EBA KYRGYZSTAN

Assessment Report | Ecosystem-based Adaptation Strategy

on behalf of: GIZ project „Ecosystem-based adaptation to climate change in high mountain regions in Central Asia“

Climate Risk

Climate-factor + Vulnerability = Risk

Climate Impacts

People or eco-systems only suffer (or gain) from climatic changes when a change or variation in climate occurs, the system is sensitive or vulnerable to it and, consequently an impact is directly or indirectly evident.

Climate Vulnerability

In order to understand why people or eco-systems are affected by climate events or variations you need to analyze the root causes of being affected (vulnerability) and to find out if they have the ability to manage these changes (adaptive capacity).

Managing Climate Risks

Once you understand climatic factors and potential impacts, a systems' sensitivity, vulnerability and adaptive capacity, you are able to identify corrective actions that help people to manage these risks.

Risk and Vulnerability Assessment

Understanding the threats, potential impacts and causes of being affected by climatic events and variations and designing the database to identify appropriate adaptation measures.

Methodology

Analysis of all available project documents and studies (see list of data sources below) + application of some instruments of a risk and vulnerability assessment (MROclima) as far as feasible, e.g. climate risk ranking, vulnerability matrix, assessing adaptation options, identify climate-related challenges and problems people in the pilot region in Tajikistan faced in the past, are currently facing and will have

to face in the future, analyze the root causes for being affected of climate-related and other risks and challenges (vulnerabilities), identify adaptation needs and assess the relevance and feasibility of adaptation option, already identified by the project, applying Open Standard methodology

1. Assessing Climate Change Exposure

from the documents provided by the project the following climate change factors could be identified:

climate change exposure	observed trend by people in pilot region KG	recorded by climate data	projected by scientific studies/modelling
warmer but still cold winter with some increase in snow	since 1990 less snow 25-30%, winter gets longer? which effects?	???	Earth Institute Columbia University
warmer springs with small to very large increase in precipitation	snow melts too fast, but rather decrease in precipitation	???	Earth Institute Columbia University
warmer summers with highly uncertain precipitation changes	it always began raining in April/May, there is no rain like before, dryer, shorter raining periods, less than one day, precipitation unpredictable, unseasonal	???	Earth Institute Columbia University
warmer fall, precipitation could slightly increase or decrease	rain is affecting hay harvest, assumption: there has not been rain in harvesting and drying time formerly	???	Earth Institute Columbia University
warmer seasons	faster snow melt indicates increase in temperatures, but needs further assessment	???	Earth Institute Columbia University
spring and winter precipitation increase	people rather observe precipitation decrease, reduction of annual snow cover from 100-200cm to 30-50cm, complete lack of snow cover in 2010	???	Earth Institute Columbia University
summer and fall precipitation increase or decrease, uncertainty	uncertainty and seasonal changes are already observed, people also observe rainfall increase and decrease in unusual times	???	Earth Institute Columbia University

climate change exposure	observed trend by people in pilot region KG	recorded by climate data	projected by scientific studies/modelling
increase in extreme events	extreme events don't play a significant role in the pilot region, but they recorded a drought period affecting pasture, according to MSF study increasing frequency of drought events	???	not stated
annual mean temperature increase by 2.6°C to 5°C until end of the Century, most pronounced for winter and summer	faster snow melt indicates increase in temperatures, but needs further assessment, reduction of glacier perceived (in earlier times covered the mountain pass)	???	GFZ evaluation of CMIP5-based climate scenarios for pilot regions
annual precipitation is likely to increase by up to 20%, most pronounced during winter season, in summer slight decrease is likely	people rather observe precipitation decrease, less snowfall since 1990s, uncertainty and seasonal changes are already observed, people also observe rainfall increase and decrease in unusual times	???	GFZ evaluation of CMIP5-based climate scenarios for pilot regions
Conclusion	increase in temperature and warmer seasons seem to be very likely and are already observed in the pilot region (less snow cover, reduction of glacier), further research and assessments is needed		
	precipitation increase in winter and spring is predicted by scientific models, but currently people observe less snow fall and precipitation decrease for that periods highly uncertain precipitation changes are predicted for summer and fall, that is already observed by people in the project region		
	seasonal changes are projected and have been already observed first consequences of changing conditions are evident: drought affected pasture, higher frequency of droughts, dried out springs, increasing water shortage, wetlands turned into drylands, grass grows later, lack of moisture, disappearance of species (frogs and snakes), occurrence of new species (coyote, snake, poisonous spider) faster snow melting negatively impacts soil quality, glaciers are completely melted by August, declined forage yield from 40-50 centner/ha to 15-20 centner/ha		

climate change exposure	observed trend by people in pilot region KG	recorded by climate data	projected by scientific studies/modelling
Climate risk ranking	observed, evident and expected climatic risks should be ranked, based on the provided information the **increase in temperature** and **highly uncertain precipitation changes** are the most serious ones, **resulting in glacier melting, seasonal changes and changes in hydrological regimes**.		

Questions:

- Are historical data available on climate change? Any studies on how climate conditions has already changed? Future projections normally are based on historical data and changes over the past period, consequently there has to be more information on that.
- What about information on extreme events?
- Are data available on climate change impacts expected for the pilot region in Kyrgyzstan? PPCR Strategy? EU-FLERMONECA? WB CAMP4CA? Vulnerability Assessment high mountain range?
- Do you also consider the region's role as water supplier for a larger region?

Recommendations:

- Assess historical data on climate change, ask GFZ and Earth Institute, additional sources could be the Worldbank Climate Change Knowledge Portal
- Further assess site-specific situation using participatory assessment tools: 1. changes in seasonal calendar 2. draw timeline indicating observed climatic changes (focus on snow fall, seasonal changes, snow melting, drought periods, unusual rains, floods, etc.), 3. prepare community maps indicating land use practices, 4. insert climatic changes and impacts/occurred damages into that map, resulting in a community climate risk map, 5. prepare a plant and animal inventory and analyze changes
- Do not only focus on risks, but also think about opportunities that might occur due to more favorable climatic conditions!
- Challenge: climate change projections are difficult to make for high mountain areas due to its marked and complex topography and varying micro-climates over short distances.
- Further research information on cc impacts on high mountain regions and future scenarios for melting glaciers, e.g. „Mountains and climate change - from Understanding to Action", FAO 2012, specifically see chapter 2 „Mountain Waters", chapter 4 „Mountain Hazards, case of Kyrgyzstan…"
- Learn from experiences others EBA-projects in high mountain areas have made, specifically in the Andes/Peru, foster knowledge exchange
- Further analyze expected impacts of glacier melting on hydrological regimes (GFZ study)
- The further assessment of climate change and its potential site-specific impact enriches the planning of adaptation measures for the short, medium and long-term, e.g. irrigation might be a short-term option, but not useful on the long-run, etc. In addition, it enables you to rank and prioritize the most threatening risks, but also most promising benefits.
- Increase water storage capacity for run-off water from snow and glacier melting is highly recommendable according to the FAO study (see above)!

2. Assessing vulnerabilities of the high mountain range in Tajikistan

High mountain ranges belong to the eco-systems most vulnerable to climate change due to their sensitive hydrological regimes (in some cases fed by glaciers and snow cover) and their complex topography. At the same time high mountain regions provide water for thousands of people and the eco-systems at lower altitudes heavily depend on the water provided by the higher regions. Projections about climate change and its consequences are very difficult, due to the lack of data and the complex topography resulting in highly varying local climates over short distances. The following table gives a brief overview of the Tien Shan mountains' high vulnerability to the above identified climate risks factors:

Climate Change exposure	Sensitivity	Potential Impact	Adaptive Capacity	Vulnerability
temperature increase	glaciers and consequently the whole hydrological regime and slopes with limited vegetation have a high sensitivity to increasing temperatures	glacier melting, resulting in modifications of hydrological regimes, increasing risk of landslides	glaciers and snow cover do not have any adaptive capacity to increasing temperatures, degraded eco-systems, decreased bush/ forest cover and eroded soils adaptive capacity is low	high
precipitation change, leading to seasonal changes	glacier, snow-cover, hydrological regime and depending eco-systems are sensitive to changes in precipitation	modification in hydrological regimes, reduced snow-cover, water scarcity, decreasing river flows, seasonal changes, inducing changes in eco-systems	degraded eco-systems, decreased bush/ forest cover, eroded soils have rather low adaptive capacity	high
extreme events (no evidence or projection available)	slopes and eco-systems with limited vegetation are sensitive to landslides, soils are sensitive to erosion	landslides/ mudflow, avalanches, floods further destroy eco-systems and boost soil erosion	degraded eco-systems, decreased bush/ forest cover, eroded soils lower adaptive capacity	high

How to assess vulnerability?

exposure	sensitivity	potential impact	adaptive capacity	Vulnerability
✓	–	–	–	–
✓	✓	✓	high	low
✓	✓	✓	medium	medium
✓	✓	✓	low	high

3. Assessing climate risks and threats in Bash-Kaiyndy and Bolshevik in Kyrgyzstan

In order to be able to understand how and how severe people are threatened by being affected by changing climate conditions, you first need to understand what their main sources of income and livelihood are. We call it people's core values. Secondly, you need to assess risks, that are endangering those core values and to understand their main problems. By analyzing why people's core values are affected by the identified risks (root-cause-analysis), you will be able to identify their main vulnerabilities. This knowledge builds the base for designing solutions for current and future problems and for a suitable community-based risk management.

From the documents provided by the project the following core values of the population in the two pilot villages has been identified:

1. people's core values:

People in the pilot villages are highly depending on surrounding eco-systems and services they provide. According to the documents population relies on the following ***eco-system services***:

- water provision, timber, water regulation, livestock forage, wild berries, garden vegetables (potatoes, wheat), natural hazards protection, firewood, energy provision, hydropower, pasture, hay, alfalfa, construction wood, fish from the rivers, medicinal plants, animals/wildlife for hunting wolves, bears, eagles, wild sheep), honey from beekeeping

In addition, the existing eco-systems provide the following services:

- snow cover as soil protector, deep root bushes as slope stabilizer, forest as soil and micro-climate stabilizer, riparian forest as stabilizer, bushland as protector from wind, sand-storms, avalanches, mudflows, landslides, pollination, cultural services (e.g. for ecotourism) etc.

Due to the fact that people's most important sources of income are livestock (cattle, horse, sheep, camel) their most important resources according to the documents summarizing the assessment process in Kyrgyzstan are:

Forests, Pasture Land, Water and Soil

According to the survey the MSS did, the most relevant ecosystem goods are **Water, Livestock, Summer Pasture & Hay Forage, Vegetables and Fruits** (see page 21).

People in the pilot villages furthermore rely on hydroelectricity and infrastructure/roads.

2. people's perceived problems endangering their core values:

The open standard method analyzed so-called ***conventional threats*** endangering their most important resources/core values. Partially, causes for those threats have been analyzed in a participatory manner, but effects have not yet been analyzed more profoundly. But some first ideas have been collected to solve the perceived problems. The following table gives an overview of people's really existing problems.

core value	problems threatening core value	triggers/causes for threats	potential solutions
forest	overcutting	cutting for firewood if energy costs are to high	
		cutting for firewood, if river flow is to low for hydropower generation	
		wood from Russia becoming more expensive	
		lack of awareness by those who have tickest from forestry department	
		no forest fire management plans	
	grazing in the forest, accidental	lack of animal control, not enough foresters	
		conflict between forest managers and herders, fine amount is to low	
		livestock trample saplings	
	degradation	forest department wants only money, has plans for pasture, but no enforcement/managemnet	new plantings since 2010 from forestry department's nursery
pasture	overgrazing	too many livestock, too litte land	work with IFAD on pasture mangement, avoid overgrazing, but first analyze alternatives, avoid grazing in hay production fields
		redistribution and good management is needed, updated pasture allocation map	people need to map pasture land and decide how to use/manage/ allocate it, maybe changing grazing times

core value	problems threatening core value	triggers/causes for threats	potential solutions
		currently grown livestock not the most appropriate one for small land amount	
	poisonous plants on pasture land		sow perennial seeds? soil management measures? conserve eco-systems, diversify plants
	since 2014 pasture in bad conditions	??? no triggers identified?	
	drought affected pasture in 2010	??? no triggers identified?	
water	acessability for irrigation	broken canals, poorly maintained, not sufficient for irrigation, lack of maintenance equipment, too little storage capacities, reservoir needed, mismatch between flow and need, need to store water in April/May, poor organization among water users	water conservation, opportunity to work with MSDSP on irrigation
soil	degradation	??? no triggers identified?	
	landslides???	??? no triggers identified?	

3. people's identified threats based on climate change scenarios:

The Open Standard method furthermore identified ***climate impacts/threats***:

- (increasing temperatures leading to) glacier melting
- loss of springs
- drought
- dryness leading to reduced productivity
- less snow, precipitation leading to lack of water from snow melt and spring rains
- sudden cold periods leading to high livestock mortality

Among those impacts and threats are some clear climate change stimuli, e.g. loss of springs, drought, dryness, less snow/precipitation, cold as well as some clear impacts, e.g. glacier melting, reduced productivity, lack of water, high livestock mortality. A climate change stimuli only will turn out to be a risk, if it meets a vulnerability. The loss of spring without a potential impact is not a risk. Consequently, an assessments needs to clearly differentiate between climate factors/stimuli, vulnerabilities, potential impacts and resulting risks.

The following identified climate impacts/threats can be clearly classified as impacts:

- loss of wildlife
- pasture erosion
- landslides
- jut (high livestock mortality due to sudden cold)
- reduced productivity (of what?) due to dryness

The identified „dams“ needs further explanation.

4. Assessing vulnerabilities in Bash-Kaiyndy and Bolshevik in Kyrgyzstan

1. People's identified vulnerabilities:

The above analyzed causes and triggers endangering people's core values conventionally, and thus, livelihood lower their adaptive capacity to changing climatic and other environmental conditions and lead to the following vulnerabilities of the population:

- overexploitation of most important eco-systems and natural resources people rely on, specifically pasture land and forests
- poor pasture and forest management, mismatch and conflicts between both land use forms, pasture management is not appropriate for local conditions, e.g. breeds, land availability, land allocation, grazing times, hay production, etc.
- poor management and support from governmental authorities, poor capacities
- poor energy supply, hydropower is not a reliable energy source, lack of alternatives energy sources
- poor water management and lack of supply, distribution canals in bad conditions, supply and demand not clear, impacts from expected climate change unclear
- high uncertainties about future availability of water and future precipitation in all seasons
- degraded soils was mentioned as conventional threat, but not explained why
- high dependence on livestock, only source of income, livestock is vulnerable to changing environmental conditions due to vulnerability of pasture land to changing climate and environmental conditions, specifically degradation and change in eco-systems and their services

- high dependence of whole region on glacier fed water regimes and hydrological cycles, and impacts on glaciers and water cycles due to increasing temperatures and changing precipitation are very likely

According to the MSS study people in the pilot region are highly vulnerable to climate changes due to their high dependence on eco-system goods. Water, livestock, summer pasture & hay forage as well as vegetables and fruits have been ranked highest in their contribution to livelihood. As livestock is by far the most important source of income, fodder production and pasture is of tremendous importance for the people. The production of vegetables and fruits in kitchen gardens is essential for their food security and nutrition. And all of these goods are highly dependent on water. Consequently, the livelihood of the people depends on the availability of water. Due to the fact, that their only water source is the melting glacier, they are highly vulnerable to climate change. MSS found out, that the currently available water amount does not cover all needs, specifically in Bolshevik, where a scarcity is already perceivable.

2. Eco-systems' identified vulnerabilities:

MSS investigated the health and conditions of the existing eco-systems and came to the conclusion, that none of the analyzed eco-systems is overexploited or degraded. Some of them were not visited due to limited time and accessibility. Changes due to climatic changes could not have been identified.

Observations:

- existing problems/threats for livelihood and subsistence well analyzed, root causes/triggers discussed and documented, first coping strategies recognized, changing climatic conditions and impacts observed/evident
- BUT: link between already observed changing climate conditions, effects and impacts, and people's vulnerabilities (reasons for being affected) not quite clear
- scenario exercise analyzes effects of potential climate change and impacts and designs coping strategies,
- BUT: leaves out vulnerability and root cause analyzes for being threatened or affected
- very good analysis of eco-system's and ecological elements' vulnerabilities with Open Standard method
- BUT: MSS study came to different conclusions
- anyway, main risks and vulnerabilities are clear und build a good base for identifying solutions and adaptation measures

Recommendations:

- link information on evident changing climate and environmental conditions with problems and threats for people's livelihood as baseline for designing adaptation strategies for all perceived and really existent threats
- link results from scenario exercises with root cause analysis for cc impacts and complete coping/ adaptation strategies
- participatory assess and plan community adaptation strategies
- a scenario planning should in every case focus on future water demand and availability changes due to very likely glacier melting!
- start with conservation measures and good management of existing ecological resources as identified in the community workshops, specifically: streams, spruce forest, forest pastures, inner pasture, hayfields, riparian forests

5. Conclusion identified risks and vulnerabilities

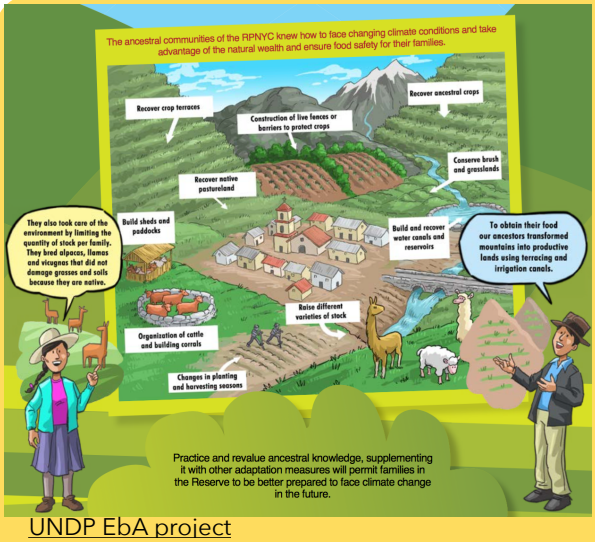
Based on the above described results and findings the following table gives an overview of identified climate related and other risks and threats, potential impacts, vulnerabilities and adaptation needs:

Identified Risk/Threat/ Opportunity	Potential Impact	Reason for being affected/Vulnerability	Adaptation Need
climate-related threats			
increasing temperatures leading to glacier melting	dramatic changes in hydrological regimes, and thus water supply not only for pilot region, but all regions and people depending on glacier-fed high mountain water supply *building up of lakes? lake outbursts? danger of rockfall and mud flows? (not yet observed, but potential impact, needs further assessment)* *potential for increased hydropower generation? (needs further assessment)*	high dependence on glacier-fed hydrological regimes (eco-systems and population) projections very difficult due to lack of knowledge, data and complex topography of mountains resulting in highly varying local climates over short distances conditions of existing eco-systems, highly vulnerable to climatic changes unsustainable use of water, lack of data about water supply and demand no water storage capacities	information, data, knowledge on expected changes and potential impacts on water availability, not only for pilot region but all regions depending on mountain water supply water storage capacities in pilot region water management capacities conservation of water and eco-systems recording and assessing climate data community-led sustainable use of water in pilot region
less snow fall, earlier melting, earlier spring (loss of spring)	changing seasonal runoffs, shifting from warm to cold season, lack of water from snow melt and spring rains (already observed) BUT: earlier spring and earlier melting could also be an opportunity for agricultural production (needs further assessment	see above	see above analyze potential for agriculture production due to more favorable climate conditions agricultural and income diversification strategy

Identified Risk/Threat/ Opportunity	Potential Impact	Reason for being affected/Vulnerability	Adaptation Need
unpredictable precipitation changes	water supply and demand out of balance low productivity for pasture, livestock, subsistence farming, negative impacts on hay harvest due to unusual rainfall	dependence on irrigation, poor water maintenance, insufficient irrigation and water management	improved water management efficient irrigation system strengthen capacities of WUA save hay harvest from being affected by rain
drought periods	low productivity, erosion, pasture affected in 2010	needs further analysis (root-cause-analysis)	coping strategy with increasing drought periods water storage capacities
sudden cold periods	high livestock mortality (jut)	needs further analysis (root-cause-analysis)	strategy to save livestock from cold
landslides due to changing soil conditions, glacier melting, less snow cover	landslides and mudflows destructing land, infrastructure and villages, not yet observed, but potential impact, needs further assessment	low slope stability due to degraded eco-systems, low forest and bushland cover? needs further analysis (root-cause-analysis)	NATASHA, EU-funded initiative, working on natural hazards in the Tien Shan Mountains of Central Asia, compiled information in regional „hot spot" catalogue, link with this initiative, need to increase slope stability by conserving soil and eco-systems
conventional threats			

Identified Risk/Threat/ Opportunity	Potential Impact	Reason for being affected/Vulnerability	Adaptation Need
overcutting, grazing and degradation of forests	reduced forest and bushland cover leading to less water availability, soil erosion, poor soil quality, loss of biodiversity	high energy costs, access to energy, river flow too low for hydropower lack of awareness for forest conservation, poor forest management capacities, no forest control to avoid accidental grazing, conflicts between herders and foresters	using dung as alternative energy source increasing hydropower generation awareness raising for forest conservation, start conservation measures for streams, spruce forest, forest pastures, inner pasture, hayfields, riparian forests, extend plantings and nursery, use native trees, strengthening local capacities for forest management link with regional planning link sustainable forest management wit sustainable pasture management, use land use map of MSS study p.33
overgrazing of pasture land, poisonous plants and poor pasture conditions	low pasture quality, insufficient area for fodder production, livestock cannot be sufficiently fed leading to decreasing number of livestock	too many livestock, grown livestock not the most appropriate one for small land amount, poor allocation of pasture land, lack of map	map pasture land, improve allocation and management, changing grazing times, avoid grazing in hay fields, use land use map of MSS study p.33 work with IFAD on pasture management
soil degradation	low agriculture productivity, increasing risk of landslides, etc	no triggers identified, needs further analysis (root-cause-analysis)	increase forest and bushland cover, improve soil management, diversify agricultural use

Identified Risk/Threat/ Opportunity	Potential Impact	Reason for being affected/Vulnerability	Adaptation Need
water scarcity, mainly for irrigation	pasture land and hay meadows cannot be irrigated, yield loss, dead of livestock, lack of water for household use, conflicts between neighboring villages, BUT: changing precipitation and melting glaciers could result in increased water availability, but need to manage it well	melting glacier is the only water source, dependence of agricultural production on irrigation, erosive stream flow in June, labour-intensive loess-type irrigation channels, unequal access to water among Bash-Kaiyndy and Bolshevik, poorly managed irrigation net, broken channels, no reservoirs installed, mismatch between flow and need	analyze alternative solutions for labour intensive maintenance of loess-type irrigation channels fair access to water and irrigation channels for both villages, strengthen communities' capacities to sustainably use water resources install water storage capacities to store water in April/May, analyze scientifically water supply and demand and future availability assuming glacier melting and precipitation changes, work with MSDSP
Conclusion	People in the pilot communities are threatened by conventional and climate risks as well.		
	The most pressing issues have to do with the availability/scarcity of water, which has definitely reduced over the past years, and the poor conditions of the eco-systems.		
Recomendations	The **conservation of natural resources**, specifically water, soil, forest and bushland, pasture and arable land is essential in order to reduce vulnerabilities, increase adaptive capacities and manage climatic and conventional threats as well. A **climate smart land use strategy** should build the framework for planning and implementation of **specific water, soil, forest, agriculture management**, whereas **water management will be of highest priority**. Besides a highly efficient use of existing water resources (rivers, canals, etc.) as well as **water storage capacities need to be fostered**.		



UNDP EbA project

Recommendations:

- rank the identified climate-related and conventional risks and threats and vulnerable core values in order to prioritize most urgent adaptation needs and measures, use participatory „pair-wise ranking" and „vulnerability matrix" tools of MRO©lima (see manual)
- further analyze the identified risks/threats using the root-cause-analysis tool „problem tree" of MRO©lima (see manual) in order to identify root causes/triggers and effects
- identify solutions for risks/threats, based on the root-cause analysis and the scenario exercise, complete the adaptation measures, using the „sun-ray exercise" tool of MRO©lima (see manual)
- assess identified adaptation options with communities and start planning implementation
- identify and link with partners for implementation
- link with other EbA projects in order to exchange knowledge and lessons learnt

6. Assessing adaptation options for pilot villages in Kyrgyzstan

Based on the analysis of identified climatic and conventional threats, potential and observed impacts as well as the eco-systems' and communities' vulnerabilities the already identified adaptation measures were assessed according to their current and future relevance for the pilot communities, their efficiency, expected impact, effectiveness and sustainability. Based on that criteria the adaptation measures were prioritized. Additional recommendable adaptation measures were proposed and recommendations on the further process were made. The complete adaptation measures assessment table is attached as Annex 1 to this report.

For the further process the application of participatory assessment tools were proposed to be carried out in an community workshop in August 2016. The main objective of the application of the participatory tools was to fit the knowledge gaps identified by this report and to analyze more profoundly the root causes and effects of the most threatening problems (climate-related and conventional) on the most valuable resources. A manual to guide the project implementers through the application of the participatory risk and vulnerability assessment was specifically adapted to the local context in the pilot villages and the specific demand of the EBA project in Kyrgyzstan. The manual is attached as Annex 2.

7. Developing an adaptation strategy for the pilot villages in Kyrgyzstan

Any adaptation strategy should be build on the identified most threatening risks for the pilot region (climate-related and conventional) the most vulnerable resources (core values for people's livelihood), and consequently the most important resulting adaptation needs. This has been done applying the Opens Standard methodology within the EbA project in Kyrgyzstan and has been supported by the present risk and vulnerability assessment.

Based on the risk and vulnerability assessment that was done in the present report, the assessment of already identified adaptation measures as well as the results of the community workshop in August 2016 for the pilot watersheds Naryn and At Bashy in Kyrgyzstan it becomes quite clear, that:

- The most threatening climate-related risks are ***increasing temperatures***, leading to ***glacier melting*** and the ***unpredictable changes in precipitation***.
- The population is already suffering from less snow in winter, earlier melting and earlier spring times. The seasonal water runoffs are changing and are very likely to change from warm to cold season.
- The whole hydrological cycle is expected to change dramatically. The consequences are unknown so far and need to be studied profoundly.
- For agriculture production this results in less water availability from snow and spring rains in spring time when water is needed most. Sowing and planting times have already been changed.
- In addition, people observe to much rain, when less rain is needed, for example during summer time. Specifically during harvest time, this could have negative impacts on e.g. hay harvest.
- Another serious problem is the ***ongoing degradation of existing eco-systems***, specifically the pasture, the forest and bushland. Not only vegetation and wildlife are overexploited, but also soil. The applied assessment methodology classified those problems as conventional threats. Degradation and overexploitation are also reasons for being vulnerable to climate risks and even further increase people's and eco-systems' vulnerabilities.
- Generally, pilot communities are highly vulnerable to the observed changes due to their high dependence on climate and eco-systems.
- The most valuable resources for the pilot communities are ***water, pasture land, forest and soil***. All those resources are threatened by degradation and climate change. Consequently, ***any corrective action and measure to save water, pasture land, soils and forest is of high priority*** for the communities.
- Consequently, as the above described climate related risks cannot be stopped, the reduction of ***identified vulnerabilities needs to be addressed urgently*** within an adaptation strategy.
- Water, soil, forest and pasture need to be managed sustainably, wildlife, vegetation, biodiversity and eco-systems need to be conserved in order to provide livelihood securing products and services.
- ***A climate smart land use strategy based on the conservation of eco-systems*** should build the base for adapting to climate change in Naryn and At Bashy. How this could look like is described as adaptation strategy framework in the following table:

Water	Adaptation of water management to climate change	
value of the resource	very high	people's livelihood based on livestock and food production as only income source heavily depends on water availability
vulnerability of the resource	very high	climate change and conventional risks are threatening water resources: water is not used sustainably, not stored, poorly maintained, no data available on water supply and demand, forest and soils are degraded, hydrological regime is glacier fed
climate risks threatening the resource	increasing temperature, glacier melting, changes in precipitation, specifically less snow, drought, changing seasonal runoffs, shifting from warm to cold season, lack of water from snow melt and spring rains	
adaptation need	very high	secure access to water for household use, kitchen gardening, livestock and agricultural production, improve distribution between both villages, avoid lack of water for agricultural purposes in spring time, avoid lack of water during drought periods, create water storage capacities, store water in April/May increase communities' capacity to sustainably use water, strengthen WUA increase efficiency of irrigation system, conservation of natural resources analyze scientifically water supply and demand and future availability assuming glacier melting and precipitation changes cooperate with MSDSP

Responding strategy	Climate Smart Water Management in Naryn and At Bashy	
specific measures	**content**	**partners**
improved water maintenance using innovative techniques for water saving, storage, distribution **prioritization: very high** *(cost-benefit-analyses)*	analyze water supply and demand, identify gaps and potential for efficient use, e.g. through terracing, rainwater and snow harvesting, reservoirs, cisterns, drainage, etc., plan fair distribution and access for irrigation channels for both communities, schedule for normative water amount find alternative for labour-intensive loess-type irrigation, analyze potential for drip irrigation, repair irrigation channels, define irrigation rules and norms, install off-channel cisterns/reservoirs, on-farm or on-pasture water storage through rainwater/snow harvesting, construct dams in Orto-Kayindy and Chon-Kayindy in gorges, promote rainwater harvesting for kitchen gardens, avoid using drinking water for kitchen gardening and livestock, build small rainwater reservoirs for household use, tanks for 1-4 families, create access to spring in the forest for livestock, improve quality and availability of drinking water, install community water reservoirs (natural) clean water springs, store runoffs from snow melt, glacier melt, precipitation **for all measures contract technical expert to carry out feasibility study and plan implementation!**	MSDSP ARIS
enhance soil moisture retention capacity **prioritization: very high**	terracing, planting trees, bushes, plants along the roads, river and in gorges, improve water disbursement infrastructure *for more details see climate smart soil management strategy*	
increase tree cover and conserve forest and other eco-systems **prioritization: very high**	nurseries, trainings, awareness raising, afforestation, reforestation, conservation, riparian habitat restoration or creation in rivers, *for more details see climate smart forest management strategy*	

Responding strategy	Climate Smart Water Management in Naryn and At Bashy	
specific measures	content	partners
study impacts of glacier melting and changing precipitation on hydrological regimes **prioritization: high**	record and assess climate and water data at local level, install weather stations, train communities, connect data with scientific and meteorological institutions, improve weather forecasting capacity, improve hydrological monitoring, contract experts to study impacts of expected climate change projections on hydrological regimes not only for pilot villages/watersheds, but for whole region, depending on glacier and mountain water supply	GFZ?
building an artificial glacier **prioritization: medium** (depending on cost benefit analysis) *(cost-benefit-analyses)*	artificial glacier melts in spring, when water is needed, but not sufficiently available any longer, reservoirs store water from additional rains in summer and autumn, so it can freeze in winter and provide melting runoffs in spring, when water si short, pipelines or channels need to installed in order to distribute the artificial glacier water, first step, collect all data, connect with other artificial glacier projects, e.g. in India, contract expert to technically plan the measure, integrate communities well into planning and implementation	
capacity building for water users and WUA **prioritization: high**	training and technical support for WUA and users on water maintenance and management, improve institutional management and government structure	CAT
integrate local water management into regional planning **prioritization: medium**	raise awareness among regional government institutions and NGOs and promote climate smart water management strategy to be integrated into regional planning	

Pasture Land	Adaptation of agricultural production to climate change	
value of the resource	very high	people's livelihood based on livestock and food production as only income source heavily depends on pasture and arable land for fodder production, human food is mainly produced in kitchen gardens
vulnerability of the resource	very high	climate change and conventional risks are threatening pasture land and agriculture: overgrazing leads to decreased pasture quality and poor pasture land conditions, specifically degradation of inner pasture, too many livestock, grown livestock not the most appropriate one for small land amount, poor allocation of pasture land, too much bare land, financial constraints to go to remote pastures (infrastructure, absence of roads and bridges), lack of fodder for livestock increases pressure on pasture, lack of rotation, poor soil conditions lead to low agriculture productivity and an increasing risk of landslides and mudflows, high dependence on irrigation, water for irrigation becomes scarce
climate risks threatening the resource	increasing temperature and changing precipitation (snow, spring rain), lack of water from snow melt and spring rains, scarcity for irrigation, earlier melting changing soil conditions, drought periods, glacier melting leading to landslides, rockfalls, etc.	
adaptation need	very high	analyze potential for additional agriculture production, assuming more favorable climate conditions, agriculture and income diversification strategy, efficient irrigation technologies, save harvest from being affected by rains, coping strategy with increasing drought periods, coping strategy to save livestock from sudden cold periods, conserve forest pasture, inner pasture, hayfields, sustainable pasture management linked with sustainable forest and water management, pasture land mapping, re-allocation, changing grazing times, improve soil management, diversify agricultural use

Responding strategy	Climate Smart Agricultural Management in Naryn and At Bashy	
specific measures	content	partners
Sustainable livestock management **prioritization: high**	create access to water spring in the forest for livestock, test enriched fodder production through silages, test new feeding model, supplemental feeding, change of breed, drought resistant fodder production? (very costly, many people failed with it), use of minerals, check if weather index insurance could be an option	
Sustainable pasture management **prioritization: very high**	improve irrigation system e.g. on-pasture water storage through rainwater/snow harvesting (see water management strategy), create access to remote pasture area, build an eco-system friendly bridge, bridge repair, install living fences, windbreaks to avoid erosion, greening with new grass/tree species, long-term grasses, seedlings and samplings eco-friendly fertilization? pasture rotation, change grazing times, avoid grazing during drought times, delaying grazing until grass sprouts have reached a more advanced stage of maturity, altering plant species composition, leguminous species, assisted natural regeneration of soils leaving land ungrazed	MSDSP IFAD Christensen Fund CAT
Climate smart („sensitive") agriculture / Good Agricultural Practices **prioritization: high**	install nursery for forest, pasture and gardening, analyze and plan agroforestry (feasibility study) as adapted land use strategy, conserving natural resources and eco-systems (see biodiversity conservation strategy), check feasibility of improved kitchen gardening techniques, e.g. by using bags, construction of greenhouses - household used and community based at school	WFP MSDSP ICRAF
Sustainable soil management, soil conservation **prioritization: very high** *(cost-benefit-analyses)*	windbreaks to prevent erosion on pasture, natural retaining walls, gabions, use of new agricultural technical technologies? crop rotation on cooperative base - household size of land is too small for crop rotation, mulching, soil restoration, using organic fertilizer, composting (manure) soil conservation, as soil contributes to a range of vital ecosystem services and functions, e.g. water storage and regulation, supply of nutrients, sequestering carbon, reducing GHG, integrated soil-crop-water management, *keep in mind the mitigation effect of soil conservation!*	

Responding strategy	Climate Smart Agricultural Management in Naryn and At Bashy	
specific measures	content	partners
Tree-crop-livestock management prioritization: medium	test system for tree-crop-livestock management as adapted land use strategy, conserving natural resources and eco-systems	
Develop value chains and income generation prioritization: high	analyze feasibility of value chain development for potato chips, juniper oil, aquaculture, donkey production, camel production, wool production and handicrafts, sea buckthorn collection, herbal, medicinal plant collection, agro- and eco-tourism	NaWi Agrolead
Integrated Pest management prioritization: high	veterinary services, construction of veterinary stations, hole of diseased animals, bathroom for livestock, vaccination, water purification improvement, correct use of fertilizers and pest control, conducting treatment for livestock and plants on time, on time veterinary check	
Capacity Building and Training prioritization: high	provide knowledge on innovative techniques and technologies, strengthen organizational structure of „agriculture/pasture committee“, train the trainers, lead farmers, train farmers, install demonstration fields	

Forest	Adaptation of forest management to climate change	
value of the resource	very high	forest is a very important resource as provider for eco-system services and goods, people rely on firewood, timber, herbals and medicinal plants, wildlife, but mainly on the forest's role as soil stabilizer and regulator of hydrological cycles
vulnerability of the resource	very high	due to overexploitation, degradation, overgrazing, fires, overcutting, harming the trees, mismanagement, lack of timber and firewood, lack of alternative energy sources, communities are lacking sustainable forest management capacities, forest conservation measures, forest control, in addition, there is a conflict between herders and foresters
climate risks threatening the resource	increasing temperature, glacier melting, changes in precipitation will have impacts on forest, vice versa, a reduced tree cover and degraded forests will have negativ impacts on micro-climates and hydrological cycles	
adaptation need	very high	alternative energy sources, e.g. using dung, increasing hydropower generation, awareness raising for forest conservation, measures for streams, spruce forest, forest pasture, riparian forests, extend plantings and nursery, strengthening local capacities for forest management, integrated water-forest-agriculture management

Responding strategy	Forest Management and Biodiversity Conservation in Naryn and At Bashy	
specific measures	content	partners
environmental education/awareness raising for conservation prioritization: high	install nursery + greenhouse at school territory, raise awareness of community members for natural resource conservation (forest and climate change mitigation, biodiversity conservation, energy efficiency, efficient use of natural resources, waste management, fire prevention, etc.), carry out on-day trainings at school, cooperate with foresters and forest coordination council, organize plantings with communities at spruce forest, riparian stripes, etc., do not only focus on trees, but also native species to be planted at pasture land, link trainings with soil management and agriculture management issues, focussing on eco-system based adaptation, cooperate wit Botanical Garden in Naryn and invite them to participate at trainings, integrate environmental education in school curriculum, learn children how to raise seedlings in nursery and how to manage a greenhouse	Botanical Garden in Naryn Forest Coordination Council

Responding strategy	Forest Management and Biodiversity Conservation in Naryn and At Bashy	
specific measures	content	partners
afforestation, joint forest management **prioritization: high**	in cooperation with forest coordination council manage well nursery at school territory, demonstrate correct tree selection criteria, grafting and pruning methods, plan with communities and foresters re- and afforestation measures (spruce forest, forest pasture, riparian stripes), organize plantings with community members, carry out fire prevention measures, let community name responsible fire control officers, protect forest from accidental grazing, cooperate with herders, based on pasture land mapping draw a community land use map and discuss with community members fair allocation of land and resources, define rules and regulations, name responsible control officers	forest coordination council
biodiversity conservation **prioritization: medium** (depending on cost benefit analysis) *(cost-benefit-analysis)*	organize a plant and animal inventory with communities, draw a map indicating eco-systems, discuss the importance of species and eco-systems + services and goods with communities, organize one day trainings, identify endangered species and define measures to protect them (protect habitats, build ecological corridors, etc.) identify eco-system services and goods that could be used more efficiently in order to diversify income and support livelihood, analyze ecological shifts of tree species in the face of climate change via ICRAF, identify tree species robust in all climates	ICRAF Botanical Garden in Naryn
energy efficiency **prioritization: medium** (depending on cost benefit analysis) *(cost-benefit-analysis)*	analyze potential for alternative energy sources in order to substitute firewood: using dung, solar water heaters, solar home systems, biogas production, wind power check opportunities for use of improved cooking stoves analyze hydropower generation potential and identify measures for more efficient use	
promote EbA within forest coordination council on political level **prioritization: medium**	train forest coordination council on eco-system based adaptation, strengthen their capacities to carry out community trainings and conservation measures, cooperate with regional government institutions in order to integrate forest and biodiversity conservation + eco-system based adaptation into regional plantings	

8. Implementing the adaptation strategy for the pilot villages in Kyrgyzstan

The implementation of the above described components (climate smart water management, climate smart agriculture, forest and biodiversity conservation) should be planned in close cooperation with pilot communities and technical experts for water, agriculture and forest/biodiversity.

1. plan one-day trainings for each of the three components for the communities, focus on the following issues: climate change + conventional threats are threatening the specific resource (water, pasture, soil, forest, etc.), reasons for being affected/vulnerabilities (use results from community workshops), responding strategies, introduce technically each of the responding strategies
2. contract technical experts to prepare training content
3. connect with potential partner institutions that provide technical support and knowledge
4. prepare and carry out the training series, start with water management, go on with climate smart agriculture, finally forest management + biodiversity conservation
5. carry out trainings, including participatory planning of implementation of each of the measures within the communities, use land use maps, ecological drawings, etc. as baseline for planning, define indicators together with communities to measure success and impacts, identify responsible persons, resources and partners needed for implementation
6. based on the participatory planning work out operational plan and motivate communities to start implementation
7. start with water management measures as everything is interlinked with the changing hydrological regimes and depends on the current and future availability of water resources
8. start each of the components with implementing the measures assessed with very high or high priority (see table above)
9. go on with climate smart agriculture management as this is the base for securing people's livelihood
10. in a third step implement forest management and biodiversity conservation measures
11. take on board potential partner institutions, technical experts, etc.
12. provide financial and technical support for implementation
13. provide support for cost benefit analyses for specific measures in cooperation with Unique Forest
14. carry out monitoring and reporting of project progress, intervene and support wherever necessary, use participatory tools for assessing risks and vulnerabilities after one year of implementation in order to cross-check changes and impacts reached so far
15. connect with other EbA projects in order to exchange knowledge and foster learning from each other, connect communities
16. document results, lessons learnt, methodologies, etc., promote results and impacts to be scaled up to other regions and communities