First Caucasus Mountain Forum
Bridging Science and Practice for Sustainability

PROCEEDINGS

Tbilisi, Georgia, 28.11.-01.12.2016
FIRST CAUCASUS MOUNTAIN FORUM: 
BRIDGING SCIENCE AND PRACTICE FOR SUSTAINABILITY 

PROCEEDINGS 

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2. THE FIRST CAUCASUS MOUNTAIN FORUM: OVERVIEW

FORUM BACKGROUND

The Caucasus is a unique mountain region situated at the crossroads of Europe and Asia, between the Caspian and Black Seas. Home to 50 ethnic groups speaking 40 languages, the region has a rich and diverse cultural history and heritage. The Caucasus is also known to be home to one of the world’s most significant – and most threatened – reservoirs of plant and animal life. The Caucasus mountain ranges naturally draw together the six countries of the region (Armenia, Azerbaijan, Georgia, Islamic Republic of Iran, the Russian Federation and Turkey). While efforts to address sustainable development challenges related to poverty reduction, social protection, and environmental quality have quite a long history, armed conflict and political volatility have largely undermined the emergence of a concerted response to urgent problems.

In an effort to build on the history of cooperation, knowledge creators and brokers of the wider Caucasus region created the Scientific Network for the Caucasus Mountain Region (SNC-mt) in 2013 (www.caucasus-mt.net). SNC-mt is organized as an open network of researchers and other stakeholders interested in disciplinary, interdisciplinary and transdisciplinary research and collaboration, building research capacity in the Caucasus region and linking research to the needs of sustainable development and environmental protection. The Network strongly relies on the input and participation of its members and also benefits from the experience of other mountain regions that is shared through such organizations as the “International Scientific Committee on Research in the Alps” (ISCAR), “Science for the Carpathians” (S4C), and the “South Eastern European Mountain Research Network” (SEEmore). International partners such as the United Nations Environment Programme Regional Office for Europe (Vienna Office), the University of Geneva, and GRID Arendal have supported SNC-mt from the start.

FORUM AIMS AND OBJECTIVES

SNC-mt activities during 2016-2017, include organizing the First Caucasus Mountain Forum (CMF), developing an online platform for scientists and practitioners, coordinating the elaboration of an up-to-date regional outlook and research agenda, establishing a regional summer school for graduate students, and carrying out a pilot test for a regional spatial data infrastructure.

The Caucasus Mountain Forum is designed to serve as an important opportunity for scientists and academics, governmental experts, and practitioners to meet and exchange views on opportunities and challenges, and thereby seek to enhance (sub)-regional dialogue and contribute to the better coordination of sustainable development of the Caucasus region. Sustainable mountain development is understood to: relate to a wide spectrum of sectoral topics; require the mobilization and linking of diverse scientific disciplines; concern actors from the public, private, and non-governmental spheres; have implications for intergenerational equity and justice; and, crucially, benefit from the involvement of practitioners and decision makers from local to global levels.

The overall goal of the Caucasus Mountain Forum and its long-term objective is to support regional cooperation and joint research among Caucasus scientists and thereby promote evidence-based decision-making for sustainable development in the region.
The immediate objectives of the “Caucasus Mountain Forum” are to:

- Offer state-of-the-art insights of scientific knowledge relevant to sustainable development in the Caucasus region
- Link research, policy-making and practice in the field of sustainable mountain development;
- Showcase scientifically informed, practical actions leading towards sustainability in the Caucasus mountain region;
- Provide a forum for promoting a joint regional mountain agenda; and
- Increase the visibility of the Caucasus region at the Pan-European and global levels.

FORUM OVERVIEW

On 28-30 November 2016, the First Caucasus Mountain Forum (CMF) was held in Tbilisi, Georgia, gathering over 160 participants from the Caucasus countries of Armenia, Azerbaijan, Georgia, Iran the Russian Federation, and Turkey, as well as Austria, Germany, Italy, France, Kenya, Poland, Switzerland and Uzbekistan. The Forum was organized within the framework of the SCOPES project “Supporting Sustainable Mountain Development in the Caucasus”, with funding from the Swiss National Science Foundation, the Swiss Agency for Development and Cooperation, and the United Nations Environment Programme.

The First CMF was hosted by Ivane Javakhishvili of Tbilisi State University and Ilia State University. The rectors of the respective universities, as well as the head of the Swiss Agency for Development and Cooperation made welcoming remarks.

The Forum was then opened by Olivier Bürgi, Director of the SDC Caucasus Office. Among high-level guests were the Extraordinary and Plenipotentiary Ambassador of the Swiss Confederation to Georgia, as well as representatives of the Ministry of Environment and Natural Resources Protection of Georgia. Among the keynote speakers of the CMF were Jean Radvanyi, Professor at INALCO1, Paris, and member of the CASCADE project2, Nugzar Zazanashvili, Conservation Director of WWF Caucasus and professor of Ilia State University, as well as high-level representatives from Tbilisi State University and Ilia State University.

A broad range of topics related to sustainable development were covered at the CMF including disaster risk reduction, climate change, tourism, regional development, biodiversity conservation, and water management. These topics were addressed in three interactive workshops, 13 thematic sessions, and poster presentations. The CMF also had four plenary sessions, including one on disaster risk reduction and one on climate change. Since both topics are part of SDC's portfolio of activities in the Caucasus, relevant presentations of SDC project experiences were made. Responsible governmental agents from Armenia, Azerbaijan and Georgia took part in the session. UNEP lead the plenary session on climate change with the involvement of UNFCCC focal points’ representatives from three Caucasus countries, and scientists from the National Environment Agency of Georgia.

The closing session of the CMF was dedicated to a plenary discussion of the Caucasus Regional Research Agenda3 with the involvement of government representatives, practitioners and scientists from the Caucasus and Carpathians.

A proposal-writing workshop for young scholars and interested stakeholders was held on the day after the closing of the CMF.

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1 www.inalco.fr
2 www.cascade-caucasus.eu/en_GB
3 http://caucasus-mt.net/projects/res-agenda
The CMF served as an important opportunity for scientists, governmental experts, and practitioners to meet and exchange views on opportunities and challenges, and thereby seek to enhance (sub)-regional dialogue and contribute to the better coordination of sustainable development of the Caucasus region. The Forum’s overall goal and long-term objective is to support regional cooperation and joint research among the Caucasus scientists and thereby promote evidence-based decision-making for sustainable development.

As one of SNC-mt's flagship activities, the first CMF benefited from high visibility, including an announcement in the UN Secretary General’s July 29 report on Sustainable Mountain Development to the General Assembly. The Network was also recognized in a recent UN General Assembly Resolution.

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OPENING SESSION

WELCOMING REMARKS

The Forum was opened by Mr. Joseph Salukvadze, Professor at Tbilisi State University, member of the Scientific Steering Group of the Scientific Network in the Caucasus Mountain Region (SNC-mt), the organizing team of the First Caucasus Mountain Forum. Mr. Salukvadze welcomed the distinguished guests and participants of the Forum and opened the floor for the opening remarks and discussion.

Olivier Bürki, Regional Director, Swiss Agency for Development and Cooperation, Office for the South Caucasus, Embassy of Switzerland

The organization of the Caucasus Mountain Forum (the Forum) is important not only because it is first in its nature to be organized in the region, but also because it comes at a very timely moment. It is clear that sustainable development is solidly back on the world agenda to comprehensively address the three dimensions of social development and social, economic and environmental challenges. Only a year ago, the United Nations General Assembly gave a key mandate to make progress in this direction, first by endorsing the sustainable development agenda and the sustainable development goals. Mountains are one of the prominent aspects of this agenda, specifically mentioned in target goal #15. This gives us a normative framework that encourages moving in this direction. A number of other initiatives have also taken place, first of all the 2015 Paris Climate Conference and a very major event in Uganda, with the World Mountain Forum. Thus the international community and the scientific community are moving forward on this important agenda.

In the Caucasus, there also is a solid basis to work on and build a partnership. In the case of Georgia was one of the first countries that actually came up with a first draft of a sustainable development agenda and respective goals that was presented in the UN General Assembly this year. However, much more needs to be done. We need to promote research, we need to provide evidence, we need to define targets for effective progress in this area and scientific and development communities have the most important roles and responsibilities. They need to provide data, they need to offer expertise, they need to come up with proposals and ideas to inform policy making and more importantly decision making.

Switzerland as a mountainous country will contribute its fair share to this collective effort. Switzerland is currently elaborating the country’s sustainable development strategy, respective goals and, of course, it will be quite active in the framework of cooperation worldwide. Switzerland has a long-standing history of cooperation with the governments of Armenia, Georgia and Azerbaijan notably in the field of disaster-risk reduction. Here in Georgia, for instance, extensive work has been conducted with the government and respective stakeholders on Swiss-inspired methodologies to comprehensively map natural hazards and suggest responses and mitigating mechanisms.

Most importantly, the Forum is all about science and practice for sustainability in the very unique cultural and social, economic and ecological setting of mountainous regions and it will cover a vast area of topics and issues specific to the regions, such as effective poverty reduction, social production, economic growth and environmental quality for sustainable development.

Giga Zedania, Rector, Ilia State University

In Georgia, you can detect a certain tension between two very important principles throughout history: the first principle is that of the sea and the second is that of the mountains. This tension has been present for centuries and it has had its geographical, geopolitical, economic and cultural dimensions. Of course, today when we think about this problematic we have to take into account the current state of knowledge. We no longer believe in the totality and unity of human knowledge, but we definitely are in
need of transcending disciplinary boundaries and in need of scholars and scientists talking to each other. We are in need of transcending this massive divide between natural sciences and human sciences. It is very welcome that the Forum is attempting to do that. It is especially important for the development of knowledge practices in this country that the same objective is reviewed from different perspectives: ecological, geographical, tourism-related etc. And it is definitely not fortuitous that we have a very strong Swiss presence, because Switzerland is a country from which our region can learn a lot in relation with the way mountains are managed or studied. The Swiss Model cannot be imitated, but at least there are some aspects that can be exemplary, applied elsewhere or taken into account when other models are developed in relation to mountainous regions. It is a very positive moment that today such an effort is being made in Georgia with the participation of Tbilisi State University and Ilia State University.

George Shervashidze Rector, Tbilisi State University

Tbilisi State University is pleased to bring back environmental as well as developmental agendas to the University’s focus, particularly since these issues have become prominent in international discourse. Tbilisi State University is working hard to start a new school of governance and sustainable development, to create an interdisciplinary place with a rigorous and intensive research agenda that would reflect all relevant disciplines, to address problems in relation to research on the mountain areas of Georgia as well as in most post-Soviet countries. Environmental problems are linked not only to environment and nature, but also to the cultural transformation of the spaces as well as demographic problems that have been severe, especially in the mountainous regions of Georgia. A number of years ago, Georgia began a smooth progression towards becoming an environmentally friendly state. This was the first attempt of the state to recognize these problems. The first organization that worked on environmental issues here was the World Wide Fund for Nature (WWF) that was represented in Georgia by German colleagues. Switzerland was one of the first countries to start sponsoring environmental education in the region. We have recently declared 20 percent of our territories to be protected territories, which was a major gift from the state to the Earth. Now there are discussions regarding sustainable usage of resources, planning in the economy and filling in the gaps. This is why this Forum is particularly important, as it brings together 160 participants from more than 15 countries to discuss these issues.

THE CAUCASUS EXPERIENCE WITH THE ECOREGIONAL CONSERVATION PLAN

Nugzar Zazanashvili (nzazanashvili@wwfcaucasus.org), Ilia State University, WWF Caucasus

This presentation aims at introducing the process of developing the Eco-regional Conservation Plan for the Caucasus and stresses the fact that even in such a politically complicated region as the Caucasus, it is possible to develop a regional network of scientists, experts, conservationist and practitioners. The process was kick-started with worldwide recognition of the Caucasus ecoregion as globally important and with its inclusion in the World Wide Fund for Nature (WWF) Global 200 and Conservation International (CI) 25 Hotspots in the late 1990s. When the Priority Places were later revised (CI 34 Hotspots and WWF 35 Priority Places), the Caucasus region was still included. The initial project plan included the WWF Caucasus as coordinators of the process, was funded by the MacArthur Foundation and covered Armenia, Azerbaijan, Georgia and the Russian Federation in 2001. Later, the full-scale eco-regional planning process started and consisted of the following steps: reconnaissance, biological and socio-economic assessment and development of the biodiversity vision, followed by development of the Eco-regional Conservation Plan (ECP) and conservation programs and projects. The first and most important step in this initiative was delineation of the Caucasian eco-region, which covers the three South Caucasian countries, the Russian Federation’s part of the North Caucasus, north-eastern Turkey and part of northwestern Iran. As part of the process, around 70 species were selected for assessment and approximately 150 maps of their distribution within these countries were compiled. Other biodiversity and socio-economic information was collected and analyzed. Country experts identified key conservation sites of target species and prepared digital maps depicting natural landscapes and ecosystems, protected areas, the actual infrastructure and demography, land use, land cover, etc. More than 160 representatives of academia, NGOs and governmental bodies participated in preparation of the ECP from all six countries of the region. The first edition of the document was quite comprehensive and ambitious.
The ECP has to be revised every five to six years, and was thus first revised in 2011-2012 to reflect the current reality and prominent issues. The document was revised to cover new and emerging threats such as: infrastructure development, illegal logging, overgrazing, poaching and wildlife trade, overfishing, pollution of rivers and wetlands, and, most importantly, climate change. The number of targets and actions were reduced in order to be more realistic and make the plan more doable.

Currently, the second revision of the Eco-regional Conservation Plan is in progress, with greater focus on targets and actions with clear regional implications, greater attention to direct transboundary work and implementable targets and actions, fewer unmeasurable formulations of indicators will be included and even fewer targets and actions will remain in place compared to the first revision. The publication of the final version of this revision is planned for December 2017.

The Caucasus Biodiversity Council (CBC) was established in 2004 as a supportive, oversight and monitoring body for the overall process. It consists of one governmental and one NGO and/or academia representative from each country plus invited experts. WWF Caucasus serves as a secretary. The CBC has ToRs for its members, periodically publishes reports and has organized 15 meetings. Currently, the CBC is in a process of transformation.

The financial sustainability of the Caucasus Protected Areas is provided by the Caucasus Nature Fund (CNF), which was announced with the Berlin Ministerial 2006 and is funded by the German Government (BMZ), Critical Ecosystems Partnership Fund (CEPF) and WWF. The current focus of the CNF is on the South Caucasian Countries and the fund is fully operational in Armenia and Georgia, supporting 16 of the 33 key protected areas and targeting an increase of this number to 20 by 2020.

The overall success of the Eco-regional Conservation Plan is ensured by the fact that it is not legally binding and its functionality is based on the input from a number of contributors representing academia, experts and the NGO sector from all six countries of the region; as well as non-formal governmental contributions. The interest and active involvement of donors, as well as the existence of the so-called “driving force” and coordinating organization from WWF are other contributing factors in its success.

THE CAUCASUS MOUNTAIN REGIONS IN TRANSITION: NEW TRENDS, NEW CHALLENGES
Jean Radvanyi (radvanyi.jean@wanadoo.fr), INALCO Paris and CASCADE project

Mountains are gaining in prominence in the Caucasus. It is worth mentioning that the country of Georgia and the Russian region of Dagestan have both recently passed new laws pertaining to mountain areas. These two laws raise many discussions, even polemics, as it is difficult to define new rules and new territories. It is partly a Soviet characteristic that mountain areas are included in broader administrative territories, thus it is difficult define which village or which valley is mountainous. Another issue is persuading politicians that mountains do matter, because the majority of the population and decision-makers in Georgia, Azerbaijan or in the Russian north Caucasus, may not know about real mountains – for them a mountain is something remote, archaic and even dangerous and the inhabitants are a little wild.

But mountains do matter, especially in the Caucasus, where vast territories are mountainous. Mountains have a real and diverse potential – first, a natural potential as a natural well or reservoir of endemic plants and animal life. Second, they also have an environmental potential, such as with agriculture. Mountain valleys can be developed and used for manufacturing different products such as cheese, wool, ham, wine, etc. Another great potential is, of course, tourism, which has become a major booming sector in the Caucasus as in all mountain areas. But at the same time these potentials present fragilities: you can easily cut the forest; abuse pastures by overgrazing and uncover slopes, creating a risk of landslides, and you can also destroy landscapes by constructing inappropriate buildings.

For sustainable development of the mountains, local populations need help, first from state and local governments. Unlike France and other Alpine countries, practices are different in the Caucasus. Huge investment projects in these areas, such as development of touristic attractions and resorts involving national and foreign partners, although sometimes successful, have one weakness: they often leave out
the local population, the local actors. Small businesses, small local actors need to be supported and encouraged in order to keep the population inside the mountain areas. This is particularly difficult to implement because the Caucasus is strained with ethnic and territorial disputes and conflicts; here there are also specific rules of agriculture management often derived from local and religious traditions. Another sensitive issue is that Islamic organizations are sometimes more active and better equipped than many official international programs. But there can be no sustainable development in mountains without the involvement of local populations or through development that is against them. Thus new ways and solutions need be found, through exchange of experiences with other mountain communities such as the Alpine countries, through different education and scientific programs, with support of governmental bodies and of course with the support of international organizations as well as national NGOs and the private sector, etc. In this regard, Switzerland has done profound work in the Caucasus and in Central Asia. Hopefully, the Forum will also serve as a platform for discussing these issues and sharing experiences in the future.

THEMATIC SESSION 1: HAZARD RISK ASSESSMENT

FLOODS, AVALANCHE AND MUDFLOW RISKS IN THE NORTH CAUCASUS
Svetlana Badina (bad412@yandex.ru), Lomonosov Moscow State University

The increased importance of natural hazards and their catastrophic consequences for the Russian population and economy make this study particularly relevant today.

To assess the socio-economic risks of natural hazards, we developed a group of indexes that were based on a comparison of the cumulative territorial socio-economic potential and the probability of natural hazards. We based our methodology on the principle that natural hazards show their essence only when they take place in areas with human development. Otherwise, these risks can only be considered natural phenomena. This is especially true for mountain regions.

First, we developed the concept of “density of accumulated territorial social-economic potential.” For this purpose, we considered the socio-economic characteristics of natural spaces outside of administrative borders (inside administrative borders we investigated only areas with human development). We tested our methods on a group of the Russian North Caucasus region (at the municipality level). We detected zones with different levels of risk. This step allowed us to select municipalities that would benefit from more large-scale studies (for example, Sochi, the site of the 2014 Winter Olympic Games). As a result, we created a series of maps and a typology of municipalities that are based on a combination of two parameters: the probability of natural disasters (in our case – floods, avalanches and mudflows) and the level of socio-economic potential. The high density of the socio-economic potential of the territory provides high development prospects for these areas. Thus, development of hazardous areas is most likely here (due to limited land resources). Therefore, we must take into account the risks of natural hazards and the proposed method is a necessary tool for this. This methodology may be used to develop monitoring systems, programs to protect the population and economic objects, territorial planning and economic development.

THE SEISMIC FEATURES OF JAVAKHETI PLATEAU
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The Javakheti volcanic area extending over the area of the highlands of the same name is situated in the central part of the Lesser Caucasus mountain system. It is an active seismic zone in the Caucasus area.

There have been many epicenters of earthquakes that have accumulated in this area throughout the 20-year period of the study. This work addresses the features of seismogenic zones in the highlands. During our study we used the seismic data for 1995-2015 period from the Armenian National Survey for
Seismic Protection (NSSP).

Conclusions
The study results were based on different types of analysis, which are presented here below:

- The analysis of results shows that epicenters have a diffuse distribution. There are young volcanoes in the study area and this situation can be connected with them.
- The study area is situated in a region where earthquakes are constantly observed, with magnitude values from 1.0-2.5 during the study period.
- Epicenters of M≥3.5 earthquakes are primarily extended along the active fault zones.
- As a result, we can note that the magnitude of completeness (Mc) in the study area is equal to Mc=2.0 (1995-2015), and seismic activity of this zone is in a range of normal values.
- In this area, high magnitude earthquakes were observed very rarely. We had only five earthquakes with a magnitude M≥4.0 (1995-2015).
- We represent the graph of earthquake repeatability to introduce the seismic characteristics of the Javakheti Highlands. Gutenberg-Richter graph (cumulative number and magnitude relation) shows that this value is b=0.7.
- Our last analysis shows that the maximal value of magnitude is equal to 6.0 (Mmax=6.0), this means that expected earthquakes in this area will not exceed the maximum Mmax=6.0.

THE STUDY OF SURFACE AND SUBSURFACE TECTONIC STRUCTURE IN THE ZONES OF ACTIVE FAULTS (ARMENIA)

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Armenia is situated in the central part of the Arabian collision and accommodates the seismogenic Pambak-Sevan-Syunik Fault, which is the most active fault in the country. Many earthquakes attest to the activity of this fault, including the 1988 Spitak earthquake. Considering the high incidence of seismic hazards in Armenia, as well as the high seismic risk that has been determined, assessment of the width of active fault impact zones has great importance. Such an assessment would enable understanding the surface and near-subsurface structures of the fault. Studying these structures, it is possible to clarify the width and the geometry of the active fault, develop a highly accurate seismo-tectonic model of the considered site, upgrade the accuracy of seismic hazard assessments, and reduce seismic risk.

The goal of the study was to apply geological and geophysical methods to study and evaluate the technique of assessment of the width of the active fault impact zone. The task was realized within individual segments of the active Pambak-Sevan-Syunik Fault, in particular, within the sites of Karkar and Sev-Lich in Syunik, as well as in the depressions of Vanadzor and Fioletovo. The structure of the fault, surface ruptures and their features were studied at individual sites. New segments of faults known earlier were identified, which supported and supplemented the facts and assumptions made concerning the tectonic structure of the sites. The surface and near-subsurface structures of the faults were investigated in detail. The following targeted studies were realized:

- Geological and geophysical study of individual segments of the active Pambak-Sevan-Syunik Fault;
- Verification of the current assumptions about the tectonic structure of individual segments of the active fault;
- Identification and study of surface and near-subsurface structures in the active fault zone;
- Efficiency of geo-radar surveys in the activities aimed at evaluation of the width of active fault zones;
- Development of 2D or 3D models of the studied sites;
- Estimation of the width of active fault impact zone.

The following conclusions and recommendations are formulated based on a summary of other surveys realized for the study and the study results:

- The investigations aimed at estimating the width of impact zones of the active faults present within the selected sites of the active Pambak-Sevan-Syunik Fault were realized through a complex of field geological and geophysical works. The collected data were also correlated and confirmed by the irregularities of relief manifested along geo-morphological profiles. Near-
subsurface faults were identified by the geo-radar survey at the first site and then exposed by the paleoseismological trench;

- Near-subsurface and deep elements of active tectonics were identified within the studied sites: they developed flower-shaped structures in the form of pull-apart basins. Their inner structures can be different and depend on the regional extension or compression force effects, active fault direction, rocks encompassing the active fault, and other factors; thus, oval-shaped uplifts and oval-shaped depressions are observed in the Fioletovo depression and within the Karkar and Sev-Lich areas, respectively; and

- Based on the data of the completed studies, 3D tectonic models were developed that included both the near-subsurface and deep structural elements. The width of the zone of the active Pambak-Sevan-Syunik Fault varies in a range from a few hundred meters up to six kilometers, the dimensions that are determined by the structural and geodynamic features of the site, and by the developed pull-apart type basins.

GROUND PENETRATING RADAR (GPR) 3D SURVEY FOR INVESTIGATION ARCHAEOLOGICAL OBJECTS

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The goal of the survey is to find out and study archaeological objects in Armenia and Egypt. During the study we used GPR geophysical method. Ground penetrating radar (GPR) is the only near-surface geophysical tool that can make three-dimensional maps and images of the subsurface at archaeological sites. The technique involves transmitting radar waves from a surface antenna, reflecting them off the buried discontinuities and measuring the elapsed time before the reflections are received again at the surface. When many linear transects of reflections are collected in a grid, with many reflections recorded every second, a three-dimensional cube of reflections is derived from the buried features and related stratigraphy is visible.

The memorial temple of Amenhotep III is located on the west bank of the Nile River opposite of the modern city of Luxor (Egypt). Luxor or ancient Thebes was the capital of Egypt for many centuries and is one of the most famous archaeological sites in the world. The memorial temple of Amenhotep III was the largest temple ever built in Egypt.

Shengavit (Armenia) is located in Yerevan. It was an urban area in 3400 BC until about 2000 BC age. At the sites, GPR maps and images were used as a guide to excavations. A number of buried buildings were discovered, as well as stratigraphic horizons that were later found to contain evidence of ancient settlements. Archaeological information from the test trenches whose locations were chosen using GPR maps was then used to calibrate the GPR reflections, effectively testing the accuracy of the method, which proved to be excellent. The GPR data were not only successful in guiding excavation strategy, but when integrated with information from the excavations, will be used to make detailed maps of many areas of the site that will likely remain buried.

During the mentioned archeological surveys, the GPR survey method was applied largely to study buried artifacts and identify possible discontinuity zones formed as a result of earthquakes during the ancient time.
RADAR MONITORING OF DANGEROUS METEOROLOGICAL PROCESSES IN EASTERN GEORGIA

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In 2015, after having been out of service for 25 years, an Anti-Hail System was re-launched by DELTA with the participation of the M. Nodia Institute of Geophysics of Tbilisi State University. This system is equipped with modern radar (Meteor 735CDP10 by SELEX ES) with special software. This radar is placed in Eastern Georgia in the Chotori village at 1090 m a.s.l., with an actual working radius of 70-100 km, but an observation radius of more than 200 km with good data quality. Modern weather radar is mostly pulse-Doppler radar, capable of detecting the motion of rain droplets in addition to the intensity of the precipitation. The data can be analyzed to determine the structure of storms and their potential to cause severe weather. Weather radars send directional pulses of microwave radiation, on the order of a microsecond long, using a cavity magnetron connected by a waveguide to a parabolic antenna. Radar pulses spread out as they move away from the radar station. Thus, the volume of air that a radar pulse is traversing is larger for areas farther away from the station, and smaller for nearby areas, decreasing resolution at far distances. The radar is applicable also in hazard detection and prognostic aims. It also has educational value. Real-time experimental data is obtained and stored using this technique.

The most common application for weather radar is to monitor weather conditions, nationally and locally. Currently, weather conditions are observed for the entire territory of Eastern Georgia and large parts of neighboring countries – Armenia and Azerbaijan. As an example, the Tbilisi flooding on 13 June 2015 and other cases of heavy precipitation and hail processes have been analyzed.
WORKSHOP 1: POLICY ADVOCACY AT THE SCIENCE-POLICY INTERFACE

INTERNATIONAL CAUCASUS MOUNTAIN CENTRE (ICM-C): CONCEPTUAL FRAMEWORK
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The main goal of the initiative is to promote and facilitate the establishment and development of an International Caucasus Mountain Centre (ICM-C) through facilitating inter-country and regional civic dialogue platforms for peaceful and sustainable mountain development in the Caucasus. In order to achieve this goal, the Initiative, which had been successfully registered in February 2015 in Tbilisi, aims at preparing the fertile ground for the establishment of the ICM-C/Caucasus Convention through facilitating and promoting inter-country and regional dialogue grounded on the sustainable multi-stakeholder platforms for advocating peaceful co-existence and sustainable mountain development in the Caucasus.

With recognition of the growing importance of a comprehensive and specific mountain agenda, both globally and regionally, it is of utmost importance to facilitate the establishment and development of a “centre of excellence” that is well anchored regionally for integrated mountain development and research in the Caucasus Region. The overall mission of such a centre will be to foster sustainable development in the Caucasus Mountains by promoting an economically and environmentally sound mountain eco-system and by improving the living standards of the mountain population. The mission shall be achieved through the promotion of policy dialogue, cooperation, advocacy, facilitation of the transfer of academic research to the economic, social, and political spheres, and the strengthening of various stakeholder networks within the Caucasus Mountain communities as well as among the six participating states in the region.

The objectives of the above are to:
1. Ensure a solid platform for various networks and initiatives addressing sustainable mountain collaboration and the development agenda in the Caucasus;
2. Encourage and facilitate multi-stakeholder platforms for intra-regional collaboration and peaceful settlement of disputes and related issues in the Caucasus region;
3. Engage the governments of the six riparian states, academic institutions, the private sector, and major bilateral and international donors in agreeing on the necessary implication for the pathway towards the setting up of a sustainable regional ICM-C;
4. Accumulate learning through regional exchanges about relevant international experiences and mobilize government, donor, and private resources to ensure efficient and effective performance of a regionally based centre of excellence;
5. Advocate for this initiative among regional civil societies, the private sector and academia through sharing of experiences and knowledge as well as through research, enabling the ICM-C to exchange with the worldwide community of friends of the mountains.
THEMATIC SESSION 2: CLIMATE CHANGE AND MOUNTAIN ENVIRONMENTS

PHYSICAL MECHANISMS OF THE INTENSIVE MELTING OF GLACIERS OF THE NORTH CAUCASUS IN THE LAST 20 YEARS
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A negative glacier mass balance is determined by temperature anomalies during the ablation and a lack of winter precipitation. However, it is difficult to confirm or to deny these seemingly obvious conclusions because of the lack of systematic meteorological observations in the mountains. The only source of long-period series of meteorological data in the glacial areas of the Greater Caucasus are the results of global and regional reanalysis performed by numerical weather prediction models. In this work, a widely known reanalysis (NCEP/NCAR) is used because it covers a significant period of time (1948-2014). Statistical verification of the reanalysis data was performed for the summer season using seasonal meteorological measurements in different areas of Mount Elbrus in 1960, 2007 and 2013. This verification showed that the reanalysis successfully reproduces the temperature and humidity conditions of Elbrus and surrounding areas. This fact allows us to use reanalysis data for reproducing the meteorological regime of the Central Caucasus in the last 65 years. It is shown that air temperature and humidity characteristics in the high-altitude areas of Elbrus were changing slowly. However, an intensive melting of glaciers in the period 2000-2010 is observed. According to the reanalysis, verified by observations, a possible reason for the increased layer of glacier ablation could be an anomaly of the radiation balance. The value of the balance for the period 2001-2010 exceeded the average climatic value (1961-1990) by 5%. This result could be important because 85-88% of ablation energy on the Greater Caucasus is exactly equal to the radiation balance. It is interesting that the increase of the radiation balance during the 2001-2010 period occurred due to the growth of the downward flux of long-wave radiation.

SOLAR RADIATION MODEL FOR MOUNTAIN REGIONS
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The model for calculation of global solar radiation and its components in mountain territories is presented. The main factors contributing to decreasing solar radiance, both deterministic (solar azimuth, zenith and relief of the territory) and random (atmosphere turbidity, cloud amount) are taken into account.

Most of the territory of the Caucasus consists of mountains and foothill regions with complex relief which directly affect the amount of declining solar radiation. It is impossible to use “The European Solar Radiation Atlas” which has a low resolution (about 10 km x 10 km) for solving many practical problems, for example, such as choosing optimal locations for solar plant construction in mountain regions. To create a dense network of measurements in mountain regions is very expensive and unrealistic; therefore, the development of an adequate method for calculation of solar radiation characteristics seemed the only possible path. To accomplish this, we developed the “Solar Radiation Model for Mountain Regions” that consists of four stages. At the first stage, for any given instance of time, the location of the Earth on the elliptical orbit around the Sun is found; at the second stage, the latitude and the longitude of the Sun are determined for this considered instance; at the third stage, at any point on the Earth and at the point of time under consideration, the Solar zenith and azimuth are found; at the fourth stage, solar radiation falling onto the Earth’s surface is calculated for the instance of time and point under consideration. The model uses as input parameters: the 3D model of territory with 100m spatial steps; optical thicknesses of atmosphere (or Linke turbidity factor); and the cloud amount and gives various characteristics of solar radiation as output parameters, both statistical and predicted. Thus, the model can be applied to the choice of optimal locations for solar plants as well as to
predicting the amount of solar energy available (for example, in upcoming days by using the predicted Linke turbidity factor and the cloud amount). The correctness of the model has been tested and trusted by natural experiments.

RECONSTRUCTING GLACIER HISTORY IN THE CENTRAL CAUCASUS BY MEANS OF TREE RING INVESTIGATIONS
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Studying the dynamics of glaciers in the past and present is one of the most important areas in glaciology. One of the methods of determining the glacier condition is the determination of the position of its snout in different periods of time. There are many different methods of determining the position of the snout of the glacier in different periods. This position can, for example, be determined by the presence of large accumulations of glacial deposits – “moraine”.

The dating of the moraines is carried out by various methods. In this paper, we used dendrochronology, which is based on counting the annual rings of tree trunks, determining their age and tracking changes in the width of the growth rings, compared with the previous and subsequent growth rings. With the age of the tree, the minimum age of the surface on which it grows can be determined, in this case – the surface of the moraine. And knowing the age, you can precisely determine the altitude of the end of the last glacier snout. It is important to point out the basis of the science of dendrochronology and all its applications – dating by tree rings is made with an accuracy of within one year.

Dendrochronological work was carried out in the forefields of the Bolshoy Azau and Donguzorun glaciers on the territory of Kabardino-Balkaria. The analysis of more than 200 samples for dendrochronological dating showed that in the forefields of glaciers there are trees whose age reaches almost 500 years. The trees therefore provide important information about the dynamics of glaciers. This study makes it possible to estimate glaciers’ colonization of woody vegetation and provide important additional information about the age of the glacier moraine.
PLENARY SESSION 1: CLIMATE CHANGE

TECHNOLOGY TRANSFER AND FINANCIAL INSTRUMENTS IN THE CLIMATE CHANGE CONTEXT

Narine Mailyan, Representative of UNFCCC National Focal Point, Armenia

The Intergovernmental Panel on Climate Change defines technology transfer as “a broad set of processes covering the flows of knowledge, experience, and equipment for mitigating and adapting to climate change among different stakeholders such as governments, private sector entities, financial institutions, NGOs, and research and education institutions”. The activity of technology transfer is based on the Paris Agreement, which was negotiated and adopted by 195 countries at the 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change in December 2015. While this agreement will not be enforced until 2020, beforehand, many activities have to be performed in accordance with Article 10 of the Agreement which proclaimed that “the Technology Mechanism established under the Convention shall serve this Agreement” and “financial support shall be provided to developing country Parties for the implementation of this Article”. This envisages the provision of an institutional framework and employs two forms of financial assistance to projects aimed at climate change mitigation. There are both Internal (domestic): Climate Revolving Investment Civil Fund, to be replenished on a permanent basis by allocations from environmental fees, ecosystem service fees, including “carbon taxes”; and External (international) financial instruments: the Global Environment Facility (GEF), Adaptation Fund of the Kyoto Protocol (AFKP), the Green Climate Fund (GCF), the Clean Development Mechanism and other bilateral and multilateral funds.

With the help of multilateral international financial instruments, some projects are being implemented in Armenia at this moment. For example, solid waste processing into electricity in the Nubarashen landfill of Yerevan city with the help of the Japanese Shimizu Corporation. Another project is energy-efficient housing implemented in Yerevan city and several small towns with the help of the GEF. Another important and promising project is poultry manure processing into biogas at the Lusakert poultry farm sponsored by the Clean Development Mechanism as well as a green lighting project in Yerevan and 10 small towns implemented with the help of UNDP and GEF. Of course, these projects were based but not limited to related scientific issues. These issues must be considered in the future: environmental aspects of waste processing into electricity; assessment of energetic efficiency of several types of insulating materials in various natural conditions; a feasibility study of biogas production from poultry manure; and a comparative analysis of the influence of various lighting technologies on health.

The important features of the internal financial instrument (Climate Revolving Investment Civil Fund) are the following. The Fund is community-based, that is to say that it is the inalienable property of all community residents. It is very important that community residents be involved and participate in all projects and, above all, that they be involved in decision-making. The Fund is created for financing/co-funding of environmental projects: the exclusive right to make decisions belongs to community residents who bear the responsibility for their decisions. This new internal financial instrument is able to: strengthen the financial capacity of local communities; ensure initiation and interested participation of community residents in economically profitable and socially oriented projects; create a real and effective base for consistently developing trust in public-private partnerships (PPP); and ensure a natural right of future generations "to the use of climate resources".

To get closer to achieving these objectives, two projects have been implemented in Armenia. The first, “Creation of Pilot Civic Revolving Investment Fund in Basen rural community, Shirak region” and the second, “Building awareness and capacity to create Civic Revolving Investment Fund in 22 small towns and rural communities in five regions”. There are also challenges: community residents were not aware of the environmental problems in their region, country and worldwide; community residents considered the concept of the Civil Revolving Fund to be complicated, unrealistic and hard to implement. The lessons learned are: necessity of consistent and comprehensive work, even on a volunteer basis; transfer of experience and knowledge on the creation of civic investment revolving funds. Communication, replication and scaling up have been provided: project goals, activities and results were communicated to local authorities, national authorities and CSOs; a closing conference held in Yerevan was attended by governmental counterparts, representatives of UNDP and interested CSOs. Some communities took part in project activities of their own initiative. The sustainability guarantees
are: conducted trainings and workshops; support expressed and promised by local authorities; creation of civic initiative groups. The recommendations for a way forward are: assisting communities to mobilize local resources, (green houses, energy-saving models, etc); creation of a legal basis for operation of the Civic Investment Revolving Funds; development and adoption of a law on ecosystem services; development and adoption of the “Green Economy” concept.

CLIMATE CHANGE POLICY IN AZERBAIJAN AND RESEARCH NEEDS
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Azerbaijan ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995 and its Kyoto protocol in 2000, and belongs to the Non-Annex I Group. Under the framework of UNFCCC, Azerbaijan has committed to prepare and submit national reports and to develop, implement and publish national and regional programmes that would include mitigation measures as well promote public awareness on climate change. Following UNFCCC guidelines, Azerbaijan has submitted Initial, Second and Third National Communications, as well its First Biennial Update Report to the Convention secretariat. Also, in 2015, Azerbaijan submitted its Intended Nationally Determined Contributions (INDC), signed the Paris Agreement and started the ratification process. The Paris Agreement was recently ratified by parliament. The main targets for climate change policy in Azerbaijan have been identified in “Azerbaijan-2020: Look to the Future” Development Conception. Within this Conception, Azerbaijan identified ambitious targets to approximate the amount of energy used for the production of one unit of GDP and the amount of carbon dioxide according to the respective indicators of member countries of the Organization for Economic Co-operation and Development (OECD). The mitigation and adaptation strategies of the country are also reflected in a number of long-term sectoral State Programmes. Despite the fact that Azerbaijan has not committed to any quantitative obligations under the Kyoto protocol as a non-Annex I country, during recent years, a number of climate change mitigation-related actions were implemented in the country that contributed to a global emission-reduction effort.

As mentioned above, Azerbaijan implements different kinds of mitigation actions such as introduction of low-carbon targets, energy efficiency standards, renewable energy, efficient waste management technologies, as well as expansion of forest areas. These implemented measures have led to a significant decrease in Green House Gas (GHG) emissions and an increase in removals from the “Land-Use, Land-Use Change and Forestry” (LULUCF) Sector. Within some projects, Azerbaijan has also prepared a GHG-emission prognosis out to 2050 and all future governmental development projects are designed in order to implement some mitigation measures.

Adaptation is one of the main sectors for Azerbaijan as well. Azerbaijan is very vulnerable to climate change and suffers from climate change impacts. For example, in 2010 we had immense floods near the Kura River and with all resources available, the government implemented many adaptation measures in this regard. The primary sectors that are vulnerable towards climate adaptation are the agricultural sector, the water sector, coastal zones, and mountain ecosystems.

There are several challenges to the development of adaptation technologies, i.e. economic and financial barriers such as high investment costs, inappropriate financial incentives, policy/regulatory barriers, technological barriers, information/capacity barriers and social barriers, which are all key challenges that impede the process of development of adaptation technologies in Azerbaijan.

As for research needs in Azerbaijan, there are needs for more detailed research related to mitigation such as the application of modern technologies to reduce emissions from the transport sector, the residential sector, as well as application for renewable energy sources. Research is needed also on the application of drought resistance species in the agricultural sector. There are several challenges to the development of adaptation technologies, i.e. economic and financial barriers such as high investment costs, inappropriate financial incentives, policy/regulatory barriers, technological barriers, information/capacity barriers and social barriers, which are all key challenges that impede the process of development of adaptation technologies in Azerbaijan.

As for research needs in Azerbaijan, there are needs for more detailed research related to mitigation such as the application of modern technologies to reduce emissions from the transport sector, the residential sector, as well as application for renewable energy sources. Research is needed also on the application of drought resistance species in the agricultural sector. There are some areas that are not irrigated, so this is very important for the country. There are also needs for research to develop national emission factors in order to have precise numbers in terms of emissions. There is also a need to develop specific vulnerability indicators in order to apply vulnerability analysis to the mountain ecosystems of our country. There are some initiatives regarding this, for example, under the ClimaEast Policy Project together with Georgia, there is a series of trainings for specialists of the
hydrometeorological department that were organized. They are going to use new models and develop indicators after this training. The Ministry of Ecology and Natural Resources of Azerbaijan has also applied to Climate Technology Centre and Network (CTCN), the operational arm of the UNFCCC Technology Mechanism, with a new project in order to further develop these indicators. And finally, there is a need to make significant assessments in regards to glaciers. We need to undertake an analysis to see the reason for the decrease of the area of glaciers almost by half.

RESEARCH NEEDS IN THE FIELD OF CLIMATE CHANGE IN GEORGIA

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Under the Paris agreement, all Southern Caucasian countries committed to implement their Nationally Determined Contributions (NDCs) that include adaptation and mitigation measures across all sectors. In order for the government to make informed decisions to implement the pledges of their respective NDCs, it is very important that the government, as well as citizens and the public sector, be informed about climate change impacts. It is therefore essential to properly assess vulnerability. National adaptation plans must have information on which areas and which regions of the country are most vulnerable to climate change in order to prioritize where to increase financial support. In this regard, it is important that scientists and researchers are able to formulate and deliver their messages in such a way that government officials are able to understand and are able to make informed decisions. Thus it is very important to organize forums where all the representatives of various sectors – from the sciences to the government and the private sector – come together and connect their ideas and actions so that the strategies and policies of the government are in line with the actual needs of a specific region, country or sector.

Under the UNFCCC, Georgia has to submit National Communications as well as Biennial Update Reports (BUR) and, in order to do so, Georgia has projects which last from four to five years. During these projects, there is an assessment of vulnerability and the assessment of the country situation and we then present our National Communications. Unfortunately, these Communications have always been project-based approaches, so we do not have, for example, an institution that will continuously be working on the issue of research, exploration and identification of climate-related needs since the climate is changing and information needs to be updated regularly. We believe that the establishment of such an institution would allow for think-tank like work and that it could inform the Ministry in its decision making, which would be a great help. The Ministry sometimes is not capable of doing its own research because of a lack of financial and professional resources and time and we therefore believe this issue to be very important. We have applied to a couple of institutions to help us in capacity building, not only for ministry representatives but also for the public and private sector.

EXPERIENCE OF AFRICAN MOUNTAINS AND LINKS TO RESILIENCE AND CLIMATE CHANGE ADAPTATION RESEARCH

Musonda Mumba, Ecosystem Based Adaptation (EBA) coordinator, Climate Change Adaptation Unit, UN Environmental Programme

When discussing climate change adaptation in mountain areas, Ecosystem-Based Adaptation (EBA) is the most commonly used mechanism. This tool focuses on using biodiversity and ecosystem services as the basis of making sure that communities – of both people and species – actually have the ability to adapt to the threats of climate change. This requires a lot of work, not only on local and national levels, but also at the regional and global levels. To put it in simple terms, EBA refers to using biodiversity and ecosystem services as part of an overall adaptation strategy to help people and communities to adapt to the negative effects of climate change at all levels (local, national, regional and global).

Important work has been conducted in this regard in Africa, particularly with the Mount Elgon System. Here, with the involvement of stakeholders and local communities, different climate scenarios were developed, analyzed and brought to the stakeholders’ attention. In October 2016 at the World Mountain Forum in Uganda, UNEP launched the East African Mountain Outlook to show the experience and work conducted. An atlas was also developed with assistance from the Swiss, German and Norwegian
governments. Unlike the European mountains or central Asian mountains or even Latin American mountains, African mountains not consist of a mountain range. They are distinct. This atlas illustrates that even though major mountains of Africa are quite separate entities, there are main watersheds to African river systems. For example, Mount Elgon, which is shared between Uganda and Kenya, is one of the important ecosystems for the river Nile, the world’s longest river – the veins of which feed vast territories. Thus, we realize that there is a need, more important now than ever before, to have communication across countries, especially where mountains are being managed.

Governance and management is a complex issue, whether it be at the local level or the national level. All these dynamic systems and rules play a role in how ecosystems are managed and the need to find a balance between human needs and environmental sustainability. It is no less important to recognize and support local level synergies and activities. We need to have a better understanding of what is really happening at the local level. We imagine EBA to be at the center of this kind of synergy between different approaches such as disaster risk management, community-based natural resource management, integrated conservation/resource management projects, etc.

When talking about mountains and sustainable mountain management, more questions are raised than answers found. Why are we communicating about the mountains? Why are they so important? Do we really need to rethink how development is done – especially within mountain ecosystems? Are mountains a critical issue? What does the resilient mountain actually look like? Do you know what it looks like? Is this a new problem or an old one? This thinking is never a bad thing, because it leads to new ways and better research and study.

CLIMATE OBSERVATION AND MODELLING IN THE CAUCASUS
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To analyze current and future tendencies of climate parameters, we investigated observed long-term climate data, as well as future projections based on these parameters. Observed daily and monthly temperature and precipitation time series were analysed for different time spans. To avoid artificial errors and inhomogeneity, QC/QA methods were carried out using RClimDex_extraqc (ETCCDMI WMO CCL/CLIVAR ET) software and homogeneity study – with RHtestV4 and RHtests_dlyPrcp (two phase regression model that identifies break points). For the homogeneity study with monthly temperature corrections, a range of correction [1°C to 3°C] was defined, which was smaller in the 20th century but more significant in the last decades. Corrected time series show that the trend’s angle revealed in the 1881-2013 period will reduce if “break points” in temperature series date from before the 1960s and increase when they occur after 2000. Break points after the 1990s can be considered a climate signal. Trends in mean climate parameters and their significance was assessed by ManKendall and changes in intensity and frequency of Climate extremes by RClimDEX and ClimPACTv2, probabilities of extremes (extRemes Toolkit, NCAR). Current evolutions can be summarized as follows: in Summer-Autumn, warming is more evident; Winter-Spring, warming is not significant; In west Georgia, night temperatures increase, in east Georgia day ones increase. Precipitation changes are unstable; in west Georgia, annual totals have increased, in east Georgia they have mostly decreased; Autumn totals have increased, summer totals have decreased.

For the future projections, the RegCM4 model was used. This model belongs to the group of so-called “limited area models”, it uses large-scale meteorological parameters as initial and boundary conditions on the area limited by the user, on which high-resolution geographical information can be added (such as topographic elevations, land use, vegetation and so on). A simulation was done (N 40°30'–47°; W 39°25'–44°) with maximal horizontal resolution of 20km, admissible in the area. The area used for simulation includes the territory of Georgia as well as part of the territories of Armenia, Azerbaijan, Turkey and the Russian Federation. Initial and boundary conditions were taken from EH5OM (MPI, Hamburg), global model output data (existing from 1941-2100) and A1B socio-economic scenarios. This simulation is close to the average of all available downscaled experiments for the South Caucasus region. The simulation was done from 1959 to 2100 inclusively. The 1961-1990 period was taken as the baseline, compared to which current and future climate parameters and extreme events were evaluated. Out of 180 different parameters, available as a result of modeling, we analyzed the below-listed climate parameters. Future scenarios were developed for the periods: 2021-2050 and 2071-2100.
The model was validated, tuned and bias-corrected against gridded observations and point ones. Future tendencies also indicate that summer temperatures increase and precipitation sums decrease mostly in East Georgia. Seasonal and annual temperature trends continue to gradually increase.
THEMATIC SESSION 3: TOURISM

VALUING VISITOR WILLINGNESS TO PAY FOR FOREST CONSERVATION: THE CASE OF ARASBARAN BIOSPHERE RESERVE
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The Arasbaran Biosphere Reserve situated in the north of Iran at the border of Armenia and Azerbaijan belongs to the Caucasus Iranian Highlands. In between the Caspian, Caucasus and Mediterranean region, the area covers mountains, high alpine meadows, semi-arid steppes, rangelands and forests, rivers and springs. The forests in this reserve are considered the last habitats of the Caucasian Black Grouse and other important wildlife, different species of edible wild trees provide an important income source for inhabitants, and exotic plant species with applications in traditional medicine significantly add to the ecological importance of Arasbaran forests. This area attracts many ecotourists from different parts of Iran and from abroad, which can cause both positive and negative impacts. In this paper, visitors’ ecological perceptions and “Willingness To Pay” (WTP) for forest conservation in the Arasbaran region was investigated. For this purpose, the Logit model was applied to analyze contingent valuation data from a study of 480 visitors in the spring and summer of 2016. The results indicate that over 75% of interviewees were willing to pay for forest conservation and the WTP is positively affected by their experience, income and education. The average WTP for each visitor was estimated at 10.2 USD annually. Thus, this value provides enough justification for policy makers to maintain the quality of this natural area.

CAUCASIAN TRANS-BORDER TOURISM DEVELOPMENT
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In the Caucasian region, development of trans-border tourism is now an important factor of scientific, economic and cultural networking. Tourist resources for such development are various and ample in the region, but adequate tourism programs are critical. We need a system of trans-border tours between all Caucasian states.

A peculiar tourist system existed during the last three decades of the USSR until its collapse, it was a system that operated a network of interrelated tourist centers with a more or less uniform infrastructure (Geography, 1980). The system was supported by mutually complementary resources and specialized tourist centers, and was held together by unified policies for pricing and standards.

To construct a new system, it would be essential to search out axes of development and favorite locations, to estimate general and special landscape functions, expected consequences of development etc. It is also important to coordinate all kinds of territorial development plans. For the development of any destination and tour it will be necessary to establish a community of partners.

This perspective for development has both traditional and new trans-border destinations. Possible themes and types of tours could include the following:
- Tours from the Russian ski resorts in the mountains down to the sea;
- Tours from the South Caucasus countries to the North Caucasus;
- Tours from Armenia to the Black sea cost;
- The historic monuments of Urartu, Mt. Ararat and other ancient symbols of the history of humanity as topics for the creation of pilgrimage trails and archaeological and ethnological tours;
- Sea voyages on board historic vessels, combined with recreation on the sea beaches and environmentally oriented excursions in the hinterland;
- Transit tours (bridging history with contemporary times), for instance: the Great Silk Road;
- Themed tours on traditional medicine, viticulture, cheese-making, folklore, handicrafts production;
- and other tours.
ETHNO-CULTURAL RESOURCES AND PERSPECTIVES OF THE DEVELOPMENT OF ETHNO-TOURISM IN TUSHETI

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Ethno-tourism is one perspective open for the conservation of ethnic diversity and has a major importance in the country’s regional development. Development of ethno-tourism is determined by the ethno-cultural resources of the region. Tusheti, one of the highest mountain regions of Georgia, is situated in the north-east part of the country and is famous for its resources. Its unique nature and ethno-cultural resources make it an interesting and attractive region. This mountain region has kept rich traditions of ancient eastern shepherd culture, architecture (Tushetian houses and citadels), hospitality, cuisines (Tushetian, Khinkali, Kotori, Khavitsi and etc.), clothes, national celebrations and much more. Maintaining and developing such interesting traditions is vital. International tourists are fascinated by such unique and different cultures – ethno-tourism is popular on the tourism market nowadays. Our country is rich in ethno-cultural resources, especially mountain regions, Tusheti being one of them. This paper presents the results of field work describing social, economic and ecological problems of local peoples in the development of ethno-tourism. Our main goal is to evaluate ethno-cultural resources and their perspectives in Tusheti, a region characterized by strict natural conditions and in which the population is seasonal with only 25 people staying here during the wintertime. Depopulation is a major problem for Georgia’s mountain regions, including Tusheti. Tourism has significantly affected the possibility of maintaining populations in certain areas. Thus, research on ethno-cultural resources has great importance for this region.
THEMATIC SESSION 4: REGIONAL DEVELOPMENT I

CHALLENGES AND PERSPECTIVES OF RESEARCH AND SOCIOECONOMIC ACTIVITIES IN MOUNTAIN AREAS OF AZERBAIJAN
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In the Azerbaijan Republic, the altitude of 27% of the territory is above an elevation of 1000 m. The mountains and foothill areas, covered by forests and rich in biological, underground and surface water resources, play an important role in the social life and activities of local communities as well as in the economic development of the entire country. The mountains of the Greater Caucasus, Lesser Caucasus and Talysh are very complex and varied in terms of geographical and environmental peculiarities, population distribution, land-use planning, environmental risk and socioeconomic profiles. In this regard, the conduct of geographical research on mountains is of significant importance for the country.

This presentation is devoted to the main environmental and socioeconomic problems typical of the mountain areas of Azerbaijan as well as opportunities for further sustainable development of the country’s mountain regions. Studies carried out on various aspects of mountain-area problems have been reflected in prominent monographs, compiled maps and atlases, and the different scientific projects implemented in the last decades. The research carried out concerns primarily geomorphology; natural and anthropogenic landscapes; hydrology; biodiversity; population, social and economic challenges; natural disasters and environmental problems of mountains. Moreover, a lot of important measures and work on the development of mountain areas have been conducted in accordance with a number of state programs implemented in the country during the period of independence. The most important of these are the two State Programs on Socioeconomic Development of Regions (2004-2008 and 2009-2013). State policy on sustainable economic development is aimed at fostering favorable conditions for agricultural and tourism activities, as well as the improvement of needed infrastructure, with local natural conditions and factors. All the above-mentioned issues and the scientific search for solutions are the subject of this present work.

SOCIO-ECONOMIC DEVELOPMENT OF MOUNTAIN AREAS IN THE CAUCASIAN COUNTRIES
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The continuous search for new areas to be developed is an obvious quest, demanded by social justice and political pressures. Areas on remote islands or in high altitude mountains are located far from developed and growing urban conurbations.

Although the economic development process in these areas is still advancing slowly, or made more costly by physical obstacles, they have strong appeal as they are in pristine, uncontaminated cultural-ecological conditions, a rare status, though diminishing day by day.

After recalling some basic features of high mountain socio-economic situations and the lines of thought for suitable adjustments to modern living conditions and related policies, some of the most relevant drivers for development will be discussed. The most suitable options for leading towards a sustainable approach will be examined, pointing out those, as well, which may lead to negative externalities.

Besides the basic need to improve human capital in these areas, special consideration is given to modern infrastructure and building developments. Their impact may have a devastating effect on these fragile bio-physical contexts and it will be very relevant to analyze the ways mitigations and compensations should be designed and managed to safeguard the interests of local populations, threatened as they are by powerful outside pressures. A new institutional organization, to cope with development, will have to take place at the local level to evaluate incoming changes and to be proactive to countervail unsuitable occurrences.
This paper will present a few case studies where unavoidable conflicts occurred but where suitable resolutions were found, agreed upon in such a way as to at least ease confrontations that occur—not only between residents and newcomers, but also between different generations at the local level with distinct approaches and values.

Although full preservation of these areas, to a very large extent, is not conceivable because of unavoidable and strong opposition drives, a well-designed and managed conservation approach has to be implemented and secured to minimize the burden to local populations and provide adequate returns.

MOUNTAIN POPULATIONS AND SUSTAINABLE DEVELOPMENT
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One of the factors of sustainable development of mountain areas is to maintain and even increase resident populations. However, almost everywhere there is an exodus of population from mountain areas. In addition, it is primarily the young populations that leave these areas, those who also happen to be most productive in terms of labor and those who increase populations with new families.

The above-mentioned processes of resettlement from the mountains to the plains can be observed in the history of North Ossetia. The first wave of population exodus from the mountains was observed after Ossetia had joined Russia. This was accompanied by a reverse wave of immigration from the plains areas of Ossetia by Russians, Ukrainians and others. Settlement in the North Caucasus on the whole, and in North Ossetia in particular followed the classic canons of capitalist colonization, which led to rapid and efficient development of industry, trade and transport, high marketability of agriculture and significant employment levels.

However, despite the significant levels of departure by some residents, mountain populations throughout the nineteenth century continued to grow. This was facilitated by the discovery of polymetallic ore deposits in Sadon and its subsequent mining.

The next wave of exodus coincided with the advent of Soviet rule in the 1920s. This led to a large number of new settlements on the plains and fewer (percentage-wise) in the mountains. In 1897, 40,000 people (20.2% of the total) lived in the mountains, in 1914 the absolute number rose to 47,600 but the corresponding percentage declined to 17.3%; in 1926 there was less than half as many people (22,600 or 8.3%), in 1989 a further decrease to 10,200 (1.6%) and finally in 2015 only 8,100 people (1.2%) remained.

Over the last few years, there has been a trend towards a return of a certain part of the population to the mountains, and some settlements have been repopulated. However, the interest in some to return to the mountains is coming up against the fact that almost all the mountain lands have been purchased and are now privately owned.
THEMATIC SESSION 5: BIODIVERSITY CONSERVATION

CAUCASUS MOUNTAINS AS A RESERVOIR OF BIODIVERSITY ACROSS GEOLOGICAL TIME
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The Caucasus is an important biodiversity hotspot. For this reason, there are multiple programs for planning and development of protected areas throughout the region. In the development of the respective programs, multiple factors are considered, including politics, economics, and the presence of “charismatic” animal and plant species. However, overall diversity of species and genetic diversity is usually outweighed by other factors. The Caucasus hosts multiple refugia where a diversity of animals and plants have been present for millions of years. Outside these refugia some of these organisms have periodically become extinct and some have re-colonized these areas in times of a more favorable climate. Multiple data coming from biodiversity studies, paleobiology, molecular genetics, and paleoclimate modeling suggest that the geographic position of the areas with the highest biodiversity levels within the region have been stable, very likely, since at least the early Miocene epoch, and will probably remain stable during future global climatic fluctuations. The presentation explains the methodologies on how these specific areas are identified and compares those with the existing pattern of protected areas.

POSSIBILITY OF CREATION AND PERSPECTIVES OF THE CAUCASUS BIOSPHERE RESERVES ASSOCIATION
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From year to year, the pace and extent of human impact on the biosphere is constantly growing. Currently, humanity has reached such a level of development that future progress is rendered impossible without paying closer attention to issues of ecology, environmental protection and conservation of biological and landscape diversity.

One of the ways of achieving a balance between meeting human needs and preserving nature is the creation of a vast network of biosphere reserves, which provides opportunities for the conservation and sustainable use of natural resources. Every biosphere reserve is a part of a worldwide network: the World Network of Biosphere Reserves, and the success of the Network depends on the effectiveness of each component. The creation of regional biosphere reserve associations can provide significant support for its development and functioning.

In our view, the Caucasus is a suitable area for the establishment of a regional association, because there is a great number of biosphere reserves on its territory. Together they can form an information and methodological association, which will open opportunities and prospects for development and cooperation among its participants. Creation of the Caucasian Biosphere Reserves Association will provide a new impetus to the development of scientific activities based on collaborative problem-solving in the region.

The main goal of this project is the creation of conditions for increasing the level of development of biosphere reserves. Included in its composition is mutual informational, technical, methodological and staff support.

Objectives:
1. Creation of a single information space, providing opportunities for open exchange of experiences and ideas between association members;
2. Professional help in personnel development;
3. Increasing the level of technical and scientific cooperation at the regional level;
4. Spreading of the ideas and practices of sustainable development within the association and beyond.

Discussion of ideas and preparation for the creation of the Caucasian Biosphere Reserves Association is planned to implement during a series of thematic seminars and round tables, which will lead to a conclusive conference that will establish goals and objectives, as well as the legal form of the association.

DYNAMICS OF DESERTIFICATION PROCESSES IN THE EASTERN PART OF THE REPUBLIC OF AZERBAIJAN
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During the last 50 years, one of the most vital socio-economic and ecological problems troubling science and the world community is the problem of desertification. Desertification, the destruction of the ecosystem of arid and semiarid territories, leads to the decrease of the natural and economic potential of the soil and creates the most severe ecological conditions for the development of all forms of organic life. Desertification is an extremely negative phenomena both in natural and socio-economic terms. All forms of human activity, directly or indirectly, find a reflection in the consequences of the problem of desertification. Two factors contribute to desertification processes to a significant degree: a) fluctuations in the climate with periodical droughts; and b) human activity with irrational methods of soil tenure. Studies have established that 87 per cent of the 45 factor-stimulates of desertification of landscape is anthropogenic, only 13 per cent is natural (Babayev, Zonn, Drozdov and others,1986; Babayev and Zonn, 1994).

Taking into account these problems, mainly of human origin, a UN Convention to Combat Desertification was adopted. It should be mentioned that more than 100 states are undergoing the threat of desertification. About 900 million people feel the negative impact of desertification and about 10 million people are obliged to migrate as ecological refugees from territories where desertification has struck. The territory of the Republic of Azerbaijan is not exempted from this scourge.

During the past 1,500 years, areas of mountainous-forest complexes of all types have been reduced by three to five times, but the areas of low-lying and riparian woodlands in Kura-Aras plains in Azerbaijan have been reduced by 13 times. According to M. Museibov (1999), by the middle of the first millennium A.D, more than 55 per cent of the territory of Azerbaijan was covered by various modifications of mountainous and sub-mountain forests, but together with low-lying and plain hydromorphic forests they consisted of over 62 per cent of the area of Azerbaijan. At the present time, woodlands occupy about 9 per cent of the area of Azerbaijan. The territory of Azerbaijan, especially its arid and semiarid low-lying and submountain regions, consisting of about 60 per cent of the total area, are undergoing more intensive desertification than other Transcaucasia states. Climatic conditions of Azerbaijan allow them to be classified as countries undergoing aridization, these include the high amount of sunshine hours (2200-2500 h/year), high solar radiation (125-160 kcal/sm2 per year), proximity of precipitation-evaporation ratio to the humidity regime in deserts (up to 10 per cent of the total area), low average annual quantity of precipitation (200-400 mm/year) and a large number of days with hot winds (60-80 days per year) (Shikhlinski,1963).

The destruction of forests in the flanks of the hills of South Caucasus countries led to further soil erosion and the siccation of climate and microclimate that in the end contributed to degradation and desertification of the geosystem. All this happened more noticeably in the 20th century, especially beginning from its second half, which is connected with the mechanization of labour facilities, population growth, the need for the extension of irrigated and dry soil, harvests and pastures.

Following the principles of the UN Convention to Combat Desertification, concrete measures are being taken and national action plans are being worked out in many developed countries. In Azerbaijan, this problem is ongoing. The population and at times people in positions of power do not realize the scale of the consequences of this process and no national action plan has been developed. Naturally, there is a
need for collecting information throughout the country in order to inform the population about the extent of this ecological catastrophe.

The tasks of the given studies were:

- Definition of the total geographic range of distribution of desertification processes in the eastern part of the Republic of Azerbaijan, the total area of which is 34,679.75 km² consisting of 40 per cent (2/5) of the territory of the country;
- Definition of the degree and intensity of desertification;
- Conducting studies in the region under investigation on socio-economic factors – one of the main elements contributing to desertification;
- Analysis of the condition and utilization of water resources in the eastern part of the country;
- Preparation of predictions about desertification;
- Mapping of the types, reasons and degrees of desertification, land tenure and prediction of the region under investigation, on the scale 1:1,000,000;
- Composition of the above-mentioned analogical maps separately for Absheron peninsula, on the scale 1: 100,000;
- Working out recommendations for combating desertification.

ASSESSMENT OF FOREST GOVERNANCE IN GEORGIA
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Forests cover about 40% of Georgian territory. Forests have an exceptional importance at the national, regional and global level: they not only conserve unique biological diversity, but also ensure continuous delivery of ecosystem services and resources to local communities. The quality of forestland governance is key for the protection and sustainable use of natural resources.

For the elaboration of the assessment of quality of forest governance of Georgia the “Governance of Forests Initiative (GFI) Indicator Framework” was used. The research clearly shows that the quality of forest governance in Georgia is poor. In spatial planning and EIA, legislation has not integrated issues of forestland governance. The forest categorization system is also insufficient. Frequently, decision-makers use principals of management of usable forests in management of protected areas, which leads to the reduction of the value and importance of protected areas.

To improve forest governance, the horizontal legislation of Georgia (related to EIA, SEA, spatial planning and public participation) needs substantial changes. The legislation should be harmonized with EU directives. It is necessary to reflect biodiversity conservation and sustainable forest management needs in EIA legislation.
PLENARY SESSION 2: HAZARD MAPPING: THE CASE OF GEORGIA

KEY ELEMENTS OF SUCCESSFUL PARTNERSHIP: NEA/SDC PROJECT ON DISASTER RISK REDUCTION
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A project on disaster risk reduction was supported by the Swiss Agency for Development and Cooperation and implemented by the National Environmental Agency (NEA). The main goal of the project was the natural hazard mapping of risks and an elaboration of recommendations for preventive measures for six communities in the Mestia municipality. At the same time, one of the main goals of the project was adaptation and integration of the Swiss natural hazard mapping methodology into practices in Georgia. The project implementation was based on the following methodology: a) Hazard maps were created for each phenomena such as floods, slow avalanches, landslides, rock falls; b) Hazard assessment and mapping were carried out based on the Swiss methodology combined with Georgian experience; c) Implementation of several exercises, in particular inventory study/data collection; and preliminary hazard assessment using satellite data and identification of hazardous areas followed by the fieldwork; final identification of hazards and mapping by different levels of hazard. In order to determine various parameters for each snow avalanche zone, different maps were prepared using the Spatial Analyst tool by ArcGIS software. As a result, different kinds of specific maps were developed in order to analyze hazardous locations within study areas. Based on this data, geomorphological dynamic parameters for snow avalanche zones were estimated, which include maximum elevation, relative height area, average slope, velocity and destructive power. Thus, the final version of the snow avalanche hazard maps was elaborated after the fieldwork.

Due to the lack of historical data about snow avalanche occurrences in the study area, interviews with local populations were one of the main sources for collecting information about historical events. In total, 27 snow avalanche sites were identified. During this process, several mitigation measures and recommendations were provided for each snow avalanche zone. The field survey exercise was carried out in order to depict flood inundation maps with different probabilities. Based on surveyed cross sections, various hydraulic elements were estimated. The maximum water discharge calculations were performed according to the document entitled “Technical instructions of maximum river flow calculations in the Caucasus conditions” for the rivers with a 400km² catchment area. For maximum water use, after the calculation of water discharge, we estimated average water velocities for each cross section area. Based on the water velocities and water discharge, we estimated the maximum for each cross section, then using the interpolation method we produced flood outline maps. Flood maps were divided into three hazard level zones. Zone one describes high risks with a 10-year return period of probability, the second is a medium risk zone with a 30-year return period and the third is low risk with a 100-year return period. The flood methods were produced for five rivers within the study area. Also, different kinds of criteria were elaborated during the project on landslide, debris-flow and rock-fall assessment. The landslide hazard criteria consists of different components, such as level of hazards, slope, trigger factors, man-made trigger factors, type of landslide and intensity. Debris-flow hazard criteria consist also of the level of hazard, morphological location, type of debris and intensity. The rock-fall hazard criteria consist of level of hazards, soil slope, granulometry and intensity. Based on this criteria, we produced hazard maps for landslides, debris flow and rock fall. As a result of the project we prepared hazard maps for six communities of the Mestia municipality, the final cadaster of natural processes was created and includes 119 landslides, 92 debris flow areas, 137 rock fall zones, and 26 snow avalanche zones in total. Also, different mitigation measures and recommendations for each hazard phase were provided in the final report.
PILOTING HAZARD MAPPING IN GEORGIA
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GIS and RS Consulting Center, GeoGraphic, in cooperation with the National Environmental Agency (NEA) and with the support of the Swiss Cooperation Office (SCO) in Georgia, produced this report (i) to analyse and capitalise on the Swiss hazard mapping methodology as applied on a pilot basis in Georgia by NEA; and (ii) to review current legislation and provide recommendations on the legal framework for advancing hazard mapping in Georgia.

The report contains a comprehensive overview of hazard mapping as applied in Switzerland. Basic principles of hazard mapping, such as intensity, return periods, map colour coding, integral/synoptic maps, protection structures and deficit mapping are explained. It is concluded that the Swiss example is adequate to follow in Georgia.

The experience of the NEA with pilot application of the Swiss hazard mapping methodology to six communities in Mestia Municipality of Georgia is discussed. Key finding of the report are that despite data gaps (such as lack of data for intensity and frequency components), the NEA managed to use expert judgement to generate properly scaled hazard maps in digital format, which allowed NEA and GeoGraphic to compile synoptic maps in GIS as well as in web-GIS formats, following Swiss standard data schemas.

Two important sections of the report are devoted to (i) analysis of current legal and institutional arrangements for hazard mapping in Georgia (performed by KJ Law Firm, Georgia) and (ii) recommendations on best pathways for transposition of Swiss and European hazard mapping guidelines into the Georgian regulatory reality. A key finding is that implementation is feasible without major changes in national legislation but through changes at the technical and regulatory level.

DISASTER RISK MANAGEMENT IN ARMENIA
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Disaster risk management is very important and comprises the following three subsystems: the subsystem of hazards, the subsystem of losses and the subsystem of capacities. These subsystems must be modified to reduce risk. Armenia is vulnerable to 110 natural disasters known to the world, and its territorial area is a 29,800 km². This is conditioned by several factors, first of all, Armenia has a complex topography and widely variable terrain with abruptly arising mountain chains and plains. While the lowest point is around 350 meters above sea level, the highest elevation is 4000 meters. Therefore, the difference between elevations on such a small territory is some 3500 meters. It is known that seismic hazards cover the whole territory of the Republic of Armenia and there are around 3000 landslide areas in the country, of which 2504 are for areas covering two hectares or more. Landslides have damaged 233 of 960 communities, and 280 landslides have reached 240 km of road out of a total length of 7400 km. In addition, ten landslides have damaged 4.8 kilometers of the railroad network of 870 km. Floods threaten more than 30 territories in the country. There are around 25 hazardous chemical enterprises that use ammonium, chlorine, chloric acid, and nitric acid etc. There are 19 trail reservoirs, seven of which are in conservation areas. There are more than 1500 enterprises that have fire and explosion risks. The country has a nuclear power plant. There are more than 100 water reservoirs managed by various entities.

Here is an overview of various risks and hazards according to their likelihood and overall and human impact:
According to the mapping data of landslide areas, the aggregate damage inflicted upon social and economic structures in the country amounts to an equivalent of $36 million. With damage upon existing structures, the total would come to $45 million. The annual damage from floods and mudflow in the past four years has amounted to $2.9 million on average. The amount of damage from strong winds and hails accounts for an average of $3.6 million and $6.9 million respectively. As for drought, it caused a damage equivalent to $3.2 million in 2006.

Management System – Historical Overview
The Management System began with the establishment of an Emergency Management State Administration in December 1991. Following that, in 1992 an economic basis was provided to the Emergency State Administration in accordance with the decree of the Government of Armenia. In April 1993, the civil protection republican headquarters joined the Emergency Management State Administration. In July 1995, the Emergency Management State Administration was renamed Emergency Management Administration. In October 1997, the Administration was renamed to Emergency Management Administration under the Government of the Republic of Armenia (RA). In April 1999, in accordance with the Decree of the Government of RA structural changes were made to the Administration. In 2005, as a result of reforms, the Administration was renamed the “Armenian Rescue Service” of the Ministry of the Territorial Administration of RA as a State Governmental Body. In 2005-2006 as a result of further reforms, a Law on “Armenian Rescue Service”, as well as around 23 Decrees of the RA government were adopted that regulate the activity of the Armenian Rescue Service. And lastly in March 2006, the Ministry of Emergency Situations was established. The Ministry of Emergency Situations consists of the National Service of Seismic Protection, the Administration of the Technical Supervisor, the Armenian Rescue Service, the Hydrometeorological Service and the Crisis Management State Academy. However, this entire process cannot be managed by just one body, therefore the Government of the Republic of Armenia has elaborated a process by which the Ministry of Emergency Situations is managing the national body alone whereas different ministries, regional governmental bodies, local self-governments, NGOs, etc. are also active players.

There is a significant legislative foundation in Armenia to cover disaster risk management such as the laws on population protection during emergencies, civil protection, seismic protection, fire security, rescue forces and rescue status, the Armenian Rescue Service and civil defense subdivisions. Naturally, there are many other fields of policy within the Republic of Armenia in terms of urban development, local self-governance, food security and air protection. Active international cooperation is also worth mentioning. There are three National Disaster Risk Management Capacities developed in RA: the first one has a core functional capacity, then comes technical capacity and third, community engagement and cooperation. Technical capacity consists of five parts: modernization and upgrading of technical facilities; introduction of a GIS-based risk data management system; consolidation and unified information sharing system; development and adoption of a city seismic risk assessment methodology; and establishment/development of DM National Standards. The core functional capacity also consists of five parts: optimization of structures and efficient use of internal resources; establishment and operation of the Crisis Management Center and National Disaster Office; establishment and functioning of the DRR national platform; development and adoption of the DRR national strategy and enhanced
commitment; and leading role of the Ministry of Emergency Situations of RA. And lastly the Community Engagement and Cooperation Capacity again has five parts: coordinated approach towards education and awareness; development of practical tools for addressing DRR at the local level; development and introduction of community risk certificates; establishment of DRR Local and Regional teams; and development and approval of local level risk management national concept.

To sum up, we can see that there are four processes: institutional and legal capacities, technical capacities, community engagement and cooperation and partnership building. Developing these capacities will allow for sustainability over time.

DISASTER RISK MANAGEMENT IN AZERBAIJAN
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In a few minutes at my disposal, I would like to talk to you about emergency situation management in Azerbaijan as well as research and mapping. We have a very strong ministry in Azerbaijan, the Ministry of Emergency Situations, which is a governmental body responsible for emergency management. As for research and mapping, last year, the Institute of Geography of the National Academy of Science of Azerbaijan prepared a Hydrometeorological Atlas of the Caspian Sea, which consists of seven parts covering general information about the Caspian Sea, hydrological data and parameters, meteorological characteristics as well as interactions between the sea and the atmosphere. A very interesting chapter is devoted to Caspian Sea levels. The atlas provides not only maps but also hydrometeorological information on the Caspian Sea. The atlas can be used by everyone working in the field of oil extraction, oil transportation, hydronomic construction projects, etc. It is also worth mentioning that under a governmental order, an emergency atlas is to be created. The Institute of Geography will be responsible for producing this atlas. The atlas will be developed according to a previously established road map and will cover risks of natural hazards, as well as man-made hazards and so on. The atlas will include not only maps but also environmental information and a database on the ecological and social-economic situation and emergency management issues in Azerbaijan.

DISCUSSION OUTCOMES

Regarding the Swiss methodology for Hazard Risk Mapping, Azerbaijan is open to suggestions and consultations, especially as they are currently working on the Emergency Atlas of the Country. Armenia therefore has considerable work in hazard risk mapping in certain parts of the country, using methodology from the Japan International Cooperation Agency (JICA).

Although there are institutions that can provide the necessary expertise for hazard risk mapping, due to a crisis in the country, the Institute of Geography of the National Academy of Science cannot afford the necessary software. Data collection is also associated with certain financial and other problems. In this regard, there are several institutions in Armenia working on mapping, such as the National Academy of Science and its Geology and Geography Institutes, as well as a special institution under the Ministry of Urban Development that works on landslide mapping. There is also considerable international assistance in this regard, particularly that of Japan – with the assistance of JICA, 230 landslides were mapped in 2007. As for Georgia, the National Environmental Agency and its experts are actively working on hazard mapping. Lately Tbilisi State University, Ilia State University and the Technical University have also become prominent in developing and establishing expertise in the field. However, the problem is bridging scientific efforts and decision-making, where this link is weak. In this regard, Swiss involvement is helping in reducing this gap.
THEMATIC SESSION 6: LANDSCAPE, GEOLOGY AND MANAGEMENT OF NATURAL RESOURCES

GEOGRAPHICAL PECULIARITIES AND SUSTAINABLE DEVELOPMENT OF THE SOUTH CAUCASUS

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Modern geography, both theoretical and applied, is focused on the problems of sustainable development. Sustainable development in the Caucasus is associated with regional political, social-economic and geo-ecological problems. Geographical surveys can play a certain role in demonstrating such questions as regional distribution of economics, establishment of social equality, demographic situations, etc. However, geographical studies are particularly important in solving such problems as maintaining natural and cultural heritage, securing ecological safety, landscape planning and landscape management, evaluation of the natural environment and anthropogenic factors, spatial and time forecasting and modeling, education and public awareness campaigns, evaluation of the states of environment and climate change, environmental protection, etc.

These problems are typical to almost all mountainous regions of the world, particularly to the countries of the South Caucasus with developing economies.

An essential challenge of sustainable development of the South Caucasus is the efficient prevention and management of threats and risks that may be associated with problems of different natures may they be ecological (climate change, geodynamic processes, the need for a single network of protected areas, desertification, secondary swamping, soil degradation, etc.), social (education, science, public health, sports, crime, traditions, culture, basket of goods, living environment, etc.), economic (equal economic development of the regions, new economic specialization, realization of joint international projects, public economic activity, migrant allocation, resort and tourism development, etc.), demographic (migration, emptying of villages, distribution of the population and labor resources, etc.) or political (political and social-economic processes of neighboring states, territorial claims, military actions, conflicts, etc.).

Cooperation to solve environmental problems is important for the South Caucasian countries and may become a precondition for preventing political, economic and social problems. For such cooperation to take place, the article considers the principles of uniqueness, social-economic stress and ecological stress that can be preconditions for focusing on the above-described problems.

MOUNTAIN ENVIRONMENT SHAPED BY CATASTROPHIC LANDSLIDES

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Landslide hazards are extremely common in Georgia. In addition to widespread shallow landslides, catastrophic mass movements are triggered by earthquakes, rain or human activities. Subsequent environmental evolutions in damaged regions are not always predictable, especially when landslides excavate and bring to the surface rock material not typical for the terrain. In April 1989, a large landslide buried Tsablana village in Skhalta valley, Upper Adjara (the Lesser Caucasus), destroyed vegetation and soils and changed topography in an area of about 5 km2; the total effect was much more widespread because of a dammed up river and major irreversible loss of soil and regolith material. Environmental consequences of landslides were studied over 25 years after the event. The Skhalta gorge is a humid, densely forested region with acid soils developed on deeply weathered regolith of basic effusive rocks. It was revealed that landslides have changed local geochemical landscapes, excavating deep calcareous marl and enriching the environment with dispersed carbonate mineral materials. Initial soils formed on landslide material are strongly alkaline and even their topsoil has not leached in recent years. Pine and petrophilious plants became dominant in the damaged area instead of broadleaf and mixed forests. Newly formed streams that drain the landslide body are highly enriched...
with calcium compared with local springs. Soil research in the forest and alpine meadow zones shows that the soil landscape of the Upper Adjara mountains reflects repeated mass movements and interruption of soil formation and of climate-induced spatial regularities. Local populations usually adapt stabilized slide areas for agricultural needs due to limited land availability and eroded soils. Adaptation of landslides for human needs requires special investigations and remedial measures. Research supported by the Russian Scientific Foundation (Project 14-27-00133).

LANDSLIDE AND ACOUSTIC EMISSION

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Large-scale experiments and field observations show that landslides may reveal a slow steady slip, episodic stick-slip or sudden acceleration. Acoustic emissions (AE) carry information about location, intensity, and deformation mechanisms occurring in a material.

Detecting AE generated by a developing shear surface within a slope is not an easy task. The goal of acoustic monitoring is to record acoustic signals generated by preliminary displacement of geologic formations before activation of the fast phase of landslides. The similar technique based on the recording of the acoustics generated by displacement in the gravel coating around acoustic sensors was earlier developed by a Loughborough University (UK) team. The goal of our study is registration and monitoring of slow motion landslides (creep) by recording acoustic emissions. To achieve this objective, we developed special equipment. A plastic barrel is filled with soil from the landslide, in the center of which is a cylinder filled with small stones. In the center of the gravel, a thick-wall stainless steel tube is placed through which acoustic pulses that have arisen in the gravel are transmitted to the acoustic sensor. The displacement of the experimental set-up is done with the help of a mechanical jack. Continuous recording waveform and DC voltage were added using a USB oscilloscope. The resulting signal arising in the compression and shear deformation was very small.

One of the goals of our experiment was optimization of equipment to use them in the field in a landslide area. Therefore, in some experiments we used a data logger for recording data. The data logger can record only the DC voltage with a recording frequency of 1 Hz. Our hypothesis is that research in this direction could lead to the development of early-warning acoustic systems for revealing landslide incipient slipping.
WORKSHOP 2: LEVERAGING SPATIAL DATA

REMOTE-SENSING TOOLS FOR EROSION CONTROL AND PASTURE MANAGEMENT
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Recent imagery from the Sentinel-2 Satellite provides new opportunities for large-scale multi-spectral landscape analysis. In a BMZ- and ADA-funded GIZ project implemented by the consortium of ECO-Consult, AHT and the E.C.O. Institute of Ecology, experts from Armenia and Georgia worked on remote-sensing tools to estimate the risk of erosion by adaptation of the Revised Universal Soil Loss Equation (RUSLE) to the Caucasus environment. By combining input factors such as precipitation, slope factors, soil type and vegetation cover, the potential loss of soil in t/ha/year can be calculated. The model can be used at different scales and accuracy depends mainly on the quality of input data.

Starting with the use of Rapid Eye data from 2011 in Armenia, new Sentinel data was used for a new model covering the Tusheti Protected Areas in the Greater Caucasus in Georgia. The Sentinel 2 mission started data delivery in May 2016. For Tusheti Protected Areas, data from the 5th of August was used to calculate different vegetation indices and biophysical parameters based on the 12-band multispectral image data. The results of the satellite data analysis were calibrated by field data gathered at the same period.

The results provide information on vegetation cover, available biomass and erosion risk. This spatial information is used for pasture management and spatial planning. For the whole territory of the pilot area of Gometsari Gorge, land cover maps and biomass maps as well as erosion risk maps are now available. The layers have been intersected with the pasture management units to calculate available biomass and maximum carrying capacity of livestock for each pasture unit. Overgrazed areas that are critical to erosion have been detected and alternative grazing areas, which are not used at the moment, can be identified.

The results of the remote sensing approach will be broken down at the village level to find sustainable solutions of land use with the local shepherds, stakeholders and municipality administrations.

SDI INITIATIVES IN GEORGIA WITH AN EMPHASIS ON BIODIVERSITY AND CLIMATE ACTION
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Since January 2014, Georgia has been a member of the Group on Earth Observations (GEO, https://www.earthobservations.org). The 10th Plenary and Ministerial Meeting of GEO recognized Georgia as its 90th Member. Georgia pledged to establish a coordinating mechanism within the country to further strengthen the national Earth Observation capacity and network. Two European GEO-related initiatives within the 7th Framework Programme, enviroGRIDS (http://envirogrids.net) and IASON projects, greatly contributed to stimulating the GEO Membership for Georgia, as well as other countries of the region, such as Armenia and Bulgaria. Georgia’s success story was well documented by another FP7 EOPower project (http://www.eopower.eu/success_stories/Georgia.pdf). With the support of the GEO Secretariat, the Georgia GEO Principal (representing the National Environmental Agency) regularly participates in GEO Plenaries and Ministerials. The development of the Spatial Data Infrastructure (SDI) for Earth observations also has strong support in the GEO community.

Prerequisites for developing a National SDI exist in Georgia. Various agencies lead and contribute to populating various SDI themes, such as the National Agency of Public Registry under the Ministry of Justice (designated as lead SDI agency and providing a geoportal prototype at http://nsdi.gov.ge), the National Environmental Agency of the Ministry of Environment and Natural Resources Protection of Georgia (with meteorology, hydrology and ambient-pollution monitoring datasets, as well as competencies in hazard mapping), Ministry of Agriculture (soils), various universities and research institutes (seismicity, geology), and other organizations, including both NGOs and private sector. There is an important role to be played as well by the Environmental Information and Education Centre of the Ministry of Environment and Natural Resources Protection.
In line with the European aspirations of the country, the INSPIRE model has been selected. Yet another confirmation of this choice was in 2013 when Georgia joined the implementation of the EEA-compatible Shared Environmental Information System (ENPI-SEIS), stating as a national policy to facilitate public access to data and information. There are various projects (international, national) contributing to GEO and INSPIRE processes, useful datasets are already openly available at the global level, while in situ national datasets could complement them with higher precision and resolution.

SDI and GEO provide effective tools that can be used in a wide range of applications. Several projects applied these instruments in Georgia, e.g. preparation of the climate change roadmap for Georgian regions (http://nala.ge/climatechange) supported by USAID, where climate change impacts on various economic sectors, such as infrastructure, agriculture, tourism, heritage, energy, and environment were visualized. This and some other examples on how open access to data can contribute to sustainability objectives are provided in a GiZ-supported study devoted to analysing options for the biodiversity and the forestry data management in Georgia (see report http://biodivers-southcaucasus.org/wp-content/uploads/2016/03/Report_EN_Gvilava_Assessment-and-Options_GEO_2016-2.pdf), e.g. zoning of protected areas based on integration of biodiversity and earth-observation data, as well as the use of national forest cover, and global remote sensing data on fires, coupled with climate models to assess future climate impacts on forest fire.

Within the framework of the SCOPES “Supporting Sustainable Mountain Development in the Caucasus” project, geospatial data has been proposed as a binding element, supporting the process of sustainable development in Caucasus. In order to ensure access to and use of geospatial data for visualising, monitoring and modelling specific issues, regional Spatial Data Infrastructure (SDI) for the Caucasus is being established.

ADAPTING A GEOSS/SDI TRAINING MANUAL FOR USE IN THE CAUCASUS
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GeoNode is an open source web-based application and platform for representation, analysis, and sharing of geospatial data, as well as deploying spatial data infrastructures (SDI).

GeoNode makes it easy to upload and manage geospatial data on the web. Any user can upload and create content available via standard OGC protocols such as Web Map Service (WMS) and Web Feature Service (WFS). Data is available for browsing, searching, styling, and processing to generate maps which can be shared publicly or restricted to specific users only.

By combining collaboration found on social networks with specialized geospatial tools, GeoNode makes it easy to explore, process, style, and share maps and geospatial data. Spatial datasets can be imported and shared, all through a non-technical user interface.

The aim of the current work was to adapt the GeoNode Tutorial and Manual, which has been developed by researchers of the enviroSPACE lab at the University of Geneva and the GRID-Geneva office of the United Nations Environment Programme with support of the Scientific Co-operation between Eastern Europe and Switzerland (SCOPES)-funded “Supporting Sustainable Mountain Development in the Caucasus (Sustainable Caucasus)” project.

The tutorial consisted of a number of exercises based on Kenya GIS data that it had been necessary to adapt for Caucasus users. During this work, the Kenya layers were replaced with data from the Caucasus region taken from different regional projects.

This training material could be used by focal points of the Caucasus region countries for populating the Sustainable Caucasus data-sharing platform (http://sustainable-caucasus.grid.unep.ch) with relevant data from each country.
CURRENT STATUS OF SPATIAL DATA INFRASTRUCTURE (SDI) IN AZERBAIJAN

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The necessity of establishing and developing the National Spatial Data Infrastructure (NSDI) in Azerbaijan is related to the activities of public authorities, municipalities, organizations, business entities and the population. This issue is important to policies encouraging active integration of the Republic of Azerbaijan into the European Union.

The following issues should be resolved to achieve this goal:

- Instituting the legal basis for regulating the establishment and effective usage of basic spatial data and metadata;
- Establishment and integration of the state information backups including the spatial data of the Republic of Azerbaijan and its municipalities;
- Increasing the number of entities with their data on basic spatial objects;
- Coordination of the activity of these entities in order to ensure the integrity, reliability and flexibility of the spatial data;
- Creation of the necessary scientific, technical and technological provisions for developing and effectively using the basic spatial data and metadata.

Considerable steps on the development of NSDI have been made by the government of Azerbaijan:

Development Concept “Azerbaijan-2020: Look into the Future” was signed by the President of Azerbaijan in accordance with Decree No. 800 dated December 29, 2012. The adoption of this Concept, the main strategic document in the establishment of the NSDI in Azerbaijan has given an impetus to the creation of the NSDI in the country. "National Strategy on the Development of an Information Society for 2014-2020 in Azerbaijan Republic", confirmed by the Decree of President of Azerbaijan Republic, dated April 2, 2014 includes Item 14.1.18, according to which intentions to establish the NSDI, as well as to create geographical information and navigation resources for different purposes are declared.

Institutional and legislative changes have been made regarding an Address Registry Information System that serves as a basis for the NSDI. E-government initiatives in Azerbaijan have been intensified in recent years – programs for transition to “Electronic Azerbaijan” are being consistently adopted and implemented by the government. The establishment of the NSDI in Azerbaijan and the combination of information systems in a unified geospace will contribute to the transition to e-government.

Meanwhile, projects on the establishment of the unified electronic database for a registration and cadaster of real estate in the country, as well as the development of visualization and dissemination of geo-statistical data (‘GIS web applications’) and other projects are currently being implemented.

SPATIAL DATA INFRASTRUCTURE (SDI) PILOT FOR THE CAUCASUS

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Supporting Sustainable Mountain Development in the Caucasus requires information and knowledge for making decisions based on the most solid evidence possible. In this context, geographic information has an essential role for visualizing, monitoring and modeling specific issues. Geographic information must then be shared and accessible as much as possible among the stakeholders and beyond.

It is therefore necessary to set up a long-term infrastructure that allows sharing, discovery and access to spatial data, which is one of the objectives of Work Package 4 (Science-policy-practice interface). The EGIDA methodology has been chosen as the supporting methodology to set up this infrastructure. It consists in a set of networking and technical activities running in parallel for a sustainable contribution to the Global Earth Observation System of Systems (GEOSS)\(^6\). Making a contribution to GEOSS

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implies following some of its fundamental principles such as sharing geospatial data at no cost in the easiest accessible way possible.

As part of the EGIDA technical activities, it has been decided to set up an online geospatial data-sharing platform. The Geonode™ open source web-based platform has been selected as the application to play this role. It is available at the url: http://sustainable-caucasus.grid.unep.ch and is hosted at the University of Geneva. Geonode has many helpful features such as easy management of collaborators who can contribute geospatial layers and their metadata, the possibility to create thematic maps based on available layers, to share documents, embed existing maps in websites, etc. Additionally, Geonode is fully compatible with Open Geospatial Consortium (OGC) standards and provides web services (WMS, WFS, WCS, CSW) based on hosted geospatial layers.

The goal of the presentation was to describe the Geonode platform features, to show its current data status, to demonstrate its collaborative potential, and to open the discussion for future data contributions.

http://geonode.org/ accessed February 12, 2017
THEMATIC SESSION 7: WATER RESOURCES MANAGEMENT

GEOCHEMICAL MONITORING OF NATURAL WATER IN THE CAUCASUS LANDSCAPE- GEOCHEMICAL ARENAS
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The chemistry of natural waters is one of the dynamic indicators in ecological-geochemical monitoring in the context of climate change and the increase of anthropogenic influence. Many rivers originate in the Caucasian reserves and national parks. Waters from mountain rivers are the main source of the water supply for the population living in the piedmont plains. Long-time geochemical observations of the river water are conducted in the Belaya basin (Adigeya), Baksan basin (Kabardino-Balkariya), Teberda and Kuban basins (Karachaevo-Cherkessiya) and on the south slope of the Western Caucasus. Results show their stability. However, the high activity of exogenous processes in the mountain landscapes of the Caucasus causes changes in the composition of river waters.
THEMATIC SESSION 8: REGIONAL DEVELOPMENT II (INTERDISCIPLINARY ANALYSIS)

THE AGGREGATE COST METHOD FOR ESTIMATING THE RISE IN PRICE FACTORS OF POPULATION LIVING AND ECONOMIC ACTIVITIES

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The question of costs is considered in almost all the major economic schools and many foremost economists (T. Mann, F. Quesnay, A. Smith, K. Marx, A. Marshall, J. Keynes, J. Galbraith, M. Friedman et al.). Costs serve as a basic value for assessing the effectiveness of economic activity. Economic costs may be fixed costs or sunk costs. Sunk costs are paid and will not be recovered. In assessing the impact of natural factors, these costs are, in fact, identical to the concept of "damage" from natural disasters. The economic costs are usually divided into total, average, marginal, as well as fixed and variable costs. The aggregate costs, including all costs of production of this volume of economic benefits, have a primary importance in our study. Marginal costs should be taken into account when we estimate the additional costs associated with the maintenance of production activities due to the development of new, less efficient resources. This is especially the case for the primary sector, where marginal costs are rising as deposits are depleted and the transition to a less efficient exploitation of resources.

Let us consider the method of selection the geographical components in costs (C):

\[ C = C_\alpha + C_\beta + C_\Delta \beta (1) \]

where \( C_\alpha = \) total industry average costs; \( C_\beta = \) cost of geographical location; \( C_\Delta \beta = \) costs associated with natural factors

then:

\[ C_\beta = C_k + C_g + C_{gm} + C_{EGP} + C_{cc} + C_{etc} (2) \]

where \( C_k = \) costs caused by climate change; \( C_g = \) costs caused by hydrological processes; \( C_{gm} = \) costs caused by geomorphological processes; \( C_{EGP} = \) costs caused by economic and geographical positions; \( C_{cc} = \) costs caused by the business cycle; \( C_{etc}. = \) other non-production factors affecting costs.

\[ C_\Delta \beta = C_{\Delta k} + C_{\Delta g} + C_{\Delta gm} + C_{\Delta cc} + C_{\Delta etc} (3) \]

where \( C_{\Delta k} = \) additional costs caused by climate anomalies; \( C_{\Delta g} = \) additional costs caused by abnormal hydrological processes; \( C_{\Delta gm} = \) additional costs caused by abnormal geomorphological phenomena; \( C_{\Delta cc} = \) additional costs caused by business cycles; \( C_{\Delta etc} = \) other additional costs caused by non-production factors.

Finally we get the integral cost field (C), which gradually drifts following the change of the partial indices (2) and continually "explodes" due to anomalies of natural and socio-economic origins (3).

LAND-USE AND LAND COVER CHANGE IN MOUNTAIN PASTURES OF THE EASTERN BLACK SEA MOUNTAINS, TURKEY

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The aim of this paper is to evaluate land-use and land-cover change in mountain pastures of the Eastern Black Sea Mountains in Turkey. For this purpose, four different types of samples have been taken based on research in 30 yaylas (temporary settlements in mountain pastures) in three provinces of the Eastern Black Sea Region. Both quantitative and qualitative research techniques were used in the study for data collection. The change in the number of homes in the yaylas between 1973-2004 was determined with help of aerial photographs and GIS data. Primary data was collected through a household survey during the summer of 2010 in which 900 households from 30 yaylas in three provinces participated.

The qualitative data were collected through personal observations and in-depth interviews with 45 key representatives of local communities. As a result of the analysis, it has been determined that pastoralists live in 357 houses and 543 houses are second homes in 30 yaylas located in the Eastern
Black Sea Region. The number of second homes in the yaylas has increased between 1980-2010. The other change in the yaylas is a functional change. The yaylas once primarily used by local people as mountain pastures in summer for grazing activities until the 1980s are currently used for recreation purposes by “amenity migrants” and have also been turned into holiday resorts. These changes in land use and function of yaylas have environmental, economic and social effects.
THEMATIC SESSION 9: TEACHING AND LEARNING PRACTICES

OUTDOOR LEARNING ABOUT SOIL
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Environmental literacy alone does not lead to behavioral change. Only if people are also connected to nature do they really value it. Therefore, outdoor learning plays a crucial role in environmental education. Outdoor learning allows one to experience the relationship between people’s actions and the elements which support life on earth.

Teaching units about soil are essential to understanding the importance of soil and its protection. Soil is an ideal substance to provide experiential hands-on activities at all age levels.

Examples of successful outdoor classes and 'in-school simulations' include hands-on activities, games and sensory experiences as part of a teaching unit on soil aiming to make the ecosystem tangible. 'Earth Recyclers' observation boxes, simulations to show the effects of erosion and simple research experiments to examine soil can be conducted without a budget by re-using items found in most households or neighborhoods.

Guiding pupils to experience and understand that soil is not ‘dirt’, but a very valuable resource that is easily lost is the purpose of these outdoor classes. Combined with real-life observations and discussions about the human impact on soils it is one step in preparing them to act as environmentally responsible citizens.

IMPLEMENTING THE PROJECT “LEARNING FOR THE FUTURE” IN THE CONTEXT OF “EDUCATION FOR SUSTAINABLE DEVELOPMENT” IN ARMENIA
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One of the aspects of international cooperation is introduction of virtual school opportunities into the Armenian educational system. In this regard, in 2012, Armenia, along with other countries, joined the program “Learning for the Future”. In the framework of this project, three UNESCO-associated schools took an active participation aiming to implement thematic training and to apply the knowledge gained in an educational-scientific center.

The main objective of the project was to contribute to students’ practical usage of theoretical knowledge through ICT (Information and communications technology), as well as to raise competence in the field of Education for Sustainable Development (ESD) among teachers. In addition to the main purpose of the project, there was the explanation of scientific ICT to the students and teachers used to solve actual ecological problems and a presentation of scientific information on key ecological issues.

The project was implemented in two stages: in the first part of the project, training on the principals and practice of the “Ecological Footprint” and the assessment of sustainable development were organized. The topic selection was conditioned by the fact that the concept of the ecological footprint includes and summarizes different ecological problems. In the second part of the project, thematic trainings were held in the educational-scientific center, which were followed by practical work.

Thus, the implementation of the project “Learning for the Future” in Armenia has contributed to improving the competence of students in the field of ESD: promoting the formation and development of research, communication and collaborative skills of learners.
GOAL-ORIENTED ENGLISH TEACHING FOR REFUGEES
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English, as an international language, is vital for immigrants who are moving to another country. This presentation focuses on the educational issues connected with teaching English to Refugees, namely, how to determine their needs, adapt lessons to different levels of learners, motivate them to achieve better learning and which aspects of language should be given greater emphasis (i.e. what language structures are the most important to learn?). Throughout this workshop, the basic formula for teaching “survival” or everyday English will be highlighted. Some keywords such as needs analysis, adaptation, motivation, specific purposes, and “survival English” are explored and used in practice by role-playing as learners (Refugees), imagining ourselves in concrete situations. At the end of the presentation, you will be asked for your opinions and conclusions.
THEMATIC SESSION 10: HISTORY AND ANTHROPOLOGY

SUSTAINABLE DEVELOPMENT AND HISTORICAL PRESERVATION
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The concept of sustainable development is perfectly applicable to the issue of heritage preservation. Historic preservation is indeed an important and integral part of sustainable development. Paraphrasing the famous Brundtland's definition we can state that “Sustainable development is a kind of development that meets cultural needs of the present without compromising the ability of future generations to meet their own cultural needs.” Preservation produces less CO2 emissions, uses less energy and produces less waste compared to new construction.

This paper is an attempt to discuss the methods and tools of quantifying historical preservation benefits using non-market valuation methods. The aim of the paper is to answer the question: Does preservation pay? The authors talk about direct and indirect methods of valuation and their applicability for regional valuation and valuation of heritage that is less well known or off the beaten path. Environmental, economic, and social components of sustainable development are discussed based on Western European and American examples along with local data. The heritage is categorized for better and more targeted valuation. The range of possible valuation methods for each category is considered and it is concluded that non-market valuation methods may be applicable for heritage assets that are not included in the National Heritage List. In addition, the necessity of development of financial and tax incentives is raised for the provision of a viable economic future and for better preservation and restoration of historic sites.

In conclusion, the author states that development without historic preservation is not sustainable.

GENETIC STRUCTURE OF HUMAN POPULATIONS EXPLAINS EXPANSION OF HUMANS IN THE CAUCASUS IN PRE-HISTORIC TIMES
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Our research attempts to provide an explicit explanation of human-biome interactions during the last glacial period and how these interactions and landscape complexity have influenced the current human genetics at the global scale.

Using climate, terrain, hydrography, fossil pollen and plant macrofossil data we developed a model of the distribution of biomes during climate deteriorations of the last glacial period. Subsequently, we analyzed current human genetic structure, the origins of genetic lineages and Palaeolithic human sites in relation to the inferred biomes as well as landscape permeability.

Our analyses indicated that: (1) current human Y-DNA diversity, the places of origin of Y-DNA lineages and the distribution of Palaeolithic human settlements are best explained by distance from savanna and dry woodland during a series of glacial maxima, (2) during periods of relatively benign climate conditions, humans dispersed through areas of high primary productivity while avoiding dense forest cover and (3) there is a strong correlation between genetic differentiation among the populations and landscape permeability to human migrations. The permeability is determined by the combination of terrain ruggedness, forest cover and snow cover.

In a metapopulation of Palaeolithic humans, the biome of savanna and dry woodland supported source populations and other biomes acted as sinks. Present-day genetic differences are largely related to landscape permeability between human source populations, and in the post-glacial period there has not been enough time for displacements and admixture of human populations to completely blur these differences.
CHANGES IN DISTRIBUTION OF POPULATION AND SETTLEMENTS OF AZERBAIJAN BY ALTITUDE BELTS
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Natural and geographical factors considerably affect the distribution of population and settlements. Among these factors, relief and climate conditions, usability and fertility of lands are particularly notable. Under the influence of natural conditions, large differences in the distribution of settlements and their population by altitude belts of Azerbaijan’s mountain areas are observed.

Central and eastern parts of the country covering the coastal zone of the Caspian Sea has an elevation of 0 to 200 meters. These areas make up 42% of the territory of the country. According to the census conducted in 2009, 179 cities and urban settlements, as well as 1,525 villages are situated within an elevation of 0–200 m. The population of these areas is 5.5 million persons (61.5% of the country’s population), including 3.6 million residents of cities and urban-type settlements (75.3%) and 1.9 million village dwellers (46%). The largest cities of this altitude belt include Baku, Sumgait, Lankaran, Shirvan and other cities located in the Kur-Araz lowland.

The second belt encompasses 200 to 500 m of altitude, or 15.5% of the country’s territory. It includes 68 cities and settlements, where 5.7 million people (12.6%) are concentrated, as well as 583 villages with 791,000 inhabitants (21.2%). This zone covers the Gusar inclined plain, part of the low mountainous areas of Gobustan, the Ganikh-Ayrichay valley and also the northern parts of the Shirvan plain. Such large cities as Shaki and Ganja are located in this altitude belt as well: 16.8% of all settlements of Azerbaijan are situated here.

Our analysis shows that the population settling in areas of an elevation of 500-1000 m and 1000-1500 m is gradually declining. The shares of these altitude belts are 7.1% and 1% among the country’s urban population, as well as 17.9% and 6.5% among rural population respectively. The lack or lower availability of usable areas in terms of agriculture and also agroclimatic resources led to the reduction of a number of villages and of the rural population.

A small part of the population lives above 1500 m of altitude in Azerbaijan. These areas encompass 15% of the country, while the share of population living there is only 1.3% with 2.7% of the rural population concentrated above 1500 m.

DENDROCHRONOLOGICAL AND RADIOCARBON DATING OF MEDIEVAL BUILDINGS IN THE MOUNTAIN PART OF INGUSHETIA
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A chronology of construction activity is very important for the understanding of the dynamics of human settlements and human migration in the Caucasus region. It can also reveal new evidence on climate history in the Caucasus because construction activity is inevitably connected to climate change and human adaptation to it. There are hundreds of medieval buildings in the mountain part of Ingushetia, including early Christian churches, crypts, temples, war towers, and dwellings. Very few of them have been dated so far, but even existing dates are usually based on accompanying archaeological material and provide terminus ante quem dates. No radiocarbon or dendrochronological dates for buildings in the Ingushetia mountain region have been published so far.

The aim of this project is to collect material from medieval buildings of the Ingushetia mountain and to analyze it by means of dendrochronological and radiocarbon methods. In 2014 and 2015, we collected samples from wooden construction elements of 40 stone buildings (135 samples in total). All the samples were prepared and tree-ring widths were measured. Maximum length of tree-ring series reached 177 years. Most of the wooden elements were made from pine, oak, and lime. Unfortunately, we failed to cross-date these series with the existing tree-ring chronologies from the Northern
Caucasus. We additionally prepared nine wooden samples from three buildings (two early Christian churches and one early war tower) for accelerated mass spectrometry radiocarbon analysis. These samples were collected from distinct tree rings that allowed us to use the wiggle-matching procedure for the enhancement of precision of the dating results. Finally, we determined *terminus post quem* radiocarbon dates for these three buildings. The next aim of our research is to date wood and mortar from five other buildings, including crypts and temples.
THEMATIC SESSION 11: BIODIVERSITY II

CLIMATE CHANGE IMPACTS ON RELICT CHESTNUT-LEAVED OAK (QUERCUS CASTANEIFOLIA) IN AZERBAIJAN

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The chestnut-leaved oak (*Quercus castaneifolia*) is a species of oak in the turkey-oak section *Quercus sect. Cerris* that is native to Azerbaijan and the Alborz mountains of Iran. This deciduous tree grows up to 35 m tall and has a trunk up to 2.5 m in diameter. Tree-ring widths were measured with the Lintab measuring system in the TSAP-Win program. Anatomical features were measured under a microscope. Investigations were carried out by using dendroclimatological, anatomical methods.

Response-function results showed that in the current year, May and June precipitation positively influenced and June and July temperatures negatively influenced annual radial growth. According to mean radial growth deviation analysis, during droughts, growth was 30-40 % less; and in wet years growth was 40-60% more than the mean. Calculated Pimm indices showed that even one to two years after droughts, trees did not reach normal growth levels. All these analyses showed that this species is very sensitive to local climate change – depending on the changing precipitation and temperature, radial growth changed significantly.

As a result of global climate change, there are new microclimates forming, which affect radial growth in the natural distribution area of the oak. These new extreme conditions create frost scars in the wood. In Europe, these kinds of scars form once in a century. But in our case, in samples which were collected from high altitudes (1450 m) from the oak distribution in Lenkoran region, were observed seven frost rings during the last 60 years. An interesting point is that five frost rings were formed in the last 30 years, which means that over a short period the local climate changed extremely and that is why the oak is not adapted to it.

Our investigation showed that effects of climate change are evident in high altitudes. If climate change continues in this way in the coming decades, the effects will be visible in lower elevations.

MOUNTAIN LICHENS AS MONITORS OF GLOBAL CHANGE PRESSURE

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Lichens are known as organisms sensitive to changes in atmospheric concentrations of N-, S- and C-compounds, which is why epiphytic lichens are efficiently used for biological monitoring of air quality over decades. The monitoring methodology to detect changes in a state of lichen communities due to changes in background air pollution was elaborated in the 1970s. Since then, around 30 nature reserves were studied in the former USSR, including five mountain nature reserves in Azerbaijan, Georgia and the Caucasian part of Russia.

Since the 1990s, global warming has become one of the most serious threats and is subject to increasing concern, especially in arctic and alpine regions. Lichens definitely react to climate change, e.g. the appearance of tropical and subtropical species in temperate areas have become obvious at this time.

We modified the methodology of monitoring air pollution with lichens to use epilithic lichens as monitors of climate change in mountain nature reserves. So far, this methodology has been applied in the Altai Mountains and in the Central Negev Highlands.

Monitoring and assessment of climate change with the use of epilithic lichens as proposed for the Central Negev showed that an 0.8°C change in the annual mean surface air temperature will be detectable. Such resolution appears sufficient in view of the IPCC (2013) global warming projections for the end of the 21st century.
In the Altai mountains, eight lichen species inhabiting high-mountain belts above 2300 m a.s.l. were studied. Because changes in montane species distribution consistent with a response to warming causes them to move to higher altitudes, these species are pushed to the top of the Altai mountains by rising temperatures. They are likely to be at an increasingly high risk of extinction in the face of global warming.

DISTRIBUTION AND ANALYSIS OF MACROSCOPIC FUNGI DEPENDING ON THE VERTICAL VEGETATION ZONES AND PLANT COMMUNITIES IN SHIKAHOGH STATE RESERVE: AN EARLY WARNING SYSTEM OF TERRESTRIAL ECOSYSTEM CHANGE IN MOUNTAIN NATURE RESERVES WITH CONSERVATION IMPLICATIONS IN THE CAUCASUS MOUNTAIN REGION

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Armenia is a mountainous country. More than 3000 km of mountain ridges are to be found within the borders of Armenia, which occupies 47 % of the total area of the republic. Biodiversity conservation in the republic is mainly carried out in specially protected nature areas where 60-70% of the flora and fauna species of the Republic is conserved.

The main aim of the present work is to identify the distribution of biota of macrofungi (macromycetes) on the vertical vegetation zones and plant communities in the Shikahogh national reserve. Biota of macromycetes in the investigated territory has a rich species diversity, as the studied area contains a variety of rare woody and herbaceous plants, most of which belong to specific plant communities. We analyzed the data on the formation of macrofungi depending on the altitude limits of their distribution. It was found that the fungi are unequally distributed on the altitude above sea level. In the studied national reserve we distinguished three mountain zones: lower (700-1250m), middle (1250-1900m) and the upper zones (1900-3100m).

In the lower mountain zone, 287 species are to be found. Due to the fact that in the middle mountain zone are the main forest formations, this zone has the greatest macrofungi species diversity (405 species). The upper mountain zone has the least species diversity (57 species). Moreover, among the reserve zone macromycetes, we observed species that are well adapted to environmental conditions and are thus found in all three mountain zones.

The analysis of macromycetes in different phytocenosis showed that in the first place are forest communities (354 species). In coniferous forests there were 104 species and in open areas just 50 macrofungi species. Thus, the largest number of fungi species were found in the mountainous forest vegetation formations that occupy most of the Shikahogh national reserve and that are distinguished with the richness of highly mycorrhizal woody species.

ICHTHYOFAUNA OF ARMENIAN RIVERS BELONGING TO KURA RIVER BASIN AND HUMAN IMPACT

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Rivers belonging to the Qur river basin and flowing through the territory of Armenia are famous for their fish diversity. According to Dadikyan (Dadikyan, 1986) the main species that inhabited here until the 1970s were: Brook trout (Salmo trutta fario L.), Caspian trout (Salmo caspius; Kessler, 1877), Kura khramulya (Capoeta capoeta; Güldenstädt, 1773), Kura barbel (Barbus lacerta; De Filippi, 1865), Caucasian chub (Squalius orientalis; Heckel, 1847), Kura bleak (Alburnus filippii; Kessler, 1877), and Riffle minnow (Alburnoides eichwaldii; De Filippi, 1863).

Our further studies indicated that the fish species of the above-mentioned rivers have radically changed in recent years and that the following habitat fish species are found there today: Brook trout, Kura...
barbel, Sevan khramulya (Capeota sevangi; De Filippi, 1865) and Kura khramulya, Rifflle minnow (Mursa Luciobarbus mura; Güldenstädt, 1773), Caucasian Sportive Loach (Oxynoemacheilus brandtii; Kessler, 1877). The following fish species were adapted or imported there: Goldfish (Carassius gibelio; Bloch, 1782), Common bream (Abramis brama; Linnaeus, 1758), Belica (Leucaspius delineatus; Heckel, 1843), Gudgeon (Gobio cf. gobio; Linnaeus, 1758), Topmouth Gudgeon (Pseudorasbora parva; Temminck and Schlegel, 1846), Common carp (Cyprinus carpio; Linnaeus, 1758), and the Rainbow trout (Parasalmo gerdhieri; Walbaum, 1792). At the same time, the Caucasian chub, as well as North Caucasian bleak previously studied by us are no longer found here (Kessler, 1877). Periodical changes of the fish species in the above-mentioned rivers are conditioned by the existence of numerous small hydropower plants (SHPPS), and their exploitation against environmental regulations, (Pipoyan et al., 2016 a, b), exploitation of numerous fish farms, poaching – including with banned measures such as by electricity and toxic substances, pollution from mining and household waste, using riverwater for agricultural purposes, climate change and other factors.
WORKSHOP 3: RESEARCH FOR COMMUNITIES AND/OR RESEARCH WITH COMMUNITIES: TRANSDISCIPLINARY RESEARCH AND TEACHING IN SUSTAINABLE MOUNTAIN DEVELOPMENT AND TOURISM

RESEARCH FOR DEVELOPMENT: APPROACHES, PRACTICES AND RESULTS BASED ON EXPERIENCE FROM SUMMER SCHOOL 2016
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The International Summer School “Research for Development (R4D)” was held in Abastumani, Georgia from 5-16 September 2016 as an activity of the Scientific Network for the Caucasus Mountain Region (SNC-mt), under leadership of the Institute of Geography of the Russian Academy of Sciences (IGRAS). About 30 participants – bachelors, masters and young PhDs – were invited from Armenia, Azerbaijan, Georgia, Iran, Russia and Turkey. The lecturer team included scientists from IGRAS, Tbilisi State University and Ilia State University (Georgia), Institute of Geography (Azerbaijan), and the Center for Development and Environment (CDE, University of Bern).

The concept of R4D elaborated by the CDE was accepted as a training approach with some further modifications. The Summer School was aimed at training in inter- and trans-disciplinary research methods for obtaining integrated knowledge on a given study area, involving students in a direct dialogue with local stakeholders, the identification of challenges and drafting the ways to achieve sustainable mountain development (SMD) based on a case-study approach.

The training course included lectures, field work and class work. A special workbook was elaborated for introducing students to research areas and as a guide for practical training.

The lectures were devoted to the basic scientific issues of climate change and biodiversity of the Caucasus, regional problems and those specific to the research area, introduction to research principles and methods for SMD and familiarization with the basic GIS functions and their application in SMD research. Field work included general area observation, study of mountain landscapes and resources, socio-economic studies including interviewing the local population, and field satellite image interpretation and DEM creation. During class work, students discussed research methods and the data obtained, worked on map visualization and distribution in a network environment.

Final presentations showed effective learning outcomes. Creative and well-reasoned proposals for SMD were presented. Communities and government roles were outlined, special attention was devoted to innovative agriculture and local crops promotion (e.g. Potato Fest), new kinds of tourism, and involving science (Abastumani Observatory) in the SMD.

There was a guest presentation by the ADA APPEAR project “Transdisciplinarity for Sustainable Tourism Development”, as well as excursions and a trip to Adjara for further study. A publishing workshop was conducted by Prof. Jörg Balsiger (University of Geneva).

TRANSDISCIPLINARITY FOR SUSTAINABLE TOURISM DEVELOPMENT IN THE CAUCASUS REGION (CAUCASUST)
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The role of science in addressing challenges in the field of sustainable development and the link of academia to policy and practice need to be strengthened in the Caucasus region. The project
“Transdisciplinarity for Sustainable Tourism Development in the Caucasus Region” (CaucaSusT)\(^8\), funded by the APPEAR programme of the Austrian Development Cooperation, has been developed to address this challenge.

The project is focused specifically on exchanging experiences among Austria, Armenia and Georgia in order to facilitate a stronger role for the Caucasus universities in addressing sustainable rural tourism development in cooperation with the local populations and other stakeholders. Partners include two Austrian universities: University of Natural Resources and Life Sciences, Vienna and MC University of Applied Sciences, Krems, as well as the Armenian State Pedagogical University and Tbilisi State University in Georgia.

The overall CaucaSusT project goal is contribution to the capacity building of the universities in transdisciplinary teaching, specifically by:

- Introducing a number of new pedagogical approaches;
  - Case study teaching format: development and integration of a transdisciplinary case study course into university curriculum,
  - Transdisciplinarity in teaching and interdepartmental cooperation, implemented via teacher workshops,
  - “Experience exchange” on diversity and equal opportunities in university policies and practice;
- Supporting young scholars, including by organizing a summer school for young researchers in 2019, and supporting the participation of students from Armenia and Georgia in the ISCONTOUR conference in Austria\(^9\); and
- Facilitating university-practitioner cooperation in the field of sustainable tourism development.

Contribution of tourism content to the Scientific Network for the Caucasus Mountain Region and further cooperation with the Network, including organization of the Caucasus Mountain Forum in 2020, as the final conference of the CaucaSusT project.

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\(^8\) http://caucasust.boku.ac.at
\(^9\) http://www.etourism-students.com/iscontour/
THEMATIC SESSION 12: CLIMATE CHANGE AND CLIMATE CHANGE IMPACTS

PRESENT-DAY CONVERGENCE OF VEGETATION AND SOILS OF PASTORAL ECOSYSTEMS OF THE CENTRAL CAUCASUS: LAND USE HISTORY AND CLIMATE CHANGE
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Examples from the different mountain regions underpin the significance of land use for the diversity of alpine ecosystems, and there are many arguments for the conclusion that changing land use has a greater impact on grasslands’ state than climate change. Documented land use history and the current state of pastoral ecosystems of intermontane basins of the Central Caucasus at the altitudes 1,830 – 2,560 m a.s.l. were studied, and climate changes based on space images and maps of vegetation indices were analyzed. It was revealed that in the past, vast areas of current grasslands were used as arable lands and were cultivated during centuries. They were converted into grasslands about 60 years ago and used for permanent grazing for 40 years. In the last 20 years, pastoral ecosystems were underused or abandoned. A geobotanical study showed that contemporary plant communities of grasslands are predominantly composed of meadow steppes and do not reflect climate differences of the leeward and windward slopes of intermontane basins. Present-day soils also have no clear contrasts; while the buried soils discovered are extremely distinct and show evidence of contrasting spatial environmental conditions in the past, with steppes on southern and forests on northern slopes. The concept of soil convergence because of uniform agricultural use over long periods of time is suggested. Vegetation convergence reflects soil similarity and the early stages of development of post-agricultural pastoral ecosystems as compared with the long-lived alpine pastures. A climate change study revealed increasing humidity in the intermontane basins of the Central Caucasus at altitudes 1,400 – 2500 m a.s.l., in the last three decades that may favor the general improvement of vegetation growth and temporal unification of plant composition of post-agricultural grasslands.

LONG TERM TRENDS IN CLIMATE VARIABILITY OF THE CAUCASUS MOUNTAINS
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The main goal of this study is to identify the contribution of the sun to the climate variability of the Caucasus Mountains and long-term predictions of future climate trends in the region for sustainable development.

Over the period 1855–1996, a long-term increasing trend of solar activity was observed that led to temperature increases. Solar irradiance increased 1 W/m² over this period.

The Earth's climate has changed throughout the geological history of the Earth. The movement of the Earth's plates and orbital forcing (Milankovich’s theory) are believed to explain climate changes that occur over tens or hundreds of millions of years. Observations show climate behavior is much more intense than calculated variations.

The major driving force of atmospheric circulation is solar heating, which provides the continuous movement of air. The simplest example of the influence of the sun on the earth is that of daytime and night temperatures in the Sahara desert where the diurnal range can be as great as 38°C. Our calculations show that temperature change in the region closely depends on Total Solar Irradiance (TSI). For example in Tbilisi temperatures over the period 1878-1996: T= 0.73 TSI - 980,2, r = 0,83
In Yerevan: T= 1.18 TSI - 1597, r = 0,87
In Makhachkala: T = 0.89 TSI - 1209, r = 076

In the peripheral weather stations located near mountains, a close relationship between air temperature with solar activity is also observed.
Precipitation trends in the Caucasus Mountains show negative trends:
Precipitation in Tbilisi: \( \text{Pr} = -5.6 \, \text{TSI} + 15844, r = 0.7 \)
Precipitation in Yerevan: \( \text{Pr} = -77.76 \, \text{TSI} + 10650, r = 0.82 \)

In accordance with the National Geophysical Data Center forecasting the solar cycles 24 and 25 will be very weak. This will lead to a decrease of the temperature of 0.5-1.0°C in both averaged solar cycles and more precipitation.

JUNE–SEPTEMBER TEMPERATURE RECONSTRUCTION IN THE NORTHERN CAUCASUS BASED ON BLUE INTENSITY DATA
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Although old growth trees do grow in the Northern Caucasus, no single tree-ring chronology has been reported thus far from this area in the International Tree-Ring Data Base (ITRDB), neither has one been published in international journals. Extensive tree-ring studies have been conducted over the last decade, and a tree-ring network was developed for the investigated area. The data on the minimum blue intensity based on 33 series of pine (\textit{Pinus sylvestris} L.) and fir (\textit{Abies nordmanniana} (Steven) Spach) is presented in this study. The minimum blue intensity (BI) chronology covers the period 1596–2011 with EPS value ≥0.85. The BI chronology strongly correlates with the mean June-September temperature (\( R = 0.74 \); \( p < 0.05 \)) from the weather station Kluhorskij Pereval (1951–2011). Mean June-September temperature anomalies were reconstructed using the rescaling method. Based on the reconstruction provided in this study, the 20th century is characterized by highly increased June-September temperatures. According to this study, the minimum blue intensity approach demonstrates a great potential for paleoclimatic research in the Caucasus. Vast spatial coverage of the new BI-based reconstruction based on data from only two locations in the Northern Caucasus provides prospects for reconstruction of temperature variations for a large region in the Middle East and Northern Africa.
THEMATIC SESSION 13: SPATIAL INFORMATION MANAGEMENT

TOURISM CLIMATE INDEX IN SOME LOCATIONS OF GEORGIA
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Information about different climatic and bioclimatic characteristics of known and potential health resorts and tourism zones has significant importance for an increase in the effectiveness of their potential. This is the so-called Tourism Climate Index (TCI), which is the bioclimatic characteristic of a locality for “average” tourism (mass tourism). TCI values >= 80 are excellent, while values between 60 and 79 are regarded as good to very good. Lower values (40 – 59) are acceptable, but values < 40 indicate poor or difficult conditions for mass tourism. In the southern Caucasus countries, monthly values of TCI were calculated in Georgia, first for Tbilisi, then for Batumi, Anaklia, Kobuleti, Mukhuri, etc. The values of TCI for Yerevan (Armenia) and Baku (Azerbaijan) were also calculated.

In this work, new data for the TCI for such well-known tourist and health resort places as Abastumani, Bakhmaro, Bakuriani, Gudauri, Sairme, Tskaltubo were obtained.

For example, at the alpine health resorts where the winter forms of leisure predominate, such as Bakhmaro and Gudauri, the TCI category for mass tourism respectively range in the limits “Extremely unfavorable” (January, February) to “Good” (July, August) and “Very unfavorable” (December, January, February) to “Good” (August). In Bakuriani (mountain-skiing health resort) the TCI category changes from “Unfavorable” (December, January, February, March) to “Excellent” (August). In Abastumani and Tskaltubo (known therapeutic health resorts) the TCI category respectively changes from “Unfavorable” (December, January) to “Excellent” (August, September) and “Unfavorable” (December, January, February) to “Very good” (May). In Sairme, the TCI category changes from “Very unfavorable” (January, February) to “Excellent” (August).

The comparison of TCI values in Georgia with TCI in the adjacent countries of region (Armenia, Azerbaijan, Iran, Turkey) is provided.

DECISION SUPPORT SYSTEM FOR INTEGRATED WATER RESOURCES MANAGEMENT IN ARMENIA
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In the last decade, the impact of human economic activities on water resources has been gradually increasing. Dynamics of growth of water use and increase of pressure on water resources lead to competing water uses and negative impacts on natural ecosystems. In order to achieve more effective water resources management and protection in Armenia, a Decision Support System (DSS) for Integrated Water Resources Management was constructed in 2012-2015 in the framework of a grant received from the USAID-funded Clean Energy and Water Program. The System is programmed within the GIS environment and serves as a dynamic tool for river basin management planning. The catchment areas of the rivers of a length of more than 5 km serve as the main spatial unit of operation of the DSS. Those river sections and their catchment areas were digitized and coded using the ERICA coding system. The DSS is an open-source free-of-charge extension to ArcGIS 10 and is comprised of three main models: (1) Hydrological Model, which includes four components; (2) Climate Change Model (two components); and Economic Analysis Model, (two components). The main functionalities of the DSS include: (a) calculation of the water balance for the given river basin; (b) calculation of the water supply and demand balance for the river basin by indicating the catchment areas with water surplus and water deficit; (c) estimation of the hydroenergy potential between two points along the river reach; (d) determination of the ecological flow for the river section; (e) prediction of river flow under various
climate change scenarios; and (f) forecasting the river flow under different economic development scenarios. The DSS is currently installed in the Water Resources Management Agency of the Ministry of Nature Protection of Armenia and is used for decision-making in the water use permitting process.
CLOSING SESSION: TOWARDS A REGIONAL RESEARCH AGENDA

INTRODUCTION
Jörg Balsiger, University of Geneva, Coordinator of the “Supporting Sustainable Mountain Development in the Caucasus” project

This last plenary session had two parts, the first part was dedicated to a discussion of the Caucasus Regional Research Agenda and the second part was a more formal closing for the CMF.

The development of the Regional Research Agenda is embedded in the project that the Scientific Network for the Caucasus Mountain Region has been implementing in the context of its longer collaboration. The project “Supporting Sustainable Mountain Development in the Caucasus (Sustainable Caucasus)” is supported by SCOPES, which is a joint program of the Swiss National Science Foundation and the Swiss Agency for Development and Cooperation. This Research Agenda is part of one of the five work packages of the project. The first work package has to do with network development. Under this work package an online platform was developed as a model of collaboration between different stakeholders, it has, in fact, also been supported by UNEP. The second work package, which is called “Academic Excellence” is where this research agenda is placed, where we also have curriculum development components, particularly from the perspective of how sustainable mountain development is embedded in university training and education in the Caucasus. The third work package is called “young scholar promotion”. The flagship activity of this work package is the organization of a summer school for young scholars as well as different workshops on academic publishing, proposal writing, etc. The fourth work package has to do with the integration of science policy and practice and one of the flagship activities there is a spatial data infrastructure pilot project for the Caucasus. Data sharing is very difficult not only in the Caucasus but elsewhere, however with new technologies and an institutional backbone that centers on the Group on Earth Observations (GEO) and other initiatives, there is more and more possibility not only to share the data, but also to impress on people the value of sharing the data. The fifth work package is technical support and project management.

TOWARDS A REGIONAL RESEARCH AGENDA
Joseph Salukvadze, Tbilisi State University

The Regional Research Agenda for the Caucasus has several goals. Firstly, it will provide an update of the state of knowledge and action in thematic areas. It should also help to assess the existing situation, including progress and scientific development on the one hand and practical implementation on the other. Secondly, it will serve as a mechanism for identification and prioritization of research and knowledge needs. And last, but not least, it will serve as a foundation for the creation of coordinated and cooperated knowledge and use in practice. This is viewed as an ongoing process that should be based on an active interaction between stakeholders, scholars, practitioners, and decision-makers in order to change the situation for the better.

The development of the research agenda is planned under the second work package of the project “Supporting Sustainable Mountain Development in the Caucasus”, which is supported by SCOPES, a joint program of the Swiss National Science Foundation and the Swiss Agency for Development and Cooperation.

The team responsible for this work package, known as “Academic Excellence”, has conducted considerable work during the preparation period. Almost 200 research documents from the six countries were collected, grouped and analyzed. The goal was to identify which topics are better elaborated and identify gaps that will be a focus in the future.

Consequently, and as a result of numerous workshops and seminars, the team of the work package as well as other members of the Scientific Network for the Caucasus Mountain Regions (SNC-mt) selected 11 topics: climate change; biodiversity; forest resources; water resources management; land-use and land cover change; desertification; mineral resources; natural hazards and risks; population; tourism and recreation; and socio-economic development. These are very arbitrarily defined topics, some
issues are cross-cutting. When reviewing the draft topics, one should bear in mind that there should be a link from research to practice and policy and vice versa, as well as a link between the topics and research agenda chapters themselves.

The chapters are open for comments from all interested stakeholders. Finalization of the Research Agenda is planned for May 2017 and it will be widely disseminated among scientific institutions and policy-makers. Ideally, the selected chapters will be converted into science-practice platforms for follow-up and action. The update of the document is envisaged in 2021.

CARPATHIAN (S4C) EXPERIENCE
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Science for the Carpathians (S4C) is an effort of many people from the Carpathians and outside the region working in this direction. The idea behind Science for the Carpathians is to bring a lot of people together that are working not only on environmental but also on socio-economic issues of the Carpathian region, people not only of scientific backgrounds but also practitioners and other stakeholders. S4C also aims at defining research priorities for the region, as well as enhancing international collaboration with partners from outside the Carpathians.

The history of this network started in 2003-2004, thus it has more than ten years of experience. The most important venues of the network are the Forum Carpaticums. Already four forums have been conducted, the most recent one was held in Romania. These meetings bring all the stakeholders together and allow them to talk and discuss their research and how to transfer and link research with practice.

In the beginning of the network, there was an idea to create a document summarizing the most important topics for the region. For this purpose, the idea of a Forum organization arose, the research agenda topics were actually elaborated according to the sessions of the Forum Carpaticum. A meeting in 2008, prior to the Forum, also played an important role in identifying the main research directions. As a result, 12 main research topics were identified: climate change; chemical environment; water resources and management; natural hazards and risks; land use and land cover change; forests, including their management and resources; conservation and sustainable use of biodiversity; ecosystem services and human well-being; integrated land resource management and regional development policies; urban and rural development; tourism and sustainability; and traditional knowledge.

The agenda was mainly designed by the people from the steering committee of the S4C, but for this kind of document it is really important to have meetings involving as many stakeholders as possible. The first document was in a traditional style, a small printed book, which was available online. The agenda is updated every five years. Now S4C is trying a new approach, trying to gather as many comments as possible by posting the draft of the new Research Agenda edition online for comments. Though involvement of many people in this process can be quite challenging, it is ultimately very beneficial.

The development of the regional research agenda is a good tool for identifying topics and finding the gaps in the network, research and in general, but also a good document for project development, good to use as a reference and for discussion with different institutions.

SOUTH EASTERN EUROPEAN (SEEMORE) EXPERIENCE
Mehmet Somuncu, Ankara University, Ankara, Turkey

The process started with a conference held in Borovets, Bulgaria in 2009, at a conference by the Bulgarian Academy of Science that aimed at identifying a research basis for sustainable development of the mountain regions in Southeastern Europe.

This was the start of the South Eastern European Mountain Research (SEEmore) network, which was launched at the conference. In Borovets, Bulgaria, 54 participants agreed to launch a new mountain
science network. The Borovets Declaration, released after the conference, highlights the specification of the mountains of the South Eastern Europe and elaborates on topics that emerged from the conference. During the conference, a roadmap was drawn according to which several follow-up activities were planned including: development of a joint Research Strategy based on the specific needs of the Balkan region, promotion of new research partnerships and development of international project proposals, facilitating the development of peer-reviewed papers and synthesis articles, contributing to capacity building by creating exchange opportunities and providing a review support for proposals and publications, and fostering sustainable development and conservation in the Balkan mountains.

The Borovets Conference also contributed to the identification of the SEEmore Research Agenda topics. Firstly, Research Agenda themes were discussed, then a refined survey of priority topics was conducted after the event and eight topics were identified as a result: hazards, mountain ecosystems, land-use change and management, biodiversity and depopulation, climate change, ecosystem functions and services, pollution and infrastructure.

SEEmore uses different tools for supporting and ensuring network coordination and updating: the SEEmore website, which is associated with the Mountain Research Initiative (MRI) website, a bi-monthly publication “SEEmore Newsflash”, MRI newsletter, international conferences, publications and SEEmore “Who’s who” list. Three major conferences were conducted under SEEmore, the last one was conducted in Ankara in 2012 and was devoted to “Mountain Resources and their Response to Global Change”. During this conference, participants decided to establish a Scientific Steering Committee (SSC) for network development and consolidation. Several scientists responded to the open call for candidates from most SEE countries in Autumn 2012 expressing interest in becoming members of the SSC.

The first meeting of the SSC was held in Sofia, Bulgaria in March 2013, where a SEEmore chair and vice chair were elected to serve for two years. The next election of the next chair and vice chair took place in 2015. By 2016, the network had connected almost 422 researchers working in the mountain regions of Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Greece, Macedonia, Montenegro, Romania, Serbia, Slovenia and Turkey.

CLOSING REMARKS

Joseph Salukvadze, Tbilisi State University

In a follow-up to the Caucasus Mountain Forum 2016, several activities are in the pipeline for the finalization of the SCOPES project’s Regional Research Agenda: further development of the online scientific platform, support of Caucasus SDI, and preparing ground for a continuation of the Caucasus Mountain Forum. A lot of inspiration was garnered from the other Scientific Mountain Networks from other mountain regions that have already conducted a number of mountain forums in their regions. Following in their footsteps, it is planned to have an alternating series of conference locations. The next forum should also be organized in coordination with other mountain forums, in order not to overlap in terms of dates.

Special thanks are given to the Swiss National Science Foundation and the Swiss Agency for Development and Cooperation, as well as UNEP for their support in organizing the Forum, to the host Universities of TSU and Ilia, all the participants and volunteers and finally the organizing team led by the Sustainable Caucasus NGO.

H.E. Lukas Beglinger, Swiss Ambassador to Georgia

We had the opportunity to enjoy a rich menu of sessions, workshops and panels on a broad variety of topics, such as hazard assessment, spatial data infrastructure, biodiversity, tourism, etc. These topics are not only of scientific interest, they are highly relevant and important in practice and in policies as
well. This practical relevance was also underscored by the very title of the Forum: “Bridging Science and Practice for Sustainable Development”.

The regional dimension is equally important. The Forum was an excellent opportunity to start to establish solid networks across borders. Hence, we can conclude that this forum was highly relevant and timely, especially as sustainable development is solidly back on the world agenda with the need to comprehensively address social-economic and environmental challenges. There is some skepticism about translating the scientific research into policies but there are some positive examples as well. For instance, disaster risk reduction, which is something that the Swiss Cooperation Office has very successfully worked on for years in the region, and the discussions during the Forum have shown that being aware of the hazards and also being prepared to address them is a prerequisite to sustainable development. The methodology of hazard mapping that was developed with Swiss assistance will hopefully have a regional application in time.

Switzerland, a mountainous country affected by different developments, is very much aware of the importance of sustainable mountain development and will bring its fair share of experience to this collective effort.
POSTER PRESENTATIONS

During the CMF 2016, several posters were exhibited. The poster presentations were made during breaks when all participants had the chance to get acquainted with them. For the nomination of the best poster and a runner-up, an evaluation commission was set up comprising of Jörg Balisger, coordinator of the Sustainable Caucasus Project, Mamuka Gvilava, representative of GeoGraphic, Mehmet Somuncu from Ankara University, Kamran Shayesyer from Malayer University and Tamara Mitrofanenko from the University of Natural Resources and Life Sciences, Vienna. They were guided by the following formal criteria in their evaluations: a) organization of the poster, i.e. how logically the argument was presented, b) scientific quality for a non-expert audience, clarity of the methods and references used and c) visual quality of the poster.

These posters were on display in the Main Auditorium of Tbilisi State University anteroom throughout the breaks of the forum:

<table>
<thead>
<tr>
<th>Authors</th>
<th>Title</th>
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<tbody>
<tr>
<td>Karen Ghazaryan, Hasmik Movsesyan, Hrant Khachatryan, Naira Ghazaryan</td>
<td>Environmental geochemistry of heavy metals and arsenic in soils around Zangezur Copper and Molybdenum Combine, Armenia</td>
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<tr>
<td>Astghik Poghosyan, Inessa Eloyan, Iren Shahazizyan, Siranush Nanagulyan</td>
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<td>Jeren Kazanchi, Marine Mosulishvili</td>
<td>Discovery of ethnobotanical knowledge patterns of mountain plants along the Georgian-Turkish border</td>
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<tr>
<td>Magda Bobokhidze</td>
<td>Meaning of industry in preserving mountain populations in Georgia</td>
</tr>
</tbody>
</table>

BEST POSTER AWARDS

Jeren Kazanchi and Marine Mosulishvili were selected for best poster entitled “Discovery of ethnobotanical knowledge patterns of mountain plants along the Georgian-Turkish border”. The poster of Polina Morozova and Oleg Rybak, “Downscaling of the climate model data for the mass balance calculation of mountain glaciers for future climate scenario” was runner-up. These poster authors were awarded with certificates and symbolic souvenirs.
DAY 1: MONDAY, NOVEMBER 28

7:30-9:30  Registration
         Tbilisi State University

9:30-10:45  Opening Session
         Tbilisi State University, Main Auditorium
         Welcoming remarks:
         Invited dignitaries
         Mr Olivier Bürki  Regional Director, Swiss Agency for Development and Cooperation, Office for the South Caucasus, Embassy of Switzerland
         Mr Giga Zedania  Rector, Ilia State University
         Mr George Shervashidze  Rector, Tbilisi State University
         Mr Nugzar Zazanashvili  Ilia State University, Ecoregional Conservation Plan
         Mr Jean Radvanyi  INALCO Paris and CASCADE project (Caucasus Mountain Regions in Transition: New Trends, New Challenges)

10:45-11:30  Coffee Break

11:30-13:15  Thematic Session 1: Hazard Risk Assessment
         Tbilisi State University, Room 107
         Chair:  Mr Hakan Yigitbasioglu, Ankara University, Department of Geography
         Svetlana Badina  Floods, avalanche and mudflows risks in the North Caucasus
         Elya Sahakyan, Mikayel Gevorgyan, Hayk Igityan  Assessment of the width of an active fault zone by the example of the Vedi Thrust Fault
         Vakhtang Banetashvili, Khatuna Chargazia, Nodar Javakhishvili, Manana Kaishauri, Giorgi Khurtsidze, Mikheil Mitin, Inga Samkharadze, Ioseb Sauri  Radar monitoring of dangerous meteorological processes in Eastern Georgia

11:30-13:15  Workshop 1: Policy advocacy at the Science-Policy Interface
         Tbilisi State University, Room 101
         Chair:  Mr Levan Dadiani, Oxfam, Georgia
         Levan Dadiani  International Caucasus Mountain Centre (ICM-C): Conceptual Framework
11:30-13:15 Thematic Session 2: Climate Change and Mountain Environments
Tbilisi State University, Room 115

Chair: Ms Nina Shatberashvili, Sustainable Caucasus, SNC-mt Coordination Unit, Ilia State University

<table>
<thead>
<tr>
<th>Pavel Toropov, Vladimir Mikhalenko, Stanislav Kutuzov</th>
<th>Physical mechanisms of the intensive melting of glaciers of the North Caucasus in the last 20 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rauf Gardashov, Terane Gardashova, Tural Mammadov, XedceXanim Huseynova, Guler Mammadova</td>
<td>Solar radiation model for mountain regions</td>
</tr>
<tr>
<td>Polina Polumieva, Veronika Kuznetsova</td>
<td>Reconstructing glacier history in the Central Caucasus by means of tree ring investigations</td>
</tr>
</tbody>
</table>

13:15-14:30 Lunch

14:30-16:00 Plenary Session 1: Climate Change
Tbilisi State University, Main Auditorium

Moderator: Mr Jörg Balsiger, University of Geneva, Coordinator of the project “Supporting Sustainable Mountain Development in the Caucasus”

Speakers/Presenters:

Research needs in the field of Climate Change: governmental vision
Ms Narine Mailyan On behalf of UNFCCC National Focal Point in Armenia

Mr Bariz Mehdiyev Director of Azerbaijan Branch Office of REC Caucasus, Azerbaijan

Ms Ekaterine Mikadze Climate Change Department, Ministry of Environment and Natural Resources Protection, Georgia

Ms Musonda Mumba Ecosystems based Adaptation Coordinator, Climate Change Adaptation Unit, UN Environmental Programme, Experiences of African Mountains and links to resilience and climate change adaptation research

Ms Nato Kataladze National Environment Agency, Georgia, Climate observation and modelling in the Caucasus

16:00-16:45 Coffee and Posters
Tbilisi State University, Main auditorium reception space

16:45-18:30 Thematic Session 3: Tourism
Tbilisi State University, Room 107

Chair: Mr Mehmet Somuncu, Ankara University, Department of Geography

<table>
<thead>
<tr>
<th>Kamran Shayesteh, Shiva Gharibi</th>
<th>Valuing visitor willingness to pay for forest conservation: a case of Arasbaran Biosphere Reserve</th>
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</thead>
<tbody>
<tr>
<td>Alexander Drozdov</td>
<td>Caucasian trans-border tourism development</td>
</tr>
<tr>
<td>Mariam Tsitsag, Nana Kvirvelia, Meri Gugeshashvili</td>
<td>Ethno-cultural resources and perspectives of the development of ethno-tourism in Tusheti</td>
</tr>
</tbody>
</table>
### 16:45-18:30 Thematic Session 4: Regional Development I
*Tbilisi State University, Room 115*

**Chair:** Mr Joseph Salukvadze, Tbilisi State University

<table>
<thead>
<tr>
<th>Presenter</th>
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<tbody>
<tr>
<td>Ramiz Mammadov Rovshan Karimov</td>
<td>Challenges and perspectives of researches and socioeconomic activities in mountain areas of Azerbaijan</td>
</tr>
<tr>
<td>Lorenzo Venzi</td>
<td>Socio-economic development of mountain areas in the Caucasian countries</td>
</tr>
<tr>
<td>Alexander Badov</td>
<td>Mountain population and sustainable development</td>
</tr>
</tbody>
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### 16:45-18:30 Thematic Session 5: Biodiversity Conservation
*Tbilisi State University, Room 101*

**Chair:** Mr Armen Gevorgyan, National Academy of Science of Armenia

<table>
<thead>
<tr>
<th>Presenter</th>
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<tbody>
<tr>
<td>David Tarkhnishvili, Alexander Gavashelishvili, Marine Murtskhvaladze, Mumladze Levan</td>
<td>The Caucasus mountains as a reservoir of biodiversity across geological time</td>
</tr>
<tr>
<td>Alexey Gunya, Yuri Karaev, Hetag Kasaev</td>
<td>Possibility of creation and perspectives of the Caucasian Biosphere Reserves Association</td>
</tr>
<tr>
<td>Ramiz Mammadov, Natavan Jafarova</td>
<td>Dynamics of desertification processes in the eastern part of the Republic of Azerbaijan</td>
</tr>
<tr>
<td>Irakli Matcharashvili</td>
<td>Assessment of forest governance in Georgia</td>
</tr>
</tbody>
</table>
DAY 2: TUESDAY, NOVEMBER 29

9:30-10:30 Plenary session 2: Hazard Mapping: The case of Georgia
Tbilisi State University, Main Auditorium

Moderator: Mr André Wehrli, Mountain Desk, Swiss Agency for Development and Cooperation

Mr George Gotsiridze  
Panel Discussion: GeoGraph, Georgia, *Hazard Mapping in Georgia: Experience and the Way Forward*

Mr. Ramiz Mammadov  Director of Institute of Geography of National Academy of Science of Azerbaijan

Mr. Hamlet Matevosyan  Rector of Crisis Management State Academy, Armenia

Mr Josep Kinkladze  Head of Hydrometeorological Hazards Recording and Analysis Section, NEA Georgia, *Key elements of successful partnership: NEA/SDC project on disaster risk reduction*

10:30-11:15 Coffee Break

11:15-13:00 Thematic Session 6: Landscape, Geology, and Management of Natural Resources
Tbilisi State University, Room 107

Chair: Mr George Lominadze, Institute of Geography, Georgia

| Nodar Elizbarashvili Giorgi Meladze, Salome Khvedelidzé, Tamar Cecadzé | Geographical peculiarities and topical issue of the sustainable development of the South Caucasus |
| Raisa Gracheva, Ilia Shokunov, Anzor Tavartqiladzé | Mountain environment shaped by catastrophic landslides |
| Nodar Varamashvili, Chelidze Tamaz, Chelidze Zurab | Landslide and acoustic emission |

11:15-13:00 Workshop 2: Leveraging Spatial Data
Tbilisi State University, Room 115

Chair: Mr Armen Gevorgyan, National Academy of Science of Armenia

| Mamuka Gvilava | SDI Initiatives in Georgia with Emphasis on Biodiversity and Climate Action |
| Irina Bushueva | Examples of use of spatial data in the Institute of Geography RAS |
| Suren Arakelyan | Adapting a GEOSS/SDI training manual for use in the Caucasus |
| Elvin Amrahov | Current status of Spatial Data Infrastructure (SDI) in Azerbaijan |
| Yaniss Guigos | Spatial Data Infrastructure (SDI) Pilot for the Caucasus |
11:15-13:00 Thematic Session 7: Management of Water Resources
Tbilisi State University, Room 105
Chair: Ms Nina Shatberashvili, Sustainable Caucasus, SNC-mt Coordination Unit, Ilia State University

Tatiana Kuderina
Geochemical monitoring of natural water in Caucasus landscape-geochemical arenas

13:00-14:15 Lunch

14:15-16:00 Thematic Session 8: Regional Development II (Interdisciplinary Analysis)
Tbilisi State University, Room 107
Chair: Mr Kamran Shayesteh, Department of environmental Sciences, Faculty of Natural Resources and Environment, Malayer University

Vyacheslav Baburin
The aggregate costs method for estimating the rise in price factors of population living and economic activities

Mehmet Somuncu
Land-use and land cover change in mountain pastures of the Eastern Black Sea mountains, Turkey

14:15-16:00 Thematic Session 9: Teaching and Learning Practices
Tbilisi State University, Room 101
Chair: Ms Raisa Gracheva, Institute of Geography of Russian Academy of Sciences

Susanne Waltraud Schwarz
Outdoor learning soil

Gayane Poghosyan, Gayane Melkonyan
Implementing the project “Learning for the future” in the context of “Education for sustainable development” in Armenia

Gulnoza Akhmadova
Goal-oriented teaching English to refugees

16:00-16:45 Coffee and Posters
Tbilisi State University, Main Auditorium reception space

16:45-18:30 Thematic Session 10: History and Anthropology
Ilia State University, Bookstore “Ligamus”
Chair: Mr Ramiz Mammadov, Director of Institute of Geography of National Academy of Science of Azerbaijan

Marine Ghazaryan, Artavazov Nazaretyan
Sustainable development and historical preservation

Alexander Gavashelishvili, David Tarkhnishvili
Genetic structure of human populations explains expansion of humans in the Caucasus in pre-historic times

Zakir Eminov, Rovshan Karimov, Etibar Badalov
Changes in distribution of population and settlements of Azerbaijan by altitude belts

Vladimir Matskovsky, Umalat Gadiev, Arseniy Kudikov, Nikita Lomakin
Dendrochronological and radiocarbon dating of medieval buildings in the mountain part of Ingushetia
### 16:45-18:30 Thematic Session 11: Biodiversity II

**Ilia State University, Room B201**

**Chair:** Mr David Tarkhnishvili, Dean of School of Natural Sciences and Engineering, Ilia State University

<table>
<thead>
<tr>
<th>Presenter</th>
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<tbody>
<tr>
<td>Farid Seyfullayev</td>
<td>Climate change impacts on relict chestnut-leaved oak (Quercus castaneifolia) in Azerbaijan</td>
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<tr>
<td>Gregory Insarov</td>
<td>Montane Lichens as monitors of global change pressure</td>
</tr>
<tr>
<td>Siranush Nanagulyan, Lusine Margaryan, Yeva Hovhanisyan</td>
<td>Distribution and analysing of macroscopic fungi depending on the vertical vegetation zones and plant communities in Shikahogh State Reserve</td>
</tr>
<tr>
<td>Anush Arakelyan</td>
<td>Ichthyofauna of Armenian Rivers belonging to Kura river basin and the human impact on it</td>
</tr>
</tbody>
</table>

### 16:45-18:30 Workshop 3: Research for Communities and/or Research with Communities: Transdisciplinary research and teaching in sustainable mountain development and tourism

**Ilia State University, Room A101**

**Moderator:** Ms Tamara Mitrofanenko, University of Natural Resources and Life Sciences Vienna (BOKU)

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<thead>
<tr>
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<tbody>
<tr>
<td>Raisa Gracheva</td>
<td>Research for development. Approaches, practice and results. Experience of Summer School 2016</td>
</tr>
<tr>
<td>Heino Meessen, Nodar Elizbarashvili, Ashot Khoetsyan, Rusudan Simonidze</td>
<td>Transdisciplinarity in teaching and research on sustainable mountain development</td>
</tr>
<tr>
<td>Tamara Mitrofanenko, Christian Maurer, Mariana Unapkoshvili, Merab Khokhobaia, Joseph Salukvadze, Armen Gevorgyan, Ashot Khoetsyan</td>
<td>Transdisciplinarity for Sustainable Tourism Development in the Caucasus Region (CaucaSusT)</td>
</tr>
</tbody>
</table>
DAY 3: WEDNESDAY, NOVEMBER 30

8:45-10:30 Thematic Session 12: Climate Change and Climate Change Impacts
Tbilisi State University, Room 115

Chair: Ms Nina Shatberashvili, NGO Sustainable Caucasus, SNC-mt Secretariat, Ilia State University

<table>
<thead>
<tr>
<th>Speaker</th>
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<tbody>
<tr>
<td>Raisa Gracheva, Elena Belonovskaya, Vera Vinogradova, Ilia Shorkunov</td>
<td>Present-day convergence of vegetation and soils of pastoral ecosystems of the Central Caucasus: land use history and climate change</td>
</tr>
<tr>
<td>Bakhram Nurtaev</td>
<td>Long term trends in climate variability of the Caucasus Mountains</td>
</tr>
<tr>
<td>Ekaterina Dolgova</td>
<td>June–September temperature reconstruction in the Northern Caucasus based on blue intensity data</td>
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8:45-10:30 Thematic Session 13: Spatial Information Management
Tbilisi State University, Room 107

Chair: Ms Tamar Bakuradze, GeoGraphic

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<tbody>
<tr>
<td>Avtandil Amiranashvili, Nino Japaridze, Lia Kartvelishvili, Ketevan Khazaradze, Rusiko Khazaradze</td>
<td>Tourism climate index in some locations of Georgia</td>
</tr>
<tr>
<td>Aram Gevorgyan</td>
<td>Decision support system for integrated water resources management in Armenia</td>
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10:30-10:45 Coffee Break
Tbilisi State University, Main Auditorium reception space

10:45-12:45 Closing Session: Towards a Regional Research Agenda
Tbilisi State University, Main Auditorium

Moderator: Mr Jörg Balsiger, University of Geneva, Coordinator of the project “Supporting Sustainable Mountain Development in the Caucasus”

Towards a regional research agenda:
Mr Joseph Salukvadze Tbilisi State University

Discussion panel:
Mr Mehmet Somuncu Ankara University, South East European (SEEmore) Experience
Ms Katarzyna Ostapowicz Institute of Geography and Spatial Management, Jagiellonian University, Carpathian (S4C) Experience

12:45-14:00 Lunch
DAY 4: THURSDAY, DECEMBER 1

9:00 - 16:00 Proposal Writing Workshop
(pre-registration required)
Trainers: Mr Jörg Balsiger, University of Geneva, Coordinator of the project “Supporting Sustainable Mountain Development in the Caucasus”; and Mr Robert Atkinson, Sustainable Caucasus, SNC-mt Coordination Unit

POSTER PRESENTATIONS
(during coffee breaks in the Main Auditorium of Tbilisi State University anteroom)

Karen Ghazaryan, Hasmik Movsesyan, Hrant Khachatryan, Naira Ghazaryan
Environmental geochemistry of heavy metals and arsenic in soils around Zangezur Copper and Molybdenum Combine, Armenia

Astghik Poghosyan, Inessa Eloyan, Iren Shahazizyan, Siranush Nanagulyan
Taxonomic and cenotic analysis of bryoflora of volcanic mountain range of Arailer, Armenia

Irakli Matcharashvili.
Impact of hydropower development to ecosystem services in Georgia

Natalia Miroshnichenko, Tatyana Golybochkina, S. Bagaev
Peculiarity of socio-economic development of mountain regions of Ossetia-Alania Republic

Tatiana Khromova, Gennady Nosenko
Mountain glacier changes on the territory of Russia

Jeren Kazanchi, Marine Mosulishvili
Discovery of ethnobotanical knowledge patterns of mountain plants along the Georgian-Turkish border

Polina Morozova, Oleg Rybak
Downscaling of the climate model data for the mass balance calculation of mountain glaciers for future climate scenario - supported by RFBR grant 15-05-00567

Magda Bobokhidze
Meaning of industry in preserving mountain populations in Georgia
### 5. LIST OF PARTICIPANTS

<table>
<thead>
<tr>
<th>Last Name</th>
<th>First Name</th>
<th>Institution</th>
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<th>Session Number</th>
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<tbody>
<tr>
<td>Abulashvili</td>
<td>Ana</td>
<td>Sustainable Caucasus</td>
<td>Georgia</td>
<td>n/a</td>
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<tr>
<td>Ahmadov</td>
<td>Zahir</td>
<td>Swiss Agency for Development and Cooperation, Azerbaijan Office</td>
<td>Azerbaijan</td>
<td>n/a</td>
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<tr>
<td>Akhmadova</td>
<td>Gulnoza</td>
<td>Navoi International Airport</td>
<td>Uzbekistan</td>
<td>Thematic Session 9</td>
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<tr>
<td>Amiranashvili</td>
<td>Avtandil</td>
<td>Institute of Geography, Tbilisi State University</td>
<td>Georgia</td>
<td>Thematic Session 14; Poster Presentations</td>
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<tr>
<td>Amrahov</td>
<td>Elvin</td>
<td>Institute of Geography, National Academy of Sciences</td>
<td>Azerbaijan</td>
<td>Workshop 2</td>
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<tr>
<td>Arakelyan</td>
<td>Anush</td>
<td>Scientific Center of Zoology and Hydroecology, Institute of Zoology, National Academy of Science</td>
<td>Armenia</td>
<td>Thematic Session 7</td>
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<tr>
<td>Arakelyan</td>
<td>Suren</td>
<td>“GEORISK” Scientific Research Company</td>
<td>Armenia</td>
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<td>Atkinson</td>
<td>Robert Ian</td>
<td>Sustainable Caucasus</td>
<td>Switzerland</td>
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<td>Baburin</td>
<td>Vyacheslav</td>
<td>Lomonosov Moscow State University</td>
<td>Russian Federation</td>
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<td>Badalov</td>
<td>Etibar</td>
<td>Institute of Geography, National Academy of Sciences</td>
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<td>Badina</td>
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<td>National Environmental Agency</td>
<td>Georgia</td>
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<td>Balsiger</td>
<td>Jörg</td>
<td>University of Geneva</td>
<td>Switzerland</td>
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<td>Baramidze</td>
<td>Neli</td>
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<td>Belonovskaya</td>
<td>Elena</td>
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<tr>
<td>Berikashvili</td>
<td>Ketevan</td>
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<td>Bobokhidze</td>
<td>Magda</td>
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<td>Georgia</td>
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<td>Bushueva</td>
<td>Irina</td>
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<td>Chargazia</td>
<td>Khatuna</td>
<td>State Military Scientific-Technical Center Delta; M. Nodia Institute of Geophysics, Tbilisi State University</td>
<td>Georgia</td>
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