Khasi Hills Community REDD Project Project Design Document:

Restoring and Conserving Meghalaya's Hill Forests through Community Action

Submitted to Plan Vivo, UK by

Ka Synjuk Ki Hima Arliang Wah Umiam, Mawphlang

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Mawphlang, Meghalaya, India

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Key changes in this PDD (version 4.1) from version 4.0 are the number of villages and the estimation of REDD+ and ANR climate benefit analysis including an updated effectiveness rating.

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List of Acronyms and Abbreviations

AA-CFREDD	Approved Approach for Estimation of Climate Benefits from REDD in Community Managed Forest
ANR	Assisted Natural Regeneration
CDF	Community Development Fund
CFI	Community Forestry International
CF	Community Facilitator
CPA	Chartered Public Accountant
CSR	Corporate Social Responsibility
FC	Farmers' Club
FPIC	Free, Prior, and Informed Consent
GIS	Geographic Information System
GOI	Government of India
GPS	Global Positioning System
ICAR	Indian Council of Agricultural Research
IGA	Income Generating Activities
INDC	India's Intended Nationally Determined Contribution
IUCN	International Union for Conservation of Nature
KHADC	Khasi Hills Autonomous District Council
KHEPL	Khasi Hills Ecosystem Private, Limited
KSKHAW-UMWS	Ka Synjuk Ki Hima Arliang Wah Umiam Mawphlang Welfare Society
LPG	Liquefied Petroleum Gas
LWC	Lower Working Committee
MOU	Memorandum of Understanding
NEHU	Northeast Hill University
NGO	Non-Governmental Organization
NREGA	National Rural Employment Guarantee Act
NRM	Natural Resource Management
PDD	Project Design Description
PES	Payment for Ecosystem Services
PRA	Participatory Rural Appraisal
PVF	Plan Vivo Foundation
REDD+	Reducing Emissions from Deforestation and Degradation
RTSU	REDD Technical Supporting Unit
SHG	Self-help Group
SIS	Safeguards Information System
TAC	Technical Advisory Committee
UNFCCC	United Nations Framework Convention on Climate Change
VKR	Village Knowledge Register
VWU	Village Working Units

Executive Summary

The Khasi Hills REDD+ Project is situated in the East Khasi Hills District of Meghalaya, India. The project covers 23,507 hectares, comprised of approximately 2,950 hectares of dense forests and 8,453 hectares of open forests in 2021. The project engages ten indigenous Khasi governments (*Hima)* with approximately 86 villages and small hamlets. Meghalaya has a long history of forest conservation and natural resource management grounded in Khasi tradition. Along with the unique flora and fauna found in the region, increased population and economic development pressures made Meghalaya suitable as a pilot project area. In 2017, the project contracted its first five-year verification (2011-2016) to determine impacts and as a result, the technical specifications and Project Design Document were updated to reflect actual impacts on avoided deforestation (REDD+) and Assisted Natural Regeneration (ANR).

Deforestation throughout the state of Meghalaya threatens upland watersheds, habitats, and livelihoods, while releasing substantial quantities of carbon. Loss of forest cover in the Khasi Hills District averaged 5.6% per year from 2000 to 2005. This REDD+ project is designed to slow, halt and reverse the loss of community forests by providing institutional support, new technologies for forest management, and financial incentives to conserve existing old growth forests while regenerating degraded forests. The project also seeks to improve forest connectivity in order to establish wildlife corridors by regenerating and linking degraded open forestlands.

This REDD+ project offers substantial carbon emissions reductions plus additional environmental values in terms of improved watershed management and biodiversity conservation. The project represents a long-term strategy to address the extreme poverty facing rural families through new income generating activities, training, and capitalizing women to run microfinance institutions. This strategy represents a proof of concept for REDD+ initiatives in Northeast India and could be widely replicated throughout the region. The project is one of the first REDD+ projects in Asia to be managed and implemented by indigenous communities.

Initiated by Community Forestry International (CFI) in 2010, the original project is located in the Umiam River Watershed which boasts one of the highest recorded annual rainfalls in the world. In 1995, 2,493 mm (98 inches) fell in a 48-hour period, while a world record annual rainfall reached 11,873 mm (467 inches) in nearby Sohra in the same year. Despite abundant rainfall, the communities in the project area are experiencing increasing dry season drought due to dense forest loss at an annual rate of 2.7% (between 2006 and 2010). Deforestation combined with increased temperature is undermining the hydrological function of this critical watershed. Disrupting agricultural practices and intense cyclonic storms are also contributing to erosion and downstream flooding in Bangladesh (Gangetic) and Assam (Brahmaputra) river basins. Climate change is an underlying force exacerbating key drivers of deforestation and forest degradation in Meghalaya by increasing the intensity and extent of dry season ground fires, reducing soil moisture and rainfall, and contributing to a historic pattern of aridization and biomass loss. The resulting loss of dense forest habitat has placed pressure on the region's water resources, farming systems, and biodiversity.

The REDD+ project continues to seek to demonstrate how communities and indigenous governance institutions, coordinated through their own Federation (Synjuk), can implement REDD+ activities that control drivers of deforestation. The initiative is designed to restore forest cover and improve watershed hydrology, while facilitating transitions to agricultural systems that are climate-resilient. The project has been approved by the Khasi Hills Autonomous District Council, with the encouragement of the Chief Secretary of the State of Meghalaya.

This project is designed to create capacity within the Federation or *Synjuk* to plan and implement a thirty-year climate adaptation strategy for their upper watershed. CFI, an INGO working with indigenous communities in Northeast India since 2003, provided technical and financial support to this new community institution during the project development phase 2010-2012, providing training in resource management including designing, certifying, and marketing carbon credits on private voluntary markets. The project seeks to establish a long-term income stream to support the Federation and participating communities. For the upcoming project period, 2022-2026, it is projected that 380,235 tCO_2 emissions will be reduced through community-based forest management helping to finance the project.

Key variables to be monitored over the life of the project include changes in carbon stocks, forest condition, and forest growth rates as well as other environmental indicators including biodiversity and hydrology. Socio-economic performance indicators to be monitored by the participating communities include institutional capacity, Community Development Fund (CDF) performance, and household transitions to cleaner energy technologies like liquefied petroleum gas (LPG) cooktops.

The project is significant as it is one of the first REDD+ initiatives in Asia to be developed by indigenous tribal governments on communal and clan land. The project has the potential for broad-based replication among northeast India's 240 ethno-linguistic, tribal communities.

Part A: Aims and Objectives

A1. Theory of change

The Khasi Hills Community REDD+ Project location and its design were guided by a community forestry theory that assumes some human ecological contexts are better positioned to reverse historic deforestation trends than others. The theory suggests that by assessing several key parameters high potential communities can be identified, increasing the likelihood of successful REDD+ and Assisted Natural Regeneration projects. The first parameter is social capital. This includes the presence of representative leadership within project communities, functioning traditional organizations, the presence of conservation values and sustainable management practices, as well as secure forest tenure.

The second set of parameters deals with ecological capital. This is especially important in projects involving forest restoration. It includes adequate rainfall, viable soil conditions, and biotic regenerative material including mother trees and coppicing species that can facilitate rapid, low-cost eco-recovery once community management is in place.

Many indigenous communities who possess such enabling conditions are nonetheless experiencing a deterioration of their forest environments due to demographic expansion, market forces, and a breakdown of traditional management systems and organizations. This theory of community forestry postulates that the community forest carbon process can be used to re-empower traditional management, while building new capacities to address evolving management challenges, and at the same time provide the financial support needed to meet the costs of forest protection and eco-restoration.

In the case of the Khasi Hills Community REDD+ project this theory suggested uniting villages throughout a watershed in the common cause of halting deforestation and restoring thousands of hectares of degraded forests. Dynamic and charismatic leadership from respected community elders who were accountable to their villages and conducted their decision making in ongoing consultation with their constituencies created a transparent process that engendered trust. The empowerment process was designed to ensure local control and ownership of the project and broad-based inclusion of all participating communities. The community forestry theory postulates that management is an ongoing process and

supportive projects must be adapted to maximally ensure that community resource systems will be sustainable even after projects are terminated and have accomplished their catalytic function.

A2. Project objectives and aims

The project has two main objectives which have been part of the strategy from the start of the project:

1) To create a community-based conservation area along the Umiam River under a sustainable management plan that promotes eco-tourism, environmental education, and employment for local families.
2) To establish a federation of Khasi indigenous governments and communities to coordinate the management of natural resources in the Umiam River Watershed.

Within these objectives, the project's aims are:

1) To build community capacity to implement resource planning systems and mitigation activities in order to reverse deforestation and degradation trends impacting dense forests (under REDD+).
2) To assist communities to implement a variety of forest monitoring, protection, and restoration activities that facilitate the regeneration of degraded forest lands (under ANR).
3) To enhance the economic conditions of participating households targeting the lowest-income forest dependent families. Support sustainable enterprise development among local communities through micro-finance and sustainable farming and forestry systems through PES or carbon sales.
4) To improve environmental services including the protection of endangered flora and fauna species found in the area through PES or carbon sales.

Part B: Site Information

B1. Project location and boundaries

The project is located in the sub-watersheds of Umiam River and Upper Wah Umngi within the East Khasi Hills District of Meghalaya, India. The area of the project is approximately 23,507 hectares comprised of 2,950 hectares of dense forests and 8,453 hectares of open forests (the project area was remapped in 2021 and shows a change in size from the project area listed in previous documentation) (see Figure 1). The project can be categorized as a Single Boundary Project for Forest Restoration and Conservation. The project boundary is defined by the traditional territories of the ten Khasi governments (*Hima*) that are participating in the project. The area is largely consistent with the hydrological boundaries of the Umiam River sub-watershed and is located in the East Khasi Hills District (see Figure 2).

Project mitigation activities focus on dense forests and degraded open forests that are owned by the community or under clan or private management. Some of the community forests exist in large, contiguous areas of up to several thousand hectares, while other forest fragments are only several hectares in size. Where possible, the project seeks to link forest fragments to enhance hydrological and biodiversity services by creating an unbroken wildlife corridor, especially on major and minor riparian arteries of the Umiam River.

Figure 1: 2021 Khasi Hills REDD+ Project Area Land Cover, by Norita Sohlang, GIS Consultant

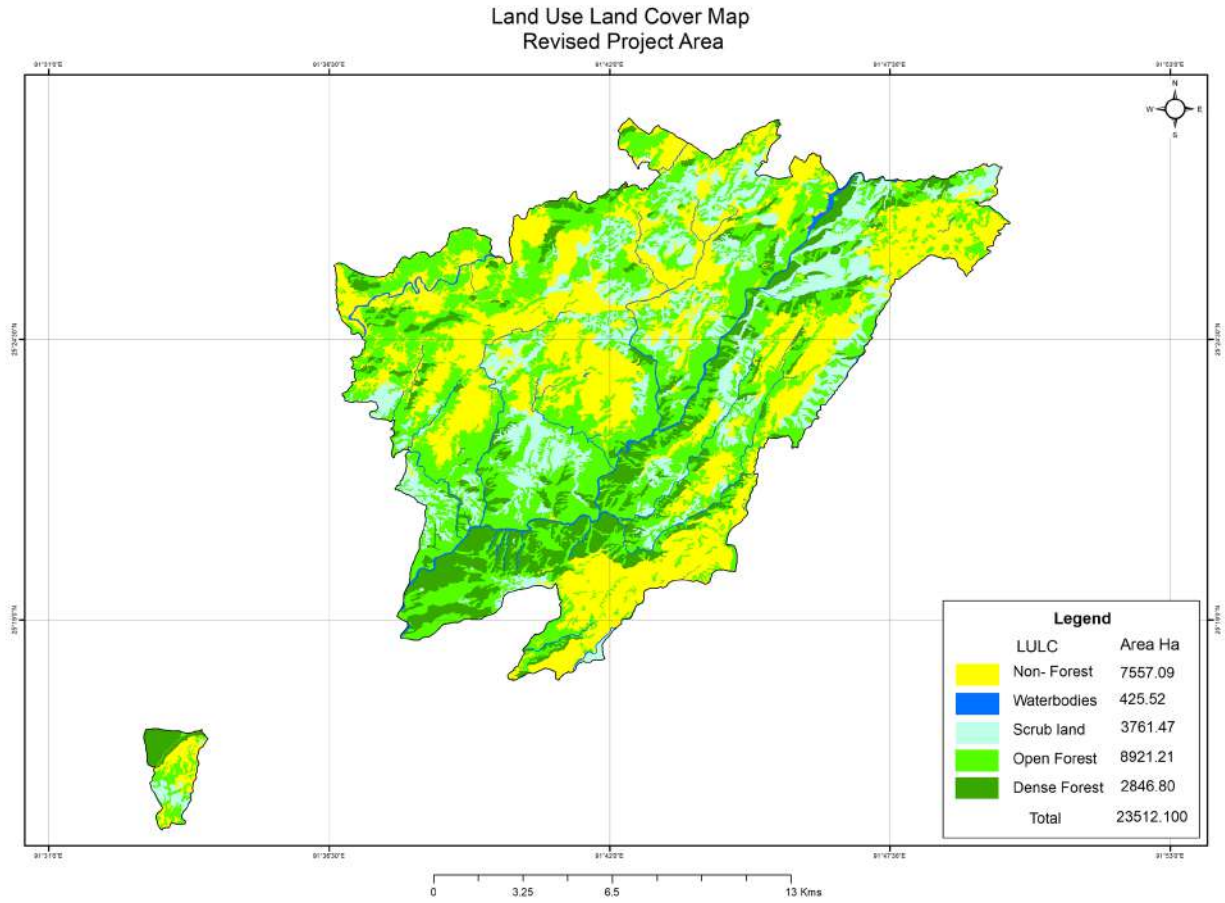
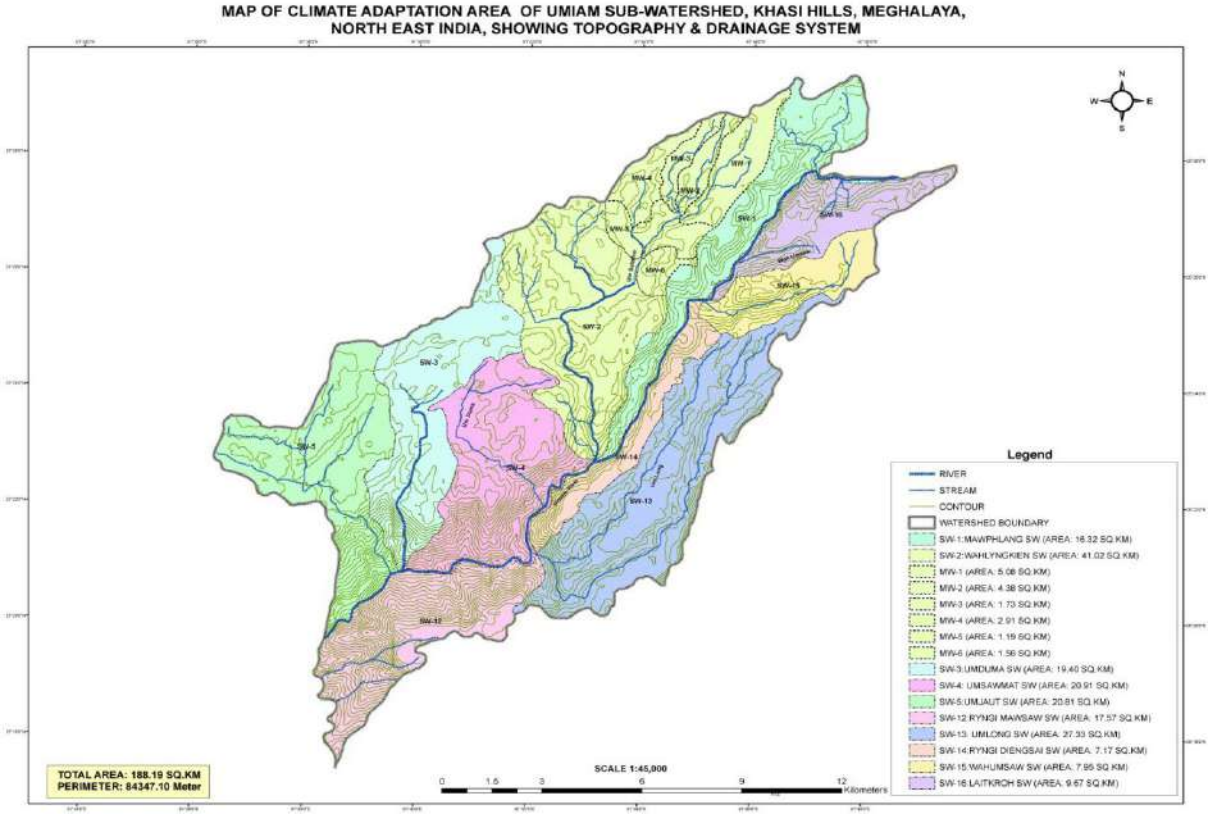


Figure 2: 2016 Umiam Sub-watershed, by Norita Sohlang, GIS Consultant



B2. Description of the project area

B2.1. Geophysical description

The project area is situated in the Central Plateau Upland region of the state of Meghalaya in Northeast India. The altitude of this plateau varies from 150m to 1,961m above the mean sea level and is characterized by a great diversity in relief. The plateau is highly dissected, with steep regular slopes to the south, which borders Bangladesh. The central plateau region within the project area consists of rolling uplands intersected by rivers and dotted with rounded hills of soft rock. The main river running through the project area is the River Umiam, which is one of the major rivers of the state and an important source of water for the state capital city of Shillong.

- ***Sub-tropical Pine Forests:*** The Khasi pine forests found in the project area are not a climax forest type for this area, but rather represent a successional community that colonizes degraded forests. They are particularly dominant in drier, more degraded sites. This is evident from a comparative study of the composition of old growth mixed evergreen forests that characterize the Khasi sacred groves and adjacent Khasi pine forests. These pine forests are often interspersed with broad leaved trees in valleys and shaded depressions. During the rainy season, there is profuse herbaceous undergrowth. Much of this growth is seasonal and lies dormant during winter giving a barren look to the ground vegetation. Moderately shaded areas and slopes support grass-legume association, which is subjected to grazing with terrestrial ferns forming gregarious patches all over the area.
- ***Mixed Evergreen Cloud Forests:*** A remarkable feature of the project area is the presence of remnants of a number of primary mixed evergreen forests known as sacred groves, of which the Mawphlang Sacred Forest is most prominent and well-preserved. These relic forests have evolved through centuries of protection. Such groves are rich in floral growth and biodiversity. Due to extremely high rainfall these mixed evergreen forests, dominated by oaks and chestnuts, are unique in the state. The forests are especially rich in endangered epiphytes and amphibians.
- ***Grassland and Savannas:*** The most common vegetation types of the project area are rolling grasslands covering large areas. Such grasslands have developed as a result of removal of their natural forest cover. A few scattered trees can also be seen within such grasslands.

The climate of the Khasi Hills is influenced by its topography. The central plateau region of the state is impacted by cyclonic air movement that brings large quantities of precipitation across Bangladesh, which is discharged in local watersheds. The climate is characterized by four seasons:

- A dry spring season from March to April
- A hot rainy summer season (Monsoons) from May to September
- A mild autumn season from October to mid-November
- A cold winter season from mid-November to February.

The mean maximum temperature of the region ranges between 15°C to 18°C. The relative humidity varies from 25% during winter and 88% during summer season. The summer maximum temperature is 28°C and the minimum is 12°C. Winter maximum temperature is 28°C and the minimum is 3°C. The region is characterized by very heavy rainfall. Mawsynram, located just south of the project area, records the world's highest rainfall of 1,372 cm. The east-west alignment of the hill ranges of the central plateau region exerts rain shadow effect and the rainfall towards the north is relatively lower.

B2.2. Presence of endangered species and habitats

The geographical location of Meghalaya, in which the project is located, favoured immigration and

introduction of various animal and plant species from neighbouring countries such as China, Myanmar, and Bangladesh. As a consequence, the project areas possess a diverse mosaic of plant and animal species, many of which are either endemic or very rare. The region is classified as a global biodiversity hot spot under the Eastern Himalayan Endemic Bird Area. The region is also a hot spot of amphibian biodiversity. A study published in the Journal of Threatened Taxa (2019), reveals 548 plant species to be endemic to Meghalaya, with trees and epiphytes each representing 25% of the endemic species. Many of the endemic species are used for timber, fuel and firewood, medicine, and for ornamental purposes. *Nepenthes khasiana, Ilex khasiana, Adinandra griffithii* and *Goniothalamus simonsii* are a few of the endangered and endemic plant species of Meghalaya (International Union for Conservation of Nature (IUCN) Red List, 2021). More than 130 mammal species are known from the Meghalaya subtropical forests, but none are endemic to this ecoregion (Meghalaya Biodiversity Board, 2017). Some of the species of conservation importance represented here include the tiger (*Panthera tigris*), clouded leopard (*Neofelis nebulosa*), Asian elephant (*Elephas maximus*), wild dog (*Cuon alpinus*), Malayan sun bear (*Helarctos malayanus*), sloth bear (*Melursus ursinus*), smooth-coated otter (*Lutrogale perspicillata*), large Indian civet (*Viverra zibetha*), Chinese pangolin (*Manis pentadactyla*), Indian pangolin (*Manis crassicaudata*), Assamese macaque (*Macaca assamensis*), bear macaque (*Macaca arctoides*), capped leaf monkey (*Semnopithecus pileatus*), and hoolock gibbon (*Hylobates hoolock*). The tiger, clouded leopard, Asian elephant, Assamese macaque, bear macaque, capped leaf monkey, wild dog, sloth bear, and smooth-coated otter are vulnerable, threatened, or endangered species (IUCN Red List, 2021).

Many of these endangered species exist within the traditional Khasi sacred forests located in the project area. This temperate type of primordial forests has evolved through hundreds of years of protection. Many endangered species, which includes orchids, rhododendrons, ferns, and other flora and fauna, are still found in these forests. The rich biodiversity of the Mawphlang Sacred Grove has attracted the attention of biologists and research scholars from India and many other countries. While most of the forests of the region have become fragmented, with little or no connectivity, a number of the sacred groves remain linked with a broad band of pristine forests lying along both banks of Umiam River. This stretch of forest is the last wildlife *refugia* in the region.

The presence of areas with rich biodiversity, harbouring rare endangered species of flora and fauna, places no constraint on the project design and implementation as a major objective of the project is to protect, conserve, and extend the forest cover. Project implementation helps to conserve and extend wildlife habitat and preserve the rich biodiversity of the area. Prominent among the rare and critically endangered and endemic flora and fauna found in the area include the following:

Table B2: Presence of Fauna and Flora in the Project Area as noted by Project Staff, 2011

Fauna	Flora
Mammals: Pangolin, Chinese ferret, badger, leopard cat, Indian porcupine, flying squirrel, flying fox, slow loris, binturong, and serow	Among the over 400 primitive angiosperms, orchids, and ferns, the following species found in the project area are **critically endangered**:
Birds: Forest wagtail, bush quail, Khaleej pheasant, red fowl, red-yellow legged falcon, and hill partridge	Red vanda, blue vanda, lady slipper orchids, and the pitcher plant (*Nepenthes khasiana*)
Reptiles: Blind snake, Khasi keelback snake, and python	
Amphibians: *Odorrana mawphlangensis, Hylarana garoensis, Hydrophylax leptoglossa, Pterorana khare, Raorchestes shillongensis, Euphlyctis hexadactylus,* and *Bufoides meghalayanus*	

B2.3. Other critical factors affecting project management

A village-based survey carried out in 2010 indicated that villages with limited motorable road access had higher rates of poverty among community families, similar results were found in 2021.

B3. Recent changes in land use and environment conditions

The project area represents a landscape dominated by four primary land covers according to the Forest Survey of India including: dense forests with more than 40% canopy closure, open forests with 10 to 40% canopy closure, scrub, and non-forests. Forest cover has been decreasing for over a century as populations have expanded and demands for timber, as well as forest conversion for agricultural land and settlements has increased. Access to minerals through mining has driven forest felling and clearing. In addition, natural forest regeneration has been suppressed due to pressures from fuel-wood collection grazing, and dry season forest fires. These forces have driven a pattern of forest biomass loss that has resulted in a steady decline in forest cover and forest health.

As Table B3a indicates, dense forest has been converted into open forest and barren lands during the ten years prior to the project start. The practice of extensive and shifting agriculture (*jhum*) has declined in the project area as farmers have focused their agriculture on more fertile soils located in valley bottoms and on lower slopes (*bun* cultivation), however some forest clearing remains on steeper slopes. The practice of charcoal production has also impacted forests in some project areas, as has forest clearing for commercial broom grass production. Table B3b shows the land use change in the project area after the project had started and to the present period. Dense forest area and open forest area have both increased during this time while scrubland has decreased. Land cover maps show transition from scrubland or non-forest to open forest during this period. In some of these areas, ANR has been implemented and an increase in forest cover has been shown. The data in Tables B3a and B3b have been produced using different mapping techniques and satellite imagery and therefore the data from prior to the project and at present cannot be accurately compared.

Table B3a: Land Use Change in the Project Area (in ha): (1990, 2006, 2010)

Category	1990	2006	2010
Dense forest	7781.78	5196.23	5042.76
Open forest	3878.74	8379.53	7814.97
Fallow	55.08	124.33	740.67
Others	11787.03	9802.53	9904.23
Total	23502.63	23502.63	23502.63

Table B3b: Land Use Change in the Project Area (in ha): (2016, 2021)

Category	2016	2021	2021 Updated
Dense forest	2685.30	2846.80	2950.4
Open forest	8174.19	8921.21	8452.5
Scrubland	5222.81	3761.47	4038.8
Waterbodies	467.10	425.52	455.9
Non-forest	6962.69	7557.09	7581.7
Unaccounted area			28.1
Total	23512.10	23512.10	23507.4

B4. Drivers of degradation

The key drivers of deforestation and forest degradation in the project area are:

- **Population growth**: Meghalaya's growth rate is expected to be 13% between 2011 and 2021 with

an estimated population of 34.4 lakhs in 2021. This is a decrease from the previous decade (2001-2011) which saw a growth rate of 27.8% and was about 10% higher than the national average. Many rural families continue to have 6 to 8 children. Out migration is not an attractive option for many Khasis as they are a highly cohesive culture.

- **Forest fires**: Fires occur during dry months when the forest floor is covered with a thick layer of dry leaves and needles. Fires are often set by lightening, human negligence, and escaping fires from agricultural burning and charcoal production.
- **Unsustainable fuel wood collection**: Being in a relatively cold region, firewood consumption per household in the area has been high, averaging 10 to 20 kg per household per day based on surveys conducted by the project team. Firewood is collected from nearby forests. If dead trees are not available, people resort to felling live trees and saplings. While some villages have regulations guiding fuel wood collection, many do not, or the systems have broken down.
- **Charcoal making**: There is a significant demand for charcoal in Meghalaya. Charcoal is used by iron-ore smelting industries and it is also used for heating homes and offices. Charcoal making and its purchase by industries is illegal in Meghalaya. In 2011, charcoal production was conducted in several villages, but it is now concentrated in a few villages with limited alternative income generating opportunities. However, though there are less people involved, the production between 2011 and 2021 has not lessened.
- **Stone quarrying**: There is a large demand for stone, sand, and gravel for construction in Shillong city. Many stone quarries exist in the project area. Quarries are usually on steep slopes, and they lead to erosion and landslides.
- **Uncontrolled grazing**: The rural communities allow cattle, goats, and sheep to graze in nearby forest areas. Grazing causes forest degradation as young seedlings and saplings are grazed or trampled. Grazing animals are reported to have little economic value, and communities are often eager to switch to stall-feeding and higher quality livestock.
- **Agricultural expansion:** Communities or clans own most of the forests in the project area. However, it has been observed that when community and clan forests are privatized, they are sometimes permanently cleared for agriculture, like for broomstick production. Forest clearance is also practiced for extensive and shifting agriculture (*jhum*) on steep slopes. Agricultural expansion is taking place in several *Hima* in the southern part of the project area where businessmen are providing loans to families to clear forests and plant broom grass for markets in other parts of India.

Part C: Community and Livelihoods Information

C1. Participating communities

The project focuses on the involvement of the Khasi people, an indigenous tribe in the state of Meghalaya, which is in the northeast of India, bordering Assam (India) and Bangladesh. The majority of the population in the Khasi Hills speak Khasi, their native language. About 85% of the Khasi are Christians while a substantial minority practice the indigenous Khasi religion, which has influenced the clan system of the Khasi society: Khasi land is divided into governments (*Hima*) which are headed by the chiefs of the most influential clans. The system of descent and inheritance is matrilineal, meaning that women continue family lineages and property is passed on to the youngest daughter.

Based on the village surveys conducted by the project team, there are over 7,700 households representing a population of more than 40,000 with an average household size of 5 to 6 members in the project area. The villages are almost exclusively Khasi, with 86 villages administered through their traditional village

councils *(Dorbar*) under the overall supervision of 10 indigenous governments (*Hima*). These indigenous governments are represented by the Khasi Hills Autonomous District Council (KHADC).

Average village size is 87 households, though project communities vary in size from 13 households to 265 households. The target households and communities reside around the private, clan, and community forests in the project area. Community forests are managed and controlled by the *Hima Dorbar* (council) for the benefit communities in the area. The project also involves forest owning clans and households with private forests.

C2. Description of the socio-economic context

The main occupation of all target groups mentioned previously is agriculture. The prominent crops grown are rice, maize, potatoes, and vegetables. To supplement their incomes the farmers also rear livestock such as cows, sheep, goats, pigs, and poultry. The average land holding in the project area is only 0.25 ha per household based on surveys conducted by the Bethany Society from 2011. The average annual income per household (of 5 or 6 members) was less than Rs. 60,000— just over USD $2 per day in 2021, which is a significant increase from the results shown in 2010. The project's village survey (2021) indicated that in most project communities 70% of the households were below the poverty line. Poverty and lack of employment opportunities was one of the most frequently noted problems facing project villages. Development priorities include creating jobs, better road access, improved water supplies, and improved access to schools and health facilities.

The East Khasi Hills district data reflects the areas heavy dependence on agriculture and natural resources, yet population expansion is exceeding land and forest carrying capacity. Many rural families depend on large families to carry on with subsistence farming and other livelihood activities. Out migration is not an attractive option for many Khasis as they are a highly cohesive culture. As a result, remittances from Khasi working out of state to rural communities are limited. It appears rapid population growth over the past century remains an underlying cause of poverty and environmental degradation in the project area.

In the project area, potatoes are the major crops. Other important crops include rice, cabbage, sweet potatoes, beans, maize, and turnips. Heavy use of fertilizers and chemical inputs in some areas are reported to be causing soil problems with the result that yields are falling. Despite the high price of inputs, vegetable prices may not reflect producer costs, with potatoes selling as low as Rs. 5 per kilo. As a result of the project, beneficiaries in the project area beginning to diversify with alternative production systems especially the cultivation of fruit trees including peaches, plums, pears, and other local fruit. Improved animal husbandry systems such as stall-fed pig and poultry raising, and freshwater aquaculture are also popular rural enterprises.

The project communities are demonstrating a strong commitment to education with a rural literacy rate for the district of 77% (2011 Census). Khasi society is quite literate, and most families place a high value on educating their children. High levels of school attendance are common among village youth, especially girls, who often seek high school graduation or college degrees. Access to schools, roads, and markets varies among the project villages. Based on village profiles conducted by the project team, the 86 villages can be categorized according to their size, access to services, and forest dependence.

The village profiles indicated that 68% of the 86 villages had a high forest dependency (with 50% or more of villagers relying on the forest for some aspect of their daily livelihood), with most villages having 1 to 3 community forest blocks within 1 to 2 km of the village. Some community forest areas were up to 10 km

from the project village. Access to roads was also a factor, with 24% of the villages farther than 0.5 km from the nearest road. Some remote hamlets were up to 6 km from the road. The village survey indicates that villages with limited motorable road access had higher rates of poverty among community families.

C3. Description of land tenure & ownership of carbon rights

The state of Meghalaya is governed under the Sixth Schedule of the Constitution of India. This means that customary beliefs and practices are recognized and legitimized, including those governing the management of land, forests, minerals, and other natural resources. The Sixth Schedule bestows the rights of resource management to the indigenous people of the state and their traditional institutions, coordinated by Autonomous District Council. The Khasi Hills of Meghalaya are comprised of small tribal administrative units known as *Hima*. Less than 10% of the state's forests are under the authority of the Government of India and the State Forest Department, and these are largely limited to national parks and wildlife sanctuaries, while the remaining 90% is held by communities, clans, and families.

Aside from private forests, most of the forests in the project area are under the stewardship of one of the 10 respective *Hima* and are managed by the *Hima Dorbar*, an indigenous council represented by all male adults of every constituent village. These community forests are managed for the benefit of the entire community including strict conservation of sacred forests, as well as multiple use in production forests. The *Hima Dorbar* does not own any land, rather they are custodians elected to manage and control such forests. Private forests are under the control of the owners, who may be private individuals or members of a clan.

The project area is comprised of ten such *Hima*, which have formed a Federation to coordinate management. In August 2011, the Federation registered under the Meghalaya Societies Registration Act as "Ka Synjuk Ki Hima Arliang Wah Umiam, Mawphlang Welfare Society". Carbon benefits arising out of the project are wholly owned by the Synjuk Federation and are used to cover the costs of mitigation activities and management, with the balance distributed to the 86 villages with the 10 *Hima* through annual development funds.

The land tenure for each forest owner, be they owners of clan, private, or community forests, has been established during the project design phase. Forest boundaries are well known and accepted, and in the few cases where disputes have arisen, they have been resolved. When forest conflict arises, they are settled by the *Hima Dorbar*, or referred to the Autonomous District Council. The Khasi Hills Autonomous District Council has approved this REDD+ project as the formal Government of India agency representing the indigenous governments. In addition, the project has been recognized by the Meghalaya department of Environment and Forests and collaborates closely with the State Government's Climate Change Center. Carbon revenues are also used to meet the operational costs of the federation and the LWC, who are responsible for project administration, coordination, and management of mitigation and livelihood activities, monitoring, and reporting.

Part D: Project Interventions and Activities

D1. Summary of project interventions

The Khasi Hills project seeks to prevent the conversion and degradation of ecosystems through the two interventions:

- Prevention of Deforestation and Degradation
- Assisted Natural Regeneration

The project aims to slow, halt, and reverse the loss and the degradation of forests in Meghalaya and is the first REDD+ project in India. Restoration of degraded forests are achieved by supporting communities in land management and forest regeneration activities that yield livelihood benefits. The project supports the development of community natural resource management (NRM) plans for the management of forests and micro-watersheds. Where possible, the project will link forest fragments to enhance hydrological and biodiversity services, especially on major and minor riparian arteries of the Umiam River.

Activities included within each of the interventions are described below:

REDD+ activities:

- Program management and institution building: A key component in the REDD+ project strategy is to build the capacity of indigenous governments to protect and restore community forests. While indigenous governments and communities possess legal ownership of local forests, increasing population and economic pressures combined with an erosion of local controls has resulted in rapid depletion of forest resources. By strengthening local institutions and management capacities, forest stewardship can improve. This component includes four key tasks:
    - Uniting the ten indigenous governments (*Hima*) within a resource management Federation to oversee the planning and coordinate strategy and financial support.
    - Establishing Lower Working Committees (LWC) that can support the 86 participating villages to formulate natural resource management plans. The LWC are operating and responsive to their respective *Hima* and the Federation.
    - Supporting the participating villages to prepare their natural resource management plan and initiate mitigation and livelihood activities.
    - Engaging government and civil society partners to collaborate in implementing the REDD+ project, drawing on their technical and financial resources.
- REDD+ mitigation activities: Reducing emissions from deforestation and forest degradation is a core component of any REDD+ project. The project seeks to achieve a range of hydrological and biodiversity goals, including storing and sequestering carbon. This is achieved through three activities:
    - Establishing and maintaining fire prevention techniques: The first activity involves preventing the spread of ground and canopy forest fires. Dry season fires delay natural regeneration in degraded forests and threaten dense forest areas, while emitting substantial carbon emissions. Through the establishment of fire lines (a traditional practice in Khasi society), the creation of awareness regarding the need to control fires quickly and effectively, and the provision of fire watchers during the dry season, the extent of forest fire damage can be dramatically reduced. Incidence of fire will be monitored by the LWC as burn areas are highly visible. Rewards to communities that prevent fires are given at the end of the season. Training in fire safety and control is also important as communities may use fire to establish fire-lines (s*anding*) as well as for agricultural clearing.
    - Sustainable fuelwood harvesting plan: The second task requires developing sustainable systems of fuelwood use. Khasi households consume between 15kg and 20 kg of fuel wood daily. Cutting and collection of firewood both reduces forest biomass and health. The establishment of a Natural Resources Management (NRM) planning process has helped to re-establish sustainable firewood production systems and can result in improved forest condition in the project area. Harvesting plans and rules that identify the time and place for fuelwood collection, as well as permitted volume allowed for extraction are

established by the village councils to regulate forest use.

- **Reduce fuelwood consumption:** The third activity focuses on reducing fuelwood consumption through the acquisition and distribution of liquid petroleum gas (LPG) cook tops and alternatives to firewood. The project seeks to install these in at least 60% of the project households over the next 5-year period (2022-2026). The project provides training to reduce the need for cooking animal feed, further reducing fuelwood consumption. Youth volunteers are enlisted to monitor fuelwood throughout the project area.

- **Livelihood activities**: Poverty is a major problem in the project area where 70% or more of the households in the 86 villages live below the poverty line of USD$2 per day. To be successful this REDD+ project addresses livelihood needs. This includes the implementation of five activities:
  - **Community benefit sharing program**: The project shares revenues from carbon offset sales through the provision of annual Community Development Funds to all participating villages. The funds vary from Rs. 15,000 to Rs. 25,000 ($214 to $357) depending on net revenues available for funding small development projects identified by each village. Projects include drinking water enclosures, ponds, playgrounds, and civic building projects. In addition to the Community Development Fund, a larger grant program, the Special Village Grant, is designed to cover the costs of bigger village projects, particularly the improvement of water resources. The villages that benefit from this grant are chosen annually by participating *Hima* of the Synjuk. It will be offered on a rotational basis along with the consensus of the Synjuk and screening of the proposals in order to avoid risks of elite capture. Another introduction to the project has been the Eco-tourism Infrastructure Program. The project area had seen a steady increase in visitors for the last decade (prior to the pandemic). With the projection that there will be rapid growth in tourism to the area once again in the future, the project team is working with communities and the state government to prepare the infrastructure to handle the incoming tourist volume. This program provides each of the ten *Hima* with funds to establish viewing sites, hiking trails, and restroom facilities, while assisting the Self-help Groups and *Hima* government to generate revenues and employment opportunities. The goal is to create opportunities for tourism while protecting the natural environment and culture of the region.
  - **Livelihood program – Women's Self-help Groups:** This livelihood strategy involves the development of Self-help Groups (SHGs) and focuses on women. SHGs are organized and trained in bookkeeping, micro-finance, GOI bank programs, and small enterprise development. Aside from training, the project provides small seed grants to help in establishing SHGs. The project also collaborates with government projects and schemes involved in micro-finance group development as well as with local NGOs working in this area. There are currently government schemes which also include availability to water resources and LPG, as well as agricultural programmes that are similar to the project activities. The need is for these resources is great and the government schemes do not reach all of the project participants. The Khasi Hills Community REDD+ Project also works as a link to join the community people with the schemes available and helps to enable the villages to seek beneficial resources. SHGs are involved, where possible, in other project activities including the sustainable farming system program and the ecotourism strategy. Earlier pilot project experience suggested that many families wished to improve their income from livestock and transition to more intensive stall feeding and this has remained true as the project continued. This strategy not only increases income from animal husbandry, but also accelerates forest restoration. The project provides support with the construction of stalls and pens. It assists communities to access government veterinary services and connect with markets. The project provides women's micro-finance groups

with piglets and poultry and is developing a pig-breeding program for the project area. Another successful venture in the first phase of the project has been mushroom cultivation. The project provides training on how to construct a mushroom house and how to grow the mushrooms as well as provides spawn and market connectivity. The project is currently developing a federation of women's SHGs for livelihood development in the project area. This SHG Federation will be led by women actively engaged in the SHGs to provide additional loaning and funding opportunities as well as share in market linkages and availability.

- **Livelihood program – Farmers' Clubs:** The second livelihood strategy is the sustainable farming systems program which focuses on both men and women. This approach is designed to improve farm incomes and reduce negative environmental impacts from the current heavy dependence on chemical fertilizers and pesticides. Special attention is given to assisting farmers to transition from low value potato cultivation to raising fruit trees, especially stone fruits, cut flowers, and other high value crops. The project provides Farmer's Clubs with protected cultivation or poly-houses, a type of green house that extends the growing season to enable farmers to earn during the lean season, through the assistance of the Indian Council of Agricultural Research (ICAR). These institutions are invited to come to the project area to demonstrate modern practices in these fields. Such training is accompanied by construction of poly-houses, advances in animal husbandry techniques, and the construction of pigpens and poultry raising.

Assisted Natural Regeneration

The activities included under the Assisted Natural Regeneration Intervention include:

- **Advance closure:** This initial activity involves mobilizing communities to restrict access and use of degraded forests, which possess good regenerative potential reflected in the presence of saplings and seedlings, rootstock for coppicing species, and favourable soil and moisture conditions. These sites would be closed to grazing and fuel wood collection for an initial period of 5 years (or other period determined by the village) to allow them to regenerate. The community would also be responsible for preventing forest fires in the area by establishing and maintaining firelines. The project currently has 1583 hectares in advance closure activity (as of 2021). Depending on the village, the area may be treated with assisted natural regeneration (ANR) activities at the same time as advance closure. These two phases often take place simultaneously.
- **ANR (silvicultural) treatment:** The second activity involves selecting open forest sites with high potential reflected in the presence of viable root stock and mother trees for ANR treatment. This activity requires 10 person days per hectare for thinning, multiple coppice shoot cutting, and weeding undesirable species. ANR treatment costs approximately 10 to 20% of plantation costs and results in accelerated forest regeneration with natural species and high survival rates. The project is currently (in 2021) implementing ANR treatment on 1,583 hectares of degraded open forests identified by communities with another 250 hectares targeted for treatment over the next 5 years.

D2. Summary of the project activities for each intervention

Table D2: Description of Intervention Activities

Intervention type	Project activity	Description	Target group	Eligible for PV accreditation
REDD+	Forest protection	• Institutional strengthening, establishing a common approach to forest protection	Community group	Yes

		and management by all participating communities (*Hima* and *Durbar*) • Forest boundary dispute resolution • Forest management planning • Controlling forest fires • Sustainable fuelwood harvesting and consumption		
REDD+	Institution building	• LWC facilitate NRM planning • Training and employment for community NRM team	Community (Federation, *Hima*, and Village Councils)	No
REDD+	Energy transition	• Distribution of LPG cooktops and rice cookers • Fuelwood monitoring • Alternatives to cooking food for piggery • Charcoal making alternatives	Households	Yes
REDD+	Income generation for low-income households	• Piggery and poultry projects • Eco-tourism • Home-based nursery management • Sustainable farming systems • Horticulture projects	Self-help Groups and Farmers' Clubs	No
Assisted natural regeneration	Assisted natural regeneration	• Enrichment planting • Protection of natural regeneration of native species • Restriction of forest areas for grazing and fuelwood collection • Silviculture activities (weeding, thinning, etc.) performed on regenerating open forests • Home-based nurseries	Community groups	Yes

D3. Effects of activities on biodiversity and the environment

D3.1. Project impacts on biodiversity

Project activities will have a far-reaching impact on biodiversity in the project area. In addition to delivering climate benefits, forest protection will prevent the loss of biodiversity. Enrichment planting will be carried out using only native and naturalised tree species. Moreover, the REDD+ project is expected to enhance, or at the very least maintain, levels of biodiversity by expanding and maintaining habitats.

Reducing the impact of key drivers of deforestation and degradation, especially forest fire and fuelwood collection, should allow for rapid re-growth of pine and mixed-evergreen forests. By the end of the project, field inventories and satellite imagery should show indications of young secondary forests on 3,000 hectares of area that is currently badly degraded. These young secondary forests should be between 5 to 10 meters in height. The project also seeks to link forest fragments connecting old growth patches in sacred forests and community forests, with newly regenerating forest areas.

Fire management plans include the creation and maintenance of fire lines and the appointment of seasonal firewatchers to reduce forest loss from fire and to improve and extend wildlife habitats. Steps are also taken to create wildlife refugia with the connection and growth of wildlife corridors. Rules on hunting and awareness raising programs also increase the rate of recovery of endangered animal and bird populations. The project gives special attention to endemic species of orchids and amphibians by creating special refugia and promoting conservation and education activities.

D3.2. Environmental impacts on soil and water

Project activities are unlikely to lead to any negative environmental impacts. Reducing deforestation and forest degradation will help to prevent soil erosion and contribute to better water quality within the project boundaries. The project continues to pursue the improvement of the hydrology of the Umiam watershed by protecting and restoring watershed forests and improving the management of riparian areas.

This riparian artery is too steep for settlements or agriculture and falls within the core project area, so conservation imposes minimal economic loss to local communities. Assisted Natural Regeneration (ANR) is the primary approach to the restoration of degraded forests due to its low cost and biodiversity benefits. The project intends to implement ANR on 50 hectares each year, with target areas identified in the 26 micro-watershed plans. This aims to cover about half of degraded open forest in the project area over the next decade. Funding for ANR activities (i.e. weeding, thinning, enrichment planting) in the target areas comes from the National Rural Employment Guarantee Act (NREGA), as well as carbon revenues, but villages also contribute their ideas and funds when funding agencies are absent. At a minimum, ANR will include protection from forest fires, grazing, and fuel wood collection.

The project also seeks to improve the hydrology of the Umiam and Umngi watersheds by protecting and restoring watershed forests. The project is measuring volume and duration of rainfall as well as infiltration rates to assess how changes in forest cover are impacting water availability.

Part E: Community Participation

E1. Participatory project design

E1.1. Planning process

Participation in the project grew out of a pilot project in Hima Mawphlang. The original pilot project was initiated at the request of the *Hima* leadership and community. Subsequently, nine additional indigenous kingdoms in the project area made a request to join the emerging REDD+ project initiative. The ten *Hima* then formed a Federation to coordinate and manage the activities. There are now 86 villages, an increase from the original 62 villages, under the supervision of the ten *Hima*, with each village consulted regarding their willingness to participate in the project. All 86 communities in the project area have participated in a series of awareness raising activities that included a description of the project. After their own internal discussions, they had the option to participate in the project. All 86 villages agreed to participate and agreed to sign a community resolution on conservation and protection of forests. Private and clan forest owners that wish to join the project may also agree to the terms of the project, though no special payments are provided to them other than those shared by other members of their local community.

Table E1a: Steps of Community Participation for Original Villages

Community Participation for Original Villages				
Target Group	**Information Shared**	**Participation (Inputs) Provided**	**Consent Sought**	**Agreement Made**
Hima	Synjuk Federation	Links between	Oversight on project	MOU to oversee

	purpose, project implementation, PES information	higher government and local indigenous institutions	activities to REDD+ team	REDD+ project implementation
Village *Dorbar*	Initial discussions on potential project areas	Vote on the constitution, by-laws, and objectives of the Federation	Consensus on project implementation, Permission to provide awareness programme to community members	REDD+ Project Implementation, PES agreement
Village Community	Awareness Programme on project implementation, livelihood alternatives, and forest conservation	Participatory Rural Appraisal, mapping of village resources	Consensus on project implementation	Community Resolution on Conservation and Protection of Forests, PES agreement
LWC	Benefit Sharing Grant procedures and funding	Natural Resource Management Plans, Grant Proposals		Benefit Sharing Agreements

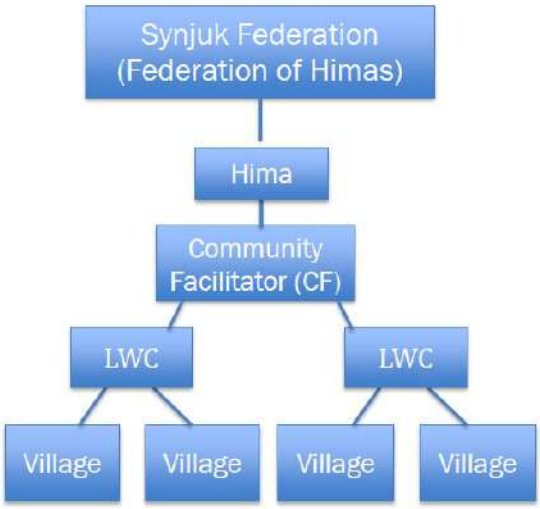
Table E1b: Steps of Community Participation for Adopting New Villages

Community Participation for Adopting New Villages				
Target Group	**Information Shared**	**Participation (Inputs) Provided**	**Consent Sought**	**Agreement Made**
Village *Dorbar*	Discussions on potential project areas	Meetings facilitated between *Hima* and village heads on project benefits	Consensus on project implementation, Permission to provide awareness programme to community members	REDD+ Project Implementation, PES agreement
Village Community	Awareness Programme on project implementation, livelihood alternatives, and forest conservation	Participatory Rural Appraisal, mapping of village resources	Consensus on project implementation	Community Resolution on Conservation and Protection of Forests, PES agreement
LWC	Benefit Sharing Grant procedures	Natural Resource Management Plans, Grant Proposals		Grant funding agreements

E1.2. Governance of community groups

Villages prepare their own Natural Resource Management (NRM) plans, which are organised into clusters. These plans include community recommendations on ways and means to enhance incomes and the standard of living of the local community. These clusters work with Lower Working Committees (LWCs) where NRM plans are discussed and then submitted to local Community Facilitators (CFs), who then incorporate all feasible proposals of the community NRM plans into a strategy for their respective *Hima* and present them to the Federation. The Federation then reviews NRM plans together with the Forestry Team working with the Synjuk (Figure 3). Each of the 86 participating villages have designed and implemented local NRM plans and have signed an agreement with the Synjuk to participate in the REDD+ project (see Annex 3).

Figure 3: Community-based Governance



Levels of community governance:

- **Village-level:** The project has the following key staff at the field level:
  - Youth Volunteers: Two per village selected by the village *dorbar* who help to undertake forest monitoring and socio-economic activities. The youth volunteer may serve for an undetermined period of time. When a youth volunteer decides they no longer wish to participate a new youth volunteer is selected.
  - Self-help Groups: Ten to fifteen members, mainly women, who propose and carry out activities that contribute to the livelihoods of the people in individual villages, such as piggery, poultry, or running a store.
  - Farmers' Clubs: About twenty farmers join to carry out agriculture and other activities.
  - Project Participants: Villages prepare NRM plans which contain forest conservation activities, as well as livelihood projects to improve living conditions at village-level.
- **Lower Working Committees (LWCs):** Participating communities are generally clustered into groups of 2-5 villages, to form Village Working Units (VWU) in consultation with the concerned *Hima*. Villages within such clusters are in close proximity to one another. One male and one female from each village chosen in the village *dorbar*, as well as the village Headmen, constitute a LWC. The Chief of each *Hima* (i.e., the *Syiem, Lyngdoh,* etc.), acts as the Chairman of all LWCs falling within his area of jurisdiction.
- **Community Facilitators (CFs):** CFs are appointed in each *Hima* by the *Hima Dorbar*. The CFs are chosen by consensus and must be educated, influential and a respected member of the community. There is one male CF and one female CF for each *Hima.* Their jobs include campaigns within the *Hima* to bring awareness to people on the need to conserve the forests and natural resources and to manage them sustainably as well as to train LWC members and extension workers on all aspects of project work, including bookkeeping, maintenance of accounts, and data collection including livelihood and socio-economic indicators.
- **Federation of *Hima* (Synjuk Federation):** A Federation comprising of all ten *Hima Dorbar* has been formed to represent all the forest owners of the project area (see Annex 6). The Federation is registered with the government as a charitable society. The long-term aims and objectives of this society include the conservation of the forest, its fauna and flora, and to initiate steps to improve the quality of life of the communities. Such a Federation ensures the adoption of a collective approach to all the scheduled activities as well as an equitable sharing of the benefits. The Federation gives the indigenous traditional institutions a much stronger voice in all matters relating to forest conservation and relies on knowledge sharing and transfer of skills to ensure a uniform

approach to natural resource management. The Federation is in a powerful position to bargain for allocation of funds from the government for the management and control of community forests. The exact constitution, by-laws, and objectives of the Federation are decided upon by the concerned *Hima Dorbars* themselves.

E1.3. Barriers to participation

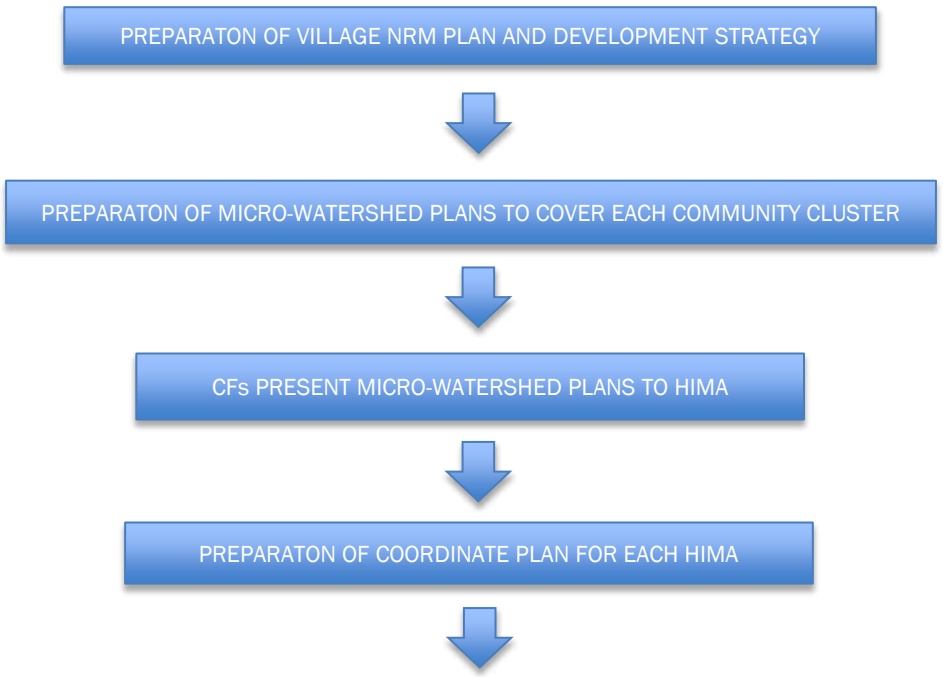
The project aims to remove barriers to participation by involving women and men equally at various stages in the project operations. In Lower Working Committees, there must be equal representation by men and women. One man and one woman must represent a village as members in the LWC. Moreover, women are especially involved in Self-help Groups (SHGs), which are common institutions across India to ensure self-financing of local development objectives. Traditionally, the ten to fifteen members of SHGs are mainly made up of women, although men are permitted to join as members. Since 2016, the project has also employed female Community Facilitators (CFs) who will specifically represent women's interests in the project and are involved in the NRM plans through the LWC and through Participatory Rural Appraisal (PRA).

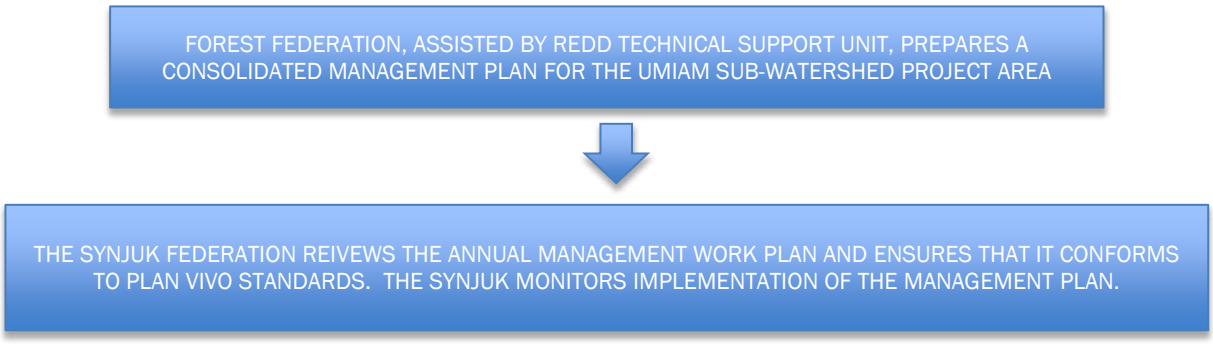
E2. Community-led implementation

Apart from preparing Natural Resource Management (NRM) plans together with village Headmen, these plans are discussed with Lower Working Committees (LWCs) which represent clusters of 2-5 villages. Once NRM plans are discussed at LWC level, they are submitted to Community Facilitators (CFs) who consolidate plans for their respective *Hima* and submit them to the Synjuk Federation.

Once the Synjuk Federation receives NRM plans, different teams (specifically the forestry team and the socio-economic team) employed by the Synjuk Federation assess them according to their technical and other criteria. If the plan does not meet the thresholds for protected forest area or length of time that forests need for recovery, the Synjuk team works with the LWC to revise and improve the plan. When the plans are centrally approved, they are stored at the central office of the Synjuk Federation and at village-level where they are kept by the village Headman. At the Federation level, all plans are consolidated into an overall Umiam Watershed Plan.

Figure 4: Community-led Implementation of *Plan Vivos*





E3. Community-level project governance

Through the preparation of Natural Resource Management (NRM) plans for each village, communities are involved in implementing their own NRM plans, which are overseen by village Headmen and Community Facilitators (CFs) together with youth volunteers from different villages. Moreover, Self-help Groups (SHGs) and Farmers' Clubs identify their own priorities and objectives and consolidate them into livelihood activities, with the help of Synjuk Community Development Funds. The project is in the process of forming a SHG Federation to create a network of SHGs to enhance collaborations. At the cluster-level, LWCs meet about 4 times a year to discuss progress and issues. The Synjuk meet 2-3 times a year to discuss implementation, challenges, and improvements to the project. If there are pressing matters at hand, the Synjuk meets more regularly.

The project is already having an important impact by strengthening indigenous government and traditional resource management institutions in the project area. By engaging them in the project design process and empowering them as the lead management institution, the indigenous *Hima* and *Durbar* are gaining recognition in the district and state government, as well as civil society and international organizations. Through the creation of an apex body in the form of a non-profit federation, the villages and *Hima* are able to prepare landscape level management plans that link their small community forests and sacred groves into a unified stewardship system. The Federation also gives the smaller governments and villages a mechanism to speak with one another, as well as with state government. This is important in securing financing for NRM activities, both from national government development schemes and programs, as well as through carbon sales on private voluntary markets.

The creation of technically specialized Lower Working Committees at the village cluster level also provides 26 new LWC organizations with the skills needed to prepare village NRM plans and implement them. The LWC is responsible to their respective *Hima* as well as to the Federation, allowing for upward and downward flows of information and financing. The institutional components should also lead to a reduction in inter-village conflicts, as well as disputes with private sector agents.

Depending on each of the 26 LWC areas, the community selects one or more degraded forest areas for Assisted Natural Regeneration (ANR), including closure to green fuel wood collection, grazing, and protection from fire. This decision considers the availability of funds and materials, enrichment planting, weeding, and thinning activities that are implemented. In each micro-watershed, several monitoring plots for dense forests and degraded forests are maintained and photo monitored yearly and measured every five years. This includes a sample of forests where ANR activities are underway. In addition, the impact on the watershed is visible in changes in the land use pattern reflected in SPOT or LISS1V satellite images as well as references from Google Earth images. These are analysed every 5 years with GPS coordinates provided for all ANR areas. At the end of each year, the LWC assesses the success of their efforts in

improving watershed conditions. (Biodiversity and hydrological indicators for communities are under development.)

The project also involves experienced forestry professionals from the Meghalaya Forest Department and the Khasi Hills Forest Department, with consultations with several retired West Bengal Forest Department officers. The technical guidance provided by these individuals includes forest inventory data collection and analysis that assist the Federation to compile annual reports on changes in forest conditions and carbon stocks in the dense and regenerated forests.

The project has implemented a grievance mechanism, which allows village members to raise any complaints with village Headmen and CFs, who are responsible for reporting complaints to the Synjuk where complaints are registered and tracked. The Synjuk will address complaints by engaging with the CFs, *Hima* heads, and village Headmen to find resolutions to grievances. A grievance is reported by the CF and presented during the monthly CF meetings for discussion at which time a resolution strategy is identified. The CF then implements the action and reports the outcome at the next meeting. If there is a grievance from outside the project area, it is also the responsibility of the CF to include that problem in his or her monthly report in order to identify a path to resolution.

Part F: Ecosystem Services and Other Project Benefits

F1. Carbon benefits

Table F1a: Carbon Benefits

Carbon Benefits					
	1	2	3	4	1-(2+3+4)
Intervention type (technical specification)	Baseline scenario emissions i.e., without project (t CO_2e)	Project scenario emissions (t CO_2e/ha)	Expected losses from leakage (t CO_2e/ha)	Deduction of risk buffer (t CO_2e/ha)	Net carbon benefit (t CO_2ef)
REDD+	485,307	111,621	18,684	71,000	284,002
ANR	0	-26,563	1,328	5,047	20,188
Total					304,190

- Note that the underlying calculations in this table come from the technical specifications described in Part G
- Normally there will be a technical specification for each intervention (in the case of REDD+ a group of activities implemented together is treated as single intervention)

Table F1b: Parameters of Carbon Benefits

Parameter	Value (Mg CO_2)	Mg CO_2 yr^{-1}
Baseline scenario emissions from deforestation and forest degradation expected during the project period (E_{BL})	485,307	See Section G.4.3
Expected project scenario emissions from deforestation and forest degradation expected during the project period (E_{PS})	111,621	See Section G.5.1
Leakage emissions expected to result from displacement of deforestation and degradation during the project period (E_{LK})	18,684	See Section G.6.2
Climate benefits expected to result from reduced deforestation and forest degradation as result of project activities during the project period (*B)**	355,002	AA-CFREDD Equation 16 (see Annex 10)
• Note that this does not include the 20% held in risk buffer		

F2. Livelihoods benefits

Table F2a: Livelihood Benefits

Livelihoods Benefits							
Food and agricultural production	**Financial assets and incomes**	**Environ-mental services (water, soil, etc.)**	**Energy**	**Timber and non-timber forest products (incl. forest food)**	**Land and tenure security**	**Use-rights to natural resources**	**Social and cultural assets**
Support for farmers through the support of Farmers' Clubs, providing training and capacity-building to improve agricultural production and book-keeping	Income generating activities increase local incomes	Reduced soil erosion through forest protection	The project is providing alternative energy sources	Regenera-tion of forest allows for better provision of NTFPs	Strong tradition of community rights in project area. Project transfers sense of ownership to local communities managing their own resources	Regulations for access to natural resources through forest management plans and participatory decision making	Increasing social cohesiveness and cooperation between different *Hima* heads
Improved incomes leading to increased purchase power and greater food security	Disbursement of funds based on locally chosen development objectives	Better water infiltration through forest regenera-tion and protection	Supply of fuelwood is maintained	Assigned plots for wood harvesting prevent over-exploitation of forest resources	Increasing focus on community-based forest management	Villages with poor topsoil condition do assert to quarry, hill sand or river sand mining.	Mobilization of communities; bottom-up approach to improving livelihoods
Community-based irrigation projects to improve crop production	Local piggery and poultry projects supported through the project enable local communities	Protec-tion and identifica-tion of natural water sources				Regulated use of community forests for charcoal making.	Empower-ment of women

Table F2b: Negative Impacts to Livelihoods

Negative Impacts to Livelihoods			
Food and agricultural production	**Energy**	**Timber & non-timber forest products (incl. forest food)**	**Use-rights to natural resources**
Farmers may experience more human-wildlife conflict as habitat increases and more wild animals occupy areas closer to village and agricultural plantations. The project keeps a record of these occurrences and works with the Wildlife Department to mitigate conflict.	Some households may be negatively affected if they have to walk further to collect assigned allotments for firewood. The project mitigates these effects by providing alternative energy sources.	Assigned plots for timber and non-timber forest products may mean that members have to travel further. The project mitigates this by introducing alternative livelihood programs.	*Hima* may decide to regulate mining and charcoal making which may have been a source of income. The project seeks to provide alternative livelihoods to those people.

F3. Ecosystem and biodiversity benefits

Table F3: Ecosystem Impacts

Ecosystem Impacts				
Intervention type (technical specification)	**Biodiversity impacts**	**Water/watershed impacts**	**Soil productivity/ conservation impacts**	**Other impacts**
REDD+ and ANR	Habitat protection and expansion; creation of a wildlife corridor; community-based monitoring of species	Stabilising ground and surface water levels	Prevention of soil erosion; improved nutrient cycling; natural regeneration improves soil productivity.	Reducing spread of forest fire.

Part G: Technical Specifications

G1. Project intervention and activities

G1.1. Project intervention

REDD+ and ANR are the Plan Vivo project interventions covered in this combined technical specification. REDD+ is the protection of dense or open forest threatened by deforestation and forest degradation. ANR is the protection, management, and regeneration of community-designated land comprising of a mix of open forest, dense forest, scrubland and non-forest.

In addition to REDD+ and ANR interventions, other income-generating activities (IGAs) are designed to improve local livelihoods. IGAs have been designed by the communities and are facilitated by the project team.

G1.2. Project activities

G1.2.1. Reducing Emissions from Deforestation & Degradation (REDD+)

REDD+ intervention addresses the key drivers of deforestation and forest degradation in the project area. It consists of the following activities: 1) forest fire control, 2) sustainable firewood plantations, 3) reducing uncontrolled grazing, 4) monitoring charcoal making and 5) agricultural containment.

Forest Fire Control

Damage from forest fires is reduced through fire prevention and early fire detection. The project area sees a dry season over several winter months when temperatures also drop. Along with burning agricultural land after harvest and using fire as a method of heating, the steep slopes of the landscape can cause fire to spread quickly over dry grassland and into forested areas. Activities to control forest fires include:

- Creating firebreaks around forests
- Controlled preventive burning or *sainding*
- Appointing firewatchers (youth volunteers) to detect and extinguish fires in the dry season
- Community fire awareness programmes to improve fire safety

Sustainable Firewood

Sustainable firewood plantations are established close to settlements and firewood gathering is organized around a rotational system of harvesting with guidelines for fuel collection during years 1 to 5 as the fuelwood plantations grow and mature. Fuelwood collection areas are associated with specific villages, so that there is limited likelihood of displacement or leakage from other communities outside the project area. With the project, fuelwood access is more regulated based on emerging NRM plans. Project woodlots take 4-5 years before annual harvesting of coppice shoots takes place. Of the approximate 15,500 ha of forest in the project area, woodlot plantations cover approximately 300 ha (5 ha for each village), depending on funding availability.

Reduce Uncontrolled Grazing

Through animal exchange programs, communities are encouraged to replace cattle with stall-fed livestock such as pigs and broiler chickens. The Mawphlang Pilot Project demonstrated that participating families were able to transition from open forest grazing of goats and cows to stall fed pigs, reducing pressure on the forests while generating additional income from pig sales.

Sustainable Farming Systems

The project supports the adoption of sustainable agricultural practices. Sustainable agriculture refers to farming systems that are likely to be practiced for extended periods without damage to forests and soils. This includes organic vegetable cultivation and orchards, stall fed livestock, floriculture and mushroom cultivation. The increase in perennial crops and the use of polytunnels and shade nets allow for long-term agricultural solutions that reduce the practice of slash and burn cultivation. Unsustainable systems such as broom grass, pineapples requiring the clearing of vegetation on steep slopes, and valley bottom potatoes requiring high use of chemical fertilizers and pesticides is phased out where possible. The project is building partnerships with the Indian Council for Agricultural Research (ICAR) that provides training and materials for exploring new agricultural practices. Project funded micro-finance groups provide capital for small farmers to adopt sustainable farming practices.

Alternatives to Charcoal Making

Charcoal making is concentrated in two of the 10 project Hima. In those areas, meetings are held with charcoal-making households to identify alternative livelihood activities including pig and poultry raising. Funds are allocated to provide support to these families to help them transition their household economy.

The core project strategy begins with a community dialogue followed by an agreement on the part of all member households to attempt to reduce the impact of drivers of deforestation activities and build mitigation activities into their NRM plan (Plan Vivo). The project has a successful approach to replacing low value agriculture and animal husbandry with alternative livelihoods (see PDD) reducing grazing pressures.

Agricultural expansion is most threatening where forests are cleared for cash crops, especially broom grass. Areas where this is occurring have been identified and targeted discussions with practitioners are used to find more sustainable crops outside the forests. Reducing charcoal making will again target the charcoal making households to help them find alternatives. Involving female members in micro-finance self-help groups and providing technical training and low interest loans to establish piggeries and poultry operations.

G1.2.2. Assisted Natural Regeneration (ANR)

ANR activities take place on community-designated land comprising of a mix of open forest, dense forest, scrubland and non-forest (Table G1a below).

Table G1a: Land Cover Classification of ANR Sites

Row Labels	Sum of Area (ha)
Open forest	724.3
Scrub	473.7
Non-Forest	235.5
Dense forest	159.2
Waterbodies	20.7
Unknown	7.4
Grand Total	**1,620.8**

There are two aspects to ANR. “Advanced closure” involves “closing” an area to fire, grazing, and firewood collection, and “ANR treatment” which is the next level of ANR treatment which involves weeding, thinning, and limited enrichment planting. No exotic species will be used in the ANR areas. The enrichment planting

will take place using native Khasi pine saplings (*Pinus khasiana*) as well as oak (*Quercus griffithi*), chestnut (*Castanopsis purpurella*) and myrica (*Myrica esculenta*).

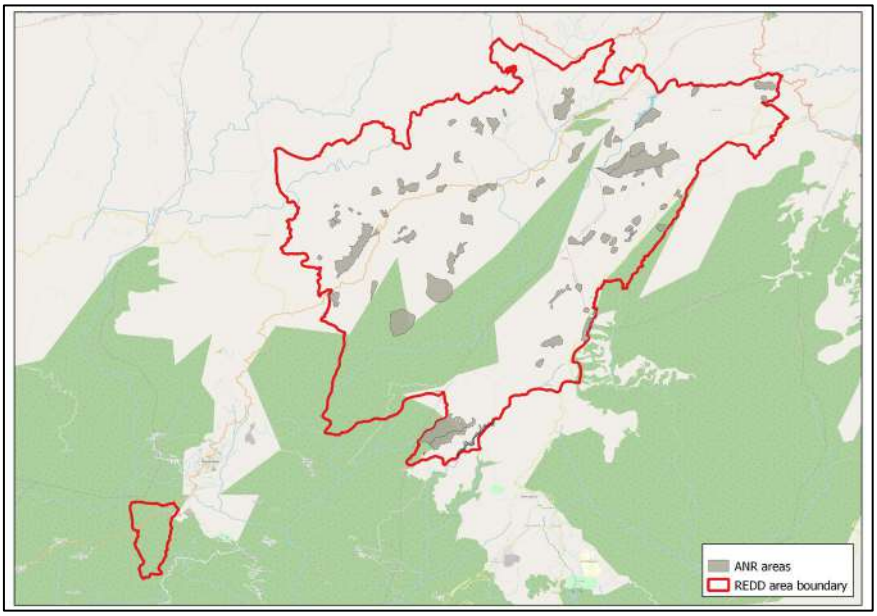
A long-term goal of the project is to improve the soil fertility, soil moisture, biomass, and species diversity of the open forests through ANR treatment. Past experience from the Mawphlang pilot project (2005-2009) indicated that with protection through advanced closure, forest regrowth was quite rapid. Open forests tend to be dominated by pioneering Khasi pine seedlings that grow quickly in many sites once grazing, hacking and fire pressures are removed. Over time, a growing number of native broadleaved and evergreen species of shrubs and trees emerge creating more diverse forest ecology. In sites with no seed sources enrichment planting of native oaks and chestnuts will be encouraged to facilitate this process.

During the first two implementation phases, 1,620.8 Ha of ANR were put under advanced closure. Of these areas, 965.9 Ha received additional ANR treatment. During the third implementation phase (2022-2026), 50 hectares of ANR area will be added each year.

Table G1b: ANR Area

ANR TREATMENT TYPE	IMPLEMENTATION PHASE 1 2012-2016 (Ha)	IMPLEMENTATION PHASE 2 2017-2021 (Ha)	IMPLEMENTATION PHASE 3 2022-2026 (Ha)	TOTAL 2012–2026 (Ha)
ANR advance closure	1154.9	465.9	250	1870.8
Of which receive further ANR treatment	500	465.9	250	1215.9

Figure 5: Location of ANR Sites



G1.3. Applicability

The project represents an innovative approach to community-based conservation and restoration that has broad application in the neighbouring watersheds in the Khasi Hills, as well as more broadly across Meghalaya. The project also seeks to build community institutional capacity to monitor changes in forest cover, fuelwood collection, and biodiversity. The project is located on the traditional forest lands of the Khasi people, which are recognized by the Government of India as community forests under the Sixth Schedule of the Constitution.

This technical specification for reducing emissions from deforestation and forest degradation (REDD+) and assisted natural regeneration (ANR) has been developed for community forests in Meghalaya, India.

REDD+ is applicable to dense or open forest under threat of deforestation or degradation. ANR is applicable to dense forest, open forest, scrubland, or non-forests as designated by the communities. Definitions for dense and open forest are taken from the Forest Survey of India. Dense forest has canopy cover from 40-100%, while open forest has canopy cover from 10-40%. Scrub includes all forest land with poor tree growth mainly of small or stunted trees having canopy density less than 10% and non-forest is any area not included in the above classes.

G2. Additionality and environmental integrity

G2.1. Regulatory surplus

Table G2a summarises the national laws relating to carbon, land and natural resource use that apply to the project activities, and how the project meets these requirements.

Table G2a: Legislation Review

Title of law/legislation	Type	Year	Content and relevance to the Plan Vivo Project
Sixth Schedule (Article 244)	Article of the Constitution of India	1949	**Description of content.** The Sixth Schedule of the Constitution of India allows for the formation of autonomous administrative divisions which have been given autonomy within their respective states (including Meghalaya). Under the provisions of the Sixth Schedule of the Constitution of India, autonomous district councils can make laws, rules, and regulations in the several areas, including: land management, forest management, water resources, agriculture and cultivation, formation of village councils, appointment of traditional chiefs and headmen, social customs, and mining and minerals. **Description of relevance/how the project meets the requirements** The customary beliefs and practices are recognized and legitimized, including those governing the management of land, forests, minerals and other resources. The Sixth Schedule bestows the rights of resource management to the indigenous people of the state and their traditional institutions, coordinated by Autonomous District Council. The Khasi Hills Autonomous District Council approved the project in 2013. The project is not a result of any legislative act, nor part of a commercial initiative that would take place without the REDD+ initiative. The project therefore demonstrates that it goes beyond the Indian regulatory framework with regards to land-use and land management in the country.

G2.2. Barrier analysis

The presence and permanency of REDD+ and ANR activities in the region would not be possible without technical and financial support. Fire prevention and control, conservation activities and the transition away from livelihoods that cause forest degradation is not common in the region due to lack of resources to implement the activity on a voluntary basis. The project demonstrates it is additional by overcoming this and other barriers to its implementation (Table G2b). While all of these barriers existed in communities prior to the project start and many of these barriers still exist in new villages that are added to the project, several barriers, especially technical barriers, have improved in the current project area over the past 5 years (the project's second implementation phase).

Table G2b: Project Barriers and Barrier Mitigation Actions

Type of Barrier	Description of Barrier	Overcoming Barrier
Financial/ economic barriers	• Lack of funds to support fire control, conservation activities, monitoring biodiversity, and transitioning from activities that cause forest degradation to alternative livelihoods.	• Funds from carbon sales will support activities

Technical barriers	• Lack of experience in developing management plans, mapping boundaries, and using monitoring equipment.	• Synjuk provides technical guidance to project participants • Training and cross-visits in planning, mapping and monitoring
Institutional/ political barriers	• Community lacks political influence to address threats from hill sand mining or quarrying • Community needs to strengthen relations with District Government leadership	• Synjuk has organised meetings with local government leaders to help the communities build communication channels and contacts in government
Ecological barriers	• Remote areas where access to mainstream support is difficult	• Structure of Synjuk allows to even reach remote areas
Logistical barriers	• Poor road linkages restrict the flow of services from government programmes.	• Networking with government agencies should increase access to government services.
Cultural barriers	• Communities distrust government and external actors leading to fewer participants taking part in convergence schemes	• Synjuk leadership and staff are chosen from within the communities and are trusted by community members to act in their best interest. • Synjuk can facilitate more interaction between government officials and community members

G2.3. Environmental integrity

The project verifies that areas are not negatively impacted prior to the intervention.

G2.4. Avoidance of double accounting

Three potential sources of double counting have been considered in the design of the project:

i) within the project – if finance raised for biodiversity conservation or other types of ecosystem service payments were used to fund protection of the same area for which Plan Vivo certificates had been sold;

ii) with other carbon projects – if the community, or other parties, entered into agreements for the sale of emission reduction credits as part of a project or jurisdictional programme that covered the Plan Vivo project area; and

iii) if Plan Vivo certificates are used to offset emissions from parties outside India, and the Government of India use those same emissions reductions to meet their Nationally Determined Contributions to the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC).

Measures the project will take to avoid double counting from these sources are summarised below.

Within the project

Other forest management/climate mitigation initiatives within the project area include:

- The government-led MNREGA scheme which involves the construction of firelines in ANR sites in one of the villages.
- The Himalaya Wellness Company's CSR program: establishment of an eco-village.

Other carbon projects

When the community groups enter into Plan Vivo agreements, they are required to relinquish all rights to emission reductions resulting from prevention of deforestation and forest degradation within the project area to the project coordinator, effectively preventing them from developing other carbon projects that deliver the same benefits with other parties or standards. Once all rights are secured the community will also have the power to prevent government or private sector interest developing carbon projects within their customary territory. Under the 6th Schedule of the Constitution of India, land rights are held by the communities under the Autonomous District Council. Once land use has been agreed upon by village Headmen for a Plan Vivo project, it will not be used for other carbon finance projects.

The project coordinator will maintain a dialogue with the Khasi Hills District Council to ensure they are made aware of and can lobby against any initiatives that could conflict with the project. If such conflicts do arise, issuance of Plan Vivo certificates will be suspended until a resolution that ensures there is no potential for double-counting of emission reductions has been found.

Nationally Determined Contribution (NDC)

The Government of India's Nationally Determined Contribution (NDC) includes emissions from forestry[1]. To prevent double counting, emission reduction certificates sold to out of state parties for use as carbon offsets should therefore be excluded from the NDC. Mechanisms for addressing this are under development in India and other countries with NDCs that include forests in their scope. According to an article in *Carbon Brief*, much of the decision as to whether or not REDD projects will be including in India's NDC relies on the outcome of Article 6 of the Paris Agreement (Evans and Gabbatiss, 2019). A potential outcome is that the Government of India could decide to prevent or limit the sale of carbon offsets from forestry projects to out of state parties. If this occurred, Plan Vivo certificates could only be marketed to those willing to make a voluntary commitment to helping India meet its NDC, but that would not make use of the certificates to offset their own emissions, which would need to be reflected in the way that certificates are recorded in Markit registry. India is also working on a mechanism called Safeguards Information System (SIS) for reporting REDD+ projects to the United Nations Framework Convention on Climate Change (UNFCCC) in order to access financial support (Mohan, 2021).

G3. Project period

G3.1. Project period

The project period is 30 years and began in 2012. The project period is divided into six five-year implementation phases for which climate benefits are calculated, verified, and credited. The first two implementation phases were between 2012-2016, and 2017-2021.

The third implementation phase for which this revised technical specification covers is the period 2022-2026.

G3.2. Project timeline

From 2005 to 2009, CFI organized REDD+ and IGA pilot activities in two communities in Mawphlang (Tech Spec v4.0 Appendix 1). Following the success of the Mawphlang pilot project, the design process for the Khasi Hills Community REDD+ project took place in 2010-2011. In 2011-2012, early REDD+ activities including institution building, awareness campaigns, field activity development, and the design of monitoring systems began. The first and second implementation phases of the project took place from 2012 to 2016, and 2017 to 2021. The third implementation period will last from 2022 to 2026.

Estimates of baseline and project scenario emissions will be revised at the end of each implementation phase, so a five-year quantification period that is renewable provides the potential to generate a more accurate estimate of the long-term impacts of forest protection than would be possible with a longer quantification period.

REDD

G4. Baseline scenario

The baseline scenario is defined according to the requirements of the Plan Vivo Standard, and the Approved Approach for Estimation of climate benefits from REDD in community managed forest (AA-CFREDD; Annex 10), as summarised below.

G4.1. Current conditions and trends

The baseline scenario is the prevalence of land use activities as seen in the reference region (see Section G4.3.1 below) immediately prior to the start of the third implementation phase. Causes of degradation and deforestation within the reference area are attributed to forest fire, grazing, fuel wood collection, charcoal making, and encroachment into forested areas by poorer communities seeking agricultural land. Areas that have seen a shift from non-forest to scrub or open forest in the past five years is in part due to private landowners moving away from agricultural activity and leaving the land to regenerate into forest.

[1] India's Intended Nationally Determined Contribution (INDC) pledges to create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030.
https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf

The consequences of these activities are described in Section B.

When defining the baseline scenario, the following potential scenarios were considered:

I. Effective protection of the project area by the community
II. A continuation of current land use activities within the project area

Scenario i) was excluded on the basis of a barrier analysis conducted by following the Approved Approach for demonstrating Additionality[2]. The results of the barrier analysis are summarised in Section G2.2.

G4.2. Carbon pools

For the first two implementation periods, biomass was only calculated in open and dense forest classes from above- and below-ground tree biomass carbon pools. This allowed for simple and less resource- intensive monitoring, measurement, and analysis.

For this third implementation period, in addition to above- and below- tree biomass in open and dense forests, above-ground shrub biomass in scrubland is used to calculate carbon benefits for REDD+ (see Table G4a). Other carbon pools are omitted for three reasons: simplicity, cost of measurement and conservativeness.

The resulting carbon benefit estimate is also conservative as the storage and sequestration in soil and, deadwood and litter, are not being claimed as credits by the project. Consequently, this represents a buffer that may help reduce project risk.

Explanations for carbon pool selection are:

- Above- and below-ground tree biomass comprise the main carbon pools in open and dense forests - these are included. Similarly, above-ground shrub biomass comprises the main carbon pool in scrubland and is therefore included. These are expected to be reduced under the baseline scenario, and project activities are expected to prevent emissions associated with the decline.
- Biomass stored in leaf litter and dead wood will increase as a result of tree-planting activities but is unlikely to be a large proportion of the total carbon and is therefore excluded.
- Soil carbon is expected to increase but the cost of measuring it is high, so it is excluded
- Dead wood is likely to increase during forest conservation, but this is not included to allow a conservative estimate of carbon benefit.

Table G4a: Carbon Pools

CARBON POOL	LIKELY IMPACT ON CARBON STOCK	MEASUREMENT LIMITATIONS	DECISION
Above-ground woody biomass	Increase	Minimal	Include
Below-ground woody biomass	Increase	Minimal	Include
Non-tree biomass in open and dense forests	Small increase	Time-consuming	Exclude
Non-tree biomass in scrub land	Increase	Time-consuming	Include
Dead wood	Increase	Minimal	Exclude
Leaf litter	Small increase	Time-consuming	Exclude
Soil	Increase	Expensive	Exclude

GHG emissions from biomass burning (other than CO2 emissions from loss of above- and below-ground biomass) are also conservatively excluded on the basis that they are expected to be higher in the baseline scenario than project scenario.

[2] http://planvivo.org/docs/Approved-Approach-Additionality.pdf

G4.3. REDD+ baseline emissions

G4.3.1 Baseline emissions methodology

First and second implementation phases

For the first and second implementation periods the project's REDD+ climate benefits were estimated using a satellite image analysis of land cover change in the project area.

The baseline scenario was estimated by calculating the rates of deforestation and degradation within the project area during the 5 years preceding (2006-2010) the project start date. Estimated climate benefits under the project scenario were then estimated in light of the woody biomass stocks at the beginning of the implementation period (2012) and the rates of deforestation experienced in the reference period, applying effectiveness and leakage coefficients.

Third implementation phase (2022-2026)

Since the development of the 2017 technical specification, Plan Vivo have approved climate benefit estimation methodologies that require the assessment of the historical deforestation in a reference area to calculate the baseline scenario. This revision of the technical specification applies one of these approaches, the *Approved Approach for Estimation of climate benefits from REDD in community managed forest* (AA-CFREDD; Annex 10), for estimating the project's REDD+ baseline emissions scenario and climate benefits for the third implementation phase (2022-2026).

The CFREDD approach assumes:

- the main factors affecting drivers of deforestation and forest degradation in the project area are forest type, legal classification and topography.
- that if the project area is not brought under effective community management it will be affected by the same drivers of deforestation and degradation to other areas of forest in a reference region that have the same forest type, topography and legal status.
- the average annual amount of deforestation and forest degradation observed during an historical reference period (expressed as a proportion of forest area present at the start of the reference period), in areas of forest in the reference region that have the same forest type and legal status as forest in the project area, will provide a conservative estimate of the annual amount of deforestation and degradation (expressed as a proportion of forest area present at the start of the project period) that would occur in the project area under the baseline scenario.

The methodology for estimating baseline emissions is described in AA-CFREDD Section 3.1.1 (see Annex 10). The data and parameters used are summarised below.

Forest strata

The forest strata present within the project area are classified according to forest type, legal classification and topographic class as summarised in Table G4b.

Table G4b: Classes used for Classification of Forest Strata

Type	Values	Source	Justification
Forest type (*i*)	- Dense Forest - Open Forest - Scrub land	Land Cover Change Assessment (see Annex 10)	Many of the dense forests are located farther from communities and are generally Sacred Groves or protected forests and are not used by communities for harvesting any products. The open forests are used more by communities over the years and are usually closer to the villages or community areas. There is more grazing and chance for fire closer to the village given the proximity along with a larger increase in population. The areas selected for scrubland plots were significantly dominated by shrubs, herbs, ferns and grasses. Small trees from seed dispersal from nearby forests can be seen growing beside the ones planted. Some of the areas

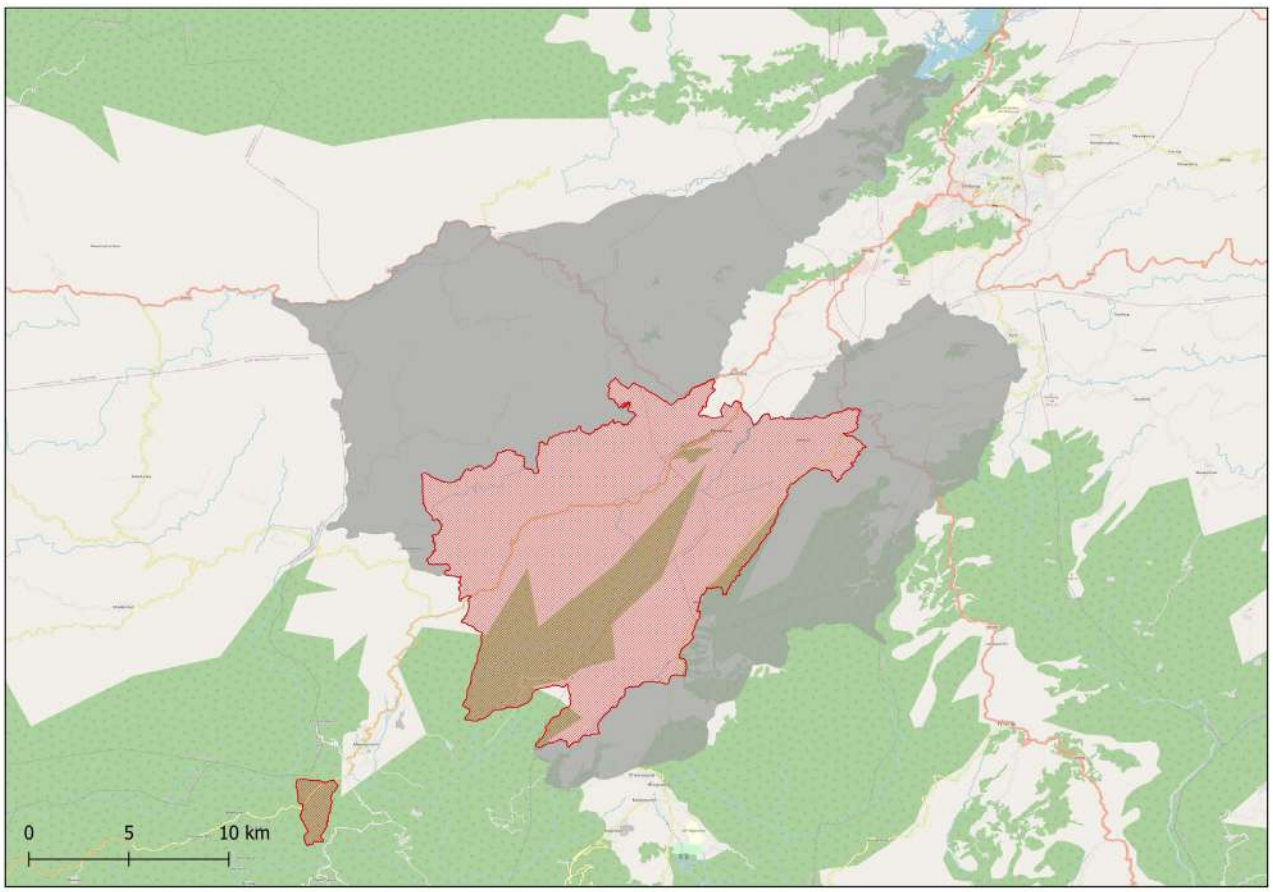
			selected were tree plantation areas such as Perkseh (Hima Lyngiong), Lumthangkanam (Hima Mawphlang), Kyndong waharkum (Hima Nonglwai), Lumwahsyllai (Hima Mawbeh). The scrubland area of Mawmihthied and Sohrarim has been the same for the past 30 years. The scrubland plots are non-disturbed areas with history of forest fires, cultivation and grazing during winter seasons.
Legal classification (*j*)	- East Khasi Hills District	NA	Both the reference area and project area are within the boundaries of the East Khasi Hills District. Despite the presence of different legal classifications of forest (see descriptions below), the lack of available boundary data mean a single strata is used. **Clan forests** are under the control of a particular clan. The discretion of the land use falls under their power. The forest habitat can either be intact or in regulated use depending on the clan's financial status. The clan would allow only clan members to use the forest and collect timber. The clan members protect the forest, but fire accidents can happen due to bun cultivation. **Sacred groves** are usually under the control of the *Hima* and are a place for carrying out rites and rituals. No harvesting or agricultural activity is allowed in these forests. The size is fixed throughout the decade. Due to its importance in the society only few occurrences of forest fire have been recorded to date. **Community protected forests** and ***Hima* protected forests** are present in almost all villages. The use is demarcated by the village *Durbar* or the *Hima Durbar*, respectively. The purpose of these forests varies from watershed, aesthetic, or as reserve funds for assisting families in the village who are in dire need. The harvesting of timber is done only for those standing dead trees. The size of the forest can vary from time to time. These forests are rarely affected by fire or illegal timber collection due to social fencing by the villagers. **Community forests** or *Raid* forests are present in most villages and the *Hima* or *Raid* along with the village council asserts its power on the use of the timber. Activities like timber harvest, charcoal making, and clearing land for agriculture are predominant. Most villages have a regulated method of land use where certain fallow lands are protected to revive the forest for future purpose. These fallow lands mostly succumb to over grazing or forest fire during the dry season. The neighbouring villages are responsible for protecting the forest. **Private forests** belong to a family or an individual where the land use solely depends on the private owners. Most keep the forest as insurance for the future and some use the forest to divide among children for new habitation. Most well-off families will try to keep the forest intact. Poorer families would have regulated use of the forest. The forests are protected by the families.
Topographic class (*k*)	- Steep ground (land on slopes >	Shuttle RADAR Topographic Mission (SRTM)	The altitude of the central plateau upland region varies from 150 m to 1,961 m above the mean sea level and is characterized by a great diversity in relief. On shallow

	17.5 degrees) - Shallow ground (land on slopes < 17.5 degrees)		slopes there is more cultivation and trees are cleared for agriculture. Dense forests are more common on steep slopes than on shallow slopes given the soil factor.

Reference region

The selected reference area spreads to the north and south of the project area (see Figure 6) and includes forest strata that have the same characteristics and are therefore expected to be exposed to similar drivers of deforestation and forest degradation, as forest within the project area. The project area itself is excluded from the reference region, however. The reference area was delimited iteratively using imagery and maps. Key informant interviews with village chiefs were completed to assess whether the reference region is affected by similar drivers of deforestation and degradation to the project area under the baseline scenario.

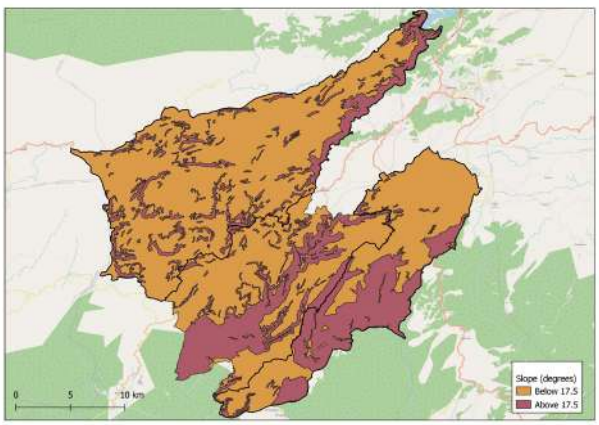
Figure 6: Map Showing Project Area (Red) and Reference Areas (Grey)



The selected reference area has similar proportions of LULC classes to the project area, with open forest and non-forest (cultivation, settlement, barren land) classes the most prevalent, followed by scrub land and dense forest (see Figure 8, Table G4c). It also has similar proportions of land with shallow slopes (74% and 63% for the reference region and project area respectively – see Table G4d). With respect to legal status, the entire project area is within the East Khasi Hills District of Meghalaya, India. The different forest classifications (clan forests, community forests, sacred groves, community protected forests and private forests) are not all mapped but similar proportions of each are thought to be found within the project and reference area as identified during Participatory Rural Appraisal and village enquiries. The team is working to compile maps and ground truthing findings in order to document the various types of forests found in the project area but they are considered to have similar rates of deforestation and degradation.

The drivers of deforestation and degradation are comparable between the reference region and project area (see Table G4e). Small details can vary from one village to another within the project and reference region, but the general trend of land use land cover remains the same.

Figure 7: Slope (Below and Above), and Figure 8: LCC. Forest Types 2020



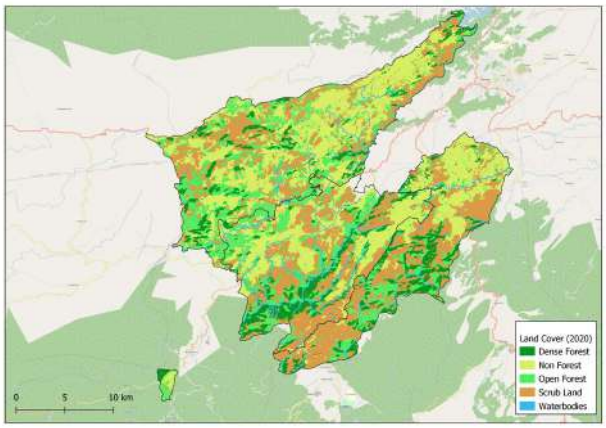


Table G4c: Proportion of Land Use Land Cover Class in Project and Reference Regions (2020)

LULC	Project area	Reference region
Dense forest	13%	8%
Non-Forest	32%	41%
Open forest	36%	34%
Scrub	17%	16%
Waterbodies	2%	1%

Table G4d: Proportion of Above and Below 17.5 in Project and Reference Regions

	Project area	Reference area
Below 17.5 degrees	66%	74%
Above 17.5 degrees	34%	26%

Table G4e: Summary Information on Drivers of Deforestation Across the Project Area and Reference Regions

Location	Project area	Tyrsad Region (southern part of reference area): *Hima*: a traditional kingdom	Sohra and Mawjrong Region (northern part of reference area): *Hima*: a traditional kingdom
Types of forest	Community forest, Clan forest, community protected forest, Sacred grove, Private forest, Law raid	Community forest, Clan forest, Community protected forest, Sacred grove, Private forest	Community forest, Clan forest, Community protected forest, Sacred grove, Private forest
Major tree species	*Pinus kesiya, Symplococus sp Castanopsis sp., Schima wallichi, Quercus fenestrata, Helicia eratica Cinnamommum sp, Myrica sp., Elaeocarpus sp,, Quercus glauca*	*Pinus kesiya, Mychelia champaca Castanopsis sp., Schima wallichi, Quercus fenestrata, Myrica sp., Betula alnoides*	*Pinus kesiya, Castanopsis sp., Schima wallichi, Quercus fenestrata, Myrica sp., Betula alnoides*, Cane and bamboo
Fragmentation causes	Agriculture, Fuelwood collection Charcoal making, Quarrying, Soil erosion /landslides	Agriculture, Fuelwood collection Charcoal making for commercial purpose	Agriculture (shifting cultivation), Fuelwood collection Charcoal making for self-consumption, Quarry

Open grazing	50% of the community owns goats and cows	90% of the communities own goats and cows	30% of the communities own goats and cows
Quarry	Less than 50 ha of land under quarry activity	No hill sand and quarry activity	5% of the communities practice quarry
Soil erosion	Heavy soil erosion occurs in the monsoon period	Heavy soil erosion occurs in the monsoon period	Heavy soil erosion occurs in the monsoon period
Biodiversity	Decline	Decline	Decline
Types of vegetation	Pine forest, Subtropical broadleaf forest Open and dense scrub land, Grassland, Barren land, Paddy field	Pine forest, Subtropical broadleaf forest Open and dense scrub land, Grassland, Paddy field,	Pine forest, Subtropical broadleaf forest Open and dense scrub land, Grassland, Paddy field,
Community activities	Agriculture is the main occupation (potato, peas and rice)., 10 villages (charcoal production for commercial purpose) 10 villages in quarry activity, 65% of families use fuelwood for cooking	Agriculture is the main occupation (rice, potato) No shifting cultivation, 95% of families use fuelwood for cooking	Agriculture is the main occupation (broom grass, pineapple, potato). Some shifting cultivation in the south of the region, 80% of families use fuelwood for cooking
Conservation activities	Through Khasi Hills Community Forest Project (REDD+, alternative source of livelihood, plantation, firelines, ANR). There are also some tree planting activities in barren land through the separate government MNREGA scheme	At the Hima and village level (Protected forest and Sacred grove), there are tree planting and silviculture interventions through various government schemes (JFMC and MNREGA)	At the Hima and village level (Protected forest and Sacred grove), Government intervention in tree plantation through various schemes: JFMC and MNREGA

Project periods

Parameters related to project periods are summarised in Table G4f.

Table G4f: Project Period Parameters

Parameter	Value	Source	Justification
Length of the reference period (T_{RP})	4 years	The reference period (*RP*) is from 2016 – 2020	The reference period was selected based on the availability of suitable remote sensing data, as well as ensuring the end year was within 2 years of the project start date. A 4-year period was also considered to be a period over which patterns of deforestation and degradation that have occurred would be likely to continue during the project period.
Length of the project period (T_{PP})	5 years	The project period will run from January 2022 to December 2026	

Land cover change

Land cover change parameters and values are summarised in Table G4g and Table G4h.

Table G4g: Land Cover Change Parameters

Parameter	Values	Source	Justification
Area of forest type *i*, legal classification *j* and topography class *k* present in the project area at the start of the project period ($APAi,j,k$)	See Table G4h	LCCA* (Figure 8)	The land cover change assessment provides an estimate of forest strata present within the project area for 2020 which is within 2 years of the start of the project period
Area of forest type *i*, legal classification *j* and topography class *k* present within the reference	See Table G4h	LCCA* (Figure 8)	The land cover change assessment provides an estimate of forest strata present within the reference region in

region at the start of the reference period ($ARRi,j,k$)			2016, which is the start of the reference period
Area of forest type *i*, legal classification *j* and topography class *k* in the reference region converted to non-forest during the reference period ($ADefi,j,k$)	See Table G4h	LCCA* (See Figure 8)	The land cover change assessment provides an estimate of forest strata present at the start and end of the reference period (2016 and 2020), from which areas deforested can be calculated.
Area of forest type *i*, legal classification *j* and topography class *k* in the reference region converted to degraded forest during the reference period ($ADegi,j,k$)	See Table G4h	LCCA* (See Figure 8)	The land cover change assessment provides an estimate of forest strata present at the start and end of the reference period (2016 and 2020), from which areas deforested can be calculated.

* LCCA = Land Cover Change Assessment, 2020 (Annex 9)

Table G4h: Area of forest strata present at in the project area at the start of the project period (A_{PA}), and in the reference region at the start of the reference period (A_{RR}); and amount of deforestation (A_{Def}) and degradation (A_{Deg1} and A_{Deg2}) of forest strata occurring in the reference region during the reference period.

Forest type and topographic class	Project area (ha)	Reference region (ha)			
	2021	2016	2020-2016		
i, k	A_{PA}	A_{RR}	A_{Def}	A_{Deg1}	A_{Deg2}
Dense forest, over 17.5 degrees slope	2531.88	3035.18	21.72	55.29	590.66
Dense forest, under 17.5 degrees slope	418.50	1266.47	34.67	83.27	361.14
Open forest, over 17.5 degrees	3826.20	5549.94	141.43	775.96	0.00
Open forest, under 17.5 degrees	4626.32	11212.14	683.60	1195.12	0.00
Scrubland, over 17.5 degrees slope	1323.34	3950.79	0.00	0.00	623.22
Scrubland, under 17.5 degrees slope	2715.55	10602.33	0.00	0.00	6316.16
Total	**15442**	**35241**	**881**	**2110**	**7891**
Notes	A_{Def}: deforestation includes conversion of dense forest to non-forest, conversion of open forest to non-forest A_{Deg1}: the first level of degradation includes conversion of dense forest to open forest, conversion of open forest to scrubland A_{Deg2}: the second level of degradation includes conversion of dense forest to scrubland, conversion of scrubland to non-forest				

Source: Land Cover Change Assessment, 2020 (Annex 9)

Carbon stocks

Above-ground and below-ground biomass carbon stock parameters were derived from biomass surveys (see Annex 8). The carbon stock for each forest type *i* remains the same regardless of the topographic class *k*. Carbon stock parameters are summarized in Tables G4i and G4j.

Table G4i: Carbon Stock Parameters

Parameter	Value	Source	Justification
Carbon density of open and dense forest type *i* (C_i)	See Table G4j	Biomass surveys (Annex 8)	Carbon stocks in above ground biomass estimated using field measurements at forest plots across the project area. Below ground biomass estimated using a root:shoot ratio of 0.15
Carbon density of scrub land type *i* (C_i)	See Table G4j	Scrubland biomass surveys (Annex 8)	Carbon stocks in above ground biomass were estimated using field measurements in a variety

			of 20 plots with differing climatic, topographic, and anthropogenic conditions.
Carbon density of non- forest (C_{NF})	See Table G4j		Biomass in non-forest areas is not monitored because limited tree/shrub biomass in land classified as non-forest (settlements, baren land, agriculture).

Table G4j: Carbon Density of Forest Types Present in the Project Area

Forest class	
	(Mg C ha^{-1})*
Dense forest	87.6
Open forest	36.6
Scrub land	18.03
Non forest	0

Sources: Woody and scrubland biomass surveys (Annex 8)

G4.3.2. Baseline emission estimates

Expected baseline emissions are estimated using the equations in AA-CFREDD Section 3.1.1 (see Annex 10) and the parameters described in Section G4.3 of this PDD. The calculated parameters and values are summarised in Table G4k and Table G4l, and the calculations are provided in Annex 11. Expected baseline emissions for the third project period are 97,061Mg CO2 per year.

Table G4k: Expected Baseline Emission Estimate Parameters

Parameter	Values	Source
Average proportion of forest type *i*, legal classification *j* and topography class *k* within the reference region that was deforested in each year of the reference period ($DRi,j\ ,k$)	See Table G4l	AA-CFREDD Equation 1 (see Annex 10)
Average proportion of forest type *i*, legal classification *j* and topography class *k* within the reference region that was degraded in each year of the reference period ($GRi,j\ ,k$)	See Table G4l	AA-CFREDD Equation 2 (see Annex 10)
Baseline scenario emissions from deforestation and forest degradation expected during the project period (EBL)	485,307 Mg CO2	AA-CFREDD Equation 3 (see Annex 10)

Table G4l: Average Proportion of Forest Strata in the Reference Region Deforested (D_{RR}) and Degraded (G_{RR}) During the Reference Period

Forest type and topographic class	Annual % deforested	Annual % degraded	
i, k	DRR	$GRR1$	$GRR2$
Dense forest, over 17.5 degrees slope	0.2%	0.5%	4.9%
Dense forest, under 17.5 degrees slope	0.7%	1.6%	7.1%
Open forest, over 17.5 degrees	0.6%	3.5%	0.0%
Open forest, under 17.5 degrees	1.5%	2.7%	0.0%
Scrubland, over 17.5 degrees slope	0.0%	0.0%	4.0%
Scrubland, under 17.5 degrees slope	0.0%	0.0%	15.4%
Notes	DRR: deforestation includes conversion of dense forest to non-forest, conversion of open forest to non-forest $GRR1$: the first level of degradation includes conversion of dense forest to open forest, conversion of open forest to scrubland $GRR2$: the second level of degradation includes conversion of dense forest to scrubland, conversion of scrubland to non-forest		

Source: Land Cover Change Assessment, 2021 (Annex 9)

G5. Ecosystem service benefits

The climate benefits are estimated according to the requirements of the Plan Vivo Standard, and the Approved Approach for estimation of climate benefits from REDD in community managed forest (AA-CFREDD; Annex 10), as summarised below.

G5.1. Climate benefit methodology

The methodology for estimating climate benefit (B) is described in AA-CFREDD Section 3.1.4 (Annex 10), with the equation:

$$B = E_{BL} - E_{PS} - E_{LK}$$

The methodology and parameters for estimating baseline emissions (EBL) are described in Section G.4.3, and for leakage emissions (ELK) in Section G.6.1. The methodology for estimating expected project scenario emissions (EPS) is described in AA-CFREDD Section 3.2.1 (see Annex 10). Following this approach, project scenario emissions are estimated by multiplying the baseline scenario emissions by an expected effectiveness factor (F).

The Synjuk Federation expects that the effectiveness of the project will continue to increase in the next project period (2022-2026). With increased awareness and participation of the community people towards conservation, the project expects to see higher rates of transition to alternative livelihoods. The project aims to reduce grazing in the project area and with community engagement can completely remove this cause of deforestation and degradation in the next five years. Participation and reception to the LPG distribution program has been strong with community members and will enable the project to further reduce the use of fuelwood.

Forest fire continues to be a driver of deforestation and degradation, as 90% of fire in the area is caused by humans. While the project implements a number of preventative measures to curb forest fire, many fires spread from outside of the project area with strong winds. The fires are quickly extinguished with community involvement when found in the project area, but it is one cause that is difficult for the project to completely remove. Quarrying is another activity that the project is less effective at reducing due to construction rates in Shillong and because most quarrying takes place on private land with landowners driven by its monetary value. While charcoal making doesn't occur throughout the entire project area, it continues to be a cause of deforestation and degradation in two of the ten *Hima.* There are several factors which contribute to its persistence: the weather causes people to a source for heat and drying capabilities, the location of those who make charcoal is often remote, and the lack of available alternative livelihoods and incomes in these areas.

Because of the potential for forest fires, quarrying and charcoal making to reduce the effectiveness of project activities at avoiding emissions from deforestation and degradation, it is not assumed that the project will be able to prevent all of baseline deforestation and forest degradation. The calculated efficacy of the project during the second implementation period (2017-2021) was 77%. Therefore, the expected effectiveness (F) of 77% is adopted for the third project period, to account for potential emissions from forest fires, quarrying and charcoal making, as well as any unavoidable or unexpected events that could affect the project area.

G5.2. Expected climate benefits

Expected climate benefits are estimated using the equation in AA-CFREDD Section 3.1.4 (see Annex 10) and the parameters described in Sections G4.3, G5.1, and G6.2. The parameters and values are summarised in Table G5, and the calculations are provided in Annex 11.

Expected REDD+ annual climate benefits for the third project period are 56,800Mg CO2 per year (including the reduction of leakage and risk buffer).

Table G5: Parameters for Estimation of Climate Benefits During the Project Period

Parameter	Value (Mg CO_2)	Mg CO_2 yr^{-1}
Baseline scenario emissions from deforestation and forest degradation expected during the project period (E_{BL})	485,307	See Section G4.3
Expected project scenario emissions from deforestation and forest degradation expected during the project period (E_{PS})	111,621	See Section G5.1
Leakage emissions expected to result from displacement of deforestation and degradation during the project period (E_{LK})	18,684	See Section G6.2
Climate benefits expected to result from reduced deforestation and forest degradation as result of project activities during the project period (B)	355,002	AA-CFREDD Equation 16 (see Annex 10)

G6. Leakage and uncertainty

G6.1. Leakage methodology

The methodology for estimating expected leakage emissions is described in AA-CFREDD Section 3.3.1 (see Annex 10). The project will adopt the expected leakage approach (Option 3.3.1b) for estimating expected leakage. Following this approach, expected leakage emissions are estimated for the first project period as a proportion of the difference between baseline scenario and project scenario emissions. A conservative estimate for the proportion of leakage expected (L) is determined based on an assessment of potential for displacement of activities that are expected to cause deforestation and forest degradation in the project area under the baseline scenario.

Potential drivers of leakage include all natural resource use activities, with the potential to cause deforestation or forest degradation, that will be reduced within the project area as a result of project activities and that have potential to be displaced. Potential for displacement also depends on the agents of deforestation and degradation linked to specific drivers. The agents and drivers with potential to cause leakage, and areas that could be affected by displacement are summarised in Table G6a.

Table G6a: Potential Agents and Drivers of Leakage

Agent	Driver	Displacement potential	Justification
Project Community	Firewood Collection	Low	Village Natural Resource Management Plans (VNRMOs) will be designed to ensure that firewood requirements are met from community land. VNRMPs will include the establishment of plantations close to villages to supply firewood. This wood will be harvested sustainably using rotational harvesting systems.
	Expansion of smallholder agriculture	None	The project will introduce sustainable agricultural practices to replace unstainable swidden farming. This will lead to agricultural containment in the project area, and agricultural expansion will not be displaced outside the project area.
	Charcoal making	Low	Charcoal making is concentrated in two of the 10 project Hima. In those areas, meetings are being held and continuing with charcoal-making households to identify alternative livelihood activities including pig and poultry raising. Funds will be allocated to provide support to these families to help them transition their household economy.
	Grazing in forest	Low	Grazing livestock will replaced with stall-fed livestock through an animal exchange program. This will reduce grazing in the project area and will not increase the risk of grazing outside the project area

Since there is little potential for leakage from the major drivers of deforestation and forest degradation, an expected leakage emissions proportion (L) of 5% will be adopted for the project period.

G6.2. Potential leakage

Potential leakage emissions are estimated using the equation in AA-CFREDD Section 3.3.1b (see Annex 10) and the parameters described in Section G6.1 (see Table G6a). The calculations are provided in Annex 11. Potential leakage emissions for the third project period are 3,737 Mg CO2 per year.

Table G6b: Potential Leakage Emissions Parameters

Parameter	Value	Source
Leakage emissions expected to result from displacement of deforestation and degradation during the project period (E_{LK})	18,684Mg CO2	AA-CFREDD Equation 11 (see Annex 10)

G6.3. Sources of uncertainty

There are a number of sources of uncertainty associated with the data and assumptions used to estimate climate benefits. The main sources of uncertainty and approaches used to reduce uncertainty are summarised below.

Data

Two main types of data source are used in the estimation of climate benefits: Land cover maps, and carbon density estimates. The accuracy of land cover maps was assessed using a confusion matrix and was between 90 and 93% (see Annex 9). The accuracy of land cover change maps is likely to be lower since they will reflect errors in both of the maps being compared. Considerable effort was made to reduce error and the resulting maps are considered to provide descriptions of land cover and land cover change with an acceptable level of uncertainty.

Estimates of carbon density also have uncertainty associated with the values used, which were derived from forest inventories in 2020. The average values adopted for the land cover types have a standard deviation associated with the survey from which they were collected. The uncertainty is reflected in the estimates used, by using a lower 90% confidence interval of the mean, resulting in a considerable underestimate of carbon stocks.

Assumptions

Although it is not possible to quantify the uncertainty of assumptions used to estimate expected climate benefits, it is likely that the uncertainty from this source is greater than for the data used. The project therefore employs a number of approaches to prevent the uncertainty associated with assumptions used in the climate benefit estimation methodology from resulting in an over-estimate of climate benefits. Expected baseline scenario emissions are estimated by assuming that the patterns of deforestation and degradation that occurred in the reference region during the reference period would occur in the project area during the project period if project activities are not carried out. If baseline emissions are overestimated, this could result in an over-estimation of climate benefits. To reduce the likelihood of overestimating baseline emissions, only deforestation and forest of the same type, and legal classification as forest in the project area is considered when considering patterns of deforestation and forest degradation in the reference region. Actual deforestation and degradation that occurred in the reference region during the project period is also used to verify emission reductions achieved.

The project scenario assumes that project activities developed to address specific drivers of deforestation and degradation in the project area will be as effective as they were during the previous project period. The effectiveness of the activities in the previous project period are calculated by comparing the rates of deforestation and degradation in the project area compared to the rates of deforestation and degradation in the reference region during the project period. The effectiveness of the activities at preventing deforestation and degradation is 77%. This effectiveness factor will be applied to the climate benefit calculation in the next period. During the project period, activity-based monitoring and adaptive management will be used to ensure that the project activities remain relevant to changing conditions. After

the project period, climate benefits will be verified and by assessing the amount of deforestation and degradation that occurred during the project period.

There is also uncertainty associated with the estimation of leakage, and again a conservative estimate of expected leakage is applied to reduce the likelihood that leakage is underestimated prior to verification at the end of the project period.

Validation of assumptions
The main assumption of the project is that if the activities are carried out as planned, they will result in the expected climate benefits. Two types of approach will be used to collect data to validate this assumption: i) Activity-based monitoring throughout the project period to determine whether activities are being carried out as planned; and ii) Verification of climate benefits and updating key parameters at the end of the project period.

Activity-based monitoring indicators, and indicators used to verify climate benefits, are described in Section K1.1.

ANR

G7. Baseline scenario

G7.1. Current conditions and trends

Forest degradation throughout the watershed area has historically been due to charcoal making, quarrying for construction, uncontrolled grazing of livestock, and fuelwood collection. Climate change has also added to the frequency and intensity in forest fires as the state has seen reduced rainfall during monsoon seasons and a longer dry season. In the absence of project activities, it is assumed that open forests would continue to degrade due to periodic forest fires, unsustainable fuelwood extraction, agricultural expansion and grazing, gradually loosing biomass, rootstock, and topsoil. Typically, without the project scenario in place, new shoots are hacked for firewood, seedlings are trampled by cattle and goats, and ground fires retard or destroy seedlings and saplings. This pattern had been observed throughout the project area leading up to the initiation of the project.

G7.2. Carbon pools

Above- and below-ground woody biomass are the carbon pools used to calculate carbon benefits for ANR (see Table G7).

The resulting carbon benefit estimate is also conservative as the storage and sequestration in soil and, deadwood and litter, are not being claimed as credits by the project. Consequently, this represents a buffer that may help reduce project risk.

Explanations for carbon pool selection for ANR technical specification are:

- Above- and below-ground tree biomass comprise the main carbon pools in open and dense forests - these are included. These are expected to be reduced under the baseline scenario, and project activities are expected to prevent emissions associated with the decline.
- Biomass stored in leaf litter and dead wood will increase as a result of tree-planting activities but is unlikely to be a large proportion of the total carbon and is therefore excluded.
- Soil carbon is expected to increase but the cost of measuring it is high, so it is excluded
- Dead wood is likely to increase during forest conservation, but this is not included to allow a conservative estimate of carbon benefit.

Table G7: Carbon Pools

CARBON POOL	LIKELY IMPACT ON CARBON STOCK	MEASUREMENT LIMITATIONS	DECISION
Above-ground woody biomass	Increase	Minimal	Include
Below-ground woody biomass	Increase	Minimal	Include

Dead wood	Increase	Minimal	Exclude
Leaf litter	Small increase	Time-consuming	Exclude
Soil	Increase	Expensive	Exclude

G7.3. ANR baseline emissions

For the first and second implementation periods, it was assumed that carbon stocks in open forest were expected to decline in absence of project interventions, but the rate of decline was not known. The project therefore adopted the conservative assumption that carbon stocks in open forests would remain constant under the baseline scenario. The third implementation period maintains this assumption.

G8. Ecosystem service benefits

G8.1. Climate benefit methodology

The climate benefits achieved from ANR activities are estimated using annual changes in carbon stock (see Annex 8 for details) between years 2016 and 2022 in permanent forest plots located in ANR sites (see Figure 8, Table G8a) The sampling strategy was designed with the assistance of the technical advisory committee to include plots areas that were under ANR treatment (silviculture activities) and those which were under advance closure. The plots fall within ANR areas that have been designated by the village Headmen as forest which would be suitable for regeneration and often include forests which had been used for fuelwood collection, grazing, or agricultural land in the past. The plots represent a range of previous land uses, treatment plans, and land cover types. These are located in open and dense forest areas, but not on areas of open ground due to the limited height and small DBH of the trees.

The plot data used to calculate climate benefits was taken from 2016-2022. Previous plot data was unreliable due to the removal of some plots which had been on private land and are no longer under ANR, the methods and calculations used prior to 2016 were performed differently and did not yield results that were comparable with new methods, and some of the plots had been destroyed by fire and new plots were constructed nearby. Plots which were removed from the project or added at a later date to replace others resulted in gaps in data collection. Data from plots under WeForest activities were used to create a more accurate picture of climate benefits under ANR as the plots were under similar interventions and resulted in supporting growth rates, however they are not part of the project's ANR area. The Shannon Index plots (labelled "S" in Tables G8b and G8c) were constructed for monitoring biodiversity in ANR areas, however the team members also took a number of other measurements including DBH. Including the data from these plots increased the representation for carbon sequestration in ANR. A number old ANR plots (labelled "O_ANR" in Tables G8b and G8c) were used in calculations and are considered reliable for measurements, but they are no longer under ANR closure or treatment and have not been included in the updated numbering system used for the rest of the plots. This is due to either a change in leadership within the village, the amount of time under ANR may have concluded, or the land may have been under private ownership and is no longer under ANR intervention.

Figure 8: Spatial Distribution of ANR Forest Sampling Plots Used for the Climate Benefit Estimation

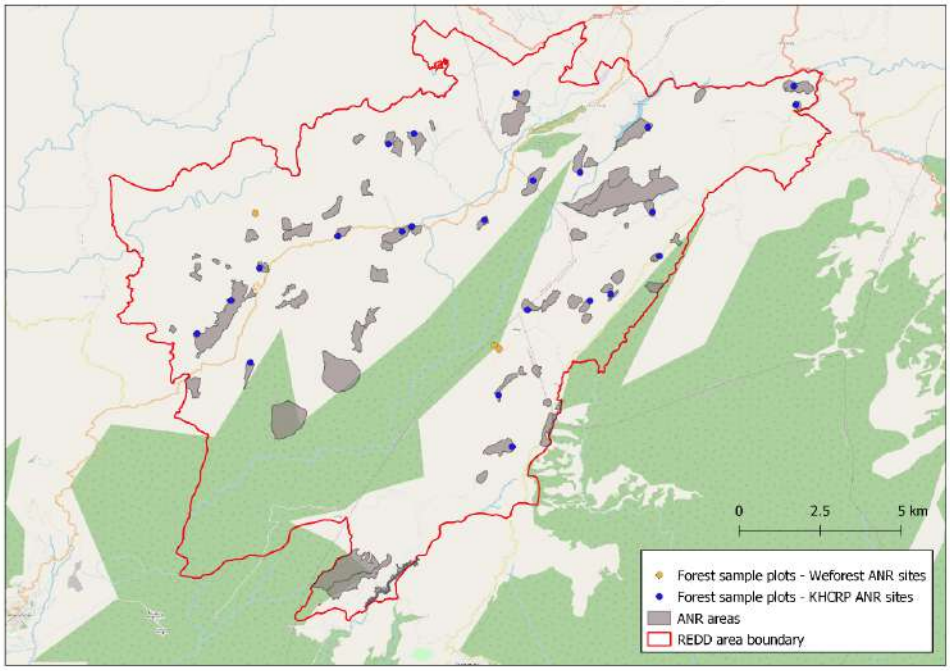


Table G8a: Stratification of Sample Plots Across Dense and Open Forest in ANR Areas

	Total number of plots in ANR sites used to calculate the climate benefits		Size of plot (ha)
Year	Dense Forest	Open Forest	
2016	1	5	0.01
2017	4	5	0.1
2018	8	6	0.1
2019	12	11	0.1
2020	8	6	0.1
2021	13	17	0.1
2022	9	12	0.1

The estimated climate benefits for the third implementation period are calculated by multiplying the average annual increase in carbon (between 2016 and 2022) in open and dense forests under ANR by the respective area of open and dense forest in the ANR areas. Ordinary least square (OLS) linear regression (Equation 1) is used to find the average annual growth.

Equation 1: $\beta = \sum_i (Avg\ (Y) - Y_i)^2 / \sum (Avg(Y) - Y_i)(Avg(B) - B_i)$

Where:

β = Average biomass change for each

B = Biomass (Mg C ha^{-1}), measured at plot level

Y = Year of forest plot measurement

The average annual growth rate and lower 90% confidence interval of the growth rate is calculated (Equation 2). The lower 90% confidence interval is used as the average annual change in biomass to ensure that a conservative estimate is given.

Equation 2: $\bar{\beta} = \frac{1}{n}\sum_{i}^{n}(\beta)_i$

Where:

$\bar{\beta}$ = Average growth rate

n = Number of plots sampled

Tables G8b and G8c summarise biomass (Mg C ha^{-1}) and average annual growth (Mg C ha^{-1} yr^{-1}) at plot level for the open forest plots and dense forest plots respectively. When applying the lower 90% confidence interval, the average annual growth is 1.40 Mg C ha^{-1} yr^{-1} for open forests and 2.43 Mg C ha^{-1} yr^{-1} for dense forests.

Table G8b: Annual Biomass (tC/ha) in Sample Plots Located in Open Forests Within the ANR Sites

Plot No.	ANR Site	Biomass (Mg C ha^{-1})							Average annual growth (Mg C ha^{-1} yr^{-1})
		2016	2017	2018	2019	2020	2021	2022	
4	Law Shlem			13.87	14.36	17.90	21.30	16.55	2.82
28	Phodumdewsaw, Hima Pamsanngut			5.45	6.01	8.40	10.22	10.12	2.13
27	Lawsubah, Pamsanngut			61.90	63.10	69.50			4.39
2	Lum U Mong, Laitkroh			1.99	2.16	2.60	3.80	4.11	1.06
14	Sohrarim, Lumnonglum			55.40	56.20	58.40	56.70	58.86	2.20
S	Lawsubah		18.93		20.56		22.83		0.98
S	Kyiem		11.37		13.70		15.57		1.05
S	Lummawtong		37.81		43.32		48.48		2.67
S	Lumphari		16.01		20.60		35.32		5.27
S	Lumpomlum		1.80		1.99		2.21		0.10
O_ANR	Jathang Lum Riatsawlia= Law Khliehriat Sawlia, Community Forest, Sohra Syiemship	20.58					48.79	50.41	6.80
O_ANR	Phudlawkhla	2.03					17.16	19.62	3.98
40	Lumdiengsai, Laitkroh	3.42		7.42	7.72	9.13	10.14	10.00	1.53
O_ANR	Laitmawhing	16.23					69.77	66.20	11.80
O_ANR	Lummawmarok	1.08						0.00	0.00
0	Themlumkhwai Laitsohpliah,Sohra Syiemship						71.78	70.20	-3.17
0	Lum Pyllun community Forest, Jathang, Sohra Syiemship						38.09	35.85	-4.48
0	Law Phudumblang Kyrphei, Mylliem Syiemship						36.98	37.36	0.76
0	Lumhati, Mawkalang, Mawbeh Sirdarship						5.10	7.70	5.20
Average annual growth (tC/ha/yr)									**2.51**
Lower 90% Confidence Interval (tC/ha/yr)									**1.40**

Table G8c: Annual Biomass (Mg C ha) in Sample Plots Located in Dense Forests Within the ANR Sites

Plot No.	ANR Site	Biomass (Mg C ha^{-1})							Average annual growth (Mg C ha^{-1} yr^{-1})
		2016	2017	2018	2019	2020	2021	2022	
151	Kseh Mylliem, Nonglwai			90.87	92.28	97.40	100.10	102.20	4.98
134	Lumphudumsim, Nonglwai			101.11	102.99	112.40	110.50	113.90	6.13
155	Lumwaharkum, Hima Nonglwai			27.30	28.20	27.20	29.90	38.26	11.61
159	Wah Mawlong, Laitumiong, Mawbeh			67.12	68.34	71.80	79.10	120.80	
127	Khlaw Rani, Pamsanngut			136.51	137.76	143.43	149.50	141.87	4.75
S	Mawlangrain		56.10		58.62		62.58		1.65
S	Umkaber		53.94		55.31		57.21		0.83
S	Lumlaitlynding		94.75		98.00		101.67		1.73
S	Laitthemlangsah		109.24		118.12		123.59		3.65
O_ANR	Phanniewlahneng	89.30					93.71	94.77	1.24
152	Lumkyndong Kmie Brial, Mawphlang			31.90	33.40	36.30	39.90	42.66	4.87
136	Wahthymmei Esdiwot, Nongspung			121.30	123.40	126.80	132.60	132.90	5.18
153	Imsotti, Nongspung			124.10	125.50	128.00	140.80	140.80	8.95
								AVERAGE GROWTH	**4.63**
								LOWER 90% CI	**2.43**

The ANR sequestration rates for open and dense forests estimated from the project (1.40 Mg C ha^{-1} and 2.43 Mg C ha^{-1} respectively) show similarities with the range of rates seen in studies of similar open pine forests where open pine forests can sequester carbon at a rate between 1.07 and 1.6 Mg C ha^{-1} (Table G8d). The related studies from central Nepal are based on degraded Chir pine forests that are very similar to the Khasi pine (*Pinus khasiana*) that dominates the open forest landscape in the project area. Further, elevation is similar, though rainfall in the project area is considerably higher than western Nepal, suggesting that growth in the project area may be more rapid. The ANR sequestration rates for open forests estimated from the project are just below the lower end of sequestration rates in open forests from these studies, while the rates seen in dense forests estimated from the project sit above the upper end of these sequestration rates. The open forest rates might be lower than those in similar studies due to proximity of open forests to communities where grazing animals may stray into rejuvenating forests. Meghalaya has experienced longer dry seasons with increased fire incidence which often spread quickly through the grassy underbrush of pine forests.

Table G8d: Carbon Sequestration in Open Pine Forests

REFERENCE	OPEN PINE FOREST (Mg C ha^{-1})
Shrestha, R. (2010)	(1.6 pine + 1.37 poor condition)/2 = 1.5
Baral et al, (2009)	1.35 (pine)
Jina et al, (2008)	1.07 to 1.27 (degraded pine)

Table G8e: Carbon Stock Parameters

Parameter	Value	Source	Justification
Carbon density of open and dense forest type	See Table G8b and G8c	Biomass surveys (Tables G8b and G8c above, and Annex 8)	Carbon stocks in above ground biomass estimated using field measurements at forest plots across the project area. Below ground biomass estimated using a root:shoot ratio of 0.15. Protocols for biomass sampling developed by the project
Area of open and dense forest type within ANR project areas	See Table G8f	LCCA* (Figure 8)	The land cover change assessment provides an estimate of forest strata present within the project area for 2020 which is within 2 years of the start of the project period
Extent of ANR project areas	See Figure G5	GPS traces of ANR boundaries	The ANR project area boundaries are demarcated in the field when a new ANR site is established with a community

G8.2. Expected climate benefits

Between 2013 and 2021 the project worked with communities to bring 1,620.8 hectares under ANR, with plans to bring an additional 250 hectares under ANR between 2022 and 2026. The annual climate benefits from ANR expected during the third phase of the project are summarized in Table G8f. Expected annual climate benefits for the project period are 5,046.98 Mg CO_2 per year. Climate benefits expected to result from ANR activities during the project period (Table G8g) are 25,234.91 Mg CO_2.

Table G8f: Estimated Annual Carbon Uptake

Land cover class	Area (ha)	Annual carbon uptake (Mg C ha^{-1})	Annual carbon uptake (Mg C yr^{-1})	Annual emission reductions (Mg CO_2 yr^{-1})
Open forest	706.1	1.40	991.54	3,639.73
Scrub	461.6	N/A	0	0
Non-forest	230.0	N/A	0	0
Dense forest	157.6	2.43	383.36	1,407.25
Waterbodies	20.6	N/A	0	0
Grand Total	**1,575.9**			**5,046.98**

Table G8g: Estimated Carbon Uptake Expected During Phase 3

Year	Annual emission reductions (MgCO2)	Cumulative emission reductions (MgCO2)
2022	5,046.98	5046.98
2023	5,046.98	10,093.96
2024	5,046.98	15,140.94
2025	5,046.98	20,187.93
2026	5,046.98	25,234.91

G9. Leakage and uncertainty

G9.1. Leakage methodology

To minimize leakage from activities that are not part of ANR intervention, the project is promoting alternatives for communities which may depend on forests as part of their livelihood. For example, fuelwood collection areas are established close to villages with rotational harvesting periods allowing plantations to grow and mature which reduces the likelihood of displacement or leakage even though ANR areas are closed to fuelwood collection. Initiating and supporting the practice of rearing stall-fed livestock instead of grazing animals also reduces amount of land needed to raise the animals. Community Facilitators and local youth volunteers monitor the ANR areas and help to bring awareness to the

community about the ANR practices. The risk of leakage from moving emission-causing activities elsewhere is low.

As a result of ANR activities, community members may look to sources of emission-causing products from outside the project area. However, the project aims to reduce this effect by providing LPG connections and rice cookers to households in order to lessen their dependence on fuelwood and charcoal. The project is also monitoring the making of charcoal both inside the project area and outside the project area to better assess the effects on communities. The risk of leakage from increased production and emissions outside the project area is low.

The ANR activities do not cause indirect super-acceptance of alternative livelihood activities. There is no risk of putting further pressure on forests by people moving into the project area.

Table G9: Potential Drivers and Risks of Leakage

Leakage risk	Risk level	Mitigation measures	Monitoring measures
Fuelwood collection	Low	Plantations within communities designated for fuelwood collection, LPG and rice cooker distribution.	CFs and youth volunteers measure fuelwood consumption within communities
Charcoal making	Low	Meetings are held to identify alternative livelihood activities and support is given for transition to those activities	CFs and youth volunteers monitor charcoal making within and outside the project area
Grazing in forest	Low	Introduction of stall-fed livestock rearing. This will reduce grazing in the project area and will not increase the risk of grazing outside the project area	CFs and youth volunteers monitor ANR areas as well as stall-fed livestock rearing.
Increased population pressure on forest	None	There are no mitigation measures needed for preventing movement into communities	Villages have their own requirements for people moving into communities

G9.2. Potential leakage

Risk of leakage based on an analysis of drivers of leakage related to ANR activities is shown in Table G9. As a result of the mitigation measures put in place by the project and described in G9.1, emissions from leakage are considered low. To ensure that a conservative estimate of climate benefits achieved by the project is presented, emissions from leakage are estimated as 5%.

G9.3. Sources of uncertainty

The main sources of uncertainty and approaches used to reduce uncertainty are summarised below.

Data

As with the climate benefit estimation for the project's REDD+ interventions, two main types of data source are used in the estimation of climate benefits: Land cover maps, and carbon density estimates. The accuracy of land cover maps was assessed using a confusion matrix and was between 90 and 93% (see Annex 9).

Estimates of carbon density also have uncertainty associated with the values used, which were derived from forest inventories between 2016 and 2022. The average values adopted for dense and open forests in the ANR boundaries have a standard deviation associated with the survey from which they were collected. The uncertainty is reflected in the estimates used, by using a lower 90% confidence interval of the mean, resulting in a considerable underestimate of carbon stocks.

Part H: Risk Management

H1. Identification of risk areas

REDD+ and ANR activities are designed to be sustainable and to supply benefits after the project period. Firstly, the project team will work to reduce financial, management, and technical risks. Secondly, political, social, land ownership, and opportunity cost risks are being addressed through the project. Thirdly, the risks of fire are minimized through project interventions. See Table H1 below. The risk table attempts to quantify the risk for a range of risk factors including socio-political, institutional, financial, and natural events. Overall, the project offers comparatively low risk in the South Asia context, due to very strong tenure security, active and democratic indigenous governments, high literacy in the project communities, and a strong local commitment to restoring forests in the watershed.

Table H1: Identification of Risk Areas

Risks and Mitigation Measures			
Risk	**Description**	**Risk Level**	**Mitigation Measures**
Environmental Risks	Forest Fire	Low	Controlled burning, awareness, fire line construction and maintenance, early detection by assigned fire watchers.
	Natural Events (Earthquake, Landslides, Floods, etc.)	Low	Tree planting helps reduce erosion and hold soil in place. Plantation also helps soil absorb more water during heavy rain events.
Social and Political Risks	Ownership and Custodianship of Land Disputes	Low	Mediation at the *Durbar, Hima* and Federation level to resolve resource related conflicts. Sense of ownership given to locals to support project goals.
	Political Reluctance to Proceed with Projects	Low	There is a strong local commitment to forest conservation through indigenous governments.
	Government Intervention of Other Forest Programmes (such as palm oil production)	Low	The Synjuk works with the local authorities to maintain that land rights and ownership stay at the community level. The project educates communities as to the importance of biodiversity and the detrimental impact of monoculture plantations.
Economic and Financial Risks	Uncertain Funding Support	Low	Develop budget options, allowing resources to be directed to critical project elements. Diversify sources of funding through government schemes and grants.
	Other Projects or Schemes May Draw Participants to Other Activities	Low	The project is in regular communication with project participants and Community Facilitators who are active in their village areas to maintain interest.

H2. Risk buffer

The risk buffer is a proportion of carbon benefits that are not sold. It is based on the risk of non-sustainability of the project. In accordance with guidance provided in *Plan Vivo's Approved Approach: Assessing Risk and Setting the Risk Buffer,* a 20% risk buffer is applied to the REDD intervention, and 20% is applied to the ANR intervention. The project has also included the risks of non-permanence including forest fire, charcoal making, and mining. These remain as risks as there might never be sufficient resources to fight all of the fires especially in difficult to reach areas and not all of those who are involved in charcoal making and quarrying will shift to alternative livelihoods. Both risk buffers are at the higher end of the proposed risk buffer estimate, therefor contributing to conservative estimates of climate benefits. The project design additionally relied on a conservative estimate of carbon stocks and benefits

in order to reduce the risks of over-estimating carbon credits generated by this project. Potential carbon offsets from litter and deadwood are also not included and can be viewed as a further increase to the risk buffer.

Part I: Project Coordination and Management

I1. Project organisational structure

The project is coordinated by the Khasi Hills Federation of ten indigenous governments (*Hima*), under the full title of Ka Synjuk Ki Hima Arliang Wah Umiam Mawphlang Welfare Society (KSKHAW-UMWS). The Synjuk Federation is recognized by the Government of India under the Societies Act 12 of 1983. Moreover, the regional Khasi Hills Autonomous District Council (KHADC) approved the project in 2011 (see Annex 6 for further details).

The project's organizational structure is based on the 86 participating communities coordinated by 26 Lower Working Committees (LWC), each of which supports the NRM activities of 2 to 5 villages located within a micro-watershed (cluster). The communities and LWC are assisted by a team of trained village staff to act as extension workers and Community Facilitators (CFs), and the community forestry Federation that oversee and coordinate the REDD+ project. As a registered society, the Federation acts as a non-profit project-implementing agency under the direction of its advisory board, board members, and elected executive officers (see Annex 6). The Federation convenes 2 to 3 formal meetings each year with representatives from all ten *Hima* to hold project management discussions. The LWCs meet quarterly to supervise the NRM plan implementation in the 86 villages. Additional meetings are held at the village level as required to implement project activities.

The Federation receives governance oversight and guidance from its Advisory Committee which includes technical advisory as well. These individuals have extensive experience managing local, national, and international NGOs, as well as expertise in project design, local forestry, and wildlife. The Advisory Committee members can be called upon by the Federation to address any organizational governance, issues related to financials, natural resource management concerns, conducting remote sensing studies, and advice on livelihood activities related to the Khasi Hills Community REDD+ project. Members of the Advisory Committee play a number of roles including reviewing data from annual silvicultural and environmental monitoring activities, reviewing and editing annual reports, and advising on Plan Vivo certification, administration and sales. See Annex 1 for a list of members involved.

Table I1a: Project Participants and Stakeholders

Key Function	Organizations Involved	Type of Group and Legal Status	Activities
Original Project Developer	CFI	Non-profit, reg. in US	Project design, technical and marketing support, project monitoring, fundraising. Has transferred project coordinating to Synjuk Federation in 2015.
Project Implementer	Synjuk Federation	Non-profit, reg. in India	Watershed management planning, mitigation, and livelihood activities
Project Technical Operations	Synjuk Federation through the REDD technical team	Non-profit, reg. in India	Administer project funding, provide technical support, liaison with government projects, support project monitoring
Community Participation	*Hima* (indigenous kingdoms)		Sanction NRM plan for *Hima* lands Guide Federation, pass *Hima* regulations and NRM policies as needed
	Village *Durbar* (village council)		Develop and implement village NRM and livelihood plans

	Lower Working Committee		Oversee project implementation, coordination, manage mitigation and livelihood activities, monitor, and report.
	Community Facilitator		Communicate and monitor activities between the Synjuk and the community participants
	Self-help Groups and Farmers Clubs)	SHGs (women's micro-finance organizations) Non-profit, reg. in Meghalaya	Initiate livelihood and small enterprise activities
	Youth Volunteer		Carries out monitoring and project activities
	Project Participants		Implement project activities and benefit from the project

During the early implementation phase (2012-2015) the project relied on technical support from Community Forestry International (CFI). Inputs during this period focused on project design issues, including institutional mechanisms for project governance, administration, financial management and implementation. Periodically, the project drew on the technical expertise of Rupantaran and BioClimate R&D for technical support and 3rd party reviews with special reference to carbon monitoring and measurement of other project benefits. A Chartered Public Accountant (CPA) is responsible for conducting periodic audits of Federation accounts.

Table I1b: Stakeholder Analysis

Stakeholder	Description of the role and stake of the stakeholder in relation to the Project	Potential impact of the Project on stakeholder (positive or negative)	Interest of the stakeholder in the Project	Influence of the stakeholder on the Project	Type of engagement required
Government agencies (national, provincial, local)					
Meghalaya Forests and Environment Dept.	Mandated with conservation of natural resources and protection of wildlife and their habitat	High impact: The project works to protect forests and prevent illegal activities. The project creates habitat for wildlife and conserves biodiversity	The Forestry Dept. is interested in the REDD project as a conservation method.	Forestry Dept. acts as a resource for technical advice	Engaged when required by the project
Local stakeholders					
Hima	The land and forest belong to the *Hima,* and they oversee their management	When benefits are seen, the *Hima* may allow more land to be involved in the project. There may be a negative impact if there are any land disputes.	They are very interested that the land and forests are preserved and taken care of while benefiting community members	They are highly influential as they are members of the Synjuk	Engaged in Synjuk General Meeting
Synjuk	The Synjuk is a representation of the 10 *Hima* which oversees the implementation	A positive impact of the project is employment of local people to implement the project.	Highly interested as this organization was created solely to	They are highly influential as they operate the project	Daily engagement

	of the REDD+ programme		implement this project		
Lower Working Committees	Represents the village, *Hima*, and CFs in project planning for land use and management	A positive impact is that the project brings more communication between the local traditional governments	Highly interested as they are all members of the communities where the project takes place	They are highly influential as they put together the Natural Resource Management Plans and oversee the grant project funds	Monthly meetings
Vulnerable groups who may be impacted by the Project					
People under the poverty line	Those who earn less than USD$2 per day.	A positive impact is that the project provides benefits such as LPG which improves health conditions. A negative impact is that they may have to travel farther to specially designated areas for wood collection	Highly invested as they are the community members in the project area and depend on natural resources including fuel wood	Carry out project activities	Engaged in project activities carried out by community members
Landless labourers	Those who do not own land, but are allowed to use community or *Hima* land for various activities	A positive impact is that the project provides benefits such as LPG which improves health conditions. A negative impact is that they may have to travel farther to specially designated areas for wood collection	Highly invested as they are the community members and often depend on natural resources	Carry out project activities	Engaged in project activities carried out by community members
Farmers	Agriculturalists in the project area	A positive impact is that the project provides training and sustainable agricultural practices which could result in higher income products	Highly invested as farmers receive in-kind benefits of fruit trees, pigs, chicken, and others from the project	Practice sustainable agricultural practices presented by the project to reduce grazing.	Engaged in trainings presented by the project
Research institutions and universities					
Indian Council of Agricultural Research (ICAR)	Co-ordinates, guides, and manages research and education in agriculture, horticulture, fisheries, and animal sciences.	The project recommends beneficiaries to be involved in ICAR sponsored programmes	Mild interest in the project as it brings advancement to agricultural practices in the area.	ICAR brings advice, training, and technical support to the project beneficiaries involved in sustainable livelihoods	Engaged in presenting trainings and meeting on a as needed basis, as well as part of the Technical Advisory Committee.
North-East Hill	Disseminates and advances knowledge by	The project could provide results for social surveys	They are interested in promoting the	NEHU provides valuable research and	Professors and scholars are engaged on an

University (NEHU)	providing instructional and research facilities. NEHU pays attention to the improvement of the socio-economic conditions of the people of the hill areas of North-East India.	conducted in the project area. The project also benefits NEHU by protecting plant and animal species which are important to scientific research at the university.	improvement of the people and the environment of the Northeast.	technical advice to the project.	as needed basis and part of the Technical Advisory Committee.

I2. Relationships to national organisations

The project conforms to the emerging National Government of India Policy on REDD+. The project has received approval of the Khasi Hills Autonomous District Council, which has already been obtained (see Annex 6). The project design team regularly briefs the Government of India's REDD+ cell regarding early sub-national REDD+ field project experiences. The project has also been presented at national REDD+ meetings and workshops, such as a symposium held in Hyderabad in December 2011, and was visited by the Prime Minister of India, Narendra Modi, in 2016. There has been increasing national interest in the project and its approach with many governmental schemes looking to the project as a potential blueprint to replication.

Forests are sparsely mentioned in India's Intended Nationally Determined Contribution (INDC), which were submitted prior to the Paris Agreement in 2015. The INDC states that the country plans large-scale afforestation of areas and is working on a REDD+ policy. This has not resulted in any concrete policies that would have an impact on the project. The project will monitor India's national efforts on jurisdictional REDD+ approaches and will update the Plan Vivo Foundation accordingly.

I3. Legal compliance

The project conserves customary laws while conforming to Government of India laws and regulations, including:

- **Protected Areas:** Protected areas are identified by the local governing *Hima* and the project adheres to their rules and regulations regarding protected areas.
- **Forests:** The majority of forests in Meghalaya are managed by the *Hima*, communities, clans, or privately owned. The project complies with all rules and acts that fall under the Meghalaya Forests and Environment Department, including protection of catchment areas, tree preservation, wild animal and bird protection, biological diversity, tree felling, and forest-based industries.
- **Biodiversity Strategy:** The project's goals are in tandem with the Meghalaya State Biodiversity Strategy and Action Plan (2016-2026), working to increase the population's awareness of the values in biodiversity, conservation, and sustainability. Some areas of the project are also included as Biodiversity Heritage Sites under Section 37 of Biological Diversity Act, 2002 within the state of Meghalaya. Under this Act, the State Government may frame rules for the management and conservation of the Biodiversity Heritage Site. The project has been in compliance with these rules.
- **Climate Change Policy:** The National Action Plan on Climate Change (2008) gives priority to enable state leaders to make plans for resources. The Meghalaya State Climate Change Action Plan (2014) focuses on reducing the dependency on natural resources and resilient ecosystems. The project is involved in the State's adaptation pathway in agriculture by promoting sustainable

agriculture, water harvesting, organic farming, diversification, increasing perennial fruit crops, and breeding stall fed livestock. Similarly, the project seeks to carry out pathways for more resilient forestry systems by providing socio-economic alternatives, diversification of agri-forestry systems, and PES to increase forest cover and biodiversity.

- **Development:** Plans for development are regulated at the *Hima* level and are shared as a Memorandum of Understanding (MOU) between the *Hima* and the village.
- **Land Tenure Laws:** The District Council makes laws to regulate and administer the allotment, occupation or use of land in the Khasi Hills Autonomous District (other than any land which is reserved forest) for the purposes of residency or agriculture.
- **Employment Laws:** The project complies with all laws and policies enforced by the Labour Commissioner with regards to the welfare of all those working in organized and unorganized sectors.

The project sought and secured certification under the Plan Vivo Standard and is in compliance with protocols established under Free, Prior, and Informed Consent (FPIC). The project also secured the approval of the Khasi Hills Autonomous District Council (KHADC), the level of government legally responsible for overseeing such activities. Equal opportunities for employment are ensured through promotion of open positions and interview processes involving the project coordinator and other team members. Positions held within the Synjuk Federation are voted on by members of the Synjuk including all ten *Hima.* The project was validated by Rain Forest Alliance, USA. No credits generated by the project have been sold outside the Plan Vivo certification system and Markit registry.

I4. Project management

The Synjuk is responsible for project management and institution building throughout the Khasi Hills Community REDD+ Project. Through the Federation of the ten *Hima* the project operates through direct communication and through constant interaction with the many factions of local leadership. While the Federation was established in 2011, many of the other activities involved in project management and development are ongoing.

Table I4: Project Timeline

Title	Type Of Activity	Objectives	Brief Description	Target Groups	Timeline
	Program Management and Institution Building				
Develop CF Federation	Create legal, democratic, and transparent apex body	Establish community-based coordinating NRM mechanisms	Hold elections, register with Government of India as Non-profit, and get training in bookkeeping.	Indigenous governments and leadership in project area	2011
Develop Lower Working Committees (LWCs)	Establish and train LWCs to support village NRM planning	Create 18 (now 26) LWCs to supervise NRM activities	26 LWCs comprised of village heads, male and female leaders create support for 62 (now 86) village NRM planning and activities	Village leaders, women SHG heads, and *Hima* representatives	2011-2013, 2021
Formulate Village NRM Plans	Mapping, PRAs, community dialogue	Design long term strategy for resource management	Map community resources, demarcate boundaries, plan forest restoration	Village leaders, *Durbar* members, SHG heads, and youth club representatives	2011-2013, Ongoing

			and livelihood activities		
Create NGO and Government Support Linkages	Meetings with state government planning agencies, cooperative agreements with NGOs	Establish long-term supportive partnerships with government and civil society	Multi-stakeholder workshop, one-on-one meetings with state employment and NRM agencies and rural banks. Contract local NGO to provide technical assistance.	State Ministers of Forestry and Environment. State Commissioner	Ongoing
Develop SHG Federation	Create a governing body of women to oversee SHG activities throughout the project	Create a network of SHGs and a structure to support members and attain economic goals	Hold elections, Business planning, capacity building, training of mapping, launch group enterprises and livelihood initiatives	Women SHGs, *Hima* representatives, Synjuk Federation	2021-
	REDD+ Mitigation Activities				
Aided Natural Regeneration (ANR)	Identify areas to implement ANR in high potential degraded forest sites	Accelerate regeneration of degraded forests, improve species composition and habitat, and produce timber	Mapping area needing treatment. Removal of suppression. Restoration of degraded forests through weeding, thinning, and multiple-shoot-cutting.	*Hima*, Communities, owners of clan and private forests	Ongoing
Forest FireControl	Organize community fire control systems and create awareness	Reduce frequency and size of forest fires	Creation of fire lines and employment of firewatchers during the fire season.	Rural households and communities	Ongoing
Sustainable Fuelwood Production	Develop fuelwood management plans	Reduce fuel collection pressure on natural forests	Establish regulations guiding fuelwood collection times, volumes, and locations. Create maps of collection zones	Federation representing all community members. Owners of Clan & Private Forests.	Ongoing
Clean Energy Program	Distribution of LPG cooktops and rice cookers to project communities	Reduce fuel wood consumption by 30%. Improve household health	Subsidize costs through project funding	All families in project area utilizing wood burning stoves	Ongoing
Biodiversity Conservation	Creation of wildlife corridor. Protection of amphibian habitats. Protection and rehabilitation of orchids	Connect the two major wildlife habitats of the project area.	Dialogue with State Ministry of Environment, Federation and *Hima* representatives. Develop bio-diversity monitoring system and management plan	Minister of Environment, KHADC, Federation, *Hima* leaders, and relevant *Durbar* representatives.	Ongoing

Soil and Water Conservation Measures	Develop and implement soil and water conservation plan	Control soil erosion & improve watershed hydrology	Plant trees along slopes, waterways, and riverbanks to reduce erosion	Youth volunteers, community members	Ongoing
	Livelihood				
Piggery and Poultry Project	Replace low quality livestock withstall-fed pigs and poultry	Protect forest from over grazing, increase family income	Inferior breed cattle to be replaced by more profitable and stall-fed livestock suchas poultry, pigs, etc.	Landowners and agriculturists	Ongoing
Sustainable Farming Systems	Training in horticulture, mushroom cultivation, beekeeping, perennial crops.	Improve sustainability and productivity of farming systems	Training of farmer innovators. Demonstrationof more productive techniques of farming. Support from Indian Council for Agricultural Research (ICAR) and NGOs	Farmers, local NGOs, and Indian Council for Agricultural Research (ICAR)	Ongoing
Formation of SHGs	Organize women-funded micro-finance groups	Augment employment generation and promote micro-enterprises.	Train women-run SHGs in bookkeeping. Assist them to open bank accounts and be registered in the GOI's rural banking program. Link to ecotourism and alternative livelihood programs	Village women	Ongoing
Promotion of Eco-Tourism in the ProjectArea	Eco-Tourism planning and program development	Increase tourist related livelihoods for local communities	Secure technical and financial support from state and central governments for organizing such training. Develop eco-tourism development strategy	State agencies, SHGs, tour organizers, and village youth clubs	Ongoing

Village-based activities are recorded by Community Facilitators (CFs) who keep centralized record-keeping books indicating forest monitoring and livelihood activities. At the same time, the central forest monitoring and the socio-economic team employed by the Synjuk Federation transmit their monthly activities to a central data entry operator at the Synjuk's office where all information is consolidated and formalised. Records are backed up every month on an external hard drive which is kept off the premises. Business development, sales, and managing transactions on the Markit environmental registry will be conducted by

the Synjuk lead accountant with support from other team members. In the past this was managed with the aid of Mark Poffenberger of CFI.

I5. Project financial management

The Synjuk is responsible for managing all carbon revenues and other Payments for Ecosystem Services (PES) income, depositing all funds in a designated project account. PES is dispersed according to the completion of Natural Resource Management (NRM) plans of each participating village and completion of monitoring and project activities.

The disbursement process includes these steps:

- Revenues from carbon sales are received and allocated to the general Project Activities described in Section D.
- Villages prepare Natural Resource Management (NRM) Plans together with the village Headmen.
- LWCs assess the plans according to overall strategy and priority. NRMs are then given to Community Facilitators (CFs) who coordinate the consolidation of plans at the *Hima* level together with *Hima* heads. These plans are then presented to the Synjuk where they are assessed and approved, and funds are allocated to proposed activities in the form of village development grants. The amount given in the form of village development grants is consistent for all villages but may vary from year to year based on revenues from carbon sales.
- During implementation, the Synjuk forestry team, socio-economic team and CFs will conduct monitoring exercises.
- If there is a problem in activity or villages fail to meet their monitoring targets, the matter will be discussed with CFs, village Headmen, and *Hima* heads.

Figure 9: Funds Disbursements of Carbon Sales

Carbon revenues allocated to:

1. Project management costs including administration and overhead
2. Project Monitoring and Reporting including data collection, analysis, and reporting
3. Community Benefits
    - Conservation and Reforestation
        - LPG distribution, plantation, training, silviculture, capacity building
    - PES Payments
        - Socio-economic Enhancement
            - Temperate fruit trees, livestock, mushroom, SHGs, FCs, LWCs, training, Community Development Fund, Special Village Grant, income generating activities
        - Restoration
            - CFs, training, Tree Adoption Programme, fireline
        - Environmental Services
            - Eco-tourism Grants, biodiversity monitoring, advocacy and networking

This REDD+ project receives support from several sources. The design of the project was funded by the U.K.-based Waterloo Foundation that provided £100,000 from 2011-2012. CFI provided technical and logistical support through the Margaret A. Cargill Foundation from 2012-2014.

The project's financial structure assumes multiple sources of financing over three, ten-year project periods (2012-2021, 2022-2031, and 2032-2041). CFI has assisted the Federation to raise funds through carbon sales as a source of support for the Federation's operations through 2015. The Federation and the participating *Hima* and communities seek additional funds and technical support from Government of

India programs. Beginning in 2015, administrative and financial management systems were fully in place and the management of REDD+ project funds are administered by the Federation. For the project period 2022-2026, most of the funding in the project will be based on the sale of carbon and only a small percentage will come from other avenues like government schemes, Corporate Social Responsibility (CSR) projects, and grants.

Due to the uncertainty regarding future financial support for the project, a series of budget scenarios are being developed to create greater flexibility in responding to actual funding availabilities. Funding priority is given to maintaining management institutions and monitoring activities.

Estimated costs are broadly divided into categories presented in Table I5a and is further broken down by funds required from carbon sales and REDD+ funds and those potentially obtainable from Government of India schemes and programs. The project budget assumes that during the first ten-year project 80 to 90% of the project communities and forest areas will be positively impacted by project related experiences. Under this budgetary scenario, based on projected costs during initial years, it would require approximately $138,000 per year in external funding to support project management, REDD+ mitigation, and livelihood activities, with approximately 75% from carbon sales and 25% from Government of India sources. Since funding from external grants and carbon sales are uncertain, the project adopts a flexible approach to financing. Funding priority is given to resource management activities with greater emphasis on livelihood activities as financing allow.

Throughout the years of the project, the Federation complies with GOI and its laws. Revenue from carbon sales is transferred from the Plan Vivo ESCROW account or from partners in India to the Federation. The Federation has set up a for-profit company called Khasi Hills Ecosystem Private Limited (KHEPL) as a sister entity to handle the day-to-day operation of the Federation. The Federation allows KHEPL to have a direct service agreement with different stakeholders and Plan Vivo to handle the Federation's revenue. After deduction of issuance fees (PVF), commission charged by the project's retail/reselling partners, and occasional consultancy/verification fees, all remaining funds derived from carbon revenues are used directly for REDD+ project activities by the Federation. Carbon sales are held in a project account for the Federation. A local CPA audits the Federation's accounts annually.

Table I5a: Annual Budget Scenario (2021)

SL.NO	BUDGET ITEM	DESCRIPTION	UNITS	UNIT COSTS ($)	REDD+ PROJECT FUND & CARBON SALES ($)	GOVT OF INDIA SCHEMES & PROJECTS ($)	TOTAL FUNDS REQUIRED ($)
A	**Project Management**						
1	Administration & Management	Federation overhead	12	$1,840	$22,080		$22,080
B	**Project Monitoring & Reporting**						
1		Data collection, analysis, and reporting	1	$10,000	$10,000		$10,000
C	**REDD+ Mitigation Activities**						
1	Forest Protection	Silviculture, fire line maintenance, local youth volunteer & awareness to the community	84	$300	$25,200		$25,200

2	Forest Restoration	Tree plantation with schools & villages in the project and fields supplies.	17	$285	$2,850	$1,995	$4,845
3	Efficient Stoves	LPG connection and rice cooker to the forest dependent families.	500	$64	$32,000		$32,000
D	**Socio-economic Enhancement Activities & Livelihood Activities**						
1	Animal Husbandry Project	Distribution of livestock to the beneficiaries selected by the village Headman	26	$200	$4,000	$1,200	$5,200
2	Micro-Finance Programs	Supporting individuals & SHGs through revolving fund and income generating activities	43	$120	$3,600	$1,560	$5,160
3	Sustainable Agriculture Program	Vermicomposting, horticulture, apiculture, temperate fruits, shade net & mushroom cultivation	15	$571	$5,710	$2,855	$8,565
4	Community Performance Award	Grants to the community	84	$300	$25,200		$25,200
TOTAL					$130,640	$7,610	$138,250

Table I5b: Expected Income from Carbon Sales Over the Next 5 Years (2022-2026)

Sl.No.	Year	Carbon in ton	Amount per Unit $	Total Amount $
1	2022	60,837		
2	2023	60,837		
3	2024	60,837		
4	2025	60,837		
5	2026	60,837		
Total expected sale				

The Federation markets and trades Plan Vivo Certificates based on actual forest carbon emission reductions and sequestration. The amount of payments depends on the degree to which the project has achieved project emission reductions and sequestration targets. During the 2016-2020 period, the project sold approximately 10,000 to 126,000 tCO_2 each year, with the revenues meeting the project financing

requirements (see Table I5c below). The funds are deposited in the Federation account with joint signatories.

Table I5c: Carbon Sales 2016-2021

Vintage	Date	Buyers	No of PVCs
2014	2/3/2016	Zero Mission	6,500
2014	9/6/2016	Ceramica Santogostino	350
2014	9/14/2016	COTAP	660
2015	8/7/2016	WeForest	2,102
2015	11/24/2016	WeForest	2,075
2015	10/11/2016	Anima Impreza	20
2015	6/12/2016	Zero Mission	8,099
2016 Total			**19,806**
2015	5/5/2017	Zero Mission	9,727
2015	2/6/2017	C-Level	850
2016	9/13/2017	COTAP	1,467
2016	10/25/2017	Zero Mission	250
2016	12/27/2017	Zero Mission	9,718
2017 Total			**22,012**
2016	9/3/2018	WeForest	1,876
2016	05/14/2018	ZeroMission	300
2016	07/21/2018	ZeroMission	10,530
2016	1/9/2018	COTAP	1,912
2016	11/28/2018	ZeroMission	5,700
2016	12/31/2018	ZeroMission	403
2018 Total			**20,721**
2016	03/31/2019	ZeroMission	600
2016	04/30/2019	ZeroMission	1,500
2012	05/13/2019	COTAP	1,644
2014	12/5/2019	COTAP	573
2016	06/14/2019	WeForest	2,565
2016	08/16/2019	ZeroMission	5,500
2016	3/9/2019	ZeroMission	5,146
2016	09/30/2019	ZeroMission	530
2018	10/31/2019	ZeroMission	10,000
2019 Total			**28,058**
2016	1/13/2020	COTAP	5,299
2016	3/31/2020	ZeroMission	5,000
2016	5/26/2020	Climate Seed	1,000
2019	2/7/2020	ZeroMission	7,001
2012-2016	2/6/2020	Lund Fund	24,000
2012-2016	2/6/2020	Lund Fund	22,000
2012-2016	2/6/2020	Lund Fund	22,000
2017	6/18/2020	C-Level	2,000
2019	6/18/2020	C-Level	2,000
2017	8/7/2020	WeForest	2,475
2018	7/30/2020	ZeroMission	5,313
2019	8/28/2020	ZeroMission	5,738
2018	9/22/2020	ZeroMission	2,565
2019	8/12/2020	ZeroMission	20,000
2020 Total			**126,391**
2017	1/6/2021	Climate Seed	537
2019	3/24/2021	Climate Seed	1,000
2017	4/29/2021	Climate Seed	318
2020	7/14/2021	Climate Seed	8,000
2020	8/26/2021	ZeroMission	20,000

2019	8/27/2021	COTAP	30
2017	8/27/2021	COTAP	2,699
2019	8/27/2021	COTAP	1,000
2020	10/10/2021	Carbon Partnership	3,000
2018	11/01/2021	ZeroMission	20,282
2017	11/01/2021	ZeroMission	19,718
2020	11/19/2021	C-Level	2,000
2021 Total			**78,584**
2016-2021 Total			**295,572**

The ANR activities of the project have been partly co-funded by Belgian reforestation company WeForest, which has sponsored trees and home-based nurseries for the enrichment planting of ANR areas. As such, the project is able to proceed with project activities when carbon sales do not generate sufficient funds to implement the annual work plan.

I6. Marketing

CFI, the original project developer, oversaw marketing during the project implementation phase (2012-2016). Responsibilities have been handed over to the Synjuk Federation, which has assumed marketing responsibilities such as administering the project's Markit account and managing certificate sales. The Synjuk has established agreements with a number of international NGOs to assist in the marketing of carbon offsets. These include ZeroMission (Sweden), COTAP (USA), C-Level (UK), Climate Seed (France), Lund Fund, Ceramica Sant'Agostino (Italy), Anima Impressa, and WeForest (Belgium). The project works closely with these organizations to develop a marketing strategy that engages new corporations that wish to offset their emissions. The project provides their partners with information about achievements in addressing REDD+ and afforestation goals, as well as socio-economic and other environmental objectives.

I7. Technical support

The Synjuk Federation receives continuous technical support through the project's Technical Advisory Committee (TAC). This includes a close working relationship with the Meghalaya State Climate Change Center and their Geographic Information Systems (GIS) team who help monitor changes in forest cover. The project also has close ties with senior professors at the Northeast Hill University (NEHU) in Shillong, the region's top research center. The project receives technical support from the Indian Council of Agricultural Research (ICAR), who help guide the sustainable agriculture strategy and provide training support, as well as other state government line agencies including fisheries, horticulture, animal husbandry, and water resource development. The forestry team and the socio-economic team provide training and technical expertise to Community Facilitators who carry out monitoring activities to track implementation and progress of the project. The Synjuk Federation continually provides training throughout the year to Self-help Groups and Farmers' Clubs to build capacity and human capital on the ground.

Part J: Benefit Sharing

J1. Payments for Environmental Services (PES) agreements

The Synjuk Federation has signed memoranda of understanding (MOUs) with each participating village in the ten different *Hima*. Agreements are based on Natural Resource Management (NRM) plans which each village has prepared at the start of the project. NRMs were prepared from the bottom-up: villages discussed their concerns and felt impacts due to increasing forest degradation and deforestation. Local plans were drawn up which detailed how villages proposed to protect any forest surrounding their villages and restrict access to forest resources in order to make forest resource use more sustainable. Each

participating village has an agreement with the Synjuk including a village map of where forests are located, and which areas will be protected (Annexes 3 & 5). Village agreements to components of PES agreements take place through the Lower Working Committees and the consensus with the *Dorbar.*

These agreements are kept on site at the central office of the Federation and are also available at village level in the local language, Khasi, and were signed after a long consultation process in the pilot phase of the project where each village had the chance to propose an overall NRM plan. Based on successful monitoring and implementation of NRMs, PES funds are disbursed in a number of ways, including cash and in-kind benefits (see J2). The project coordinator ensures that obligations are met through weekly team meetings, monthly meetings with Community Facilitators, good communication and record keeping, and through on the ground monitoring and feedback. Any grievances are shared through the proper channels and dealt with by the village leaders and the Synjuk accordingly.

There is increasing convergence between government schemes and the project in areas where governmental grants exist for sustainable development activities. As such, some projects are co-funded by governmental programmes, although these usually function on the basis of subsidies for materials, livestock, and training, whereas the Synjuk's PES in cash or in-kind are provided as a result of participating in the project.

If villagers wish to make changes to their agreement or are not content with the way PES are managed by the Synjuk Federation, they are encouraged to raise any grievances with their village Headmen and CFs, who will alert the Synjuk Federation. Issues pertaining to PES are discussed at Synjuk meetings where the Federation shall attempt to settle concerns and disputes.

Table J1a: Risks and Associated Mitigation Measures Regarding PES Agreements

Risks	Mitigation Measures
Community members may not fully understand the PES agreement because this is a new concept to them.	The project team provides awareness programmes to villagers and orientation programmes to Community Facilitators to explain the process. The project team involves other active project participants to give their feedback on how the PES works for them.
Community members may lose interest in the project if there is lack of payments to them.	There is constant involvement of the project team with the project participants. Community Facilitators are active members of the community and are involved on the village level to provide support and manage expectations.
Community members may continue with unsustainable forest management activities because they see greater economic value from them than from carbon sales.	There is constant involvement of the project team with the project participants. Community Facilitators are active members of the community and are involved on the village level to provide support and manage expectations. The project team provides awareness on the larger impact of unsustainable forest activities and promotes conservation as a social benefit to the generations to come.
Other development projects are a risk as project participants may see other projects as a joint venture and may not receive payments for them. Other development projects may pull participants away from doing project related activities.	The project brings up other development projects to community members and Community Facilitators so that participants are aware of the differences. The project continues to be directly involved with communities to know if there are any discrepancies.

If carbon sales do not materialise as fully as hoped, the project has included a statement in its agreement that project activities shall still be carried out to the best of their abilities, as it is assumed that participating

in project activities will result in community benefits for the area regardless of cash or in-kind PES disbursement. These overall community benefits are broken down in the following categories (Table J1b). These benefits are discussed with community members through CFs and the LWCs. The LWCs provide proposals for projects and the team reviews them before proceeding or may recommend an alternative activity that better falls in line with the project goals. The benefits are adaptable if the communities provide an alternative they would like to pursue that also is within the project's scope.

Table J1b: Community Benefits

Conservation & Reforestation		LPG Distribution
		Plantation
		Training
		Silviculture
		Site selection
		Capacity building
PES	Socio-economic Enhancement	Vermi-composting
		Temperate fruit trees
		Shade nets
		Livestock
		Mushroom cultivation
		SHGs/Farmers Clubs
		Income Generating Activities
		Training
		LWC
		Community Development Funds
		Special Village Grants
		Rain harvesting
		Solar streetlights
	Assist Communities with Restoration	Fireline
		Tree adoption programme
		Community Facilitators
		Youth Volunteers
		Training
		Forest Conservation Extension Programme
	Improve Environmental Services	Eco-tourism Grants
		Advocacy and networking
		Biodiversity documentation

J2. Payments and benefit sharing

Based on successful project implementation and forest monitoring, PES is disbursed to participants in a number of ways through socio-economic enhancement, restoration activities, and improvement of environmental services. The guidelines for these payments are clearly laid out in the PES agreement (see Annex 3) including the targets and thresholds that are to be met in order for payment to take place. The main methods of PES dispersal are:

J2.1. Grants

- **Community Development Funds:** Apart from forest conservation plans, villages propose village-level activity plans which benefit the whole community, such as building drinking wells and washing ponds. These plans are submitted to Lower Working Committees (LWCs) where plans for clusters of 2-5 villages are consolidated. LWCs then submit village activity plans and proposed budgets to the Synjuk Federation. With all three types of grant applications in this section, if the proposal does not link well with the project goals, it is sent back to the LWC with feedback for revision. All communities that are actively involved in the project should receive funding. Upon approval of village activity plans, funds are transferred into LWC accounts from where cash can be drawn.

Payments are sent in two instalments, with one payment covering the initiation of the activity and the second payment upon proof of completion. If activities require full payment upfront and if the fund provided by the project is not enough, the remainder will come from the village fund. Under special circumstances and if village funds are not available, the situation is discussed with the Synjuk, and an agreement is made to provide the full payment upfront. Community Facilitators (CFs) will monitor the progress of village activities and report to the Synjuk. If work is not completed in a satisfactory manner, payment is withheld.

- **Special Village Grant:** This is a larger grant program, designed to cover the costs of bigger village projects, particularly the improvement of water resources. Dams, check dams, pumps to lift drinking water, and reservoirs were included in the first grant round. The villages that benefit from this grant are chosen annually by participating *Hima* of the Synjuk. This grant program started in 2020 and it will be offered on a rotational basis along with the consensus of the Synjuk and screening of the proposals in order to avoid risks of elite capture.
- **Eco-tourism Infrastructure Program**: The project team is working with communities and the state government to prepare the infrastructure to handle the projected incoming tourist volume. This grant program provides each of the ten *Hima* with funds to establish viewing sites, hiking trails, and restroom facilities, while assisting the Self-help Groups and *Hima* government to generate revenues and employment opportunities. The goal is to create opportunities for tourism while protecting the natural environment and culture of the region. As with the other grants, approval is based on the eco-tourism development plan provided by the *Hima*. Opportunities are available for revision of the grant application if any discrepancies are found by the Synjuk.

J2.2. Self-help Group (SHG) and Farmers' Club benefits

Funds are transferred to village-based SHGs and FCs to support local groups for small-scale income generating projects, such as

- In-kind benefits, such as pigs and chickens to support local piggery and poultry projects
- In-kind benefits, such as mushroom spawn, temperate fruit trees, and materials for agricultural and horticultural activities like shade nets and polyhouses
- Managing and maintaining home-based nurseries (payments are made as purchase for saplings during the planting season)
- Capacity-building in the form of training for bookkeeping, caring for pigs and chickens, mushroom production, and maintaining nurseries

Each SHG or FC must open a bank account to receive funds. The socio-economic monitoring team employed by the Synjuk Federation undertakes monitoring and if the standard of quality or procedure is not met (as indicated in the PES agreement, Annex 3), funds are withheld. CFs and Synjuk staff visit nurseries regularly. SHG and FC members are also encouraged to maintain a database of saplings that are planted.

J2.3. Community benefits

By providing a bottom-up approach that gives each village a voice and a forum to discuss and debate plans, aspirations, and challenges, the project ensures an equitable approach that benefits all villages equally and simultaneously. Capacity building and training benefit participants in the project as well as overall communities to become more involved. Plantation and silviculture help to restore forests and aid in overall ecosystem services. Members that receive LPG stoves are selected by villages in a consultative process. This includes poverty level or number of household members.

Part K: Monitoring

The project has developed a comprehensive monitoring plan based on the requirements of the Plan Vivo Standard (2013). This plan will enable the project to monitor performance (assessed by achievement of annual targets and five-year goals), validate assumptions used for calculating the carbon benefits, and ensure community involvement. Importantly, the monitoring plan also includes monitoring of impact indicators to assess the effectiveness of project activities to mitigate the key drivers of deforestation and forest degradation and of the indicators to assess the socio-economic impacts and environmental impacts of the project. The monitoring plan is summarised in Table K1a: Ecosystems Service Benefit Indicators, Table K2: Socio-economic Monitoring Indicators, and Table K3: Environmental and Biodiversity Monitoring Indicators.

Baselines have been established at the start of the project in 2011 for each set of indicators. Annual monitoring focuses on monitoring the progress of project activities. Impact monitoring occurs every 5 years to verify project effectiveness and revise climate benefit estimations in the technical specifications for the following project period.

Indicators measured and recorded annually (see tables K1a, K2, and K3 in sections below) will be produced in the project's annual reports which are submitted to the Plan Vivo Foundation. Results from five-year indicators are reported and presented to the relevant verification body tasked with auditing the project every 5 years (SCS Global Services). The results of these verification audits are distilled into project verification reports and made available at www.planvivo.org.

K1. Ecosystem services benefits

The project will use three types of climate benefit monitoring:

i) activity-based indicators that will be monitored annually to demonstrate that project activities for ANR and REDD interventions are being carried out as planned

ii) land cover change assessment to verify climate benefits and update the REDD technical specification at the end of each project period, and

iii) biomass inventories in sample plots across ANR areas to verify climate benefits and update the ANR technical specification at the end of each project period.

K1.1. Activity-based indicators

Annually, the activities contributing to REDD will be monitored (see Table K1a). These will indicate that the planned REDD activities have taken place. Community Facilitators from each of the 21 micro-watersheds are responsible for collecting this data and reporting the findings to the monitoring officer. The annual monitoring indicator report provides information on changes in carbon stock in the monitoring plots, the total area burned by forest fire, the length of fire lines created to protect forests, fuelwood consumption, and charcoal making activities. This, in turn, provides an overview of community capacity to limit forest loss and carbon emissions. Annual reporting to the Plan Vivo Foundation includes monitoring results from biomass surveys and photo monitoring for certificate issuance as well as annual activity reports. If targets are partially achieved, mitigation measures and corrective action will be given by the project team in order to reach overall project period goals. Issuance of PVCs will correlate with five-year analysis of satellite imagery and any changes in actual issuances will take place at this time along with the third-party audit.

Table K1a: Ecosystem Service Benefit Indicators

Activity	Activity Indicator (measured annually)	Means of Assessment	Annual Targets

			Full Target Achievement	Partial Target Achievement	Missed Target
Fire control	Length of fire lines constructed by *Hima*	The project team keeps records of km of fireline reported annually by the CF of each *Hima* and is included in the annual report.	> 60 km	40-59 km	< 40 km
Forest restoration	Number of hectares with ANR Advance Closure Treatment	CFs collect data from village members and youth volunteers who record data from the field using GPS units. The results are published in the annual report.	> 50 ha	25-49 ha	< 25 ha
	Number of hectares with ANR Silvicultural Treatment	CFs collect data from village members and youth volunteers who record data from the field using GPS units. The results are published in the annual report.	> 50 ha	25-49 ha	< 25 ha
Fuelwood saving devices	Number of fuelwood saving units installed (LPG, rice cookers, etc.)	Data is collected by the CFs and the project team throughout the year and analysed at year's end for inclusion in the annual report.	> 150 units	75-150 units	<75units
Charcoal making	Number of households who have been involved in charcoal making who are now involved in alternative activities through the project	Data is collected by the CFs and the project team throughout the year and analysed at year's end for inclusion in the annual report.	5%	1-4%	0%

Impact	**Impact Indicator (measured every 5 years)**	**Means of Assessment**		**Baseline (2020)**	**Target (2026)**
Avoided deforestation	Various parameters required for CFREDD methodology (see Table K1b)	Land Cover Assessment		NA	NA
Forest condition	Average C-stock in dense forest monitoring plots	Plot data collected by the forestry team and CFs, entered into database at office, and calculated based on formulas developed by FSI		82.4 tC/ha	90 tC/ha
	Average C-stock in open forest monitoring plots	Plot data collected by the forestry team and CFs, entered into database at office, and calculated based on formulas developed by FSI		29.9 tC/ha	39 tC/ha
Fire damage	Area burnt by wildfires during year	Data is collected by the CFs and youth volunteers through dialogue with community members and visits to any burn sites. It is then reported to the		60.35 ha/yr	Average of <65 ha/year

		project team office throughout the fire season (December through March). MODIS satellite imagery is used to assess fire occurrence in the project area and reference area.			
Fuelwood consumption	Households using fuelwood saving devices (LPG or rice cookers) (number)	Baseline Survey and resurvey by CFs		1.5% of households	At least 60% of household using fuelwood saving devices
	Level of household Fuelwood consumption (kg/day)	Baseline survey and data collected by youth volunteers during the months of November through January when harvesting typically takes place. The data is then analysed by the project team.		8.7 kg/day	Fuelwood use reduced by an average of 50% across all project household

Fire control: The project team collects annual information on the length of the fire lines constructed in each *Hima*. CFs report the length of fire lines constructed or maintained in each village and convey this information to the project office, which analyses it and includes it in the annual report. The community decides where to place fire lines to best protect regenerating and dense forests from damage due to fire.

Forest restoration: These include the number of hectares that the village has placed under "advanced closure" for Assisted Natural Regeneration (ANR); the number of hectares that have received additional silvicultural treatment, such as thinning, weeding, pollarding, and singling.

Clean Energy Program: The project seeks to address the heavy reliance of project communities on fuelwood by reducing consumption and shifting project families to LPG cooktops and rice cookers. This takes pressure off local forests while improving health conditions within the homes by reduced smoke pollution. Currently the percentage of communities maintaining rules on fuelwood collection have not met the mark due to uncontrolled factors such as changes in village administration. The project has pared down the previous program based on feedback form beneficiaries, which had included fuel-efficient stoves and charcoal briquette makers, and now focuses on the distribution of LPG stoves and cylinders and rice cookers. The number of fuelwood saving units distributed is the main indicator to assess the progress and impact of this program. This data indicates the success of the project in meeting its annual goals in distributing more fuel-efficient technologies. Problems and issues in implementing the activities are discussed during team meetings in an effort to adjust the strategy and make the implementation more efficient. The project also does a sample survey to monitor fuelwood consumption. At the end of a five-year period, the impact of these activities should be reflected in the targets described in Table K1a. Charcoal making is another cause of deforestation and monitoring this activity also serves as another method of assessing where livelihood activities should be introduced. The data is used to identify communities with charcoal making and provides a basis for a dialogue with those villages to develop income-generating plans for the coming year. The project seeks to reduce the number of households dependent on charcoal making in the forests and find an alternative income for those families which would put less pressure on the forests.

K1.2. Impact indicators

Forest protection: To verify climate benefits achieved by REDD intervention during a project period and revise estimates of climate benefits expected in subsequent project periods, an assessment of land cover change in the project area and reference region during the project period will be carried out at the end of each project period, by a trained remote sensing and GIS technician. The leakage area approach will be used to verify leakage (see AA-CFREDD Section 3.3.2b; Annex 10). The parameters that will be assessed are described in AA-CFREDD (Annex 10) and summarised in Table K1b. The methods and datasets used will follow those used for the initial land cover change assessment (see Annex 9) and will be reported in a revised version of this PDD.

Table K1b: Land Cover Change Parameters Assessed to Verify Climate Benefits and Update the PDD

Parameter	Approach	Frequency
Area of forest type *i*, legal classification *j* and topography class *k* in the reference region converted to non-forest during the project period ($AA_{Def\,i,j,k}$)	Analysis of remote sensing (RS) data	Every 5 years
Area of forest type *i*, legal classification *j* and topography class *k* present within the reference region at the start of the project period ($AA_{RRi,j,k}$)	Analysis of remote sensing (RS) data	Every 5 years
Area of forest type *i*, legal classification *j* and topography class *k* in the reference region converted to degraded forest during the project period ($AA_{Degi,j,k}$)	Analysis of remote sensing (RS) data	Every 5 years
Area of forest type *i*, legal classification *j* and topography class *k* within the project area that was deforested during the project period ($D_{PAi,j,k}$)	Analysis of remote sensing (RS) data	Every 5 years
Area of forest type *i*, legal classification *j* and topography class *k* within the project area that was degraded during the project period ($G_{PAi,j,k}$)	Analysis of remote sensing (RS) data	Every 5 years
Area of forest type *i*, legal classification *j* and topography class *k* within the leakage area that was deforested during the project period ($D_{LAi,j,k}$)	Analysis of remote sensing (RS) data	Every 5 years
Area of forest type *i*, legal classification *j* and topography class *k* within the leakage area that was degraded during the project period ($G_{LAi,j,k}$)	Analysis of remote sensing (RS) data	Every 5 years
Area of forest type *i*, legal classification *j* and topography class *k* present in the leakage area at the start of the project period ($A_{LAi,j,k}$)	Analysis of remote sensing (RS) data	Every 5 years
Carbon density of forest type *i* (see Table G4j)	Biomass survey	Every 5 years

Above-ground biomass (tC/ha) in Open Forest, Dense Forest and shrub biomass in Scrubland is captured in biomass surveys across 62 dense forest plots (0.1 ha), 52 open forest plots (0.1 ha), and 20 scrubland plots (0.1 ha). The surveys (inventories) are conducted in late November of under the leadership of the forestry technical team. In the first two implementation periods, the biomass survey was completed annually. For the third implementation period, each plot will be re-measured once every five years. For efficiency, one fifth of the plots will be remeasured each year to ensure that all plots are revisited one in five years. The Community Facilitators (CFs) and youth volunteers collect the data with community members from the respective area under the supervision of the senior forestry specialist. Each local data collection team submits their findings to the senior forestry specialist who analyses the information and creates summary tables for inclusion in the annual report. The plot locations are marked with paint and identified using GPS coordinates. Resources required for monitoring include a forestry professional guide, the Community Facilitator team that works for the Federation, and members of the LWC who are trained in forest inventory techniques. Equipment includes plot and tree measuring tapes, clipboards and data collection forms, cameras, GPS units, plot lines, and paint. The data will be analysed by the Federation and the project's REDD Technical Support Unit (RTSU) using an EXCEL and ACCESS database system.

Forest restoration: To verify climate benefits generated through the ANR intervention, biomass surveys are carried out annually in the ANR areas. Thirty-two ANR plots were established for monitoring purposes to assess changes in carbon stock in areas that are being protected by the community through social fencing. The project also reports on any additional degraded forests that have been placed under "advanced closure" by communities and the area receiving silvicultural forest restoration treatment. Every five years,

ANR areas will also be monitored using satellite image analysis as for REDD+ areas. To detect forest regeneration or a lack of change in ANR areas, the perimeters of ANR areas are marked on maps and satellite images using GPS data.

Fire control: Avoiding emissions from deforestation and forest degradation includes reducing the impact of forest fire through community-based fire control activities. The data is analysed at the end of each calendar year and included in the annual report. Where fires have occurred, community meetings are held to discuss the causes, the effectiveness of fire control activities, and future measures that can be taken to better control incidences of fire. In addition, the project team requests the assistance of the Meghalaya State Climate Change Center to analyse MODIS satellite imagery to assess the location and frequency of fire events in the project area, as well as in the larger East Khasi Hills District. This data helps distinguish the impact of the fire control activities in the project area in comparison to neighbouring forests outside the project area. This exercise is done every five years as part of the verification process and to assess the effectiveness and impact of the fire control program.

K2. Socio-economic impacts

K2.1. Livelihood activities

Improving the Capacity of Community Institutions: The sustainability of the project is determined by the capacity of the participating villages and their institutions to continue implementation into the future. The project has multiple strategies to build this capacity and monitors impact by collecting information on the number of functioning Self-help Groups and Farmer's Clubs., the number of Lower Working Committee (LWC) meetings held each year, and the number of training exercises conducted for community groups.

Awareness Raising: The project will annually monitor the number of awareness raising activities which should lead to broad-based knowledge of the project and the Federation among participating households. Knowledge of the project should reach 90% of all families by 2026. A Village Knowledge Register (VKR) is developed for each participating community. This database is managed by the project team and updated on an ongoing basis to provide information regarding community leadership, institutions, assets, problems, and goals. It is reviewed by project staff visiting the village to provide them with helpful data on the community. The Community Facilitator (CF), youth volunteers, village leaders, and community members collect the data.

Benefit Sharing: Each year the project distributes revenues from carbon offset sales to the participating villages through the Community Development Fund (CDF) program. The size of the grants depends on the volume of carbon sold and typically range from $200 to $400 per village. Program monitoring indicators include number of grants made, funds transferred to each village, type of activity undertaken by the community, and outcome of the funding.

Improved Livelihoods for Low Income Families: Approximately 70% of households in the project area are below the national poverty line. Raising income levels is an important goal of the project and a number of activities are monitored under this strategy. These include the number of families that have benefited through participation in income generating programs, such as the piggery and poultry project and the Farmers' Clubs. Other indicators include the number of pigs, poultry, fruit trees, and poly-houses distributed to low income families.

K2.2. Socio-economic monitoring plan

The monitoring plan includes socio-economic monitoring to ensure that the project is delivering benefits to participants that enhance their livelihoods and quality of life in accordance with the Plan Vivo Standard.

The project seeks to distribute benefits and share them with communities through the provision of annual Community Development Funds (CDF) to each participating village. The village members decide what project they wish to implement and submit proposals to the Federation for funding. Each year, the Federation compiles a report on the type of project, amount spent, and impact of the activity. The Federation also assesses how many community families benefited directly from the project. In addition, the project seeks to build the capacity of community institutions including the LWCs, SHGs, and FCs. Trainings are held by the Federation to build awareness regarding forest conservation and management, bookkeeping, technical skills in agriculture, animal husbandry, and other income generating activities. The number and results of the trainings are reported each year as an annual indicator (see Table K2). If the annual targets are not met, the project team will provide mitigation measures to work with project communities to reach overall project period goals. Issuance of PVCs will be based on satellite imagery analysis as well as third party audits.

Table K2: Socio-economic Monitoring Indicators

Activity	Activity Indicator (measured annually)	Means of Assessment	Annual Targets		
			Full Target Achievement	Partial Target Achievement	Missed Target
Benefit sharing and participation	Number of villages with Community Development Funds (CDFs)	The data is collected by the CFs from the village leaders and members to gain their input and is analysed by the project team to identify any problems and implications for the coming year's grant program. The findings are included in the annual report.	> 70 villages	40-69 villages	< 40 villages
	Number of families accessing CDFs	The data is collected by the CFs from the village leaders and members to gain their input and is analysed by the project team to identify any problems and implications for the coming year's grant program. The findings are included in the annual report.	> 2000 households	1500-1999 households	< 1500 households
Institutional capacity	Number of training programs	This data is collected by the project team through the year and is analysed at year's end by the team to determine if capacity is improving. The quantitative data is supplemented by case studies and in-depth interviews. The data is reported in the annual	> 10 programs	6-9 programs	< 6 programs

		report to Plan Vivo and other stakeholder institutions.			
	Percentage of participants who take up an activity after receiving training (within 1 year)	This data is collected by the CFs and project team throughout the year and is analysed at the year's end by the team to determine if the training is beneficial. The data is reported in the annual report to Plan Vivo.	> 50%	20-50%	<20%
	Number of families participating in Income Generating Activities	Data is collected by CFs from village leaders and members and is analysed by the project team. The findings are included in the annual report.	> 200 families	100-200 families	< 100 families
Impact	**Impact Indicator (measured every 5 years)**	**Means of Assessment**		**Baseline (2020)**	**Target (2026)**
Knowledge and awareness	Knowledge of the Federation and project	Baseline survey and resurvey conducted by the CFs and team members.		75% of households	85% of all households with knowledge of the Federation and project activities.
Livelihoods benefits	% of all project households receiving benefits from Community Development Funds	Baseline survey and resurvey conducted by the CFs and team members.		75% of households	80% of households receiving benefits from Community Development Funds
	% of households with livelihoods activities reflecting conservation of forests and natural resources	Baseline survey and resurvey conducted by the CFs and team members.		30% of households	50% of all households with expansion of livelihood activities that also reflect conservation of forests and natural resources

K3. Environmental and biodiversity impacts

The project seeks to monitor the effects of the forestry and social activities on the forest habitat by assessing the biodiversity of the project area. Table K3 presents annual indicators to be used to assess project impact on environmental and biodiversity indicators. The project is working with local governments (*Hima* and *Durbar*) to encourage a reduction in size of the areas under open pit mining operations. The project will monitor the total area currently being mined in each village to assess how this environmental awareness program is progressing. Finally, the project team will collect data on the observation of key indicator species that are threatened or endangered. Siting data gathered by youth volunteers, Community Facilitators, and through the use of camera traps will be analysed at the end of each year and included in the annual report to Plan Vivo. If the annual targets are not met, the project team will provide mitigation measures to work with project communities to reach overall project period goals. Issuance of PVCs will be based on satellite imagery analysis as well as third party audits.

Landscape Management: This program seeks to reduce the number of operating quarries in the project area due to their negative impacts on the environment. The project monitors the number of operating quarries by collecting data from each village. The project shares the data with the *Hima* leadership and village councils, and it encourages them to not lease community lands to private quarrying operators. Five-year targets for the reduction in operational quarries and their expansion are described in Table K3 below.

Biodiversity Monitoring: The program monitors the siting of key indicator species of birds, mammals, amphibians, and reptiles. Any decrease or increase in the presence of key species is reported, as are incidence of illegal hunting. The five-year target (2026) is for a 50% increase in the observation of endangered mammal species.

Table K3: Environmental and Biodiversity Impact Indicators

Activity	Activity Indicator (measured annually)	Means of Assessment	Annual Targets		
			Full Target Achievement	Partial Target Achievement	Missed Target
Biodiversity	Number of biodiversity surveys conducted by CFs and youth volunteers	The CFs and youth volunteers record any observations on biodiversity record sheets. Information recorded includes the name of the species observed, time and place, GPS location, evidence of its presence (scat, fur, animal or bird, call, etc.), and the condition of the location. The record is presented and reviewed by the project team at the end of the year.	> 2 surveys	1 survey	0 surveys
Quarrying	Number of reports and lobby advocacy meetings or reports held	The data is collected by the CF and reported to the project team which analyses the data and	2 reports or lobbying meetings	1 report or lobbying meetings	0 reports or lobbying meetings

		includes it in the annual report and shares it with the *Hima* leadership and village councils.			
Impact	**Impact Indicator (measured every 5 years)**	**Means of assessment**		**Baseline (2020)**	**Target (2026)**
Biodiversity	Number of observations of endangered mammal species	Records from surveys conducted by youth volunteers		37 No. of observations during 2020	50% increase over baseline
Quarrying	% of villages with active quarrying	Baseline assessment and resurvey		15% of villages with active quarrying	< 12% of villages with active quarrying

K4. Other monitoring

A number of monitoring indicators are collected and reported annually in the Plan Vivo Annual Report.

Restoration: Community Facilitators (CFs) from collect data from the village members, nursery managers, and youth volunteers on the number of active nurseries providing supplemental saplings; the number of saplings planted; and the number of planted saplings surviving. The final results are tabulated by the office staff at the end of the year and published in the annual report.

Village Oversight: Each participating village develops their own NRM plan. The impact of this planning process is to create sustainable use rules and regulations. Hunting and poaching rules are currently present in 90% of the villages as of 2021 and the project seeks to ensure that 100% of the communities have rules governing fuelwood collection and hunting by 2026.

Conflict Resolution: The CFs monitor any conflict arising among project participants related to the implementation of all project activities. If conflicts occur, the CF records that name of individuals involved, nature of the dispute, time, and place on the conflict monitoring form and reports this to the project team at the monthly CF meeting. The team is responsible for following up on the dispute and attempting to resolve it. Results are also reported on the form which is summarized in the annual report.

Clean Drinking Water: This program is supported through the Community Development Funds (CDFs) and seeks to improve the availability of clean drinking water. The annual indicators include the number of communities that improved their drinking water source and periodic sample surveys of drinking water quality to check for coliform contamination. The project has met its goal to ensure that at least 75% of villages in the project area have clean drinking water by 2021. In the next phase, the project seeks to continue to improve drinking water conditions by planting trees where it is feasible to reduce erosion, filter runoff, and absorb more water into the soil. Additional monitoring of nearby waterbodies will assess the impact of tree plantation.

Risk Mitigation: The project oversees monitoring any risks that may take place in the project area (see Section F). The project aims to apply mitigation measures to avoid negative impacts, however, if they do occur the project evaluates and makes changes accordingly to activities. For example, some alternative

livelihood programmes take time for the beneficiaries to learn new techniques and to earn income. The project helps provide the right tools necessary to make the transition as smooth as possible.

Table K4: Other Monitoring

Activity	Monitoring Indicator	Data Collection
Restoration	Number of saplings per nursery, number of saplings planted, and percentage of saplings surviving	CFs and youth volunteers collect information which is passed on to the project team and presented in the annual report.
NRM plans containing conservation rules	Number of villages having NRM plans which include rules on fuelwood collection and hunting	LWC work with villages to create plans. CFs report back to the project team on the plans that have been implemented and the information is provided in the annual report.
Conflict resolution	Percentage of cases that have been resolved.	The CFs record any conflict that occurs regarding the project, communities, and participants. The case is reported to the team at the monthly CF meeting and the team is responsible for following up and resolving the issue.
Clean drinking water	Number of CDF used for drinking water projects	The proposals and monitoring of CDF projects inform the project team of any work completed on improving drinking water systems in the communities.
Risk Mitigation	Percentage of cases that have been resolved.	CFs monitor any negative impacts and work with the project staff to resolve the issues.

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Annexes

Annex 1. List of key people involved

Advisory Board to the Synjuk Federation

Dr. Kathryn Smith-Hanssen	Former Administrative Director, CFI, California USA ksmithhanssen@gmail.com
Dr. Mark Poffenberger	Former Executive Director CFI, California USA mpoffen2@gmail.com
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Dr. Subhash Ashutosh	Co-Chair and Director, Center of Excellence, Natural Resource Management and Sustainable Livelihoods. Shillong. sashutosh30@yahoo.com
Mr. Tambor Lyngdoh	CCF. KSKHAWUMWS, Mawphlang. tamborlyngdoh70@gmail.com

Technical Advisory Committee

Mr. Felix Pde	Forestry Team Leader, KSKHAWUMWS, Mawphlang felixpdefelix@gmail.com
Ms. Rebecca Stedham	Natural Resource Management Specialist, The Landscapes and Livelihoods Group LLP, Devon UK becky@landscapesandlivelihoods.com
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Ms. Norita Sohlang	GIS Specialist, Shillong noritasohlang@gmail.com
Mr. Shanme Marbaniang	Subject Matter Specialist, Krishi Vigyan Kendra, Department of Agriculture and Farmer's Welfare, Gov't of Meghalaya seanmay.or.b@gmail.com
Shri. V.K. Mishra	Director ICAR, NEH, Umiam Ri-Bhoi District vkmishra_63@yahoo.com
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Dr. Sanggai Leima	(Phd) Assistant Professor, SIRD, Shillong sanggai@gmail.com
Smti. Anu James	DFO, Khasi Hills Division, Wildlife dfowildlifedivisionshillong@gmail.com
Mr. W.S. Manner	CCF, Social Forestry & Environment, Gov't of Meghalaya wsmanner@gmail.com

Annex 2. Information about funding sources

Sl.No.	Particulars	Year
1	Caring Friends	2015-2017
2	Tambourine Trust	2017-2018
3	We forest	2014-present
4	Eco Treezing/UjakkarTrust	2017
5	Himalaya Wellness Co.	2019-present

Annex 3. Producer/group agreement template

COMMUNITY RESOLUTION ON CONSERVATION AND PROTECTION OF FORESTS

We the residents of Village_____of Hima _____

East Khasi Hills District, after fully understanding the clauses of "Ka Synjuk Ki Hima Arliang Wah Umiam Mawphlang Welfare Society" together with Awareness Programmes conducted by ResourcePersons on the need to protect and conserve the forests within the Umiam Mawphlang Sub- watershed and the urgent need to take appropriate actions by the Hima lying on both sides of theUmiam River, Mawphlang, to put an immediate stop to degradation of forests brought about by fire,rampant felling, over-grazing, etc. As a Village, with the Federation, we undertake this Resolution to accept and undertake mitigation measures as per the REDD+ Project to preserve and protect the forests and environment and to take measures to improve the income and standard of living ofthe community by taking action to prepare a Management Plan to that effect. We also seek assistance from the Government and other Agencies to help us protect and conserve our forests and surrounding environment.

Signed on behalf of_____Village

Signature of Headman/Sordar/Matabor: _____

Print Name of Headman/Sordar/Matabor: _____

Executive Members:

Sl. No.	Name & Designation	Signature
1.		
2.		
3.		
4.		
5.		

3.1 PES Agreement Template

MEMORANDUM OF UNDERSTANDING
PES AGREEMENT

This Memorandum of Understanding (**MOU**) and Payment for Ecosystem Services (**PES**) Agreement is executed on this 1st January 2022 by and between:

KA SYNJUK KI HIMA ARLIANG WAH UMIAM MAWPHLANG WELFARE SOCIETY, (SYNJUK) a charitable society established in the year 2011 Registration Number E.16/5/of 2010/274, having its registered office at Mawphlang, P.O. Mawphlang, East Khasi Hills District, Meghalaya, 793121. (India) (hereinafter referred to as **"SYNJUK"**)
AND
Village Councils of the Umiam Sub-Watershed in the East Khasi Hills Districts of Meghalaya (hereinafter referred to as **VC Durbar**).
SYNJUK and shall hereinafter be individually referred to as a "**Party**" and collectively as "**Parties**".

Preamble

This document lays out the terms of mutual commitment between the Synjuk that coordinates the Khasi Hills Community REDD+ Project and the participating Village Councils (VC) located in the Umiam Sub-watershed of the East Khasi Hills District who agree as follow:

1. Introduction

1.1 The Khasi Hills Community REDD+ Project which is funded through carbon offset payments is testing the application of REDD+ in the context of community forests in Northeast India. This MoU describes the roles and responsibilities of the Synjuk and the Village Councils who are responsible for coordinating and implementing project activities in the 86-participating villages in the East Khasi Hills District and the terms and conditions governing the generation of benefits from forest protection, eco-restoration, and related management activities.

1.2 Ecosystem services arise from the processes by which the environment produces resources needed by humans, such as clean air, water, food and materials. For the purposes of this MoU, ecosystem services are those services arising from forest protection and related management activities. The provision of the ecosystem services is indicated by the health of village forests and their active management and protection by the village which is monitored by the community and the project team.

1.3 The Khasi Hills Community REDD+ Project is intended to facilitate community forest protection and management efforts by strengthening community institutions that sustainably manage the forest area and livelihood activities, promoting community-wide benefits, and improving the well-being of the most disadvantaged sections of the community. In support of this intention, the local communities in 86 villages shall be considered beneficiaries of this MoU/PES agreement, and Synjuk and Village Councils shall enter into a benefit-sharing PES agreement governing the management and distribution of benefits received under this MoU/PES agreement upon consensus. Benefits shall take the form of an improved natural environment, Community Development Funds to finance natural resource management, public health facilities, and livelihood activities implemented by village based Self Help Groups and Farmer's Clubs.

2. Roles and obligations of the parties

2.1 The Synjuk shall serve as the Coordinator of the Khasi Hills Community REDD+ Project. As the Coordinator, the Synjuk is responsible for planning and coordinating forest and socio-economic monitoring, making Payments for Ecosystem Services (PES), funding livelihood activities, producing and submitting reports to the Plan Vivo Foundation, undertaking corrective actions as needed during the course of the MoU and any negotiated extension and overseeing the negotiation and implementation of the MoU/PES Agreement. Specifically, the Synjuk shall:

a. Plan and coordinate forest monitoring
b. Support village level facilitators including men, women and youth volunteers
c. Conduct periodic socio-economic assessment
d. Manage Community Development Funds to the Village Council in annual instalments and in accordance with forest monitoring results in relation to the targets and thresholds described in Annex B
e. Produce and submit annual monitoring reports
f. In the event that Community Development Funds are withheld based on annual forest monitoring results outlined in Annex B, negotiate for corrective actions and a MoU extension with the Village Council; and
g. Oversee the negotiation and implementation of the Village Council agreement.

2.2 The Village Council shall serve as the Implementer of the Community REDD+ Project on village lands. As the Implementer, the Village Council is responsible for the generation of ecosystem services from the village forest and negotiation and implementation of the terms of the forest management plan and Community Development Fund activities. Specifically, the Village Council shall:

a. Prepare and implement a Forest and Resource Management Plan and map with the assistance of the project team and Local Working Committee
b. Allocate degraded open forest land as mutually agreed upon for assisted natural regeneration
c. Manage activities to protect the village forest are and thereby generate ecosystem services including protecting dense forests from fire and unauthorized utilization
d. Negotiate the terms of a Community Development Fund with Synjuk, including setting standards of performance for forest patrolling and monitoring groups and all other activities
e. Implement and manage the Community Development Fund
f. Oversee implementation of any corrective actions and negotiate with the Synjuk for a MoU extension.

3. Monitoring and payment system

3.1 Monitoring. Forest monitoring activities and methods are described in Annex B. A simple set of forest monitoring indicators will be used and monitoring observations will concentrate on these aspects:

a. Existence and use of Forest and Resource Management Plan and map
b. Prevention and/or control of forest fire
c. Maintenance of fire line
d. Protection of dense forest
e. Successful Assisted Natural Regeneration (ANR) of degraded forest

The forest monitoring and PES corresponds with the forest management guidelines in the Technical Specifications. The system shows the monitoring indicators, performance targets and thresholds, and corresponding payments that apply under this MoU/PES Agreement.

3.2 PES will be linked to forest monitoring results in relation to the targets and thresholds described in Annex B. Payments will only be made if monitoring responsibilities and, where applicable, corrective actions are carried out by the parties to this MoU/PES Agreement. Payment amounts will vary and are based on carbon market value.

4. Use of Payments

4.1 A percentage of the total amount of money made available through the Payment for Ecosystem Services (PES) under this MoU will be used for implementation village forest management plans. The balance will be used by the village for forest monitoring targets (see Annex B).

4.2 Village Forest management plans consist of activities such as (1) forest protection, (2) forest restoration, (3) supporting economic livelihoods, such as developing horticulture, poly-houses, and microfinance, (4)

institutional strengthening including village council, LWC, Farmer's Clubs, and Self-Help Groups, (5) improving capacity building of local people, and (6) development of eco-tourism programmes.

5. Corrective action

5.1 In the event that corrective action is required during the term of this MoU, the Synjuk and the Village Council shall reach agreement on the corrective actions necessary, a schedule for the corrective action, and an extension of this MoU.

5.2 In the event that the Synjuk and the Village Council are in dispute or unable to agree on corrective actions, the respective *Hima* (Indigenous government) will act as a third-party arbitrator, approved by both parties, and will be appointed to oversee dispute resolution.

5.3 The Village Council shall pay the costs of monitoring any corrective actions under any MoU extension out of the money remaining in their PES/Community Development Fund under this MoU.

6. Dispute Resolution – Grievance Mechanism

Should a dispute arise between the Village Council and/or village members and Synjuk, the project's Community Facilitator is responsible for receiving and documenting all grievances and reporting them to the Synjuk office for prompt resolution during the team meeting. Should the Synjuk fail to resolve the dispute it will be referred to the responsible local government (*Hima*) for resolution by a third party.

7. MoU term

This MoU shall remain in force through 31st December 2026 from the date of signing, unless either party decides to void the agreement. The PES term is 5 years.

The parties agree to the terms and conditions contained in this MoU/PES Agreement and all Annexes.

8. Indemnity

The Village Council (*Durbar*) shall indemnify and hold Synjuk harmless against all claims, demands, causes of action, liabilities, losses, damages, costs and expenses awarded against or incurred or paid by Synjuk arising directly and/or indirectly from a breach of this MoU/PES Agreement.

9. Amendment

No amendment to this MoU/PES Agreement shall be valid unless agreed to in writing by the Parties.

Mawphlang Welfare Society (Synjuk)	Village Council (Durbar)
Name: _____	Name:_____
Signature: _____	Signature: _____
Date:_____	Date:_____

Annex A: MoU Details and Performance Targets

This MoU between the Synjuk and the Village Council (*Durbar*) establishes a partnership whereby the Village Council will ensure the forest management plan jointly developed will be implemented as agreed meeting targets stated in the table below. The Forest and Resource Management Plan and Map provide the basis for this MoU (see Annex D).

Performance Targets:

Village Name:		
Contact Person:		
Protected Dense Forest Area		**Ha.**
Open Forest Area Under ANR	**WeForest Supported**	**Ha.**
	PV Supported	**Ha.**
Fire Line Length		**Km.**
SHGs in Village		**SHGs**
Farmer's Clubs		**FC**
Number of Participating Households		**HH**
Percentage Below Poverty Line		**%**

In return for achieving forest protection and restoration goals outlined in the Plan, the Synjuk will support one male and one female village youth volunteers, one male and one female Community Facilitator, and Assistant Community Facilitator, as well as village Self-Help Groups and Farmer's Clubs. Support will take the form of material goods including: fruit tree saplings, poultry, poly-houses, LPG cooktops, and other benefits as available. In addition, the village will be provided PES in the form of Community Development Fund (CDF) at the end of each year for fulfilling its MoU and achievement awards when appropriate. The community agrees that these benefits will be subject to availability based on the performance of carbon offset sales. The Village Council is responsible for maintaining an agreed upon length of fire line as stated in the resource management plan, protect the dense forest, and restore the targeted degraded open forest. In addition, the Village Council is required to provide support for local Self-Help Groups and Farmer's Clubs and carry out all monitoring activities listed under the resource management plan. The community will be responsible for assisting the project team during the annual forest plot inventory conducted during November and December, as well as other surveys of firewood use, biodiversity assessment, and socio-economic data collection. The community will also be responsible for the protection of dense forests, with special attention to high biodiversity areas, springs and waterways. The community will support the restoration of mutually agreed upon degraded open forests. The community will also sustainably manage their fuelwood production forests by regulating use and rotating collection blocks.

Annex B: Forest monitoring activities and methods

1. Annual monitoring of forest cover will be used to determine the impact of project interventions on the location and extent of deforestation and forest degradation.
2. Deforestation is measured by the area impacted as follows:

Activity	Activity Indicator (measured annually)	Means of Assessment	Annual Targets		
			Full Target Achievement	Partial Target Achievement	Missed Target
Fire control	Length of fire lines constructed by *Hima*	The project team keeps records of km of fireline reported annually by the CF of each *Hima* and is included in the annual report.	> 60 km	40-59 km	< 40 km
Forest restoration	Number of hectares with ANR Advance Closure Treatment	CFs collect data from village members and youth volunteers who record data from the field using GPS units. The results are published in the annual report.	> 50 ha	25-49 ha	< 25 ha
	Number of hectares with ANR Silvicultural Treatment	CFs collect data from village members and youth volunteers who record data from the field using GPS units. The results are published in the annual report.	> 50 ha	25-49 ha	< 25 ha
Fuelwood saving devices	Number of fuelwood saving units installed (LPG, rice cookers, etc.)	Data is collected by the CFs and the project team throughout the year and analysed at year's end for inclusion in the annual report.	> 150 units	75-150 units	<75units
Charcoal making	Number of households who have been involved in charcoal making who are now involved in alternative activities through the project	Data is collected by the CFs and the project team throughout the year and analysed at year's end for inclusion in the annual report.	>5%	1-4%	0%
Impact	**Impact Indicator (measured every 5 years)**	**Means of Assessment**		**Baseline (2020)**	**Target (2026)**
Avoided deforestation	Various parameters required for CFREDD methodology (see Table K1b)	Land Cover Assessment		NA	NA
Forest condition	Average C-stock in dense forest monitoring plots	Plot data collected by the forestry team and CFs, entered into database at office, and calculated based on formulas developed by FSI		82.4 tC/ha	90 tC/ha
	Average C-stock in	Plot data collected by the		29.9 tC/ha	39 tC/ha

	open forest monitoring plots	forestry team and CFs, entered into database at office, and calculated based on formulas developed by FSI			
Fire damage	Area burnt by wildfires during year	Data is collected by the CFs and youth volunteers through dialogue with community members and visits to any burn sites. It is then reported to the project team office throughout the fire season (December through March). MODIS satellite imagery is used to assess fire occurrence in the project area and reference area.		60.35 ha/yr	Average of <65 ha/year
Fuelwood consumption	Households using fuelwood saving devices (LPG or rice cookers) (number)	Baseline Survey and resurvey by CFs		1.5% of households	At least 60% of household using fuelwood saving devices
	Level of household Fuelwood consumption (kg/day)	Baseline survey and data collected by youth volunteers during the months of November through January when harvesting typically takes place. The data is then analysed by the project team.		8.7 kg/day	Fuelwood use reduced by an average of 50% across all project household

3. Annual community monitoring will take place at the end of each calendar year. Communities achieving Green Level will work with the team to develop a proposed use for their Community Development Fund which will be made in the first quarter of the following year. Those with missed monitoring results of Yellow Level or Red Level will work with the team to implement corrective actions to reach the full target and to develop a proposed use for Community Development Fund.

Annex C: Estimates of Ecosystems Services and Risk Buffer

Year	Net REDD+ benefit* (tCO_2)	Net ANR benefit** (tCO_2)	Overall project benefit (tCO_2)	20% Buffer (tCO_2)	Net Total (minus buffer) (tCO_2)
2022	71,000	5,047	76,047	15,209.4	60,837.6
2023	71,000	5,047	76,047	15,209.4	60,837.6
2024	71,000	5,047	76,047	15,209.4	60,837.6
2025	71,000	5,047	76,047	15,209.4	60,837.6
2026	71,000	5,047	76,047	15,209.4	60,837.6
Total	**355,000**	**25,235**	**380,235**	**76,047**	**304,188**
***deducts estimated emissions from leakage (at 5%) and considers project effectiveness (at 77%)** ****deducts estimated emissions from leakage (at 5%)**					

Annex D: Community Forest and Resource Management Map

***For the purpose of this PDD, see Annex 5 for an example**

Annex 4. Database template

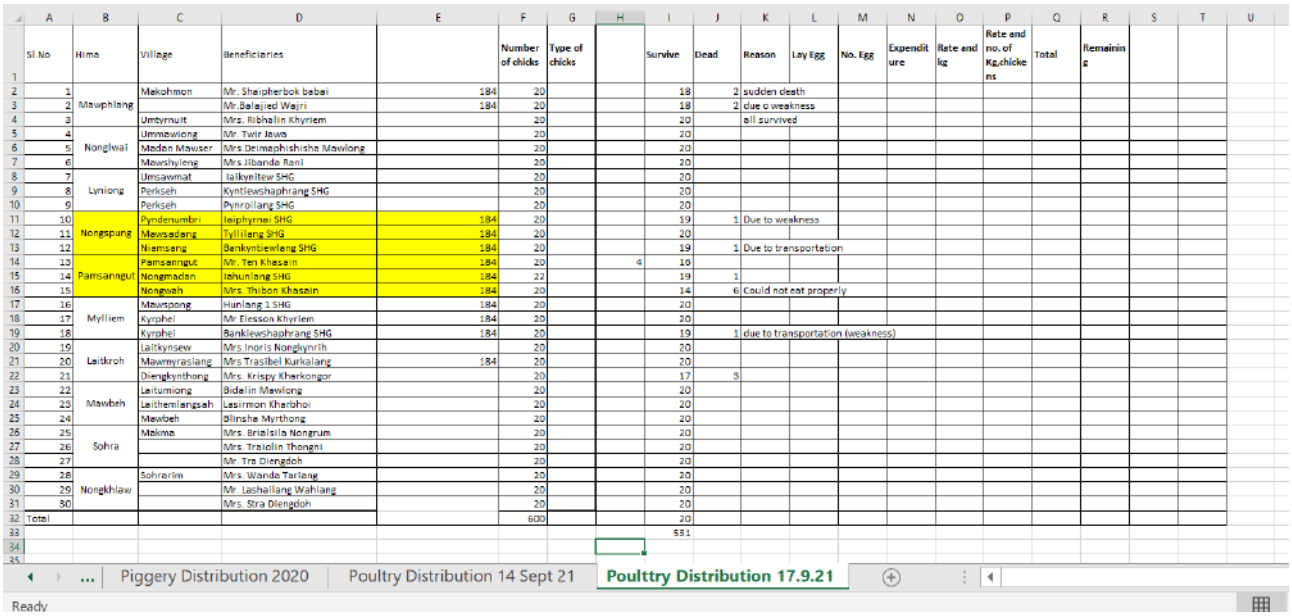
4.1 Example of Fuelwood Monitoring

Name/ Month	18A/ 18B	Energy Consumption	Uses	Fuelwood Consumed Per Day			
Tikisila khongwar/ December. Kyiem	5/1	500kg	Tiew umsum	Day 1- 25kg	Day 2- 151/2kg	Day 3- 6kg	Day 4- nil
Tiikisila khongwar/ January	5/1	500kg	Tiew umsum	Day 1 - 25kg	Day 2- 15kg	Day 3- 8kg	Day 4- nil
Tikisila khongwar/ February	5/1	500kg	Tiewumsum	Day 1- 24kg	Day 2- 15kg	Day 3- 8kg	Day 4- nil
Tikisila khongwar/ March	5/1	500kg	Tiewumsum	Day 1- 22kg	Day 2- 141/2kg	Day 3- 8kg	Day 4- nil
Badashisha Lyngdoh/ December Ramklang	3/1	400kg	Tiewumsum	Day 1- 20kg	Day 2- 10kg	Day 3-5 1/2kg	Day 4- nil
Badashisha Lyngdoh/ January	3/1	400kg	Tiewumsum	Day 1- 29kg	Day 2- 13kg	Day 3- 6kg	Day 4- nil
Badashisha Lyngdoh/ February	3/1	400kg	Tiewumsum	Day 1- 20kg	Day 2- 15kg	Day 3- 6kg	Day 4- nil
Badashisha Lyngdoh/ March	3/1	400kg	Tiewumsum	Day 1- 20kg	Day 2- 14kg	Day 3- 7kg	Day 4- nil
Sottilia kharshohnoh/ December Sunei	2/1	600kg	Cooking all	Day 1- 20kg	Day 2- 14kg	Day 3-7 1/2kg	Day 4- nil
Sottilia k.shohnoh/ January	2/1	600kg	Cooking all	Day 1- 20kg	Day 2- 12kg	Day 3- 7kg	Day 4- nil

4.2 Example of Charcoal Monitoring

Sohra		
	Laitlyngdop.	Mawkma
Date	15-09-2020	05-09-2020
Total number of houses depending on Charcoal burning	25	25
	Old: 22	18
	New :3	5
Reason for engaging in this job	To provide the family.	To provide the family.
Type of forest	Private forest on Rent.	Private forest on rent
How many sacks do you produce in a year	150	1 acre
How many Kgs per Sack?	25	26
At what rate do you sell each Sack?	450	
Which month do you burn charcoal most?	July- August	July- August
Which season do you produce the maximum and how much?	Winter/ 5 sacks per week.	Winter/ 6 Sacks per week.
What other jobs does the family members engaged in?	Daily Wages	Daily Wage
Are there other jobs other than burning of Charcoal?	Rearing of animals	No
How long does the forest will grow back after cutting the trees?	25	25
Do you think burning of charcoal depletes the forest cover?	Yes it does but I don't have any other jobs that we can do to provide for the family.	

4.3 Example of Poultry Distribution and Monitoring

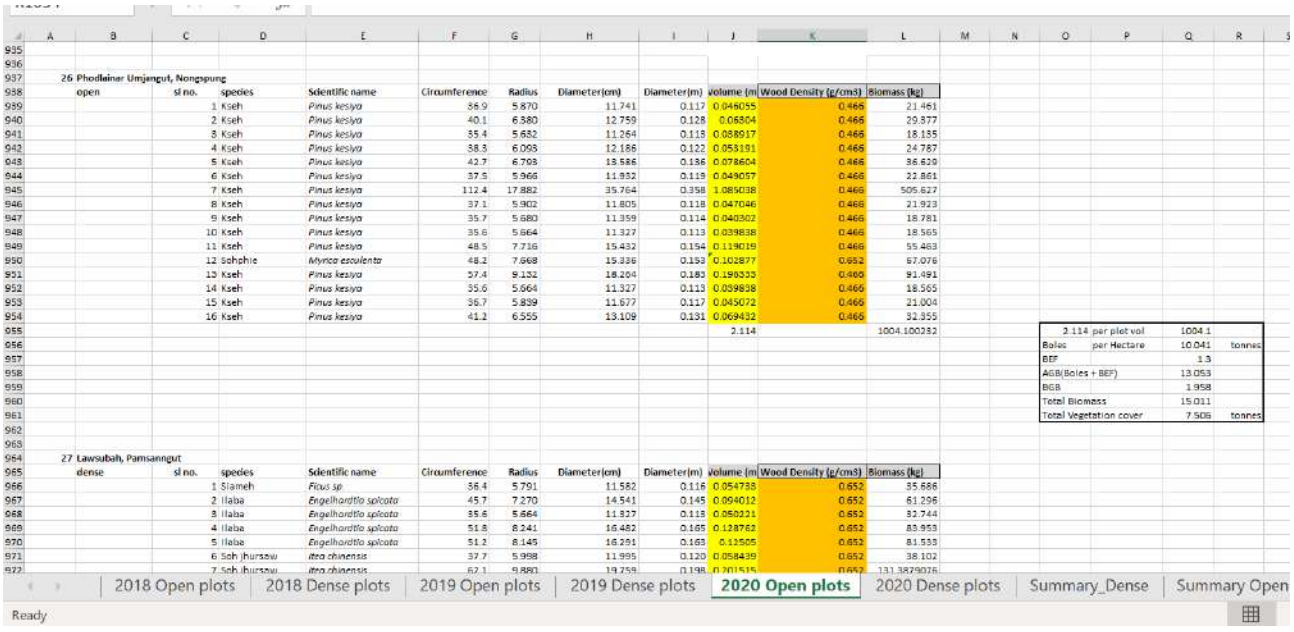


Sl.No	Hima	Village	Beneficiaries		Number of chicks	Type of chicks		Survive	Dead	Reason	Lay Egg	No. Egg	Expenditure	Rate and kg	Rate and no. of Kg.chickens	Total	Remaining
1		Makohmon	Mr. Shaipherbok babai	184	20			18	2	sudden death							
2	Mawphlang		Mr.Balajied Wajri	184	20			18	2	due o weakness							
3		Umtyrnuit	Mrs. Ribhalin Khyriem		20			20		all survived							
4		Ummawiong	Mr. Twir Jawa		20			20									
5	Nongkwai	Madan Mawser	Mrs.Deimaphishisha Mawlong		20			20									
6		Mawshyleng	Mrs Jibanda Rani		20			20									
7		Umsawmat	Iaikynitew SHG		20			20									
8	Lyniong	Perkseh	Kyntlewshaphrang SHG		20			20									
9		Perkseh	Pynroilang SHG		20			20									
10		Pyndenumbri	Ieiphyrnai SHG	184	20			19	1	Due to weakness							
11	Nongspung	Mewsadang	Tyllileng SHG	184	20			20									
12		Niemsang	Benkyntiewlang SHG	184	20			19	1	Due to transportation							
13		Pamsanngut	Mr. Ten Khasain	184	20		4	16									
14	Pamsanngut	Nongmadan	Iahunlang SHG	184	22			19	1								
15		Nongwah	Mrs. Thibon Khasain	184	20			14	6	Could not eat properly							
16		Mawspong	Hunlang 1 SHG	184	20			20									
17	Mylliem	Kyrphei	Mr Elesson Khyriem	184	20			20									
18		Kyrphei	Banklewshaphrang SHG	184	20			19	1	due to transportation (weakness)							
19		Laitkynsew	Mrs Inoris Nongkynrih		20			20									
20	Laitkroh	Mawmyrasiang	Mrs Trasibel Kurkalang	184	20			20									
21		Diengkynthong	Mrs. Krispy Kharkongor		20			17	3								
22		Laitumiong	Bidalin Mawlong		20			20									
23	Mawbeh	Laithemlangsah	Lasirmon Kharbhoi		20			20									
24		Mawbeh	Blinshe Myrthong		20			20									
25		Makma	Mrs. Brialsila Nongrum		20			20									
26	Sohra		Mrs. Traiolin Thongni		20			20									
27			Mr. Tra Diengdoh		20			20									
28		Sohrarim	Mrs. Wanda Tarlang		20			20									
29	Nongkhlaw		Mr. Lashallang Wahlang		20			20									
30			Mrs. Stra Diengdoh		20			20									
Total					600			20									
								581									

Piggery Distribution 2020 | Poultry Distribution 14 Sept 21 | **Poulttry Distribution 17.9.21**

Ready

4.4 Example of Carbon Plot Monitoring and Calculations



26 Phodlainer Umjangut, Nongspung

open	sl no.	species	Scientific name	Circumference	Radius	Diameter(cm)	Diameter(m)	Volume (m	Wood Density (g/cm3)	Biomass (kg)
	1	Kseh	*Pinus kesiya*	86.9	5.870	11.741	0.117	0.046055	0.466	21.461
	2	Kseh	*Pinus kesiya*	40.1	6.380	12.759	0.128	0.06804	0.466	29.377
	3	Kseh	*Pinus kesiya*	85.4	5.632	11.264	0.113	0.088917	0.466	18.155
	4	Kseh	*Pinus kesiya*	58.3	6.093	12.186	0.122	0.053191	0.466	24.787
	5	Kseh	*Pinus kesiya*	42.7	6.793	13.586	0.136	0.078604	0.466	36.629
	6	Kseh	*Pinus kesiya*	37.5	5.966	11.932	0.119	0.049057	0.466	22.861
	7	Kseh	*Pinus kesiya*	112.4	17.882	35.764	0.358	1.085038	0.466	505.627
	8	Kseh	*Pinus kesiya*	37.1	5.902	11.805	0.118	0.047046	0.466	21.923
	9	Kseh	*Pinus kesiya*	35.7	5.680	11.359	0.114	0.040302	0.466	18.781
	10	Kseh	*Pinus kesiya*	35.6	5.664	11.327	0.113	0.039838	0.466	18.565
	11	Kseh	*Pinus kesiya*	48.5	7.716	15.432	0.154	0.119019	0.466	55.483
	12	Sohshie	*Myrica esculenta*	48.2	7.668	15.336	0.153	0.102877	0.652	67.076
	13	Kseh	*Pinus kesiya*	57.4	9.132	18.264	0.183	0.199333	0.466	91.491
	14	Kseh	*Pinus kesiya*	35.6	5.664	11.327	0.113	0.039838	0.466	18.565
	15	Kseh	*Pinus kesiya*	36.7	5.839	11.677	0.117	0.045072	0.466	21.004
	16	Kseh	*Pinus kesiya*	41.2	6.555	13.109	0.131	0.069432	0.466	32.355
								2.114		1004.100232

2.114	per plot vol	1004.1	
Boles	per Hectare	10.041	tonnes
BEF		1.3	
AGB(Boles + BEF)		13.053	
BGB		1.958	
Total Biomass		15.011	
Total Vegetation cover		7.506	tonnes

27 Lawsubah, Pamsanngut

dense	sl no.	species	Scientific name	Circumference	Radius	Diameter(cm)	Diameter(m)	Volume (m	Wood Density (g/cm3)	Biomass (kg)
	1	Slameh	*Ficus sp*	86.4	5.791	11.582	0.116	0.054738	0.652	35.686
	2	Ilaba	*Engelhardtia spicata*	45.7	7.270	14.541	0.145	0.094012	0.652	61.296
	3	Ilaba	*Engelhardtia spicata*	35.6	5.664	11.327	0.113	0.050221	0.652	32.744
	4	Ilaba	*Engelhardtia spicata*	51.8	8.241	16.482	0.165	0.128762	0.652	83.953
	5	Ilaba	*Engelhardtia spicata*	51.2	8.145	16.291	0.163	0.12505	0.652	81.533
	6	Soh Jhursaw	*Itea chinensis*	37.7	5.998	11.995	0.120	0.058439	0.652	38.102
	7	Soh Jhursaw	*Itea chinensis*	62.1	9.880	19.759	0.198	0.201415	0.652	131.3829076

2018 Open plots | 2018 Dense plots | 2019 Open plots | 2019 Dense plots | **2020 Open plots** | 2020 Dense plots | Summary_Dense | Summary Open

Ready

Annex 5. Example forest management plans/*plan vivos*

PLAN VIVO OF LYNGKIEN SUNEI VILLAGE

1. Location: The village is located in Mawphlang Lyngdohship and falls within the Mawphlang Community and Rural Development Block, East Khasi Hills District, Meghalaya. The GPS location of the village;N 25.444495°- E 91.736968°. The village is located on the Shillong – Balat Road. The area of the village including forests is 243.7 ha. Of this, 4.98 ha and 84.64 is comprised of human settlement and agriculture land respectively. 8.2 ha is dense forests and 23.91 ha is comprised of open forests. The river flows through the village. A map of the village showing the land-use pattern, location of forests and other landmarks is attached in Appendix I.

2. Description of the Area: The village is situated in the plateau region of the State, at an altitude of 990 m above mean sea level. The area is characterized by a great diversity in relief. The village is in the valley which is surrounded by hillocks on all sides. The river provides a good resource for paddy fields and agriculture. All the settlements are within the valley and some agricultural fields are present on the slopes of the hills.

3. Population: 600 (Male = 350, Female = 250).

4. Number of Households: 98

5. Forest Sector Plan: The village plan period is proposed to be 5 years. The management plan involves restoring the open forests through reducing fuel wood collection pressures, controlling fire, and grazing. Fuel wood reduction is being achieved through the installation of fuel efficient, LPG connections (44 units), electric rice cookers (4 units) and halting the cooking of pig food. Fuel wood plantations are being re-established to helpmeet demands for firewood. Fire lines and watchers are utilized to reduce the impact of dry seasonfires. Animal husbandry projects reduce the number of free grazing cows and goats. Introduction of wide range of livelihood activities for mitigating grazing effects has also been placed. The nature of the activities and the physical and financial costs thereof are proposed as under:

    - Degraded area to be treated under Aided Natural Regeneration (ANR): The area under open forests covering over 39.63 ha will be treated under ANR.

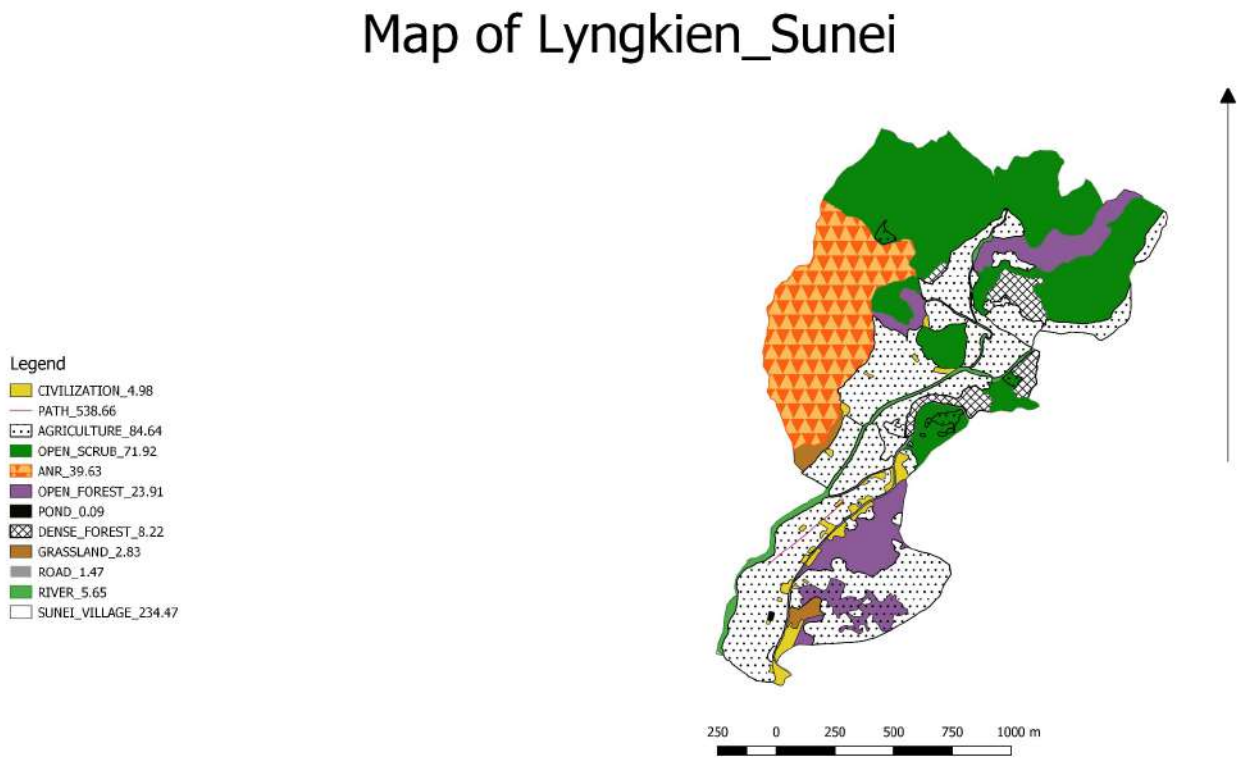
    - Degraded area needing afforestation: Under the Advance Closure approach, noafforestation is proposed during the first 2-year plan period. Depending on the success of ANR activities, afforestation works may be implemented as needed. Enrichment planting or gap planting are proposed for speeding up the natural regeneration of the depleted forest land.

Table A below presents a tentative five-year budget for forest conservation and restoration activities, as well as soil conservation measures. Figure A provides a resource management plan map for the village.

Table A: Proposed Forest Protection and Restoration Activities for Lyngkien Sunei Village

Name of Activity	Unit	Rate (Rs)	Amount (Rs)	Proposed Convergence
Aided Natural Regeneration	30 ha	2500/ha	75,000	NREGS, Basin Programme
Protection of forests from fires	30ha	2000/km	60,000	REDD+
Installation of LPG (stoves)	5 HH	5000/HH	25,000	REDD+
Fuelwood Plantation (To be used on rotational basis)	5 ha	25,546/ha	127,730	NREGS
Improvement and protection of wildlife habitat including conservation of existing flora and fauna	-	-	70,000	REDD+
Soil Conservation measures to improve the watershed hydrology and protect village drinking water resources	-	-		Basin Programme (CLLMP)
Solar lights	2	-	-	REDD+
Total			3,57,730	

Figure A: REDD+ Project Map

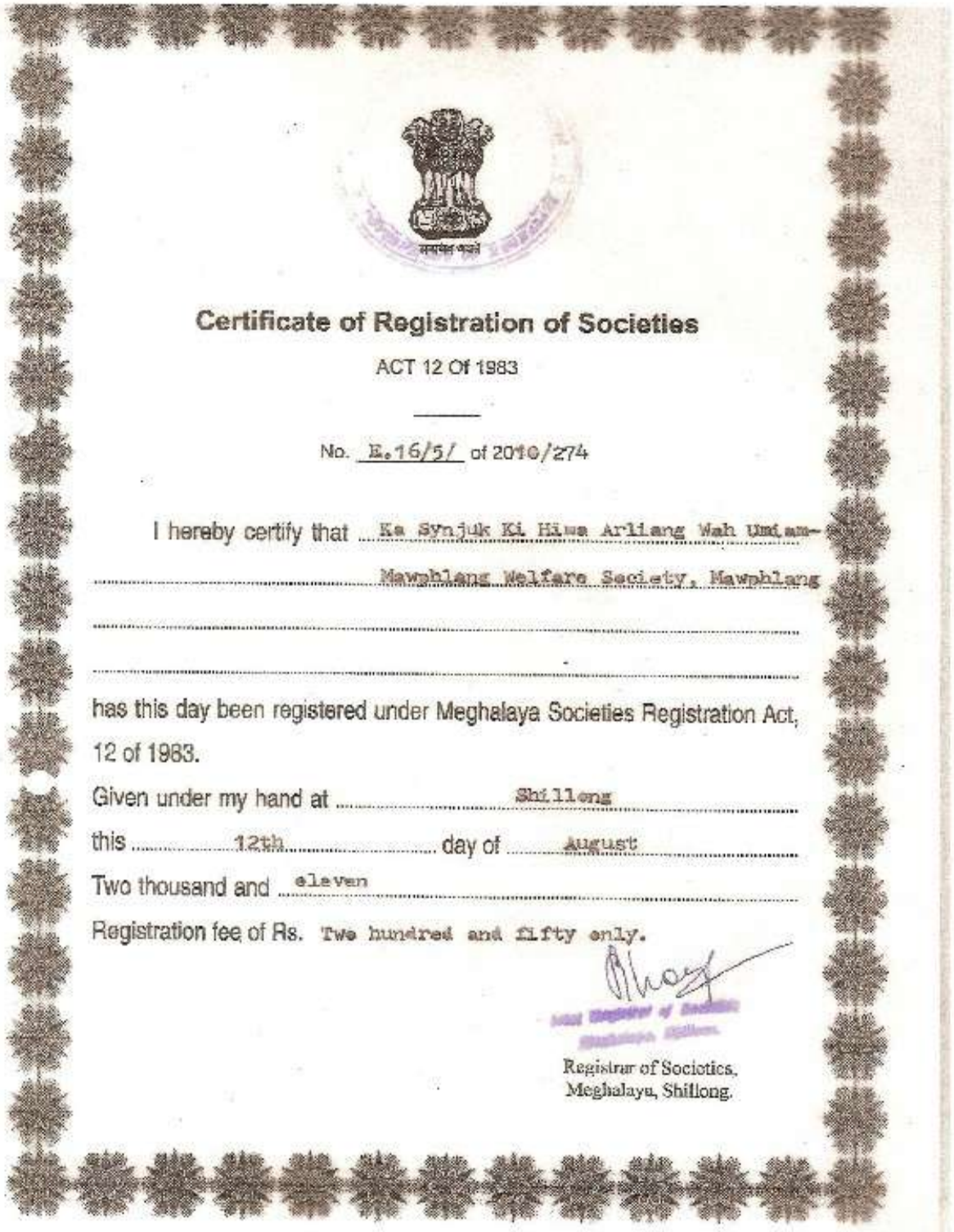


6. Socio-economic Development Plan --Preferred Income Generating Activities (IGAs) of the community: The villagers prioritized growing of rice, planting potatoes and peas. Piggeries and Poultry are other activities where people can generate income. Rice is one of the most important crops that people grow for their own consumption. Carrot is the cash crop of the region. The river that flows through the village is a boon for agricultural purpose. The proposed strategy presented in Table B represents a series of activities that will increase the sustainability and economic productivity of agricultural and animal husbandry activities.

Table B: Socio-Economic Development Plan for Lyngkien Sunei Village (2022-2027)

Name of activity	Units	Amount (Rs)	Proposed convergence (For details, see Project Management Plan)
Formation and Development of Farmer's club	1	25,000	NABARD
Orchard based farming	30	2,100	REDD+
Soil & water conservation			Basin CLLMP
Water resource management Lawkyntang		129,000	MGNREGA, Basin CLLMP
Creation of new SHGs		17,500	NRLM
		1,802,958	
Improvement of Agriculture			ICAR & Line Dept
Carrot seed for 1/2-acre land		38,250	
Vermicompost @Rs 25/kg (maintenance, cost price of worm, Vermi bed,)	2	2,00,000	REDD+
Livestock			ICAR & Government agency, REDD+
Piglets for 2 nos @4000 per piglet		84,000	
Shed for 2 piglets concrete floor @230 x 24sqft (6ftx4ft) for 1 unit	1	1,00,000	MGNREGA
Training			ICAR, REDD+, Horticulture, Agriculture.
Convergence & Collaboration with development agencies			
Poultry	400	60,000	
Mushroom Cultivation 5members	150	30,000	
Apiculture	2	15,000	
Goatery	-	-	MGNREGAS, Directorate of Animal Husbandry and Veterinary Department, Govt of Meghalaya
Community Micro-Finance Group			
Eco Tourism			REDD+,
Special Grant			REDD+,
Community Development Fund			REDD+,
Self-help Group Capacity Building		20,000	REDD+, NRLM
Inter loaning			REDD+NRLM
Forest Protection and Restoration Award		100,000	REDD+
		120,000	
Total		2,560,013	

Annex 6. Permits and legal documentation



Certificate of Registration of Societies

ACT 12 Of 1983

No. E.16/5/ of 2010/274

I hereby certify that Ka Synjuk Ki Hiwa Arliang Wah Umiam-Mawphlang Welfare Society, Mawphlang

has this day been registered under Meghalaya Societies Registration Act, 12 of 1983.

Given under my hand at Shillong

this 12th day of August

Two thousand and eleven

Registration fee of Rs. Two hundred and fifty only.

Registrar of Societies,
Meghalaya, Shillong.

OFFICE OF THE EXECUTIVE COMMITTEE
KHASI HILLS AUTONOMOUS DISTRICT COUNCIL
SHILLONG.

No. DC.XIV(A)/6/2011/2/279 Dt. Shillong, the 23rd May, 2011.

From: The Chief Forest Officer,
Khasi Hills Autonomous District Council,
Shillong.

To: Shri Ivan Roy Pariat, IFS (Retd),
Assistant Programme Coordinator,
Community Forestry Alliance for N.E. India (CFANE),
Windermere, Rngi Jynriew,
Nongthymmai, Shillong – 793014.

Subject: **Community based Carbon Sequestration Project in the sub-catchment of Umiam River.**

Ref: Your letter dt. 19th April, 2011.

Sir,

I am directed to inform you that the Chief Executive Member, Khasi Hills Autonomous District Council welcomes the Pilot Project on Community based Carbon Sequestration Project in the sub-catchment of Umiam River with great interest and formally accord its approval for the said Pilot Project.

Further, the Khasi Hills Autonomous District Council appreciates the efforts taken up by CFANE and CFI in promotion of Sustainable Management of Natural Resources and Sustainable Livelihood of Forest dependent Communities and has also taken notice of the good works undertaken by CFI in the Pilot Project at Mawphlang areas.

I would also like to inform you that the consent of the local village durbars is also required before implementing any project.

Thanking you.

Yours faithfully,

T. Sailo

Chief Forest Officer,
Khasi Hills Autonomous District Council,
Shillong.

OFFICE OF THE EXECUTIVE COMMITTEE
KHASI HILLS AUTONOMOUS DISTRICT COUNCIL,
SHILLONG.

NO.DC.XIV(A)16/2011-2013/162 Dated Shillong, the 11th June, 2013.

To,

Secretary,
Ka Synjuk ki Hima Arliang Wah Umiam Mawphlang Welfare Society.

Sub: - Community base Carbon Sequestration Project in the sub-catchment of Umiam River.

Ref: - Your letter dt. 28.9.2012.

Sir,

In partial modification to the Office Order NO.DC.XIX(A)16/2011/2/279 dt. 23.5.2011, I am directed to inform you that the Executive Committee, Khasi Hills Autonomous District Council is pleased to accord approval/recognition to the change of the earlier name "Community Forestry Alliance for North East India (CFANE)" to "Ka Synjuk ki Hima Arliang Wah Umiam Mawphlang Welfare Society" or Federation/Synjuk as requested for vide NO.KSKHAWUMWS/REDD+/KHADC/2012/1/ Dt.28.9.2012.

I would also like to inform you that the consent of the local village of the local village dorbar is also required before implementing any project.

Thanking you.

Yours faithfully,

T. Sawkmie

Chief Forest Officer,
Khasi Hills Autonomous District Council,
Shillong.

Annex 7. Evidence of community participation

Training on Mushroom Cultivation

Awareness Programme

Community Fireline Creation

Participatory Rural Appraisal

Tree Plantation

LWC Meeting

Annex 8. Biomass Surveys

The project area represents a landscape dominated by five primary land covers:

- **dense forests** with more than 40% canopy closure,
- **open forests** with 10 to 40% canopy closure,
- **scrub land** with poor tree growth mainly of small or stunted trees having canopy density less than 10 percent,
- **non-forest** encompassing all other land not included in the preceding classes (includes barren or fallow lands, agricultural lands, grassland and settlements),
- **water bodies**.

The classification scheme is the same as that used by the forest survey of India[3].

To determine the carbon stocks of above-ground and below-ground woody biomass of forests and scrub land within the project area, biomass surveys are conducted for dense forest, open forest and scrub land classes. Dense and open forest areas were initially identified in 2010 on a land cover stratification map based on remote sensing data from the Forest Survey of India (2004), contour maps and path network maps. Most of the forestland is relatively inaccessible, far from roads or tracks or on steep slopes and plateaus cut by gullies and cliffs. For this reason, sample plots were selected randomly along transects that follow the existing local path network running east- west and north-south. In each plot, the tree species, and diameter at breast height (DBH) are recorded.

Annual biomass surveys have been completed for open and dense forest classes between 2011 and 2021. Forest inventories are completed in permanent plots within which trees are tagged and remeasured. The number and size of plots in each year within the REDD+ project area and the ANR sites (located within the REDD+ project area) are summarized in Table A1.1.

Originally, the plot sizes were 0.01 ha (10m x 10 m) for dense forests and 0.04 ha (20m x 20m) for open forests and ANR plots in order to take inventory more quickly of the Project area and to achieve a broad sample. In response to suggestions from the Plan Vivo Technical Advisory Committee (TAC) and in line with the Government of India Standards, the project increased the size of plots to 0.1 ha as well as the number of plots to measure changes more accurately in carbon stocks over time[4].

Inventories of the scrub land class are included in the 2021 biomass survey to improve climate benefit estimates for the third implementation phase (2022-2026) in light of changes to climate benefit estimation methodology (see Section G4 and G5 in PDD and Annex 8 for the scrubland biomass survey methodology and results).

Table A1.1 Summary of the number and size of forest inventory plots in each biomass survey.

	Total number of plots (number of plots within the ANR site boundaries)		Size of plot (ha)	
Year	Dense Forest	Open Forest	Dense Forest	Open Forest
2010	22	20	0.01	0.04
2011	22	20	0.01	0.04
2012	22	20	0.01	0.04
2013	22 (6)	20(5)	0.01	0.01
2014	22 (6)	20(5)	0.01	0.01
2015	22 (6)	20(5)	0.01	0.01

[3] https://fsi.nic.in/scheme-of-classification

[4] When trees in the carbon inventory plots reach a DBH of 10 cm or greater, they will be added to the inventory for biomass equations and may reflect an increase in the number of trees from year to year.

2016	22	20	0.01	0.01
2017	22	20	0.1	0.1
2018	57	36	0.1	0.1
2019	56	36	0.1	0.1
2020	54	36	0.1	0.1
2021	62	48	0.1	0.1
2022	62	52	0.1	0.1
*All plots are located within the project boundary in the area under REDD+ activities. Of these, 5 open forest plots and 6 dense forest plots that are located in sites of ANR activities.				

Woody biomass

To calculate biomass from sample plot measurements for dense and open forest plots, species-specific volume equations (FSI 1996; Table A1.2) are used to estimate stem volume of individual trees. The equations are developed by The Forest Survey of India and are based on measurements of the tree dimensions during past fellings of thousands of trees over two decades. Where species-specific equations are not available, a generic equation for north-east Indian tree species is used. Stem volume is converted to stem biomass by multiplying the volume estimate by species-specific wood density values for trees in India from the Global Wood Density Database (Zanne 2009). If species- specific wood density values are not available a values of 0.652 g/cm3 is applied, which is the average of all Indian species in the Global Wood Density Database.

A biomass expansion factor (BEF) was then applied to convert stem biomass estimates to estimates of whole tree biomass was applied. Biomass expansion factors recommended by Brown (1997) were applied[5]:

- When inventoried biomass was >190 t/ha a BEF of 1.74 was applied;
- When inventories biomass as <190t/ha a BEF = EXP(3.213-0.506*LN(BV)), was applied where BV=inventoried volume;
- For plots dominated by pines a BEF of 1.3 was applied.

Table A1.2: Local volume equations for different species for Meghalaya state.

SPECIES	VOLUME EQUATION *	NOTE
Castanopsis hystix	V=0.13937-0.35988√D+6.81318D2	
Castanopsis indica	√V=0.22234+4.90695D+1.5124√D	
Engelhardtia spicata	LogeV=2.47635+2.51046 LogeD	
*Pinus kesiya***	V=0.0232-0.011613D+0.0011549D2	(diameter in cm)
Quercus fenestrata	V/D2=0.000295/D2-0.0079835/D+0.00086	(diameter in cm)
Quercus glauca	V/D2=0.000295/D2-0.0079835/D+0.00086	(diameter in cm)
Quercus griffithii	V/D2=0.000295/D2-0.0079835/D+0.00086	(diameter in cm)
Rhododendron arboreum	V=0.08934+0.70730D+2.13941D2	
Schima wallichii	V=0.27609-3.68443D+15.866870D2	
Symplocus theaefolia	V=0.03754+0.000587D2	(diameter in cm)
Others	V=0.11079-1.81103D+11.4132D2+0.38528D3	

[5] In the past, the project team in an attempt to prevent over-estimation of carbon took a conservative calculation using BEF of 1.3 for open forests. This may affect the comparison of plot calculations from previous and current years.

In the past the project team had used the formula BEF = EXP(3.213-0.506*LN(BV)) for those forests with a biomass <190t/ha and containing mixed pine and broadleaf species. This may affect the comparison of plot calculations from previous and current years.

Source: FSI 1996. Note: Equations selected were those derived from measurements of trees in closest proximity to the project site.
* V=Volume in m3; D = Diameter in m (unless specified otherwise)
** If the dbh of the pine trees are <10 cm, the generic volume equation was applied, as the species-specific equation was not intended for use on trees <10 cm diameter.

Below-ground biomass was estimated by assuming a root:shoot ratio of 0.15 for all species. FSI (1996) reports a range of root-shoot ratios, with values up to 0.32. Other studies in Punjab (e.g. Rawat et al. 2015) report lower values however, ranging from 0.15 to 0.19 depending on tree age. To avoid overestimating below ground biomass, the most conservative value from the literature was selected.

Forest Biomass

The resulting biomass estimates (tC/ha) in the REDD+ areas are summarized in table A1.3. These values represent the total woody biomass values (above and below ground woody biomass) for each of the forest types, and are used in the REDD+ technical specification. The lower 90% confidence interval of mean values are adopted to estimate biomass for each forest type to account for uncertainty in estimated biomass from tree inventories, related to the variation in biomass between sample plots in the same forest type. The plot level biomass estimates for both REDD and ANR plots are summarized in tables A1.4 to A1.7.

Table A1.3: Estimated biomass (tC/ha) for each land cover type across the REDD+ project area (2018-2022)

	Open	Dense
	tC/ha	tC/ha
2018	27.0	75.6
2019	27.8	76.9
2020	29.9	82.4
2021	34.7	86.5
2022	36.6	87.6

Table A1.4 Plot level woody biomass (tC/ha) of dense forest in REDD project area

	Plot level woody biomass (tC/ha)						Plot level woody biomass (tC/ha)				
Plot no	**2022**	**2021**	**2020**	**2019**	**2018**	**Plot no**	**2022**	**2021**	**2020**	**2019**	**2018**
101	93.0		83.2	81.0	80.3	**145**	98.9	102.0	97.2	94.6	93.4
102			32.7	31.5	31.2	**146**		71.9	70.5	66.8	65.2
103	87.6	84.8	80.3	77.5	76.9	**147**	28.8	28.1	26.9	24.5	23.8
104			127.9	125.8	124.1	**148**	89.6	87.7	86.3	81.2	79.9
105			134.5	127.6	126.9	**149**		68.5	67.5	72.9	72.0
106	115.9	118.7	116.5	108.9	107.7	**150**				32.3	31.0
107						**154**	54.8	56.8	56.2	51.9	50.0
108			64.1	60.3	59.3	**156**	88.5	94.7	92.7	85.0	83.7
109	74.2	69.8	68.6	65.9	64.4	**157**	85.7	87.3	82.0	80.7	79.8
110			72.5	70.6	69.9	**158**			17.6	16.4	16.1
111	139.0	140.7	136.0	135.8	134.7	**160**	45.9	42.9	40.3	30.8	29.9
112	64.1	73.1	70.2	68.0	66.5	**161**	19.8	19.5	17.9	15.4	15.2
113	79.5	73.9	74.6	71.1	69.4	**162**	81.1	80.0	76.9	76.7	75.2

114			109.8	109.5	108.5	**163**			101.8	98.3	96.0
115	149.1	149.6	125.9	128.0	126.8	**164**	84.6	89.5	91.0	86.6	84.4
116			27.9	25.5	24.3	**165**	138.6	145.3	137.8	134.3	132.5
117	69.8	71.4	70.8	66.9	65.0	**166**	37.4	36.6			
118	46.0	38.8	38.2	31.9	31.0	**167**	102.9	106.0			
119			49.1	46.9	46.0	**168**	62.5	63.5			
120	35.9	19.8	23.8	15.9	15.0	**169**		21.0			
121	33.4	27.9	27.0	22.5	21.9	**170**	119.4	114.0			
122	116.6	126.5	120.5	113.3	112.2	**171**	20.4	16.5			
123		151.5	157.7	154.6	154.1	**172**	26.2	23.9			
124			50.5	34.7	34.1	**173**	140.7	139.5			
125	108.7	116.3	109.9	103.8	102.1	**174**	116.0	117.5			
126	168.9	175.2	179.4	173.5	172.5	**175**	115.9	115.4			
128	91.5	97.6	95.0	93.8	92.2	**176**	103.4	104.0			
129	145.9	158.2	153.1	150.0	148.4	**177**	123.1	123.6			
130	106.3	105.2	102.2	93.1	91.1	**178**	112.8	107.1			
131	97.0	99.3	95.4	91.1	88.4	**179**	114.0	114.5			
132	136.6	131.3	127.9	123.2	121.0	**180**	23.2	24.4			
133	124.4	123.6	123.2	119.1	117.3	**181**	122.8	120.2			
135	195.8	188.4	176.0	172.5	170.7	**182**	52.2	56.5			
137	150.1	156.0	151.0	146.1	145.2	**183**	145.7	144.5			
138	135.0	133.3	137.1	125.5	124.6	**184**	115.5	112.9			
139	159.0	173.0	166.7	157.1	156.4	**185**	74.0	72.5			
140			108.1	104.8	103.2	**186**	47.9	49.5			
141	149.1	144.9	143.5	138.1	135.7	**187**	152.6	140.5			
142	112.0	116.9	114.7	111.1	109.7	**188**	25.8				
143				56.5	54.2	**189**	49.4				
144	71.5	69.5	67.4	57.8	56.4						
	2022	2021	2020	2019	2018						
Mean	96.7	95.8	92.1	86.4	85.1						
Standard Error	5.4	5.6	5.8	5.7	5.7						
Standard Deviation	42.0	44.2	42.9	42.8	42.6						
Minimum	19.8	16.5	17.6	15.4	15.0						
Maximum	195.8	188.4	179.4	173.5	172.5						
Confidence Level (90.0%)	9.1	9.3	9.8	9.6	9.5						
Lower limit (90% interval)	87.6	86.5	82.4	76.8	75.6						
Higher limit (90% interval)	105.7	105.1	101.9	96.0	94.7						

Table A1.5 Plot level woody biomass (tC/ha) of open forest in REDD+ project area

	Biomass (tc/ha)						Biomass (tc/ha)				
Plot No	**2022**	**2021**	**2020**	**2019**	**2018**	**Plot No**	**2022**	**2021**	**2020**	**2019**	**2018**
1		15.2	14.7	11.1	10.4	**46**	41.7	40.1			
3			11.8	10.8	10.4	**47**	59.8	57.8			
5	48.9	64.6	55.4	52.9	51.5	**48**	9.6	7.5			
6	61.5	69.4	63.8	60.6	58.3	**49**	19.2	19.1			
7	48.9	54.2	53.7	51.5	50.4	**50**	48.3	51.0			
8	67.9	43.6	42.7	41.6	41.1	**51**	12.9	12.3			
9	66.8	62.0	60.4	58.4	57.2	**52**	32.4	46.1			
10	13.7	13.3	13.0	12.4	12.3	**53**	25.8	14.7			
11	66.6	66.5	61.4	58.4	57.6	**54**	29.7	30.7			
12	78.1	50.1	49.2	47.5	46.4	**55**	58.8	57.3			
13			62.2	61.4	60.5	**56**	85.9	82.7			
15	62.5	62.7	59.3	54.7	52.9	**57**	83.0	74.8			
16		54.8	51.2	51.7	50.8	**58**	37.2	39.0			
17			44.4	43.4	42.3	**59**	107.1	105.8			
18			13.5	11.9	11.1	**60**	35.5	36.1			
19	53.9	50.5	49.2	46.6	45.7	**61**	27.7	26.4			
20	58.8	58.2	57.3	57.2	56.1	**62**	109.0	115.1			
21	62.4	59.5	57.3	55.0	54.1	**63**	27.8	27.2			
22	8.8	7.8	6.8	6.7	6.3	**64**	19.4	17.6			
23	61.1	55.0	52.5	50.9	49.8	**65**	15.5	15.8			
24	54.4	46.6	43.3	40.9	39.9	**66**	85.8				
25			17.2	15.4	14.2	**67**	32.6				
26	10.0	8.9	7.5	7.1	7.1	**68**	10.7				
27			69.5	63.1	61.9	**69**	13.9				
29	43.7	49.0	47.7	45.2	44.1	**70**	11.4				
30			3.1	2.8	2.7	**71**	25.0				
31			12.8	11.8	11.4						
32			5.9	5.2	4.9						
33			10.6	9.8	9.4						
34			15.3	13.8	13.3						
35	22.0	21.5	17.4	12.5	12.0						
36	55.8	56.0	50.4	40.7	39.7						
37	47.8	46.2	42.4	29.9	28.6						
38	67.5	67.1	65.3	61.8	61.1						
39	7.9	6.7	7.1	5.4	5.1						
41			10.9	10.4	9.8						
42	54.3	54.3									
43	3.8	4.3									
44	28.9	28.5									
45	5.4	4.3									

	2022	2021	2020	2019	2018
Mean	42.8	40.8	36.3	33.9	33.1
Standard Error	3.7	3.6	3.8	3.6	3.6
Standard Deviation	26.7	26.1	22.5	21.8	21.4
Minimum	3.8	3.8	3.1	2.8	2.7
Maximum	109.0	115.1	69.5	63.1	61.9
Confidence Level (90.0%)	6.2	6.0	6.3	6.1	6.0
Lower limit (90% interval)	36.6	34.7	29.9	27.8	27.0
Higher limit (90% interval)	49.0	46.8	42.6	40.0	39.1

Table A1.6 Plot level woody biomass (tC/ha) of dense forest in ANR project area

Plot No.	ANR Site	Biomass (tc/ha)							
		2016	2017	2018	2019	2020	2021	2022	Beta
151	Kseh Mylliem, Nonglwai	0.0	0.0	90.9	92.3	97.4	100.1	102.2	5.0
134	Lumphudumsim, Nonglwai	0.0	0.0	101.1	103.0	112.4	110.5	113.9	6.1
155	Lumwaharkum, Hima Nonglwai	0.0	0.0	27.3	28.2	27.2	29.9	38.3	11.6
159	Wah Mawlong, Laitumiong, Mawbeh	0.0	0.0	67.1	68.3	71.8	79.1	120.8	0.0
127	Khlaw Rani, Pamsanngut	0.0	0.0	136.5	137.8	143.4	149.5	141.9	4.8
S	Mawlangrain	0.0	56.1	0.0	58.6	0.0	62.6	0.0	1.6
S	Umkaber	0.0	53.9	0.0	55.3	0.0	57.2	0.0	0.8
S	Lumlaitlynding	0.0	94.8	0.0	98.0	0.0	101.7	0.0	1.7
S	Laitthemlangsah	0.0	109.2	0.0	118.1	0.0	123.6	0.0	3.7
O_ANR	Phanniewlahneng = Umlangnei, Lyngiong	89.3	0.0	0.0	0.0	0.0	93.7	94.8	1.2
152	Lumkyndong Kmie Brial, Mawphlang	0.0	0.0	31.9	33.4	36.3	39.9	42.7	4.9
136	Wahthymmei Esdiwot, Nongspung	0.0	0.0	121.3	123.4	126.8	132.6	132.9	5.2
153	Imsotti, Nongspung	0.0	0.0	124.1	125.5	128.0	140.8	140.8	8.9
								AVERAGE GROWTH	**4.6**
								LOWER 90% CI	**2.4**

Table A1.7 Plot level woody biomass (tC/ha) of open forest in ANR project area

Plot No.	ANR Site	Biomass (tc/ha)							
		2016	2017	2018	2019	2020	2021	2022	Beta
4	Law Shlem	0.0	0.0	13.9	14.4	17.9	21.3	16.6	2.8
28	Phodumdewsaw, Hima Pamsanngut	0.0	0.0	5.5	6.0	8.4	10.2	10.1	2.1
27	Lawsubah, Pamsanngut	0.0	0.0	61.9	63.1	69.5	0.0	0.0	4.4
2	Lum U Mong, Laitkroh	0.0	0.0	2.0	2.2	2.6	3.8	4.1	1.1
14	Sohrarim, Lumnonglum	0.0	0.0	55.4	56.2	58.4	56.7	58.9	2.2

S	Lawsubah	0.0	18.9	0.0	20.6	0.0	22.8	0.0	1.0
S	Kyiem	0.0	11.4	0.0	13.7	0.0	15.6	0.0	1.1
S	Lummawtong	0.0	37.8	0.0	43.3	0.0	48.5	0.0	2.7
S	Lumphari	0.0	16.0	0.0	20.6	0.0	35.3	0.0	5.3
S	Lumpomlum	0.0	1.8	0.0	2.0	0.0	2.2	0.0	0.1
O_ANR	Jathang Lum Riatsawlia = Law Khliehriat Sawlia, Community Forest, Sohra Syiemship	20.6	0.0	0.0	0.0	0.0	48.8	50.4	6.8
O_ANR	Phudlawkhla	2.0	0.0	0.0	0.0	0.0	17.2	19.6	4.0
40	Lumdiengsai, Laitkroh	3.4	0.0	7.4	7.7	9.1	10.1	10.0	1.5
O_ANR	Laitmawhing	16.2	0.0	0.0	0.0	0.0	69.8	66.2	11.8
O_ANR	Lummawmarok	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0	Themlumkhwai Laitsohpliah,Sohra Syiemship	0.0	0.0	0.0	0.0	0.0	71.8	70.2	-3.2
0	Lum Pyllun community Forest, Jathang, Sohra Syiemship	0.0	0.0	0.0	0.0	0.0	38.1	35.9	-4.5
0	Law Phudumblang Kyrphei, Mylliem Syiemship	0.0	0.0	0.0	0.0	0.0	37.0	37.4	0.8
0	Lumhati, Mawkalang, Mawbeh Sirdarship	0.0	0.0	0.0	0.0	0.0	5.1	7.7	5.2
								AVERAGE GROWTH	**2.5**
								LOWER 90% CI	**1.4**

Carbon Calculation on Scrubland

Quantifying carbon stored in ecosystem is a critical component of understanding overall carbon storage. Carbon dioxide is most significant because of the large quantities used by the plants during photosynthesis. In this context, several studies point out the potential of forests in terms of carbon storage. This is how forest ecosystems appear as large carbon sinks containing more than 80% of all above-ground carbon. Nevertheless, carbon storage capacity can vary markedly depending on the structure and composition of a forest. In this case the estimation of above-ground carbon was done in the scrubland in the project area. Furthermore, scrub biomass density varies considerably because of climatic, topographic differences and also due to human disturbance. In view of the importance of biomass estimates in Carbon cycle, the study aimed to estimate the above-ground phytomass and sequestered carbon of shrub ecosystem in the project area.
A significant number of methodologies and guidelines have been established. However in this case, a method has been modified and adapted for easy execution of the field sampling.

Materials and Methods for field sampling for AG Biomass/AG Carbon in scrubland

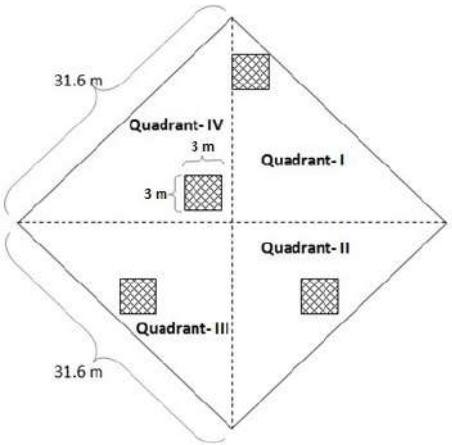
Materials:

1. A weighing spring balance(digital)
2. Secateurs/billhook knife
3. Labeling paper tags
4. Plastic bags for weighing cut stems/ pieces together

Method:

Laying out the plot and sampling:

1. Lay out 0.1 ha plots in the identified location, similar to the way it was laid for forest plots.
2. Divide the plot into 4 sub quadrants.
3. Layout 4 subplots of 3m x 3m dimension in each quadrant.
4. Lay the subplots in a random manner and so as to represent the plot/vegetation condition in the surrounding.



Plot layout for vegetation sampling for biomass estimation of scrublands

In the sub-plot of 3x3 m:-

i) Note down all the shrubs, bushes, hedges, etc. by name and counts.

ii) Measure the Collar girth (10 cm above surface) or diameter of each bush/shrub plant and their heights (and crown diameter if necessary) within the sub plot and record it against the names recorded.

iii) For each species, observe the size (height and/collar girth or crown width) of the shrub or small trees and see whether they can be grouped in the same size category or different size category. (Sizes categories may be like <1 m ht, 1-2 m ht, >2 mt ht)

iv) For each category of the plant species identified, count the number of branches in each plant (for bushy shrub), record them.

v) Choose 3 branch samples representing different sizes, like one each from the lower portion, middle and top position and cut them from the main stem. Measure the weight of each branch without removing any plant parts.

vi) Record the weight measurements against the selected sample from among the plants within the plot.

vii) Do this for all different species/size categories and bring a sample (a piece about 10 inches long) for each sample of 3 sizes (lower, mid and upper branches selected) after recording the weight of the piece taken. {Tie a tag with the fresh weight measured written on it}

viii) If the plants are monocots/grasses types of plants, then count the number of tillers with different size/height categories, and collect samples from each size categories, measure the weights; cut some smaller samples (each category, about 10 inches long) tagged with fresh weight of the cut sample.

ix) All the freshly cut and measured pieces of the stems/branches samples are to be measured before drying in the oven.

x) All the plant samples brought from the field have to be dried in the hot air oven at 105°C for 24 hours.

xi) Measure the dry weight of all the above samples.

xii) Work out the moisture content (MC) for each sample using the fresh weight and dryweight. Using this MC, estimate the total dry weight for each species of plant individuals within the sub-plot.

xiii) Now calculate the above ground plant (woody) of the sub plot by adding up all the dry weight of plants measured in the sub-plot. This will give the above ground biomass.

xiv) Half of the AGB will be the carbon content (in gm)

xv) Determine the same for all the 4 sub-plots and calculate the average biomass in 9m^2 sample plots.

xvi) Extrapolate it to determine the above biomass carbon for the 0.1 ha sample plot or to 1 ha area (t/ha).

Investigation Area

20 sample plots, two from each Hima under the project area were selected. The inclination angle lies between 3º- 40º slopes with an elevation ranging from 1640m to 1803m above sea level. The areas were significantly dominated by shrubs and grasses, also including small trees and herbs. Some of the areas selected were under tree plantation. The shrubs are mostly-branched woody plants with less than 5 m height with many stems. The plots selected are as follows:

Sl.No	Hima	Name of the plot selected	Inclination angle	GPS location
1	Mylliem	Diengkynthong	25º	N 25.38060º E 91.65827º
2	Mylliem	Phodumblang	39º	N 25.39222º E 91.66027º
3	Pamsanngut	Lawsubah	23º	N 25.39915º E 91.65263º
4	Pamsanngut	Mawsawrit	25º	N 25.40753º E 91.65637º
5	Lyngiong	Lumniewkor	24º	N 25.42048º E 91.70501º
6	Lyngiong	Perkseh	32º	N 25.40169º E 91.66179º
7	Nonglwai	Kyndongwah arkum	28º	N 25.42031º E 91.72222º
8	Nonglwai	Lumarkum	25º	N 25.40703º E 91.72283º
9	Mawphlang	Lummeimah	16º	N 25.44011º E 91.74773º
10	Mawphlang	Lumthangkanam	37º	N 25.45366º E 91.76500º
11	Nongspung	Mawkohshiel	24º	N 25.40455º E 91.63757º
12	Nongspung	Lummawbynna	18º	N 25.37843º E 91.64293º
13	Mawbeh	Lumwahsyllai	22º	N 25.38958º E 91.75659º
14	Mawbeh	Synrangsohnoh	21º	N 25.42144º E 91.77104º
15	Laitkroh	Rngi kseh	18º	N 25.43045º E 91.77017º
16	Laitkroh	Lumpdeng	26º	N 25. 45371º E 91.79123º
17	Sohra	Lumphodtarik	19º	N 25.40998º E 91.77702º
18	Sohra	Mawmihthied	15º	N 25.33843º E 91.73209º
19	Sohra	Lad mawphlang	24º	N 25.37816º E 91.74682º
20	Nongkhlaw	Sohrarim	12º	N 25.35157º E 91.74446º




After sampling in different sample plots is done under different terrain, different vegetation conditions, different slope-aspects, different anthropogenic influenced landscapes, the average value of the above ground carbon was determined.

Findings

The total scrubland carbon estimation is attached below:

Plot Name	Plot 1 tC/ha	Plot 2 tC/ha	Plot 3 tC/ha	Plot 4 tC/ha	Average tC/ha
Diengkynthong, Mylliem	35.2	17.2	26.4	19.75	24.63
Phudumblang, Mylliem	14.6	16.4	19.4	17.35	16.93
Lawsubah, Pamsanngut	12.4	15.65	31.35	11.75	12.73
Mawsawrit, Pamsanngut	3.2	13.65	9	8	8.46
Lumniewkor, Lyngiong	12.35	9.25	7	11.75	10.0875
Perkseh, Lyngiong	15.55	8.05	6.4	6.4	11.6625
Lumarkum, Nonglwai	9.6	9.75	7.55	10.35	9.3125
KyndongWaharkum, Nonglwai	20.7	10.9	11.2	12.65	13.8625
Lummeimah, Mawphlang	19.9	10.4	17.25	17.95	16.375

Lumthangkanam, Mawphlang	17.15	18.9	12.6	22.2	17.7125
Mawkohshiel, Nongspung	23.3	13.65	10.4	11.65	14.75
Lummawbynna, Nongspung	15.05	20.2	25.55	17.55	19.5875
Lumwahsyllai, Mawbeh	22	11.9	20.9	13.65	17.1125
Synrangsohnoh, Mawbeh	10.05	13.4	19.7	29.95	18.275
RngiKseh, Laitkroh	19.4	8.95	18.45	47	23.45
Lumpdeng, Laitkroh	54.35	39.45	46.586	40.05	45.109
Lumphodtarik, Sohra	26.9	25.95	15.45	30.45	24.6875
Mawmihthied, Sohra	21.45	22.8	25	24.5	23.4375
Ladmawphlang, Sohra	11.45	11	12.95	31.9	16.825
Sohrarim, Nongkhlaw	14	18.15	12.95	17.35	15.6125

Annex 9. Land Cover Change Assessment

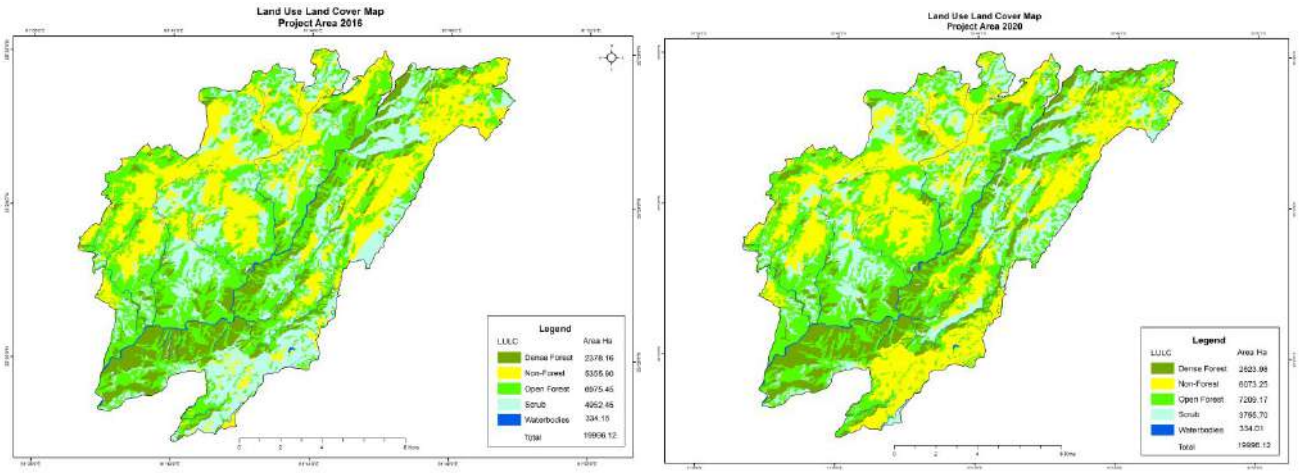
INTRODUCTION

Land use land cover is important spatial information in understanding interactions of human activities with the environment and thus it is necessary to monitor and detect the changes to maintain a sustainable environment. Land use change is defined as the alteration of land use due to human intervention for various purposes, such as for agriculture, settlement, transportation, infrastructure and manufacturing, mining and fishery. In contrast, land cover change refers to the conversion of land cover from one category of land cover to another and/or the modifications of conditions within a category [1]. The knowledge of land use and land cover is important for many planning and management activities as it is considered as an essential element for modeling and understanding the earth's features.

METHODOLOGY

Study Area

This study has been conducted in Khasi Hills Project area, Land use/land cover change detection analysis was carried out for two different time period i.e.2016 and 2020.



(a) (b)

Figure 1. Land use land cover map of Project area (a) 2016 (b) 2020

Data Collection

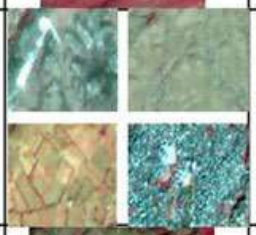
Multi-spectral satellite imageries IRS P6 LISS VI of 2016 imagery and IRS P6 LISS VI of 2019 has been used in the study. Interpretation of the Satellite data for identifying land use and land cover classes has been done by on-screen visual analysis after collecting adequate signature from ground for each class. The interpretation of IRS P6 LISS IV data was done on the scale of 1:10,000. Google earth imagery data was also used in classification to improve accuracy of classification. Field observations and ground truthing were conducted to verify the interpreted area with the real world. Geo-tagged photos have been used for referencing the features in the satellite images related to the ground. A LULC map on a scale 1:10,000 was prepared for digitization and ground verification.

Image Interpretation Methods

Image Interpretation was undertaken using Multi-spectral satellite imageries IRS P6 LISS VI of 2016 imagery, IRS P6 LISS VI of 2019 and Google earth Images 2020 for reference in visual image

interpretation method. Visual image interpretation method was chosen because it improves the accuracy and efficiency of the classification which involves feature identification through both spectral and spatial pattern recognition, using the interpretation key (Table I) based on the relationships between ground features and image elements like size, texture, tone, shape, location, pattern, site, situation and association. The LULC classes include non-forest area (i.e. settlements, agricultural land, barren land, grassland), water bodies, scrub land, open forest, dense forest. ArcGIS 10.2 software was used for visual image interpretation.

TABLE 1. INTERPRETATION KEYS

Codes	LULC Class	LISS IV Image	Ground Photos from parts of East Khasi Hills District
1	Open Forest		
2	Non-Forest(Barren land,Grassland,Agricultural land, Settlement)		
3	Scrub land		
4	Dense Forest		
5	Water Bodies		

Calculation of Statistic:

The LULC area are calculated from the attribute table and the area in Hectares (Ha) for all the land use of 2016 and 2020.

LULC	Area_ha 2020	Area_ha 2016	Area in ha Change
Dense forest	2623.98	2378.16	245.82
Non-Forest	6073.25	5355.90	717.36
Open forest	7209.17	6975.45	233.72
Scrub	3755.70	4952.45	-1196.75
Waterbodies	334.01	334.15	-0.14
Grand Total	**19996.12**	**19996.12**	

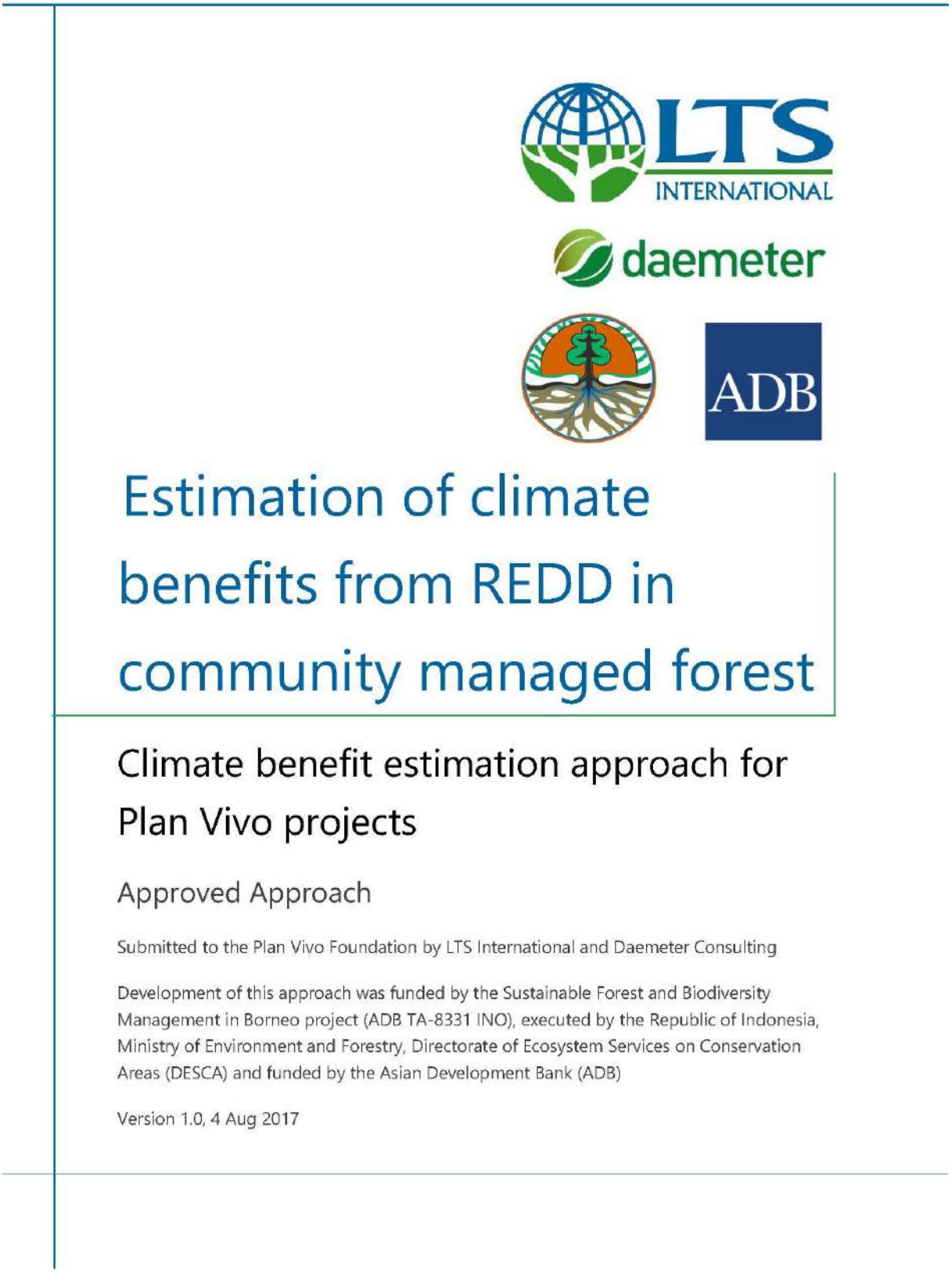
References

[1] National Remote Sensing Centre,2012.National Land Use Land Cover Mapping using Multi-temporal Satellite Data .Technical Manual (2nd Cycle)NRSC,Hyderabad.66p

[2] Meyer W, Turner IIB (1992), "Human Population Growth and Global Land-Use/Cover Change", Annual Review of Ecology and Systematics, 23: 39-57.

[3] Temesgen Gashaw, Amare Bantider, Abraham Mahari, "Evaluations of Land Use/Land Cover Changes and Land Degradation in Dera District, Ethiopia: GIS and Remote Sensing Based Analysis", International Journal of Scientific Research in Environmental Sciences, 2(6), pp. 199-208, 2014.

Annex 10. Approved Approach for Climate Benefit Estimation of REDD in Community Managed Forests



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Contents

Title	Estimation of climate benefits from REDD in community managed forest
Version	1.0
Date of approval	4 Aug 2017
Scope	Baseline scenario emissions; Project scenario emissions; Leakage emissions, Climate benefits
Project type(s)	Prevention of deforestation and forest degradation
Geographical area	Global
Carbon pool(s)/Emission source(s)	Above-ground woody biomass; Below-ground woody biomass
Author(s)	Nicholas Berry (nicholas.berry@gmail.com)

Summary

This approach is for the estimation of climate benefits from Plan Vivo projects aiming to reduce emissions from deforestation and forest degradation in community managed forests. There is no geographical restriction on the use of this approach. It includes four components which can be applied independently or used in combination. The components included are:

1. Estimation of baseline scenario emissions
2. Estimation of project scenario emissions
3. Estimation of leakage emissions
4. Estimation of expected climate benefits

For each of these components approaches are described for estimating expected emissions or climate benefits at the start of a project period, and for verification of emissions or climate benefits at the end of the project period.

Plan Vivo projects adopting the approaches described here will be required to:

- Adopt all definitions described in the latest version of the Plan Vivo Standard and in Section 1 of this document;
- Demonstrate that project areas and interventions meet all of the applicability criteria described in Section 2;
- Provide spreadsheets demonstrating that all calculations have been made according to the relevant equations in Section 3; and
- Provide a full description of all data and parameters used, with sufficient evidence to demonstrate that they meet the requirements described in Section 4.

The information used for estimates at the start of the project period should be presented in a project design document (PDD). At the time of verification the PDD should then be updated to include relevant calculations and data used for verification of emissions and climate benefits.

1 Definitions

Project scenario	The conditions that are expected to occur if the planned project intervention is successful
Project area	The area of forest that will be brought under effective community management
Reference period	A period of time over which historical rates of deforestation and forest degradation are assumed to provide an indication of likely rates of deforestation and forest degradation during the project period
Project period	The period of time over which estimated climate benefits are assumed to be achieved if project activities are carried out as planned
Reference region	A region encompassing the project area, that is defined by a physical or political boundary, that includes at least twice the area of each forest type and legal classification within the project area, and that is assumed to be affected similar drivers of deforestation and degradation to the project area under the baseline scenario
Forest stratum	An area of forest with the same forest type, legal classification, and topographic class
Forest	Accepted national definitions should be applied, and if none are available a definition should be specified based on minimum crown cover (between 10 and 30 percent), land area (between 0.05 and 1 ha) and tree height (between 2 and 5 m)
Non-forest	Land that falls outside the minimum criteria for being considered forest
Deforestation	Conversion from Forest to Non-forest
Degraded forest	Forest that has had its biomass reduced by natural or anthropogenic disturbances

2 Applicability

2.1 Description

The approaches described are intended to be applicable to a broad range of geophysical and socio-economic contexts. The main applicability a criterion is that it should be applied in relatively small areas of community managed forest. It should be noted however that users will be required to demonstrate and justify that the data and parameters used meet the requirements described in Section 4 and will not result in an overestimation of climate benefits.

2.2 Applicability conditions

This approach is applicable to project areas where:

- Most of the variation in tree biomass is explained by forest type
- The main factors affecting drivers of deforestation and forest degradation in the project area are forest type, legal classification and topography

2.3 Exclusion criteria

This approach cannot be used for project areas where:

- The baseline scenario includes effective community management
- Total forest area exceeds 100,000 hectares

3 Approach

The approaches described below for estimation and verification of baseline scenario emissions, project scenario emissions, leakage emissions and climate benefits can be used independently or in combination by all projects that meet the applicability criteria described in Section 2, provided data and parameters applied meet the requirements described in Section 4. Full details of all calculations, data and parameters must be included in the PDD; as well as any changes or modifications made to the approaches described here.

3.1Baseline scenario emissions

Expected baseline scenario emissions are estimated at the start of each project period, and verified at the end of each project period, using the approaches described below.

3.1.1 Expected baseline scneario emissions

To estimate baseline scenario emissions it is assumed that if the project area is not brought under effective community management it will be affected by similar drivers of deforestation and forest degradation to other areas of forest in a reference region that have the same forest type and legal status.

It is further assumed that the average annual amount of deforestation and forest degradation observed during an historical reference period (expressed as a proportion of forest area present at the start of the reference period), in areas of forest in the reference region that have the same forest type and legal status as forest in the project area, will provide a conservative estimate of the annual amount of deforestation and degradation (expressed as a proportion of forest area present at the start of the project period) that would occur in the project area under the baseline scenario.

On the basis of these assumptions, the baseline scenario emissions are estimated at the start of each project period with the Equations 1 to 3.

The average annual amount of deforestation and degradation in the reference region during the reference period, as a proportion of the forest area present at the start of the reference period, is calculated for each of the forest types and legal classifications present in the area with Equations 1 and 2.

$$D_{RR_{i,j,k}} = \frac{A_{Def_{i,j,k}}}{(A_{RR_{i,j,k}} \cdot T_{RP})}$$

[Equation 1]

Where:

$D_{RR_{i,j,k}}$ = Average proportion of the forest area present at the start of the reference region for forest type *i*, legal classification *j* and topography class *k* that was deforested in each year of the reference period;

$A_{Def_{i,j,k}}$ = Area of forest type *i*, legal classification *j* and topography class *k* in the reference region converted to non-forest during the reference period (ha);

$A_{RR_{i,j,k}}$ = Area of forest type *i*, legal classification *j* and topography class *k* present within the reference region at the start of the reference period (ha); and

T_{RP} = Length of the reference period (years).

$$G_{RR_{i,j,k}} = \frac{A_{Deg_{i,j,k}}}{(A_{RR_{i,j,k}} \cdot T_{RP})}$$

[Equation 2]

Where:

$G_{RR_{i,j,k}}$ = Average proportion of the forest area present at the start of the reference region for forest type *i*, legal classification *j* and topography class *k* that was degraded in each year of the reference period; and

$A_{Deg_{i,j,k}}$ = Area of forest type *i*, legal classification *j* and topography class *k* in the reference region converted to degraded forest during the reference period (ha).

The baseline scenario CO_2 emissions expected to result from deforestation and forest degradation in the project area during the project period, assuming that the average annual proportions of initial forest area deforested and degraded estimated with Equations 1 and 2 occur within the project area, are calculated with Equation 3.

$$E_{BL} = T_{PP} \cdot \frac{44}{12} \cdot \sum_{i,j,k} \left(\left(D_{RR_{i,j,k}} \cdot A_{PA_{i,j,k}} \cdot (C_i - C_{NF}) \right) + \left(G_{RR_{i,j,k}} \cdot A_{PA_{i,j,k}} \cdot (C_i - C_{SF_i}) \right) \right)$$

[Equation 3]

Where:

E_{BL} = Baseline scenario emissions from deforestation and forest degradation expected during the project period (Mg CO_2);

T_{PP} = Length of the project period (years);

$\frac{44}{12}$ = Factor to convert from carbon to carbon dioxide based on molecular weights of carbon (12) and oxygen (16);

$A_{PA_{i,j,k}}$ = Area of forest type *i*, legal classification *j* and topography class *k* present in the project area at the start of the project period;

C_i = Carbon density of forest type *i* (Mg C ha^{-1});

C_{NF} = Carbon density of non-forest (Mg C ha^{-1}); and

C_{SF_i} = Carbon density of degraded forest of forest type *i* (Mg C ha^{-1}).

3.1.2 Verification of baseline scenario emissions

At the end of each project period expected baseline scenario emissions must be verified by comparing the baseline emissions expected during the project period E_{BL} to a revised estimate of baseline emissions that occurred during the project period. The actual baseline scenario emissions that would have occurred during the project period (AE_{BL}) are estimated by considering deforestation and degradation that occurred within the reference region during the project period, with Equations 4 to 6.

$$AD_{RR_{i,j,k}} = \frac{AA_{Def_{i,j,k}}}{AA_{RR_{i,j,k}}}$$

[Equation 4]

Where:

$AD_{RR_{i,j,k}}$ = Proportion of forest type *i*, legal classification *j* and topography class *k* within the reference region that was deforested during the project period;

$AA_{Def_{i,j,k}}$ = Area of forest type *i*, legal classification *j* and topography class *k* in the reference region converted to non-forest during the project period (ha); and

$AA_{RR_{i,j,k}}$ = Area of forest type *i*, legal classification *j* and topography class *k* present within the reference region at the start of the project period (ha)

$$AG_{RR_{i,j,k}} = \frac{AA_{Deg_{i,j,k}}}{AA_{RR_{i,j,k}}}$$

[Equation 5]

Where:

$AG_{RR_{i,j,k}}$ = Proportion of forest type *i*, legal classification *j* and topography class *k* within the reference region that was degraded during the project period; and

$AA_{Deg_{i,j,k}}$ = Area of forest type *i*, legal classification *j* and topography class *k* in the reference region converted to degraded forest during the project period (ha).

$$AE_{BL} = \frac{44}{12} \cdot \sum_{i,j,k} \left(\left(AD_{RR_{i,j,k}} \cdot A_{PA_{i,j,k}} \cdot (C_i - C_{NF}) \right) + \left(AG_{RR_{i,j,k}} \cdot A_{PA_{i,j,k}} \cdot (C_i - C_{SF_i}) \right) \right)$$

[Equation 6]

Where:

AE_{BL} = Actual baseline scenario emissions from deforestation and forest degradation expected during the project period (Mg CO_2).

3.2Project scenario emissions

Expected project scenario emissions are estimated for the first project period by employing a conservative assumption about the likely impacts of project activities on baseline scenario emissions. At the end of each project period, actual project scenario emissions are estimated and used to verify emission reductions achieved during the previous project period, and to update expected project scenario emissions for the subsequent project period. The approaches for estimating expected project scenario emissions, and verifying project scenario emissions that are achieved, are described below.

3.2.1 Expected project scenario emissions

Expected project scenario emissions are estimated with Equation 6.

$$E_{PS} = E_{BL} \cdot (1 - F)$$

[Equation 7]

Where:

E_{PS} = Expected project scenario emissions from deforestation and forest degradation expected during the project period (Mg CO_2); and

F = Expected effectiveness of project activities in reducing emissions from deforestation and forest degradation, expressed as a proportion of baseline scenario emissions that can conservatively be expected to be avoided as a result of project activities.

For the first project period, a conservative value of F should be adopted based on the value adopted for F should be informed by the actual effectiveness (AF) achieved in previous project periods.

3.2.2 Verification of project scenario emissions

At the end of each project period actual project scenario emissions should be estimated using Equations 7 and 8.

$$AF = \frac{\frac{44}{12} \cdot \sum_{i,j,k} \left(\left(D_{PA_{i,j,k}} \cdot (C_i - C_{NF}) \right) + \left(G_{PA_{i,j,k}} \cdot (C_i - C_{SF_i}) \right) \right)}{AE_{BL}}$$

[Equation 8]

Where:

AF = Actual effectiveness of project activities in reducing emissions from deforestation and forest degradation, expressed as a proportion of actual baseline scenario emissions;

$D_{PA_{i,j,k}}$ = Area of forest type i, legal classification j and topography class k within the project area that was deforested during the project period (ha); and

$G_{PA_{i,j,k}}$ = Area of forest type i, legal classification j and topography class k within the project area that was degraded during the project period (ha).

$$AE_{PS} = AE_{BL} \cdot AF$$

[Equation 9]

Where:

AE_{PS} = Actual emissions from deforestation and forest degradation that occurred in the project area during the project period (Mg CO_2).

3.3 Leakage emissions

Expected leakage emissions are estimated at the start of the project period, and verified at the end of the project period. The approaches used depend on the availability of data for the project area, as described below.

3.3.1 Expected leakage emissions

Expected leakage emissions are estimated at the start of the project period, and verified at the end of the project period. The approaches used depend on the availability of data for the project area, as described below.

There are two possible approaches for estimating expected leakage emissions:

a. Income data approach - based on assumptions relating to displacement of deforestation and forest degradation by stakeholders whose income (including cash and non-cash income, and food production) could be negatively affected by project activities; or

b. Expected leakage approach – based on a conservative estimate of the proportion of climate benefits that could be lost through leakage.

If sufficient quality income data are available, or can be collected, the income data approach is preferable. However, this will not be feasible for many projects, in which case the expected leakage approach can be used.

3.3.1a Income data approach

Expected leakage emissions should be calculated with Equation 10 for all stakeholder groups involved in activities with potential to cause deforestation or degradation in the project area under the baseline scenario, and whose activities could potentially be displaced as a result of project activities.

$$E_{LK} = \frac{44}{12} \cdot \sum_{a,s} \left(\frac{\Delta I_{a,s}}{V_{a,s}} \cdot \Delta C_{a,s} \right)$$

[Equation 10]

Where:

E_{LK} = Leakage emissions expected to result from displacement of deforestation and degradation during the project period (Mg CO_2);

$\Delta I_{a,s}$ = Expected change in income from activity *a* for stakeholder group *s* during the project period as a result of project activities ($);

$V_{a,s}$ = Expected average income per hectare from activity *a* for stakeholder group *s* during the project period ($ ha^{-1}); and

$\Delta C_{a,s}$ = Change in carbon stocks associated with activity *a* if carried out by stakeholder group *s* in the reference region (Mg C ha^{-1}).

3.3.1b Expected leakage approach

Expected leakage scenario emissions are estimated with Equation 11.

$$E_{LK} = L \cdot (E_{BL} - E_{PS})$$

[Equation 11]

Where:

L = Expected emissions from deforestation and forest degradation that result from displacement of activities from the project area as a result of project activities,

expressed as a proportion of climate benefits that are expected to be lost as a result of leakage.

For the first project period, a conservative value of L should be adopted. For subsequent project periods the value adopted for L should be informed by the actual effectiveness (AE_{LK}) achieved in previous project periods.

3.3.2 Verification of leakage emissions

Two options are then available for verifying leakage emissions at the end of the project period:

a. Income data approach - assessing the changes in income that occurred during the project period, and assuming that any reduction in income that resulted from project activities would cause in displacement; or
b. Leakage area approach - defining a leakage area according to the mobility of stakeholders whose activities could be displaced; and comparing deforestation and degradation that occurred within the leakage area to the deforestation and degradation within the rest of reference region.

3.3.2a Income data approach

For verification of leakage using income data leakage emissions are verified using the same approach employed to estimate expected leakage at the start of the project, but replacing expected change in income ($\Delta I_{a,s}$) as a result of project activities with an estimate of actual change in income ($A\Delta I_{a,s}$), and updating the value per hectare from each activity with potential to be displaced ($V_{a,s}$) to reflect any changes that have occurred during the project period. This approach provides a conservative estimate of leakage emissions since it provides a maximum value for the amount of displacement that could be attributed to project activities. Verified leakage emissions are therefore estimated with Equation 12.

$$AE_{LK} = \frac{44}{12} \cdot \sum_{a,s} \left(\frac{A\Delta I_{a,s}}{AV_{a,s}} \cdot \Delta C_{a,s} \right)$$

[Equation 12]

Where:

AE_{LK} = Maximum potential leakage emissions that could have occurred as a result of displacement of deforestation and degradation during the project period (Mg CO_2);

$A\Delta I_{a,s}$ = Change in income from activity a for stakeholder group s during the project period as a result of project activities ($); and

$AV_{a,s}$ = Average income per hectare from activity *a* for stakeholder group *s* during the project period ($ ha^{-1}).

3.3.2b Leakage area approach

To use the leakage area approach for verification emissions from deforestation and degradation in the leakage area that have occurred as a result of project activities are estimated. To estimate leakage emissions in this way, the emissions expected in the leakage area if deforestation and degradation occurred at the same rate as in the rest of the reference area are subtracted from the emissions that occurred in the leakage area. Verified leakage emissions can therefore be estimated with Equations 13 to 15.

$$AE_{LA} = \frac{44}{12} \cdot \sum_{i,j,k} \left(\left(D_{LA_{i,j,k}} \cdot (C_i - C_{NF}) \right) + \left(G_{LA_{i,j,k}} \cdot (C_i - C_{SF_i}) \right) \right)$$

[Equation 13]

Where:

AE_{LA} = Actual emissions from deforestation and degradation that occurred in the reference area during the project period (Mg CO_2);

$D_{LA_{i,j,k}}$ = Area of forest type *i*, legal classification *j* and topography class *k* within the leakage area that was deforested during the project period (ha); and

$G_{LA_{i,j,k}}$ = Area of forest type *i*, legal classification *j* and topography class *k* within the leakage area that was degraded during the project period (ha).

$$EE_{LA} = \frac{44}{12} \cdot \sum_{i,j,k} \left(\left(AD_{RR_{i,j,k}} \cdot A_{LA_{i,j,k}} \cdot (C_i - C_{NF}) \right) + \left(AG_{RR_{i,j,k}} \cdot A_{LA_{i,j,k}} \cdot (C_i - C_{SF_i}) \right) \right)$$

[Equation 14]

Where:

EE_{LA} = Expected emissions from deforestation and degradation in the leakage area during the project period if no leakage occurred (Mg CO_2);

$A_{LA_{i,j,k}}$ = Area of forest type *i*, legal classification *j* and topography class *k* present in the leakage area at the start of the project period.

$$AE_{LK} = AE_{LA} - EE_{LA}$$

[Equation 15]

Where:

AE_{LK} = Maximum potential leakage emissions that could have occurred as a result of displacement of deforestation and degradation during the project period (Mg CO_2).

3.4Climate benefits

The values calculated above are used to estimate and verify climate benefits that result from project activities.

3.4.1 Expected climate benefits

Expected climate benefits are estimated at the start of the project with Equation 16.

$$B = E_{BL} - E_{PS} - E_{LK}$$

[Equation 16]

Where:

B = Climate benefits expected to result from reduced deforestation and forest degradation as result of project activities during the project period (Mg CO_2).

3.4.2 Verification of climate benefits

Climate benefits achieved are calculated at the end of the project period with Equation 17

$$AB = AE_{BL} - AE_{PS} - AE_{LK}$$

[Equation 17]

Where:

AB = Actual climate benefits resulting from reduced deforestation and forest degradation as result of project activities during the project period (Mg CO_2).

4 Data and parameters

4.1Forest strata

Description	Reference region
Symbol	RR
Units	None
Value	Defined for each project area
Source	A reference region must be identified for each project area. The reference region must: • Be a contiguous area surrounding or adjacent to the project area; • Exclude the project area; • Have had at least three times the area of each forest stratum present within the project area at the start of the reference period (i.e. if the project area includes 200 ha of a forest stratum, the reference area must have had at least 600 ha of that stratum at the start of the reference period); • Be exposed to similar drivers of deforestation and forest degradation as the project area.
Justification	It is assumed that forest close to the project area will be exposed to similar drivers of deforestation and degradation as forest of the same strata within the project area, and that patterns of deforestation and degradation that occurred in the reference region during the reference period are likely to occur in forest of the same strata in the project area during the project period. The project area should not be included in the reference region so that changes in the reference region can compared to those in the project area.
Use	For defining the area of each forest stratum within the reference region ($A_{RR_{i,j,k}}$), the amount of deforestation and degradation that occurs in the reference region during the reference period ($A_{Def_{i,j,k}}$ and $A_{Deg_{i,j,k}}$)
Comments	The PDD must clearly identify the reference region for each project area and the area of each forest stratum in the project area present that was present at the start of the reference period. A justification for why the reference region was selected, with reference to the drivers of deforestation and degradation must also be included. Note that reference regions that are too large (for example national boundaries) are unlikely to exposed to similar drivers of deforestation and degradation as the project area, and smaller reference regions (for example using district or provincial boundaries) are likely to be more appropriate.
Frequency	Established at the start of the project. The reference region is not usually revised unless new evidence suggests that it is no longer appropriate.

Description	Leakage area
Symbol	LA
Units	None
Value	Defined for each project area if the leakage area approach is used to verify leakage emissions
Source	The leakage area must be defined according to the area within which the activities of specific stakeholder groups expected to engage in activities that cause deforestation or degradation in the project area under the baseline scenario, and whose activities could be displaced as a result of project activities
Justification	The area susceptible to leakage will depend on the stakeholders and activities with potential to be displaced
Use	For defining the area used to verify leakage emissions using the leakage area approach
Comments	If the leakage area approach will be used to verify leakage emissions the PDD must clearly identify the leakage area for each project area. A justification for why the leakage area was selected, with reference to the agents and drivers of deforestation and degradation whose activities could be displaced as a result of project activities.

Description	Forest type
Symbol	i
Units	None
Value	Defined for each project area
Source	Forest type classifications should reflect the main differences in tree biomass that occur in the project area. These are likely to include ecological types as well as disturbance history.
Justification	Forest type is an important determinant of above- and below-ground biomass. Different forest types are also likely to be affected differently by drivers of deforestation and degradation. Stratifying the forest area according to forest type is therefore help to improve the accuracy of estimates of baseline and project scenario emissions.
Use	For defining forest strata
Comments	The PDD must clearly identify the forest types used for defining forest strata in the project area, and justify why these are appropriate to represent the variation in tree biomass that occurs within the project area.
Frequency	Established at the start of the project. Forest type classifications are not usually revised unless new evidence suggests they are no longer appropriate.

Description	Legal classification
Symbol	j
Units	None
Value	Defined for each project area
Source	Forest legal classifications must identify the legal status of the forest and the activities that are legally permitted in the area; additional classifications can be added to reflect other factors that are likely to affect how the forest is used, for example efficacy of protection or enforcement, or land ownership.
Justification	The legal classification is an important determinant of how a forest area is used. Stratifying the forest according to legal classification therefore helps to improve the accuracy of estimates of baseline scenario emissions.
Use	For defining forest strata
Comments	The PDD must clearly identify the legal classification categories used for defining forest strata in the project area, and justify why these are appropriate to represent the variation in land-use regulations and enforcement in the project area.
Frequency	Established at the start of the project. Legal classifications are not usually revised unless new evidence suggests they are no longer appropriate.

Description	Topographic class
Symbol	k
Units	None
Value	Defined for each project area
Source	Forest topographic classes must distinguish between the main topographic characteristics that are likely to affect the drivers of deforestation and forest degradation in the project area, such as elevation and slope.
Justification	Topography is an important determinant of how forest is used. Stratifying the forest according to topographic class therefore helps to improve the accuracy of estimates of baseline scenario emissions.
Use	For defining forest strata
Comments	The PDD must clearly identify the topographic classes used for defining forest strata in the project area, and justify why these are appropriate for representing the range of topographic variation within the project area.
Frequency	Established at the start of the project. Topographic classes are not usually revised unless new evidence suggests they are no longer appropriate.

4.2 Project periods

Description	Reference period
Symbol	RP
Units	None
Value	Defined for each reference region and project period. The reference period must be at least 5 years and must not exceed 15 years. The end of the reference period must be within 2 years of the start of the project period.
Source	A reference period must be selected for which sufficient data are available, and during which the patterns of deforestation and degradation that occurred are likely to continue during the project period.
Justification	A minimum of 5 years is required to reduce the effects of inter-annual variation on the average annual area deforested or degraded. A maximum of 15 years helps to ensure that the patterns of land cover change in the reference period reflect drivers of deforestation and degradation that are likely to be present during the project period.
Use	For defining the period during which deforestation and degradation in the reference period are assessed.
Comments	The PDD must specify the reference period start and end dates, and justify why these are appropriate to represent the drivers of deforestation and forest degradation that are expected to affect the project area during the project period.
Frequency	The reference period must be revised at the start of each project period (usually every 5 years), so that the period ends within 2 years of the start of the new project period.

Description	Length of the reference period
Symbol	T_{RP}
Units	Years
Value	Defined for each reference region, from 5 to 15 years.
Source	See reference period (RP)
Justification	See reference period (RP)
Use	Calculating average annual proportion of the forest area present at the start of the reference region deforested and degraded during the reference period (Equations 1 and 2)
Comments	See reference period (RP)
Frequency	See reference period (RP)

Description	Project period
Symbol	PP
Units	None
Value	Defined for each project area and project period. The length of the project period must be 5 years, with a start date that coincides with the start of project activities or the end of the previous project period.
Source	A project period must be selected over which project participants are able to make a commitment to carry out project activities.
Justification	A 5 years is project period is aligned with the requirement to revise project design documents and verify emission reductions achieved at least every 5 years, it is also a period over which participants are able to make a meaningful commitment to fulfill the management activities.
Use	For defining the period during which the climate benefits from reduced deforestation and degradation are assessed.
Comments	The PDD must specify the project period start and end dates, and justify why these are appropriate for the planned activities.
Frequency	The project period is defined at the start of the project, and revised at the start of each subsequent project period.

Description	Length of the project period
Symbol	T_{PP}
Units	Years
Value	5
Source	See project period (PP)
Justification	See project period (PP)
Use	Calculating estimated climate benefits (Equation 3)
Comments	See project period (PP)
Frequency	See project period (PP)

4.3 Land cover change

Description	Average proportion of the forest area present at the start of the reference region for forest type i, legal classification j and topography class k that was deforested in each year of the reference period
Symbol	$D_{RR_{i,j,k}}$
Units	None
Value	Calculated for each forest stratum in the project area
Source	Equation 1
Justification	Assumed that, within a forest strata, the annual proportion of forest converted to non-forest in the reference region during the reference period would occur in the project area under the baseline scenario
Use	Estimating expected baseline scenario emissions (Equation 3)
Comments	The PDD must report the value for each forest stratum in the project area and provide a spreadsheet with the calculations
Frequency	Calculated at the start of each project period (usually every 5 years)

Description	Area of forest type forest type *i*, legal classification *j* and topography class *k* in the reference region converted to non-forest during the reference period
Symbol	$A_{Def_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area
Source	Land cover change assessment from analysis of remote sensing imagery or a time-series of land cover maps
Justification	An appropriate and accurate land cover change assessment provides a transparent and repeatable method for identifying deforestation.
Use	To estimate the annual proportion of different forest strata deforested in the reference region during the reference period (Equation 1)
Comments	The PDD must include full details of the land cover change analysis including: • The value for each forest stratum in the project area and a spreadsheet with the calculations; • Maps of forest strata in the reference region at the start and end of the reference period and/or a map showing land cover change during the reference period; • A description of the datasets and methodologies used to generate land cover maps and/or conduct the land cover change assessment, with sufficient detail that they could be repeated by a suitably qualified technician
Frequency	The land cover change assessment must be repeated, and $A_{Def_{i,j,k}}$ estimated for each forest stratum present in the project area, at the start of each project period (usually every 5 years)

Description	Area of forest type *i*, legal classification *j* and topography class *k* present within the reference region at the start of the reference period
Symbol	$A_{RR_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area
Source	Land cover assessment from analysis of remote sensing imagery or forest cover maps
Justification	Land cover maps provide a transparent and repeatable method for estimating the area of forest strata
Use	To estimate the annual proportion of different forest strata deforested and degraded in the reference region during the reference period (Equations 1 and 2)
Comments	The PDD must include full details of the land cover assessment including: • The value for each forest stratum in the project area; • A map of forest strata in the reference region at the start of the reference period; • A description of the datasets and methodologies used to generate land cover maps, with sufficient detail that they could be repeated by a suitably qualified technician
Frequency	The assessment of forest cover at the start of the reference period must be repeated, and $A_{RR_{i,j,k}}$ estimated for each forest stratum present in the project area at the start of each project period (usually every 5 years), so that the values represent the new reference period.

Description	Average proportion of the forest area present in the reference region at the start of the reference period for forest type *i*, legal classification *j* and topography class *k* that was degraded in each year of the reference period
Symbol	$G_{RR_{i,j,k}}$
Units	None
Value	Calculated for each forest stratum in the project area
Source	Equation 2
Justification	Assumed that, within a forest stratum, the annual proportion of forest degraded in the reference region during the reference period would occur in the project area under the baseline scenario
Use	Estimating baseline scenario emissions (Equation 3)
Comments	The PDD must report the value for each forest stratum in the project area and provide a spreadsheet with the calculations
Frequency	Must be recalculated for each forest stratum in the project area at the start of each project period (usually every 5 years).

Description	Area of forest type forest type *i*, legal classification *j* and topography class *k* in the reference region converted to degraded forest during the reference period
Symbol	$A_{Deg_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area
Source	Land cover change assessment from analysis of remote sensing imagery or a time-series of land cover maps
Justification	An appropriate and accurate land cover change assessment provides a transparent and repeatable method for identifying forest degradation
Use	To estimate the annual proportion of different forest strata degraded in the reference region during the reference period (Equation 1)
Comments	The PDD must include full details of the land cover change analysis including: • The definition of forest degradation applied; • Details of how degradation was quantified; • The value for each forest stratum in the project area and a spreadsheet with the calculations; • Maps of forest strata in the reference region at the start and end of the reference period and/or a map showing land cover change during the reference period; and • A description of the datasets and methodologies used to generate land cover maps and/or conduct the land cover change assessment, with sufficient detail that they could be repeated by a suitably qualified technician.
Frequency	The land cover change assessment must be repeated, and $A_{Deg_{i,j,k}}$ for each forest stratum present in the project area estimated for the new reference period at the start of each project period (usually every 5 years).

Description	Area of forest type *i*, legal classification *j* and topography class *k* present in the project area at the start of the project period
Symbol	$A_{PA_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area
Source	Land cover assessment from analysis of remote sensing imagery or land cover maps from within 2 years of the start of the project period
Justification	Appropriate and accurate maps representing land cover at the start of the project period provide a transparent and repeatable method for assessing the area of different forest strata present
Use	Estimating the amount of deforestation and forest degradation expected during the project period (Equation 3)
Comments	The PDD must include full details of the land cover assessment including: • The value for each forest stratum in the project area; • A map of forest strata in the project area at the start of the project period; and • A description of the datasets and methodologies used to generate land cover maps and/or conduct the land cover assessment, with sufficient detail that they could be repeated by a suitably qualified technician.
Frequency	The land cover assessment must be repeated every 5 years, and $A_{PA_{i,j,k}}$ estimated for each forest stratum in the project area at the start of each project period.

4.4Carbon stocks and emissions

Description	Baseline scenario emissions from deforestation and forest degradation expected during the project period
Symbol	E_{BL}
Units	Mg CO_2
Value	Calculated for each project area
Source	Equation 3
Justification	Estimated by multiplying the area of each forest straum expected to be deforested and degraded under the baseline scenario by the carbon stock change associated with the change in land cover. Assumes any reduction in biomass is converted to an instantaneous CO_2 emission.
Use	Providing a baseline against which project benefits can be assessed (Equation 16).
Comments	The PDD must specify the baseline scenario emissions and provide a spreadsheet with the calculations
Frequency	Calculated at the start of each project period (usually every 5 years)

Description	Carbon density of forest type i
Symbol	C_i
Units	Mg C ha^{-1}
Value	Estimated for each forest type in the project area
Source	Local or regional carbon stock survey
Justification	Where existing studies provide estimates of carbon stocks in the forest types present within the project area that are likely to provide a conservative estimate of carbon density in the project area, inventory of sample plots within the project area may not be necessary. If local or regional studies are not available, or provide values that are unlikely to provide conservative estimates if applied to the project area, inventory plots and/or remote sensing analysis may be required.
Use	Estimating the change in carbon stocks that results from deforestation and forest degradation (Equation 3)
Comments	The PDD must include: • Values for each forest type in the project area • Details of the source of values used, and a justification for why the values adopted are expected to be conservative when applied to the project area. If unpublished research is cited copies of the relevant reports should be provided as an Annex to the PDD. • Full details of any carbon surveys conducted including survey and analysis methodologies, raw data, and estimates of uncertainty associated with carbon density values.
Frequency	Usually estimated once at the start of the project, although can be updated if new data become available during the project.

Description	Carbon density of non-forest
Symbol	C_{NF}
Units	Mg C ha^{-1}
Value	Estimated for each project area
Source	Local or regional carbon stock survey
Justification	Where existing studies provide estimates of carbon stocks of deforested land within the project area that are likely to provide a conservative estimate of carbon density of deforested land within the project area, inventory of sample plots within the project area may not be necessary. If local or regional studies are not available, or provide values that are unlikely to provide conservative estimates if applied to the project area, inventory plots and/or remote sensing analysis may be required.
Use	Estimating the change in carbon stocks that results from deforestation (Equation 3)
Comments	The PDD must include: • Values for each project area • Details of the source of values used, and a justification for why the values adopted are expected to be conservative when applied to the project area. If unpublished research is cited copies of the relevant reports should be provided as an Annex to the PDD. • Full details of any carbon surveys conducted including survey and analysis methodologies, raw data, and estimates of uncertainty associated with carbon density values.
Frequency	Usually estimated once at the start of the project, although can be updated if new data become available during the project.

Description	Carbon density of degraded forest of forest type i
Symbol	C_{SF_i}
Units	Mg C ha^{-1}
Value	Estimated for each forest type in the project area for which emissions from forest degradation will be estimated
Source	Local or regional carbon stock survey
Justification	Where existing studies provide estimates of carbon stocks of degraded forest for the forest strata present within the project area that are likely to provide a conservative estimate of carbon density of degraded forest within the project area, inventory of sample plots within the project area may not be necessary. If local or regional studies are not available, or provide values that are unlikely to provide conservative estimates if applied to the project area, inventory plots and/or remote sensing analysis may be required.
Use	The PDD must include: • Values for each project area • Details of the source of values used, and a justification for why the values adopted are expected to be conservative when applied to the project area. If unpublished research is cited copies of the relevant reports should be provided as an Annex to the PDD. • Full details of any carbon surveys conducted including survey and analysis methodologies, raw data, and estimates of uncertainty associated with carbon density values.
Comments	Usually estimated once at the start of the project, although can be updated if new data become available during the project.

Description	Expected project scenario emissions from deforestation and forest degradation expected during the project period
Symbol	E_{PS}
Units	Mg CO_2
Value	Calculated for each project area
Source	Equation 7
Justification	Estimated by multiplying the expected baseline scenario emissions by the expected effectiveness of project activities at reducing emissions from deforestation and forest degradation
Use	Assessment of expected emission reductions (Equation 16)
Comments	The PDD must specify the expected project scenario emissions and provide a spreadsheet with the calculations
Frequency	Calculated at the start of each project period (usually every 5 years)

Description	The expected effectiveness of project activities in reducing emissions from deforestation and forest degradation, expressed as a proportion of baseline scenario emissions that can conservatively be expected to be avoided as a result of project activities
Symbol	F
Units	None
Value	Estimated for each project area
Source	Conservative assumption for the first project period, which should be updated for subsequent project periods with reference to actual effectiveness achieved to date
Justification	A conservative estimate for project effectiveness should reduce the likelihood that projects will under-achieve on expected emission reductions
Use	Estimation of expected project scenario emissions (Equation 7)
Comments	The PDD must specify the value adopted for F and justify why this is conservative for the project area
Frequency	Estimated at the start of each project period (usually every 5 years) based on a conservative assumption for the first project period, which should be informed by actual effectiveness achieved to date for subsequent project periods

Description	Climate benefits expected to result from reduced deforestation and forest degradation as result of project activities during the project period
Symbol	B
Units	Mg CO_2
Value	Calculated for each project area
Source	Equation 16
Justification	Estimated by subtracting project scenario emissions and leakage emissions from baseline scenario emissions
Use	For estimating climate benefits at the start of the project period
Comments	The PDD must specify the expected climate benefit and provide a spreadsheet with the calculations
Frequency	Calculated at the start of each project period (usually every 5 years)

4.5 Leakage

Description	Natural resource use activities that causes deforestation or degradation and is expected to be reduced in the project area as a result of project interventions
Symbol	a
Units	None
Value	Identified for each project area
Source	Analysis of local drivers of deforestation and forest degradation
Justification	Analysis of local drivers of deforestation and forest degradation should reveal the activities that have the potential to be displaced as a result of project activities
Use	For defining activities that could cause leakage emissions
Comments	The PDD must clearly identify the natural resource use activities in the baseline scenario, and justify which of these is expected to be reduced in the project area as a result of project interventions

Frequency	Established at the start of the project. Leakage activity classifications are not usually revised unless new evidence suggests they are no longer appropriate
Description	Stakeholder groups expected to engage in activities that cause deforestation or degradation in the project area under the baseline scenario, and whose activities could be displaced as a result of project activities
Symbol	s
Units	None
Value	Identified for each project area
Source	Analysis of local drivers of deforestation and forest degradation
Justification	Analysis of local drivers of deforestation and forest degradation should reveal the stakeholder groups whose activities could be displaced as a result of project activities
Use	For defining stakeholder groups whose activities could be displaced as a result of project interventions
Comments	The PDD must clearly identify and describe the stakeholder groups expected to engage in natural resource use activities with the potential to cause deforestation and forest degradation in the baseline scenario, and justify which of these groups could have their activities displaced as a result of project activities
Frequency	Established at the start of the project. Leakage stakeholder group classifications are not usually revised unless new evidence suggests they are no longer appropriate

Description	Leakage emissions expected to result from displacement of deforestation and degradation during the project period
Symbol	E_{LK}
Units	Mg CO_2
Value	Calculated for each project area
Source	Equation 10
Justification	The amount of leakage expected is assumed to be equal to the emissions that would result from the land cover change needed to replace income from natural resource use activities that are reduced as a result of project activities, if those activities have the potential to be displaced
Use	Estimating expected climate benefits (Equation 16)
Comments	The PDD must specify the expected leakage emissions and provide a spreadsheet with the calculations

Frequency	Calculated at the start of each project period (usually every 5 years)
Description	Expected change in income from activity *a* for stakeholder group *s* during the project period as a result of project activities
Symbol	$\Delta I_{a,s}$
Units	$
Value	Estimated for each activity and stakeholder group with potential to cause deforestation and forest degradation as a result of displacement from the project area
Source	Surveys of land use and socio-economic conditions of stakeholder groups expected to use the project area under the baseline scenario, and projections of income expected to be generated by project activities
Justification	Loss of income from natural resource use activities is assumed to be the main driver for displacement of deforestation and forest degradation as a result of project activities
Use	Estimating expected leakage emissions (Equation 10)
Comments	The PDD must describe and justify the expected change in income for all activities and stakeholder groups for which income is expected to be reduced as a result of project activities, and for which there is potential for displacement. Published studies and surveys conducted at the project site should be referenced where appropriate. Activities and stakeholder groups for which income is not expected to be reduced, or for which there is no potential for displacement should also be identified and justification provided for why they are not expected to contribute to leakage.
Frequency	Estimated at the start of each project period (usually every 5 years)

Description	Expected average income per hectare from activity *a* for stakeholder group *s* during the project period
Symbol	$V_{a,s}$
Units	$ ha^{-1}
Value	Estimated for each activity and stakeholder group with potential to cause deforestation and forest degradation as a result of displacement from the project area
Source	Published sources or village surveys
Justification	Average income from specific activities is likely to vary between villages and between stakeholder groups within villages and estimates from local surveys are likely to be necessary, if there is uncertainty a conservative estimate would assume a higher value
Use	Estimating expected leakage emissions (Equation 10)
Comments	The PDD must state the estimates used for average income for each activity and stakeholder group with potential to cause deforestation and forest degradation as a result of displacement from the project area. Published studies and surveys conducted at the project site should be referenced where appropriate.
Frequency	Estimated at the start of each project period (usually every 5 years)

Description	Change in carbon stocks associated with activity *a* if carried out by stakeholder group *s* in the reference region
Symbol	$\Delta C_{a,s}$
Units	Mg C ha^{-1}
Value	Estimated for each activity and stakeholder group with potential to cause deforestation and forest degradation as a result of displacement from the project area
Source	If areas where leakage from a specific activity and stakeholder group can be identified change in carbon stock should be estimated according to the expected change to the land cover type(s) as a result of the activity. If it is not clear which areas activities would be displaced to conservative estimates for change in carbon stocks should be used based on the land cover types that could be affected that would result in the greatest loss of carbon stocks as a result of the displaced activity. Published estimates of carbon stocks in different land cover types (such as those used to for C_t, C_{NF}, and C_{SF_t}) may be applied, or local surveys could also be necessary if relevant existing data are not available.
Justification	A conservative estimate of expected change in carbon stocks as a result of displacement can be derived by considering a worst case scenario for change in carbon stocks within the area that could be affected by leakage
Use	Estimating expected leakage emissions (Equation 10)
Comments	The PDD must state the maximum change in carbon stock for each activity and stakeholder group with potential to cause deforestation and forest degradation as a result of displacement from the project area. Published studies and surveys conducted at the project site should be referenced where appropriate.
Frequency	Estimated at the start of each project period (usually every 5 years)

Description	The expected emissions from deforestation and forest degradation that result from displacement of activities from the project area as a result of project activities, expressed as a proportion of climate benefits that are expected to be lost as a result of leakage
Symbol	L
Units	None
Value	Estimated for each project area (if expected leakage approach is used to estimate expected leakage emissions)
Source	Conservative assumption for the first project period, which should be updated for subsequent project periods with reference to actual leakage in previous project periods
Justification	A conservative estimate for expected leakage should reduce the likelihood that projects will over-estimate expected climate benefit
Use	Estimation of expected leakage emissions using expected leakage approach (Equation 11)
Comments	The PDD must specify the value adopted for L and justify why this is conservative for the project area
Frequency	Estimated at the start of each project period (usually every 5 years) based on a conservative assumption for the first project period, which should be informed by actual leakage to date for subsequent project periods

4.6Verification

Description	Average proportion of forest type i, legal classification j and topography class k within the reference region that was deforested in each year of the project period
Symbol	$AD_{RR_{i,j,k}}$
Units	None
Value	Calculated for forest stratum in the project area
Source	Equation 4
Justification	Assumed that, within a forest strata, the annual proportion of forest converted to non-forest in the reference region during the project period would have occurred in the project area without the project interventions
Use	Verification of baseline scenario emissions
Comments	The revised PDD must report the value for each forest stratum in the project area and provide a spreadsheet with the calculations
Frequency	Must be recalculated at the end of each project period (usually every 5 years)

Description	Area of forest type i, legal classification j and topography class k in the reference region converted to non-forest during the project period (ha)
Symbol	$AA_{Def_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area
Source	Land cover change assessment from analysis of remote sensing imagery or a time-series of land cover maps
Justification	An appropriate and accurate land cover change assessment provides a transparent and repeatable method for identifying deforestation.
Use	To estimate the annual proportion of different forest strata deforested in the reference region during the project period (Equation 4)
Comments	The revised PDD must include full details of the land cover change analysis including: • The value for each forest stratum in the project area and a spreadsheet with the calculations; • Maps of forest strata in the reference region at the start and end of the project period and/or a map showing land cover change during the project period; • A description of the datasets and methodologies used to generate land cover maps and/or conduct the land cover change assessment, with sufficient detail that they could be repeated by a suitably qualified technician
Frequency	The land cover change assessment must be repeated, and $AA_{Def_{i,j,k}}$ estimated for each forest stratum present in the project area, at end of each project period (usually every 5 years).

Description	Actual baseline scenario emissions from deforestation and forest degradation expected during the project period
Symbol	AE_{BL}
Units	Mg CO2
Value	Calculated for each project area
Source	Equation 6
Justification	Calculated as for Equation 3, but replacing the amount of deforestation and degradation expected in the reference region during the reference period, with the amount of deforestation and degradation observed in the reference region during the project period
Use	Verification of baseline emissions
Comments	The revised PDD must specify the actual baseline scenario emissions from the previous project period and provide a spreadsheet with the calculations
Frequency	Calculated at the end of each project period (usually every 5 years)

Description	Area of forest type *i*, legal classification *j* and topography class *k* present within the reference region at the start of the project period (ha)
Symbol	$AA_{RR_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area
Source	Land cover assessment from analysis of remote sensing imagery or forest cover maps
Justification	Land cover maps provide a transparent and repeatable method for estimating the area of forest strata
Use	To estimate the annual proportion of different forest strata deforested and degraded in the reference region during the project period (Equations 4 and 5)
Comments	The revised PDD must include full details of the land cover assessment including: • The value for each forest stratum in the project area; • A maps of forest strata in the reference region at the start of the project period; • A description of the datasets and methodologies used to generate land cover maps, with sufficient detail that they could be repeated by a suitably qualified technician
Frequency	The assessment of forest cover at the start of the project period must be repeated, and $AA_{RR_{i,j,k}}$ estimated for each forest stratum present in the project area at the start of each project period (usually every 5 years).

Description	Average proportion of forest type *i*, legal classification *j* and topography class *k* within the reference region that was degraded in each year of the project period
Symbol	$AG_{RR_{i,j,k}}$
Units	None
Value	Calculated for each forest stratum in the project area
Source	Equation 5
Justification	Assumed that, within a forest stratum, the annual proportion of forest degraded in the reference region during the project period would have occurred in the project area in the absence of project interventions
Use	Verifying baseline scenario emissions
Comments	The PDD must report the value for each forest stratum in the project area and provide a spreadsheet with the calculations
Frequency	Must be recalculated for each forest stratum in the project area at the end of each project period (usually every 5 years).

Description	Area of forest type *i*, legal classification *j* and topography class *k* in the reference region converted to degraded forest during the project period (ha)
Symbol	$AA_{Deg_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area
Source	Land cover change assessment from analysis of remote sensing imagery or a time-series of land cover maps
Justification	An appropriate and accurate land cover change assessment provides a transparent and repeatable method for identifying forest degradation
Use	To estimate the annual proportion of different forest strata degraded in the reference region during the project period (Equation 5)
Comments	The PDD must include full details of the land cover change analysis including: • The value for each forest stratum in the project area and a spreadsheet with the calculations; • Maps of forest strata in the reference region at the start and end of the reference period and/or a map showing land cover change during the project period; and • A description of the datasets and methodologies used to generate land cover maps and/or conduct the land cover change assessment, with sufficient detail that they could be repeated by a suitably qualified technician.
Frequency	The land cover change assessment must be repeated, and $AA_{Deg_{i,j,k}}$ for each forest stratum present in the project area estimated at the end of each project period (usually every 5 years).

Description	Actual effectiveness of project activities in reducing emissions from deforestation and forest degradation, expressed as a proportion of actual baseline scenario emissions
Symbol	AF
Units	None
Value	Estimated for each project area
Source	Equation 8
Justification	Assumed that any reduction, or increase, in emissions from deforestation and degradation within the project area relative to the actual baseline scenario emissions (AE_{BL}) are attributable to effectiveness of project activities
Use	Verification of project scenario emissions (Equation 9), and informing expected effectiveness for subsequent project periods
Comments	The PDD must specify the value of AF and provide a spreadsheet with the calculations
Frequency	Calculated at the end of each project period (usually every 5 years)

Description	Area of forest type *i*, legal classification *j* and topographic class *k* within the project area that was deforested during the project period
Symbol	$D_{PA_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area
Source	Land cover change assessment from analysis of remote sensing imagery or a time-series of land cover maps
Justification	An appropriate and accurate land cover change assessment provides a transparent and repeatable method for identifying deforestation.
Use	To estimate the actual effectiveness of project activities during the project period (Equation 8)
Comments	The PDD must include full details of the land cover change analysis including: • The value for each forest stratum in the project area and a spreadsheet with the calculations; • Maps of forest strata in the project area at the start and end of the project period and/or a map showing land cover change during the project period; • A description of the datasets and methodologies used to generate land cover maps and/or conduct the land cover change assessment, with sufficient detail that they could be repeated by a suitably qualified technician
Frequency	The land cover change assessment must be repeated, and $D_{PA_{i,j,k}}$ estimated for each forest stratum present in the project area, at the end of each project period (usually every 5 years)

Description	Area of forest type *i*, legal classification *j* and topographic class *k* within the project area that was degraded during the project period
Symbol	$G_{PA_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area
Source	Land cover change assessment from analysis of remote sensing imagery or a time-series of land cover maps
Justification	An appropriate and accurate land cover change assessment provides a transparent and repeatable method for identifying deforestation.
Use	To estimate the actual effectiveness of project activities during the project period (Equation 8)
Comments	The PDD must include full details of the land cover change analysis including: • The value for each forest stratum in the project area and a spreadsheet with the calculations; • Maps of forest strata in the project area at the start and end of the project period and/or a map showing land cover change during the project period; • A description of the datasets and methodologies used to generate land cover maps and/or conduct the land cover change assessment, with sufficient detail that they could be repeated by a suitably qualified technician
Frequency	The land cover change assessment must be repeated, and $G_{PA_{i,j,k}}$ estimated for each forest stratum present in the project area, at the end of each project period (usually every 5 years)

Description	Actual emissions from deforestation and forest degradation that occurred in the project area during the project period
Symbol	AE_{PS}
Units	Mg CO_2
Value	Calculated for each project area
Source	Equation 9
Justification	Estimated by multiplying the actual baseline scenario emissions by the actual effectiveness of project activities at reducing emissions from deforestation and forest degradation
Use	Verification of emission reductions
Comments	The PDD must specify the actual project scenario emissions and provide a spreadsheet with the calculations
Frequency	Calculated at the end of each project period (usually every 5 years)

Description	Maximum potential leakage emissions that could have occurred as a result of displacement of deforestation and degradation during the project period
Symbol	AE_{LK}
Units	Mg CO_2
Value	Calculated for each project area
Source	Equation 12
Justification	The maximum potential leakage that could have occurred during the project period is assumed to be equal to the emissions that would result from the land cover change needed to replace income from natural resource use activities that are reduced as a result of project activities, if those activities have the potential to be displaced
Use	Verification of climate benefits (Equation 17)
Comments	The revised PDD must specify the maximum potential leakage emissions and provide a spreadsheet with the calculations
Frequency	Calculated at the end of each project period (usually every 5 years)

Description	Change in income from activity *a* for stakeholder group *s* during the project period as a result of project activities
Symbol	$A\Delta I_{a,s}$
Units	$
Value	Estimated for each activity and stakeholder group with potential to cause deforestation and forest degradation as a result of displacement from the project area
Source	Surveys of land use and socio-economic conditions of stakeholder groups expected to use the project area under the baseline scenario, and estimates of income generated by project activities
Justification	Loss of income from natural resource use activities is assumed to be the main driver for displacement of deforestation and forest degradation as a result of project activities
Use	Estimating actual leakage emissions (Equation 12)
Comments	The PDD must describe and justify the expected change in income for all activities and stakeholder groups for which income is expected to be reduced as a result of project activities, and for which there is potential for displacement. Published studies and surveys conducted at the project site should be referenced where appropriate.
Frequency	Estimated at the end of each project period (usually every 5 years)

Description	Average income per hectare from activity *a* for stakeholder group *s* during the project period
Symbol	$AV_{a,s}$
Units	\$ ha^{-1}
Value	Estimated for each activity and stakeholder group with potential to cause deforestation and forest degradation as a result of displacement from the project area
Source	Village survey
Justification	Average income from specific activities is likely to vary between villages and between stakeholder groups within villages and estimates from local surveys are likely to be necessary, if there is uncertainty a conservative estimate would assume a higher value
Use	Estimating leakage emissions (Equation 12)
Comments	The revised PDD must state the estimates used for average income for each activity and stakeholder group with potential to cause deforestation and forest degradation as a result of displacement from the project area. Details of village survey's conducted must be provided.
Frequency	Estimated at the end of each project period (usually every 5 years)

Description	Actual climate benefits resulting from reduced deforestation and forest degradation as result of project activities during the project period
Symbol	AB
Units	Mg CO_2
Value	Calculated for each project area
Source	Equation 17
Justification	Estimated by subtracting project scenario emissions and leakage emissions from baseline scenario emissions
Use	For verifying climate benefits
Comments	The revised PDD must specify the expected climate benefit and provide a spreadsheet with the calculations
Frequency	Calculated at the end of each project period (usually every 5 years)

Description	Actual emissions from deforestation and degradation that occurred in the reference area during the project period
Symbol	AE_{LA}
Units	Mg CO_2
Value	Calculated for each project area if the leakage area approach is used to verify leakage
Source	Equation 13
Justification	Estimated from deforestation and forest degradation observed during the project period
Use	Verification of leakage emissions using the leakage area approach
Comments	The PDD must specify the actual leakage emissions and provide a spreadsheet with the calculations
Frequency	Calculated at the end of each project period (usually every 5 years)

Description	Area of forest type i, legal classification j and topography class k within the leakage area that was deforested during the project period
Symbol	$D_{LA_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area if leakage area approach is used to verify leakage
Source	Land cover change assessment from analysis of remote sensing imagery or a time-series of land cover maps
Justification	An appropriate and accurate land cover change assessment provides a transparent and repeatable method for identifying deforestation.
Use	To estimate the actual leakage during the project period using the leakage area approach (Equation 13)
Comments	The PDD must include full details of the land cover change analysis including: • The value for each forest stratum in the leakage area and a spreadsheet with the calculations; • Maps of forest strata in the leakage area at the start and end of the project period and/or a map showing land cover change during the project period; • A description of the datasets and methodologies used to generate land cover maps and/or conduct the land cover change assessment, with sufficient detail that they could be repeated by a suitably qualified technician
Frequency	The land cover change assessment must be repeated, and $D_{LA_{i,j,k}}$ estimated for each forest stratum present in the leakage area, at the end of each project period (usually every 5 years)

Description	Area of forest type i, legal classification j and topography class k within the leakage area that was degraded during the project period
Symbol	$G_{LA_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the project area if leakage area approach is used to verify leakage
Source	Land cover change assessment from analysis of remote sensing imagery or a time-series of land cover maps
Justification	An appropriate and accurate land cover change assessment provides a transparent and repeatable method for identifying forest degradation.
Use	To estimate the actual leakage during the project period using the leakage area approach (Equation 13)
Comments	The PDD must include full details of the land cover change analysis including: • The value for each forest stratum in the leakage area and a spreadsheet with the calculations; • Maps of forest strata in the leakage area at the start and end of the project period and/or a map showing land cover change during the project period; • A description of the datasets and methodologies used to generate land cover maps and/or conduct the land cover change assessment, with sufficient detail that they could be repeated by a suitably qualified technician
Frequency	The land cover change assessment must be repeated, and $G_{LA_{i,j,k}}$ estimated for each forest stratum present in the leakage area, at the end of each project period (usually every 5 years)

Description	Expected emissions from deforestation and degradation in the leakage area during the project period if no leakage occurred
Symbol	EE_{LA}
Units	Mg CO_2
Value	Calculated for each project area if the leakage area approach is used to verify leakage emissions
Source	Equation 14
Justification	Estimated by assuming that if no leakage occurred deforestation and forest degradation would have occured in the leakage region at the same rate as it occurred in the reference region (excluding the leakage area) during the project period
Use	Verification of leakage emissions using the leakage area approach (Equation 15)
Comments	The PDD must specify the expected leakage emissions and provide a spreadsheet with the calculations
Frequency	Calculated at the end of each project period (usually every 5 years)

Description	Area of forest type i, legal classification j and topography class k present in the leakage area at the start of the project period
Symbol	$A_{LA_{i,j,k}}$
Units	Hectares
Value	Estimated for each forest stratum in the leakage area if the leakage area approach is used to verify leakage emissions
Source	Land cover assessment from analysis of remote sensing imagery or land cover maps from within 2 years of the start of the project period
Justification	Appropriate and accurate maps representing land cover at the start of the project period provide a transparent and repeatable method for assessing the area of different forest strata present
Use	Estimating expected emissions from the leakage area in no leakage occurred (Equation 14)
Comments	The PDD must include full details of the land cover assessment including: • The value for each forest stratum in the leakage area; • A map of forest strata in the project area at the start of the project period; and • A description of the datasets and methodologies used to generate land cover maps and/or conduct the land cover assessment, with sufficient detail that they could be repeated by a suitably qualified technician.
Frequency	The land cover assessment must be repeated every 5 years, and $A_{LA_{i,j,k}}$ estimated for each forest stratum in the project area at the start of each project period.

Annex 11. Calculations

Parameters

		Years
Length of the reference period	T_{RP}	4
Length of the project period	T_{PP}	5

Forest type and topographic class		Carbon density (Mg C ha^{-1})
Open forest, above 17.5 degrees		36.6
Open forest, below 17.5 degrees		36.6
Dense forest, above 17.5 degrees slope		87.6
Dense forest, below 17.5 degrees slope		87.6
Scrubland above 17.5 degrees slope		18.03
Scrubland, below 17.5 degrees slope		18.03
Non-forest above 17.5 degrees slope		0
Non-forest, below 17.5 degrees slope		0

Project effectiveness	F	77%
Expected leakage	L	5%
Risk buffer		20.0%

Baseline

	Forest type and topographic class	Project area	Reference region (ha)							Project area (ha)			C stock reduction (Mg C ha^{-1})			Baseline C stock reduction (Mg C)
		2020	2016	2016 - 2020			Annual % deforested (to non-forest)	Annual % deforested (to scrub)	Annual % degraded	Annual deforestation (to non-forest)	Annual deforestation (to scrub)	Annual degradation	Deforestation (to non-forest)	Deforestatio (to scrub)	Degradation	2016 - 2020
	i, k	A_{PA_i}	A_{RR}	A_{Def}		A_{Deg}	D_{RR}						$C_i - C_{RF}$		$C_i - C_{Dg_i}$	
	Dense forest, over 17.5 degrees slope	2,531.88	3,035.18	21.72	55.29	590.66	0.2%	0.5%	4.9%	4.5	11.5	123.2	88	70	51	7,481
	Dense forest, under 17.5 degrees slope	418.50	1,266.47	34.67	83.27	361.14	0.7%	1.6%	7.1%	2.9	6.9	29.8	88	70	51	2,251
	Open forest, over 17.5 degrees	3,826.20	5,549.94	141.43	775.96	0.00	0.6%	3.5%	0.0%	24.4	133.7	0.0	37	19	0	3,376
	Open forest, under 17.5 degrees	4,626.32	11,212.14	683.60	1,195.12	0.00	1.5%	2.7%	0.0%	70.5	123.3	0.0	37	19	0	4,870
	Scrubland, over 17.5 degrees slope	1,323.34	3,936.52	0.00	0.00	623.22	0.0%	0.0%	4.0%	0.0	0.0	52.4	0	0	18	944
	Scrubland, under 17.5 degrees slope	2,715.55	10,241.25	0.00	0.00	6,316.16	0.0%	0.0%	15.4%	0.0	0.0	418.7	0	0	18	7,549
Total		15,442	35,241	881	2,110	7,891				102	275	624				26,471

Benefit

		Mg CO_2	Mg CO_2 yr^{-1}
Baseline scenario emissions from deforestation and forest degradation expected during the project period	E_{BL}	4,85,307	97,061
Expected project scenario emissions from deforestation and forest degradation expected during the project period	E_{PS}	1,11,621	22,324
Leakage emissions expected to result from displacement of deforestation and degradation during the project period	E_{LK}	18,684	3,737
Climate benefits expected to result from reduced deforestation and forest degradation as result of project activities during the project period	B	3,55,002	71,000
Certificates produced during the project period held in risk buffer		71,000	14,200
Saleable Plan Vivo certificates produced during the project period		2,84,002	56,800

		ha	ha yr^{-1}
Hectares of forest protected		11,890	2,378
Hectares of deforestation avoided during the project period		368	74
Hectares of degradation avoided duringn the project period		2,247	449

The purpose of this sheet is to estimate the effectiveness of the project activities. This is done by looking at the deforestation and degradation rates between 2016 and 2020 in the project area compared with that in the reference area

Forest type and topographic class	Project area (ha)							Reference region (ha)							Project area			C stock reduction (Mg C ha-1)			Baseline C stock reduction in	Baseline C stock reduction in project		
	2016	Project area 2016 - 2020			Annual % defogested	Annual % deforested (to scrub)	Annual % degraded	2016	Reference area 2016 - 2020			Annual % deforested		Annual % degraded	estimated total deforestation during project period (if using the reference region rates)	estimated total deforestation to scrub during project period (if using the reference region rates)	estimated total degradation during project period (if using the reference region rates)	Deforestation (to non-forest)	Deforestation (to scrub)	Degradation	2016-2020	2016-2020		
	A_{PA}	A_{Def}	ADef2	A_{Deg}	D_{RR}^{Def}		G_{RR}	A_{RR}	A_{Def}	ADef2	A_{Deg}	D_{RR}	D_{RR}	D_{RR}^{Deg}										
Dense forest, over 17.5 degrees slope	2163.23	0.32	2.77	80.83	0.004%	0.032%	0.934%	3200.65	23.18	55.29	590.70	0.181%	0.432%	4.614%	19.59	46.71	499.04	87.60	69.57	51.00	4,343.67	30,416.62		
Dense forest, under 17.5 degrees slope	203.15	1.21	1.91	6.30	0.149%	0.235%	0.775%	1333.52	34.80	83.27	362.83	0.652%	1.561%	6.802%	6.63	15.86	69.09	87.60	69.57	51.00	560.46	5,207.33		
Open forest, over 17.5 degrees	3669.78	24.86	198.31	0	0.169%	1.351%	0.000%	5838.15	144.56	838.04	0	0.619%	3.589%	0.000%	113.59	658.48	0.00	36.60	18.57	0.00	4,592.39	16,385.19		
Open forest, under 17.5 degrees	3695.50	118.09	154.13	0	0.799%	1.043%	0.000%	12161.03	719.54	1328.14	0	1.479%	2.730%	0.000%	273.32	504.49	0.00	36.60	18.57	0.00	7,184.36	19,371.92	project effectiveness	
Scrubland, over 17.5 degrees slope	1371.11	0	0.00	122.05	0.000%	0.000%	2.225%	3950.79	0.00	0.00	632.97	0.000%	0.000%	4.005%	0.00	0.00	274.59	0.00	0.00	18.03	2,200.59	4,950.83	between 2016-2020	
Scrubland, under 17.5 degrees slope	3652.95	0	0.00	1593.08	0.000%	0.000%	10.903%	10602.33	0.00	0.00	6662.86	0.000%	0.000%	15.711%	0.00	0.00	2869.54	0.00	0.00	18.03	28,723.19	51,737.87		
	14755.72	**144.49**	**357.12**	**1802.26**				**37086.45**	**922.08**	**2304.74**	**8249.36**				**413.12**	**1225.54**	**3712.27**	**0.00**		**0.00**	**16,680.89**	**71,381.06**	**77%**	

Method:

This analysis estimates the C stock change in the project area if using the rates of deforestation and degradation seen in the project area during the reference period.

Column B: the area of each strata in the project area in 2016

Columns C-E: the area (ha) of each strata in the project area that undergo land cover (strata) change during the project period (4 years)
dense -> non-forest (deforestation), dense-scrub (deforestation 2), desnse-open (degradation)

Columns F-H: the annual deforestaion and degradation rates seen in the project area during the project period

Column H: the area of each strata in the reference region in 2016 (start of project period)

Columns J-L: the area (ha) of each strata that undergo land cover (strata) change in the reference area during the project period (5 years)

Columns M-O: the annual deforestaion and degradation rates seen in the reference area during the project period

Columns P-R: the estimated total deforestation and degradation in the project area when applying the deforestation and degradation rates seen in the reference area (columns M:O) to the project area during the project period (i.e. what would be the total deforestaion in

ANR Tech Spec Tables

Open Forest ANR Sample Plots

Plot No.	ANR Site	Biomass (tc/ha) 2016	2017	2018	2019	2020	2021	2022	Beta
4	Law Shlem	0.0	0.0	13.9	14.4	17.9	21.3	16.6	2.8
28	Phodumdewsaw, Hima Pamsanngut	0.0	0.0	5.5	6.0	8.4	10.2	10.1	2.1
27	Lawsubah, Pamsanngut	0.0	0.0	61.9	63.1	69.5	0.0	0.0	4.4
2	Lum U Mong, Laitkroh	0.0	0.0	2.0	2.2	2.6	3.8	4.1	1.1
14	Sohrarim, Lumnonglum	0.0	0.0	55.4	56.2	58.4	56.7	58.9	2.2
S	Lawsubah	0.0	18.9	0.0	20.6	0.0	22.8	0.0	1.0
S	Kyiem	0.0	11.4	0.0	13.7	0.0	15.6	0.0	1.1
S	Lummawtong	0.0	37.8	0.0	43.3	0.0	48.5	0.0	2.7
S	Lumphari	0.0	16.0	0.0	20.6	0.0	35.3	0.0	5.3
S	Lumpomlum	0.0	1.8	0.0	2.0	0.0	2.2	0.0	0.1
O_ANR	Jathang Lum Riatsawlia = Law Khliehriat Sawlia, Community Forest, Sohra Syiemship	20.6	0.0	0.0	0.0	0.0	48.8	50.4	6.8
O_ANR	Phudlawkhla	2.0	0.0	0.0	0.0	0.0	17.2	19.6	4.0
40	Lumdiengsai, Laitkroh	3.4	0.0	7.4	7.7	9.1	10.1	10.0	1.5
O_ANR	Laitmawhing	16.2	0.0	0.0	0.0	0.0	69.8	66.2	11.8
O_ANR	Lummawmarok	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0	Themlumkhwai Laitsohpliah,Sohra Syiemship	0.0	0.0	0.0	0.0	0.0	71.8	70.2	-3.2
0	Lum Pyllun community Forest, Jathang, Sohra Syiemship	0.0	0.0	0.0	0.0	0.0	38.1	35.9	-4.5
0	Law Phudumblang Kyrphei, Mylliem Syiemship	0.0	0.0	0.0	0.0	0.0	37.0	37.4	0.8
0	Lumhati, Mawkalang, Mawbeh Sirdarship	0.0	0.0	0.0	0.0	0.0	5.1	7.7	5.2
								AVERAGE GR(	2.5
								LOWER 90% (	1.4

Dense Forest ANR Sample Plots

Plot No.	ANR Site	Biomass (tc/ha) 2016	2017	2018	2019	2020	2021	2022	Beta
151	Kseh Mylliem, Nonglwai	0.0	0.0	90.9	92.3	97.4	100.1	102.2	5.0
134	Lumphudumsim, Nonglwai	0.0	0.0	101.1	103.0	112.4	110.5	113.9	6.1
155	Lumwaharkum, Hima Nonglwai	0.0	0.0	27.3	28.2	27.2	29.9	38.3	11.6
159	Wah Mawlong, Laitumiong, Mawbeh	0.0	0.0	67.1	68.3	71.8	79.1	120.8	0.0
127	Khlaw Rani, Pamsanngut	0.0	0.0	136.5	137.8	143.4	149.5	141.9	4.8
S	Mawlangrain	0.0	56.1	0.0	58.6	0.0	62.6	0.0	1.6
S	Umkaber	0.0	53.9	0.0	55.3	0.0	57.2	0.0	0.8
S	Lumlaitlynding	0.0	94.8	0.0	98.0	0.0	101.7	0.0	1.7
S	Laitthemlangsah	0.0	109.2	0.0	118.1	0.0	123.6	0.0	3.7
O_ANR	Phanniewlahneng = Umlangnei, Lyngiong	89.3	0.0	0.0	0.0	0.0	93.7	94.8	1.2
152	Lumkyndong Kmie Brial, Mawphlang	0.0	0.0	31.9	33.4	36.3	39.9	42.7	4.9
136	Wahthymmei Esdiwot, Nongspung	0.0	0.0	121.3	123.4	126.8	132.6	132.9	5.2
153	Imsotti, Nongspung	0.0	0.0	124.1	125.5	128.0	140.8	140.8	8.9
								AVERAGE GR(	4.6
								LOWER 90% (	2.4

Benefits

	Area (ha)	Annual carbon uptake (tC/ha)	Annual carbon uptake (tC)	Annual emission reductions (tCO2)
Open forest	706.1	1.40	991.54	3639.73
Scrub	461.6	N/A	0	0
Non-Forest	230	N/A	0	0
Dense forest	157.6	2.43	383.36	1407.25
Waterbodies	20.6	N/A	0	0
Grand Total	**1575.9**			5046.98

Year	Annual emission reductions (tCO2)	Cumulative emission reductions (tCO2)							
2022	5046.98	5,046.98	252.349075	4,794.63					
2023	5046.98	10,093.96	504.69815						
2024	5046.98	15,140.94	757.047225						
2025	5046.98	20,187.93	1009.3963						
2026	5046.98	25,234.91	1261.74537						
	25234.91		**3785.24**		21449.67				
					4289.93427				
		17159.74							