Community based climate change adaptation and disaster risk reduction action plan for the Samsatskaro community of Dedoplistskaro Municipality, Lower Alazani Watershed, Republic of Georgia

Integrated Natural Resources Management in the Republic of Georgia Program

Technical Summary Report

Community based climate change adaptation and disaster risk reduction action plan for the Samsatskaro community of Dedoplistskaro Municipality, Lower Alazani Watershed,

Republic of Georgia

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Preface

The present report has been developed within the framework of the program Integrated Natural Resources Management in Watersheds (INRMW) of Georgia, being implemented by the following partners:

- Florida International University (FIU)
- UNESCO-IHE Institute for Water Education
- CARE International
- Winrock International
- Caucasus Environmental NGO Network (CENN)

The geography of the program covers the following watersheds of Georgia: the Rioni River basin in West Georgia, and the Iori River and Alazani River basins in East Georgia. The following pilot watershed areas were selected for the implementation of the pilot program:

- Upper Rioni pilot watershed area – Municipalities of Oni and Ambrolauri
- Lower Rioni pilot watershed area – Municipalities of Khobi and Senaki
- Upper Alazani pilot watershed area – Municipalities of Akhmeta and Telavi
- Lower Alazani Iori pilot watershed area – Municipality of Dedoplistskaro

The program considers the development of a community based climate change adaptation and disaster risk reduction plan for one community in each targeted municipality.

The present report contains the community based climate change adaptation and disaster risk reduction plan developed for the Samtatskaro community of Dedoplistskaro municipality (Lower Alazani pilot watershed area).

1. Methodology

Process

The process of developing the community based climate change adaptation and disaster risk reduction plan consisted of the following main stages:

- selection of a pilot community;
- community mobilization and working meetings with community members with the purpose of identification of urgent issues;
- experts' field visits to targeted communities;
    - working meetings with local communities;
    - field examination of hazards identified during working meetings with community members;
    - finalization of recommendations with community members;
- final report.

A brief overview of the methodology used at the key stages of the plan's development is given below.

Selection of pilot communities

The INRMW program considered selection of one community in each targeted municipality where participatory community based climate change adaptation and disaster risk reduction plans would be developed (7 communities in total).

A web-based decision support tool[1] developed by the Helsinki University of Technology was used to select targeted communities. This tool is often used for environmental research (e.g., EIAs, ESIAs).

The selection process comprised of the several stages:

- identification of selection criteria;
- data collection;
- integration of data into the web system;
- data processing (weighting, standardization, "criteria tree");
- web analysis of results;
- validation of the results of the web-based decision;
- finalization of the results with implementing partners.

[1] http://www.hipre.hut.fi/

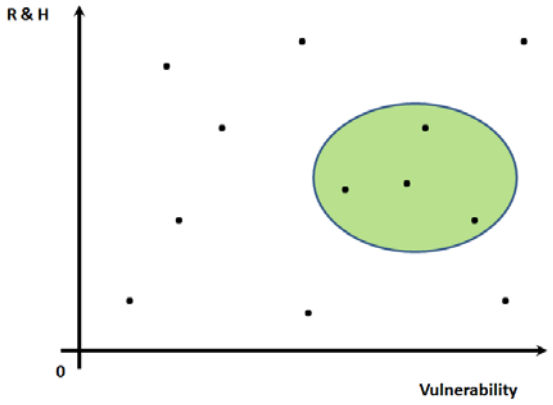
One of the most important stages of the selection process was the identification of selection criteria. These criteria included:

INRMW program pilot community – pilot communities should be selected from pilot communities of the INRMW program. Therefore communities with a small number of members were excluded from the very beginning**.** This approach ensured the availability of a Community Based Organization (CBO) in each selected community (the INRMW program has established CBOs in pilot communities) which would be responsible for the development of adaptation plans.

vulnerability of the community – vulnerability of communities to climate change and natural disasters was one of the main selection criteria. The highest value of vulnerability was used as a selection criterion. The vulnerability of the targeted municipalities of INRMW program was assessed at the previous stages of the program[2].

hazard and risk index of the community – hazard and risk indices of the communities were taken into account during the selection process (hazards and risks of the targeted municipalities of INRMW program were assessed at the previous stages of the program)[3]. An average value of hazard and risk was used as a selection criterion. The diversity of natural hazards identified in the community was given special attention.

The diagram below illustrates the selection criteria. The diagram shows that communities with high vulnerability and medium hazard and risk values were given preference in the selection process (see Diagram below).

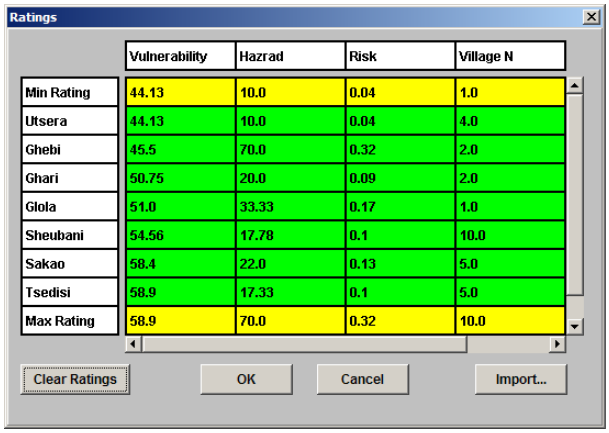


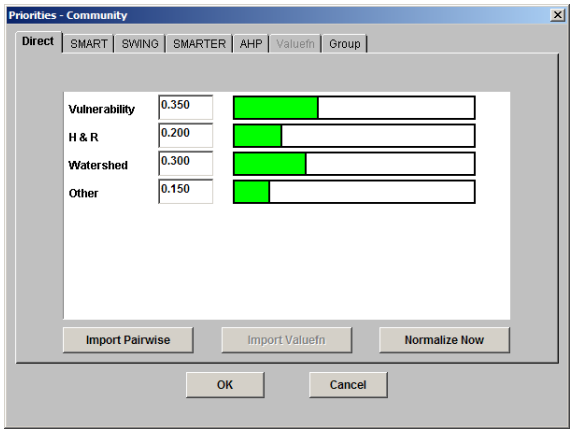
Along with the abovementioned, other criteria were also used for the selection of pilot communities: location of a community within a single watershed, potential impact on other communities, area of the community, number of villages in the community, size of population, area of forested land, etc.

After identification of criteria the data corresponding to these criteria were integrated into the special web-based database. Each criterion was assigned a weight for formulation of a final decision.

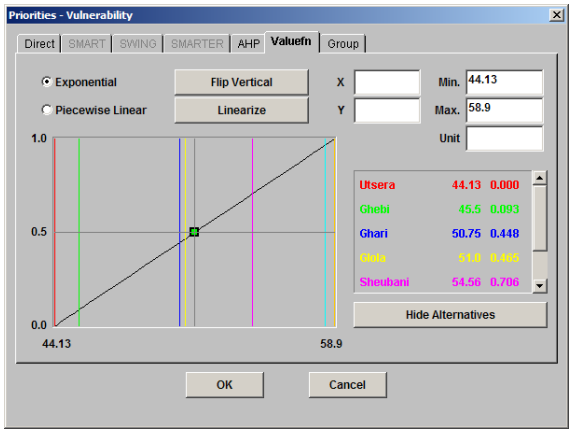
[2] see reports – Assessment of the vulnerability to natural disasters and climate change of INRMW program targeted municipalities. Adaptation and mitigation plan.

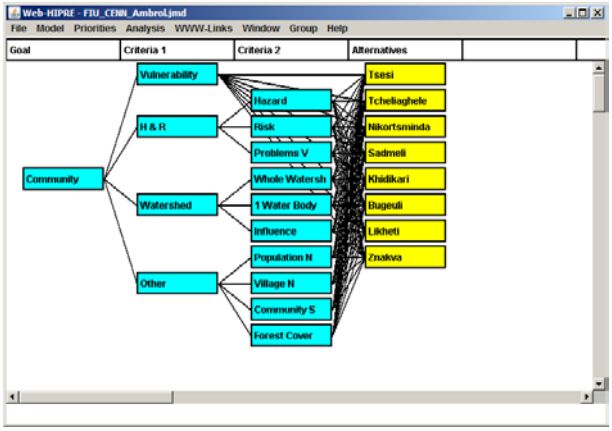
[3] Assessment of the vulnerability to natural disasters and climate change of INRMW program targeted municipalities. Adaptation and mitigation plan



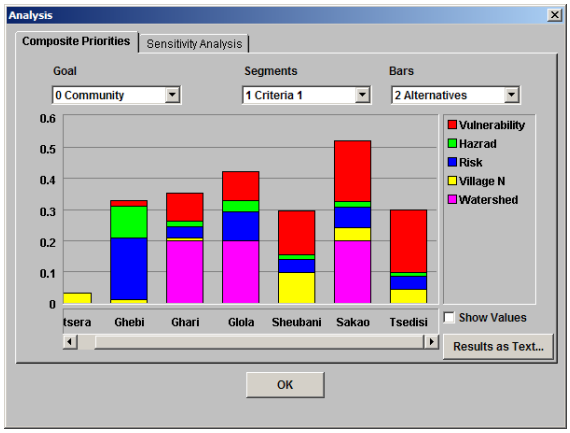


Following weighting the data was standardized and a so-called criteria tree was developed.





The system allows for multi-criteria analysis of the results, based on which potential targeted communities were identified.[4]



At the final stage of the selection process the data was communicated to the INRMW program implementing partners. On the basis of consultations the following communities were selected:

[4] for details refer to: http://www.hipre.hut.fi/ FIU_CENN_Dedoplistskaro.jmd

INRMW program targeted municipalities	Selected community
Oni	Sakao
Ambrolauri	Kikheti
Senaki	Zemo Chaladidi
Khobi	Sagvichio
Akhmeta	Jokolo
Telavi	Ikalto
Dedoplistskaro	Samtatskaro

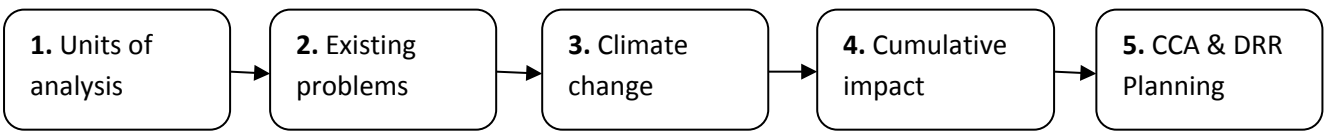
Development of community based natural hazards risk reduction and climate change adaptation plans

Participatory approaches implying the involvement of local community members at all stages of the plan development were used.

Experts were also involved in the process. They visited the local communities to study the situation on the ground and took part in the development of relevant recommended actions. It should be mentioned that the main purpose of the process was to discuss issues of natural disaster risk reduction in the context of climate change. Therefore the main goal was to study those geomorphological processes (erosion, mudflow, landslide, floods and flashfloods) occurring in the community, which are the main causes of natural disasters. Thus the experts of relevant fields were involved in this process.

Since the economies of the targeted communities are based mainly on agriculture, the agriculture expert was involved in the process of developing climate change adaptation and natural disaster risk reduction plans. Therefore, analysis of the agricultural sector and relevant recommendations constitute an important part of the final plans.

The process of the development of plans was divided into several logically linked stages that eventually formed the structure of the final versions of the plans. The diagram shows the general framework of the planning methodology. A brief description of each stage and the activities implemented at these stages is given below.



Stage 1: Identification of units of analysis

The aim of the first stage is to identify key aspects of the community (natural components, infrastructure, activities), to be analyzed at the next stages in the context of climate change and natural disasters.

Stage 2: Identification of existing problems

The aim of the second stage is to better understand the natural disaster related problems faced by the community. At this stage existing (not future) potential problems should be identified. The identified difficulties and problems should be linked to those units of analysis that have been identified at the first stage of planning.

The first two stages are the most important components of the planning process since the outcomes of these stages determine a content and character of the next stages of planning. The involvement of the local community is especially important at these stages. Therefore, the first two stages of the development of the present plan were implemented based on the working meetings with local community members.

Stage 3: Future climate change and its consequences

The aim of the third stage is to determine the patterns of climate change and its direct potential impact on units of analysis and the community in general. Climate change scenarios have been developed within the INRMW program during the process of assessing the vulnerability of targeted areas to natural disasters and climate change. Therefore the results of this assessment have been used in this case.

Stage 4: Combined impacts

The aim of this stage is to determine the interrelation between direct impacts of climate change and current problems and challenges. Therefore the aim of this stage is to develop a matrix of combined impacts.

To evaluate the level of impact on a specific unit of analysis the following matrix was used:

Scales of impact	**High**			
	Medium			
	Low			
		Low	**Medium**	**High**
		Duration of impact		

where the vertical axis shows scales of impacts of climate change and natural disasters. In this regard the following three levels are identified:

- low – impact occurs locally;
- medium – impact occurs in a considerable part of the community (about half of the community);

- high - impact occurs in the major part of the community.

The horizontal axis indicates scales and duration of impact caused by climate change and natural disasters. In this regard the three levels are distinguished:

- low – short-term impact (impact occurs during a relatively short period of time and quickly diminishes. Consequences of the impact are evidenced seasonally, during one or two days a season);
- medium – medium-term impact (consequences of the impact occur during a certain period of time, however they diminish with time. Consequences of the impact are evidenced seasonally, during up to one month a season);
- high – long-term / permanent impact (consequences of the impact occur over long periods of time or they never diminish).

Stage 5: Identification and planning of risk reduction activities

The aim of the final fifth stage is the development of an action plan that will ensure avoidance or mitigation of negative consequences of impacts identified at the previous stages. At this stage the involvement of experts is important. Therefore, the planning process at this stage has been implemented in close cooperation with the experts of relevant fields.

2. General characteristics of the community

Location and natural environment

The Samtatskaro community is located in the north-easternmost part of Dedoplistskaro municipality. The eastern border of the community follows the Alazani River, which at this section is a state border of Azerbaijan and Georgia. The territory of the community is dissected by riverbeds of small seasonal rivers – right tributaries of the Alazani River, as well as irrigation canals. The Samtatskaro community is comprised of one village – Samtatskaro located 45 km from the municipal center.

The village Samtatskaro is located on the right bank of the Alazani River, at 350 m above sea level. Hilly relief with thin vegetation borders the village to the west.

Two climate types are observed in the Dedoplistskaro community: a moderate warm steppe climate with hot summers in its southern part, and a moderate humid climate with moderate cold winters and long warm summers in the northern part, where the community is located. Mean annual temperature is 10.3°C, and the absolute maximum is 38°C. Annual precipitation reaches 400-600 mm – 540 mm in Shiraki and 650 in Dedoplistskaro. Lower precipitations are recorded in the Eldari lowlands (250-300 mm) and Didi Shiraki plain (490 mm).

In general, semi-desert vegetation is present along with cuscus grass-feather grass and thorny steppe vegetation, hemixerophytic thin forests and flood-plain forests are spread across the Dedoplistskaro municipality. From grasses, mugwort, cuscus grass and saltwort groups are found. A thin arid forest grows on the Iori plateau. On plains and depressions cuscus grass and feather grass steppe vegetation is spread: oats, cuscus grass, feather grass, sickleweed, etc. The vegetation of the Samtatskaro community is formed mainly by floodplain forests, the area of which has been considerably decreased due to human activity (clearing for agricultural lands and timber or firewood harvesting).

The fauna of the municipality is diverse. The following mammals are found in the territory of the municipality: lynx, jackal, fox, wolf, jungle cat, weasel, badger, and gazelle. Striped hyena is also occasionally found. Rodents including jird, vole and wood mouse are widespread. From reptiles, vipers are found. Birds: grey partridge, great bustard, bee-eater, skylark, crow, quail, oriole, mistle thrush, potoo, rock partridge, etc. Mursa, khramulya, Kura nase, bleak, etc. are found in the rivers Alazani and Iori.

Population

There are 425 households in the community with a population of around 1,700.

The majority of the population of the community are able-bodied – about 75%. The share of people under 18 is 18%. The number of people at pensionable age does not exceed 7%.

Sex ratio information is not available in the community, however, during the meeting the community members mentioned that the number of women exceeds the number of men.

Samtatskaro is not an old settlement. It was established in the 1930s by the Ingilos[5] resettled from Azerbaijan. Initially the settlement was comprised of 30-40 households. In 1979 ecomigrants from Adjara were settled in Samtatskaro. At that time the population of Samtatskaro reached its maximum – over 600 households. Due to the hard living conditions, a part of the population (especially ecomigrants who failed to adapt to the severe conditions) left the village and resettled in other regions of Georgia (Tsalka, Marneuli, Gardabani, Rustavi, Achara). At present, the ecomigrants resettled from Achara (305 households) constitute a majority of the population of the community.

An absolute majority of the population of the Samtatskaro community is self-employed. The main source of their incomes are revenues from small private farms. The share of people with salaried jobs (school, local administration, frontier service, infrastructure, etc.) does not exceed 10%. According to the statistical data obtained during the working meetings with the local population about 91 households (more than 20% of the local population) are below the poverty level and receive state allowances.

[5] Georgian ethnic group living in the territory of Azerbaijan.

3. Units of analysis of the Samtatskaro Community

The first stage in the methodology of planning the community based climate change adaptation and disaster risk reduction activities considered the identification of those units of analysis that are most vulnerable to hazardous natural processes and would be more severely affected in the future under the forecasted climate change scenarios. At the same time, these units have an important role in the life of the community and determine the level of adaptation of the community to the expected impacts of climate change.

In the process of identifying units of analysis for the Samtatskaro community, important issues associated with the risks of natural disasters and expected impacts of climate change were identified. The following sources of information were used to identify the units of analysis:

- DRR and Climate Change Reports for targeted watersheds including lower Alazani watershed area developed within the framework of the INRMW program. The Samtatskaro community is discussed in the context of the Dedoplistskaro municipality.

- Meetings with the local population – the aim of these meetings was to study the views of the local community on problems, existing situation, expected impacts of natural disasters and climate change in the life of the community, as well as their perception of methods of future development for the community.

- The expert team working on community based adaptation plans was an important source of information. The team was involved in community meetings, as well as in collection of baseline information and identification and planning of relevant adaptation activities at the final stage of the process.

Based on these information sources, and consultations with the local population and expert team, the following environmental components have been determined as units of analysis for the Samtatskaro community:

- Agricultural lands (arable lands and pastures) – the main source of income of the community members are revenues from agricultural products. Therefore, agriculture is a basis for the economic well-being of the community.

- The Alazani River – as the only river in the territory of the community it is the main source of irrigation water for local agricultural lands and the main source of natural hazards occurring in the community.

- Infrastructural facilities located in the territory of the community – including drinking and irrigation water supply infrastructure, motor roads, electricity transmission lines, drainage canals, etc.

Below are given short descriptions of each components and brief characteristics of their role and importance in the life of the community.

3.1 Agriculture and agricultural lands

Crop growing

The total area of agricultural lands in the Samtatskaro community is about 500 ha. 70 ha are occupied by vine and 8 ha by pomegranate tree plantations. Some areas are under hazelnut tree plantations. The total area of pastures is 100 ha, 35 ha of which are degraded and covered with thorny vegetation and stones. The rest of the agricultural lands are arable lands. As a result of land privatization each household has 1.13 ha of vineyards and 0.6-0.8 ha of arable lands.

Vine is the main agricultural plant, however, its productivity is rather low – 2-3 tons per ha due to the shortage of irrigation water. Shortage of irrigation water restricts the production of both vegetables and vine crops. Water is the main factor determining the nature and content of agriculture in the community.

Animal breeding

Pastures occupy smaller areas. The total area of pastures does not exceed 100 ha. At present there are up to 1,000 heads of cattle in the community determining a very high pasture load index and the high level of their degradation.

3.2 Rivers flowing on the territory of the community

The Alazani river and its general hydrological characteristics

The Alazani River – the second largest river in eastern Georgia has its source on the southern slopes of the Caucasus Range at an altitude of 825 m, at the conjunction of two rivers - Tsiplovaniskhevi and Samkuristskali, at the village of Khadori. The Alazani River joins Mingachevir reservoir at the southern edge of the Gare Kakheti highland. The length of the river is 351 km, the total drop is 745 m, and its average gradient is 0.0021. The area of the watershed comprises 11,800 km^2.

1,803 tributaries of various types, with a total length of 6,851 km, flow into the Alazani River. The watershed of the river is asymmetric. 65.3% of the watershed of the Alazani river is located on the left side of the river. A 20 km long upstream section of the watershed, from the source up to city of Akhmeta, is located within the high and medium mountainous zones of the Caucasus Range. The remaining 330 km of the watershed stretches from the city of Akhmeta to the confluence, located on the Kakheti intermountain lowlands.

The watershed is bordered by the Caucasus Range in the north and north-east. The average height of the Caucasus Range at this section varies between 2,600-2,800 m above sea level. The western border of the watershed lies on the Kakheti Range and its extension – the Gombori Range. Their highest points vary from 1,682 m (Mount Manavis Tsivi on the Gombori Range) to 2,050 m (Mount Gareja on the Kakheti Range). The lower part of the watershed is bordered by the Gare Kakheti Plateau in the south-west. Its average altitude varies from 700 m to 1,084 m above sea level.

The upstream section of the Alazani River watershed, located within in high and medium mountainous zones of the Caucasus range, is dissected by deep gorges and eroded ravines. This part of the watershed is made up of sand-stones and clay shales, which are widespread on the left side of the watershed. On the right side of the watershed limestone and conglomerates are found. The downstream area of the watershed is made up of quaternary alluvial and alluvial–diluvial sediments. Soils and vegetation of the watershed are diverse. Loamy forest grey soils are found in the mountainous part of the watershed.

Alluvial non-carbonate forest soils are present downstream on the left side of the of the watershed, while alluvial carbonate soils are found on its right side. Medium and heavy loamy forest brown soils are widespread on the north-eastern slopes of the Tsiv-Gombori Range. Alpine meadows are found at altitudes from 2,000 m up to 2,200 m. Deciduous forests grow below 1,400 m. Lowlands are used mainly for agricultural purposes. Natural vegetation is formed of thin shrubbery and semi-desert vegetation. The head of the river gorge is box shaped. Its slopes merge with the slopes of adjacent mountains. The river gorge downstream of the city of Akhmeta is not clearly formed. The riverbed from the source up to the Chiaura bridge is meandering and branched. The river banks are steep and covered with pebbles. Downstream of the Chiaura bridge, the river flows in a single unbranched riverbed. The riverbanks are made up of argillaceous soils prone to erosion during floods and flashfloods. After joining the Matsimi River, the Alazani River becomes a freely meandering flow. As a result of washing from the meandering and riverbed straightening some forested floodplains appear on the territory of Azerbaijan. The width, depth and velocity of the flow vary from the river source to the convergence. The width of the flow varies from 10-12 m (at the village Birkiani) up to 60-80 m (downstream of the junction with the Argichay River). The depth varies from 1.0-1.5 m up to 4.5-5.8 m. The velocity varies from 1.5-2.5 m/sec to 0.8-1.2 m/sec. The riverbed is covered with pebbles at its source. Downstream of the Chiaura bridge the riverbed is sandy. The river is fed by snowmelt, rains and ground waters. The pattern of the flow is characterized by spring floods caused by Snowmelt, flashfloods caused by summer and autumn rains, and relatively low water levels in winter. The flow during the spring-summer flood period is 65-72% of the annual flow (35-40% during spring and 30-32% during summer). The autumn flow is 20-23% of the annual flow, although it often increases to summer levels. Winter is characterized by low waters. The winter flow is 8-18% of the annual flow.

Observations of the Alazani River runoff have been conducted by 11 hydrological posts since 1912. 4 hydrological posts were operational until 1991.

The Alazani River is used for irrigation and energy generation purposes. There are 23 irrigation canals, including 3 main irrigation canals and one large pump station on the Alazani River and its tributaries.

Other canals are of local importance. Besides the main and local irrigation canals there are 5 irrigation water reservoirs within the Alazani River watershed. The Khadori hydro power station, with 24 megawatt installed capacity, has been constructed and recently opened at the source of the Aazani River – at the conjunction of the rivers Samkuristskali and Tsiplovaniskhevi. The Alazani hydro power plant, with 4,8 megawatt installed capacity, operates on the main canal of the Lower Alazani irrigation system.

3.3 Infrastructure

Drink water supply infrastructure

The village Samtatskaro is being supplied with water from 5 artesian wells located on its territory. Water pumped from these wells is being supplied to the population through an internal pipeline (the internal pipeline is a simple system independently built by the community members). At the working meetings it was revealed that there are some blocks in the village suffering from water shortage. About a half of the population is not being supplied with an adequate amount of water (24 hours supply). According to the local population, the reason for water shortage is not scarcity of water, but clogging of the system – the wells are clogged with sediment and require cleaning.

Irrigation water infrastructure

The irrigation system of the community was built in the beginning of the 1980s (1980-1981), and took water from the Alazani River. Water was distributed mainly among the state-owned agricultural lands (Kolkhozs) through pipes and valves. These agricultural lands were occupied mainly by vineyards. The majority of pastures were irrigated well, which led to the development of animal breeding in the community. After the collapse of the Soviet Union, in 1990-2000, the system was dismantled and stolen.

Destruction of the irrigation system created the main problem in the community – shortage of irrigation water. The sharp reduction of irrigated areas determined a degradation of the main source of income (agriculture) of the population. Therefore, the sharp reduction in incomes from agriculture (the main source of income for the local population) determined the high level of migration from the community.

At present, an irrigation canal taking water from the Alazani River by gravity irrigates a small part of the agricultural lands (20-25%). According to the locals, this canal is private property and its owner ensures its maintenance, therefore the population pays for this service.

Road and social infrastructure

The distance between the village Samtatskaro and the administrative center of the municipality is more than 45 km. The main motor road to the village is in a bad condition. The poor state of the motor road hampers transportation and negatively impacts the provision of the village with required goods and the sale of agricultural products produced in the village (it increases their costs). The motor road connecting the Samtatskaro village with the city of Tsnori is also in a bad condition and is not serviceable. The total length of internal roads in the community is about 6 km. The population also uses access roads to agricultural lands, the length of which is more than 30 km. Internal and access roads are in a bad condition and require rehabilitation. There are two bridges over the Alazani River in the territory of the community, connecting the community with Azerbaijan. At present these bridges are not used due to the absence of a relevant checkpoint.

There are 450 residential houses in the community, 52 out of which are closed (former houses of migrants). These are mainly standard two-storied permanent structures built of blocks.

The Samtatskaro community has permanent electricity supply. The electricity transmission system covers the whole community. However, the existing electricity transmission infrastructure (power transmission networks, poles) is outdated and requires rehabilitation. The poor state of this system often, especially in bad weather, leads to electricity cuts The total length of the electricity transmission system in about 10 km.

The community is not supplied with natural gas.

In the Soviet times the village was provided by a sewage system, however, it is completely outdated and inoperative; the population now uses simple latrines. Some portion of domestic wastewater flows into sewer pits arranged by the population and the remaining portion is released into the ground.

There are no dumpsites in the community. The locals take their garbage out by vehicles and dispose of it in nearby ravines. Some community members have built garbage pits on the areas adjacent to their household plots, where household wastes are disposed.

There are no infrastructure facilities posing a threat to the community.

Medical service

The community has got an ambulatory. According to the locals the building of the ambulatory is in a satisfactory condition. A local nurse provides medical services at the ambulatory. The community is served by a doctor located in the village Arkhiloskalo (7 km away). A first aid station is in the village Zemo Kedi (12 km away) providing assistance to patients in a timely manner. For full medical services the community members have to go to the city of Dedoplistskaro or Tsnori, and to Tbilisi in severe cases. According to the locals, the community is not provided by adequate medical services. There is a need for a dentist, gynecologist, etc.

Table 1 provides a summary of information on the units of analysis for the Samtatskaro community, identified during the working meetings with the local population and consultations with the relevant experts.

Table 1. Units of analysis identified in the Samtatskaro community

Unit of analysis	Description/Importance
Agricultural lands	• Agriculture is the main source of income for the community. • Total area of agricultural lands is up to 500 ha. • Main agricultural plant - vine. • Animal breeding is the main branch of agriculture. 1,000 heads of cattle are registered in the community
The Alazani River	• Main river of the community is Alazani • The Alazani River is the main source of irrigation water • The rivers of the community are the main source of hazards occurring in the community
Infrastructure	• Drinking water supply depends on the condition of the drinking water infrastructure. • Agriculture of the community entirely depends on availability of irrigation water • Road and social infrastructure is important for the development of the community. Remoteness of the community from the municipal center increases the dependence of the community on the quality of road infrastructure • The condition of the infrastructure is an important factor determining the vulnerability of the community

4. Problems/challenges faced by the Samtatskaro community

The present chapter contains a brief description of problems and challenges faced by the Samtatskaro community. A special emphasis is put on those natural hazards that determine the risk profile and the potential/ability of the community to adapt to expected climate change. The interrelation of these problems with the units of analysis identified at the first stage of planning is also described.

Problems of agricultural sector in the Samtatskaro community

The agricultural sector of the Samtatskaro community faces a number of problems.

The main problem of agriculture in the Samtatskaro community is a shortage of irrigation water. Due to the nature of local agriculture this problems negatively affects both crop growing and animal breeding.

In crop growing the shortage of irrigation water determines the low fertility of soils. As has been stated above, the main agricultural plant in the community is vine. Its productivity is very low (2-3 tons per ha) mainly due to the shortage of irrigation water. For this reason the choice and yields of other plants (vegetables, vine crops) are restricted. Production of grain crops is restricted due to the limited choice of quality seed materials and plant protection products.

The development of animal breeding in Soviet times was determined by a well-developed irrigation infrastructure and availability of irrigated pastures. Currently, the pastures are heavily degraded as a result of the destruction of the irrigation infrastructure and a shortage of irrigation water. The carrying capacity of pastures has decreased considerably, limiting prospects for the development of animal breeding in the community. As was revealed during the field studies, about one third (35 ha) of total pastures (100 ha) are degraded and covered with thorny vegetation and stones (Pic. 1).

Pic. 1. Degraded pastures

Another reason for the degradation of agricultural lands is improper agricultural practices applied in the community. In particular, the local farmers do not implement any activities directed at the improvement of soil fertility. They consider that it makes no sense in conditions of irrigation water shortage. Pasture overloading, aggravated by a dry local climate, is observed. Due to the low precipitation pasture vegetation is not able to recover and gradually declines primarily affecting valuable and nourishing plant species.

Animal breeding depends mainly on the green mass of pastures. In such conditions of such loads the productivity of pastures declines and degrades.

The fact that the village Samtatskaro is located 48 km from the administrative center and the road is in a bad condition is noteworthy. The poor state of the motor road hampers transportation and negatively impacts the provision of the village with required goods and the sale of locally produced agricultural products.

Hazardous natural processes occurring in the territory of the community affect local agricultural lands and lead to their degradation.

River erosion

An identification/survey of hazardous sites and sites exposed to risks as a result of floods and flash floods in the rivers of the Alazani River basin, within the territory of the Samtatskaro community, has been carried out in accordance with the results of the consultations and working meetings with the

local population. These consultations and working meetings were carried out during the field studies undertaken within the framework of the INRMW program.

A considerable part of the state border between Georgia and Azerbaijan follows the Alazani River, including the section located within the territory of the Samtatskaro community. Generally, Alazani is a strongly meandering river. There are a number of old fragments of meanders separated from the Alazani River that are filled with sediments and can be viewed only on aerial photos or old topographic maps. In the last century a rather large meander separated from the right bank of the Alazani River and a bridge over the river was constructed at the village Erisimedi. Separation of meanders from the main riverbed creates problems for the demarcation of state frontiers.

As a result of the monitoring of river banks carried out in the Samtatskaro community three hazardous sites have been identified.

The first site (coordinates - X-625635, Y-4586182 WGS 1984 UTM Zone 38N) – floods occurring at this site result in inundation of the right bank of the river and make about 9 ha of agricultural lands useless. For fear of flooding and losing harvests these areas have not been cultivated for 4-5 years. The area is uncultivated and covered with shrubs and thorns (Pic. 2).

Pic. 2. Arable lands covered with shrubbery

The second site (coordinates - X-6222891, Y-4587819 WGS 1984 UTM Zone 38N) – the study site is adjacent to the Samtatskaro village and represents a wide meander of the Alazani River. The height of the erosion cliff on the right bank at the neck of the meander reaches 3 m. The left bank (located in Azerbaijan) is low, concaved where modern accumulation is observed. The terrace is vertically exposed.

At the end of the neck of the meander, towards the “peninsula”, traces of floods are observed. During large-scale floods water inundates even the “peninsula” covered with forests. If the erosion processes on the neck’s surface continue, there is a threat of the meander separating and associated

problems related to the demarcation of state borders will emerge. Currently, the width of the neck is 230 m.

Periodic side erosion in observed on the bank. Floods result in inundation of the neck of the meander and water overflowing (Pic. 2).

Pic. 2. Meander of the Alazani River

The third site (coordinated - X-618535, Y-4591475 WGS 1984 UTM Zone 38N) – according to the information of the Samtatskaro community members, floods occurring at this site result in the inundation of arable lands located on the right side of the river (Pic. 3). The satellite images show that at this section the river meanders and intensely scours the floodplain growing on the right bank of the river. If no measures are taken, a 100-120 m wide forest strip will eventually be washed and agricultural lands will be threatened.

Pic. 3. Agriculture lands on the right bank of the Alazani River

Table 2, below, contains a summary of information on the problems and challenges identified in the Samtatskaro community on the basis of working meetings with local population and consultations with relevant experts and the impacts of their units of analysis:

Table 2. Problems identified in the Samtatskaro community and corresponding units of analysis

Identified problems/impacts	Corresponding units of analysis
Shortage of irrigation water determining degradation and low productivity of agricultural lands (arable lands, pastures)	• Agricultural lands • Infrastructure (irrigation water system)
Degraded agricultural lands – arable lands. Inadequate soil cultivation practices leading to low soil productivity	• Agricultural lands
Degraded agricultural lands – pastures. Unregulated grazing and high loads result in degradation of about one third of pastures (35 ha)	• Agricultural lands
Floods and flash waters occurring as a result of river bank erosion cause serious damages to the community – large areas of agricultural lands are being damaged	• Agricultural lands • Hydrographic network
Improper road infrastructure (road to the municipal center and access roads to agricultural lands) – restricted movement hampering the sale of agricultural goods produced locally and provision of the community with required products and increasing the level of vulnerability of the community.	• Agricultural lands • Infrastructure – motor roads

5. Climate change and its consequences

After identification of the existing challenges in the community the trends of climate change have been identified to determine the potential direct impacts of climate change, in terms of emerging new challenges and aggravation of already existing problems, to the community. Climate change trends have been identified on the basis of local knowledge/experience as well as using the results of the climate change studies carried out at the previous stages of the program[6]. Table 3 contains climate change trends with descriptions of their potential direct impacts and an indication of the units of analysis that might be potentially affected by the mentioned changes.

Table 3. Climate change and potential direct impacts

Climate change trends	Direct impacts	Corresponding units of analysis
Expected increase of all parameters of air temperature (mean annual, seasonal, etc.)	• Change of the agricultural calendar. • Increase in temperature will result in higher evapotranspiration rates and determine increased demands of plants on irrigation water on the background of expected increase of dry periods despite of the growth of total amount of rainfall • Reduction of river water flows and groundwater discharges	• Agricultural lands • Hydrographic network • Infrastructure – drinking water system
Increase of the duration of draughts	• Intensification of the land degradation and desertification processes • Intensification of the process of degradation of pastures • Intensification of water and wind erosion of agricultural lands	• Agricultural lands – arable lands, pastures
Change of the seasonal distribution of precipitation.	• Expected increase of occurrence and intensity of floods and the consequent increased risk of flooding and acceleration of erosion of riverside areas • The areas prone to floods and river erosion will face increased risks • Increased risk of accelerated landslide processes • Change of agrotechnical terms. Reduction in yields of agricultural crops	• Agricultural lands • Hydrographic network
Increase of wind strength and speed	• Intensification of wind erosion • Intensification of the process of degradation of agricultural lands (arable lands, pastures) • Reduction in yields of agricultural crops	• Agricultural lands – arable lands, pastures

[6] see INRMW program, report - Assessment of the Vulnerability to Natural Disasters and Climate Change for Lower Alazani Pilot Watershed Area & Plan of Mitigation and Adaptation Measures.

6. Combined impacts in the Samtatskaro community

At this stage the potential combined impacts of the challenges faced by the community and the consequences of climate change on the units of analysis have been assessed on the basis of the results of experts' work and participatory working meetings with the local population.

Impacts on agriculture

Under forecasted climate change scenarios, predicting increased air temperatures (mean annual, seasonal), an increased demand for irrigation water in the Samtatskaro community is expected. Against this background the qualitative degradation of already poor and low productive agricultural lands of the community is expected, which will negatively affect both qualitative and quantitative characteristics of agricultural yields and lead to increased expenses in agriculture.

Pastures of the community will be also affected by climate change. Under conditions of changed climatic parameters (temperature, precipitation), a shift in grazing periods is expected. Considering the present level of pasture loads (exceeding the standard loads of medium productivity pastures by 10 times) aggravation of existing problems, specifically the severe degradation of the pastures and widespread development of thorny vegetation and inedible weeds, may be expected.

Increased strength and frequency of winds will result in greater wind and water erosion and facilitate the degradation of pastures, leading to a sharp reduction in agricultural produce and incomes from agriculture.

Based on the above-mentioned, it can be concluded that climate change will have a substantial impact on agriculture in the Samtatskaro community.

Negative natural phenomena

The analysis of the existing situation shows that the Samtatskaro community is being affected by negative natural phenomena such as river erosion, leading to flooding in the territory of the community and causing damage to the scarce agricultural lands. As a result of river erosion and floods many agricultural lands remain uncultivated, leading to further degradation in the future.

According to the climate change scenarios increased occurrence and intensity of floods and flash waters are expected due to increased precipitation. This processes will lead to an acceleration of river erosion. Therefore, damages caused to the Samtatskaro community by negative natural phenomena will increase. The areas currently threatened by these hazards will be the worst affected.

The analysis of the combined impacts of climate change shows that climate change will have a medium impact on the development of hazardous natural processes in the Samtatskaro community.

Table 4, below, contains a summary of the information on combined impacts.

Table 4. Combined impacts identified in the Samtatskaro community

Combined impact	Corresponding units of analysis
Soil degradation (deterioration of quality), reduction of the volumes and deterioration of the quality of agricultural products due to the change of precipitation patterns and the growth of dry periods	• Agricultural lands
Degradation of pastures and haylands as a result of changed climate parameters. Resulted reduction of livestock and incomes from animal breeding	• Agricultural lands - pastures
Reduction of the volumes of agricultural products due to increased demand on irrigation water and increased temperature, as well as changed agrotechnical terms	• Agricultural lands
Increased intensity of winds will determine intensification of wind and water erosion facilitating the process of degradation of agricultural lands	• Agricultural lands
Accelerated floods, flash waters and river erosion will lead to increased damages of agricultural lands	• Agricultural lands • Hydrographic network

7. Adaptation and disaster risk reduction activities

The final stage of the selected methodology of planning climate change adaptation and natural disaster risk reduction activities considers the development of an action plan to ensure the prevention or mitigation of the impacts identified at the previous stages of planning. The following set of activities for each impact identified for the Samtatskaro community have been selected in close cooperation with the experts of relevant fields.

Agriculture

As has been already mentioned (Chapter 4) the main problem of agriculture in the Samtatskaro community is a shortage of irrigation water. This problem will be further aggravated according to the forecasted climate change scenarios. Therefore, adaptation of agriculture in the community to climate change requires activities that ensure the development of water deficit mitigation. This was the main issue discussed at the meetings with local community members. The recommendations given below were developed on the basis of the results of these meetings. We hope that these recommendations will reduce the vulnerability of local agriculture to climate change, ensure its development and increase its productivity under conditions of a changed climate. Considering the fact that agriculture is the main source of income of the community, the implementation of these recommendations will reduce the vulnerability of the community and increase its resilience and adaptation to climate change and natural disasters.

1 Vine is the main agricultural plant in the Samtatskaro community. Watermelon and vegetable growing is a profitable activity, however, their production is restricted due to the shortage of irrigation water.

To increase the productivity of vineyards in the Samtatskaro community the plants should be provided with adequate water. According to the locals, rehabilitation of a centralized irrigation system is associated with considerable expenses and cannot be expected in the nearest future. An increase in the demand for irrigation water is expected under the predicted climate change scenarios, according to which the mean annual temperature in Dedoplistskaro will increase by 2^0C, and summer temperature - by 3^0C

Therefore, it is very important to implement activities ensuring retention and increase of moisture content in soils:

a) First of all soil productivity, specifically the content of organic matter in soils, should be increased. Organic matter in soils is able to retain about 10 times as much water as its weight. Therefore its content determines the ability of soils to retain moisture. This can be achieved through the application of organic fertilizers. Taking into account the current level of soil fertility, application of 25-30 tons of composted manure, compost manure or compost per 1 ha is recommended. The amount of fertilizers can be increased depending on the needs of crops, or if applied to soils low in organic matter.

The content of organic matter in soils can also be increased by sowing green manure (so-called green fertilizers). For this purpose mainly legumes (e.g. vetch, grass pea) are used. Green manure can be used under perennials (vine, fruits), as well as in case of annual crops. For the preparation of land plots for autumn cereals (wheat, barley) green manure can be sowed in spring and ploughed into soils during their flowering period, while in case of spring crops (corn, majority of vegetables and vine crops) they can be sowed in autumn (September-October) and ploughed into the soils prior to sowing the main crops.

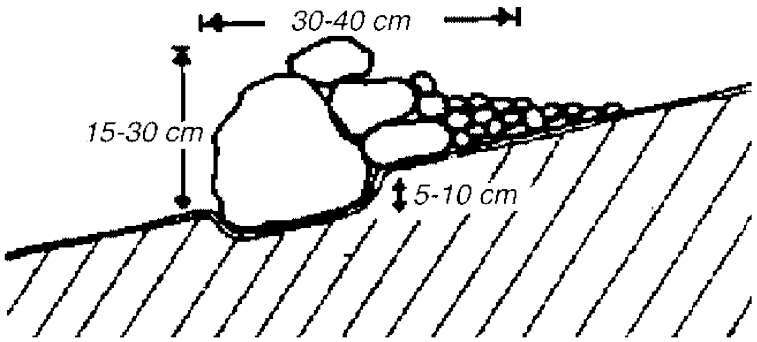
b) Mulching is an important activity for ensuring moisture retention in soils. Mulching is effective for vines and other perennials. Mulching material has to be made of locally available hay or crop remains. Hay used for mulching should not contain the seeds of weeds, therefore grass should be mowed during flowering season. Mulching under perennials should be done in spring before rains, in the case of vegetables – after transplanting or when sprouts reach a desirable height.

Along with the dead mulch so-called live mulch can be used between the rows of perennials. For this purpose cover plants have to be sowed. Cover plants are comprised of legumes or the combination of legumes and grain grasses. Cover plants retain moisture in soils as well as revitalizing and improving their structure. The presence of legumes (vetch, grass pea, clover, etc.) in cover plants ensures the accumulation of biological nitrogen in soils and thus improves consumption of nitrogen by the main crops.

The use of cover plants on arable lands is important in the case of spring crops, when soils are free from vegetation during autumn-winter and early spring. During this period cover plants can protect soils form erosion, retain moisture in soils, restrict the development of weeds, accumulate biological nitrogen and provide significant amounts of green mass that can be used as green fertilizers, forage and in the preparation of mulch and nourishing hay.

In the case of the Samtatskaro village the addition of mulch prepared from hay or crop remains is recommended under vine and fruit plantations. Specifically, mulch can be applied to the zone surrounding the roots of plants, while cover plants can be sowed between the rows. This measure will ensure retention of moisture in soils for a long period of time during droughts. Cover plants will not compete for water with main crops, moreover, they will provide additional nitrogen, prevent the development of soil crusts and mitigate the need for plowing, reduce rain water losses, and ensure the accumulation of water in soils.

c) Contour barriers (Pic. 4) built of stones can be installed on small plots of arable lands that are naturally stony and located the slopes with an inclination not exceeding 5%. Contour barriers have to be placed perpendicular to the slope face to collect the maximum amount of rain water. These barriers can be reinforced with vegetation to be sowed/planted on the upper part of the barrier. Noninvasive weeds can be used for this. Such barriers are constructed to collect rain water and are able to increase productivity by 50% or more. This measure can be applied together with mulching.



Pic. 4. Schematic visualization of a water collecting barrier

d) To ensure the effective and rational use of irrigation water and minimization of water losses, water saving irrigation techniques such as drip and sprinkling irrigation should be introduced and promoted.

e) To mitigate the negative impacts of winds the recovery-rehabilitation of cut, degraded and disabled windbreaks, as well as planting of new ones, is important.

2 To increase the productivity of cattle the improvement of local breeding stock is required. Currently the average yield per dairy cow is around 4-5 l a day, which is a very low index.

Dairy production is one of the main sources of income for the local population. Therefore relevant measures have to be taken to increase its output. First of all, an adequate forage basis has to be created to provide both milk cows and dry cows with sufficient and nourishing forage. One milk cow needs around 50 kg of green grass a day. For this amount of green mass 1 ha of a medium productivity pasture is required. The current ratio of the number of livestock and available pastures in the Samtatskaro community is 10 heads per 1 ha, which exceeds the load of medium productivity pastures by 10 times. This figure is even worse as one third of the existing pastures (35 ha) are degraded and covered with thorns and stones and their low productivity is aggravated by low precipitation levels.

In conditions of high pasture loads the livestock do not receive adequate forage to satisfy their minimum needs, which is reflected by reduced milk yields and growth retardation. In addition, the livestock are not provided with supplemental nutrition, which also increases the pressure on pastures. To ensure proper nutrition of the livestock in conditions of inadequate grazing 1 kg per day of concentrated foodstuff (e.g. 1:1 mix of corn and soya) should be provided. During cold seasons (from late fall to early spring) and droughts both succulent (e.g. silage) and dry fodder (e.g. hay, straw) have to be provided along with the concentrated food.

It is also important to improve local breeding stock and select relevant breeds: dairy, beef and dairy-beef breeds. However, highly productive breeds will not ensure high milk and beef production if the livestock is not provided with adequately nourishing forage.

3 To improve the degraded pastures of the Samtatskaro community they have to be cleaned of stones and thorns using special machinery.

Afterwards drought resistant forage grasses (e.g. sainfoin, sudan grass, etc.) have to be sown. Grazing of the improved pastures have to be restricted for 1 year. Afterwards, rotation grazing practices have to be applied to ensure that each plot is unused once every 4-5 years, or used as hayland. If this practice is not followed decline and further degradation of the pastures should be expected. It is also recommended to plant certain drought resistant tree species on the pasture to ensure shelter for the livestock during periods of intense heat. For this purpose the following evergreen relict pine species: Eldar pine (*Pinus eldarica*) or black pine (*Pinus nigra),* which can adapt to soil and climate conditions of Georgia, can be used. From drought resistant deciduous tree species included in the Red List of Georgia - Caucasian hackberry (*Celtis caucasica*) can be planted. These plantations have to be tended during their first years to ensure a high chance of survival and protected from winds and livestock.

Hazardous natural processes

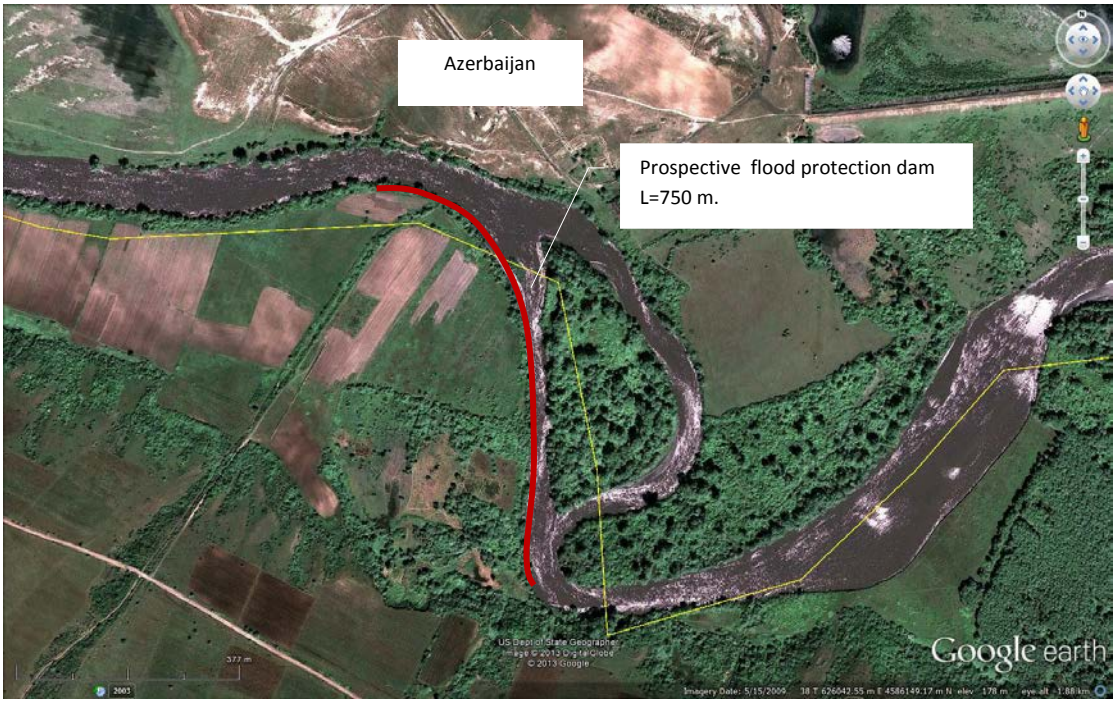
River erosion

To mitigate river erosion and protect eroded river banks, which in turn will ensure protection of agricultural lands from flooding, the following activities should be implemented at the hazardous sites identified during field studies.

The first site (coordinates - X-625635, Y-4586182 WGS 1984 UTM Zone 38N) – floods occurring at this site result in the inundation of agricultural lands located on the right side of the Alazani River (around 9 ha). Therefore these lands are not being cultivated, which leads to their degradation.

To solve this problem and protect agricultural lands from flooding a 750 m long flood protection dam has to be constructed 10-15 m from the river bank. Rock needed for the dam can be carried from the areas located at a distance of 3-4 km. Bioengineering methods have to be used for the development of vegetation cover on the surface of the dam – grasses have to be sowed.

The estimated volume of the dam is 13,100 m^3 (Pic. 5).



Pic. 5. Hazardous site, the Samtatskaro community, configuration of the flood protection dam on the Alazani River

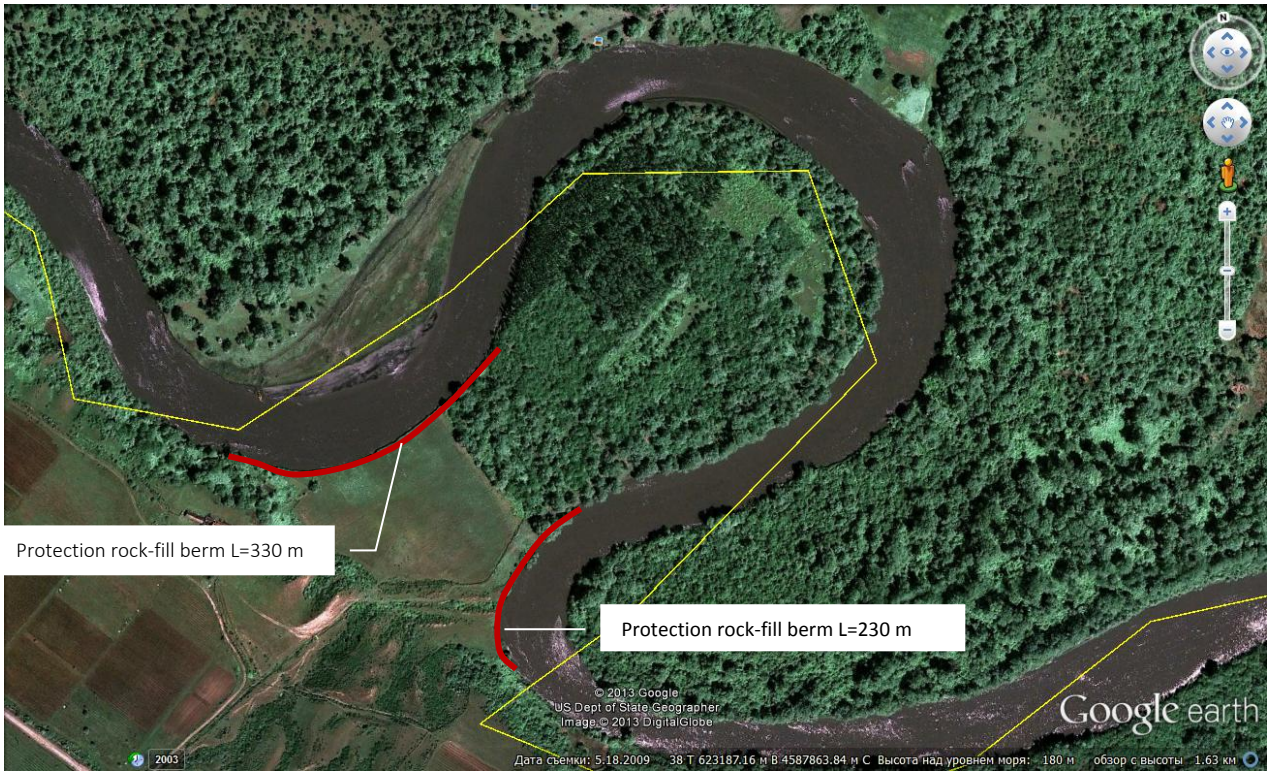
The estimated cost of construction of the flood protection dam is 100-120 thousand GEL.

The second site (coordinates - X-6222891, Y-4587819 WGS 1984 UTM Zone 38N) – at this site the threat of meander separation, with all problems associated to the demarcation of the state border, exists due to river erosion processes observed at this site (in the case of separation of the meander the territory will appear on the Azerbaijani side). Currently the width of the neck of the meander is 230 m.

To protect banks from on-going erosion the both sides of the "neck" of the meander, they have to be protected with a rock-fill berm. The total length of the bank to be protected is 560 m (Pic. 6). The designed diameter of stones will be 0.8-1.0 m, corresponding to the discharge of 1% probability rock will be required for 1 lineal meter of a protection rock-fill berm. Total volume of rock required for the protection of the study site is 20,160 m^3.

The nearest quarry (limestone) in the region is located near the city of Dedoplistkaro, 40 km away from the study site. According to its owners, the required amount of stone is not available in the quarry. We have inquired about a so-called "outcrop" of relevant rocks (near the existing quarries) where the required amount of stones can be acquired through explosion of rocks. This will have a considerable effect on the costs of activities to be implemented.

Considering the abovementioned, the estimated cost of construction-assembling activities is 1,700,000 GEL.



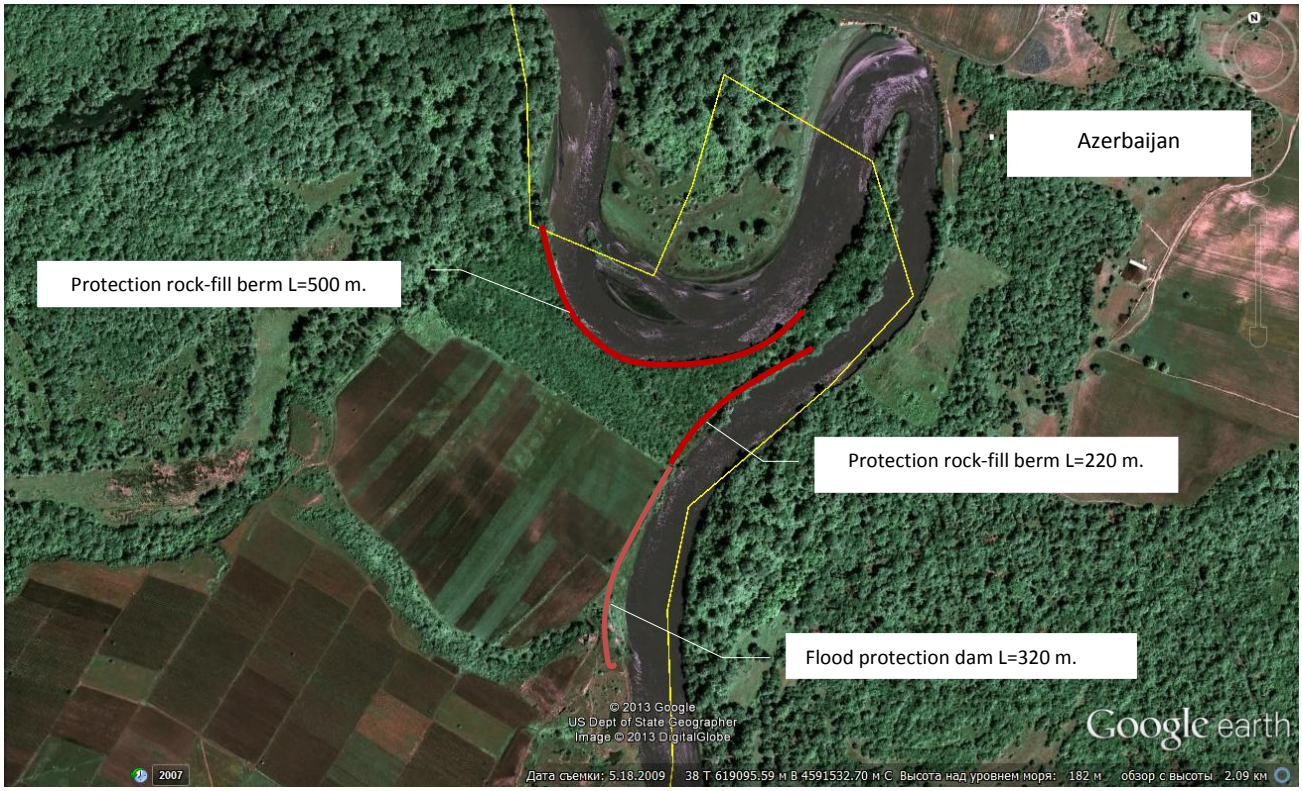
Pic. 6. Hazardous site, the Samtatskaro community, the Alazani River. Parameters of bank protection berms

The third site (coordinates - X-618535, Y-4591475 WGS 1984 UTM Zone 38N) – the results of the field studies and analysis of satellite images show that floods occurring at this site damage arable lands and a floodplain forest belt located on the right side of the river (Chapter 4).

Considering the existing situation the implementation of relevant erosion control activities is recommended at this site, along with activities oriented towards flood control.

To protect the surface of the study area a rock-fill berm with a total length of 720 m, and a 320 m long flood protection rock-fill dam have to be constructed (Pic. 7). The estimated volume of the berm is 25,920 m^3, the volume of the rock-fill dam - 5,600 m^3.

The estimated cost of the construction-assembling works of the rock-fill berm is 2,120,000 GEL, the cost of construction of flood protection dam - 41,000 GEL. Therefore the total cost of recommended actions is 2,161,000 GEL.



Pic. 7. Hazardous site, the Samtatskaro community, the Alazani River. Outline of recommended actions

Table 5, below, contains a summary of information on climate change adaptation and natural disaster risk reduction activities to be implemented in the Samtatskaro community.

Table 5 Summary of climate change adaptation and disaster risk reduction activities to be implemented in the Samtatskaro community

Activity	Aim	Estimated budget	Duration[7] (ST; MT; LT)	Responsible institution	Potential Source of Funding
Global aim of the activities: • Adaptation and increase the resilience of agriculture of the Samtatskaro community to climate change and natural disasters • Reduction of vulnerability of the community					
Application of organic fertilizers (manure, manure-compost, compost) to agricultural lands (25-30 tons per 1 ha) on a regular basis.	• Increase of the moisture content and retention capacity of soils • Increase of the content of organic substances in soils • Increase of soil fertility	< 50,000	**ST**	• Local farmers • Agricultural development services • Local self-governance	• Local farmers • Agricultural development service • NGOs
Introduction of the practice of application of green manure (so-called green fertilizers) mainly legumes (e.g. vetch, grass pea) under perennials (vine, fruits) and annual crops (wheat, barley) agricultural lands. Education and awareness-raising of farmers on this issue.	• Increase of soil fertility • Increase of the content of organic substances in soils • Increase of the moisture content and retention capacity of soils	< 50,000	**ST**	• Local farmers • Agricultural development services • Local self-governance	• Local farmers • Agricultural development service • NGOs
Introduction of the practice of mulching on agricultural lands, under perennials and annual crops. Application of both dead mulch and cover plants. Combination of dead mulch and	• Increase of the productivity of perennials • Retention of moisture in soils • Prevention of the	< 50,000	**ST**	• Local farmers • Agricultural development services • Local self-governance	• Local farmers • Agricultural development service • NGOs

[7] Short-term (ST) implementation period – less than 1 year; medium-term (MT) – 1-5 years; long-term (LT) – more than five years

Activity	Aim	Estimated budget	Duration[7] (ST; MT; LT)	Responsible institution	Potential Source of Funding
cover crops. Education and awareness-raising of farmers on mulching.	development of soil crust and reduction of rain water losses • Improvement of soils structure • Accumulation of biological nitrogen in soils • Protection of soils from erosion • Ensuring additional forage basis for animal breeding				
Installation of contour barriers using bioengineering methods (using stones and grasses) the slopes with inclination not exceeding 5% to retain rain water. Combination of barriers with mulching methods.	• Regulation of surface runoff – retaining/collecting rain waters • Abatement of soil erosion/reduction of the loss of topsoil • Increase of soil fertility (50% and more) • Reduction of vulnerability of soils to extreme precipitation events	< 50,000	**MT**	• Local farmers • Agricultural development services • Local self-governance	• Local farmers • Agricultural development service • NGOs
Introduction of water saving irrigation practices (drip and sprinkling irrigation). Education and awareness raising of farmers on water saving irrigation practices.	• Abatement of soil erosion/reduction of the loss of topsoil • Increase of soil fertility	< 50,000	**MT**	• Local farmers • Agricultural development services • Local self-governance	• Local farmers • Agricultural development service • Development agencies

Activity	Aim	Estimated budget	Duration[7] (ST; MT; LT)	Responsible institution	Potential Source of Funding
	• Saving irrigation water			• Municipal and regional government	(USAID, UNDP, EU, Dutch government, GIZ, Sida, etc.) • NGOs
Recovery/rehabilitation of windbreaks. Planting new windbreaks. Education and awareness raising of farmers on importance of windbreaks.	• Protection of soils from water and wind erosion • Reduction of the loss of topsoil • Increase of soil fertility	50,000 – 100,000	**LT**	• Local farmers • Agricultural development services • Local self-governance • Municipal and regional government • Ministry of Regional Development and Infrastructure	• Local farmers • Agricultural development service • Development agencies (USAID, UNDP, EU, Dutch government, GIZ, Sida, etc.) • NGOs
Improvement of breeding stock of cattle.	• Increase of milk and meat yields in cattle breeding	< 50,000	**MT**	• Local farmers • Agricultural development services • Local self-governance	• Local farmers • Agricultural development service • NGOs
Improvement of forage base of livestock through effective use of arable lands and feeding livestock with additional concentrated foodstuff (e.g. corn, barley, soya).	• Expanding the forage base under condition of shortage of pastures • protection of pastures from degradation	< 50,000	**MT**	• Local farmers • Agricultural development services • Local self-governance	• Local farmers • Agricultural development service • NGOs

Activity	Aim	Estimated budget	Duration[7] (ST; MT; LT)	Responsible institution	Potential Source of Funding
Improvement of degraded pastures – removal of stones and thorny vegetation. Sowing draught resistant forage grasses (e.g. sainfoin, sudan grass, etc.) on pastures.	• Rehabilitation of degraded pastures • Protection of pastures from degradation • Expanding the forage base under condition of shortage of pastures • Increase of the index of pasture load	< 50,000	**MT**	• Local farmers • Agricultural development services • Local self-governance	• Local farmers • Agricultural development service • Development agencies (USAID, UNDP, EU, Dutch government, GIZ, Sida, etc.) • NGOs
Development of pasture and hayland management plans – introduction of the rotational grazing practice. Education of the population in sustainable use of pastures.	• Improvement of forage base for animal breeding • Rehabilitation of degraded pastures • Protection of pastures from degradation • Maintenance and improvement of pasture productivity	< 50,000	**MT**	• Local farmers • Agricultural development services • Local self-governance	• Local farmers • Agricultural development service • Development agencies (USAID, UNDP, EU, Dutch government, GIZ, Sida, etc.) • NGOs
Global aim of the activities: • Mitigation of hazards faced by the Samtatskaro community and reduction its vulnerability to natural disasters and climate change • Reduction of risks of natural disasters in the Samtatskaro community • Adaptation to climate change					
Construction of flood protection 750 m long dam on the Alazani River.	• Abatement of river erosion • Reduction of the risk of floods	70,000	**MT**	• Municipal and regional government	• Local budget • State budget

Activity	Aim	Estimated budget	Duration[7] (ST; MT; LT)	Responsible institution	Potential Source of Funding
I site (X-625635, Y-4586182) Total volume - 13,100 m^3.	and flash waters • Protection of agricultural lands from flooding			• National Environmental Agency • Ministry of Regional Development and Infrastructure	• Development agencies (USAID, UNDP, EU, Dutch government, GIZ, Sida, etc.) • NGOs
Construction of bank protection rock-fill berms. Total length - 560 m. II site (X-6222891, Y-4587819) Total volume - 20,160 m^3.	• Abatement of river erosion • Reduction of the risk of floods and flash waters • Protection of agricultural lands from flooding • Reduction of the risk of separation of the meander (in case of separation the territory may appear on the Azerbaijanian side)	1,000,000	**MT**	• Municipal and regional government • National Environmental Agency • Ministry of Regional Development and Infrastructure	• Local budget • State budget • Development agencies (USAID, UNDP, EU, Dutch government, GIZ, Sida, etc.) • NGOs
Construction of bank protection rock-fill berm. Total length - 720 m. Construction of flood protection rock-fill dam. Total length - 320 m. III site (X-618535, Y-4591475) Total volume of the berm - 25,920 m^3. Total volume of the rock-fill dam - 5,600 m^3.	• Abatement of river erosion • Reduction of the risk of floods and flash waters • Protection of agricultural lands from flooding • Protection of floodplains from scouring	1,200,000	**MT**	• Municipal and regional government • National Environmental Agency • Ministry of Regional Development and Infrastructure	• Local budget • State budget • Development agencies (USAID, UNDP, EU, Dutch government, GIZ, Sida, etc.) • NGOs

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