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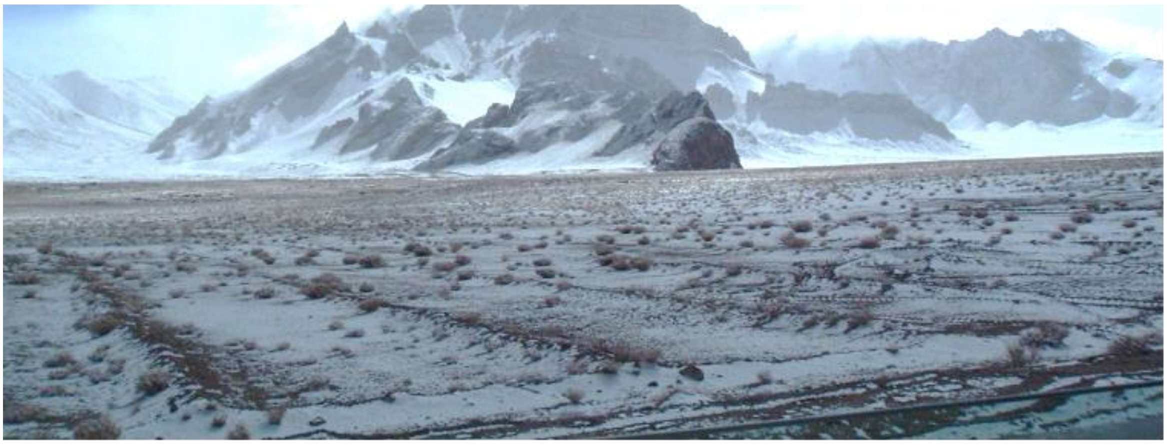
APPLIED WORK –DRAFT

# Ex-ante GHG Appraisal of the Environmental Land Management and Rural Livelihoods Project in Tajikistan (2014-2019)

## Targeting Climate Change Mitigation in Agriculture and Forestry with the EX-Ante Carbon Balance Tool (EX-ACT)



**About EX-ACT:** The *Ex Ante* Appraisal Carbon-balance Tool aims at providing *ex-ante* estimations of the impact of agriculture and forestry development projects on GHG emissions and carbon sequestration, indicating its effects on the carbon balance.

See EX-ACT website: ***www.fao.org/tc/exact***

### Related resources

- EX-ANTE Carbon-Balance Tool (EX-ACT): (i) User Guidelines; (ii) Tool; (iii) Flyer
- See all EX-ACT resources in EASYPol under the Resource package, Investment Planning for Rural Development, EX-Ante Carbon-Balance Appraisal of Investment Projects

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# Ex-ante GHG Appraisal of the Environmental Land Management and Rural Livelihoods Project (ELMRL) in Tajikistan (2014-2019)

by

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for the

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, FAO

**About EASYPol**

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# Contents

# Table of Abbreviations

| | |
|---|---|
| AFOLU | Agriculture, Forestry and Other Land Use |
| CC | Climate Change |
| CEA | Country Environment Analysis |
| CDM | Clean Development Mechanism |
| $CH_4$ | Methane |
| $CO_2$ | Carbon Dioxide |
| DM | Dry Matter |
| EX-ACT | EX-Ante Carbon-balance Tool |
| FAO | Food and Agriculture Organisation of the United Nations |
| FFA | Federal Forestry Agency |
| ELMRL | Environment Land Management and Rehabilitation of Livelihood Project |
| GHG | Greenhouse Gas |
| GWP | Global Warming Potential |
| HAC | High Activity Clay |
| IPCC | Intergovernmental Panel on Climate Change |
| LAC | Low Activity Clay |
| MNRE | Ministry of Natural Resources and Environment |
| MRV | Monitoring, Reporting and Verification |
| Mt | Million metric tonnes |
| $N_2O$ | Nitrous Oxide |
| PIU | Project Implementation Unit |
| PPLMP | Pasture and Livestock Management plans (PPLMP) |
| PUG | Pasture User Group (PUG) |
| SPCR | Strategic Programme for Climate Resilience (SPCR) |
| $tCO_2$-e | Tonnes of $CO_2$ equivalents |
| UNFCCC | United Nations Framework Convention on Climate Change |

# 1. Background

## 1.1 Study Framework: Ex-ante appraisal of the Environmental Land Management Rural Livelihoods Project (ELMRL)

This report is prepared to provide an ex-ante carbon balance appraisal of the Environmental Land Management and Rural Livelihoods Project (ELMRL) in Tajikistan. The project is currently under initiation starting from early 2014. The carbon-balance is the estimated mitigation impact which will be generated in 20 years (2014-2034) by the implementation of the project. This appraisal also provides performance indicators of the project on climate resilience through increased natural capital, such as the incremental biomass generated and the incremental soil organic carbon, which directly affect the climate resilience of landscapes and watersheds.

## 1.2 Current situation of agriculture, land and pasture management in Tajikistan

Tajikistan has an area of around 141,000 $km^2$ (14,100,000 ha) of which about 90% is considered upland and mountainous. More than two thirds of the population is rural and dependent on 4.6 million ha of agricultural land, the majority of which is rain-fed pasture. Only about 850,000 ha are arable land, of which some 500,000 ha are irrigated and under rotation of cotton and cereal crops. The remaining 3.86 million ha of agriculture land are pasture, fallow lands and meadows.

Wheat, potatoes and horticulture with few significant irrigation systems and extensive pasture areas characterize upland agro-ecosystems. Irrigated cotton in rotation dominates lowland systems. The agricultural sector accounts for around 24% of GDP (average for 2000-2010, World Bank, 2011) as well as 64% of employment, and is generally characterized by low productivity. Environmental degradation and unsustainable use of natural resources are important constraints, and the country's predominantly mountainous terrain makes it particularly vulnerable to natural disasters.

More than 90% of the total rangeland is degraded (CACILM, 2006). All pasture lands of Tajikistan are strongly subject to erosion - with 89% of the summer pastures and 97% of winter pastures suffering from medium to strong erosion (SAIGAL, 2003). Nowadays, unpalatable grasses make up 75 to 90% of the herbage. In total, the production of fodder mass has decreased to 20% or possibly even 10% (Akhmadov K.M., Breckle S.W., Breckle U, 2006). Bussler emphasizes also the decline in feed crops combined with the decrease of nearly 400 thousand ha (more than 10%) in pastures since 1990-1995 which indicates a contraction of feed supply (Bussler, 2010). The livestock in Tajikistan is a mix of cattle and sheep, with over 1 million head of cattle and around 3 million head of sheep and goats (SAIGAL, 2003).

## 1.3 Tajikistan and climate change resilience issues

With about three-fourths of Tajikistan's population living in the countryside and being heavily dependent on farming, agriculture is one of the most important livelihood sectors for the poor. About 32 percent of the total land-area in the country is used for agriculture, and much of it is exposed to the impacts of CC particularly via land degradation and erosion of fertile topsoil. Climate variability and change are likely to pose additional and significant risks, particularly for those pursuing subsistence agriculture or pastoralism, and only reinforce the need to follow sound land management principles. Climate projections suggest Tajikistan will experience higher temperatures, reduced rainfall and higher evapotranspiration with an increased frequency of extreme events.

Different types of land degradation in the country (soil erosion, salinization, contamination, loss of organic matter, etc.) contribute to further impoverishment and decreasing resilience to climate change, including expansion of such natural disasters like mudslides (damaging and destroying villages, roads and farmland, and irrigation and water systems), productive soil loss (undermining agricultural productivity) and silting of waterways used for drinking water and irrigation. The mountains and foothills in Tajikistan are also globally important ecosystems with diverse flora and fauna (including many of economic importance), which face persistent threats from unsustainable land use and natural resource management. However, these areas have good productive potential which is currently underutilized.

## 1.4 Public cost of environment degradation in Tajikistan

*"Land degradation is the principal environmental problem in the country, the main causes of which include irrigation-related land degradation, in particular secondary salinity, water-logging and irrigation-related soil erosion, soil erosion in rain-fed farmlands, degradation of summer and winter pastures in vast mountain areas, and other forms of land degradation caused by natural disasters and soil contamination. Although the principal cause of natural resource losses is degradation of agricultural lands, it is important to mention that all elements of natural resource degradation in Tajikistan are interrelated -- causality links often work both ways. Land degradation eventually causes more landslides and mudflows especially in the sensitive mountainous areas. Most affected by degradation are village-near pasture lands as well as bush and tree vegetation. Common causes include ineffective land management and the lack of energy resources. Land degradation not only affects agricultural productivity, biodiversity and wildlife, but also increases the likelihood of natural hazards, that in turn cause destruction to limited agricultural assets. The total annual loss, due to land degradation in Tajikistan, is about 62.1 million US$"* (Country environment Analysis).

*"The second major environmental damage is from fragile soil structure in the mountain area causing natural disasters by way of mudflows and boulders sliding down the hills. About 85% of Tajikistan's area is threatened with mudflows and 32% of the area is situated in the high mudflow risk zone. Anthropogenic activity, such as deforestation, irrigation and land use practices, as well as improper grazing systems adoption on the communal property lands, increase frequency and magnitude of floods, landslides, avalanches, and storms, and intermittent droughts, the total costs of which is modestly estimated to account for about 26 million US$"* (WORLD BANK, 2008).

As such while participating to the land degradation, the deforestation process is another major damage. It translates into 6000-7000 ha of annual deforestation. Based on the country Environment Analysis (CEA) using FRA 2005, and taking into account direct and indirect use values of forest (see extracted CEA table below) it is estimated to represent an additional (NPV) cost 14.5 million Tsh or of 3 million US$ (0.2 % of GDP in 2006), with a range from 2-4 million US$, when taking into account only the direct and indirect use values of forests. To be used with caution these estimations however do not account for the loss of carbon linked with deforestation, landscape degradation and soil degradation.

**Table 4.3.1: Costs of Annual Deforestation (Thousand TJS)**

| Forest service | Annual Cost | | | NPV* |
|---|---|---|---|---|
| | Low estimate | Mean | High estimate | (mean) |
| **Direct use values** | 167 | 290 | 412 | 2,747 |
| Fuel wood production | 3 | 4 | 4 | 38 |
| Non timber products | 167 | 181 | 195 | 1,719 |
| Tourism and recreation | 0 | 109 | 217 | 1,028 |
| **Indirect use values** | 558 | 605 | 651 | 5,730 |
| **Non-use values** | 242 | 642 | 1042 | 6,083 |
| Option value (bioprospecting) | 0 | 228 | 456 | 2,160 |
| Existence value | 242 | 414 | 586 | 3,923 |
| **Direct Plus Indirect** | 725 | 894 | 1063 | 8,478 |
| **Total value** | 967 | 1536 | 2105 | 14,560 |

Source: Estimated using FRA, 2005; UNECE, 2004; Pearce D. et al, 1999; Lampietti and Dixon, 1994.; An annual discount rate of 10 % is used to calculate NPV.

## 1.5 Natural resources policies and programmes in Tajikistan

Key constraints in environmental management in the country do not seem to be due to the absence of well-defined environmental policies but rather from inadequate legislation and by law-guidelines to implement specific polices in particular, weaknesses in institutional design, lack of vertical and horizontal coordination, lack of capacity of institutions, and insufficient funding.

Tajikistan has several strategies and programs relevant to natural resource and sustainable land management. These programmes include the National Framework Programme to Combat Desertification (2005), the National Action Plan for Climate Change Mitigation (2003), and the National Communications on Climate Change (2002, 2008). The Government is currently preparing the Third National Communication on Climate Change which aims to enhance the evidence base for climate change risks and impacts on priority sectors (natural resources, national economy and human health) and provide opportunities to mainstream climate adaptation and mitigation activities in national development policy and programs, as well as in other projects and programs on climate change and sustainable development (extracts from PAD 2013).

Pilot Program for Climate Resilience**.** Tajikistan is one of 18 countries participating in the Pilot Program for Climate Resilience[2] (PPCR) supported by Multilateral Development Banks (MDBs). In Tajikistan, the participating MDBs are: World Bank (WB); European Bank for Reconstruction and Development (EBRD); and Asian Development Bank (ADB). The PPCR will help ensure that, in the shorter term, investments in critical sectors become resilient to climate change and enhanced capacity, awareness, evidence and institutional frameworks are built for a longer-term climate resilient development pathway within Tajikistan, thus providing a catalyst for further investment.

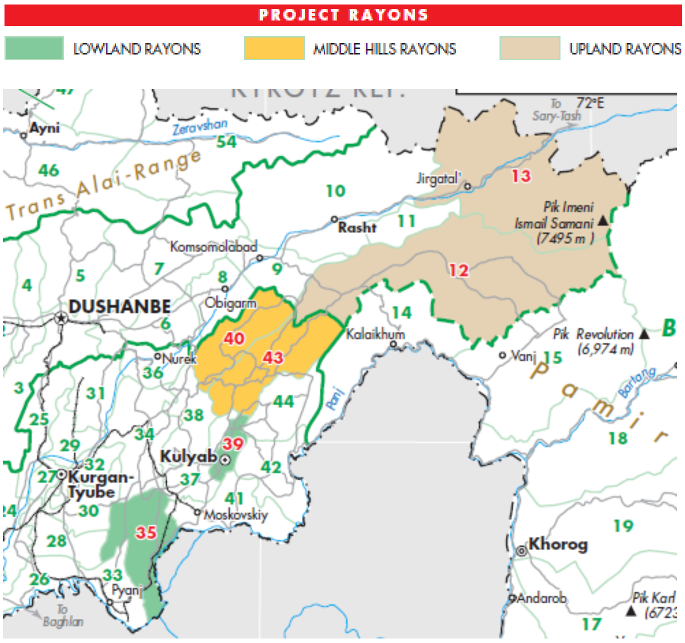
## 1.6 Environmental Land Management and Rural Livelihoods Project: Framework and implementation status

The overall Project Development Objective (PDO) and Global Environmental Objective (GEO) is to enable rural people to build their productive assets in ways that sustainably improve natural resource management and build resilience to climate change in selected climate vulnerable sites.

Examples of the expected outcomes by the end of the project are: at least 30,000 ha in the project area should be practicing by effective agricultural, land, and water management. This includes areas affected by direct (e.g. area under drip irrigation, rotation, etc.) and indirect practices (e.g. summer pasture made available through provision of watering holes, livestock shelter) and investments which result in at least one of the following:

- Prevent or reduce soil erosion
- Increase vegetative cover through perennial crops and pasture
- Provide soil and moisture conservation
- Improve soil quality
- Improve water use efficiency
- Increase sustainable fodder or wood supply
- Increase sustainable renewable energy supply
- Extend integrated pest management

Project sites will comprise districts in three different agro-ecological zones - uplands, hill lands and lowlands (see map below). The selected project areas include Farhor (35 on the map), Kulyab (39), Hovaling (40), Baljuvon (43), Tavildara (12) and Jirgatol (13) raions. They all suffer from a large number of constraints at the bio-physical level, mostly related to climatic variations, soil degradation, lack of energy resources, dilapidated infrastructure, and poor availability of quality drinking water. At the same time, there is no concerted effort to manage the natural resources in the area.




The project will finance investments in three categories that are expected to contribute to household assets as well as sustainable land management, and increase climate resilience, examples of which are listed below:

(i) Farm Production: field and horticultural crop productivity and diversification, livestock production efficiency, agro-processing and market access;

(ii) Land Resource Management: pasture management, water management, soil fertility, integrated pest management, and sustainable sloping lands cultivation (including orchards, woodlots, shelter-belts); and

(iii) Small-scale rural production infrastructure: irrigation/drainage system rehabilitation, minor transport infrastructure, renewable energy, and energy efficiency measures.

# 2. Methodology and tools used

## 2.1 EX-ACT tool

The Ex-Ante Carbon-balance Tool (EX-ACT) is an appraisal system developed by FAO providing ex-ante estimates of the impact of agriculture and forestry development projects, programmes and policies on the carbon-balance. The carbon-balance is defined as the net balance from all GHGs expressed in $CO_2$ equivalents that were emitted or sequestered due to project implementation as compared to a business-as-usual scenario.

EX-ACT is a land-based accounting system, estimating C stock changes (i.e. emissions or sinks of $CO_2$) as well as GHG emissions per unit of land, expressed in equivalent tonnes of $CO_2$ per hectare and year. The tool helps project designers to estimate and prioritize project activities with high benefits in economic and climate change mitigation terms. The amount of GHG mitigation may also be used as part of economic analysis as well as for the application for funding additional project components.

EX-ACT has been developed using mostly the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (IPCC, 2006) that furnishes EX-ACT with recognized default values for emission factors and carbon values, the so called Tier 1 level of precision. Besides, EX-ACT is based upon chapter 8 of the Fourth Assessment Report from working group III of the IPCC (Smith, et al., 2007) for specific mitigation options not covered in NGGI-IPCC-2006. Other required coefficients are from published reviews or international databases. For instance embodied GHG emissions for farm operations, transportation of inputs, and irrigation systems implementation come from Lal (Lal, 2004) and electricity emission factors are based on data from the International Energy Agency (IEA, 2013)

The EX-ACT appraisal process is interactive as well as participatory, and can strengthen the overall project design process, especially when a training and workshop element (for project teams, government counterparts, and other stakeholders) is integrated as part of the process. It may facilitate the discussion on ways to create incentives and institutional conditions that can promote their uptake (such as payments for environmental services).

### 2.2 Link with project monitoring

In this ex-ante appraisal, the project monitoring unit has played a key role in discussing data on the future development of land use and land use change, on energy consumption and construction of new infrastructure.

Future project carbon-inclusive monitoring: Furthermore the brainstorming with the monitoring team allowed to adapt future sub-project questionnaires which will be filled by micro-investors (farmers or farmers groups) so that they collect all the information allowing mid-term and final evaluation of the actually reached carbon balance impacts either for selected samples that represent the various types of project actions as well as the diversity in agro-ecological areas or or for the whole project.

## 3. Data used for the EX-ACT appraisal

While agricultural development projects usually implement a large set of complementary field actions, not necessary all project activities have impacts on GHG emissions and carbon sequestration. This section concisely summarizes the project activities that were considered for analysis by EX-ACT and also lists the taken assumptions on agro-ecological variables.

Ex-ante assessments are in parts necessarily based on assumptions and have to manage existing information gaps. The amount of missing information thereby decreases throughout the process of project design, while selected data can only adequately be collected as part of project monitoring and evaluation activities

### 3.1 Agro-ecological variables

The project area is characterized by a warm temperate climate with a dry moisture regime. The dominant soil type was specified as High Activity Clay Soils. Thereby the project will be implemented about a period of 5 years, EX-ACT will account in addition for a 15 year period of capitalization, which is needed in order to capture the full impact of introduced changes in land use and management of soil and biomass carbon stocks.

The project intends to improve land management on around 30,000 ha. This is concerning improved pasture management (14,000 ha), promotion of agroforestry and perennials through land use change (7,500 ha), improved annual, irrigated crops (6,000 Ha) and afforestation (1,000 ha) as well as forest rehabilitation (1,500 ha).

## 3.2 Pasture management

The project would support pasture and livestock improvement interventions including access to pastures, rehabilitation of pasture schemes, and water supply. Eight Participatory Pasture and Livestock Management plans (PPLMP) will be designed with Pasture User Groups (PUGs). The PUGs will be responsible for developing and implementing the plans. These plans should cover around 14,000 ha of pasture that is initially mostly severely degraded (13,000 ha with soil C stock of 26.6 tC/ha as IPPC2006 default coefficient) and moderately degraded (1,000 ha with soil C stock of 36.1 tC/ha as IPPC default coeff).

| Corresponding soil C stocks | tC/ha | |
|---|---|---|
| | Default | Tier 2 |
| Non degraded | 38.0 | |
| Severely Degraded | 26.6 | |
| Moderately Degraded | 36.1 | |
| Improved without inputs management | 43.3 | |
| Improved with inputs improvement | 48.1 | |

Among the severely degraded pastures, it is assumed that 5,000 ha will become moderately degraded with the project through reduced pressure, 4,000 ha will become non degraded (38 tC of soil C stock as IPPC coeff) through improved pasture management, 4,000 ha will become improved without inputs (43.3 tC/ha as IPCC coeff) using fencing. The initial pasture land with better potential (1,000 ha initially moderately degraded) will be improved with inputs (48.1 tC/ha).

| 4.1.2. Grassland systems remaining grassland systems *(total area must remains contant)* | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Description** | Initial state | Final state of the grassland | | Fire use to manage | | | | **Area (ha)** | | | |
| | | Without project | With project | Periodicity without | | Periodicity with | | Start | Without | | With |
| | | | | (y/n) | (year) | (y/n) | (year) | | | * | |
| reduced pressure | Severely Degraded | Severely Degraded | Moderately Degraded | NO | *5* | NO | *5* | 5,000 | 5,000 | D | 5,000 |
| improved pasture magt | Severely Degraded | Severely Degraded | Non degraded | NO | *5* | NO | *5* | 4,000 | 4,000 | D | 4,000 |
| Fencing | Severely Degraded | Severely Degraded | Improved without inputs manageme | NO | *5* | NO | *5* | 4,000 | 4,000 | D | 4,000 |
| fertil+seeds | Moderately Degraded | Moderately Degraded | Improved with inputs improvement | NO | *5* | NO | *5* | 1,000 | 1,000 | D | 1,000 |
| | Select state | Select state | Select state | NO | *5* | NO | *5* | 0 | 0 | D | 0 |

## 3.3 Promotion of agroforestry and perennials through land use change

The sub-projects supportive of extension of fruit trees and horticulture areas will be developed using existing land areas currently used for annual crops (33%), degraded unused land (33%) and pasture land (33%). It is assumed to represent around 7,500 ha of land use change.

| 2.3. Other Land use changes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Fill with you description** | **Initial land use** | | **Final land use** | **Message** | **Fire use** | **Area transformed** | | |
| | | | | | (y/n) | Without | * | With |
| annual crop with add tree | Annual Crop | → | Perennial/Tree Crop | | NO | 0 | D | 2500 |
| degr. land rehab agrofor | Degraded Land | → | Perennial/Tree Crop | | NO | 0 | D | 2500 |
| deg grassland planted | Grassland | → | Perennial/Tree Crop | | NO | 0 | D | 2500 |

## 3.4 Annual crops

Within the project area, beneficiaries manage over 13,500 ha of annual crops in cotton, wheat, barley and horticulture. Cotton areas are very progressively reducing in without project situation between 2014 and 2020. The project will support a wide switch of 7,500 ha of annual crops (over 60%) to improved sustainable practises increasing their climate resilience.

| 3.1.2. Annual systems remaining annual systems *(total area must remains contant)* | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Fill with you description** Def? | Improved agro--nomic practices | Nutrient management | NoTill./residues management | Water management | Manure application | Residue/Biomass Burning | **Area (ha)** Start | Without | * | With | * | **Total Emissions (tCO2-eq)** Without | With |
| Cotton | ? | ? | ? | ? | ? | YES | 6000 | 4500 | D | 3000 | D | 58,800 | 42,336 |
| Trad wheat-barley | ? | ? | ? | ? | ? | NO | 6000 | 7000 | D | 2000 | D | 0 | 0 |
| Trad horticulture | ? | ? | ? | ? | ? | NO | 1500 | 2000 | D | 1000 | D | 0 | 0 |
| improved wheat-barley | Yes | ? | ? | Yes | Yes | NO | 0 | 0 | D | 5000 | D | 0 | -134,750 |
| Improvde horticulture | Yes | ? | Yes | Yes | Yes | NO | 0 | 0 | D | 2000 | D | 0 | -53,900 |
| improved feeder crops | Yes | ? | ? | Yes | ? | NO | 0 | 0 | D | 500 | D | 0 | -9,975 |
| description 7 | ? | ? | ? | ? | ? | NO | 0 | 0 | D | 0 | D | 0 | 0 |
| description 8 | ? | ? | ? | ? | ? | NO | 0 | 0 | D | 0 | D | 0 | 0 |
| description 9 | ? | ? | ? | ? | ? | NO | 0 | 0 | D | 0 | D | 0 | 0 |
| description 10 | ? | ? | ? | ? | ? | NO | 0 | 0 | D | 0 | D | 0 | 0 |
| | | | | | | | 13500 | 13500 | | 13500 | | | |

It is simulated as a progressive annual crop reallocation in favour of improved wheat – barley cropping (crop rotation, water management, manure), improved horticulture (similar practises+ reduced tillage) and feeder crops.

## 3.5 Afforestation and forest rehabilitation

While the project does not target wide reforestation, it will be supportive of community-based adaptation actions targeting erosion and land slide fixing in sloped areas, which will drive to reforestation through plantation on targeted spots. Fire wood production oriented plantations will also be encouraged. An assumed aggregated area of 1,000 ha of forest plantation is considered,

| 2.2. Afforestation and Reforestation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Available AEZ | 1.Subtropical humid forest - 2.Subtropical dry forest - 3.Subtropical steppe - 4.Subtropical mountains systems | | | | | | | |
| **Type of vegetation** that will be planted | **Fire Use** (y/n) | **Previous land use** | **Area that will be afforested/reforested** Without | * | With | * | **Total Emissions (tCO2-Eq)** Without | With |
| Plantation Zone 3 | NO | Degraded Land | 0 | D | 1000 | I | 0 | -406,267 |
| Select the vegetation | NO | Select previous use | 0 | D | 0 | D | 0 | 0 |
| Select the vegetation | NO | Select previous use | 0 | D | 0 | D | 0 | 0 |
| Select the vegetation | NO | Select previous use | 0 | D | 0 | D | 0 | 0 |
| Select the vegetation | NO | Select previous use | 0 | D | 0 | D | 0 | 0 |
| Select the vegetation | NO | Select previous use | 0 | D | 0 | D | 0 | 0 |

* Note concerning dynamics of change : **D correspond to "Default"**, "I" to Immediate and "E" to Exponential (Please r

Within component 1.2 larger-scale initiatives in sustainable community, land management are considered on pasture and watershed management. They could cover support to forest rehabilitation within the need to secure irrigation infrastructure, or to restore degraded watershed spots.

| **Degradation level (% of biomass los** | Default | Tier 2 |
|---|---|---|
| None | 0 | |
| Very low | 10 | |
| Low | 20 | |
| Moderate | 40 | |
| Large | 60 | |
| Extrem | 80 | 75 |

An area of 1,500 ha of forest rehabilitation is planned. Currently forests in Tajikistan are estimated by FAO (GFRA 2010) to have an above biomass carbon stock average of only 7 tC/ ha. This was used to derive a tier 2 coefficient based on the carbon stock of a subtropical steppe (28.2 tC) with 75% of degradation. Therefore it is assumed that rehabilitation allows a 75% degraded forest (extremely degraded) to be restored (very low degradation).

| 5.1. Forest degradation and management | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Available AEZ | 1.Subtropical humid forest - 2.Subtropical dry forest - 3.Subtropical steppe - 4.Subtropical mountains systems | | | | | | | | | | | | |
| **Type of vegetation that will be degraded** | **Degradation level of the vegetation** Initial state | At the end without project | with project | **Fire occurrence and severity** Without (y/n) | Periodicity (year) | Impact (% burnt) | With (y/n) | Periodicity (year) | Impact (% burnt) | **Area (ha)** Start (ha) | Without (ha) | * | With (ha) |
| Forest Zone 3 | Extrem | Extrem | Very low | NO | | | NO | | | 1,500 | 1,500 | D | 1,500 |

## 3.6 Inputs – investments

While not being in the centre of a GHG impact analysis, project implementation generates a set of resource uses related to the consumption of agricultural inputs such as fertilizers, fossil fuels and investments in infrastructure whose carbon footprint is as well accounted for as part of an impact analysis.

| 6.1 Inputs (liming, fertilizers, pesticides, herbicides,…) | | | | |
|---|---|---|---|---|
| **Description and unit to report** | Amount applied per year | | | |
| **Lime application** | Start | Without | * | With |
| Limestone (tonnes per year) | 0 | 0 | D | 0 |
| Dolomite tonnes per year) | 0 | 0 | D | 0 |
| not-specified (tonnes per year) | 0 | 0 | D | 0 |
| **Fertilizers** | | | | |
| Urea (tonnes of N per year - Urea has 46.7% of N) | 252 | 252 | D | 514 |
| Other N-fertilizers (tonnes of N per year) | 0 | 0 | D | 6 |
| N-fertilizer in irrigated rice (tonnes of N per year) | 0 | 0 | D | 0 |
| Sewage (tonnes of N per year) | 0 | 0 | D | 0 |
| Compost (tonnes of N per year) | 0 | 0 | D | 1,600 |
| Phosphorus (tonnes of P2O5 per year) | 0 | 0 | D | 6 |
| Potassium (tonnes of K2O per year) | 0 | 0 | D | 0 |
| **Pesticides** | | | | |
| Herbicides (tonnes of active ingredient per year) | 0 | 0 | D | 0 |
| Insecticides (tonnes of active ingredient per year) | 0 | 0 | D | 11 |
| Fungicides (tonnes of active ingredient per year) | 0 | 0 | D | 15 |

The main incremental consumption induced by the project is gasoil consumption due to (i) additional irrigation areas and improved pasture, a total of 8,500 ha for which incremental consumption of 25 l of diesel per ha are currently accounted per year

| 6.2 Energy consumption (electricity, fuel,…) | | | | |
|---|---|---|---|---|
| **Description and unit to report** | Quantity consumed per year | | | |
| | Start | Without | | With |
| **Electricity (MWh per year)** | | | * | |
| Please select the country of origin | 0 | 0 | D | 0 |
| **Liquide or gaseous (in m$^3$ per year)** | | | | |
| Gasoil/Diesel | 0 | 0 | D | 212.5 |

Moreover additional energy consumption is linked to (i) building of concrete livestock parks / water points (100 m$^2$ x 50 units), (ii) rehabilitation of drainages – irrigations canals (100 x 100 m$^2$), (iii) road construction (20 km of basic concrete track road 3 m wide) for improving access to pasture areas, and (iv) agriculture stock house buildings or processing units (100 units x 50 m$^2$). As will be seen in the later analysis, this expectedly has a negligible impact on the overall GHG impact.

| 6.3 Construction of new infrastructure for the project (irrigation systems, buildings, roads | | | |
|---|---|---|---|
| **Description and unit to report** | Surface concerned | | |
| | | Without | With |
| **Irrigation systems (total in ha)** | | | |
| Hand moved sprinkle | | 0 | 5000 |
| Traveler sprinkle | | 0 | 5000 |
| **Buildings and roads (total in m$^2$)** | | | |
| Other (concrete) | Betail-hydro | 0 | 5000 |
| Agricultural Buildings (concrete) | | 0 | 5000 |
| Road for medium trafic (concrete) | | 0 | 60000 |
| Other (concrete) | channel drain | 0 | 10000 |
| Please select | | 0 | 0 |

# 4. EX-ACT appraisal results

## 4.1 ELMRL project carbon balance – Direct impact

As described in detail further above the optimistic scenario impacts over 37,500 ha, mostly related to pasture, horticulture- agroforestry and annual crops. The table below summarizes the land use change impacts arising under the project and business as usual scenario.

### *Land Use Change Matrix*

| **Surfaces evolutions by land use / category (hectares - ha)** | | | | |
|---|---|---|---|---|
| | | State at the beginning | Without Project | With Project |
| Forest/Plantation | | 1,500 | 1,500 | 2,500 |
| Cropland | Annual | 16,000 | 16,000 | 13,500 |
| | Perennial | 0 | 0 | 7,500 |
| | Rice | 0 | 0 | 0 |
| Grassland | | 16,500 | 16,500 | 14,000 |
| Other Land | Degraded | 3,500 | 3,500 | 0 |
| | Other | 0 | 0 | 0 |
| Organic soils | | 0 | 0 | 0 |
| **Total area =** | | 37,500 | 37,500 | 37,500 |

The table below lists in the first two columns the Gross Fluxes of the with- and without-project scenario, which is defined as the overall impact from all GHGs that are emitted or sequestered due to the realization of the respective scenario:

- The *without-project scenario* is expected to emit 492,000 t CO2-e mostly through livestock activities. The without-project scenario is depicted in blue in the graph below.
- The *with- project scenario* instead leads to GHG mitigation through improved cropping systems and grasslands, accounting for around 1.96 million t CO2-e over the entire period of analysis of 20 years. On the other hand, increased emissions from the augmenting livestock have a size of around 2.2 million t $CO_2$-e over 20 years The conversion of grassland also generates GHG emission though at a lower level with 140,500 t CO2-e emitted. The with-project scenario is depicted in red in the graph below.

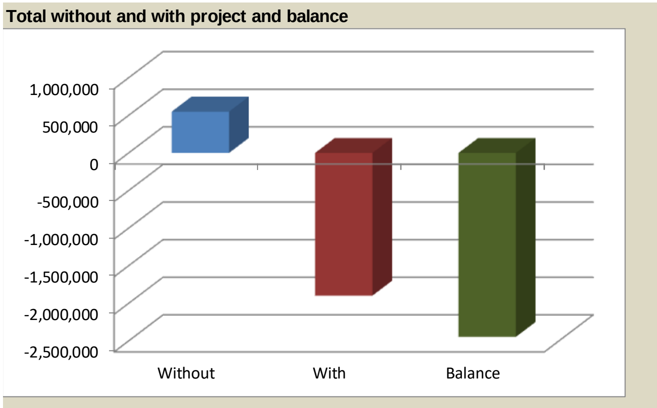
### *Carbon balance of ELMRL project – direct impact*

| | | | | |
|---|---|---|---|---|
| **Name of the project** | Tajikistan Env. Land r | **Climate** | Warm Temperate (Dry) | **D** |
| **Continent** | Asia (Continental) | **Soil** | HAC Soils | **Tot** |

| **Component of the project** | **Gross fluxes** **Without** | **With** | **Balance** | **Share per GHG of the Balance** **Result per GHG** **$CO_2$** **Biomass** | **Soil** | **Other** | **$N_2O$** | **$CH_4$** |
|---|---|---|---|---|---|---|---|---|
| | **All GHG in $tCO_2eq$** **Positive = source / negative = sink** | | | | | | | |
| **Land Use Changes** | | | | | | | | |
| Deforestation | 0 | 0 | 0 | 0 | 0 | | 0 | 0 |
| Afforestation | 0 | -406,267 | -406,267 | -312,913 | -93,353 | | 0 | 0 |
| Other | 0 | -245,552 | -245,552 | 19,617 | -265,169 | | 0 | 0 |
| **Agriculture** | | | | | | | | |
| Annual | 58,800 | -156,289 | -215,089 | 0 | -198,625 | | -4,557 | -11,907 |
| Perennial | 0 | -1,025,063 | -1,025,063 | -981,750 | -43,313 | | 0 | 0 |
| Rice | 0 | 0 | 0 | 0 | 0 | | 0 | 0 |
| **Grassland & Livestocks** | | | | | | | | |
| Grassland | 0 | -551,722 | -551,722 | 0 | -551,722 | | 0 | 0 |
| Livestock | 433,830 | 513,185 | 79,355 | | | | 39,293 | 40,062 |
| **Degradation** | 0 | -279,383 | -279,383 | -219,948 | -59,434 | | 0 | 0 |
| **Inputs & Investments** | 0 | 184,439 | 184,439 | | | 70,483 | 153,819 | |
| **Total** | 492,630 | -1,966,650 | **-2,459,280** | -1,494,995 | -1,211,616 | 70,483 | 188,556 | 28,155 |
| **Per hectare** | 13 | -52 | -66 | -38.0 | -32.3 | 1.9 | 5.0 | 0.8 |
| **Per hectare per year** | 0.7 | -2.6 | -3.3 | -1.9 | -1.6 | 0.1 | 0.3 | 0.0 |

The Carbon Balance is thus equal to a mitigation impact of 66 t CO2-e per hectare or 3.3 t CO2-e per hectare and year. Reflecting the wide focus of the project on perennials and pasture which high level of C rehabilitation, the FPRP has thus a relevant Climate mitigation impact which is demonstrated, with a connected high mitigation intensity on a per hectare basis. The uncertainty of the estimation is estimated at 42% due to use of mostly tier 1 default coefficients except for forest rehabilitation.

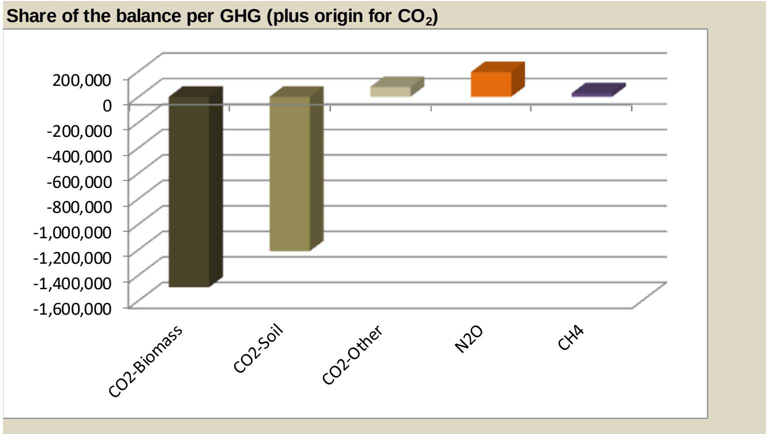
### *Total balance of Environmental Land Management and Rural Livelihoods Project*




The displayed figure shows how the project implementation transforms the project area from being a net source of GHG emission (without project 0.4 million t CO2eq) to a net sink of GHG emissions (-1.9 million t Co2 eq with project).

Having a more detailed look at the sub-components, it can be identified that the strongest single impacts stem from perennials (1 million t CO2-e) and pasture rehabilitation (0.55 million t CO2-e). Differentiating not regarding practices, but concerning the concerned carbon pools, the project mostly enriches carbon levels in biomass (1.5 million t CO2-e) and in soil (1.2 million t CO2-e).

### *GHG impacts by Carbon Pool and GHG*




While the above values provide the expected likely mitigation impacts, it is at the same time important to associate also a rough monetary value with the in that way generated benefits. Based on a Social Cost of Carbon of 21 US$ per ton (Interagency Working Group on Social Cost of Carbon, 2010) and discounted at 10% over the 20 years of the carbon balance appraisal, the net present value of the GHGs mitigation is estimated around US$ 21.5 million.

While with the current uncertainties of future climate change impacts it is strongly uncertain how much costs each tonne of today emitted CO2-e will induce to society, it is nevertheless necessary to assume a reference price for current policy making purposes, that helps to provide a rough orientation of the value of mitigation measures. Using here the Social Cost of Carbon by the US Interagency Working Group allows illustrating the relevant and significant impacts generated in terms of climate change mitigation by the project beyond a pure non-monetary estimation of the mitigation potential.

## 4.2 ELMRL project carbon balance appraisal – Direct and indirect impacts

In the perspective of a close coordination between various natural resource oriented interventions in the country as part of the Strategic Programme for Climate Resilience (SPCR) and the capacity building for climate resilience (PPCR), it exist positive context conditions for sharing results and experiences, as well as contributing to the derivation of lessons learned at the programme level in order to help achieve the overall goals of the PPCR in Tajikistan. Such a commitment allows defining a targeted, scaled up scenario, in which the ELMRL project achieves some indirect impacts with partners and institutions outside the initial project targeted area. A first quantitative estimate suggests that in such a way an additional area of improved areas particularly through community–based actions (landscape management plans, Pasture Groups) could be achieved, accounting afforestation (+80%), forest rehabilitation (+100%), and pasture rehabilitation (+60%).

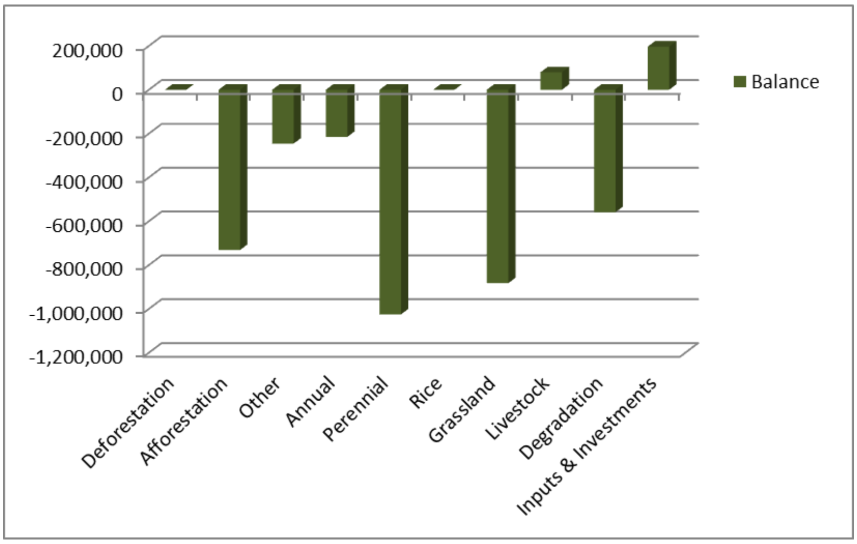
Such a scenario would lead to a whole improved area of 48,200 ha and a carbon balance of 3.4 million $tCO_2$-e, or 3.5 $tCO_2$-e mitigated per ha per year. This translates into an increase of 38% of the GHG mitigation impact.

## *Carbon balance of the Environmental Land Management and Rural Livelihoods Project: Direct and indirect impact*

| Name of the project | Tajikistan Env. Land m | Climate | Warm Temperate (Dry) | | | | | Duration (yr) | 20 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Continent | Asia (Continental) | Soil | HAC Soils | | | | | Total area (ha) | 48200 | | |

| Component of the project | Gross fluxes Without | With | Balance | Share per GHG of the Balance, Result per GHG, $CO_2$ Biomass | Soil | Other | $N_2O$ | $CH_4$ | Results per year without | with | Balance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | All GHG in $tCO_2eq$; Positive = source / negative = sink | | | | | | | | | | |
| **Land Use Changes** | | | | | | | | | | | |
| Deforestation | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 |
| Afforestation | 0 | -731,280 | -731,280 | -563,244 | -168,036 | | 0 | 0 | 0 | -36,564 | -36,564 |
| Other | 0 | -245,552 | -245,552 | 19,617 | -265,169 | | 0 | 0 | 0 | -12,278 | -12,278 |
| **Agriculture** | | | | | | | | | | | |
| Annual | 58,800 | -156,289 | -215,089 | 0 | -198,625 | | -4,557 | -11,907 | 2,940 | -7,814 | -10,754 |
| Perennial | 0 | -1,025,063 | -1,025,063 | -981,750 | -43,313 | | 0 | 0 | 0 | -51,253 | -51,253 |
| Rice | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 |
| **Grassland & Livestocks** | | | | | | | | | | | |
| Grassland | 0 | -882,755 | -882,755 | 0 | -882,755 | | 0 | 0 | 0 | -44,138 | -44,138 |
| Livestock | 433,830 | 513,185 | 79,355 | | | | 39,293 | 40,062 | 21,691 | 25,659 | 3,968 |
| **Degradation** | 0 | -558,765 | -558,765 | -439,897 | -118,869 | | 0 | 0 | 0 | -27,938 | -27,938 |
| **Inputs & Investments** | 56,496 | 253,294 | 196,798 | | | 77,471 | 159,190 | | 2,825 | 12,665 | 9,840 |
| **Total** | 549,126 | -2,833,225 | **-3,382,350** | -1,965,274 | -1,676,766 | 77,471 | 193,926 | 28,155 | 27,456 | -141,661 | -169,118 |
| **Per hectare** | 11 | -59 | -70 | -39.2 | -34.8 | 1.6 | 4.0 | 0.6 | | | |
| **Per hectare per year** | 0.6 | -2.9 | -3.5 | -2.0 | -1.7 | 0.1 | 0.2 | 0.0 | 0.6 | -2.9 | -3.5 |

## *GHG impacts by activity area*




### 4.3 Assessment of other environment impacts on natural capital

As a project that rehabilitates degraded forest and grassland areas and engages in afforestation of degraded areas, the ELMRL project reconstitutes landscape and watershed climate resilience capacity in targeted areas. It thus produces a set of benefits that are clearly distinct from their climate change mitigation achievements and are closely related to the incremental existence of additional biomass and reactivation of the ecosystem. While most of the benefits are of public nature, environmental resources and non-degraded natural capital may also provide a significant source of income and contribute to food security.

EX-ACT permits to produce a series of natural resource flows which contribute to natural capital, such as soil carbon, incremental biomass, additional areas with improved resilience to floods and drought, incremental saved natural resources (water) all used to assess the incremental natural capital that is generated due to an intervention.

This computation is being based on an incremental appraisal, and thus the only natural resources targeted in this quantification are those whose stock is affected by the project. The table below presents the proposed categorization of natural capital that was identified as relevant and quantifiable. The classification provides a structured framework for accounting the changes in environmental assets. Three categories of natural assets are differentiated.

Direct use values concern the benefits from self-consumption or sale (mostly in a considerable distant future) of additional timber, fuel wood and non-timber forest products (NTFP). They thus concern a directly realized private benefit to the household, in form of either monetary revenue, or increased household consumption or supply of inputs as the yield benefits of higher Soil Organic Carbon (SOC) contents through soil conservation practices, soil rehabilitation measures, composting, or the greater availability of fodder for livestock raising.

The indirect use values category subsumes those functions of natural capital that over a longer period provide benefits to mainly annual and perennial cultures or any other entities that provide direct private values. It thus concerns indirect contributions to increases in monetary household revenue or increased household consumption. This concerns the indirect benefits due the prevention of future erosion, the prevention of drought stresses, as practices that limit the yield impacts of erratic rainfall and dry spells or measures that increase the availability of water and protect productive areas from flooding. Such indirect use values were mostly estimated using the willingness to pay approach.

| | | INCREMENTAL CAPITAL GENERATED BY THE PROJECT | | | | | |
|---|---|---|---|---|---|---|---|
| **Project:** | | Tajikistan Env. Land mgt Project | 1 United States Dollar = 5 TJS (ocrober 2014) | | | | |
| | | Normal scenario | **Units** | **Quantity** (units) 20 years | **Economic price (US$)** | **Estimated total Value (US$) NPV** | |
| **Area** | | 37500 | | | | | |
| **Duration:** | | 20 | | | | | |
| | | **Natural Capital** | | | | | |
| ***Direct private value*** | | | | | | | |
| A01 | | Incremental accumulated SOC on cultivated land (soil fertility) | t C | 65,983 | $ 11.37 | $ 750,226 | (i) |
| A02 | | Incremental stocks of non-timber biomass | t dm | 777,974 | | | (ii) |
| | *15%* | Fuelwood and -material | t dm | 116,696 | $ 10.00 | $ 488,077 | |
| | *15%* | Fodder | t dm | 116,696 | $ 15.00 | $ 732,115 | |
| | *60%* | Anti-erosive watershed coverage | t dm | 466,784 | $ 1.00 | $ 195,231 | |
| | *10%* | Compost | t dm | 77,797 | $ 5.00 | $ 162,692 | |
| A03 | | Incremental stocks of NTFP in forestry and agro-forestry | | | | | |
| ***Indirect private value*** | | | | | | | |
| A04 | | Incremental area with erosion protection | ha | 10,000 | $ 94.80 | $ 948,000 | (iii) |
| A05 | | Incremental area with increased drought resilience | ha | 21,500 | $ 11.70 | $ 251,550 | (iv) |
| ***Public value*** | | | | | | | |
| A09 | | Incremental timber stocks in forestry and agro-forestry | t dm | 91,108 | $ 87.72 | $ 3,342,620 | (v) |
| A10 | | GHG balance (reduced emissions and C sequestration) | t CO2-e | 2,447,000 | $ 21.00 | $ 21,492,407 | (vi) npv |
| | | **Total incremental natural capital** | | | | **$ 28,362,919** | |

*(i) 1.18 USD/t SOC per year discounted over 20 years (wander Nissen 2013)*
*(ii) differentiating potential uses: fuelwood, fodder, .. At opportunity prices (Bajcain Shakya 2005)*
*(iii) based on cost of soil erosion of 1.32 USD/ton (Acharya 2010) , tons of erosion and discounted as NPV*
*(iv) based on willingness to pay 2 US$/ha / year discounted on 8 years*
*(v) timber vprice derived from international market USD 87.72 per t of timber using European price and US price in 2012 US$ 50 /m3 average divided by 0.57 density*
*(vi) US Interagency on social cost of carbon in 2013 (21 USD) Eco value computed as NPV (higher value to quick GHG reductions)*

The mitigation of GHG emissions and increases in carbon sequestration provides an important public value, by minimizing the causes of further climate change and limiting resulting damage and abatement costs to society. Another public value considered here is the forest timber stock.

The table above illustrates that the project leads to an estimated increase of 64,000 t of Soil Organic Carbon in agriculture soils, an increase in timber stock of roughly around 91,100 t of dry matter due to the project, compared to 788,000 t of non-timber biomass over the full period of analysis of 20 years. Thereby the differentiation into further uses of nontimber biomass is based on an assumed distribution between watershed coverage, fodder, fuelwood, and compost.

Rehabilitation processes thus lead to important increases in biomass stocks with their multiple benefits. Again engaging in conservative assumptions 10,000 additional hectares should in such a way be effectively protected against erosion and 21,500 ha of mostly annual crops and pasture areas will become more drought resilient.

When using instruments of environmental valuation, as e.g. willingness to pay, selected indicators can also be translated into monetary values: Valuing timber at 87.72 USD per cubic meter and thus utilizing the average between the higher European and lower US-American timber price, the over 20 years created incremental timber stocks have a Net Present Value of 3.34 mio USD.

The Net Present Value of incremental natural capital generated over the full period of 20 years accounts for an estimated 28.3 million US$ of public value mostly due to the beneficial Carbon Balance (75%) and incremental timber stocks (12%).

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- **Land Use Change Module**

**2.2. Afforestation and Reforestation**

Available AEZ: **1.Subtropical humid forest - 2.Subtropical dry forest - 3.Subtropical steppe - 4.Subtropical mountains systems**

| Type of vegetation that will be planted | Fire Use (y/n) | Previous land use | Area that will be afforested/reforested: Without | * | With | * | Total Emissions (tCO2-Eq): Without | With |
|---|---|---|---|---|---|---|---|---|
| Plantation Zone 3 | NO | Degraded Land | 0 | D | 1000 | I | 0 | -406,267 |
| Select the vegetation | NO | Select previous use | 0 | D | 0 | D | 0 | 0 |
| Select the vegetation | NO | Select previous use | 0 | D | 0 | D | 0 | 0 |
| Select the vegetation | NO | Select previous use | 0 | D | 0 | D | 0 | 0 |
| Select the vegetation | NO | Select previous use | 0 | D | 0 | D | 0 | 0 |
| Select the vegetation | NO | Select previous use | 0 | D | 0 | D | 0 | 0 |

* Note concerning dynamics of change : **D correspond to "Default"**, "I" to Immediate and "E" to Exponential (Please refer to the Guidelines)

Tier 2

**Total Af/Re-forestation** 0 -406,267

**2.3. Other Land use changes**

| Fill with you description | Initial land use | | Final land use | Message | Fire use (y/n) | Area transformed: Without | * | With | * | Total Emissions (tCO2-Eq): Without | With |
|---|---|---|---|---|---|---|---|---|---|---|---|
| annual crop with add tree | Annual Crop | → | Perennial/Tree Crop | | NO | 0 | D | 2500 | D | 0 | -34,375 |
| degr. land rehab agrofor | Degraded Land | → | Perennial/Tree Crop | | NO | 0 | D | 2500 | D | 0 | -214,294 |
| deg grassland planted | Grassland | → | Perennial/Tree Crop | | NO | 0 | D | 2500 | D | 0 | 3,117 |
| | Select Initial Land Use | → | Select Final Land Use | Fill initial LU | NO | 0 | D | 0 | D | 0 | 0 |
| | Select Initial Land Use | → | Select Final Land Use | Fill initial LU | NO | 0 | D | 0 | D | 0 | 0 |
| | Select Initial Land Use | → | Select Final Land Use | Fill initial LU | NO | 0 | D | 0 | D | 0 | 0 |
| | Select Initial Land Use | → | Select Final Land Use | Fill initial LU | NO | 0 | D | 0 | D | 0 | 0 |
| | Select Initial Land Use | → | Select Final Land Use | Fill initial LU | NO | 0 | D | 0 | D | 0 | 0 |
| | Select Initial Land Use | → | Select Final Land Use | Fill initial LU | NO | 0 | D | 0 | D | 0 | 0 |
| | Select Initial Land Use | → | Select Final Land Use | Fill initial LU | NO | 0 | D | 0 | D | 0 | 0 |

* Note concerning dynamics of change : **D correspond to "Default"**, "I" to Immediate and "E" to Exponential (Please refer to the Guidelines)

**Total Other LUCs** 0 -245,552

- **Grassland Module**

**4. Grassland systems**

**4.1. Grassland systems from other LUC or converted to other LUC *(Please fill step 2.LUC previously)***

| Description | Initial state | Final state of the grassland: Without project | With project | Fire use to manage: (y/n) | Periodicity (year) | (y/n) | Periodicity (year) | Yield: Start (t/ha) | Without (t/ha) | With (t/ha) | Area (ha): Start | Without |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Grassland after Deforestatio | Select state | Select state | Select state | NO | 5 | NO | 5 | | | | 0 | 0 |
| Converted to A/R | Select state | Select state | Select state | NO | 5 | NO | 5 | | | | 0 | 0 |
| Grassland after non-forest L | Select state | Select state | Select state | NO | 5 | NO | 5 | | | | 0 | 0 |
| Converted to OLUC | Severely Degraded | Severely Degraded | Severely Degraded | NO | 5 | NO | 5 | | | | 2,500 | 2,500 |

**4.1.2. Grassland systems remaining grassland systems *(total area must remains contant)***

| Description | Initial state | Final state of the grassland: Without project | With project | Fire use to manage: Periodicity without (y/n) | (year) | Periodicity with (y/n) | (year) | Yield: Start (t/ha) | Without (t/ha) | With (t/ha) | Area (ha): Start | Without |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| reduced pressure | Severely Degraded | Severely Degraded | Moderately Degraded | NO | 5 | NO | 5 | | | | 5,000 | 5,000 |
| improved pasture magt | Severely Degraded | Severely Degraded | Non degraded | NO | 5 | NO | 5 | | | | 4,000 | 4,000 |
| Fencing | Severely Degraded | Severely Degraded | Improved without inputs manageme | NO | 5 | NO | 5 | | | | 4,000 | 4,000 |
| fertil+seeds | Moderately Degraded | Moderately Degraded | Improved with inputs improvement | NO | 5 | NO | 5 | | | | 1,000 | 1,000 |
| | Severely Degraded | Severely Degraded | Severely Degraded | NO | 5 | NO | 5 | | | | 0 | 0 |
| | Select state | Select state | Select state | NO | 5 | NO | 5 | | | | 0 | 0 |
| | Select state | Select state | Select state | NO | 5 | NO | 5 | | | | 0 | 0 |
| | Select state | Select state | Select state | NO | 5 | NO | 5 | | | | 0 | 0 |
| | Select state | Select state | Select state | NO | 5 | NO | 5 | | | | 0 | 0 |
| | Select state | Select state | Select state | NO | 5 | NO | 5 | | | | 0 | 0 |

* Note concerning dynamics of change : **D correspond to "Default"**, "I" to Immediate and "E" to Expo

Tier 2

Total grassland sys

**4.2. Livestock**

| Livestock categories | Head number (mean per year): Start | Without project | * | With project | * | Feeding practices*: Start | Without | With | Specific Agents*: Start | Without | With | Breeding*: Start | Without | With |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dairy cattle | 0 | 0 | D | 0 | D | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Other cattle | 5,000 | 4,500 | D | 5,500 | D | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Buffalo | 0 | 0 | D | 0 | D | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Sheep | 30,000 | 27,000 | D | 33,000 | D | 0% | 0% | 20% | 0% | 0% | 0% | 0% | 0% | 25% |
| Swine (Market) | 0 | 0 | D | 0 | D | | | | | | | | | |
| Swine (Breeding) | 0 | 0 | D | 0 | D | | | | | | | | | |
| *Goats* | 30,000 | 27,000 | D | 33,000 | D | | | | | | | | | |
| *Horses* | 1,000 | 1,000 | D | 1,000 | D | | | | | | | | | |
| *Please select* | 0 | 0 | D | 0 | D | | | | | | | | | |

**Technical mitigation option (%)**

<u>Feeding practices</u>: e;g. more concentrates, adding certain oils or oilseeds to the diet, improving pasture quality,…

<u>Specific agents</u>: specific agents and dietary additives to reduces CH4 emissions (Ionophores, vaccines, bST…)

<u>Breeding</u>: Increasing productivity through breeding and better management practices (reduction in the number of replacement heifers)

**Production (meat, milk, etc)** in tonnes of product per year: Start Without With

Total livestock

Tier 2

- # Forest Management Module

**5.1. Forest degradation and management**

Available AEZ: **1.Subtropical humid forest - 2.Subtropical dry forest - 3.Subtropical steppe - 4.Subtropical mountains systems**

| Type of vegetation that will be degraded | Degradation level of the vegetation: Initial state | At the end without project | At the end with project | Fire occurrence and severity: Without (y/n) | Periodicity (year) | Impact (% burnt) | With (y/n) | Periodicity (year) | Impact (% burnt) | Area (ha): Start (ha) | Without (ha) | * | With (ha) | * | Total Emissions (tCO2-eq): Without | With | Balance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Forest Zone 3 | Extrem | Extrem | Very low | NO | | | NO | | | 1,500 | 1,500 | D | 1,500 | D | 0 | -279,383 | -279,383 |
| Select the vegetation | Select level | Select level | Select level | NO | | | NO | | | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Select the vegetation | Select level | Select level | Select level | NO | | | NO | | | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Select the vegetation | Select level | Select level | Select level | NO | | | NO | | | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Select the vegetation | Select level | Select level | Select level | NO | | | NO | | | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Select the vegetation | Select level | Select level | Select level | NO | | | NO | | | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Total forest degradation | | | | | | | | | | | | | | | 0 | -279,383 | -279,383 |

* Note concerning dynamics of change : **D correspond to "Default"**, "I" to Immediate and "E" to Exponential (Please refer to the Guidelines)

- # Input and Energy Module

**6.1 Inputs (liming, fertilizers, pesticides, herbicides,…)**

| Description and unit to report | Amount applied per year: Start | Without | * | With | * | Total emissions at field level in (tCO2-eq): CO2 emissions Without | CO2 emissions With | N2O emissions Without | N2O emissions With | Emissions from production, transportation, storage and transfer (in tCO2-eq): Without | With | Total Emissions (tCO2-eq): Without | With | Balance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lime application** | | | | | | | | | | | | | | |
| Limestone (tonnes per year) | 0 | 0 | D | 0 | D | 0 | 0 | - | - | 0 | 0 | 0 | 0 | 0 |
| Dolomite tonnes per year) | 0 | 0 | D | 0 | D | 0 | 0 | - | - | 0 | 0 | 0 | 0 | 0 |
| not-specified (tonnes per year) | 0 | 0 | D | 0 | D | 0 | 0 | - | - | 0 | 0 | 0 | 0 | 0 |
| **Fertilizers** | | | | | | | | | | | | 0 | 0 | 0 |
| Urea (tonnes of N per year - Urea has 46.7% of N) | 252 | 252 | D | 514 | D | 7,920 | 15,107 | 24,552 | 46,831 | 24,024 | 45,824 | 56,496 | 107,761 | 51,265 |
| Other N-fertilizers (tonnes of N per year) | 0 | 0 | D | 6 | D | - | - | 0 | 512 | 0 | 501 | 0 | 1,012 | 1,012 |
| N-fertilizer in irrigated rice (tonnes of N per year) | 0 | 0 | D | 0 | D | - | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sewage (tonnes of N per year) | 0 | 0 | D | 0 | D | - | - | 0 | 0 | - | - | 0 | 0 | 0 |
| Compost (tonnes of N per year) | 0 | 0 | D | 1,600 | D | - | - | 0 | 136,400 | - | - | 0 | 136,400 | 136,400 |
| Phosphorus (tonnes of P2O5 per year) | 0 | 0 | D | 6 | D | - | - | - | - | 0 | 77 | 0 | 77 | 77 |
| Potassium (tonnes of K2O per year) | 0 | 0 | D | 0 | D | - | - | - | - | 0 | 0 | 0 | 0 | 0 |
| **Pesticides** | | | | | | | | | | | | | | |
| Herbicides (tonnes of active ingredient per year) | 0 | 0 | D | 0 | D | - | - | - | - | 0 | 0 | 0 | 0 | 0 |
| Insecticides (tonnes of active ingredient per year) | 0 | 0 | D | 11 | D | - | - | - | - | 0 | 3,682 | 0 | 3,682 | 3,682 |
| Fungicides (tonnes of active ingredient per year) | 0 | 0 | D | 15 | D | - | - | - | - | 0 | 3,754 | 0 | 3,754 | 3,754 |
| Total from inputs | | | | | | | | | | | | 56,496 | 252,685 | 196,189 |

* Note concerning dynamics of change : **D correspond to "Default"**, "I" to Immediate and "E" to Exponential (Please refer to the Guidelines)

**6.2 Energy consumption (electricity, fuel,…)**

| Description and unit to report | Quantity consumed per year: Start | Without | * | With | * | Total Emissions (tCO2-eq): Without | With | Balance |
|---|---|---|---|---|---|---|---|---|
| **Electricity (MWh per year)** | | | | | | | | |
| Please select the country of origin | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| **Liquide or gaseous (in $m^3$ per year)** | | | | | | | | |
| Gasoil/Diesel | 0 | 0 | D | 212.5 | D | 0 | 9,791 | 9,791 |
| Gasoline | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Gas (LPG/ natural) | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Butane | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Propane | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Ethanol | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| User defined (Tier 2): | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| **Solid (in tonnes of dry matter per year)** | | | | | | | | |
| Wood | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Peat | 0 | 0 | D | 0 | D | 0 | 0 | 0 |
| Total from energy | | | | | | 0 | 9,791 | 9,791 |

* Note concerning dynamics of change : **D correspond to "Default"**, "I" to Immediate and "E" to Exponential (Please refer to the Guidelines)

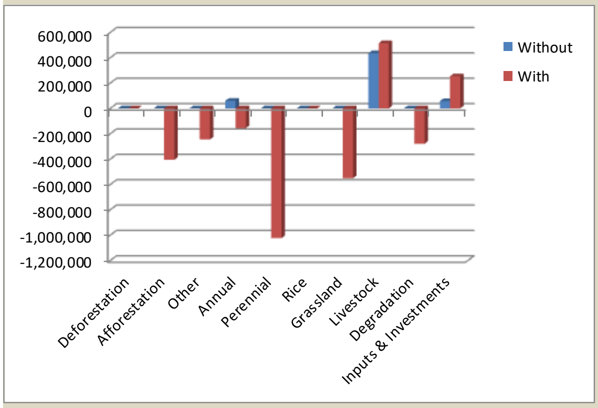
**6.3 Construction of new infrastructure for the project (irrigation systems, buildings, roads)**

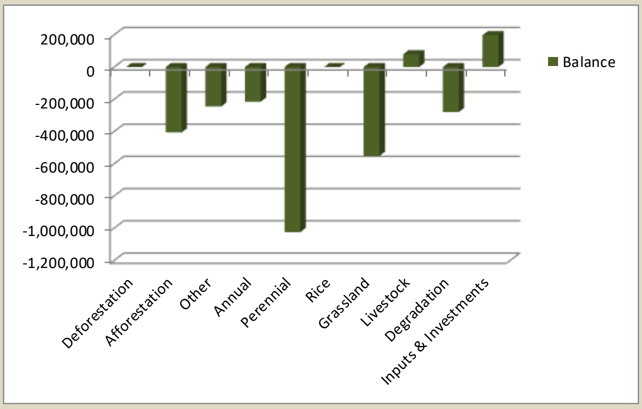
| Description and unit to report | | Surface concerned: Without | With | Total Emissions ($tCO_2$-eq): Without | With | Balance |
|---|---|---|---|---|---|---|
| **Irrigation systems (total in ha)** | | | | | | |
| Hand moved sprinkle | | 0 | 5000 | 0.0 | 298.8 | 298.8 |
| Traveler sprinkle | | 0 | 5000 | 0.0 | 309.8 | 309.8 |
| **Buildings and roads (total in $m^2$)** | | | | | | |
| Other (concrete) | Betail-hydro | 0 | 5000 | 0.0 | 2,750.0 | 2,750.0 |
| Agricultural Buildings (concrete) | | 0 | 5000 | 0.0 | 3,280.0 | 3,280.0 |
| Road for medium trafic (concrete) | | 0 | 60000 | 0.0 | 19,140.0 | 19,140.0 |
| Other (concrete) | channel drain | 0 | 10000 | 0.0 | 5,500.0 | 5,500.0 |
| Please select | | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Please select | | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Please select | | 0 | 0 | 0.0 | 0.0 | 0.0 |
| Total from construction | | | | 0 | 31,279 | 31,279 |

## *Annex 2B: Framework of results:*

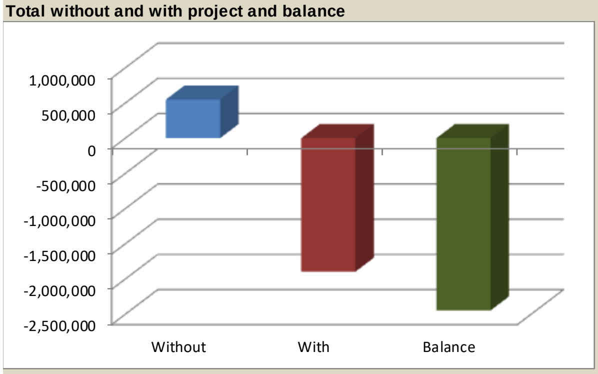
| | | | | | |
|---|---|---|---|---|---|
| **Name of the project** | Tajikistan Env. Land r | **Climate** | Warm Temperate (Dry) | **Duration (yr)** | 20 |
| **Continent** | Asia (Continental) | **Soil** | HAC Soils | **Total area (ha)** | 37500 |

| **Component of the project** | **Gross fluxes** **Without** | **With** | **Balance** | **Share per GHG of the Balance** **Result per GHG** $CO_2$ **Biomass** | **Soil** | **Other** | $N_2O$ | $CH_4$ | **Results per year** **without** | **with** | **Balance** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **All GHG in $tCO_2eq$** **Positive = source / negative = sink** | | | | | | | | | | |
| **Land Use Changes** | | | | | | | | | | | |
| Deforestation | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 |
| Afforestation | 0 | -406,267 | -406,267 | -312,913 | -93,353 | | 0 | 0 | 0 | -20,313 | -20,313 |
| Other | 0 | -245,552 | -245,552 | 19,617 | -265,169 | | 0 | 0 | 0 | -12,278 | -12,278 |
| **Agriculture** | | | | | | | | | | | |
| Annual | 58,800 | -156,289 | -215,089 | 0 | -198,625 | | -4,557 | -11,907 | 2,940 | -7,814 | -10,754 |
| Perennial | 0 | -1,025,063 | -1,025,063 | -981,750 | -43,313 | | 0 | 0 | 0 | -51,253 | -51,253 |
| Rice | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 0 |
| **Grassland & Livestocks** | | | | | | | | | | | |
| Grassland | 0 | -551,722 | -551,722 | 0 | -551,722 | | 0 | 0 | 0 | -27,586 | -27,586 |
| Livestock | 433,830 | 513,185 | 79,355 | | | | 39,293 | 40,062 | 21,691 | 25,659 | 3,968 |
| **Degradation** | 0 | -279,383 | -279,383 | -219,948 | -59,434 | | 0 | 0 | 0 | -13,969 | -13,969 |
| **Inputs & Investments** | 56,496 | 253,294 | 196,798 | | | 77,471 | 159,190 | | 2,825 | 12,665 | 9,840 |
| **Total** | 549,126 | -1,897,796 | **-2,446,921** | -1,494,995 | -1,211,616 | 77,471 | 193,926 | 28,155 | 27,456 | -94,890 | -122,346 |
| **Per hectare** | 15 | -51 | -65 | -37.8 | -32.3 | 2.1 | 5.2 | 0.8 | | | |
| **Per hectare per year** | 0.7 | -2.5 | -3.3 | -1.9 | -1.6 | 0.1 | 0.3 | 0.0 | 0.7 | -2.5 | -3.3 |

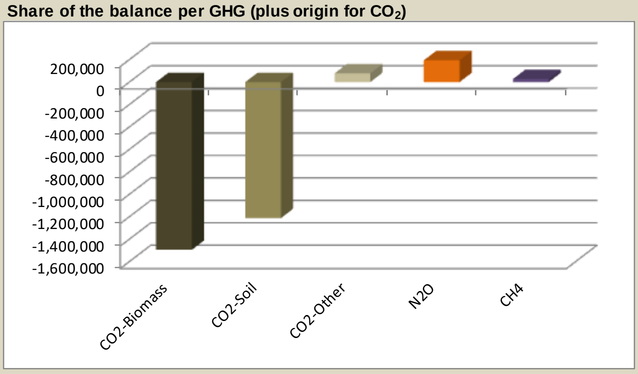



**Total without and with project and balance**




**Share of the balance per GHG (plus origin for $CO_2$)**




| **Surfaces evolutions by land use / category (hectares - ha)** | | State at the beginning | Without Project | With Project |
|---|---|---|---|---|
| Forest/Plantation | | 1,500 | 1,500 | 2,500 |
| Cropland | Annual | 16,000 | 16,000 | 13,500 |
| | Perennial | 0 | 0 | 7,500 |
| | Rice | 0 | 0 | 0 |
| Grassland | | 16,500 | 16,500 | 14,000 |
| Other Land | Degraded | 3,500 | 3,500 | 0 |
| | Other | 0 | 0 | 0 |
| Organic soils | | 0 | 0 | 0 |
| **Total area =** | | 37,500 | 37,500 | 37,500 |

| **Uncertainty level** | |
|---|---|
| Net balance | -2,446,921 |
| Total uncert. | 1,037,978 |
| % of uncertain | 42 |

**Detailed matrices of changes**