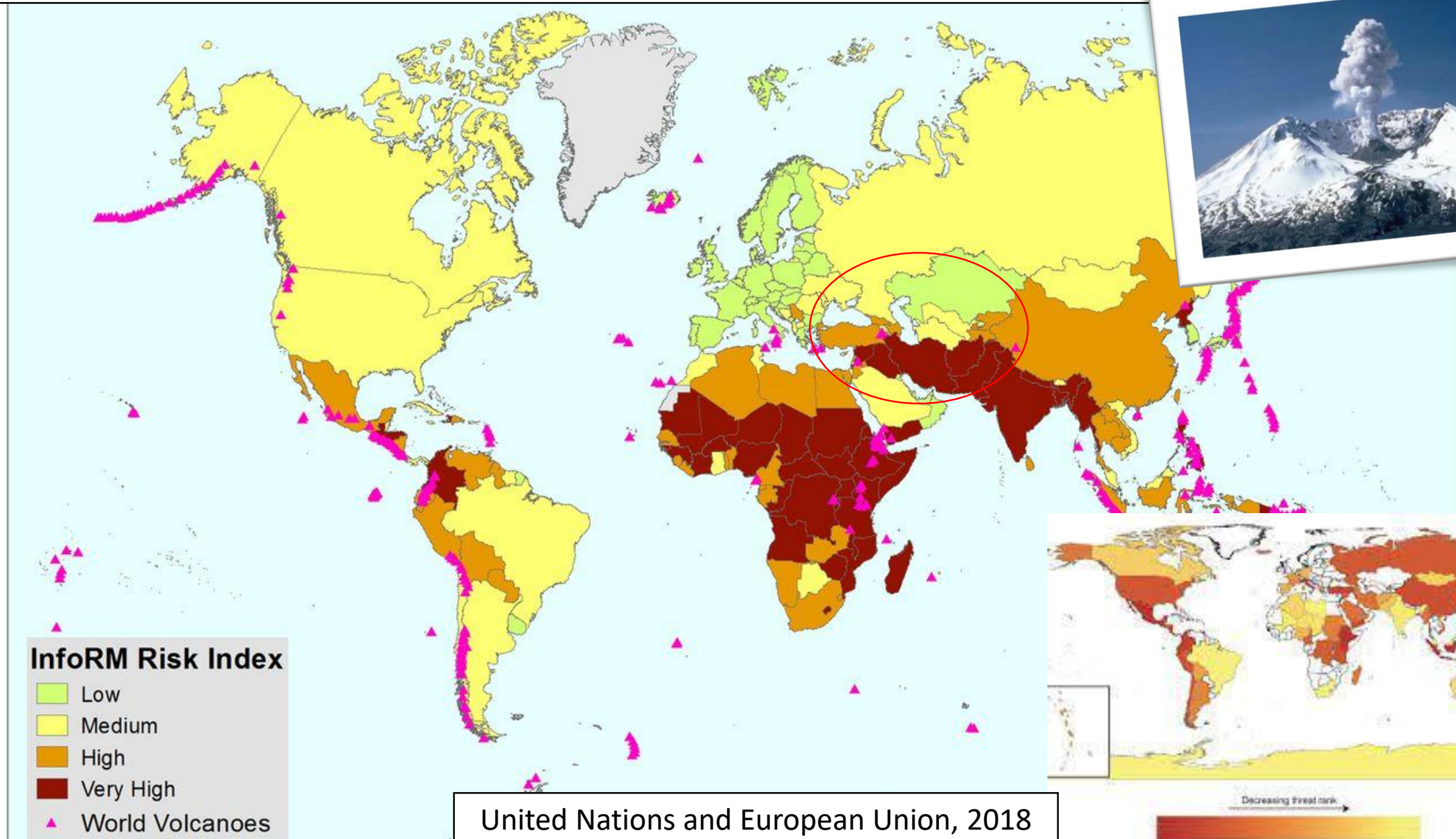


2016

<https://sedac.ciesin.columbia.edu/data/collection/ndh/maps/gallery>



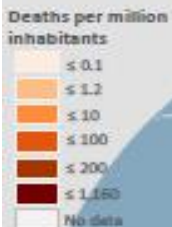
Global Volcano Risk Index Map



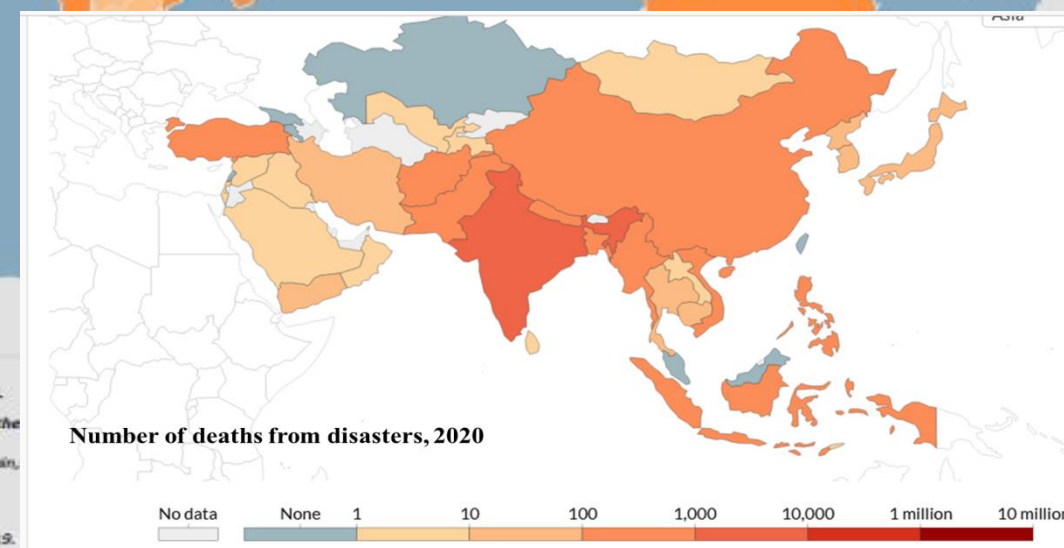
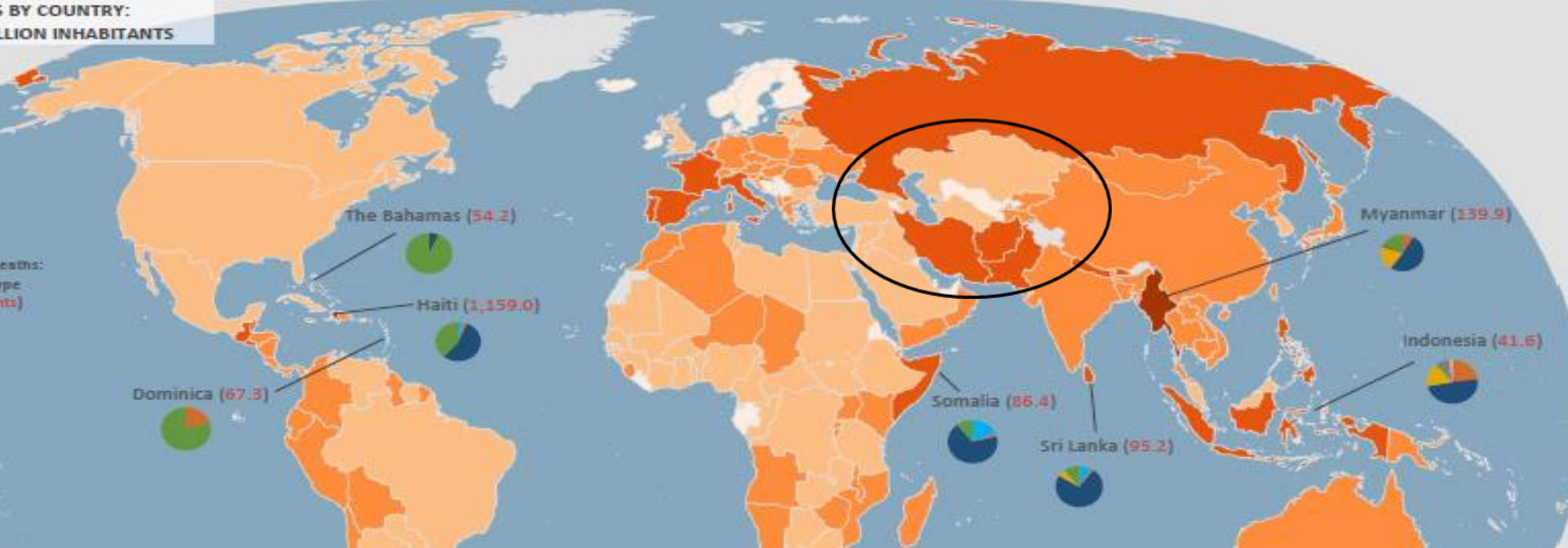
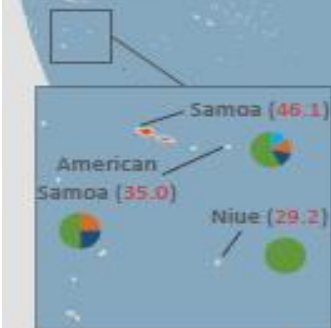
United Nations and European Union, 2018

The depiction and use of boundaries are not warranted to be error free nor do they necessarily imply official endorsement or acceptance by the United Nations and European Union.

**IMPACTS OF DISASTERS BY COUNTRY:
TOTAL DEATHS PER MILLION INHABITANTS**



Countries with the highest deaths:
Frequency of disasters¹ by type
(deaths per million inhabitants)

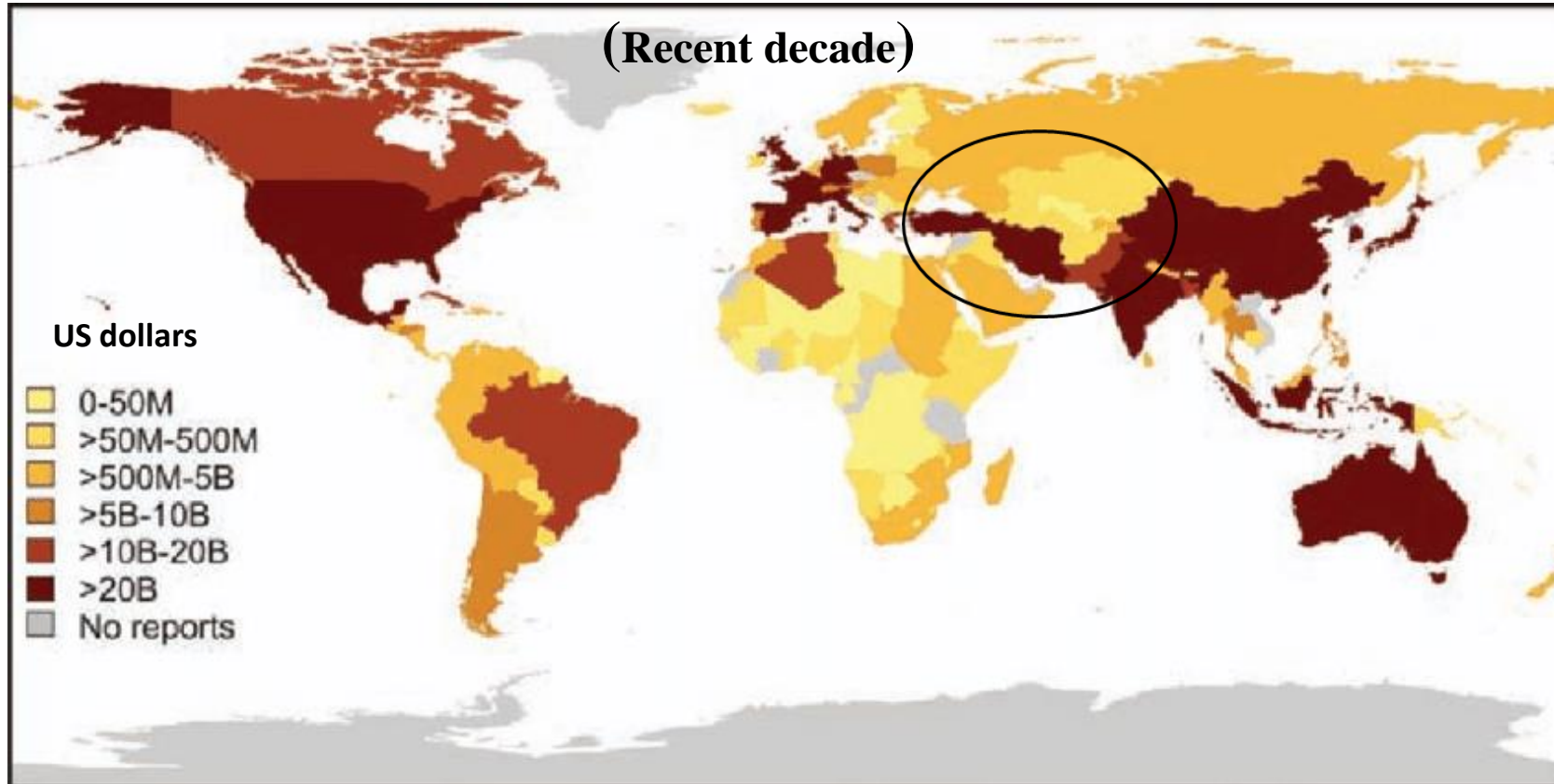


¹For the purpose of this analysis the term "disaster" is reserved for natural hazard-related disasters, not including biological or technological disasters.
All analyses are based on the report: 'The human cost of disasters: An overview of the last 20 years (2000 – 2019); Centre for Research on the Epidemiology of Disasters, Institute of Health and Society, UC Louvain, Belgium, and the UN Office for Disaster Risk Reduction'. Disaster data sourced from the EM-DAT International Disaster Database, Centre for Research on Epidemiology of Disasters – CRED / UC Louvain, Brussels, Belgium www.emdat.be (D.Guha Sapir)
NOT ALL EVENTS MAY HAVE BEEN REPORTED OR RECORDED IN THIS DATABASE.

Population data sourced from United Nations, Department of Economic and Social Affairs, Population Division (2019). World Population Prospects 2019. Copyright, European Union, 2020. Map created by DG ECHO Situational Awareness Team. Sources: DG ECHO, GISCO. The boundaries and names shown on this map do not imply official endorsement or acceptance by the European Union.

Source: Our World in Data based on EM-DAT, CRED / UCLouvain, Brussels, Belgium – www.emdat.be (D. Guha-Sapir)

Global Costs of Disasters Related to Geo-hazards

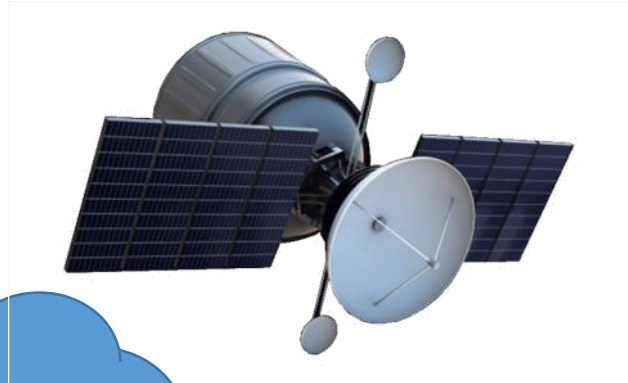


Source: United Nations Statistics Division
<https://unstats.un.org/sdgs/indicators/database/>

Direct Natural Disasters Economic Loss, 2018 (US Million \$)	
Azerbaijan	
Afghanistan	<u>52</u>
Iran	<u>70</u>
Kazakhstan	<u>5</u>
Kyrgyzstan	<u>15</u>
Pakistan	<u>17</u>
Tajikistan	<u>6</u>
Turkey	
Turkmenistan	3
Uzbekistan	3

Most of Environmental Hazards are Unpreventable

What Should Have
Done to raise
environmental
quality?



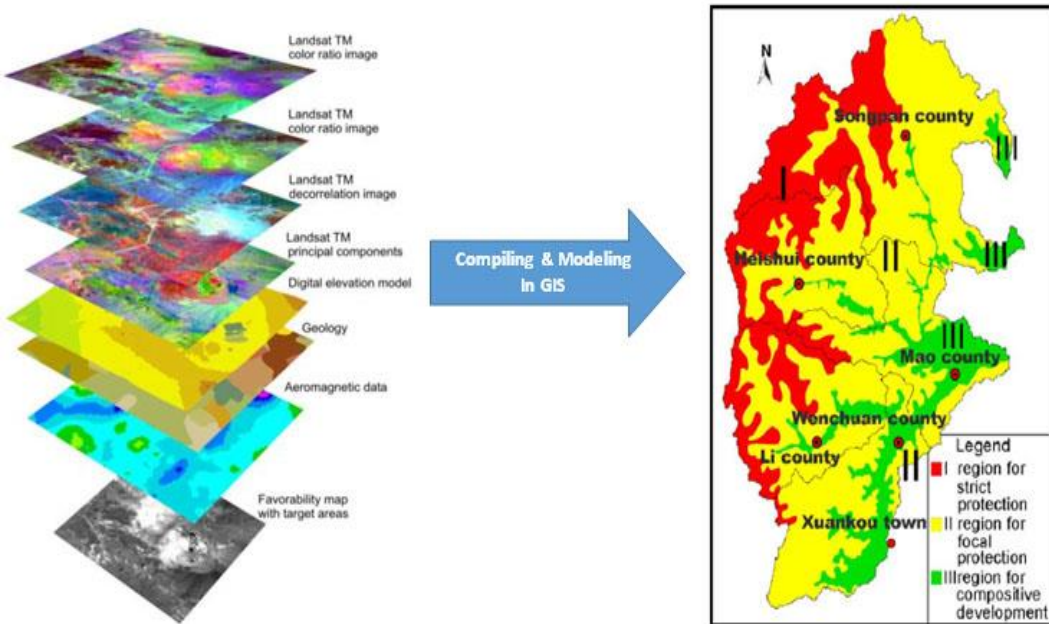
A Solution:
Mapping the
threatening factors of
environmental quality
by Geospatial
Techniques



Employing Advanced Geospatial Technology
such as Remote Sensing and GIS for
Development, generating applications, and
dissemination of EQI maps

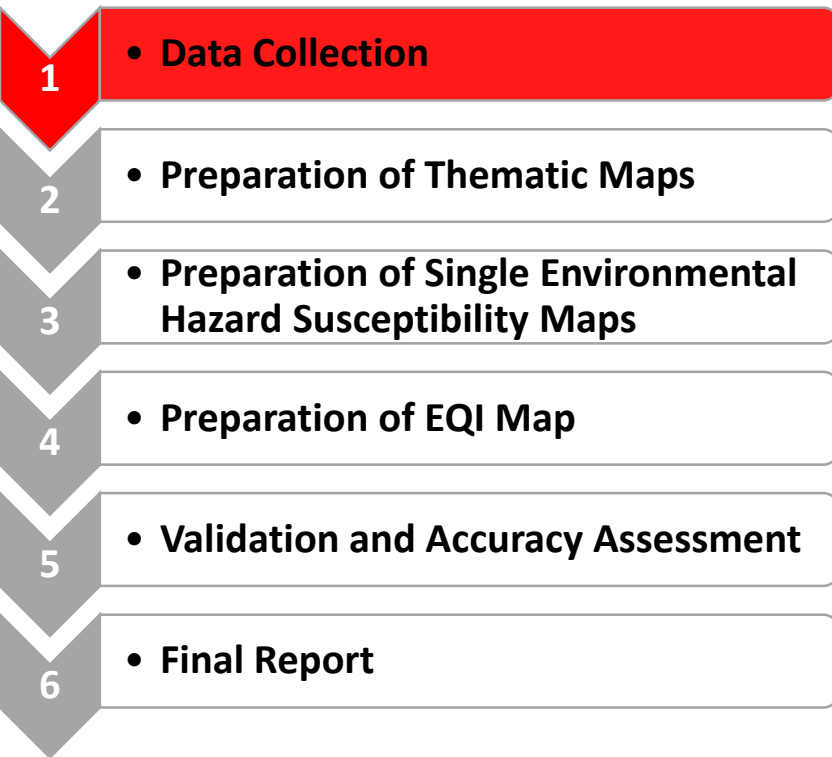
Why are the EQI Maps Important?

**Gather together the information
of different environmental
hazards in one map**



- Presents a composite picture of different environmental hazards in one map in area of effect
- Provides visual information for decision-makers for land use planning and environmental hazards management
- Identifies susceptibility of area by using a modeling method within GIS environment
- Predicts future geo-hazards based on occurrence mechanism within the study area
- Provides a management tool to minimize the economic and human loss
- Identifies vulnerable areas for disaster preparedness and management of environmental hazards

Work Plan of ECO-EQI Project



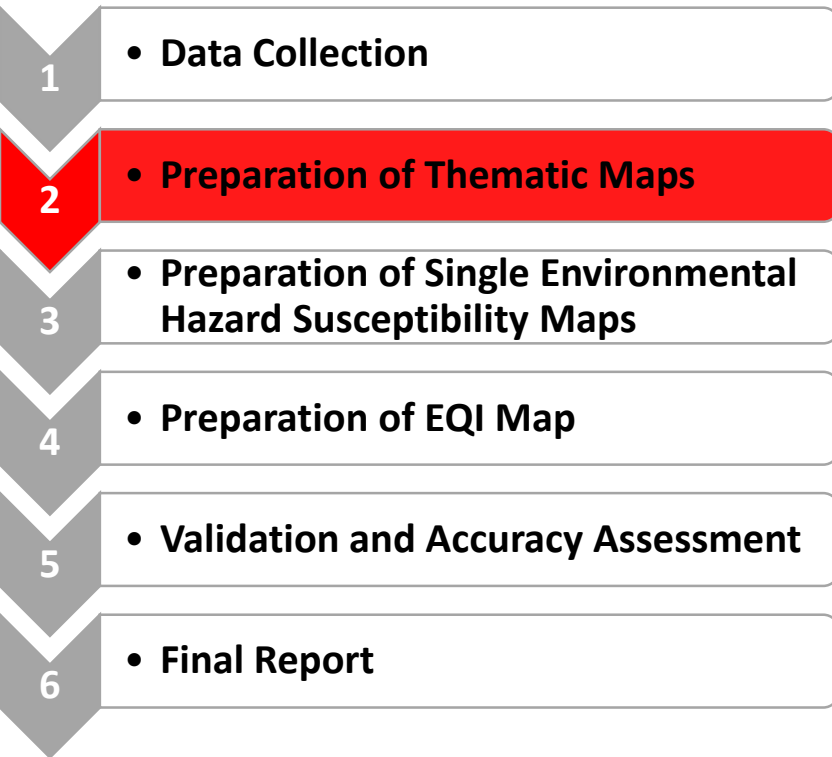
Primary data:

- Digital Elevation Model (DEM)
- Satellite images (Landsat, MODIS and Sentinel1A-Radar)
- Meteorological data
- Seismic data
- Information on mines
- Information on volcanoes
- Topographical maps
- Geological maps
- Soil maps
- Land Use/Cover maps
- Spatial distribution of infrastructures, industrial areas, population centers...

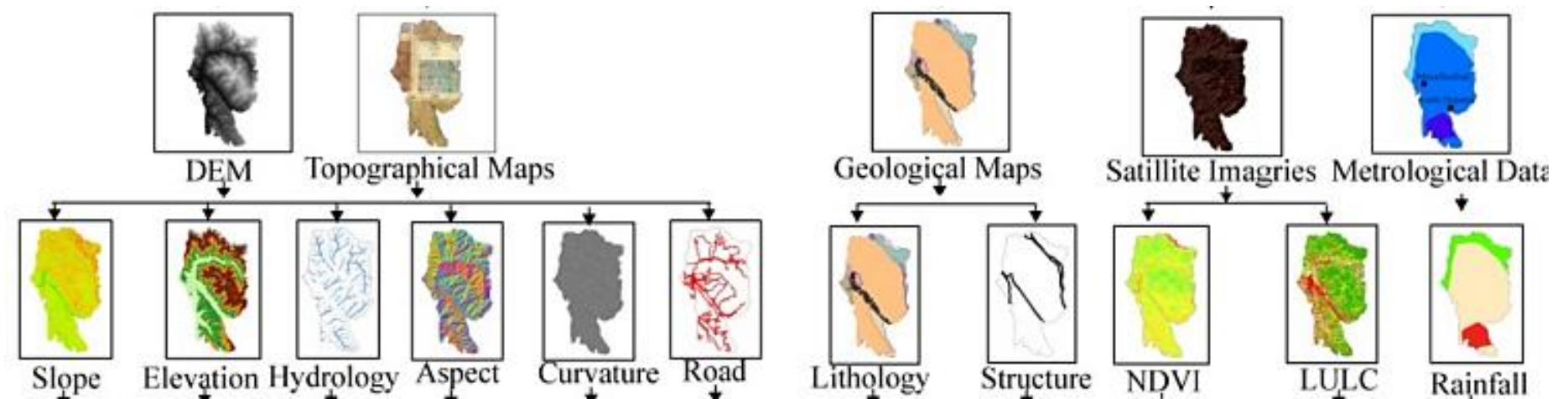
Secondary data:

Geological hazard maps previously prepared by ECO member countries on a national scale

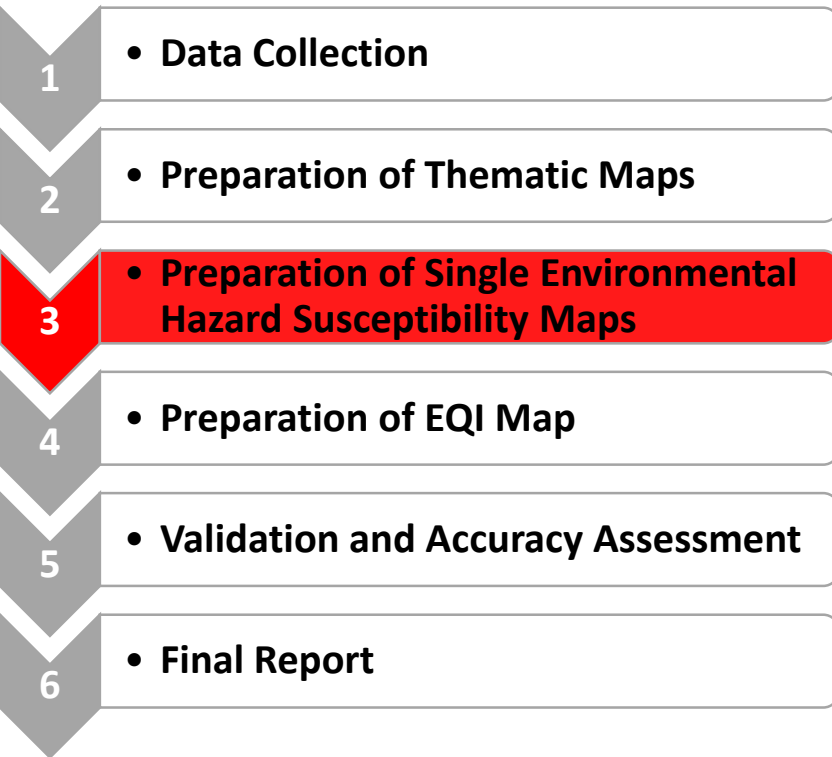
Work Plan of ECO-EQI Project



- Slope
- Slope aspect
- Elevation
- Profile curvature
- Plan curvature
- Topographic Wetness Index (TWI)
- Drainages
- Flow accumulation/Flow density
- NDVI
- Isohyetal map
- Distance to stream/roads/faults
- Hydrology



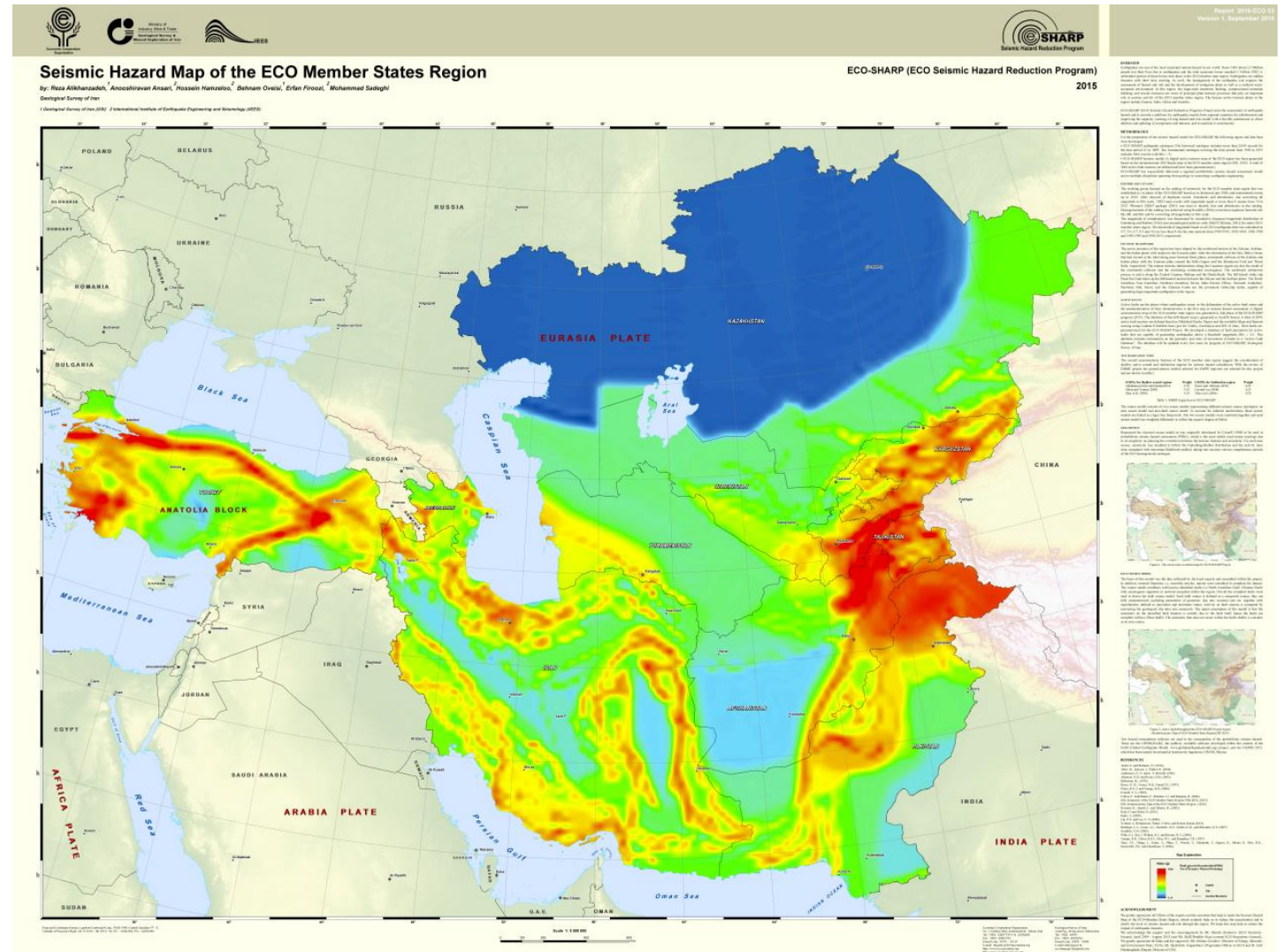
Work Plan of ECO-EQI Project



1. [Seismic Hazard \(Available\)](#)
2. [Soil Erosion](#)
3. [Flood Risk](#)
4. [Land Subsidence](#)
5. [Volcanic Risk](#)
6. [Mine Pollution](#)

Seismic Hazard Map

Seismic Hazard Map of the ECO Member State Region was initially produced by the Geological Survey of Iran (GSI) in 2015 under the ECO Seismic Hazard Reduction Program (ECO-SHARP).

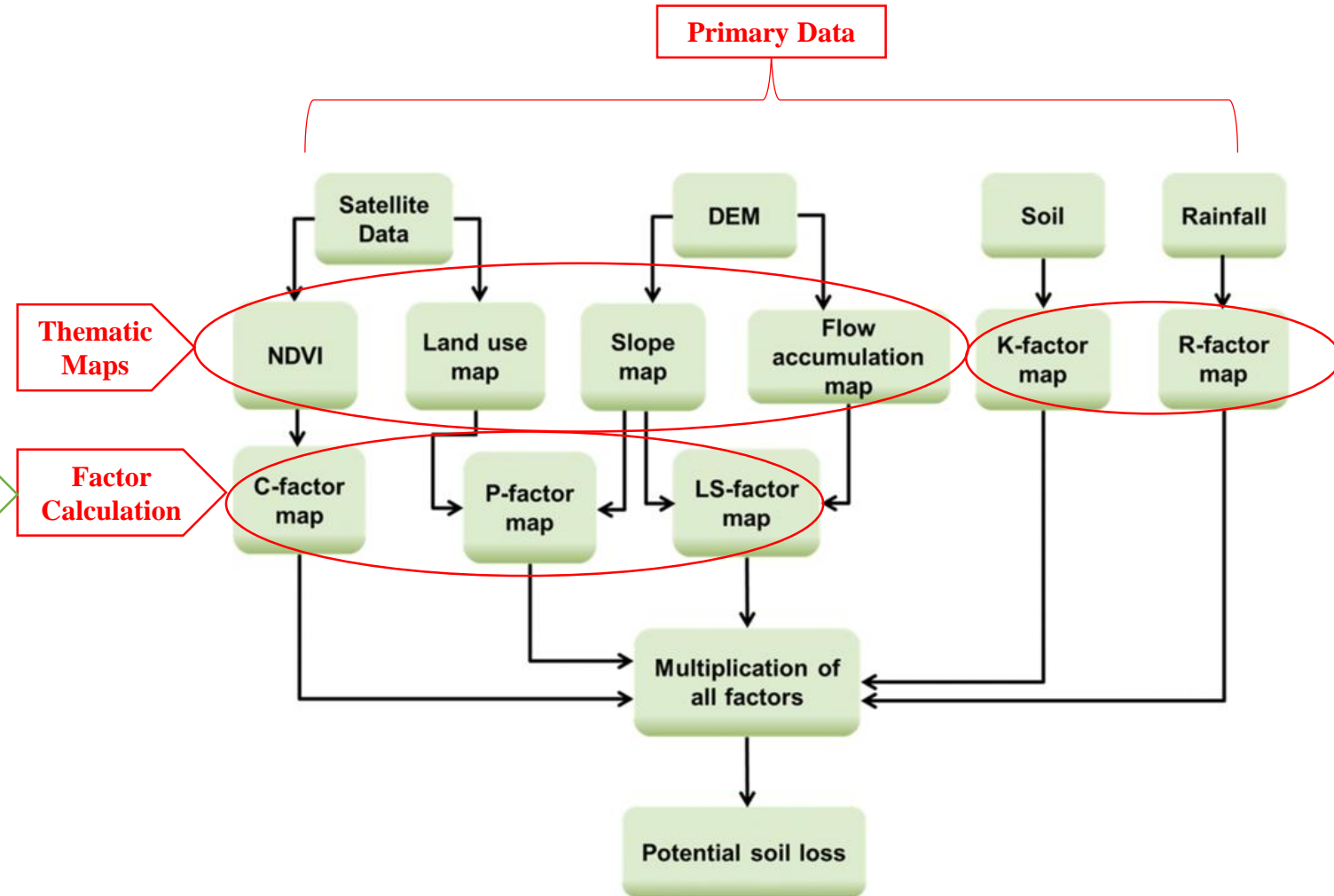


Soil Erosion Susceptibility Map

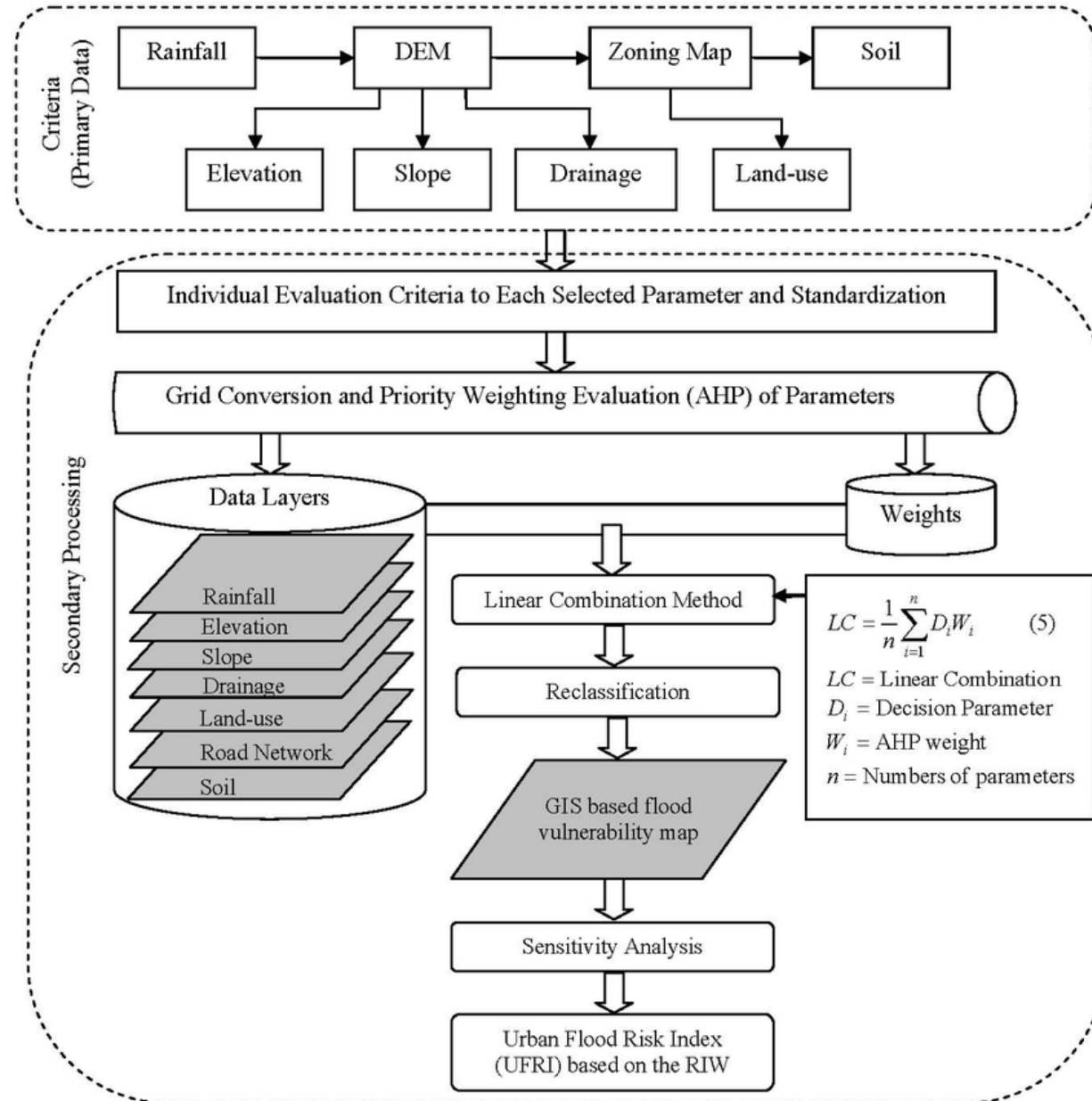
To model soil erosion, the “Revised Universal Soil Loss Equation (RUSLE) Model”, is used as is illustrated in the chart.

$$\text{Erosion} = R \times K \times LS \times C \times P$$

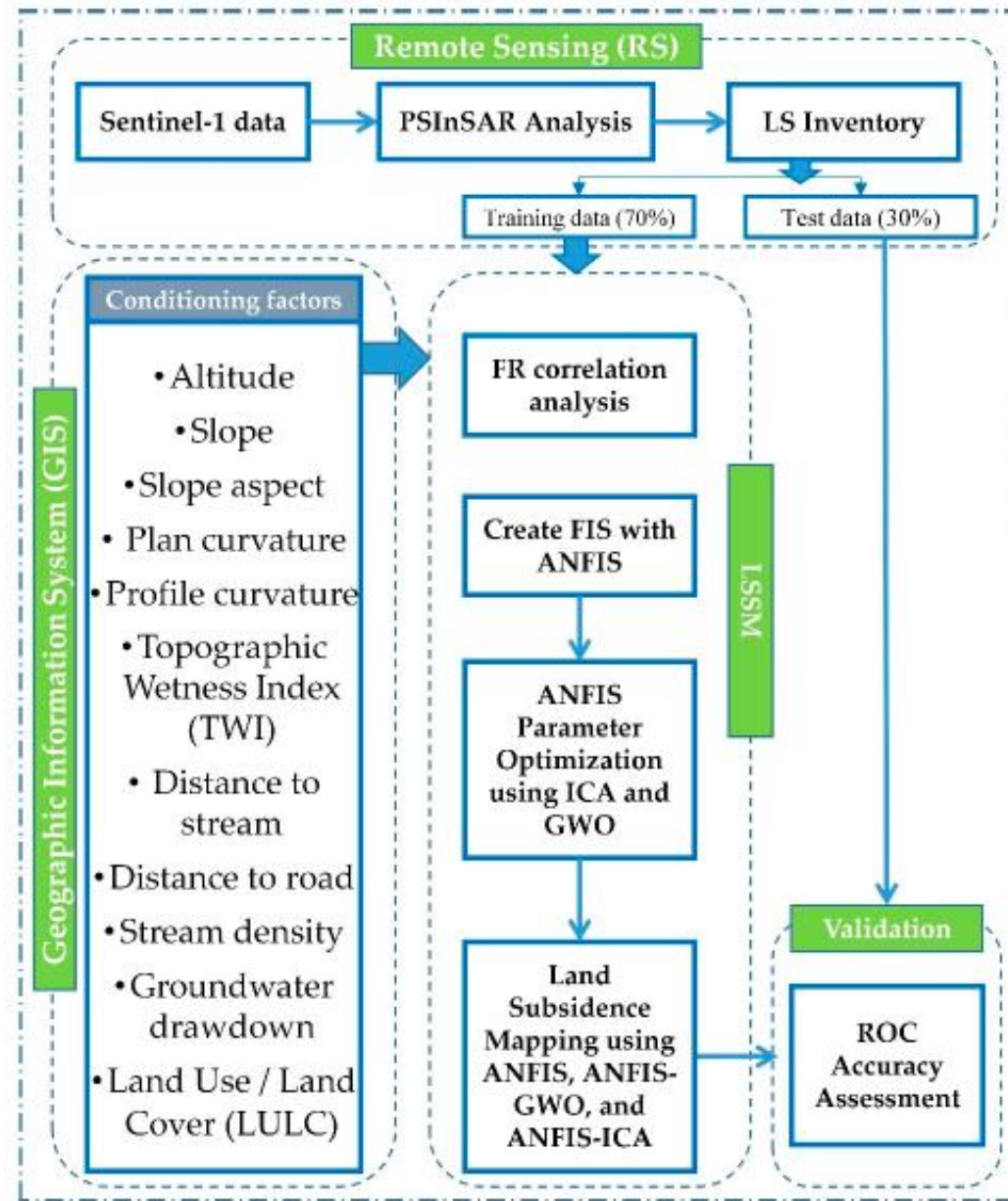
R factor: Rainfall erosivity
K factor: Soil erodibility
LS factor: Topographic factor based on slope length and steepness
C factor: land cover management factor
P factor: Conservation support practice factor



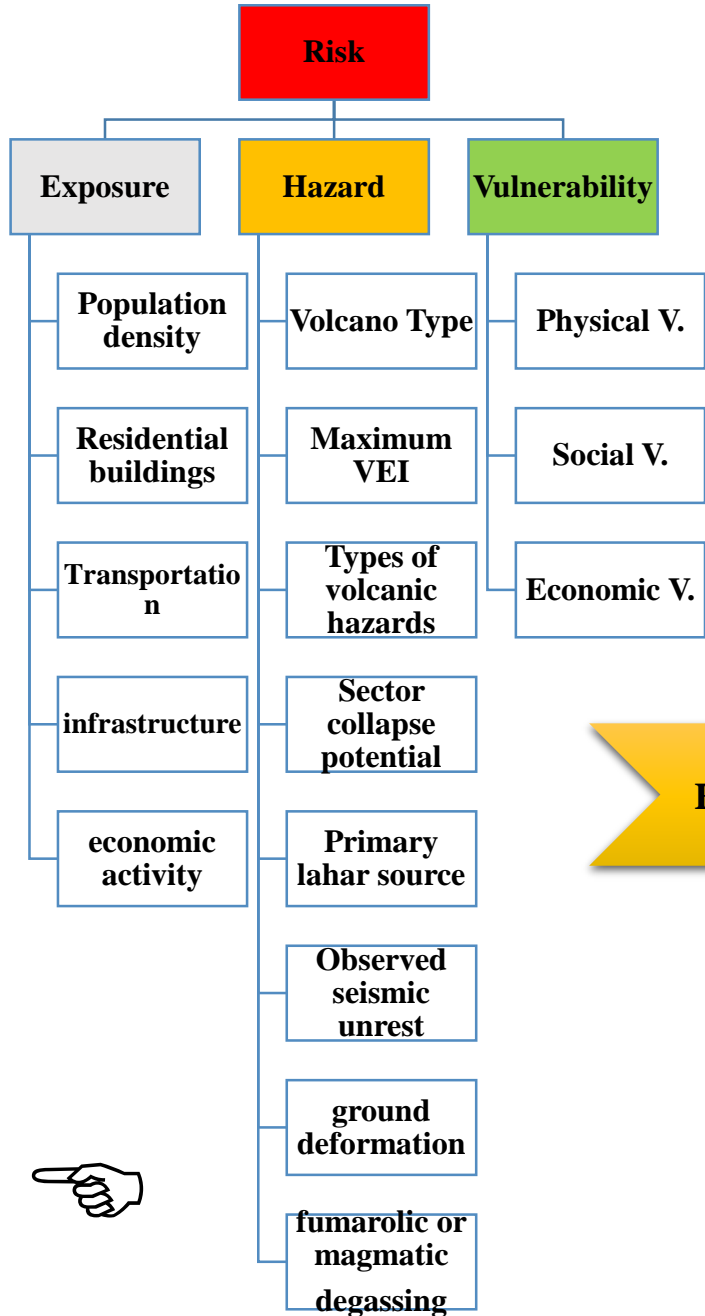
Flood Risk Susceptibility Map



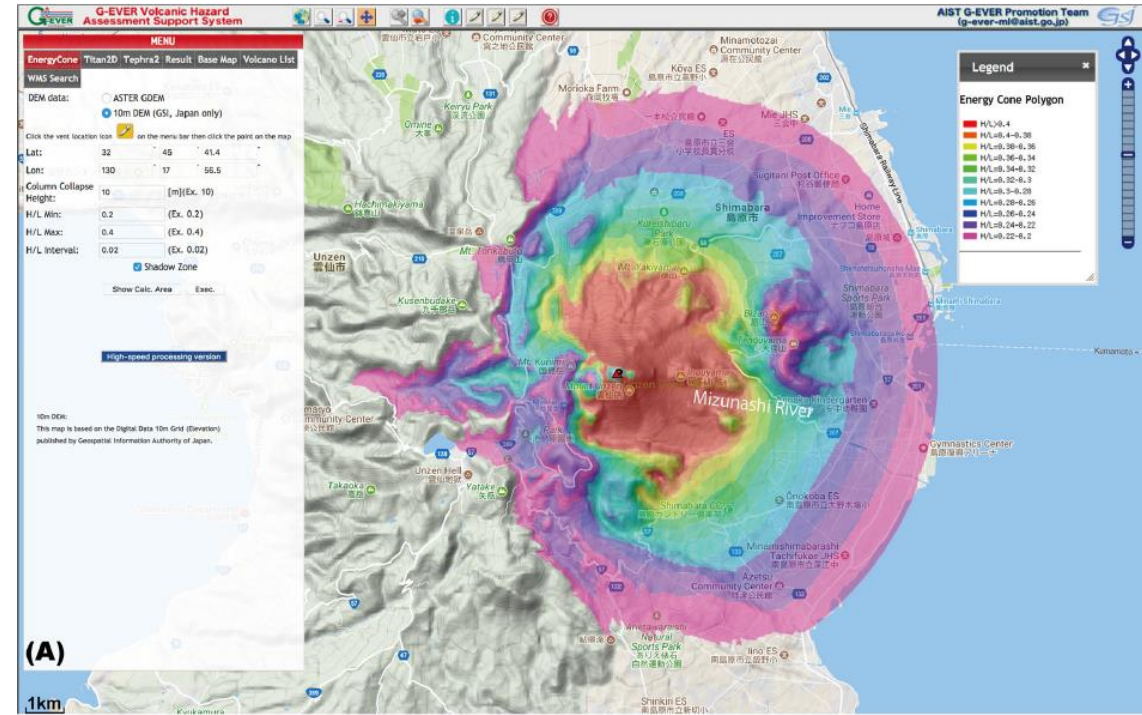
Land Subsidence Susceptibility Map



Volcanic Risk Assessment Map

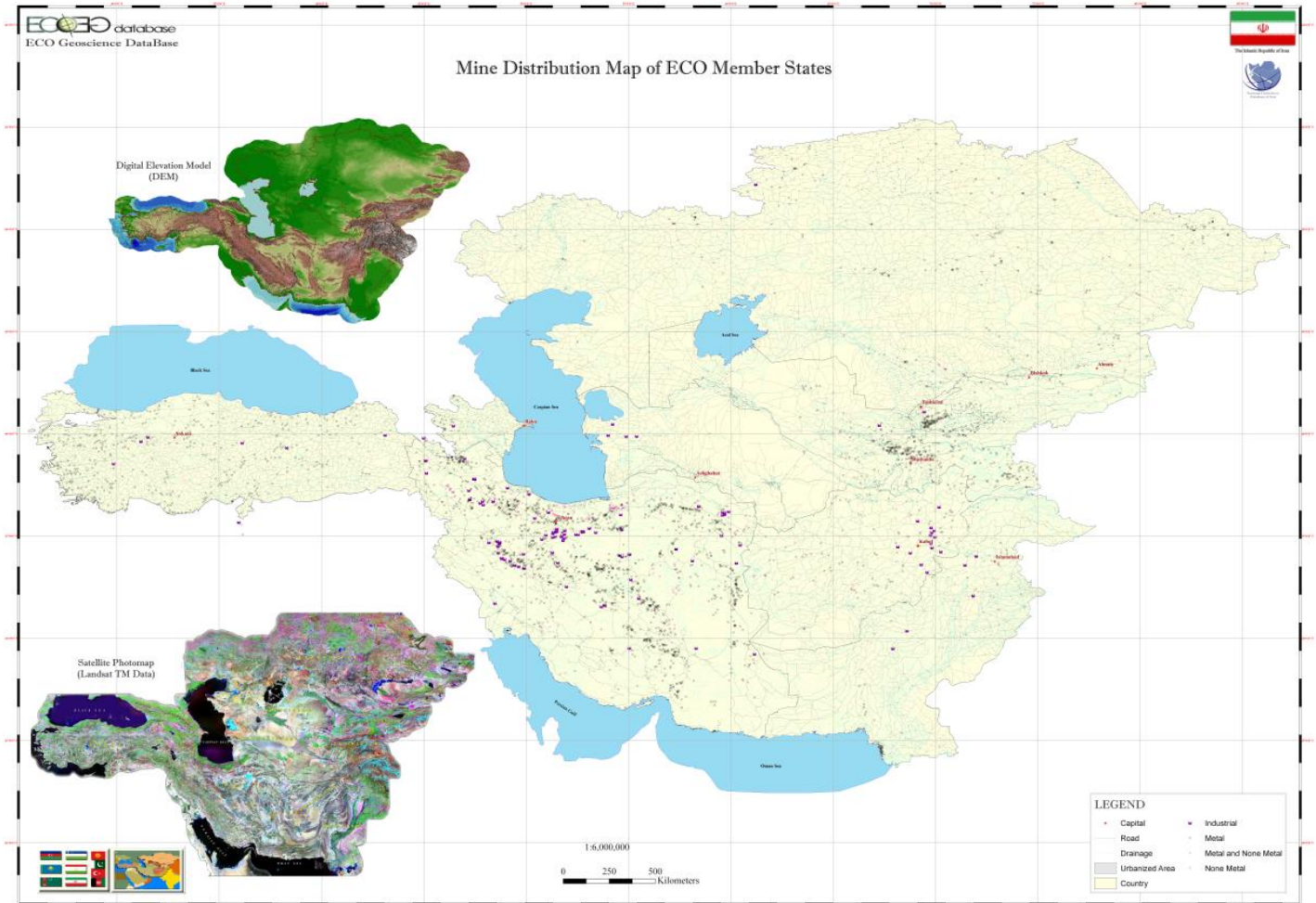
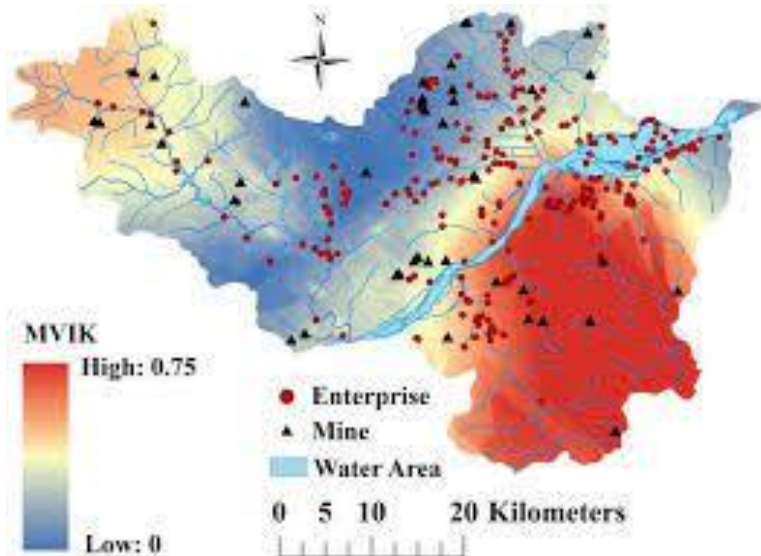


Risk =
Hazard × Exposure × Vulnerability



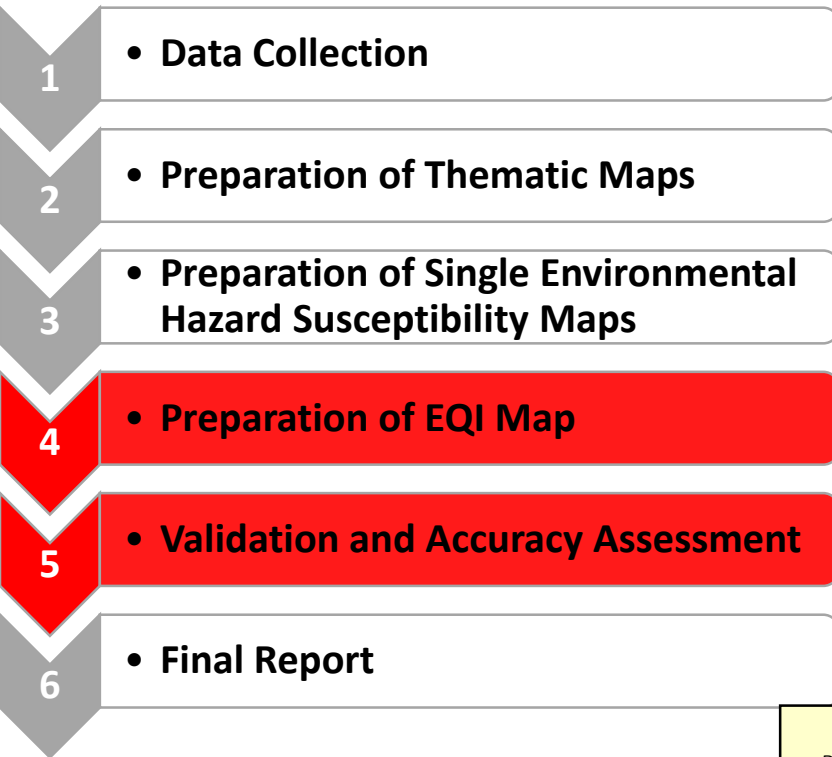
Mine Surface Pollution Map

- Modeling the dispersal pathways forms an essential part of regional assessment of pollution.
- the catchment related to the mines are derived from DEM.
- Each catchment will be scored based on parameters such as ore deposit genesis, extent of mining area, the extracted element and its paragenesis.



Mine distribution map of ECO Member States (prepared by GSI)

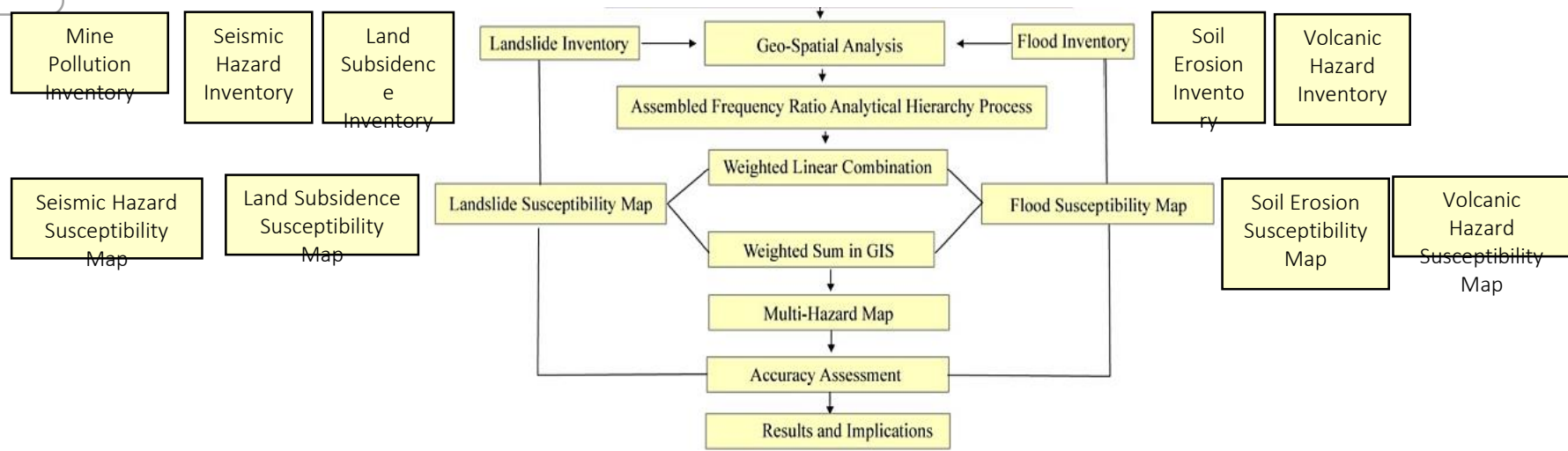
Work Plan of ECO-EQI Project



- EQI map is produced by synthesizing 6 environmental hazard susceptibility maps.
- The weights of all hazards are calculated using the assembled AHP geospatial techniques.
- The overall score of the EQI map is computed using the equation:

$$S = \sum_{i=1}^n H_i W_i,$$

n: number of the environmental hazards, H: hazard, W: weight of hazard.
- EQI map will be reclassified into four classes based on the susceptibility (high, medium, low and insusceptible).
- For validation of the results, sensitivity analysis will be used to assess effects of the input criteria on the model output performance

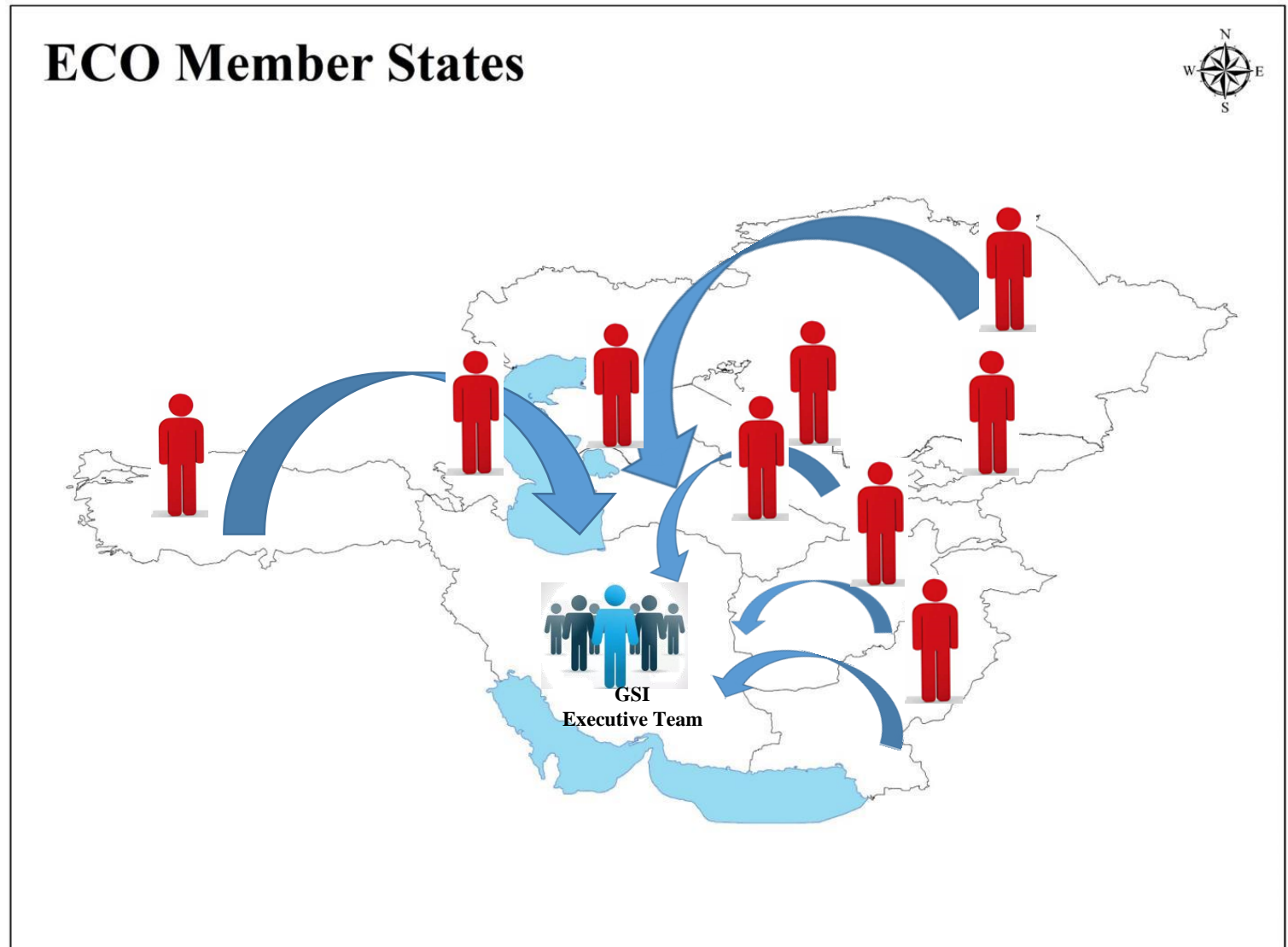


Objective of Project

- Preparing country-specific environmental risk assessment maps for **national planning**..
- To develop a **standard method** to assess ecological-environmental quality in **regional scale**.
- Identify and **prioritize vulnerable areas** using **cost effective methods** such as remote sensing and GIS for detailed studies.
- **Periodic monitoring** of ecologically prone areas through regular updating of the ECO EQI maps.
- Identification of the areas for the development of **population centers** and **agricultural lands** by codifying the national land use strategies.
- Provision of **basic data** compatible with environmental standards for improving Mining, Forestry and Farming.
- Integrating the scattered data in different organizations to design a **regional database** and facilitate the access to information needed by decision-makers and researchers.
- Empowerment of Member States in protecting **human habitat, natural resources, biodiversity, forests, pastures, soil and water resources**.
- Identify **natural and anthropogenic factors** affecting the vulnerability of ecological areas and to develop solutions to reduce the impact of harmful factors
- Employing **quantitative assessment methods** instead of traditional qualitative ones for regional planning

Cooperation of the Member States in ECO-EQI Project

- **National Focal Points of ECO Member States assigned by their respective authorities on Energy, Minerals in particular, will interact with Executive Team in GSI on matters relating to data and information for the project.**
- **The Executive Team in GSI will create online interactive linkages using social media platforms as convenient for contacts in the framework of execution of the project.**





Economic Cooperation
Organization



Thanks for Your Kind Attention

We hope that our cooperation together under the ECO-EQI project will be a great stride to solving the environmental problems of the Member States and will lead to prosperity in the whole region in the near future.