Pastures, Conservation and Climate Action, Mongolia

Plan Vivo Project Design Document

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Executive Summary

This programme is a community-led initiative which is taking place at three different sites in Mongolia's mountain, steppe and desert steppe environments. For the initial commitment period (2015-2019), herders in participating community groups will undertake activities designed to sequester carbon in grasslands through improved grazing management practices. In line with the new Plan Vivo standard, herders' planned activities will also make important contributions to livelihoods and wellbeing, the conservation of a globally important biodiversity heritage and to a range of ecosystem services, as well as to carbon sequestration. This Plan Vivo project is based on an earlier Darwin Initiative funded project ('Values & Valuation: New Approaches to Conservation in Mongolia', 2012-2015), managed by University of Leicester (UK) and the Mongolian Society for Range Management (MSRM), which focused on training, capacity building, establishment of baselines and planning for PV activities with these same herder groups. MSRM, a nationally recognised NGO with a substantial track record in community/ herder group support and engagement, are the in-country managers for the 2015-19 Plan Vivo project, with direct responsibility for overall project coordination and administration.

Specifically the 2015-19 Plan Vivo project will involve:

i) Carbon sequestration through improved land managed and reduced grazing pressure, achieved through restoration of traditional seasonal mobility between pastures and/or reduction in livestock numbers at each project site;

ii) Biodiversity conservation through herders' cooperation to protect key wildlife species and habitats, for example Mongolian gazelle, ibex, red deer, marmot, saxaul forests, and through protection of key grassland habitats and vegetation.

iii) Improvements in livelihoods/ well-being, for example through herders' collaborative processing and marketing of livestock products, livelihood diversification and protection of locally important cultural landscapes and resources.

The programme is collaborating with some 140 herder households, these being the members of Hongor *Ovoo* herder group, Ikh Tamir *soum* (district), Arkhangai *aimag* (region); Ikh Am herder group, Undurshireet *soum*, Tov *aimag*; and Dulaan Khairkhan herder group, Bogd *soum*, Bayankhongor *aimag*. In total the territories of these groups cover an area of approximately 78,500ha.

These rangelands are typically experiencing degradation, which recent trends

indicate may reasonably be expected to worsen under a baseline ('without project') scenario. Degradation is widely linked to another trend; that of increasing livestock numbers year-on-year at project sites. Many participating households have poor or below average income levels, according to various established and participatory criteria.

The project activities and associated payments therefore offer the prospect of real transformations in livelihoods, in conjunction with protection and conservation of a valuable and internationally recognised biodiversity heritage. As the first such project in Mongolia, this also offers an important precedent for rangeland and conservation policy into the future.

Conservative estimates, based on site specific field data and on carbon modelling, indicate that some 132,000 tCO2 will be sequestered across these sites through improved grazing management practices over the project commitment period. Financial benefits from sale of certificates will be invested back into these herder groups through their existing, well established group management structures, with intra-group allocation and use of funds to be determined by the herders themselves. Ongoing project coordination and administration will also be supported by certificate sales.

Part A: Aims and objectives

The overall aim of the project is to enhance biodiversity conservation and herders' livelihoods at sites in rural Mongolia, thus contributing to national efforts to combat degradation of ecosystem services (ES) and growing rural poverty, whilst protecting a globally important biodiversity heritage. The project is shaped by the wider context of climate change and the growing proliferation of formal and informal mining in the Mongolian countryside, with attendant impacts of pollution, loss of water sources, failure to meet (inter)national biodiversity targets and struggles over resource access.

The specific project objectives are as follows:

- Through participatory analysis and valuation of ES, to facilitate the implementation of a sustainable, locally relevant PES scheme (the first rangeland PES scheme in Mongolia).

- To promote wider awareness of Plan Vivo and voluntary carbon markets, amongst local herding communities and government policy makers, thus supporting the wider uptake of this approach in the future.

- To facilitate the wider spread of methodological innovations in the participatory valuation of ES, as developed during preparatory work for this project, and to embed a 'carbon plus' approach, under the new Plan Vivo standard.

- To make measurable, positive impacts on participating herder groups' livelihoods, through facilitating access to carbon finance and through support of locally developed strategies for livelihood diversification, economies of scale, restoration of seasonal mobility and collaborative practices in herding.

- To facilitate recognition of customary knowledge, values and practices in conservation planning, including through links to national strategies for the development of Local Protected Areas (LPAs) and with positive measurable impacts on local biodiversity.

The project is timely and innovative in a number of ways. As indicated above, it is to our knowledge the first pilot rangeland PES scheme in Mongolia, linked to the voluntary carbon market. It comes at a time of growing national policy interest in and attempts to deploy ES thinking and planning in natural resource governance in Mongolia, including through development of a national REDD-iness strategy, and in line with wider government commitments to the 'Green Economy'. For Plan Vivo

(PV) it is also one of the first projects to deploy the new PV standard, with its express commitment to a 'carbon plus' type approach, encapsulating landscape scale and ES- based concerns, with attention to biodiversity and cultural ES. It is also the first application of PV to rangeland contexts.

Part B: Site Information

The project covers four case study areas (sub sites):

i) Arkhangai *aimag*, Ikh Tamir *soum* (forest steppe). **Hongor *Ovoo heseg***.[1]
ii) Tov *aimag*, Undurshireet *soum* (steppe). **Ikh Am *heseg.***
iii) Dundgov *aimag*, Ulziit *soum* (desert steppe). **Dert *heseg***.
iv)Bayanhongor *aimag*, Bogd *soum* (steppe/ desert steppe). **Dulaan Khairkhan herder group**.

Undurshireet *soum*, Tov *aimag*

Ulziit *soum*, Dundgov *aimag*

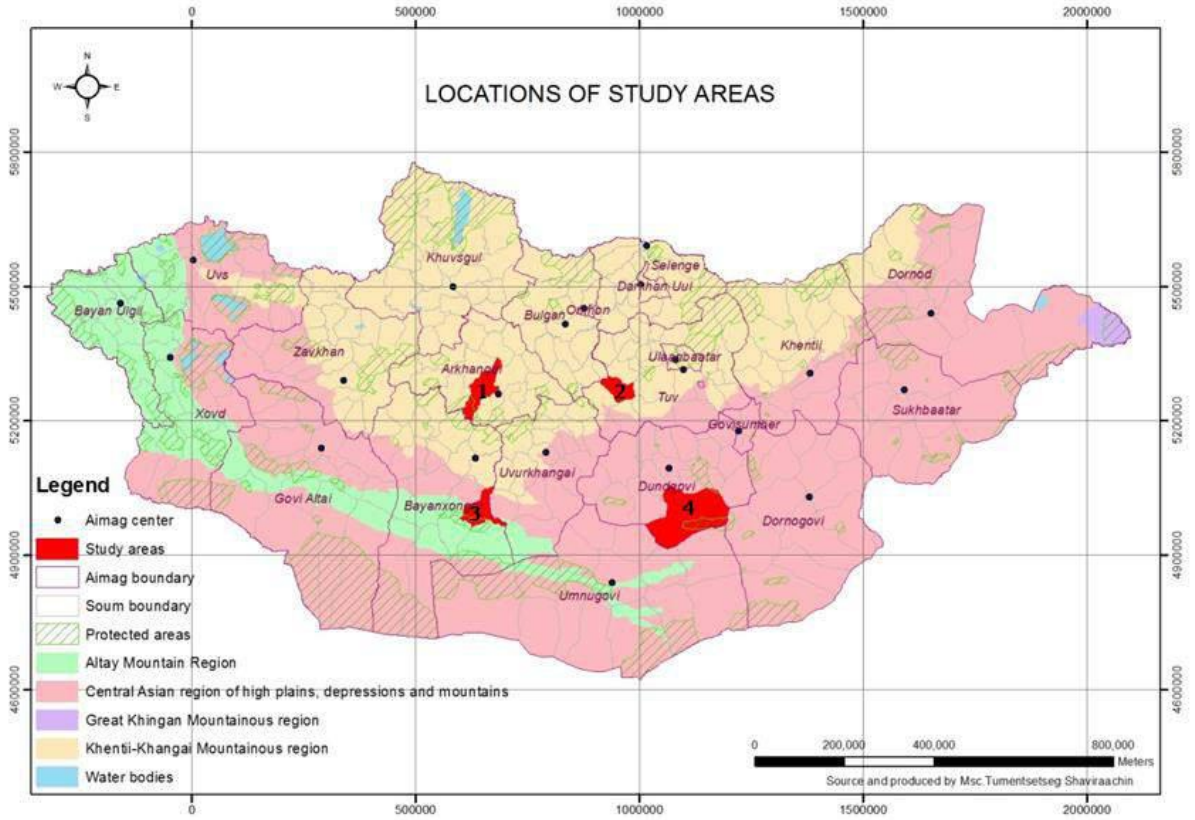
Ikh Tamir *soum,* Arkhangai *aimag*

Bogd *soum,* Bayanhongor *aimag*

These are located across Mongolia, as shown overleaf:

[1] *Aimag* denotes region; *soum* is a district; *heseg* is a herder group

Figure 1. Location of Plan Vivo sites, Mongolia



1.Hongor *Ovoo heseg*, Ikh Tamir *soum*, Arkhangai *aimag*; 2. Ikh am *heseg*, Undurshireet *soum*, Tuv *aimag*

3.Dulaan Khairkhan herder group, Bogd *soum* Bayanhongor *aimag*,4. Dert *heseg*, Ulziit *soum*, Dundgov *aimag*

All sites share the following commonalities:

- Predominance of extensive grassland areas, providing the main livelihood sources for herding communities.
- Evidence of degradation of grasslands, as shown by changing species composition, desertification etc. These trends are widely attributed to overgrazing though increased livestock numbers and growing sedentarisation, in conjunction with climate change/ variability.
- For Dert *heseg*, Ulziit *soum* only, localised mining (including informal artisanal mining practices) are also contributing to degradation.
- Increasing climate variability, especially in rainfall patterns; increasing incidence of harsh winters.

The rationale for selecting multiple sites for this project is that for the Plan Vivo and ES-based conservation approaches to gain traction in Mongolia and to have lasting impact they must be adaptable across a range of environmental, biodiversity and socio-economic conditions. Thus, within the framework of key commonalities, as set out above, which together form the framework for a coherent PV project, we are

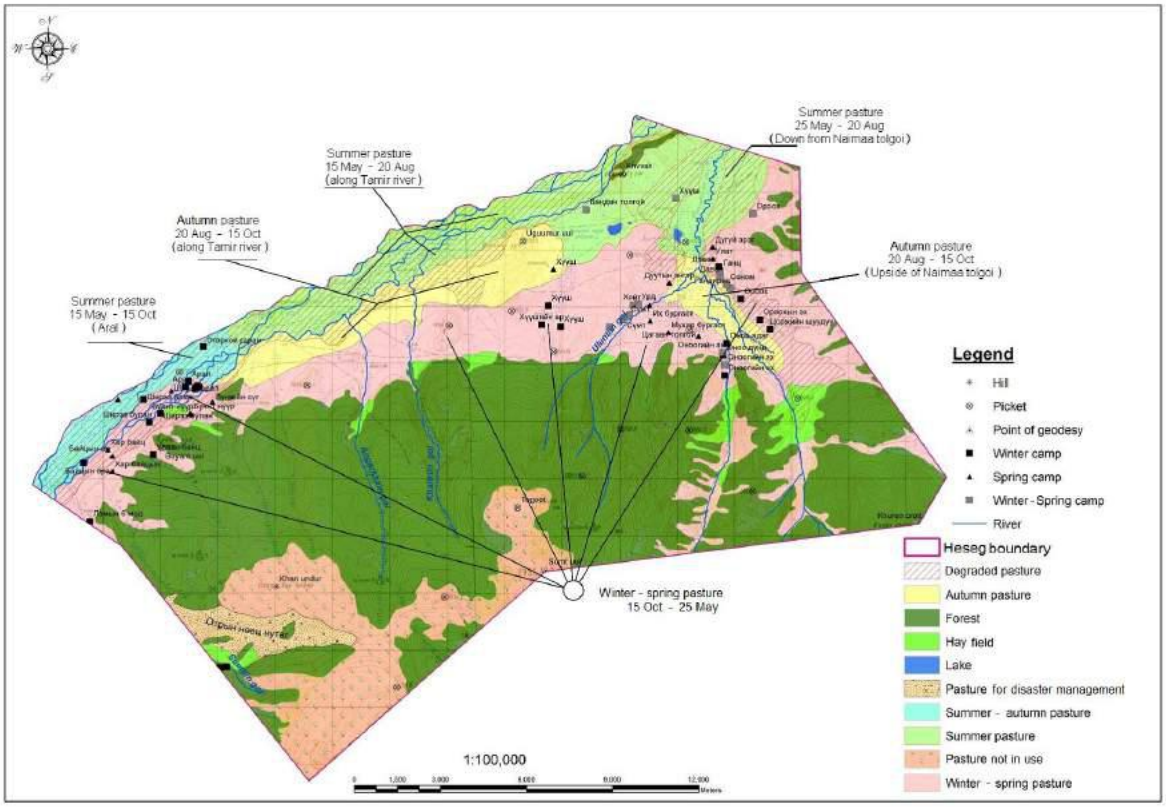
committed to the realization of project objectives across these carefully selected case study sites. Specifics of these sites are set out below. It should be noted that the Mongolian Society for Range Management (MSRM), the in-country project coordinator, have been instrumental in the development and support of herder *heseg* at three of the four study sites over the last decade. For the fourth, Bogd *soum*, University of Leicester (UOL) have well established links with local herder groups. For all sites, these existing relations of trust were considered integral to the successful co-development of this innovative PV approach.

B1. Project location and boundaries

i) Hongor Ovoo Heseg

The territory of Hongor *Ovoo heseg*, Arkhangai *aimag* is shown in Figure 2. This map also shows the *heseg's* pasture use plan, to be implemented from 2015 under Plan Vivo. This is described more fully as part of planned activities in Part D, the summary of activities and monitoring protocols (Part K) and the site specific Management Plan (Annex 5).

Figure 2. Hongor *Ovoo heseg*, Ikh Tamir *soum*, Arkhangai *aimag*



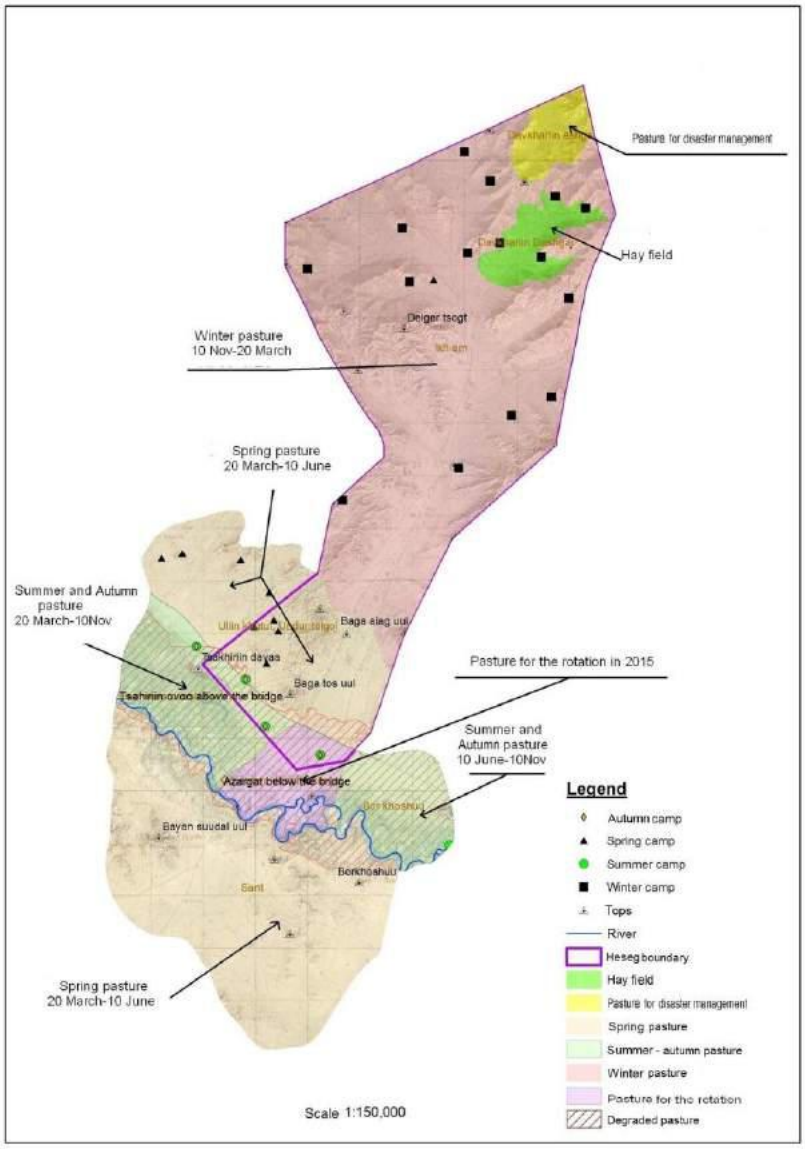
The *heseg* territory covers 36756 ha, of which some 46% (16908 ha) is covered by forest, with the remainder constituting seasonal pasture and haymaking areas.

ii) Ikh Am Heseg

The territory of Ikh Am *heseg*, Tov *aimag* is shown in Figure 3. This map also shows the *heseg's* pasture use plan, to be implemented from 2015 under Plan Vivo. This is described more fully as part of planned activities in Part D, the summary of activities and monitoring protocols (Part K) and the site specific Management Plan (Annex 5).

The total *heseg* territory covers some 18241ha and is predominantly pastureland, used for seasonal grazing.

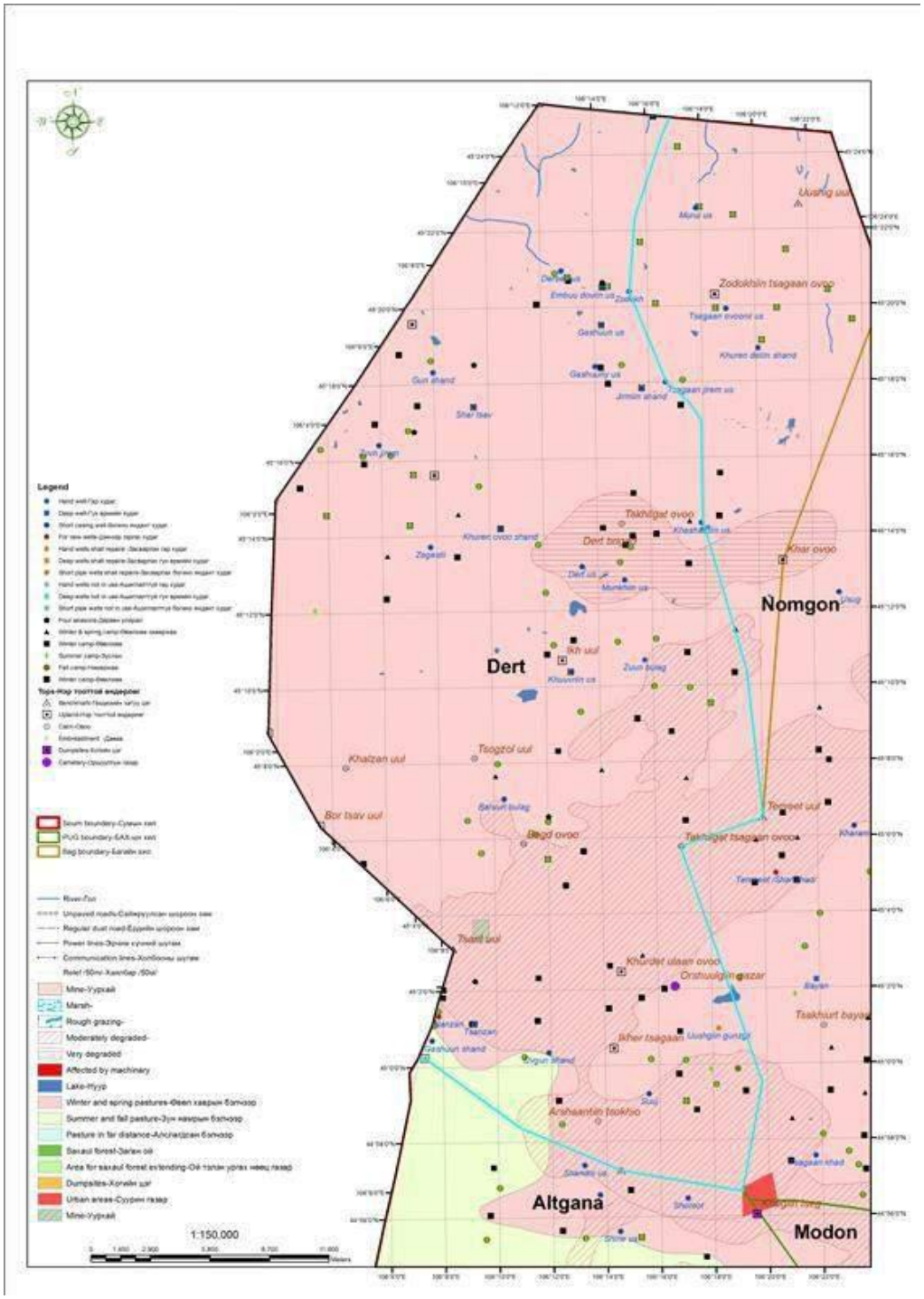
Figure 3. Ikh-Am *heseg*, Undurshireet *soum*, Tuv



iii) Dert Heseg

The territory of Dert *heseg*, Ulziit *soum*, Dundgov *aimag* is shown in Figure 4. This comprises some 83126ha of arid pastureland.

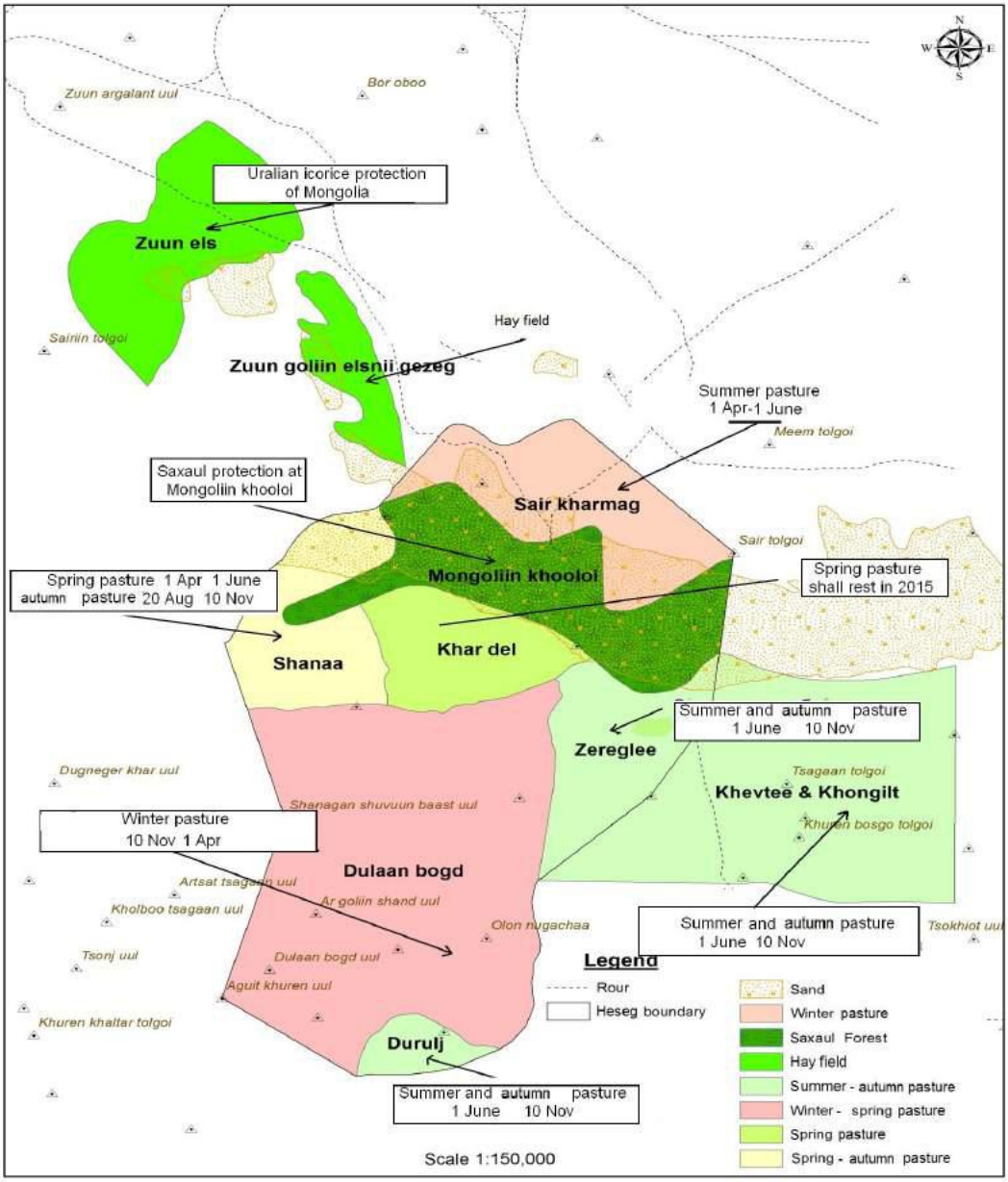
Figure 4. Dert *heseg*, Ulziit *soum*, Dundgobi



iv) Dulaan Khairkhan

The territory of Dulaan Khairkhan herder group, Bayanhongor *aimag* is shown in Figure 5, below. The territory covers some 22485ha, of which 15.5% or 3485ha is covered by saxaul forest. The map also shows the *heseg's* pasture use plan, to be implemented from 2015 under Plan Vivo. This is described more fully as part of planned activities in Part D, the summary of activities and monitoring protocols (Part K) and the site specific Management Plan (Annex 5).

Figure 5. Dulaan Khairkhan herder group, Bogd *soum*, Bayanhongor *aimag*



B2. Description of the project area

i) Hongor Ovoo Heseg, Ikh Tamir soum

***Climate*:** Ikh Tamir *soum* has a continental climate, with marked seasonal and monthly fluctuations. Temperatures range from +20^{0}C in the summer to -14 to -19^{0}C in winter. The average annual temperature is -2 to -4^{0}C. The first snow occurs in beginning of September. The first rains now typically occur from June onwards. Annual average precipitation is 300-400mm.

Topography and Soils: The *soum* and *heseg* area are characterised by undulating topography, some 1600-2525m above sea level (asl). The western part of the *soum* comprises mountain and forest areas, with forest steppe zones in the central and eastern areas. Common soil types are mountain kastanozem, meadow chernozem and clay kastanozem soils, with typically thin humus layers.

Vegetation: The southern part of rangelands in the Hongor *Ovoo heseg* area are covered by mountain forest and mountain steppe vegetation, the central part by steppe vegetation and the northern and south-eastern part by interzonal or low land vegetation. A total of 6 types of rangeland are present within the *heseg* area, constituting diverse forms of mountain, plain and meadow rangelands.

Conservation activities/ Endangered species and habitats: The *soum* has 104,000 ha of protected area belonging to Khangai Nuruu National Park within its boundary. The land under this protection does not fall within Hongor *Ovoo heseg*. The park boundary is approximately 10km away at its closest point. One endangered species and 2 near threatened species, Siberian marmot (*Marmota sibirica*), Altai weasel (*Mustela altaica*), and Pallas's cat (*Otocolobus manul*) respectively have been noted within the *soum* following a review of IUCN Red List species distributions and interviews with local herders.

***Mining activities*:** Natural resources such as coal, spar, iron ore and chalk are present in the *soum*. A private company is conducting mining operations on a 2 million tonne resource of Anthracite coal in Bayantsagaan located to the east of the *soum* centre. Mining is not occurring within the *heseg* territory, which is dominated by extensive livestock production.

ii) Ikh Am Heseg, Undurshireet soum

Climate: Undurshireet *soum* and Ikh Am *heseg* have a continental climate, which results in fluctuating day and night temperatures and significant variation between seasons. The annual average temperate is +1.7^{0}C, July being the warmest month with average temperature of +20.3^{0}C, and January the coldest with an average temperature of -17.1^{0}C. The area gets an average of some 200-250mm of precipitation annually, of which 70-75% falls from April to October.

***Topography and soils*:** The area is characterised by flat to undulating topography of

grassland plains and small hills. The *soum*'s soil consists of mainly dry-steppe chestnut (kastanozem) soils which lack nutrition and have a thin humus layer. The soil has a light mechanical component and granular texture, is weak alkaline and neutral, containing about 1.8-2.4% humus.

Vegetation: The Ikh Am *heseg* area consists of 4 types of steppe and meadow rangelands. 63% of the total land area is covered with steppe vegetation, 29.7% with mountain steppe and 7.3% with meadow. The meadow and steppe rangeland, particularly sedge-grass-forb alluvial meadow and *Cleistogenes-Elymus* steppe are used primarily as summer and autumn rangeland. Mountain steppe and steppe located in the valley of the mountain are used during winter and spring. There are no forests except some strips of cotton birch forests that occur on mountain slopes and in narrow ravines. Glycyrrhiza is a notable rare plant species that grows in the *soum*.

Conservation activities/ Endangered species and habitats: One IUCN Endangered species has been recorded in the *soum*, Siberian marmot (*M. Sibirica)* and Near Threatened Pallas's cat (*O. manul*). Conservation responsibilities are taken on by local community groups such as *Tumen Mal,* a local NGO situated in Ikh Am within the species' distribution areas. Members of Ikh Am *heseg*, in common with other herder groups/ *heseg* in the *soum*, are included within this NGO. The State Professional Inspection Agency also inspects marmot burrows after hibernation season ends to monitor losses, as part of their remit to monitor marmot populations.

Industry: Mining activities have not been developed intensively in Undurshireet *soum*. There are a number of small scale artisanal production units providing livestock food, boots, dairy products and building materials locally, with plans to build an additional dairy factory, food production and wool processing factories and small local meat storage units in the *aimag* development plan.

Other issues**:** In recent years herders have become semi-sedentary and urbanised. Many do not typically graze their livestock on a seasonal/ rotational basis, as in the past. Due to the proximity of the *soum* to Ulaanbaatar and a major east-west road, large migrations of people and livestock towards Ulaanbaatar have resulted in some increases in soil degradation and overgrazing in the *soum* territory, and adverse impacts on wildlife populations. This occurrence is most prevalent in the Tuul river valley and around the *soum* centre. Hence, the government has an important role to ensure that wildlife and migratory species in the province territory are protected and only utilised in accordance with best practice under law. There is also scope for community involvement in such activities, as indicated by the recent formation of *Tumen Mal*. Undurshireet *soum* has populations of Argali, ibex, white-tailed gazelles, red deer, roe deer, grey wolf, red fox and Mongolian marmot. Each year a quota of hunting licenses is available to the public. These are due to be reviewed under forthcoming legal changes.

iii) Dert Heseg, Ulziit soum

Climate**:** Ulziit *soum* has an extreme continental climate. The weather is sunny, clear

with little precipitation for 120 to 150 days per year. The temperature range in Ulziit is less than at other sites, especially those in more mountainous areas. The annual average temperature is 1.0-1.5^{0}C and annual precipitation is typically less than 100 mm. The coldest period is in January when air temperature can drop to -34^{0}C. The hottest period is in July with air temperature up to 39^{0}C. Sudden cold weather is common in spring (May) and autumn (September). Cold weather periods in spring often overlap with flowering time of saxaul and bushes, thus having a negative impact on vegetation growth. Sand storms and sand movement occurs in April and May.

Topography and soils**:** The area is generally flat and low lying (up to 1500m asl). Soil types include steppe, desert steppe and semi desert soils. Gobi brown grey soil, riverbeds and surface stony soils are common in the northern part and desert light brown, sandy, desert steppe brown and marshes are distributed mainly in the southern region. Desert steppe brown soil occurs in hills, flat steppe, small hills, big depression valleys, dale and high mountain slopes. Brown soil covers 10-25% and supports needlegrass, wild leek and chives. Most of the soil surface is covered by grass, pebbles and rocks as a result of the high winds. The brown soil is mostly alkaline due to low humus levels of 1.0-1.2%. Riverbed soil and salt-meadow soil covers only a small area of the *soum*.

Vegetation**:** The eastern and east-northern part of rangelands in Dert *heseg* area are covered by mountain desert steppe vegetation, the central part by desert steppe and western, south-eastern part by interzonal or low land vegetation. The area is relatively sparse in vegetation and is typified by Stipa and Artemisia associations.

Conservation activities/ Endangered species and habitats: The *soum* contains Zagiin us Nature Reserve which covers 273,606 ha; over 80% of this reserve territory lies within Ulziit *soum*. Dert *heseg* itself does not lie within Zagiin us Nature reserve. It is situated 5km to the north-west of the reserve at its closest point. There is also one Local Protected Area at Del Hunjliin Mountain in Tagt *bag,* beyond the boundaries of Dert *heseg,* to the south west. These protected areas have 1 ranger each. In cooperation with The Nature Conservancy (TNC) a project to mitigate mining impacts on the environment in the southern Gobi ecological region was implemented in 2013. Through this project, mining effects were defined and conservation priority areas set. Recommendations to get Tsagaan suvraga and Del Khunjliin Mountain areas under state protection were submitted. However, no measures were taken in response to this recommendation. There were plans to resubmit the recommendation at the time, although the project is now closed with no further concrete plans for action. Key fauna in the *soum* include wild ass (*Equus hemionus)* listed as Endangered by the IUCN, argali sheep (*Ovis amon)* listed as Near Threatened, and goitered gazelle (Gazella subgutturosa), listed as Vulnerable. Mongolian gazelle (*Procapra gutturosa*), listed as Least Concern, appear to be increasing in numbers over the last 5 years although detailed population surveys for the *soum* are not available. Since 2004, there has been a blanket ban on the hunting of argali (*O. amon*) and ibex (*C. sibirica*). Once again this appears to have resulted in

increased populations.The population of goitered gazelle has decreased as a result of the *dzud* in 2008 (pers. com, Tserensugir, Dundgov *aimag* Environmental Specialist).

Industry: The *soum* has many natural resources such as uranium, copper, coal, gold and fluorspar. Two spar mines are currently operating. Mineral exploration licences have been granted over some 30% of the *soum* territory. Livestock herding and sale of livestock products remain the main economic sector of the *soum*.

***Other issues*:** several major roads pass through the *soum*, such as Ulaanbaatar-Umnugobi, Choir-Oyutolgoi and Choir-Tavantolgoi roads. A recent unpublished study by the Wildlife Conservation Society (WCS) has indicated that major roads do have an impact on wild ass migration throughout the Gobi region, although the significance of this impact has not yet been quantified. Due to low levels of rainfall and steady increases in mean temperatures throughout the Gobi region over the last 20 years, soil nutrition and structure are being adversely affected, with increasing problems of desertification in the *soum*, affecting an estimated 75% of the territory (Tserensugir, Dundgov *aimag* Environmental Specialist).

iv) Dulaan Khairkhan Herder Group, Bogd soum

Climate*:* Average air temperatures are 20 to 25^{0}C in the summer and -18 to -20^{0}C in the winter. Annual average precipitation is 71mm. The hottest month is July and the average is 35.7^{0}C. The coldest month is January with average temperatures of -29.3^{0}C and average wind speeds of 4.1 m/s. Bogd is susceptible to sudden air temperature changes and it is common to have sudden cold weather, snow and dust storms

Topography and soils: Bogd *soum* has a highly variable topography, including high mountains, valleys, flat steppe, hills and river valleys. The highest point is Ikh Bogd Mountain, the highest peak of the Gobi-Altai mountain range at 3957m asl, with the lowest point being Orog lake shore at 1221m asl. The Tuin River feeds into Orog Lake in Bogd *soum*. Also over 130 small rivers, streams and springs have been recorded in the *soum*, although with reported drying of some of these in recent years. Orog lake itself dried up in recent hot summers, although water levels have recovered more recently. Desert steppe brown soil is dominant in steppe areas. From Orog lake shore to the peak of Ikh Bogd Mountain there are clear altitudinal differences in soil characteristics. Within only 20 to 30km there are substrates associated with desert steppe, arid steppe, mountain steppe, high mountain meadow and aiguilles. These latter soils have a humus component of around 5 to 15 percent, making them the most fertile soils in the *soum*.

Vegetation: The southern part of the rangelands in Dulaan Khairkhan group area is covered by mountain desert steppe vegetation and the northern part by desert steppe vegetation. Overall, there are 145 species of vascular plants recorded in Bogd *soum*. Bogd has unique desert steppe vegetation in its lake depressions and a variety of examples of Gobi-Altai mountain species occur with variations on

community structure depending on substrate and surface features. Around the southeastern part of the lake there is a small saxaul (*Haloxylon ammodendron*) forest. Ikh Bogd and its bordering mountains have distinct altitudinal vegetation zones.

***Conservation activities/ Endangered species and habitats*:**

***Fauna*:** Following interviews with local herders and reviews of the national Red Lists, argali sheep (*O. Amon)*, ibex (*C. Sibirica)*, snowleopard (*U. Uncia*) and Pallas's cat (*O. manul*) can be found in the rocky areas leading onto the mountain steppe. At lower, flatter habitats goitered gazelle (*G. Subgutturosa)*, Siberian marmot (*M. Sibirica)* and corsac fox (*Vulpes corsac*), are present and play important roles in nutrient cycles and soil conditioning. The marmot in particular is notable as a habitat engineer, providing key benefits to the grasslands directly and providing dens for many other species. White-tailed eagle (*Haliaeetus albicilla*), Altai snowcock (*Tetraogallus altaicus*), mute swan (*Cygnus olor*) and Dalmatian pelican (*Pelecanus crispus*) are notable bird species for their listing in the IUCN Red Lists.

From the late 1990s, early 2000s a number of sustainable pasture management projects were implemented in the *soum*, for example by the German Technical Cooperation Agency (GTZ, now GIZ) with the aim of improving pasture management. Also in 2014 the Green Gold project funded by the Swiss Development Cooperation came to its planned end. In 2009 a *soum* Conservation Action Plan for the following 4 years was approved. In 2013 the outputs and results of this plan and donor initiatives were reported to the public and assessed by a meeting of citizen's representitives. 98% of planned activites under The *soum* Conservation Action Plan were completed by the end of 2013. Following from this success a 'Clean *Soum*' programme was approved by the Citizens Representative *Khural*[2] in 2013 and will run till 2017. This programme entails activities such as rubbish collection and tree planting.

Ikh Bogd Mountain National Park was established by the decision of Parliament in January 2008 and currently has one ranger. Another state ranger operates across the whole *soum*. Activities carried out by the rangers typically include monitoring of potential illegal activities and law enforcement as necessary. They have no specific patrols, but rather visit areas based on what they hear from local herders/other citizens and their own observations. This strategy in part reflects lack of capacity/ resources. In addition and by the decision of leaders of the Citizens' Representative *Khural*, 15 new Local Protected Areas have recently been established. The *Soum* governor signed contracts with *Bag* governors and local communities around the LPAs to protect these places. Of the 15 LPAs in the *soum* 3 lie at least partially within the boundaries of Dulaan Khairkhan herder group area. These are:

1) the saxaul forest area

[2] *Khural* literally translates as 'meeting', and is widely used to denote statutory bodies and organisations – e.g. State Parliament is the Great *Khural*. Citizens' Representative *Khurals* are comparable to local councils.

2) petroglyphs at Dulaan Bogd Mountain

3) A rock formation known locally as “twin fish”.

Of these only 1), the saxaul forest area, has direct application for nature conservation, although the others are important cultural sites. These LPAs are volunteer-based. Any local herders who want to volunteer contact the *bag* administration and sign a volunteer contract. There are no formal terms of reference or budget available at present, which has prevented any significant activity under the auspices of these new LPAs. These thus create a good basis for, but do not duplicate, planned activities under Plan Vivo, for which the herder groups currently lack support and capacity.

Industry: There are no registered mining activities by companies or local people, and no mining developments in the *soum*. However, ore and non-ore minerals such as gold, copper, iron ore, coal, asbestos, gypsum, salt and soda are common. Resources for building materials are also present such as sand, pebbles and volcanic rocks, which are used in small quantities by local communities. A midterm development plan for *soum* industry was approved at a Citizens’ Representative *Khural* meeting in 2013. Livestock herding remains the primary activity and source of income.

Other issues: In 2013, the *soum* prepared 804 tonnes of hay and was awarded the 1st place in the hay preparation competition among the *soums* of Bayanhongor *aimag*. It was also noted as the most effective *soum* at pasture management. However, recent increases in livestock numbers are leading to overgrazing, breakdown in pasture management and a decrease in the number of pastureland species. There is a lack of funds, techniques and equipment to protect and use pasture properly, conduct restoration and plant livestock fodder, including in the area of the Dulaan Khairkhan Bogd herder group.

B3. Recent changes in land use and environmental conditions

Pasture degradation/ desertification, linked to increasing livestock numbers and reductions in seasonal livestock mobility, is an issue at all project sites. The impacts of overgrazing are further exacerbated by changes in climate, especially in Ulziit *soum*. Seasonal droughts and *dzud* have necessitated movement of herders out of the *soum* on long distance migration (*otor*) in search of grazing in recent years. For sites which receive large numbers of migrant herders (e.g. Hongor *Ovoo*, Ikh Tamir *soum*), this further exacerbates overstocking and grassland degradation. Loss of water points (wells) has also resulted in concentration of grazing around natural sources (rivers, lakes and streams) at other sites, for example along the Olont and Tamir rivers in Ikh Tamir *soum* and the Tuul river in Ikh Am *heseg* area, Undurshireet *soum*. Periodic pollution of water sources, especially the Tuul river, is also a factor.

Significant increases in rodents such as Brandt's vole (*Lasiopodomys brandtii*) have also resulted in further deterioration of pasture in Ikh Am and Dulaan Khairkhan Bogd *heseg* areas. Adverse impacts on saxaul forests have also been noted at the latter site.

B4 Drivers of degradation

i) Hongor Ovoo Heseg, Ikh Tamir soum

Most of the herders have only 2 seasonal camps: spring-summer and autumn-winter camps. In warmer seasons the livestock concentrate close to the Olont and Tamir rivers, which are the main water resources in this area. In winter time livestock rely on snow for drinking water. When snowfall is late or insufficient livestock remain close to these two rivers, resulting in localized overgrazing. The pasture of this project site is also very overgrazed because of significant increases in livestock numbers, due both to existing herder households and new migrants from western *aimags*. The latest *soum* level estimates suggest that *soum* livestock numbers exceed the overall pasture carrying capacity by some 2.8 times. Recent years have shown a trend for a year-on-year increase in livestock numbers for the *soum* as a whole, reflected in livestock numbers within the *heseg* area (Table B4, below).

ii) Ikh Am Heseg, Undurshireet soum

The Ikh Am *heseg* site is located only some 100km from the capital city, Ulaanbaatar. Since the change to the market economy system in the early 1990s, livestock numbers have increased significantly as many herder families have moved here from western areas to be close to urban facilities and markets. Recent statistics for the *soum* show a steady trend of increasing livestock numbers year-on-year, which are reflected in livestock trends within the *heseg* area (Table B4, below). The pasture in this *soum* is locally heavily degraded/ overgrazed. In the last few years drought and increasing numbers of rodents, especially Brandt's vole, have further contributed to pasture degradation. Lack of water points is also an issue. There are only two main sites in the *heseg* area: one is the Tuul River and the second is a deep well. Some of the Ikh Am herder families stay at the same camp for the whole year or move only very small distances around these water sources. Others regularly move out of the *heseg* area in the spring and summer seasons due to grazing pressure within the *heseg* area. Interviews with local herders reveal this as an established pattern over a number of years. Pollution of the Tuul River by factories in Ulaanbaatar has also been an issue in recent years. Recent *soum* level estimates indicate that pasture is overgrazed by 1.4 times over its carrying capacity.

iii) Dert Heseg, Ulziit soum

Due to its location in the relatively arid Gobi desert area, and the climatic and soils issues outlined in Section B2 above, the pasture of Dert *heseg* is very poor in comparison to other project sites. Most of Dert *heseg* herders undertake quite

extensive seasonal movements, in order to access good pasture. In winter time herders may move some 500 km, far beyond the *heseg* and *soum* boundaries, to look for pasture. Out migration (*otor*) in summertime is also becoming increasingly prevalent. Nonetheless, due to poor quality pasture, *soum* records still suggest that current livestock numbers exceed carrying capacity.

iv) Dulaan Khairkhan Herder Group, Bogd soum

Local environmental/ climatic conditions make the *soum* suitable for camel and goat herding in particular. Recent years have seen a trend of increasing numbers of goats as a proportion of livestock herds, driven by cashmere price and market demands, as well as in total livestock numbers. This trend has adversely impacted on pasture quality. The second biggest driver of pasture degradation is significant increases in Brandt's vole in the pasture and in the saxaul forest area. Increased *soum* livestock numbers, currently estimated at some 3.7 times carrying capacity, are also a significant factor in pasture degradation.

Table B4: Recent Livestock Trends in Study *Soum*s (total livestock numbers by *soum* and *heseg*/ herder group).

	2010	**2011**	**2012**	**2013**
Ikh Tamir *soum*, Arkhangai *aimag*	186463	200631	229131	256511
Hongor Ovoo heseg	*13249*	*10827*	*12013*	*13160*
Undurshireet *soum*, Tov *aimag*:	144039	153065	175541	181935
Ikh Tamir heseg	*15360*	*16986*	*18510*	*18023*
Ulziit *soum*, Dundgov *aimag*	85413	104794	126914	149371
Dert heseg	*3690*	*4701*	*5247*	*6437*
Bogd *soum*, Bayanhongor *aimag*	122939	139836	151217	174278
Dulaan Khairkhan herder group	*2523*	*3076*	*3621*	*4511*

Note: these figures post-date 2009/2010 *dzud* (natural disasters) across Mongolia, which resulted in the loss of some 8.5 million livestock- or 20% of the national herd. Study *soum*s were classified by UNICEF in January 2010 as 'extremely affected' in the case of Ikh Tamir and 'affected' for the other three *soum*s. The trend from 2010 (or 2011 for Hongor *Ovoo*) shows rapid recovery of livestock numbers in the post-*dzud* period.

Part C: Community and Livelihoods Information

C1 Participating communities/groups

The target populations at the four participating sites are livestock herders, for whom herding and associated livestock products provide for the majority of their livelihoods at present. Cultural and ethnic diversity is low, with participating groups belonging to the majority Khalkh Mongol population, as do more than 80% of the country's population. Religious affiliations where present are primarily to Buddhism, resurgent in Mongolia since the end of the Soviet-inspired collective (*negdel*) period in the early 1990s. Shamanic practices are also remerging in some areas. The groups all include both male and female-headed households. Further details on population demographics by age and gender are provided in Table C2 below.

The participating community groups have recognized land tenure rights, as specified in Section I3 and in accordance with traditional land use rights and practices and the 2002 Land Law. The participating *heseg*/ herder groups, as named above, arose from a series of donor projects across Mongolia, particularly from 2000, albeit based on traditional kinship/ geographical groups. The three *heseg* groups-Dert, Ikh Am and Hongor *Ovoo*, were formalized through the activities of MSRM, the key in-country project partner for the PV activities. MSRM have been active in the creation, training and capacity building of *heseg* in Mongolia since 2007. Ikh Am, Hongor *ovoo* and Dert *heseg* have all been active from this date. The Dulaan Khairkhan Herder Group in Bogd *soum* was established in 2003 as part of the GTZ (now GIZ) project 'Nature Conservation and Bufferzone Development/ Conservation and Sustainable Management of Natural Resources' projects (1995-2006), since which time the group has operated independently, with periodic support from other organizations such as World Vision, although this support has now ceased. Again, the formal group is based on traditional kinship affiliations and geographical proximity in seasonal pastures.

C2 Socio-economic context

As highlighted in C1 above, participating herder groups/*heseg* have access to land and associated resources (grazing, water, haymaking areas) through kinship-based, traditional rights and as enshrined and supported through the 2002 Land Law. Land areas allocated to specific *heseg*/ herder groups through local agreements with *soum* authorities and grounded in the provisions of the Land Law are as specified in Section B1. A sample *heseg* contract for pasture use and rights with local *soum* authorities is included at Annex 6. Final contracts for all Plan Vivo sites, including explicit recognition of carbon rights, are being signed in conjunction with the Producer Group Agreement (Annex 3).

Land areas are used primarily for extensive, seasonal grazing of livestock, as specified in Section B1, with recent changes and key issues as summarized in B3 and B4 above. Access to natural resources is therefore a key dimension of livelihoods, with most participating households deriving the majority of their income/ livelihood from their livestock. This encompasses both subsistence use of livestock products and varying degrees of engagement with local markets/ middlemen for sale of products. In the latter case, this comprises primarily raw materials (milk products, cashmere for example), with little added value through processing. As part of attempts at livelihood diversification, a proportion of participating households also engage in non-herding activities, from which they may derive supplementary products and/ or income, for example vegetable production. However, as indicated in Table C2, the majority of households at all sites do not have additional, non-herding sources of income (other than in some instances the pensions of elderly household

members), but are reliant solely on herding and livestock products. Where present, for example in Bogd *soum*, vegetable plots are very small fenced areas near to households' key seasonal camps. Reservation of small areas for production of fodder plants has also become more prevalent across sites in recent years, but again in support of the primary activity of herding. Extensive cultivation of pasture or agricultural (crop) production does not feature in any of the four participating *heseg*/ herder group areas. Key socio economic indicators are summarized for each site in Table C2 overleaf. These are subsequently linked to livelihood benefits indicators and baselines (see Section F, below).

These indicators reflect a range of poverty/ well-being measures in Mongolia, both official/ state indicators and local, participatory indicators. Mean monthly monetary income for rural households according to latest government statistics (2013) is 625,859 tg, or 7.5m tg pa. As Table C2 indicates, for all four areas, the majority of participating households are below this average. One official state poverty line of $2/ day translates into some 1.5m Mongolian togrog (tg) per capita pa at current exchange rates (although this does include self-provisioned foodstuffs as well as cash income). A minimum subsistence level of 146,700 tg per capita per month (National Statistics 2014) translates into a comparable 1.7m tg pa. Taking the lower of these as the most conservative estimate, and with a minimum household size of 2 persons, over 80% of Hongor *Ovoo* and Dulaan Khairkhan households fail to meet this level, with over 40% of households at other sites.

Table C2: Socio Economic Contexts & Indicators

	H. *Ovoo*	**Ikh Am**	**Dert**	**D. Khairkhan**
% female headed hh	3%	10%	3.6%	0%
Annual hh income (% by income category):				
i) <1 million tg	50%	13.8%	7.1%	-
ii) 1.1-3 million tg	36.4%	27.6%	35.7%	33.3%
iii) 3.1-6 million tg	13.6%	27.6%	35.7%	50%
iv) 6.1>10 million tg	-	6.9%	17.9%	16.7%
v) >10 million tg	-	24.1%	3.6%	-
% hh with non-herding income sources*	9.1%	0%	17.9%	22.2%
Monthly non-food expenditure				
i) >51% income	27.3%	65.5%	57.1%	33.3%
ii) 31-50% income	30.3%	24.1%	35.7%	66.7%
iii) 30% or less income	42.2%	10.3%	7.1%	-
% hh with savings	18.2%	44.8%	21.4%	40%
Participatory poverty/ livelihood evaluation				
i) Below average(Poor/ very poor)	6.1%	10.3%	28.6%	30.8%
ii) Average	83.3%	69%	57.1%	53.8%
iii) Above average/ good	10.6%	20.6%	14.3%	15.4%
Total livestock nos per hh-mean (min –max)	136 (0-750)	388 (14-1127)	267 (20-740)	385 (98-821)
Total annual movement by hh (km) – mean (min –max)	82 (20-220)	156 (36-400)	148 (30-400)	89 (25-150)

*non herding incomes do not include pensions and other forms of state support or subsidy as these are out with herders' control. They also exclude income from informal (ninja) mining, mentioned by only 2 households, as this form of diversification is not supported as a Plan Vivo activity and thus should not form part of the project baseline where monitoring indicators are based on increased diversification (see Table F2.2).

Participatory evaluations show most households consider themselves to have at best average or below average livelihoods. The lack of livelihood diversification also indicates a lack of resilience in the face of change, as do the relatively small proportions of households at each site with savings, especially for Dert and Hongor *Ovoo*. Livestock numbers are a traditional indicator of wealth. Recent research and guidance suggests that households with less than 100 animals may be considered poor; households with 101-200, or by some estimates up to 500 animals are average, while those with more than 500 animals are wealthy. However, this offers only a rough rule of thumb and depends also on many other factors such as type of livestock, ecological zone, existence of other sources of household income etc. Government and donor policies are also trying to reduce livestock numbers and therefore move away from high livestock numbers as an indicator of wealth/ well-being. Other indicators which are becoming widely used as a measure of poverty/ well-being and vulnerability include: proportion of non-food expenditure; existence of savings and non-herding income/ diversity. Overall, across a range of indicators Hongor *Ovoo* and Dert *hesegs* appear to have the poorest/ most vulnerable households, with greater variations in socio-economic status of populations at Ikh Am and Dulaan Khairkhan, both of which *hesegs* include a significant proportion of poor/ vulnerable households.

Energy for heating and cooking is derived primarily from wood and/ or dried dung, with households relying on a traditional central stove in the *ger* for both. Low cost solar panels and small wind turbines are also becoming more prevalent on *gers* for the provision of electricity for TV and radio. Even households who have solar/ wind power continue to rely on traditional wood/ dung fuelled stoves for heating and cooking.

C3 Land tenure & ownership of carbon rights

The situation with regards to land tenure is as specified in C1/2 above and I3. A sample contract is included at Annex 6. There is currently no specific legislation relating to ownership of carbon in Mongolia. Under the type of sample agreement included at Annex 6 and to be signed for each *heseg*/ herder group as part of the site specific Plan Vivo agreement (Annex 3), *soum* authorities have recognized the rights of local herder groups/ *heseg* to any carbon related benefits accruing through Plan Vivo activities. This applies to all land included in the project areas.

Part D: Project Interventions & Activities

D1 Summary of project interventions

The project interventions focus on improved land use management, as defined by Plan Vivo guidance. However, in line with the new Plan Vivo standard, the project interventions pay specific attention to livelihood, socio-economic and biodiversity

benefits, which may derive directly from or in parallel with the planned changes in land use/ management practices at the study sites. Project activities and interventions for livelihoods and biodiversity, as well as climate/ carbon benefits are summarized below. Where protection of key species forms part of planned activities, these may also be deemed as contributing towards further prevention of ecosystem degradation or ecosystem conversion.

Increasing soil carbon stocks

Project activities that aim to prevent further degradation of rangeland areas and allow soil carbon stocks to increase include:

- Grazing management - Reducing the numbers of livestock grazing for extended periods within project intervention areas within the broader project area, for example by introducing seasonal pasture rotations and by reductions in livestock numbers over the four year duration of the project.
- Fodder or forage cultivation - Planting fodder or forage crops, and changes to the management of existing cultivation practices, for example by planting green fodder, or improving water supply to pasture areas.

Biodiversity conservation

A key aim of nature protection activities is to prevent and reverse reductions in wild species such as gazelle, ibex and deer populations. This can be achieved by activities that directly reduce pressures on these animal species, and those that prevent degradation of or enhance the habitat they require, as well as protecting other key flora, for example by:

- Establishing herder partnerships to protect the local environment and encourage increased participation in decision-making on environmental issues, for example issuing licences for wood cutting, and controlling illegal hunting activities;
- Protecting forest areas from degradation or deforestation for example by preventing illegal timber harvesting, and including protection of saxaul forests;
- Reforestation of degraded forest areas by producing and planting seedlings
- Reducing grazing pressure and grazing-induced pasture/ habitat degradation, through enhanced seasonal mobility between pastures and reduction in livestock numbers.
- Working towards cessation of mining activities. Amelioration of adverse environmental impacts in the interim, through citizen action to ensure observation of environmental regulations by miners. This applies specifically to Dert *heseg*.

Livelihood improvement

The aim of livelihood improvement activities is to increase herders' income by maximising value from livestock products and developing new sources of income, for example by:

- Increased marketing of milk products – forming groups to deliver milk products to local and urban markets;
- Production and sale of wool products – for example felt;
- Gathering and sale of natural resources – for example wild fruit and nuts;
- Production and sale of vegetables.

Sale of PV certificates will also enhance herders' income in the future. Such activities, in conjunction with the biodiversity conservation/ ES service protection activities, are also designed to contribute to wider well-being, resilience and perceptions of security amongst participating herding communities and as evidenced through participatory well-being indicators.

D2 Summary of project activities for each intervention

Table D2 – Description of activities				
Intervention type	**Project Activity**	**Description**	**Target group**	**ES contracted (yes/no)**
Improved land management	Seasonal pasture use/ grazing management	Develop and implement schedule for enhanced mobility through seasonal pasture use, linked to reduced grazing pressure and enhanced soil C stocks.	Herders (through *heseg*/HG)	Yes
Improved land management	Fodder/ forage cultivation	Planting fodder or forage crops	Herders	Yes
Improved land management	Improving water supply to pasture areas	Repairing/constructing hand wells	Herders	Yes
Improved land management (prevention of ecosystem conversion/ degradation)	Biodiversity conservation	Establishing herder partnerships to protect local environment & encourage increased participation in decision-making	Herders	Yes
Improved land management (prevention of ecosystem conversion/ degradation; ecosystem restoration & sustainable resource use)	Biodiversity conservation	Protection of forest areas from degradation or deforestation for example by preventing illegal timber harvesting, and including protection of saxaul forests; production of seedlings for reforestation.	Herders	Yes
Improved land management (prevention of ecosystem conversion/ degradation; ecosystem restoration and sustainable use)	Biodiversity conservation	Reducing grazing pressure and grazing-induced pasture/ habitat degradation, through enhanced seasonal mobility between pastures and reduction in livestock numbers.	Herders	Yes
Improved land management (prevention of ecosystem conversion/ degradation; ecosystem restoration)	Biodiversity conservation	Protecting/conserving key named wild animal populations.	Herders	Yes
Improved land management	Livelihood improvement	e.g. Increased marketing of milk products – forming groups to deliver milk products to local and urban markets; Production and sale of wool products – for example felt; Gathering and sale of natural resources – for example wild fruit and nuts; Production and sale of vegetables; Collaborative repair of key infrastructure such as winter/ spring shelters.	Herders	Yes

D3 Effects of activities on biodiversity and the environment

For all four sites, project activities are designed to make a positive contribution to biodiversity conservation through a) establishment of partnerships between herders for monitoring and protection of key resources, in conjunction with local administration, thus enhancing local participation in biodiversity conservation (a key goal under national CBD commitments); b) monitoring and protection of key named species (e.g. saxaul forest, key fauna); c) prevention of ecosystem degradation/ ecosystem restoration through protection of forest areas, production of seedlings; d) enhancement of rangelands at wider landscape scale, through reduction of grazing pressure and habitat degradation. As part of improved pasture management and livelihood improvement activities, small areas of pasture may be fenced for vegetable production or fodder crops. Such planned activities are very small in scale and have been reviewed in relation to possible impacts on biodiversity. These are not considered to pose a threat to biodiversity at the locations and scales proposed for such activities. Full details of proposed activities, monitoring and indicators are included in Section K and in site specific Management Plans at Annex 5.

The activities are also designed to make a positive contribution to local soil and water issues, primarily through enhancing seasonal mobility of livestock and thus reducing seasonal grazing pressures and localized soil erosion, even where there are no significant reductions in overall livestock numbers. Measures to repair wells and enhance water access will also help to spread grazing pressure.

Part E: Community participation

E1 Participatory project design

All activities within the project were developed by project participants with the support of the project coordinator, MSRM. During the preparatory phase of the PV projects, and as part of the Darwin Initiative 'Values and Valuation' project (2012-2015)[3], MSRM have worked with *heseg*/ herder groups to facilitate the participatory development of each group's own activity plan. These groups self-identified as wishing to take part in the Plan Vivo process, from a wider range of groups involved with the Darwin project. All were in existence and functioning prior to the initiation of the Darwin or PV projects and had worked with the project coordinators (MSRM) or Dr Upton previously. The process of participatory planning with self-identified PV groups is also detailed under Section J1. Through a series of meetings with MSRM all members of herder groups have undertaken participatory planning in relation to the following main issues:

[3] The Darwin Initiative funded 'Values and Valuation: New Approaches to Conservation in Mongolia' project was instituted by University of Leicester (Dr C. Upton) and MSRM (Professor Dorligsuren and D. Dulmaa) from 2012-2015. Preparation and initiation of Plan Vivo activities formed a key part of the activities under this project.

i. ***Pasture use planning***: herders have discussed and developed new plans for seasonal movement schedules, use of previously under used pasture area, resting of certain pasture areas, development of hayfields, as appropriate to specific locations and pasture conditions.
ii. ***Maintenance/ repair of winter and other shelters and hand wells***, through cooperation within the group.
iii. ***Cooperation in livestock/ raw material marketing, felt processing and dairy product manufacturing***. At present, most herders process products only at the household level, and in some cases only for their own domestic use. More effective manufacturing and marketing, taking account of economies of scale, has the potential to play a big role in income generation and livelihood improvement in the future.
iv. ***Environmental protection/ conservation***: for example in relation to forest protection and deforestation; protection of key fauna, as specified for each participating *heseg* in Section D, above and in more detail in Section K and the site specific Management Plans at Annex 5.

The planning process was driven by the requirement to address local needs and priorities, with herders identifying their own lists of planned activities. Subsequent discussions with MSRM and, for biodiversity related activities in particular, with Zoological Society of London (ZSL), were then used to filter out activities that may not be admissible under the Plan Vivo process or were unacceptable to Darwin (for example extensive fencing of pasture; planting of non-native species), to arrive at a final agreed list. Herder groups then participated in the development of monitoring plans and indicators for these activities, through repeated field visits by MSRM from 2013 and, specifically for biodiversity, by visits and training events with ZSL over the same period, and culminating in an Ulaanbaatar-based workshop in June 2015. MSRM/ Dr Upton ensured that agreed indicators were clearly set out in site specific Management plans and linked to the Technical Specification. Herder group leaders also compiled and mapped information on planned activities and secured approval for any planned changes in resource use from local government officials (e.g. *soum* and *bag* governors).

Heseg members working with ZSL, Ulaanbaatar workshop, June 2015

The *heseg*/ herder groups are already set up to include poorer, marginalized households, and typically include all households who share key seasonal pasture areas. Thus households are not excluded on the basis of age, gender, income, ethnicity etc. The target groups participating in the project are as identified in Section C, namely Hongor *Ovoo heseg*, Ikh Tamir *soum*, Arkhangai *aimag*; Ikh Am *heseg*, Undurshireet *soum*,

Tuv *aimag*; Dulaan Khairkhan herder group, Bogd *soum*, Bayanhongor *aimag*.

A fourth group, Dert *heseg*, Ulziit *soum*, Dundgov *aimag*, have also shown commitment to participating in the PV process and took part in a series of initial planning exercises. However, due to adverse climatic and pasture conditions, they were all away from their *heseg* territory on long distance migration (*otor*) in summer/ autumn 2014, the critical period for finalization of plans. Therefore, they are not included here, but the plan is to include them in the latter stages of this initial 4 year commitment period (if permitted by PV) or in any future rounds of PV commitments, should they still wish to be included. Members of Dert *heseg* attended the project training workshop in Ulaanbaatar in June 2015, when the reaffirmed their commitment to participate in the Plan Vivo process in the future.

The participating groups all have their own established structures, with elected leaders, accountants and committees, accountable to all members. These structures and procedures require meetings of all members at least twice per year, with additional meetings of all members to be called as required. Leaders are elected by a democratic process involving all members, with elections typically taking place every four years. These structures have enabled the participatory development of Plan Vivos, including all *heseg* members. The final signing of the PES agreements will be by members nominated through existing structures and processes, and with the free, prior and informed consent of all *heseg*/ herder group members.

As outlined above, groups typically include all households within shared seasonal pasture areas, and as such do not exclude marginalized or vulnerable groups. Where any local households are not *heseg* members, for example due to financial or labour implications of group membership, they will be encouraged to join, for example by waiving any membership fees, to be repaid out of initial PV income.

E2 Community-led implementation

The Plan Vivos & Management Plans (as summarized in Section K and included in full for each sites at Annex 5), were prepared through the processes set out above. These were finalized and GIS versions prepared during an intensive round of meetings and community planning activities in September/ October 2014. These were then approved by the project coordinator, MSRM, for submission as part of this PDD. They have been cross checked with and are consistent with the project's Technical Specifications, submitted as part of this PDD, within Section G. These Plan Vivos, as submitted, are designed to enhance livelihoods and will not undermine food security. The project coordinator has made this evaluation on the basis of a lengthy track record of working with these communities and through the participatory planning process with the communities themselves. An Ulaanbaatar-based workshop in June 2015 was used to address any revisions required in the first submission of

the PDD through detailed discussion with herder groups/ *heseg*. This also provided an opportunity for further training by MSRM on Plan Vivo monitoring and implementation and for mutual learning between all parties. Further training was also provided to government officials through this workshop. These plans have now been signed off by local *soum* officials as part of the official inception of Plan Vivo activities.

During the September/ October 2014 planning round a GIS technician from MSRM worked with the *heseg* to record boundary coordinates of all planned Project Intervention Areas and to produce maps, irrespective of whether these exceeded 5 ha. These are appended at Annex 5. Mongolian language versions have been made available to participating *heseg*. These have been discussed extensively with participating *heseg* during their production in autumn 2014, and again at the June 2015 workshop, as a final check prior to submission of this updated PDD.

E3 Community-level project governance

Heseg have been central to development of PVs so far, through the participatory planning process outlined above. During the initial 4 year commitment period regular *heseg*/ community meetings will provide the forum for discussions of the design and running of the PV project. Such discussions will be minuted and shared with MSRM, for their feedback and comment if desired. *Heseg* may also invite MSRM staff to attend such meetings, where required, for example to discuss and problems or grievances, but this will be at the behest of the *heseg* themselves.

Any non-participating households will be able to raise any problems and grievances through *soum* and *bag khural* (meetings) and the local Citizens' Representative *Khural* (CRK), the usual local channels for discussion and decision-making. Where required the project coordinator can be called to attend these meetings. Otherwise, discussions can be reported back by *soum* or *bag* governors or CRK members. All grievances received, by whatever channel, will be recorded by MSRM in writing. They will also be required to respond in writing or in person to the appropriate *bag*/ *soum khural* or *heseg*. Grievances and details of their resolution will also be reported to Plan Vivo by MSRM.

Part F: Ecosystem Services & Other Project Benefits

F1 Carbon benefits

The climate benefits expected to result from project activities were estimated using the approaches described in the Technical Specification (Part G, and as set out in Annex 8).

In addition, existing sources of data, such as published analyses of biomass and biomass utilisation rates, in conjunction with site specific measurements of biomass at project sites were assessed in order to determine and contextualise 'with project' benefits. Specifically:

i) Hongor Ovoo heseg, Ikh Tamir soum:

The CENTURY model was previously validated for this area of Mongolia, based on extensive soil and biomass sampling and analyses, by Values for Development, who also undertook the modelling work in this instance. In accordance with the Annex 8 methodology, the validated CENTURY model was parameterised for this *heseg* area, drawing on site specific baseline grazing management practices, planned 'with project' grazing practices over the initial 4 year commitment period (spring 2015-19) and local climate, soil and vegetation data. In Hongor *Ovoo*, as in all cases, the baseline grazing scenarios were developed by MSRM through repeated discussions with *heseg* members, observation, and cross checking with *soum* officials and analysis of annual livestock records for each *soum* and *heseg*. Participatory mapping with herder groups enabled spatial analysis of baseline movement patterns and stocking rates for different types of pasture. These data were combined with baseline biomass data, derived from project specific sampling, *soum* pasture reports, other published sources and Values for Development modelled data, to calculate baseline biomass utilisation rates and to determine stocking rates and biomass utilisation rates under planned 'with project' scenarios. For Hongor *Ovoo heseg*, herders have undertaken to reduce total livestock numbers (converted into sheep units)[4] by 5% against baseline rates the end of the first four year commitment period. They have also undertaken to reduce grazing pressure through increased numbers of seasonal camps, in accordance with the indicators summarised in Section K and specified in detail in the Management Plans at Annex 5. Herders' planned changes in grazing practices were then combined with modelled data to determine carbon sequestration rates per ha for the planned changes in grazing practices. This is the key data here, with reductions in biomass utilisation rates rather than biomass per se being the important parameter and the positive 'with project' change. In accordance with modelled data, and to ensure a conservative approach, only grazing practices and stocking rates equivalent to 50% biomass utilisation or less were considered to make significant contributions to carbon sequestration. Table G5.3 in Section G shows modelled changes in carbon sequestration associated with different 'with project' management scenarios (50%, 40% and 30% biomass utilisation rates) for Hongor *Ovoo*. As for all sites, carbon sequestration calculations relate only to grasslands and to improved grazing management practices. This is a conservative approach, as certain planned activities such as production and planting of tree seedlings at this

[4] Sheep units (SU) are based on the following conversions and in accordance with accepted best practice in Mongolia: adult camel: 5 SU; young camel: 1 SU; adult cattle: 6 SU; young cattle: 1.2 SU; adult horse: 7 SU; young horse: 1.4 SU; adult goats: 0.9 SU; young goats: 0.2 SU.

site may also reasonably be expected to have positive benefits in relation to carbon sequestration. Nonetheless the technical specification and modelling in relation to carbon (see section G) and subsequent calculations of carbon benefits do not include tree planting. The planned movement patterns, stocking rates and biomass usage are incorporated into to the Management Plans and monitoring indicators at Annex 5, and as summarised in Section K.

ii) Ikh Am Heseg, Undurshireet soum:

Data on livestock numbers, stocking rates and mobility for this site are summarised in Table F1a below (equivalent tables for other sites are in Annex 5). The table also links the baseline and these planned with project activities to biomass utilisation rates. Baseline and with project biomass figures are derived from site specific sampling and analysis conducted as part of this project, and from secondary and published sources as highlighted above, which are also used to predict changes in biomass year on year under 'with project' scenarios. For Ikh Am *heseg*, herders have undertaken to reduce total livestock numbers (converted into sheep units) by 30% against baseline rates the end of the first four year commitment period. They have also undertaken to reduce grazing pressure through increased numbers of seasonal camps, in accordance with the indicators specified in the Management Plans at Annex 5. As specified for Hongor *Ovoo*, above, these data were then mapped onto soil carbon and C sequestration through parameters derived from the CENTURY model for comparable landuse, soil and vegetation types and in accordance with published data. The CENTURY model already includes adjustment for uncertainty (see Section G6). For this site and for Dulaan Khairkhan (Bogd), further adjustments were applied, with an increased risk factor of 20% for this site by comparison with Hongor *Ovoo*, for which the model was originally calibrated. It is also notable that summer pastures are not included in carbon calculations for the Ikh Am site. This reflects established grazing practices over many years, by which usage of summer pastures is highly variable year on year, with many incoming herders and irregular usage patterns of Ikh Am herders, making planning for and calculation of grazing pressure into the future especially problematic. This is a conservative approach, but given the particularly variable nature of usage of these summer pastures, incoming herders and leakage issues, as identified by Ikh Am *heseg* members, these pastures are conservatively omitted from calculations. Spring pastures are included, as usage by incoming herders is not a significant issue, even though movement of a proportion of Ikh Am herders to spring pastures outside their *heseg* area is a well-established practice over many years. Monitoring of 'with project' activities is designed to ensure that additional leakage does not occur under the project, especially given planned reductions in livestock numbers. The planned movement patterns, stocking rates and biomass usage are incorporated into to the Management Plans and monitoring indicators at Annex 5, and as summarised in Section K.

Table F1a Grazing Management, Stocking Rates and Biomass Utilisation, Ikh Am *heseg*, Undurshireet *soum*.

		Riparian meadow	Mountain steppe		Steppe	
		Spring	Spring	Winter	Spring	Winter
1.1	**description of baseline grazing practices (1/4/14/-31/3/15)**					
	number of days grazing in this location	82	82	130	82	130
	average number of moves (camps) in this location	2	2	1	2	1
	average number of sheep units grazing in this location	2511.0	1977.7	12615.7	4272.3	10623.9
	area (ha)	851.7	703.3	7804.8	1517.1	7441.3
	yield (kg DM ha)	450	350	350	256	256
	total yield (kg DM)	383265	246155	2731680	388378	1904973
1.2	**estimation of biomass utilization rate**					
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	41	41	130	41	130
	total biomass demand	144131	113520	2296057	245230	1933550
	estimated biomass utilization rate (%)	0.4	0.5	0.8	0.6	1.0
2.1	**description of with-project grazing**					
2.1.1	**Year 1 (i.e. first year of implementation: 1/4/2015-31/3/16)**					
	number of days grazing in this location	101	101	102	101	102
	average number of moves (camps) in this location	3	3	1	3	1
	average number of sheep units grazing in this location	2511.0	1977.7	12615.7	4272.3	10623.9
	area (ha)	851.7	703.3	7804.8	1517.1	7441.3
	yield (kg DM ha)	450	350	350	256	256
	total yield (kg DM)	383265	246155	2731680	388378	1904973
2.1.2	**estimation of sustainable carrying capacity**					
	recommended biomass utilization rate (%)	0.4	0.4	0.5	0.5	0.5
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	34	34	102	34	102
	total number of SU that can be grazed to sequester carbon	3252.6	2089	9564.7	4120	6670.1
		0.77	**0.95**	**1.32**	**1.04**	**1.59**
2.1.3	**Year 2 (1/4/2016-31/3/17) 10% reduction in livestock numbers against 2014 baseline**					
	number of days grazing in this location	101	101	101	101	101
	average number of moves (camps) in this location	3	3	1	3	1
	average number of sheep units grazing in this location	2260	1780	11354	3845.1	9561.6
	area (ha)	851.7	703.3	7804.8	1517.1	7441.3
	yield (kg DM ha)	540	420	420	332	332
	total yield (kg DM)	459918	295386	3278016	503677	2470511
	estimation of sustainable carrying capacity					
	recommended biomass utilization rate (%)	0.3	0.3	0.5	0.4	0.5
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	34	34	101	34	101

	total number of SU that can be grazed to sequester carbon	2927.3 **0.77**	1880.1 **0.95**	11591.3 **0.98**	4274.5 **0.90**	8735.9 **1.09**
	Year 3 (2017-18) 20% reduction in livestock numbers against 2014 baseline					
	number of days grazing in this location	101	101	101	101	101
	average number of moves (camps) in this location	3	3	1	3	1
	average number of sheep units grazing in this location	2008.8	1582.2	10092.6	3417.8	8499.1
	area (ha)	851.7	703.3	7804.8	1517.1	7441.3
	yield (kg DM ha)	540	420	420	332	332
	total yield (kg DM)	459918	295386	3278016	503677	2470511
	estimation of sustainable carrying capacity					
	recommended biomass utilization rate (%)*	0.3	0.3	0.5	0.4	0.5
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	34	34	101	34	101
	total number of SU that can be grazed to sequester carbon	2927.3	1880.1	11591.3	4274.5	8735.9
		0.69	**0.84**	**0.87**	**0.80**	**0.97**
	Year 4 (2018-19) 30% reduction in livestock numbers against 2014 baseline					
	number of days grazing in this location	101	101	101	101	101
	average number of moves (camps) in this location	3	3	1	3	1
	average number of sheep units grazing in this location	1758	1384.4	8831	2991.1	7436.7
	area (ha)	851.7	703.3	7804.8	1517.1	7441.3
	yield (kg DM ha)	540	420	420	332	332
	total yield (kg DM)	459918	295386	3278016	503677	2470511
	estimation of sustainable carrying capacity					
	recommended biomass utilization rate (%)	0.3	0.3	0.4	0.3	0.5
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	34	34	101	34	101
	total number of SU that can be grazed to sequester carbon	2927.3	1880.1	9273.0	3205.9	8735.9
		0.60	**0.74**	**0.95**	**0.93**	**0.85**

*0.3 denotes 30%; 0.4=40% etc.

iii) Dulaan Khairkhan herder group, Bogd soum:

Detailed data on livestock numbers, stocking rates and mobility for this site, equivalent to the example Table F1a for Ikh Am above, are presented in Annex 5, in conjunction with the site specific management plans. As for Ikh Am and Hongor *Ovoo*, the table also links the baseline and the planned with project activities for Dulaan Khairkhan to biomass utilisation rates. Baseline and with project biomass figures are derived from site specific sampling and analysis conducted as part of this project, and from secondary and published sources as highlighted above, which are also used to predict changes in biomass year on year under 'with project' scenarios. Herders have undertaken to reduce total livestock numbers (converted into sheep

units) by 5% against baseline rates the end of the first four year commitment period. They have also undertaken to reduce grazing pressure through increased numbers of seasonal camps, in accordance with the indicators specified in the Management Plans at Annex 5. As specified for Hongor *Ovoo*, above, these data were then mapped onto soil carbon and C sequestration through parameters derived from the CENTURY model for comparable landuse, soil and vegetation types and in accordance with published data. Further adjustments were applied, with an increased risk factor of 20% for this site by comparison with Hongor *Ovoo*, for which the model was originally calibrated .The planned movement patterns, stocking rates and biomass usage are incorporated into to the Management Plans and monitoring indicators at Annex 5, and as summarised in Section K.

The expected climate benefits for the three project sites are summarized in Table F1b.

Table F1b – Summary of Climate benefits

	1	2	3	4	5	2-(1+3+4+5)
Project site	Baseline carbon uptake i.e. without project (t CO_2e)	Additional modelled carbon uptake/ emissions reductions with project (t CO_2e)	Expected losses from leakage (t CO_2e)	Deduction of risk buffer (t CO_2e)	Uncertainty adjustment (t CO_2e)	Net carbon benefit (t CO_2eha)
i) Hongor *Ovoo*	(see Table G5.3)	51139	(see below)	5114 (10%)	(included in column 2 figures)	46025
ii) Ikh Am	(see Table G5.3)	20055	(see below)	4011 (20%)	As above	16044
iii) Dert	(Not included in this round of commitments)					
iv) Dulaan Khairkhan	(see Table G5.3)	38375	(see below)	7675 (20%)	As above	30700

A worked example for Ikh Am is included below to show how figures in column 2 are derived from the grazing management plans summarised in Table F1a and the CENTURY modelling of changes in carbon sequestration under different pasture type and grazing pressure scenarios. Equivalent data for the other two sites is included for information at Annex 5.

Table F1c – Worked Example of Carbon Uptake Calculations, Ikh Am *heseg*.

Undurshireet Ikh Am	**1. Area (ha)**	**2. Additional carbon uptake per ha pa at 30% grazing pressure (with project)** (PE(SOC,m,t))	**3.Maximum additional carbon uptake pa for 30% grazing pressure (column 1x2)**	**4. Actual additional carbon uptake at 30% over 4 year project***	**5. Additional carbon uptake per ha pa at 40% grazing pressure (with project)** (PE(SOC,m,t))	**6.Maximum additional carbon uptake pa for 40% grazing pressure (column 1x5)**	**7. Actual additional carbon uptake at 40% over 4 year project***	**8. Additional carbon uptake per ha pa at 50% grazing pressure (with project)** (PE(SOC,m,t))	**9.Maximum additional carbon uptake pa for 40% grazing pressure (column 1x8)**	**10. Actual additional carbon uptake at 50% over 4 year project***
Riparian Meadow		*(CENTURY model)*			*(CENTURY model)*			*(CENTURY model)*		
Mar- June	851.7	1.1600	988	2964	0.5468	466	466	0.0156	13	0
Mountain Steppe										
Mar- June	703.3	0.8923	628	1883	0.323	227	227	0.0656	46	0
Nov-March	7804.8	0.5512	4302	0	0.4528	3534	3534	0.2836	2213	4427
Steppe										
Mar- June	1,517.0	0.8923	1354	1354	0.323	490	980	0.0656	100	0
Nov-March	7,441.3	0.5512	4102	0	0.4528	3369	0	0.2836	2110	4221
Total carbon uptake for 30%, 40% and 50 % grazing pressure				**6200**			**5207**			**8648**
Total carbon uptake (For 4 year period without risk deduction)	20055	*these 'actual' figures are calculated from the grazing management spreadsheet F1a, by adding up the number of years at a particular grazing pressure for each pasture type from Year 1-Year 4 (i.e. under 'with project' scenarios), and hence the total area and change in carbon uptake for that pasture type at 30%, 40% and 50% grazing pressure. Where stocking rates exceed 50% grazing pressure, additional carbon uptake against the baseline is conservatively assumed to be zero. The CENTURY modelled figures are those for changes against baseline levels (PE(SOC,m,t))- see Table G5.3 for baselines for various pasture types.									
20% risk deduction	4011									
Total carbon uptake (4 year period with risk deduction)	16044									

Table G.5.3, Section G, provides further details of the modelled changes in carbon uptake by pasture type and grazing practices from which the figures in columns 2, 5 and 8, above are derived.

Further information on leakage, risk and uncertainty is included in Section G.

F2 Livelihoods benefits

The project activities are expected to benefit the livelihoods of project participants in a number of ways. Table F2.1 (overleaf) relates to the main social group for all four sites (Khalkh Mongol, herders).

In addition to these general benefits, the expected impacts of project activities on key livelihood indicators were also assessed for each project site (see Table F2.2, overleaf). This provides a clear indication to those purchasing Plan Vivo certificates from the project of how the project will affect local livelihoods. Assessing whether expected changes have been achieved at the end of the project period also provides valuable information for refining project activities and assessing expected livelihood benefits ahead of subsequent project periods – in line with the approaches used for the assessment of climate benefits.

Heseg **meeting, Undurshireet *soum*, January 2013**

***Heseg* member's seasonal grazing areas, Hongor *Ovoo heseg*, Summer 2012**

Table F2.1 – Livelihoods Impacts

Food and agricultural production	Financial assets and incomes	Environmental services (water soil etc.)	Energy	Timber & non-timber forest products	Land & tenure security	Use-rights to natural resources	Social and cultural assets
Benefits: Enhanced livelihood and food security through: i) better seasonal use of pasture, thus enhancing long term sustainability of livelihoods and managing risk; ii) added value through processing and marketing of livestock products – especially milk and wool products iii) diversification e.g. into small scale vegetable production; iv) collaborative haymaking and production of fodder crops. **Negative livelihood impacts**: None expected. Activities have all been developed by the *heseg*/ herder groups on the clear understanding that these should in any case, be designed to have positive impacts on livelihoods, irrespective of any Plan Vivo funding. (See further comment below)	**Benefits:** Enhanced income through: i) added value through processing and marketing of livestock products; ii) livelihood diversification e.g. into small scale vegetable production. Risk management and financial security will also be enhanced through contributions to *heseg*/ herder groups' revolving funds from PV income, thus enabling more low cost loans to be made to low income families/ female headed households, at critical times in the seasonal cycle. **Negative livelihood impacts**: None expected. See comments under 'Food and Agricultural Production'.	**Benefits:** Enhanced access to good quality environmental services – through better pasture use and reduction of soil erosion/ degradation through overgrazing; repair of hand wells. Also protection of cultural ES through proposed landscape/ species conservation measures- which link to wider notions of well-being. **Negative livelihood impacts**: None expected. See comments under 'Food and Agricultural Production'.	**Benefits**: The planned interventions do not specifically target energy provision. However, enhanced financial assets and incomes will enable a higher proportion of participating household to purchase low cost solar panels and wind turbines, in turn reducing pressure on local forest resources. **Negative livelihood impacts:** None expected. New sources of low cost wind and solar technology are coming on stream all the time and are providing herders with important access to electricity for light, refrigeration and an ever- expanding range of applications. Benefits from this project will help to bring such innovations within the reach of a wider range of households.	**Benefits**: Managed offtake and sale of wild fruits through PV project. **Negative livelihood impacts**: None expected. Existing *heseg*/ herder group governance mechanism and d agreed procedures for benefit sharing (se e Section I5 and Annex 3 agreements) should ensure inclusion and equitable allocation of benefits from such activities.	**Benefits**: Tenure rights and security are explicitly recognized for all participating herder groups/ *heseg* through agreement with local *soum* authorities (see Annex 6). The PV project thus serves to strengthen and make more legible existing tenure rights. **Negative livelihood impacts**: None expected. Risks related to leakage/ displacement and the need to maintain traditional practices of long distance migration outwith project areas are considered further in Section H. This sets out how balance will be struck between these two issues, given that any attempt to impose rigid boundaries which herders cannot cross in times of need would, in all probability, lead to negative livelihood impacts for participating and neighboring herding households. Thus under PV herders will enjoy more secure and legible rights, whilst maintaining traditional norms of flexibility and reciprocity (see Section H).	**Benefits:** Use rights to key natural resources, particularly grasslands and water resources are already established through customary norms, supported by specific legal provision such as the 2002 Land Law. Through the specific PV management plans and agreement developed by the participating herder groups/ *heseg*, requirements for fair and equitable access, including for the poorest and most vulnerable have been further emphasised and enshrined. **Negative livelihood impacts**: None expected. See also comments under 'Land and tenure security'.	**Benefits**: The development of PVs has taken place in parallel with examination of ES values and well-being amongst participating groups. This process has highlighted the importance of cultural norms and cultural ES (aesthetic and spiritual values, linked to landscape and biodiversity, for example) as well as more tangible provisioning services. These have shaped herders' identification of key PV activities. Similarly well-being reflects a range of factors, including financial security, environmental quality etc. as well as income. These have shaped the participatory indicators, as well as the PV activities (see Section K and Annex 5). **Negative livelihood impacts:** None expected.

For ‘Food and Agricultural Production’, as for other benefits, PV activities have been designed by participating herders to build on traditional/ established notions of best practices, for example in relation to seasonal mobility and seek to facilitate and support these. Added value for livestock products will offer the prospect of better livelihoods without the need to increase livestock numbers *ad infinitum*. The whole package of measures which together form this Plan Vivo ensure that the adverse ecological and carbon related impacts of increasing stocking rates are also factored into herders’ decision making and act as an additional disincentive for increasing livestock numbers. Markets for ‘added value’ livestock products are already well established in Mongolia – but much of this added value at present goes to people other than the producers (herders). Government policy for the livestock sector is supportive of attempts to enhance local processing and market access. Diversification is designed to support livelihoods and spread risk, while not undermining livestock production as the core source of livelihoods.

Livelihood benefit assessment

Expected livelihood benefits are assessed using six key indicators (Table F2.2) that were selected to align with indicators used in national assessment criteria and poverty reports and in discussion with herder groups at project sites. As explained in Section E1, final detailed plans for activities are only presented for 3 sites herein. The herders of Dert *heseg*, Ulziit *soum*, were away from their *heseg* territory on extended migrations in 2014 during the critical period for final development of the Plan Vivos. The intention is to work with them to finalise their Plan Vivo in the future, with a view to their being included in the latter rounds of the initial commitment period or in a future commitment period, should they still wish to be included. For the remaining 3 sites, livelihood indicators are designed to capture important components of herders’ livelihoods, as derived both from participatory development of indicators with HG/ *heseg* and drawing on national criteria and poverty/ well-being assessments. The ‘own life evaluation’ indicator (6) is an important component of the participatory evaluation, with herders explaining that they based this on a balance of factors including income, livestock numbers, judgment of livelihood security, options for diversification, opportunities for children and good environmental quality. Elsewhere, livestock numbers does not feature as a standalone indicator, as increasing grazing pressure is often detrimental to pasture and biodiversity, with government and donor efforts typically focused on improved well-being through, for example, added value of livestock products, fewer high quality animals and diversification opportunities. Disposable income/ savings are an important aspect of well-being/ good livelihoods, as is the interlinked ability to spend on non-food items.

Potential negative livelihood impacts have also been considered as part of this assessment. These are explained more fully in relation to diverse aspects of livelihoods in Table F2.1 above. Overall, it is not expected that negative livelihood impacts will arise from project activities. Nonetheless, the interim monitoring

indicators and procedures, as set out in Annex 5 and summarized in Section K, are designed to provide an ongoing assessment of livelihood impacts, which will not only trigger disbursement of PV payments (assuming targets are met), but will serve to flag up any unexpected/ adverse impacts amongst participating households. For non-participating households, they have been made aware of PV activities and provisions through *soum*/ *bag* and citizen's representative *khural* (meetings) (see Section J). These meetings will take place on a regular basis throughout the first PV commitment period, and will thus continue to offer a forum for non-participants to highlight any concerns as the project proceeds. Elected leaders of citizen's representative *khural* participated in the June 2015 Ulaanbaatar-based training workshop, together with *heseg* leaders and members and local government officials.

Table F2.2 Initial indicator values (baseline, 2015) & expected indicator values (end 1st commitment period, 2018)

Indicator	Site	Initial (2015)	Expected (2019)
1) **Livelihood diversification**: Percentage (%) of herder households (HH) involved in non-herding activities at start of monitoring period	i) Hongor *Ovoo*	9.1%	30%
	ii) Ikh Am	0%	25%
	iii) Dulaan Khairkhan	22.2%	65%
2) Financial capital: % of HH with savings	i) Hongor *Ovoo*	18.2%	60%
	ii) Ikh Am	44.8%	75%
	iii) Dulaan Khairkhan	40%	70%
3) Household revenue: % of HH with an income >3 million tg	i) Hongor *Ovoo*	13.6%	40%
	ii) Ikh Am	58.6%	80%
	iii) Dulaan Khairkhan	66.7%	85%
4) Mobility: a) Mean *heseg* mobility (km pa) b) % of HH that increase mobility during monitoring period	i) Hongor *Ovoo*	a) 82 b) N/A	a) 92 b) 50%
	ii) Ikh Am	a) 156 b) N/A	b) 165 b) 60%
	iii) Dulaan Khairkhan	a) 89 b) N/A	a) 95 b) 60%
5) Income availability: % of HH spending >50% of their income on non-food items	i) Hongor *Ovoo*	27.3%	50%
	ii) Ikh Am	65.5%	80%
	iii) Dulaan Khairkhan	33.3%	65%
6) Own life evaluation: % of HH with "good" or "very good" own life evaluation score	i) Hongor *Ovoo*	10.6%	50%
	ii) Ikh Am	20.6%	60%
	iii) Dulaan Khairkhan	15.4%	55%

The baseline values in Table F2.2 have been determined for all sites through household surveys conducted during the preparatory Darwin Initiative funded project, and in the summers of 2013/14. A realistic assessment of the expected impact of project activities on the indicator values has then been made, based on repeated socio-economic surveys to confirm trends, multiple meetings and discussions with participating *heseg*/ herder groups and review of wider *soum/ aimag* trends.

These indicators will be monitored at the end of the first four year commitment period, to check progress and adjust as necessary before any second commitment period. They operate in parallel with but do not replace the activity-based, participatory monitoring indicators set out in Section K and in the management plans (Annex 5) which will be the triggers for disbursement of payments from sale of PV

certificates.

As explained in Section C2 and F2 (above), the indicators in Table F2.2 are designed to capture diverse components of herders' livelihoods/ well-being, as derived from herder groups/ *heseg* themselves during preparatory meetings and evaluations, and also to align with aspects of national and common donor assessment criteria. The predicted improvements or gains in relation to these indicators, as set out in Table F2.2 reflect a) current site specific issues and contexts and b) planned activities under Plan Vivo, as detailed in Management Plans. These may be summarised for the three participating sites as follows:

i) Hongor Ovoo heseg

Levels of livelihood diversification at this site are currently low. Proposed activities under Plan Vivo focus more on improved income from herding, particularly through collaborative marketing and processing of livestock products, rather than on diversification *per se*. Hence the expected improvement against this indicator over the four year period is deliberately modest, but will nonetheless prove significant to local families. The large number of households in this *heseg* (71 households in 2015) also make improvement of percentages for various indicators more challenging than for some smaller *heseg*, as it requires a greater number of families to experience significant change for overall improvements to be seen. However, enhanced income will, of course, provide opportunities for further livelihood diversification in the future, while activities such as sale of wild nuts and fruits will provide one source of non-herding income. Following from the above the expected gains in relation to financial capital (savings) and increased income (indicators 2 and 3 in Table F2.2) are more ambitious, constituting up to half of the maximum potential improvement for each of these indicators. The proposed livelihood improvement activities under Plan Vivo (see Annex 5) can reasonably be expected to generate additional livestock-based income through better marketing and economies of scale in processing and selling products. Such activities also fit well with emergent government policy initiatives and support for the livestock sector, for example through the National Livestock Programme, and linked to better and more stable prices for livestock products. The PV activities proposed will not duplicate such initiatives, but will enable the herders of Hongor *Ovoo* (and other participating *heseg*/ herder groups) to engage with and derive maximum benefit from them. Increased income over the four year period will also enable increased expenditure on non-food income (Indicator 5: income availability). Expected gains in annual mobility, as evaluated both at household and *heseg* level, are based on the currently relatively low levels of annual mobility, and taking account of a) the need to avoid leakage; b) the size of and distribution of pastures in the *heseg* territory and c) plans for increased numbers of camps within seasonal pasture areas under 'with project' scenarios (Figure 2, Section B and Annex 5). This improved pasture rotation is designed to enhance mobility both through better use of currently undergrazed pasture areas and through more

frequent movements within currently grazed areas. Stocking rates and numbers of seasonal camps are summarised for with and without project scenarios in Annex 5. It may also reasonably be expected that support and cooperation between *heseg* members, and their shared commitment to the new schedules for pasture use, as developed in the Plan Vivo, will translate into assistance for poorer and weaker *heseg* members to move and to comply with these schedules, hence the significant expected improvement in individual HH mobilities, against indicator 4b, above. The significant expected improvements in the own life evaluation indicator reflect the fact that the majority of Hongor *Ovoo* HH (83.3%) had an own life evaluation score of "moderate", thus necessitating relatively modest improvements to move them up to categories "good" and "very good". On the basis of the diverse, locally specific nature of this indicator, as previously explained (Section F2, above), not only socio-economic/ risk management activities, but biodiversity conservation, ES values and pasture management also feed into this indicator. Given the suite of proposed activities and benefits under PV, it is reasonable to expect a significant proportion of *heseg* households to move from "moderate" to "good" or "very good" over the first commitment period.

ii)Ikh Am heseg.

Existing levels of livelihood diversification for this *heseg*, currently with 50 member households signed up to the PV process, are low to negligible. This is despite the good transport/communication links of Undurshireet *soum* and its proximity to Ulaanbaatar, which should facilitate access to markets and other livelihood opportunities, by comparison with other sites[5]. Predicted improvements need to be balanced against the fact that specific non-herding livelihood activities do not feature as a priority in the *heseg*'s Plan Vivo management plan (Annex 5). Nonetheless, it may reasonably be expected that, given the nature and location of the site, improved income and income availability, as derived from other PV activities, will facilitate livelihood diversification over the PV commitment period. Livestock-based income generating activities feature quite prominently in Ikh Am *heseg*'s Plan Vivo. Again, good market links and access will facilitate realisation of livelihood gains through planned activities and, as in the case of Hongor *Ovoo*, in the context of emergent government policy initiatives and support for the livestock sector, through the National Livestock Programme, and linked to better and more stable prices for livestock products. Expected improvements across indicators 2, 3 and 5 thus reflect the above conditions and contexts, whilst also taking account of the starting point (baseline) of *heseg* households in relation to these indicators: for example non-food expenditure is currently already quite high for a significant proportion of households, thus relatively modest changes will be needed to move households above the 50% threshold. This is reflected in the expected gains against this indicator in Table F2.2.

[5] Ikh Am *heseg* members reported pensions, loans and various forms of state subsidies as non-herding income sources. As stated previously (Table C2) these are not included for the purposes of this assessment, as they are outwit herders' control.

The expected improvements in the mobility and own life evaluation indicators are derived from the same analyses and judgements as explained for Hongor *Ovoo*, above, and set out in Annex 5 (see also Figure 3, Section B).

iii)Dulaan Khairkhan herder group

For this herder group, levels of livelihood diversification are quite high by comparison with other sites. Further diversification activities are proposed explicitly in the Plan Vivo, in this case through vegetable production. This is reflected in the expected improvement, in conjunction with possible future opportunities arising from increased herding-related income from Plan Vivo activities. As the smallest participating herder group (21 households), changes for a modest number of households will bring significant improvements for the profile of the herder group as a whole. In addition, opportunities for alternative income exist through tourism – a tourist camp was previously located in the area (although now defunct) and the area also attracts tourists through the birdlife at Orog Nuur (lake) and the recently designated Ikh Bogd protected area. The recently revived *ovoo* ceremonies (traditional Buddhist spiritual ceremonies) at Ikh Bogd also attract visitors to the area. A number of herder group members have expressed interest in engaging with these opportunities in the future, although it was considered too ambitious to include specific tourism related activities and indicators in the first phase of Plan Vivo commitments. As for the other sites, expected improvements in relation to income-based indicators reflect wider contexts (such as the National Livestock Programme), and existing baselines. For example, for both indicators 3 and 5, a large percentage of Dulaan Khairkhan herders are currently just below the desired improvement threshold (see Tables C2 and F2.2, above). Hence movement above this threshold over the four year initial Plan Vivo commitment period appears feasible for a large majority of households. As for other sites, mobility changes reflect both local contexts and pasture use plans, and the increased support for poor/ less mobile households under these collaborative arrangements.

F3 Ecosystem & biodiversity benefits

The ecosystem and biodiversity benefits are specified below, where intervention types are taken to denote specific planned activities, rather than the three generic categories of intervention types specified under PV requirements 2.1.1 – 2.1.4.

Table F3.1 – Ecosystem impacts				
Intervention type	**Biodiversity impacts**	**Water/ watershed impacts**	**Soil productivity/ conservation impacts**	**Other impacts**
Biodiversity Conservation: Protection of key fauna e.g. Argali, ibex, Mongolian and goitered gazelle, red deer, marmot.	**Benefits:** Argali, ibex, gazelle, marmot and red deer populations increase. **Potential negative impacts:** none foreseen. Planned conservation activities have been developed in conjunction with Zoological Society of London (ZSL) and their local partners at National University of Mongolia (NUM), who are recognised experts in conservation planning and practice in Mongolia. Planned livelihood activities (Table F2.1) have been checked by ZSL/NUM for any adverse biodiversity impacts. No such impacts have been identified. Indicators set out in Annex 5 Management Plans are designed to track biodiversity improvements through the project commitment period. These will also pick up any unexpected negative impacts, should these arise, enabling corrective measures to be undertaken.	(see Table F2.1)	Improved soil structure and nutrient cycling reduction in grassland degradation.	Seed dispersal and grassland grazing will improve the health of grasslands. Potential to reduce wolf predation of livestock as natural wild prey increases.
Biodiversity Conservation/ Livelihood Improvement: Plant Sea Buckthorn.	**Benefits**: Small scale Sea buckthorn plantation established, with appropriate permissions and to complement existing areas. Habitat for numerous insect, bird, small mammal and raptor species. Potential biodiversity increase. **Potential negative impacts:** The sea buckthorn plantation (Dulaan Khairkhan herder group, Bogd only) will be <2ha in total at the end of the 4 year commitment period. This area will no longer available for use by livestock or wildlife but is small relative to the area of the herder group. A condition of planting is that there is a signed and stamped letter of authorisation by local administration head –to indicate previous uses of sites and confirm no loss of significant areas for biodiversity conservation. The location of the planted area will also be approved by ZSL.	(as above)	Greater soil moisture retention, reduction in loss of nutrients, and desertification.	(Existing wild habitat will not be altered to generate farmed agricultural land in its place).
Biodiversity Conservation: Protection of saxaul forest.	**Benefits**: Improved status of important native saxaul forest which is declining throughout Asia. Saxaul is a keystone species in the Gobi Desert, so its conservation has impacts well beyond the species; it is an obligate host for one parasitic plant species and is an important forage species for several desert wildlife species. The species is also important in soil conservation, such that increases in sand-storms in recent years have been attributed to the loss of saxaul and its associated vegetation **Potential negative impacts:** None foreseen- see above.	(as above)	Improved soil structure, nutrient cycling. Reduction in loss of nutrients and reduction in impacts of desertification.	Regeneration of habitat for numerous wildlife species. Regeneration of regionally threatened habitat type; saxual forest.

(Table F3.1 – Ecosystem impacts continued)				
Intervention type	**Biodiversity impacts**	**Water/ watershed impacts**	**Soil productivity/ conservation impacts**	**Other impacts**
Biodiversity Conservation (governance): i) Establish herder partnerships to protect local environment at mountain passes in herder group area ii) Increased herders' participation in decision making on environmental issues - e.g. licences for wood cutting.	**Benefits**: Reduced poaching at mountain passes leading to healthier local wildlife populations. **Potential negative impacts:** None foreseen- see above.	(as above)		The wider impact on ES/ biodiversity of this intervention is also likely to be through increased participation and capacity building of local herders, linked to more effective implementation of enhanced management/ conservation measures across all other interventions.
Biodiversity Conservation: Cooperate in groups to implement forest clean-up and protection activities.	**Benefits**: Reduced loss of habitat and therefore directly contribute to reducing threats to native species. **Potential negative impacts:** Excessive clearing of the undergrowth may result in the loss of undergrowth species such as invertebrates, small mammals and birds. This will be prevented through careful development of plans between hesegs and ZSL and regular monitoring (see Annex 5).	(as above)	Improved forest soil structure, water and nutrient content in the soil.	Reduced risk of forest fire through forest management activities.
Biodiversity Conservation: Develop tree seedlings for community reforestation.	**Benefits**: Preventing the loss of forest habitat, reducing the threat of desertification and erosion. **Potential negative impacts:** None foreseen- see above. Nursery areas for production of tree seedlings (planned in Hongor *Ovoo* site only) will require fencing, of a small area ; benefits of reforestation will outweigh the enclosure of this very small area, and will be located in the forest steppe zone, not in open pasture areas.	(as above)	Soil structure maintenance, moisture retention and nutrient cycling. Improved habitat for numerous species.	
Biodiversity Conservation: Take under protection bushes at Ovootiin Aral, Ikh Am.	**Benefits**: Provide nesting habitat for a number of small mammals, passerines and raptors. **Potential negative impacts:** None foreseen- see above. The area will not be fenced, but instead it is planned that trees will be collared, to ensure no impacts on mobility for grazing livestock or wild animals on the steppe, whilst protecting the trees.	(as above)	Maintaining soil structure, moisture, and nutrients.	Maintaining key habitat for rich biodiversity.

Biodiversity benefit assessment

Biodiversity benefits are assessed in part using the presence or absence and estimated population size of the flagship species listed in Table F3.2. These species were selected as they are all keystone species and/or indicators of broader habitat quality, as well as being national conservation priorities. They are also species whose presence or absence, and population size can be estimated with relatively simple survey approaches.

Table F3.2. Flagship species to be assessed for presence/ absence, or population size in each project intervention area

Species and conservation status
Black tailed (goitered) gazelle (VU) *Gazella subgutturosa* numbers were estimated at 120,000-140,000 in Mallon and Kingswood (2001) and the taxon has a very wide distribution across the Middle East and Asia. However, populations throughout the range are subject to illegal hunting and habitat loss. Declines are widely reported and continuing. In Mongolia, a substantial proportion of the known global population remained until recently, but heavy poaching has wiped out almost all the large herds and cut the numbers by well over 50%. Overall the rate of decline is now estimated to have exceeded the figure of 30% over 10 years that qualifies for Vulnerable under criterion A2 of the IUCN Red List
Mongolian Gazelle *Procapra gutturosa* listed on the regional Red Lists as Endangered in Mongolia, with a population of up to 4.75 million in Mongolia in the early 1900s. Exploitation in the mid-1990s reduced the population to less than 500,000, while drought and disease in 1980 drove the population as low as 150,000. The current population size is not clear, with estimates of 8-900,000 from a ground-based survey in 2002 and more recent aerial survey estimates of >2.5 million. However, the range of the species in 2000 was less than one quarter of the area known to be occupied in the mid-1990s. There is heavy illegal hunting of the species for meat, on top of the legal annual hunting quota: the total estimated harvest in 2004 was in excess of 250,000 gazelles. The species is also threatened by habitat loss, degradation and fragmentation, competition for resources and human disturbance, the latter particularly related to disruption of migratory patterns by extensive fences along borders and along the Ulaanbaatar-Beijing railway,
Red deer *Cervus elaphus* listed on the regional Red Lists as Critically Endangered in Mongolia. The Mongolian population in 1986 was estimated at 130,000, which declined to 8-10,000 by 2004 (92% over 18 years). The species is primarily targeted for its antler velvet (highly valued in regional traditional medicine), but has also suffered habitat loss and fragmentation, and human disturbance resulting from mining activity and infrastructure development.
Siberian ibex (LC/NT) *Capra sibirica*. The species inhabits rocky habitats in several countries in Central Asia. Globally it is listed as Least Concern but the species is considered Near Threatened in Mongolia. The population is probably less than 100,000 individuals and is thought to be declining, primarily due to exploitation for meat, skins and trophies. There is an annual permitted hunting quota but some additional illegal hunting occurs (scale unknown).
Argali sheep *O. ammon.* The species inhabits mountain habitats in several countries in Central Asia. Globally it is listed as Vulnerable but the species is considered Endangered in Mongolia. The population in Mongolia was estimated at 50,000 in 1975, 60,000 in 1985 and at 13-15,000 in 2001, representing a 72% decline over 26 years. The principle threat to the species is illegal/unsustainable hunting, but increased competition for resources and degradation of habitat due to increased livestock numbers, and high mortality during recent periods of drought have also contributed to declines.
Siberian Marmot *Marmota siberica* listed on the regional Red Lists as Endangered in Mongolia. Widely distributed the population of marmots in Mongolia was estimated at 20 million in 1990 and had declined by 75%, to 5 million, when last estimated in 2001. There is (now illegal) trade in marmot fur, meat and medicine, both national and international, with as many as 3 million marmots removed from the population in 2004, alone. Marmots live in communal burrow systems and, as bioengineers, can have important positive impacts on local soils provide shelter for a variety of small-medium sized animals.
Saxaul *Haloxylon ammodendron* is widely distributed across arid and semi-arid Central Asia. Over the past several decades, saxaul forests have shrunk dramatically in many areas across its range, including Mongolia, both in terms of coverage and growth rate. Forests of saxaul -- the most important native plant in the Gobi region – have contracted by some 50 percent over 25 years. This decline is believed to have contributed to the increasing frequency of harmful sandstorms in recent years in Mongolia. Saxaul is used for fuel and in some areas is an important livestock fodder. The species is declining because of exploitation by growing human populations and their livestock and it may also be declining as a result of climate change. White and Black Saxaul are the obligate hosts for the parasitic plant *Cistanche deserticola*, which is highly prized for medicinal uses, and saxaul is an important food-plant for many Gobi wildlife species.

The project will contribute to the conservation of these wildlife species in several ways. Some specific actions will directly benefit species, such as saxaul and forest tree species, through protection and propagation. Conservation of the Flagship animal species will be enhanced through i) direct protection of wildlife by herders from illegal hunting, ii) enhanced herders' collaboration for conservation of key sites and habitat protection, and iii) perhaps most importantly, agreement among herders to better manage the pasture through enhanced seasonal mobility, some reduction in livestock numbers and, therefore, reduction in grazing pressure on pasturelands also used by these wildlife species.

Biodiversity conservation actions include those related to governance and herders' participation in decision-making (see Table F3.1 above, Section G and Section K, plus site specific management plans in Annex 5). Enhanced herders' participation in governance and decision-making are key goals in National conservation planning and CBD commitments. These are addressed through enhanced herders' collaboration for conservation of key sites and species, in conjunction with the local administration (LA). Furthermore, as highlighted above, measures to restore seasonal mobility and reduce grazing pressure will contribute to wider conservation of rangeland vegetation associations. Monitoring details for ES and biodiversity benefits are provided as part of management plans at Annex 5.

Part G: Technical Specifications

G1 Project intervention and activities

This Technical Specification is applicable to Mongolian rangeland areas that:

i. Meet the applicability conditions for quantification of climate benefits of grazing and forage management described in Section 1.1.1 of the Plan Vivo Climate Benefit Quantification Methodology - *Carbon sequestration through improved grassland and natural resources management in extensively managed grasslands Version 1.0* (CBAA, included at Annex 8); and

ii. Are managed by individuals or entities that lack capacity to improve pasture management, and carry out nature protection and livelihood improvement activities.

It is not applicable to areas where introduction of regulations on livestock numbers or seasonal pasture rotation would result in displacement of grazing to non-grassland areas, or negatively affect the livelihoods or wellbeing of local communities.

The climate benefits are expected to accrue through the grazing management fodder or forage cultivation, nature protection, and livelihood improvement activities described in Section D. Management plans that describe the specific activities to be carried out and the resources required are developed for each project site (Annex 5).

Increasing soil carbon stocks

Project activities that aim to prevent further degradation of rangeland areas and allow soil carbon stocks to increase include:

- Grazing management - Reducing the numbers of livestock grazing for extended periods within project intervention areas within the broader project area, for example by introducing or enhancing seasonal pasture rotations and/or reducing overall livestock numbers.
- Fodder or forage cultivation - Planting fodder or forage crops, and changes to the management of existing cultivation practices, for example by planting green fodder, or improving water supply to pasture areas.

Biodiversity conservation

A key aim of nature protection activities is to prevent and reverse reductions in wild species such as gazelle, ibex, deer, marmot and Argali sheep populations. This can be achieved by activities that directly reduce pressures on these animal species, and those that prevent degradation or enhance the habitat they require, as well as protecting other key flora, for example by:

- Establishing herder partnerships to protect the local environment and encourage increased participation in decision-making on environmental

issues, for example issuing licences for wood cutting, and controlling illegal hunting activities;
- Protecting forest areas from degradation or deforestation for example by preventing illegal timber harvesting, and including protection of saxaul forests;
- Reforestation of degraded forest areas by producing and planting seedlings;
- Reducing grazing pressure and grazing-induced pasture/ habitat degradation
- Working towards cessation of mining activities. Amelioration of adverse environmental impacts in the interim, through citizen action to ensure observation of environmental regulations by miners.

Livelihood improvement
The aim of livelihood improvement activities is to increase herders' income by maximising value from livestock products and developing new sources of income, for example by:

- Increased marketing of milk products – forming groups to deliver milk products to local and urban markets;
- Production and sale of wool products – for example felt;
- Gathering and sale of natural resources – for example wild fruit and nuts;
- Production and sale of vegetables.

Such activities, in conjunction with the biodiversity conservation/ ES service protection activities, are also designed to contribute to wider well-being and perceptions of security amongst participating herding communities and as evidenced through participatory well-being indicators.

G2 Additionality and Environmental Integrity

Regulatory surplus
In Mongolia the principal legislation guiding rangeland management remains the Land Law (2002). This does not specify particular regulations on herders themselves in respect of grazing management, although giving rights to local governors in relation to timing of seasonal movements and allocation of spring and winter campsites. In practice, decisions over localised seasonal movements in specific *bags* (sub district areas) are typically (partially) devolved to herder groups, who may negotiate and agree specific movement schedules for their group with local governors, within the wider framework of *soum* (district) pasture use planning. This is the case for the *heseg* (herder groups) who will take part in this Plan Vivo project. The Land Law does not require herders to engage in fodder or forage cultivation, biodiversity conservation, wildlife species protection or livelihood improvement activities. The activities described in this Technical Specification are therefore additional to legal requirements on herders throughout Mongolia.

Barrier analysis
This Technical Specification is only applicable in project areas where the local

communities lack capacity to improve pasture management, and carry out nature protection and livelihood improvement activities (see Applicability Conditions, above). Mongolian herder groups that meet the applicability criteria face financial, technical and institutional barriers to the implementation of improved land use management practices. A summary of these barriers and the actions the project will take to overcome these is included in Table G2.

Table G2: Barriers to sustainable land management in potential target communities

Barrier	Actions to overcome barrier
Financial Short term opportunity costs of improved pasture management, and nature protection mean these activities are unlikely to be financially viable in their own right; and target communities lack financial resources to support them on an ongoing basis. The costs of establishing and maintaining livelihood improvement activities are also prohibitive to most Mongolian herder groups. Financial incentives currently tend to drive herders to increase livestock numbers, with adverse effects on local environments and little benefit for livelihoods.	Through the sale of Plan Vivo certificates, the project will provide the finance necessary to incentivise and sustain improved pasture management and nature protection activities; and to establish and maintain livelihood improvement activities.
Technical Herders in the target communities lack the technical expertise to develop, implement and sustain improved pasture management, nature protection and livelihood improvement activities, and grazing and pasture management practices.	The project will work with herder groups to raise awareness of linkages between livelihoods and conservation activities, and develop capacity to implement and sustain improved pasture management, nature protection and livelihood improvement activities.
Institutional Herders in the target communities are members of *heseg*/ herder groups, derived from previous donor projects. These provide a good basis for initiation of Plan Vivo activities. Nonetheless, they currently lack robust and representative management institutions designed to deal specifically with the environmental protection activities proposed under this Plan Vivo project.	The project will support the establishment and subsequent activities of herder partnerships from amongst the existing *heseg* and through development of links to the *soum* administration, in order to protect the local environment and encourage increased participation in decision making on environmental issues, for example issuing licences for wood cutting, and preventing illegal hunting activities.

Avoidance of double counting

Mongolia is a focal country of the UN-REDD programme, but there are currently no initiatives affecting the participating herder groups/*heseg* and Plan Vivo project areas that generate credits specifically for climate benefits or other ecosystem services included herein. The project coordinator will monitor the local and national situation, and review this at the end of the project period so that any necessary agreements can be put in place prior to the commencement of subsequent project periods.

Environmental integrity

This technical specification is not applicable to areas of grassland that have been deliberately degraded for the purpose of meeting the applicability conditions stated above, or to areas covered by other projects or initiatives providing financial support for Improved Land Use Management or Ecosystem Restoration/Rehabilitation.

G3 Project Period

The climate benefits from grazing and forage management activities are expected to accrue from reduced grazing pressure and increased vegetation in degraded grassland areas that will result in increases in soil carbon stocks. The expected climate benefits will be estimated at the start of each project period using the Plan Vivo Climate Benefit Quantification Methodology - *Carbon sequestration through improved grassland and natural resources management in extensively managed grasslands Version 1.0* (Annex 8). This approach estimates average annual climate benefits over a 20 year period. The climate benefits over the years immediately after the change in management practices are greatest however, and these diminish over time as soil carbon stocks approach an equilibrium level. The approach therefore provides a conservative estimate of climate benefits over the initial four year project period. It is these conservative figures that are used in calculations of carbon benefits for 2015-19 in Tables F1b-d and the linked Table F1a for Ikh Am and in equivalent tables for other sites at Annex 5.

The length of this initial project commitment period will thus be 4 years, from 1st April 2015 to 31st March 2019. This is an appropriate length of time for herder groups to commit to carrying out management activities. After each four year project period, the project will evaluate whether expected climate benefits were achieved, and use this information to inform estimations of climate benefits in any subsequent project periods. Management plans and expected climate benefits will therefore be revised prior to the start of each subsequent project period, following the approaches described in Section K. The revised project design documents must be approved by the Plan Vivo Foundation prior to the start of the project period.

G4 Baseline Scenario

Carbon pools and emission sources
The carbon pools and emission sources, and climate benefit methodology used to quantify expected climate benefits are described in Annex 8 Modules 1.2 and 2.2

Baseline emissions
A baseline scenario (i.e. – the most likely land use scenario in the absence of the project intervention) must be described for each project intervention area. In some cases, the most likely baseline scenario may be that pre-project land use will not change, but in other cases the baseline scenario may involve a change in pre-project land use.

The applicability conditions in Annex 8 Section 1.1.1 require that project intervention areas are grasslands that are degraded and will continue to degrade in the absence of project intervention; but Annex 8 conservatively assumes that there will be no

change in grassland soil carbon stocks in the baseline scenario (Annex 8 Module 1.3 and 2.3). The baseline scenario should therefore demonstrate that the drivers of degradation (e.g. grazing management practices) will be present throughout the project period under the most likely future land use scenario.

Information that characterises the land use practices under the baseline scenario is recorded in the Management Plan for the project intervention area for each of the three sites in Annex 5. The management practices in the baseline are specific to the project intervention area and are characterised with an appropriate set of parameters.

These land use parameters, as used to characterise the baseline scenario, typically include:

- The number and type of livestock that would graze within the project intervention area during each season
- The area that would be cultivated with nitrogen fixing species each year, if any.

Information on baseline scenario land use practices has been obtained from surveys carried out at the project sites and from existing secondary data. Full details are provided in the site specific management plans at Annex 5 and summary tables such as F1a for Ikh Am and equivalent tables in Annex 5 for other sites. Table G5.3 shows the baseline carbon stocks by various pasture types, as derived from the Annex 8 methodology and explained in the Annex 9 pilot study report.

For the biodiversity baseline scenario, as set out In Annex 5 management plans, further *heseg* specific analyses by ZSL and herders trained by ZSL are amongst the initial 2015 monitoring indicators and will enable evaluation of population changes in subsequent years of the initial Plan Vivo commitment period.

Socio economic baselines, including for key indicators are set out in Tables C2 and F2.2.

Data sources

Baseline scenario emissions for grasslands are calculated using Equation 2 in Annex 8 Module 1. The parameters used in this equation are summarised in Table G4.

Table G4. Parameters for estimation of baseline scenario emissions

Parameter	Symbol and units	Value/Source	Use
Baseline scenario emissions within the project intervention area during the quantification period	$BE_{G,a}$ (tCO_2e)	0 (CBAA M1 Eq.2)	CBAA Eq.5
Baseline scenario emissions from cultivation of	$BE_{NF,fo,a}$	0 (CBAA M1.3)	CBAA Eq.2

nitrogen fixing plants in the project intervention area during the quantification period	(tCO_2e)		
Baseline emission from soil organic carbon in the project intervention area during the quantification period	$BE_{SOC,G,a}$ (tCO_2e)	0 (CBAA M1 Eq.3)	CBAA Eq.2

G5 Ecosystem service benefits

Climate benefits methodology

The climate benefits from grazing management and forage or fodder cultivation activities etc. are estimated for each project intervention area using the approved approach *"Plan Vivo Climate Benefit Quantification Methodology - Carbon Sequestration Through Improved Grassland and Natural Resources Management in Extensively Managed Grasslands Version 1.0*" (Annex 8). Annex 8 provides a set of methodologies and quantification tools to be applied for ex-ante estimation of climate benefits from individual project intervention areas, based on defined changes to management activities. These tools include a tool to quantify leakage emissions due to displacement of grazing activities from within the project boundary. The main steps involved are summarized in Table G5.1, with more detailed information on specific project sites, management plans and project intervention areas in Annex 5.

Table G5.1. Main steps in estimating climate benefits from improved grazing management and forage cultivation in a project intervention area

Step	Description	Key outcome
1. Check the project intervention area meets the relevant applicability conditions	The applicability conditions for quantification of climate benefits of grazing and forage management activities can be found in Annex 8 Section 1.1.1.	Checklist comparing conditions in the project intervention area against the applicability conditions.
2. Map the project intervention area and describe its environmental conditions, initial land use and land cover and the management interventions that will be made	This technical specification estimates climate benefits under specific site conditions and management interventions. Each project intervention area should therefore have similar a soil type and initial land use and land cover throughout its whole area; and the same management intervention must be applied to the entire project intervention area.	Map of the project intervention area; and a description of environmental conditions, initial land use and land cover, and the management interventions that will be made.
3. Define the baseline scenario for the project intervention area	Climate benefits of management interventions are estimated by comparing the greenhouse gas emissions with the management intervention to those expected if the intervention was not made. A description of the most likely land use scenario in the absence of the management intervention is therefore required.	A description of the baseline scenario for the project intervention area – describing the most likely land use scenario in the absence of the project intervention.
4. Estimate the greenhouse gas emissions under the baseline scenario	Using the approaches in Annex 8 Module 1.3 will give a conservative estimate of greenhouse gas emissions under the baseline scenario, for project intervention areas that meet the applicability conditions.	A conservative estimate of the greenhouse gas emissions expected during the project period under the baseline scenario.
5. Estimate the greenhouse gas emissions and removals under the project scenario	The greenhouse gas emissions and removals that are expected to result from the management interventions described in the Management Plan are estimated using default values derived using the approaches described in Annex 8 Module 1.4.	A conservative estimate of the greenhouse gas emissions and removals expected during the project period, if the specified management interventions are carried out.

6. Estimate leakage emissions that are likely to result from displacement of livestock grazing	If the management interventions will displace livestock to areas that are not heavily grazed, the emissions expected to result from this displacement are estimated using the approach in Annex 8 Module 3. These are then subtracted from the climate benefit for the project intervention area.	A conservative estimate of emissions expected from displacement of livestock grazing as a result of the project intervention.
7. Estimate expected climate benefits	The climate benefits from the management activities in the project intervention area described in the Management Plan are estimated by subtracting the project scenario emissions and leakage emissions from the baseline scenario emissions as described in Annex 8 Section 3.	A conservative estimate of the climate benefits expected during the project period, as a result of the project intervention.

Data sources

The climate benefits from the management activities in the project intervention area as described in the various Management Plans (Annex 5) are estimated by subtracting the project scenario emissions and leakage emissions from the baseline scenario emissions.

The greenhouse gas emissions from management activities in the project intervention area are calculated using Equation 4 in Annex 8 Module 1, and approaches described in Appendixes I and II to Annex 8. The parameters used in these equations are summarised in Table G5.2.

Table G5.2. Parameters for estimation of project scenario emissions

Parameter	Symbol and units	Value/Source	Use
Project scenario emissions within the project intervention area during the quantification period	$PE_{G,a}$ (tCO2e)	CBAA M1 Eq.4	CCBA Eq.5
Project scenario emissions from cultivation of nitrogen fixing plants in the project intervention area during the quantification period	$PE_{NF,fo,a}$ (tCO2e)	CBAA Eq.I.4	CCBA M1 Eq.4
Project scenario removals by soil organic carbon in the project intervention area during the quantification period	$PE_{SOC,G,a}$ (tCO2e)	CBAA Eq.II.10	CCBA M1 Eq.4
Project scenario N2O emissions from nitrogen-fixing species in the project intervention area during year t	$PE_{NF,fo,a,t}$ (tCO2e)	CBAA Eq.I.1	CBAA Eq.I.4
Amount of N in additional nitrogen-fixing species (above and below ground) returned to soils in project year t	$PE_{NF,fo,i,t}$ (t N)	CBAA Eq.I.2	CBAA Eq.I.1
Emission factor for N2O emissions from N inputs of N-fixing species to soil	EF_{NF} (kg N2O-N/kg N input)	0.01 (IPCC 2006a Table 11.1) or other appropriate default	CBAA Eq.I.1
Global warming potential for N2O	GWP_{N2O} ($tCO_2e/tN2O$)	310 (IPCC 2006a)	CBAA Eq.I.1
Total annual area of N-fixing species g in year t	$Area_{g,i,t}$ (ha)	Management plan	CBAA Eq.I.2
Annual dry matter, including aboveground and below ground, returned to soils by N-fixing species g in project year t	$Crop_{g,t}$ (t dm/ha)	Locally relevant yield data	CBAA Eq.I.2
Fraction of N in dry matter in N-fixing species g	N_g (tN/ t dm)	0.027 (IPCC 2006a Table 11.2)	CBAA Eq.I.2
Annual change in SOC stocks per hectare in the project intervention area during project year t	$\Delta SOC_{m,i,t}$ (tC/ha/year)	Table G5.3 or site specific modelling	CBAA Eq.II.8

A calculated deduction to the estimate of the change in soil organic removals carbon for the specified land use stratum and management practice in year t	$\Delta SOC_{Deduct,m,i,t}$ (%)	CBAA Eq.II.2 to II.7; or 50% if using a default value from Table 5	CBAA Eq.II.8
Estimate of annual change in SOC stocks per hectare in the project intervention area during year t	$\Delta SOC_{C,m,i,t}$ (tC/ha/year)	CBAA Eq.II.8	CBAA Eq.II.9
Project emissions due to changes in SOC in project year t	$PE_{SOC,m,i,t}$ (tCO2e)	CBAA Eq.II.9	CBAA Eq.II.10
Duration of the quantification period	T_{QP} (years)	3 (Section G3)	CBAA Eq.II.10
Project scenario emissions per hectare due to change SOC stocks in the project intervention areas during the whole quantification period	$PE_{G,SOC,i,QP}$ (tCO2e/ha/year)	CBAA Eq.II.10	CBAA Eq.II.11
Area of the project intervention area in year t	A_i (ha)	Management plan	CBAA Eq.II.11
Project scenario emissions due to change in SOC stocks in the project intervention area during the whole quantification period	$PE_{G,SOC,a}$ (tCO2e/ha/year)	CBAA Eq.II.11	CCBA M1 Eq.4

Expected climate benefits

The expected climate benefits estimated for each project intervention area are calculated with Equation 1.

$$CB_{G,a} = BE_{G,a} - PE_{G,a} - L_{QP}$$

(Equation 1)

Where:

$CB_{G,a}$= The expected climate benefits from grazing and forage management in the project intervention area during the project period (tCO_2e);

$BE_{G,a}$= Baseline scenario emissions within the project intervention area during the quantification period (tCO_2e);

$PE_{G,a}$= Project scenario emissions within the project intervention area during the project period (tCO_2e); and

L_{QP}= Potential leakage emissions due to displacement of grazing activity during the project period (tCO_2e).

Default values for parameters used in the estimation of climate benefits are provided in Table G5.3.

Table G5.3.
CENTURY modelled data for changes in carbon sequestration (PE (SOC,m,t) by grassland type and according to diverse grazing practices

Grassland type	Baseline grazing time	SOC(s,base) (tC ha)	With-project management options	SOC(m,2035) (tC ha)	ΔSOC(m,t) (tC / ha / yr)	Uncertainty(%)	ΔSOC deduct$_{,m,i,t}$ (tC ha yr)	ΔSOC C,m,l,t (tC ha yr)	PE(SOC,m,t)
Riparian meadow	Apr-Aug; 80%	30.7000	Apr-Aug; 30%	37.6000	0.3450	0.2330	0.0286	0.3164	**-1.1600**
			Apr-Aug; 40%	33.9000	0.1600	0.2180	0.0109	0.1491	**-0.5468**
			Apr-Aug; 50%	30.8000	0.0050	0.2970	0.0007	0.0043	**-0.0156**
	Jun-Aug; 80%	32.7000	Jun-Jul; 30%	38.7000	0.3000	0.3160	0.0198	0.2802	**-1.0274**
			Jun-Jul; 40%	36.8000	0.2050	0.2650	0.0236	0.1814	**-0.6652**
			Jun-Jul; 50%	34.9000	0.1100	0.3330	0.0091	0.1009	**-0.3699**
Mountain meadow	Oct-Mar; 70%	62.5000	Oct-Mar; 30%	63.8000	0.0650	0.2550	0.0068	0.0582	**-0.2133**
			Oct-Mar; 40%	63.1000	0.0300	0.3370	0.0026	0.0274	**-0.1004**
			Oct-Mar; 50%	62.9000	0.0200	0.2560	0.0021	0.0179	**-0.0656**
	Jun-Oct; 80%	46.5000	Jun-Oct; 30%	55.5000	0.4500	0.2270	0.0347	0.4154	**-1.5230**
			Jun-Oct; 40%	50.7000	0.2100	0.3250	0.0158	0.1943	**-0.7123**
			Jun-Oct; 50%	46.1000	-0.0200	0.2440	-0.0019	-0.0181	**0.0664**
	Oct-May; 80%	52.8000	Nov-Apr; 30%	59.1000	0.3150	0.2820	0.0416	0.2734	**-1.0025**
			Nov-Apr; 40%	58.7000	0.2950	0.3420	0.0271	0.2679	**-0.9822**
			Nov-Apr; 50%	58.4000	0.2800	0.3250	0.0210	0.2590	**-0.9497**
Mountain steppe	Aug-Oct; 80%	26.7000	Aug-Sep; 30%	31.1000	0.2200	0.2160	0.0145	0.2055	**-0.7534**
			Aug-Sep; 40%	29.2000	0.1250	0.3470	0.0121	0.1129	**-0.4139**
			Aug-Sep; 50%	27.4000	0.0350	0.2080	0.0020	0.0330	**-0.1209**
	Jun-Oct; 80%	23.7000	Jun-Oct; 30%	28.9000	0.2600	0.2140	0.0166	0.2434	**-0.8923**
			Jun-Oct; 40%	25.7000	0.1000	0.2690	0.0119	0.0881	**-0.3230**
			Jun-Oct; 50%	23.3000	-0.0200	0.2610	-0.0022	-0.0178	**0.0652**
	Oct-May; 80%	29.3000	Oct-May; 30%	32.8000	0.1750	0.2910	0.0247	0.1503	**-0.5512**
			Oct-May; 40%	31.9000	0.1300	0.2000	0.0065	0.1235	**-0.4528**
			Oct-May; 50%	31.0000	0.0850	0.2400	0.0077	0.0774	**-0.2836**

Expected biodiversity benefits

As wildlife populations are allowed to increase ecosystem services associated with bioengineering, such as soil aeration, nutrient cycling, soil water retention, and seed dispersal will increase accordingly. Wildlife population sizes at the study sites are predicted to increase against baselines as specified on a site/ species specific basis in Annex 5 Management plans. Further benefits will accrue through enhancement of rangeland vegetation and habitats, associated with enhanced grazing management, and through enhanced participation of herders in governance (as summarised in Tables F3.1 and 3.2 above, and set out in Annex 5 management plans).

G6 Leakage & Uncertainty

Leakage

Potential leakage from displacement of livestock grazing is accounted for using Annex 8 Module 3. The parameters used for the assessment of leakage are summarised in Table G6.

Table G6. Parameters for estimation of potential leakage emissions

Parameter	Symbol and units	Value/Source	Use
Dry matter intake requirement of the reference type and class of animal	$DMI_{daily,ref}$ (kg)	Locally relevant intake data	CBAA Eq.15
Baseline scenario livestock grazing activities in project intervention area in year b	$LGA_{baseline,a,b}$ (AUM)	CBAA Eq.10	CBAA Eqs.11,14
Baseline scenario livestock grazing activities by animals owned by project participants grazing in project intervention area in year b	$PPI_{baseline,a,b}$ (AUM)	Management plan	CBAA Eq.10
Baseline scenario livestock grazing activities by animals owned by project non-participants grazing in project boundary implementation area in year b	$NPI_{baseline,a,b}$ (AUM)	Management plan	CBAA Eq.10
Project scenario livestock grazing activities in project intervention area in year t	$LGA_{project,a,t}$ (AUM)	CBAA Eq.12	CBAA Eqs.13,14
Project scenario livestock grazing activities by animals owned by project participants grazing in project intervention area in year t	$PPI_{project,a,t}$ (AUM)	Management plan	CBAA Eq.12
Project scenario livestock grazing activities by animals owned by project non-participants grazing in project boundary implementation area in year t	$NPI_{project,a,t}$ (AUM)	Management plan	CBAA Eq.12
Net displacement of livestock grazing attributed to the project activities in year t	GD_t (AUM)	CBAA Eq.14	CBAA Eq.15
Planned off-take of animals owned by project participants in the project scenario	$PO_{project,t}$ (AUM)	Management plan	CBAA Eq.14
Area of grassland required to support the displaced livestock	$Area_{GD}$ (ha)	CBAA Eq.15	CBAA Eq.16
Above ground net primary productivity of grasslands in the project region	$ANPP_{ref}$ (kg/ha)	1800 (IPCC 2006b Table 3.4.2)	CBAA Eq.15
Leakage emissions due to loss of soil carbon caused by displacement of grazing activities outside the project boundary in project year t	$L_{G,t}$ (tCO2e)	CBAA Eq.16	CBAA Eq.17

Soil organic carbon stocks in grasslands in the project region	SOC_{REF} (tC/ha)	Locally relevant value	CBAA Eq.16
Carbon stock change factor for management regime for severely degraded grasslands	$F_{MG,SD}$	0.7 (IPCC 2006a)	CBAA Eq.16
Leakage emissions due to displacement of grazing activity during the quantification period	L_{QP} (tCO2e)	CBAA Eq.17 (or 0 if negative)	Section 4.4.3

* An animal unit month is calculated by multiplying the number of animal units by the number of months of grazing

In the context of this project, leakage denotes grazing of *heseg* members' livestock outside the defined *heseg* grazing areas. As noted in Section H, Table H1, mobility between seasonal grazing areas is a well-established, integral aspect of traditional Mongolian pastoralism, and one which the project is seeking to support/ restore. Although mobile, seasonal grazing will typically occur within each *heseg*'s designated pasture areas, these lands are not privately owned and the practice of long distance movements (*otor*) outside these areas in times of natural disaster (*dzud*) is well established and an important aspect of traditional risk management. The project does not and should not seek to curtail this. However, the pasture use plans included in the Management Plans and for Ikh Am in Table F1a do not incorporate leakage as part of normal, everyday grazing practices. The figures for biomass utilisation and carbon sequestration presented in the tables above are based on *heseg* livestock grazing within *heseg* boundaries. Pastures are excluded from calculations where incoming herders and off site migrations preclude reasonable estimates of stocking rates and carbon sequestration (e.g. summer pastures in Ikh Am). If during the initial commitment period, any households move outside the project area for significant periods of time, and where this was not established practice under the baseline scenario, this will be negotiated with local administrations in the appropriate areas. LA in receiving areas will be made aware of the incomers' Plan Vivo commitments and may wish to negotiate a proportion of PV benefits as compensation for pasture use in non-project areas under such circumstances.

Uncertainty

There are three main sources of uncertainty in the climate benefits estimated with this Technical Specification: i) The expected climate benefits are estimated based on a description of planned management interventions, so there is a chance that these interventions will not be carried out as planned; ii) Expected changes in soil organic carbon stocks are determined using a biogeochemical model, the outcomes of which are dependent on the quality of data used to parameterise the model; and iii) Default values derived from other areas may not fully represent the site conditions in the project intervention area. The approaches employed to account for these sources of uncertainty are described below.

Project interventions

The most significant way in which the risk that project interventions are not carried out as planned is managed is through the participatory design of project activities. Since the herder groups decide the activities they wish to carry out based on a full understanding of the inputs required and the expected benefits, there is a high likelihood that management plans will be upheld. This is not taken as read however.

To ensure that management interventions are carried out as planned, activity based monitoring is used that clearly links management plans to performance indicators with thresholds for the receipt of payments or support financed by the sale of Plan Vivo certificates. This mechanism provides an incentive to the project participants to carry out the planned activities throughout the project period. The activity-based monitoring approach is described in Part K.

Model predictions

The tool for estimation of soil organic carbon removals from improved grazing and perennial forage management (Annex 8, Appendix II) uses the CENTURY model to estimate changes in soil organic carbon stocks under different management practices. With any modelling approach there is the potential for errors in model predictions if the model or input data are inaccurate. The tool therefore includes an approach for estimating the uncertainty in model predictions and making an appropriate adjustment to changes in carbon stocks to ensure that climate benefits are not over estimated. For details of the approach see Annex 8, Appendix II Equations II.2 to II.8.

Default values

The default values employed in the Technical Specification and the sources from which they were obtained are described in the Tables in Part G. With the exception of Table G5.3 all are widely used values that are not expected to vary greatly and are therefore used without an adjustment for uncertainty, in line with common practice. The values for expected changes in soil organic carbon stocks in Table G5.3 were derived from modelling outcomes carried out at intensively studied pilot sites in Mongolia (see Annex 8 and 9).

The research effort required to obtain site specific estimates of changes in soil organic carbon stocks with an acceptable level of uncertainty using the modelling approaches in Annex 8, Appendix II, means that this approach cannot feasibly be implemented in all project intervention areas. The resource requirements would outweigh any potential benefits from the sale of Plan Vivo certificates, or at least divert a significant proportion of available finance away from supporting the management interventions. This technical specification therefore provides projects with the opportunity to use default values derived from pilot studies as an alternative

to site specific modelling.

In acknowledgement of the fact that it is not possible to assess the uncertainty of default values for changes in soil organic carbon stocks that are employed outside the areas from which they were obtained, this Technical Specification requires an additional adjustment equivalent to a 20% reduction in expected climate benefits from changes in soil organic carbon stocks to all project intervention areas using the default values in Table G5.3. This is incorporated into the risk buffer adopted by the project (see Section H).

Part H: Risk Management

H1a Identification of risk areas

Risk	Level of risk	Management/ mitigation measures
Drought/ *dzud*[1]	Varies by project area. High in Ulziit; medium to low in other project sites	A selection of PV activities are designed to help participating groups manage climatic risk. Climate variability is endemic in project areas. Activities such as hay cutting for winter, fodder preparation, maintenance and repair of winter shelters, livelihood diversification will help herders maintain their own well-being and livestock herds under these conditions. Enhanced seasonal mobility and better use of pasture areas is also an important adaptation, to be facilitated by PV activities. As indicators include the % of households who comply with new plans for seasonal pasture use and distances moved (see Section K), intra-group/ *heseg* cooperation to assist weaker or poorer members in moving is expected, which will increase the resilience of these members in the face of adverse climatic conditions. Cooperation will also enhance groups' ability to maintain 'static' interventions such as vegetable production, while other members may take livestock to better pasture areas, as necessary. Better market links and processing of livestock products will not only enhance income, but give herders the opportunity to sell livestock in adverse climatic conditions, rather than lose them to drought etc. The efficacy of these risk mitigation measures will be assessed biannually as part of standard monitoring practices (see Section K and Annex 5 Management Plans). The Technical Specification for soil carbon is designed to take account of climatic variability.
Population increase/ variability (human and/ or livestock)	Medium	Spatial variability of human and especially livestock populations is a feature of mobile herding practice. Key project interventions have been specifically designed to enhance this variability in order to reduce/ spread grazing pressure, with impact on soil carbon stocks. This only becomes a risk where a) resident herders increase their livestock holdings significantly over time and/ or b) herders from other areas come into the project area in response to drought/ *dzud* in their own home territories. In relation to a), PV project activities are designed to decrease reliance on livestock nos *per se*, through promoting livelihood diversification, and improved income from high quality livestock products. A number of participating herder groups have expressed interest in reduction of livestock numbers over time to protect pasture resources, but feel unable to commit to significant reductions at present, due to lack of income from livestock products and other sources. Livestock numbers, as well as improved livelihoods/ income from other sources, will be monitored as part of standard monitoring practices (see Annex 5 and at the end of the first project commitment period). For b) this relates to issues of leakage and displacement (See below and Section G6).
Leakage/ displacement		Mobility between seasonal grazing areas is an integral – and desirable- aspect of Mongolian pastoralism, and one which PV activities are seeking to enhance/ restore. This does traditionally include long distance migration outside a households'/ herder groups' own customary areas when climatic conditions necessitate (e.g. in times of drought/ *dzud*). Thus there is the risk of participating herders moving to other non-project areas and of herders from outside moving into project areas in particular circumstances. This cannot – and arguably should not – be prevented, as it constitutes a core aspect of traditional reciprocity. However, such in/out migration is usually temporary and not without control and management, from local administrations and herders themselves. PV agreements should strengthen the ability of resident herders to negotiate with incomers and

		to minimize any adverse impacts on project activities. Indicators (see Section K and Annex 5 Management Plans), where related specifically to the participating herders, should not be affected by any temporary incomers. Others, e.g. protection of medicinal plants etc. rely on the capacity of *heseg*/ herder groups to enforce agreements in conjunction with the local administration. Cooperation and capacity building through PV can only enhance this. With regard to outmigration of resident herders, none of the planned activities require or promote this.
Pests/ diseases	Low/Medium	Degradation of pasture by pests; loss of forest cover due to pests and disease. Impact on pasture by species such as Brandt's Vole is an endemic issue in parts of Mongolia, including in some of the project areas, as previously specified. Evidence of impact of pests and diseases will be reported annually, in conjunction with the monitoring of specific indicators (Section K; Annex 5).
Forest fire	Low	The majority of activities do not in any case relate to forests or to maintenance/ enhancement of forest cover. The development of herder environmental protection partnerships will also include working with local administrations on fire alert and monitoring systems where applicable. Activities such as forest cleaning and maintenance will work to reduce risk of forest fire.
(Mining related) land loss/ alienation	Medium/ Low	At present, mining related land alienation is an issue only at the Dert *heseg*, Ulziit site – not part of the initial 4 year commitment period. Planned activities for this site include collaboration with the local administration to manage/ stop mining and enforce existing legislation around land restoration and land rights. There are no existing plans for significant mining developments, or widespread ninja (informal) mining at the other three sites. The recognition of herders' rights under MSRM/ PV activities will strengthen abilities to resist uncompensated land alienation in the future should this become an issue.
External factors driving wildlife population nos	Medium	Changes in wildlife population sizes are being used to monitor the impacts of changed pasture management and forest management practices on biodiversity. However, wildlife populations also respond to many of the risk factors already mentioned above – drought, fire, pests/diseases, human disturbance – both inside and outside of the project areas. These need to be taken into account in overall analysis of project contributions over the initial 4 year commitment period, for example through attention to wider trends and contexts. ..
Legislative/ administrative changes	Low	Pastureland law in Mongolia has been in discussion by various incumbent governments, since the 2002 Land Law. This remains the situation at present. The tenure provisions under the planned PV activities reflect local administrations' recognition and support for *heseg*/ herder groups' land rights (Annex 6), in accordance with their interpretation of and devolved rights under the Land Law. It is always possible that significant legislative changes may occur in the future which contradict these provisions, but this is unlikely. All discussions point towards a strengthening of the type of provisions developed herein.
Inadequate management	Low	The *heseg*/ herder groups involved in PV activities are already well established with well-developed working procedures and mechanisms. The *heseg* have also worked closely with MSRM over a number of years and have benefitted from training and capacity building over this time. The participating *heseg* are amongst the most successful of those who originally formed with the assistance of MSRM. They have a good track record of collaboration and management of group activities. Further support and training will be available from MSRM as required during the PV activities.
Over reliance on external support	Low/ medium	Capacity building activities and training to date have equipped *heseg*/ herder groups to discharge the planned activities effectively and independently (albeit with further training from MSRM as requested). All PV activities have been developed with the clear awareness and proviso that any financial income through PV may be very limited or even absent, should it not be possible to sell the certificates. Hence activities must be designed to be self-supporting where possible and to be beneficial to livelihoods, environment and biodiversity, irrespective of any additional PV derived income. The long term sustainability of project interventions will be reviewed annually throughout the PV crediting period, with support to link to further initiatives and funding sources (e.g. through national conservation planning; donor initiatives on local protected areas).

1 *Dzud* is the Mongolian term for natural disaster.

Risks specifically to climate benefits are managed with the following approach:

- Identification of the risks that expected climate benefits will not be realized within the project period, the risk that climate benefits will not be maintained beyond the project period, and approaches that will be taken to mitigate these risks;
- Assessment of the impact the risk would have if it is realized, and the likelihood of the risk being realized; and
- Assigning a proportion of climate benefits that will be held in a risk buffer that is proportional to the identified risks.

Table H1b Factors that put the delivery or maintenance of climate benefits at risk

Risk factor and risk level	Potential impact	Mitigation	Likelihood
Social			
Low Land tenure and/or rights to climate benefits are disputed	**Moderate** If the rights of the community groups to manage their pasture areas are not upheld land uses that lead to reversals of climate benefits could be introduced.	The participating community groups have recognized land tenure rights in accordance with traditional land use rights and practices and the 2002 Land Law.	**Low** Pastureland law in Mongolia has been in discussion by various incumbent governments, since the 2002 Land Law. It is always possible that significant legislative changes may occur in the future which contradict these provisions, but this is unlikely.
Low Political or social instability	**Moderate** Disputes among different groups within the communities could lead to management plans not being followed, and/or a failure to coordinate project activities.	Project activities include the formation of herder partnerships that represent the interests of all members of the community, and that have mechanisms for resolution of conflict or disputes.	**Low** If representative and functional herder partnerships are maintained these should be able to respond to and address threats to management activities that arise from political or social instability.
Low Maintenance of community support	**Moderate** The success of project activities requires members of the community to uphold controls on grazing within pasture areas, otherwise climate benefits from soil carbon sequestration will not be realised	The participatory planning process is designed to ensure that the interests of all members of the community are reflected in management plans, and that sufficient incentives are in place to encourage their implementation	**Low** If management plans are well designed, and communities receive performance-based support throughout the project period, the likelihood that community support will not be maintained is low.
Economic			
Low Insufficient finance secured to support project activities	**Moderate** Without sufficient finance it may not be possible to support the full range of activities needed to bring about long term changes in pasture management.	New pasture areas will only have Plan Vivo certificates issued against them once sufficient finance is available to support activities throughout the project period; low cost activities will form an integral part of Plan Vivos.	**Low** By managing the expansion of project areas in line with available finance, and ensuring management plans are achievable with the funding available, the risk that insufficient funding will prevent project activities being carried out is low.
Low Alternative land uses become more attractive to the local community	**Moderate** It is possible that herder groups will decide to increase grazing intensity in pasture areas, or that herders from other areas could graze their livestock within project areas for example during periods of	Project activities are designed to decrease reliance on livestock numbers by promoting livelihood diversification, and improving income from high quality livestock products; Mobility between seasonal grazing areas is an integral,	**Low** Since project activities are expected to decrease reliance on livestock and strengthen capacity to manage the in-migration, and resist mining operations, the risk that alternate grazing arrangement will become more

	drought. Mining operations could also threaten some project areas where valuable minerals are present.	and desirable, aspect of Mongolian pastoralism. However, such migration is usually temporary and controlled by local administrations and herders. Plan Vivo management plans will strengthen the ability of resident herders to negotiate with incomers and to minimize any adverse impacts temporary migration on project activities; and to prevent mining activities through the enforcement existing legislation around land restoration and land rights	attractive is expected to be low.
Environmental			
Low Fire	**Moderate** Fires that affect large areas of pasture land could undermine the benefits from reduced grazing pressure, if a large proportion of above-ground biomass is burned.	The project does not include any fire management activities.	**Low** Wildfires that affect large areas of pasture are infrequent.
Low/medium Pest and disease attacks	**Low** Species such as Brandt's Vole can cause degradation in Mongolian pastureland. However impacts are usually localised.	No project activities are targeted at addressing this risk	**Moderate** There is a moderate risk that some patches of pastureland will be affected by pests such as Brandt's vole, but these are unlikely to be significant in relation to the entire project area.
Low (variable) Extreme weather or geological events	**Moderate** Prolonged drought could prevent the realisation of expected climate benefits if it prevents biomass growth in pasture areas.	Climatic variation is factored into expected soil carbon sequestration under baseline and project scenarios.	**Low** An increase in drought frequency may be expected over the long term as a result of climate change, but during the project period significant alterations to drought frequency beyond usual levels of variation are not expected.
Technical			
Low/Moderate Project activities fail to deliver expected climate benefits	**Low/Moderate** If modelling results are inaccurate climate benefits may be overestimated, but significant bias is unlikely. The risk of bias is higher for project areas where local parameters are not used for modelling expected climate benefits.	The modelling approach used to estimate climate benefits includes adjustments to account for uncertainty and is inherently conservative. Additional risk deductions are applied where uncertainty is higher.	**Low/Moderate** The likelihood that estimated climate benefits are significantly overestimated is low if locally derived parameters are used for modelling, however if local parameters are not then uncertainty cannot be assessed so the likelihood of bias increased to a moderate level.
Low Project activities fail to deliver expected livelihood benefits	**Moderate** If new livelihood activities are not successfully implemented the expected livelihood benefits may not be fully realised.	Livelihood activities are targeted at scaling up existing activities, or gaining access to existing markets.	**Low** Since the planned livelihood activities make use of local skills and practices and are targeted at proven markets, the risk that project activities will not result in expected livelihood benefits is low.
Low Technical capacity to implement project activities is not maintained	**Moderate** The project activities are not highly technical, but do require some training to support their implementation. If a sufficient number of	Training of individuals in herder partnerships will be carried out as required throughout the project period. Annual performance indicators are used to assess whether herder	**Low** Since projects are required to demonstrate that individuals have received necessary training and that there likelihood that capacity to implement project activities will

	trained individuals are not maintained realization of climate benefits could be undermined.	groups have the capacity to implement their management plans.	not be maintained is low.
Administration			
Low Capacity of the project coordinator to support the project is not maintained	**Moderate** Achieving climate benefits will requires the ongoing support of the project coordinator. If this is not maintained throughout the project period, the ability of community groups to carry out project activities could be undermined, especially if mechanisms for delivery of PES are not maintained.	The project coordinator is a well-established organisation with a long history of effective project and programme management.	**Low** Given the proven track record of the project coordinator the likelihood that their capacity to deliver the project will be maintained is high.

H2 Risk buffer

The highest risk level for each type of risk factor in Table H1b, is summarised in Table H2. A risk buffer, proportional to these risk levels was determined by assigning buffer percentages of 20% for a high risk level, 10% for a moderate risk level, and 1% for a low risk level in each category. A total risk buffer was then calculated by summing the percentages under each risk category.

Table H2 Risk buffer calculation

Risk type	**Sites with modelled with local parameters**		**Sites modelled with default parameters**	
	Risk level	**Risk buffer**	**Risk level**	**Risk buffer**
Social	Low	2%	Low	2%
Economic	Low	2%	Low	2%
Environmental	Low	2%	Low	2%
Technical	Low	2%	Moderate	10%
Administration	Low	2%	Low	2%
TOTAL		**10%**		**18%**

For sites modelled with default parameters the risk buffer was conservatively increased to 20% to make additional allowance for uncertainties and hence risk associated with modelling.

Part I: Project Coordination & Management

I1 Project Organisational Structure

The Mongolian Society for Range Management (MSRM) is the main in-country project coordinator. It is a non-governmental and non-profit organization established and registered in 2006 in accordance with Mongolian legislation on NGOs. It has the stated mission to support and contribute to all endeavours promoting sustainable use of Mongolian grasslands and to ensure sustainable livelihoods for Mongolian

herdsmen. It is engaged in grassland research and monitoring, community development, project cycle management, marketing, information technology and public relations. It has previously worked extensively with herder groups (*heseg*) throughout Mongolia, and through acting as the lead in- country partner for a series of international development projects, such as Peri-Urban Range Land Project of MCA, Market and Pasture Management Development Project of IFAD, the Swiss Development Corporation (SDC) Green Gold project and others. MSRM has previously worked with local herders in three of the Plan Vivo project sites – Dert, Hongor *Ovoo* and Ikh Am *hesegs* – in the original formation of these groups, and in their subsequent development, capacity building and organisation. This latter work is ongoing. MSRM are therefore uniquely placed to work with these groups in developing and delivering the Plan Vivo project, not least through established relations of trust and well developed working relationships.

Key MSRM staff with responsibility for the Plan Vivo project are:

i) **D. Dorligsuren**, Executive Director, MSRM. Key in-country manager for Plan Vivo project. Will manage all funds received through Plan Vivo, and distribute to participating *heseg* in accordance with the agreed procedures (see Part J). He will also be responsible for external coordination, with Dr. Caroline Upton, at the University of Leicester, UK, and with key Mongolian government ministries, local government and its agencies.

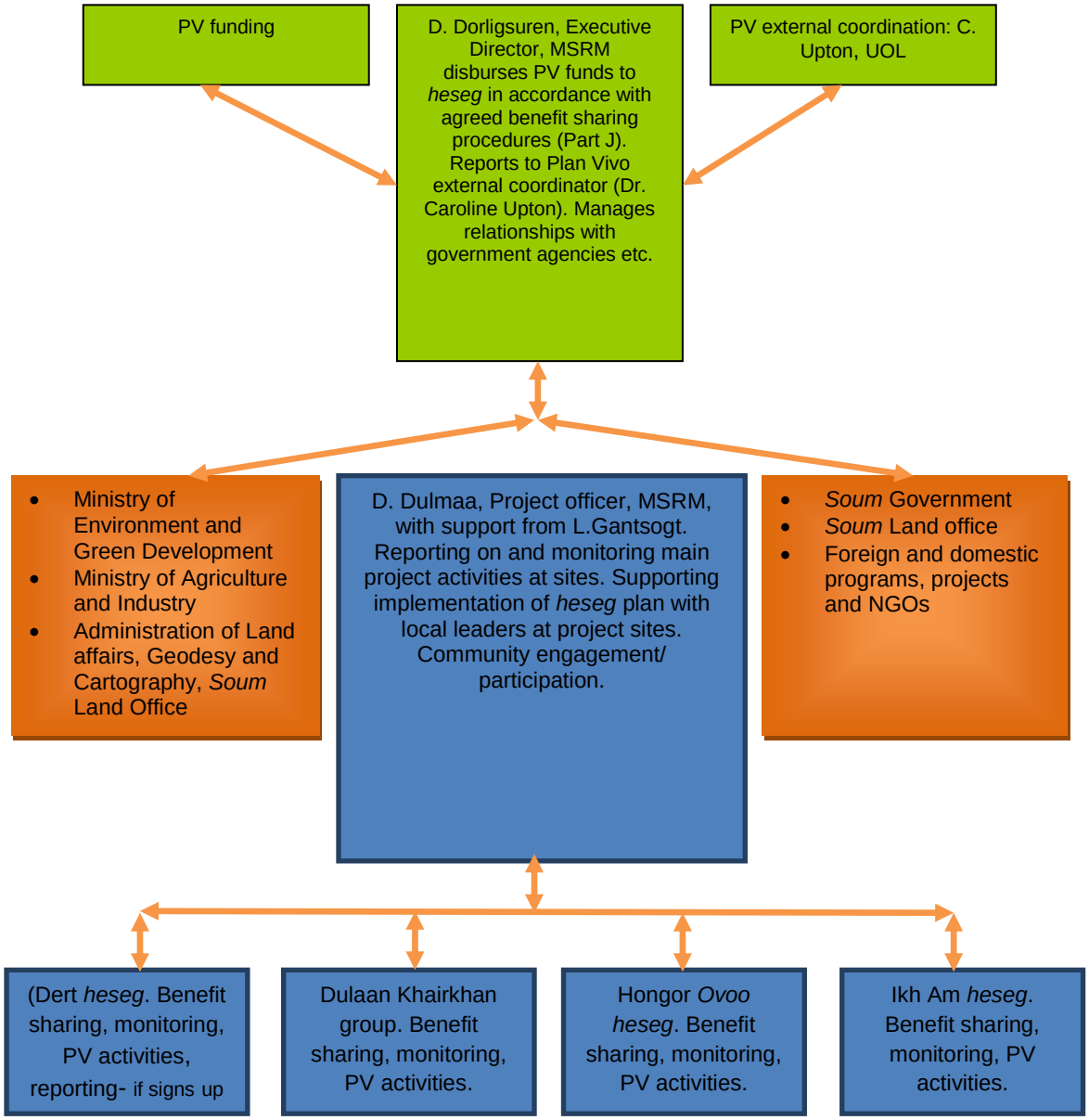
ii) **D. Dulmaa**, Project officer, MSRM, with support from L. Gantsogt (Plan Vivo project team). Reporting on and monitoring main project activities at sites. Supporting implementation of *heseg* plan with local leaders at project sites.

Other staff:

iii) **Dr Caroline Upton**, University of Leicester. External coordinator. Dr Upton is the PI for the ongoing Darwin Initiative 'Values and Valuation: New Approaches to Conservation in Mongolia' project (2012-2015), which has worked extensively with the four participating *heseg*/ herder groups in collaborative design of the proposed Plan Vivo projects and activities. Darwin funding has been used to support a series of workshops and training events with the *heseg*, to develop and agree the detailed Plan Vivo proposals provided in this document. She has previously been the PI of a number of other major projects with herders' groups in Mongolia, most recently the Leverhulme Trust funded 'Community, Place and Pastoralism: Nature and Society in Post-Soviet Central Asia' project (2010-2012). Good links were developed with herder groups in Bogd *soum*, including Dulaan Khairkhan, as part of this project, which led to their inclusion in the Plan Vivo process at their own request.

The organisational structure of the project is summarised below:

Project Organizational Structure



Roles of key partners may be further summarized as follows:

Key function	Organization involved	Legal status	Description of activities
Project Coordination & Administration	Mongolian Society of Range Management	Independent Non-Governmental Organization engaged in pasture and herder livelihood improvement	• Overseeing project implementation and development • Negotiation and recording carbon sales with buyers • Managing Plan Vivo payments to *heseg* based on annual monitoring • Management of Plan Vivo certificates and reporting to Plan Vivo Foundation (with C. Upton) • Coordination of external reviews • Liaising with project team (MSRM staff and C. Upton) • Interacting with state and local Governments • Securing donor funds and/ or income from sale of PV certificates to make PES payments (with C. Upton).
Project implementation	Plan Vivo Project team	Plan Vivo project implementation team from MSRM	• Overseeing development and initial implementation of project activity • Improving local organizational capacity • Organising project meetings for participants • Conducting workshops/training with project participants • Monitoring
Project technical operations	Mongolian Society of Range Management	Independent Non – Governmental organization engaged in pasture and herder livelihood improvement	• Participated in development of Plan Vivos with *heseg* (with C. Upton) • Evaluation of Plan Vivos (with C. Upton) • Review of internal annual monitoring • Overseeing project implementation on an ongoing basis (with C. Upton) • Organisation of ongoing training/ workshops with project participants. • Ongoing provision of technical support

Table I1 PV Organisational Structure and Responsibilities

Key stakeholders comprise the participating *heseg*/ herder groups, as listed above, and their constituent households. Since the inception of the Darwin Initiative project in 2012, MSRM/ Dr Upton have met with these groups on multiple occasions (see Annex 7 for further details) to explain the nature of the Plan Vivo process and work with *heseg* to develop agreed activities and indicators, and to ensure Free, Prior and Informed Consent. Other key stakeholders include government ministries and officials, as listed in the project organizational structure above. Again meetings and consultations with these officials have been held and letters of support provided, as appended (see Annex 6). In each project area, meetings and consultations have been held with *soum* governors and approval received (e.g. see Annex 7). These meetings were held most recently in March 2014 in Bogd *soum*, June 2014 in Undurshireet *soum* and again in September 2014 in Bogd, Undurshireet and Ikh Tamir *soum*s. Subsequent meetings were held through the training workshop in Ulaanbaatar in June 2015 and on site with *heseg* also in summer 2015. Non-*heseg* member herders in adjacent areas should not be directly affected by the planned activities, as these take place within the *hesegs*' own land area, with activities designed to avoid leakage. Nonetheless, in recognition of the flexible nature of seasonal movement patterns and periodic need for *otor* (traditional risk management strategy of long distance migration out of their own area in search of grazing), final planned activities under Plan Vivo for participating groups have and will be presented

at local *bag* and *soum* meetings to ensure full, ongoing awareness of other local residents. Furthermore, herders from the participating Plan Vivo are being trained as 'ambassador herders' as part of the ongoing Darwin Project, to enable them to explain the process to neighbouring herders and empower others to develop and submit their own Plan Vivo projects, if desired.

I2 Relationships to national organizations

As highlighted above, MSRM staff and C. Upton have met with key government bodies and officials during the development of the Plan Vivo projects and secured their support. These bodies include the Administration of Land Affairs, Ecology, Geodesy and Cartography implementation agency of the Government of Mongolia, the Ministry of Environment and Green Development of Mongolia and the Ministry of Industry and Agriculture of Mongolia. Letters of support, where provided, are appended at Annex 6. A training workshop including herders and government officials was held in June 2015, funded through the Darwin Initiative 'Values and Valuation: New Approaches to Conservation in Mongolia' project, through which the Plan Vivo process, outcomes to date and policy lessons were presented. Further feedback will be provided through end of Darwin project meetings, training events and briefing materials in September 2015. This approach is designed to ensure incorporation of the Plan Vivo approach in future policy development and planning. Relationships to national organisations are thus already well developed and will be further developed and strengthened throughout the lifetime of the Plan Vivo project.

MSRM and local state representatives in project areas have also agreed to sign a triple contract of cooperation (MSRM - Local Government – *heseg*/ herder groups) within the framework of the Plan Vivo project (sample *soum* administration – herder group pasture management agreement at Annex 6, final PV specific version to be signed in conjunction with each site's PES agreement).

The project will cooperate with the existing Swiss Development Agency Green Gold Project, the National Livestock Programme of the Mongolian Government, national level biodiversity planning and initiatives through our partners ZSL (Zoological Society of London) and National University of Mongolia (NUM), emergent REDD-iness planning and other climate- related initiatives and other international and domestic activities on environmental protection and herders income generation activities, as these emerge.

I3 Legal compliance

Pastureland cannot be held under private ownership in Mongolia under current legislation, notably the 2002 Land Law. However, chapter 52.2 of the Land Law (2002) permits a group of herders to jointly possess winter and spring campsites.

This has been widely interpreted as extending to surrounding pasture also, where approved by the *Soum* Governor after submission of a pasture use request and its discussion at a *Soum* Representative meeting (*khural*). So in this way *heseg* or other herder groups in parts of the country have begun to manage winter and spring pasture based on a Pasture Use Agreement approved by *Soum* Governors. In some instances local *Soum* Governors have extended this agreement to include all four seasonal pasture areas, thus including summer and autumn pastures also. These are the strongest level of rights currently available in Mongolia and reflect state recognition of herders' customary rights and usage of wider pasture, linked to possession of campsites and shelters. A replacement draft Pastureland Law has been under debate for many years, but has yet to be agreed. Expert opinion and drafts under debate indicate that the type of herder group contract attached at Annex 6 will be further strengthened and supported under any future legislative changes. *Soum* administration in participating Plan Vivo project areas are supportive of these types of contracts and the rights of herders to resources in designated areas, including carbon or other benefits accrued under Plan Vivo. Other legislation relating specifically to carbon ownership does not currently exist in Mongolia.

Where activities pertain specifically to wildlife protection/ conservation, these will be undertaken in full accordance with the Mongolian Law on Forests, specifically article 29.1.1., which states that cutting or otherwise destroying saxaul trees is prohibited. The Mongolian Law on Animals, article 9, relates to the hunting bans on species present at the project sites such as goitered gazelle, Mongolian gazelle, argali sheep and Pallas's cat. In addition to these wildlife laws The Mongolian Law on Soil Protection and the Prevention of Desertification, article 7.1.4, highlights the importance of adhering to livestock capacity and rotation. This same law, article 6.2.2, also supports the plantation of forest patches as a technique to help prevent grassland desertification. The Law on Environmental Protection is relevant in relation to the overuse of medicinal plants. Article 15.1.4. states the plenary power of the Central State Administration is to establish off-take or harvest limits in accordance with the legislation on the annual use of forest resources, plants or animals and to restrict the use of certain natural resources taking into account known reserves.

Where employment opportunities may arise during the Plan Vivo project, the Executive Director of MSRM as the in-country coordinator, shall ensure equal employment opportunities for community participants or other community members according to the Constitution of Mongolia and related law of Mongolia. This requirement will be discharged in discussion and in conjunction with *heseg*, and through established *heseg* constitutions.

I4 Project management

The officially project start date is 1st April 2015, with the first monitoring against

established baselines due to take place in September 2015 (see Section K and Annex 5 Management Plans for details). Project establishment has been ongoing since the inception of the Darwin Initiative project in April 2012, through the identification of target communities, and subsequent work with and facilitation of these communities to design their own Plan Vivos. From spring 2015, communities and the Plan Vivo team have and will follow the agreed monitoring schedules and indicators as set out in Part K. According to current agreed timelines, site specific activities, as detailed herein, will take place for an initial period of 4 years (until end March 2019), following which the Plan Vivo team and participating herder groups will review and agree prospects for continuing and scaling up activities.

The project record keeping system will be maintained and continuously updated by MSRM. This will entail recording all Plan Vivos submitted by participants, PES agreement, monitoring and disbursements in accordance with agreed procedures, as specified in Part J. These records will be regularly backed up and copies held at an independent location to protect against data loss.

I5 Project financial management

MSRM will establish an account solely for the management and disbursement of PV funds and separate from their general operational finances. To date, seed funding for establishment of Plan Vivo activities has been provided through the Darwin Initiative project 'Values and Valuation: New Approaches to Conservation in Mongolia'. This did not take the form of direct payments to participating *heseg*/ groups, but rather was used to fund workshops, community meetings and training events, through which PVs were developed and agreed by *heseg* and through enabling herders' attendance at these meetings. Future funds derived from the sale of PV certificates and any other sources of income (donor funding etc.) will be held in this separate account, with funds released to participants following MSRM's review and approval of each periodic monitoring report. Payments will be made into the existing accounts of the participating herder groups/ *heseg*. *Heseg* have their own structures and procedures for management and disbursement of funds to members (Part J). Full records will be kept a) by MSRM of income and its disbursement to specific *heseg* and b) by each *heseg* through their existing accounting system, to ensure transparency and fairness of disbursements, in accordance with agreed benefit sharing procedures.

Since its inception, the project has therefore received funding from Darwin Initiative, which has been invested in the development of the Plan Vivos through training and capacity building of participant communities, participatory planning and discussions.

The shares of carbon credit revenues to be generated during the project implementation phase are planned to be divided as follows:

- 70% to participating communities
- 30% to MSRM to cover organizational, coordination, monitoring and administration costs.

I6 Marketing

A marketing plan for the project has been prepared in conjunction and with advice from Plan Vivo. We have had preliminary discussions with Zeromission on marketing PV project certificates, to be developed in further detail now that the PDD is finalized. The project team has also identified a number of other potential purchasers of the certificates. Detailed negotiations will be initiated now that the PDD has been finalized and we have a clear product to sell. These include i) companies/ stores who purchase and stock cashmere goods sourced from Mongolia (e.g. Edinburgh Woollen Mills); ii) (eco) tourism/ travel companies, both within Mongolia, where there are rapidly growing numbers of domestic travel agencies (e.g. Nomad Tours) and international companies and hotel chains with business interests in Mongolia (Kempinski Hotels; Exodus Travel; Cox and Kings; Responsible Travel; British Horse Society, who run horse-riding tours in Mongolia); iii) Mining companies.

Dr Upton is leading the marketing plan, in conjunction with MSRM. We aim to have agreements in place with purchasers in autumn 2015, although dates for selling certificates will depend upon the duration of the forthcoming project registration process. In the meantime, preparation for and initiation of PV activities has all been funded under the Darwin 'Values and Valuation' project. We are also exploring opportunities for additional/ matching funding through donor funds (e.g. linking to GIZ funding for development of Local Protected Areas) and through state sources.

I7 Technical Support

MSRM has already conducted extensive training with participating *heseg*/ herder groups, both under the auspices of the Darwin project and PV preparation, and prior to this (excepting Dulaan Khairkhan), in the sites where they were involved in the initial creation of the herder groups. These trainings have variously addressed issues such as reseeding; pasture management and rotational pasture use; processing and marketing of livestock products; accounts/ financial management; vegetable growing etc. MSRM will continue to provide technical support and training to PV *heseg*/ herder groups, throughout the period of their commitment to the project. This may entail further training in any of the above topics. It will also include ongoing training in management of the PV process; especially monitoring against agreed indicators, disbursement of benefits and record keeping. The initial monitoring period against the baselines, to be conducted from September 2015, will be undertaken by MSRM staff in conjunction with *heseg*/ herder group members, to ensure the latter are fully

trained and able to conduct the monitoring on their own in the future. ZSL training has been undertaken with *heseg* members, and will be followed up in the future to enable them for example to undertake manned surveys of key species (see management plans, Annex 5). Members of *heseg*/ herder groups are also being trained as 'PV/PES Ambassador Herders' through the PV process and encouraged to share their expertise in the development and management of PV projects with other local herder groups. Key PV *heseg* members, as selected by the other members of their group, have already taken part in a Darwin project workshop training event for herders and for government staff in the capital, Ulaanbaatar (June 2015), and in the development of training materials.

Part J: Benefit sharing

J1 PES agreements

PES agreements have been developed with participating *heseg*/ herder groups (template at Annex 3; final site specific PES currently being signed by all herder group/ *heseg* members). These have been derived from a lengthy series of meetings between the Project Coordinators, MSRM, and each *heseg*/ group since 2012 to a) explain and discuss the PV process; b) facilitate *heseg*/ groups in developing proposed activities and their own Plan Vivo; c) develop and agree indicators and monitoring plans, d) agree mechanisms for benefit sharing and disbursement. In accordance with PV requirements, these procedures have taken full account of the need for Free Prior and Informed Consent (FPIC) (Annex 7). These agreements are designed to generate ecosystem services, as specified in Sections D and F. MSRM have worked with *heseg*/ groups to identify these ES, trends and monitoring requirements and to ensure that planned activities meet livelihood needs and do not endanger food security. They have also been designed to avoid leakage/ displacement into adjacent land areas. Interim targets, which will trigger payments, have been agreed and specified, as have procedures where targets are not met, and conflict resolution procedures (see below). Agreements will be signed and dated by all parties on approval of the Plan Vivos through the PDD process. Throughout the PV preparation period MSRM have been in discussion with local officials (e.g. *soum* governors) and national officials of pertinent agencies and regulatory bodies to ensure their support for the scheme and their recognition of herders' land rights and rights to any benefits accrued during the PV activities (sample letters of support and contracts at Annex 6; further information at Annex 7). This support has been a condition for entering into PES agreements with participating groups.

The project coordinator will ensure that obligations are met. Specifically, all participating *heseg*/ herder groups are aware that any payments a) are performance based *and* b) are also dependent upon sale of certificates and any income accrued through this process. It has been made very clear to all participants that payments are not guaranteed and will only be triggered when *both* a) and b) are met. This is

clearly set out in the sample agreement at Annex 3. Given the proposed timing of the first round of payments, it is in any case anticipated that purchasers will have been secured for certificates through the marketing strategy outlined above. Participating *heseg*/ groups will be kept fully informed by the project coordinator of sales and income accrued throughout this process. It has also been made very clear to participating groups that all activities planned under PV and facilitated by seed funding from the Darwin project should be designed to be beneficial for herders' livelihoods and/or for local environments, irrespective of any additional funding secured under PV.

PV agreements are in line with current legislation around land tenure and pasture use, and with local *soum* level planning mechanisms and responsibilities, as previously outlined. They have also been shared with adjacent herders for example and *soum khural* (meetings) to ensure wider local support and awareness of their provisions. They will not remove, diminish or threaten participants' land tenure, but rather will serve to strengthen it.

Should additional groups wish to enter PES agreements with the coordinator in the future, this will depend on a) funding having been secured through sale of certificates and/or state/ donor support and b) the ability to secure additional funding for any new participants. Any new participants will also have to meet the conditions for entering into PES agreements as outlined above. Where more groups wish to join than can be funded and all other conditions are met, applications will be decided by the project coordinator. Preference will be given to groups with higher proportions of low income and/ or female headed households and the greatest potential for environmental as well as livelihood benefits through PV.

J2 Payments & Benefit Sharing

Payments for sale of certificates will be received initially by the project coordinator, MSRM, who will set up a dedicated bank account for these payments, as set out in Section I5 . Funds will be released to participants at the agreed intervals, as set out in the individual PV agreements and following MSRM's review and approval of each periodic monitoring report. Payments will be made into the existing accounts of the participating herder groups/ *heseg*. *Heseg* already have their own established structures and procedures for management and disbursement of funds to members, which are designed to ensure equitable and fair sharing of benefits. For most groups, this will be based on equal distribution of benefits to all participating households. Where variations are proposed, for example a higher percentage of payments to be made to poor or female headed households, these are as specified in the relevant PV agreement (template at Annex 3). Full records will be kept a) by MSRM of income and its disbursement to specific *heseg* and b) by each *heseg* through their existing accounting system, to ensure transparency and fairness of disbursements,

in accordance with agreed benefit sharing procedures. Payments will be withheld where agreed targets, as evaluated by agreed interim monitoring indicators, are not met (see Section K). In such cases, payments will be deferred until the *heseg* can demonstrate that targets for the specific period have been met, at which point payments will be released by the project coordinator.

Overall the benefit sharing mechanism will allocate 70% of income from sale of certificates or other sources to participating communities. 30% will be retained by MSRM to cover organizational, coordination, monitoring and administration costs. This has been agreed and is incorporated clearly within PV agreements (Annex 3). The initial period of the commitment is only for 4 years. It is anticipated that this benefit sharing arrangement will remain in place throughout the initial 4 years of the project. Should the participating *heseg*/ groups wish to continue, or new groups to come in at this stage, this allocation of benefits can be renegotiated between the parties, as desired. The benefit sharing mechanism, as part of the sample PES agreement, is available to all participants in Mongolian. Agreed payments to participating *heseg*/ groups will be made as cash, not in kind. The benefit sharing mechanism described above was developed with participating *heseg*/ groups, through a series of meetings, as outlined above. Specifically, this issue was discussed in detail and finalized at meetings in September/ October 2014 (details at Annex 7). At the meetings with *heseg*/ herder groups at project sites project participants have understood and agreed with project requirements and benefits. As the activities in the Plan Vivos were initiated and developed by participants themselves, with support and guidance from MSRM, project activities are reliable and workable, and have enthusiastic support from the *heseg*/ herder groups involved.

Part K: Monitoring

During the project period, achievement of the expected climate, biodiversity and livelihood benefits will be assessed with activity-based monitoring linked to the specific activities planned at each project site. This activity-based approach provides a cost-effective method for monitoring, and only requires participant communities to collect and report information that is directly relevant to their management activities. A brief summary of the approach and of thresholds is given in Table K1. A detailed breakdown of activities and indicators is provided in the site specific management plans at Annex 5.

The assumption that expected climate, biodiversity and livelihood benefits will be achieved by the activities described in the management plans must be validated using evidence from the project area prior to the start of a second (or subsequent) project period. In addition to activity-based monitoring, projects should therefore collect data to assist with this validation. Plans for this are set out under ‘assessment

of expected benefits' below.

K1 Activity-based monitoring

Activity-based indicators are used to demonstrate whether the project is on track to achieve the expected climate, biodiversity and livelihood benefits. The specific indicators for each activity and for each site are as detailed in the management plans at Annex 5. Table K1 and the text below merely summarise a number of these and also explain thresholds for three levels of performance:

- Green – indicating that the project is on track to achieve the expected climate, biodiversity and livelihood benefits, and that any performance related payments or in kind support should be made in full.

- Orange – indicating that project activities have fallen short of those required to achieve the expected climate, biodiversity and livelihood benefits. If projects have one or more indicator at the orange performance level, corrective actions may be required and part of the performance related payment or in-kind support for that monitoring period should be withheld until it can be demonstrated that the a green performance level has been reached for all indicators.

- Red – indicating that project activities have fallen far short of those required to achieve expected climate benefits. If projects have one or more indicator at the red performance level, corrective actions are required and no performance related payments or in-kind support should be made until a green performance level has been reached for all indicators.

These approaches will be applied in relation to 1: evidence for ongoing support from herder groups for continuation of project activities: 2. Progress against specific indicators related to site specific project activities, as detailed in Annex 5; 3: evidence for the continuing capacity of the group to carry out project activities (see Table K1, overleaf).

Table K1. Annual performance indicators and thresholds to be assessed throughout the project period

Indicator	Thresholds			Means of Verification
1. Project area	● Green – There is evidence of ongoing support from the herder group, for project activities	● Orange – There are no obvious objections to continuation of project activities but evidence of ongoing support is not sufficient to determine if the whole herder group in favour them.	● Red – It has been clearly indicated that some or all of the herder group do not wish to continue with project activities	Meeting reports
2. Project activities	● Green – In the last 12 months: Pasture management; and Biodiversity conservation; and Livelihood improvement activities meet or exceed the minimum requirements described in the management plans. In summary these activities may include: • Compliance with annual pasture management plans designed to achieve modelled reductions in grazing pressure and hence carbon sequestration. • Establishment of herder partnerships for environmental protection • Annual mammal, bird and vegetation surveys – with increases in populations as specified in Annex 5 • Processing of named livestock products and sale – with indicators linked to improved household income and/ or volumes of named products produced per *heseg* per year Full details of activities, monitoring and indicators are given in Annex 5 management plans.	● Orange – In the last 12 months: Pasture management; and/or Biodiversity conservation; and/or Livelihood improvement activities have mostly been carried out as described in the management plan, but there have been some minor infringements or omissions	● Red – In the last 12 months there have been significant infringements or omissions of activities described in the management plan for: Grazing and fodder management; and/or Biodiversity conservation; and/or Livelihood improvement	Monitoring reports (see Annex 5)
3. Project management	● Green – The Herder Partnership: Has met at least once every three months for the last year; and Has the capacity and resources required to carry out all activities in the management plan, or a feasible plan for appropriate capacity building and/or resource procurement	● Orange – The Herder Partnership: Has met less than once every three months in the previous year; and/or Lacks the capacity or resources to carry out all of the activities in the management plan, and has no feasible plan for appropriate capacity building and/or resource procurement	● Red – The Herder Partnership has not met in the last six months	Meeting reports; Training/Resource needs assessments

The monitoring plans for each project intervention are summarized by site and by type (e.g. overall ES benefits, specific environmental and biodiversity impacts; socio-economic benefits) in the specific management plans (Annex 5). In some instances specific participatory indicators are designed to contribute to wider benefits – for example a number of the biodiversity indicators are not only about populations of key species but also relate to improved participation in management and governance of biodiversity (e.g. establishment of herders' partnerships; enhanced participation in environmental decision-making). These are key goals in themselves under national biodiversity planning and CBD commitments, as well as creating the context for enhanced protection and conservation of key habitats and species.

Assessment of expected benefits

Prior to the start of a second or subsequent project period the effectiveness of the project activities described in the management plan must be assessed, and the expected benefits updated accordingly. In this case this will entail measurements against 2019 targets for socio economic indicators in spring 2019, and as set out in Table F2.2. Validation of carbon benefits will be achieved through annual monitoring of above ground biomass from summer 2016 and at the end of the initial commitment period, in addition to annual monitoring of grazing management practices, to ensure compliance with figures on which the modelling is based. In addition:

- The changes to soil carbon stocks in the pilot project areas may also be assessed at the end of the first commitment period by limited sampling of soils in selected areas to determine whether they are in line with the model predictions for the project period. Default values in Table G5.3 of the Project Design Document will be updated accordingly.
- The impact of project activities on the indicator species listed in Table F3.2 will be assessed at the end of the fist commitment period (in addition to interim indicators set out in Annex 5) by repeating the survey approaches used to define baseline presence or absence and population sizes. Expected impacts on biodiversity will be updated accordingly.
- The impact of project activities on the livelihoods of herder groups will be assessed using the framework described in Part F2, and expected impacts on livelihoods will be updated accordingly.

Community involvement

Reporting activity-based indicators is the responsibility of the herder partnerships, who will be trained and supported by the project coordinator. Copies of all monitoring reports will be held by the herder partnerships and will be presented and discussed annually at a community meeting.

Annexes

Annex 1. List of key people involved with contact information

The main in-country Project Co-ordinators are the Mongolian Society for Range Management (MSRM):
D. Dorligsuren: Executive Director (d.dorlig@yahoo.com)
D. Dulmaa: Project Officer (dorjgotovd@yahoo.com)

Website: **http://www.msrm.mn**. Tel: 976-11-70151458

At the University of Leicester, UK:
C. Upton: External project support/ coordination (PI of Darwin 'Values and Valuation: New Approaches to Conservation in Mongolia' project). (cu5@le.ac.uk)

Webpage: **http://www2.le.ac.uk/departments/geography/people/cu5**.
Tel: +44 (0)1162523824.

Bioclimate project development support:
Nicholas Berry; Rob Harley; Mike Riddell: **nicholas.berry@brdt.org**; **rob.harely@brdt.org**; Mike.Riddell@brdt.org.

Annex 2. Information about funding sources

Since its inception, the project has received funding from the Darwin Initiative 'Values and Valuation: New Approaches to Conservation in Mongolia' project (2012-2015), worth £235,000 over the three year project period. A proportion of this budget has been invested in the development of the Plan Vivos through training and capacity building of participant communities, participatory planning and discussions.

A marketing plan for the project has been prepared in conjunction and with advice from Plan Vivo. We have had preliminary discussions with Zeromission on marketing PV project certificates. The project team has also identified a number of other potential purchasers of the certificates. These include i) companies/ stores who purchase and stock cashmere goods sourced from Mongolia (e.g. Edinburgh Woolen Mills); ii) (eco) tourism/ travel companies, both within Mongolia, where there are rapidly growing numbers of domestic travel agencies (e.g. Nomad Tours) and international companies and hotel chains with business interests in Mongolia (Kempinski Hotels; Exodus Travel; Cox and Kings; Responsible Travel; British Horse Society, who run horse-riding tours in Mongolia); iii) Mining companies.

Dr Upton is leading the marketing campaign, in conjunction with MSRM. We are also exploring opportunities for additional/ matching funding through donor funds (e.g. linking to GIZ funding for development of Local Protected Areas) and through state sources.

Annex 3. Producer/group agreement template

"Pastures, Conservation and Climate Action, Mongolia". Plan Vivo PES project in Mongolia.

This agreement is made this …… day of ……...in the year…….between the **Mongolian Society for Range Management (MSRM)** of Ikh Toiruu 49, khoroolol 12, 13381, Bayanzurkh district, Precinct 3, Ulaanbaatar, Mongolia hereinafter referred to as the "**Project Coordinator**"
AND Hongor *Ovoo heseg* (herder group) of Ikh Tamir *soum*, Arkhangai *aimag*, Mongolia. Its purpose is to provide terms and conditions agreed on by the above parties for the sale of ecosystem services under the Plan Vivo project "Pastures, Conservation and Climate Action, Mongolia".

WHEREAS the **Project Coordinator** has **agreed** to facilitate marketing and sale of carbon credits on behalf of the **Producer** to *(particulars of a-yet-to-be-identified buyer)* hereinafter referred to as the "**Buyer**" who has **agreed** to buy (*indicate quantity of credits*) at (*indicate price*) on conditions set out in this agreement.

WHEREAS the **Producer** has long term use rights over the piece of land described in **TABLE A** of this agreement and in the site specific Management Plan at Annex 5 of this document, with the approved attached Plan Vivo number…… and **agrees** to sell carbon credits to (particulars of buyer identified above) facilitated by MSRM, generated through implementing the land-use system described in the attached Plan Vivo (see Management Plan at Annex 5) for the period stipulated herein.

IT IS FURTHER AGREED AS FOLLOWS:
1. The agreement shall remain in force for 4 years (1st April 2015-31 March 2019)**.**

The Project Coordinator agrees:
1. To carry out monitoring of the participant's land/livelihood/ biodiversity conservation activities over the period, on a biannual or annual basis and against the targets agreed in in the site specific **Management Plan (Annex 5, Table A5 1a for Hongor *Ovoo heseg*)** and the end of project indicators (Tables F1, F2.2, F3.2).
2. To coordinate the purchase of carbon credits as demanded by the buyer from the Producer at a price agreed with the buyer and to pay the resultant amount (less 30%

for MSRM's organisational and project management costs) to the Producer in instalments based on achievement of annual and biannual targets as set out in the site specific **Management Plan (Annex 5)** where results of monitoring show that the corresponding targets have been met. It is proposed to allocate 30% of total payments in year 1, with 20% each in Years 2, 3 and 4. These will be disbursed twice per year in equal amounts and dependent on achievement of the specific agreed targets as set out in the **Management Plan (Annex 5).** Where one or more targets are not fully met, part of the performance related payment may be withheld, in accordance with the procedures and triggers set out in Section K.

The Producer agrees:

1. To implement activities (summarized in **Management Plan, Annex 5**) and carry out management actions, monitoring and reporting as set out in their Plan Vivo number……(**Management Plan, Annex 5**) and to implement any corrective actions prescribed during the monitoring process.
2. To deposit **10%** of the credits as stipulated in **Table A** in a risk buffer maintained by the Project Coordinator.
3. To refrain from entering into any ecosystem service/ carbon sale agreement with any other party in respect of the same plan vivo and its associated activities.
4. To inform the project coordinator of any circumstances arising which prevent them from continuing with any of the management activities in their Plan Vivo.

Table A: Plan Vivo details

Participant:	Hongor *Ovoo heseg*
Location:	Ikh Tamir *soum*, Arkhangai *aimag* (plan showing boundaries attached)
Plan Vivo ID number	(tbc)
Total C benefit	
Biodiversity benefits	(the number of certificates is based on carbon, with 1 certificate denoting sequestration of 1t carbon. Biodiversity benefits are diverse in nature and quantity. See Management Plan. A single figure for biodiversity benefits can therefore not be calculated. However, meeting biodiversity targets is linked to disbursement of payments, see Section K. The price of certificates to purchasers also reflects these co benefits).
Livelihood benefits	(the number of certificates is based on carbon, with 1 certificate denoting sequestration of 1t carbon. Livelihood benefits are diverse in nature and quantity. See Management Plan. A single figure for livelihood benefits can therefore not be calculated. However, meeting livelihood targets is linked to disbursement of payments, see Section K. The price of certificates to purchasers also reflects these co benefits).
Buffer	10%
Total benefits eligible for payment (C, biodiversity and livelihood benefits, minus buffer and MSRM allocation)	32218 (t CO_2eha)
Price	(tbc)
Total payment ($)	Example payments: £5/ certificate =£161088 ; £8/ certificate = £257740
Account/ other payment details	(tbc)

(signatures have been collected for most participating households. The final few signatures are awaited from households away from the *soum* at present. This applies for all 3 sites).

Annex 4. Database template

The project will use the Plan Vivo database template.

Annex 5. Example Management Plans/Plan Vivos

Management plans for each project site describe the project activities and locations (including the maps in Part B1 of the Project Design Document and produced again here). These GIS maps are the Plan Vivos developed with participating herder groups/ *heseg*, as finalized and confirmed in September/ October 2014. Further evidence of the participatory process by which these and the overall management plans were developed is included at Annex 7. Some of the planned activities lack a specific spatial component (e.g. processing of felt; increased herders' participation in environmental decision-making). These are described further in the following management plans and summarized in the following site specific tables.

Specific monitoring indicators (including indicators of ES benefits, specific environmental and biodiversity impacts; socio-economic benefits) and thresholds for each site are also described. In some instances specific participatory indicators are designed to contribute to wider benefits – for example a number of the biodiversity indicators are not only about populations of key species, but also relate to improved participation in management and governance of biodiversity (e.g. establishment of herders' partnerships; enhanced participation in environmental decision-making). These are key goals in themselves under national biodiversity planning and CBD commitments, as well as creating the context for enhanced protection and conservation of key habitats and species.

Development of detailed plans and indicators with Dert *heseg*, Ulziit are scheduled to take place during 2015-16, with a view to including them in the PV mechanism from summer 2016 if possible, or if not then in the next round of commitments.

For the remaining three sites, tables below summarise the planned activities, activity-based indicators and monitoring plans. For socio-economic indicators these include interim indicators which are readily measured and tracked by participating HG/ *heseg* – for example numbers of shelters/ fences repaired each year, % of households preparing hay for the winter, volumes of felt. These are therefore complementary to the end of the 1st four year commitment period indicators set out in Part F. The latter Part F indicators are not repeated below, except where they also form part of interim monitoring. Some indicators will be monitored biannually, others annually only, depending on the nature of the activity and as specified overleaf.

Data on seasonal grazing pressure, stocking rates and biomass utilization under baseline and with project scenarios has been used to calculate carbon benefits for sites, through the methodology and pilot study report in Annexes 8 and 9 respectively, and with due account of uncertainties and default values, as set out in Section G6. Site specific data tables for stocking rates and associated carbon benefits are appended here, after the relevant management plans.

Table A5. 1a): Management plan by project intervention, Hongor *Ovoo heseg*, Ikh Tamir, Arkhangai *aimag*					
Project Interventions	**Specific Activities (2015-2019)**	**Result/ Outcome**	**Monitoring details/ protocols**	**Indicator (1) & targets**	**Indicator (2/3):**
Pasture management (incl. C sequestration)	Develop & implement annual schedule for seasonal pasture use (rotation).	Herder group (HG)/ *heseg* members have annual schedule for seasonal camps/ pasture use approved by HG meeting, local administration (LA) and MSRM. Herder group members comply with schedule. From Year 1 'with project' schedule to be equivalent to 50% grazing pressure or less across seasonal pasture areas and taking account of pasture biomass etc. to meet carbon sequestration targets in accordance with carbon modelling (Tables 1c, 1d).	2 x p.a. Self-reported by *heseg* members, subject to biannual confirmation by MSRM August/ September 2015, February/ March 2016, then repeated at same intervals for PV project duration.	• Development of agreed annual schedule (approved by HG members & LA (by end March each year), and which is equivalent to 50% grazing pressure or less for seasonal pasture areas and in accordance with carbon modelling. Any subsequent updates/ changes also agreed and approved by same parties. • 1% reduction in livestock (sheep units) against baseline by end March 2017; 3% by end March 2018; 5% by end March 2019. • % of HG households that comply with schedule (70% in summer and winter 2015; 80%, 2016, 90% 2017, 90-100% 2018/19).	• Average annual mobility (km pa) by household. Baseline developed through socio-economic survey. Indicators will be year in year increase in *heseg*/ HG mean km pa.
	Organise seasonal camping in underused areas (Khanuin gol, Khukh *nuur*).	Improved pasture conservation through using reserve (less used) pasture and camping.	Built into pasture use planning – above. No other specific indicators or monitoring for this activity.		
Biodiversity conservation	Establish herders' partnership to protect local environment at each mountain pass in the herder group area.	Objectives, work plans, responsibilities, mission statements and registration documents for herder groups produced. Herder groups able to conduct collaborative work to protect local habitat, through collaboration with LA.	Herder groups will report to local administration on planned and conducted activities at quarterly meetings. Copies of reports, with LA confirmation of activities to be supplied to MSRM biannually (June, Dec).	MoUs signed by herder group partnerships by end 2015.	Work plans and objectives of herder groups are documented by the project and completed according to agreed work plans, according to biannual targets set out in MoU. (indicators can be updated for 2016 onwards once indicator 1 is achieved and according to targets agreed therein).
	Cooperate in groups for forest cleaning and protection.	Reduced decline of forest habitat and target mammal and plant species.	Annual bird and vegetation surveys, highlighting improved population of target species conducted by *heseg*. Self-reported 'cleaning' (removal of dead	July/ August 2015: forest patrol routes established, baseline vegetation and bird surveys completed (ZSL). By end 2015 cleaning of initial 2ha area. Summer 2016 – 1 repeat vegetation survey and bird survey conducted and reported against baselines. Cleaning of	Statistically significant increase in populations of key species by 2019 against 2015 baselines.

			undergrowth to encourage natural regeneration) of target 2 ha per year	further 2ha area by end 2016. Summer 2017- repeat vegetation and bird surveys conducted and reported against baselines. Cleaning of further 2ha area by end 2017. Summer 2018 –repeat vegetation and bird surveys conducted. All surveys will use agreed protocols supplied by ZSL. ZSL will train *heseg* members in vegetation surveys in 2015/16. Other surveys to be carried out by ZSL.	
	Increased herders' participation in decision-making on environmental issues - e.g. licenses for wood cutting.	Develop a herder representative committee to liaise with local administration (may be linked to herders' partnership, above).	Meeting minutes, as supplied by the committee to show input into decision making process by *heseg*. Independently validated on annually by LA/ MSRM.	By September 2015 herder committees are established and recognised and integrated into local administration decision making process for environment issues.	Subsequent indicators are annual/ biannual targets met, as set by the committee. (Indicators can be updated for 2016 onwards once indicator 1 is achieved & according to targets agreed therein).
	Production of tree seedlings (native species) for reforestation.	Nurseries established to produce birch, fir and larch seedlings. Initial planting activities completed. Enhanced provision of forest habitat to native species.	Each planted sapling will be mapped and surveyed to indicate successful development into maturation.	By end 2016 nursery is established and has produced first year of seedlings ready for planting.	By end 2017 200 saplings have been replanted in *soum* forest area. By end 2018 1000 saplings have been planted.
Socio-economic (incl. risk management)	Repair fences & winter/spring shelters.	20 shelters/ fences repaired.	Self-reported. Annual verification by MSRM.	5 fences/ shelters p.a. 1st monitoring spring 2016.	
	Collaborative production & marketing of local brand milk products.	Increased income through marketing milk products.	Self-reported; *heseg* accounts and meeting minutes. Annual verification by MSRM.	Local brand named milk products produced end 2015. Collaboration on processing & marketing within *heseg* by end 2016- reported in meeting minutes. Cooperative established end 2017.	Enhanced household income by end 2016 and in subsequent years – (% households with increased income, against baseline).
	Gathering and sale of wild fruit & nuts.	Increased income.	Self-reported; *heseg* accounts and meeting minutes. Annual verification by MSRM.	Enhanced household income by end 2016 and in subsequent years (% households with increased income, evaluated against baseline)	
	Comb yak wool & deliver to markets.	Increased income through marketing wool/ wool products.	Self-reported; *heseg* accounts and meeting minutes. Annual verification by MSRM.	Enhanced household income by end 2016 and in subsequent years – (% households with increased income, evaluated against baseline; year on year increase).	
For all activities – see also end of project indicators, to be monitored against existing baselines in 2019 only (except where otherwise specified above) – as set out in Table F2.2 (livelihoods), F3.2 (biodiversity) and Section G/ Annex 8 (carbon benefits)					

Table A5. 1b): Project Intervention Areas, Hongor *Ovoo heseg*, Ikh Tamir, Arkhangai *aimag*

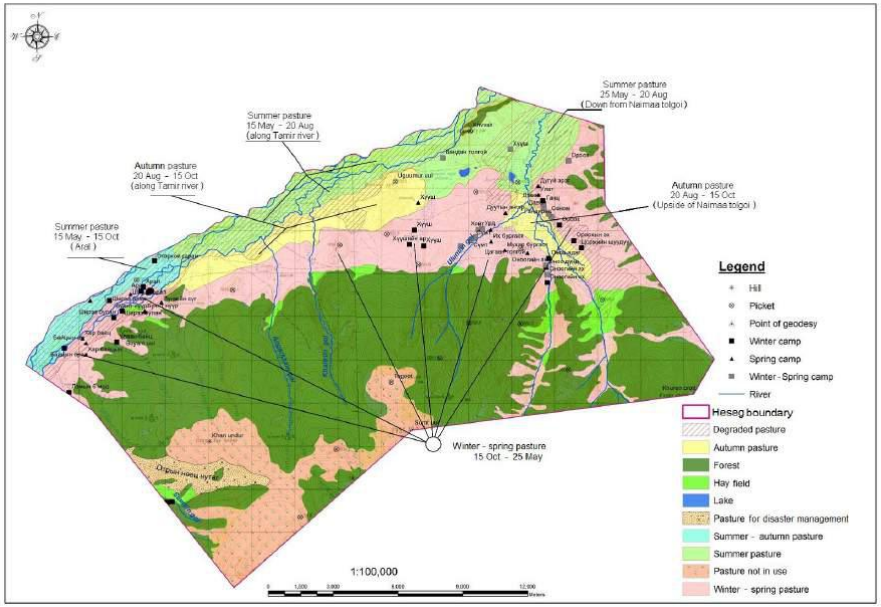
	Data requirement i)	Data requirement ii)	Data requirement iii)
Pasture management	a) Area in hectares (ha) of each key pasture area, according to planned grazing activities (summer, winter, autumn pastures etc.): ***Winter-Spring pasture*** (15 Oct-25 May) /Ha/-7883.2 ***Summer pasture*** (15 May- 20 Aug) /Ha/-4030.85 ***Autumn pasture*** (20 Aug-15 Oct) /Ha/-2345. b) Areas/ boundaries of underused pasture (Khanuin gol and mountain area of Khukh nuur), where camping is planned under PV: see pasture area map.	Coordinates for each key pasture area a) ***Winter-Spring pasture*** Lat 47°29'30.78"N Long 101° 4'18.49"E ***Summer pasture*** 1 Lat 47°30'42.69"N Long 100°58'47.22"E 2 Lat 47°31'44.63"N Long 101° 6'21.90"E ***Autumn pasture*** 1 Lat 47°30'0.80"N Long 100°59'25.11"E 2 Lat 47°29'23.40"N Long 101° 6'57.85"E ***Summer- Autumn pasture*** Lat 47°28'37.04"N Long 100°52'7.29"E	Map showing boundaries of each key pasture area (jpeg), supported by GIS file. (a and b) 
Forest cleaning/ protection	Planned area and locations where forest protection will take place: To be confirmed in planning meetings of herder partnerships with *soum* administration, April 2015.	Coordinates for planned areas to be taken under protection: (tbc April 2015)	
Herders partnership for protection of environment at mountain pass areas	Coordinates for the mountain pass areas: **Ikh Ulunt** Partnerships Lat 47°27'17.93"N Long 101° 5'19.69"E **Khaluun Us** Partnerships Lat 47°26'55.65"N Long 100°54'31.80"E	**Mandal** Partnerships Lat 47°27'12.99"N Long 100°57'49.78"E **Neg sanaa** Partnerships Lat 47°27'51.65"N Long 47°27'51.65"N **Shiree bulan** Partnerships Lat 47°25'51.56"N Long 100°52'4.57"E	

Table A5 1C: Grazing management, stocking rates and biomass utilisation, Hongor *Ovoo heseg*, Ikh Tamir *soum*

	Location 1	Riparian meadow		Mountain meadow			Mountain steppe		
		Spring/Summer/Fall	Summer	Winter	Summer/Fall	Winter/Spring	Fall	winter/spring	summer/fall
1.1	**description of baseline grazing practices**								
	number of days grazing in location	148	87	161	143	222	56	222	143
	average number of moves (camps) in this location	2	1	1	2	2	1	2	2
	average number of sheep units grazing in this location	3222.6	8125.8	3948.6	2224.3	6357.8	8125.8	8106.5	4840.2
	area (ha)	1,483.5	2,651.2	4,639.4	786.4	2,169.1	1,647.9	4,481.8	1,292.6
	yield (kg DM ha)	**757**	**735.4**	**1000**	**414**	**1000**	**414**	**1000**	**414**
	total yield (kg DM)	1123009.5	1949699.8	4639370.0	325569.6	2169100.0	682214.0	4481800.0	535144.7
1.2	**estimation of biomass utilization rate**								
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	74.0	87.0	161.0	71.5	111.0	56.0	111.0	71.5
	total biomass demand	333861.4	989722.4	890014.4	222652.4	988002.1	637062.7	1259750.1	484504.0
	estimated biomass utilization rate (%)	**0.3**	**0.5**	**0.2**	**0.7**	**0.5**	**0.9**	**0.3**	**0.9**
2.1	**description of with-project grazing**								
2.1.1	**Year 1 (i.e. first year implementation)**								
	number of days grazing in this location	148	69	162	160	206	56	223	143
	average number of moves (camps) in this location	4	2	1	3	2	2	3	3
	average number of sheep units grazing in this location	3222.6	8125.8	3948.6	2224.3	6357.8	8125.8	8106.5	4840.2
	area (ha)	1,483.5	2,651.2	4,639.4	786.4	2,169.1	1,647.9	4,481.8	1,292.6
	yield (kg DM ha)	**757**	**735.4**	**1000**	**414**	**1000**	**414**	**1000**	**414**
	total yield (kg DM)	1123009.5	1949699.8	4639370.0	325569.6	2169100.0	682214.0	4481800.0	535144.7
2.1.2	**estimation of sustainable carrying capacity**								
	recommended biomass utilization rate	0.3	0.3	0.3	0.5	0.5	0.5	0.3	0.5

	(%)								
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	37	35	162	53	103	28	74	48
	total number of SU that can be grazed to sequester carbon	6503.9	12109.9	6136.7	2180.2	7521.2	8701.7	12920.0	4009.6
		0.50	**0.67**	**0.64**	**1.02**	**0.85**	**0.93**	**0.63**	**1.21**
2.1.3	**Year 2 (1/4/16-31/3/17) 1% reduction in livestock numbers against 2014 baseline**								
	number of days grazing in this location	148	50	161	160	181	56	222	143
	average number of moves (camps) in this location	4	2	1	3	2	2	3	3
	average number of sheep units grazing in this location	3190.0	8045.0	3909.0	2202.0	6294.0	8045.0	8025.0	4792.0
	area (ha)	1,483.5	2,651.2	4,639.4	786.4	2,169.1	1,647.9	4,481.8	1,292.6
	yield (kg DM ha)	**2819.7**	**3,381**	**4905.9**	**3430.2**	**5023.3**	**2103.2**	**3506.5**	**1107.1**
	total yield (kg DM)	4183025.0	8962945.6	22760285.3	2697509.3	10896040.0	3465779.2	15715431.7	1431059.6
	estimation of sustainable carrying capacity								
	recommended biomass utilization rate (%)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	37	25	161	53	91	28	74	48
	total number of SU that can be grazed to sequester carbon	24226.0	76825.2	30293.2	10838.2	25799.6	26523.8	45508.0	6433.3
		0.13	**0.10**	**0.13**	**0.20**	**0.24**	**0.30**	**0.18**	**0.74**
	Year 3 (1/4/17-31/3/18) 3% reduction in livestock numbers against 2014								
	number of days grazing in this location	148	50	161	160	181	56	222	143
	average number of moves (camps) in this location	4	2	1	3	2	2	3	3
	average number of sheep units grazing in this location	3126.0	7882.0	3830.0	2157.6	6167.1	7882.0	7863.3	4694.8

	area (ha)	1,483.5	2,651.2	4,639.4	786.4	2,169.1	1,647.9	4,481.8	1,292.6
	yield (kg DM ha)	**2819.7**	**3,381**	**4905.9**	**3430.2**	**5023.3**	**2103.2**	**3506.5**	**1107.1**
	total yield (kg DM)	4183025.0	8962945.6	22760285.3	2697509.3	10896040.0	3465779.2	15715431.7	1431059.6
	Est. sustainable carrying capacity								
	recommended biomass utilization rate (%)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	37	25	161	53	91	28	74	48
	total number of SU that can be grazed to sequester carbon	24226.0	76825.2	30293.2	10838.2	25799.6	26523.8	45508.0	6433.3
		0.13	**0.10**	**0.13**	**0.20**	**0.24**	**0.30**	**0.17**	**0.73**
	Year 4 (1/4/18-31/319) 5% reduction in livestock numbers against 2014 baseline								
	number of days grazing in this location	148	50	161	160	181	56	222	143
	average number of moves (camps) in this location	4	2	1	3	2	2	3	3
	average number of sheep units grazing in this location	3061.5	7719.5	3751.2	2113.0	6057.9	7719.5	7701.2	4598.2
	area (ha)	1,483.5	2,651.2	4,639.4	786.4	2,169.1	1,647.9	4,481.8	1,292.6
	yield (kg DM ha)	**2819.7**	**3,381**	**4905.9**	**3430.2**	**5023.3**	**2103.2**	**3506.5**	**1107.1**
	total yield (kg DM)	4183025.0	8962945.6	22760285.3	2697509.3	10896040.0	3465779.2	15715431.7	1431059.6
	estimation of sustainable carrying capacity								
	recommended biomass utilization rate (%)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	37	25	161	53	91	28	74	48
	total number of SU that can be grazed to sequester carbon	24226.0	76825.2	30293.2	10838.2	25799.6	26523.8	45508.0	6433.3
		0.13	**0.10**	**0.12**	**0.19**	**0.23**	**0.29**	**0.17**	**0.71**

Table A5 1d –Carbon Uptake Calculations, Hongor Ovoo *heseg*.										
Hongor *Ovoo*, Ikh Tamir	**1. Area (ha)**	**2. Additional carbon uptake per ha pa at 30% grazing pressure (with project)** (PE(SOC,m,t))	**3.Maximum additional carbon uptake pa for 30% grazing pressure (column 1x2)**	**4. Actual additional carbon uptake at 30% over 4 year project***	**5. Additional carbon uptake per ha pa at 40% grazing pressure (with project)** (PE(SOC,m,t))	**6.Maximum additional carbon uptake pa for 40% grazing pressure (column 1x5)**	**7. Actual additional carbon uptake at 40% over 4 year project***	**8. Additional carbon uptake per ha pa at 50% grazing pressure (with project)** (PE(SOC,m,t))	**9.Maximum additional carbon uptake pa for 40% grazing pressure (column 1x8)**	**10. Actual additional carbon uptake at 50% over 4 year project***
Riparian Meadow		*(CENTURY model)*			*(CENTURY model)*			*(CENTURY model)*		
Mar- Aug	1485.3	1.1600	1723	6892	0.5468	812	0	0.0156	23	0
May-Aug	2652	1.0274	2725	10899	0.6652	1764	0	0.3699	981	0
Mountain Meadow										
Oct-Mar	4639.8	0.2133	990	3959	0.1004	466	0	0.0656	304	0
May-Oct	786.4	1.523	1198	3593	0.7123	560	0	-0.0664	-52	-52
Oct-May	2169.1	1.0025	2175	6524	0.9822	2130	0	0.9497	2060	2060
Mountain Steppe										
Aug-Oct	1,647.9	0.7534	1241	3724	0.4139	682	0	0.1209	199	199
May-Oct	1,292.6	0.8923	1153	3460	0.323	418	0	-0.0652	-84	0
Oct-May	4,481.8	0.5512	2470	9881	0.4528	2029	0	0.2836	1271	0
Total carbon uptake for 30%, 40% and 50 % grazing pressure				**48932**			**0**			**2207**
Total carbon uptake (For 4 year period without risk deduction)	51139	*these 'actual' figures are calculated from the grazing management spreadsheet A51c1a, by adding up the number of years at a particular grazing pressure for each pasture type from Year 1-Year 4 (i.e. under 'with project' scenarios), and hence the total area and change in carbon uptake for that pasture type at 30%, 40% and 50% grazing pressure. Where stocking rates exceed 50% grazing pressure, additional carbon uptake against the baseline is conservatively assumed to be zero. The CENTURY modelled figures are those for changes against baseline levels (PE(SOC,m,t))- see Table G5.3 for baselines for various pasture types.								
10% risk deduction	5114									
Total carbon uptake (4 year period with risk deduction)	46025									

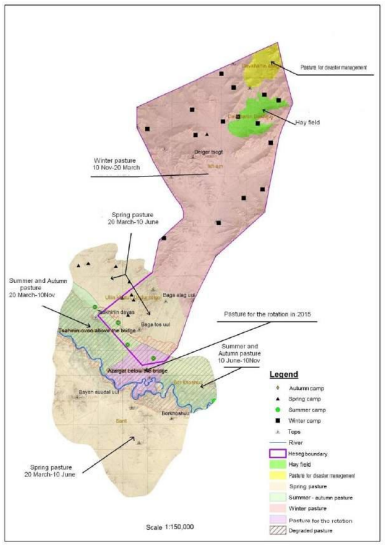
Table A5 2a): Management plan by project intervention, Ikh Am *heseg*, Undurshireet, Tov *aimag*

Project Interventions	Specific Activities (2015-2019)	Result/ Outcome	Monitoring details/ protocols	Indicator (1) & targets	Indicator (2/3)
Pasture management (incl. C sequestration)	Develop & implement schedule for seasonal pasture use (rotation).	Herder group (HG)/ *heseg* members have annual schedule for seasonal camps/ pasture use approved by HG meeting, local administration (LA) and MSRM. Herder group members comply with schedule. From Year 1 'with project' schedule to be equivalent to 50% grazing pressure or less across seasonal pasture areas and taking account of pasture biomass etc. to meet carbon sequestration targets in accordance with carbon modelling (Tables 1c, 1d).	2 x p.a. Self-reported by *heseg* members, subject to biannual confirmation by MSRM August/ September 2015, February/ March 2016, then repeated at same intervals for PV project duration.	• Development of agreed annual schedule (approved by HG members & LA (by end March each year), and which is equivalent to 50% grazing pressure or less for seasonal pasture areas and in accordance with carbon modelling. Any subsequent updates/ changes also agreed and approved by same parties. • 10% reduction in livestock (sheep units) against baseline by end March 2017; 20% by end March 2018; 30% by end March 2019. • % of HG households that comply with schedule (70% in summer and winter 2015; 80%, 2016, 90% 2017, 90-100% 2018/19).	• Average annual mobility (km pa) by household. Baseline developed through socio-economic survey. Indicators will be year in year increase in *heseg*/ HG mean km pa.
	Dig hand wells.	2 new hand wells created, enhancing water supply in currently under-used pasture areas.	Photographic evidence supplied by *heseg*. Confirmation by MSRM.	1 well completed by end 2015; 1 well completed by end 2016.	
Biodiversity conservation	Protect red deer, argali, marmot and Mongolian gazelle - through conservation measures outlined in the IUCN summary Action Plans for the target species.	Enhanced populations of target species as measured against baselines.	Camera traps will be used to define species' local distribution. Manned surveys will be conducted to confirm the baseline population (summer 2015). Established methods of data collection and analysis, approved by ZSL, will be used. 2015 to 2019 will involve annual camera trap surveys of 30 cameras active for up to 1 month at the site managed by ZSL, in conjunction with *heseg* members. Annual reports in August/ September	Baseline survey (manned survey and camera trap methods) of each target species completed and reported by project team (ZSL) by beginning of September 2015. 4-5 local *heseg* herders trained in manned survey methods – by beginning of September 2015. For manned surveys, baseline and subsequent surveys will comprise 4 events per year over the summer from May to August, repeated at the same times and locations annually. Monitoring information pack produced for manned surveys by (ZSL), including	Work plans and objectives of herder groups are documented by the project and completed according to agreed work plans.

			each year.	standardised data collection sheets, for herders to use and complete: summer 2015. Annual manned surveys completed and reported to ZSL by herders trained by ZSL and using approved methods and data sheets. ZSL to check and report to MSRM. From 2015 baseline Annual camera trap surveys completed and reported (by ZSL). By 2019 statistically significant increase in target population size of each target species against 2015 baselines.	
	Protect bushes at Ovootiin and clean area (collect rubbish brought downriver from Ulaanbaatar and deposited locally)	Area of 3ha fenced in order to prevent ungulates from grazing willow saplings; planting of new areas.	ZSL report confirming benefits of fencing and lack of adverse impacts on wider grazing patterns and mobility, and evaluation of alternatives (e.g. collars) (summer 2015). Training of herders (e.g. in collaring trees) as appropriate. Photographic evidence of fence/ collars, confirmed by MSRM (December 2015). Annual reports and photographic evidence of any new planting, confirmed by MSRM. Also to include photographic evidence of and reports on cleaning/ litter collection (3x per year)	Area of 3ha at Ovootiin is fenced by end of 2015 OR trees protected using collars, according to recommendations of ZSL report in summer 2015. Area free of litter. Planting of additional 0.5 ha in 2016, 2017, 1ha in 2018. Recreational/ aesthetic qualities of area improved through *heseg* members' regular litter collection.	

Socio-economic (incl. risk management)	Repair fences & winter/spring shelters.	10 shelters/ fences repaired p.a.	Self-reported. Annual verification by MSRM.	10 fences/ shelters p.a. 1st monitoring December 2015.	
	Collaborative production & marketing of milk and curd in season.	Increased income through marketing milk products.	Self-reported; *heseg* accounts and meeting minutes. Annual verification by MSRM.	Enhanced household income by end 2016 and in subsequent years – linked to milk products (% households with increased income, evaluated against baseline).	
	Produce felt and deliver to markets.	Increased income through marketing wool/ wool products.	Self-reported; *heseg* accounts and meeting minutes. Annual verification by MSRM.	*Heseg* produces 100m felt from own prepared wool by end 2015 and markets it. *Heseg* produces a further 150m by end 2016. *Heseg* produces 200m in 2017 and 250m in 2018. Enhanced household income by end 2015 and in subsequent years (% households with increased income, evaluated against baseline).	
	Hay preparation.	Establishment of *heseg* hayfield. Every *heseg* family to prepare hay annually.	Self-reported; *heseg* meeting minutes. Annual verification by MSRM.	Establishment of hayfield by end 2015. Increased % of *heseg* households with adequate hay provision year on year from end 2015. Annual targets to be confirmed by *heseg* end 2015.	Year in year targets to be updated on *heseg* confirmation/ reporting end 2014

For all activities- see also end of project indicators, to be monitored against existing baselines in 2019 only (except where otherwise specified above) – as set out in Table F2.2 (livelihoods), F3.2 (biodiversity) and Section G/ Annex 8 (carbon benefits).

Table A5. 2b): Project Intervention Areas, Ikh Am *heseg*, Undurshireet, Tov *aimag*			
	Data requirement i)	**Data requirement ii)**	**Data requirement iii)**
Pasture management	Area in hectares (ha) of each key pasture area, according to planned grazing activities: ***Winter pasture*** (10 Nov-20 March) - 13666.7 ha ***Spring pasture*** (20 march-10 June)-4438.3 ***Summer-Autumn pasture*** (10 June-10 Nov)-3918.8 ha	Coordinates for each key pasture area: ***Winter pasture*** Lat 47°25'30.97"N Long 105°23'11.92"E ***Spring pasture*** Long 47°22'17.73"N Lat 105°17'45.32"E ***Summer- Autumn pasture*** Lat 47°19'20.18"N Long 105°16'53.93"E	Map showing boundaries of each key pasture area (jpeg), supported by GIS file 
Take under protection bushes at Ovootiin island	(see pasture use map)	Lat 47°18'2.79"N Long 105°18'24.32"E	

Tables for grazing management, stocking rates and biomass utilisation and carbon calculations for Ikh Am are included in main body of text as F1a and F1c respectively**.**

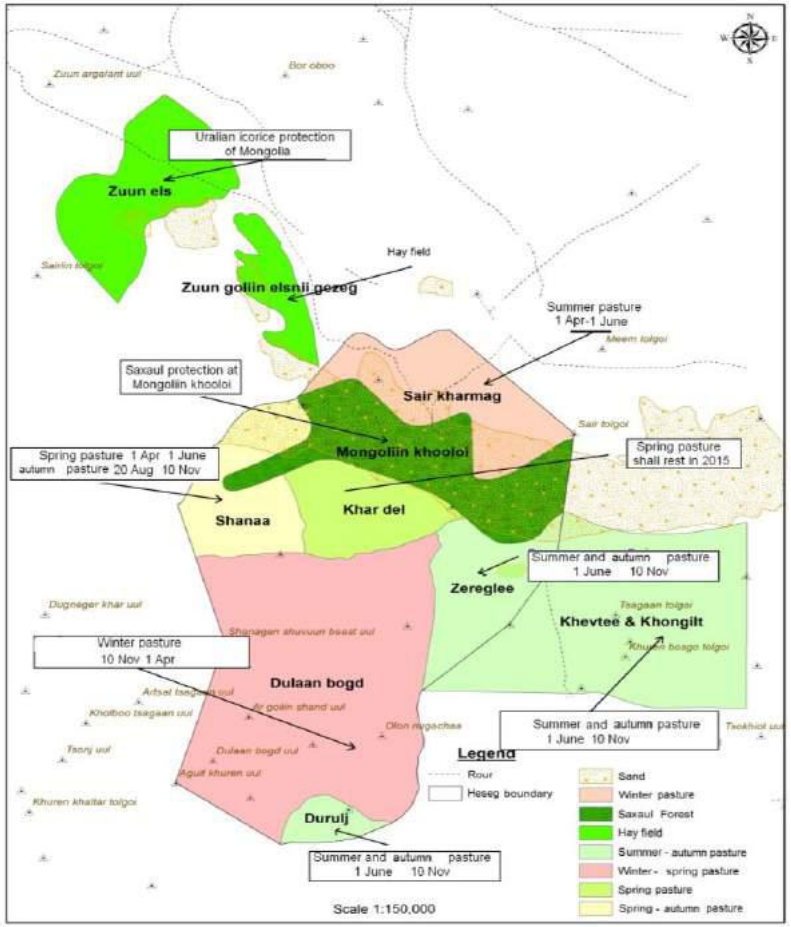
Table A5 3a): Management plan by project intervention, Dulaan Khairkhan HG, Bogd, Bayanhongor *aimag*

Project Interventions	Specific Activities (2015-2019)	Result/ Outcome	Monitoring details/ protocols	Indicator (1) & targets	Indicator (2/3)
Pasture management (incl. C sequestration)	Develop & implement schedule for seasonal pasture use (rotation).	Herder group (HG)/ *heseg* members have annual schedule for seasonal camps/ pasture use approved by HG meeting, local administration (LA) and MSRM. Herder group members comply with schedule. From Year 1 'with project' schedule to be equivalent to 50% grazing pressure or less across seasonal pasture areas and taking account of pasture biomass etc. to meet carbon sequestration targets in accordance with carbon modelling (Tables 1c, 1d).	2 x p.a. Self-reported by *heseg* members, subject to biannual confirmation by MSRM August/ September 2015, February/ March 2016, then repeated at same intervals for PV project duration.	• Development of agreed annual schedule (approved by HG members & LA (by end March each year), and which is equivalent to 50% grazing pressure or less for seasonal pasture areas and in accordance with carbon modelling. Any subsequent updates/ changes also agreed and approved by same parties. • 1% reduction in livestock (sheep units) against baseline by end March 2017; 3% by end March 2018; 5% by end March 2019. • % of HG households that comply with schedule (70% in summer and winter 2015; 80%, 2016, 90% 2017, 90-100% 2018/19).	• Average annual mobility (km pa) by household. Baseline developed through socio-economic survey. Indicators will be year in year increase in *heseg*/ HG mean km pa.
	Organise seasonal camping in underused areas	Improved pasture conservation through using reserve (less used) pasture and reducing grazing pressure in other areas.	Built into pasture use planning – above. No other specific indicators or monitoring for this activity.		

	Protection of Argali, Ibex and goitered gazelle.	Baselines for target species populations are established. Capacity to conduct monitoring is established. Enhanced populations of target species as measured against baselines.	Production of baseline. Established wildlife survey methods used and detailed in the summer 2015 report to allow for replication. ZSL to approve methods and analysis. Ongoing wildlife monitoring methods will be developed and approved by ZSL in conjunction with HG members. Monitoring schedule will be developed collaboratively and submitted to MSRM by ZSL summer 2015.	Manned survey and camera trapping completed and reported by September 2015. 30 cameras active for up to 1 month for camera trapping. 4-5 herders from *heseg* trained in manned survey methods. For manned surveys, baseline and subsequent surveys will comprise 4 events per year over the summer from May to August, repeated at the same times and locations annually. Monitoring info pack produced for manned surveys by (ZSL), including standardised data collection sheets, for herders to use and complete: summer 2015. Annual manned surveys completed and reported to ZSL by herders trained by ZSL and using approved methods and data sheets. ZSL to check and report to MSRM. Subsequent annual HG activities completed in accordance with agreed monitoring schedules.	Current population sizes of target species confirmed by summer 2015. Trend data on target populations established by the end of 2015 and to continue at least to 2018. By 2019 the populations of each of the three target species have shown a statistically significant increase from the baseline taken in 2015.
Biodiversity conservation	Protection of saxaul forest.	Regular controlled monitoring of saxaul forest by HG established. Patrol routes, times and staff will be recorded and, where necessary, amended by the *soum* government and pasture user groups. Throughout 2015 the project should analyse data collected by the patrols and use	Annually – by HG. Verified by MSRM. Patrol routes, times and staff recorded, data presented and analysed by HG. Provided to MSRM on annual basis.	By September 2015 – Baseline number of stumps estimated (indicative of extent of illegal cutting). December 2015: Management plan developed and approved with local administration.	By end 2016 –number of new stumps decreased by 25% on 2015 data. End 2017 – Number of stumps decreased by 50% on 2015 data. By 2018 number of stumps reduced by >80% on 2015 data.

		it to make management decisions regarding protection activities.			
	Plant sea buckthorn.	Sea buckthorn plantation established.	Signed and stamped letter of authorisation by local administration head –to indicate previous uses of sites and confirm no loss of significant areas for biodiversity conservation. Self-reported planting confirmed by photographs. Verified and mapped (incl GPS coordinates) by MSRM.	Gain written local administration authorisation for planting – by September2015.	By end September 2015 an area of 0.5ha has been planted with alfalfa and sea buckthorn. By September 2016 1ha has been planted, by 2017 a total of 1.5ha is planted.
Socio-economic (incl. risk management)	Repair fences & winter/spring shelters	5 shelters/ fences repaired p.a.	Self-reported. Annual verification by MSRM.	5 fences/ shelters p.a. 1st monitoring December 2015.	
	Establish greenhouse for vegetable production and grow vegetables.	HG has greenhouse. Regular sales of vegetables to local markets (linked to enhanced income and livelihood diversification).	Self-reported; *heseg* accounts and meeting minutes. Annual verification by MSRM.	Greenhouse established by December 2015.	Enhanced household income by end 2015 and in subsequent years – linked to vegetable production (% households with increased income, evaluated against baseline).
	Hay preparation	Every *heseg* family to prepare hay annually.	Self-reported; *heseg* meeting minutes. Annual verification by MSRM.	Increased % of *heseg* households with adequate hay provision year on year from end 2015. Annual targets to be confirmed by *heseg* end 2015.	

For all activities – see also end of project indicators, to be monitored against existing baselines in 2019 only (except where otherwise specified above) – as set out in Table F2.2 (livelihoods), F3.2 (biodiversity) and Section G/ Annex 8 (carbon benefits)

Table A5 3b): Project Intervention Areas, Dulaan Khairkhan Herder Group			
	Data requirement i)	**Data requirement ii)**	**Data requirement iii)**
Pasture management	a) Area in hectares (ha) of each key pasture area, according to planned grazing activities (summer, winter , autumn pastures etc.): ***Winter-spring pasture*** :(10 Nov-1 June)-9590 ha ***Winter pasture*** :(10 Nov-1 Apr)-2822 ha ***Summer- Autumn pasture:*** (1 June-10 Nov) 2589 ha ***Spring & autumn pasture*** :(1 Apr-1 June, 20 Aug-10 Nov)-2158 ha	Coordinates for each key pasture area (including Khar Delt); a) Coordinates of Each key pasture area: ***Winter-spring pasture:*** Lat 44°56'32.61"N Long100°56'5.05"E ***Winter pasture:*** Lat45° 3'59.66"N Long100°59'9.00"E ***Summer- Autumn pasture:*** 1 Lat 44°53'7.89"N Long 100°56'9.82"E 2 Lat 44°59'5.00"N Long 101° 0'36.23"E ***Spring & autumn pasture:*** Lat 45° 0'51.49"N Long 100°53'35.75"E **Khar delt (to be rested in 2015)** Lat 45° 0'40.84"N Long 100°57'6.98"E	Map showing boundaries of each key pasture area (jpeg), supported by GIS file. (a and b) 
Protection of saxaul forest	Area (ha) of saxaul forest to be taken under protection (ha): 3474 ha	Coordinates for planned areas to be taken under protection: Lat 45° 2'3.79"N Long 100°58'27.96"E	Map for planned areas to be taken under protection (jpeg), supported by GIS file.

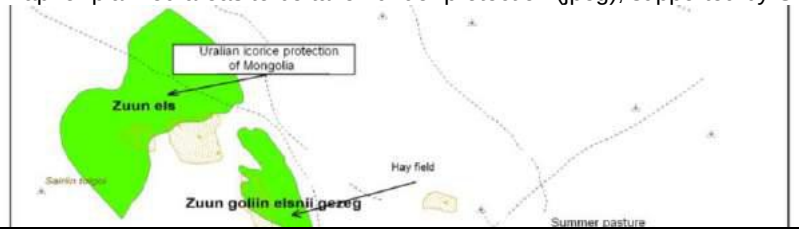
			
Protection of medicinal plants at Mongoliin khooloi	Area (ha) of medicinal plants to be taken under protection:2922 ha	Coordinates for planned areas to be taken under protection 45° 8'47.61"N 100°51'35.73"E	Map for planned areas to be taken under protection (jpeg), supported by GIS file. 
Plant alfalfa and sea buckthorn		Coordinates for planned areas to be planted: 45°12'22.20"N 100°45'31.60"E	Map for planned planting areas (jpeg), supported by GIS file. 
Establish greenhouse	-	Coordinates for planned location of greenhouse 45°12'22.26"N 100°45'34.13"E	Map for planned location of greenhouse (jpeg), supported by GIS file. (see above).

Table A5 3c: Grazing management, stocking rates and biomass utilisation, Dulaan Khairkhan, Bogd *soum*

	Location 1	Mountain desert steppe		Desert steppe	
		Winter	**Fall**	**Summer&Fall**	**Fall**
1.1	**description of baseline grazing practices**				
	number of days grazing in this location	172	82	193	82
	average number of moves (camps) in this location	1	1	2	1
	average number of sheep units grazing in this location	3963.0	693.8	1616.2	1287.5
	area (ha)	9023	4010	1105	2051
	yield (kg DM ha)	**140**	**210**	**210**	**210**
	total yield (kg DM)	1263220	842100	232050	430710
1.2	**estimation of biomass utilization rate**				
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	172	82	96.5	82
	total biomass demand	954290.4	79648.2	218348.6	147805.0
	estimated biomass utilization rate (%)	0.8	0.1	0.9	0.3
2.1	**description of with-project grazing**				
2.1.1	**Year 1 (i.e. first year of implementation:1/4/2015-31/3/16)**				
	number of days grazing in this location	173	82	193	82
	average number of moves (camps) in this location	3	2	3	2
	average number of sheep units grazing in this location	3963.0	693.8	1616.2	1287.5
	area (ha)	9023	4010	1105	2051
	yield (kg DM ha)	**140**	**210**	**210**	**210**
	total yield (kg DM)	1263220.0	842100.0	232050.0	430710.0
2.1.2	**estimation of sustainable carrying capacity**				
	recommended biomass utilization rate (%)	0.3	0.3	0.5	0.3
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	58	41	64	41
	total number of SU that can be grazed to sequester carbon	4694.0	4401.2	1288.2	2251.1
		0.84	**0.16**	**1.25**	**0.57**
2.1.3	**Year 2 (1/4/2016-31/3/17) 1% reduction in livestock numbers**				
	number of days grazing in this location	172	82	193	82
	average number of moves (camps) in this location	3	2	3	2

	average number of sheep units grazing in this location	3923.4	686.9	1600.0	1274.6
	area (ha)	9023	4010	1105	2051
	yield (kg DM ha)	**168**	**252**	**252**	**252**
	total yield (kg DM)	1515864.0	1010520.0	278460.0	516852.0
	estimation of sustainable carrying capacity				
	recommended biomass utilization rate (%)	0.3	0.3	0.5	0.3
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	57	41	64	41
	total number of SU that can be grazed to sequester carbon	5665.6	5281.5	1545.9	2701.3
		0.69	**0.13**	**1.04**	**0.47**
	Year 3 (1/4/2017-31/3/18) 3% reduction in livestock numbers against 2014 baseline				
	number of days grazing in this location	172	82	193	82
	average number of moves (camps) in this location	3	2	3	2
	average number of sheep units grazing in this location	3844.1	673.0	1567.7	1249.1
	area (ha)	9023	4010	1105	2051
	yield (kg DM ha)	**168**	**252**	**252**	**252**
	total yield (kg DM)	1515864.0	1010520.0	278460.0	516852.0
	estimation of sustainable carrying capacity				
	recommended biomass utilization rate (%)	0.3	0.3	0.5	0.3
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	57	41	64	41
	total number of SU that can be grazed to sequester carbon	5665.6	5281.5	1545.9	2701.3
		0.68	**0.13**	**1.01**	**0.46**
	Year 4 (1/4/2018-31/3/19) 5% reduction in livestock numbers against 2014 baseline				
	number of days grazing in this location	172	82	193	82
	average number of moves (camps) in this location	3	2	3	2
	average number of sheep units grazing in this location	3765.0	659.1	1535.4	1223.1
	area (ha)	9023	4010	1105	2051
	yield (kg DM ha)	**168**	**252**	**252**	**252**

	total yield (kg DM)	1515864.0	1010520.0	278460.0	516852.0
	estimation of sustainable carrying capacity				
	recommended biomass utilization rate (%)	0.3	0.3	0.5	0.3
	kg DM per sheep unit per day	1.4	1.4	1.4	1.4
	number of days grazing for each plot in this location	57	41	64	41
	total number of SU that can be grazed to sequester carbon	5665.6	5281.5	1545.9	2701.3
		0.66	**0.12**	**0.99**	**0.45**

Table A5 3d –Carbon Uptake Calculations, Dulaan Khairkhan, Bogd.										
Hongor *Ovoo*, Ikh Tamir	**1. Area (ha)**	**2. Additional carbon uptake per ha pa at 30% grazing pressure (with project)** (PE(SOC,m,t))	**3.Maximum additional carbon uptake pa for 30% grazing pressure (column 1x2)**	**4. Actual additional carbon uptake at 30% over 4 year project***	**5. Additional carbon uptake per ha pa at 40% grazing pressure (with project)** (PE(SOC,m,t))	**6.Maximum additional carbon uptake pa for 40% grazing pressure (column 1x5)**	**7. Actual additional carbon uptake at 40% over 4 year project***	**8. Additional carbon uptake per ha pa at 50% grazing pressure (with project)** (PE(SOC,m,t))	**9.Maximum additional carbon uptake pa for 40% grazing pressure (column 1x8)**	**10. Actual additional carbon uptake at 50% over 4 year project***
Mountain desert Steppe										
Nov-May	9023	0.5512	4973	19894	0.4528	4086	0	0.2836	2559	0
desert steppe										
Aug-Nov (1)	4010	0.7534	3021	12085	0.4139	1660	0	0.1209	485	0
May-Nov	1,105.0	0.8923	986	0	0.323	357	0	0.0652	72	216
Aug-Nov (2)	2,051.0	0.7534	1545	6181	0.4139	849	0	0.1209	248	0
Total carbon uptake for 30%, 40% and 50 % grazing pressure				**38159**			**0**			**216**
Total carbon uptake (For 4 year period without risk deduction)	38375	*these 'actual' figures are calculated from the grazing management spreadsheet A51c, by adding up the number of years at a particular grazing pressure for each pasture type from Year 1-Year 4 (i.e. under 'with project' scenarios), and hence the total area and change in carbon uptake for that pasture type at 30%, 40% and 50% grazing pressure. Where stocking rates exceed 50% grazing pressure, additional carbon uptake against the baseline is conservatively assumed to be zero. The CENTURY modelled figures are those for changes against baseline levels (PE(SOC,m,t))- see Table G5.3 for baselines for various pasture types.								
20% risk deduction	7675									
TOTALS C (4 year period with risk deduction)	30700									

Annex 6. Permits and legal documentation

The following documents include a sample pasture use contract between a *heseg, an NGO (such as MSRM or local herders' organisation)* and a *soum* administration, as previously developed with input from MSRM. Specific tripartite Plan Vivo contracts have been signed for each participating *heseg*/ herder group and for the duration of the Plan Vivo commitment period in conjunction with signature of the producer/ group agreement template. English language versions are currently awaited. These are based on the attached but include specific reference to Plan Vivo and associated herders' rights to benefits accrued through the Plan Vivo project. Letters of support from key government staff and ministries are also included here. These provide evidence of the legal status of the project, its acceptance and support by a range of key stakeholders. Further information on key legislation for example around land tenure is provided in the main body of the text.

SAMPLE Collaboration contract

Date **No.** **Place**

This contract is made between Ts. Munkhbat Ikh Tamir *soum* governor of Arkhangai *Aimag*, D.Bazar Bugat *bag* governor, B.Enkhbayar head of *heseg* and J.Dashzeveg "Arvijin saijrakh" *soum* herders association NGO according to the provisions 24.1.3, 52.2 of Land law Mongolia.

1. General provisions

1.1 According to order of Ikh Tamir *soum* governor of Arkhangai *Aimag* 2010, from Bugat *bag* territory

- for winter pasture /place's name, quantity/ - Agit, Beekh, Olzii tolgoi, Baraan burgas, Teeremt and Bugat;
- for spring pasture /place's name, quantity/ - Khoyor Uul, Gants Burgas, Ikher baga Uul, Ulziit dund bulag and Baishint;
- for winter and spring pasture /place's name, quantity/ - Ulaan khad, Teeremt, Ikh baga khyiten, Tatsan;
- for autumn pasture /place's name, quantity/ - Ikh Uul, Khukh tseel, Dund bulgiin am;
- for summer pasture /place's name, quantity/ - Khukh tseel, Burd, Khunyin gol.

These places will be used by Khunyin gol *heseg* according to the pasture use management plan with a long term aim to reduce pasture degradation, to prevent overgrazing, to use the pasture rotationally for improving pasture yield quality, to protect pasture and fences, to improve usage and protection of water points, to spread seed and manure, to plant additional fodder crops.

1.2 The above mentioned pasture resources are, in normal weather conditions, sufficient for the following:

A. Winter pasture …… in sheep head

B. Spring pasture……. in sheep head

C. Winter and spring pasture 15592 sheep head.

1.3 Winter and spring pasture coordinates, place names and pasture use scheme with the border will be attached in the contract.

1.4 Pasture land for herders is for the common use of the *heseg*.

2. Rights and roles of contract parties pertaining to pasture use

2.1 Heseg's rights and roles

2.1.1 *Heseg* meetings should be held at least once per season.

2.1.2 To develop draft agreements for vacating the pasture, entering the pasture, taking a tax and fee from *otor* animals, water use, adjusting the animal numbers according to the carrying capacity and to take measures to have these plans approved at the *bag* and *soum* citizens' representatives meetings.

2.1.3 To participate actively in implementation of the agreed pasture use plan.

2.1.4 To follow the *heseg* meeting decisions on when to vacate certain pasture areas, and to move according to the agreed pasture use schedule.

2.1.5 To protect pasture, to reseed hay and pasture field and to spread manure for increase yield.

2.1.6 To sow fodder plants.

2.1.7 To follow the requirements of *soum* and *bag* governor and *soum* herders' association on pasture use and protection

2.1.8 To not graze animals from 15 May to 15 October within 3.5 km of the winter place.

2.1.9 In adverse weather conditions to move to the place appointed by the *soum* governor.

2.1.10 To make contracts with the local governor on water point use; to establish a new water point and to repair it.

2.1.11 To solve arguments related to pasture use, in conjunction with local governors.
2.1.12 to respect other herders' pasture use rights.
2.1.13 If herder with animals outside the contract use the pasture and stay more than two days, to inform the governor in order that they can take any necessary measures.
2.1.14 If a new family joins the *heseg* and/or herders migrate in from other places, their access to seasonal pasture and to winter and spring campsites will be discussed and agreed by *bag* and *soum* citizens' representatives meetings.
2.1.15 to discuss adjusting and limiting animal number according to pasture capacity at the *heseg*'s meeting and to follow any agreed actions.
2.1.16 *Heseg* should take measures for sustainable use of forest, water, plant, animal and other natural resources, and to stop any illegal activity.
2.1.17 If any part of the *heseg* territory is located in a protected area, any pertinent legislation about the protected area should be followed in this area.
2.1.18 Where possible to establish nature protecting citizens' groups within the *heseg* territory and to introduce these to the citizens' representatives meeting. Any such groups should make a contract with a *soum* governor.

2.2 Soum governor's rights and roles

2.2.1 To develop measures to define the appropriate pasture carrying capacity and a rational usage scheme; to solve pasture management problems and to have these measures approved by the *soum* citizens' representatives khural. To ensure these plans are followed.
2.2.2 To evaluate hesegs' activity and to participate in selection of the best *heseg*; to support its activity and to promote it.
2.2.3 To make decisions on pasture schedules, and to monitor their implementation
2.2.4 To negotiate about movement to another *aimag* and *soum* territory with the governors in case of natural disaster and to manage any such *otor* movements.
2.2.5 To organize annual assessment of the pasture by a suitable professional organization.
2.2.6 To introduce pasture use arguments between the *soum*s to the *aimag* governor and to take measures to resolve these.
2.2.7 To charge any guilty persons, who didn't follow the *soum* governor's decisions and requirements.
2.2.8 To monitor the *soum*'s specialists labor scheme.

2.3 Herder association or NGO's rights and roles

2.3.1 To provide the *heseg* with information, and to support and collaborate with *soum* and *bag* governors
2.3.2 To organize training and extension on pasture community management.
2.3.3 To support the rotational grazing system, rehabilitation and resting of pasture.
2.3.4 To collect and summarize the suggestions and proposals of hesegs and introduce them to the bags and *soum* citizens' representatives meeting.
2.3.5 To organize meetings of *heseg* and to discuss and make decisions on activity reports presented therein.
2.3.6 To organize and advertize activity of any relevant government/ donor programs in the rural area.
2.3.7 To collaborate with other projects and programs.
2.3.8 To introduce the *heseg* activity reports to the *bag* and *soum* citizens' representatives meeting; to reflect on the decisions in the *bag*'s and *soum* governor's work plan and to collaborate with them.

2.4 Bag governor's rights and roles

2.4.1 To support the hesegs to develop their annual pasture use plan in accordance with wider *soum*/ *bag* level planning; to introduce the plan to the citizens' representatives meeting.

2.4.2 To follow the decision of the *soum*'s citizens' representatives meeting and governor on the annual pasture use plan; to implement the regulations.
2.4.3 To facilitate coherence/ coordination between the hesegs.
2.4.4 To allocate hay making fields and to settle any disputes; to have allocations approved by the *soum* governor.
2.4.5 To settle any pasture use disputes according to the regulations.
2.4.6 To report the results of pasture use and pasture use planning to the citizens' representatives meeting.
2.4.7 To organize and support any donor program's implementation.

3. Contract term

3.1 Contract will be valid after signature by all parties.
3.2 This contract is made for four years duration between March 25, 2010 and December 30, 2013.
3.3 Contract parties can negotiate and prolong the contract term.

4. Contract monitoring

4.1 Contract parties have a right for monitoring the contract activity, implementation separately.
4.2 Contract parties have a role for reporting about the collaboration to other contract parties.

5. Liability

5.1 Anyone breaking the terms of this contract will be deemed responsible for any loss or other adverse impacts resulting.
5.2 *Soum* governor will be responsible for organizing:
restitution by the guilty party, who, for example broke down the fence, didn't move to the appointed pasture, grazed his or her animals to someone's reseeded and fertilized pasture.
Implementation of a penalty according to the "Administration responsibility law".

6. Others

6.1 Contract parties will provide an annual summary of activities/ contract implementation and attach it to the contract.
6.2 If disputes arise which cannot be resolved between the contract parties, these should be introduced to the *soum*'s citizens' representatives meeting and solved.
6.3 The provisions of this contract shall be changed or amended only as agreed by all parties.
6.4 Parties shall not pass to third party their rights by this contract without written consent of the other party.
6.5 The present Contract is concluded in four copies in Mongolian, all authentic.

SIGNED

Ikh Tamir *soum* governor
Ts. Munkhbat

"Bugat" *bag* governor
D.Bazar

heseg head "Khunyin gol"
B. Enkhbayar

NGO leader "Arvijin saijrakh"
J.Dashzeveg

Sealed

ADMINISTRATION OF LAND AFFAIRS,
GEODESY AND CARTOGRAPHY
IMPLEMENTING AGENCY OF THE GOVERNMENT OF MONGOLIA
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Date 2014.03.21
Ref. 1/323

TO WHOM IT MAY CONCERN

On behalf of the Agency for Land Affairs, Geodesy and Cartography, Mongolia we are please to express our support for the Plan Vivo projects currently being developed with herder communities in Ikh Tamir soum, Arkhangai aimag; Undurshireet soum, Tov aimag; Ulziit soum, Dundgovi aimag and Bogd soum, Bayankhongor aimag.

These Plan Vivo projects are being developed through the Mongolian Society for Range Management (MSRM), as the Plan Vivo project coordinator in Mongolia, and initially within the wider context of the Darwin Initiative funded 'Values and Valuation: New Approaches to Conservation in Mongolia' study, led by the University of Leicester (UOL), UK. The details of the specific Plan Vivo project plans have been communicated to us by MSRM and UOL and we are happy to support these.

We understand that under the Plan Vivo projects, established herder groups (e.g. MSRM pasture user groups), who already have group user-rights agreements with local (soum) administration, will implement a range of pasture management, conservation and livelihood-oriented projects within these designated group areas over a number of years (e.g. 5-10 years). As part of these activities, the evaluation and improved conservation and sequestration of soil carbon will form key components, thus enabling links to voluntary carbon markets through the Plan Vivo standard. This is an important development for Mongolia and one that we are happy to support.

We confirm that this approach is in full compliance with pertinent areas of government policy and legislation. Mongolia's Land Law (2002) does not allow for the private ownership of pasture, but under this Law and it's expected updates in the spring session of parliament, group user rights (e.g. for heseg or similar herder groups) can legally be agreed and enforced with the local (soum) administrations, as in these cases.

Such agreements may also specify herder group rights to any carbon-related benefits realised through the Plan Vivo projects.

We therefore confirm our support for the Plan Vivo projects and look forward to success outcomes and benefits for Mongolia and its herding communities.

VICE DIRECTOR J.DAVAABAATAR

MINISTRY OF ENVIRONMENT
AND GREEN DEVELOPMENT
OF MONGOLIA

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Date 2014.03.25
Ref. 7/1488

To whom it may concern

On behalf of the Ministry of Environment and Green Development, Mongolia we are pleas to express our support for the Plan Vivo projects currently being developed with herder communities in Ikh Tamir soum, Arhangai aimag; Undurshireet soum, Tuv aimag; Ulziit soum, Dundgovi aimag and Bogd soum, Bayanhongor aimag.

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The details of the specific Plan Vivo project plan have been communicated to us by MSRM and UOL and we are happy to support these also.

We consider the Plan Vivo projects to be positive, new initiative in Mongolia, and to be in full compliance with pertinent areas of government policy and legislation for example Mongolia's evolving climate change and REDD-iness strategy; the development of Payment for Ecosystem services approaches and our conservation commitments and policies in relation of Protected Area planning 8 the national biodiversity action plan and Convention on Biological Diversity.

We therefore confirm our support for the Plan Vivo projects and look forward to success outcomes and benefits for Mongolia and its herding communities.

B. GANTULGA

DIRECTOR OF DEPARTMENT OF POLICY
IMPLEMENTATION

332

MINISTRY
OF INDUSTRY AND AGRICULTURE
OF MONGOLIA

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Date 21st Apr 2014
Ref. 04/1542

TO WHOM IT MAY CONCERN

On behalf of the Ministry of Industry and Agriculture of Mongolia we are pleased to express our support for the Plan Vivo projects currently being developed with herder communities in IkhTamir soum, Arkhangai aimag; Undurshireet soum, Tov aimag; Ulziit soum, Dundovi aimag and Bogd soum, Bayankhongor aimag.

These Plan Vivo projects are being developed through the Mongolian Society of Range Management (MSRM), as the Plan Vivo project coordinator in Mongolia, and initially within the wider context of the Darwin Initiative funded 'Values and Valuation: New Approaches to Conservation in Mongolia' study, led by the University of Leicester (UOL), UK. The details of the specific Plan Vivo project plans have been communicated to us by MSRM and UOL and we are happy to support these.

We understand that under the Plan Vivo projects, established herder groups (e.g. MSRM *heseg*), who already have group user-rights agreements with local (Soum) administration, will implement a range of pasture management, conservation and livelihood-oriented projects within these designated group areas over a number of years (e.g. 5-10 years). As part of these activities, the evaluation and improved conservation and sequestration of soil carbon will form key components, thus enabling links to voluntary carbon markets through the Plan Vivo standard. This is an important development for Mongolia and one that we are happy to support. We confirm that this approach is in full compliance with pertinent areas of government policy and legislation in relation to the Agricultural and livestock sector.

We therefore confirm our support for the Plan Vivo projects and look forward to success outcomes and benefits for Mongolia and its herding communities.

L.CHOI-ISH

ACTING STATE SECRETARY

00000119

MINISTRY OF NATURE,
ENVIRONMENT AND TOURISM
OF MONGOLIA

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Date 13 September 2011
Ref. 6/4132

Subject: Letter of Support for "Values and valuation: new approaches to conservation in Mongolia" to Darwin Initiative

Dear Madam/Sir,

On behalf of the Ministry of Nature, Environment and Tourism, it is my pleasure write a letter in support of the proposal for "Values and valuation: new approaches to conservation in Mongolia" being submitted to Darwin Initiative by Dr.Caroline Upton, Department of Geography, University of Leicester.

Since the Ministry of Nature, Environment and Tourism is a key government organization to develop the national policies and strategies on environmental protection and natural conservation of Mongolia, I concern that this proposed project is significant to bring new approaches to biodiversity conservation by values of ecosystem services and efficacy of PES schemes. In addition, the proposal is also covered the implementation of CBD, CMS, and CITES in Mongolia with synergetic approach. It is also important to develop conservation policy and practice in Mongolia.

In conclusion, I fully support the efforts of the Dr.Caroline Upton, Department of Geography, University of Leicester as she seeks external funding to collaborate with our conservation activities in Mongolia.

I hereby to confirm you that we will assist this project facilitation, dissemination and utilization of project outputs to our policy and practice.

Sincerely yours

D.ENKHBAT

DIRECTOR GENERAL FOR THE DEPARTMENT OF ENVIRONMENTAL PROTECTION AND NATURAL RESOURCES MANAGEMENT

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c/o LTS
Pentlands Science Park, Bush Loan,
Penicuik, Edinburgh,
EH26 0PH
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Email: darwin-applications@ltsi.co.uk

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MINISTRY OF ENVIRONMENT
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OF MONGOLIA

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Date 21 Feb. 2013
Ref. 11/756

To Whom It May Concern,

I am pleased to express my support for "Plan Vivo" pilot project under the study on 'Values and Valuation: New Approaches to Conservation in Mongolia' (2012-2015) funded by Darwin Initiative. I understand that this project is being implemented in Mongolia by a team composed of members from University of Leicester (UK), Mongolian Society for Rangeland Management (MSRM), Mongolian State University of Agriculture, Centre for Ecosystem Studies and Mongolian Nature Protection Civil Movements Coalition. In addition, the Ministry of Environment and Green Development will be involved in the project activities as a government key administrative institution for supervising and coordination of project activities as well as receiving the project outputs and results. I noted that the "Plan Vivo" pilot project will take place in Ikh Tamir soum of Arkhangai province, Undurshireet soum of Tov province, Ulziit soum of Dundgov province and Bogd soum of Bayankhongor province respectively, relying on one herder group (heseg) at each location. These pilot study will be one of the pioneering studies which is looking at prospects for carbon sequestration in Mongolian rangelands, possibility to generate carbon revenues through the voluntary carbon market and associated environmental conservation and livelihood benefits for participating herders. The activities conducted within the project are consistent with the National Action Programme on Climate Change of Mongolia and other policy documents on climate change. As such I am pleased to support this pilot project and look forward to the successful outcomes and benefits to Mongolia.

Sincerely yours,

D. Dagvadorj, Special Envoy for Climate Change, and
Chairman of Climate Change Coordination Office

00007

Annex 7. Evidence of Community Participation

Since April 2012, when the Darwin Initiative project officially commenced, MSRM have held more than 20 meetings with the Plan Vivo herder groups/ *heseg*. A sample report of a meeting/training workshop is attached overleaf.

Most recently, in 2014, the following Plan Vivo specific meetings and training workshops have also taken place, which have included further work on the participatory planning process with *heseg*/ herder group members, and also with the wider community through the *soum* administration and key bodies such as the *Soum* Citizen's Representative *Khural*. This latter elected body is a vital part of the local democratic process, which in addition to various statutory responsibilities, provides a forum for information sharing and citizen engagement in all issues of local importance.

Bogd soum. *March 2014*: Project team organized meeting with *heseg* herders who developed their Plan Vivo for seasonal camping and pasture use activities and their overall activity plan within the framework of Plan Vivo. Project staff also met with the *Soum* Governor and heads of Livestock and Land Offices. During the meeting the *soum* authorities stated their full support for Plan Vivo project and its implementation. They further stated their willingness to aid plans to develop pasture reserves through provision of water resources. *September 2014*: During the trip project team met the *soum* Environment officer and Leader of *Bag* citizen Representative *Khural*. They gave their agreement to work together with the team and Dulaan Khairkhan herder group in successful implementation of the Plan Vivo project.

Undurshireet soum. June 2014: The Project team organized meetings with *heseg* herders during which they developed their Plan Vivo for seasonal camping and pasture use activities and their overall activity plan within the framework of Plan Vivo. We also had a meeting with the *Soum* Governor and heads of Livestock and Land offices who declared their support for the Plan Vivo project. Project team also met with the leader of the Citizen's Representative *Khural* and discussed the Plan Vivo project, its implementation and opportunities. *September 2014*: The project team organized a meeting with *Soum* Governor, Land officer and Tumen mal NGO leader. Issues of seasonal pasture rotation and support for implementation of the *heseg* plan on pasture rotation formed the main focus of the meeting, in conjunction with discussion of deforestation around the Tuul River. The *Soum* authority declared their full support for the implementation of Plan Vivo.

Ikh Tamir soum. October 2014: The project team met with the *Soum* Governor, leader of the *soum* Citizen Representative *Khural* and head of the Forest Department. We discussed the Plan Vivo project and its input into local community development and nature conservation; including through support for community partnerships in forest protection and regeneration (see planned activities, Section K). The *soum* government has approved the establishment of these Forest partnerships and officially registered them; ready for Hongoo *Ovoo*'s planned activities under Plan Vivo.

Training report of the "Value and valuation: New approaches of nature conservation Mongolia" PES project

25 June, 2013

Reported by Prof. D.Dorligsuren, Executive director of MSRM

MSRM organized a training for "Hongor *Ovoo*" *heseg* in Ikh Tamir *soum*, Arkhangai *aimag* on 23 April 2013, 27 participants were involved in the training; for "Dert" *heseg* of the Ulziit *soum*, Dundgovi *aimag* on 8 May 2013, 12 participants were involved in the training; for "Ikh am" *heseg* Undurshireet *soum*, Tuv *aimag* on 15 June 2013, 21 people from this *heseg* participated in the training (Participants' names are shown in appendix 1 and training photos in appendix 2, respectively).

The training agenda included the following topics:

- New approaches to nature protection, nature resource management (e.g. pasture, medicinal plants, wildlife and minerals)
- Payment for ecosystem services
- Further training/ capacity building for Plan Vivo in relation to linked livelihood/ environmental improvements; carbon financing in Mongolia
- Rational pasture use
- Value chains for livestock products
- Improvement of herder groups income

At the beginning of the training the trainer Prof.D.Dorligsuren provided further information/ progress updates on the project "Values and Valuation: New Approaches to Nature Conservation in Mongolia".

Participants were subsequently divided into groups, participants of "Ikh am" and "Khongor-*Ovoo*" HG into 3 groups, "Dert" *Heseg* into 2 groups respectively. Groups worked on participatory environmental assessment and planning in relation to the following topics and with reference to statutory *soum* level environmental plans:

- Climate change/ warming
- Pasture yield
- Change of pasture plant species composition
- Water quality
- Water supply
- Weather difficulty and frequency of drought and *dzud*
- Wildlife
- Livestock numbers
- Increase of herders income
- Herders' number
- Forest issues and conservation
- Herders' mutual respect/ collaboration.

Results of herders' participatory environmental assessment can be summarised as follows (supporting figures are shown in appendix 3):

- Climate is changing and warming up in all three *soum*s, year by year.
- Pasture yield is decreasing and pasture plant species composition is changing in all three *soum*s.
- Both water quality and supply is decreasing in all three *soum*s.
- Frequency of weather difficulty such as drought and *dzud* is increasing.
- Wildlife is rare in Ulziit *soum*, deer numbers are increasing in Undurshireet *soum*, and wild animal numbers are decreasing in Ikh Tamir *soum*.
- Livestock numbers are now increasing in all three *soum*s, but decreased in Ulziit *soum* in 2010, due to drought-induced losses. Herders of Ikh am *heseg* of Undurshireet *soum* are paying attention to quality of animals instead of animal numbers.
- Herder family income is decreasing due to the weather difficulty in Ulziit *soum*, but in Ikh Tamir and Undurshireet *soum* it is increasing gradually. This is connected to the price increase of animal products such as meat.
- Herder numbers are increasing in Undurshireet *soum*, Tuv *aimag*, but not in the remaining two *soum*s.
- There is no forest in Ulziit *soum*, Dundgovi *aimag*. The overall forested area is decreasing in Undurshireet *soum*, Tuv *aimag* and Ikh Tamir *soum*, Arkhangai *aimag*.
- Herders trust/ cooperation are being maintained in Undurshireet *soum*, but there is a tendency towards loss of trust between households in Ikh Tamir *soum* Arkhangai *aimag*.

Conclusion: There is big water pollution issue in Undurshireet *soum*. It is impossible to use water of the Tuul River, horses do not drink from the river. Mongolian Government is giving promotion for sheep wool, goat cashmere and skin to the cooperatives. This is encouraging increases in animal numbers. It is necessary to promote and provide incentives for pasture protection and conservation, instead of animal products.

The pasture carrying capacity is exceeded in Ikh Tamir *soum*, Arkhangai *aimag*. This is connected to the high number of herder households in Ikh Tamir *soum*. Herders in this *soum* are participating in the Home to Home tourist service.

There is a drought problem in Ulziit *soum*, Dundgovi *aimag*, therefore herders are moving to another *soum*. Therefore pasture boundaries should be certified by the state, herders should be supplied with an *otor* area and animal numbers should be reduced.

APPENDICES:

Appendix 1. List of participants

Name of participants of the “Ikh Am” *heseg*, Undurshireet *soum* Tuv *aimag*

- Ts.Oyun – Local NGO leader
- L.Dogsom – HG leader
- S.Banzragch – HG member
- Sh.Mendbayar – HG member
- B.Erdenebat – HG member
- N.Tuvaanjav – HG member
- Kh.Baasanjav – HG member
- S.Ishdorj – HG member
- B.Tumenjargal – HG member
- D.Galtushig – HG member
- B.Ulziinyam – HG member

- B.Damdinsuren – HG member
- B.Davaasambuu – HG member
- J.Bayarsaikhan – HG member
- Ch.Dorjkhand – HG member
- N.Odbaatar – HG member
- T.Dashnyam – HG member
- T.Bayanbaatar – HG member
- D.Purevdorj – HG member
- T.Chuluunbaatar – HG member
- N.Bat-Ochir – HG member

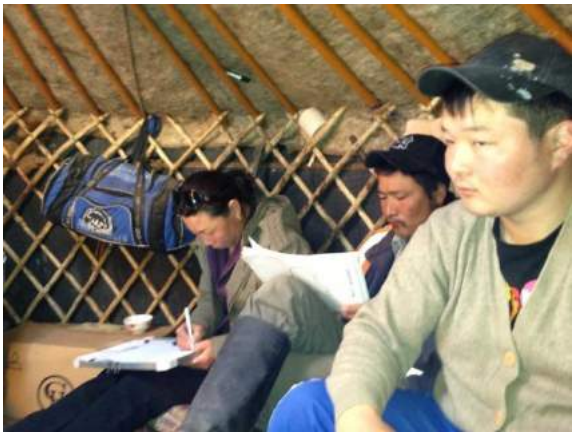
Name of participants of the "Dert" heseg

- Jargalsaikhan - Local NGO leader
- Ts.Aldarkhuu - HG leader
- Ts.Narantsend – HG member
- Kh.Tuya – HG member
- A.Tsogbadrakh – HG member
- S.Baigalmaa – HG member
- Z.Boldchuluun – HG member
- G.Chuluunbat – HG member
- D.Otgonmunkh – HG member
- N.Enkhtuya – HG member
- G.Barkhas – HG member
- D.Sainbayar – HG member
- Ts.Gonio – HG member

Name of participants of the "Hongor ovoo" heseg

- L.Nergyibaatar - HG leader
- D.Batbaatar – HG member
- B.Khurelkhuu – HG member
- B.Sumiyadash – HG member
- B.Batnasan – HG member
- E.Khudulmur – HG member
- B.Nina – HG member
- L.Naranbaatar – HG member
- B.Baasansuren – HG member
- G.Olon– HG member
- D.Bolibat – HG member
- L.Bayarmaa – HG member
- N.Badrakh – HG member
- G.Zulaa – HG member
- Ch.Tumensaikhan – HG member
- S.Tsasanchikher – HG member
- G.Bumuu – HG member
- B.Bokhbat – HG member
- D.Erdenebaatar – HG member
- T.Altan-Ochir – HG member
- B.Munkhsaikhan – HG member
- S.Altantsetseg – HG member
- N.Enkhmaa – HG member
- B.Khurelbat – HG member
- P.Bulgantamir – HG member
- R.Shar – HG member
- L.Bayaraa – HG member

Appendix 2. Pictures of the training
"Hongor ovoo" heseg, Ikh Tamir soum, Arkhangai aimag, 23 April 2013

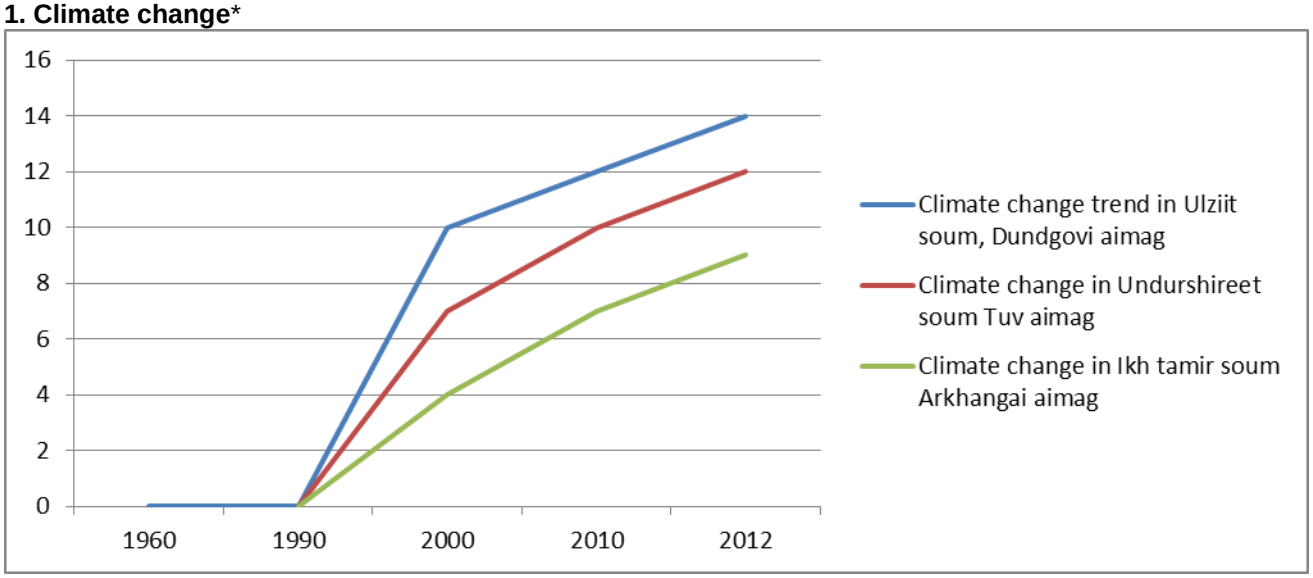
“Dert” heseg, Ulziit soum, Dundgovi aimag, 8 May 2013




“Ikh am” heseg Undurshireet soum, Tuv aimag on 15 June 2013

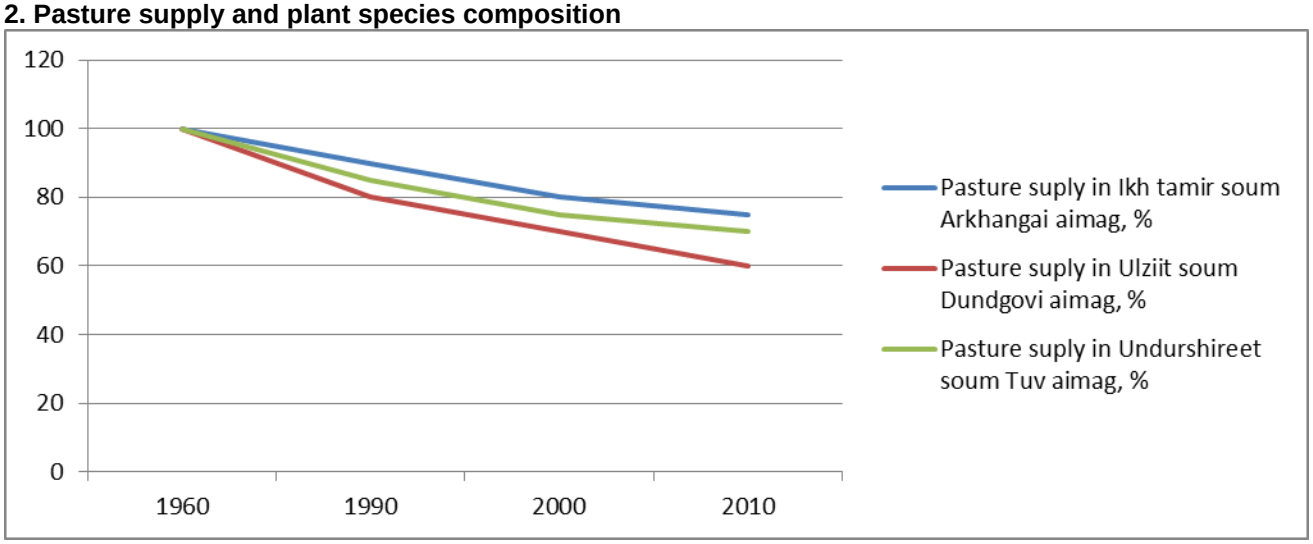
Appendix 3. Result of the groups (working groups' average of three soums)

1. Climate change*



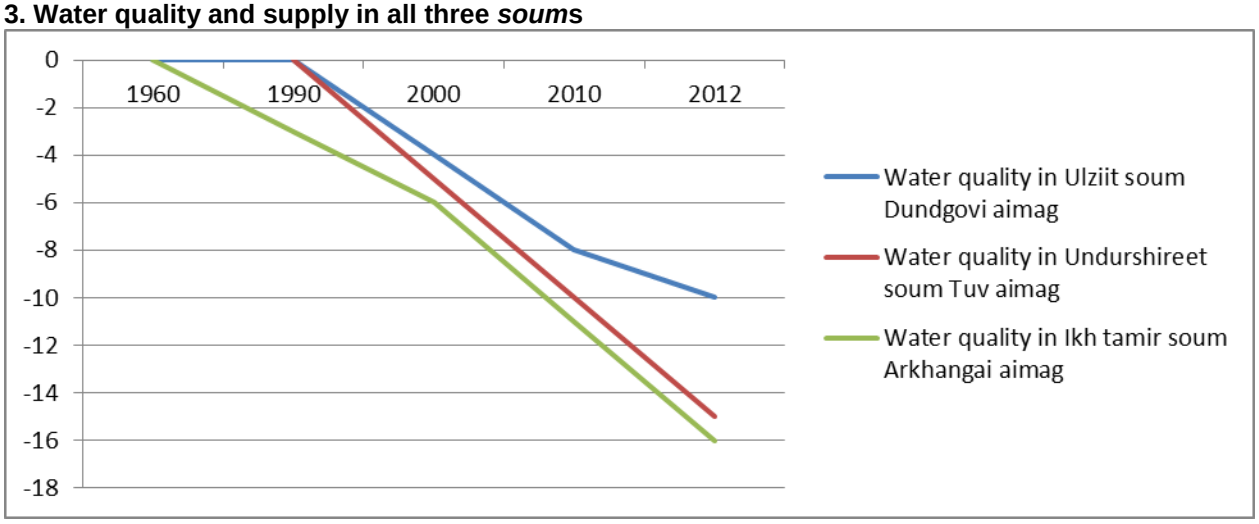
*Herders think that climate condition was normal in 1960 and 1990.

2. Pasture supply and plant species composition

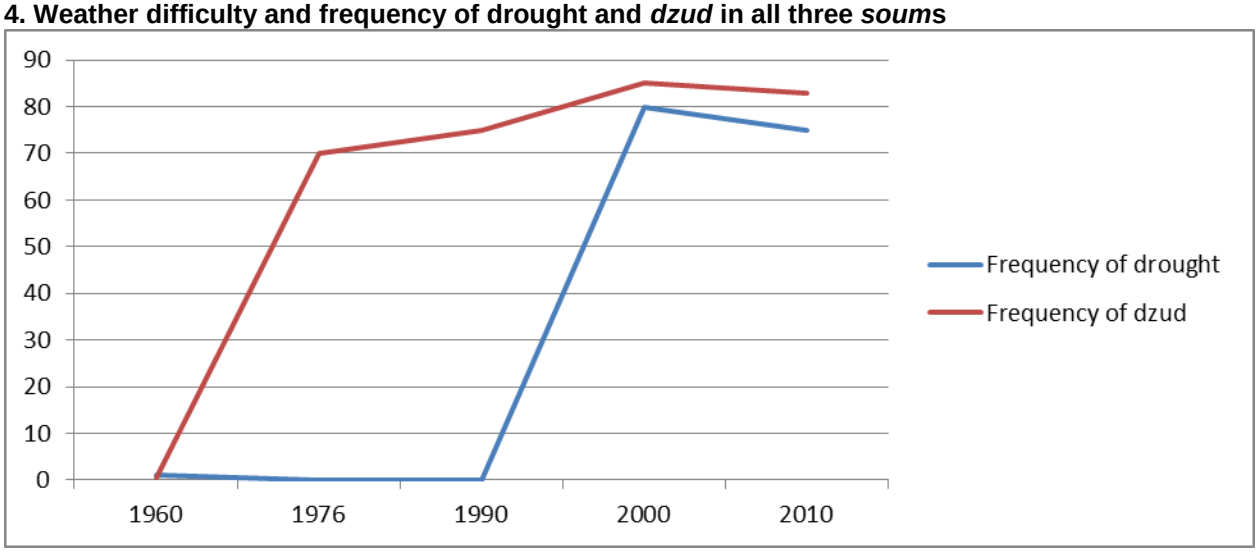


Herders think that the plant species composition is changing since 1960.

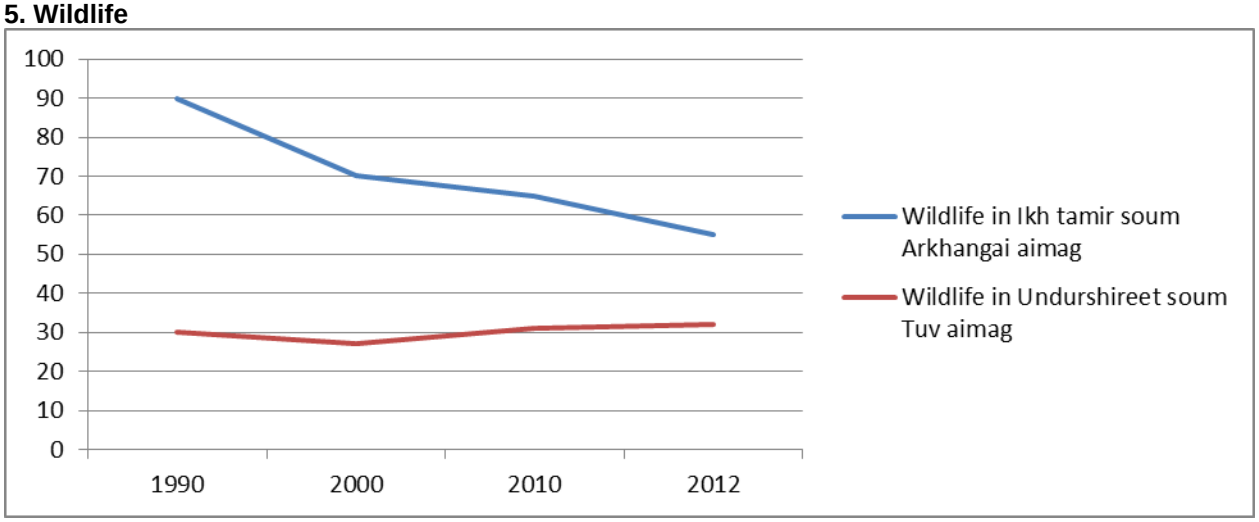
3. Water quality and supply in all three *soum*s



4. Weather difficulty and frequency of drought and *dzud* in all three *soum*s

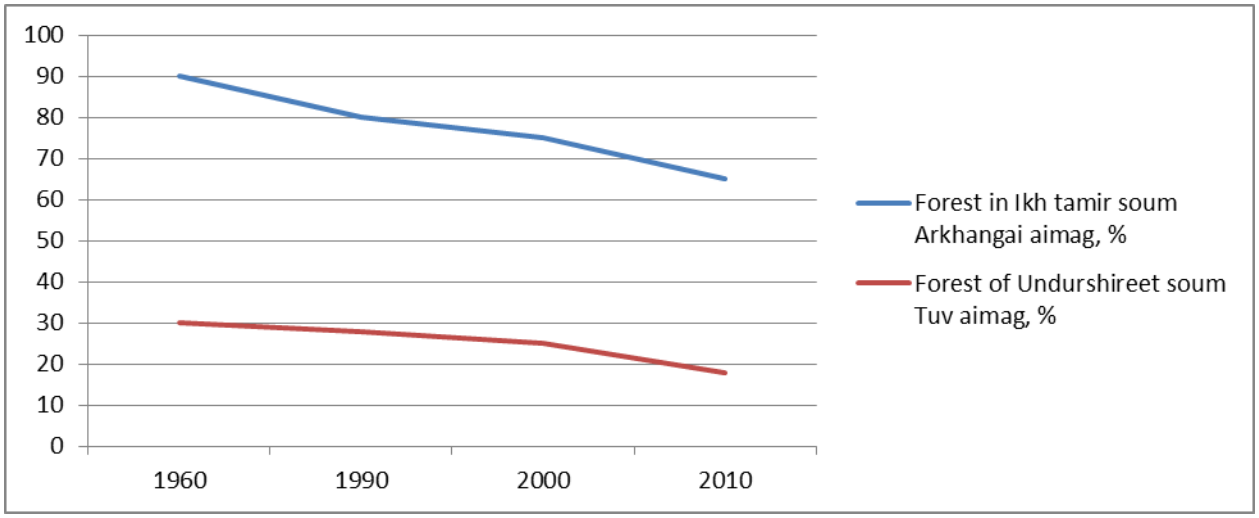


5. Wildlife



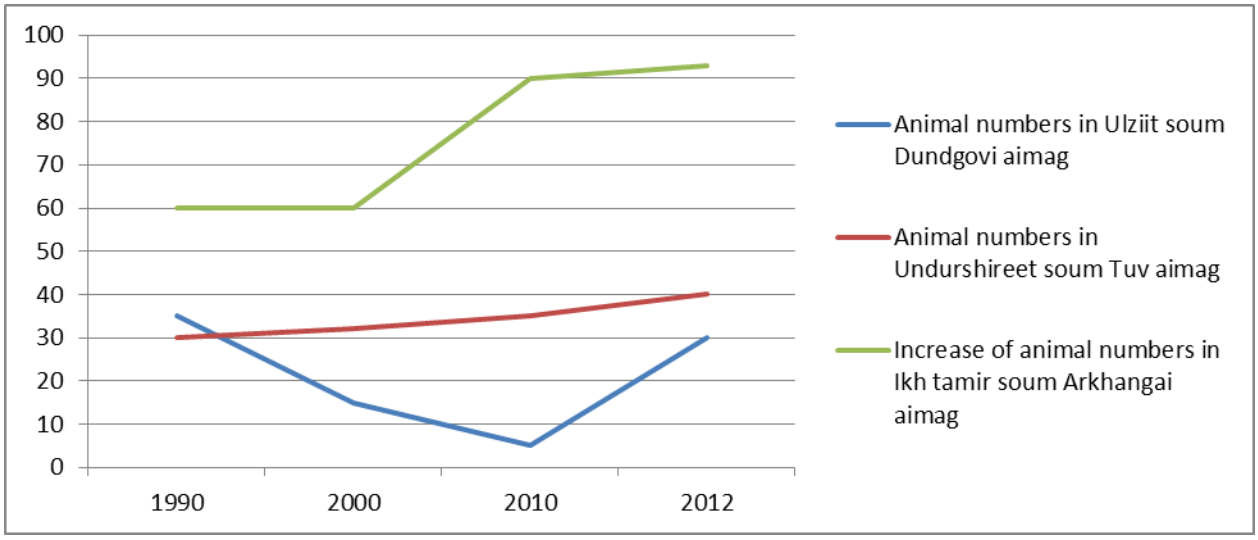
*Deer numbers are increased in Undurshireet *soum*, wildlife is very rare in Ulziit *soum*, Dundgovi *aimag*

6. Forest*



*There is no forest in Ulziit *soum*.

7. Animal numbers



Annex 8. Plan Vivo Climate Benefit Quantification Methodology – Carbon Sequestration through Improved Grassland and Natural Resource Management in Extensively Managed Grasslands.

(previously submitted to Plan Vivo as an Approved Approach/ Methodology on 5/1/15).

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Plan Vivo Climate Benefit Quantification Methodology

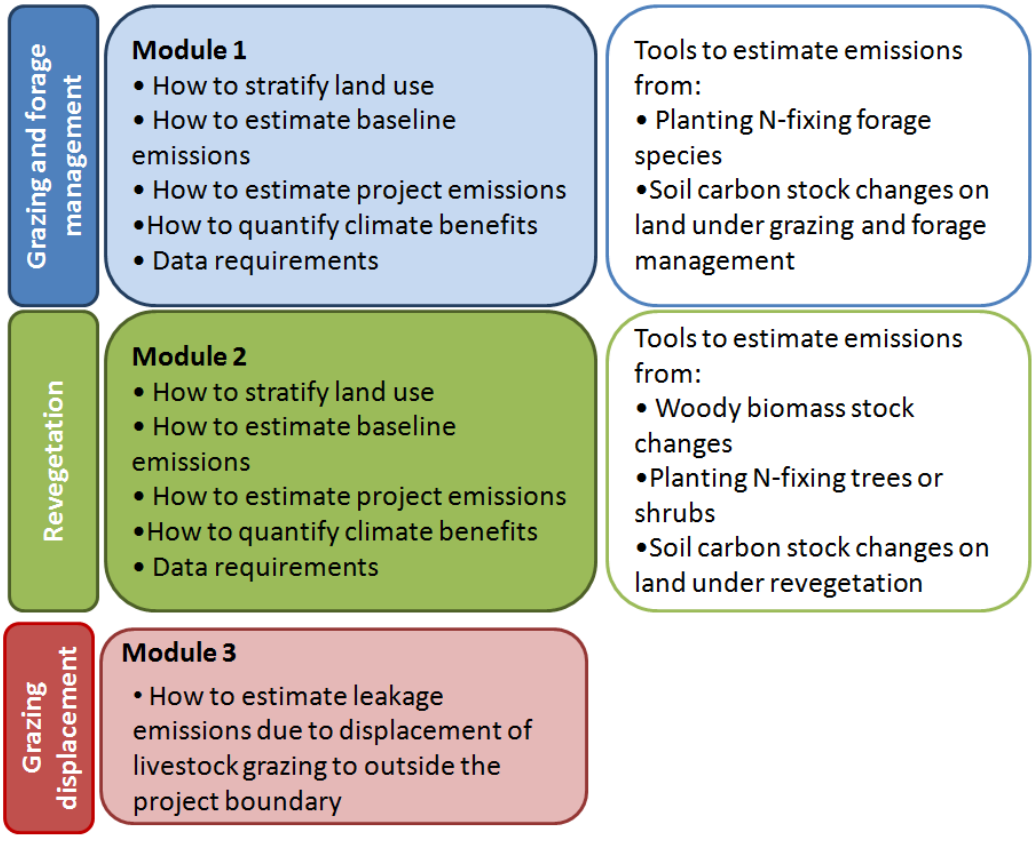
Title	Carbon sequestration through improved grassland and natural resources management in extensively managed grasslands
Version	0.3
Date	05 December 2014
Prepared by	Values for Development Ltd.

Summary

This methodology can be used to estimate the climate benefits of the following types of natural resources management activity in extensively managed grasslands: (1) Improved management of grasslands, including: improved grazing management and forage management (e.g. perennial forage cultivation, hay harvesting); (2) Revegetation of grassland, shrubland or forest, by (1) afforestation or reforestation and assisted natural regeneration of degraded shrub communities. Relevant improved grazing management activities may include changes in the timing of grazing and increased rotation of grazing between plots, changes in stocking rates and the intensity of grazing.

For grassland management activities, the sinks and sources accounted for include changes in soil carbon stocks, and emissions from cultivation of nitrogen-fixing forage species. The applicability conditions of the methodology limit its use to situations where project activities do not increase livestock numbers, so emissions from livestock enteric fermentation and manure management are not accounted for. For forest and shrub management, the methodology accounts for change in above and below ground woody biomass carbon stocks and soil carbon stocks, and emissions from re-vegetation with nitrogen-fixing tree or shrub species.

To make the methodology more accessible to natural resource management practitioners, the quantification requirements are set out separately for grazing and forage management (Module 1), and for re-vegetation activities (Module 2). Each of these modules presents guidance on stratification of the project area, quantification of baseline and project emissions, and guidance on the data required for quantification of climate benefits. Project emissions can be quantified for each emission source by following the procedures set out in 6 appendixes to the methodology. A separate module provides guidance for quantifying leakage emissions due to displacement of grazing activities from the project boundary (Module 3).



1. Scope and applicability of the methodology

This methodology can be used to estimate the climate benefits of several natural resource management activities that are common in extensively managed grasslands:

1. Improved management of grasslands, including:
    a. Improved grazing management on grasslands
    b. Forage management (e.g. perennial forage cultivation, hay harvesting) on grasslands
2. Revegetation of degraded grasslands, shrublands or forest, by:
    a. Afforestation or reforestation with trees or shrubs; and
    b. Assisted natural regeneration of degraded shrub communities.

A PV project using this methodology must choose at least one of these land uses and activities for climate benefit quantification, but not all activities will be relevant or need to be chosen in all projects. Depending on which land uses and activities are chosen, different conditions ("applicability conditions") must be met in order for the application of this methodology to be valid. Project proponents should follow the guidance in Section 1.1. to identify land uses and project activities in the proposed project, in order to identify the applicability conditions that apply to the quantification of climate benefits from project activities implemented in the project boundary.

1.1 Assessment of the applicability of this climate benefit quantification methodology

In order to identify which applicability conditions apply to the quantification of climate benefits from project activities in the project boundary, project proponents should follow these steps:

Step 1: Identify all land cover types in the project boundary.

Step 2: Are there grasslands in the project boundary? If the answer is 'yes', are improved grazing management and/or forage management activities proposed on these grasslands in the PV project? If any these activities are proposed, then the applicability conditions set out in Section 1.1.1 apply. Are afforestation activities proposed on these grasslands in the PV project? If any of these activities are proposed, then the applicability conditions set out in Section 1.1.2 apply. If there are no grasslands, or the proposed activities on grasslands do not involve grazing or forage management or afforestation, then this methodology cannot be used to quantify climate benefits of PV project activities.

Step 3: Are there shrublands in the project boundary? If the answer is 'yes', are afforestation, reforestation or assisted natural regeneration activities proposed on these shrublands in the PV project? If any of these activities are proposed, then the applicability

conditions set out in Section 1.1.2 apply. If there are no shrublands, or the proposed activities on shrublands do not involve afforestation, reforestation or assisted natural regeneration, then this methodology cannot be used to quantify climate benefits of PV project activities.

Step 4: Are there forests in the project boundary? If the answer is 'yes', are afforestation, reforestation or assisted natural regeneration activities proposed on these forests in the PV project? If any of these activities are proposed, then the applicability conditions set out in Section 1.1.2 apply. If there are no forests, or the proposed activities on forests do not involve afforestation, reforestation or assisted natural regeneration, then this methodology cannot be used to quantify climate benefits of PV project activities.

The Technical Specifications should justify that these applicability criteria are met for each land use stratum for which climate benefits are quantified.

1.1.1 Applicability conditions for quantification of climate benefits of grazing and forage management activities in the project scenario

For all land subject to grazing and forage management activities in the project scenario, the following conditions apply:

a) The land is grassland at the start of the project, and the project does not involve conversion of grassland to other land uses. (Cultivation of perennial forages is not considered to be a land use conversion).
b) In the baseline, land is subject to grazing, or mowing for hay, or cultivation of perennial forage grasses.
c) Project activities do not directly cause an increase in the numbers of grazing livestock inside the project area. (Numbers of wildlife are not considered in this methodology)
d) Land is degraded at the start of the project and degradation is expected to continue in the baseline scenario on the basis that degradation drivers or pressures are still present in the absence of the Plan Vivo project activities.
e) In the baseline, animal dung is deposited on grassland or in animal corrals and the management of animal dung is not expected to change due to implementation of project activities.
f) A biogeochemical model that is able to model the proposed management activities to be conducted in the project has been validated in the same climate region or agroecological zone as the project. If the project uses a model that has been validated in a different location from the project, then the model can only be used if the vegetation and soil types are the same.
g) Inorganic nitrogen fertilizers are not applied to grassland in either the baseline or project scenario.

h) If grazing activities are displaced from grasslands in the project boundary, grazing activities must not be displaced to forests.
i) The land is an eligible project intervention area as defined by the Requirements in the Plan Vivo Standard.

1.1.2 Applicability conditions for quantification of climate benefits of afforestation, reforestation or assisted natural regeneration activities in the project scenario

For all land subject to afforestation or reforestation with trees or shrubs, and/or assisted natural regeneration of shrub stands in grasslands, shrublands or forest, the following conditions apply:

j) The land is grassland, shrubland or forest at the start of the project.
k) The land is degraded at the start of the project and degradation is expected to continue in the baseline scenario on the basis that degradation drivers or pressures are still present in the absence of the Plan Vivo project activities.
l) Litter remains on the site and is not removed in the project activities.
m) Soil disturbance due to afforestation or reforestation with trees or shrubs
    i. Apply soil conservation practices (e.g. contour planting), where appropriate
    ii. Occur in site preparation only but are not expected to be repeated in 20 years after planting of trees or shrubs, except for replacement of non-surviving trees or shrubs.
n) Inorganic nitrogen fertilizers are not applied to land planned for re-vegetation in either the baseline or project scenario.
o) Biomass burning for site preparation is not practiced.
p) The land is an eligible project intervention area as defined by the Requirements in the Plan Vivo Standard.

2. Determining project intervention areas for climate benefit quantification

A PV project may be implemented in one contiguous area or may consist of multiple discrete project areas that are grouped into one project. For each geographical area (referred to as a ‘project intervention area’) included in a project there must be a documented land management plan that covers all land uses and project activities (see Section 2.1). For each project intervention area, there may be different vegetation types, land uses and project activities. Within each project intervention area, land must be stratified into distinct land use strata based on their baseline conditions and planned project activities to enable elaboration of relevant technical specifications and more accurate quantification of climate benefits from activities implemented in each land use stratum (see Section 2.2). The procedures for quantification of expected climate benefits in this methodology are used to calculate the climate benefits of activities implemented in each project intervention area.

2.1 Documentation of a land management plan

Project proponents must follow the requirements of the PV Standard for preparation and documentation of a land management plan. Documentation of the land management plan must, *inter alia*, record

- The location and scale of each project intervention area
- The project interventions to be undertaken in each project intervention area
- Technical specifications (e.g. species-mix, planting densities, grazing intensities and dates) for each specific intervention within each project intervention area.

In addition, the PDD must show:

- Documentation or attestation of project participants' land ownership or land use rights;
- Attestation that each project intervention is additional (i.e. would not have occurred in the absence of the project), by demonstrating that the interventions are not required by existing laws or regulations (unless these laws are commonly not enforced) and that there are financial, social, cultural, technical, scientific or institutional barriers preventing the intervention from taking place.
- Attestation that the project areas are not enrolled in any other ecosystem service programme, or that there is a formal agreement with other programmes to ensure that there is no double counting of ecosystem service benefits.

2.2 Stratification of project intervention areas

The purposes of stratifying project intervention areas into different land use strata are to enable elaboration of technical specifications suited to each type of land, and to enable more accurate estimation of climate benefits from implementation of different management activities in each land use stratum. Within each project intervention area, lands to which different activities will be applied in the PV project must be clearly identified, distinguishing (as appropriate to each project) areas that will be subject to the following land uses:

- Grazing management;
- Fodder or forage cultivation;
- Planting trees or shrubs on grassland, shrubland or forest land;
- Assisted natural regeneration of shrub communities in grasslands, shrublands or forests.

Within each of the identified land use categories, specific land use strata should be identified that can be described by different baseline scenarios (i.e. what would have happened in the absence of the PV project) and that are expected to have different carbon sequestration rates or GHG emissions due to adoption of the planned activities outlined in the land management plan. For with-project land use stratification, land use strata should be identified as distinct where with-project carbon stock changes or GHG emissions are expected to differ, either due to initial site characteristics or to management practices in the with-project scenario. Further guidance on stratification is given in Module 1 for grasslands under grazing and forage management, and in Module 2 for lands under re-vegetation activities.

Land plots allocated to a given baseline land use stratum may be the same as the land plots allocated to a given with-project land use strata (e.g. where with-project management activities are determined on the basis of pre-project site characteristics). Land plots allocated to a given baseline land use stratum may be allocated to one or more with-project land use strata (e.g. where only some plots of a baseline land use stratum are to be afforested in the with-project scenario). Each identified land plot should be allocated to one unique land use stratum.

Each area or plot of land on which project activities will be implemented should be given a unique ID code, and all relevant physical and management variables recorded so that the characteristics of each numbered plot can be identified in the baseline and with-project scenarios. The geographical location of each area or plot of land should be recorded in the land management plan.

3. Quantification of expected climate benefits

If there are grasslands, shrubland or forests in the project boundary to which the applicability conditions set out in Sections 1.1.1 or 1.1.2 apply, then project proponents may choose to apply this methodology to quantify the climate benefits of PV project activities. For those lands and activities where the project proponent decides to quantify climate benefits, Table 1 presents a summary of the main modules of this methodology that can be used to quantify climate benefits. Procedures for quantification of climate benefits in project intervention areas subject to grazing or forage management activities in the project scenario are given in Module 1 of this methodology, and procedures for quantification of climate benefits for project intervention areas subject to re-vegetation activities are given in Module 2 of this methodology. All PV projects using this methodology must apply the procedures set out in Module 3 for assessment and quantification of leakage due to displacement of grazing activities, and the procedures in the remainder of the main text of this methodology. Climate benefits shall be quantified for the duration of the quantification period, which must not exceed the period over which project participants can make a meaningful commitment to implementation of project activities.

If there are grasslands, shrubland or forests in the project boundary to which the applicability conditions set out in Sections 1.1.1 or 1.1.2 do not apply, then this methodology cannot be used to quantify climate benefits, but activities conducted on those lands may still be eligible for quantification of non-climate benefits (e.g. biodiversity, livelihoods, cultural values) that the project proponent decides to value.

Table 1: Selection of modules for quantification of climate benefits

Eligible lands	Climate benefit quantification
Grassland with grazing and forage management activities	Use Module 1: Quantification of climate benefits of grazing and forage management activities
Grassland, shrubland or forest with afforestation, reforestation or assisted natural regeneration activities	Use Module 2: Quantification of climate benefits of re-vegetation activities
All eligible lands in the project area	Use Module 3: Estimation of leakage from displacement of grazing, and Requirements and procedures in the main text of this methodology

The result of applying Module 1 and its associated quantification tools is estimation of expected climate benefits in each project intervention area under improved grazing or forage management activities in the project scenario during the quantification period, $CB_{G,a}$. The result of applying Module 2 and its associated quantification tools is estimation of expected climate benefits from each project intervention area under revegetation activities in the project scenario during the quantification period, $CB_{R,a}$. Module 3 specifies procedures for ex ante quantification of leakage emissions due to displacement of grazing activities from the whole project area. The total expected net climate benefits in the project quantification period are the sum of climate benefits from all project intervention areas, minus leakage emissions:

$$CB_{QP} = \sum_{a=1}^{A} CB_{G,a} + \sum_{a=1}^{A} CB_{R,a} - LE_{QP} \quad \text{(Eq. 1)}$$

where

CB_{QP}	Total net climate benefits from project activities implemented in all project intervention areas during the quantification period; tCO_2e
$CB_{G,a}$	Climate benefits from implementation of grazing and forage management activities on grasslands in project intervention area *a* during the quantification period; tCO_2e
$CB_{R,a}$	Climate benefits from implementation of revegetation activities on grasslands in project intervention area *a* during the quantification period; tCO_2e
LE_{QP}	Leakage emissions due to displacement of grazing activities from the project boundary during the project quantification period; tCO_2e
A	Index of project intervention areas (a=1…A)

4. Plan Vivo Certificates risk buffer

Where projects seek to generate Plan Vivo Certificates, the PV Standard requires that where there is a risk of reversal associated with project interventions, a proportion of expected climate services must be held in a risk buffer to protect the project from unexpected reductions in carbon stocks or increases in emissions. An approved approach for assessing risk and defining risk buffers is to be used to estimate the proportion of total net climate benefits during the quantification period to be held in the risk buffer reserve. At each PV project verification event, implementation of project activities and the occurrence of risk events shall be reviewed on the basis of annual monitoring results during the quantification period and other relevant information. Based on the findings of the project verification, the project proponent shall revise estimates of project risks and use the same approved approach to recalculate the proportion of climate benefits to be held in the risk buffer during the subsequent quantification period.

5. Monitoring

All projects must prepare a monitoring plan that specifies: the parameters for which data will be collected; the methods to be used for data collection; the frequency of data collection; procedures for data analysis; roles and responsibilities in monitoring data collection, analysis and reporting; and the resources and inputs required. Performance indicators and targets, and the monitoring methodology must be described in the Technical Specifications for each project intervention area.

Performance indicators and parameters for monitoring may refer to adoption of the activities set out in the PDD and Technical Specifications, to indicators of change in the condition of vegetation, or to direct indicators of climate benefits. Where a project is intended to be implemented for more than one quantification period, prior to the second quantification period, the Technical Specifications must be verified, for which monitoring data is an essential input and the following guidance applies.

For grassland and forage management activities, where expected change in soil carbon stocks is estimated using simulations with a carbon model, it is not appropriate to directly measure soil carbon stock changes. However, monitoring data should be provided that enables quantification of the proportion of grassland in each land use stratum that has been managed in accordance with the management activities described in the carbon model and used to estimate expected soil carbon stock changes. Depending on the activities planned, this may require monitoring of management activity data only (e.g. area planted with perennial forage plants), or may also require monitoring of biophysical parameters (e.g. above ground grass biomass) on an annual basis.

For re-vegetation activities, where expected change in woody biomass carbon stocks is estimated using a variety of approaches, it is required to provide directly measured data that can be used to estimate the actual change in woody biomass. This data may be collected only once prior to verification of the Technical Specifications, and projects may choose to monitor management activities (e.g. how many hectares planted with each species of tree or

shrub) or change in condition of vegetation (e.g. visual indicators of shrub community health) on an annual basis.

Other monitoring data required by project participants to improve implementation and management of the project may also be collected.

All projects must put in place a system for ensuring the quality of monitoring data and for checking the robustness of monitoring results.

Module 1: Quantification of climate benefits of grazing and forage management activities

The procedures in this module must be followed to quantify climate benefits of grazing and forage management activities in the PV project. The module is structured as follows:

M1.1 provides guidance on stratification of grasslands in the project area to identify distinct land use strata in each project intervention area.

M1.2 identifies the carbon pools and GHG sources included and excluded in the quantification process.

M1.3 sets out procedures for quantification of GHG emissions and removals in the baseline scenario for each project intervention area.

M1.4 sets out procedures for quantification of GHG emissions and removals for each project intervention area under grazing or forage management in the project scenario.

M1.5 sets out procedures for quantifying climate benefits from each project intervention area under grazing or forage management in the project scenario.

M1.6 summarizes data requirements for quantifying climate benefits of grazing or forage management in the project scenario for each project intervention area.

For all projects applying this module, Module 3 (Estimation of leakage from displacement of grazing) must be applied to the whole project area.

M1.1 Stratification of grasslands

As set out in Section 2 of the methodology, stratification of the project intervention area can improve the accuracy of climate benefit estimates. For projects with improved grazing and forage management activities, this is particularly important because changes in soil carbon stocks will be estimated using a carbon model that requires baseline site characteristics and management practices as well as with-project management practices as input parameters. If areas or plots of grassland have different baseline site characteristics (e.g. soil types or degrees of degradation), management histories (e.g. cultivation, grazing), or with-project activities (e.g. changes in grazing duration, cultivation of forage), carbon stock changes will be expected to differ. Therefore, for grassland under grazing or forage management, it is necessary to identify distinct land use strata within each project intervention area.

From the perspective of climate benefit quantification, the relevance of a physical site or management characteristic should be assessed with regard to whether the variable is expected to influence carbon sequestration or GHG emissions. Relevant physical characteristics should be determined based on the existing local, technical or scientific knowledge of grassland condition. In grasslands, relevant physical characteristics are likely to include vegetation type, soil type and indicators of grassland degradation or grassland health. Relevant baseline management characteristics are likely to include the history of

grazing, timing of grazing (e.g. summer or winter pasture), the presence or absence of any other management practices (e.g. hay making, reseeding, cultivation). Relevant project scenario management characteristics are likely to include planned grazing durations, seasons and intensities, or forage management practices such as hay harvesting or the cultivation of nitrogen-fixing species.

Each plot of grassland subject to grazing or forage management activities should be identified in the land management plan, and its area (hectares) recorded. The area of a given land use stratum will be sum of areas of individual plots in the same land use stratum.

M1.2 Carbon pools and GHG emission sources quantified

The carbon pools and GHG emission sources included in or excluded from the estimation of climate benefits of grazing and forage management activities are described in Tables 2 and 3. If any carbon pool or emission source is not relevant to quantification of the climate benefits of specific activities included in a PV project using this methodology, then that source or pool may be excluded. If the decrease in any carbon pool or increase in any GHG source is less than 5% of the total climate benefits from lands under grazing or forage management activities (as calculated in M1.5), it may be ignored, but justification must be presented in the project Technical Specification.

Table 2: Carbon pools accounted for in this module

Carbon pools	Included	Justification / explanation
Above and below ground non-woody biomass	No	The increase of above and below ground non-woody biomass resulting from improved grassland management is transient and is conservatively excluded.
Aboveground woody biomass	No	Although woody shrub biomass may be increased by improved grazing practices, it is conservatively excluded
Below ground woody biomass	No	Although woody shrub biomass may be increased by improved grazing practices, it is conservatively excluded
Dead wood	No	None of the applicable management practices decrease dead wood, so it can be conservatively excluded.
Litter	No	None of the applicable management practices decrease the amount of litter, so it can be conservatively excluded.
Soil organic carbon	Yes	This is a major carbon pool affected by grazing and forage management practices that is expected to increase in the project scenario
Wood products	No	None of the applicable management practices increases or decreases wood products, so it can be conservatively ignored.

Table 3: Emission sources accounted for in this module

Source	Gas	Included?	Justification
Use of fertilizer	CO_2	No	Not main gas for this source
	CH_4	No	Not main gas for this source
	N_2O	No	Excluded by applicability condition (g)
Use of N-fixing species	CO_2	No	Not applicable
	CH_4	No	Not applicable
	N_2O	Yes	Main gas for this source
Manure management	CO_2	No	Not main gas for this source
	CH_4	No	Conservatively excluded on the basis of applicability condition (e)
	N_2O	No	Conservatively excluded on the basis of

			applicability condition (e)
Enteric fermentation	CO_2	No	Not applicable
	CH_4	No	Conservatively excluded on the basis of applicability condition (c)
	N_2O	No	Not applicable
Fossil fuel use in transport	CO_2	No	Not likely to be a significant emission source, excluded for simplification.
	CH_4	No	Not main gas for this source.
	N_2O	No	Not main gas for this source.

M1.3 Baseline emissions and removals

Removals by soil carbon sequestration and emissions due to cultivation of leguminous forage species are the main sinks and sources considered in quantifying baseline emissions and removals from grasslands. Baseline removals and emissions from each project intervention area *a* that will be under grazing and forage management project activities shall be quantified using Equation 2:

$$BE_{G,a} = BE_{NF,fo,a} + BE_{SOC,G,a} \quad \text{(Eq. 2)}$$

where

$BE_{G,a}$ GHG emissions from grassland in project intervention area *a* in the baseline during the quantification period; tCO_2e

$BE_{NF,fo,a}$ GHG emissions from cultivation of nitrogen fixing forage species in project intervention area *a* in the baseline during the quantification period; tCO_2e

$BE_{SOC,G,a}$ GHG emissions due to change in soil organic carbon stocks in grasslands in project intervention area *a* in the baseline during the quantification period; tCO_2e

Baseline emissions from cultivation of nitrogen-fixing forage species are conservatively excluded in the baseline, but the project proponent shall record the area under N-fixing species in each project intervention area prior to project implementation. This figure will be used to determine whether the increase in nitrogen-fixing species within each project intervention area in the project scenario is significant. Therefore $BE_{NF,fo,a}$ is equal to zero. Furthermore, following applicability condition (d), it is expected that baseline soil carbon stocks are decreasing. However, carbon stock losses are difficult to quantify reliably and it is therefore conservatively assumed that soil carbon emissions and removals ($BR_{SOC,G,a}$) are equal to zero. Thus,

$$BE_{G,a} = 0 \quad \text{(Eq. 3)}$$

M1.4 Project emissions and removals

Project emissions from management of natural grasslands and perennial forage in each project intervention area *a* during the quantification period are calculated as:

$$PE_{G,a} = PE_{NF,fo,a} + PE_{SOC,G,a} \quad \text{(Eq. 4)}$$

where

$PE_{G,a}$	GHG emissions from grassland in project intervention area *a* in the project scenario during the quantification period; tCO_2e
$PE_{NF,fo,a}$	GHG emissions from cultivation of nitrogen fixing forage plants in project intervention area *a* in the project scenario during the quantification period; tCO_2e
$PE_{SOC,G,a}$	GHG emissions due to change in soil organic carbon stocks in grasslands in project intervention area *a* in the project scenario during the quantification period; tCO_2e

M1.4.1 Project emissions due to N_2O from cultivation of nitrogen-fixing forage species

If in the project scenario, the area of any given project intervention area that is planned to be cultivated with nitrogen-fixing species is more than 50% of the area cultivated with nitrogen-fixing species in the baseline, then N_2O emissions are to be calculated using the 'Tool for estimation of N_2O emissions from cultivation of nitrogen-fixing species' (Appendix I to the methodology), producing an estimate of $PE_{NF,fo,a}$ for each project intervention area.

M 1.4.2 Project soil carbon removals

Removals due to soil carbon sequestration are expected to be the main benefit of grazing management and management of perennial forage. Project emissions due to soil carbon sequestration by grazing and forage management in each project intervention area *a* in the quantification period ($PE_{SOC,G,a}$) shall be estimated using the procedures specified in the 'Tool for estimation of soil organic carbon removals from improved grazing and perennial forage management' (Appendix II of the methodology).

M1.5 Quantification of climate benefits

The expected climate benefits from grazing and forage management activities on grassland in each project intervention area *a* during the quantification period shall be calculated using Equation 5:

$$CB_{G,a} = BE_{G,a} - PE_{G,a} \quad \text{(Eq. 5)}$$

Where

$CB_{G,a}$	Climate benefits from grassland and forage management in project intervention area *a* during the quantification period; tCO_2e

M1.6 Data requirements

Calculation of project emissions and removals from grazing and forage management using the tools in Appendix I and II requires data on the area of each land use stratum in each project intervention area, data that can represent management practices to be applied to each land use stratum, and data for parameters used to estimate GHG emissions or removals. The main data and requirements of the data sources are summarized in Table 4 and Table 5. The Century model used in the tool in Annex II requires a large number of input parameters, of which only the relevant activity parameters are listed here.[6]

Table 4: Data used for estimating climate benefits of grazing management

Parameter	Description	Source of data	Use of parameter
Area of each land use stratum under grazing management	Area (hectares) of each land use stratum	Field survey using GPS or calculated from existing maps	Quantification of area subject to different grazing management practices, and estimation of baseline and project scenario biomass removal rates
Above ground biomass	Above ground biomass (kg dry matter) of grassland vegetation in each land use stratum	Field survey or reliable values from monitoring plots in the project area, or peer reviewed literature that is representative of the project area	Quantification of biomass removal rates as input into Century model
Population of livestock of each type in each season	Type of livestock distinguished by sex and age class (young, mature)	Reliable statistics, or baseline activity survey	Quantification of biomass removal rates as input into Century model
Dates & number of grazing days in each season	Dates of grazing and nnumber of days spent grazing during each season by each type / class of livestock	Bbaseline activity survey	Quantification of biomass removal rates as input into Century model

Table 5: Data used for estimation of climate benefits of forage management

Parameter	Description	Source of data	Use of parameter
For all forage			
Area of each land use stratum planted with each type of forage	Area (hectares) of each land use stratum	Field survey using GPS or calculated from existing maps	Quantification of the area planted to each type of forage
Pre-project area under N-fixing forage species	Area (hectares) of land use stratum planted with N-fixing species in the baseline	Field survey	Assessment of the significance of the increase in N-fixing forage species area
Forage cultivation	Parameters describing management of	Technical specifications for each	As input into Century model

[6] For other parameters, refer to Century operation manuals: https://www.nrel.colostate.edu/projects/century/

practices	cultivated forage plots (e.g. timing of sowing and harvest, tillage methods, proportion of biomass removed etc.)	land use stratum	
For nitrogen-fixing forage			
$Crop_{g,t}$	Annual dry matter returned to soils by N-fixing species *g*	Measurements from existing plots in project area, published estimates, expert judgment or IPCC default values	Estimation of N_2O emissions from cultivation of N-fixing forage species
EF_{NF}	Emission factor for N-fixing forage species	Published estimates or IPCC default values	Estimation of N_2O emissions from cultivation of N-fixing forage species
GWP_{N2O}	Global warming potential of N_2O	IPCC default value	Estimation of N_2O emissions from cultivation of N-fixing forage species
N_g	Fraction of N in dry matter of N-fixing species	Published estimates or IPCC default values	Estimation of N_2O emissions from cultivation of N-fixing forage species

Module 2: Quantification of climate benefits of re-vegetation activities

The procedures set out in this module must be followed to quantify climate benefits of re-vegetation activities in the PV project. The module is structured as follows:

M2.1 provides guidance on stratification of the project area to identify distinct land use strata in each project intervention area.

M2.2 identifies the carbon pools and GHG sources included and excluded in the quantification process.

M2.3 sets out procedures for quantification of GHG emissions and removals in the baseline scenario for each project intervention area.

M2.4 sets out procedures for quantification of GHG emissions and removals for each project intervention area under re-vegetation activities in the project scenario.

M2.5 sets out procedures for quantifying climate benefits from each project intervention area under re-vegetation activities in the project scenario.

M2.6 summarizes data requirements for quantifying climate benefits of re-vegetation activities in the project scenario for each project intervention area.

For all projects applying this module, Module 3 (Estimation of leakage from displacement of grazing) must be applied to the whole project area.

M2.1 Stratification of the project area and identification of project intervention areas

As set out in Section 2 of the methodology, stratification of the project intervention area can improve the accuracy of climate benefit estimates. For re-vegetation activities in grasslands, shrublands or forests, distinct land use strata should be identified on the basis of relevant site characteristics, management histories, and with-project activities. The relevance of a physical site or management characteristic should be assessed with regard to whether the variable is expected to influence carbon sequestration or GHG emissions. Relevant physical characteristics should be determined based on the existing local, technical or scientific knowledge of ecological conditions in the project area.

For areas where re-vegetation activities are planned, relevant physical site characteristics are likely to include:

- Soil type, soil depth, slope, existing erosion
- Presence or absence of existing vegetation and the species present
- Condition of existing vegetation
- Signs of recent use, e.g. burning, logging, fuel collection, grazing etc.

A stratum within which there is a significant variation in any factor such as vegetation type, soil type or signs of human intervention should be divided into different strata.

With project management plans and technical specifications can also lead to different carbon sequestration and GHG emissions between land uses. Therefore, separate land use strata should be identified where there is significant variation in the planned

- Species to be planted or planting densities
- Management of shrub or tree stands

Lands that are expected to have significant differences in woody biomass growth rates in the project scenario, due either to site conditions or management practices, should be divided into separate strata.

M2.2 Carbon pools and GHG emission sources quantified

The carbon pools and GHG emission sources included in or excluded from the estimation of climate benefits of re-vegetation activities are described in Tables 6 and 7. If any carbon pool or emission source is not relevant to quantification of the climate benefits of specific activities included in a PV project using this methodology, then that source or pool may be ignored. If the decrease in any carbon pool or increase in any GHG source is less than 5% of the total climate benefits from lands under re-vegetation activities (as calculated in M2.5), it may be ignored, but justification must be presented in the PDD.

Table 6: Carbon pools accounted for in this module

Carbon pools	Included	Justification / explanation
Above and below-ground non-woody biomass	No	The increase of non-woody biomass resulting from re-vegetation activities is transient can be conservatively excluded.
Aboveground woody biomass	Yes	This is a potentially significant pool and is considered for tree and shrub planting and regeneration activities
Below ground woody biomass	Yes	This is a potentially significant pool and is considered for tree and shrub planting and regeneration activities
Dead wood	No	None of the applicable management practices decrease dead wood, so it can be conservatively excluded.
Litter	No	None of the applicable management practices decrease the amount of litter, so it can be conservatively excluded.
Soil organic carbon	Yes	This is carbon pool is likely to be affected by re-vegetation activities and is expected to increase in the project scenario
Wood products	No	None of the applicable management practices increases or decreases wood products, so it can be conservatively ignored.

Table 7: Emission sources accounted for in this module

Source	Gas	Included?	Justification
Use of fertilizer	CO_2	No	Not main gas for this source
	CH_4	No	Not main gas for this source
	N_2O	No	Excluded by applicability condition (n)
Use of N-fixing species	CO_2	No	Not applicable
	CH_4	No	Not applicable
	N_2O	Yes	Main gas for this source
Fossil fuel use in transport	CO_2	No	Not likely to be a significant emission source, excluded for simplification.
	CH_4	No	Not main gas for this source. Excluded for simplification.
	N_2O	No	Not main gas for this source. Excluded for simplification.

M2.3 Baseline emissions and removals

Baseline emissions from re-vegetation in project intervention area *a* during the quantification period are calculated as

$$BE_{R,a} = BE_{R,WB,a} + BE_{R,SOC,a} + BE_{R,NF,a} \quad \text{(Eq. 6)}$$

where

$BE_{R,a}$	Total emissions in the baseline from lands planned to be revegetated in project intervention area *a* during the quantification period; tCO_2e
$BE_{R,WB,a}$	Total emissions from woody biomass in the baseline in project intervention area *a* during the quantification period; tCO_2e
$BE_{R,SOC,a}$	Total emissions by soils subtending grassland, forest or shrubland in project intervention area *a* in the baseline during the quantification period; tCO_2e
$BE_{R,NF,a}$	Total emissions from nitrogen-fixing trees or shrubs in grassland, forest or shrubland in project intervention area *a* in the baseline during the quantification period; tCO_2e

Since re-vegetation activities are only applicable where soils and existing vegetation is degraded or degrading, and planting of woody biomass is not planned in the absence of the PV project activity, baseline emissions from change in woody biomass and soil carbon pools can be conservatively ignored. It is also conservative to ignore baseline N_2O emissions from nitrogen-fixing trees and shrubs in the project intervention area. So for each project intervention area *a* with lands planned to be subject to re-vegetation activities, the value of emissions in the baseline during the quantification period is zero, thus:

$$BE_{R,a} = 0 \quad \text{(Eq. 7)}$$

M2.4 Project emissions and removals

Project emissions from re-vegetation activities in project intervention area *a* during the quantification period are calculated as

$$PE_{R,a} = PE_{R,WB,a} + PE_{R,SOC,a} + PE_{R,NF,a} \quad \text{(Eq. 8)}$$

where

$PE_{R,a}$	Total project emissions from re-vegetation activities in project intervention area *a* during the quantification period; tCO_2e

$PE_{R,WB,a}$	Total project emissions from change in woody biomass on grassland, shrubland or forests under re-vegetation in project intervention area *a* during the quantification period; tCO_2e
$PE_{R,SOC,a}$	Total project emissions from change in soil carbon in soils subtending grassland, forest or shrubland under re-vegetation in project intervention area *a* during the quantification period; tCO_2e
$PE_{R,NF,a}$	Total project emissions from nitrogen-fixing tree or shrub species in project intervention area *a* under re-vegetation during the quantification period; tCO_2e

M2.4.1 Project emissions from change in woody biomass

Project emissions from change in carbon stocks in woody perennials in project intervention area *a* are expected to arise from planting trees or shrubs or assisted natural regeneration of trees or shrubs, and must be estimated following the procedures in the 'Tool for estimation of carbon stock changes in woody biomass' (Appendix III to this methodology).

M2.4.2 Project emissions from change in soil carbon stocks

Where trees or shrubs are planted or assisted natural regeneration measures applied to a given project intervention area *a*, change in soil carbon stocks can be estimated using the 'Tool for estimation of change in soil organic carbon stocks due to re-vegetation activities' (Appendix IV of this methodology), which provides procedures for estimation of change in soil carbon stocks due to re-vegetation activities, $PE_{R,SOC,a}$.

M2.4.3 Project emissions from nitrogen-fixing tree or shrub species

Where the trees or shrubs that are planted or subject to assisted natural regeneration measures are nitrogen-fixing species, N_2O emissions from nitrogen-fixing trees and shrubs in a given project intervention area *a* can be estimated using the 'Tool for estimation of N_2O emissions from cultivation of nitrogen-fixing tree and shrub species' (Appendix V to the methodology), producing an estimate of $PE_{R,NF,a}$ for each project intervention area.

M2.5 Quantification of climate benefits from re-vegetation activities

The expected climate benefits of re-vegetation activities in each project intervention area *a* during the quantification period shall be calculated using Equation 9:

$$CB_{R,a} = BE_{R,a} - PE_{R,a} \quad \text{(Eq. 9)}$$

Where

$CB_{R,a}$	Climate benefits from re-vegetation activities in project intervention area *a* during the quantification period; tCO_2e

M2.6 Data requirements

For estimating climate benefits of re-vegetation activities, Table 8 summarizes the data required. The specific data required by each project will vary depending on the project activities and the method chosen for ex ante estimation of woody biomass stock changes (see Appendix III).

Table 8: Data required for quantification of climate benefits of re-vegetation activities

Parameter	Description	Source of data	Use of parameter
For all re-vegetation land use strata			
Area of each land use stratum	Area (hectares) of each with-project land use stratum	Field survey using GPS or calculated from existing maps	Quantification of the area under each re-vegetation practice
For re-vegetation with trees			
Tree dimensions	Dimensions of trees, e.g. stem diameter, height	Sample surveys, scientific literature, forest inventories	Estimation of biomass volume per tree
Tree stem volume for each species in each land use stratum	m^3	Volume tables or sample biomass survey	Estimation of biomass volume per tree
Tree population density for each species in each land use stratum	Number of trees per sample plot or per hectare	Sample survey	Estimation of biomass volume per hectare
Area of sample plots	hectares	Sample survey protocol	Estimation of biomass volume per hectare
Expected growth rates of tree stem volume per year for each species in each land use stratum	Expected growth rates of tree stem volume (m^3 per year)	Volume tables, field survey of trees at different ages, or literature values appropriate for the tree species in the region	Estimation of woody biomass stock at the end of the quantification period
For re-vegetation with shrubs			
Shrub dimensions of each species	Various, e.g. basal diameter, crown cover	Sample survey	Estimation of biomass per shrub species
Area of sample plots	hectares	Sample survey protocol	Estimation of shrub biomass volume per hectare
Shrub biomass per hectare	t dry matter per ha	Calculated from sample survey data or literature values	Estimation of biomass volume per hectare
Expected growth rate of shrub biomass per hectare	Expected growth rates of above ground shrub biomass (t dry matter per ha per year)	Estimated with growth curves or based on literature values appropriate for the shrub vegetation in the region, or field survey of shrub stands of different ages	Estimation of final shrub biomass per hectare at the end of the quantification period

Module 3: Accounting for expected leakage emissions

Applicability condition (h) states that this methodology is not applicable where grazing activity is displaced to forest where it may cause deforestation or forest degradation. The methodology assumes that farmers (whether project participants or non-participants) have incentives to prevent displacement of grazing to cropland. Therefore, this methodology assumes that livestock displaced from the project boundary are displaced to grasslands.

It is assumed that the grasslands to which livestock are displaced are already grazed, and that displacement of grazing to grasslands outside the project boundary leads to overgrazing and degradation of those grasslands, thus causing GHG emissions from soil carbon loss. If it is planned to displace livestock to an area that is previously not grazed, then it is recommended to include this area within the project boundary as a leakage management zone.

It is not reasonable to expect project proponents to undertake field surveys in areas outside the project boundary to monitor grazing displacement. Therefore, the approach to estimating leakage depends on estimation of the number of animal unit months (AUM) of grazing displaced and estimation of the area affected by grazing displacement, based on which loss of soil carbon stocks is estimated. Estimates of baseline grazing activity should derive from baseline surveys. Estimates of project scenario grazing activity should derive from land management plans described in the PDD.

Units and Variables

The variable estimated by this module is net leakage emissions due to grazing displacement (L_{QP}), which can only take non-negative values. Where the calculated value is negative, it is assumed that L_{QP}=0.

The unit for calculating leakage is the animal unit month (AUM). AUM may be calculated with reference to any standard animal unit, e.g. Livestock Unit (LU), Tropical Livestock Unit (TLU), Animal Unit (AU), Sheep Unit (SU) etc, where local or national standards or literature values can be used to create equivalence between the dry matter intake requirements of different types and classes of animals. One AUM indicates grazing activity by 1 standard animal unit during 30 days in a month. The same type and class of animal must be used as the reference unit in all calculations using this tool.

Procedures

STEP 1: DETERMINE APPLICABILITY OF THE TOOL

For ex ante estimation of grazing displacement, determine whether grazing displacement is likely to take place. Grazing displacement may be due to

(a) Displacement of livestock owned by the project participants to grassland outside the project boundary (e.g. in order to reduce grazing intensity and restore grasslands inside the project boundary), or

(b) Displacement of livestock owned by people not taking part in the project to grassland outside the project boundary (e.g. prohibiting neighbouring communities from using grassland in the project area).

If grazing displacement is not likely to take place, then the value of L_{QP}= 0.

If grazing displacement due to animals owned by either or both types of grazing agent is likely, then follow the remaining procedures in this tool to estimate the value of L_{QP}.

STEP 2: Estimate displacement of grazing activity

STEP 2.1 Calculate annual grazing activity inside the boundary of each project intervention area in the baseline

Calculation of livestock grazing activity inside the boundary of each project intervention area should consider livestock owned by project participants and people not taking part in the project (e.g. residents of adjacent communities). Estimates should be based on survey data, considering the numbers and types of livestock as well as the duration of the year these livestock spend grazing inside the project intervention area. For the baseline scenario, livestock grazing activities shall be calculated as:

$$LGA_{baseline,a,t} = PPI_{baseline,a,t} + NPI_{baseline,a,t} \quad \text{(Eq. 10)}$$

Where,

$LGA_{baseline,a,t}$ Total livestock grazing activities in project intervention area *a* in year *t* in the baseline; AUM

$PPI_{baseline,a,t}$ Total livestock grazing activities by animals owned by project participants grazing in project intervention area *a* in year *t* in the baseline; AUM

$NPI_{baseline,a,t}$ Total livestock units grazing activities by animals owned by project non-participants grazing in project boundary implementation area *a* in year *t*; AUM

STEP 2.2 Calculate total annual grazing activities inside the project boundary in the baseline

The total amount of grazing activity inside the project boundary in the baseline can be summed across all project intervention areas and calculated as:

$$LGA_{baseline,t} = \sum_a LGA_{baseline,a,t} \quad \text{(Eq.11)}$$

Where

$LGA_{baseline,t}$ Total livestock grazing activities in project the project boundary in year *t* in the baseline; AUM

STEP 2.3 Calculate with-project annual grazing activity inside the project boundary of each project intervention area

Ex-ante estimates of livestock grazing activity inside a given project intervention area in the project scenario should be based on the land management plan and should consider livestock owned by project participants as well as those owned by people not taking part in the project (e.g. residents of adjacent communities). In estimating these numbers, it should be considered whether some livestock owned by project participants will grazing for some portion of the year outside the project boundary in order to enable grassland restoration within the project area, and whether some livestock owned by people not participating in the project will be prohibited from grazing in the project area in order to enable grassland restoration within the project area. If project participants plan to sell animals for slaughter in the project scenario, this does not cause displacement of grazing activities. The animal unit months of grazing activities in the year for the animals that are planned to be slaughtered should be recorded as $PO_{project,t}$, i.e. if 10 animal units are to be sold at the beginning of the year, this shall be measured in animal unit months as 10 AU multiplied by 12 months. Total grazing activities in each project intervention area shall be calculated as:

$$LGA_{project,a,t} = PPI_{project,a,t} + NPI_{project,a,t} \quad \text{(Eq. 12)}$$

Where,

$LGA_{project,a,t}$ Total livestock grazing activities in project intervention area *a* in year *t* in the project scenario; AUM

$PPI_{project,a,t}$ Livestock grazing activity by livestock owned by project participants in project intervention area *a* in year *t* in the project scenario; AUM

$NPI_{project,a,t}$ Livestock grazing activity by livestock owned by project non-participants in project intervention area *a* in year *t* in the project scenario; AUM

STEP 2.4 Calculate total annual grazing activities inside the project boundary in the baseline

Total grazing activities each year inside the project boundary in the project scenario can be summed across all project intervention areas and calculated as:

$$LGA_{project,t} = \sum_a LGA_{project,a,t} \quad \text{(Eq.13)}$$

Where

$LGA_{project,t}$ Total livestock grazing activities in project the project boundary in year *t* in the project scenario; AUM

STEP 2.5 Calculate total grazing displacement due to project activities

Annual displacement of livestock grazing attributed to the project activities shall be calculated as:

$$GD_t = LGA_{baseline,t} - LGA_{project,t} - PO_{project,t} \quad \text{(Eq. 14)}$$

where

GD_t	Displacement of livestock grazing activities attributable to project implementation in year *t* in the project scenario; AUM
$PO_{project,t}$	Planned off-take of animals owned by project participants in year *t* in the project scenario; AUM

STEP 3 Estimate annual carbon stock losses due to displacement of grazing activity

STEP 3.1 Estimate the grassland area required to support the displaced livestock

$$Area_{GD} = \frac{GD_t \times (DMI_{daily,ref} \times 30)}{(ANPP_{ref} \times 0.5)} \quad \text{(Eq. 15)}$$

where

$Area_{GD}$	Area of grassland required to support the displaced livestock; ha
$DMI_{daily,ref}$	Daily dry matter intake for each standard animal unit; kg d.m. (which may be taken from literature values, national standards or local measurements, or calculated using IPCC default data)
$ANPP_{ref}$	Above ground net primary productivity of grasslands in the project region; kg ha^{-1}
30	Number of days in a month

ANPP is multiplied by 0.5 on the conservative assumption that removal of more than 50% of ANPP by grazing livestock is likely to reduce SOC stocks. If local data for ANPP of grasslands in the region surrounding the project area are available, they should be used. If no data are available, values for ANPP appropriate to the project region from Table 3.4.2 of the IPCC GPG may be used.

STEP 3.2 Estimate annual carbon stock losses due to grazing displacement

$$L_{G,t} = Area_{GD} \times SOC_{REF} \times (1 - F_{MG,SD}) \times \left(\frac{44}{12}\right) \quad \text{(Eq. 16)}$$

Where

$L_{G,t}$	Leakage emissions due to loss of soil carbon caused by displacement of grazing activities outside the project boundary in project year *t*; tCO_2e
$Area_{GD}$	Area of grassland required to support the displaced livestock; ha
SOC_{REF}	Soil organic carbon stocks in grasslands in the project region; tC ha^{-1} (see table 3.4.4 IPCC GPG)

$F_{MG,SD}$	carbon stock change factor for management regime for severely degraded grasslands (0.7) see table 3.4.5 IPCC GPG; dimensionless
44/12	Conversion factor from carbon to carbon dioxide; tCO2e tC^{-1}

STEP 4 Estimation of total leakage emissions due to displacement of grazing activity

Total leakage emissions due to displacement of grazing activity during the quantification period is the sum of annual soil carbon losses across all years in the quantification period:

$$L_{QP} = \sum_t L_{G,t} \quad \text{(Eq. 17)}$$

Appendix I: Tool for estimation of N_2O emissions from cultivation of nitrogen-fixing forage species

Application of this tool:

Forage species that fix nitrogen may emit N_2O. Project emissions from nitrogen-fixing forage species must be accounted for if the area planned to be cultivated with nitrogen-fixing species in the project is more than 50 percent larger than the area cultivated with nitrogen-fixing species in the baseline. Baseline N_2O emissions from cultivation of nitrogen-fixing species are conservatively ignored.

Parameters determined with this tool:

This tool is used to estimate GHG emissions from cultivation of perennial nitrogen-fixing forage species in the project scenario in each project intervention area *a*, which is denoted by $PE_{NF,fo,a}$.

Calculation of annual project emissions from nitrogen-fixing forage species:

For each land use stratum *i*, annual project emissions from cultivation of nitrogen-fixing forage species must be calculated using the following equations:

$$PE_{NF,fo,i,t} = F_{CR,i,t} \times EF_{NF} \times (44/28) \times GWP_{N2O} \quad \text{(Eq. I.1)}$$

where,

$PE_{NF,fo,i,t}$	Project N_2O emissions from nitrogen-fixing forage species in land use stratum *i* in year t; t CO_2e
$F_{CR,i,t}$	Amount of N in nitrogen-fixing forage species (above and below ground) returned to soils in land use stratum *i* in project year t; t N
EF_{NF}	Emission factor for N_2O emissions from N inputs of N-fixing species to soil; kg N_2O-N / kg N input
$44/28$	Conversion of N_2O-N /kg N to N_2O
GWP_{N2O}	Global warming potential for N_2O; t CO_2e / t N_2O

$$F_{CR,i,t} = \sum_{g=1}^{G} Area_{g,i,t} \times Crop_{g,t} \times N_g \quad \text{(Eq. I.2)}$$

where,

$F_{CR,i,t}$	Amount of N in N-fixing species (above and below ground) returned to

	soils in land use stratum *i* in project year t; t N
$Area_{g,i,t}$	Total annual area of N-fixing species *g* in land use stratum *i* in year t; ha
$Crop_{g,t}$	Annual dry matter, including aboveground and below ground, returned to soils by N-fixing species g in project year t; t dm / ha
N_g	Fraction of N in dry matter in N-fixing species g; t N / t dm
g	Index of nitrogen-fixing species

The total annual project emissions from cultivation of nitrogen-fixing forage species in project intervention area *a* can be calculated as the sum of emissions from each land use stratum *i* in the intervention area:

$$PE_{NF,fo,a,t} = \sum_i PE_{NF,fo,i,t} \quad \text{(Eq. I.3)}$$

where,

$PE_{NF,fo,a,t}$	Project N_2O emissions from nitrogen-fixing forage species in project intervention area *a* in year *t*; t CO_2e

Calculation of total project emissions from nitrogen-fixing species during the quantification period:

The sum of project emissions in project intervention area *a* from cultivation of nitrogen-fixing fodder or shrub species during the whole quantification period is calculated as:

$$PE_{NF,fo,a} = \sum_t PE_{NF,fo,a,t} \quad \text{(Eq. I.4)}$$

where,

$PE_{NF,fo,a}$	Project N_2O emissions from nitrogen-fixing forage species in project intervention area *a* during the quantification period; t CO_2e

Sources of data for ex ante estimation of project emissions from nitrogen-fixing species:

For parameters in this tool that are not calculated values, data used to make ex ante estimates of project emissions from nitrogen-fixing species shall consider the following data sources.

Parameter	Data sources
EF_{NF}	Use emission factors from the peer reviewed scientific literature that are specific for the project area or host country. If these are unavailable, use default emission factors (EF1 or EF2, as appropriate) from IPCC 2006 Guidelines Volume 4 Chapter 11, Table 11.1.
GWP_{N2O}	The IPCC default value of 310 shall be used.
$Area_{g,i,t}$	The area cultivated with each species of nitrogen fixing plant in each land

	use stratum shall be obtained from the project implementation plans
$Crop_{g,t}$	Use values from the peer reviewed scientific literature that are specific for the project area or host country, or if these are unavailable estimate fresh or dry matter yield based on the knowledge of experts in the project area, and if necessary convert to dry matter using the default values in IPCC 2006 Guidelines Volume 4 Chapter 11, Table 11.2.
N_g	Use values from the peer reviewed scientific literature that are specific for the project area or host country. If these are unavailable, use the appropriate values for forage crop species from IPCC 2006 Guidelines Volume 4 Chapter 11, Table 11.2.

Appendix II: Tool for estimation of soil organic carbon removals from improved grazing and perennial forage management

Application of this tool:

Increase in soil organic carbon stocks is the main expected climate benefit of improved grassland management, including grazing management and the management of perennial forage. Improved grazing management practices may include changes in the timing of grazing in particular grassland plots and increased rotation of grazing between plots, changes in stocking rates and the intensity of grazing. Perennial forage management may include cultivation of forage grasses and legumes and/or changes in hay harvesting practices. Project proponents should consider the relative costs and benefits of estimating soil organic carbon stock changes, and may consider to conservatively ignore soil organic carbon stock changes due to project activities.

Parameters determined with this tool:

This tool is used to estimate project emissions from soil organic carbon (SOC) due to changes in grazing and perennial forage management practices in each project intervention area *a* during the quantification period, which is denoted by $PE_{G,SOC,a}$. Since a single project area may include several areas or plots of grassland to which different management practices are applied, the project Technical Specification should stratify grassland according to initial conditions affecting SOC sequestration rates (e.g. vegetation type, degradation level) and with-project management practices. Expected project emissions from changes in SOC stocks in each project intervention area are the sum of changes in SOC stocks in each relevant land use stratum during the quantification period.

Calculation of annual project removals from improved grazing management and cultivation of perennial forage grasses:

Estimation of project emissions due to SOC stock changes from improved grassland management in each land use stratum in a given project year ($PE_{G,SOC,i,t}$) is based on the results of ex ante modelling using the CENTURY model, a biogeochemical model that can provide estimates of change in soil organic carbon stocks due to change in a range of management practices.[7] The model may be used in estimating climate benefits of grassland management activities as part of a PV project where there are existing studies (e.g. publications in scientific journals, university thesis or work carried out by the project proponents) demonstrating that the use of the model is valid for the IPCC climatic region[8] or agroecological zone[9] in which the project area is located. Following applicability condition (f) of this methodology, if the project uses a model that has been validated in a different specific

[7] http://www.nrel.colostate.edu/projects/century/
[8] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_03_Ch3_Representation.pdf
[9] http://www.fao.org/nr/gaez/en/

location from the project, then the model can only be used if the vegetation and soil types are the same. For land use strata that have the same vegetation and soil types as represented in the validated model, the model must be parameterized for the project area using data from the project area on climate variables and other parameters to which the model is sensitive. Results of field surveys and laboratory measurements of aboveground biomass productivity should be used to re-validate the model parameterization for the project area.

Estimation of baseline carbon stocks: The model simulated value of initial SOC stocks shall be taken as the baseline SOC stock for each land use stratum ($SOC_{s,base,i}$). Using site-specific climate data and data on other variables to which the model is sensitive, run simulations for at least 5,000 years to reach soil carbon equilibrium under grazing conditions assuming 50% biomass removal rate[10] by repeating mean monthly temperature in Century's stochastic precipitation generator. Starting from this equilibrium, input recent historical monthly climate variables and management practices to represent the climate and management practices of the project area. Match as closely as possible the simulated output with the observed biomass data, adjusting other parameters as required to reasonably represent the grassland ecosystem being simulated. The resulting estimates of soil organic carbon stocks in each land use stratum will be taken as the baseline estimates of $SOC_{s,base,i}$.

Estimation of annual carbon stock changes: Using CENTURY model, for each land use stratum (*i*), represent the planned with-project activities in the model, and estimate SOC stocks at equilibrium ($SOC_{m,eq,i}$) and the time to reach the equilibrium ($D_{m,eq,i}$) under the planned management practices. The details of each management practice that are input into the model will depend on the type of management activity planned. The annual change in SOC stock in each land use stratum ($\Delta SOC_{m,i,t}$) shall be calculated as:

$$\Delta SOC_{m,i,t} = \frac{SOC_{m,eq,i} - SOC_{s,base,i}}{D_{m,eq,i}} \qquad \text{(Eq. II.1)}$$

where,

$\Delta SOC_{m,i,t}$	Annual changes in SOC stocks under management practice *m* in land use stratum *i* in project year t; t C $ha^{-1}year^{-1}$
$SOC_{m,eq,i}$	Estimated SOC stocks in the top 30 cm of soil layer at equilibrium, under management practice *m* in land use stratum i; t C ha^{-1}
$SOC_{s,base,i}$	Baseline SOC stock in the top 30 cm of soil layer at the start of the project in land use stratum *i*; t C ha^{-1}
$D_{m,eq,i}$	Number of years required to reach equilibrium under management practice *m* in land use stratum *i*; years

[10] This assumes there is a long history of grazing on grasslands in the project area. If there is not a long history of grazing, then equilibrium conditions may be simulated with no grazing.

Note that for projects implemented over short periods (i.e. <20 years), this method of calculating annual carbon sequestration rates gives a conservative estimate of annual sequestration rates, since sequestration rates are often highest in the first few years after adopting improved management practices.

Quantification of uncertainty: The PV Standard requires that uncertainty is quantified and factored into the conservativeness applied in the quantification of climate benefits. Firstly, project proponents should plan to diminish uncertainty in the process of planning data collection, in particular by stratifying grasslands into distinct land use strata; ensuring sufficiently high sampling intensity in each land use stratum for key model input parameters; and ensuring that good laboratory analysis procedures are followed. Secondly, the project proponent must estimate the uncertainty of the model output values, by calculating the model response using the model input parameters with the upper and lower confidence levels as set out in the steps below:
Step 1: Calculate the values for all input parameters at the upper and lower confidence limit.

For the estimate of annual changes in SOC stocks in each land use stratum ($\Delta SOC_{m,i,t}$), calculate the mean, X_p and standard deviation, ∂_p for all parameters measured, and estimate the standard error of the mean as:

$$SE_p = \frac{\partial_p}{\sqrt{n_p}} \qquad \text{(Eq. II.2)}$$

Where,

SE_p	Standard error of the mean of each parameter p;
∂_p	Standard deviation of the parameter p;
n_p	Number of samples used to calculate the mean and standard deviation of parameter p

Assuming that values of the parameter are normally distributed about the mean, the minimum and maximum values for the parameters are given by Equation II.3:

$$P_{\min} = \overline{X_p} - 1.96 * SE_p$$
$$P_{\max} = \overline{X}_p + 1.96 * SE_p \qquad \text{(Eq. II.3)}$$

where,

$P_{\min}$	The minimum value of parameter p at the 95 percent confidence interval
$P_{\max}$	The maximum value of parameter p at the 95 percent confidence interval

SE_p Standard error of the mean of parameter p

1.96 The value of the cumulative normal distribution at 95 percent confidence interval

Step 2: Calculate the project removals due to changes in soil organic carbon with the minimum and maximum values of the input parameters: Estimated changes in soil organic carbon using the minimum and maximum values of the parameters are given by

$$\Delta SOC_{i,min} = Model(P_{min}, Temperature_{max}, Precipitation_{max}, ClayContent_{min})$$

$$\Delta SOC_{i,max} = Model(P_{max}, Temperature_{min}, Precipitation_{min}, ClayContent_{max}) \quad \text{(Eq.II.4)}$$

where,

$\Delta SOC_{i,min}$ The minimum value of project removals due to changes in soil organic carbon at the 95 percent confidence interval in land use stratum *i*

$\Delta SOC_{i,max}$ The maximum value of project removals due to changes in soil organic carbon at the 95 percent confidence interval in land use stratum *i*.

Step 4: Calculate the uncertainty in the model output.

The uncertainty in the output model for the estimate of annual changes in SOC stocks in each land use stratum is calculated using Equation II.5:

$$UNC_{SOC,m,i,t} = \frac{|\Delta SOC_{i,max} - \Delta SOC_{i,min}|}{2 \times \Delta SOC_{m,i,t}} \quad \text{(Eq. II.5)}$$

Step 5: Adjust the estimate of soil carbon sequestration based on the uncertainty in the model output.

If the uncertainty of the model output for any land use stratum ($UNC_{SOC,m,i,t}$) is less than or equal to 15 percent of the mean value, then the project proponents may use the estimated value without any deduction for conservativeness.

If the uncertainty of the model output is greater than 15 percent but less than or equal to 30 percent of the mean value, then a deduction for uncertainty shall be calculated as defined in Equation II.6:

$$\Delta SOC_{Deduct,m,i,t} = \Delta SOC_{m,i,t} \times \left(UNC_{SOC,m,i,t} - 15\%\right) \quad \text{(Eq. II.6)}$$

If the uncertainty of the model output is greater than 30 percent but less than or equal to 50% of the mean value, then a deduction for uncertainty shall be calculated as defined in Equation II.7:

$$\Delta SOC_{Deduct,m,i,t} = \Delta SOC_{m,i,t} \times \left(UNC_{SOC,m,i,t} - 25\%\right) \quad \text{(Eq. II.7)}$$

The deductions shall be applied to the estimated value as in Equation II.8:

$$\Delta SOC_{C,m,i,t} = \Delta SOC_{m,i,t} - \Delta SOC_{Deduct,m,i,t} \quad \text{(Eq. II.8)}$$

where,

$\Delta SOC_{C,m,i,t}$	Estimate of changes in soil organic carbon in land use stratum *i* under management practice *m* in year *t* after adjustment for uncertainty; t C ha^{-1} $year^{-1}$
$\Delta SOC_{m,i,t}$	Estimated annual changes in SOC stocks under management practice m in land use stratum *i* in project year *t* before adjustment for uncertainty; t C ha^{-1} $year^{-1}$
$\Delta SOC_{Deduct,m,i,t}$	A calculated deduction to the estimate of the change in soil organic removals carbon in land use stratum *i* under management practice *m* in year *t*; %

If the uncertainty of soil models is greater than 50 percent of the mean value, then the project proponents should increase the sample size of the input parameters until the soil model uncertainty is better than ± 50 percent.

Convert estimated carbon sequestration to project emissions of atmospheric carbon dioxide:

For each land use stratum *i,* convert the estimated soil carbon sequestration measured in tonnes of carbon per hectare per year to an estimate of project emissions of atmospheric carbon dioxide per hectare per year:

$$PE_{SOC,m,i,t} = \frac{44}{12} \times -\left(\Delta SOC_{C,m,i,t}\right) \quad \text{(Eq. II.9)}$$

where

$PE_{SOC,m,i,t}$	Estimate of project emissions due to change in soil organic carbon in land use stratum *i* under management practice *m* in year *t* after adjustment for uncertainty; t CO_2 ha^{-1} $year^{-1}$
$\frac{44}{12}$	Conversion of carbon into carbon dioxide.

Calculate total project emissions in each project intervention area during the quantification period:

Project emissions per hectare due to change in SOC stocks during the quantification period in each land use stratum can be calculated as:

$$PE_{G,SOC,i,QP} = PE_{SOC,m,i,t} \times T_{QP} \quad \text{(Eq.II.10)}$$

where

$PE_{G,SOC,i,QP}$	Project emissions due to change in grassland SOC stocks in land use stratum *i* during the whole quantification period; t CO_2 ha^{-1} $year^{-1}$
T_{QP}	Duration of the quantification period; years

Total project emissions due to change in grassland SOC stocks during the quantification period in each project intervention area can be calculated as:

$$PE_{G,SOC,a} = \sum_i PE_{G,SOC,i,QP} \times \sum_i A_i \quad \text{(Eq.II.11)}$$

where

$PE_{G,SOC,a}$	Project emissions due to change in grassland SOC stocks in project intervention area *a* during the whole quantification period; t CO_2 ha^{-1} $year^{-1}$
A_i	Total area of each land use stratum *i* under grazing or forage management practices in project intervention area *a*; ha

Appendix III: Tool for estimation of carbon stock changes in woody biomass

Application of this tool:

Increase in woody biomass due to project re-vegetation activities is expected to sequester atmospheric CO_2. Project activities that may increase woody biomass include planting trees or shrubs in grasslands, shrublands or forest land that either has no existing woody vegetation prior to the PV project or that has some existing woody vegetation in a state of degradation, and assisted natural regeneration of trees or shrubs in degraded forest, shrubland or grassland, e.g. by removing degradation pressures such as grazing or enrichment planting. In this methodology, eligible lands must be degraded and degrading, so baseline changes in woody biomass carbon stocks are conservatively ignored. This tool is applied to estimation of expected carbon stock changes in woody biomass in the project scenario.

Parameters determined with this tool:

This tool is used to estimate project emissions due to expected changes in woody tree and shrub biomass during the quantification period in a given project intervention area *a* ($PE_{R,WB,a}$).

Quantification approach:

The approach to ex ante estimation of expected carbon stock changes in woody biomass in a project intervention area *a* involves estimating the difference between woody biomass carbon stocks prior to implementation of the PV project (denoted by $C_{TR,a,t1}$ for trees and by $C_{SH,a,t1}$ for shrubs) and expected woody biomass carbon stocks after implementation of the measures specified in the Technical Specifications for each land use stratum to which re-vegetation activities are applied (denoted by $C_{TR,a,t2}$ for trees and by $C_{SH,a,t2}$ for shrubs).

Three alternative approaches can be used to estimate change in woody biomass in trees and shrubs between these two dates:

Method 1: Space-time substitution with direct measurements. Direct measurements of tree and shrub stands in the project area, where one sample of trees or shrubs measured can represent woody biomass stocks prior to PV project implementation, and another sample of trees or shrubs can represent trees or shrubs of a known age after application of the measures specified in the Technical Specifications.[11] If the plant communities sampled are sufficiently similar (e.g. in terms of species, site characteristics etc.), with knowledge of the age and management of those stands, the difference in woody biomass between the two samples can be divided by the number of years that the transition between states may take

[11] i.e. space-for-time substitution. See White, P. S. & Walker, J. L. (1997). Approximating nature's variation: selecting and using reference information in restoration ecology. *Restoration Ecology*, *5*(4), 338-349.

to provide an estimate of annual increments in woody biomass and thus woody biomass during the quantification period. Sample survey results can be combined with biomass expansion factors or allometric equations to produce estimates of woody biomass and carbon stocks, using the procedures set out in Sections A and B of this tool.

Method 2: Combining site-specific measurements and default values for projected growth. Where existing growth models, growth curves or yield tables or peer reviewed scientific literature are available for a species or plant community, they may be used to estimate expected woody biomass stocks at the end of the quantification period for new plantings. Where assisted natural restoration measures are applied to existing, degraded plant communities, sample surveys should be conducted to measure existing plants, which can be combined with biomass expansion factors or allometric equations to produce estimates of initial woody biomass and carbon stocks, using the procedures set out in Sections A and B of this tool.

Method 3: Default method. If change in woody biomass carbon stocks contributes less than 10% of total net climate benefits in a project (i.e. $[\sum_{a=1}^{A} CB_{R,a}]/CB_{QP} < 0.1$, where $CB_{R,a}$ is the climate benefits from re-vegetation activities in each implementation area *a* during the quantification period, and CB_{QP} is the total net climate benefits from all project activities implemented during the quantification period), existing and expected woody biomass carbon stocks may be estimated using values from the peer reviewed scientific literature for woody biomass stocks at time *t1* and time *t2*, representing woody biomass stocks pre-project and at the end of quantification period. However, justification must be given that the literature values chosen are appropriate to the species and site conditions of the land use stratum, and that the values chosen are conservative, i.e. do not tend to overestimate change in woody biomass carbon stocks.

For direct measurements, general guidance on sampling and measurement for forest inventory and quantification of carbon stocks in afforestation projects should be followed.[12] Where volume tables or equations, biomass expansion factors, allometric equations, root-shoot ratios, growth models or equations or yield tables are used to estimate woody biomass stocks at time *t1* or *t2*, these should be applicable to the conditions of the project. The general order of preference for sources is: they should be specific to the project region and tree or shrub species, specific to the project country and tree or shrub species (e.g. from national forest inventories), specific to the species but from neighbouring countries with similar ecological conditions, or global but specific to the species (e.g. from IPCC sources). If species specific information is unavailable, information for similar species can be used. If information other than that specific to the project region or species is used, justification shall be given that the values chosen do not underestimate tree biomass at *t1* or overestimate expected tree biomass at the end of the quantification period (*t2*).

[12] See, e.g. CDM (2014) Measurement of carbon stocks in afforestation and reforestation project activities under the Clean Development Mechanism (https://cdm.unfccc.int/filestorage/e/x/t/extfile-20140929185122152-draft-field-manual.pdf/draft-field-manual.pdf?t=eUJ8bmZ3YmlsfDDmSfURKY5HOzEXW94jrUm9); Winrock (2012) Standard Operating Procedures for Terrestrial Carbon measurement (http://www.forestcarbonasia.org/wp-content/uploads/2012/09/Winrock_Terrestrial_Carbon_Field_SOP_Manual_2012_LR.pdf)

Estimation of woody biomass carbon stocks:

The remaining sections of this tool provide guidance on quantifying woody biomass and biomass carbon stocks, and for calculating project emissions from change in woody biomass carbon stocks. If Methods 1 and 2 above are used, Section A sets out procedures for estimation of woody biomass stocks in trees in each project intervention area, and Section B sets out procedures for estimation of woody biomass stocks in shrubs in each project intervention area. For Methods 1, 2 and 3, Section C sets out procedures for conversion of change in woody biomass stocks in trees and shrubs to atmospheric carbon removals.

Section A: Estimation of woody biomass carbon stocks in trees

Biomass stocks in trees should be calculated separately for each tree species *g* in each land use stratum *i* at two points in time representing conditions prior to project implementation (*t1*) and conditions at the end of the quantification period (*t2*). Biomass stocks in trees are estimated on the basis of one or more tree dimensions (e.g. diameter, basal area, height), which are converted to tree biomass stock estimates using either one of two methods: the Biomass Expansion Factor (BEF) method or allometric equation method. Because tree dimension data in existing volume tables are not likely to represent the condition of trees in degraded forests, tree dimension data should derive from measurements in the project intervention area.

A.1.1 Estimation of tree biomass using the BEF method

The BEF method uses volume tables or volume equations to convert tree dimensions to stem volume, which is then converted to above-ground tree biomass using wood density and biomass expansion factors. Above-ground tree biomass is expanded to total tree biomass using root-shoot ratios.

For each tree of species *g* sampled, tree biomass of trees of species *g* in sample plot *p* is estimated as:

$$B_{TR,g,p,i,t} = V_{TR,g,p,i,t} \times D_g \times BEF_{2,g} \times \left(1 + R_g\right) \quad \text{(Eq. III.1)}$$

where:

$B_{TR,g,p,i,t}$	Biomass of trees of species *g* in sample plot *p* of stratum *i* in year *t*; t d.m.
$V_{TR,g,p,i,t}$	Stem volume of trees of species *g* in sample plot *p* of stratum *i* in year *t*, estimated by entering tree dimensions into a volume table or volume equation; m^3
D_g	Wood density of tree species *g*; t d.m. m^{-3}
$BEF_{2,g}$	Biomass expansion factor for conversion of stem biomass to above-ground tree biomass for tree species *g*; dimensionless
R_g	Root-shoot ratio for tree species *g*; dimensionless
g	Index of tree species (*g=1…G*)
P	Index of each sample plot in each stratum *(p=1…P)*
I	Index of land use strata *(i=1…I)*
t	Year (e.g. for existing stocks in year 1, *t*=1, for expected stocks at end of the quantification period, *t*=5, as appropriate)

A.1.2 Estimation of tree biomass using the allometric method

The allometric method uses allometric equations to convert tree dimensions to above-ground biomass of trees, and root-shoot ratios are used to estimate total tree biomass. For each tree species *g* sampled, tree biomass in sample plot *p* is calculated as:

$$B_{TR,g,p,i,t} = f_g(DBH_t, H_t) \times (1 + R_g) \quad \text{(Eq. III.2)}$$

where

$B_{TR,g,p,i,t}$ Biomass of trees of species *g* in sample plot *p* of stratum *i* in year *t*; t d.m.

$f_g(DBH_t, H_t)$ Sum of above-ground biomass of trees of species *g* in sample plot *p* of stratum *i* in year *t* calculated using an allometric equation relating above-ground tree biomass to tree dimensions; t d.m.

A.1.3 Estimation of the total tree biomass in a project intervention area

Tree biomass of all species in each sample plot *p* of stratum *i* is estimated as:

$$B_{TR,p,i,t} = \sum_g B_{TR,g,p,i,t} \quad \text{(Eq. III.3)}$$

where

$B_{TR,p,i,t}$ Tree biomass in sample plot *p* in stratum *i* in year *t*; t d.m.

Tree biomass per hectare in each plot *p* in stratum *i* is estimated as:

$$b_{TR,p,i,t} = \frac{B_{TR,p,i,t}}{A_{p,i}} \quad \text{(Eq. III.4)}$$

where:

$b_{TR,p,i,t}$ Tree biomass per hectare in sample plot *p* in stratum *i* in year *t*; t d.m. ha^{-1}

$A_{p,i}$ Area of sample plot *p* in stratum *i*; ha

Total tree biomass in each stratum *i* in year *t* is estimated as:

$$b_{TR,i,t} = b_{TR,p,i,t} \times A_i \quad \text{(Eq. III.5)}$$

where

A_i Total area of stratum *i*; ha

and total tree biomass in each project intervention area *a* in year *t* is estimated as:

$$b_{TR,a,t} = b_{TR,i,t} \times \sum_i A_i \quad \text{(Eq. III.6)}$$

where

$b_{TR,a,t}$ Tree biomass in project intervention area *a* in year *t*; t d.m. ha^{-1}

A.1.4 Estimation of the total carbon stock in tree biomass

Total carbon stock in tree biomass in project intervention area *a* in year *t* is estimated as:

$$C_{TR,a,t} = b_{TR,a,t} \times CF_{TR} \quad \text{(Eq. III.7)}$$

where

$C_{TR,a,t}$ Carbon stock in tree biomass in project intervention area *a* in year *t*; t C

CF_{TR} Carbon fraction of tree biomass; t C t $d.m.^{-1}$ (a default value of 0.50 may be used)

A.1.5 Estimation of change in carbon stock in trees

The total change in carbon stock in tree biomass in project intervention area *a* during the quantification period is estimated as:

$$\Delta C_{TR,a} = C_{TR,a,t2} - C_{TR,a,t1} \quad \text{(Eq. III.8)}$$

where

$\Delta C_{TR,a}$ Total change in tree biomass carbon stock in project intervention area *a* in the quantification period; t C

$C_{TR,a,t2}$ Estimated carbon stock in tree biomass in project intervention area a at the end of the quantification period; t C

$C_{TR,a,t1}$ Estimated carbon stock in tree biomass in project intervention area a at the start of the quantification period; t C

Section B: Estimation of woody biomass carbon stocks in shrubs

Biomass stocks in shrubs should be calculated separately for each shrub species *g* in each land use stratum *i* at two points in time representing conditions prior to project implementation and conditions at the end of the quantification period. Biomass stocks in shrubs are estimated on the basis of one or more shrub dimensions (e.g. basal diameter, crown cover), which are converted to biomass stock estimates using allometric equations.

For each shrub species *g* sampled, biomass in sample plot *p* is calculated as:

$$B_{SH,g,p,i,t} = f_g(BD_t, CC_t) \times \left(1 + R_g\right) \quad \text{(Eq. III.9)}$$

where:

$B_{SH,g,p,i,t}$ Biomass of shrub of species *g* in sample plot *p* of stratum *i* in year *t*; t d.m.

where:

$f_g(BD_t, CC_t)$ Sum of above-ground biomass of trees of species *g* in sample plot *p* of stratum *i* in year *t* calculated using an allometric equation relating above-ground tree biomass to tree dimensions; t d.m.

B.1.1 Estimation of the total shrub biomass in a project intervention area

Shrub biomass of all species in each sample plot *p* of stratum *i* is estimated as:

$$B_{SH,p,i,t} = \sum_g B_{SH,g,p,i,t} \quad \text{(Eq. III.10)}$$

where:

$B_{SH,p,i,t}$ Shrub biomass in sample plot *p* in stratum *i* in year *t*; t d.m.

Shrub biomass per hectare in each plot *p* in stratum *i* is estimated as:

$$b_{SH,p,i,t} = \frac{B_{SH,p,i,t}}{A_{p,i}} \quad \text{(Eq. III.11)}$$

where:

$b_{SH,p,i,t}$ Shrub biomass per hectare in sample plot *p* in stratum *i* in year *t*; t d.m. ha^{-1}

$A_{p,i}$ Area of sample plot *p* in stratum *i*; ha

Total shrub biomass in each stratum *i* in year *t* is estimated as:

$$b_{SH,i,t} = b_{SH,p,i,t} \times A_i \quad \text{(Eq. III.12)}$$

where

A_i Total area of stratum *i*; ha

and total shrub biomass in each project intervention area *a* in year *t* is estimated as:

$$b_{SH,a,t} = b_{SH,i,t} \times \sum_i A_i \quad \text{(Eq. III.13)}$$

where

$b_{SH,a,t}$ Shrub biomass in project intervention area *a* in year *t*; t d.m. ha^{-1}

B.1.2 Estimation of the total carbon stock in shrub biomass

Total carbon stock in shrub biomass in project intervention area *a* in year *t* is estimated as:

$$C_{SH,a,t} = b_{SH,a,t} \times CF_{TR} \quad \text{(Eq. III.14)}$$

where

$C_{SH,a,t}$	Carbon stock in shrub biomass in project intervention area *a* in year *t*; t C
CF_{SH}	Carbon fraction of shrub biomass; t C t d.m.$^{-1}$ (a default value of 0.50 may be used, unless justification for an alternative value can be given based on peer reviewed scientific literature)

B.1.3 Estimation of change in carbon stock in shrubs

The total change in carbon stock in shrub biomass in project intervention area *a* during the quantification period is estimated as:

$$\Delta C_{SH,a} = C_{SH,a,t2} - C_{SH,a,t1} \quad \text{(Eq. III.15)}$$

where

$\Delta C_{SH,a}$	Total change in shrub biomass carbon stock in project intervention area *a* in the quantification period; t C
$C_{SH,a,t2}$	Estimated carbon stock in shrub biomass in project intervention area a at the end of the quantification period; t C
$C_{SH,a,t1}$	Estimated carbon stock in shrub biomass in project intervention area a at the start of the quantification period; t C

Section C. Calculation of project emissions from change in woody biomass in trees and shrubs

Project emissions from expected changes in woody biomass in trees and shrubs during the quantification period in a given project intervention area *a* is calculated as:

$$PE_{R,WB,a} = \frac{44}{12} \times -\left(\Delta C_{TR,a} + \Delta C_{SH,a}\right) \quad \text{(Eq. III.16)}$$

where:

$PE_{R,WB,a}$	Project emissions from expected changes in woody biomass in trees and shrubs in a project intervention area *a* during the quantification period; t CO_2e

Appendix IV: Tool for estimation of change in soil organic carbon stocks due to re-vegetation activities

Application of this tool:

Planting trees or shrubs or assisted natural regeneration measures may increase in soil organic carbon stocks in areas where re-vegetation activities are carried out. This is only likely to occur if land is degraded at the start of project activities (so soil carbon stocks are not saturated), litter remains on site, and soil disturbance is minimized, as in the applicability conditions of the methodology.

Parameters determined with this tool:

This tool is used to estimate project emissions due to soil organic carbon (SOC) due re-vegetation activities in a given project intervention area *a* during the quantification period, which is denoted by $PE_{R,SOC,a}$ (see Equation 9 of the methodology).

Quantification approach:

Estimates of stock change in soil organic matter are based on the difference between estimated initial soil carbon stocks and estimated soil carbon stocks at the end of the quantification period. SOC stocks on degraded lands under re-vegetation may take many years to reach a stable equilibrium (the IPCC default value is 20 years), but accurate estimation of change in soil carbon stocks over a short time period can require intensive sampling and be costly. Therefore, this tool allows the following alternative options for estimation of SOC stock changes under re-vegetation activities:

Method 1: Default values from the peer reviewed scientific literature. Initial SOC stocks (tC ha^{-1}) are estimated for degraded lands on the basis of existing studies in the project region, and annual average increments per hectare are estimated on the basis of peer reviewed scientific literature on the effects of relevant management practices (e.g. tree or shrub planting, or regeneration) on SOC stocks, with annual increments added over the duration of the quantification period.

Method 2: IPCC default method. If there are no reliable estimates of initial SOC stocks applicable to degraded lands in the project region, or no reliable estimates of annual increment due to re-vegetation activities, the IPCC default method may be applied, provided that conservative estimates of SOC stock changes are made and subject to the limits outlined below.

Section A: Default values from the peer reviewed scientific literature.
Default values from the scientific literature for initial SOC stocks and for annual stock changes may be used if there are reliable studies applicable to the project region for both types of data. A value for initial SOC stocks should be selected that gives a conservative estimate of SOC density (tC ha^{-1}) for degraded lands in the land use strata to which re-

vegetation activities will be applied. Estimates of annual SOC stock changes or total stock changes over a given period for re-vegetation activities similar to those proposed in the Technical Specifications can be obtained from the scientific literature. Most reported studies provide a standard error or standard deviation for mean annual stock changes, which can be used to choose a conservative value for annual stock changes. Where the literature reports annual stock changes, the annual stock change should be multiplied by the number of years in the quantification period to produce an estimate of SOC stock changes in the quantification period:

$$\Delta C_{R,SOC,i,QP} = \Delta C_{R,SOC,i} \times T_{QP} \quad \text{(Eq.IV.1)}$$

where

$\Delta C_{R,SOC,i,QP}$ Total change during the quantification period in soil carbon stock reported in the literature for re-vegetation practices to be applied to land use stratum *i*; t C ha^{-1}

$\Delta C_{R,SOC,i}$ Annual soil carbon stock change reported in the literature for revegetation practices to be applied to land use stratum *i*; t C ha^{-1} $year^{-1}$

T_{QP} Duration of the quantification period; years

Where the literature reports the total stock change between two dates (t_1,t_2) and the number of years between these dates, the total stock change can be divided by the number of years to produce a conservative estimate of the annual stock change, and this estimated annual stock change can be multiplied by the number of years in the quantification period to produce an estimate of SOC stock changes in the quantification period.

$$\Delta C_{R,SOC,i,QP} = \left(\frac{C_{R,SOC,i,t2} - C_{R,SOC,i,t1}}{T_{t1-t2}}\right) \times T_{QP} \quad \text{(Eq.IV.2)}$$

where

$C_{R,SOC,i,t2}$ Final soil carbon stock at time *t=2* reported in the literature for re-vegetation practices to be applied to land use stratum *i*; t C ha^{-1}

$C_{R,SOC,i,t1}$ Initial soil carbon stock at time *t=1* reported in the literature for revegetation practices to be applied to land use stratum *i*; t C ha^{-1}

T_{t1-t2} Duration between the initial and final carbon stock reported in the literature; years.

The total expected change in soil carbon stocks from lands under re-vegetation in a given project intervention area are calculated as:

$$\Delta C_{R,SOC,a,QP} = \sum_i A_i \times \Delta C_{R,SOC,i,QP} \quad \text{(Eq.IV.3)}$$

where

A_i Area of land stratum *i* in project intervention area *a*; ha

Section B: IPCC default method.

If no reliable scientific literature is available, the IPCC default method may be used. Given the uncertainty involved in using a Tier 1 method, the following adjustments must be applied:

- Soil carbon losses are assumed to occur due to soil disturbance when trees or shrubs are planted
- A limit is placed on the annual SOC stock change that can be assumed to occur.

Estimate initial soil carbon stock:

The initial SOC stock is estimated as:

$$C_{R,SOC,i,t1} = C_{SOC,REF,i} \times f_{MG,i}$$ (Eq.IV.4)

where:

$C_{R,SOC,i,t1}$ Initial soil carbon stock at time *t=1* for land use stratum *i* with planned re-vegetation activities; t C ha^{-1}

$C_{SOC,REF,i}$ Reference soil carbon stock corresponding to the reference condition in non-degraded grasslands by climate region and soil type applicable to stratum *i*; t C ha^{-1}. (Default values may be taken from Table 1 in this tool, or from other sources specific to the project region if their use is justified)

$f_{MG,i}$ Relative stock change factor for baseline management in stratum *i*; dimensionless. (Default values may be taken from Table 2 in this tool, or from other sources specific to the project region if their use is justified)

Estimate soil carbon loss due to planting trees or shrubs:

If trees or shrubs are planted in a given land use stratum, it is assumed that soil disturbance occurs on 10% of the land area, resulting in soil carbon loss. Soil carbon loss is estimated as:

$$C_{R,SOC,loss} = C_{R,SOC,i,t1} \times 0.1$$ (Eq.IV.5)

where

$C_{R,SOC,loss}$ Loss of soil carbon stock in stratum *i* under re-vegetation due to planting trees or shrubs; t C ha^{-1} year^{-1}

If a land use stratum under re-vegetation is not planted with trees or shrubs, then no soil disturbance is assumed to occur and the value of $C_{R,SOC,loss}$ is zero.

Estimate soil carbon stock change during the quantification period:

The annual change in soil carbon stocks in land stratum *i* under re-vegetation is estimated as:

$$\Delta C_{R,SOC,i,t} = \frac{C_{R,SOC,REF,i} - (C_{R,SOC,i,t1} - C_{R,SOC,loss})}{20}$$ (Eq.IV.6)

where

$\Delta C_{R,SOC,i,t}$ The annual change in soil carbon stock in stratum *i* under re-vegetation; t C ha^{-1} year^{-1}

20 Default IPCC assumption for number of years for transition to equilibrium; years

Considering the uncertainties inherent in this estimation approach, the assumed annual change in soil carbon stocks may not exceed 0.5 t C ha^{-1} yr^{-1}. If the calculated value of $\Delta C_{R,SOC,i,t}$ exceeds 0.5 tC ha^{-1} year^{-1}, then a default value of 0.5 will be adopted.

The total change in soil carbon stocks for in stratum *i* during the quantification period is estimated as:

$$\Delta C_{R,SOC,i,QP} = \Delta C_{R,SOC,i,t} \times T_{QP}$$ (Eq.IV.7)

and the total change during the quantification period in soil carbon stocks for all strata in project intervention area a is calculated as:

$$\Delta C_{R,SOC,a,QP} = \sum_i A_i \times \Delta C_{R,SOC,i,QP}$$ (Eq.IV.8)

where

A_i Area of land stratum *i* in project intervention area *a*; ha

Section C. Estimate project emissions from change in soil carbon stocks in lands under re-vegetation:

Project emissions from expected changes in soil carbon stocks in lands under re-vegetation during the quantification period in a given project intervention area *a* is calculated as:

$$PE_{R,SOC,a} = \frac{44}{12} \times -\left(\Delta C_{R,SOC,a,QP}\right) \quad \text{(Eq. IV.9)}$$

where:

$PE_{R,SOC,a}$ Project emissions from expected changes in soil carbon stocks in lands under re-vegetation activities in project intervention area *a* during the quantification period; t CO_2e

Table 1: Default reference SOC stocks ($C_{SOC,REF}$) for mineral soils (t C ha^{-1} in 0-30 cm depth)

Climate region	HAC soils[a]	LAC soils[b]	Sandy soils[c]	Spodic soils[d]	Volcanic soils[e]
Boreal	68	NA	10	117	20
Cold temperate, dry	50	33	34	NA	20
Cold temperate, moist	95	85	71	115	130
Warm temperate, dry	38	24	19	NA	70
Warm temperate,	88	63	34	NA	80
Tropical, dry	38	35	31	NA	50
Tropical, moist	65	47	39	NA	70
Tropical, wet	44	60	66	NA	130
Tropical montane	88	63	34	NA	80

a: Soils with high activity clay (HAC) minerals are lightly to moderately weathered soils, which are dominated by 2:1 silicate clay minerals (in the World Reference Base for Soil Resources (WRB) classification these include Leptosols, Vertisols, Kastanozems, Chernozems, Phaeozems, Luvisols, Alisols, Albeluvisols, Solonetz, Calcisols, Gypsisols, Umbrisols, Cambisols, Regosols; in USDA classification includes Mollisols, Vertisols, high-base status Alfisols, Aridisols, Inceptisols);
b: Soils with low activity clay (LAC) minerals are highly weathered soils, dominated by 1:1 clay minerals and amorphous iron and aluminium oxides (in WRB classification includes Acrisols, Lixisols, Nitisols, Ferralsols, Durisols; in USDA classification includes Ultisols, Oxisols, acidic Alfisols);
c: Includes all soils (regardless of taxonomic classification) having > 70% sand and < 8% clay, based on standard textural analyses (in WRB classification includes Arenosols; in USDA classification includes Psamments);
d: Soils exhibiting strong podzolization (in WRB classification includes Podzols; in USDA classification Spodosols);
e: Soils derived from volcanic ash with allophanic mineralogy (in WRB classification Andosols; in USDA classification Andisols)
Source: *2006 IPCC Guidelines for National Greenhouse Gas Inventories*

Table 2: Relative stock change factor for grassland management (f_{MG})

Condition	Climate region	Factor value	Description
Non-degraded grassland	All	1.00	Non-degraded and sustainably managed grassland, but without significant management improvements
Moderately degraded	Temperate/Boreal	0.95	Overgrazed or moderately degraded grassland, with somewhat reduced
	Tropical	0.97	

Condition	Climate region	Factor value	Description
grassland	Tropical Montane	0.96	productivity (relative to the native or nominally managed grassland) and receiving no management inputs
Severely degraded	All	0.70	Implies major long-term loss of productivity and vegetation cover, due to severe mechanical damage to the vegetation and/or severe soil erosion.
Improved grassland	Temperate /Boreal	1.14	Represents grassland that is sustainably managed with moderate grazing pressure and that receive at least one improvement (e.g. fertilization, species improvement, irrigation).
	Tropical	1.17	

Appendix V: Tool for estimation of N_2O emissions from re-vegetation with nitrogen-fixing tree or shrub species

Application of this tool:

Shrub and tree species that fix nitrogen may emit N_2O. Project emissions from nitrogen-fixing trees and shrubs must be accounted for in all project areas where re-vegetation activities involve nitrogen-fixing tree or shrub species. Baseline N_2O emissions from existing nitrogen-fixing species are conservatively ignored.

Parameters determined with this tool:

This tool is used to estimate GHG emissions from re-vegetation of nitrogen-fixing tree and shrub species in the project scenario in each project intervention area *a*, which is denoted by $PE_{R,NF,a}$.

Calculation of annual project emissions from nitrogen-fixing species:

Annual project emissions from re-vegetation with nitrogen-fixing species must be calculated using the following equations:

$$PE_{R,NF,i,t} = F_{CR,i,t} \times EF_{NF} \times (44/28) \times GWP_{N2O} \quad \text{(Eq. V.1)}$$

where,

$PE_{R,NF,i,t}$	Project N_2O emissions from nitrogen-fixing species under re-vegetation in land use stratum *i* in project year *t*; t CO_2e
$F_{CR,i,t}$	Amount of N in nitrogen-fixing species (above and below ground) returned to soils in land use stratum *i* in project year t; t N
EF_{NF}	Emission factor for N_2O emissions from N inputs of N-fixing species to soil; kg N_2O-N / kg N input
$44/28$	Conversion of N_2O-N /kg N to N_2O
GWP_{N2O}	Global warming potential for N_2O; t CO_2e / t N_2O

$$F_{CR,i,t} = \sum_{g=1}^{G} Area_{g,i,t} \times Crop_{g,t} \times N_g \quad \text{(Eq. V.2)}$$

where,

$F_{CR,i,t}$	Amount of N in N-fixing species (above and below ground) returned to soils in land use stratum *i* in project year *t*; t N

$Area_{g,i,t}$	Total area of land use stratum *i* with N-fixing species *g* under re-vegetation in project year *t*; ha
$Crop_{g,t}$	Annual dry matter, including aboveground and below ground, returned to soils by N-fixing species *g* in project year *t*; t dm / ha
N_g	Fraction of N in dry matter in N-fixing species *g*; t N / t dm
g	Index of nitrogen-fixing species
i	Index of land use strata

Calculation of annual project emissions from nitrogen-fixing species in a given project intervention area:

Annual project emissions from re-vegetation with nitrogen-fixing species in a given project intervention area can be estimated as:

$$PE_{R,NF,a,t} = \sum_i A_i \times PE_{R,NF,i,t} \quad \text{(Eq. V.3)}$$

Where

$PE_{R,NF,a,t}$	Annual project emissions from re-vegetation with nitrogen-fixing species in project intervention area *a*; tCO2e
A_i	Total area of all land use strata in project intervention area *a* with N-fixing species under re-vegetation; ha

Calculation of total project emissions from nitrogen-fixing species during the quantification period:

The sum of project emissions in project intervention area *a* from cultivation of nitrogen-fixing fodder or shrub species during the whole quantification period is calculated as:

$$PE_{R,NF,a} = \sum_t PE_{R,NF,a,t} \quad \text{(Eq. V.4)}$$

Sources of data for ex ante estimation of project emissions from nitrogen-fixing species:

For parameters in this tool that are not calculated values, data used to make ex ante estimates of project emissions from nitrogen-fixing species shall consider the following data sources.

Parameter	Data sources
EF_{NF}	Use emission factors from the peer reviewed scientific literature that are specific for the project area or host country. If these are unavailable, use default emission factors (EF_1 or EF_2, as appropriate) from IPCC 2006

	Guidelines Volume 4 Chapter 11, Table 11.1.
GWP_{N2O}	The IPCC default value of 310 shall be used.
$Area_{g,i,t}$	The area cultivated with each species of nitrogen fixing plant shall be obtained from the project implementation plans
$Crop_{g,t}$	Use values from the peer reviewed scientific literature that are specific for the project area or host country, or if these are unavailable estimate fresh or dry matter yield based on the knowledge of experts in the project area. If these are unavailable, for N-fixing shrubs and trees, use estimates of aboveground biomass multiplied by 0.02.
N_g	Use values from the peer reviewed scientific literature that are specific for the project area or host country. If these are unavailable, for N-fixing shrubs and trees use the default value for N-fixing forages (0.027) in IPCC 2006 Guidelines Volume 4 Chapter 11, Table 11.2.

Annex 9. Pilot Study Report

Carbon modelling using methodology at Annex 8, for Hongor *Ovoo* site. (provided separately as Values for Development (VFD) reports).