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Report on Options for Nature-based Solutions to Enhance NDC Commitments in Three Countries (Kazakhstan, Kyrgyzstan and Tajikistan)

Technical and financial analysis of promising nature-based solutions for climate change

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LIST OF ABBREVIATIONS

BMEL	Bundesministerium für Ernährung und Landwirtschaft
CO_2	Carbon dioxide
COP21	21st Conference of the Parties to the UNFCCC
DBH	Diameter at breast height
EX-ACT	Ex-Ante Carbon-balance Tool
FAO	Food and Agriculture Organization of the United Nations
FC	Financial Component
FGP	Fast Growing Plantations
FSC	Forest Stewardship Council certification
FWC	Forestry and Wildlife Committee (Kazakhstan)
GHG	Greenhouse Gases
GIS	Geographic Information System
GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit* (*GIZ*) GmbH
ha	hectare
(I)NDC	(Intended) Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JFM	Joint Forest Management
KAZ	Kazakhstan
KG	Kyrgyzstan
KZT	Kazakhstan Tenge
M	Million
NbS	Nature-based Solution
NDC	Nationally Determined Contribution
NFP	National Forestry Programme (Tajikistan)
NGO	Non-Governmental Organization
NSP	NAMA Support Project
NTFP	Non-Timber Forest Products
PA	Paris Agreement
PEFC	Programme for the Endorsement of Forest Certification
PUU	Pasture User Union
SAEPF	State Agency for Environmental Protection and Forestry
SFF	State Forest Fund
SFM	Sustainable Forest Management
tCO_2e	Tons CO_2 equivalents

TJK	Tajikistan
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollar
WB	World Bank
WOCAT	World Overview of Conservation Approaches and Technologies

EXECUTIVE SUMMARY

The Paris Agreement (PA) of 2015 is the main outcome after a decade of climate negotiations under the UNFCCC. It stresses the urgent need to mitigate greenhouse gases emissions (GHG) and to limit the expected impacts of climate change. Most Parties have outlined specific sectors relevant for mitigation and adaptation in their appropriate Nationally Determined Contributions (NDC), and in many of them the land use sector play a key role for both.

This report analyzes the potential contribution of Nature-based Solutions (NbS) to the Nationally Determined Contributions (NDC) for three Central Asian countries – Kazakhstan, Kyrgyzstan and Tajikistan. The option assessment includes technical and financial analyses of nature-based solutions with promising potential for addressing climate change.

Four particular NbS provide effective instruments for the mitigation and adaptation goals of these countries especially in the context of the upcoming NDC updates.

In Kazakhstan, the development of fast growing plantations (FGP) and Sustainable Forest Management (SFM) could have strong impact on an ecosystem level for entire regions in the country and at the same time contribute to a high extend to the NDC achievement through CO_2 sequestration. Next to that, these models could enhance the domestic wood production.

In Kyrgyzstan FGP combined with agricultural crops, even on small farming scale, can reduce the pressure on forests, strengthen self-supply in rural areas and contribute to a long-term carbon sequestration through wood processing into long-lasting products.

Joint Forest Management and improved pasture management will contribute to national NDC goals in Tajikistan by restoring degraded and overgrazed land.

Upscaling opportunities exist especially for the FGP development in Kazakhstan. With the implementation of the FGP model, Kazakhstan has a potential to reach its entire mitigation goals set in its NDC. Projections based on current policies forecast an increase in GHG emissions by 2030 at 416 million tCO_2e. With an ambitious large-scale FGP implementation on 1 M ha in the next 30 years, Kazakhstan can save around 350 M tCO_2e.

An enabling policy for afforestation in Kazakhstan is of high importance for the further development. The initiation of large-scale afforestation activities should be accompanied by a policy towards wood-based economy. Clear political actions should enable the investment environment for wood production, processing and use. Some very first steps in this direction such as the clear political attempt to establish a subsidy system for private afforestation have been already made. However, the crucial land availability analysis is still missing, linking suitable natural conditions and land use types with no restrictions for plantation establishment and resulting in the overall area potential for FGP in the country. For a future upscaling, further and larger piloting with afforestation should be considered. This, however, would require targeted incentive mechanisms to involve significant private sector investments in these efforts.

In addition to the committed NDC in the context of the PA, Kazakhstan, Kyrgyzstan and Tajikistan have made voluntary pledges to restore around 2 M ha of degraded land under the Bonn Challenge. Land use change and improvement of existing land use systems are considered as highly relevant to contribute to the national NDCs via the mentioned NbS.

1 OBJECTIVE AND BACKGROUND

1.1 Objective of the assignment

The objective of this study is to identify appropriate options for nature-based solutions (NbS) with significant potential to deliver on the Nationally Determined Contribution (NDC) commitments of three countries in Central Asia: Kazakhstan, Kyrgyzstan and Tajikistan. The study can serve the decision-making stakeholders, e.g. via the NDC Partnership's Focal Points, to review and update their NDC goals in the land use sector based on the identified options. Ultimately, this serves the purpose to enhance the role of Nature-based Solutions in the actual implementation of NDCs.

The study documents the potential of NbS for the NDC update and implementation in Central Asia. Key activities in Central Asia focus on afforestation and restoration of natural forests in Kazakhstan, as well as international best practices. A minimum of three nature-based models suitable for Central Asia are presented in detail. They are analyzed based on technical and financial criteria of the most promising NbS for climate change.

1.2 NDCs and Paris Agreement: NDC enhancement 2020

The 2015 Paris Agreement (PA) negotiated at COP21 stresses the urgent need to reduce emissions of greenhouse gases and limit the global temperature below 2°C above pre-industrial levels. The 'Intended Nationally Determined Contributions (INDC)' were a successful instrument to let countries take account of their specific national circumstances and needs; it helped pushing forward the adoption of the PA, under which NDCs have become the central elements for implementation: they are the superordinate national climate plans for each country. They highlight climate actions, targets, policies and measures each government aims to implement.

For increasing ambition, NDCs are to be revised, updated and submitted every five years to the Secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). The next NDC submission is requested for 2020. Updated NDCs should represent a progression compared to the previous NDCs. Tajikistan, Kyrgyzstan and Kazakhstan are planning to comply and for the first time to update their NDCs.

1.3 Nature-based solutions in NDCs

The International Union for Conservation of Nature (IUCN) defines Nature-based Solutions as "actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits."[1] As such, NbS provide opportunities for both adaptation and mitigation.

The PA acknowledges "the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity, recognized by some cultures as Mother Earth" and

[1] https://www.iucn.org/theme/ecosystem-management/our-work/a-global-standard-nature-based-solutions

includes references to natural ecosystems (especially forests) in several of its articles. Of all NDCs submitted, 66% include NbS in their NDCs[2] (UNDP (2019) provides a seven-step approach for enhancing NDCs through NbS)[3]. In total, 117 NDCs have indicated the land use as a priority sector for the implementation of national mitigation and adaptation strategies.

Hence, the PA contains clear objectives for preserving and enhancing carbon sinks, thereby calling for stronger support to developing countries to protect forests and enhance the adaptive capacity of the land use sector. It signals the beginning of a new phase in international climate diplomacy that is to be driven by national country contributions, with respective technical and financial support.

To improve the possibility of channeling climate financing for the implementation of such models, the three countries considered in this report should clearly mention NbS in the process of the NDC updates. The links between the countries' NDC targets and the NbS models are presented in this report (chapter 3).

1.4 Synergies with other sectoral and national policies

Below is a list of the sectoral and national policies with an impact on the NDC and NbS topic for each country.

Kyrgyzstan

- Bonn Challenge Pledge, Kyrgyzstan pledges to restore 324,000 ha of degraded land
- Concept of forestry industry development until 2025
- Concept of forest development of the Kyrgyz Republic for the period up to 2040
- Biodiversity conservation priorities of the Kyrgyz Republic until 2024
- Action Plan for implementation of biodiversity conservation priorities of the Kyrgyz Republic for 2014-2020
- Climate Change Adaptation Programme and Action Plan for 2015-2017 for the Forest and Biodiversity Sector
- Strategy of the Kyrgyz Republic on adaptation to climate change until 2020
- Third National Communication of the Kyrgyz Republic under the United Nations Framework Convention on Climate Change
- National low-carbon emission policy

Tajikistan

- Bonn Challenge Pledge, Tajikistan pledges to restore 66,000 ha of degraded land
- Forest Code, 2011

[2] https://www.naturebasedsolutionsinitiative.org/wp-content/uploads/2018/12/NBSTalkforSideEvent.pdf
[3] https://www.ndcs.undp.org/content/dam/LECB/docs/pubs-tools-facts/undp-ndcsp-pathway-for-increasing-nbs-in-ndcs-final.pdf

- National development strategy of the republic of Tajikistan for the period up to 2030[4]
- National Disaster Risk Reduction Strategy of the Republic of Tajikistan for 2019-2030
- National Strategy and Action Plan for the Conservation of Biodiversity until 2020
- National Strategy and Action Plan on Conservation and Sustainable Management of Biological Diversity
- National Strategy of Adaptation to Climate Change of the Republic of Tajikistan for the period till 2030
- Program for Pasture Development for 2016-2020
- Program of Medium-term Development (MtDP) of the Republic of Tajikistan for 2016-2020
- Program on Development of Horticulture and Viticulture for 2016-2020
- The draft Forestry Sector Development Strategy (2016-2030)
- The First Biennial Report of the Republic of Tajikistan on Inventory of Greenhouse Gases under the UN Framework Convention on Climate Change. Dushanbe, 2018

Kazakhstan

- Kazakhstan pledges to restore at least 1.5 million ha of degraded land under the Bonn Challenge
- Kazakhstan's long-term objective is to become one of the 30 most developed countries in the world by 2050
- Following a path of low carbon economy growth Kazakhstan adopted the law "On energy saving and energy efficiency", "On Supporting the Use of Renewable Energy Sources" aiming at greater use of renewable energy sources
- In order to emphasize its commitment to low carbon growth, Kazakhstan has adopted a Concept on transition to a «Green» Economy
- For the implementation of the «Green» Economy Concept, an action is developed, under which government programs on waste management, modernization of housing and communal services, development of sustainable transport, conservation of ecosystems and enhancement of forest cover were adopted. The laws on extended responsibility of entrepreneurs and greening of vehicles are being formulated
- The implementation of the «Green» Economy Concept, and adoption of related legislative acts, should lead to modernization of key infrastructure and production technologies based on energy-efficient technologies, and will make a significant contribution to reducing the emissions of greenhouse gases (GHG)

[4] National Development Strategy of the Republic of Tajikistan until 2030, 2016 It is approved by the resolution of the Majlisi namoyandagon of the Majlisi Oli of the Republic of Tajikistan of October 1, 2016, No. 392

2 METHODS

2.1 Multi-level approach

This report analyses four NbS suitable for the following three countries in Central Asia – Kazakhstan, Kyrgyzstan and Tajikistan, in their potential to contribute to the countries' NDCs. The overall analysis prioritizes the models to a different extent. The three levels of assessment examine different aspects of the same models. The deeper the assessment gets, the less models are object of examination.

2.1.1 First level of assessment

The first level of assessment comprises a compilation of information on the existing experiences of all four models:

- Fast growing plantations (FGP) in Kazakhstan,
- Agroforestry system (FGP in combination with an agricultural crop) in Kyrgyzstan,
- Joint forest management and improved pasture management in Tajikistan,
- Natural forest management in Kazakhstan.

Here, the present report draws information especially from previous assignments that UNIQUE implemented in the region in the past few years. Additional international experiences on similar models are taken into account.

2.1.2 Second level of assessment

Within the second level of assessment, the analysis takes a closer look to three out of the four models listed above. These are:

- Fast growing plantations (FGP) in Kazakhstan,
- Joint forest management and improved pasture management in Tajikistan,
- Natural forest management in Kazakhstan.

For every NbS, a cost-benefit analysis and a calculation of the carbon benefits are carried out. In addition, the socio-economic potential and the adaptation potential are analyzed.

The agroforestry model has restricted potential for upscaling according to the analysis, thus the impact for the NDC of Kyrgyzstan is not expected to be as significant as for the other models.

2.1.3 Third level of assessment

In the last, third step, a market study on wood and wood products takes place. This study has a strong link with the NbS fast growing plantations in Kazakhstan. This study considered international and national statistics on trade, consumption and production of wood and wood products. The authors analyze this information subsequently in the context of macroeconomic developments for Kazakhstan and derive assumptions on the development.

2.2 EX-ACT tool

The Ex-ante Carbon Balance Tool (EX-ACT) was developed by the Food and Agriculture Organization of the United Nations (FAO). It allows for ex-ante measurements of the mitigation impact of agriculture and forestry development projects by estimating net carbon balance[5] from GHG emissions and carbon sequestration. EX-ACT is a land-based accounting system, measuring carbon stocks, stock changes per unit of land, and CH_4 and N_2O emissions expressed in tones of CO_{2e} per ha per year.

EX-ACT has been developed using primarily the IPCC 2006 Guidelines for National GHG Inventories, complemented by other existing methodologies and reviews of default coefficients. Tier 1 emission factors make it possible to estimate themitigation impact of projects and programs with the project activity data. Default values for mitigation options in the agriculture sector are mostly from the IPCC Fourth Assessment Report (2007). Thus, EX-ACT[6] allows for a mitigation impact appraisal of new investment programs and projects for donors and planning officers, project designers, and decision makers within agriculture and forestry sectors in developing countries.

EX-ACT tool was used for the carbon balance estimation for the NbS cases: fast growing plantations (FGP) in Kazakhstan, forest and pasture management in Tajikistan, and natural forest management in Kazakhstan. Region specific coefficients were applied in the tool such as climate, moisture regime, dominant regional soil type, and type of vegetation.

Assumptions used for the calculation of carbon benefit for various scenarios are presented in detail in the Annex (8.1).

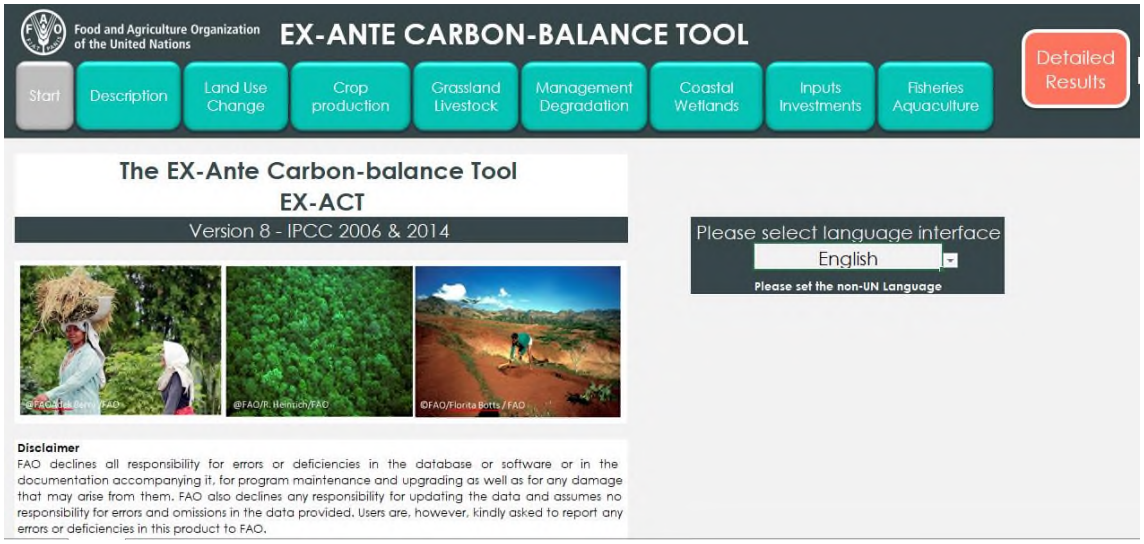

Figure 1: Screenshot of the EX-ACT tool[7]

[5] The carbon balance is defined as the net balance from all greenhouse gases expressed in CO2 equivalent that were emitted or sequestered due to project implementation as compared to a business-as-usual scenario.

[6] The tool can also help to identify the mitigation impacts of various investment project options, and thus provide an additional criterion for consideration in project selection.

[7] http://www.fao.org/tc/exact/carbon-balance-tool-ex-act/en/

3 TYPICAL LAND USE MODELS IN THE CONTEXT OF NBS IN CENTRAL ASIA

3.1 Fast growing plantations (FGP) in Kazakhstan

Model for a nature based solution:

Fast growing plantations in Kazakhstan

Background

- Afforestation operations do not only serve the production of wood, they also have a strong impact on the ecosystems and can contribute to climate change mitigation through CO_2 sequestration. This is why plantations with fast growing species can have a positive impact on the achievement of the NDC target of a country. Even after harvesting of the wood, the carbon is stored in the product and stays there throughout the product's lifetime. In addition, wood products serve as carbon-neutral substitutes for other products (such as concrete).
- Kazakhstan is among the 30th largest emitters of GHG, mainly due to its large oil and gas industry. In 2017, total net emissions balance of Kazakhstan was 535 M t CO_2e /a.[8] The country is the leader for the Green Economy transition in Central Asia and has adopted an emission reduction target of 15-25% from 1990 GHG levels by 2030, including the land use sector, as indicated in its NDC.
- Afforestation is considered to be one of the domestic carbon sequestration efforts.
- In this context, the government of Kazakhstan is interested in developing an incentive system for the establishment of fast growing plantations for timber use in private hand. The goal is to support the development of a private forest sector in the country and

[8] https://climateactiontracker.org/countries/kazakhstan/

simultaneously enhance the forest cover of the country to an extent that cannot be achieved by public afforestation activities only.

- Currently, the forest coverage in Kazakhstan is low (4.6 %). Overall, 11.5 M ha are covered with forests. More than 99 % of which are state-owned. Nearly all forests are under protection with restricted cutting regimes.
- The concept of the NbS presented here concentrates on one Oblast in Kazakhstan – Almaty. This decision is based on the natural and economic conditions in the region and as well on previous experiences with piloting experience (UNIQUE 2018, 2019).

NbS description – production model

- Large-scale fast growing plantations (FGP) with a variation of Poplar hybrids operated by private investors (land tenants or landowners) with an objective to provide wood material for processing industries.
- Rotation period: up to 25 years (depending on the site and the production goal).
- Thinning operations within the rotation period (up to 3 operations).
- Clear-cut and reforestation (after the end of the rotation period).
- Inclusion of a certification system (e.g. FSC, PEFC, and so on) should be considered.
- Irrigation systems are crucial for the development and vitality in many cases.

Products and value chains

Primary production goal - wood production:

- Quality wood / sawn wood
- Industrial wood
- Firewood

Area potentials (upscaling)

Two scenarios

- 100,000 ha (2,000,000 m^3/year)
- 1,000,000 ha (20,000,000 m^3/year)

Previous experiences

- Small-scale experience in the scope of a piloting project (FWC/GIZ/UNIQUE) of 6 ha in 3 regions (UNIQUE 2018 and UNIQUE 2019).
- Long-term breeding experience on a regional level with hybrids development. Local hybrids: *Kazakhstanskii* and *Kairad.*
- Traditional land use especially back from Soviet times as wind shelter belts protecting agricultural fields.
- No previous experience with piloting of large FGP areas. Relevant for:
  - micro-climate within the plantation
  - wood sales / value chains / processing / products of fast growing species

International best practices

▪ Incentives for commercial plantations in Colombia[9] - successfully implemented subsidy system for private afforestation activities ▪ Private afforestation programme in Chile[10]
Embedding of societal and legal aspects
▪ Clear conditions of the land tenure ▪ Investment security ▪ Subsidy programme – conditions ▪ Policy enabling final cuts
Potential socio-economic benefits
▪ Employment potentials ▪ Regional forest and wood cluster development ▪ Rural development (infrastructure, tax revenues for the region) ▪ Income diversification of rural population ▪ Shelter belt function ▪ Ecologic / landscape aspects ▪ Erosion protection ▪ Carbon sequestration for climate change mitigation
Possible threats
▪ Insecurity on land use systems (final cuts permissions) ▪ Land tenure uncertainty (land tenure conditions not adapted to the rotation cycle) ▪ Provision of quality planting material ▪ Lack of a wood processing industry ▪ Low wood use per capita ▪ Subsidy system not yet introduced (to be defined: overall budget unclear; payment regulations, clear conditions between donor and beneficiary) ▪ High maintenance costs in the first three years after establishment ▪ Changing natural conditions induced by climate change (e.g. long lasting drought periods).

[9] https://www.minagricultura.gov.co/tramites-servicios/apoyos-incentivos/Paginas/Certificado-de-Incentivo-Forestal-CIF-2013-v2.aspx

[10] http://www.conaf.cl/nuestros-bosques/plantaciones-forestales/dl-701-y-sus-reglamentos/

Table 1: NbS embedding in the NDC

Sectors and Priority areas in the current NDC	Recommended NbS-related activities to enhance NDC
Mitigation	
Covered sectors: ▪ Energy, ▪ Agriculture ▪ Waste ▪ Land use, Land use Change and Forestry	▪ Increasing forest area by afforestation with FGP ▪ Increasing forest area by restauration ▪ Increasing forest density by natural rehabilitation ▪ Improving forest productivity by SFM ▪ Establishment of national carbon markets
Adaptation	
not included in the NDC	

3.2 Natural forest management in Kazakhstan

Model for a nature-based solution:

Natural forest management

Background

- Forests contribute to climate change mitigation through CO_2 sequestration (above and below ground biomass, and soil carbon). Through sustainable forest management practices, the forestry sector can have a positive impact on the achievement of the NDC of a country.
- The carbon in wood products is stored throughout the product lifetime. In addition, wood products serve as carbon-neutral substitutes for other products such as steel, concrete or aluminium.
- The forest coverage in Kazakhstan is low (4.6 %). Overall, 11.5 M ha are covered with forests. More than 99 % of which are state-owned. Nearly all forests are under protection with restricted cutting regimes.
- The NbS model, presented here concentrates on Eastern Kazakhstan Oblast, which is rich on forests and presents high potential for sustainable forest management activities.
- The overall forest area in the area is about 2 M ha, 36 % of which are under protection (with no forestry interventions permitted).
- Many former productive forest stands have been degraded by human intervention. These stands have currently very low annual increment rates, which can be enhanced by sustainable forest management practices.

NBS description – production model

- The sites targeted for this approach mainly consist of forest with current low standing volume and suboptimal tree-species composition.
- The production aims to develop highly productive forests through improved (silvicultural) management practices:
  - Tree species selection

○ Site-species optimization ○ Reforestation with improved tree species through breeding (genetics of local species) - Management according to forest development types[11] ○ Diameter-oriented harvesting operations ○ Forest restructuring - Building of forest roads - Harvesting operations ○ harvesting techniques / machinery ○ skidding / storage of harvested wood ○ improved assortments - pest and fire prevention and monitoring ▪ Costs for interventions depend on the current situation of the stands (tree species composition, standing volume, necessity of enrichment planting.
Products and value chains
Primary production goal - wood production: ▪ Quality wood / sawn wood, industrial wood, firewood ▪ Non-Timber Forest Products (NTFP)
Area potentials (upscaling)
▪ Approx. 1,300,000 ha of forests
Previous experiences
▪ Forest Management Planning in place ▪ Leskhozes / state nurseries
International best practices
▪ The economics of Forest Landscape Restoration (UNIQUE 2019)[12]
Embedding of societal and legal aspects
▪ Establishment of a policy that enable final cuts ▪ Connecting long-term lease contracts with private tenants with stronger management requirements and control ▪ Finances – economic viability and/or state subsidies ▪ Ban on roundwood export

[11] Forest Development Types are the basis for silvicultural activities in the state forest of the federal province of Baden-Württemberg in Germany. The forest development types comprise forest stands with a comparable condition and comparable development target. They describe the suitable measures for achieving this development goal, taking into account the diversity of forest functions (ForstBW 2014).

[12] https://www.unique-landuse.de/images/publications/vereinheitlicht/2019-10-14_Economics_of_FLR_UNIQUE.pdf

Potential socio-economic benefits
▪ Higher productivity of forest stands ▪ Higher resilience of forest stands ▪ Employment potentials ▪ Regional forest and wood cluster development ▪ Rural development (infrastructure, tax revenues for the region) ▪ Income diversification of rural population ▪ Ecologic aspects i.e., improved stability of the forests ▪ Protection function (i.e., on steep areas), protection functions (erosion, landslides, avalanches etc.) ▪ Water resources protection ▪ Carbon sequestration for climate change mitigation
Possible threats
▪ Obstacles in the implementation of the entire process chain: forest management inventory and planning, implementation of the plan ▪ Lack of management according to the needs of forest types ▪ Sufficient staff resources (and know-how, trainings) ▪ Legal insecurity (final cuts permissions – diameter-oriented harvesting operations) ▪ Climate change induced risks (suitability of tree species changes with the fast changing conditions) ▪ Lack of investments ▪ Underdevelopment of modern and energy-efficient wood processing industry - Plywood boards - Wood construction modules - Solid structural timber ▪ Low wood prices / high shares of imported cheap wood material (from Russia)
NDC embedding
The NDC of Kazakhstan considers Land Use, Land-Use Change and Forestry to play an important role in mitigation. In 2018, Kazakhstan announced its commitment to restore at least 1.5 M ha of degraded land under the Bonn Challenge. Therefore, promotion of an improved forest management has a direct contribution to the achievement of the Bonn Challenge Pledge of Kazakhstan which is in turn strongly related to NDC i.e. Paris agreement[13]. For further information, see also Table 1.

[13] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Kazakhstan%20First/INDC%20Kz_eng.pdf

3.3 Agroforestry in Kyrgyzstan

Model for a nature based solution:

Agroforestry with FGP in Kyrgyzstan

Background

- Kyrgyzstan is amongst the countries predicted to be most severely affected by climate change. In order to take some measures, the Government of Kyrgyzstan announced its commitment to restore 324,000 ha of degraded land by 2030 under the Bonn Challenge. Afforestation with FGP may contribute to this goal and additionally help reduce the pressure on forests and contribute to a long-term carbon sequestration in wood products.
- Kyrgyzstan has around 1.2 million ha forest fund land, out of which approximately 637,000 ha are actually covered by forests (FAO, 2015). Around 12.5 % of forest in Kyrgyzstan suffer from land degradation (SAEPF and FAO, 2010) due to logging, use as fuel wood and grazing.

NBS description – production model

- Small-scale fast growing plantations (FGP) with a variation of Poplar hybrids (local) operated by private tenants / landowners with an objective to provide wood material for construction and fuel wood. Agricultural crops are integrated within the plantations in order to ensure a short-term income for the operating party (e.g. black currant / potato crops).
- Rotation period: 20-25 years
- Up to 4 thinning operations within the rotation period
- Clear cut and reforestation
- Especially suited areas: Lowland areas in the South of the country (Jalalabad region)

Products and value chains
Primary production goal - wood production: ▪ Firewood ▪ Construction wood (traditional house building) ▪ If applicable: Sawn wood and industrial wood Additionally: ▪ Potato and/or blackcurrant
Area potentials (upscaling)
▪ 300.000 ha by 2030[14]
Previous experiences
▪ Some experiences with Poplar in the southern lowlands of the country (small plantations < 1 ha; micro-nurseries; shelter belts) ▪ Existing tradition in producing Poplar for construction wood (for traditional housebuilding), beams for wall construction and beams for roof construction. ▪ 70 Million Trees for Kyrgyzstan, Thevs and Aliev, 2017[15] ▪ Towards a More Water Efficient Agriculture in Central Asia through Agroforestry, Thevs, 2017[16]
International best practices
▪ Agroforestry and tenure, FAO, 2019[17] ▪ World Agroforestry (ICRAF)[18] ▪ Quantification and distribution of agroforestry systems and practices at global level[19] ▪ Achieving the Global Goals through agroforestry. Agroforestry Network and Vi-Skogen, 2018[20]
Societal embedding and legal aspects
▪ Create incentives through subsidies ▪ Strengthen forest policy towards enabling final cuts (linked to particular land use types) ▪ Formulating and implementing clear conditions of the land tenure ▪ Creating of investment security

[14] http://www.unece.org/fileadmin/DAM/timber/Forest_Policy/Capacity_building/FLR_CCA_challenges___opportunities_081018-ENG-edited.pdf
[15] http://www.tropentag.de/2017/abstracts/posters/1098.pdf
[16] http://www.tropentag.de/2017/abstracts/links/Thevs_ChKPrUB6.pdf
[17] http://www.fao.org/3/CA4662en/CA4662en.pdf
[18] http://www.worldagroforestry.org/
[19] www.researchgate.net/publication/261707874_Quantification_and_distribution_of_agroforestry_systems_and_practices_at_global_level
[20] https://www.siani.se/wp-content/uploads/2018/09/AchievingTheGlobalGoalsThroughAgroforestry_FINAL_WEB_144ppi-1.pdf

Potential socio-economic benefits
▪ Rural development (infrastructure, tax revenues for the region) ▪ Income diversification of rural population ▪ Shelter belt function ▪ Ecologic / landscape aspects ▪ Erosion protection ▪ Carbon sequestration for climate change mitigation
Possible threats
▪ Legal insecurity (final cuts permissions, permissions to plant trees on agricultural land for a certain period) ▪ Land tenure insecurity (land tenure conditions adapted to the rotation cycle) ▪ Provision of quality planting material ▪ High maintenance costs in the first three years after establishment ▪ Changing natural conditions induced by climate change (e.g. long lasting drought periods)

Table 2: NbS embedding in the NDC

Sectors and Priority areas in the current NDC	Recommended NbS-related activities to enhance NDC
Adaptation	
Sectors: ▪ Water resources ▪ Agriculture ▪ Energy ▪ Emergencies ▪ Healthcare ▪ Forest and Biodiversity	▪ Enhancing research on forest and biodiversity vulnerability to climate change ▪ Enhancing research on agroforestry ▪ Improving livelihood of forest-dependent population
Mitigation	
Scope: ▪ Energy ▪ Industrial processes, solvents and other product use ▪ Agriculture ▪ Land use, land use change and forestry ▪ Waste	▪ Increasing forest area by afforestation/reforestation, land restoration and promotion of agroforestry ▪ Increasing forest density by natural rehabilitation ▪ Avoiding deforestation and forest degradation by decreasing grazing, cutting, erosion

3.4 Improved forest and pasture management in Tajikistan

Model for a nature based solution:

Afforestation/reforestation and improved pasture management in Tajikistan

Background

- Forest cover is Tajikistan is around 2.9%, 412,000 ha, mainly Juniper forests, pistachio forests, saxaul and riparian forests in the mountains. Forests are under constant pressure mainly due to overgrazing and firewood extraction.
- To prevent this, the Government of Tajikistan announced its commitment to restore 66,000 ha of degraded land under the Bonn Challenge – a global effort to restore 350 million ha of degraded and deforested land by 2030.
- Forests are located within the State Forest Fund and are almost all state owned. At the local level, forests are managed by leskhoz. Through Joint Forest Management approach, forests are leased to local population for 20 years.
- Tajikistan has roughly 3.8 million ha of pasture – almost 29% of its total land area. These natural resources, particularly year-round pastures near villages, are being depleted and degraded.[21]
- Pasture in Tajikistan are located in the State Forest Fund area and outside. With the SFF, pastures are managed by the leskhoz administration. Outside of the SFF areas, the Pasture User Union (PUU) manages pastures. A PUU is a union of pasture users established at the Jamoat (rural municipality) level, which consists of a cluster of villages. It is a formal organization, with a statute and legal registration, and has a stamp and a bank account.

[21] http://www.fao.org/europe/news/detail-news/en/c/882116/

NBS description
At the leskhoz level: ▪ Improved forest management (partly including grazing) - JFM - JFM aspects: improved forest management based on an agreement between the leskhoz and local people ▪ Improved pasture management - Improved grazing management (stock route rehabilitation and/or fencing along forest plots, fencing off hay making plots, bridge construction/rehabilitation, watering points construction/rehabilitation, shelter construction, rotational grazing practices) - Intensive livestock management (less in quantity and better in quality, cultivation of fodder crops, improved feeding practices, stallfeeding of animals, improved housing, bull fattening, setting up breeding schemes for goats and sheep and introduction of improved breeds, good quality of livestock (through breeding), healthcare measures...)
Products and value chains
Primary production goal: ▪ Firewood (forests) ▪ NTFP (forests) ▪ Fodder for livestock (pastures)
Area potentials (upscaling)
Forests: ▪ As a preparation for the Bonn Challenge, UNECE has conducted a study on Forest Landscape Restoration in the Caucasus and Central Asia.[22] According to the study, Tajikistan has the potential to plant new forests on 15,000 ha, rehabilitate 30,000 ha, and support natural forest regeneration on 120,000 ha by 2030. The actual pledge of Tajikistan was the restoration of 66,000 ha of degraded land by 2030. This number is general and does not differentiate between afforestation / reforestation and rehabilitation. Furthermore, there is no cost benefit analysis available for this target. ▪ For further analysis within this study, we consider the NAMA Feasibility Study conducted in 2015-16 in Tajikistan due to available data on cost-benefit and carbon sequestration. The study proposed reforestation on 2,000 ha, hard rehabilitation of 4,000 ha and soft rehabilitation of 50,000 ha of forests. Pastures: ▪ 14,000 ha[23]

[22] http://www.unece.org/fileadmin/DAM/timber/Forest_Policy/Capacity_building/FLR_CCA_challenges___opportunities_081018-ENG-edited.pdf

[23] http://www.fao.org/fileadmin/templates/ex_act/pdf/case_studies/ELMRL-TAJIKISTAN-carbonbalance-Appraisal-2014.pdf

National NbS related experiences
▪ Pasture management reforms yielding good results in Tajikistan, FAO, 2017[24] ▪ Institutional analysis on pasture management in Tajikistan, UNIQUE, 2014[25] ▪ Impact Assessment – Livestock and Pasture Development Project (LPDP): Tajikistan, 2019[26] ▪ Role of Pasture User Unions in the Rehabilitation and Sustainable Management of Pastures in Tajikistan[27] ▪ Pasture and Livestock Management Plan Tajikistan, WOCAT, 2018[28] ▪ Pasture management through rotational grazing Tajikistan. WOCAT, 2013[29] ▪ Rehabilitation of Pasture Land through fencing Tajikistan. WOCAT, 2018[30] ▪ Cluster Level Pasture User Union Tajikistan. WOCAT, 2018[31]
International best practices
▪ Sustainable Forest Management, FAO[32] ▪ Sustainable Forest Management, PEFC[33] ▪ Sustainable Forest Management in the tropics, ITTO[34] ▪ International projects on sustainable forest management, BMEL[35] ▪ Sustainable natural forest management in the tropics, UNIQUE[36] ▪ Community forestry, FAO[37]
Embedding of societal and legal aspects
Forestry ▪ Creating broader societal acceptance for forest restoration through trainings, subsidies, JFM (inclusion) Pasture:

[24] http://www.fao.org/europe/news/detail-news/en/c/882116/
[25] https://www.landuse-ca.org/wp-content/uploads/2019/11/Institutional-analysis-on-pasture-management-in-Tajikistan.pdf
[26] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3389336
[27] https://www.bfn.de/fileadmin/BfN/ina/Dokumente/KTF/Course_2015/10_Abstract_Umed_Vahobov.pdf
[28] https://qcat.wocat.net/en/wocat/approaches/view/approaches_3459/
[29] https://qcat.wocat.net/en/wocat/technologies/view/technologies_1585/
[30] https://qcat.wocat.net/en/wocat/approaches/view/approaches_3463/
[31] https://qcat.wocat.net/en/wocat/approaches/view/approaches_3443/
[32] http://www.fao.org/forestry/sfm/en/
[33] https://www.pefc.org/what-we-do/our-approach/what-is-sustainable-forest-management
[34] https://www.itto.int/sustainable_forest_management/
[35] https://www.bmel.de/SharedDocs/Downloads/EN/Agriculture/Forestry/ProjectLetter-6-2018.pdf?__blob=publicationFile
[36] http://www.unique-landuse.de/images/publications/UNIQUE%202016%20Sustainable%20Natural%20Forest%20Management%20in%20the%20Tropics.pdf
[37] http://www.fao.org/3/u5610e/u5610e04.htm

▪ Further development of the Pasture Networking Platform which is well received by members, as it provides access to relationships, information and opportunities outside their normal scope of work. ▪ Allocation of exclusive pasture use rights ▪ Strengthening the already established pasture management institutions at village level to better perform their functions. This is where the greatest opportunities for change lie.
Potential socio-economic benefits
▪ Rural development / Income diversification ▪ Improved production (firewood/NTFP) self-sufficiency in remote areas ▪ Ecologic aspects / Erosion protection (landslides etc.) ▪ Carbon sequestration for climate change mitigation
Possible threats
Forestry ▪ Grazing ▪ Illegal logging ▪ Lack of acceptance of management plans within JFM Pasture[38] ▪ A newly elaborated institutional setup created Commission on Pastures has a wide range of functions but may have neither funds nor capacity to perform those functions ▪ Lack of acceptance for management plans within PUU ▪ Lack of willingness to invest in infrastructure for the sustainable management practices

Table 3: NbS embedding in the NDC

Sectors and Priority areas in the current NDC	Recommended NbS-related activities to enhance NDC
Adaptation	
Priority sectors: ▪ agriculture, irrigation and water systems, ▪ power engineering and industrial facilities, ▪ transport and housing infrastructures ▪ as well as in the following areas: ▪ resilience to the hydro-meteorological hazards and climate changes ▪ disaster risk reduction	▪ Enhancing research on forest vulnerability to climate change ▪ Improving livelihood of forest-dependent population ▪ Improving pasture and livestock management (based on the carrying capacity of pastures) ▪ Identification of livestock improved breeds and breeding strategies ▪ Improving feed production and feeding practices

38 https://www.landuse-ca.org/wp-content/uploads/2019/11/Institutional-analysis-on-pasture-management-in-Tajikistan.pdf

▪ promotion of adaptation of globally significant biological species and natural ecosystems to climate change ▪ monitoring and preservation of glaciers and water resources ▪ improvement of occupational safety, life-sustaining activity and health of the population, maternity and childhood protection	▪ Strengthening institutions performance on forestry and pastures/livestock ▪ Enhancing animal productivity
Mitigation	
Basic spheres of economic activity, included in the NDC: ▪ Power industry and water resources ▪ Industry and construction ▪ Land use, agriculture and gardening and grazing ▪ Forestry and biodiversity ▪ Transportation and infrastructure	▪ Increasing forest area by afforestation/reforestation, land restoration ▪ Increasing forest density by natural rehabilitation ▪ Avoiding deforestation and forest degradation by decreasing grazing, cutting, erosion ▪ Improved livestock management (based on the carrying capacity of pastures) ▪ Reducing emissions from enteric fermentation, manure management

4 NBS WITH AREA EFFECTS IN THE CONTEXT OF THE COUNTRIES' NDC

Table 4: Main findings of the in-depth analysis

	FGP	SFM	Pasture & JFM
Cost – benefit	Calculation of investment for newly established forests	Calculation of profits of existing forests under improved management	Calculations on improved pasture and livestock management
Carbon benefit	11.9 tCO_2/year/ha	6.6 tCO_2/year/ha	7.0 tCO_2/year/ha for JFM 2.9 tCO_2/year/ha for pastures
Adaptation potential	Provision of timber, fuel and bio products Erosion protection Natural barrier for desertification and steppe expansion	Stable forests, with higher resilience towards climate change Erosion protection Landslides protection Resilient forest stands through adapted management Provision of forest ecosystem services such as carbon storage, nutrient cycling, water and air purification, habitat provision.	Resilient grassland systems Provision of fodder (grass) and food (milk, meat, etc.) Support to the livelihood of vulnerable groups (food security and income) Erosion/land degradation protection.
Socio-economic	Employment Wood cluster Wood-based economy	Employment Sawmill industry	Long-term security for pasture systems

4.1 FGP Kazakhstan

4.1.1 Cost-benefit analysis

This cost-benefit analysis is based on experiences from FGP piloting in Kazakhstan (UNIQUE 2015), as well as on interviews and on a desk research, that took place in December 2019. For the analysis, authors made assumptions based on these sources regarding three aspects:

- growth rate
- plantation costs and
- plantation revenues (based on wood prices)

The experience from the pilot areas only gives a rough overview on the costs and the growth rate of FGP in Kazakhstan. In order to be able to assume possible growth for the future, the

available gathered data was compared to regional and international yield tables for Poplar.[39] The annual growth rate for a first and generic estimation (for a site with suitable conditions for Poplar) is between 33 and 38 m^3/year/ha. Thinning operations are considered throughout the rotation period.

Following assumptions guide the analysis regarding the costs and the benefits of a plantation, based on the conducted desk research:

- Establishment costs until secured FGP (first 3 years): 1,000 – 1,200 EUR/ha
- Price of firewood: 15 EUR/m^3 (price at forest road)
- Price for sawn wood (max DBH > 30 cm): 15 – 40 EUR/m^3 [40]
- Price for construction wood (DBH 20 – 25 cm): 15 – 20 EUR/m^3
- Costs for cutting and skidding up to the road: 8 – 12 EUR/m^3

The distribution of the assortments within the final cut volume and the harvested volume from the thinning operations is as follows:

- 1st thinning: 100 % firewood (harvesting volume of about 30 m^3, circa 20 to 30 % of the standing volume),
- 2nd thinning: 60 % construction wood, 40 % firewood (harvesting volume 150 – 200 m^3, 25 – 35 % of the standing volume),
- Final cut: sawn wood 60%, 40 % firewood (harvesting volume of about 300 – 360 m^3).

Following this assumption, rough calculations on the annual expenses and benefits from the plantation can be made. A certain subsidy level for the establishment costs could be incorporated.

However, in order to develop a robust cost-benefit estimation, following additional data should be derived and taken into account within a sound investment calculation:

- interest rate for large scale afforestation in Central Asia,
- administrative costs for forest enterprises,
- investment in infrastructure not covered by the state (roads, water supply systems),
- opportunity costs of abstaining other land use types.

4.1.2 Estimation of carbon benefits

The carbon balance for the FGP in Kazakhstan is estimated to be 11.9 t CO_2e per ha per year. Afforestation of 100,000 ha results in increased net forest carbon stock of 35.7, million tCO_2e over 30 years (10 years of planting, 20 years of rotation cycle). For the scenario of 1 M ha afforestation, the net carbon stock for the 30-year period is 360 M tCO_2e.

The two scenarios (100,000 ha and 1 M ha) are realistic under different frameworks – investment and market conditions. The smaller scale scenario with 100,000 ha of afforestation is realistic for the near future, if carbon markets are in place on a national level (e.g. through

[39] Sarisekova (2015), UNIQUE (2017)

[40] Local timber price deviates strongly from international timber markets. A wide price range has therefore been indicated.

carbon offsetting mechanisms for national companies). The larger scale scenario with 1 M ha of FGP could function in the context of working carbon markets on an international level as an incentive for afforestation activities.

Table 5: Net carbon balance achievable with FGP in Kazakhstan over 30-year timeframe.

Type of intervention	ha	total tCO_2e	tCO_2e/ha/year
Afforestation (scenario 1)	100,000	35.7 M	11,9
Afforestation (scenario 2)	1,000,000	360 M	11,9

Corresponding carbon stocks according IPCC values used in EX-ACT (tC/ha/year) for temperate continental forest
Above-ground C default – 1.88
Below-ground C default – 0.83
Litter C default – 28
Soil carbon default – 33

4.1.3 Assessment of adaptation potential

Adaptation potential assessment is based on the framework of ecosystem services. Potential benefits from fast growing plantations are considered:

- Erosion protection
- Natural barrier for desertification and steppe expansion
- Provision of timber, fuel and bio products
- Protection against climate change induced risks such as fire, storms, and outbreak of diseases and pests.

However, an in-depth climate risk and vulnerability assessment of forests in this specific site is recommended in order to identify climate risk and suitable adaptation measures.

4.1.4 Assessment of socio-economic benefits

see chapter 3.1, Potential socio-economic benefits

4.2 Improved forest and pasture management in Tajikistan

4.2.1 Forests

Cost-benefit analysis

Cost and benefit analysis is based on the NAMA pre-feasibility study data. The NAMA proposal foresees for the mobilization of the local population, local NGOs to be contracted by the FC

component mobilize and support interested participant in the adoption of joint forest management (JFM). Based on previous GIZ experience the cost for the mobilization of one NGO averages 20,000 EUR in year 1 and followed by 10,000 EUR/year over the NAMA Support Project (NSP) implementation period. In total the JFM mobilization investment amounts to 100,000 EUR in the first year for five Leskhozes and 200,000 EUR over the NSP implementation period.

For the financial assessment of the reforestation and hard forest rehabilitation measures, authors developed 1 ha production and financial models for different forest types which are then scaled up to each leskhoz. Thereby we differentiate between investment into seedlings, transportation and organic fertilizers and labour inputs for planting and maintenance. The financial assessment assumes that investment costs will be fully covered by NSP grants. Reforestation and hard forest rehabilitation will require contracted labour to fulfil the targets as presented in the tables below. We assume that 85% of contracted leskhoz labour will be paid by the NSP grants while 15% is paid by Leskhozes themselves. These 15% are counted as public finance leverage. If reforestation and forest rehabilitation is carried by JFM participants, the NSP grants will cover only the investments, while labour costs are fully covered by the local population which is counted as private finance leverage. In the frame of the NSP lifetimes, we assume that approximately 50% will be carried out by JFM and 50% by the Leskhozes. In total, about 2,000 ha will be newly reforested; 3,950 ha will be subject to enrichment planting and assisted natural regeneration (hard forest rehabilitation) and 50,000 ha will be subject to soft forest rehabilitation. The total investment amounts to 2,500,000 EUR over the implementation time frame of 5 years.

Table 6: Reforestation and forest rehabilitation costs

Investment costs on SFE level	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	Total 5 years
Reforestation (SFE)	€	0 €	98,553 €	173,222 €	219,230 €	251,580 €	**742,584 €**
Reforestation (JFM)	€	0 €	148,251 €	238,627 €	283,232 €	227,445 €	**897,554 €**
Forest rehabilitation (SFE)	€	0 €	57,242 €	93,397 €	123,478 €	143,420 €	**417,537 €**
Forest rehabilitation (JFM)	€	0 €	86,588 €	139,305 €	165,177 €	132,549 €	**523,619 €**

Monetary values of the economic benefits of reforestation and forest rehabilitation were not estimated in the study.

Estimation of carbon benefits

Potential carbon benefits are calculated based on the following assumptions:

- **Reforestation:** (=tree planting on barren land) refers to the planting of non-forested land which include the land preparation, planting of various native tree species and sustainable management of the established forest land. In total 2,000 ha with locally adapted species
- **Hard forest rehabilitation**: (=rehabilitation assisted by tree planting) refers to active interventions in existing degraded forest on State Forest Enterprises land. Investment and activities will be targeted towards land reparation and enrichment planting of native species and sustainable management of these forests, protection and harvesting of forest products. Measures to reduce forest degradation such as enrichment planting and others are

foreseen. In EX-ACT tool, from "large" degradation level to "moderate" degradation level on 4,000 ha over 20 years.

- **Soft forest rehabilitation:** (=rehabilitation of degraded forest lands without tree planting) refers to indirect improvement of forest quality and management of state enterprise forest lands. The rehabilitation will be achieved through improved capacities of forest management staff, more effective forest protection and law enforcement and adoption improved forest management practices. In EX-ACT tool, from "moderate" degradation level to "low" degradation level on 50,000 ha over 20 years.

Carbon balance for total 56,000 ha is calculated (see table below).

Table 7: Carbon potential of SFM in Tajikistan.

Type of intervention	ha	Total tCO_2e (with interventions)	tCO_2e/ year/ha (with interventions)
Reforestation	2,000	530,354	13.30
Hard forest rehabilitation	4,000	706,200	10.30
Soft forest rehabilitation	50,000	6,620,625	6.90
Sum	**56,000**	**7,857,179**	**7.0**

Carbon balance without project interventions over the accounting period (20 years) is 4.7 M tCO_2e and 4.3 tCO_2e/ha/year. Thus, additional net carbon balance achieved through interventions is 2.8 tCO_2e/ha/year. See the Appendix for details.

Assessment of adaptation potential

Reforestation and forest rehabilitation can have multiple benefits for adaptation, especially for the vulnerable communities that are dependent on forest resources.

- Erosion protection
- Landslides protection (when afforested on slopes and landslide zones)
- Resilient forest stands through resilient tree species
- Provision of forest ecosystem services such as carbon storage, nutrient cycling, water and air purification, habitat provision.

Assessment of socio-economic benefits

One of the main goals of the NAMA feasibility study was to involve the leskhozes, local population in forest management, thus, improving livelihoods. About 50% of reforestation and hard forest rehabilitation and about 30% of soft forest rehabilitation was expected be accomplished through the involvement of at least 875 households living in the proximity of the leskhoz land. The leskhoz will be responsible for the remaining 50% and 70% respectively. The application of JFM approaches was supposed to provide local population with access to forest resources and open up opportunities for income generation. About 875 households were expected to be involved. Next to giving local people access to forest resources a likely major

benefit of the NSP was supposed to be the creation of new jobs and incomes for local inhabitants. Further socio-economic benefits are discussed in chapter 3.4.

New forested areas under the project were also crucial for biodiversity conservation, climate change adaptation and ecosystem services.

4.2.2 Pastures

Cost benefit analysis

Muminabad pasture example: The total average costs for PMP development under Muminabad pasture conditions are estimated at 2,000 EUR. The break down is 320 EUR for making the plan, 1,600 EUR for fencing 3 plots for pasture yield demonstrations (100 m^2) and 72 EUR for dividing the pasture land into sections for determining the ideal rotational scheme. This includes 3 training days for the PUUs and 7 days for hiring an expert. This expert is hired to do 3 days of training or the PUU, assist with setting up the demonstration plots and to make ideal sub-division of the pastures.

Average investment per leskhoz (NAMA FS): The cost for the improved grazing investment package (capacity building of leskhoz and communities as well as infrastructure) is 73,000 EUR per leskhoz and the costs for the intensive livestock management investment package (capacity development and demonstrations) is 48,000 EUR per leskhoz. The total required funds for the investment packages are 121,000 EUR per leskhoz.

Data on monetary benefits on improved pasture use are not available.

Estimation of carbon benefits

Estimates of carbon benefits for pasture and livestock improvement interventions that could be integrated into Participatory Pasture and Livestock Management Plans in Tajikistan are calculated based on the following assumptions:

- 15,000 ha of pasture that is initially mostly severely degraded and 2,000 ha moderately degraded
- It is assumed that among severely degraded pastures, it is assumed that 5,000 ha will become moderately degraded through reduced pressure and 4,000 ha will become non-degraded through improved management, and 4,000 ha will become improved without inputs using fencing.
- The initial pasture land with better potential, 2,000 ha initially moderately degraded will be improved with inputs.

Carbon balance from improved pasture management activities over 20 years is estimated to be 865,000 tCO_2e in total, and 2.9 tCO_2/ha/year (See Annex for results).

Assessment of adaptation potential

Adaptation potential from improved pasture management are:

- Resilient grassland systems
- Provision of fodder (grass) and food (milk, meat)

- Support to the livelihood of vulnerable groups (food security)
- Erosion/land degradation protection.

Assessment of socio-economic benefits

see chapter 3.4, Potential socio-economic benefits

4.3 Natural forest management Kazakhstan

For the model of natural forest management in Kazakhstan, in this report we take a closer look to one Oblast of Kazakhstan with large forest areas – Eastern Kazakhstan. The total forest fund area in the East Kazakhstan amounts to 3,700,000 ha, and out of this area, forests cover about 2,000,000 ha. Within this area, about 730,000 ha are reported to be special protected areas (where no forestry operations take place at all).

4.3.1 Cost-benefit analysis

On a company level, additional investment costs of about 20 EUR/ha/a[41] should be calculated for the implementation of the enhanced forest management in Eastern Kazakhstan. These costs should cover measures such as:

- road construction,
- maintenance after felling securing natural regeneration,
- planting activities (enrichment plantings in existing stands),
- additional cuts resulting from the enhanced management activities.

On the benefit side, the revenues per hectare will be higher, as the enhanced management practice causes a simultaneously higher felling intensities and wood extraction. Not only the higher wood volume would lead to higher revenues – also a shift in the quality of wood assortments (from firewood and industrial wood towards quality wood) can cause higher mean commercial price per hectare.

On a larger scale, investments in the according processing industry will be necessary.

4.3.2 Estimation of carbon benefits

The data on the development of the mean and overall growing stock per hectare between 2013 and 2018 (accounting periods) in Eastern Kazakhstan shows the development towards forest degradation (see Table 8).
The mean annual increment per ha of about 1.8 m^3 is considered very low having in mind the natural preconditions in the forest areas of Eastern Kazakhstan and the tree species growing there. Even though the area contains 20 % bush and shrub vegetation, this value seems very low and must be questioned.

[41] This sum of 20 EUR/ha/a rests on benchmarking experiences from forest management activities in Germany (road construction: 8 to 10 EUR/ha/a, maintenance securing natural regeneration, enrichment plantings and additional cuts: 15 to 18 EUR/ha/a) reduced by 30% due to lower machine and labor costs in Kazakhstan in comparison to Germany.

Through implementation of enhanced natural forest management, (see chapter 0), we assume as a result an increase of the annual increment per ha to at least 4 m^3/ha.

Table 8: Development of the forests in Eastern Kazakhstan between 2013 and 2018

	Unit	Periods		Difference	
		2013	2018	absolute [m^3]	%
Overall growing stock	1000 m3	2916.8	2988.6	71.8	2.5
Increment / ha	m3	1.8	1.8	0,0	0
Growing stock / ha	m3	128	127	-1	-0.8

These assumptions led to the following calculation of the carbon benefits through the implementation of enhanced natural forest management.

Carbon benefits are estimated for 1.6 M ha of degraded forest with initial level of degradation being "moderate" and through SFM intervention changing towards "very low" level over the 20 years. The results are presented in the table below.

Table 9: Carbon fluxes with and without project interventions.

Type of intervention Reduced degradation	**tCO_2e fluxes without project**	**tCO_2e fluxes with project**	**Balance**
Total emissions	140.5 M	210.7 M	70.2 M
Per hectare	88	132	44
Per hectare per year	4.4	**6.6**	2.2

When the level forest degradation is reduced, the carbon balance ha/year is 6.6 tCO2e, which provides a considerable potential.

4.3.3 Assessment of adaptation potential

Potential adaptation benefits from natural forest management include:

- Stable forests, with higher resilience towards climate change
- Erosion protection
- Landslides protection
- Resilient forests through resilient tree species
- Provision of forest ecosystem services such as carbon storage, nutrient cycling, water and air purification, habitat provision.

4.3.4 Assessment of socio-economic benefits

see chapter 3.1 and 3.2, Potential socio-economic benefits

5 MARKET VIEW: PLANTATIONS AS A STRONG INSTRUMENT OF THE NATURE BASED SOLUTIONS

5.1 Macroeconomic data

Macroeconomic data show that Kazakhstan has a growing economy and rising population. Gross domestic product and the construction sector grow disproportionately.

Table 10: Macroeconomic data

Economic Data Kazakhstan	2012	2013	2014	2015	2016	2017	2018
Population, (M total)	16.8	17.0	17.3	17.5	17.8	18.0	18.3
Pop. growth (annual %)	1.4	1.4	1.5	1.5	1.4	1.4	1.3
GDP (Billion US$; current)	167	177	184	186	188	196	204
GDP growth (annual %)	4.8	6.0	4.2	1.2	1.1	4.1	4.1
GDP growth, construction sector (annual %)	6.2	6.0	5.9	6.0	5.9	5.5	5.3

Source: World Bank

Population and wood consumption is going hand in hand. Wood consumption correlates with the population growth. Furthermore, rich economies have a higher per capita wood consumption than less developed ones. The reasons for this are the preference for more living comfort, increasing paper consumption and efficient energy generation from wood. Countries with a long tradition in timber house construction like Austria or Scandinavian countries are the leaders in per capita wood consumption.

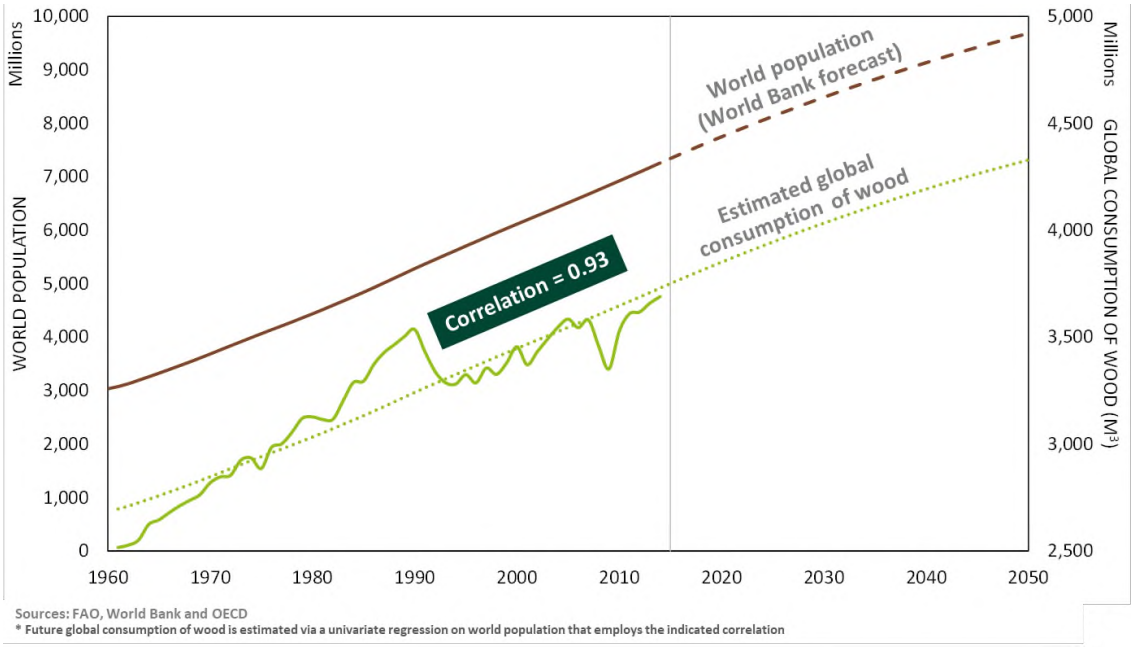

Figure 2: Correlation between population growth and wood consumption

Wood consumption in Kazakhstan decreased from 0.32 m^3/capita in 2012 to 0.18 m^3/capita in 2018. In comparison, Austria is the country with highest consumption rate (0.87 m^3/a/ha), followed by Sweden, Norway and Finland[42].

In summary, the consumption of wood products does not go hand in hand with the economic development of the country. Kazakhstan - with decreasing wood consumption rates - is now even further away from a wood-based economy than it was a few years ago.

5.2 Wood processing sector in Kazakhstan

The wood-producing sector in Kazakhstan is declining. Production of sawnwood and veneer, plywood, fibre and particle board from 2012 to 2014 went drastically down. The only increasing production figures show increase in production of paper and paperboard. The production figures reported to the FAO have remained unchanged since 2015.

It is unclear whether this is actually the case (data reliability) or whether changes have occurred. According to expert estimates, the figures can be expected to remain more or less constant.

Table 11: Wood production in Kazakhstan

Economic Data Kazakhstan	2012	2013	2014	2015	2016	2017	2018
Sawnwood production	1,244,600	464,000	464,000	464,000	464,000	464,000	464,000
Veneer and plywood production	612,000	392,600	160,600	160,600	160,600	160,600	160,600
Fibre and particle board production	452,850	195,300	64,600	64,600	64,600	64,600	64,600
Wood pulp production	0	0	0	0	0	0	0
Paper and paperboard production	383,216	590,408	590,408	590,408	590,408	590,408	590,408

Source: World Bank

The reasons for the low and declining production are complex. An important cause is the lack of tradition in the use of wood, for example in house construction. Cheap timber imports from Russia harm the overall domestic timber industry. In general, the production level of sawn timber is extremely low. The strong restrictions on the use of natural forests ensures that attractive and easily processable assortments are withdrawn from the market.

From the perspective of the timber industry, Kazakhstan has a shrinking production sector, with little reliable data overall.

Side note: FGP (and SFM) in the context of the national wood processing sector

FGP (with fast growing Poplar) could provide a new opportunity for the development of timber and timber-based industry on a regional and/or local level, that in this case economically only makes sense with proximity between the production site (plantation) and the processing site (sawmill). In the context of a development of a new processing industry (in clusters), only domestic timber production and supply could serve these new production plants; imported raw material (for example from Russia) is in this case not attractive due to the long transport distance and the according higher costs.

[42] Source: Bank Austria, https://www.bankaustria.at/files/Forstwirtschaft%20Holzverarbeitung.pdf

Next to that, FGP offer the production of resources that should be clearly distinguished from wood resources from natural forests.

The two NbS models for Kazakhstan presented in this report are similar when it comes to the targeted resource to be produced – wood. However, the processed products in the two cases are very different. Whereas, in the scope of SFM of natural forests (in Eastern Kazakhstan) the main goal is the better management of the existing stands with parallel production of construction wood (development of an existing industry branch), FGP aim at the establishment of new plantations for the production of wood-based materials and the setup of a new industry branch.

The two models serve different markets and value chains and have very different production cycles. For FGP with Poplar one rotation cycle can be between 12 to 20 years; in natural forests, depending on the species, the production time comprises between 60 and 100 years.

These facts should be considered when comparing the two proposed models and their suitability in the context of NbS.

5.3 Framework conditions enabling FGP

5.3.1 Legal framework (e.g. land use change, final cuts)

An economy that meets the NDC's objectives (trough NbS) needs a sound legal framework for wood production and an encouraging environment for the consumption of wood products. Kazakhstan lacks currently the robust legal framework for an FGP-promoting environment. Especially two aspects play a role here:

Transparent regulation on land use types for private afforestation activities

The government of Kazakhstan formulated the goal of supporting private afforestation as early as 2012 (UNIQUE 2015) through an according subsidy programme and with up to 50 % of the establishment costs. However, it is still unclear on which land use categories private investors can establish FGP and be able to implement a final cut of the plantation. This issue concerns both private and public land. Additionally, a regulatory framework for international investors regarding land rights or long-term lease contracts for afforestation projects does not exist. For afforestation on large scale and to attract investments, these regulations should be developed and implemented.

To date, it also seems unclear whether areas of the forest fund land, that are not covered by forests, could be part of private FGP activities or not (and – if possible – under which conditions).

Investment conditions are unclear

Until now, the procedure of the subsidy programme for private afforestation has not been defined yet and hence its implementation is still overdue. The amount of available financing resources for subsidies is unknown. Further uncertainties are linked to the targeted scale of private FGP in the country. Whether it is planned to support the afforestation on large areas or rather on scattered, small-scale areas is not clear.

Large-scale afforestation requires above all investment security and the prospects of an increasing demand for timber. Therefore, investments must be embedded in an overall wood-friendly industry policy.

The enterprises operating in the mining, steel, gas, oil and coal industry could voluntarily offset greenhouse gas emissions by supporting FGP. As a precondition, however, there should be official and legally binding guidelines that define the working mechanisms for this kind of compensation. The positive ecological and social impact of the afforestation measures serves as an additional incentive for the improvement of the image of such major enterprises (Corporate Social Responsibility, CSR). The possible benefit from timber use is not the focal point for this group, but it is perceived as an additional stimulation (UNIQUE 2015).

5.3.2 Infrastructure

For the development of plantations, existing infrastructure is of great importance. In the following, the three aspects knowledge of suitable areas, existence of forest roads/access to the road network and the supply of planting material (i.e. the existence of tree nurseries) are briefly outlined.

Knowledge of suitable sites

Next to the land use types suitable for FGP establishment, the natural conditions of the potential sites are decisive factors. Suitable areas for afforestation (from a natural point of view) can be identified through GIS. For this, factors such as annual precipitation / precipitation during growing season, soil conditions, altitude, and average temperature should be considered when analyzing suitable sites. The knowledge of regions with suitable, as well as sufficient area resources, would allow a better assessment from an economic perspective for suitable FGP site implementation.

Access to road network

Access to forests is crucial for any efficient form of forest management. Both the existing forests and the areas to be afforested demand the use of machinery or trucks, and the transport of forest workers or materials. It should be considered that for instance, in EU-member states, co-financing construction and maintenance of forest roads has been developed as a successful instrument of EU forest policy (UNIQUE 2015).

Provision with planting material / nurseries

There are about 20 public nurseries and more than 20 private nurseries in Almaty region. Public nurseries belong to forestry institutions and National Parks. Next to the production of planting material for forestry purposes, one of the main activities is the growing of plants for landscape design. So far, only a few private nurseries are interested in growing hybrid poplars. Some of them have the capacities to do that (in terms of expertise).

Research on hybridization of poplars is however not a completely new topic in the region – it began already by the works of Prof. Besschetnov P.P. in the '70s of last century. This resulted in the creation of several hybrids of poplar, two of which were wide spread (*Kazakhstanskii* and

Kairat). At the same time, public nurseries in Almaty oblast continue to grow hybrid poplars for forestry activities and for urban green areas.

The supply of planting material of poplar in the region is possible. In a developing demand market, supply will also develop. This will be supported by the existing poplar cultivation and research tradition in the region.

5.3.3 Scaling of FGP

The following outline shows in which direction an economic, sectoral and subsidy policy should go with regard to planned afforestation sizes (FGP upscaling). To a certain extent, the three orders of magnitude represent an ideal-typical form of reforestation. In practice, all three types should function in parallel.

Large scale

Large-scale investments (assuming over 0.5 M hectares, with respectively 10 M m^3 timber) in most cases depend on private invested money from institutional donors on an international level. National subsidies are welcome to private investors. Nevertheless, experiences show that state budgets are often insufficient when the areas become very large and quickly run short. This damages the overall development towards larger afforested areas.

For institutional investors, investment security is a decisive criterion. The promotion of a wood-friendly economy (keyword: wood cluster) is also of great importance. This includes strengthening the demand for timber, promoting investment by the timber industry and, if necessary, creating special economic zones for the timber industry.

Large-scale afforestation would therefore have to be accompanied by an economic policy that sends a clear signal with regard to the production, processing and consumption of wood.

Medium scale

A start into a reforestation economy can also be medium-sized reforestation areas (from 50,000 to 1 M ha; min. 1 M m^3 timber). In order to provide an incentive for this afforestation scale, compensation mechanisms for energy-intensive companies could apply.

Kazakhstan has a large number of companies that would be ideal contacts in the field of energy compensation. One is the fossil energy sector itself. Energy-intensive companies, e.g. server farms, could be suitable investors as well.

Small scale

Small-scale afforestation will not attract wood-processing industries. It comprises areas that in perspective cover less than 50,000 hectares. In many cases, concentration and professional management will not succeed. The scale entails production risks, lower growth rates and lower efficiency of the maintenance measures. It increases transport costs and makes this type of afforestation particularly valuable for energy use on a local level or for erosion control and nature conservation reasons.

5.3.4 Poplar: products and prices

Poplars provide a very lightwood with high moisture content, which is often considered too soft for construction use. There are, however, many other possibilities to process poplar wood. The following table presents a categorized list with description of typical poplar wood products.

Table 12: Wood products from poplar

Base product	Product
Solid wood	Construction (sawn wood)
	Wood-based panels (peeled veneer, laminated wood, chipboard)
	Packaging (fruit boxes and other boxes)
	Household products (Instruments, matches, wooden cutlery etc.)
	Firewood
Wood fibre	Paper, pulp, tissue
Biomolecules	Biochemicals, biomedicals
Other	Filling for pillows and blankets from seeds, tea, spirit from buds

Table 13: Shares of Poplar roundwood use – international (Source: Lebedys 2016)

Roundwood use	%
Veneer & plywood	49,3%
Fibreboard & particleboard	23,7%
Pulp	15,3%
Sawnwood	7,9%
Fuelwood	3,7%
Total	100,0%

International prices for poplar

France is a good example of an established market for poplar prices. The difference between pruned and not-pruned timber (veneer production) is remarkable. This price level can be confirmed by UNIQUE's own experiences in the German market.

Table 14: Poplar price development in France [standing wood, in EUR/m^3]

Timber assortments	2015	2018	Average change 2015-2018
Timber for veneer production 1st grade, pruned log	40	50 - 55	+30%
Timber for veneer production 2nd grade, pruned log	30	35 - 50	+40%
Timber 2nd grade, no pruning	20-25	30 -35	+30%

Source: Poplar Association of Nouvelle Aquitaine[43]

Regional prices for poplar

According to interviews with wood trader (information from December 2019), a cubic meter of sawn poplar wood costs about 60 000 KZT (EUR 140). As there is no knowledge of the production and transport costs, it is not possible to calculate to the roundwood price.

According to own surveys there is no roundwood trade with poplar in the Almaty region established. This is also an indication that large-scale reforestation must also include the wood processing sector from the very beginning.

5.3.5 Extended piloting using compensation mechanisms

Kazakhstan has no tradition of large foreign investments in the land use sector. As a result, there is a complete lack of experience in establishing large-scale afforestation with international financial resources. Moreover, there is no developed wood industry sector. Therefore, it is likely to be difficult for both Kazakhstan's government and foreign investors to get started. In addition, the sales market and the lack of a timber industry do not represent, at least for the moment, an attractive investment environment. In general, the sawmill industry in Eastern Kazakhstan has been operating in a difficult market situation in recent years. This means that a realistic start into FGP requires a phase of development and gathering of experience.

In order to overcome the phase of very small-scale afforestation (UNIQUE 2015, 2018), it is advisable to implement first steps with regard to the compensation for energy-intensive industries.

For a start-up phase, four to six sites of 20 to 50 ha each would be sufficient. This could initiate both the financing instrument and the development of a plantation with the aim of timber production.

With this experience, specific yield tables for poplar cultivation can be developed for the according areas in Kazakhstan. This information is an important basis for private investors. In parallel, a cluster policy can support the development of wood industry centres.

Even if the operational costs (administrative costs not included) for an extensive pilot phase do not reach the optimum of a large-area afforestation, it must be possible to identify approaches for economies of scale also in the afforestation of 100 to 200 hectares, compared to the individual areas of the six existing pilot plots.

[43] https://www.fordaq.com/news/France_poplar_prices_61345.html

6 CONCLUSIONS AND OUTLOOK

NbS play a major role for climate change mitigation and adaptation in Central Asia; they have significant potential to contribute to the achievement of NDC targets. This study takes a closer look at three countries – Kazakhstan, Kyrgyzstan and Tajikistan – and examines different NbS options, potentially suitable for this purpose. Depending on the scaling potential and the adaptation and mitigation effect, these models are considered to be promising options to enhance the according NDC to a different extend.

NDC enhancement of the models

With the implementation of the FGP model, Kazakhstan has a potential to reach its mitigation goals set in its NDC. Projections based on current policies forecast an increase in GHG emissions by 2030 at 416 million tCO_2e.[44] With a large-scale FGP implementation on 1 M ha in the next 30 years, Kazakhstan can save around 350 M tCO_2e. Implementing this significant potential can generate also other socio-economic and adaptation benefits.

The other models analyzed in this report – improved pasture management and sustainable management of natural forests (SFM) – also show high effects on strengthening the NDC via NbS.

Further development of FGP in the context of Nature based Solutions

In this sense, the one very promising model identified in this study is the establishment of FGP in southern Kazakhstan. Some very first steps in this direction have already been taken but further efforts are necessary. The two main aspects of FGP are the analysis of suitable areas and the extension of the pilot areas.

Area potential for FGP in Kazakhstan unclear

Currently the knowledge about the overall potential area resources for FGP in Kazakhstan is completely lacking. An analysis of the possible land potential is crucial for any further development towards afforestation upscaling. A land availability analysis, linking suitable natural conditions and land use types with no restrictions for plantation establishment should be prepared. This task can take place for one region (part of oblast) at first. Next to the analysis it will establish the mechanism for such GIS process and define the necessary data. This way, the land availability analysis can be replicated on other regions, promising for FGP.

In a previous GIZ project, UNIQUE contributed to the establishment of six small plots of FGP with private landowners that facilitated first experiences in this area in the region. For a future upscaling, further and larger afforestation piloting should be considered. It should enable the collection of robust data on large-scale afforestation. For this type of extended piloting, compensation mechanisms (e.g. for energy intensive industry companies) could be used to involve institutional investors.

Improvements of other land use systems

The role of the other examined land use systems (NbS models) is also large. In order to achieve an impact, the improvements require changes in the regulations and/or control via incentive

[44] https://climateactiontracker.org/countries/kazakhstan/

systems. Functioning examples could already act as flagship projects. They support politicians and stakeholders in policy decisions and, at the same time convince those who are supposed to implement the improved methods on the ground.

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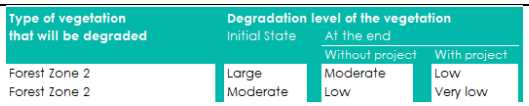
8 ANNEX

8.1 Data input for carbon balance calculation for the EX-ACT tool

Case	Fast growing plantations (FGP) in Kazakhstan
Module in EX-ACT tool	Module 2: Land Use Change (LUC) 2.2: Afforestation and Reforestation
Continent	Asia (Continental)
Climate	Cool temperate
Moisture regime	Dry
Dominant regional soil type	HAC soils
Implementation phase	10
Capitalization phase	20
Accounting phase	30
Type of vegetation	Zone 2 = Temperate continental forest
Fire use	No
Previous land use	Annual crop

Case	SFM in Tajikistan
Module in EX-ACT tool	Module 2: Land Use Change (LUC) 2.2: Afforestation and Reforestation Module 5: Degradation management 5.1: Forest degradation and management
Continent	Asia (Continental)
Climate	Cool temperate
Moisture regime	Dry
Dominant regional soil type	HAC soils
Implementation phase	5
Capitalization phase	15
Accounting phase	20
Type of vegetation	Zone 2 = Temperate continental forest
Module 2 data entry	
Fire use	No
Previous land use	Annual crop
Module 5 data entry	
Degradation level of the vegetation at the initial state and at the end of project	

Type of vegetation that will be degraded	Degradation level of the vegetation		
	Initial State	At the end	
		Without project	With project
Forest Zone 2	Large	Moderate	Low
Forest Zone 2	Moderate	Low	Very low

Case	Improved pasture management in Tajikistan

Module in EX-ACT tool	Module 4: Grasslands
Continent	Asia (Continental)
Climate	Cool temperate
Moisture regime	Dry
Dominant regional soil type	HAC soils
Implementation phase	5
Capitalization phase	15
Accounting phase	20
Type of vegetation	Zone 2 = Temperate continental forest
Module 7 data entry	

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

Fill with your description	Initial State	Final state of the grassland	
		Without project	With project
reduced pressure	Severely Degraded	Severely Degraded	Moderately Degraded
improved pasture managem	Severely Degraded	Severely Degraded	Non degraded
fencing	Severely Degraded	Severely Degraded	Improved with inputs improven
fertilser + seeds	Moderately Degraded	Moderately Degraded	Improved with inputs improven

Case	SFM in Kazakhstan
Module in EX-ACT tool	Module 5: Management 5.1. Forest degradation and management
Continent	Asia (Continental)
Climate	Cool temperate
Moisture regime	Dry
Dominant regional soil type	HAC soils
Implementation phase	6
Capitalization phase	14
Accounting phase	20
Type of vegetation	Zone 2 = Temperate continental forest
Data input	

5.1. Forest degradation and management

?	Zone 1 = Temperate oceanic forest	Zone 2 = Temperate continental forest	Zone 3 = Temperate mountains systems Zone 4 =

Type of vegetation that will be degraded	Degradation level of the vegetation			Fire occurrence and severity						Area (ha)				
	Initial State	At the end		Without	Periodicity	Impact	With	Periodicity	Impact	Start	Without		With	
		Without project	With project	(y/n)	(year)	(% burnt)	(y/n)	(year)	(% burnt)			*		*
Forest Zone 2	Moderate	Low	Very low	NO	1	100%	NO	1	100%	1,600,000	1,600,000	D	1,600,000	D

8.2 Carbon calculations for FGP in Kazakhstan using EX-ACT tool

Project Name	*Kazakhstan fast growing plantc*	Climate	*Cool Temperate (Dry)*	Duration of the Project (Years)	*30*
Continent	*Asia (Continental)*	Dominant Regional Soil Type	*LAC Soils*	Total area (ha)	*100000*

Components of the project	Gross fluxes Without	Gross fluxes With	Balance	Share per GHG of the Balance All GHG in tCO2eq CO_2 Biomass	CO_2 Soil	CO_2 Other	N_2O	CH_4	Result per year Without	Result per year With	Result per year Balance
Land use changes	All GHG in tCO2eq Positive = source / negative = sink										
Deforestation	0	0	0	0	0		0	0	0	0	0
Afforestation	0	-35,669,333	-35,669,333	-33,249,333	-2,420,000		0	0	0	-1,188,978	-1,188,978
Other LUC	0	0	0	0	0		0	0	0	0	0
Agriculture											
Annual	0	0	0	0	0		0	0	0	0	0
Perennial	0	0	0	0	0		0	0	0	0	0
Rice	0	0	0	0	0		0	0	0	0	0
Grassland & Livestocks											
Grassland	0	0	0	0	0		0	0	0	0	0
Livestocks	0	0	0				0	0	0	0	0
Degradation & Management											
Forest degradation	0	0	0	0	0		0	0	0	0	0
Peat extraction	0	0	0		0		0	0	0	0	0
Drainage organic soil	0	0	0		0		0	0	0	0	0
Rewetting organic soil	0	0	0		0		0	0	0	0	0
Fire organic soil	0	0	0	0				0	0	0	0
Coastal wetlands	0	0	0	0	0		0	0	0	0	0
Inputs & Investments	0	0	0			0	0	0	0	0	0
Fishery & Aquaculture	0	0	0			0	0	0	0	0	0
Total	0	-35,669,333	-35,669,333	-33,249,333	-2,420,000	0	0	0	0	-1,188,978	-1,188,978
Per hectare	0.0	-356.7	-356.7	-332.5	-24.2	0.0	0.0	0.0			
Per hectare per year	0.0	-11.9	-11.9	-11.1	-0.8	0.0	0.0	0.0	0.0	-11.9	-11.9

8.3 Carbon calculations for JFM in Tajikistan

Project Name	Tajikistan afforestation and fore:	Climate	Cool Temperate (Dry)	Duration of the Project (Years)	20
Continent	Asia (Continental)	Dominant Regional Soil Type	HAC Soils	Total area (ha)	56000

Components of the project	Gross fluxes All GHG in tCO2eq Positive = source / negative = sink			Share per GHG of the Balance All GHG in tCO2eq					Result per year		
	Without	With	Balance	CO_2 Biomass	CO_2 Soil	CO_2 Other	N_2O	CH_4	Without	With	Balance
Land use changes											
Deforestation	0	0	0	0	0		0	0	0	0	0
Afforestation	0	-530,354	-530,354	-530,354	0		0	0	0	-26,518	-26,518
Other LUC	0	0	0	0	0		0	0	0	0	0
Agriculture											
Annual	0	0	0	0	0		0	0	0	0	0
Perennial	0	0	0	0	0		0	0	0	0	0
Rice	0	0	0	0	0		0	0	0	0	0
Grassland & Livestocks											
Grassland	0	0	0	0	0		0	0	0	0	0
Livestocks	0	0	0				0	0	0	0	0
Degradation & Management											
Forest degradation	-4,766,850	-7,326,825	-2,559,975	-2,094,767	-465,208		0	0	-238,343	-366,341	-127,999
Peat extraction	0	0	0		0		0	0	0	0	0
Drainage organic soil	0	0	0		0		0	0	0	0	0
Rewetting organic soil	0	0	0		0		0	0	0	0	0
Fire organic soil	0	0	0	0				0	0	0	0
Coastal wetlands	0	0	0	0	0		0	0	0	0	0
Inputs & Investments	0	0	0			0	0	0	0	0	0
Fishery & Aquaculture	0	0	0			0	0	0	0	0	0
Total	-4,766,850	-7,857,179	-3,090,329	-2,625,121	-465,208	0	0	0	-238,343	-392,859	-154,516
Per hectare	-85.1	-140.3	-55.2	-46.9	-8.3	0.0	0.0	0.0			
Per hectare per year	-4.3	-7.0	-2.8	-2.3	-0.4	0.0	0.0	0.0	-4.3	-7.0	-2.8

8.4 Carbon calculations for improved pasture management in Tajikistan

Project Name	Pasture rehabilitation in Tajikista	Climate	Cool Temperate (Dry)	Duration of the Project (Years)	20
Continent	Asia (Continental)	Dominant Regional Soil Type	HAC Soils	Total area (ha)	15000

Components of the project	Gross fluxes All GHG in tCO2eq Positive = source / negative = sink			Share per GHG of the Balance All GHG in tCO2eq					Result per year		
	Without	With	Balance	CO_2 Biomass	CO_2 Soil	CO_2 Other	N_2O	CH_4	Without	With	Balance
Land use changes											
Deforestation	0	0	0	0	0		0	0	0	0	0
Afforestation	0	0	0	0	0		0	0	0	0	0
Other LUC	0	0	0	0	0		0	0	0	0	0
Agriculture											
Annual	0	0	0	0	0		0	0	0	0	0
Perennial	0	0	0	0	0		0	0	0	0	0
Rice	0	0	0	0	0		0	0	0	0	0
Grassland & Livestocks											
Grassland	0	-865,031	-865,031	0	-865,031		0	0	0	-43,252	-43,252
Livestocks	0	0	0				0	0	0	0	0
Degradation & Management											
Forest degradation	0	0	0	0	0		0	0	0	0	0
Peat extraction	0	0	0		0		0	0	0	0	0
Drainage organic soil	0	0	0		0		0	0	0	0	0
Rewetting organic soil	0	0	0		0		0	0	0	0	0
Fire organic soil	0	0	0	0				0	0	0	0
Coastal wetlands	0	0	0	0	0		0	0	0	0	0
Inputs & Investments	0	0	0			0	0	0	0	0	0
Fishery & Aquaculture	0	0	0			0	0	0	0	0	0
Total	0	-865,031	-865,031	0	-865,031	0	0	0	0	-43,252	-43,252
Per hectare	0.0	-57.7	-57.7	0.0	-57.7	0.0	0.0	0.0			
Per hectare per year	0.0	-2.9	-2.9	0.0	-2.9	0.0	0.0	0.0	0.0	-2.9	-2.9

8.5 Carbon calculations for SFM in Kazakhstan

Project Name	SFM Kaz	Climate	Cool Temperate (Dry)	Duration of the Project (Years)	20
Continent	Asia (Continental)	Dominant Regional Soil Type	HAC Soils	Total area (ha)	1600000

Components of the project	Gross fluxes Without	Gross fluxes With	Balance	Share per GHG of the Balance All GHG in tCO2eq CO_2 Biomass	CO_2 Soil	CO_2 Other	N_2O	CH_4	Result per year Without	Result per year With	Balance
	All GHG in tCO2eq Positive = source / negative = sink										
Land use changes											
Deforestation	0	0	0	0	0		0	0	0	0	0
Afforestation	0	0	0	0	0		0	0	0	0	0
Other LUC	0	0	0	0	0		0	0	0	0	0
Agriculture											
Annual	0	0	0	0	0		0	0	0	0	0
Perennial	0	0	0	0	0		0	0	0	0	0
Rice	0	0	0	0	0		0	0	0	0	0
Grassland & Livestocks											
Grassland	0	0	0	0	0		0	0	0	0	0
Livestocks	0	0	0				0	0	0	0	0
Degradation & Management											
Forest degradation	-140,506,667	-210,760,000	-70,253,333	-57,786,667	-12,466,667		0	0	-7,025,333	-10,538,000	-3,512,667
Peat extraction	0	0	0		0		0	0	0	0	0
Drainage organic soil	0	0	0		0		0	0	0	0	0
Rewetting organic soil	0	0	0		0		0	0	0	0	0
Fire organic soil	0	0	0	0				0	0	0	0
Coastal wetlands	0	0	0	0	0		0	0	0	0	0
Inputs & Investments	0	0	0			0	0	0	0	0	0
Fishery & Aquaculture	0	0	0			0	0	0	0	0	0
Total	-140,506,667	-210,760,000	**-70,253,333**	**-57,786,667**	**-12,466,667**	**0**	**0**	**0**	-7,025,333	-10,538,000	**-3,512,667**
Per hectare	-87.8	-131.7	**-43.9**	**-36.1**	**-7.8**	**0.0**	**0.0**	**0.0**			
Per hectare per year	-4.4	-6.6	**-2.2**	**-1.8**	**-0.4**	**0.0**	**0.0**	**0.0**	-4.4	-6.6	**-2.2**

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