United Nations Development Programme

(UNDP-GEF)

“Mainstreaming Sustainable Land and Forest Management in Mountain Landscapes of North-Eastern Armenia”

Project

Report

on project work aimed at studying degraded forest and forest adjacent communities pastures of the RA Lori and Tavush marzes, assessment results, implemented rehabilitation measures and organizing works of land cultivation, sowing of fodder crops in demonstrative areas of uncultivated arable lands, as well as providing professional consultation

Yerevan 2018-2020

Content

1. Preface

In scope of the UNDP-GEF "Mainstreaming Sustainable Land and Forest Management in Mountain Landscapes of North-Eastern Armenia" Project, this Report presents project functions and results in regard to the study results of forest and forest-adjacent community degraded pastures of the RA Lori and Tavush marzes, recommendations for implementing rehabilitation measures, and implementation of improvement measures in demonstrative areas selected from degraded forest and forest-adjacent pastures in 8 communities (Gugark, Margahovit, Yenoqavan, Lusadzor, Koghb, Berd, Vahagni and Mets Parni), organization of works of soil cultivation and sowing of fodder crops in demonstrative areas of uncultivated arable lands, as well as providing professional consultations to LSG bodies and economic operators engaged in livestock breeding.

The scope of envisaged project functions is.

1. Studying predetermined 1000 ha forest and forest-adjacent community degraded pastures in Lori and Tavush marzes; identifying cause-effect relationships of degradation and adjustments of the predetermined areas. Preparing recommendations aimed at an increase in sustainability of vegetation restoration and livestock system productivity of specified and adjusted degraded forest pastures with an area of 1000 ha, and for measures underlying further activities.

2. Preparing training materials regarding restoration of vegetation, an increase in sustainability of the livestock system productivity of specified and adjusted forest and forest-adjacent community degraded pastures with an area of 1000 ha. Organizing and delivering training courses on rehabilitation and sustainable use of degraded pastures for 100 residents of forest-adjacent communities in the RA Lori and Tavush marzes, including 30 women.

3. Selection of about 510 ha pilot areas of 1027 ha forest and forest-adjacent community degraded pastures being mapped and studies in administrative territories of 7 target communities of the RA Lori and Tavush marzes (Gugark, Margahovit, Yenoqavan, Lusadzor, Koghb, Berd, Vahagni) for the purpose of organizing and implementing demonstrative rehabilitative improvement measures in line with the elaborated improvement projects.

4. Selection of about 490 ha pilot areas from uncultivated arable lands in administrative territories of 7 target communities of the RA Lori and Tavush marzes (Gugark, Margahovit, Berd, Yenoqavan, Lusadzor and Mets Parni) for the purpose of organizing and performing works of soil cultivation and sowing of fodder crops in line with the previously developed projects.

5. Conducting assessments (monitoring) for clarification of the results ensuing from implementation of demonstrative projects of degraded pasture improvement and cultivation of uncultivated arable lands in target communities - 2019-2020.

The project goal is:

Identification of cause-effect relationships of the degradation and assessment of the degree of degradation, given the study of 1000 ha forest and forest-adjacent community degraded pastures predetermined in target rural communities of the RA Lori and Tavush marzes, as well as adjustment of pilot areas by the mapping of studied and assessed pastures, where the consequences ensuing from the existing degradation occurrences would be the recommendation for complex improvement rehabilitative measures aimed at restoration of the consequences. Delivering training courses and providing consultation on effective pasture use and improvement of degraded pastures for the LSG bodies and pasture user farmers of target communities, as well as selection of around 510 ha degraded areas from studied forest pastures, and organization and implementation of improvement rehabilitative measures in the selected areas. It would be selection of about 490 ha uncultivated areas from uncultivated arable lands from 7 target communities, organization and implementation of works of soil cultivation and sowing of fodder crops in line with the previously developed projects with the view to managing field fodder production, as well as providing professional consultation to the LSG bodies and economic operators engaged in livestock breeding regarding sustainable management of natural forage lands and effective cultivation of arable lands in course of performing the works.

The project activities were performed in 2018-2020 in accordance with the schedule defined under the Terms of Reference.

2. Introduction

To provide opportunities for maintenance of natural forage lands in mountain landscapes being formed by plant symbiosis and normal reproduction of the existing vegetation cover, the key issues would be mostly conditioned by performing efficient and sustainable management (pasture use and grass mowing) in these areas, mainly based on permanent study and assessment of the ecological condition and productive potential of pasture and grassland resources. General biological and agricultural diversity of the surrounding environment, including the natural forage lands (pastures and grasslands), is an important basis for life and subsistence; along with its long-term use, maintenance of areas with such resources is, in the meantime, a necessary condition; so is also implementation of artificial rehabilitation measures aimed at restoration of certain degraded sections. In case of the latter, implementation of various reasoned measures will contribute to the productivity of natural forage lands – grasslands and pastures, as well as enrichment and protection of biological diversity.

In many rural communities of different RA marzes, much work is being carried out in the project functions implemented by various international and local organizations and companies (aimed at development of the livestock sector, environment protection, sustainable biodiversity management) for mitigation, reduction of ecological problems (risks) arisen in the ecological system of the surrounding environment from spontaneous livestock management, as well as for development and application of functions aimed at efficient and sustainable management of natural forage lands. The UNDP-GEF **"Mainstreaming Sustainable Land and Forest Management in Mountain Landscapes of North-Eastern Armenia"** project is also one of such projects; the main goal of its implementation is to improve sustainable management of lands and forests in the North-Eastern regions of Armenia with the view to ensuring continuous flow of diverse ecosystem services. By adopting working modes that are harmless for sustainable management of pastures, the natural resources, and the surrounding environment, contribute to reduction of the pressure exerted on the mountain ecosystems of the North-Eastern section of Armenia, including the forests, so as it would be possible to ensure the integrity and normal development of ecosystems, as well as continuous supply of ecosystem services, such as ensuring carbon absorption.

The objective of the implemented project is to exhibit a model for sustainable management of natural resources in mountain pastures and forests of Armenia, that, under the conditions of climate change, will enhance carbon absorption capacity of ecosystems, in the meantime, maintaining the biodiversity and economic values.

3. Planned functions

The project activities were performed in 2018-2020, in accordance with the schedule defined under the Terms of Reference. The works were performed in Berd, Ijevan, Noyemberyan regions of Tavush Marz, as well as Gugark and Spitak regions of Lori Marz.

To implement the envisaged project, the following target communities and community settlements were selected by marz regions – Berd community (Navur and Artsvaberd settlements) from Berd region; Yenoqavan and Lusadzor communities from Ijevan region; Koghb community from Noyemberyan region; Margahovit, Gugark and Vahagni communities from Gugark region; Mets Parni community from Spitak region.

Selection of the communities and community settlements was conducted based on landscape zoning, prevalence of forests and forest pastures in the community administrative territories, the main direction of economic activity (livestock breeding) in the communities and community rural settlements, as well as willingness of the community to the project implementation. In administrative territories of communities, studies were conducted in forest and forest-adjacent degraded community pasture areas.

Performed functions are:

1. Site inspection of forest and forest-adjacent pasture areas within administrative territories of target communities and community settlements selected from different regions, and selection of degraded pastures. Based on GI coordinates of the sampling taken from the selected areas, mapping was conducted to adjust the sites and pilot areas.
2. In selected pilot areas, field studies (monitoring) were conducted, through which ecological-economic conditions of pasture symbiosis, and the degree and the nature of the degradation existing in pastures were assessed.
3. By the analysis of the data produced through field surveys and assessments, cause-effect relationships of the degradation existing in pasture areas were clarified.
4. To mitigate, eradicate the degradation occurrences existing in the assessed pasture areas, and to restore the consequences ensuing from the degradation, complex rehabilitative improvement programs were elaborated by the degree and nature of degradation, and material cost for implementation of each community project was calculated.
5. To reduce the seasonal (early spring period) livestock number load in the assessed forest and forest-adjacent pastures and to improve the ecological-economic condition of pastures at a normal pace, alternative solutions were elaborated (development of field fodder production) with the view to solving problems of housing fodder provision and increasing sustainability of the livestock system productivity in the communities.

6. For LSG bodies of target communities and pasture user farmers (residents engaged in livestock breeding within communities), training courses on efficient pasture use, sustainable pasture management, as well as restoration/improvement of degraded pastures were organized and delivered. Training consultative materials on efficient pasture use and sustainability of livestock system productivity were elaborated and provided.
7. Organization, implementation of improvement measures (surface improvement agro-measures) in the areas selected from degraded pastures and uncultivated arable lands of communities and field works (soil cultivation and sowing), as well as ensuring control.
8. Conducting studies and assessments in degraded pasture areas having improvement measures implemented and in the demonstrative arable land areas having field works performed to assess the efficiency of the taken measures.

4. Performed works and the results

The envisaged project activities were performed in 2018-2020 **in four phases**.

Phase one - the activities envisaged in 2018 incorporated selection, mapping, assessment of degraded pasture areas in administrative territories of target communities, and elaboration of improvement programs and field fodder production projects for alternative fodder provision with the view to increasing the sustainability of livestock system productivity.

Phase two - in 2018, training courses on effective and sustainable pasture use, and restoration/improvement of degraded pastures for LSG bodies and pasture user farmers of target communities were envisaged and delivered.

Phase three - activities envisaged in 2019 included community meetings; presentation and discussions of projects; selection of areas for improvement from degraded pastures being studied, assessed and mapped in administrative territories of target communities; selection of demonstrative areas from uncultivated arable lands to conduct soil cultivation and to sow fodder crops, and compiling the work plan for already elaborated improvement projects and performing field works; and performing the works. Professional consultancy was provided regarding improvement measures and performance of field works.

Providing professional consultancy in 2019, improvement agro-measures and field works were performed in demonstrative areas of each target community as provided for under the project, which continued also in 2020.

Phase four - in 2019, preliminary field assessments were conducted in degraded pasture areas having rehabilitative improvement measures implemented, as well as in selected demonstrative arable land areas having soil cultivation and fodder crop sowing carried out to clarify the efficiency of performed works for the improvement of the ecological and economic conditions of degraded pastures (in selected pilot areas), eradication of the existing degradation, as well as for improvement of productivity of arable lands and qualitative indicators of the produced crop production.

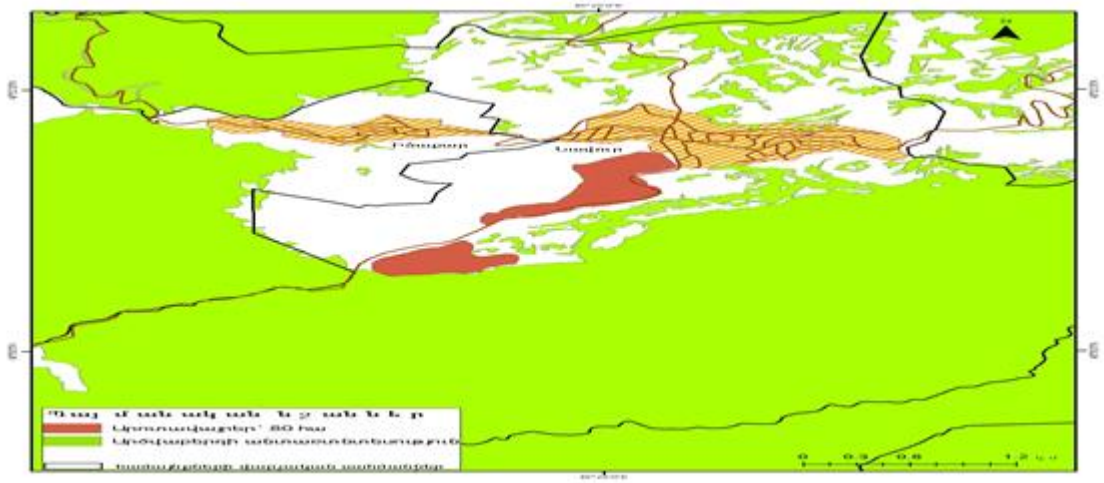
Assessment process of the results obtained through similar measures, being implemented in 2020, has not yet been completed.

4.1 Selection of degraded pasture areas and conducting mapping (2018)

Given the field observations conducted in target communities selected from Tavush and Lori marzes, degraded pasture areas were selected in administrative territories of target communities, where pilot area mappings were conducted by GIS sampling coordinates (via Remote Sensing system).

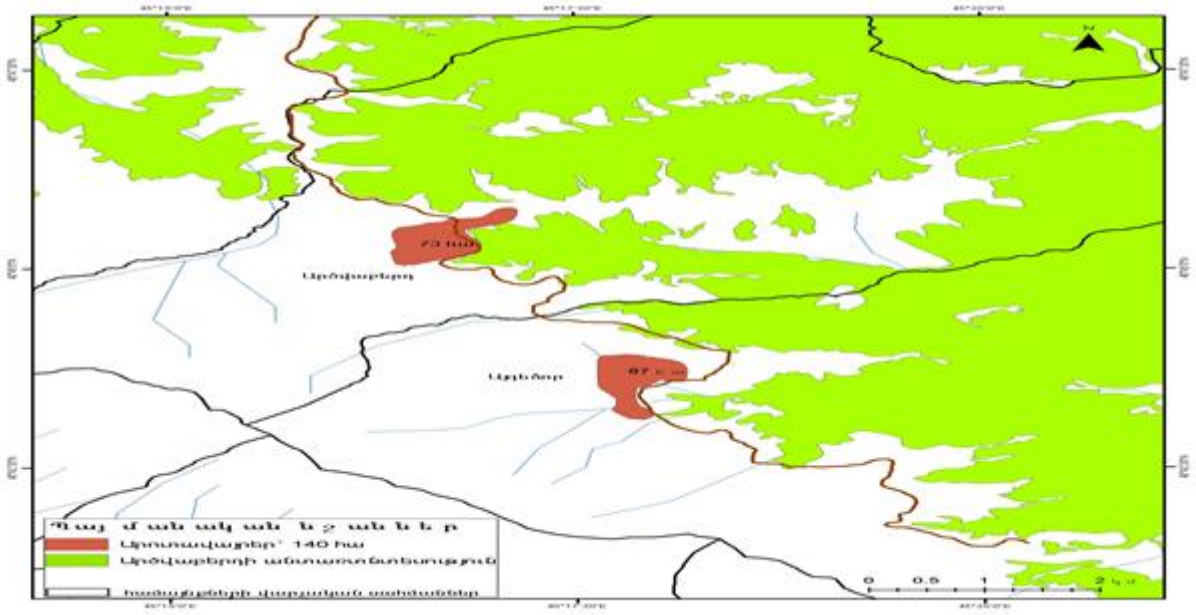
In administrative territory of the Berd consolidated community from Berd region, three different degraded pasture areas were specified and mapped - 2 different sites, with a total area of 80 ha, were selected and mapped from the forest pasture called Mamad Ghlas adjacent to Navur settlement.

Areas selected from Mamad Ghlas pasture in Berd community



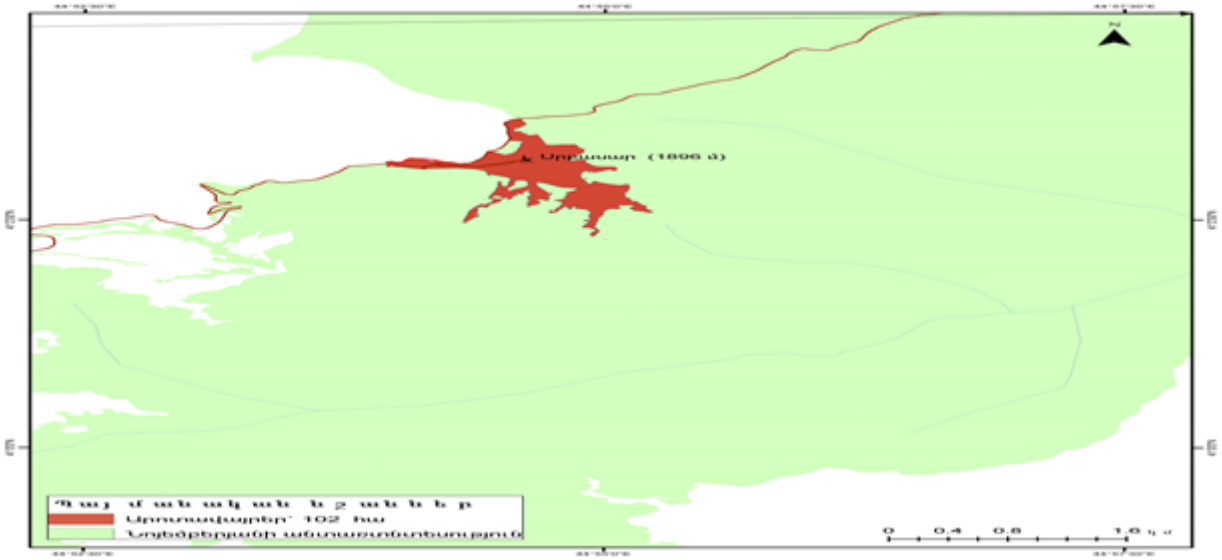
In forest-adjacent pasture areas of summer pasture land called Chatagh area, being registered in administrative territories of Artsvaberd and Aygedzor rural settlements of Berd Community, two degraded pasture grounds, 140 ha in total area, were selected and mapped.

Areas selected from Chatagh area pasture in Berd community



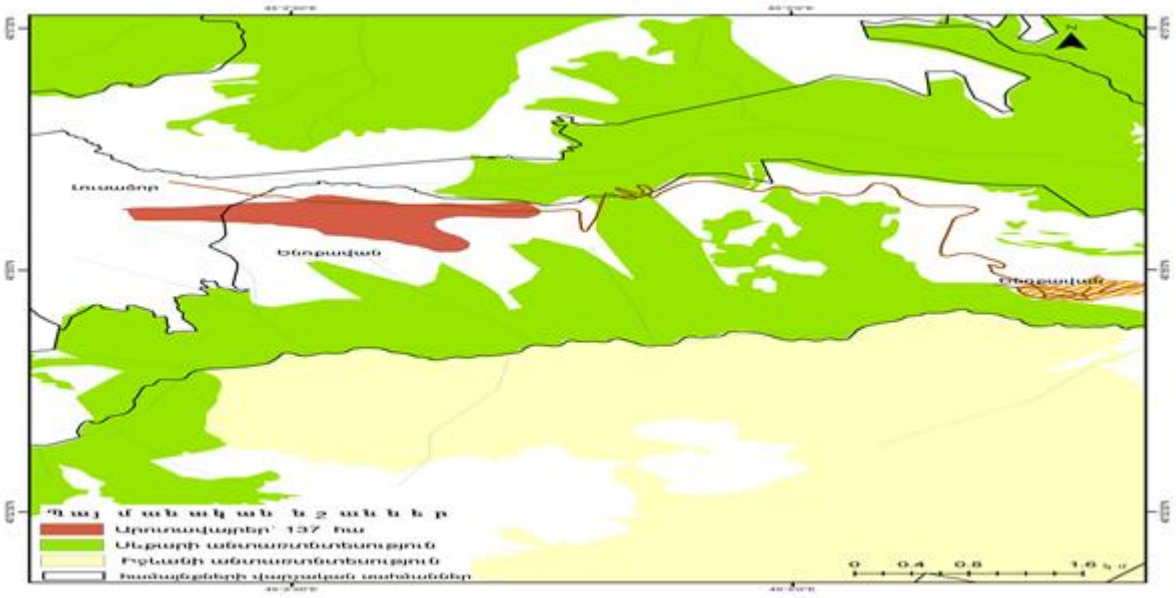
In the administrative area of Koghb rural settlement in Noyemberyan region, forest degraded pasture, with a total area of 102 ha, called Srbasar for summer pasturing was selected as a pilot area.

Areas selected from Srbasar summer pasture in Koghb community

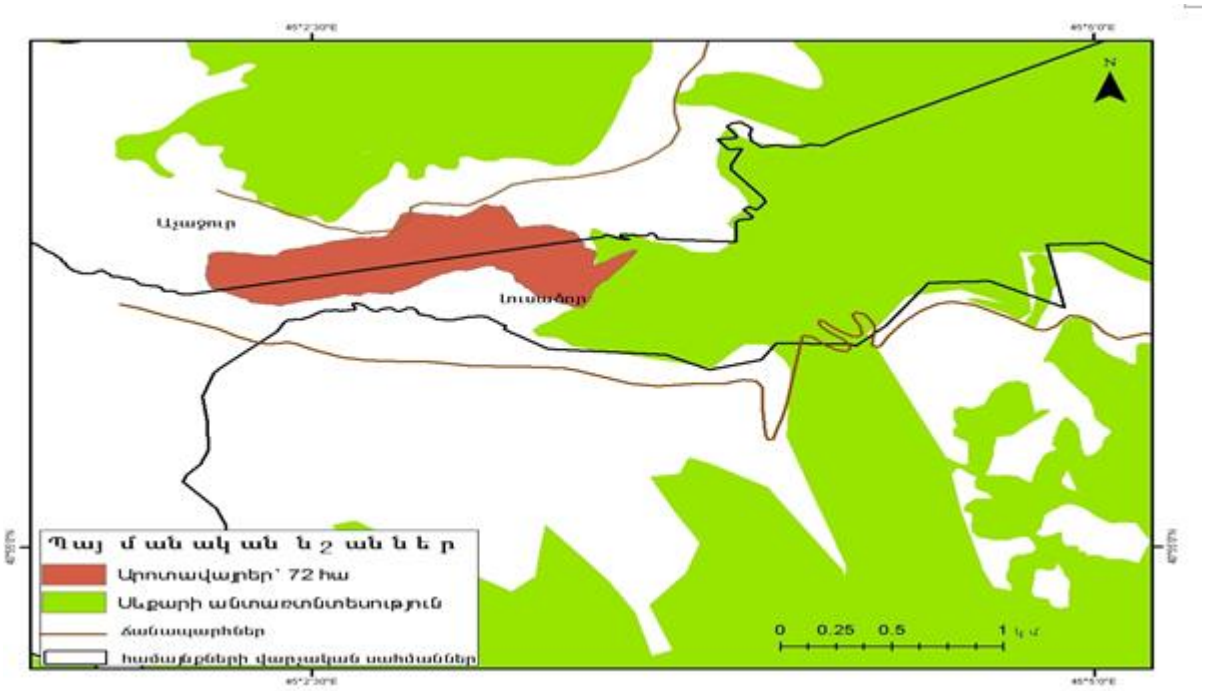


In administrative territories of Yenoqavan and Lusadzor communities, in Ijevan region, degraded areas, with total areas of 137 ha and 72 ha, respectively, from summer pastures of Pstik Sar (Yenoqavan) and Agrichay (Lusadzor) were selected as pilot areas.

An area selected from Pstik Sar pasture in Yenoqavan community

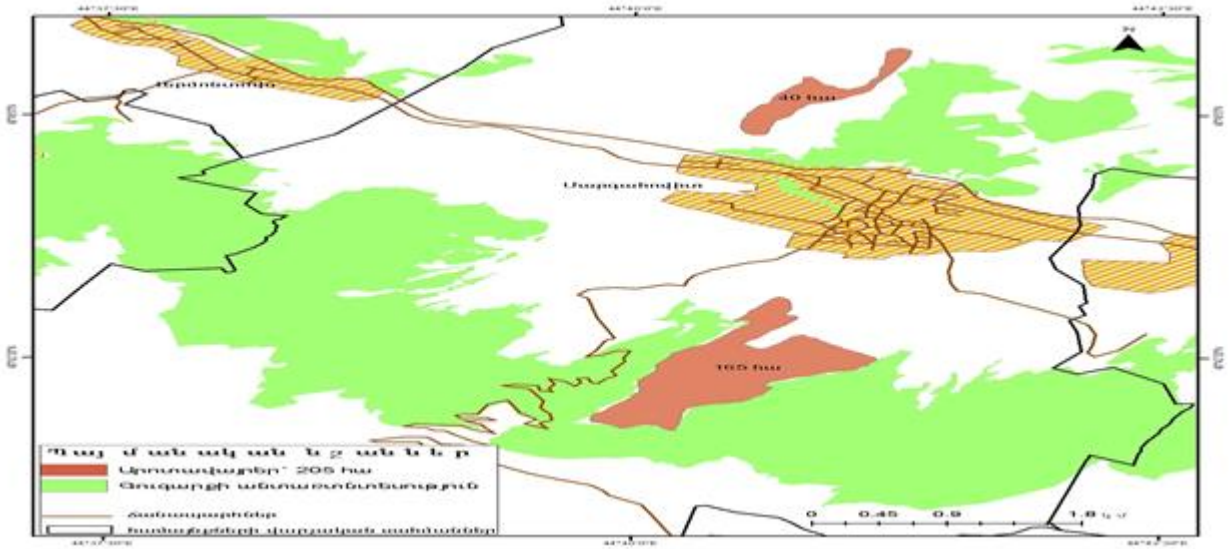


An area selected from Agrichay pasture in Lusadzor Community

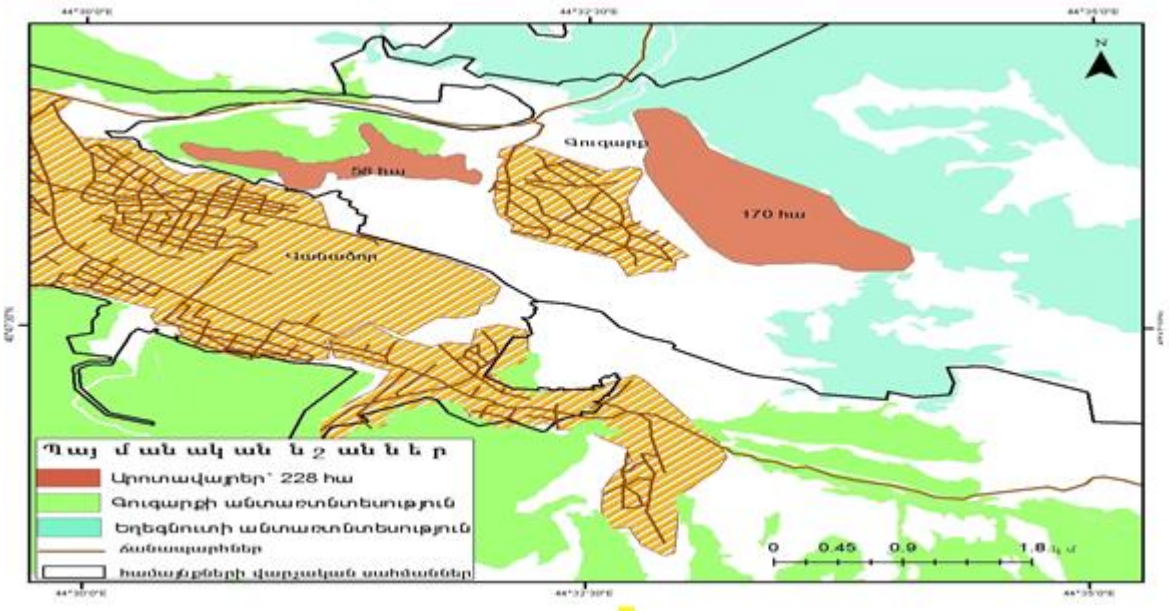


In administrative territories of Margahovit and Gugark communities from Gugark region of Lori Marz, 4 degraded forest pasture areas were selected, with a total area of 433 ha, of which two pasture lands with a total area of 205 ha in Margahovit community, in forest pastures called Shori Tala (165 ha) and Sari Hogher (40 ha), and in Gugark community – two pasture grounds with an area of 228 ha – in forest pastures of community significance called village-adjacent Sari Glukh (58 ha) and Ker Hogher (178 ha).

Areas selected from Shori Tala and Sari Hogher Pastures in Margahovit community



Areas selected from Sari Glukh and Ker Hogher pastures in Gugark community



In degraded pasture areas selected in administrative territories of target 7 communities in Tavush and Lori marzes, field studies (monitoring) and assessments were conducted with the view to clarifying ecological-economic conditions of pasture symbiosis and the degradation existing in pastures.

4.2 Assessment of ecological-economic condition of selected degraded pasture areas

Field studies in pastures (for the purpose of assessment) were conducted by the methodology referred to in “Manual for Monitoring of Pastures, Armenia” elaborated in scope of “Sustainable Management of Biodiversity, South Caucasus” Project implemented by the German Agency for International Cooperation (GIZ), as well as “Technical Reference 1737-7 of Ecological site Inventory” (Technical Reference 1737-7 of Ecological site Inventory, Colorado, 2001, NSTC, BLM)” elaborated by the Bureau of Land Management of the National Science and Technology Center, Colorado, taking into account also the main provisions of the RA Government Decree No. 389-N, dated April 14, 2011, regarding Regulation “On pasture and grassland use”.

Given field studies and assessments conducted in degraded pasture areas, being selected for the project implementation, within administrative territories of 7 target communities average vegetation coverage of plant habitat, botanical composition of vegetation - primitive plant aggregations, the correlation of the latter, percentage of the content of good quality (edible) fodder plants in the total vegetation cover (Table 1) were clarified. The degree of degradation and erosion proneness also was assessed; erosion proneness (EPI), pasture degradation (PDI) and pasture condition indicators (PCI) were calculated. Given the latter’s clarification, the economic value of pastures by actual load permissibility with conventional large unit (CLU) was assessed (Table 2).

In general, 12 different pastures from 7 communities, with a total area of around 1027 ha, were studied and assessed.

Table - 1

Characteristic of the condition of selected pastures

Community	Settlement	Pasture	Area (ha)	Vegetation coverage (%)	Graminaceous, legumes species (%)	Mixed herbs (%)	
						total	of which non-edible plants of poor quality
Berd	Navur	Mamad Ghlasi	80	78	48	52	13
	Artsvaberd	Chatagh	73	82	54	46	17
	Aygedzor	Chatagh	67	80	52	48	19
Yenoqavan	Yenoqavan	Pstik Sar	137	74	44	56	26
Lusadzor	Lusadzor	Agrichay	72	77	49	51	13
Noyemberyan	Koghb	Srbasar	102	84	53	47	18
Margahovit	Margahovit	Shori Tala	165	76	49	51	15
		Sari Hogher	40	82	54	46	12
Gugark	Gugark	Sari Glukh	58	74	47	53	11
		Ker Hogher (Shajnaktorner)	170	73	51	49	13
Vahagni	Vahagni	Yaler and Garan Gyaduk	63	71	54	46	10

According to the analysis results of the data obtained from field assessments (Table-2), it becomes clear that average vegetation coverage of any unit area in various selected areas of target communities is 71-84%, which is a relatively low indicator and would largely affect the vegetation cover productivity (crop yield) indicators. The content of good quality fodder crops (grain crop and legumes) in the existing vegetation cover is rather low (44-54%), and the content of mixed herb species is relatively high (46-53 %). The latter contains a significant amount of harmful, poor quality, non-edible and poisonous species (10-26 %).

In Chatagh summer pasture areas of Berd community, white hellebore poisonous semi shrub plant species are widely spread, and its prevalence has significantly contributed to the reduction of qualitative indicators of pasture grass cover and caused serious problems for organizing sustainable animal behavior of live-stock animals in these pasture areas. With such species, rapid increase in

fouling of pasture areas of this section contributes also to the gradual decrease of many species of high-quality edible grass plants and to crowding out of symbiosis.

Degraded pastures

Lusadzor Gugark Margahovit Yenoqavan

The qualitative composition of the existing vegetation is significantly deteriorated in the assessed areas; biodiversity is depleted. There is significant amount of trampling and poor plant species related compactions. Particularly, expansion of bare (vegetation-free) path-like turfless sections formed through trampling related compaction and areas with thinned vegetation cover contributed to the development of fragmental erosion occurrences of the fertile soil layer.

Ecological condition of selected areas accounts for the degree of degradation of the latter, and indicators thereon being calculated by the assessment is presented in Table-2.

Table-2

Characteristic of ecological-economic condition of selected pasture areas

Community	Settlement	Pasture a	area /ha/	PDI	EPI	PCI	Permissible load of pasture CLU/HA
Berd	Navur	Mamad-Ghlasi	80	2.5	2.5	5.0	0.6
	Artsvaberd	Chatagh area	73	2.5	2.5	5.0	0.6
	Aygedzor	Chatagh area	67	0	2.5	2.5	0.4
Yenoqavan	Yenoqavan	Pstik Sar	137	0	2.5	2.5	0.4
Lusadzor	Lusadzor	Agrichay	72	2.5	2.5	5.0	0.6
Noyemberyan	Koghb	Srbasar	102	2.5	2.5	5.0	0.6
Margahovit	Margahovit	Shori Tala	165	0	2.5	2.5	0.4
		Sari Hogher	40	2.5	5.0	7.5	0.8
Gugark	Gugark	Sari Glukh	58	2.5	2.5	5.0	0.6
		Ker Hogher	170	2.5	2.5	5.0	0.6
Vahagni	Vahagni	Garan Gyaduk	63	2.5	2.5	5.0	0.6

Note: *red color – high risk; yellow color – average risk.*

Given the analysis and calculation of the indicators obtained through field assessments, it was found that the degradation of selected pasture areas (PDI) is in the range of average and high risks. In the assessed pasture areas, erosion proneness indicator is mainly within the range of average risk.

Pastures with degraded vegetation cover

Navur Yenoqavan Margahovit Koghb

4.3 Assessment of cause-effect relationships of pasture area degradation

In various selected pastures, mainly degradation of different nature and intensity was seen, being mostly expressed by deterioration of the plant habitat condition and qualitative and quantitative indicators of the vegetation cover.

According to the analysis of the data produced from the field monitoring results, it was found that degradation in selected pastures is mainly man-induced and is attributed to irregular and spontaneous pasture use going on for years in pasture areas. Especially in the early spring period, when vegetation cover has not yet provided sufficient outgrowing, while grazing takes place in these areas with free behavior, such process contributed to gradual depletion of the pasture turf layer through trampling and creation of vegetation-free path-like formations (trampling related compaction). The density of animal units being taken for grazing in the areas also contributed to the occurrence and intensification of the degradation that is available in pastures; this is a case where grazing by the live-stock animals mainly with irregular free behavior in the same pastures for a long-term period (the entire grazing period) contributed to soil hardening, caused by trampling, and deterioration of airing, as well as to the decline in good quality edible plant species caused by overgrazing and an increase in poor quality, harmful (non-edible) species.

Formation and intensification of the current degradation occurrences in community pastures is mainly attributable to irregular and spontaneous pasture use, some of the main reasons of which are:

- ✓ insufficient knowledge and professional capacities of pasture user farmers in terms of efficient management of natural forage lands;

- ✓ low professional capacities of LSG bodies and their inconsistent attitude to the process of organizing sustainable pasture management;
- ✓ social-economic problems existing in communities;
- ✓ limitation in the access to pastures due to the distance from pastures, lack or insufficient condition of pasture infrastructures (roads, ponds, paddocks for summer behavior, farmhouses);
- ✓ existing problems regarding poor fodder provision for ruminant live-stock animals during housing period and fodder stocking for housing period (along with the development of field fodder production).

Given the above-stated main reasons, nowadays in pasture areas of target communities spontaneous and irregular pasture using is underway, without taking into account permissible and reasonable pasture use timing and duration, permissible norms of the livestock number load on pasture grounds. Resulting from such practice, as a consequence, degradation having occurred and evolved in rather big areas of natural pastures, resulted in occurrence and intensification of serious economic and environmental problems. Improvement of environmental and economic conditions and restoration of the normal development regularity of vegetation cover in already degraded pastures assume artificial interventions for implementation of sustainable management and complex agro-technical rehabilitation measures.

5. Developing projects to improve degraded pastures and to increase the sustainability of the livestock system productivity

In view of the current condition of the pastures assessed in administrative territories of target communities (selected degraded areas), i.e. the degree and the nature of degradation, complex projects with artificial rehabilitation/improvement measures were developed, implementation of which would possibly ensure comprehensive improvement of ecological and economic conditions of the areas – increase of the extent of vegetation coverage, increase in the assimilating surface, enrichment of vegetation, improving productivity and qualitative indicators of the vegetation cover.

Selection of the envisaged rehabilitative measures was attributed to the condition of selected areas, and reasonableness of any measure that is required for ensuring potential rehabilitation/improvement. Mainly complex agrotechnical improvement measures were envisaged; particularly, measures for cultural-technical, nutritional and air regime improvement and those for grass sowing through undersowing, which are aimed at increasing useful vegetation surfaces of degraded areas, removal of poisonous semishrub plant species, handling the turf layer, improvement of the soil layer airing, nutritional enrichment, prevention of any surface soil removal, as well as enrichment of the existing vegetation and increasing vegetation coverage.

As the main reason of the existing degradation in target community pasture areas is uncontrolled, irregular and termless pasture use, where the biggest impact (pressure) on the pasture vegetation is created mainly due to the grazing going on during early spring period (before sufficient outgrowing of pasture vegetation), it was recommended to consider feasible prevention of the pasture use in early periods (before sufficient outgrowing of pasture green plants) as a priority condition with the view to mitigating existing degradation in pastures and ensuring possible self-restoration of vegetation cover at a normal pace. Taking ruminant animals to pastures in early periods is mainly conditioned by the shortage of housing fodder stocks in households. For any possible solution of the problem, development of field fodder production in communities with potential support was considered as a necessary condition that will also contribute to enrooting of fodder crop rotation through cultivation of already turf-bound arable lands and those being left without cultivation for a long time, and formation of a sustainable fodder base. In case of the latter, given solution of the problem regarding fodder provision for the housing period, seasonal (early spring) pressure in pastures will be significantly reduced.

Taking into account this fact, with the view to improving degraded pasture areas through artificial intervention and to ensuring possible self-restoration at a normal pace, two approaches were recommended and applied:

1. implement demonstrative complex surface improvement measures in pilot sections selected from degraded pasture areas, being selected in each community, with the view to excluding the

consequences of the existing degradation and improving the ecological and economic condition of forage land through an artificial intervention;

2. for the purpose of establishing a sustainable fodder base required for the housing period, support the communities in developing field fodder production sector through technical means (agrotechnics), so as it would be possible to prevent pasture grazing during earlier periods, given housing fodder provision, and to ensure self-restoration of degraded vegetation cover at a normal pace.

In case of the latter, sufficient opportunities will be created for preventing pasture use during early spring period (before sufficient outgrowing of pasture grass cover), that will afford opportunities for the gradual increase of vegetation coverage in degraded pastures at a normal pace, maintenance of plant cover and species, as well as ensuring normal self-restoration due to mitigation of the existing degradation. In the meantime, this approach will also contribute to stimulation of the use of already turf-bound and uncultivated arable lands available in communities for their operational significance, which may be also of great importance for increasing sustainability of the livestock system productivity.

To implement the project with both proposed approaches, comprehensive community projects were elaborated with the view to implementing rehabilitative improvement measures in degraded pastures, developing field cropping and supporting with agrotechnics. The material cost for implementation of community projects was calculated

Business meeting and discussions



To implement the projects with the recommended approaches, arable land areas for field fodder production and the degraded pasture areas for making surface improvements were calculated by the communities (Table – 3). In the meantime, given the discussion with the LSG bodies, brand names and units of the agrotechnics and technical means to be provided to communities through co-financing was assessed by priority and need.

Table-3

Areas in target communities for performing surface improvements and field fodder production, ha

Community	Name of the improved area	Improvement and field cropping areas; envisaged measures (ha)				
		Total ha	**Undersowing with mixed grass crop + raking**	**Only raking ha**	**Removing poisonous weeds ha**	**Sowing in arable lands ha**
Gugark	Shajnaktorner, Sarik Glukh	**125**	25	85	-	15
Margahovit	Shori Tala, Sari Hogher	**140**	45	65	-	30
Vahagni	Yaler and Garan Gyaduk	**63**	40+23	-	-	-
Mets Parni	Community arable lands	**130**				130
Total Lori Marz		**458**	**133**	**150**	**-**	**175**
Yenoqavan	Pstik Sar	**100**	10+10	60	-	20
Lusadzor	Agrichay	**65**	10	20	-	35
Koghb	Srbasar	**7**	7			
Berd-Navur	Mamad Ghlasi	**30**	30	-	-	-
Berd – Artsvaberd	Chatagh area	**30**	10	20	-	-
Berd – Artsvaberd	Chatagh area	**50**	-	-	50	-
Berd – Artsvaberd	Community arable lands	**260**	-	-	-	60+200
Total Tavush Marz		**542**	**77**	**100**	**50**	**315**
Total ha		**1000**	**210**	**250**	**50**	**490**

According to the elaborated projects, it is envisaged to carry out surface improvements of 510 ha degraded areas in administrative territories of 8 communities, of which in 210 ha area – application of complex agrotechnical measures; aeration improvement only by raking in 250 ha severely trampled areas, and mechanical control measures only to eradicate poisonous plant species. In the meantime, it was envisaged to carry out soil cultivation and sowing of fodder crops on uncultivated arable lands, in 490 ha area, to manage field fodder crop production.

By handling field fodder production on turfed and uncultivated arable lands with an area of about 490 ha and implementing improvement measures in 510 ha degraded pastures, a model of sustainable management of natural resources (soil, natural vegetation cover) and productivity increase was exhibited in communities, which in addition to its great economic significance, will also contribute to an increase in

carbon absorption capacity from atmosphere through ecosystems under the conditions of climate change, in the meantime maintaining the economic value of natural diversity and ecosystem. With the project implementation, sufficient conditions were created in communities to tackle the problem of fodder provision during housing period and to reduce the pressure of grazing n pastures during early spring period (before sufficient outgrowing of grass plants).

6. Training and consultation for capacity building in restoration and sustainable use of degraded pastures

In target communities, for the LSG bodies and pasture using farmers training courses with previously elaborated agenda and thematic plan were organized regarding sustainable management and efficient use of pastures, and the methodology and procedure of implementation of rehabilitative improvements in degraded pastures. Information and educational materials on sustainable pasture management and the methods for implementation of rehabilitation/improvement measures in degraded pasture areas had been previously elaborated and provided to the community population participating in the training courses. The training courses presented ecological and economic significance and importance of pastures. The role and significance of pastures in protection of biodiversity, in the processes of various ecosystem service provision and ensuring carbon absorbing capacity from the atmosphere was interpreted as a component part of the ecosystem. Significance of pasture-meadow fodder production, as production means, in development of the livestock sector and in increasing the profitableness from this sector for households in such communities was explained.

Potential ecological problems and consequences arising in the surrounding environment as a result of spontaneous and irregular pasture use were clarified. Particularly, ecological problems – degradation, soil removal - occurring in pastures as a result of overgrazing going on with free irregular behavior and high trampling. Problems arising from the animal unit grazing in forest areas, particularly, the pressure on newly formed tree plants and young shoots, distorting the normal self-restoration process of forests. The reasons of degradation occurrence and possible ecological and economic consequences resulting from degradation, were presented with professional interpretation. The methods of implementing artificial rehabilitation measures in degraded pastures, the procedure and necessity of implementing organizational measures aimed at ensuring potential self-restoration in degraded pastures were taught. Professional consultation was provided with the view to capacity building in implementation of key rehabilitation measures in degraded pastures. With thematic trainings, the significance of measures prescribed in the projects, being developed for rehabilitation of selected demonstrative degraded pasture areas, technological peculiarities of performance, the procedure and timing for implementation of envisaged agrotechnical measures were explained in each community.

As a result of the training courses, gaining sufficient initial knowledge and information, the participant LSG bodies and community population (economic operators engaged in livestock breeding) developed capacities in efficient pasture use practices and implementation of the required rehabilitative agrotechnical measures in degraded pasture areas.

In general, the total number of the participants of the training courses, being organized and delivered in communities, was 81 (of which 33 were women).

Training courses and consultation in communities on sustainable pasture management and improvement of degraded areas




7. Organization of improvement works in selected degraded areas

According to previously elaborated improvement programs, in all selected improvement areas, except for the pasture called Chatagh area in Berd community, surface improvement agro-measures (stone gathering, shrub removal, raking, fertilizing through N :P :K mineral fertilizers and undersowing with multicomponent grass mixture) were implemented in 2019-2020, and in the 50 ha area selected in Chatagh area, mechanically applied devitalization measures for white hellebore poisonous semishrub were implemented and those are still underway.

In selected degraded pasture areas, to improve soil airing before outgrowing of vegetation cover in spring, raking, 4-6 cm deep, was conducted with toothed rakes and disk harrows; raking was combined with fertilization using mineral phosphoric (concentrated superphosphate) and potassium (potassium chloride), with a norm of 100 kg (P) and 75 kg (K) chloride per hectare, respectively. To enrich the qualitative composition of the existing vegetation cover, to thicken the overall vegetation coverage of the area, to increase the productivity of forage land (crop yield), as well as to enrich the qualitative composition of the resulted production (pasture phytomass), undersowing with multi-component grass mixture (mixture of biologically compatible graminaceous and legumes fodder grass plant seeds) was conducted (with a norm of 15-20 kg per ha) in combination with harrowing. According to the timeline approved for the previously elaborated improvement projects and project implementation, the improvement agro-measures of the areas selected in target communities of various regions were implemented in different time periods. In the period of rapid vegetation outgrowing in forage lands (in the third 10-day period of April and the first 10-day period of May), mineral nutrition with nitrogen fertilizers (ammonium nitrate) was organized and implemented by the N_{60} norm – the norm of 170 kg for 1 ha, to stimulate outgrowing of grass plants and to improve nutrition of newly formed plants. In 2019, of degraded pasture areas selected in 6 communities as provided for under the Work Plant, rehabilitative improvement measures were implemented in around 87 ha areas. In the 30-ha area being selected from Chataghi area in Berd community, mechanical eradication of poisonous semishrubs was carried out.

Improving air regime of soil through raking

Improvement of nutritional regime through mineral fertilization



Thickening vegetation cover through undersowing and harrowing



Removal of harmful semishrubs



8. Organizing field cropping in areas selected from uncultivated arable lands

In 2019-2020, in 490 ha areas selected from uncultivated arable lands of target communities, works of soil cultivation and sowing of crops of fodder significance were performed for the purpose of managing field fodder production. Field cropping works were organized and implemented in accordance with elaborated projects and timeline. In the total of 490 ha demonstrative areas being selected in all communities, sowing of perennial grasses was carried out with alfalfa and melilot seed materials. Sowing of the main fodder crops was combined with undersowing of grain crops, as a cover. For the alfalfa crop, 25 kg/ha seed material was defined as a norm for sowing; for the melilot – 150 kg/ha seed material. As per 'crop as cover' project, it was envisaged to use spring sowing barley seed material (with 150 kg/ha norm); however, as it was impossible to provide sufficient quantities of the barley seed material, in the main share of the sowings being carried out, spring sowing of wheat seed material was used with 150 kg/ha norm.

Plowing and sowing works

9. Preliminary assessment of the ecological-economic condition in pasture areas with improvement measures being implemented

In 2019, field studies in pastures (for the purpose of assessment) in demonstrative areas, with surface improvement measures being implemented, were conducted by the methodology referred to in "Manual for Monitoring of Pastures, Armenia" elaborated in scope of "Sustainable Management of Biodiversity, South Caucasus" Project implemented by the German Agency for International Cooperation (GIZ), as well as "Technical Reference 1737-7 of Ecological site Inventory" (Technical Reference 1737-7 of Ecological site Inventory, Colorado, 2001, NSTC, BLM)" developed by the Bureau of Land Management of the National Science and Technology Center, Colorado.

Given the field studies and the preliminary assessments, average vegetation coverage of areas (plant habitat), botanical composition of vegetation - primitive plant aggregations, the correlation of the latter, percentage of the content of good quality (edible) fodder plants in the total vegetation cover were found out. The recorded preliminary data were compared with the existing baseline data to explain the efficiency of the measures implemented. The recorded data are presented in table in a manner of preliminary comparison (Table 4).

Possible changes in the degree of degradation and erosion proneness, being recorded in the improved areas (baseline indicators) also were assessed; erosion proneness (EPI), pasture degradation (PDI) and pasture condition indicators (PCI) were calculated. Given the explanation regarding the latter, preliminary changes of the current condition in pastures and the economic value contingent thereon by actual load permissibility with conventional large unit (CLU) were assessed (Table 4).

Table - 4

Preliminary characteristic of the condition of improved pasture sites /baseline and preliminary comparable data, 2019/

Community	Settlement	Pasture Area	Recorded results	Vegetation coverage, (%)	Legumes and graminaceous species (%)	Mixed herbs (%)	
						Total	of which poor quality weeds
Berd	Navur	Mamad Ghlasi	Baseline	78	48	52	13
			Preliminary	90	59	41	10
	Artsvaberd	Chatagh area	Baseline	82	54	46	17
			Preliminary	80	61	39	11
Yenoqavan	Yenoqavan	Pstik Sar	Baseline	74	44	56	26

			Preliminary	80	54	46	14
Lusadzor	Lusadzor	Agrichay	Baseline	77	49	51	13
			Preliminary	81	57	43	7
Koghb	Koghb	Srbasar	Baseline	84	53	47	18
			Preliminary	87	61	39	12
Margahovit	Margahovit	Shori Tala	Baseline	76	49	51	15
			Preliminary	91	67	33	6
Gugark	Gugark	Sari Glukh	Baseline	74	47	53	11
			Preliminary	92	66	34	6

According to the analysis results of the data obtained through preliminary assessments (Table – 4), it becomes clear that average plant coverage of a unit area in various areas selected from target communities has increased by 3-18%, except for Chataghi area pasture site in Berd community, where reduction in vegetation coverage is seen, being mainly attributable to the removal of poisonous semishrubs.

The actual preliminary ecological condition of the selected areas is attributable to the degree of the latter's degradation; in this regard, the calculated indicators of the results obtained from the preliminary assessment are presented in Table – 5.

Table -5

Preliminary characteristic of the ecological-economic condition of selected pastures 2019

Community	Pasture	area /ha/	Baseline			Actual			PLP CLU/HA
			PDI	**EPI**	**PCI**	**PDI**	**EPI**	**PCI**	
Berd	Mamad – Ghlasi	10	2.5	2.5	5.0	5.0	2.5	7.5	0.8
	Chatagh area	30	2.5	2.5	5.0	5.0	2.5	7.5	0.8
Yenoqavan	Pstik Sar	10	0	2.5	2.5	2.5	2.5	5.0	0.6
Lusadzor	Agrichay	10	2.5	2.5	5.0	2.5	2.5	5.0	0.6
Noyemberyan	Srbasar	7	2.5	2.5	5.0	5	2.5	7.5	0.8
Margahovit	Shori Tala	10	0	2.5	2.5	5	2.5	7.5	0.4
Gugark	Sari Glukh	58	2.5	2.5	5.0	5	2.5	7.5	0.8

Note: *red color – high risk; yellow color – average risk, green color – low risk.*

As per the analysis and calculation of the data obtained through field assessments conducted in 2019, it becomes clear that after implementation of improvement measures in the selected pasture areas, ecological and economic conditions of pastures have changed significantly; the degradation indicator

(PDI) changed from high risk to average and low risk. In the assessed pasture areas, the erosion proneness indicator is mainly in the range of average risk.

The monitoring activities for assessment of ecological and economic conditions of total areas, improved with the rehabilitation works being performed in 2019-2020, continue in 2020 as well, at the end of which summary data on obtained results will be summarized and presented.

Improved pasture areas



10. Assessment of sowing efficiency in cultivated arable lands

In 490 ha sowing areas being created through field cropping works performed in target communities, observations were periodically organized and conducted in 2019 (assessments of 2020 have not been yet finalized) to study and assess the pace of vegetation and development of the formed crops. Due to high quality of the used seeds and faultless implementation of cultivation technological measures, luxuriant vegetation covers composed of main and cover crops formed in cultivated sown areas. Beginning from the mid-summer, formation of dry weather conditions and scarcity of natural precipitations (no precipitations were recorded for about 2 months and more) had some impact on further development and efficiency of the sowing carried out in some communities.

Cultivated arable lands, sown areas

By managing field fodder production in turf-bound arable lands with an area of 490 ha and implementing improvement measures in degraded pastures with an area of 510 ha, as envisaged by the project, a model of sustainable management of natural resources (soil, natural vegetation cover) and productivity increase in communities was exhibited, which, in addition to its great economic significance, may also contribute to an increase in carbon absorption capacity from atmosphere through ecosystems under the conditions of climate change, in the meantime maintaining the economic value of natural diversity and ecosystem. With the intervention of the project implemented, sufficient conditions were definitely created in communities for partial solution of fodder provision problem during housing period and for reducing the pressure of grazing in the pastures during early spring period (before sufficient outgrowing of grass plants).

11. Actual and projected long-term results

Regulation of the issue regarding prevention of vegetation cover degradation in forest pastures of the RA North-Eastern regions, and mitigation and elimination of the consequences being already created will be unequivocally conditioned by sound and sustainable pasture use procedures in the grassland farming sector. In some cases, any possible solution of various ecological problems created in already degraded and decomposed pastures would also assume effective interventions through implementation of sound technological functions, which will, to the extent possible, prevent the ecological regressive degradation process, in the meantime, ensuring restoration and maintenance of landscape vegetation cover, enrichment of vegetation and natural diversity, and improvement of the plant resource (pasture green plants) productivity indicators. According to the preliminary assessments, implementation of the functions and agrotechnical measures aimed at solution of such problems ensured positive results in terms of preventing degradation in forest ecosystems, eradication of consequences, as well as mitigation of social problems that are available in rural communities. According to the preliminary monitoring results, it was found that:

- Implementation of artificial rehabilitation/improvement measures in more degraded and decomposed sectors of forest and forest-adjacent pastures is the most demanded and justified function, as a result of implementation of which the existing problems of fodder provision for grassland farming in the communities have been definitely solved; the pressure of the grassland farming on forest ecosystems was significantly mitigated. Restoration of degraded areas ensured rehabilitation and stabilization of the distorted natural regularities, preventing development of biological diversity.
- An essential function for mitigation of the pressure resulting from spontaneous and irregular grassland farming management in forest pastures of forest ecosystems in the regions was also considered to be the development of field fodder production through cultivation of arable lands, in which case sound opportunities were created for reducing the grazing period and performing the pasture use in reasonable and permissible periods.
- In degraded areas, further soil degradation and erosion occurrences were prevented through rehabilitation measures. As a result of planting and vegetation cover thickening, pasture productivity and the assimilating surface enhanced, which will also account for the increase of carbon absorbing capacity from the atmosphere.
- Trainings delivered and consultations provided along with field agrotechnological measures, significantly contributed to the improvement and strengthening of capacities of the community specialists and pasture user economic operators, due to which grassland farming and pasture management functions in communities improved, in which case, in a long-term, it would be possible to mitigate the pressure exerted by spontaneous husbandry on the forest ecosystems; this is considered as a vital issue for the regions.