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Towards a Multi-Hazard Early Warning System for Georgia

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Introduction

Early warning is a major element of disaster risk reduction. It prevents loss of life and reduces the economic and material impact of disasters (UNISDR, 2006).

Several countries, such as Cuba, Bangladesh, France etc., have developed effective EWS that have brought to a substantial reduction in loss of lives associated to natural hazards.

For example, the EWS developed in Bangladesh, part of its Cyclone Preparedness Programme, has led to a substantial reduction of losses. The 2007 super cyclone Sidr accounted for less than 3 500 deaths while for similar cyclones there were 300 000 and 140 000 casualties in 1970 and 1991, respectively.

To be effective, early warning systems need to actively involve the communities at risk, facilitate public education and awareness of risks, effectively disseminate messages and warnings and ensure there is constant state of preparedness. This report assessed the capacities of early warning systems at national level in Georgia using the UNISDR checklist (UNISDR, 2006).

1 Risk knowledge: Key Findings

1.1 Organizational Arrangements

Georgia is subject to both geological and hydro-meteorological hazards and the different hazards fall within the responsibility of several national agencies: the National Environmental Agency (NEA) is responsible for hydro-meteorological and geological hazards (except earthquakes) as well as environmental pollution, the Seismic Monitoring Center of the Ilia State University (IliaUni) and the Institute of Geophysics are responsible for seismic hazard and secondary natural hazards assessment caused by earthquakes, the National Forestry Agency (NFA) for forest fire hazard.

The National Statistics Office of Georgia (Geostat) provides information on demography, level of education, health conditions, and level of employment, environmental factors and cultural aspects gathered from relevant government institutions. The information regarding the disasters is provided to Geostat by Emergency Management Agency (EMA) of the Ministry of Internal Affairs (MIA) (Civil Safety Law, 2014).

Currently, a unified hazard mapping and risk assessment guideline regulated through a dedicated legal framework is lacking. As a consequence, hazard and risk assessments are being conducted in a sectorial or project-based manner (UN, 2014).

1. Risk Knowledge - Key findings:

- Different hazards fall within the responsibility of several national agencies
- A hazard mapping and risk assessment guideline regulated through a dedicated legal framework is lacking
- Hazard maps are not available at local level
- The Risk Atlas provides information on 9 types of hazards but is not used for decision-making (Risk Atlas portal is not available through the state agency webpage). In addition, combined multi-hazard maps are not available from NEA and Seismic Monitoring Centre
- Several relevant disasters-related databases exist but are not integrated neither centralized
- National risk maps are available but local risk assessments aren't

1.2 Natural Hazards Identification

National level hazard maps (Atlas of Natural Hazards and Disaster Risks of Georgia) were developed as part of the project "Institutional building for natural disaster risk reduction in Georgia" implemented by the Faculty of Geo Information Science and Earth Observation, the University of Twente (ITC) and Caucasus Environmental NGO Network (CENN), NEA, EMA and IliaUni. The Risk Atlas provides information on 9 types of hazards and various elements at risk (i.e. population, buildings, GDP, etc.) at different levels (Regional, District, Commune) (van Westen, 2012) and is available online on the Web-based Risk Atlas (portal). Through the portal, users can combine different types of information, and display this information in a variety of ways, for example: different types of hazard maps, information on elements at risk, exposure maps, vulnerability maps and maps of individual, specific risk types. The portal gives an opportunity for public/users to report the disaster events and thus update the historical disaster record. However, it has to be noted that assessments given in the Risk Atlas were hardly used for decision making (Risk Atlas portal is not available through the state agency webpage) and were not updated since its development in 2012.

Hydro-meteorological hazard maps (flood/flashflood, mudflow, landslides) are also available by NEA (See Annex 8.1) and the Institute of Geophysics and seismic hazard maps are available from the Seismic Monitoring Centre and the Institute of Geophysics. The hazards maps developed by NEA (see Annex 8.1) are based on the expert judgment as currently the law does not indicate a specific methodology/guideline to be followed.

1.3 Community Vulnerability Analysis

Vulnerability assessments have been performed at local and national level as part of various projects (Varazanashvili, 2012; Van Westen, 2012; Oxfam, 2011) with partnership of state agencies (i.e. EMA) but, with a lack of a standardized methodology, results cannot be compared neither integrated nor used for local level risk assessments. Georgia Red Cross Society has implemented several community based vulnerability assessment projects across Georgia. For example, the GRCS Climate Forum East, an EU funded project, aims to build the capacity of civil society in the Eastern Partnership region. As part of the project, a national climate vulnerability assessment was developed (UN, 2014).

1.4 Risks Assessment

Multi-hazard risk maps (Risk Atlas for Georgia) were developed as part of the project “Institutional building for natural disaster risk reduction in Georgia” on the basis of modern, international and national research and assessment methods. As it is mentioned in the section 1.2 the risk information is available online on the risk portal³. In addition, a multi-hazard risk assessment (namely, earthquakes, landslides, snow avalanches, flash floods, mudflows, drought, hurricanes, frost, hail) was developed in 2006-2009 (but results were made available in 2013) by the Institute of Geophysics of Tbilisi State University under the Georgia National Science Foundation (GNSF) project “Reducing natural disasters multiple risk: a positive factor for Georgia development” and two international projects: NATO SFP 983038 “Seismic hazard and Risk assessment for Southern Caucasus-eastern Turkey Energy Corridors” and EMME “Earthquake Model for Middle East Region”. Multi hazard risk assessment for the Rioni river basin were developed as part of the UNDP project “Developing Climate Resilient Flood and Flash Flood Management Practices to Protect Vulnerable Communities of Georgia”.

The analysis found that efforts to identify activities that increase risks are insufficient. It was also found that local risk assessments are lacking but there is an increased government awareness of its importance for the development of risk-informed local risk management plans. For example, the analysis found that the current Master plan/Land use plan of Tbilisi is not risk informed and the building codes are not based on a multi-hazard risk assessment. Nevertheless, the ongoing revisions of the building codes and Tbilisi Master/land use plan allow for this change in overall approach and provide a huge opportunity to prevent the creation of new risk (WB and UNDP, 2015).

1.5 Information Stored and Accessible

To facilitate access to information, as mentioned above the risk portal³ was created in 2012, as part of the “Institutional building for natural disaster risk reduction in Georgia” project. However, the assessment found that the portal is not known, used or widely referenced by stakeholders at central and local levels. Moreover, the portal was not maintained since when it was created and makes it difficult to be used if regular updating is not ensured. It has to be noted that the portal is not under government institution and, according to the Civil Safety Law, EMA is responsible for official statistics regarding disaster and its impacts. EMA database contains information since 2006. The National Spatial Data Infrastructure (NSDI) is currently being initiated and could facilitate the creation of a centralized and systematized disaster database. NEA maintains two ORACLE databases on meteorological and hydrological data. The Seismic Monitoring Center maintains a seismic information database.

2 Monitoring and warning service: Key findings

2.1 Institutional mechanisms

At national level, NEA is responsible for warnings related to hydro-meteorological and geological hazards (except earthquakes) and environmental pollution (see the organigram of hydrometeorology department of NEA in the Annex 8.2), the Seismic Monitoring Center is responsible for seismic data collection, monitoring and processing (however the center is not mandated by law and there is no agency responsible for seismic hazard monitoring and is not listed under the Civil Safety National Plan), the National Forestry Agency is responsible for forest fire hazard, the Legal Entity of Public Law (LEPL) Georgian State Hydrographic Service (Under the Ministry of Economy and Sustainable Development) is responsible for coordinating warnings addressed to the aviation sector and the Georgian Civil Aviation Agency (GCAA) under the Ministry of Economy and Sustainable Development is responsible for aviation meteorology (monitoring and information dissemination).

The hydro-meteorological department (in particular the division of hydro-meteorological forecasting and division of telecommunication) and Seismic Monitoring Center is working 24 hour per day, seven days per week. The Emergency Management Operations Centre (under EMA) is also functioning 24 hour per day, seven days per week to receive the warning and communicate/disseminate it to the relevant institutions and public.

The warnings by NEA, Seismic Monitoring Center and National Forestry Agency are communicated to the relevant government structures at national level (EMA among them), the State Security and Crisis Management Council, local government, mass media. The warnings within and between the governments institutions are communicated via electronic Document Management System (eFlow). All government institutions are part of the eFlow system. Based on the eFlow the warnings are disseminated to all the relevant agencies at national and local level. The Seismic Monitoring Centre has its transmission equipment located in the Emergency Management Operations Centre of EMA so the earthquake information is directly received and disseminated by EMA to relevant agencies.

2.2 Monitoring systems

Georgia has a long history of hydro-meteorological activities. In the 1980's hydro-meteorological service of Georgia possessed a large network of the hydro-meteorological parameters on the territory of Georgia. In that period the meteorological observing network covered almost all residential areas and places with different micro climate conditions, including hilly and mountainous regions, while the hydrological observations covered almost all large and medium-sized rivers. In addition, radar, aerological, actinometrical, ozonometric, agrometeorological and other types of specialized observations were conducted.

After Georgia became independent, the hydro-meteorological service funding was drastically reduced, which led to a dramatic decrease of the observation network. At first, the number of standard hydro-meteorological parameters observation has reduced three to five times and then the above listed specialized observations has completely stopped. Since 2000, a number of projects aimed at strengthening the hydro-meteorological service have been implemented and are still carried out by the World Meteorological Organization, other international organizations and donor countries. Within the frame-

2. Monitoring and warning - Key findings:

- Different hazards fall within the responsibility of several national agencies but no agency responsible by the law for seismic hazard monitoring
- Warnings are communicated to the relevant government structures at national level (EMA among them), the State Security and Crisis Management Council, local government, mass media
- Observations were stopped over the years (i.e. upper air, RADAR, ozone, water-balance, glaciological)
- The hydro-meteorological observation network covers the whole Georgia (Figure 2) but has been degrading over years (Figure 1)
- Seismic monitoring network is composed of 25 stations (Figure 3) (7 more are planned to be added)
- Hydro-meteorological forecasts lack reliability and specificity
- Since 2000, geological monitoring is not performed for Tbilisi Municipality

work of these projects, dozens of meteorological and hydrological stations have been purchased and installed. It should be noted that after the natural disasters in Devdorak and in the basin Vere, 1 automatic meteorological station has been installed on Devorak and 2 meteorological and 1 water level gauge automatic posts were also installed in the Vere gorge.

The evolution of the number of hydro-meteorological monitoring stations are given in the Figure 1, while Figure 2 represents the map of the current active hydro-meteorological stations in Georgia.

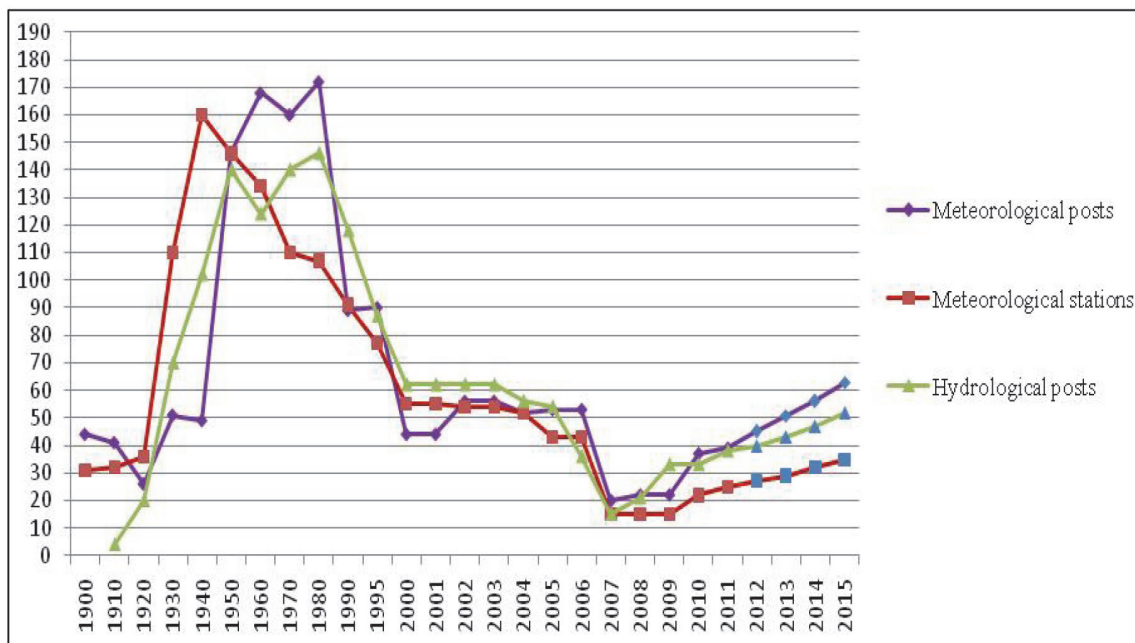


Figure 1. Number of stations (1900-2015) (source: NEA)

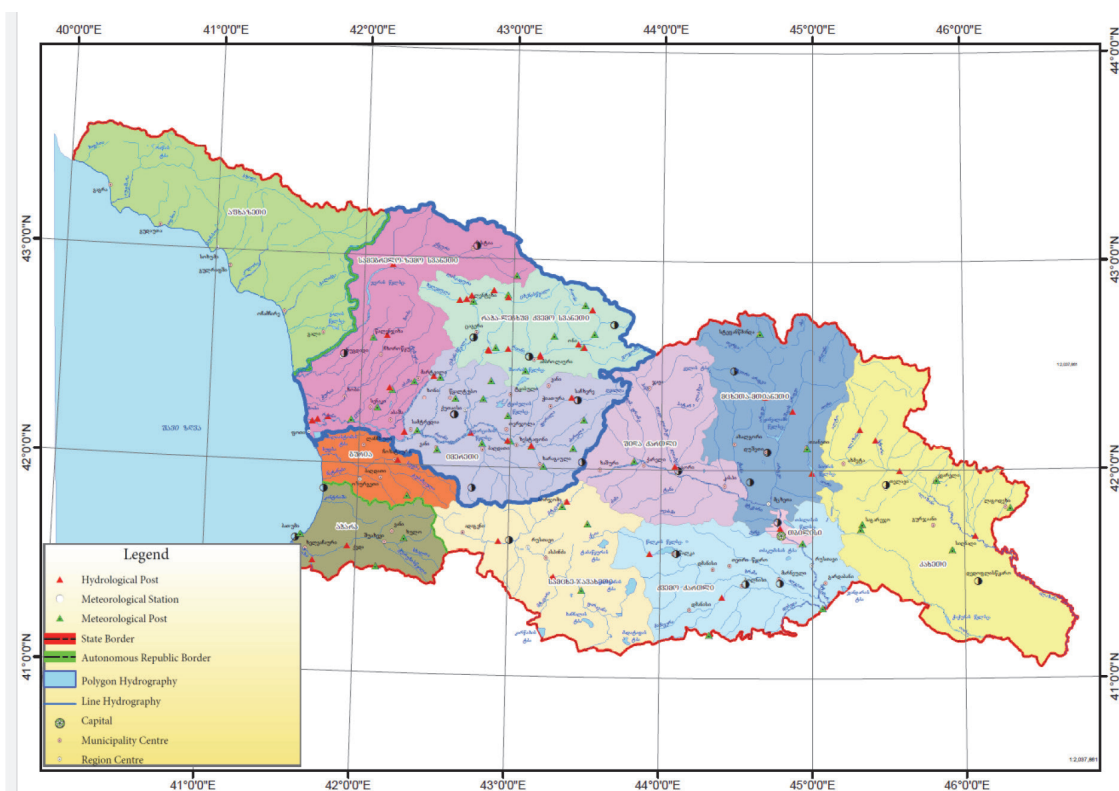


Figure 2. Hydro-Meteorological Stations (source: NEA)

The department of geology, once in a year is conducting the monitoring of geological hazardous processes including land-slides, rock-fall, and mudflows throughout the Georgia (except Tbilisi municipality since 2000). A significant reduction of staff and equipment has taken place over the years. Currently about 20 people are responsible for geological monitoring making it difficult to carry out large scale studies. There is huge data archive available (geological maps), but majority of the maps are in paper format. The lack of adequate equipment, human resource and finances is an obstacle for availability of reliable and timely warnings. The assessment of the geological hazards are made based of the visual monitoring of the sites and based on the inventory performed in the '70s and '80s (geological maps). It should be noted that, in August 2015, the National Environment Agency initiated the project to digitize the geological information kept in archives in paper format. The project will be carried out by the Georgian National Archive within the 3 years period.

The Seismic Monitoring Center maintains a seismic monitoring network composed of 25 stations (See Figure 3) 7 more seismic stations are planned to be added in 2015-2016, to be in line with international standards. The seismic data are received online from the seismic stations of the neighboring countries (Turkey, Armenia, Russia and Azerbaijan) as well. The software used for data acquisition, processing, distribution and interactive analysis is SeisComP. In addition, the earthquake epicenter and magnitude is determined automatically and the information is made available (earthquake with a magnitude greater than 3) on the website (www.seismo.ge).

Currently, there are 3 local networks of Tbilisi, central Caucasus and Javakheti (that are united in one regional network). Also, there is the Enguri Dam local monitoring network that however needs further expansion. Unfortunately, seismic monitoring is not performed for dams and critical facilities. Additional stations would be required to improve the seismic monitoring and prediction. In case of strong earthquake, within 2-3 hours after the earthquake additional stations are installed in the epicenter zone (Centre has about 10 special field devices) are temporarily installed to monitor aftershocks.

Georgian State Hydrography Service as a National Coordinator for navigational warnings consists of Navigational systems and equipment which is located on the coast of Georgia, and open sea to provide information for the safe navigation (48 ground-based and 34 sea from ground-based, 22 units occupied territory).

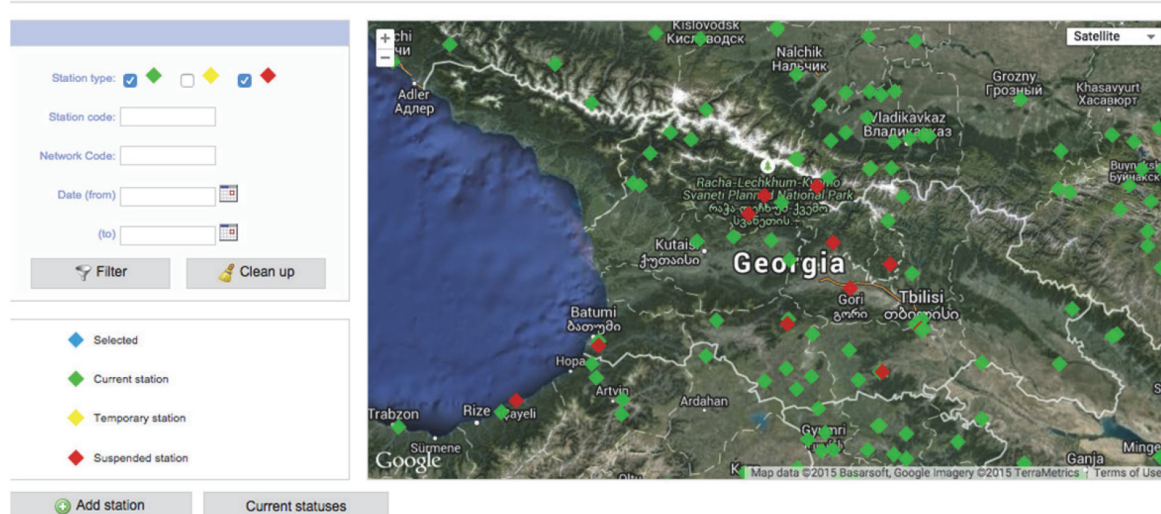


Figure 3. Seismic Monitoring System (source: Seismic Monition Centre)

2.3 Forecasting and warning systems

NEA is responsible for preparing and distributing short (3 days beforehand) and medium-term (10 days beforehand) weather and hydrological forecasts daily. If necessary, NEA prepares and delivers timely warnings of impending natural hydro meteorological events to the decision-makers (heavy precipitation, floods, hail storms, snow avalanches, strong winds, droughts).

The spring flood and weather long-term forecasts (monthly and seasonal) are also regularly produced and delivered to the interested customers.

For the preparation of the short and medium-term weather forecasts the American and German models are commonly used. Due to the lack of the high-resolution models as well as radar and aerological observation data, the spatial and time resolution of forecasts is low. This makes it difficult, in some cases even impossible, for decision-makers to use these forecasts to avoid or mitigate the effects associated to the disaster. For example, on 12 June 2015, the day before the floods that have affected Tbilisi, NEA sent a warning informing of the potential risk of heavy rainfall, floods-flashfloods and mudflow processes in Georgia, but the warning didn't include information on the possible locations and expected time.

NEA cooperates and exchanges the information with Georgian Civil Aviation Agency (GCAA) responsible for aviation meteorology and Georgian State Hydrographic Service. One of the objectives of Georgian State Hydrographic Service is marine navigation equipment monitoring and modernizing in line with international hydrographic services IHO and IALA standards, as well as according to UN Convention SOLAS requirements.

NEA Department of Geology provides an annual geo-hazards bulletin which is sent to municipalities, the EMA, the Ministry of Regional Development and Infrastructure of Georgia, and other interested parties along with an outlook for the year to come.

The Institute of Earth Science - Seismic Monitoring Centre of the Ilia State University is responsible for seismic data collection and processing and, in case of an earthquake in Georgia, provides information on location of the epicenter and magnitude by SMS and through its website. The Seismic Monitoring Centre is part of the network of Incorporated Research Institutions for Seismology (IRIS), ORFEUS - Observatories and Research Facilities for European Seismology and European-Mediterranean Seismological Centre (EMSC).

Currently there is one major ongoing project for flash flood forecasting and early warning in western part of Georgia. The project "Developing Climate Resilient Flood and Flash Flood Management Practices to Protect Vulnerable Communities of Georgia" is being implemented by UNDP. The project includes a component on "Early warning system in place to improve preparedness and adaptive capacity of population", which has the following objectives:

- Long term historical observation data digitized and used in policy formulation and risk management practices;
- Multi hazard risk assessment for the Rioni river basin;
- Series of targeted trainings delivered to NEA staff and partner organizations on advanced methods of climate change risk assessment and forecasting;
- Essential equipment to increase monitoring and forecasting capabilities in the target basin procured and installed;
- Systems established at the national and sub-national level led by the NEA for long and short term flood forecasting of hydrological risks, including dissemination and communication of forecasts.

In addition, a landslide warning system is being initiated in the mountainous area (Devdoraki –Amali gorge) in the northern part of Georgia. This early warning system will provide warning to the communities in case of landslide to initiate the evacuation procedures ahead of the disaster.

Moreover, the Organization for Security and Co-operation in Europe (OSCE), within the framework of the Environment and Security (ENVSEC) Initiative "Enhancing National Capacities on Fire Management and Wildfire Disaster Risk Reduction in the South Caucasus", is developing the regional Wild-land Fire Early Warning System for Georgia.

3 Dissemination and communication

3.1 Organizational and decision-making processes

The main regulatory frameworks regulating the warning dissemination process in case of emergency and the responsibility of the different agencies are: the Civil Safety law; Civil Safety National Plan (known as National Plan); and regulation on Unified System of Emergency Situation Management (draft to be adopted). According to the Civil Safety National Plan, prevention, mitigation, response and early recovery activities are ensured by the activation of the 17 emergency assistance functions which indicates the responsible institutions and the necessary measures to be activated. According to the Civil Safety National Plan, EMA is one of the main responsible institutions for disseminating the warnings. Once EMA receives the warning from NEA, the Seismic Monitoring Center, National Forestry Agency or the Emergency Response Center I I 2, EMA initiates the Inter-agency Emergency Management Operations Centre and starts the emergency measures, by communicating the warnings to the relevant agencies and the State Security and Crisis Management Council. In case of warnings indicate specific geographic area that could be potentially affected, EMA communicates the warnings to the heads of regional emergency management units via eFlow, SMS, Fax, etc. In addition, Regional Governors, mayors and emergency services of the potentially affected areas are also informed. The Emergency Management Operation Centers of the respective local government(s) disseminate the alarm and communicate with the responsible units to initiate the security measures. The NEA's daily weather newsletter is sent in electronic format to the central and local authorities, State Security and Crisis Management Council, to the interested legal entities and individuals of the Ministries and the media (however NEA is not mandated by law). According to the National Plan, the main responsible institution for the activities for communication and warnings (Function 2) is the department of communication, information technology and innovation under the Ministry of Economy and Sustainable Development in cooperation with EMA and other relevant institutions at national and local levels. The relevant institutions are: Patrol Police Department of Ministry of Internal Affairs (MIA), State Financial Resources Department of MIA, Security Police Department of MIA, the Ministry of Defense, The Ministry of Energy, the Ministry Environment and Natural Resources Protection, Ministry of Labor, Health, and Social Affairs, the public broadcaster and private broadcasters companies, Georgian National Communications Commission, Electronic communications and postal service operator companies and Organizations owning Electronic communications Networks.

With 36 branches spread across the country, the Georgia Red Cross Society has a network of thousands of volunteers including: First Aid Network consisting of 48 volunteers in 8 regions of Georgia, Psychosocial Network consisting of 32 volunteers in 8 regions of Georgia, Community volunteer disaster preparedness and response teams consisting of 240 volunteers in 12 regions of Georgia. GRCS volunteers are trained and equipped. In addition, teams of trained community volunteer groups have been established in communities across Georgia, with the support of EMA and GRCS (UN, 2014). Volunteers could play a significant role in disseminating early warning information to communities.

3.2 Communication systems and equipment

EMA uses eFlow system and SMS to inform the heads of regional emergency management units and teams and Regional Governors, mayors and emergency services of the potentially affected areas are informed by letter as well. The main channels used for disseminating warnings to communities are: the media, the national radio communication network and loudspeakers installed on cars. NEA provides information to the potentially affected municipalities by using several channels (SMS, cell phones, etc). The advantage of using media is that TV and cellphones have a very good coverage in the country. However, it should be noted that Media lacks skills and knowledge for proper risk information dissemination. In addition,

3. Dissemination and communication - Key findings:

- EMA is one of the main responsible institutions for disseminating the warnings
- EMA receives the warning from NEA, the Seismic Monitoring Center, National Forestry Agency or the Emergency Response Center I I 2
- EMA send warnings to relevant agencies, the State Security and Crisis Management Council, regional units of EMA, Regional Governors, mayors and local emergency services of the potentially affected areas
- The Emergency Management Operation Centers of the respective local government(s) disseminate the alarm
- NEA also provides information to the potentially affected municipalities, creating the potential for confusion
- Lack of consistency across warning dissemination and communication systems used for the different hazards
- Warnings are disseminated through the media, radio and loudspeakers installed on cars
- Warnings are not tailored to user needs, are not geographic-specific and do not contain specific information on the potential impacts.

EMA is actively using the patrol cars with voice speakers (patrol offices are available everywhere within the country). However, there is no consistency across warning dissemination and communication systems used for the different hazards. In case of need, EMA can mobilize private sector resources.

According to the regulation on Unified System of Emergency Situation Management, the warning/risk information communication/exchange with other states and international organization are made according the international agreements. The State Security and Crisis Management Council is in process of developing a database of assets (available heavy machinery per administrative units, etc.) for contingency planning. In addition, the project “National Emergency Management Information System (NEMIS)” funded by UNDP and implemented by the RDFG Disaster Risk Reduction (DRR) Center intends to assist EMA to collect prompt data collection, handling and dissemination using modern technologies. NEMIS is a user-friendly information management software platform for emergency situations. This solution provides situational awareness for emergency management institution's activities, logistics, development, and gap analysis to generate real-time reporting and seamless information sharing.

3.3 Warning messages

Warnings are not tailored to user needs and, as forecasts do not always indicate the area at potential risk, the messages are not geographic-specific. Moreover, warnings do not contain specific information on the potential impacts. Studies to assess how warnings are accessed and interpreted are lacking and are needed.

4 Response capability

4.1 Warnings

Warnings are generally generated and distributed to those at risk by credible sources (see section 1.1. and 2.1). However, there is a lack of trust in warnings as forecasts are often not reliable, as indicated by several respondents (e.g. due to the lack of monitoring network for weather forecasting). Respondents also indicated that other international sources of weather forecast are consulted instead of the national ones.

4. Response capability - Key findings:

- Lack of trust in warnings as forecasts are often not reliable
- Lack of strategies to build credibility and minimize false and missed alarms
- Existing plans are not regularly updated, and simulation exercises are not carried out systematically in all locations of Georgia
- Community response capacity building efforts remain constrained to the project level and are not systematized
- EMA website provides educational material on disaster response. However, information provided needs improvements
- DRR public awareness is scattered.

4.2 Disaster preparedness and response plans

The Civil Safety Law (2014) regulates the disaster risk management system in Georgia and defines the following emergency response levels (WB and UNDP, 2015):

- National level – in case of national scale crisis;
- Autonomous level – in case of a crisis within the boundaries of autonomous republic;
- Regional level – in case of a crisis within the boundaries of a region;
- Local level – in case of a crisis within the boundaries of a municipality;
- Unit level – in case of a crisis within territories of a structural unit.

The new National Plan (that was adopted in September, 2015) defines the roles of the central and municipal authorities, and provides for the cooperation among relevant national institutions in its implementation.

Response plans exist at municipal level, but the plans should be updated according to the newly adopted National Plan. Currently simulation exercises are not carried out systematically in all locations of Georgia. Moreover, as there aren't local risk assessments, the existing plans are not risk informed. The civil safety law mandates that Emergency Management and Emergency Situation Risk Management plans at municipal level to be updated/developed within 2015-2016.

Previous disaster events and responses are not systematically analyzed and reported by the state agencies except the recently prepared Post Disaster Needs Assessment reports (WB and UNDP, 2012 and 2015).

4.3 Community response capacity

Several projects have been implemented by GRCS and Oxfam for example to undertake contingency planning activities and simulation exercises. But the efforts remain constrained to the project level and are not systematized. Thorough assessments of community ability to respond to disasters are not performed.

4.4 Public awareness and education

The details regarding the trainings and awareness rising on disaster prevention, preparedness and response are presented and regulated based on the Civil Security National Plan.

EMA website provides guidelines on how to respond to different types of hazards, as well as several games and educational materials for children. Hazards, vulnerability and risk information at different administrative levels (i.e. Risk Atlas) are not

available at state agencies (i.e., EMA or NEA) websites.

Several DRR education activities in schools and preschool institutions are being implemented by a number of stakeholders (i.e. training of teachers and students). In 2013 an interagency working group on DRR education was set up by the Ministry of Education and Science of Georgia (MES), with the support of UNICEF (UN, 2014).

Together with EMA and within the framework of the first phase of the UNICEF-DIPECHO programme focused on mainstreaming Disaster Risk Reduction in Education, DRR curriculum was developed and incorporated in the primary and secondary education within the subjects of 'Civil Protection and Safety' for grades IV and VIII and the mandatory 'Head Teacher' program for grades V-IX (UN, 2014). However, as a monitoring school program does not exist, the assessment performed in 2014 (UN) found that DRR is taught in schools on a rather sporadic basis. A new strategy for the Georgian education system for 2014-2024 puts safe schools as one of the priorities and includes a systemic approach to DRR issues. In addition, EMA has trained about 3000 teachers throughout Georgia. As part of the UNICEF-DIPECHO programme, in 2013 the National Centre for Teachers' Professional Development implemented a project aimed at supporting effective teaching of the new DRR curriculum at schools. Several universities offer courses related to DRR¹.

DRR public awareness is scattered and linked with external sources of funding. A weekly TV programme on basic risks and safe behavior existed but was abolished because considered ineffective even though no assessment was made.

1 Tbilisi State University, Private Agrarian University, Technical University of Georgia, Aviation University, Ilia State University.

5 Recommendations

5.1 Risk Knowledge

- There is a **need for a multi-hazard risk assessment** (based on **agreed methodology and standards**) for which the government feels ownership and ensures regular updating and use for DRR. **Existing efforts in assessing risks need to be built upon.** Results need to be verified and updated and widely disseminated to feed into national decision making as well as the design of the MHEWS. The communication/cooperation and data exchange mechanisms between scientific institutions and government agencies have to be strengthened.
- There is the need to store and update the data and information in **one central repository** / national disaster data base (based, for instance, on the portal¹ or NSDI) and introduce procedures and regulations ensuring open access and data sharing from all relevant stakeholders at all levels. Results of risks assessment need to be integrated into local risk management plans and warning messages and development planning.

5.2 Monitoring and Warning

- **Enhance the monitoring network:** firstly the pre-existing, presently inactive hydrometeorological stations and posts should be rehabilitated, secondly additional stations should be added where gaps exist. Automatic measuring devices are recommended. It is vitally necessary to restore the radar and aerological observations. Inaccuracy of the weather forecasting is also associated to this. NEA also needs to enhance its human capacity in the numerical modeling of the weather forecasting as well as in hydrological modeling (with the help of MIKE, the river Rioni hydrological modeling training sessions have already been held, but the mentioned works needs to be performed at other river basins of Georgia too). The geological monitoring of the Tbilisi municipality is also necessary. In addition, the number of seismic monitoring stations should be increased. It is planned to add 7 more stations to the current monitoring network to be in line with the international standards. For each additional station there will be a need of human resources who will be assigned to the stations. There is a need for more seismic station, so called local seismic network should be in place to improve the monitoring details and quality as well as to be able to ensure the backup of the seismic data (currently there is no back up for the seismic data).
- **Impact-based forecasting and warning** should be implemented and early warning products should be users' friendly (simple to understand and easy to use).

5.3 Dissemination and communication

- **Clarify roles between agencies** and improve SOPs for exchange of data, bulletins and alerts and early warning dissemination (i.e. EMA and SSCMC and respective operation centers).
- **Implement Common Alerting Protocol (CAP)²** for early warning messages.
- **Means of communication should be modernized (and automatized)** moving away from paper copy bulletins.
- **Provide specialized on-the-job training for the staff involved in EWS** to know what to do and how to interpret and use the information.
- **Media should be trained in how to interpret the messages/warning** from respective agencies and how to communicate the information to the public

² The Common Alerting Protocol (CAP) is a simple but general format for exchanging all-hazard emergency alerts and public warnings over all kinds of networks. CAP allows a consistent warning message to be disseminated simultaneously over many different warning systems, thus increasing warning effectiveness while simplifying the warning task. CAP also facilitates the detection of emerging patterns in local warnings of various kinds, such as might indicate an undetected hazard or hostile act. And CAP provides a template for effective warning messages based on best practices identified in academic research and real-world experience. <http://docs.oasis-open.org/emergency/cap/v1.2/CAP-v1.2-os.html>

5.4 Response capability

- **Strengthen the capacity of the Ministry of Education and Science** to regularly monitor teaching of disaster preparedness and response related curricula, and expand teacher training on this issues nationwide.
- **Ensure the integration of disaster preparedness and response into the preschool curriculum** based on available good practices in Georgia, and ensure its implementation.
- Develop and implement a systematic **public preparedness and response awareness campaign** in partnership with the Media. An institution shall be mandated for this.
- **Systematize simulation exercises or evacuation drills** for public buildings and at risk communities throughout the Georgia.
- Review and update the current municipal response plans to clarify and strengthen the roles and responsibilities of stakeholders and communities and their relations.

6 National Protocol

6.1.1 Main Actors relevant to MHEWS: Current status³

- The **National Environmental Agency (NEA)** is the main responsible agency for hydro-meteorological and geological hazards assessment (except earthquakes) as well as to provide monitoring of environmental pollution, the **Seismic Monitoring Center and Institute of Geophysics** for seismic hazard and secondary natural hazards assessment caused by earthquakes (although not mandated by law), the **National Forestry Agency** for forest fire hazard (see section 2). The **Environmental Information and Education Centre** under the Ministry of Environmental and Natural Resources Protection is responsible to collect and share environmental related information.
- The **Emergency Management Agency (EMA)** is the agency responsible for emergency prevention, preparedness, response and early recovery/reconstruction, according to the Civil Safety Law (2014)
- The **State Security and Crisis Management Council (SSCM)** under the Prime Minister's office has been established to adopt political decisions of the highest level to ensure state security and crisis management. The **National Centre for Crisis Management**⁴ was created within the Office of the Council. Upon occurrence of a crisis, the National Crisis Management Centre is subordinated directly to the Prime Minister.
- The **Natural Disaster Prevention and Rapid Response Unit** established in 2014 under **Ministry of Regional Development and Infrastructure (MRDI)** is mandated to integrate disaster prevention, early warning, response and post-disaster recovery in infrastructure planning and development. The unit is also in charge of the effective use of early warning systems for infrastructure.
- **Local Governments** are responsible for (Civil Safety Law, 2014):
 - Design and implementation of disaster prevention measures;
 - Development and approval of disaster risk management plans together with EMA;
 - Evacuation and shelter of affected people;
 - Distribution of humanitarian aid;
 - Emergency response and recovery activities;
 - Awareness raising and trainings.
- The **Georgia Red Cross Society (GRCS)** is a member of the International Red Cross Movement and it acts as a voluntary, humanitarian, non-governmental and independent organization with an auxiliary role to public authorities in humanitarian work, and with a mandate to coordinate the NGO response in emergency situations (see section 3.1).

6.1.2 Proposed MHEWS National Protocol

Early warnings must reach those at risk on time. Linking the warning provider to communities at risk requires the involvement of numerous actors from different levels and the time available is limited. EWS protocols follow top-down logic, starting from a warning provider and ending to the communities at risk. Nevertheless, different factors need to come into play (gender, cultural, social, etc.). Involving communities and local governments is essential.

³ <http://3w.org.ge/index.php?m=1>

⁴ Law of Georgia on Planning and Coordination of the National Security Policy, Article 26 - National Centre for Crisis Management

Protocols shall include two main decision-making processes (UNESCO/IOC, 2015):

1. The first process leads to a decision on issuing warnings and the respective warning levels. This usually takes place at the institutions responsible for hazard monitoring and warning (“provider organizations”).
2. The second process leads to a decision on whether to officially call for an evacuation and helps to translate the warning message into guidance for a community at risk. In most countries, Disaster Management Organizations (DMO) are involved to disseminate warnings to the public and to take decisions on whether or not to call for evacuations.

The current situation in Georgia is shown in Figure 4.

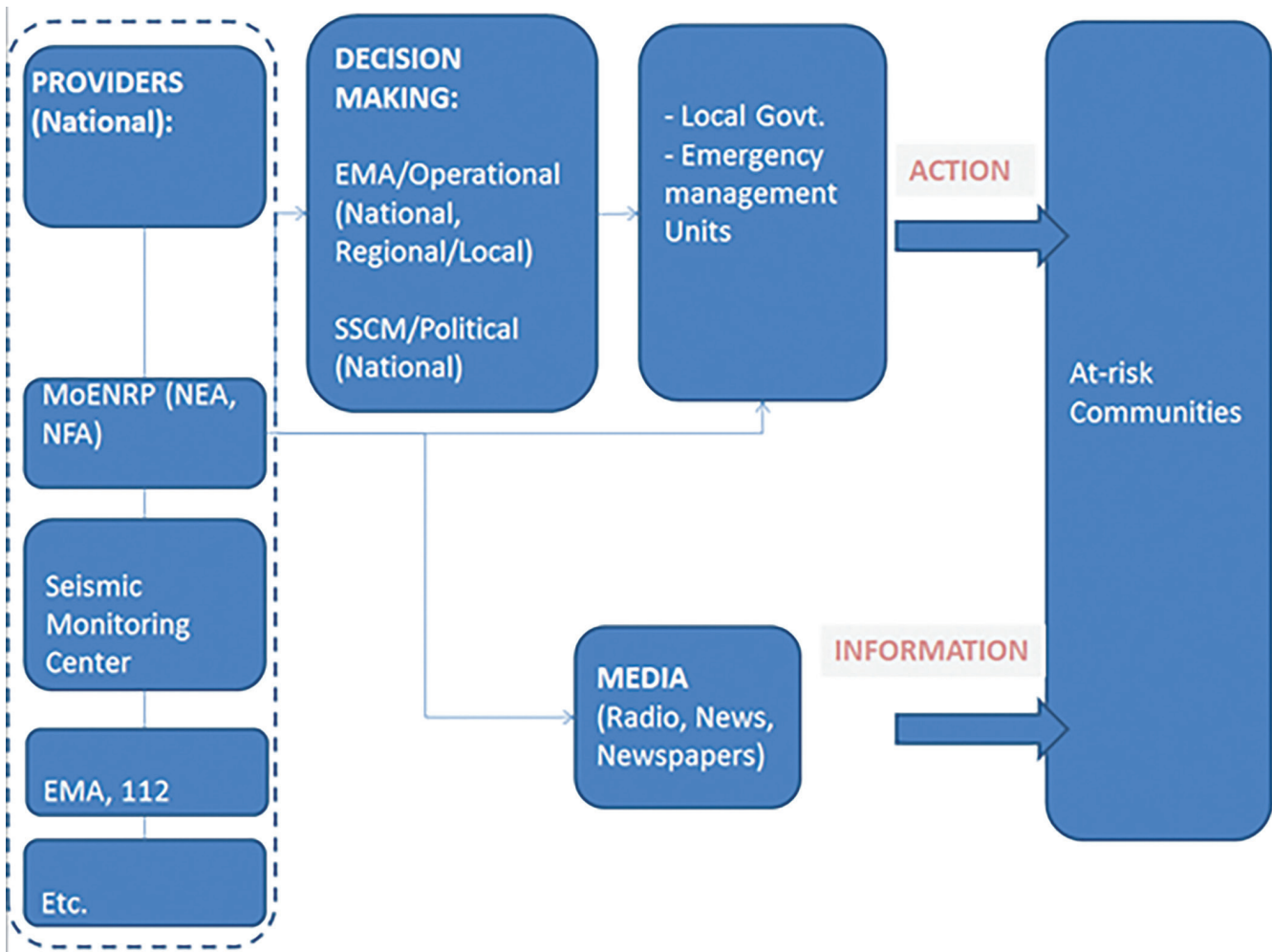


Figure 4. EWS decision making process in Georgia (Current).

A clear division of tasks between the organization that is responsible to provide warnings (“provider organizations”) and the one that is in charge of providing the necessary guidance to enable communities (EMA) to react adequately is essential. Currently, this doesn’t apply in Georgia, where the responsibilities are mixed, with warning providers also disseminating information to municipalities at risk.

Therefore, the following decision making process is proposed (Figure 5), where providers provide warnings to EMA which provide clear guidance and instructions to local governments which then initiate the necessary actions to put people in safety. In addition, the information dissemination could be facilitated not only through media but also using the existing network of volunteers who can timely disseminate warnings to isolated communities for example (Golnaraghi, 2012).

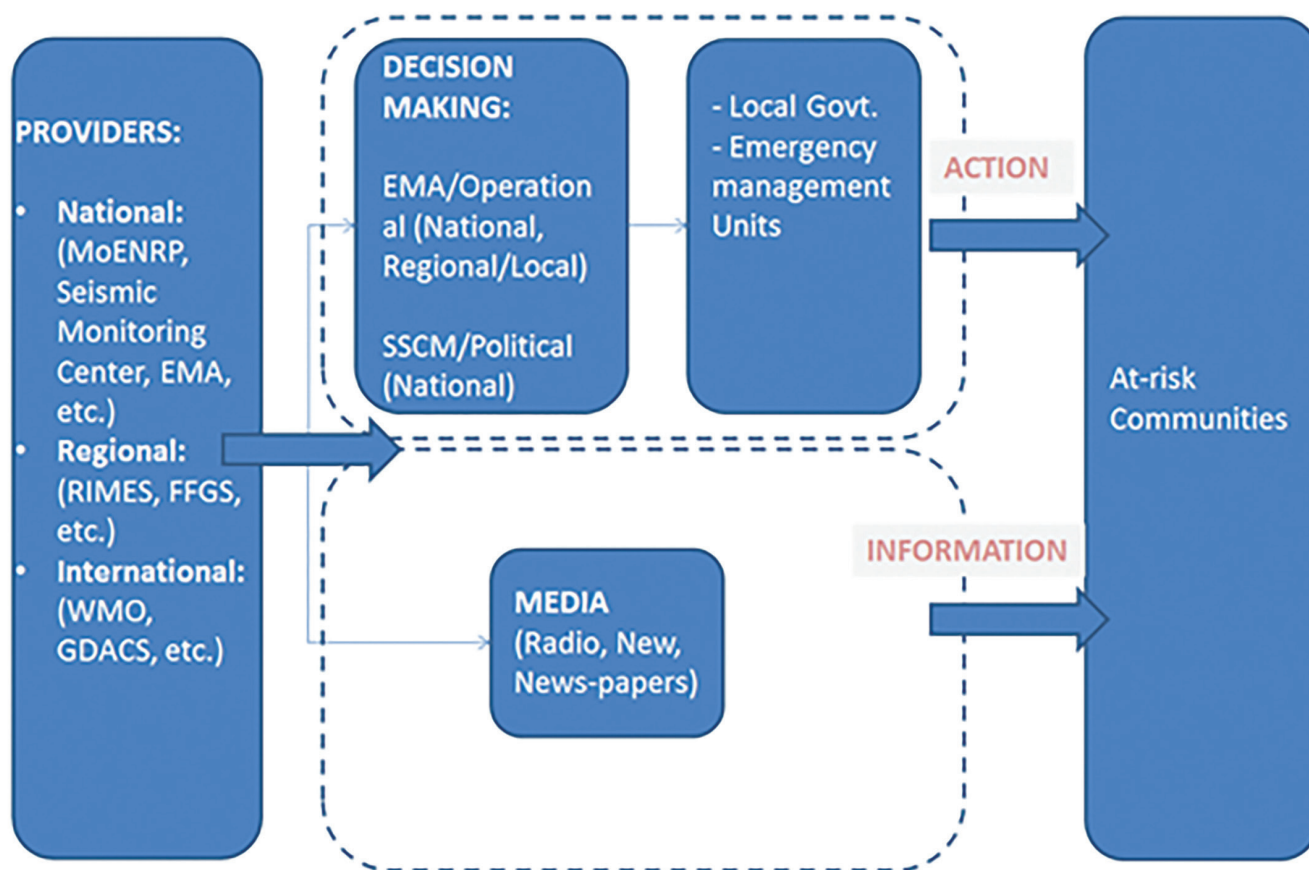


Figure 5. MHEWS decision making process (proposed).

It is recommended that this decision-making process is regulated through the adoption of an early warning protocol, as circumstances may require the staff on duty to take immediate decisions without being able to consult directly with the highest authority in charge.

A centralized decision-making process allows for the involvement of national media at an early stage to help provide guidance directly to communities. Formal procedures with national media are required.

Warning dissemination should use existing networks and a variety of methods (fax, phone, email, internet, radio communication (via VHF or FM radio stations), sirens (loudspeakers) and SMS. It requires a back-up power back-up system.

Over time transition to a local level decision making can be considered if the necessary local level capacities are developed, with warnings being provided directly to the local level (emergency management services and local governments). This option will reduce the transmission time and increase lead times for reaction.

6.1.3 Roles and responsibilities (who does what and when)

6.1.3.1 Early Warning Providers

- Providers include:
 - NEA
 - Seismic Monitoring Center
 - National Forestry Agency
 - Environmental Information and Education Centre

HAZARD TYPE	WARNING	RESPONSIBLE AGENCY	CONTRIBUTORS
Heavy rains	YES	NEA	EMA
High winds	YES	NEA	EMA
Storm	YES	NEA	EMA
Snow and ice	YES	NEA	EMA
Intense heat	YES	NEA	Min. of Health, EMA
Intense cold	YES	NEA	EMA
Drought	YES	NEA	Min. of Agriculture, EMA
Landslide	YES	NEA	Seismic Monitoring Center, Institute of Geophysics, EMA
Avalanche	YES	NEA	Seismic Monitoring Center, Institute of Geophysics, EMA
Forest fire	YES	National Forestry Agency (NFA)	EMA
Flood/Flash-flood	YES	NEA	EMA
Earthquakes	YES	Seismic Monitoring Center	Institute of Geophysics, EMA

Table I. Natural hazards and institutional monitoring responsibilities

- **Roles (in addition to normal duties):**

1. **Normal situation:**

- Be mandated as authoritative sources of information and warnings (i.e. mandate for seismic hazard monitoring and warning needs to be clarified)
- Monitor hazards (under their respective responsibility) based on information collected from monitoring networks and information from credible international and regional sources

Ensure improvement of forecast and prediction procedures

- Set warning thresholds based on intensity and potential impacts
- Supply information on regular basis to EMA
- Establish MoUs with EMA and media
- Ensure effectiveness of the quickest channel of communication for warning dissemination

2. **Alert Stage:**

- Detect potential threat
- Estimate hazard intensity and potential impacts
- Decide on warning level and if issue warning or not (based on thresholds)

3. **Warning stage:**

- Disseminate the warning to EMA and (indicating: hazard type, intensity, potential impacts, areas at risk, level of uncertainty, lead time)
- Explain the level of associated uncertainty
- Provide regular updates over time
- Provide “All clear” once the threat is over

The MHEWS stages:

- | | | |
|--------------------|---|---|
| • Normal situation | • Alert: take closer look and continue monitoring | • Warning: thresholds exceeded, issue the warning |
|--------------------|---|---|

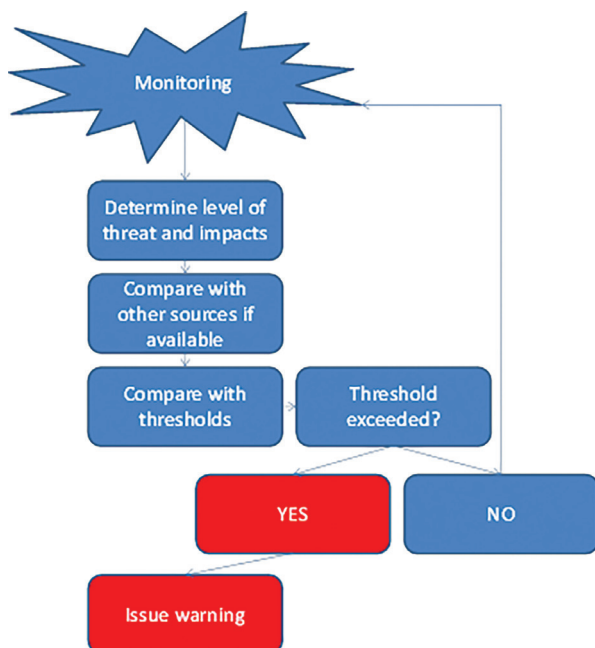


Figure 6. Standard Operating Procedures for provider organizations.

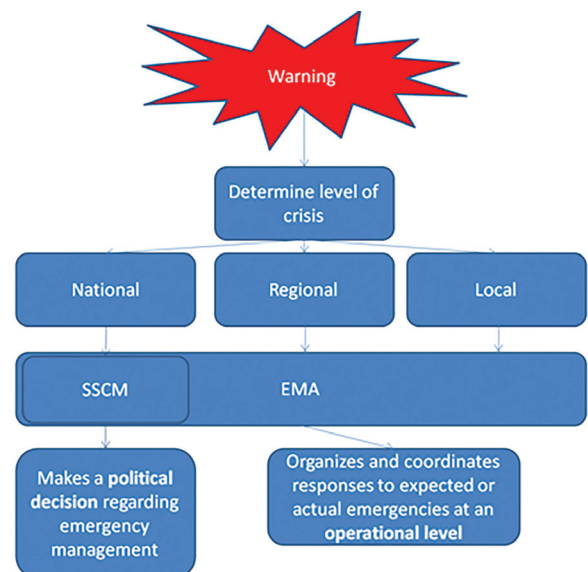


Figure 7. SOPs for decision making based on the warning.

6.1.3.2 Emergency Management Agency

- Roles (in addition to normal duties):

1. Normal situation:

- Undertake activities related to awareness raising to enhance understanding of early warning procedures (and messages) and improve disaster preparedness
- Arrange publication and distribution of SOPs for MHEWS
- Propose legislation to support MHEWS
- Trainings to EMA staff (HQ and field offices) and media on SOPs, scenarios and understanding of warning messages
- Ensure the Emergency Management Operations Centers is fully equipped, staffed and operational
- Define disaster scenarios and define response actions for each scenario
- Perform regular drills and exercises (especially for critical facilities)
- Establish MoUs with provider organizations defining format, frequency and type of information to be provided
- Ensure linkage and sharing of info between the emergency management centers at regional and local level
- Assess lessons learnt from past disasters and emergency drills to improve the MHEWS.

2. Warning stage:

- Receive warnings
- Decide on the level of crisis (national, regional, local) and responsibilities (SSCM vs. EMA)
- Decide on evacuation and safety measures (based on predefined scenarios)
- Issue warning to emergency management centers in potentially impacted areas
- Provide clear guidance to local governments
- Call upon support from other ministries, institutions, private sector as needed
- Publish daily situation reports.

6.1.3.3 Local Governments

As they are at the center of effective early warning systems, it is important these are empowered by national governments and be actively involved in the design and maintenance of early warning systems. They must understand advisory information received and be able to implement guidance provided by EMA by advising, instructing and engaging the local population. Local 24/7 Emergency Management Operations Centre are key players in the warning chain.

6.1.3.4 The Media

Television and radio stations can play a crucial role in the early warning chain as they are capable of immediately spreading information over a wide area. Nevertheless, involving the mass media requires a long-term strategy to develop relations and create the required pre-conditions to enable broadcasters to disseminate warnings and provide relevant information to the public during an emergency. These include a proper understanding of the warning system and its warning services and products, standard procedures for receiving and disseminating warnings, the development of appropriate and easy-to-understand visual warning formats on television screens, and back-up communication channels.

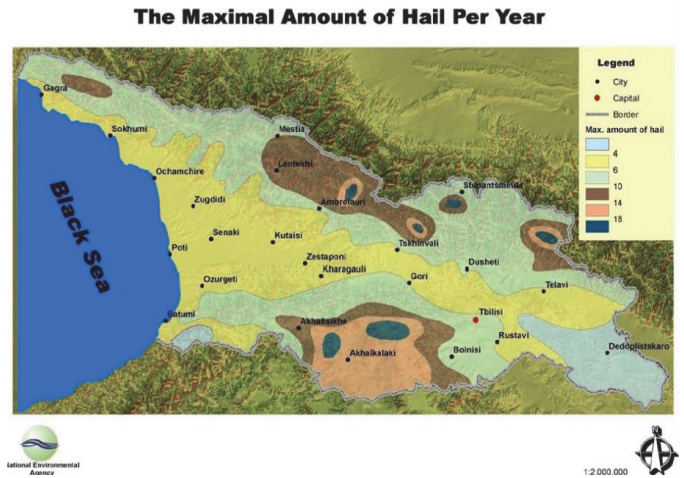
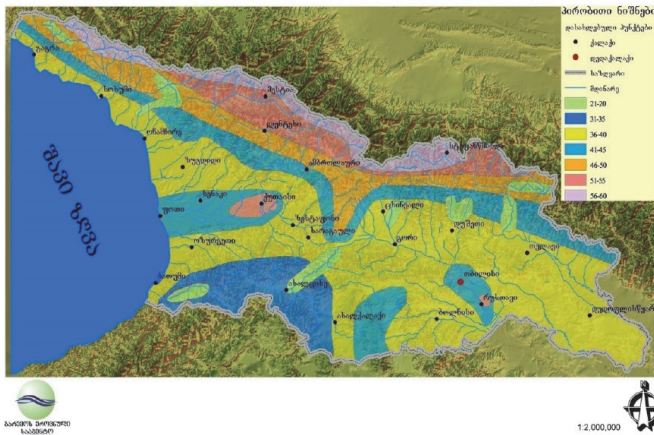
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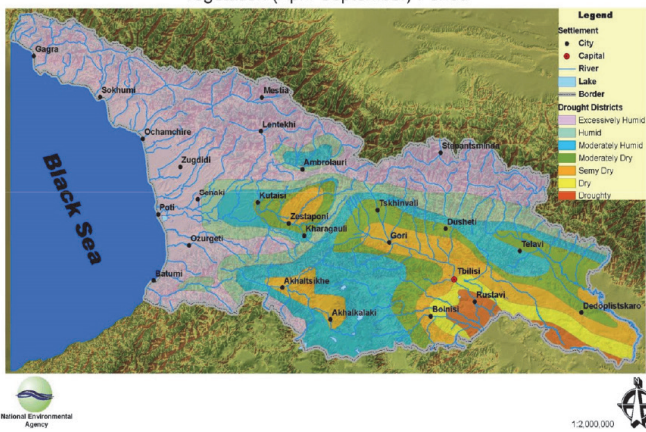
8 Annex

8.1 Hazard Maps at National Environmental Agency

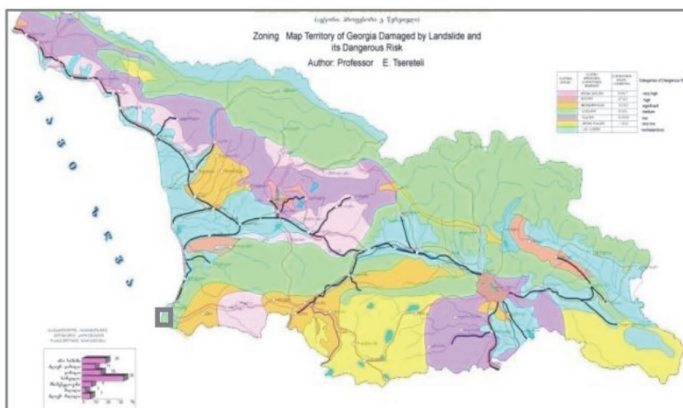
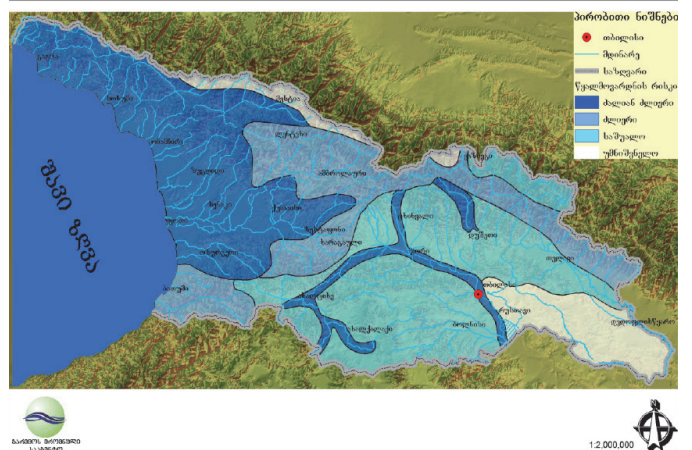
საქართველოს ტერიტორიის დარღობების კარის მაქსიმალური სიჩქარეების მიხედვით (I-VIII რაიონები, ქარის სიჩქარის გრაფიკები მ/წმ-ში)



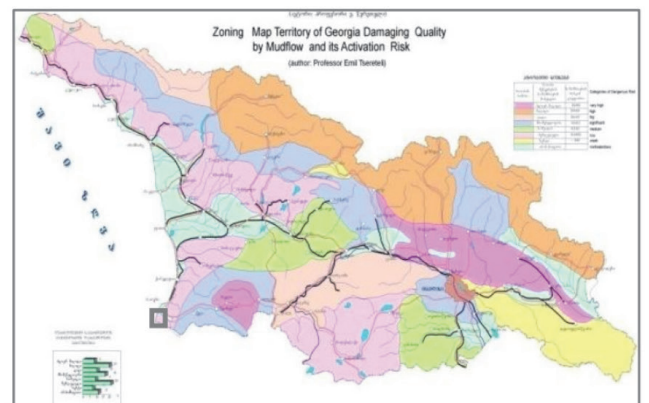
Drought Map of Georgia
Vegetation (April-September) Period



საქართველოს მდინარეებზე წყალგამარტების რისკების განაწილება



Landslide risk map of Georgia.



Mudflow risk map of Georgia.

8.2 Structure of the Hydrometeorological Department of the National Environmental Agency

