

Vision for Development of Georgia's High Mountainous Regions adapted to the Climate and Landscape Changes

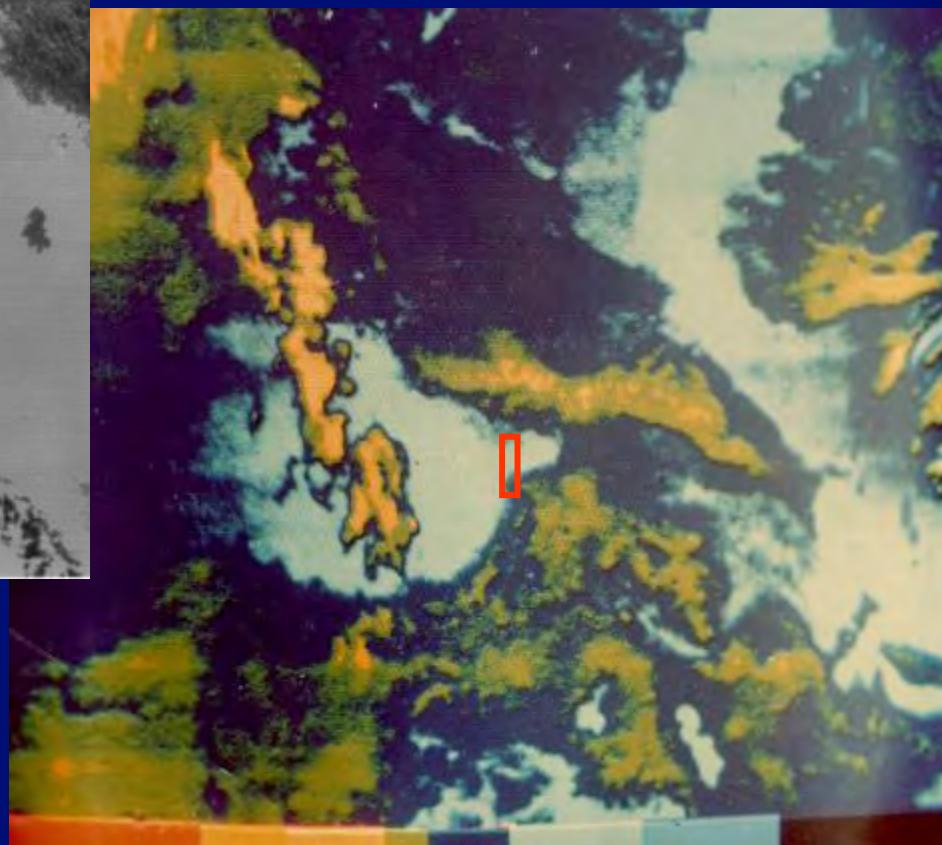
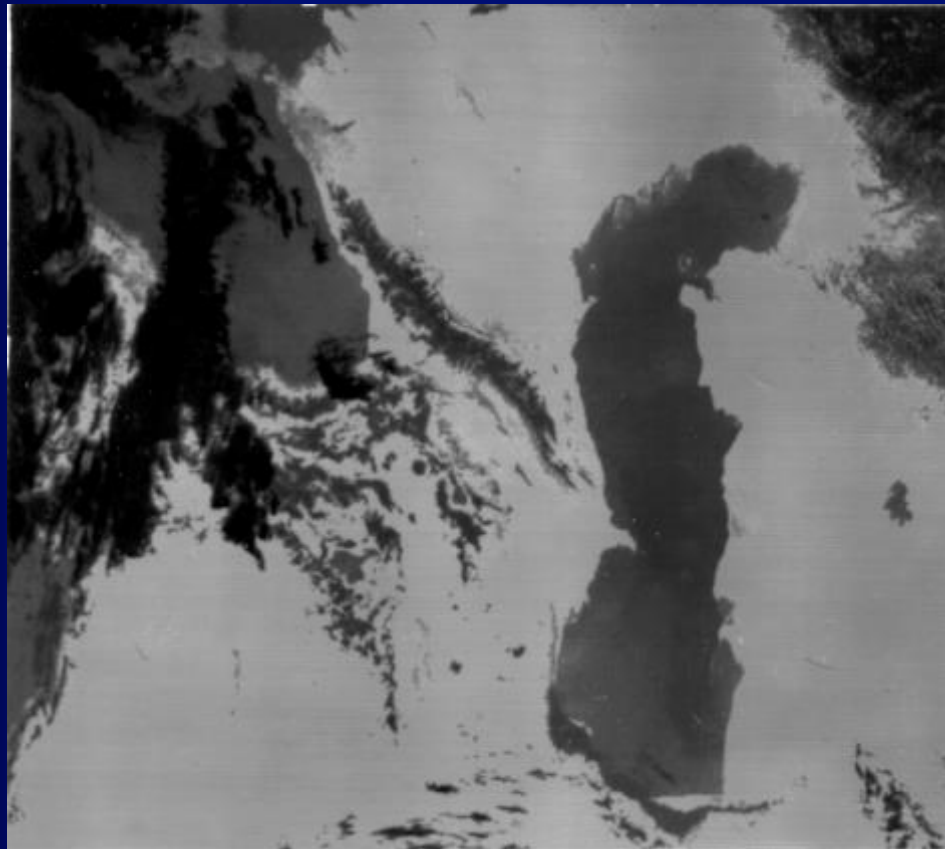


George Gotsiridze

3rd EURO-ASIAN MOUNTAIN RESORTS CONFERENCE

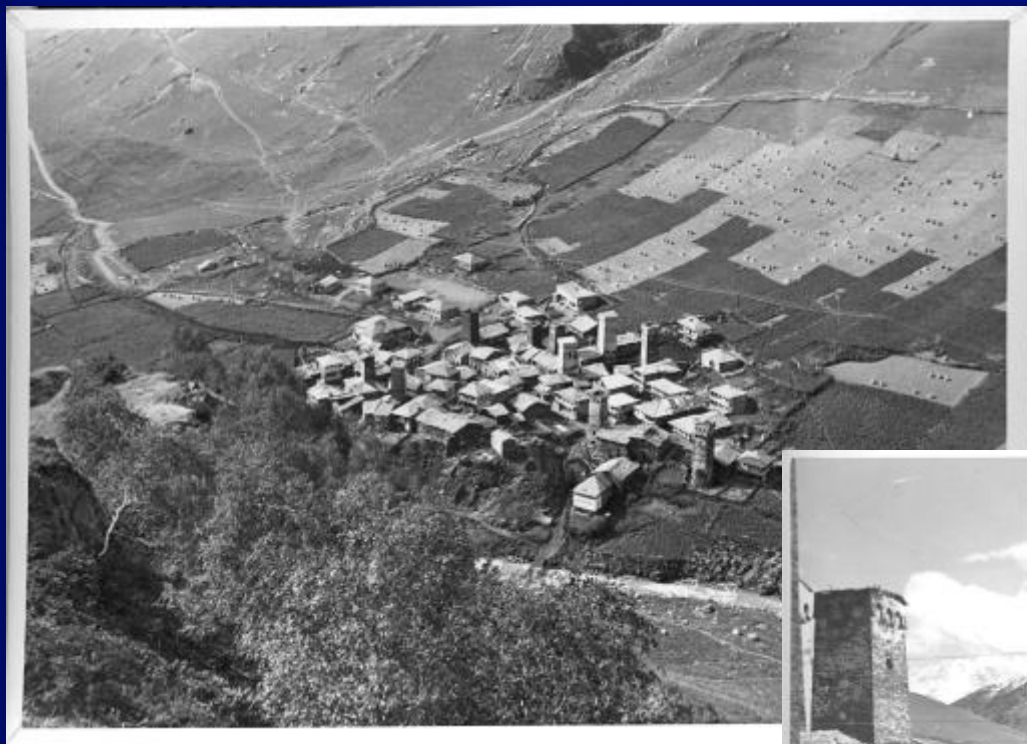
4 - 7 April, 2017, Tbilisi, Georgia

Caucasus – June 1984



Chokheltkari - 1987





Murkmeli-Ushguli, 1956.





Murkmeli-Ushguli, 2007



Jamushi-Mulakhi, 1895.



Jamushi-Mulakhi, 1987

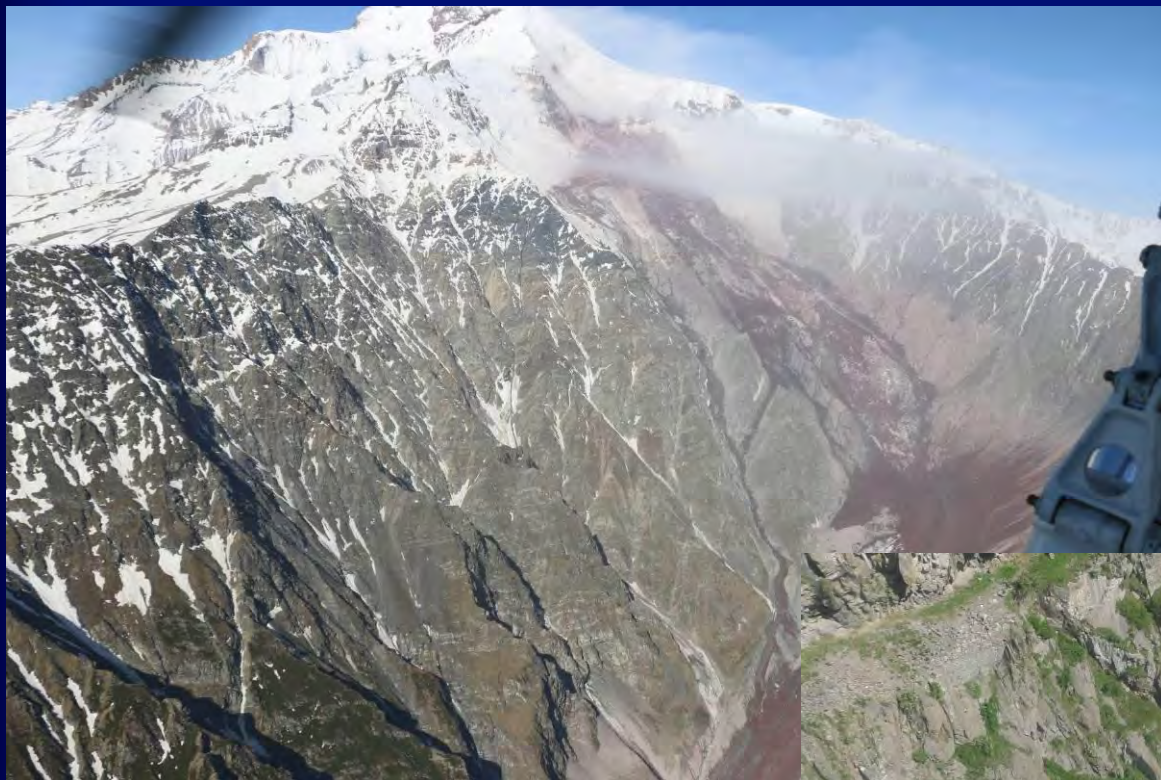


Mulakhi - 2014



© Giorgi Nikolava

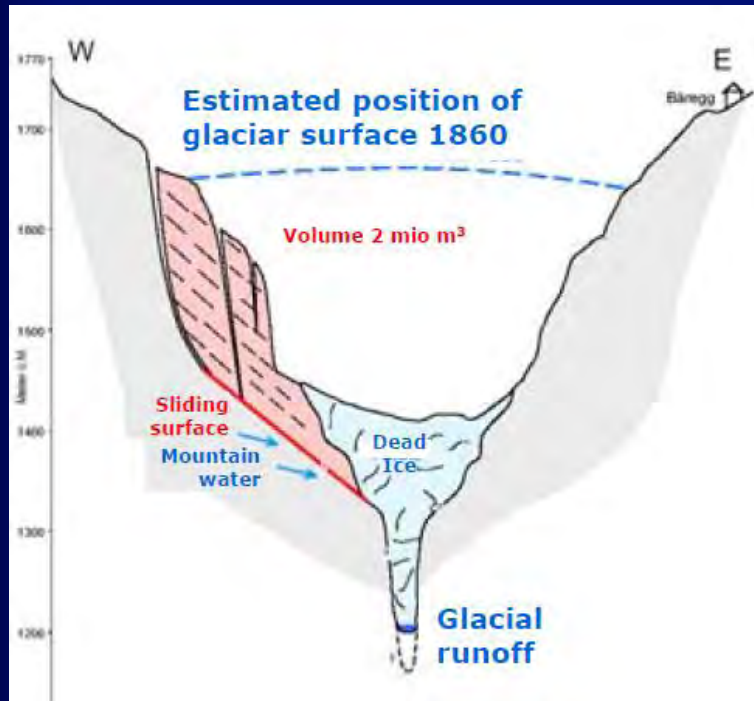
Devdoraki, 2014



Jabeshi-Mulakhi, 2016

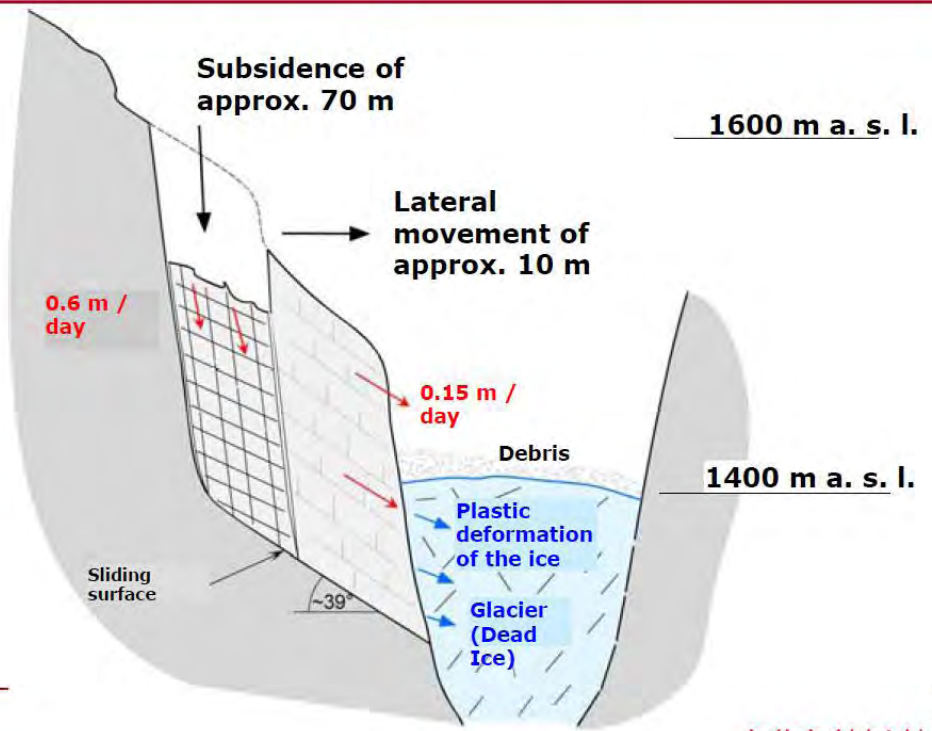


New Problem !



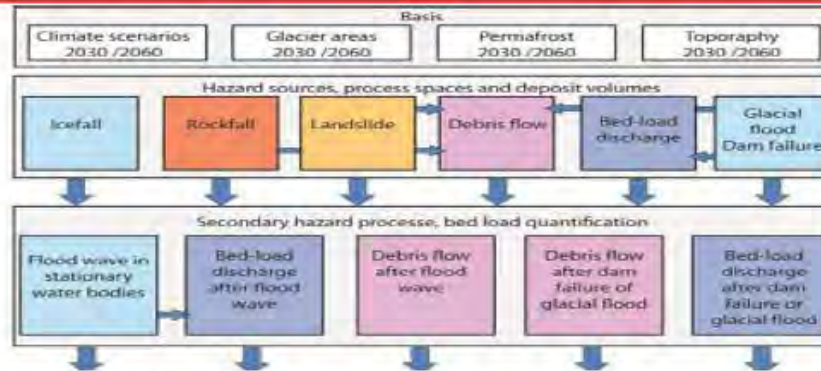
15th PLANALP M
Exkursion Septe

Eiger Rockslide - Progression of Movement

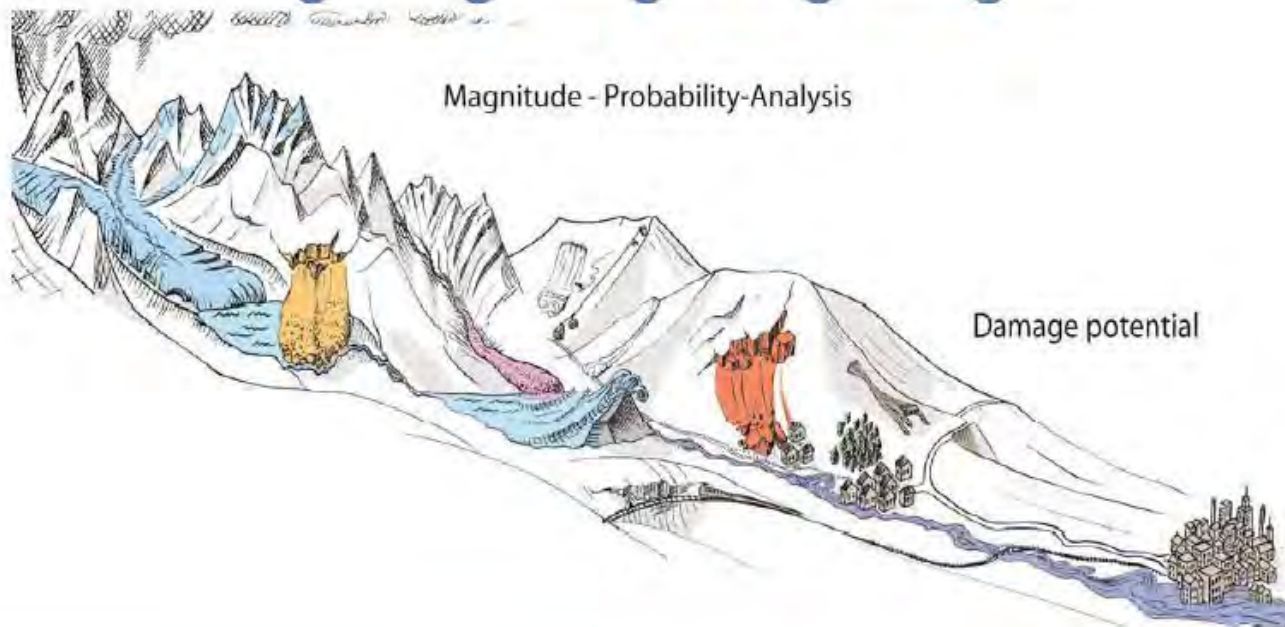


GEOTECHNISCHE
INGENIEUR
GEOPHYSIKER
UMWELTACHTE

Concept – Process Chain



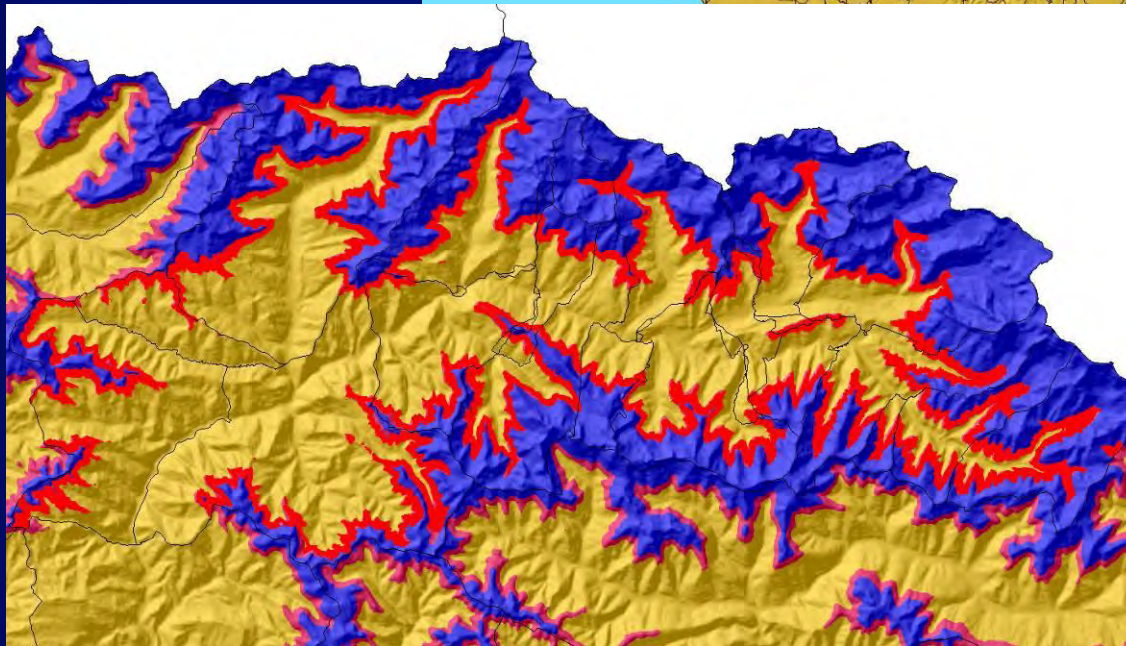
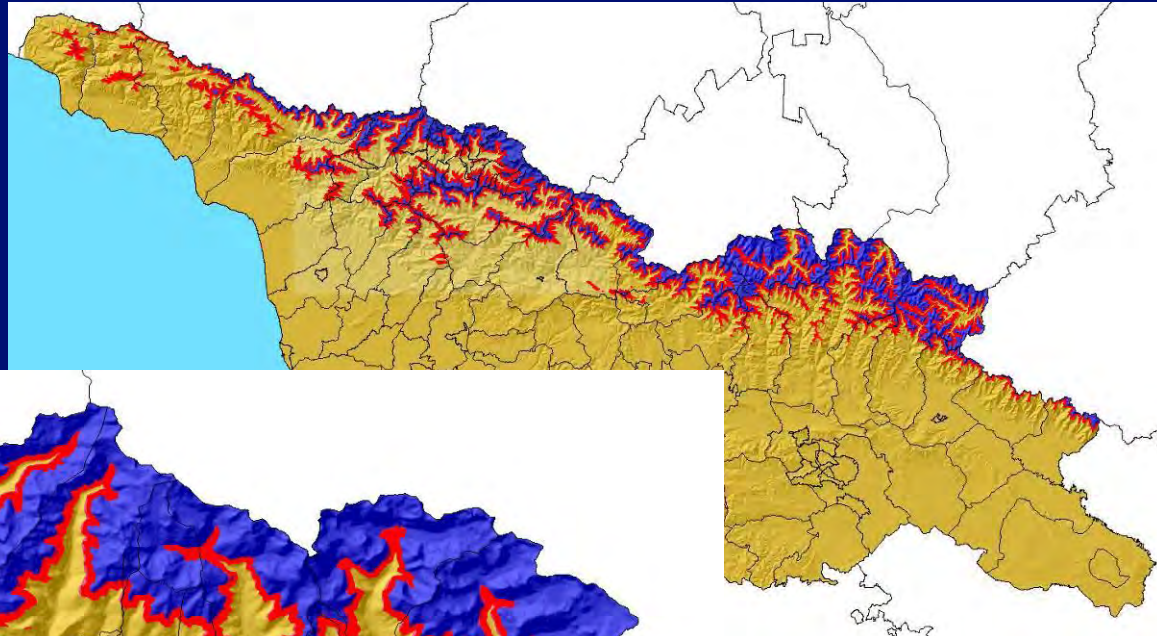
Magnitude - Probability-Analysis



www.geotest.ch

New Risky Areas

GEORGIA



Mestia Municipality

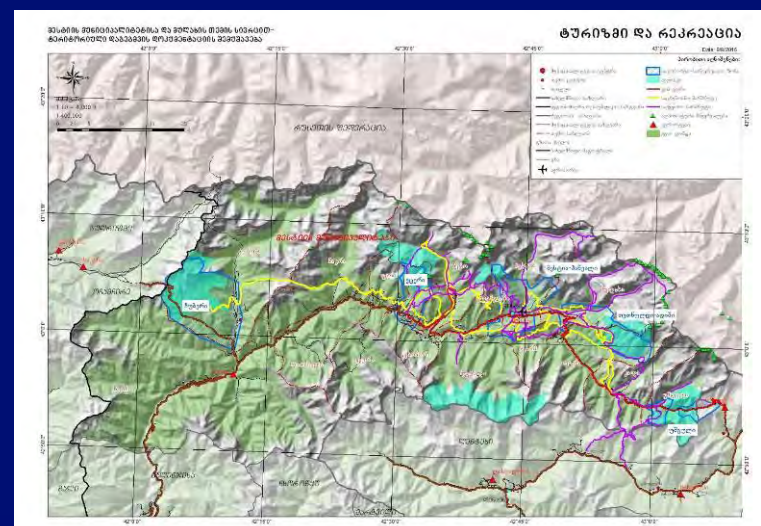
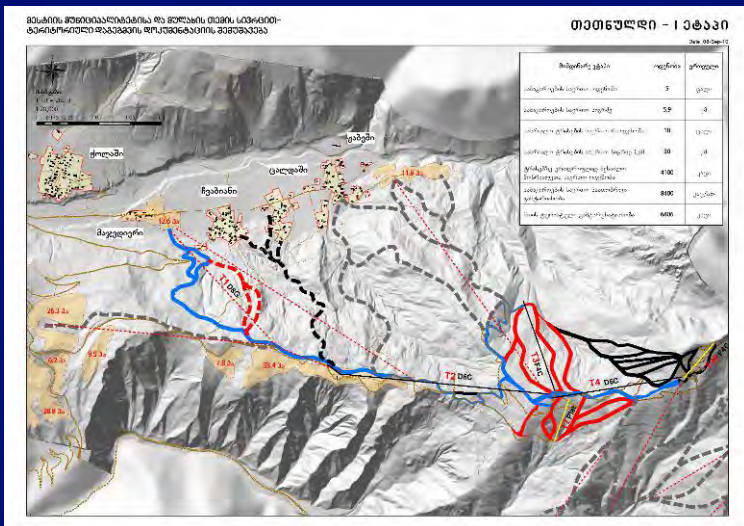
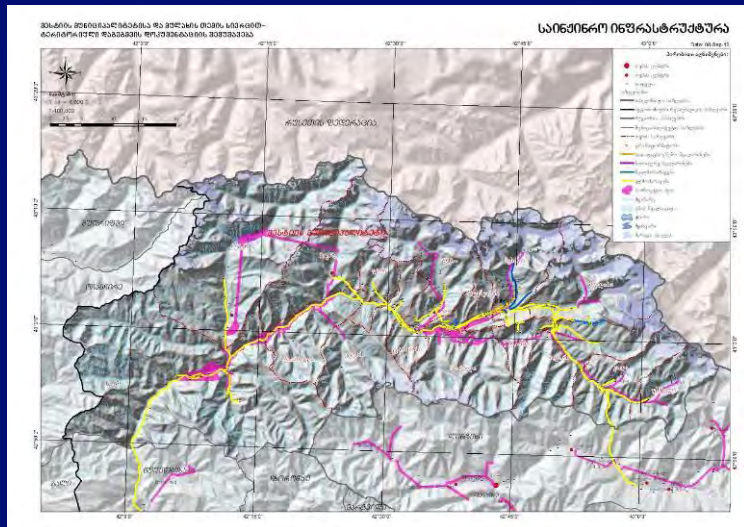
Sensitive Villages



Ethno-Ecological Degradation, Mulakhi - 2016



Regional and Municipal Plans



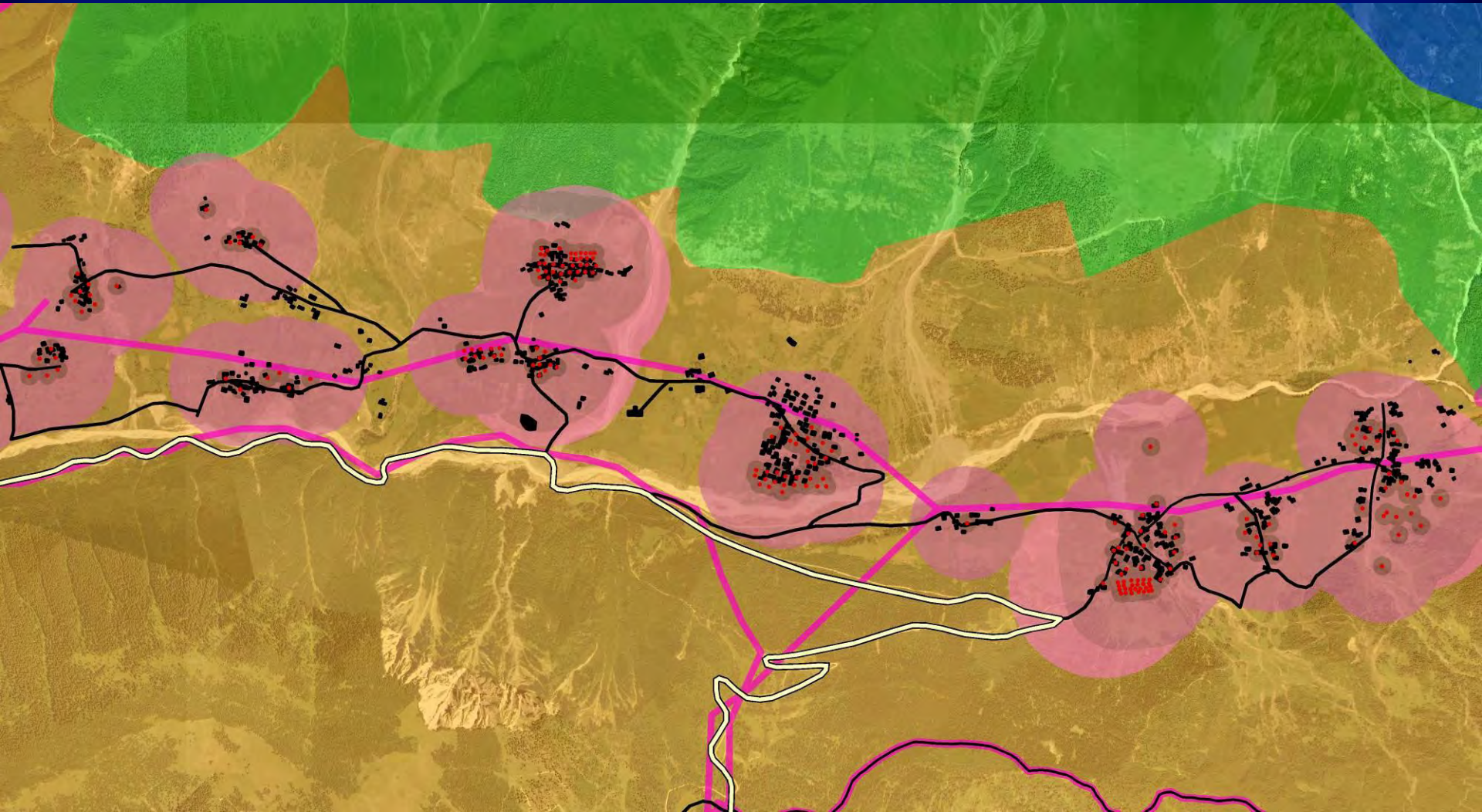
Tourism



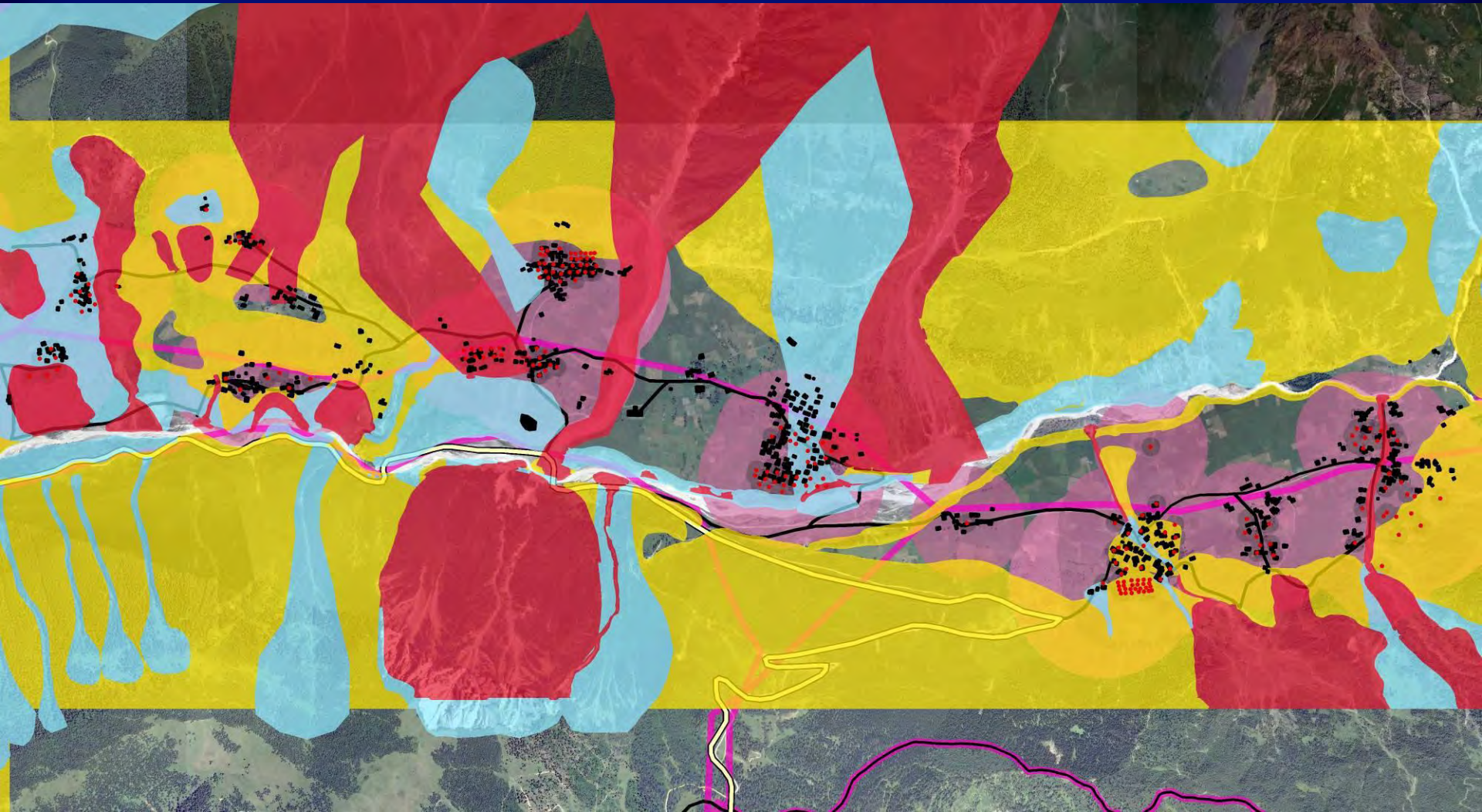
Master Planning




Master Planning



HazMap





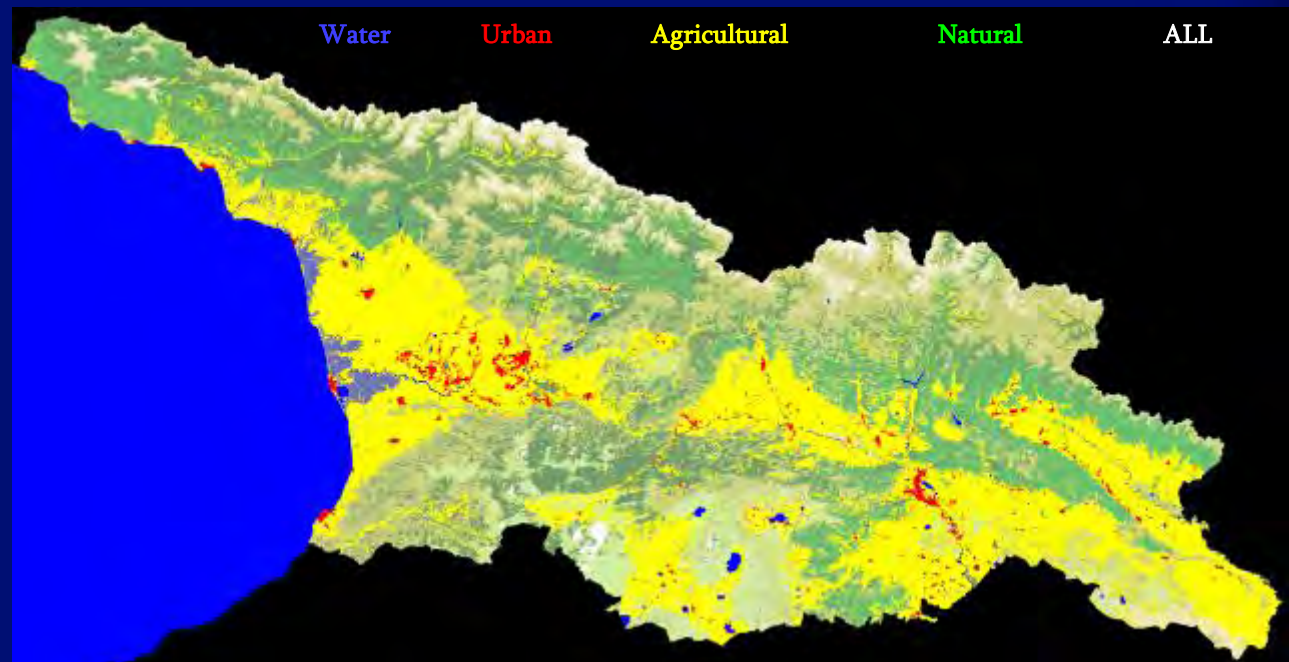
Values of Spatial Categories	%
Safety	51
Ethno-Cultural Heritage	15
Natural Environment	15
Other Resources and . . .	19
	100



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INSTITUTIONALIZATION OF
CLIMATE CHANGE ADAPTATION
AND MITIGATION
IN GEORGIAN REGIONS

Mapping the Road Map: SEEING is KNOWING Exposure Subsystems



ՀՀ-ում կառավարող և քաղաքացիական ընկերությունների միջոցով իրականացվող



ԱՄԵՐԻԿԱՆ ԿԵՆՏՐՈՆԱԿԱՆ
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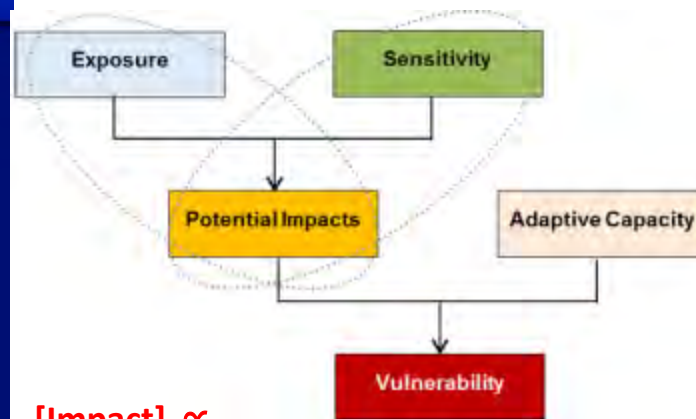
ԱՄԵՐԻԿԱՆ ԿԵՆՏՐՈՆԱԿԱՆ
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ՔԱՂԱՔԱՐԱԿԱՆ ԵՎ ԴԱՐՈՒՄԱՆ
ՔՈՆԿՐԵՐԱՆԻ ԳՐԱԴԱՆՈՒ
ՈՐԱՏՈՒՄՆԵՐՈՒԹՅԱՆ



ՀՀ-ում կառավարող և քաղաքացիական ընկերությունների միջոցով իրականացվող
ՀՀ-ում կառավարող և քաղաքացիական ընկերությունների միջոցով իրականացվող
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IMPACT MATRIX



[Impact] \propto
[Sensitivity] \times [Change in Exposure]

SENSITIVITY INDICATORS

	Change in annual mean temperature	Change in seasonal mean temperature	Change in extreme temperatures (max. & min.)	Change in annual mean of temperatures below 8°C (heating period length)	Change in annual mean of temperatures above 25°C (cooling period length)	Change in annual mean number of summer days	Change in annual mean number of frost days	Relative change in annual mean precipitation	Relative change in seasonal mean precipitation	Change in annual mean number of days with heavy rainfall	Relative change in annual mean evaporation	Change in annual mean snow cover (CDS/C) depth	Change in annual mean wind speed	Avalanches ¹⁴	Trigger Climate effects: River floods
Physical sensitivity															
Municipalities' sensitivity to landslides								x	x	x					
Municipalities' sensitivity to debris-flows, flash floods, and mudflows								x	x	x					
Municipalities' sensitivity to river floods															x
Municipalities' sensitivity to avalanches														x	
Motorways' sensitivity to river floods															x
Social sensitivity															
Population sensitivity to summer heat			x			x									
Population sensitive to natural disasters								x	x	x					
Agricultural sensitivity															
Agriculture sensitivity to soil moisture	x								x						
Agriculture sensitive to water and wind erosion	x								x					x	
Forestry sensitive to forest fires	x								x						
Tourism sensitivity															
Summer tourism sensitive to summer temperatures									x						
Winter tourism sensitive to snow cover changes													x		
Protected natural areas sensitive to different climate exposures	x	x	x	x	x	x	x	x	x	x	x	x	x		
Cultural heritage sites sensitive to river flooding and avalanches															x x
Museums sensitive to river floods and avalanches															x x
Energy sector sensitivity															
Energy demand correlated to summer heat (HDD)				x		x									
Energy demand (CDD)					x										
Cooling load			x	x											
Heating load			x												
Energy supply sensitive due to changing river water levels and hydrology									x						
Physical infrastructure sensitivity to river floods and avalanches														x	x

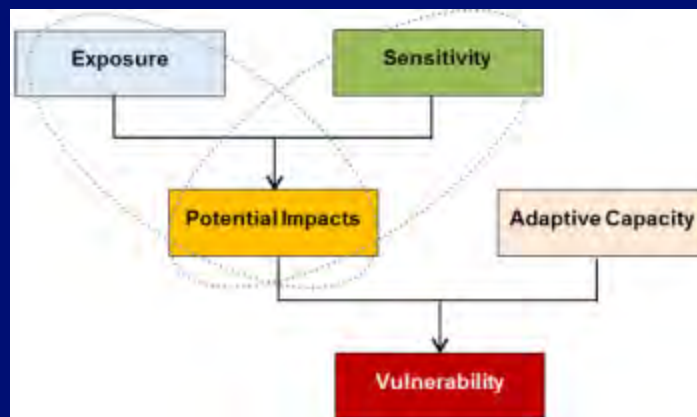
EXPOSURE INDICATORS



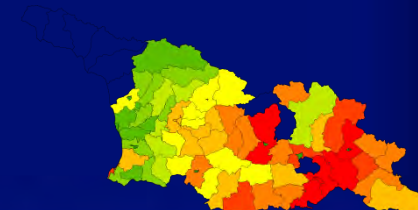
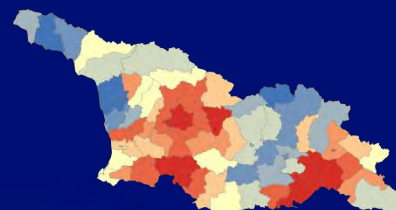
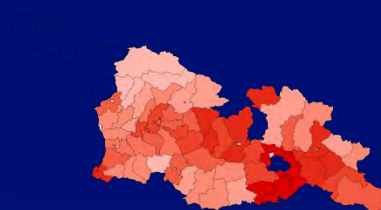
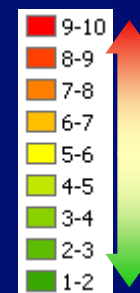
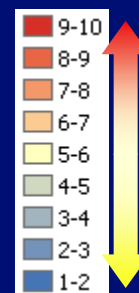
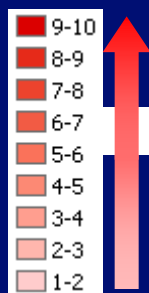
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IMPACT ASSESSMENT SYMBOLOGY



$$[\text{Sensitivity}] \times [\text{Change in Exposure}] \propto [\text{Impact}]$$



INSTITUTIONALIZATION OF CLIMATE CHANGE ADAPTATION AND MITIGATION IN GEORGIAN REGIONS



The program is made possible by the generous support from the American people through the United States Agency for International Development (USAID) and is implemented by the National Association of Local Authorities of Georgia (NALAG).



ჰაერის ტემპერატურის აბსოლუტური მინიმუმის ცვლილება 2071-2100 წ.წ. პერიოდისათვის, °C

სახელმწიფო საზღვარი
 ავტონომიური რესპუბლიკის საზღვარი
 მუნიციპალიტეტის საზღვარი
 რეგიონის საზღვარი
 დასახლებული პუნქტი



მკერდის ქვედა ნაწილში
მკერდის ქვედა ნაწილში



ამერიკის შეერთებული
შტატების საერთაშორისო

மாண்புமிகு பேரவைத் தலைவர் அவர்களே, கீழ்க்கண்ட கேள்விகளுக்குத் தயவுசெய்து பதிலளிப்பாரா:

புதிதேர்தல்-புதிதான உருவம்





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ROAD MAP ON CLIMATE CHANGE

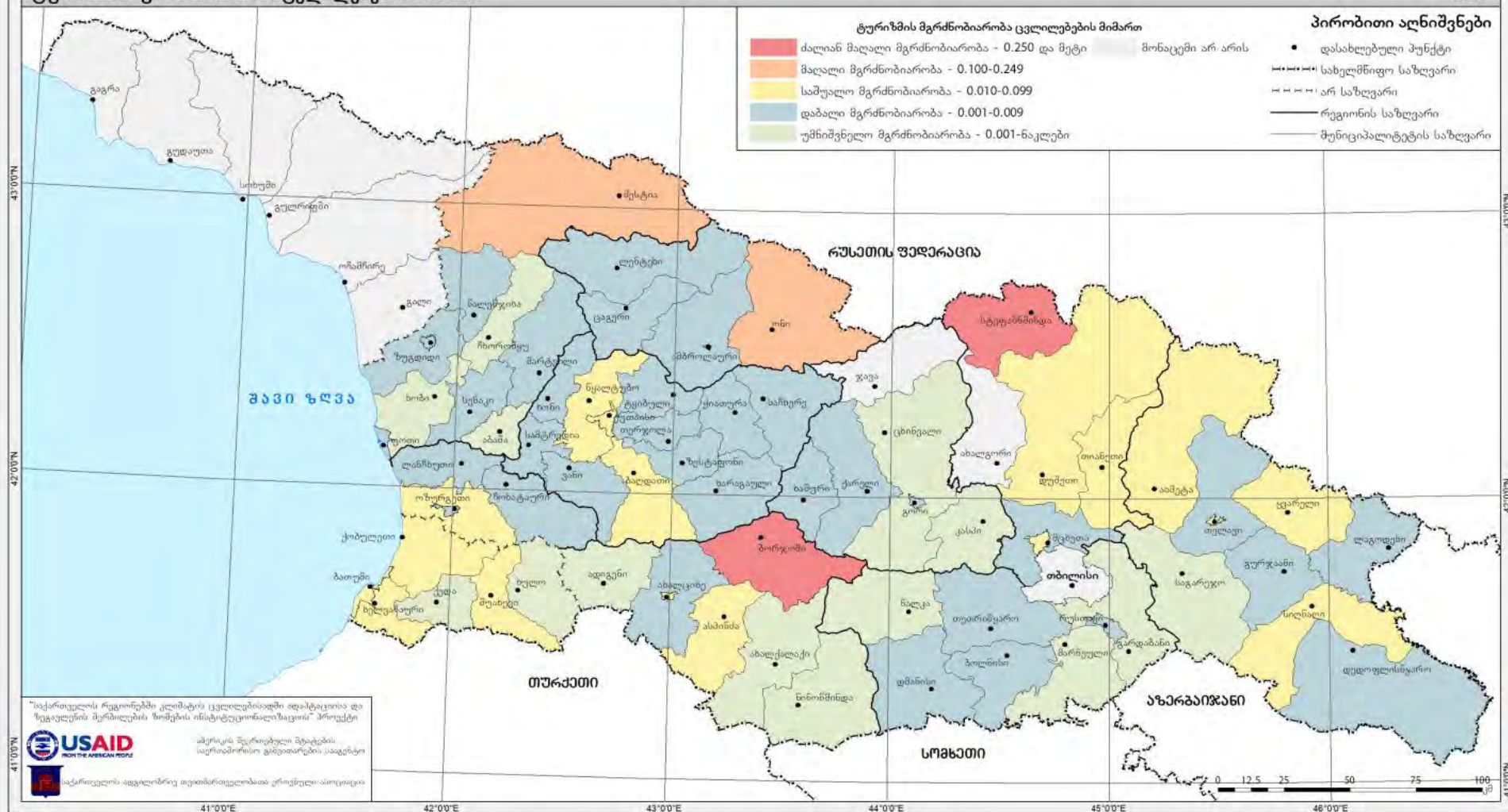
Tourism Sector

- Impacts to Georgia:
- Tourism comprises 6 percent of Georgia's GDP;
- The further growth of this sector, together with other economic factors, are greatly dependent on the environment, climate changes and the ability of municipal governments to implement adaptation measures;
- The evaluation of climate change impacts on the tourist industry, as well as the planning of appropriate adaptation mechanisms are important for the future development of eco-tourism and the overall environmental potential to support these activities.

CC SENSITIVITY OF TOURISM SECTOR

ტურიზმის მგრძნობიარობა ცვლილებების მიმართ

2015



გის და დზ საკონსულტაციო ცენტრი „გეოგრაფიკი“

გეოგრაფიკი
GIS & RS CONSULTING CENTER

GEOGRAPHIC
GIS & RS CONSULTING CENTER

CC SENSITIVITY OF THE TOURISM SECTOR

The map displays the sensitivity of the tourism sector to potential climate change impacts. The tourism sensitivity indicator is calculated the ratio of the total number of beds in hotels/hostels with the relevant population size. This indicator reflects the economic importance of tourism to a particular municipality as it indicates actual and potential employment opportunities.

As indicated by the map, Kazbegi and Borjomi Municipalities, both of which have active tourist sectors, have a very high sensitivity to climate change. The Mestia Municipality has a high sensitivity as the area has witnessed development in its tourist sector over the last several decades. These three municipalities are located within the mountainous zones as Kazbegi and Mestia are within the Great Caucasus, and Borjomi is located in the Georgian southern highlands.

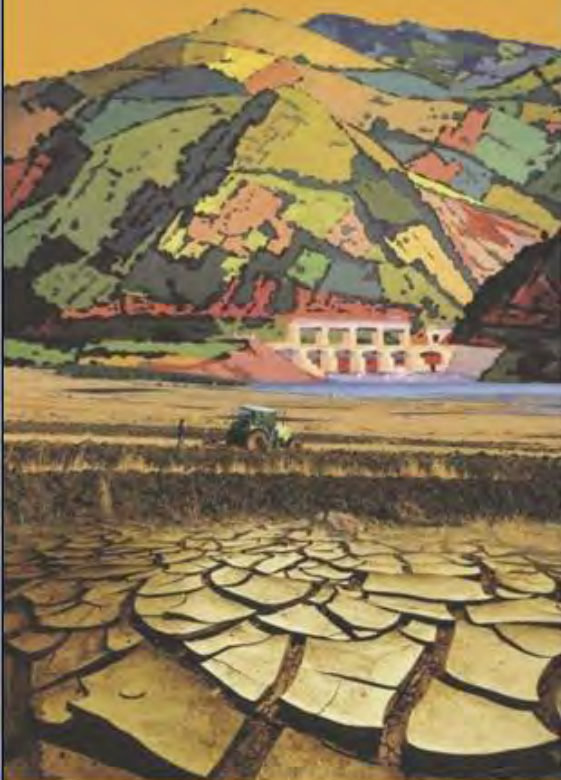
These municipalities all have well-developed tourist sectors, hence their high sensitivity.



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ՀՀ-ում տուրիզմի զարգացման
առաջնություն



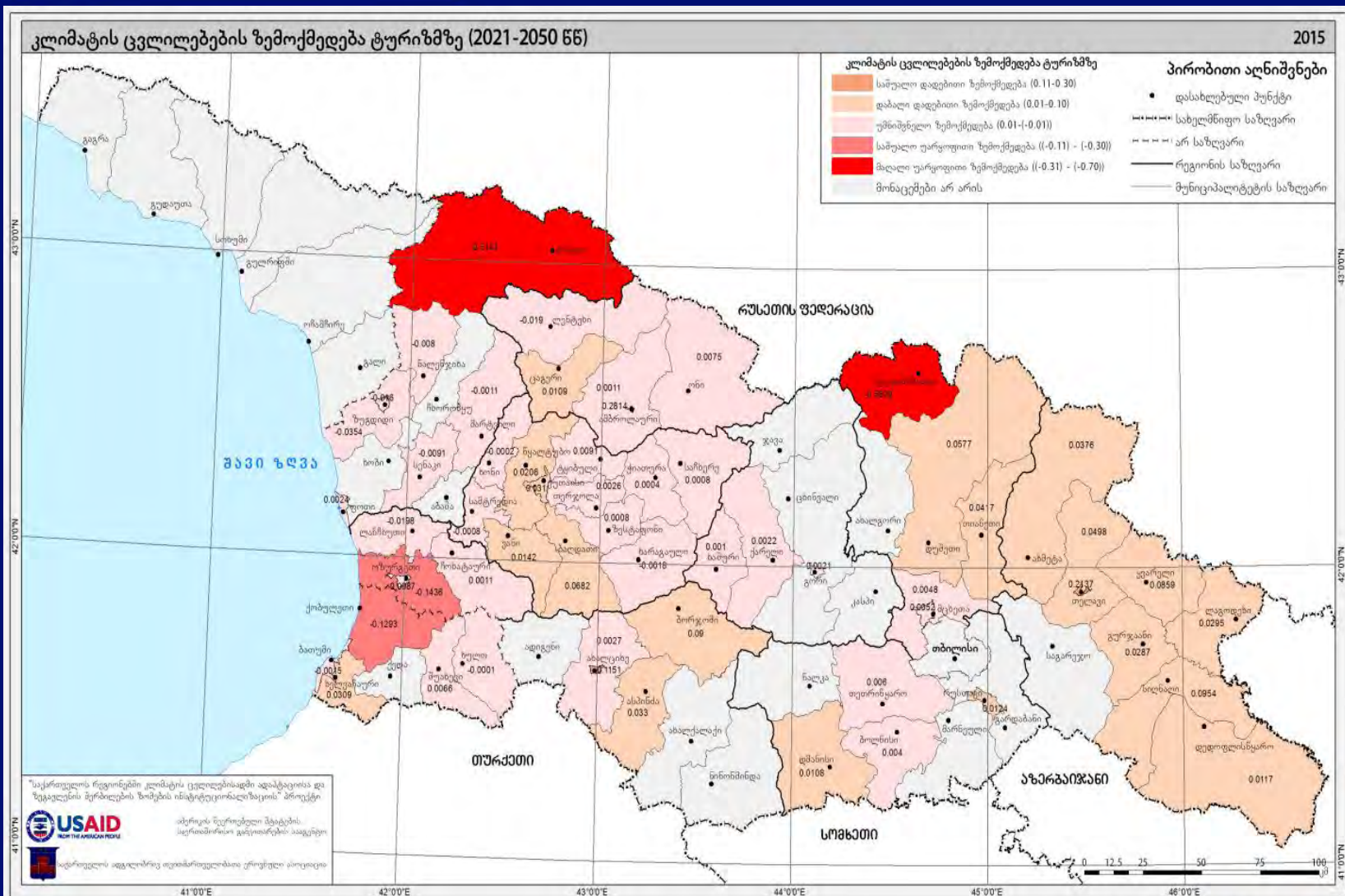
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ՈՏԱՆՈՒՄԵՆՈՒՄԵՆՈՒՄԵՆՈՒ

TOURISM EXPOSURE INDICATORS USED

- Relative change in seasonal mean precipitation for summer tourism
- Change in annual mean snow cover (CDSC) depth for winter tourism

CC IMPACTS ON TOURISM 2021-2050



გის და დბ საკონსულტაციო ცენტრი „გეოგრაფიკი“



CLIMATE IMPACTS ON TOURISM SECTOR, 2021-2050

The map presents the potential impact of climate change on tourism for the period of 2021-2050. The climate change impact on tourism is calculated by combining indicators/values of the climate change impact on summer and winter tourism (mean value).

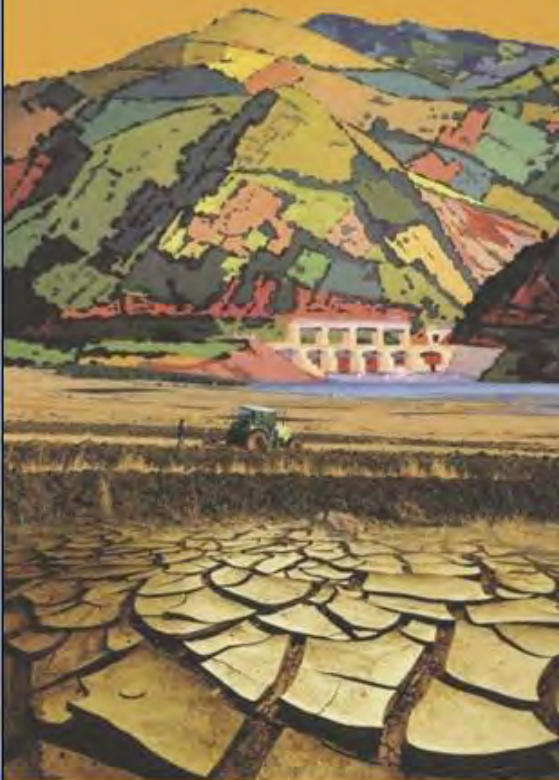
The forecast for 2021-2050 indicates a decline in the mean annual number of snow days, which will negatively impact the winter tourism centers located in Kazbegi, Mestia and Borjomi Municipalities.

In addition, the forecast for 2021-2050 indicates a precipitation increase during the summer and autumn seasons, which will impact seashore resorts. Those resorts located in the Kobuleti and Ozurgeti Municipalities will be negatively impacted.

During the period of 2021-2050, the forecasted increases in air temperature combined with decreases in summer precipitation decrease will prolong the tourism season, but reduce the number of tourists during in the peak tourist season, i.e. summer. In some municipalities, the average impact will be positive and will be potentially observed in Ambrolauri, Telavi and Akhaltsikhe.

საქართველოს ტერიტორიის
კლიმატის ცვლილების
განმარტება

საქართველოს ტერიტორიის
კლიმატის ცვლილების
განმარტების და რეკომენდაციების
განმარტების პროექტი
საქართველოს ტერიტორიის
კლიმატის ცვლილების
განმარტების პროექტი



საქართველოს ადგილობრივი
მთავრობებისთვის
განხილვისათვის

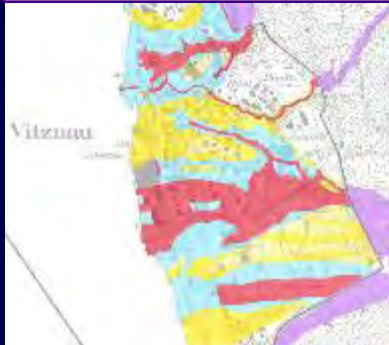
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მთავრობებისთვის
განხილვისათვის
საქართველოს ადგილობრივი
მთავრობებისთვის
განხილვისათვის

Recommendations for Tourism Sector

- It is recommended that the relevant Georgian Ministries develop a sustainable tourism plan integrating the potential impacts of climate change;
- It is recommended to develop a municipal based climate monitoring system that focuses in a variety of disciplines such as climatology, bio-geography, hydrology, geo-morphology, tourism geography;
- It is recommended that general infrastructure, such as roads, transport and water supply networks, be further improved and supplemented. These work should be performed with due regard to potential climate change trends and probable natural hazards caused therein;
- In developing and planning future tourism activities, the promotion of alternative kinds of winter tourism, a particularly vulnerable sector, and the sharing of international experience from the Alpine region, should be taken into account.

Synoptic map of hazards

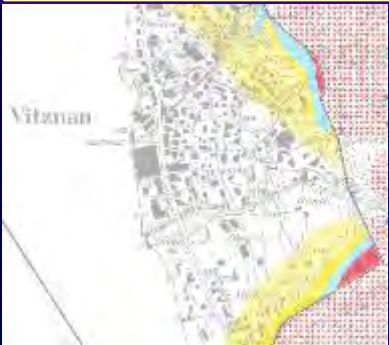
flood



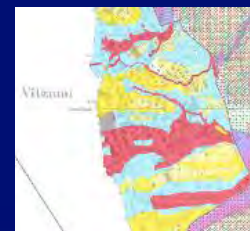
landslide



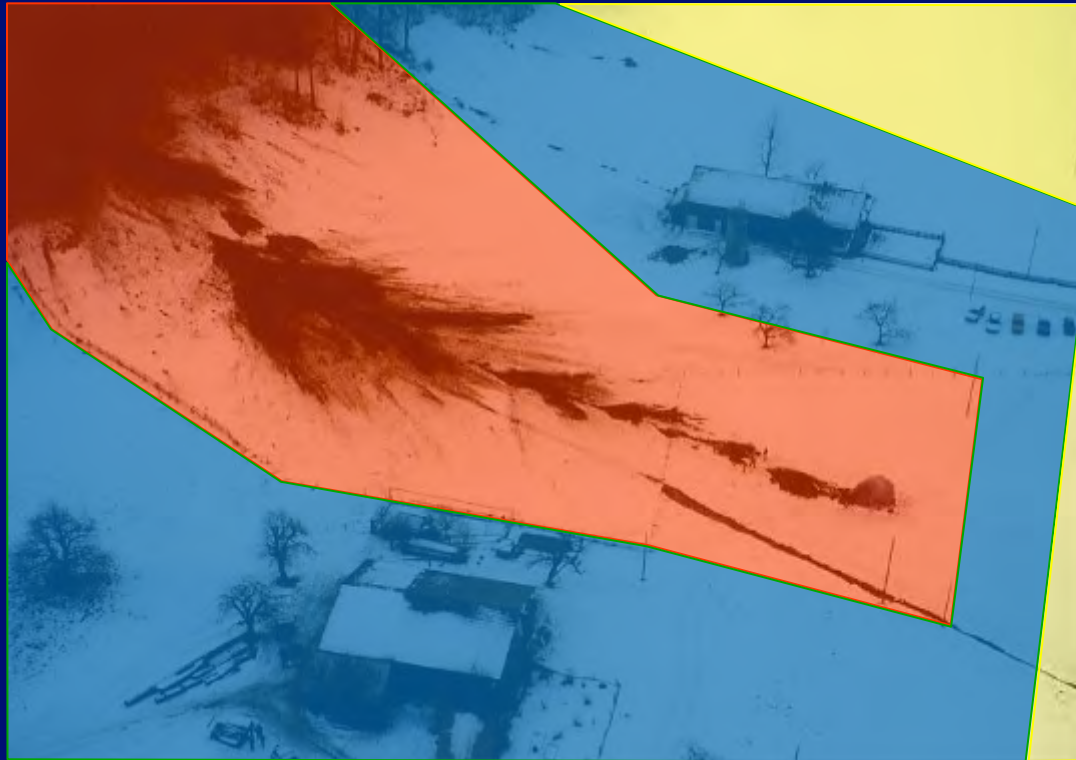
Rock fall



avalanche



HazMap into land-use plan



	considerable hazard:	construction of new buildings prohibited
	medium hazard:	construction only allowed with restrictions
	low hazard:	local protection recommended

Risk Assessment and Zoning

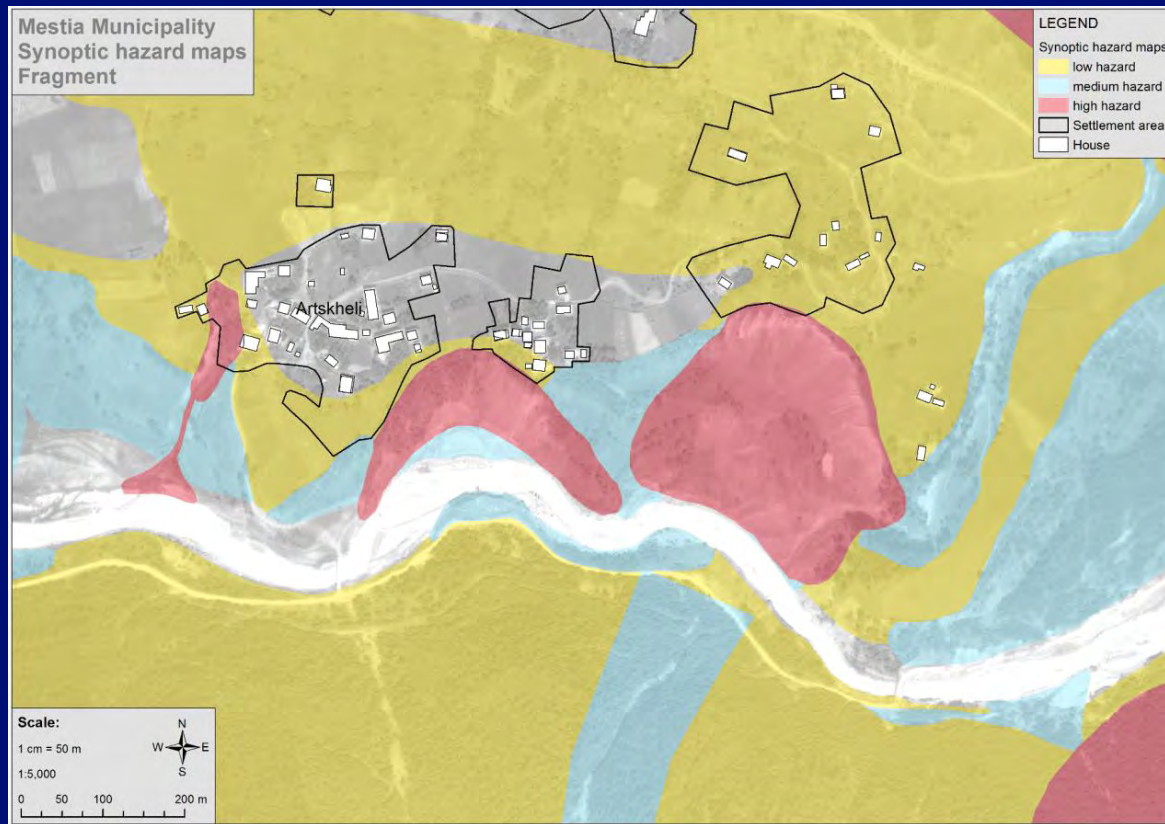
 accepted risk

 not accepted risk





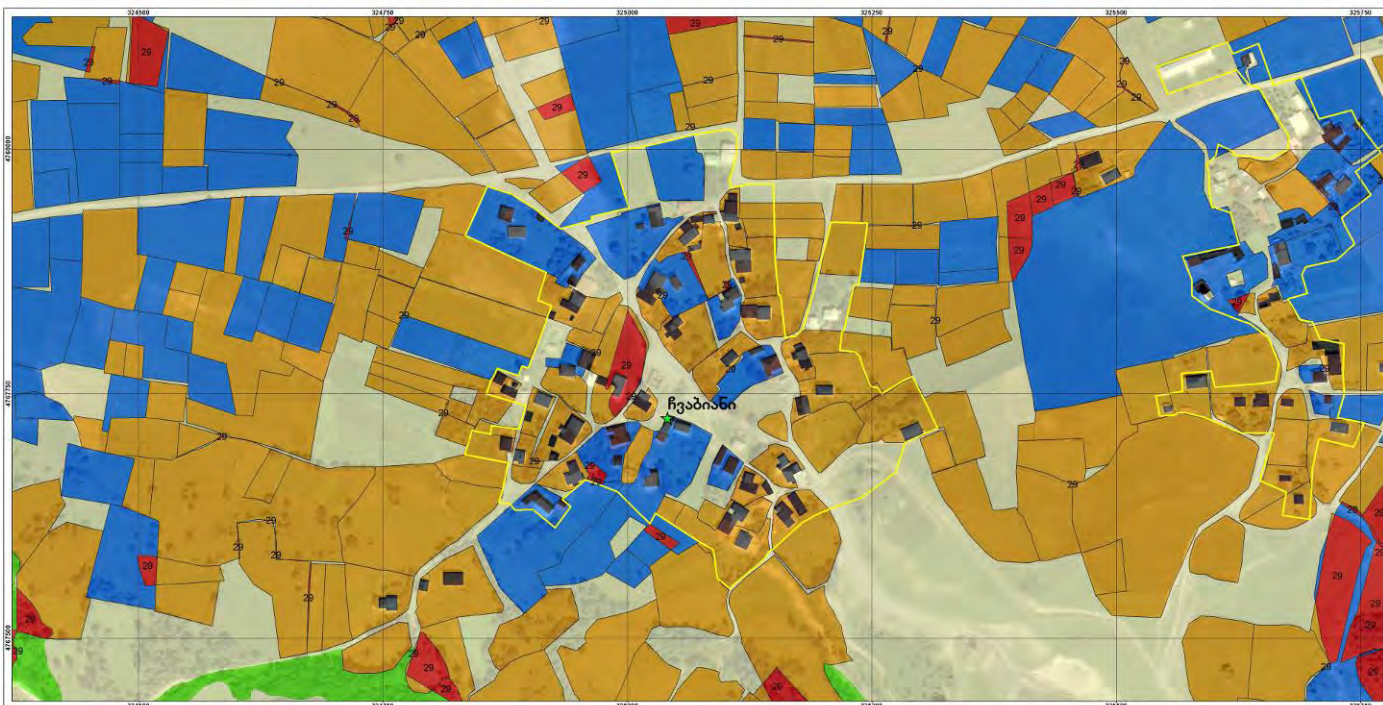
NEA and GeoG HazMaps



Land Information System

სოფელი ჩვაბიანის მიწის ნაკვეთები - მიწის კადასტრის არსებული მგდომარეობის ანალიზი 2016 ოქტომბერი

12.



დაბეჭდეთ:

საქართველოს ეკონომიკისა და
მდგრადი განვითარების სამინისტრო

პროექტი:

მესტიის მუნიციპალიტეტისა და მულახის თემის
სიერცხთ-ტერიტორიული დაჯგუფების
დოკუმენტაცია

გვრძახი 1:

მუღაბის თემის სოფელი წაბიანის
განაშენიანების რეგულირების გეგმის
გეგმარებითი დეტალებს შედგენისათვის
ხინისპროექტო კლუბი და სტრატეგიული
განვითარების ბუფი (კონცეფცია)
1.2.1. სამუშაო ვერსია

1.2.1. နာမိဉ္ဇာနိယ ဖြန့်ချိမှု

პიკოგითი აღნიშვნები:

★ *Verdient*

 Springer

 anlyt
 anlyt

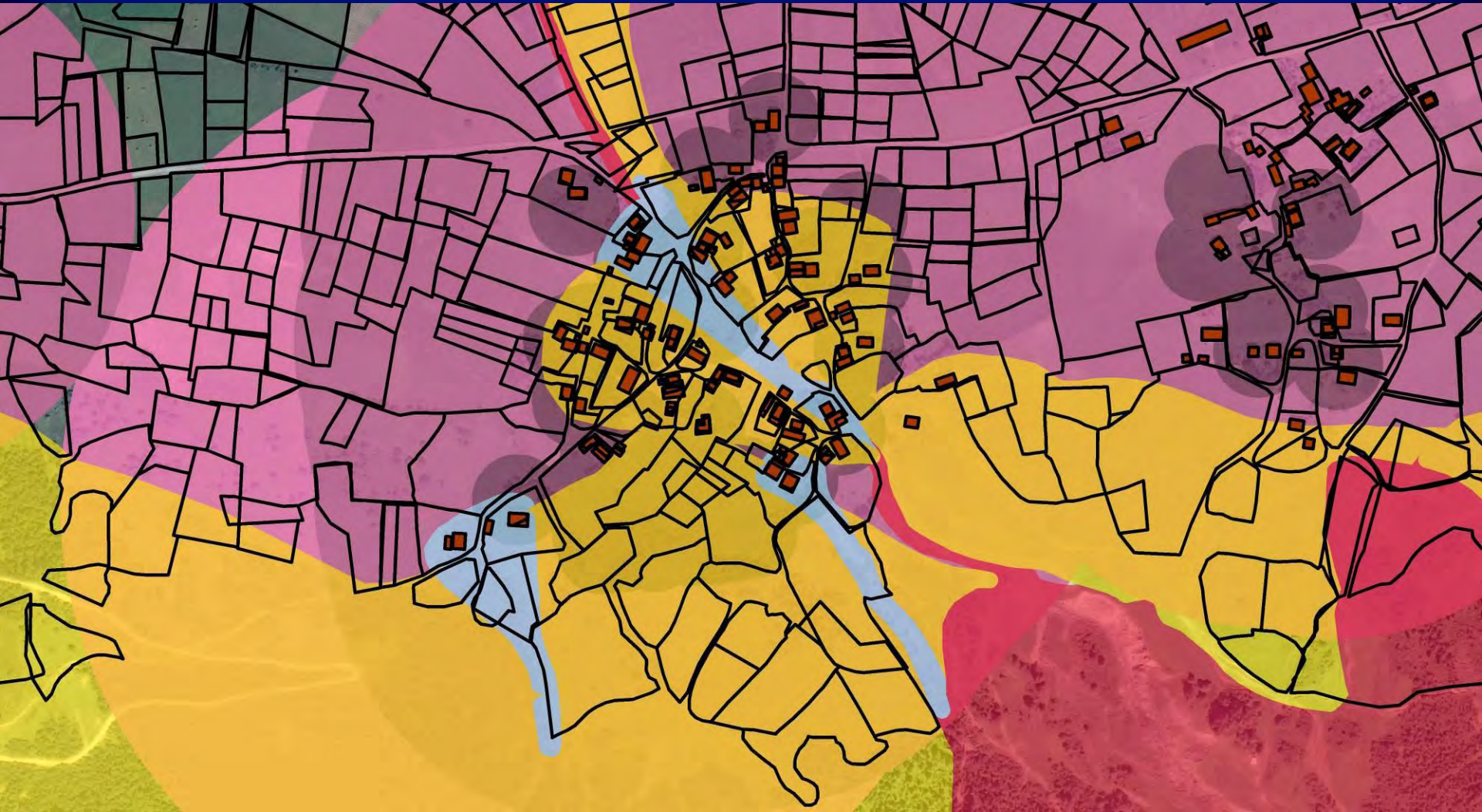
 60.22%
 39.78%

Subject

2010



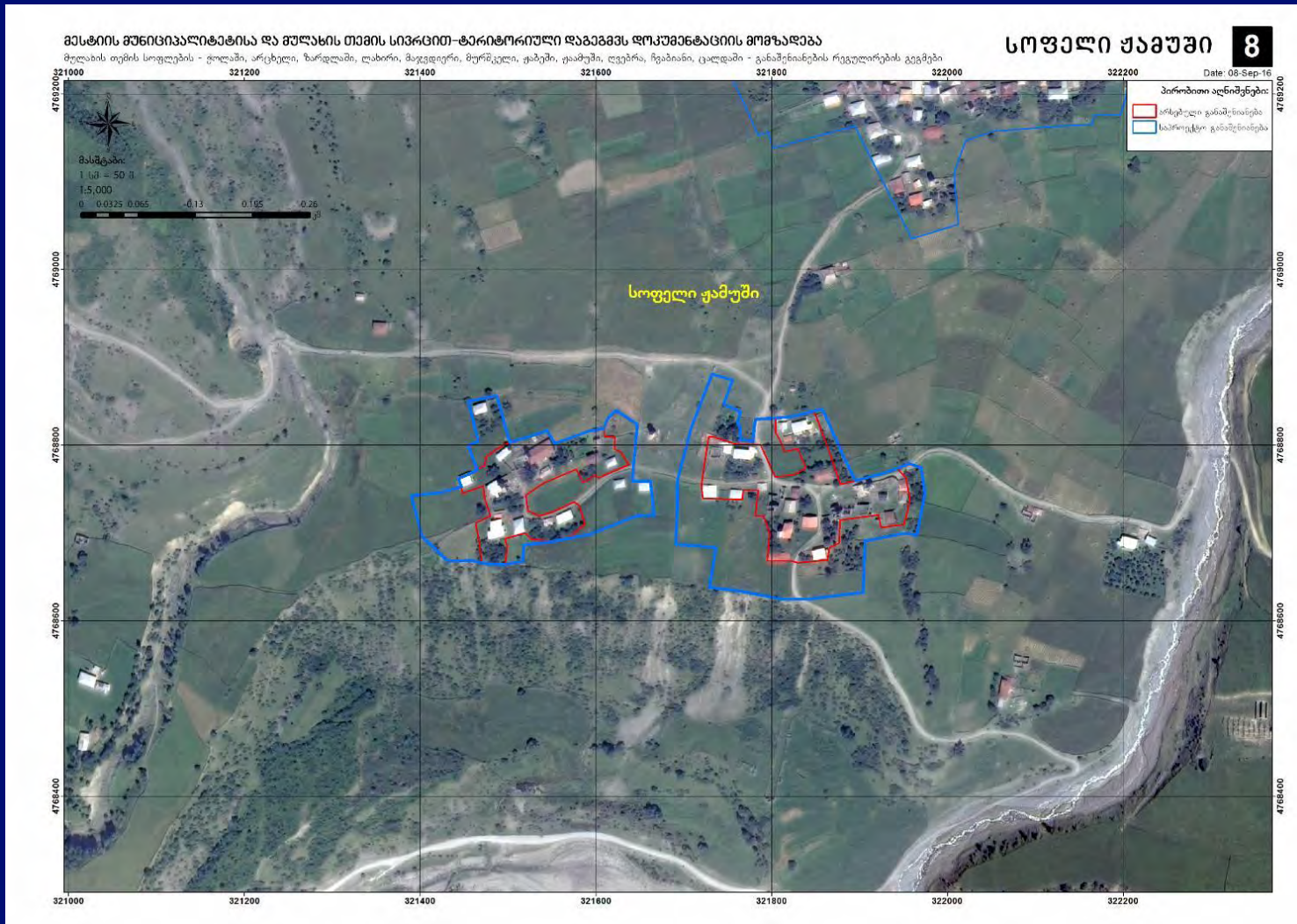
HazMap



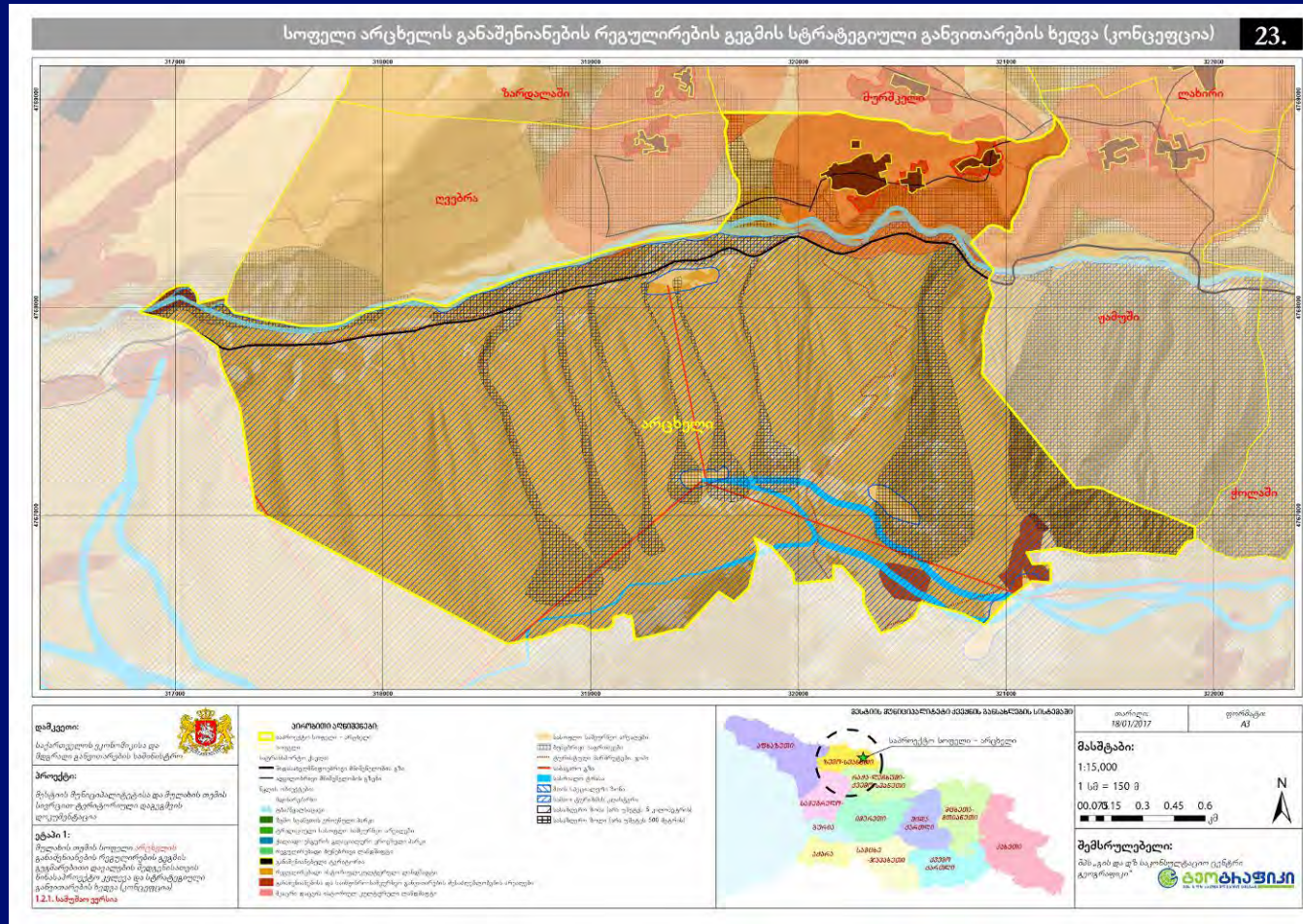
Public Discussions



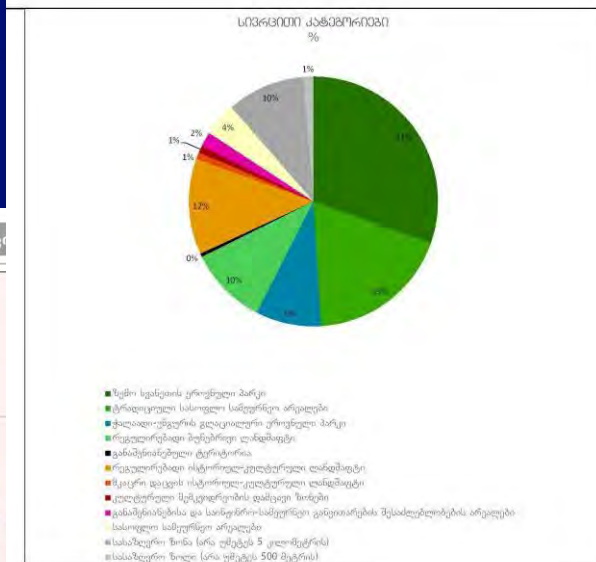
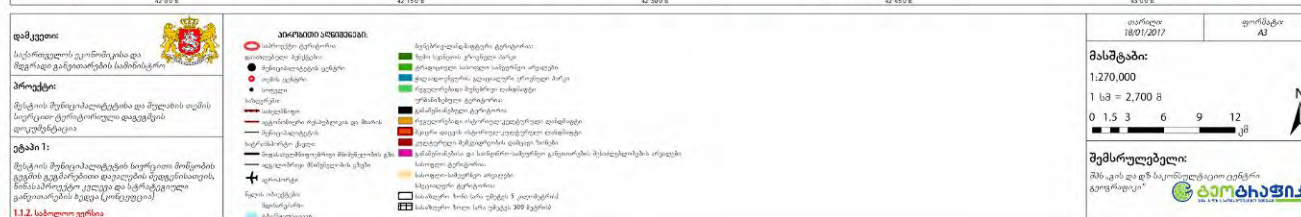
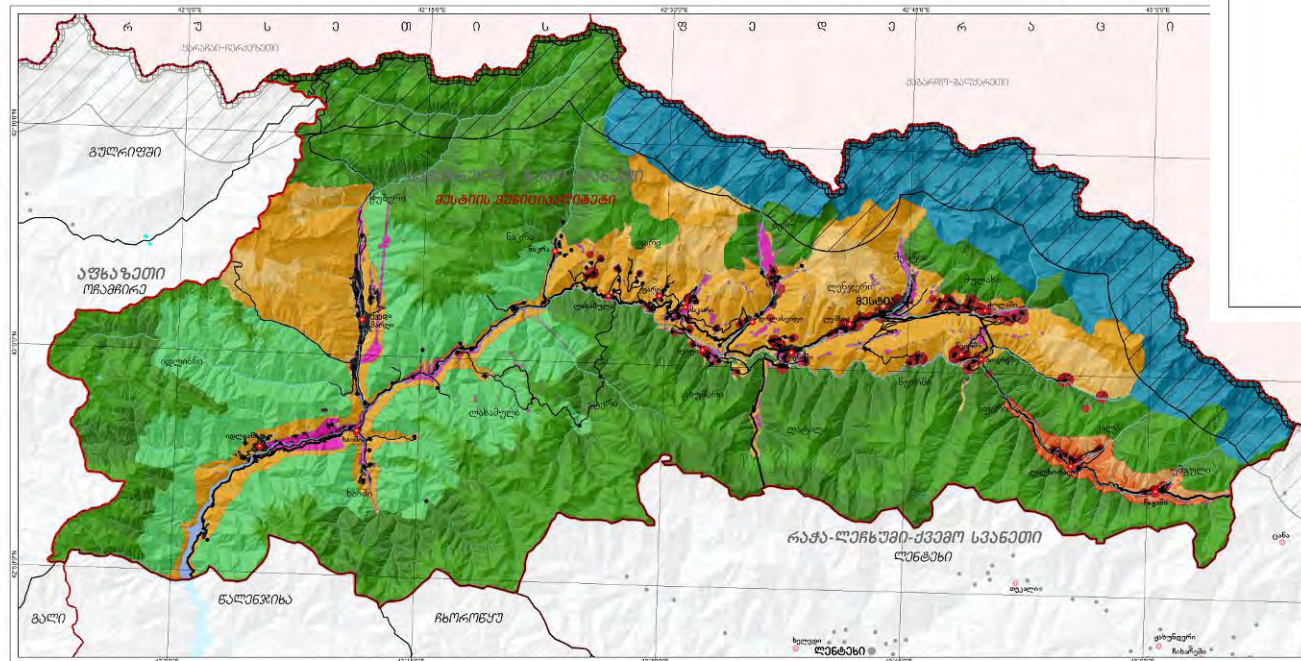
Spatial Design



Integrated Spatial Plans – Good Master-Plans



Integrated Municipal Spatial Plans





Steps of Development

- Focused Studies
- Modeling Scenarios
- Integrated Vision
- Adaptation Guidelines
- Integrated Planning
- Zoning and Regulations
- Adapted Design/Redesign
- “Green” Construction
- Precise Operation
- Integrated Management

Figure 2 shows for example the potential increase in debris flow discharge.

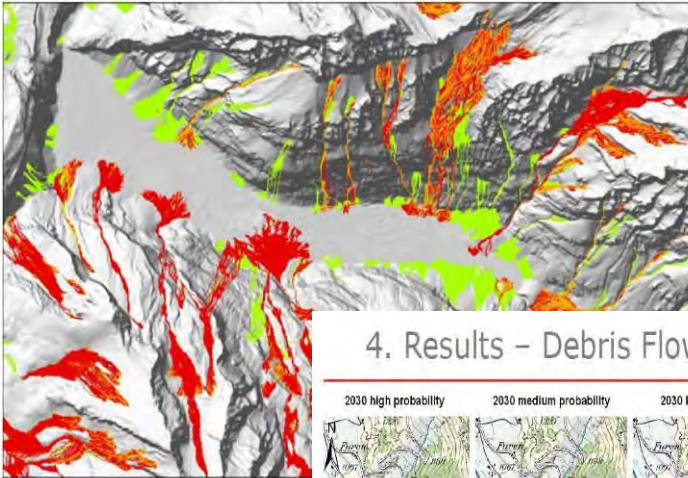
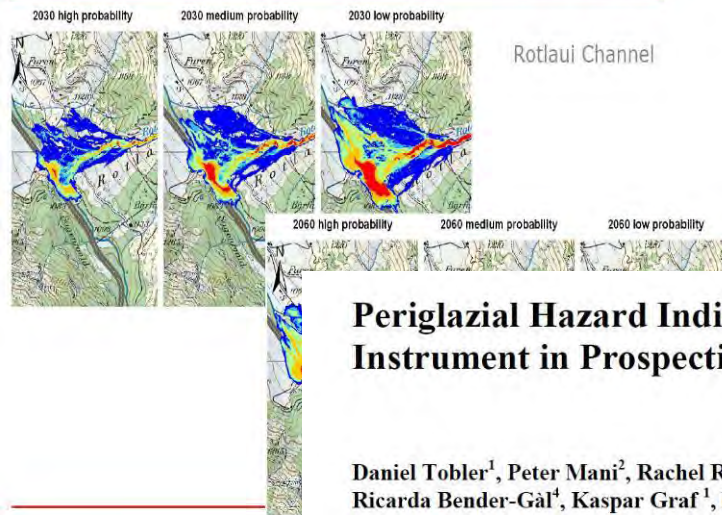


Figure 2: Potential increase in debris valley (Bernese Oberland).

URGENT STEPS – ASAP!

4. Results – Debris Flow

GEOTEST GEOLOGEN
UND INGENIEURE
GEOPHYSIKER
UMWELTSCHUTZ



Periglacial Hazard Indication Map: A Basic Instrument in Prospective Hazard Management

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- 1. Start of surveys and monitoring - URGENT!**
- 2. Modeling, processing of scenarios and zoning;**
- 3. Revision of sectoral visions and consolidation into the unified integrated vision;**
- 4. Processing of unified integrated planning and regulatory document/s;;**
- 5. Integrated management using modern technologies;**
- 6. General and specialized education system adaptation to climate change challenges.**

To avoid:



Public School - Tbilisi, Vere Valley, 2015

Thank You...