Integrated Biodiversity Management, South Caucasus

Synthesis Report on Erosion control measures 2014-2017

Azerbaijan



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Report

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Table of Content

1.	Introduction	1
	1.1 Project context	1
	1.2 About this report	1
2.	Overview of pilot sites	3
3.	Description of pilot sites and activities	5
	3.1 Village Birinci Yeniyol	5
	3.1.1 Birinci Yeniyol – Site 1	5
	3.1.2 Birinci Yeniyol – Site 2	7
	3.2 Village of Diyalli	8
	3.2.1 Diyalli – Site 1	8
	3.3 Village of Dvoryan	. 11
	3.3.1 Dvoryan – Site 1	. 11
	3.4 Village of Ehen	. 13
	3.4.1 Ehen – Site 1	. 13
	3.4.2 Ehen - Site 2	. 17
	3.4.3 Ehen - Site 3 & 4	. 17
	3.4.4 Ehen - Site 5	. 19
	3.4.5 Ehen - Site 6	.22
	3.4.6 Ehen – site 7	.24
	3.4.7 Ehen – Site 8	.26
	3.4.8 Ehen – Site 10	. 30
	3.4.9 Ehen – Site 20	. 32
	3.4.10 Ehen/Lahic – Site 30	. 33
	3.5 Village of Garagaya	. 34
	3.5.1 Garagaya 1	.35
	3.6 Village of Goydan	. 36
	3.6.1 Goydan – Site 2	. 37
	3.7 Village of Talistan	. 39
	3.7.1 Talistan - Site 1	.40
	3.7.2 Talistan – Site 2	.41
	3.7.3 Talistan – Site 3	.41
	3.7.4 Talistan – Site 4	.41
	3.7.5 Talistan – Site 5	.42
	3.7.6 Talistan – Site 6	.42
	3.8 Village of Tezekend	.44
	3.8.1 Tezekend - Site 1	.44
4.	Overview on mission reports and concepts 2014-2017	.46

4.1 Screening Report	. 46
4.2 Baseline Report	. 46
4.3 Concept for erosion control measures	. 47
4.4 Erosion risk assessment by remote sensing	. 48
4.5 Hazelnut Concept	. 48
4.6 Study tour	. 49
4.7 Overview on available information about the pilot villages	. 49

List of Tables

Table 1: Overview on sits in Ismayilli pilot area. Right two columns give the year of concept and the	year,
when implementation was started.	4
Table 2: Potential sites for hazelnut orchards.	33
Table 3: Overview on the proposed sites of intervention in Talistan	40
Table 4: Overview on village information available in the reports	49

List of Figures

Textmarke nicht definiert.	
Figure 36: Wooden and gabion check dam 3 and 4 in site 8 showing sediment accumulation Feh	ler!
Figure 25: Check dam 1 offer construction in May 2017 (left) and in New 2017 (right) offer his flood	. 30
Figure 34: Start of the gully close to the road. This part was heavily affected by flooding in summer 20)17.
Figure 33: location of check dams and proposed intake structure	. 29
Figure 32: Sprouting willows of a willow wattle on site 8 Fehler! Textmarke nicht defini	ert.
Figure 31: Fascines implemented on steep river bank close to the road on site 8.	. 28
2017	. 28
Figure 30: willow-fence along river bed (left) and fascines on slopes (right) during implementation in N	Иay
Figure 29: 3D views of the wooden structure of the vegetated crib wall	. 27
Figure 28: Implementation measures along river bed on the right side of the road	. 27
Figure 27: Trees with single-tree protection and drip irrigation on site 7 in Ehen (Nov. 2017)	. 26
Figure 26: Site 7 and 8 along the road from Lahic to Ehen	. 25
new sprout while those have been completely browsed in the previous years	. 24
Figure 25: Existing shrubs and trees are showing positive response to the fencing. Red arrow is showing	ng a
site.	. 24
Figure 24: at the east end of the fence there is a gap of 2-3m where livestock can enter the afforesta	tion
Figure 23: Site 6 in Ehen in November 2017.	. 23
seedlings) Fehler! Textmarke nicht defini	ert.
Figure 22: Afforestation schema of groups (7 trees, 1m radius) on a 6x6m raster (green dots = 1	tree
Figure 21: Site 6 is recommended for establishing closed forest Fehler! Textmarke nicht defini	ert.
Figure 20: Gabion arming on site 5 (Nov. 2017)	. 22
Figure 19: Trees planted on lower part of the trench inside the fence on site 5 (Nov. 2017).	. 21
Figure 18: Established fence on site 5 (Nov. 2017).	. 21
Figure 17: Situation of the site 5 in April 2015	. 20
Figure 16: Site 5 is located north of the village along a trench system to prevent stone fall and flooding.	. 20
Figure 15: Test plots for hay-residuals in the front and hay mulch in the back	. 19
Figure 14: new plants germinating under the hay mulch layer (May 2017).	. 19
	. 18
Figure 13: View from the road across site 4 to site 3 in the background. Left April 2015, right Nov. 20)17.
at site 3.	. 18
Figure 12: Pasture and hay meadow on the same site conditions showing significant difference in eros	sion
Figure 11: Sprouting willows and irrigation system on a pile wall (Nov. 2017).	. 17
Figure 10: Implemented pile walls on site 1 in Nov. 2017.	. 16
Figure 9: Hay mulch test site in Nov. 2017 one year after application.	. 16
Figure 8: Local hay residuals collected from farmers in Ehen in autumn 2016.	. 15
Figure 7: Ehen site 1. Current state of fence and vegetation improvement in Nov. 2017.	. 15
Figure 6: Site 1 is located north-east above the village Ehen.	. 14
Figure 5: River re-direction in Dvoryan village.	. 12
the houses.	. 12
Figure 4: Natural hazard situation in Dvoryan village. The pink polygon is indication the sever gully close	e to
Figure 3: The pasture gets overgrown by shrubs, which leads to higher trampling on open areas	9
Figure 2: Step eroded slope along the road to the village Birinci Venivol	0
trampling. Red marked area is proposed for hazelput hedge	anu 6
Figure 1. The pasture on municipality land in Birinci Yenivol shows erosion caused by grazing a	and

igure 37: The tree nursery was equipped with watering tanks and new seedlings are permar replanted	nently 31
Figure 38: The erosion gully is leading to a hay meadow and a farm house behind	32
-igure 39: The erosion rill gets its water from a small water catchment sparsely covered with veget	ation. 32
Figure 40: Gabion armour	32
Figure 41: Wooden check dam on the vertical gully close to the junction with the horizontal trench 2017)	(Nov. 33
igure 42: three-layered gabion arming on the junction of the gully with the horizontal trench (Nov. 2	2017). 33
-igure 43: Vegetation structure on site 1 in Garagaya	35
-igure 44: Optional position of pile walls (green lines). Length of displayed pile walls is 500-600m. Fe	hler!
Textmarke nicht definiert.	
Figure 45: Pile walls under construction on in Goydan (east -part)	38
Figure 45: Pile walls under construction on in Goydan (west -part)	38
Figure 46: The pile walls support the rehabilitation of vegetation on the created terraces	38
Figure 47: The pile walls are supported by stone walls when the surface is uneven	39
Figure 50: Current state of site 1 in Talistan (Nov. 2017)	41
Figure 51: Current state of site 4 in Talistan (testing tools to remove shrubs) (Nov. 2017)	42
Figure 53: Current state of site 5 in Talistan (Nov. 2017)	42
Figure 54: Current state of site 6 in Talistan (Nov. 2017)	43
Figure 55: Natural revegetation at the steep slope of the brim is up to now very limited	45

List of Abbreviations

ADC	Austrian Development Cooperation
BMZ	German Federal Ministry of Economic Cooperation and Development
GIZ	Deutsche Gesellschaft fuer Internationale Zusammenarbeit GmbH
GPS	Global Positioning System
IBiS	Integrated Biodiversity Management, South Caucasus
IEC	Integrated Erosion Control [Project]
M&E	Monitoring and Evaluation
MZ	Modulziel
NBSAP	National Biodiversity Strategy and Action Plans
NGO	Non-governmental Organization
RBM	Result based monitoring
ToR	Terms of Reference

1. Introduction

1.1 Project context

The unsustainable use of pastures and forest areas leads to erosion, degradation, desertification and loss of biodiversity in high mountain areas of the South Caucasus (key problem). The project "Integrated Erosion Control in Mountainous Areas in the South Caucasus" contributes to the conservation of biodiversity through the protection of natural resources from anthropogenic induced erosion processes and to the rehabilitation of degraded areas. The four-year project, which commenced on 30 November, 2013 and will last until 30 November, 2017, is being implemented in selected areas in Georgia, Azerbaijan and Armenia. The project is assisted by the German Government via the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. The project is implemented by a German-Austrian consortium of ECO Consult, AHT and E.C.O. Institute of Ecology. E.C.O. Institute of Ecology was contracted for concept development and backstopping for the Azerbaijan component in 2016 directly by GIZ.

The developed concepts should support the implementation of pilot measures in selected project areas. The project areas are the following:

- Azerbaijan: Mountainous valley in the Ismayilli district
- Armenia: Northern and eastern slopes of Mount Aragats in the Aragatsotn and Shirak district
- Georgia: Tusheti Protected Area complex in the Achmeta district

The objective of the project is that "Integrated erosion control measure in high-risk mountain areas in the South Caucasus are considered for national regulations for sustainable land use and for securing biodiversity." The local population who uses the natural resources of communally managed land is the main target group. Special consideration has been given to livestock farmers and shepherds, poor smallholder farms and women.

A basic principle of the project is the combination of a village-based approach with ecosystembased adaptation.

1.2 About this report

Within the framework of the of GIZ project "Integrated Erosion Control in South Caucasus" (2013.2143.9), various measures for sustainable management of erosion phenomena in mountainous areas have been piloted since 2014. Key measures implemented in the Ismayilli pilot district in Azerbaijan, include afforestation, bioengineering measures, fencing and vegetation monitoring amongst others.

This report intends to document the overall process of piloting the erosion control measures – including the conception of activities, their implementation, as well as their upscaling. As measures might have been adjusted compared to the initial concept or are not completed yet, the report describes the current state of implementation at the bioengineering and afforestation sites in Ismayilli district as of November 2017.

References to and an overview of mission reports and implementation concepts developed between 2014-2017 (chapter "Overview on mission reports and concepts 2014-2017"), shall support the fast orientation among the gathered knowledge & experiences.

The compiled information is based on data and information collected during the short-term expert missions of Hanns Kirchmeir (E.C.O. Institute of Ecology) between 2014 and 2017 and has been enriched by additional information from the GIZ-Project-Team and national experts.

2. Overview of pilot sites

During the project time frame 2014-2017, a number of 23 pilot sites for the implementation or erosion control measures have been selected in a dynamic and participatory process together with local stakeholders, international and national experts. The pilot sites belong to eight different villages within the district Ismayilli (see Map , 2).

Table 1 summarizes for each pilot site, the foreseen pilot activities, the size of the site, the year of concept development and the year, in which the implementation of measures started.



Map 1: Location of Ismayilli district in Azerbaijan.



Map 2: Sites in the Ismayilli project area, Azerbaijan.

Village Site Planned measure Size Year of Year of name ID (ha) concept started development implem. Birinci 1 Hazelnut-hedges in pasture 2017 1,7 _ Yeniyol Birinci 2 Hazelnut-hedge along road 2017 0,1 Yeniyol 1 Hazelnut plantation in pasture 4,4 2017 Diyalli Dvoryan 1 Stop gully erosion which threaten houses 0,3 2017 1 Stabilisation of erosion on steep slope Ehen 2,8 2015 2016 above the village (pile walls, fencing, hedge-rows) 3 Establishing Hay-Meadow (fencing, hay 2015 Ehen 0,5 2016 mulch) 4 Establishing Hay-Meadow (fencing, hay Ehen 0,3 2015 2016 mulch) 5 Tree/shrub hedge for stabilisation of Ehen 0,1 2015 2017 trenches Ehen 6 Fencing and reforestation of remote step 1,4 2015 2017 slopes above village 7 Tree/shrub hedge for stabilisation of road 0,3 2015 2017 Ehen 8 Stabilisation of deep gully along the road by 2017 Ehen 0,8 2015 wooden check dam, gabion and fascine 0,02 2014 2014 Ehen 10 Tree Nursery Ehen 20 Surface water flow control by gabions and 0,04 2015 check dams Ehen/Lahic 30 Hazelnut plantation for erosion control 24,5 2016 2017 (incl. fencing) 1 Hazelnut plantation for erosion control Garagaya 4,1 2017 _ 1 Fencing and vegetation rehabilitation by 2,7 2017 2017 Goydan pile walls 1 Hazelnut plantation for erosion control Talistan 1,2 2017 _ Talistan 2 Hazelnut plantation for erosion control 1,5 2017 -Talistan 3 Reduce overgrazing by increasing pasture 0,3 2017 land- remove shrubs Talistan 4 Reduce overgrazing by increasing pasture 0,3 2017 _ land- remove shrubs Talistan 5 Reduce overgrazing by increasing pasture 1,9 2017 _ land- remove shrubs Talistan 6 Hazelnut-hay meadow to avoid grazing 4,1 2017 _ damage 1 Hazelnut hedge, hedge-rows for erosion 2017 Tezekend 0,1 _

Table 1: Overview on sites in Ismayilli pilot district.

control

3. Description of pilot sites and activities

This chapter examines the 23 pilot sites in alphabetical order village by village. For each site, the respective basic information (size, planned measures, year of concept, year of implementation), as well as the current state of implementation (as of November 2017) are described.

3.1 Village Birinci Yeniyol

In Birinci Yeniyol, two sites have been assessed in May 2017. Details are given in the report "Short Term Mission April 2017: Implementation of measures and selection of new sites" (Cask_kze20_az_missionreport_May_2017_170706.docx).



Map 1: Sites in Birinci Yeniyol.

3.1.1 Birinci Yeniyol – Site 1

Basic information

- Erosion phenomena:
- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation:

Sheet erosion on pasture land Hazelnut-hedges along contour-lines of slope 1.7 ha 2017 not started yet in 2017



Figure 1: The pasture on municipality land in Birinci Yeniyol shows sheet erosion caused by grazing and trampling. The red marked area is proposed for hazelnut hedges.

Proposed measures

HazeInut hedges. Along the contour-line of the eroded ridges and rather short slopes, lines (hedges) of hazelnut trees shall be planted. The proposed hedge length is 500-700 m. The distance between the individual hazelnut seedlings should be about 2.5 m, resulting in approximately 200-250 seedlings for the entire site.

The seedlings need **protection from browsing** by livestock either by single-tree protection or electric fencing, until they reached a height of 1.3 m.

To **compensate the loss of pasture** land through the planting of hazelnut hedges along the slopes, the pasture area on the rather even land should be increased by removing redundant shrubs. If this compensation measure is not applied, there is the risk of triggering erosion on the remaining open pastures, where trampling and grazing pressure might increase.

State of implementation

In November 2017, the implementation of measures has not started yet.

3.1.2 Birinci Yeniyol – Site 2

Basic information

- Erosion phenomena:
- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation:

Sheet erosion on slope above the village road Hazelnut-hedge along road 0.1 ha (about 170 m length x 5 m width) 2017 not started in 2017

Proposed measures

Planting of 170 m fruit tree hedge. Recommended is the establishment of a dense hedge on 170 m along the road, composed of fruit tree species and hazelnut shrubs. Wild plumb (*Prunus divaricata*), rosehip (*Rosa sp.*), Cornell cherry (*Cornus mas*) and walnut (*Juglans*) could be mixed with hazelnut.



Figure 2: Steep eroded slope along the road to the village Birinci Yeniyol.

State of implementation

In November 2017, the implementation of measures has not started yet.

3.2 Village of Diyalli

The proposed site of intervention in Diyalli is located 1km north of the main village. It has a size of 4.5ha and covers municipality land which is used for grazing but is covered by shrubs (mainly Hornbeam (*Carpinus orientalis*)). The continuous spreading of shrubs let to a reduction of open land available for grazing. This created a concentrated increased impact of grazing and trampling to the remaining fragments of grassland. This problem is not only visible at the selected site of intervention, but on many areas of municipality pasture land above the village. Large areas surrounding the village are covered by shrubs and young trees. These areas are obviously used for fuel-wood harvesting. This process seems not to be done in a coordinated, planned method. It is likely, that a community based forest management plan could improve situation significantly by a meaningful combination of grazing, fuel-wood production and timber production.



Map 2: Site in Diyalli.

3.2.1 Diyalli – Site 1

Basic information

- Erosion phenomena:
- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation:

Sheet & rill erosion on overgrazed pasture, shrubs reduce grazing area Hazelnut plantation in pasture 4.4 ha 2017 not started in 2017

Proposed measures:

Improve pasture quality. On even ground, the total cover of shrubs should be reduced significantly to reduce the overall grazing pressure. The removed shrubs could be used to afforest the eroded and steep parts of the pasture land.

Natural fencing/exclusion from grazing. Slopes steeper than 20° should be covered by shrubs and not be grazed. For this steep slope, hazelnut can be used. The optimal way to do so is to remove not needed shrubs and use them for building a "natural" fence, as farmers do so to protect their hay meadows.

Planting of hazelnut seedling. Then plantation of hazelnut on steep parts in autumn or spring should be done. The site needs 3-4 years of exclusion from pasture, till hazelnuts have reached appropriate height. In this period, the site needs maintenance by frequently mowing to avoid the cut shrubs to re-sprout from their root-system. This time also will help vegetation to recover and compacted soil to regenerate.

Species, tools & planting scheme. About 30% of the site are steep and affected by erosion and therefore should be excluded from heavy grazing. The density of planted hazelnut shrubs on these areas should be 3x3m (1100 hazelnut/ha), resulting in **1600 hazelnut seedlings** for the entire pilot site in Diyalli. Appropriate tools for removing shrubs and maintenance of the area (**chain saw, brush-cutter, sickle bar mower**) are not only needed for the intervention area. These tools could help to improve pasture quality in the surrounding area as well, if this is included into a broader pasture/forest development program.

Stakeholder involvement. It depends on the objectives of the IBiS project, the farmers and governmental organizations how large the area of hazelnut afforestation at this plot of pasture land should be. The process would need intense discussion with municipality and the farmers using this site.



Figure 3: The pasture gets overgrown by shrubs, which leads to higher trampling on open areas.

State of implementation

In November 2017, the implementation of measures has not started yet.

3.3 Village of Dvoryan

Dvoryan village is located 2.5 km north-west from Goydan at 1,510 m above sea level.

The river west of the village has created a deep gully-like riverbed. Heavy rainfalls in 2016 led to a deepening of the gully and to an undercutting of the slope right next to the village. Landslides reaching into house gardens was the result.

To reduce the high risk of a continued deepening of the gully and further landslides threatening the settlements, the original water flow was changed by villagers to a more south-western direction.



Map 3: Site in Dvoryan.

3.3.1 Dvoryan – Site 1

Basic information

- Erosion phenomena:
- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation:

2017

0.3 ha

not started in 2017, needs further discussion, if meaningful within GIZ program

Gully erosion and landslides next to the village

Stop gully erosion which threaten houses

Proposed measure

Technical engineering. Currently, the redirection of the water is realized through a simple dam built from gravel material (1 m height, 2-3 m width). In the case of heavy rainfalls, it is very likely that the dam would not withstand the erosive power of the water and that the river would return to its old riverbed.

As houses of the village are endangered, it is recommended to develop a comprehensive natural hazard plan. It would need technical engineering competence to calculate water catchment, extrapolation of high water events and to develop appropriate technical solutions for protection of the village.



Figure 4: Natural hazard situation in Dvoryan village. The pink polygon is indicating the gully close to the houses.



Figure 5: River re-direction in Dvoryan village.

State of implementation

In November 2017, the implementation of measures has not started yet.

3.4 Village of Ehen

In Ehen village, the highest number of erosion control measures has been implemented. The village has been assessed in the screening mission in May 2014 and was subject of several further field missions. Ehen acts as a demonstration site for the other villages, as many different measures have been implemented here.



Map 4: Sites in Ehen.

3.4.1 Ehen – Site 1

Basic information

- Erosion phenomena:
- Measure:

- Size:
 - Year of site selection and conception: 2
- Year of start of implementation: 2016

Proposed measures

This site is located directly above the village near to the water house. The slope is heavily eroded and used as pasture for lambs. The houses below the slope are endangered by rockand stone fall. The villagers are very engaged in reducing this risk. In September 2014, the site was delineated by village stakeholders and marked in the field. GPS-coordinates have been taken and vegetation monitoring plots have been installed along the proposed fence.

The size is 2.7 ha and the length of the permanent fence is 620 m. As two trails are crossing the site, in total 3 gates for people are needed.

Heavy sheet erosion on steep pasture land Stabilisation of erosion on steep slope above the village (pile walls, fencing, hedge-rows) 2.8 ha 2015



Figure 6: Site 1 is located north-east above the village Ehen.

The objective of the measures are (1) rehabilitation of the vegetation cover on the steep slope and (2) reduction of the risk of rock fall by horizontal hedges and tree rows.

Following concrete working steps/measures are proposed:

<u>Measure 1: Fencing</u>: A permanent fence (needed at least 10 years) has to be established to avoid further degradation by livestock. The total length will be 620 m and three gates for passengers are needed.

<u>Measure 2: Application of coconut net:</u> A coconut net will be spread on the steepest and most eroded part near to the path from the water house to fix the gravel and stones until vegetation is established.

<u>Measure 3: Application of hay residuals:</u> The eroded slope lacks organic material and seeds. Both can be provided by application of the residuals from hay depots in spring. These residuals consist of organic materials and seed form the grass and herb species of the hay.

Measure 3b Hay mulching (alternative to Hay residuals)

The area to apply hay mulching is 0.5 ha. The aim is to harvest fresh hay with high amounts of ripe seeds (best mid of July to mid of August).

Measure 4: Building of pile walls to stabilize slopes

To prevent stones and rocks from falling down to the village, to stabilize the slope and to create shade and decrease drought and wind, lines of trees and shrubs shall be established by means of pile walls. The planting of trees will be supported by the establishment of small terraces of 40-70 cm width.

State of implementation

In November 2017, the following measures were concluded:

<u>Measure 1: Fencing</u>: The permanent fence is installed. The exclusion from grazing has significantly improved the vegetation biomass and vegetation cover.



Figure 7: Ehen site 1. Current state of fence and vegetation improvement in Nov. 2017.

<u>Measure 2: Application of coconut net:</u> Coconut nets are not available in Azerbaijan at reasonable costs. This measure was skipped, as it is not up-scalable to other villages.

<u>Measure 3: Application of hay residuals and hay mulching</u>: On four test-plots of 10 x 10 m the application of hay residuals and hay mulching has been piloted in autumn 2016. One year later, in November 2017, the hay mulch was still visible, while the smaller pieces of the hay residuals were mostly washed away. Hence, the hay mulch provides a good physical protection against sheet erosion caused by the impact of raindrops. The hay cover allows that more moisture is kept by the soil and germination of seeds can be observed.



Figure 8: Local hay residuals collected from farmers in Ehen in autumn 2016.



Figure 9: Hay mulch test site in Nov. 2017 one year after application.

Measure 4: Building of pile walls to stabilize slopes

The pile wall system was constructed in autumn 2016. Only 3.2 m (instead of 4m) long wooden post with diameter of 12-17cm have been available. A drip irrigation system was installed. In November 2017, it was visible that the willow cuttings profiting from the irrigation system show significantly higher survival rates than those without irrigation. Another observation was, that willow cuttings with less than 2 cm diameter (thumb-like) have significantly lower survival rates than those with diameters of 2-4 cm. On the terraces, walnut and oak trees have been planted which show high survival rates when irrigated.

As timber cannot be extracted from the local forests, availability and up-scaling potential of the measure is limited. Adaptation of legal regulations to extract local timber for erosion control measures would be helpful.



Figure 10: Pile walls on site 1 in Nov. 2017.



Figure 11: Sprouting willows with irrigation system on a pile wall (Nov. 2017).

3.4.2 Ehen - Site 2

The initial site 2 was situated between site 3 and 8. Planned measures on the eroded pastureland were (1) fencing and (2) the conversion into a hay meadow. In 2017, the concept was changed, and the measures were replaced by the planned establishment of a hazelnut orchard (described below under Site 30)

3.4.3 Ehen - Site 3 & 4

Basic information

•	Erosion phenomena:	Heavy sheet erosion on pasture land				
•	Measure:	Establishing Hay-Meadow (fencing, hay mulch)				

0.5 ha (site 3) and 0.3 ha (site 4)

- Size:
- 0126. - Veere
- Year of site selection and conception: 2015
- Year of start of implementation: 2016

Proposed measures

South-West from the village Ehen, the bedrock consists of soft silt and clay which leads to an increased risk of erosion on steep slopes. These sites are very sensitive towards grazing (see Figure 12). The left part in this figure is grazed, while the right side of the fence is a hay meadow under private use.

On this heavy eroded site, the objective is the rehabilitation of the vegetation cover through a temporary exclusion from any use and after 1-2 years, the use as hay meadow. The following working steps /measures are foreseen:

Fencing. The eroded parts should be fenced in a first step.

Application of hay residuals/hay mulch. In order to support the rehabilitation of vegetation, hay residuals as described under site 1 should be applied. On some very exposed areas, the hay residuals need to be covered by jute/coconut nets to avoid immediate removal by wind or heavy rain (see recommendations on hay residuals and coconut net above).



Figure 12: Pasture and hay meadow on the same site conditions showing significant difference in erosion at site 3.

State of implementation

In summer 2016, site 3 and 4 were fenced and hay residuals and hay mulch have been applied in autumn 2016. The fence is showing a positive impact on the vegetation cover and biomass (see comparison in Figure 13). Site 4 might be already use for hay production in 2018. The productivity of this site could be significantly increased through the removal of stones and an active control of the water run of from the road (which washes down the stones). An open question remains the land use-rights (hay harvesting) for the community land.

The western ridge (site 3, in the background of figure 14) shows more biomass after fencing, but due to the minimal humus layer and the low soil fertility, regeneration of vegetation is limited. On this site, the hay-mulching test plot shows better results than the application of hay residuals, which seem to be washed away quite quickly on slopes > 5°. The hay mulch supports the retention of moisture and supports germination of local herbs and grasses.



Figure 13: View from the road across site 4 to site 3 in the background. Left April 2015, right Nov. 2017.



Figure 14: new plants germinating under the hay mulch layer (May 2017).



Figure 15: Test plots for hay-residuals in the front and hay mulch in the back.

3.4.4 Ehen - Site 5

Basic information

- Erosion phenomena:
- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation: 2017

Proposed measures:

Establishment of a hedge along the trench. Above the north-western part of the village a trench was constructed to channel the water run-off from the hillside and to stop stone fall. With the planting of a hedge, the effectiveness and durability of the trench shall be enhanced.

Heavy gully erosion above road Tree/shrub hedge for stabilisation of trenches 0.1 ha 2015



Figure 16: Site 5 is located north of the village along a trench system to prevent stone fall and flooding.

The following working steps/measures are needed:

<u>Measure 1: Temporary Fencing</u>: To establish tree and shrub vegetation, a temporary fencing (electric fence; 5-8 years) is needed to avoid browsing by livestock (especially from goat). Trees and shrubs should only be planted on one side of the trench (towards the road) but the fence should also cover the opposite slope to foster natural vegetation rehabilitation.

<u>Measure 2: Planting of a tree or shrub row:</u> A row of trees and shrubs stabilizing the edge of the trench on the downhill side should be planted. Trees should be planted in October 2016 to avoid damage by summer drought.



Figure 17: Situation of the site 5 in April 2015.

<u>Measure 3: Arming of trenches by gabions:</u> in the eastern part of the trench two gullies are connected in a 90° angle. The impact of the water flow on the opposite part of the trench should be limited by two gabion arming.

State of implementation

In November 2017, the measures were implemented as follows:

<u>Measure 1: Temporary Fencing</u>: As electric fence was not available a mesh-wire fence was established to exclude livestock from the sensitive area.



Figure 18: Established fence on site 5 (Nov. 2017).

<u>Measure 2: Planting of a tree or shrub row:</u> A line of trees were planted inside the fence. Most of them were still alive in November 2017.



Figure 19: Trees planted on lower part of the trench inside the fence on site 5 (Nov. 2017).

<u>Measure 3: Arming of trenches by gabions:</u> The gabion arming was installed in summer 2017. Two layers of gabion arming 0.5x0.5 m and 5 m length have been placed at each of the gully-mounting places.



Figure 20: Gabion arming on site 5 (Nov. 2017)

3.4.5 Ehen - Site 6

Basic information

•	Erosion phenomena:	Heavy sheet erosion on dry & steep site
•	Measure:	Fencing and reforestation of remote step slopes
		above village
	Size:	1.4 ha
	Year of site selection and conception:	2015
•	Year of start of implementation:	2017

Proposed measures

Reforestation. The village stakeholders are reporting, that the mountain ridge above the village was covered by forest in earlier times. The slope is very steep (60% inclination). As a consequence of deforestation, the spring at the bottom of the hillside has dried out. The village stakeholders now would like to reforest the hill side and have already stopped the collection of fuel wood in this area. As a result, some plots of *Populus tremula* have already recovered and have now reached a tree height of 7-8 m, a diameter of 15 cm at an age of 17-20 years.

Objective of the measure is the reduction of water run-off and soil erosion as well as a prevention of rockfall on the steep hillside.

Technical specifications. Site 6 has an area of 2.8 ha and perimeter is 700 m. Only the lower part of the site has to be fenced (1.4 ha), as the upper part might not be accessible to livestock. The access by goats has to be strictly controlled by shepherds. If needed, the upper part has to be fenced as well.

It is recommended, to use small plant holes (not trenches) for plantation of trees (width 20 cm, depth 40 cm). The proposed planting scheme of small groups of 5 trees with 5x5 m distance,

results in 1,500-2,000 seedlings per hectare. As natural regeneration of trees will occur as well, this density should be sufficient. Seedlings from the local tree nursery are recommended.

To see how fast the natural regeneration of forest after exclusion of livestock will take place, only 0.5 ha shall be afforested, and 2.3 ha should be within the fenced plot but without planting trees.

- Populus tremula (Aspen popular)
- Quercus iberica (Georgian Oak)
- Carpinus caucasica (Caucasian hornbeam)

State of implementation

In November 2017, the situation of the afforestation site was as follows:

Tree seedlings have been planted in spring 2017 and in summer 2017, the fence at the lower part of the afforestation site was established.

The fence is not surrounding the whole plot, as the upper part is only hardly accessible, and it is unlikely that livestock will invade from above. Only on the eastern part, a few meters of fence are missing to make it even more inaccessible. It seems that still some goats are entering the afforestation site, but there was no sever damage of seedlings so far. Existing shrubs and trees are showing positive responses to the fencing by increased number and length of this year's sprouts. The seedlings have not been planted in the proposed group scheme but are randomly distributed within the mosaic of open soils, stone fields and groups of shrubs.

The seedling survival rate was around 50%, which is still good under the harsh conditions of this very dry site. Acer and Oak have the highest survival rates in those areas, as observed in November 2017. Drip irrigation is not possible on this slope



Figure 21: Site 6 in Ehen in November 2017.



Figure 22: At the east side of the fence there is a gap of 2-3m where livestock can enter the afforestation site.

Figure 23: Existing shrubs and trees are showing positive response to the fencing. Red arrow is showing a new sprout while those have been completely browsed in the previous years.

3.4.6 Ehen – site 7

Basic information

- Erosion phenomena:
- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation: 2017

Erosion threatening road stability Tree/shrub hedge for stabilisation of road 0.3 ha 2015

Proposed measure:

Planting a row of trees along the road. In the geophysical assessment, Mr. Arndt recommends planting a row of trees on the west side of the road from Lahic to Ehen. This part of the road is following the edge of the earthflow which leads to instable underground. The more water is in the ground, the faster is the movement. However, trees can extract water from deeper layers of the soil and evaporate this water through their leaves in the crown.

Stabilization of the top surface of the ground and extraction of water from the ground is the objective of the measure.

<u>Technical specifications:</u> Site 7 has an area of 0.3 ha and the fence length would be 580m. The tree row is 250 m. Every 2 m a tree should be planted (125 trees).

Figure 24: Site 7 and 8 along the road from Lahic to Ehen.

State of implementation

A twin-row of trees was established along the road in spring 2017. To reduce fencing costs, single-tree protection made of mesh-wire fence was applied. In addition, drip irrigation was installed using the water from the small creek close by. Survival rates were more than 90%.

Figure 25: Trees with single-tree protection and drip irrigation on site 7 in Ehen (Nov. 2017).

3.4.7 Ehen – Site 8

Basic information

- Erosion phenomena:
- Measure:
- Size:
- Year of site selection and conception: 2015
- Year of start of implementation: 2017

Proposed measure

Site 8 shows a severe gully erosion paralleling the road and is adjacent to Site 2. The gully is close to the road. The site starts at 1,380 m and ends at 1,350 m above sea level. The length is around 200 m and the average inclination of the riverbed is 12%. Further erosion of the orographic left side of the gully will lead to a destruction of the road. As the gully and the road are located on the earth flow, stabilization is very difficult, but necessary. Being close or next to the road, the site is considered an ideal demonstration site.

0.8 ha

Heavy gully erosion next to a road

wooden check dam, gabion and fascine

Stabilisation of deep gully along the road by

<u>Objective</u>: Slow-down of water speed and erosive energy on the left bank of the gully to protect the road.

Figure 26: Implementation measures along river bed on the right side of the road

<u>Measure 1:</u> Establishment of willow wattle fence along the road to stabilize the slope and redirect the water flow

<u>Measure 2:</u> Building of 1 wooden check dam and 1 gabion check dam to avoid further deepening of the gully, reduce water speed and to stabilize the river bed.

Figure 27: 3D views of the wooden structure of the vegetated crib wall

<u>Measure 3:</u> Planting of shrub and trees species along the road. The stems, branches and roots help to fix the soil on the side of the road.

State of implementation

<u>Measure 1:</u> Establishment of willow wattle fence along the road to stabilize the slope and redirect the water flow.

Willow wattle fences have been established in the upper part of the gully (above the wooden check-dam 1) and along the river until the second group of check dams. Additionally, willow fascines have been installed on steep eroded river banks close to the road. Both measures

have been established in May 2017. In this time, the willows had already full developed leaves and where harvested 1-3 days before implementation to the ground. This led to the fact, that in November 2017, only few of the horizontal branches of the fascines and the willow wattle where showing living sprouts. To fix the fascines and the vertical piles of the willow wattle were made of thicker branches (4-6cm diameter). About 50% of these thicker branches were showing living sprouts. Obviously, the thicker branches were not affected that much by storing them 1-3 days before putting them into the ground.

If the willows would have been cut earlier (e.g. March) in a development stage without leaves and placed in the same day of cutting, it is expected that survival rates would have been higher.

Figure 28: willow-fence along river bed (left) and fascines on slopes (right) during implementation in May 2017.

Figure 29: Fascines implemented on steep river bank close to the road on site 8 (left). Sprouting willows of a willow wattle on site 8 (right).

<u>Measure 2: Building of 1 wooden check dam and 1 gabion check dam to avoid further</u> <u>deepening of the gully, reduce water speed and to stabilize the river bed.</u>

In 2017, four check dams have been implemented on site 8. Two wooden check dams with a height of 110 cm and a width of 320 cm and two gabion check dams with height of 100 cm and width of 400cm. Right after implementation in May 2017, an intensive flood (10-30 yearly event according to local stakeholders) created a test event. All four check dams as well as the willow wattles stand the flood and were not broken. On gabion check dam number 2 (upper one) the flood started to establish a by-pass left of the gabion, but it was only 5-10 cm deep in November 2017.

The timber used was only available in a length of 3.2 m, which limits the maximum width of the wooden check dams. Timber with 4m (or even longer) would enable to fix the check dam better to the left and right bank of the gully.

At the begin of the gully, the flood created a 1m depth canyon into the weak and loamy soil. Some sort of intake-structure would be needed to stop this backwards moving erosion process. A wooden or gabion staircase structure with armed side walls could be an option.

All check dams were showing positive effect in accumulating sediments in the bottom of the gully by slowing down the water speed. This already stopping the deepening process in the upper part of the gully.

Additional check dams should be added in the lower part of the gully to fix the problem along the road.

Measure 3: Planting of shrub and trees species along the road:

The planting of trees along the road was done on site 7. On the right river bank of the gully, additional trees have been planted.

Figure 30: Location of check dams and proposed intake structure.

Figure 31: Start of the gully close to the road. This part was heavily affected by flooding in summer 2017 (left). Wooden and gabion check dam 3 and 4 in site 8 showing sediment accumulation (right).

Figure 32: Check dam 1 after construction in May 2017 (left) and in Nov. 2017 (right) after big flood.

3.4.8 Ehen – Site 10

Basic information

- Measure: Improve the local tree nursery
- Size: 0.02 ha
- Year of site selection and conception: 2014
- Year of start of implementation: 2014

Proposed measures:

To provide sufficient numbers of seedlings, a tree nursery has already been established in Ehen. Supporting measures are required to enhance the production of the tree nursery.

Figure 33: Location of tree nursery (site 10) near to the school in Ehen.

Objective: Improve and further develop the tree nursery by improving the water supply.

<u>Measures</u>: Provision of water tanks and rain gutters for saving rainwater for irrigation of the tree seedlings.

State of implementation

In November 2017, the tree nursery was still operating. Local villagers are making use and supporting the tree nursery by adding tree seeds and cuttings to grow there. Seedlings from the nursery have been used for site 1 and 8.

The nursery was equipped with a new water tank, which was not linked to the rain water collection system from the school by May 2017. Tubes and other irrigation materials from the project are available in the tool shed to be installed.

Figure 34: The tree nursery was equipped with watering tanks and new seedlings are permanently replanted.

3.4.9 Ehen – Site 20

Basic information

- Erosion phenomena:
- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation: 2017

Proposed measures:

This pilot site was recommended to work with by Mr. Arndt in his assessment from April 2015. A gully of 2-3 m width is in slope line directing towards a hay meadow and a farm house beyond. The origin of the gully is a small water catchment with only rare vegetation cover.

0.04 ha

2015

Gully erosion through surface water-flow

Construction of gabions & check dams

Figure 35: The erosion gully is leading to a hay meadow and a farm house behind (left). The erosion rill gets its water from a small water catchment sparsely covered with vegetation (right).

Objective: Slow-down of speed of water and erosive energy to stop or reduce ongoing erosion

Measure 1: Building of gabions

For arming the horizontal gully, a gabion wall will be implemented

The gabion boxes might be purchased or built by villagers. The boxes should be filled with river pebbles because the local stones are less durable (for details see Arndt 2015). The boxes should be located at the very bottom, where the gully turns sideward to prevent the water flow from going straight. We suggest implementing two rows (each 0.5x0.5x10m) (one above the other).

Figure 36: Gabion wall.

Measure 2: Building of 1 wooden check dams

In his report Arndt recommends to slow down the speed of water by Gabion boxes building horizontal blocks to the water flow. As there is no road access to this gully, and an amount of 8 m³/14 tonnes of stones would be needed for two gabion check dams, we recommend to make two wooden check dam instead of the gabion check dam (see above).

State of implementation

One wooden check dam and a gabion arming were installed in summer 2017 on site 20. Besides this, other gabion arming have been installed in site 5 close by.

Figure 37: Wooden check dam on the vertical gully close to the junction with the horizontal trench (Nov. 2017, left). Three-layered gabion arming on the junction of the gully with the horizontal trench (Nov. 2017, right).

3.4.10 Ehen/Lahic - Site 30

Basic information

- Erosion phenomena: Several plots with sheet erosion
- Measure: Hazelnut plantation (incl. fencing)
 Size: 24.5 ha
- Year of site selection and conception: 2016
- Year of start of implementation: 2017

Proposed measures

Part of the development goals of the district for income generation and erosion control, is the establishment of hazelnut orchards on eroded sites. In Ehen and Lahic there are two main plots that have been distinguished in spring 2017: one plot west of the village of Ehen with a size of 16 ha on the territory of the municipality of Ehen and a second plot with the size of 9 ha south of the road to Ehen on the territory of the municipality of Lahic.

To be able to start with a smaller pilot site, the Ehen-site was split into a small part (H1) of 1.4 ha and the remaining part (H2) with 15.1 ha.

Name	Municipality	ha	Fence length (m)		
H 1	Ehen	1,4 300			
H 2	Ehen	15,1	1500		
Н 3	Lahic	9,4	1400		

Table 2: Potential sites for hazelnut orchards.

The south-eastern part of site H1 and H2 are bordering to existing hay meadows, which are fenced by permanent fences. These parts have been excluded from the calculation of fence length in Table 2.

All three sites are showing signs of erosion. Because of steepness and landslides, the erosion signs in site H1 and H2 are much more severe than on site H3.

State of implementation

At the mission in beginning of November 2017, the hazelnut orchards were about to be established. The final position of fences had been discussed with local stakeholders and with the implementing company. Plant holes have been dug on several places to check the quality of soil and to discuss the planting scheme.

Implementation of measures was planned to still start in November 2017.

3.5 Village of Garagaya

The proposed site of intervention in Garagay is at an elevation of 900 m above sea level in a distance of 300m west of the road to Lahic. The site has a size of 4.1 ha and a perimeter of 800 m. The current site shape is a rough proposal and according to the major, it could be enlarged if needed.

The site is located in the deposition area of a torrent. The ground is built by gravel material sedimented by the torrent. Although the climate was rather wet during the field assessment, vegetation seems to be adapted to semi-dry soil conditions. Opposite to the other villages

assessed, soil is rich on medium and small stones and not that rich on clay. The micro-relief is rather uneven and small hills of 5-10m height are structuring the surface.

Vegetation is a mosaic of shrubland with small patches of grassland embedded. Grazing is present, but not of severe impact. Without human intervention, the shrub vegetation will cover the whole area within the next 2-3 decades.

Signs of erosion are mainly limited to the area near to the torrent. Impact of grazing is not intense. There are no visible indicators that overgrazing or trampling causes soil erosion on this site.

Map 5: Site in Garagaya.

3.5.1 Garagaya 1

Basic information

- Erosion phenomena:
- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation:

Proposed measures

The site conditions will allow to establish a hazelnut orchard on this site. As erosion is not a big issue on this site and grazing pressure is low, we would rank priority of intervention as low. The surface is well protected by vegetation and most of the area is already covered by shrubs and trees.

State of implementation

In November 2017, implementation had not started yet.

Slight Sheet and rill erosion HazeInut plantation for erosion control 4.1 ha 2017 not started in 2017

Figure 38: Vegetation structure on site 1 in Garagaya.

3.6 Village of Goydan

The village of Goydan is located 5 km north of Ehen at an elevation of 1,500 m above sea level. Above the village, there are steep slopes with inclination of 30-35°. In 2016, new land-slide happened after heavy rain falls. The slopes are heavily grazed and show signs of surface erosion beside occurrence of the land-slides. The steep eroded slopes above the village, starting at the current landslide at the western side to the ridge at the east side has an area of about 2.7 ha. For fencing, there would be two options.

Option 1 is fencing only the very steep and eroded slope above the village, which make use of the fences along the hay-meadows and orchards in the village. Fence length of option 1 is 680m.

Option 2 would include a larger area of 4.7 ha from the village up to the road and the large hay meadows above the village. As option 2 takes advantage of the existing fences at the village and the hay meadows, length is only 570m. Advantage of option 2 is the reduced fence length and the larger protected area which would help to reduce surface water run of above the village. The disadvantage is, that the corridor for livestock between village and the large hay meadows above, is blocked.

Map 6: Site 1 in Goydan.

State of implementation:

In November 2017, implementation has not started yet.

3.6.1 Goydan - Site 1

•	Measure:	Fencing and pile wall construction
	Size:	2.7 ha
•	Year of site selection and conception:	2017
	Year of start of implementation:	2017

Proposed measure:

Fencing the eroded area will support rehabilitation of vegetation. The biomass, which is not grazed, will help to cover soil surface and reduce impact of rain and speed of surface water runoff. More above ground biomass will also lead to more below ground biomass and rootsystems will fix the upper soil layer more efficiently. On steep, heavily eroded slops with less than 30% of vegetation cover, pile-walls could help to establish micro-terraces. This micro terrace could act as starting point for re-vegetation of heavily eroded slops by stopping downmovement of soil and accumulate fine-material and water. Pile walls are constructed by horizontal timber-logs fixed by two iron posts. Above the horizontal log soil and fine material are gathered to build a micro terrace (see examples from Ehen). Willow cuttings and seedlings could be used to establish horizontal hedge-rows. Trees and shrubs can establish deeper root systems than grass and herb species and can contribute to water reduction from deeper soil layers. This could reduce land slide risk. Optional position is displayed in Fehler! Verweisquelle konnte nicht gefunden werden. Length of proposed pile-walls is 500-600m. Depending on length of logs this needs 125-200 logs and 250-400 iron post (diameter 20mm and 60-100cm length). For establishment of tree and shrub rows 500-600 seedlings would be needed. Number of shrub-seedlings can be reduced, when willow-cuttings (2-3cm diameter, 40-60cm length) are included into micro-terraces.

Areas with surface erosion can be covered by hay-mulch to protect from rain-impact and create better germination conditions for seeds. Based on the vegetation assessment by the aerial-image this measure can be implemented on 2000-3000m². Harvesting area of haymulch should be 1.5x the size of the application area. Optimal results can be expected when harvesting the hay-mulch end of July or begin of August, when seeds.

most herbs and grasses have Figure 39: Optional position of pile walls (green lines). Length of displayed pile walls is 500-600m.

Application of measures can make use on the experience and knowledge built up in Ehen village (site nr. 1).

State of implementation

In November 2017, the implementation of measures had started. Within 3 days, more than 50 pile walls have been constructed. The implementation was done by local workers from the community. As the available timber had only 15-20 cm diameter, two logs have been used for each pile wall. The pile walls are located in the steep, eroded parts of landslides to enable regeneration of vegetation. Cuttings of local willow varieties are placed on top of the small terraces and covered with 5 - 10 cm of soil. It is expected that the cuttings will sprout in spring 2018 and the root system of the willows will help to stabilise the soil on the steep slopes. In the middle of the site is a resent landslide located. The soil material there builds a soft, 0.5 -1.5 m deep layer. It was not possible to fix pile walls there, so this part was skipped.

The electric fence was not available by this time, so the site was unfenced in November 2017.

Figure 40: Pile walls under construction on in Goydan (east -part).

Figure 41: Pile walls under construction on in Goydan (west -part) (left). The pile walls support the rehabilitation of vegetation on the created terraces (right).

Figure 42: The pile walls are supported by stone walls when the surface is uneven.

3.7 Village of Talistan

The proposed sites of intervention are located east of the village Talistan at the foot of the mountains at an elevation of 730-800m above sea level. The 6 sites are located at the municipality pasture land. Large parts of the pasture land are already covered by shrubs and young trees, which limits the area of available grassland for the livestock significantly. The northern part of the terrain is structured into human made terraces (see **Fehler! Verweisquelle konnte nicht gefunden werden.**). In the southern part, a deep gully (2-4 m depth) and a landslide are visible (site 1). The open grassland is heavily grazed. Impact of trampling is visible almost everywhere on the pasture and already in May vegetation was limited to a few centimeters of height. It is quit obvious, that the pastureland is to small for the amount of livestock grassed there.

Map 7: Sites in Talistan.

Proposed measures

The concept for this part of pasture land is to reduce the impact of grazing along the gully and the landslide by fencing and plantation of hazelnuts. To avoid negative impacts by increasing

pressure of grazing on the remaining grassland, the overall area of pasture should be increased. This could be done on sites 2-6. Here the cover of shrubs and trees should be reduced on the flat part of the terraces, while the steep slopes between the terraces could be used for hazelnut plantation. Beside these measures, weed-control should be applied to reduce the share of thistles in the pasture land.

The measures should be applied in several phases step by step. Electric fence systems would help to set up flexible fenced areas to protect young seedlings of hazelnut for the first 2-4 years. During this time of enclosure of grazing, mowing could help to reduce thistles and to compensate temporary reduction of pasture land.

Village	Site nr.	ha	Fence length (m)	Measure
Talistan	1	1.19	624	Hazelnut-hay-meadow
Talistan	2	1.53	714	Hazelnut-pastureland
Talistan	3	0.26	205	Hazelnut-pastureland
Talistan	4	0.32	250	Hazelnut-pastureland
Talistan	5	1.88	938	Hazelnut-pastureland
Talistan	6	4.13	808	Hazelnut-pastureland
Total		9.29	3539	

Table 3: Overview on the proposed sites of intervention in Talistan.

3.7.1 Talistan - Site 1

- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation:

Hazelnut plantation for erosion control 1.2 ha 2017 not started in 2017

Figure 43: Current state of site 1 in Talistan (Nov. 2017)

3.7.2 Talistan – Site 2

- Measure:
- Size:

Hazelnut plantation for erosion control 1.5 ha

0.3 ha

2017

- Year of site selection and conception: 2017
- Year of start of implementation: not started in 2017

3.7.3 Talistan – Site 3

- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation: not started in 2017

3.7.4 Talistan – Site 4

- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation:

Remove shrubs to increase overall pasture area 0.3 ha 2017 not started in 2017

Remove shrubs to increase overall pasture area

Figure 44: Current state of site 4 in Talistan (testing tools to remove shrubs) (Nov. 2017).

3.7.5 Talistan – Site 5

- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation:

Remove shrubs to increase overall pasture area 1.9 ha 2017 not started in 2017

Figure 45: Current state of site 5 in Talistan (Nov. 2017)

3.7.6 Talistan – Site 6

- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation:

Hazelnut-hay meadow to avoid grazing damage 4.1 ha 2017 not started in 2017

Figure 46: Current state of site 6 in Talistan (Nov. 2017)

3.8 Village of Tezekend

The proposed site of intervention in Tezekend is within the village and marks the starting edge of a former landslide. Because of the landslide houses are absent in this part of the village. The brim on the upper part of the landslide is still free of vegetation. As inclination is more than 30°, natural revegetation is limited. Total area of the brim is 0.1 ha and the site is located 700m above sea level. Exposition is South, which additionally makes rehabilitation of vegetation difficult because of high evapo-transpiration rate.

Map 8: Sites in Tezekend.

3.8.1 Tezekend - Site 1

- Measure:
- Size:
- Year of site selection and conception:
- Year of start of implementation:

Proposed measures

The steep slope could be structured by 3 lines of pile walls into micro terraces. Along the terraces hazelnut cut be planted. The micro terraces would reduce water run of speed and it is more likely, that water is captured by soil instead of run off.

Soil is very rich on clay, which might be a challenge on water availability under dry climate conditions. Irrigation might be needed in dry periods in the summer.

The length of the site is 80m. Three lines of pile walls would give a total length of 240m (80 logs of 3m length). Hazelnut should be planted in distance of 3m (80 seedlings). Other shrubs could be mixed with the hazelnut.

Hazelnut hedge, hedge-rows for erosion control 0.1 ha 2017 not started in 2017 Priority of the intervention is medium. Condition of local eroded site can be improved. The site should be fenced (200m length). The rehabilitation will not prevent the risk of future landslides in this area. The location within the village would increase public awareness. An info-board could be placed to give information on erosion and vegetation rehabilitation.

Figure 47: Natural revegetation at the steep slope of the brim is up to now very limited.

4. Overview on mission reports and concepts 2014-2017

This chapter lists the documents developed by E.C.O. (and partners) in the scope of the IEC project. It does not cover all documents provided by international and national experts (which is done by the internal web-page tool provided by EcoConsult).

The overview on reports and concepts especially focuses on the documents relevant for Azerbaijan and summarizes the main contents for each document. Thus, finding relevant concepts, results and recommendations developed during the project period May 2014 to December 2017 shall be eased.

4.1 Screening Report

Document name: cask_kze01_screening_report_08112014.docx

This report includes assessments from all three countries. For Azerbaijan, it includes the first assessment of potential sites of intervention in Ehen. It recommends activities in the field of pasture management, erosion prevention and the establishment of a tree nursery. Potential sources of alternative income generation are mentioned.

4.2 Baseline Report

Document name: Baseline_Study_Report_final.docx (+ 7 annexes)

The Baseline Report covers all three countries. The report is structured into a main report (summary) and seven Annex-reports (1 Geodata availability, 2 Environmental Data, 3 Pasture Assessment (only AZ and GE), 4 Vegetation monitoring, 5 Socioeconomic Data and Recommendations, 6 Result Matrix, Result Model and Status of Indicators, 7 Quick Assessment Xinalig).

For Azerbaijan the following contents are relevant:

- Annex 1 Geodata availability: Available remote sensing date for erosion risk assessment
- Annex 2 Environmental Data: Description of main habitats, rare and endangered SPECIES and habitats, protected Areas, list of data sources.
- Annex 4 Vegetation monitoring: Methodology, results and recommendations for the vegetation monitoring applied in September 2014 according the planned sites in Ehen. Foto-Documentation and coordinates of 18 plots.
- Annex 5 Socioeconomic Data and Recommendations: Socioeconomic data (demographic, education, sources of income, agricultural products, livestock ...) for 6 villages in the 3 selected pilot municipalities (Ehen, Lahic, Burovdal). Stakeholder analysis.
- Annex 6 Result Matrix, Result Model and Status of Indicators: Critical review on the Module and Output indicators and Result Matrix. Only on regional level without break down on countries.
- Annex 7 Quick Assessment of Xinalig region: In a short field mission the Xinaliq regions was checked, if it is suitable to be included as a second pilot region in AZ. The finding was, that Ismayilli regions will already cover most of the challenges in erosion assessment and erosion control and a second pilot region is not needed.

4.3 Concept for erosion control measures

Short Term Mission April 2015: First concept for measures in Ehen

Document name: Cask_kze4_az_report_150515b.docx

Based on a field visit in April 2015 the base concept for implementation measures on 9 sites in the village of Ehen are given in the report. This includes rehabilitation of vegetation on overgrazed sites and landslides, change from pasture to hay meadows, planting of tree rows, afforestation (including tree species selection), bioengineering measures for stabilisation of gully erosion, arming of banks. Additionally, alternative income generation measures based on the existing apple orchards are included.

Concept on the implementation process 2016

Document name: caaz_implementation_process_160529.docx

A short implementation schema was drawn for 2016.

Detailed implementation concept for Ehen 2016 based on field mission in June 2016 Document name: caaz_implementation_concept_160623.docx

The final implementation concept was based on the concept of May 2015 and was refined based on the field mission in June 2016. It covers the following:

- Description of implementation sites
- Description of planning steps towards implementation
- Elaboration of an implementation concept
- Determination of required procurements and workforce
- Preparation of draft implementation schedule

It includes calculation of working days and needed materials and builds the base for the tendering of services for implementation.

Short Term Mission October 2016: Mission report

Document name: caaz_mission_report_october_2016_161104.docx

Contact to the Institute of Soil Science and Agro-chemistry (Erosion and Irrigation is a department at the mentioned institute) at the Academy of Science have been established. Field visit in Ehen with assessment of tree nursery in the school yard, check of availability of hay residuals and needs of fodder per cow. Meetings with the community administration and discussion of the proposed measures.

Short Term Mission February 2017: Planning meetings, site visit and stakeholder meeting Azerbaijan

Document name: Cask_kze20_az_missionreport_Feb_2017_170314.docx

In the field mission to Ehen new potential sites for hazelnut plantations have been selected in close cooperation with local stakeholders from the villages. A road map of activities for 2017 is given in the report including technical advice on afforestation, tree protection and bioengineering activities in the gully erosion. Examples from wooden check dam construction

in Tusheti (Georgia) are included. The hazelnut plantation concept is refined and included in this report.

Short Term Mission April 2017: Implementation of measures and selection of new sites Document name: Cask_kze20_az_missionreport_May_2017_170706.docx

In this mission local stakeholders were trained in building wooden check dams, gabions and fascines. The process is documented in the report in detail giving also the needed working days per activity. Additionally, potential sites for implementation of erosion control measures in Goydan and Dvoryan are assessed and base concepts are given in the report. In the lowland of Ismayilli 5 villages have been assessed for hazelnut plantation on eroded sites (Birinci Yeniyol, Diyalli, Garagaya, Talistan, Tezekend). Finaly Assessment of erosion risk potential in Southern Ismayilli

4.4 Erosion risk assessment by remote sensing

Remote Sensing Concepts on Erosion Control and Pasture Management

Document name: caaz_remote_sensing_concepts_161118e.docx

The report focuses on the development of first concepts on how remote sensing can help to assess current erosion and erosion risk, current landslides and maximum carrying capacities for livestock breeding based on the available biomass and suitable pastures. The following topics are addressed:

- Methodology for assessment of current status of eroded areas based on remote sensing information
- Methodology for erosion risk mapping (including wind erosion risk in lowlands)
- Methodology for an assessment of landslide risks
- Methodology for an assessment of maximum stocking units based on the erosion assessment.
- Changing erosion risks from a climate change perspective

These concepts should provide a sound basis for discussion with national partners to develop final plans and strategies on the national level.

4.5 Hazelnut Concept

Hazelnut plantations could be an alternative land use on steep slopes, where grazing can easily cause surface erosion. To check the potential a draft study was included in the .

First draft Hazelnut Concept (March 2017):

Document name: cask_HazeInut_orchard_base_information_170313.doc

Based on literature review some basic characteristic on ecological requirements (soil, climate), growing requirements, production cycle and maintenance are given. A first assessment of suitability of sites in Isamyilli are included in the report.

Hazelnut plantation concept (November 2017):

Document name: Cask_kze20_az_hazelnut_planting_concept_171113.docx

The first draft concept from March is refined and the chapters on Ecosystem Services, Potential Risks and Benefits as well as on Risk & Challenges are added. The full process from site selection, preparation of sites, planting and maintenance are described. A draft calculation of costs and potential income has been included.

4.6 Study tour

Report on study tour to Austria in September 2016

Document name: cask-13_kze13_studytour_report_160929.docx

The focus for the joint study tour with Georgian and Azerbaijan participants to Austria was to enable a direct experience of current practices in the Alps giving the participants an impression how the issue of land management and erosion control is handled in mountainous areas of Austria. The topics have been: biosphere reserve and national park approach and management, alpine pasture cooperatives, organic cheese production and marketing of local farmer cooperative, cooperative of meet production and marketing, bioengineering for road protection.

4.7 Overview on available information about the pilot villages

	Birinci Yeniyo I	Diyall i	Dvorya n	Ehe n	Garagay a	Goyda n	Talista n	Tezeken d
Screening Report				а				
Baseline Report			а	а		а		
Short Term Mission April 2015: First concept for measures in Ehen				с				
Concept on the implementation process 2016				с				
Detailed implementation								
concept for Ehen 2016 based								
on field mission in June 2016				с				
Short Term Mission October								
2016: Mission report				С				
Short Term Mission February								
2017: Planning meetings, site								
visit and stakeholder								
meeting Azerbaijan				С				
Short Term Mission April								
2017: Implementation of		c						
measures and selection of		C						
new sites	С		С	i	С	С	С	С

Table 4: Overview on village information available in the reports.

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