

## Annex 14: Assessment of GHG emission reductions

### 1. Introduction

1. Emission reductions were estimated using FAO's NEXT Tool. All emission reductions were assumed to fall under the 'Forest Land' category, considering reforestation efforts and improved management of community forests, and used the IPCC 2019 Refinement & IPCC 2013 methodologies. S-shaped curve dynamics were used for all analyses.
2. The project site crosses two physiographic regions — Middle Mountain and High Mountain — and three climate zones — Cool temperate Dry in the High-mountain areas, and a combination of Warm Temperate Moist and Warm Temperate Dry under the Middle mountain areas. Given that the Forest Reference Level (FRL) estimates did not differentiate between carbon stocks in moist versus dry environments in the middle mountain region, the areas for these two climatic zones were merged under the Warm Temperate Moist category (as no difference would be observed when using the tier 2 data). All sites are predominantly high-activity clay (HAC) soils.
3. Estimates of carbon stocks, as well as average deforestation, degradation, and afforestation rates were all based off the most recent FRL assessment compiled under the Ministry of Forests and Environments REDD Implementation Centre (2026)<sup>1</sup>. Specific sources within the FRL are described for each relevant section below.
4. The analysis period considered 4 years of implementation and 20-year period for management, assuming start of on-the-ground implementation in 2027.

### 2. Reforestation

5. A total of 1,000ha is targeted for reforestation under the project.
6. While the specific sites for and nature of reforestation will be determined through locally-led planning processes during implementation, for the purpose of analysis the split between the three climate zones assumed a split that approximately matches the physical area under each zone, as shown below.
  - High mountain (Cool Temperate Dry; Subtropical dry mountain system): ~50%
  - Middle mountain (Warm Temperate Moist; Subtropical moist mountain system): ~50%
7. Moreover, by using average estimates of carbon stocks related to afforestation efforts from the FRL analysis, the analysis accounts for a combination of different restoration efforts, defined under the FRL as long-term or permanent conversion of non-forest land use categories to forest through afforestation/reforestation/restoration activities. Detected afforestation used for FRL estimates in Nepal consist mainly of assisted natural regeneration, which on average takes 20 years to grow back to the average biomass stock of forest in the five different physiographic regions. Community-Based Forest Management (CBFM) practices, particularly community forests (CF) and pro-poor Leasehold Forestry programs, are considered to contribute significantly to reforestation/afforestation/ restoration.
8. Initial land use was set as 'Other land' and will mostly target barren or heavily degraded land. All three sites were further classified as 'forest' land.

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<sup>1</sup> Government of Nepal. (2026). Proposed Forest Reference Level (FRL) (2008-2017).  
[https://redd.unfccc.int/media/firlnepal\\_report\\_final\\_draft\\_16january2026\\_v2.pdf](https://redd.unfccc.int/media/firlnepal_report_final_draft_16january2026_v2.pdf)

9. Tier 2 above-ground biomass (AGB) and below-ground biomass (BGB) carbon stock values were adopted from the FRL analysis for afforestation across each physiographic region (Table 1). Using the method described in the FRL document, annual growth was obtained by dividing the average biomass in the physiographic regions by 20 (Poorter et al., 2021<sup>2</sup>) and then multiplying by 3.5, which represents the average age of the afforested area during 2008-2017. Given that the values for AGB and BGB in Table 1 represent the total dry mass, the values were adjusted for carbon fraction of dry biomass by multiplying by 0.47.

Table 1: The removal from afforestation across physiographic region (FRL, 2026)

Physiographic region	AGB	BGB	Total carbon	Removals per ha t CO <sub>2</sub> e/ha
Terai	35.87	15.78	24.28	89.09
Churia	29.55	13.00	20.00	73.39
Middle Mountain	24.43	10.75	16.54	60.69
High Mountain and High Himal	44.98	19.79	30.45	111.73

### 3. Forest Management

10. As with the reforestation section above, specific sites for forest management interventions will be identified through community-led processes during implementation—with the objective of restoring already degraded forests through improved management. Therefore, for the purpose of this analysis, the same 50-50 split between middle and high mountain areas was used. A stock difference approach was used, drawing carbon stock values for various scenarios from the latest FRL reports in Nepal.
11. **Forest carbon stock:** Above-ground biomass values were taken from the FRL for well stocked and degraded forests (Table 2), considering middle and high mountain areas separately. Below-ground biomass used a shoot-to-root ratio of 0.44 for below-ground (BGB) to above-ground biomass (AGB) for natural forests of the sub-tropical dry ecological zone of Asia. Given that the values for AGB and BGB in Table 2 represent the total dry mass, the values were adjusted for carbon fraction of dry biomass by multiplying by 0.47.

As noted above, initial and reference values used degraded forest estimates, and target scenarios used a midway value between degraded and well stocked forests.

Table 2: Above-ground biomass (tDM/ha) in degraded and well stocked forest plots (FRL 2026)

Physiography	Degraded Forests			Well Stocked Forests			Δ Degradation	
	Plots	AGB	SD	Plots	AGB	SD	AGB	SD
Terai	24	58.59	39.70	147	237.95	110.34	179.36	117.27
Churia	31	83.00	82.78	435	176.41	90.68	93.41	122.78
Middle Mountain	62	98.38	118.19	361	153.10	135.23	54.72	179.60
High Mountain & High Himal	76	195.93	248.31	383	265.54	224.76	69.61	334.93

12. Soil organic carbon (SOC) was omitted from the FRL due to the absence of credible, country-specific data and because the cost and effort required to generate such data would outweigh the expected benefits of inclusion at this stage. Default Tier 1 values were therefore used in the analysis.

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<sup>2</sup> Poorter, L., Craven, D., Jakovac, C. C., Van Der Sande, M. T., Amisshah, L., Bongers, F., Chazdon, R. L., Farrior, C. E., Kambach, S., Meave, J. A., Munoz, R., Norden, N., Ru ger, N., Van Breugel, M., Almeyda Zambrano, A. M., Amani, B., Andrade, J. L., Brancalion, P. H. S., Broadbent, E. N., ... He rault, B. (2021). Multidimensional tropical forest recovery. *Science*, 374(6573), 1370–1376. <https://doi.org/10.1126/science.abh3629>

13. **Baseline Scenario (Initial Period):** The baseline scenario assumes that target forests are already degraded, as defined in the FRL<sup>3</sup>. For this purpose, FRL estimations of AGB values for ‘degraded forests’ were used to determine carbon stocks, as discussed above.
14. **Without-intervention Scenario (Reference Period):** This scenario considers the end of the project in the absence of improved forest management practices. While in the absence of change forest degradation is likely to continue, a conservative approach was adopted that assumes degraded forests are in a state of equilibrium and that degradation levels will remain unchanged over time. The final carbon stocks were, therefore, assumed to remain those of a degraded forest, as defined in the FRL.
15. **With-intervention Target Scenario (Target Period):** This scenario considers the end of the project with improved community forest management practices. The evidence from Nepal supports substantial recovery under community forestry, but also shows that recovery is context-specific and often incomplete under standard community management. Future carbon stocks, therefore, should consider a suitable recovery co-efficient that accounts for partial recovery. The future carbon stock, therefore, was calculated as follows:
- $$C_{30} = C_{\text{degraded}} + r \times (C_{\text{well-stocked}} - C_{\text{degraded}})$$
- where:
- $C_{\text{degraded}}$  = baseline carbon stock from the FRL,
  - $C_{\text{well-stocked}}$  = carbon stock of the healthy/reference forest,
  - $r$  = recovery co-efficient; proportion of the degraded-to-healthy gap closed over 30 years under improved management.
16. While the FRL does not give a specific recovery coefficient, assumptions can be drawn by comparing lower-quality and higher-quality forest conditions under different management states. A conservative estimate of  $r=0.5$  was selected, accounting for implementation in harsher sites, higher elevations, steeper slopes, or where biomass accumulation is likely to remain slow. It should also be noted that the NEXT tool considers a 30-year capitalization period, whereas the project targets consider only the first 20 years; resulting in more conservative estimates.

## 4. Results

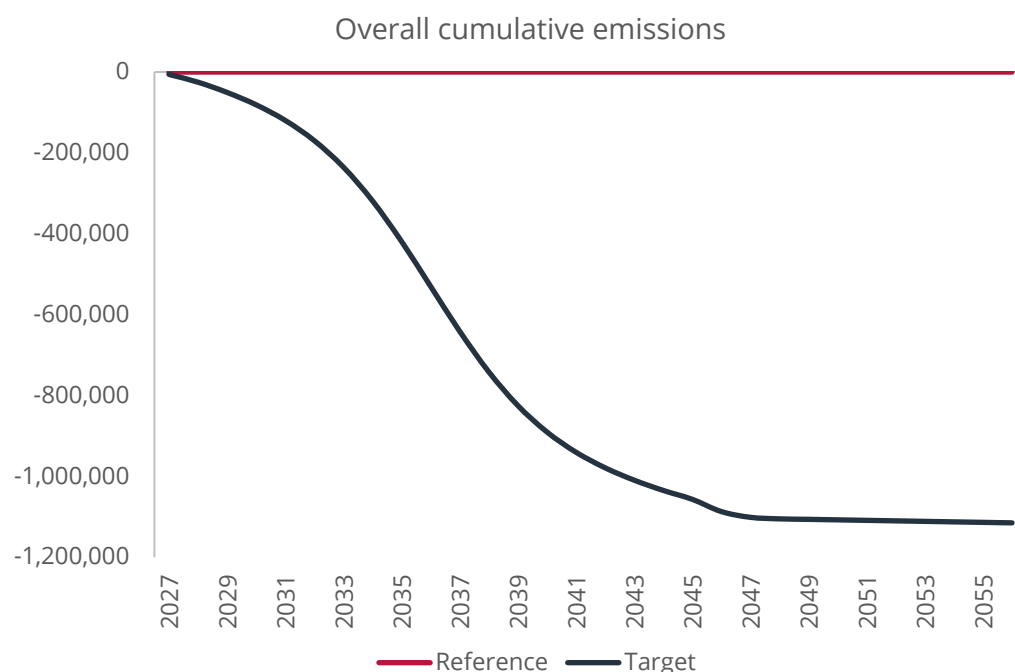
17. Table 3 shows the results of the analysis, as per the above-described scenarios. The emissions reductions depicted below (in tCO<sub>2</sub>-eq) assume the project to start at the beginning of 2027, with estimates for the mid-point (2028), project end (2030), and 20-year (2047) periods being used to set targets for the project—as shown in the Funding Proposal and Logical Framework (Annex 2a)

Table 3. Emission reduction targets

Cumulative emissions - Emissions expected by:	2028 (Midpoint)	2030 (Project end)	2047 (20 years)
Without Intervention Reference scenario:	0 tCO <sub>2</sub> -eq	0 tCO <sub>2</sub> -eq	0 tCO <sub>2</sub> -eq
With-intervention target scenario:	-25,119 tCO <sub>2</sub> -eq	-119,649 tCO <sub>2</sub> -eq	-1,101,385 tCO <sub>2</sub> -eq
Mitigation potential:	-25,119 ▼ tCO <sub>2</sub> -eq	-119,649 ▼ tCO <sub>2</sub> -eq	-1,101,385 ▼ tCO <sub>2</sub> -eq

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<sup>3</sup> Based on the combined evidence from field-measured biomass change and remote sensing interpretation, plots were classified as degraded forest plots only if both criteria were met.



## 5. Monitoring and Reporting

### 5.1. Overview

18. The mitigation result area monitoring system is designed to:
  - Verify implementation of reforestation and forest management activities;
  - Capture the actual spatial distribution across High Mountain and Middle Mountain zones;
  - Record activity data required for the adopted accounting approaches;
  - Provide verified inputs to the NEXT tool for periodic recalculation of mitigation performance; and
  - Meet Green Climate Fund (GCF) reporting requirements and national Nationally Determined Contribution (NDC) reporting systems.
19. Although the ex-ante estimates assumed a 50/50 split between mountain zones, the final allocation will be determined through the community-led processes under the umbrella of the Local Adaptation Plans of Action (LAPA), in line with the locally-led climate action (LLCA) approach. Monitoring will therefore record the actual area distribution, and mitigation calculations will be adjusted accordingly through the NEXT tool.

Throughout implementation, the project will draw on a dual-layered monitoring structure combining direct monitoring and oversight by the Project Management Unit (PMU) with community-based monitoring by Community Forest Management Groups (CFMGs). The PMU team will be responsible for consolidating spatial data, reviewing implementation records, conducting remote sensing analysis, and undertaking periodic verification visits. At the community level, CFMGs will be trained in community-based forest monitoring, including maintenance of plantation registers, recording of harvesting and fuelwood extraction data, identification of disturbance events, and basic geo-referencing of intervention areas. This approach strengthens local ownership, improves data accuracy through continuous presence on the ground, and ensures that monitoring is embedded within existing forest governance systems while maintaining centralized quality control and reporting consistency.

## 5.2. Reforestation Monitoring (1,000 ha)

### Parameters Monitored

- Area established (ha)
- Geospatial boundaries (GIS polygons)
- Altitudinal classification (High vs Middle Mountains)
- Year of establishment
- Survival status (qualitative verification)
- Any gross loss or replanting events

### Data Sources and Methods

- Community planting registers and nursery distribution records
- GPS-based mapping of established sites
- Remote sensing analysis to confirm land-cover conversion and detect loss
- Random field verification visits to confirm establishment and survival (non-destructive)

20. Area data and spatial classification will be consolidated annually and used as inputs to update mitigation estimates.

## 5.3. Improved Forest Management Monitoring (10,000 ha)

### Parameters Monitored

- Status of the forest areas under targeted across 80 CFUGs
- Area under improved management (ha)
- Mountain classification (High / Middle)
- Annual wood removals
- Fuelwood extraction levels
- Major disturbance events (fire, illegal logging, pest outbreaks)
- Implementation of community forest management plans

### Data Sources and Methods

- Community Forest User Group (CFUG) operational records and harvest permits
- Annual reporting registers at community forest level
- Sample plot measurement
- Remote sensing analysis to detect canopy loss and major disturbances
- Periodic field audits to verify consistency between reported removals and observed forest condition

21. No direct biomass re-measurement will be conducted. Reported activity data will be cross-checked against remotely observed forest cover dynamics.

## 5.4. Data Management and Quality Assurance

22. NTNC will maintain a centralized digital database integrating:

- Geospatial layers of intervention areas
- Annual implementation records
- Harvest and fuelwood data
- Disturbance records
- Remote sensing outputs

23. Annual quality assurance procedures will include:

- Cross-validation of reported removals against canopy change data,
- Verification of mountain-zone classification,
- Random site audits,
- Documentation of assumptions applied during recalculation.

## 5.5. Recalculation and Reporting

24. The FAO NEXT tool will be used at baseline confirmation, mid-term review, and project completion to:
  - Confirm actual areas implemented,
  - Adjust for the actual High/Middle Mountain split,
  - Incorporate recorded removals and disturbance data,
  - Recalculate mitigation performance accordingly.
25. Results will be reported through:
  - GCF Annual Performance Reports (APR),
  - Mid-term and terminal evaluations,
  - Final mitigation outcome reporting (tCO<sub>2</sub>e).
26. Where appropriate, verified results will be shared with national authorities to support integration into Nepal's Agriculture, Forestry and Other Land Use (AFOLU) inventory and NDC reporting framework.

## 5.6. Monitoring Principle

27. The project monitors activity data and spatial implementation, not carbon stocks directly. Verified implementation records and remote sensing data will be translated into mitigation outcomes using the established carbon accounting methodology and FRL parameters. This approach ensures methodological consistency, operational feasibility for the National Trust for Nature Conservation (NTNC), and alignment with GCF and national reporting requirements. Uncertainties in mitigation potential are managed through conservative adjustment factors, as described in the methodology above.