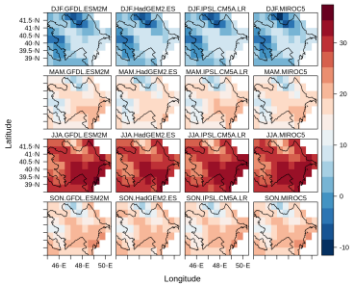
Strengthening Capacities to Assess Climate Change Vulnerability and Impacts to Shape Investments in Adaptation Technology for Azerbaijan's Mountain Regions

Online presentation to CTCN and UNEP
16th December 2020

Outline

1. Introduction
2. Methodological phases
3. Results
    a) Risk of drought
    b) Risk of erosion
    c) Risk of forest damage
    d) Risk of flood
4. Conclusions and future developments

1. Introduction



Climate change effects on Azerbaijan environment, economy and society

Climate Adaptation as a strategy to get ready for future impacts (e.g. water, agriculture)

Objective:

This study aims to develop an **indicator-based climate change assessment** for Azerbaijan's mountain regions to support decision making in adaptation planning.

2. Methodological phases - Stakeholder analysis

- Overview of existing studies on climate change and adaptation in Azerbaijan

1. Ecosystem-based approached to climate change
2. Climate change risk management
3. National Adaptation Plan (NAP)
4. Multi-Hazard Early Warning Systems
5. Natural resources management

Annex 1: Summary report on existing studies on climate and adaptation in Azerbaijan

"Strengthening Capacities to Assess Climate Change Vulnerability and Impacts to Shape Investments in Adaptation Technology for Azerbaijan's Mountain Regions" in Azerbaijan

Summary report on existing studies on climate change and adaptation in Azerbaijan

Policy, legal and institutional framework related to climate change

Environmental protection problems, as well as climate change, are reflected in the main development priorities and strategies of the Republic of Azerbaijan. In fact, "Azerbaijan 2020: Outlook for the future. Development conception" includes one section which describes environmental problems. This conception determines a target to decrease the average energy consumed for the production of one unit GDP and the amount of carbon dioxide in Azerbaijan for the period covered by the convention up to the relevant indicators for Economic Cooperation and Development countries.

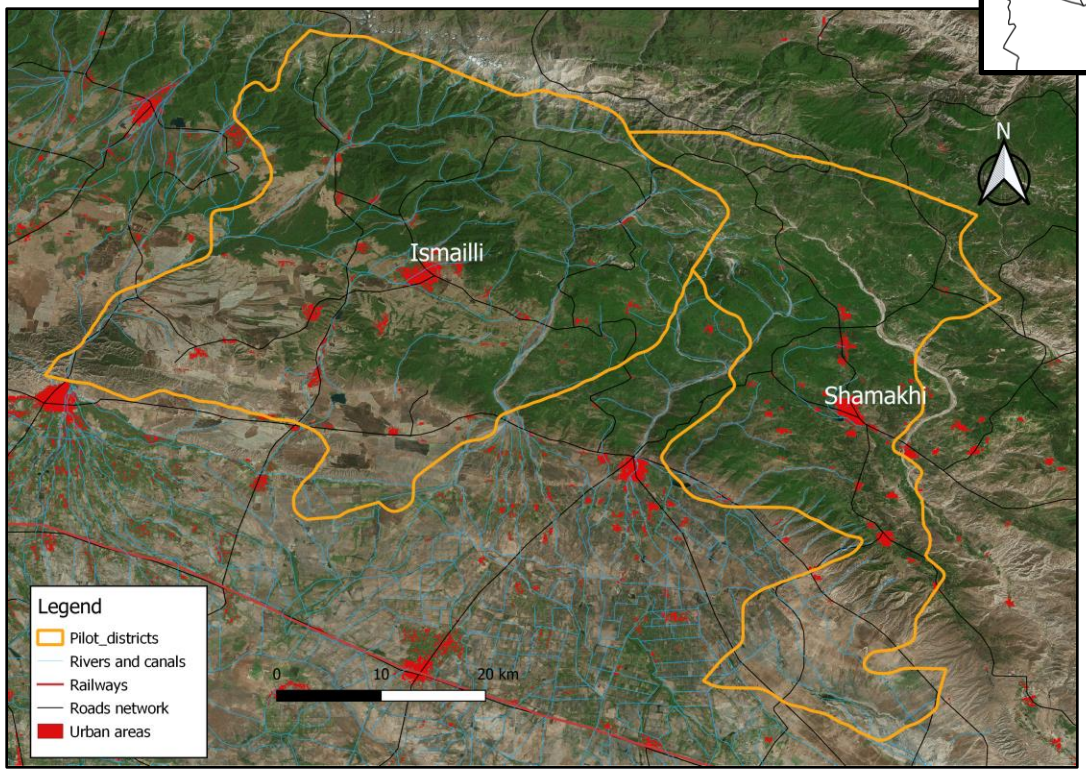
In addition, climate change mitigation and adaptation issues were considered under strategic road maps approved in 2016. In particular, issues related to climate change mitigation and adaptation are described in "Strategic Road Map for development of heavy industry and machinery in the Republic of Azerbaijan" and "Strategic Road map for the development of utilities (electric, heating energy, water and gas) in the Republic of Azerbaijan." The "Strategic Road Map for manufacturing and processing agricultural products in the Republic of Azerbaijan" and specific measures were considered for the period up to 2025 and beyond.

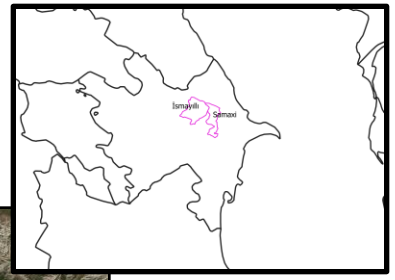
The Republic of Azerbaijan has joined international efforts to mitigate the negative effects of global climate change after the ratification of the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and followed by the Kyoto Protocol in 2000. As a non-Annex I country to the Convention, Azerbaijan has undertaken commitments such as the preparation and regular update of the cadastre of greenhouse gas emissions, the preparation of national data, public awareness raising and the submission of the data to the Conference of the Parties of the Convention. The abovementioned commitments are being systematically implemented.

Some institutional measures to coordinate and carry out the activities in this sphere in a deliberate way have been undertaken. Thus, the State Commission on Climate Change was established by the Decree of the President of the Republic of Azerbaijan, dated April 30, 1997, to ensure the coordination of the implementation of the commitments of the UN Framework Convention on Climate Change. The Ministry of Ecology and Natural Resources, under the Decree of the President of the Azerbaijan Republic dated April 1, 2005, has established a National Competent Authority for the Clean Development Mechanism of the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

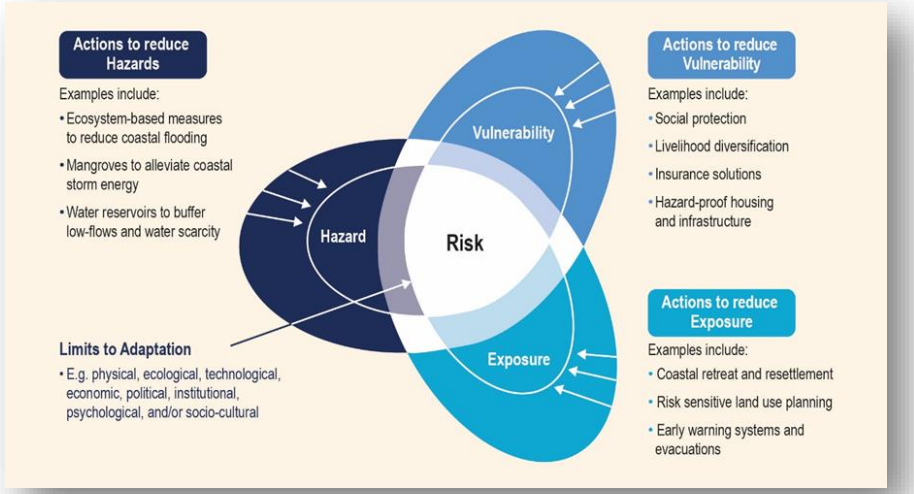
2. Methodological phases – Case studies

Ismayilli and Samakhi rajons selected for their mountain characteristics having a variety of agro-ecological zones



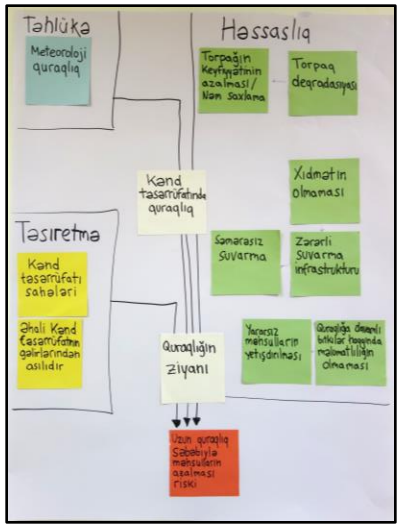


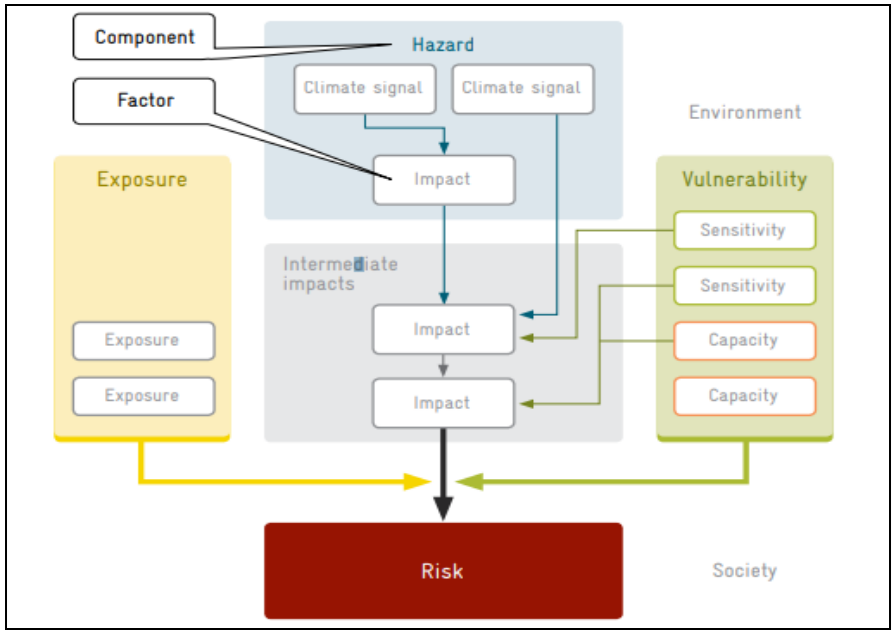
2. Methodological phases – Impact chains



Impact chains for risk assessments:

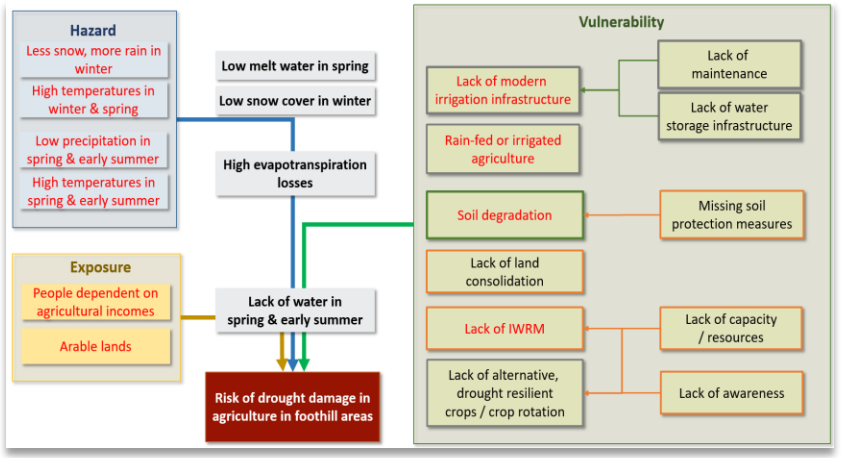
- Stepwise & indicator-based approach
- Identification of the factors involved in climate change risk
- Combination of quantitative & qualitative data



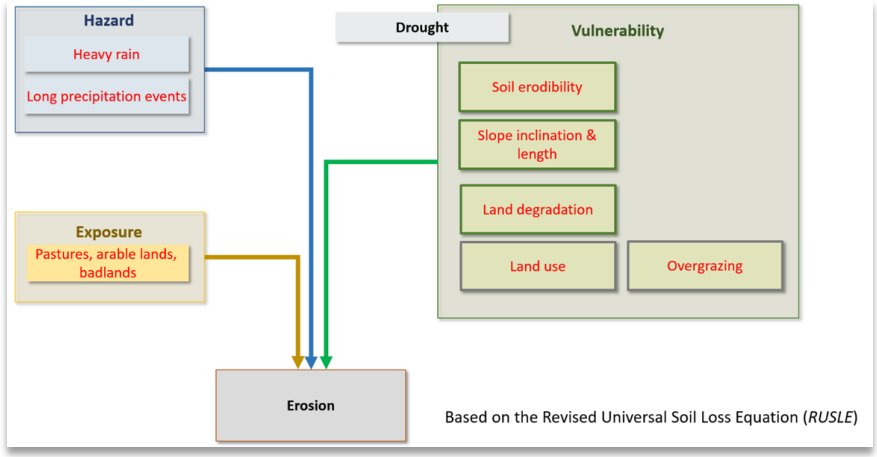


2. Methodological phases - Workshop in Baku

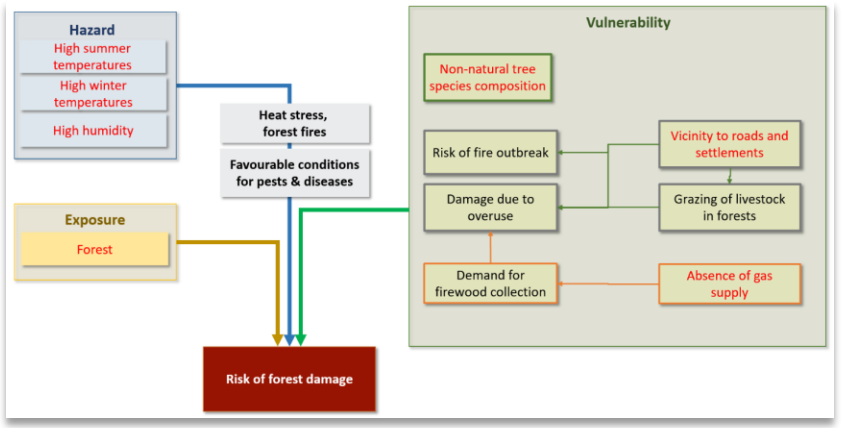
Risk of drought



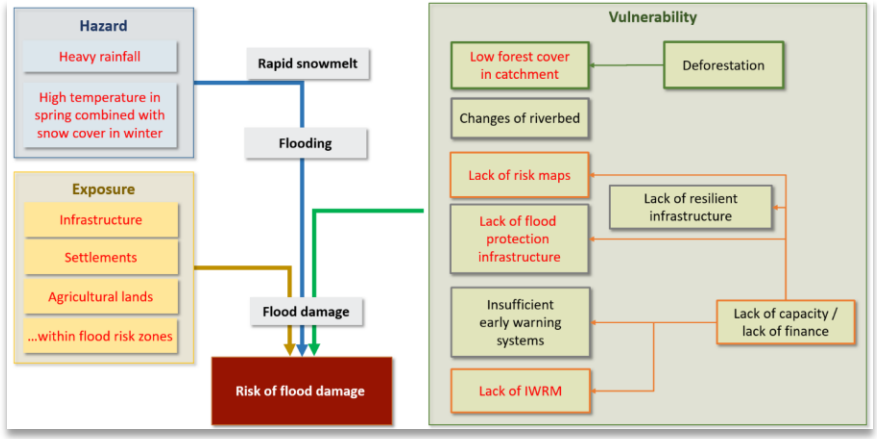
Risk of erosion



Risk of forest damage



Risk of flood damage



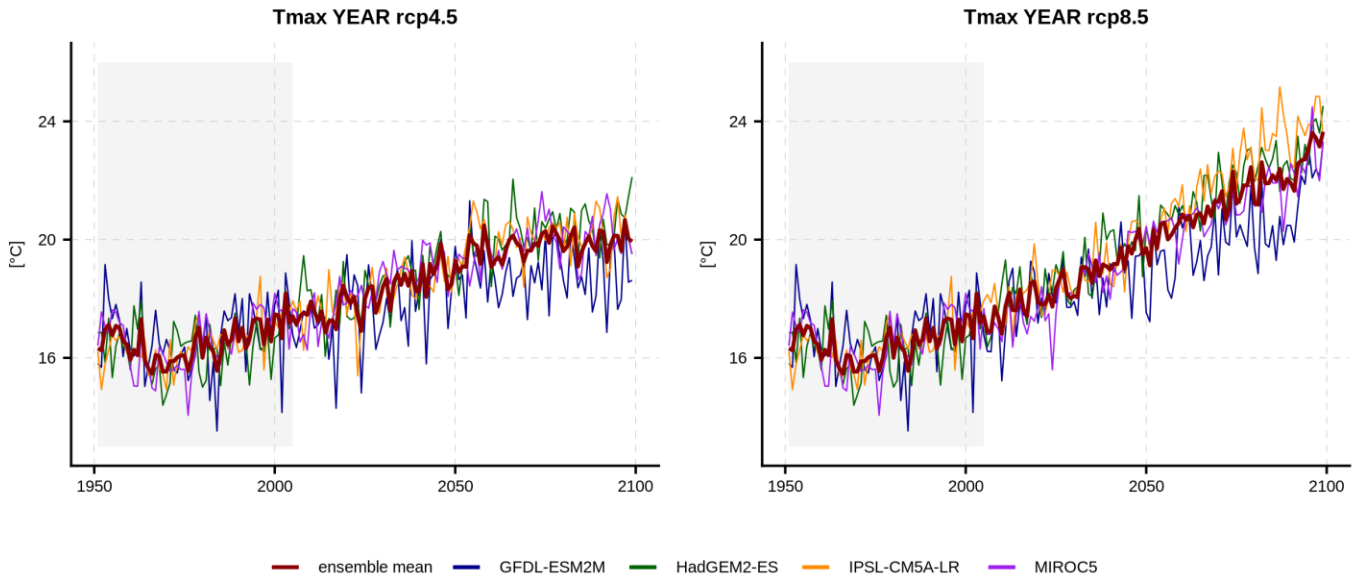
3. Methodological phases - Climate data analysis

Global downscaled climate projections:

- ISIMIP

ISIMIP
Inter-Sectoral Impact Model Intercomparison Project

- 0.5° x 0.5° resolution
- Two different emission scenarios:
  - RCP 4.5 (emission reduction) and
  - RCP 8.5 (business as usual)
- Four global model simulations
- 1951 – 2100 annual mean series

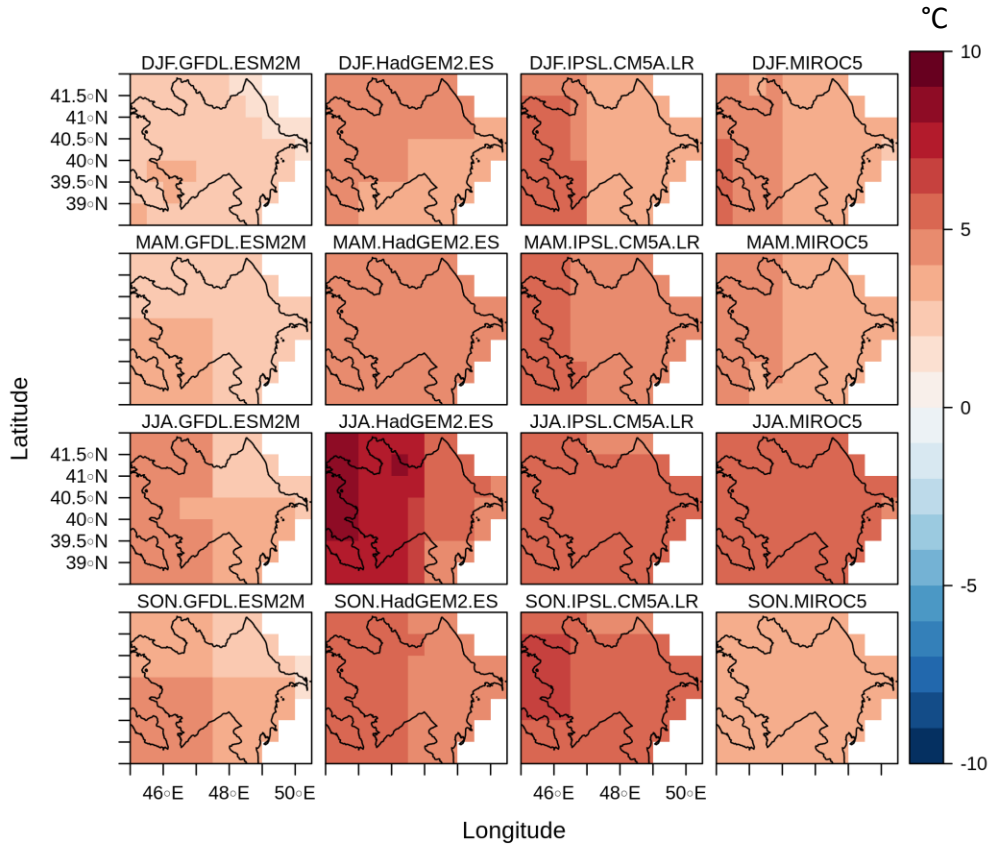


https://www.isimip.org/

3. Methodological phases – Climate data analysis

Change in temperature

- Changes in seasonal 2051 – 2080 maximum temperature climatologies with respect to recent past (1971 – 2000) for the 4 model simulations under the RCP 8.5 scenario
- Smoothed spatial variability
- Coherent increasing signal among models
- Greater increases in summer (+ 5–10 °C) and autumn (+ 4–7 °C)

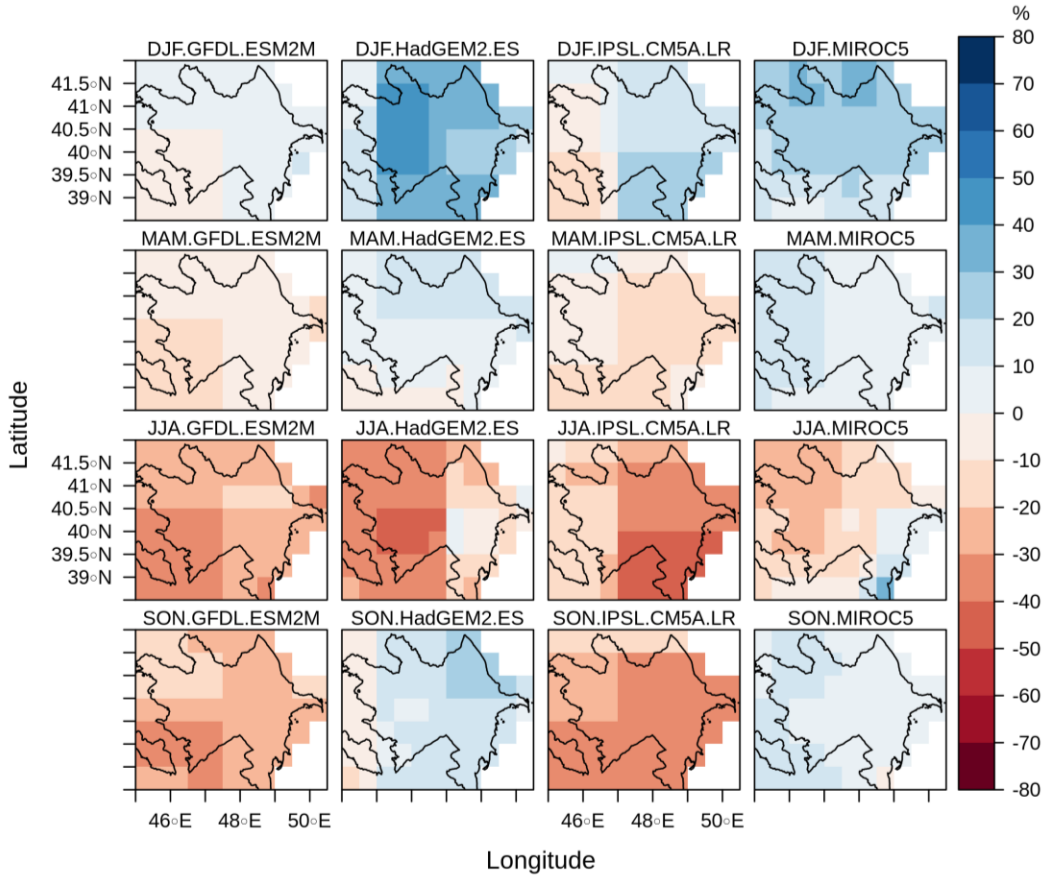


Similar **temperature changes**, but different **impacts** on different areas (e.g. mountains, coastal region, ...)

3. Methodological phases - Climate data analysis

Change in total precipitation
(mean relative differences in seasonal total precipitation between 2051 – 2080 and 1971- 2000 for RCP8.5)

- Higher model variability especially in spring and autumn
- Higher spatial variability over the whole country in all seasons with both positive and negative changes



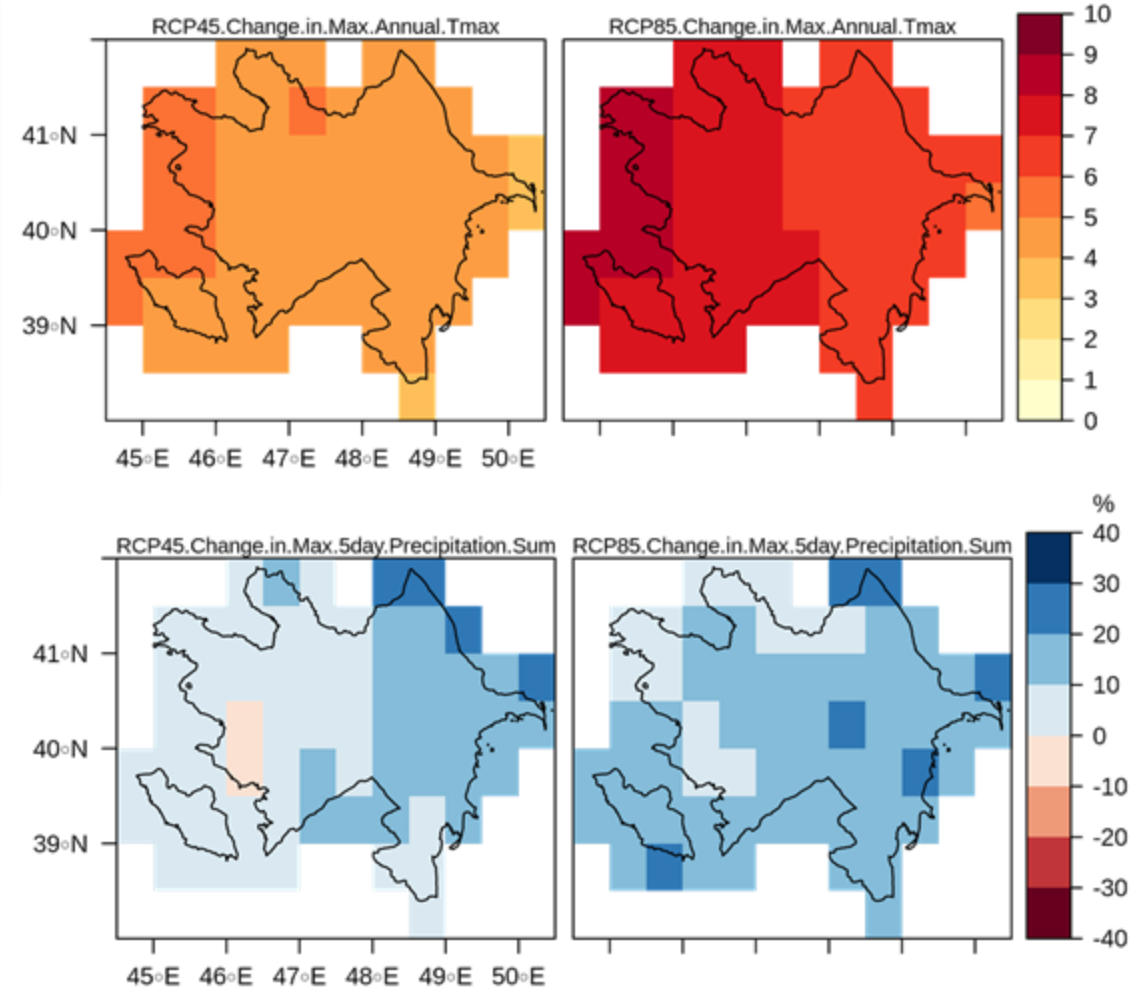
3. Methodological phases - Climate data analysis

Temperature extremes:

- Increase in annual maximum daily temperature extreme up to 10 °C (RCP 8.5) over 2070 – 2099 with respect to 1970 - 1999
- Greater increase in the western Azerbaijan

Precipitation extremes:

- Increase in annual maximum of 5-day precipitation sum over the whole country
- up to + 40% over 2070 – 2099 with respect to the recent past (1970 – 1999)



3. Methodological phases - Climate data analysis

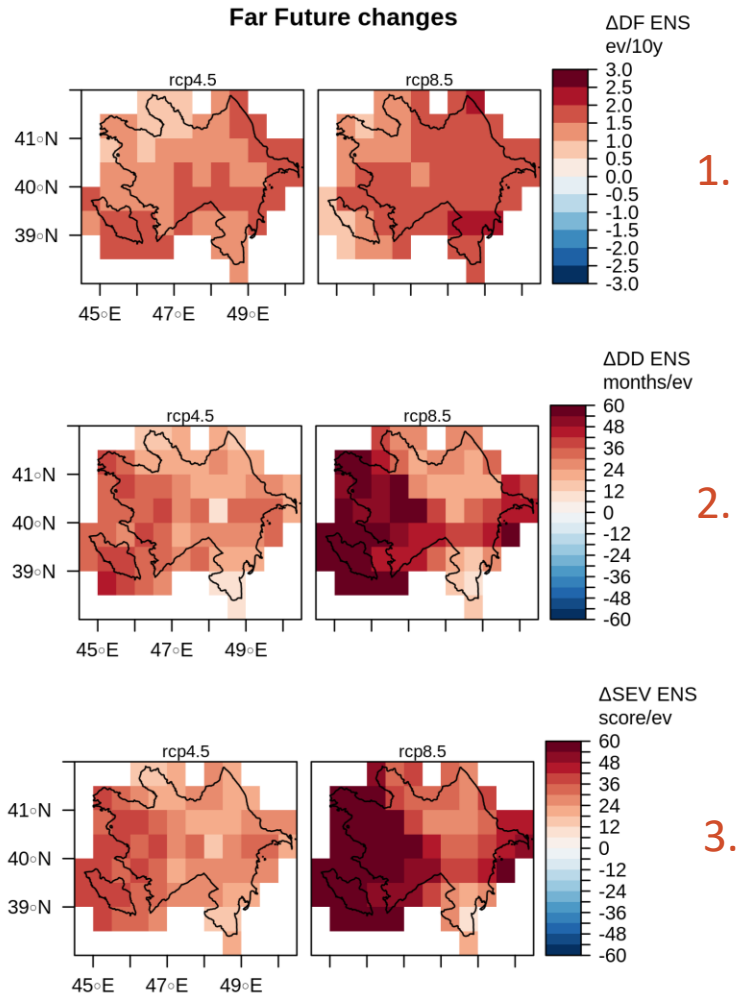
Drought indices:

- SPI (Standardized Precipitation Index) and SPEI (Standardized Precipitation-Evapotranspiration index)
- Aggregation over 12 months
- Changes in water availability

Drought events in current present and future are identified and characterized by considering:

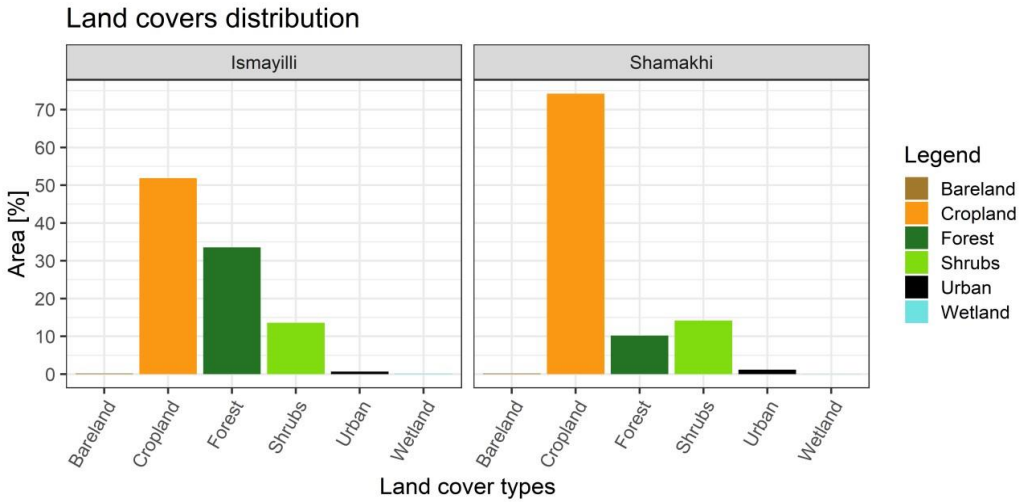
1. Frequency (N of events per decades)
2. Duration
3. Severity

Increase in mean duration and mean severity of drought events in future (2070 – 2099) especially in western Azerbaijan



3. Methodological phases - Vulnerability and impact assessment

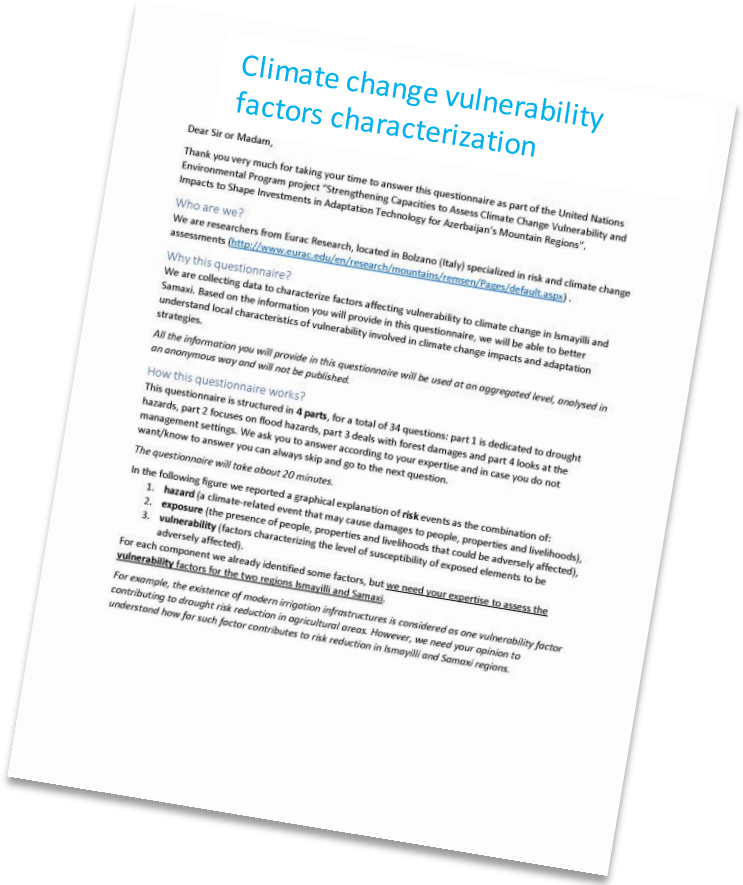
Desk-based research exploring open territorial datasets



Resource	Data type	Resolution	Link
Digital Elevation Model	Regular grid	90 m	https://cgiarcsi.community/data/srtm- 90m-digital-elevation-database-v4-1/
Land Cover	Regular grid	300 m	https://sustainable-caucasus.unepgrid.ch/layers/ESA2010_ Cauc:geonode:ESA2010_Cauc
Global forest change	Regular grid	30 m	https://earthenginepartners.appspot.com/ science-2013-global-forest
Built-up settlements	Regular grid	3 arcs	https://www.worldpop.org/geodata/summary?id=17065
Road networks	Vector data	-	https://geonode.wfp.org/layers/ogcserver .gis.wfp.org:geonode:aze_trs_roads_osm
Rivers	Vector data	-	https://sustainable-caucasus.unepgrid.ch/layers/geonode:river_of_azerbaijan_republic_1
National statistics	Aggregated information at rayon levels	-	https://www.stat.gov.az/source/agriculture/?lang=en

3. Methodological phases - Vulnerability and impact assessment

- To characterize the two pilot regions
- Retrieve information on vulnerability factors:
  - Existence and maintenance of irrigation structures
  - Flood protections and early warning systems
  - Forest composition
  - Forest disturbance
  - Integrated Water Resources Management (IWRM)
  - Financial and human resources



Climate change vulnerability factors characterization

Dear Sir or Madam,

Thank you very much for taking your time to answer this questionnaire as part of the United Nations Environmental Program project "Strengthening Capacities to Assess Climate Change Vulnerability and Impacts to Shape Investments in Adaptation Technology for Azerbaijan's Mountain Regions".

Who are we?

We are researchers from Eurac Research, located in Bolzano (Italy) specialized in risk and climate change assessments (http://www.eurac.edu/en/research/mountains/remsen/Pages/default.aspx) .

Why this questionnaire?

We are collecting data to characterize factors affecting vulnerability to climate change in Ismayilli and Samaxi. Based on the information you will provide in this questionnaire, we will be able to better understand local characteristics of vulnerability involved in climate change impacts and adaptation strategies.

All the information you will provide in this questionnaire will be used ot an aggregated level, onalysed in an anonymous way and will not be published.

How this questionnaire works?

This questionnaire is structured in **4 parts**, for a total of 34 questions: part 1 is dedicated to drought hazards, part 2 focuses on flood hazards, part 3 deals with forest damages and part 4 looks at the management settings. We ask you to answer according to your expertise and in case you do not want/know to answer you can always skip and go to the next question.

The questionnaire will take about 20 minutes.

In the following figure we reported a graphical explanation of **risk** events as the combination of:

1. **hazard** (a climate-related event that may cause damages to people, properties and livelihoods),
2. **exposure** (the presence of people, properties and livelihoods that could be adversely affected),
3. **vulnerability** (factors characterizing the level of susceptibility of exposed elements to be adversely affected).

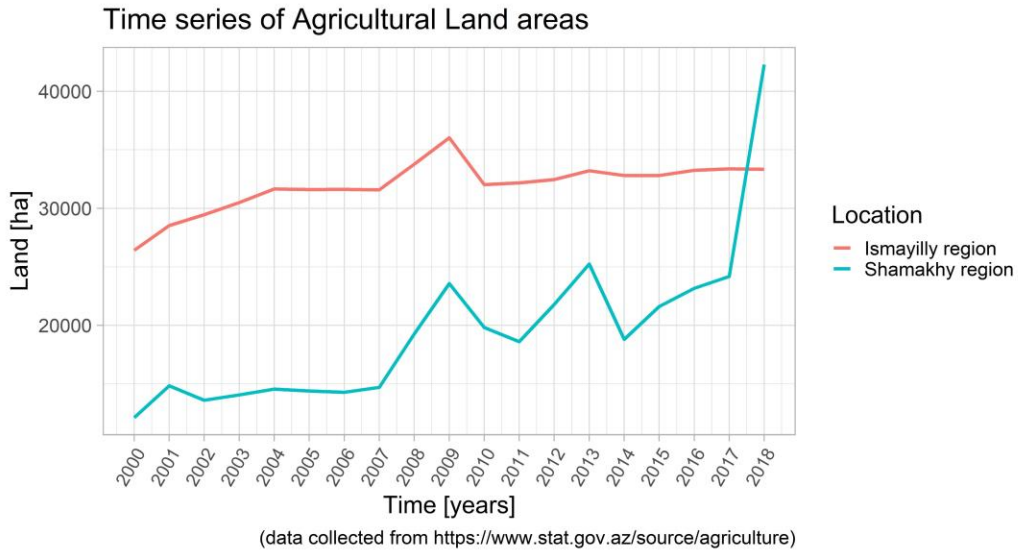
For each component we already identified some factors, but we need your expertise to assess the **vulnerability** factors for the two regions Ismayilli and Samaxi.

For example, the existence of modern irrigation infrastructures is considered as one vulnerability factor contributing to drought risk reduction in agricultural areas. However, we need your opinion to understand how far such factor contributes to risk reduction in Ismayilli and Samaxi regions.

4. Results – Risk of drought

Information on the:

- coverage and maintenance of irrigation structures
  - Better and more irrigation infrastructures in Ismayilli than Samaxi
  - Expansion of the (irrigated) agricultural land
- Lack of an Integrated Water Resources Management (IWRM)



4. Results – Risk of drought

Risk of drought in agriculture in mid elevation areas				
	Current Situation		Future (2050-2080)	
	Ismayilli	Shamakhi	Ismayilli	Shamakhi
Hazard (Drought)	Moderate	Moderate	High	High
Vulnerability	Low	Low	Low/Moderate	Low/Moderate
Exposure	Low	Low	Low/Moderate	Low/Moderate
Risk	**Low**	**Low**	**Moderate**	**Moderate**
Confidence of Assessment	Moderate		Moderate - Low	

Risk of drought in agriculture in foothill areas				
	Current Situation		Future (2050-2080)	
	Ismayilli	Shamakhi	Ismayilli	Shamakhi
Hazard (Drought)	High	High	Very High	Very High
Vulnerability	Moderate	High	Moderate	High
Exposure	Moderate	High	Moderate	High
Risk	**Moderate**	**High**	**High**	**Very High**
Confidence of Assessment	Moderate		Moderate - Low	

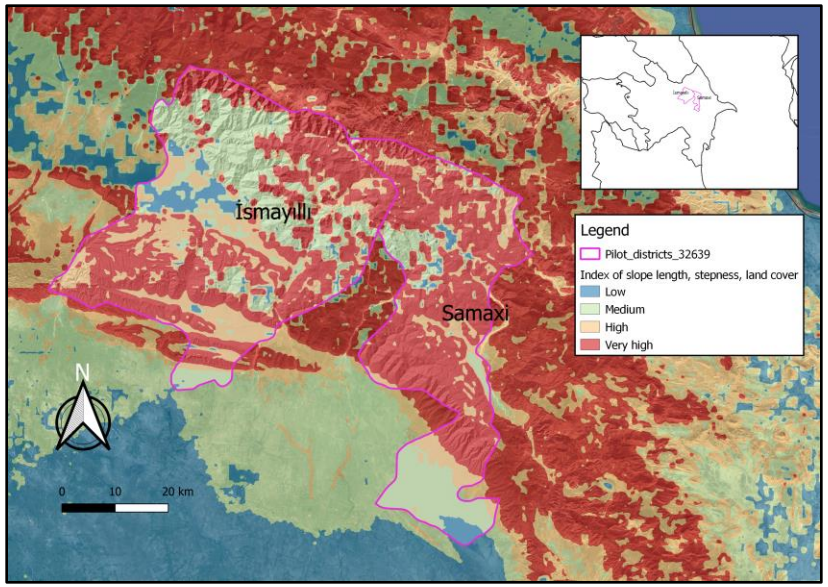
Key messages:

- Increase of irrigated agriculture land → increase of water demand
- Need to better understand irrigation infrastructure / agricultural practices and how to make them more resilient
- Drought events increase in western part of Azerbaijan → consequences downstream foothill areas

4. Results – Risk of erosion

1. **Index based analysis**:
   - Slope length, steepness and land cover affecting erosion processes
2. **Expert opinion**

1.



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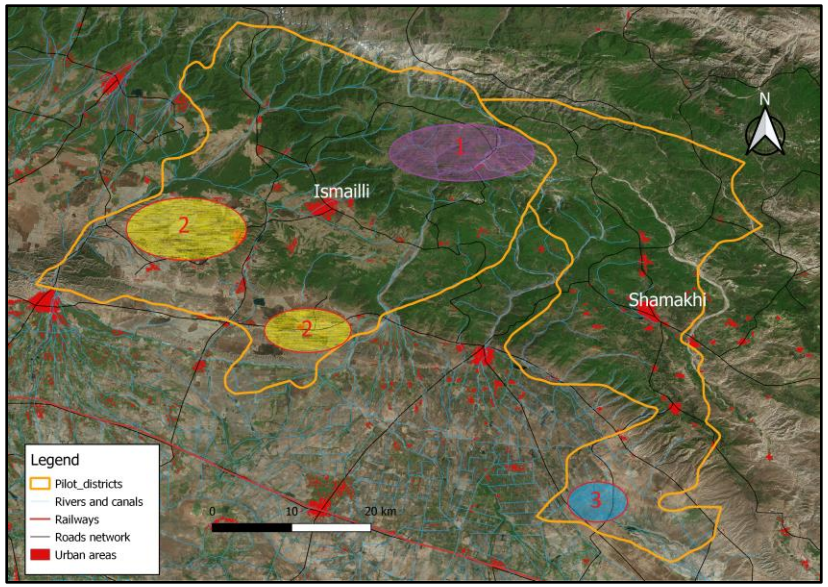


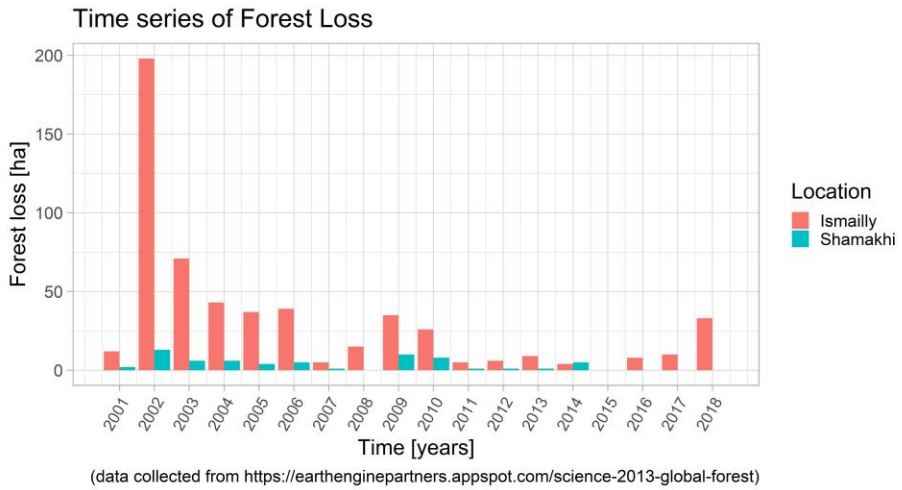
4. Results – Risk of erosion

Summary Table: Risk of erosion (on steep slopes)				
	Current Situation		Future (2050-2080)	
	Shamakhi	Ismayilli	Shamakhi	Ismayilli
Hazards (heavy rain)	Moderate	Moderate	Moderate / High	Moderate / High
Vulnerability	High	High	High/ Very High	High/ Very High
Exposure	High	High	High	High
Risk	**High**	**High**	**High/ Very High**	**High/ Very High**
Confidence of Assessment	High		Moderate	

Key messages:

- Conversion from winter pasture to cropland → soil erodibility + increase of water demand
- More pressure on summer pastures → more land degradation → erosion

4. Results – Risk of forest damage

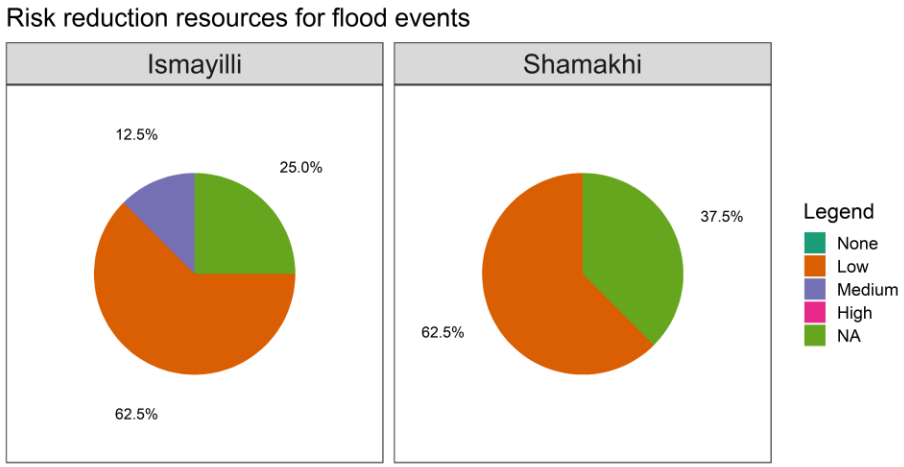


Risk of forest damage				
	Current Situation		Future (2050-2080)	
	Ismayilli	Shamakhi	Ismayilli	Shamakhi
Hazards (high temperatures)	Low	Low	Moderate	Moderate
Vulnerability	Low	Moderate	Moderate / High	Moderate / High
Exposure	Low	Low	Moderate	Moderate
Risk	**Low**	**Low**	**Moderate**	**Moderate**
Confidence of Assessment	High		Moderate	

Key message:

- Forest loss has been moderate and mainly in Ismayilli
- Forest areas not subjected to conversion into pasture/cropland
- Forest cover plays a big role in reducing erosion processes

4. Results – Risk of flood



Risk of flood in foothill areas				
	Current Situation		Future (2050-2080)	
	Ismayilli	Shamakhi	Ismayilli	Shamakhi
Hazard (heavy rain)	Moderate	Moderate	Moderate/High	Moderate/High
Vulnerability	Moderate/High	Moderate/High	High	High
Exposure	Moderate	Moderate	Moderate	Moderate
Risk	**Moderate**	**Moderate**	**Moderate**	**Moderate**
Confidence of Assessment	Moderate - Low		Low	

Key message:

- Precipitation increase mainly in the easter part of AZ
- Lack of flood hazard maps
- Resources and infrastructures to reduce risk are limited or missing

5. Conclusions and future developments

Ismayilli and Shamakhy

1. Drought and erosion are the two main risks
2. Land conversions (pasture → cropland) increase erosion and water demand for agriculture
3. Forest cover should be considered to reduce erosion processes

Azerbaijan

1. Future climate conditions are likely to increase drought events (western AZ)
2. Climate effects on intense precipitation (eastern AZ) → increasing floods and erosions processes.

5. Conclusions and future developments

Limitations:

Data availability

- Limited time coverage for local climate data
- ISMIP data as a good work-around but with problems related to spatial resolution
- Good local land-cover data was missing

Covid-19

- No second workshop, important for expert assessment.
- Analyses as a mix of quantitative data and expert assessment (supported by questionnaire)
- Vulnerability factors need local knowledge
- Good assessments based on data and narratives from local stakeholder and expert assessments

5. Conclusions and future developments

Ismayilli and Shamakhy

1. Final report in english
2. Summary report in English and Azeri

Further developments:

- scientific basis for adaptation planning, such as the **National Adaptation Plan** (NAP).
- international financial mechanisms, such as the **Green Climate Fund** and **Adaptation Fund**.
- replicability to other mountain regions of Azerbaijan and across the Caucasus region.

GREEN CLIMATE FUND

ADAPTATION FUND

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