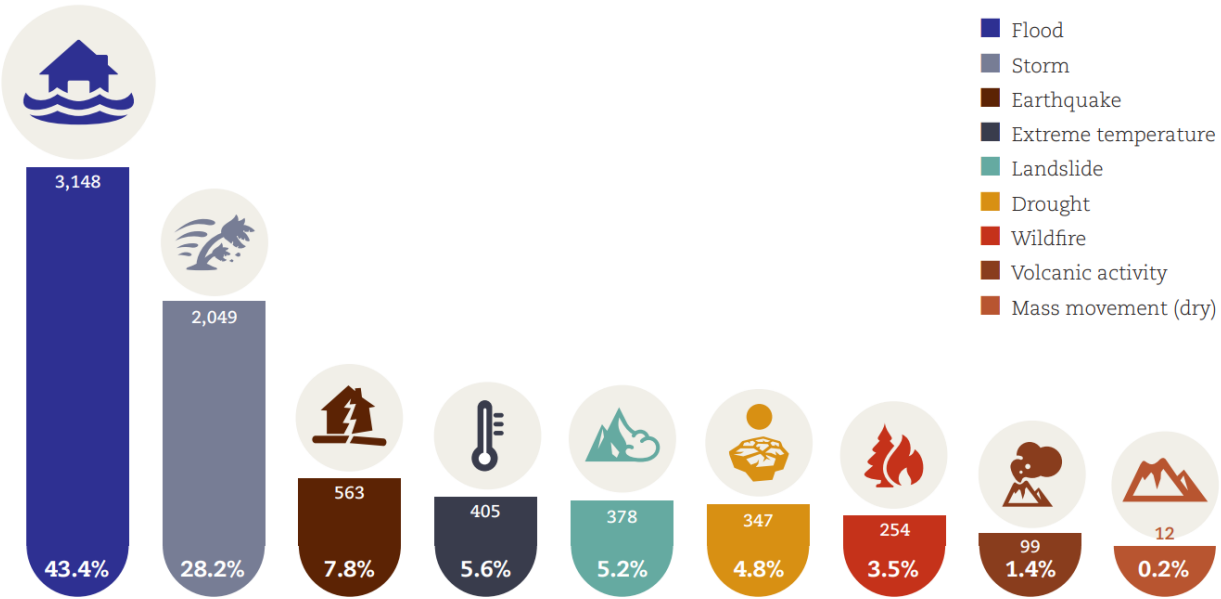


Landslide Hazard Zonation (LHZ)

of ECO Member States



Numbers of disasters per type 1998-2017



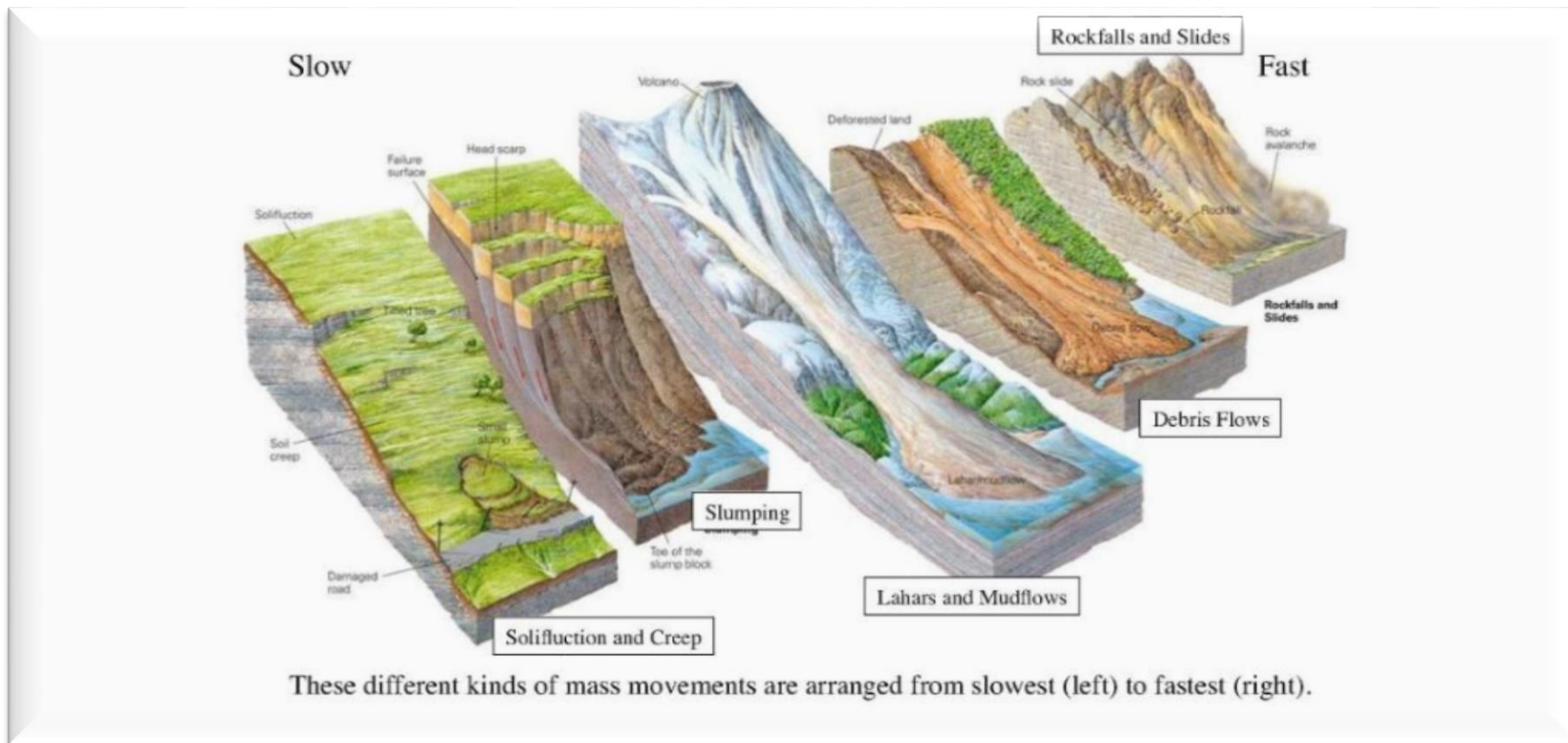
UNISDR (United Nations Office for Disaster Risk Reduction)

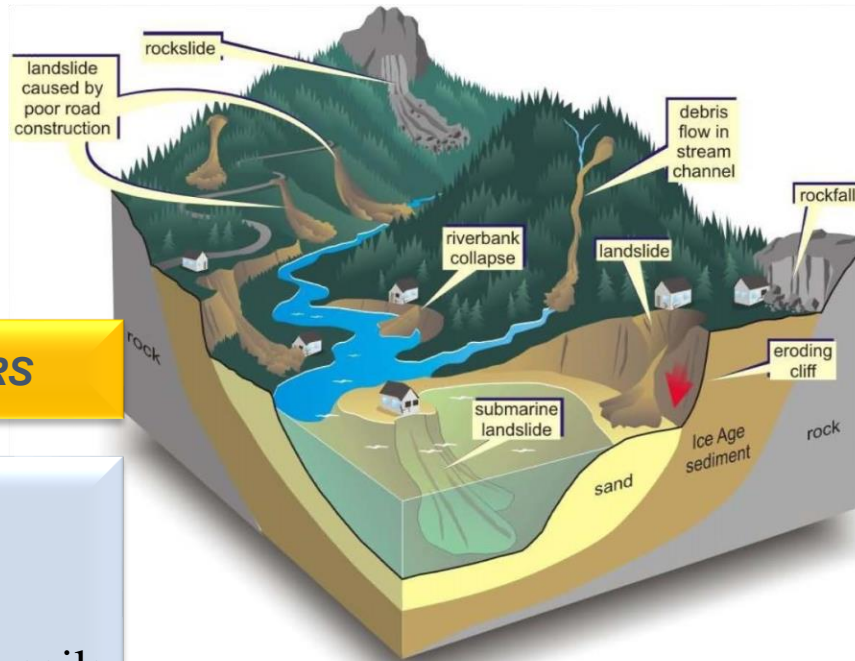
The distribution of global landslides
Data from Froude and Petley (2018)



Landslides

all categories of gravity-related slope-failures events





NATURAL FACTORS

Lithology
 Steep slopes
 Strength of bedrock & soils
 Location of faults
 Geomorphology
 Steep mountains
 Heavy rain
 Land cover
 Frost effects
 Weathering
 Major natural disasters
:Earthquake Flood

MAN-MADE FACTORS

Land use change
 Deforestation
 Construction
:Roads, buildings, dam
 Slope gradient change
 Overloading by embankments
 Changing water content
 Changing vegetation cover
 Shocks and Vibrations
:through mining activity

CAUSES

IMPACTS

Extent of impacts

Abe Bareek landslide, Afghanistan



Oshan landslide, Tehran, Iran



Local issues

state, province or national issues

IMPACTS

socio-economic impacts

socio-economic
systems

destroy
the properties

population

becoming
homeless

1998-2017 Worldwide
4.8 million people affected
More than 18000 deaths

in northern Turkey on 16th May 2019

**Broken power, water
and gas pipes**

**burial of whole
village**

**communication lines
general transportation
destruction**

**infrastructure
destruction**

health system

**tourism
mining
industry**

Landslide damage in Rize, Turkey, July 2021



IMPACTS

environmental impacts

habitats
destruction

natural
environment

land-use
change

making useless
farmlands, forests

structural
damage

loos of
vegetation

weakening the
rock masses

plants
animals



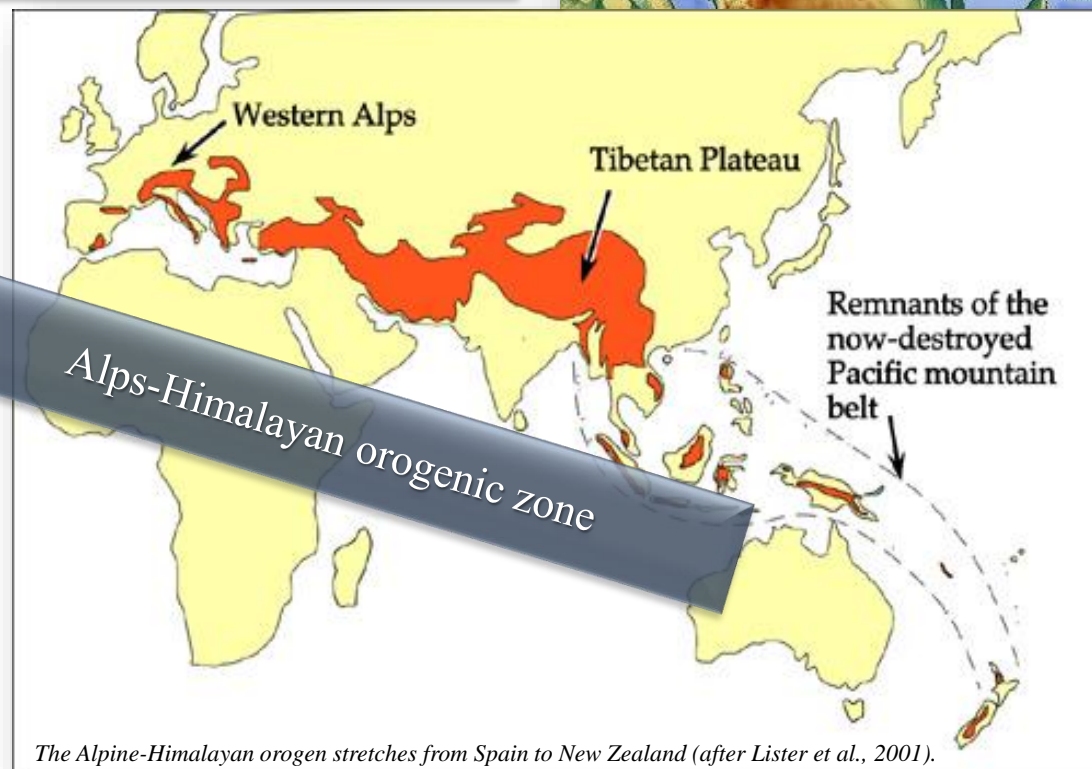
Pakistan



Azerbaijan



Mountain Map of Asia
(world map blank.org, 2021)



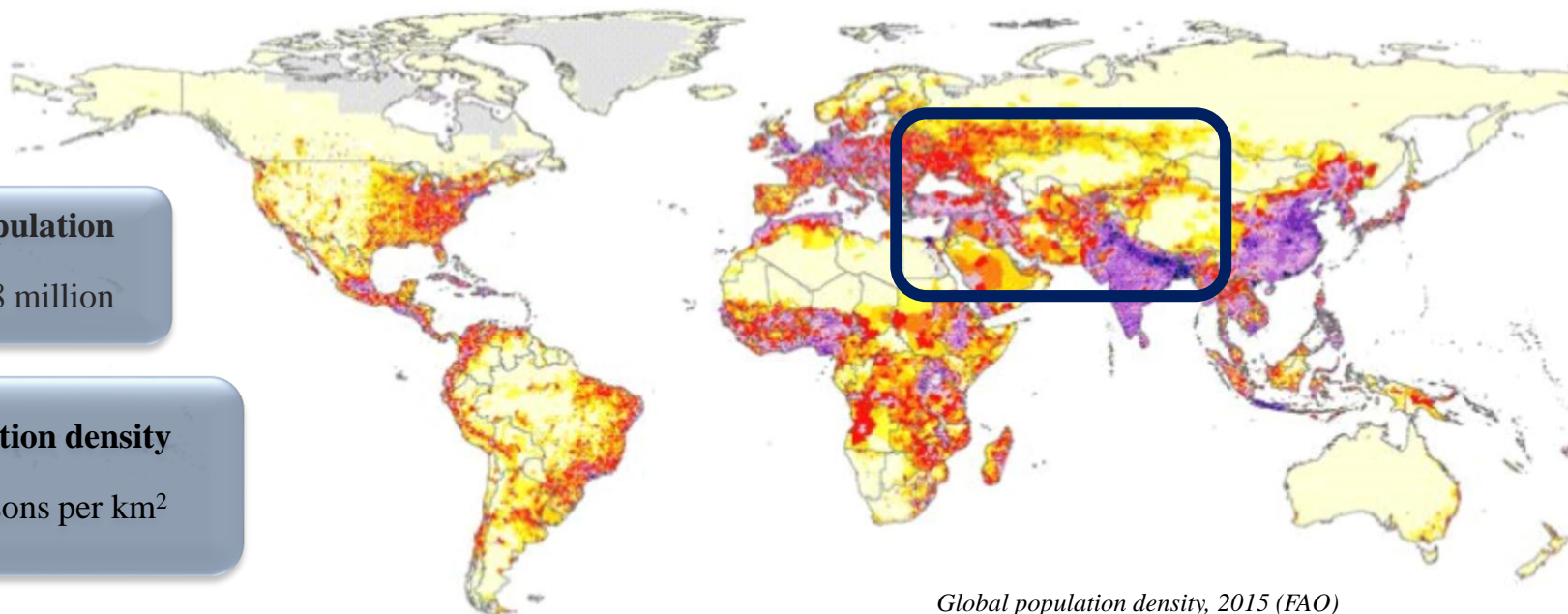
The Alpine-Himalayan orogen stretches from Spain to New Zealand (after Lister et al., 2001).

population

488 million

population density

60 persons per km²



Global population density, 2015 (FAO)

Persons per square kilometre

0

0 - 2

2 - 5

5 - 10

10 - 20

20 - 50

51 - 100

100 - 200

200 - 500

500 - 1 000

> 1 000

Global Landslide Hazard Distribution



Source:

Dilley, Maxx, Robert S. Chen, Uwe Deichmann, Arthur L. Lerner-Lam, and Margaret Arnold. 2005. *Natural Disaster Hotspots: A Global Risk Analysis*. Washington, D.C.: World Bank.

Copyright 2005 International Bank for Reconstruction and Development/The World Bank and Columbia University.



Afghanistan

Azerbaijan

Kazakhstan

Kyrgyzstan

Pakistan

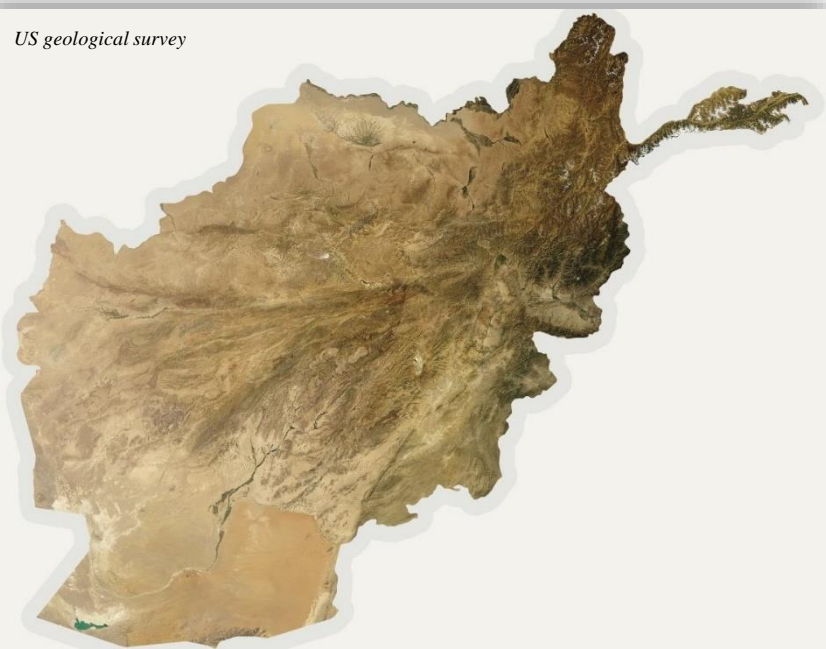
Tajikistan

Turkey

Turkmenistan

Uzbekistan

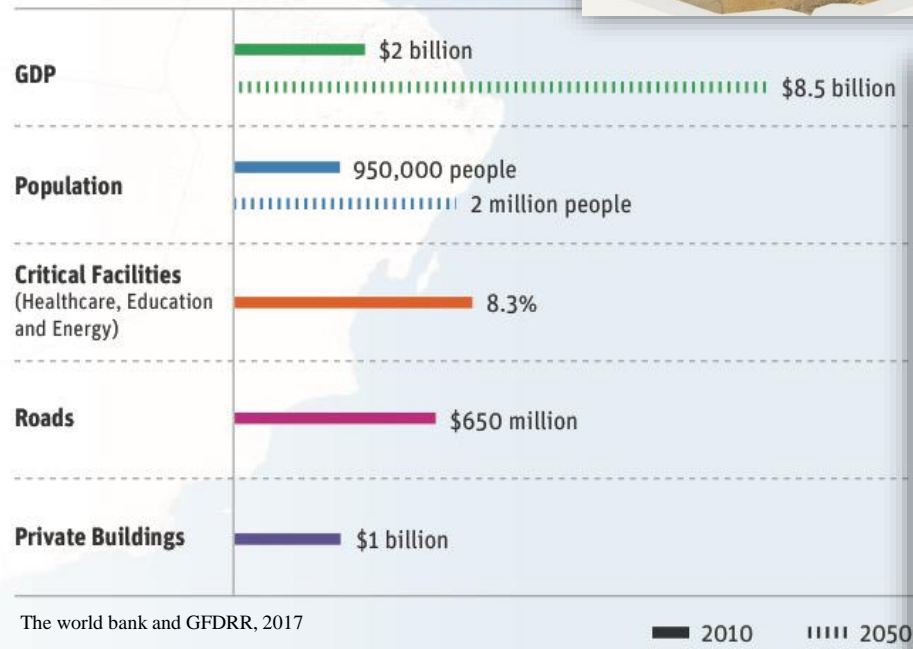
US geological survey



Afghanistan

- over 3 million people
- over 6 billion dollars worth of assets
- including more than 400 schools & 300 health centers

are exposed to landslides



The world bank and GFDRR, 2017



Possible failures in the future

An old landslide

Ab barak landslide,
UNOSAT, 2014

Afghanistan

2nd May 2014

Ab barak village

heavy subsequent rain

devastating damage

more than 2000 deaths

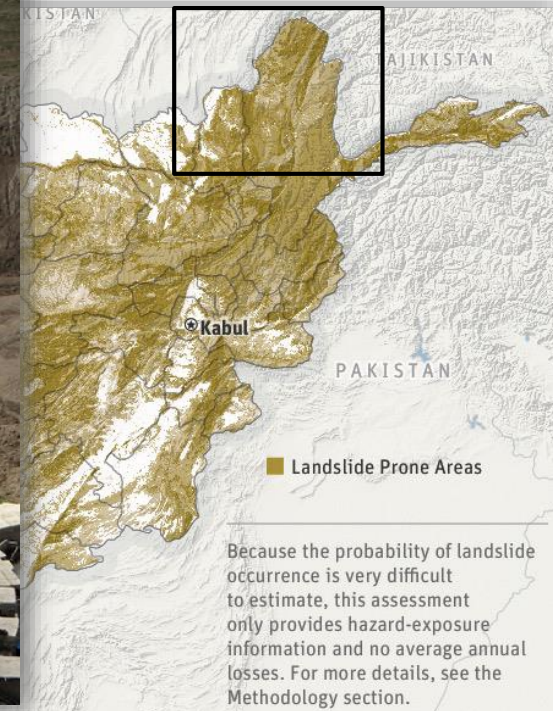
blocked valley

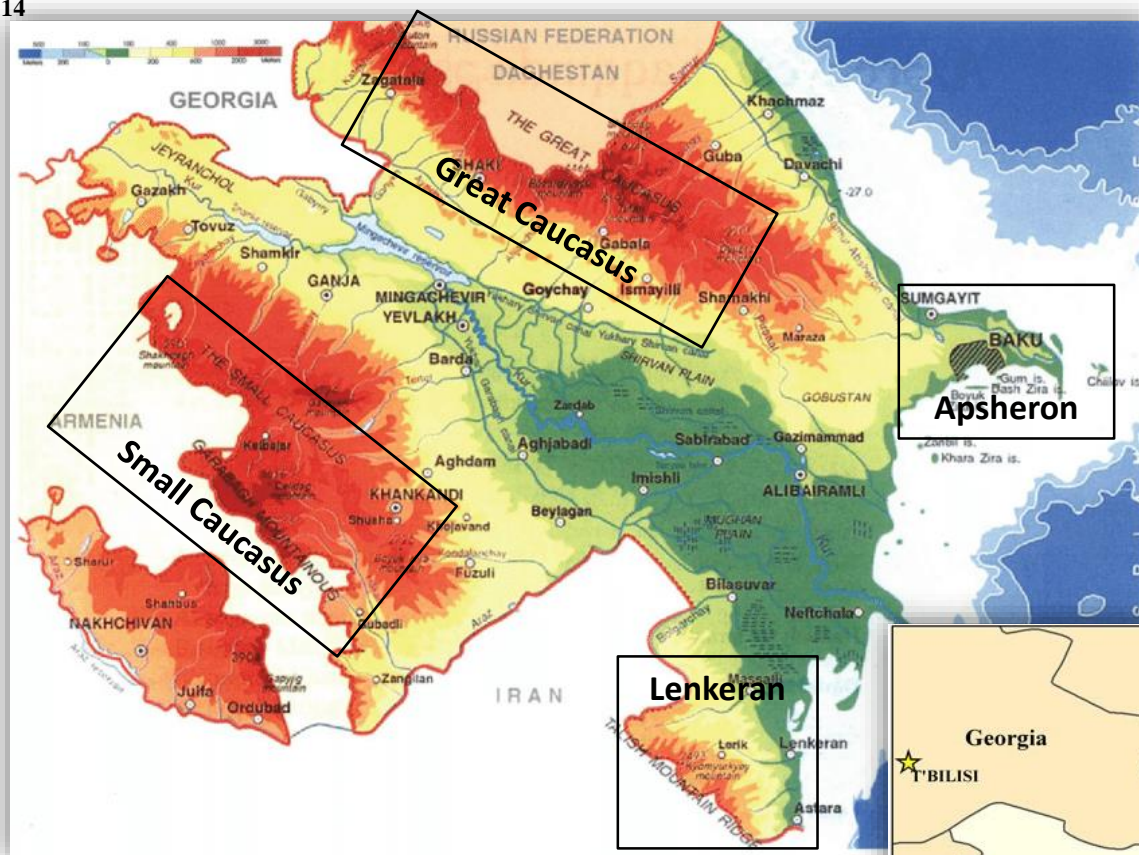
a landslide dam and a barrier lake

Barrier
Lake

Source area

Deposition area





Orographic map of Azerbaijan, 2016

Azerbaijan

Floods/Landslides 6 May 2003

Source: OCHA Situation Report No. 1 Azerbaijan



Kazakhstan

1967 - 1990

major landslide and mudflow events only in the Almaty region

1991 - 2015

frequency of mudflows in the country has increased by 82%

(Third Biennial Report, 2017).

1921

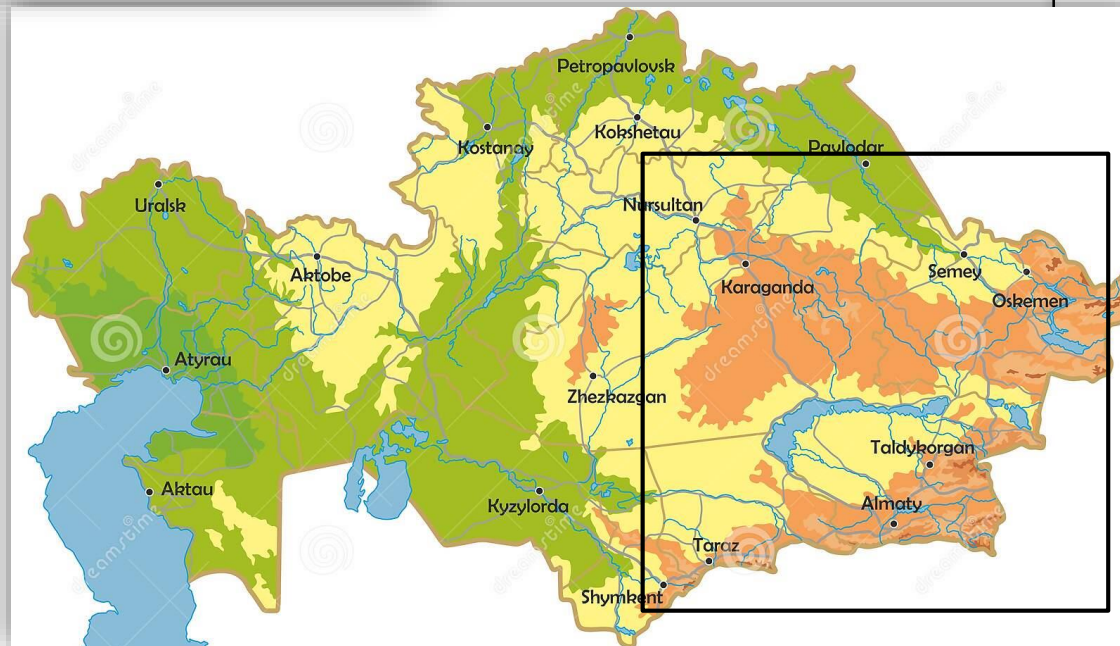
Almaaty region

snow melt, subsequent rainfall

debris flow

500 deaths

*mudflow in Almaty region of Kazakhstan
23 July 2015.*



Kyrgyzstan



The Hattian Bai Landslide Dam, Pakistan, 2005



Pakistan

2005

Hattian Bai Landslide

Kashmir earthquake, magnitude 7.6

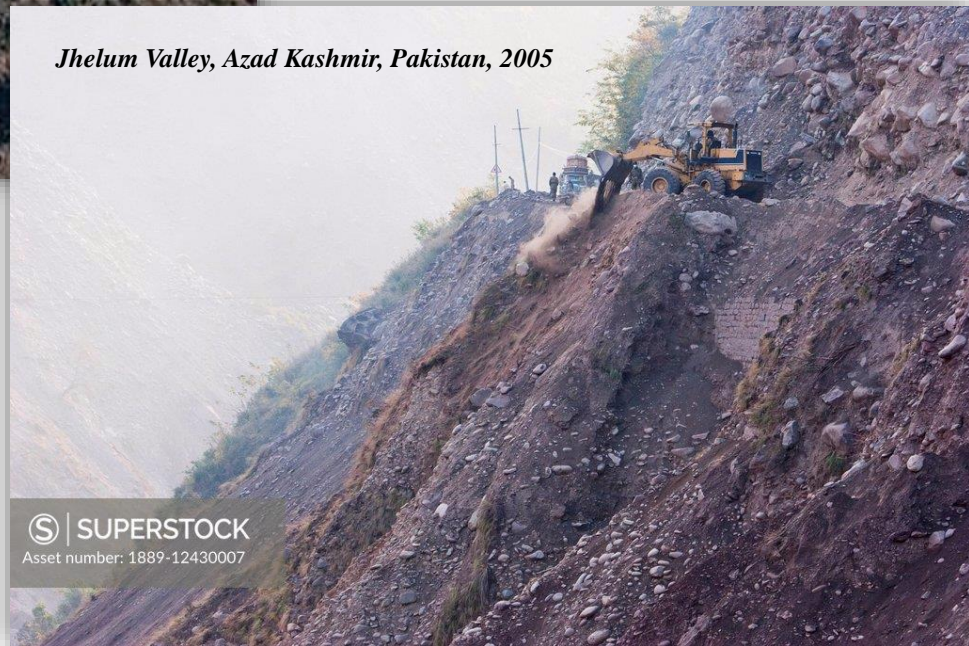
buried villages

blocked river

landslide dams

25500 deaths

Jhelum Valley, Azad Kashmir, Pakistan, 2005



© SUPERSTOCK
Asset number: 1889-12430007

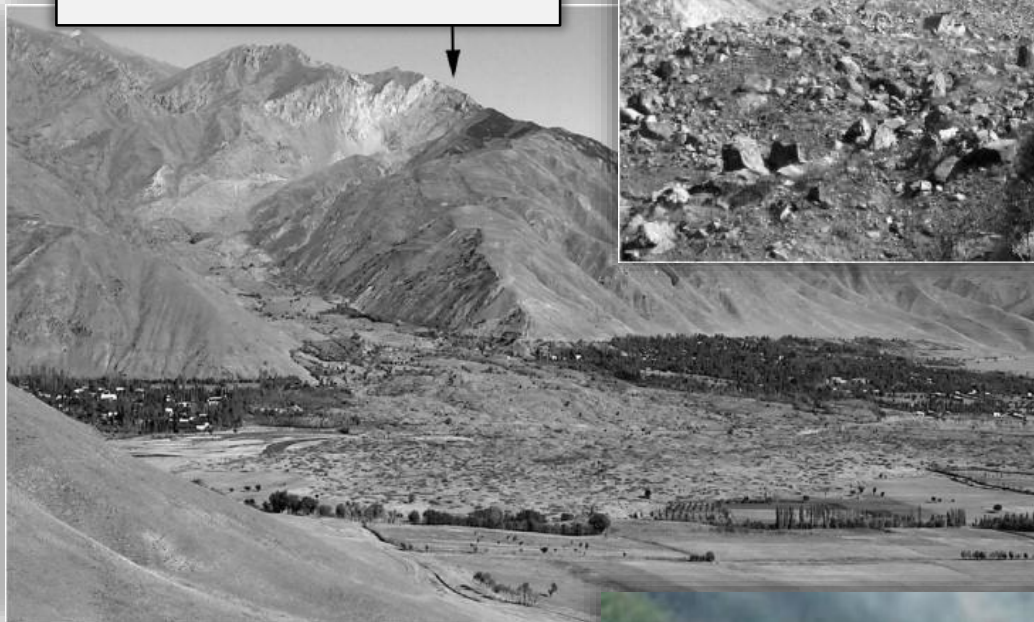
July 1949

Khait, (Tien Shan Mtns.)

Khait earthquake, magnitude 7.4

245 million m³ affected

7200 deaths



Tajikistan

7-13th May, 2021

many of the country's districts

Floods in Khatlon

Over 12 mudflows and landslides

70 households homeless

22000 people affected

9 deaths



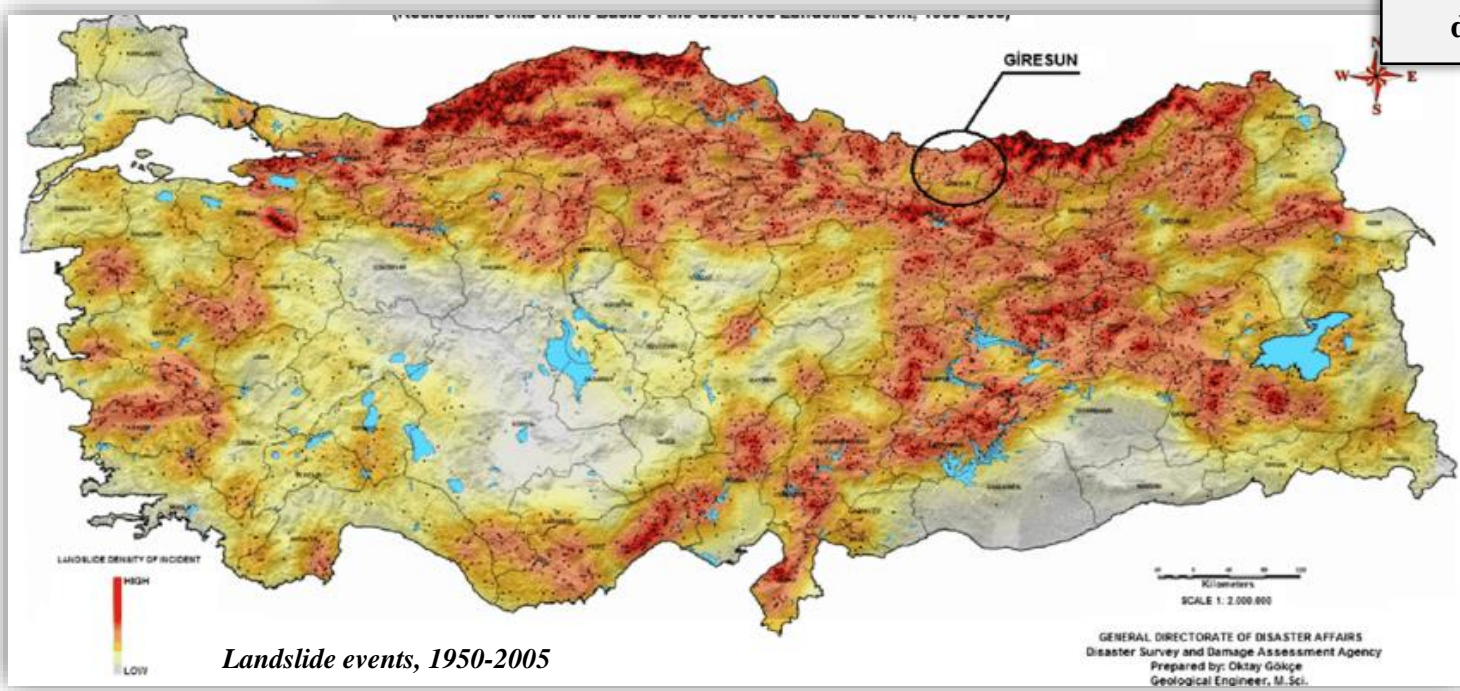
Turkey



16th May 2019

**Aybasti in Ordu
northern Turkey**

**major rotational landslide
destroyed 53 buildings**





Turkmenistan



7th August 2002

The Village of Dasht

mudflow

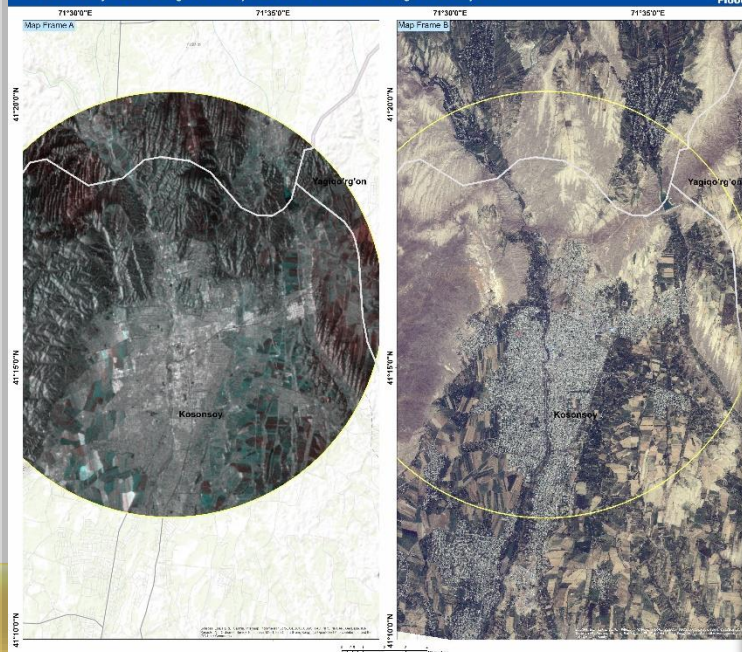
destroyed facilities

(roads, bridges, electricity transmission systems)

destroyed 75 houses

501 people shelterless

24 deaths



Uzbekistan

13th July 2021
in border regions
(between Uzbekistan and Kyrgyzstan)

Mudflow

14 deaths

in 50 years

8300 landslide displacements

65% snowmelt, precipitation and groundwater

15-20% earthquakes

20-25% man-made factors

Source: ADRC

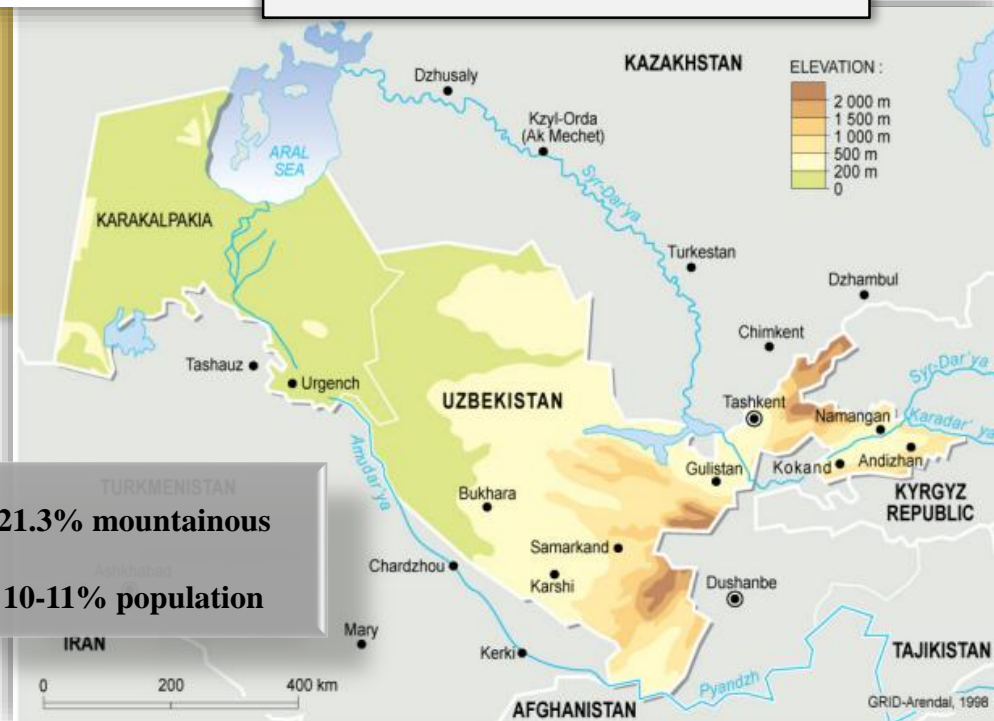
landslides

mud flows

debris processes

21.3% mountainous

10-11% population



Landslide Hazard Zonation (LHZ) of ECO Region Project

ACHIEVEMENTS

- ❖ **creation of a basic databank**
- ❖ **identification of landslide effective factors**

for example:

access to landslide risks areas that overlap with important sites. such as; population centers or tourism hubs

- ❖ **identifying and determining sensitive and landslide prone areas**
- ❖ **increase authorities awareness of danger zones**
- ❖ **providing technical support to disaster reduction and prevention action**

for example: providing a basis for the implementation of slope stabilization

- ❖ **conducting landslide hazard assessment**
- ❖ **planning and funding in order to study and risk reduction in national & local level**

BASIC ACTIVITIES

Step 1. Preparing digital basic database

Step 2. Preparing basic thematic maps

Step 3. Estimating factor score coefficients

Step 4. Integration and modelling

Step 5. Zoning & Classifying

BASIC ACTIVITIES

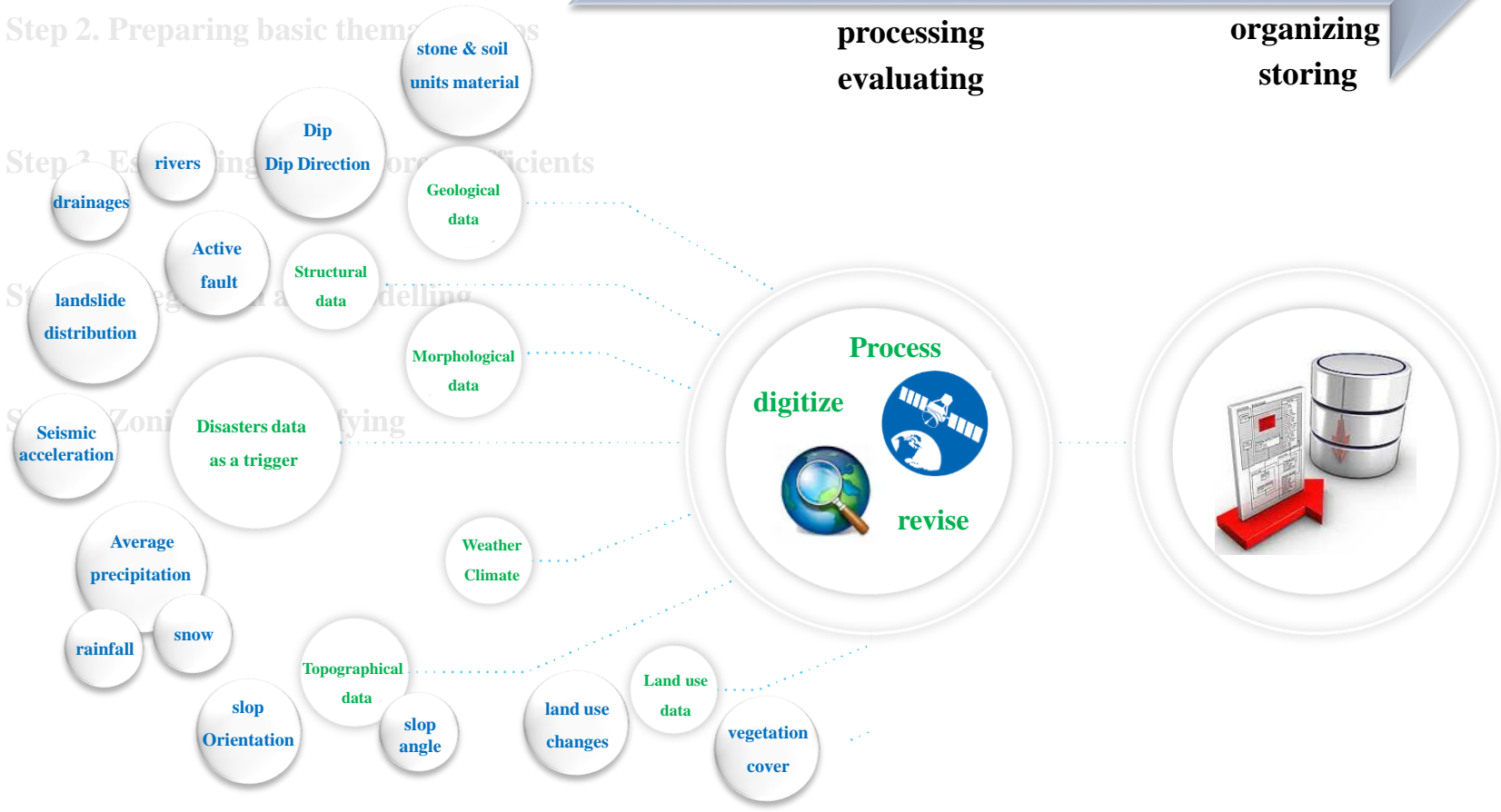
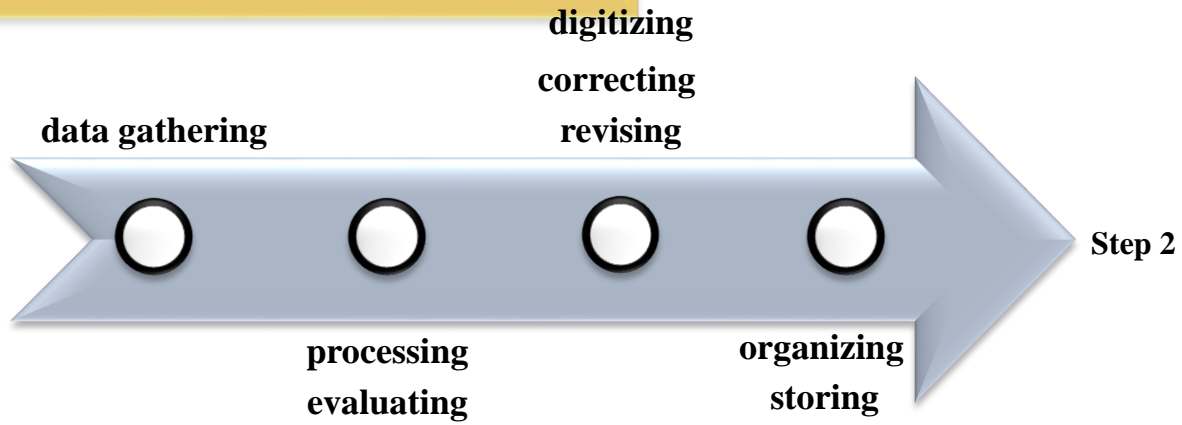
Step 1. Preparing digital basic database

Step 2. Preparing basic thematic maps

Step 3. Estimating correction coefficients

Step 4. Regional mapping

Step 5. Zoning and classifying



BASIC ACTIVITIES

Step 1. Preparing digital basic database

Step 2. Preparing basic thematic maps

Step 3. Estimating factor score coefficients

Step 4. Integrating

Step 5.

extracting layers

extracting basic maps

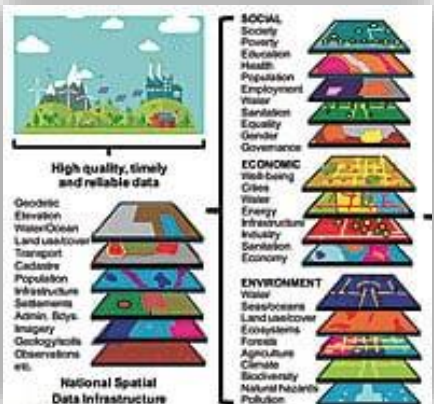
Step 3

appropriate scale

lithological map
fault map
slop map
slop orientation map
climatology map
land cover map
landslide density map
digital elevation model



vulnerability factors



BASIC ACTIVITIES

Step 1. Preparing digital basic database

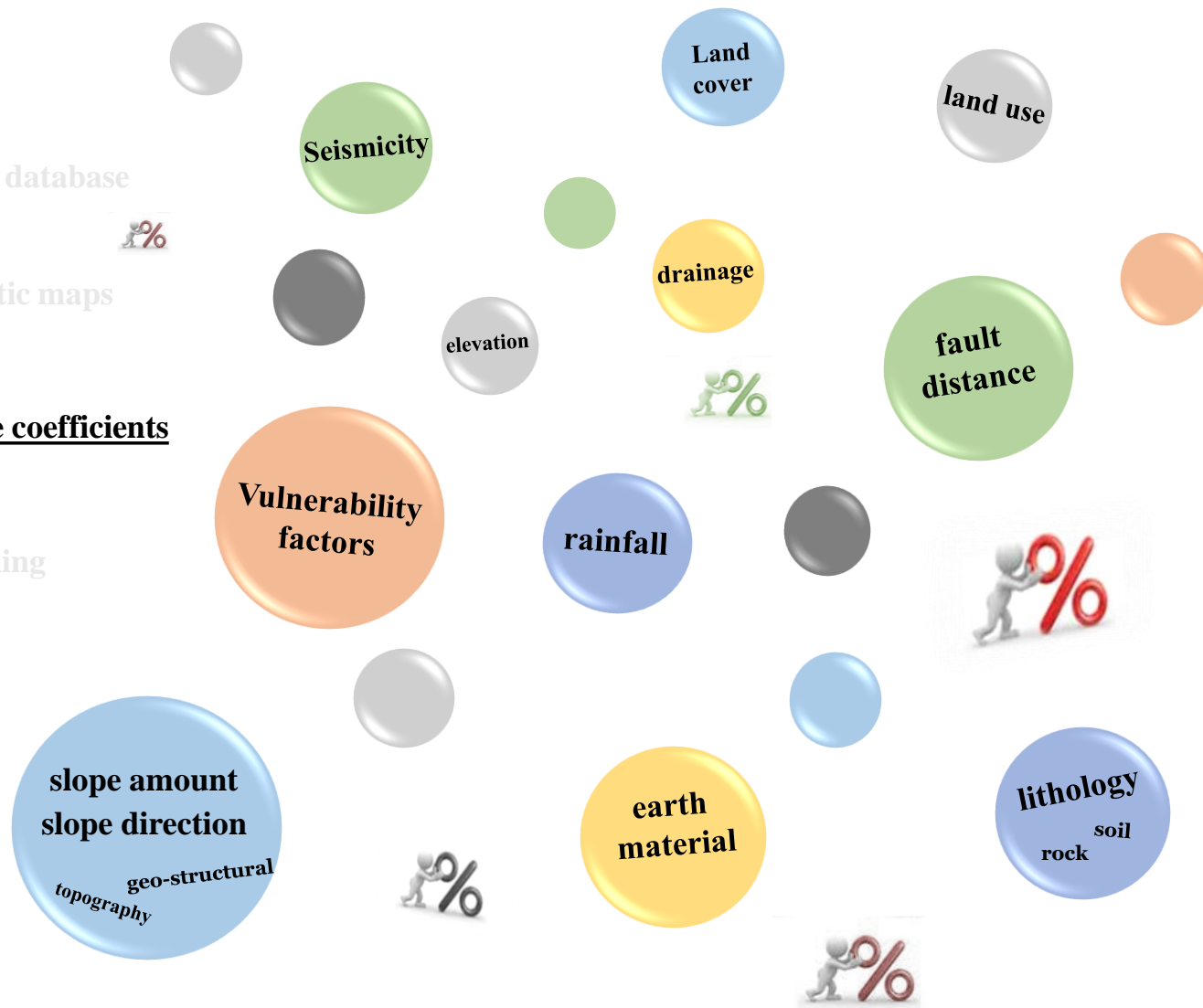


Step 2. Preparing basic thematic maps

Step 3. Estimating factor score coefficients

Step 4. Integration and modelling

Step 5. Zoning & Classifying



Step 4

BASIC ACTIVITIES

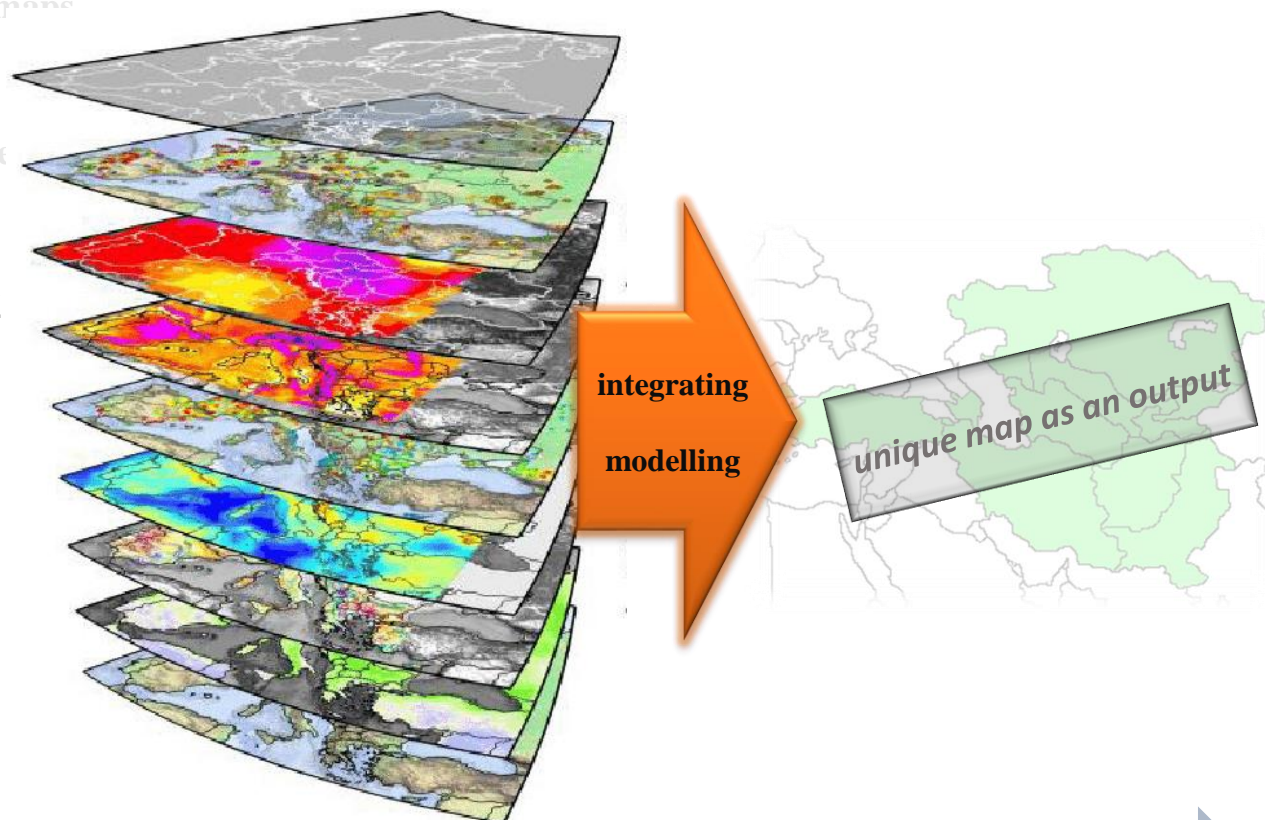
Step 1. Preparing digital basic database

Step 2. Preparing basic thematic maps

Step 3. Estimating factor score coefficients

Step 4. Integrating and modelling

Step 5. Zoning & Classifying



Step 5

BASIC ACTIVITIES

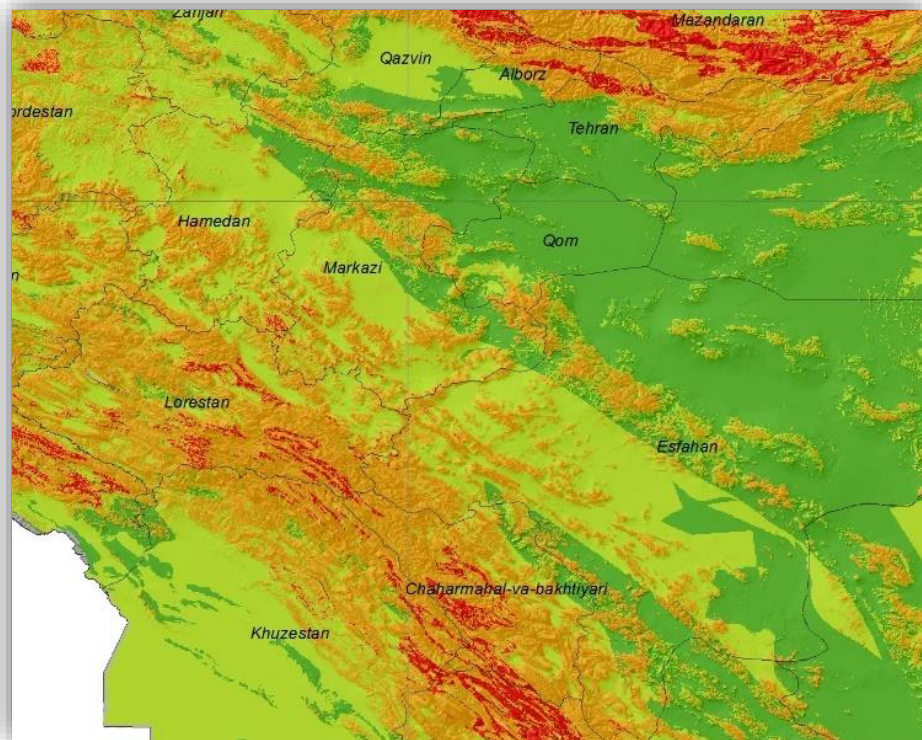
Step 1. Preparing digital basic database

Step 2. Preparing basic thematic maps

Step 3. Estimating factor score coefficients

Step 4. Integration and modelling

Step 5. Zoning & Classifying



RESULT

Step 1. Preparing digital basic database

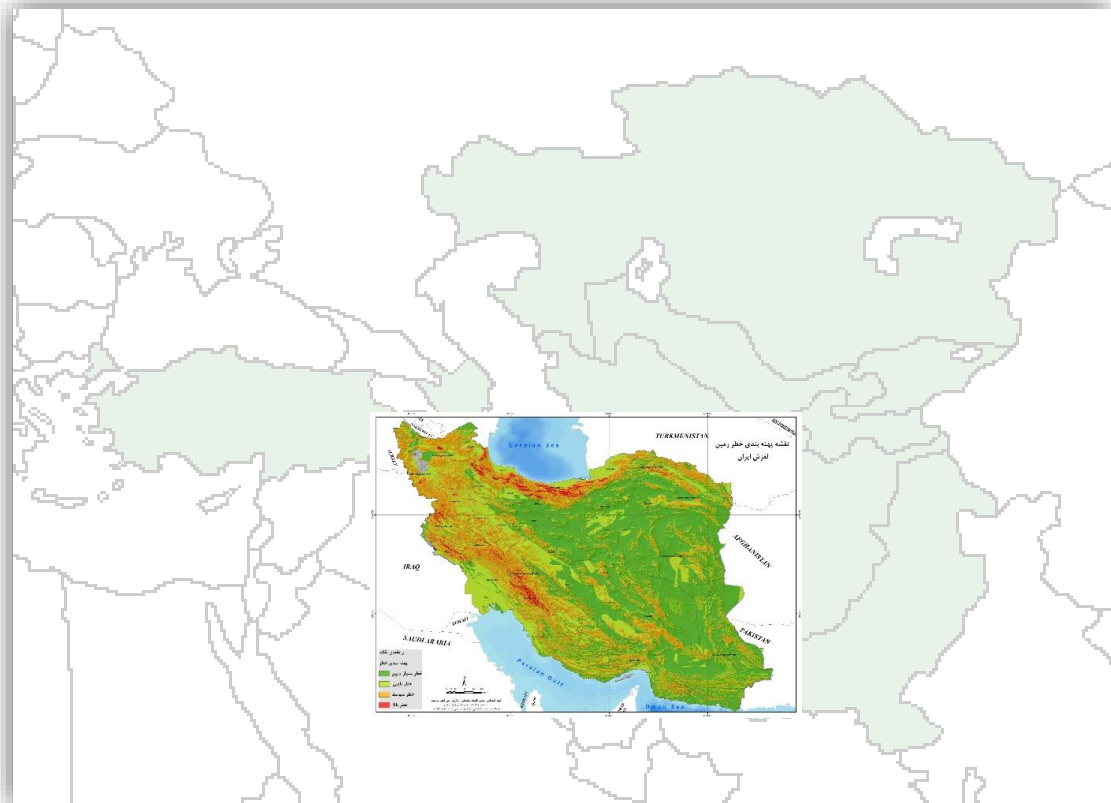
Step 2. Preparing basic thematic maps

Step 3. Estimating factor score coefficients

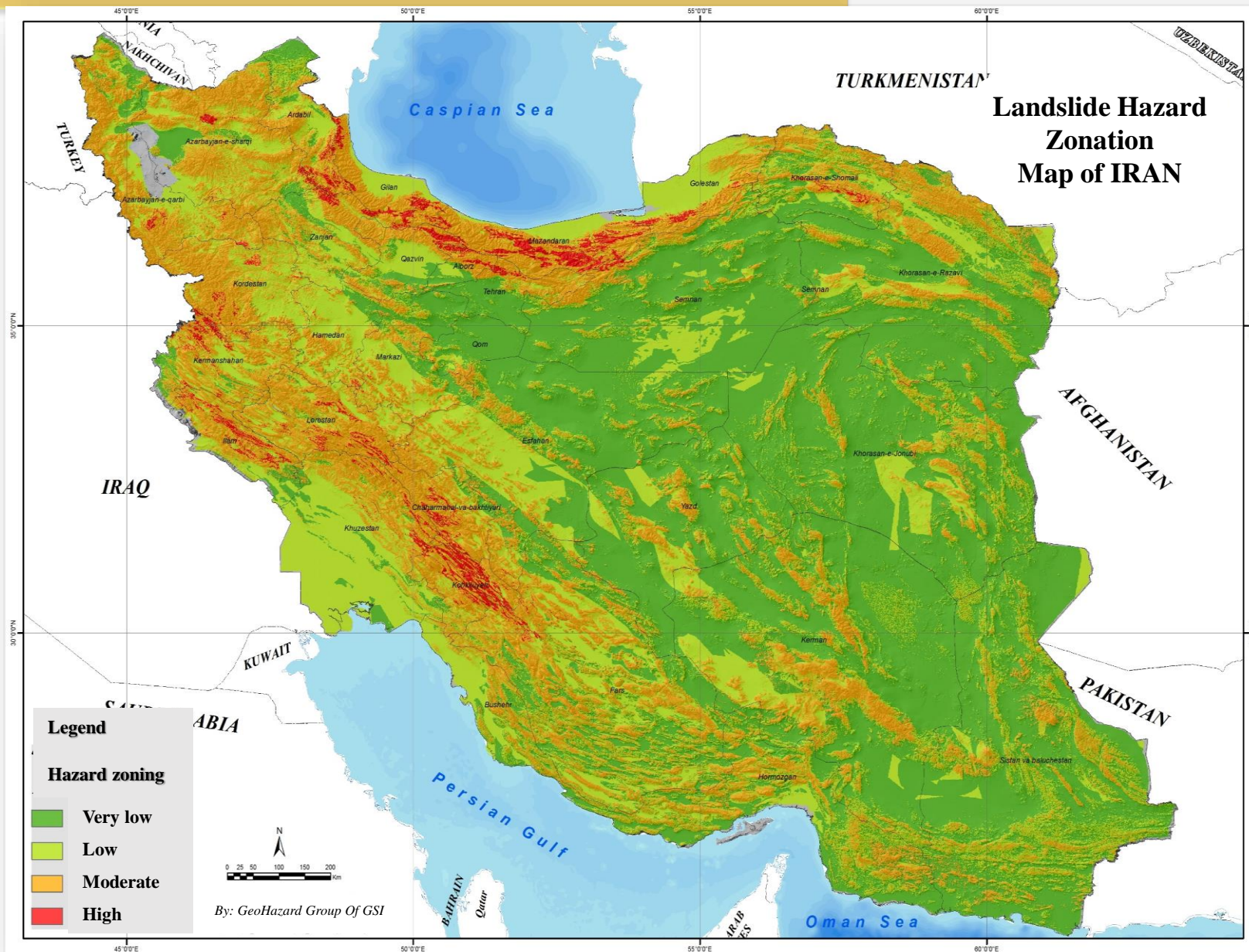
Step 4. Integration and modelling

Step 5. Zoning & Classifying

Result



RESULT







Thank you for your attention