ინფომაციის სია

ახალგაზრდა თავის შექსპირება ისტორიაში მოუთხოვა. მისი მნიშვნელობა და გამოფერდება სასწავლებლად და ღირებული დედამის ფოლკლორში, მოცულობა ბავშვთა სახელობაში სოლოლოგიური ადრეული ინახების პროგრამა (MATRA) ფაქტორზე მიუხედავად.

ახალგაზრდა თავის შემოქმედება რეალური თავშეფარვას ახალი სამუშაო პერიოდში მოაწერა. სოლოლოგიის სახელობა ომ ჩვეულებრივ დაამრჩხა, ისევე, როგორც გამოფერდების შემოქმედება. ის ორგანორებისთვის რეალური ხარჯდა და დადებითი ჟანგბადები გამოიწვია.

ახალგაზრდა არის ციფრულმა ინსტატურებთან ახლოს, როგორც ევროპულ ცენტრი (ITC) სამეურაბო ორგანიზაცია (AICD) და საზღვარში მოუწესრებული.

ახალგაზრდა მიიღო მასალად ვაჟი საქართველოს საგანგებო და საფრთხეს სამინისტროს სოფლის საღრმა თანამედროვე საქმის პროგრამა (MATRA) ფაქტორზე მიუხედავად.


Information about the Atlas

The Atlas was elaborated by CENN and University of Twente’s (ITC) Geo-Information Science and Earth Observation Faculty, with financial support provided by the Social Transformation Programme (MATRA) of the Ministry of Foreign Affairs of Netherlands.

The Atlas was updated and republished in the scope of the project Sustainable Forest Governance in Georgia – Phase II with financial support provided by the Austrian Development Cooperation (ADC).

The publication aims to improve state institution capabilities regarding Disaster Risk Management, as well as implement modern spatial approaches and technologies in spatial planning.

Updating and republishing the Atlas was based on two factors. First, the Atlas was out of print. Second, CENN decided to include forest cover maps in the Atlas as it serves to mitigate and/or prevent natural hazards and risks (i.e. landslides, mudslides, flash floods, avalanches, droughts, etc.).

The Atlas reflects information concerning natural hazards and risks, exposure analysis (buildings, population, GDP, etc.), vulnerability and risk analysis.

The Atlas aims to support governmental institutions in DRM, developing effective policies in terms of mitigating and/or preventing natural hazards, and effectively planning and implementing various development projects. By utilizing the Atlas, interested individuals and organizations will have the opportunity to evaluate current natural disaster risks and relevant challenges on a community level.

The maps depicted in the Atlas are based on modern local and international research and assessment methods. Together with the Atlas, the web-atlas was developed, which includes detailed maps and relevant data enabling users to analyze risks on an administrative level.

The views and opinions expressed in the Atlas are the project implementer’s and do not necessarily reflect the official policy or viewpoint of ADC.

The web-atlas is available at the following link: drm.cenn.org.

Within the initiative:
• The risk assessment guidelines were prepared;
• The qualification of state institutions working on DRM issues was increased in modern technologies and approaches to DRM and DRR;
• A new system of disaster risks data management and analysis was created;
• The web-atlas and printed version of the natural hazards and risks in Georgia were developed;
• The risk assessments of specific examples of different types of natural hazards were conducted by using modern technologies and approaches;
• The risk communication strategy was developed;
• The maps and data were updated.

Note: A large majority of the maps and tables in the Atlas were elaborated based on data from 2008-2011. Parts of the maps (i.e., protective areas; forest cover; tree cover gain and tree cover loss; recorded earthquakes; recorded landslides, mudflows and rockfalls; landslides, mudflow and rockfall threats; recorded floods and flash floods; recorded wildfires; wildfire threats; and forest cover hazard zoning) have been updated based on data from 2017.

Prepared by: CENN / ITC
Tbilisi, Georgia
August, 2018

Contributors

Dr. Cees Van Westen, ITC
Nana Janashia, CENN
Dr. Menno Straatsma, ITC
Dr. Ulan Turdukulov, ITC
Wim Feringa, ITC
Koert Sijmons, GeoMapa
Dr. Chichiko Janelidze, CENN
Rezo Getiani, CENN
Levan Natsvlishvili, CENN
Dr. George Gaprindashvili, NEA
Irakli Megrelishvili, NEA
Gigi Geladze, NEA
Vakhtang Gloveli, EMS
Lasha Sukhishvili, Ilia State University
Mikheil Elashvili, Ilia State University

Contributors
The territory of Georgia (covering 69.8 thousand km²) rises to a height of 5,000 m above sea level (46.1% up to 1,000 m above sea level; 39.7% – from 1,000 m to 2,200 m; 14.2% – above 2,200 m). The strong tectonic movements determine a high degree of the relief-dissection and the intensive erosion processes, along with climate conditions, landslides, mudflows, snow avalanches, etc. supports natural disasters. At certain locations, the depths of erosion-cuts exceed 2,000 m. The main factors contributing to the triggers of natural disasters within Georgia are as follows:

Geography

The territory of Georgia (covering 69.8 thousand km²) rises to a height of 5,000 m above sea level (46.1% up to 1,000 m above sea level; 39.7% – from 1,000 m to 2,200 m; 14.2% – above 2,200 m). The strong tectonic movements determine a high degree of the relief-dissection and the intensive erosion processes, along with climate conditions, landslides, mudflows, snow avalanches, etc. supports natural disasters. At certain locations, the depths of erosion-cuts exceed 2,000 m.

Seismic Activity

The movement of the Arabian Plate (roughly 4.65 cm per year) towards the Eurasian Plate determines and controls the seismic activity within the Caucasus Region. The territory of Georgia, within this region, is characterized by a medium level of seismicity, where strong earthquakes can occur several times every one hundred years. Two of the most prominent earthquakes within the last century is the Spitak Earthquake of 1988, which measured 7.4 on the Richter magnitude scale, and the Racha Earthquake of 1991, measuring 7.00. Seismic activity in the country is one of the most destructive hazards and causes human deaths and economic losses; whereas, on the other hand, strong earthquakes often trigger the development and occurrence of landslides and avalanches. For example, the strong earthquake that occurred in 1991 in the territory of Racha-Imereti and Shida Kartli activated and triggered, not only existing landslide bodies but also created tens of new landslide and rockslide areas in the respective regions.
Climate
Climatic conditions play an essential role in triggering hazardous natural events within Georgia. There are often periods of heavy and prolonged rainfall (especially, in the west of Georgia). A rapid rise in the air temperature and the subsequent, rapid and intensive melting of the snowpack and/or the prolonged rains, occurring in late winter and early spring, further facilitate the rapid rise of the water levels in rivers causing floods, mudflows and other natural disasters. The snow avalanches are quite frequent especially, in western and central parts of the Caucasus as well as in the territory of mountainous Adjara. Snow avalanches are often associated with heavy snows and the constant fluctuations in air temperature observed at the end of winter and beginning of spring.

Anthropogenic Factors
One of the most noteworthy factors that contribute to the formation of natural processes is unnecessary human agricultural activities (i.e. deforestation, over-grazing pastures, building infrastructure at the bottom of river valleys, cutting off steep hillsides, etc.), that provokes and activates natural disaster processes (i.e. mudflows, landslides, flash floods, etc.) in a number of locations. During 70 years of Soviet rule, infrastructural activities in the country were carried out without consideration for local environmental conditions. During this period, the local population had not participated in any kind of natural resource and agriculture management. To further compound this issue the local traditional knowledge and experience of sustainable resource management were lost. Furthermore, the economic crisis that developed after the collapse of the Soviet Union forced the local population to use local resources in an uncontrolled and unplanned manner, which, within years, resulted in the further development and increasing frequency of occurrence of natural disasters.
Table of Contents

III

1. General Introduction
   1.1 Introduction
   1.2 Natural Disaster Risk Management
   1.3 Disaster Risk Assessment Methodology
   1.4 Risk Communication Tools

2. Baseline Data
   2.1 Introduction
   2.2 Natural Conditions
   2.2.1 Hypsometry
   2.2.2 Geology
   2.2.3 Geomorphology
   2.2.4 Climate
   2.2.5 Precipitation
   2.3 Social-Economic and Ecological Conditions
   2.3.1 Cultural Heritage
   2.3.2 Forest Cover
   2.3.3 Land Cover
   2.3.4 Forest Cover
   2.3.5 Administrative-Territorial Division
   2.3.6 Buildings
   2.3.7 Population
   2.3.8 Transportation Infrastructure
   2.3.9 Protected Areas
   2.3.10 Economy

3. Natural Hazards in Georgia
   3.1 Introduction
   3.2 Natural Hazard Events Recorded in the Past
   3.2.1 Recorded Earthquake Events
   3.2.2 Earthquake Hazard Assessment
   3.3 Landslides, Mudflows and Rockfalls
   3.3.1 Recorded Landslide, Mudflow and Rockfall Events
   3.3.2 Landslide, Mudflow and Rockfall Hazard Assessment
   3.4 Floods and Flash Floods
   3.4.1 Recorded Flood and Flash Flood Events
   3.4.2 Flood Discharge Analysis
   3.4.3 Flood-flash Flood Hazard Assessment
   3.5 Snow Avalanches
   3.5.1 Recorded Snow Avalanche Events
   3.5.2 Snow Avalanche Hazard Assessment
   3.6 Wildfires
   3.6.1 Recorded Wildfire Events
   3.6.2 Wildfire Hazard Assessment
   3.6.3 Forest cover hazard zoning
| 3.8.1 | Recorded Drought and Hail Storm Events | 66 |
| 3.8.2 | Drought and Hail Storm Hazard Assessment | 68 |

4. Exposure Analysis

4.1 Introduction
4.2 Exposure of Crops, Forests and Protected Areas
4.3 Exposure of Buildings
4.4 Exposure of Population
4.5 Exposure of Road Network
4.6 Exposure of Gross Domestic Product (GDP)
4.7 Summary of Exposure Information

5. Vulnerability and Risk Analysis

5.1 Introduction
5.2 Vulnerability
5.2.1 Physical Vulnerability
5.2.2 Social Vulnerability
5.2.3 Environmental and Economic Vulnerability
5.2.4 Overall Vulnerability
5.3 Risk Assessment

6. Conclusions and Recommendations

7. Annex
The English version of the topographic map can be found in Annex 3.

Source: The basic data provided by Geoland was further developed by CENN/ITC

SRTM DEM is used to display relief.


The frequency and magnitude of natural hazard events is growing (see Figure 1.1), leaving disasters that have negative impacts on humans, the economy and the environment in its wake. Many areas in the world are now prone to single or multiple natural hazards. These hazard events result in serious disasters when they come into contact with vulnerability and inadequate capacity or coping capabilities of local populations and governments. Avoiding these kinds of disasters or, at the very least, reducing their impact, can be facilitated successfully by engaging relevant actors in DRR strategies. Consequently, developing a specific focus on DRR is an important and vital issue for a multitude of actors operating around the world.

According to two separate assessments of Georgia, both of which were carried out by the World Bank, taking into account the different recurrence probabilities of disasters in the country (0.5%, 5%, 20%), the possible cost of these annual risks of natural disasters is estimated to range between $146 mln to $3.3 bln. According to additional information provided by the NEA of the Ministry of Environment Protection and Agriculture of Georgia, between 1995 and 2017 the total amount of damage, as a result of geological and hydro-meteorological natural hazards, amounted to 3,547.9 mln GEL.
Natural Disaster Risk Management

Hazard Identification

1990-2000 decade was a crucial moment in terms of natural disaster risk management (IDNDR). 2000's decade saw the emergence of a new concept of risk management in the international arena, known as ISDR. The next phase was a follow up called the International Strategy for Disaster Reduction (ISDR) which stressed the need to mitigate risk before disasters occur. At the same time, this strategy sought to foster an increased awareness, more public commitment, better knowledge sharing, and partnering. A general strategy for DRR should first start by establishing the risk management context and criteria, and by characterizing the potential threats to a community and hazards for its living environment. The strategy should analyze the social and physical vulnerability of a population to determine the potential risks from a range of hazardous scenarios in order to implement effective risk reduction strategies at all levels. This more proactive concept has been referred to as the ‘risk management cycle’, or ‘spiral’, in which learning from a disaster can stimulate and facilitate adaptation and modification in development planning rather than a simple reconstruction of pre-existing social and physical conditions.

The decade covering 1990 to 2000 was declared by the UK to be the International Decade for Natural Disaster Reduction (IDNDR). After the year 2000 a follow up called the International Strategy for Disaster Reduction (ISDR) was developed, which stressed the need to move from top-down management of disasters and a cycle that focuses on rehabilitation and preparedness, towards a more comprehensive approach that works to avoid or mitigate risk before disasters occur. At the same time, this strategy sought to foster an increased awareness, more public commitment, better knowledge sharing, and partnering. A general strategy for DRR should first start by establishing the risk management context and criteria, and by characterizing the potential threats to a community and hazards for its living environment. The strategy should analyze the social and physical vulnerability of a population to determine the potential risks from a range of hazardous scenarios in order to implement effective risk reduction strategies at all levels. This more proactive concept has been referred to as the ‘risk management cycle’, or ‘spiral’, in which learning from a disaster can stimulate and facilitate adaptation and modification in development planning rather than a simple reconstruction of pre-existing social and physical conditions.

The decade covering 1990 to 2000 was declared by the UK to be the International Decade for Natural Disaster Reduction (IDNDR). After the year 2000 a follow up called the International Strategy for Disaster Reduction (ISDR) was developed, which stressed the need to move from top-down management of disasters and a cycle that focuses on rehabilitation and preparedness, towards a more comprehensive approach that works to avoid or mitigate risk before disasters occur. At the same time, this strategy sought to foster an increased awareness, more public commitment, better knowledge sharing, and partnering. A general strategy for DRR should first start by establishing the risk management context and criteria, and by characterizing the potential threats to a community and hazards for its living environment. The strategy should analyze the social and physical vulnerability of a population to determine the potential risks from a range of hazardous scenarios in order to implement effective risk reduction strategies at all levels. This more proactive concept has been referred to as the ‘risk management cycle’, or ‘spiral’, in which learning from a disaster can stimulate and facilitate adaptation and modification in development planning rather than a simple reconstruction of pre-existing social and physical conditions. (See Figure 1.2).

A general strategy for DRR should first start by establishing the risk management context and criteria, and by characterizing the potential threats to a community and hazards for its living environment. The strategy should analyze the social and physical vulnerability of a population to determine the potential risks from a range of hazardous scenarios in order to implement effective measures to reduce the damage and casualties. The final goal, the reduction of disaster risk in the present and the control of future disaster risk, should be achieved by combining both structural and non-structural measures that foster risk management as an integrated concept and practice. This should be incorporated into all stages of a community’s development process, not just as a post-disaster response. DRR requires a deep understanding of the root causes and underlying factors that cause disasters in order to arrive at solutions that are practical, appropriate and sustainable for the communities at risk. Evidently, managing risk in this manner requires a consensual and collaborative approach. The United Nations International Strategy for Disaster Reduction (UN-ISDR) has widely advocated new ways in which authorities, communities, experts and other stakeholders can jointly diagnose problems, decide on plans of action and implement them. Clearly a new ethic of DRM is emerging based on ‘informed consent’ as opposed to paternalism. Risk assessment as the starting point for further risk management processes should, in turn, be a multifaceted activity, aimed at integrating the likelihood and potential consequences of an event with subjective interpretations of interacting, heterogeneous actors. Figure 1.3 shows a DRM framework that focuses on the use of (spatial) risk information.
Natural Disaster Risk Management in Georgia

Since 2005, a system of reform has been initiated in Georgia based on the “Hyogo Framework for Action.” This reform includes legislative and institutional changes in order to implement sustainable natural disaster management practices. Nowadays, the “Sendai Framework for Disaster Risk Reduction” (2015-2030) serves as an international legal basis for field reforms. System improvement measures to prevent and respond to natural and man-made disasters are also reflected in the Association Agreement, an agreement between Georgia and the European Union in 2014. Topics related to natural disaster management and reducing climate change impacts are also included in the global policies of the United Nations: “Sustainable Development Goals” (September, 2015) and “Paris Agreement on Climate Change” (December, 2015).

In Georgia, disaster management activities are regulated by the normative acts adopted in different periods of time listed below:

- Law of Georgia “On Planning and Coordination of the National Security Policy”;
- Law of Georgia “On Public Safety”.

The major state authorities engaged in natural DRM are depicted in table 1.1.

Based on legal and institutional analysis, a number of important issues can be identified, studied and potentially resolved that will improve the natural DRM system in the country:

- Replacing the existing emergency response practice with the practice of natural DRR and removal-mitigation of triggering factors;
- Implement basin management principles;
- Implement modern risk assessment methods in current methodology;
- Improved communication between central and local institutions working on risk management issues;
- Consideration of natural disaster risks in spatial development projects.
Disaster Risk Assessment Methodology

In disaster risk assessment, three central components are: 1) hazard; 2) vulnerability; 3) buildings at risk of exposure characterized by both spatial and non-spatial attributes. Hazards are characterized by their temporal probability and intensity, derived from a frequency-magnitude analysis. The hazard component in the equation actually refers to the probability of occurrence of a hazardous phenomenon within a specified period of time (a reference period). During the analysis 9 different hazard types were taken into account: earthquake, flood, landslide, mudflow, rockfall, snow avalanche, wildfire, drought and hailstorm. For each of these hazard types a specific susceptibility map was generated and classified into three distinct classes: high, moderate and low. The historical information available regarding past events was then used to estimate the number of events that are likely to happen and the size of individual events within a reference period of roughly 50 years. The spatial probability was then calculated by dividing the area of the expected events by the total area of each hazard class. The historical data on past hazardous events and the hazard maps will be presented in chapter 3.

Vulnerability and exposure were estimated for the following types of elements at risk: buildings, population, GDP, roads, forests, crops and protected areas. These factors will be covered in more detail in Chapter 2 (baseline data). For each combination of hazard type and element at risk the overlapping areas were calculated using GIS, this provided the exposure information. The social, physical, environmental and economic vulnerability was expressed using a qualitative spatial multi-criteria evaluation technique. Vulnerability values were estimated for each combination of a hazard class and the elements at risk, and presented in a matrix. These were then used in the estimation of the final risk maps.

A risk assessment is a process which determines the extent and nature of certain risks by combining the technical characteristics of hazards, people’s vulnerability to these risks and their social conditions and their exposure to these risks (UN/ISDR, 2004). Thus, Disaster Risk can be conceptually represented as:

\[
\text{Disaster Risk} = \text{Hazard} \times \text{Vulnerability} \times \text{Amount of elements at risk} \quad (R = H \times V \times A)
\]

In risk analysis, three central components are: 1) hazard; 2) vulnerability; 3) buildings at risk of exposure characterized by both spatial and non-spatial attributes. Hazards are characterized by their temporal probability and intensity, derived from a frequency-magnitude analysis. The hazard component in the equation actually refers to the probability of occurrence of a hazardous phenomenon within a specified period of time (a reference period). During the analysis 9 different hazard types were taken into account: earthquake, flood, landslide, mudflow, rockfall, snow avalanche, wildfire, drought and hailstorm. For each of these hazard types a specific susceptibility map was generated and classified into three distinct classes: high, moderate and low. The historical information available regarding past events was then used to estimate the number of events that are likely to happen and the size of individual events within a reference period of roughly 50 years. The spatial probability was then calculated by dividing the area of the expected events by the total area of each hazard class. The historical data on past hazardous events and the hazard maps will be presented in chapter 3.

Vulnerability and exposure were estimated for the following types of elements at risk: buildings, population, GDP, roads, forests, crops and protected areas. These factors will be covered in more detail in Chapter 2 (baseline data). For each combination of hazard type and element at risk the overlapping areas were calculated using GIS, this provided the exposure information. The social, physical, environmental and economic vulnerability was expressed using a qualitative spatial multi-criteria evaluation technique. Vulnerability values were estimated for each combination of a hazard class (high, moderate and low) for each of the 9 hazard types and the elements at risk, and presented in a matrix. These were then used in the estimation of the final risk maps.
Hazard and Risk Assessment at National Scale

Hazard and Risk Assessment using GIS can be carried out on different geographical scales, and for various purposes. Hazard and risk assessment at the national level requires to process extremely large amount of information and appropriate resources. Project team carry out the modelling using 'Raster Maps' which use a total cell size of 100 by 100 meters (1 ha). It is important to carry out hazard and risk assessment on a national scale in order to provide awareness raising about the problems of hazards and risks, to improve national planning purposes, to allow for the implementation of national disaster-risk reduction policies, to serve as an early-warning system and to allow for the development of disaster preparedness plans and insurance policies. Given the large size of the country, the limitations with respect to the data availability, and the methods that could be applied, the resulting maps should be considered as general approximations and not as guaranteed information. They cannot be used for detailed land use planning or DRR on the scale of individual communities. The risk assessment applications in planning become more helpful when zooming in to the larger scales, such as the regional or municipal levels. Hazard and risk assessment become integral components and facilitate the comprehensive development of regional development plans and Environmental Impact Assessments for future infrastructure developments. At the municipal level, hazard and risk assessments are carried out as a basis for land-use zoning, and for the design of non-structural risk-reduction measures. At a community level, hazard and risk assessments are carried out in participation with local communities and local authorities, as a means to obtain local commitment and support for disaster-risk reduction programmes. Consequently, more detailed follow-up work will be required, in the future, at this scale.

R = H * V * A

Figure 1.5 | Risk assessment methodology
There are also a number of factors which play an important role in deciding what scale of hazard and risk assessment should be selected. These are related to the aim of the hazard assessment, the type of hazard, the operational scale at which these hazard processes are triggered and how they specifically manifest themselves. These factors also relate to the size and characteristics of the study area, the available data sources and resources, and the required accuracy of the information.

The hazard maps are general, consisting of 3 classes, and are made using simplified methods given the availability of data sources at the national level in Georgia. Some of the maps were taken from earlier research (such as with the earthquakes, drought and hailstorm hazard maps). Other maps have been made utilizing the methodology of selecting and weighting important factors in the maps for the particular hazards with a "Spatial Multi-Criteria Evaluation technique". The decision to use three classes in this map was made in order to make the maps easier to interpret for non-experts. Within the maps the high hazard zones indicate that, in general, about 90% of the hazard events are expected to occur within that specific zone. The moderate hazard zones are where another 9% of the events may occur, and the low hazard zones are those where less than 1% of the hazard events may occur.

The reference period of 50 years, which has been used as the basis for the risk assessment, is a rather arbitrary period. Ideally, when selecting a series of reference points several return periods are selected for each different hazard type, and the specific losses are then calculated for each of them and, integrated into the total risk. Given the incompleteness of the temporal information this was not possible.

The spatial probability estimation depends to a large degree on the detail of the hazard estimation (the smaller the high hazard units are, the better the prediction will be) and on the data of past occurrences from the incomplete recorded database.

The vulnerability values used in the risk assessment are general approximations, and do not take into account the different degrees of intensity and the different classes of elements at risk (e.g. building types).
Risk communication is an important component of effective risk governance, and is defined as "an interactive process of exchange of information and opinion among individuals, groups, and institutions" (National Research Council, 1990). Communication is therefore at the core of successful disaster mitigation, preparedness, response and recovery. Communicating information regarding potential and particular hazards, vulnerabilities and risks is, however, challenging, as it is customary to human behaviour to not concern citizens are informed instantaneously by the relevant local authorities, utilizing media to gather and processed before the final visualization. A range of different maps covering different interests can also be downloaded in this section. Better interpretation of risk information by emergency managers, or by the public, depends considerably on the risk visualization. Visualization of risks is one of the key processes in effective risk governance. Since risks are spatially varying phenomena, GIS technology has become a standard tool for the production and presentation of comprehensive risk information.

Risk Maps
The Atlas includes texts, graphs, figures, tables and maps that effectively communicate to the user to combine different types of information, and display this information in a variety of ways, allowing the user to tailor the presentation of information to their needs. The database includes hazardous events recorded in the past, based on information that was gathered during the project's initial implementation phases and which was presented by various administrative units. Newly reported events will now be added to the existing database and updated or processed before the final visualization. The database contains a wide range of information, including the number of recorded natural hazardous events present, displayed as graphs and tables; the number of registered natural hazardous events per type; the hazard maps (with high, moderate and low classes) the exposure of elements at risk (buildings, population, GDP, transportation, forest and crops) listed by percentages for each hazard type. Community profile: where a shortened version of the information regarding the different administrative units, and is also therefore referred to as a hazard awareness programs.

Risk communication in the form of the Atlas is aimed at:

- making citizens, media, and both local and national authorities aware of the existing risks in the country;
- improving their knowledge of possible disasters, and their potential impacts;
- improving their knowledge of how best to prepare for these events;
- changing their attitude towards disaster prevention and preparedness; and
- eventually changing their behaviour towards these events.

Disaster database: where users can query different hazards by types (e.g. landslide, rock-falls, mudflows, flash flooding, wildfires, snow avalanches, etc.), by date, by location, etc. The database includes hazardous events recorded in the past, based on information that was gathered during the project's initial implementation phases and which was presented by various administrative units. Newly reported events will now be added to the existing database and updated or processed before the final visualization. A range of different maps covering different interests can also be downloaded in this section. Better interpretation of risk information by emergency managers, or by the public, depends considerably on the risk visualization. Visualization of risks is one of the key processes in effective risk governance. Since risks are spatially varying phenomena, GIS technology has become a standard tool for the production and presentation of comprehensive risk information.

Risk Maps
The Atlas includes texts, graphs, figures, tables and maps that effectively communicate to the user to combine different types of information, and display this information in a variety of ways, allowing the user to tailor the presentation of information to their needs. The database includes hazardous events recorded in the past, based on information that was gathered during the project's initial implementation phases and which was presented by various administrative units. Newly reported events will now be added to the existing database and updated or processed before the final visualization. A range of different maps covering different interests can also be downloaded in this section. Better interpretation of risk information by emergency managers, or by the public, depends considerably on the risk visualization. Visualization of risks is one of the key processes in effective risk governance. Since risks are spatially varying phenomena, GIS technology has become a standard tool for the production and presentation of comprehensive risk information.

Web-atlas
Web-atlas is a tool for the communication of disaster risk information, particularly because of its vast potential for information management. In the field of disaster management, among others, internet based technologies are already widely used for the communication of risk information. Web-atlas was developed as a risk communication tool (See Figure 1.6). The web-atlas allows the user to combine different types of information, and display this information in a variety of ways, for example: hazard maps of individual hazard types; hazard maps at elements at risk; exposure maps; vulnerability maps and maps of specific risk types.

The Main Functions of Web-atlas

Disaster reporting: where users (general public, local authorities, universities, experts, media, etc.) can report about disasters/hazardous events in their own area in real time. Firstly, the user has to be registered to be able to make a report and, after the process of registration, a user can then locate the hazardous event as a point, line or area on the map.

Disaster database: where users can query different hazards by types (e.g. landslide, rock-falls, mudflows, flash flooding, wildfires, snow avalanches, etc.), by date, by location, etc. The database includes hazardous events recorded in the past, based on information that was gathered during the project's initial implementation phases and which was presented by various administrative units. Newly reported events will now be added to the existing database and updated or processed before the final visualization. A range of different maps covering different interests can also be downloaded in this section. Better interpretation of risk information by emergency managers, or by the public, depends considerably on the risk visualization. Visualization of risks is one of the key processes in effective risk governance. Since risks are spatially varying phenomena, GIS technology has become a standard tool for the production and presentation of comprehensive risk information.

Risk Maps
The Atlas includes texts, graphs, figures, tables and maps that effectively communicate to the user to combine different types of information, and display this information in a variety of ways, allowing the user to tailor the presentation of information to their needs. The database includes hazardous events recorded in the past, based on information that was gathered during the project's initial implementation phases and which was presented by various administrative units. Newly reported events will now be added to the existing database and updated or processed before the final visualization. A range of different maps covering different interests can also be downloaded in this section. Better interpretation of risk information by emergency managers, or by the public, depends considerably on the risk visualization. Visualization of risks is one of the key processes in effective risk governance. Since risks are spatially varying phenomena, GIS technology has become a standard tool for the production and presentation of comprehensive risk information.

Web-atlas
Web-atlas is a tool for the communication of disaster risk information, particularly because of its vast potential for information management. In the field of disaster management, among others, internet based technologies are already widely used for the communication of risk information. Web-atlas was developed as a risk communication tool (See Figure 1.6). The web-atlas allows the user to combine different types of information, and display this information in a variety of ways, for example: hazard maps of individual hazard types; hazard maps at elements at risk; exposure maps; vulnerability maps and maps of specific risk types.