



Securing Permanent Forests to Combat Climate Change and Enhance Sustainable National and Local Economies in Cameroon

ANNEX 22A

Assessing the mitigation potential of SPEFOCE field activities through ex-ante estimations of emission reductions (ERs)

Version Date: 27/05/26

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1. Executive summary

This Annex estimates ex-ante greenhouse-gas emission reductions for the SPEFOCE Cameroon GCF project using two complementary and additive accounting components, applied to non-overlapping activity areas across Waza, Dja-Lobéké, and Bakossi-Bamboutos.

The first component quantifies enhanced sequestration from four activity types: agroforestry on existing cropland, reforestation of community forests, restoration of council forest reserves and park areas, and restoration of riparian forests and buffers. For each activity, landscape, and cohort, a baseline without the programme is compared to a with-project case. Per-hectare annual net effects are calculated from changes in above- and below-ground biomass and soil organic carbon, with deductions for non-CO₂ emissions and fuel or open-burning terms where evidence indicates relevance. Implementation is phased through annual cohorts carried forward across a 20-year accounting horizon. Agroforestry effects are treated as constant with time since establishment; forestry-related effects apply a survival fraction at the end of Year 1 and a constant annual mortality rate thereafter.

The second component quantifies avoided emissions from sustainable forest management (SFM) governance activities, management plan development, community patrolling, fire management, and enforcement, that reduce deforestation in designated permanent forest

areas within each landscape. A historical landscape-scale deforestation rate is compared to a with-project case in which improved governance reduces ongoing clearing. Emission factors are drawn from Cameroon's proposed Forest Reference Level submitted to the UNFCCC in January 2026 (Table 24), providing alignment with the national framework wherever currently possible. Once the proposed FRL has completed UNFCCC technical assessment, the reference level values will be reviewed and updated for full alignment. This component is assessed over the 7-year implementation period, with a Year 1 ramp-up factor of 0.50 applied to reflect the time required to establish effective governance coverage.

The Restoration Opportunities Assessment (Annex H) identified a combined restoration potential of approximately 190,330 ha across the three landscapes. The project intervenes on approximately 60,008 ha drawn from within this broader potential: 10,008 ha of active agroforestry and forest restoration, and 50,000 ha of forest under SFM governance. Intervention locations will be confirmed through participatory land use planning at project inception.

Leakage is applied as a scalar deduction to both components. An attribution factor of 0.85 is applied to the sequestration component, reflecting the complexity of landscape carbon dynamics. An attribution factor of 1.0 is applied to the avoided emissions component, reflecting the direct and bounded causal link between SFM governance interventions and the reduction in deforestation, with leakage separately deducted. All estimates adopt the LOW end of the uncertainty range for external reporting, reflecting a 20% deduction applied to the central estimate, with HIGH values retained for sensitivity disclosure.

Seven-year implementation phase

Over the seven-year implementation period, the project delivers a combined portfolio mitigation potential of **1,642,165 tCO₂e** (LOW estimate). Of this total, 1,589,313 tCO₂e is attributable to avoided emissions from SFM governance activities and 52,851 tCO₂e to enhanced sequestration from agroforestry, reforestation, and restoration activities.

Table 1. Combined mitigation potential by landscape and component, seven-year implementation phase (LOW estimate, tCO₂e).

Landscape	Avoided emissions (SFM governance) LOW (tCO ₂ e)	Enhanced sequestration (Agroforestry, reforestation and restoration) LOW (tCO ₂ e)	Combined mitigation potential LOW (tCO ₂ e)
Waza	1,517,350	6,799	1,524,149
Dja-Lobéké	10,216	15,743	25,959
Bakossi-Bamboutos	61,747	30,310	92,057
Portfolio total	1,589,313	52,851	1,642,165

Twenty-year mitigation lifetime

When the accounting horizon is extended to twenty years, incorporating the continued growth of sequestration cohorts beyond the implementation phase, the combined portfolio mitigation potential reaches **2,467,777 tCO₂e** (LOW estimate). The avoided emissions component contributes 1,589,313 tCO₂e (7-year accounting period only) and the sequestration component contributes 878,464 tCO₂e.

Table 2. Combined mitigation potential by landscape and component, twenty-year mitigation lifetime (LOW estimate, tCO₂e).

Landscape	Avoided emissions (SFM governance) LOW (tCO ₂ e)	Enhanced sequestration (Agroforestry, reforestation and restoration) LOW (tCO ₂ e)	Combined mitigation potential LOW (tCO ₂ e)
Waza	1,517,350	114,816	1,632,166
Dja-Lobéké	10,216	258,532	268,748
Bakossi-Bamboutos	61,747	505,115	566,862
Portfolio total	1,589,313	878,464	2,467,777

2. Project overview (landscapes and activity types)

2.1 Activity typology and consolidation into accounting families

The activities described in span four operational activity types that recur across the three landscapes. For ex-ante greenhouse-gas accounting, these types are grouped into three accounting components, two of which use an enhanced sequestration framework and one of which uses an avoided emissions framework.

2.1.1. Agroforestry, Reforestation and Restoration (enhanced sequestration)

Activity Type	Description and Target Area
Activity type	Description and target area
Agroforestry on existing cropland (AGRO)	Establishment or intensification of tree-based agroforestry systems on parcels that remain in agricultural production. Total area: 2,101 ha across all three landscapes.
Reforestation of community forests (COM)	Assisted natural regeneration and enrichment planting in designated community forest compartments under Sustainable Forest Management (SFM). Total area: 2,134 ha in Waza and Dja-Lobéké.
Restoration of council forest reserves and park areas (PRK/FOR)	Protection, enrichment planting, access control, and fire management in degraded protected-area compartments and council forest reserves. Total area: 1,666 ha across all three landscapes.
Restoration of riparian forests and buffers (RIP)	Linear revegetation and protection of riparian corridors along rivers and water bodies. Total area: 4,107 ha across all three landscapes.

For ex-ante greenhouse-gas accounting, these types are categorised into two activity families with distinct applicability conditions and parameterisation pathways:

- **Agroforestry (non-forest) activities:** this family covers all interventions that establish or intensify tree-based systems on land that is cropland at baseline and remains in agricultural production. In accounting terms, these parcels are treated as non-forest land. The intervention increases living woody biomass (above- and below-ground) and improves soil organic matter through perennial inputs and reduced disturbance. Nitrogen inputs and burning are assumed zero at this stage unless later evidenced. Diesel emissions are included only where mechanised operations are planned and documented.
- **Forestry-related activities.** this family includes reforestation of community forests, restoration of council forest reserves and park compartments, and restoration of riparian forests and buffers where these lie within forest land or protected riparian zones. In accounting terms, these interventions act within forest land or forest-managed zones to raise biomass stocks and stabilise them under sustainable forest

management. Establishment is represented with a survival fraction applied at the end of Year 1 and a constant annual mortality rate thereafter, net of any planned replanting. Burning is included only if recurring fire is evidenced and material and other non-CO₂ terms are included when supported by data.

This categorisation serves two purposes. First, it clarifies parameter choices, allowing family-specific increments, soil-carbon factors, and scaling schedules (e.g., no age factors for agroforestry and Year 1 survival plus annual mortality for forestry-related activities). Second, it streamlines MRV design (see Section 8), as evidence requirements — parcel mapping, survival verification, fire occurrence, fertiliser use, diesel logs — can be specified and audited coherently by family while retaining disaggregation by landscape and operational type for reporting.

2.1.2. Sustainable Forest Management (avoided emissions)

SFM governance activities (avoided emissions component) covers the forest areas within each landscape that are placed under improved governance arrangements, specifically improved management plans, patrolling, fire management, and community enforcement, that reduce ongoing deforestation. The activity data are the forest areas covered under governance arrangements in each landscape (see Table 1 below), and the baseline is the landscape-scale historical deforestation rates calculated in Annex 22E. Emission factors for each landscape are drawn from Cameroon's recent submission on proposed reference levels for the country¹.

In the remainder of this annex, references to “agroforestry (non-forest) activities” denote all agroforestry interventions on cropland across Waza, Dja–Lobéké and Bamboutos–Bakossi. References to “forestry-related activities” denote reforestation of community forests, restoration of council forest reserves and park areas, and restoration of riparian forests and buffers of water bodies across the three landscapes. References to “SFM governance activities” denote the avoided emissions component covering defined forest areas under improved governance arrangements in each landscape.

2.2 Cohort Phasing, Annual Establishment, and Cumulative Area

The Restoration Opportunities Assessment Report (Annex H)² identified a combined restoration potential of approximately 190,330 ha across the three project landscapes, 158,730 ha in Waza, 16,525 ha in Dja-Lobéké, and 15,075 ha in Bakossi-Bamboutos, spanning agroforestry, reforestation, and restoration of community and council forests and riparian buffers. These figures represent the ecologically suitable area assessed as available and appropriate for each activity type, based on land cover analysis, field surveys, and community consultations conducted under the methodology (ROAM) used in the Restoration Opportunities Assessment Report.

In addition to these active restoration activities, the project will support SFM governance interventions, encompassing management plan development, patrolling, fire management, and community enforcement, across a further 50,000 ha of forest under existing or proposed permanent forest area designations in the three landscapes. Table 3 below presents the indicative areas for all activities, covering approximately 10,008 ha of active restoration and agroforestry drawn from the broader restoration potential, together with the 50,000 ha under SFM governance. The specific location of these intervention areas within each landscape will be determined and mapped through further stakeholder engagement and participatory land

¹ Republique du Cameroun (2026). Niveau de reference pour les forêts du Cameroun.

² Annex H FS Landscape Restoration Opportunity Report Assessment_IUCN_CameroonCentral Africa_030425_SPEFOCE

use planning at the start of project implementation, ensuring that site selection reflects community priorities, tenure arrangements, and on-the-ground conditions at the time of establishment.

The indicative unit costs per hectare for implementation of SFM governance activities across the 3 landscapes were derived as literature-informed proxies anchored to the most relevant available cost evidence. For Waza, the USD 100/ha value was set slightly above a case-study estimate of USD 79.06/ha for forest carbon management in Tanzania³ and within a broader low-cost implementation context reported for REDD+ pilots, where implementation costs were estimated at USD 3.7–7.9/ha/year⁴. This was considered a reasonable lower-range proxy for a drier landscape with relatively lower-cost governance and protection measures.

For Dja–Lobéké, the USD 150/ha value was selected as a mid-range proxy. It is informed by the Cameroon-specific REDD+ cost and benefit literature⁵, although that source does not report a direct sustainable forest management cost per hectare and is therefore used only as contextual support alongside broader REDD+ cost evidence⁶. For Bakossi–Bamboutos, the USD 200/ha value was anchored to the peer-reviewed global restoration synthesis reporting a median forest management cost of USD 185/ha^{7,8}, and was rounded upward slightly to reflect the more demanding terrain and operational conditions expected in the highland context. Overall, the three values should therefore be understood as indicative planning proxies derived from the published literature, rather than site-specific measured costs.

Table 3. Activity types, estimated cost per hectare, and indicative areas by landscape.

Landscape	Activity	Activity type	Key species / description	Indicative area (ha)	Estimated cost (USD/ha)	Source for cost per ha
Waza	Parkland agroforestry on agricultural land	Agroforestry	<i>Prosopis</i> , <i>Acacia</i> spp., <i>Faidherbia albida</i> with millet/sorghum intercropping	1,020	USD 1,000/ha	See Annex H Section 9. WRI/Reij & Winterbottom 2017: Sahel parkland agroforestry \$500–800/ha. 25% uplift for Cameroon context and 3-year maintenance.
	Community forest reforestation	Active restoration / SFM	<i>Acacia</i> , <i>Balanites</i> , <i>Prosopis</i> multi-use species	516	USD 900/ha	See Annex H Section 9. Active enrichment planting, Sahelian zone; WRI/Reij & Winterbottom 2017; PNDPF field component.
	Waza National Park degraded area restoration	Active restoration / SFM	<i>Acacia</i> , <i>Balanites</i> — conservation purpose	210	USD 900/ha	See Annex H Section 9. As above.

³ John, K., Silayo, D.S.A. & Vatn, A. (2014) The Cost of Managing Forest Carbon under REDD+ Initiatives: A Case of Kolo Hills Forests in Kondo District, Dodoma, Tanzania. International Journal of Forestry Research.

⁴ Merger, E., Held, C., Tennigkeit, T. & Blomley, T. (2012) A bottom-up approach to estimating cost elements of REDD+ pilot projects in Tanzania. Carbon Balance and Management.

⁵ Bellassen, V. & Gitz, V. (2008) Reducing Emissions from Deforestation and Degradation in Cameroon: Assessing costs and benefits. Ecological Economics, 68(1–2), 336–344.

⁶ Merger, E., Held, C., Tennigkeit, T. & Blomley, T. (2012) A bottom-up approach to estimating cost elements of REDD+ pilot projects in Tanzania. Carbon Balance and Management.

⁷ Verhoeven, D., Berkhout, E., Sewell, A. & van der Esch, S. (2024) The global cost of international commitments on land restoration. Land Degradation & Development.

⁸ One Earth story (Bell, 2025): <https://www.oneearth.org/true-cost-of-global-land-restoration-commitments/>

Landscape	Activity	Activity type	Key species / description	Indicative area (ha)	Estimated cost (USD/ha)	Source for cost per ha
	Riparian forests and buffer zones	Active restoration / SFM	Bamboo (<i>Oxytenanthera abyssinica</i>)	207	USD 700/ha	See Annex H Section 9. ANR + riparian enrichment; lower cost than upland planting; Busch et al. 2024
	SFM governance (patrolling, fire management, management plans)	SFM governance (avoided emissions component)	Governance only — no active planting	20,000	USD 100/ha	See Annex H Section 9. Merger et al. (2012) ; Hindawi (2014)
Waza total				21,953		
Dja-Lobéké	Shaded cocoa agroforestry on agricultural land	Agroforestry	Cocoa with <i>Irvingia gabonensis</i> , <i>Dacryodes edulis</i> , <i>Garcinia cola</i> , bamboo	748	USD 1,200/ha	See Annex H Section 9. Zero Carbon Analytics 2025: Congo Basin agroforestry \$861–1,005/ha. 20% uplift for shaded cocoa input costs and FIP Programme 1 context.
	Community and council forest restoration	Active restoration / SFM	Assisted regeneration and multi-use species	1,618	USD 800/ha	See Annex H Section 9. Enrichment planting in degraded forest; FIP Programme 1; Busch et al. 2024
	Park and forest reserve restoration	Active restoration / SFM	<i>Irvingia gabonensis</i> , <i>Dacryodes edulis</i> , Bitter Kola — conservation purpose	706	USD 750/ha	See Annex H Section 9. Within GCF range; FIP Programme 1
	Riparian forests and buffer zones	Active restoration / SFM	Bamboo (<i>Oxytenanthera abyssinica</i>)	1,063	USD 550/ha	Passive + assisted regeneration; Busch et al. 2024
	SFM governance (community patrols, management plans, enforcement)	SFM governance (avoided emissions component)	Governance only — no active planting	15,000	USD 150/ha	See Annex H Section 9. Bellassen and Gitz (2008); Merger et al. (2012)
Dja-Lobéké total				19,135		
Bakossi-Bamboutos	Avocado and safou agroforestry on agricultural land	Agroforestry	<i>Persea americana</i> , <i>Dacryodes edulis</i> , <i>Raphia</i> spp., bamboo, <i>Eucalyptus</i> on smallholder land	333	USD 2000/ha	See Annex H Section 9. Component decomposition: grafted material ~USD 300–600/ha, establishment ~USD 600–1,000/ha, extension ~USD 200–400/ha. The decomposition was developed as an estimate by the IUCN country team, given the absence of a peer-reviewed source for avocado/safou agroforestry establishment costs at this scale in the Western Highlands

Landscape	Activity	Activity type	Key species / description	Indicative area (ha)	Estimated cost (USD/ha)	Source for cost per ha
						context. The total of USD 2,000/ha sits above the GCF restoration benchmark range of USD 100–1,500/ha, with the premium justified by the specialty grafted material requirements and highland site conditions.
	Forest reserve and montane hill restoration	Active restoration / SFM	<i>Eucalyptus</i> , bamboo, native montane species	750	USD 1,100/ha	See Annex H Section 9. Montane forest restoration; FIP Programme 3 ; The Restoration Initiative (see Section 7.1.3 in Annex H).
	Riparian forests and buffer zones	Active restoration / SFM	Bamboo, <i>Raphia</i> — water body protection	2,837	USD 400/ha	See Annex H Section 9. Highland riparian; ANR dominant; within GCF range ; Busch et al. 2024
	SFM governance (management plan support, fire management, patrolling)	SFM governance (avoided emissions component)	Governance only — no active planting	15,000	USD 200/ha	See Annex H Section 9. One Earth (2024); comparable montane East Africa proxy
Bakossi-Bamboutos total				18,920		
Portfolio total				60,008		

2.2.1. Agroforestry, reforestation and restoration

The project interventions are implemented in seven distinct annual cohorts, corresponding to the seven-year implementation period. Year 1 defines Cohort 1, Year 2 defines Cohort 2, and so on through Year 7 (Cohort 7). Each cohort comprises all hectares that are physically established (i.e., planted or formally brought under management) within that calendar/implementation year. Cohorts are tracked as distinct units for monitoring and accounting, allowing survival verification, corrective actions (i.e., replanting), and performance assessment over the subsequent mitigation lifetime.

Cumulative implementation

For each year $k = 1, \dots, 7$, let A_k be the new area established in that year. The cumulative area at the end of year k is the running sum of all annual additions to date:

$$C_k = \sum_{i=1}^k A_i = A_1 + A_2 + \dots + A_k.$$

Thus, “cumulative” denotes the total hectares under implementation by the end of each year, not the annual increment.

No new cohorts are created after Year 7. From Year 8 onward, the established area remains constant at C_7 and is managed under maintenance, monitoring, and the agreed survival/mortality assumptions.

Cohort framing and persistence in accounting

A cohort begins contributing emission reductions (ERs) in the year it is established and is then carried forward through the 20-year accounting horizon. With a seven-year implementation period, Cohort 1 contributes for 20 years, Cohort 2 for 19 years, ..., and Cohort 7 for 14 years; no new cohorts are added after Year 7.

Table 2. Annual and cumulative implementation by cohort and activity (Years 1–7).

Intervention and landscape	Cohort 1 (in ha)	Cohort 2 (in ha)	Cohort 3 (in ha)	Cohort 4 (in ha)	Cohort 5 (in ha)	Cohort 6 (in ha)	Cohort 7 (in ha)	Total (ha)
Agroforestry on farms/hillsides in Waza	102	153	153	204	204	153	51	1,020
Community forest restoration in Waza	52	77	77	103	103	77	26	516
Riparian restoration in Waza	21	31	31	41	41	31	10	207
Degraded parkland restoration in Waza	21	32	32	42	42	32	11	210
Cocoa agroforestry on farms in Dja-Lobéké	75	112	112	150	150	112	37	748
Community forest restoration in Dja-Lobéké	162	243	243	324	324	243	81	1,618
Council/parks/reserves restoration in Dja-Lobéké	71	106	106	141	141	106	35	706
Riparian buffer restoration in Dja-Lobéké	106	159	159	213	213	159	53	1,063
Agroforestry on farms in Bamboutos-Bakossi	33	50	50	67	67	50	17	333
Forest reserve/hills restoration in Bamboutos-Bakossi	75	113	113	150	150	113	38	750
Riparian protection/restoration in Bamboutos-Bakossi	284	426	426	567	567	426	142	2,837
Total (ha)	1,001	1,501	1,501	2,002	2,002	1,501	500	10,008

Family-specific performance determine the contributions:

- **Agroforestry (non-forest):** a constant per-hectare annual net effect is applied (no age-factor schedule), so annual project totals plateau from Year 8 onward once all seven cohorts are established.
- **Forestry-related activities:** contributions are scaled by a survival at end of Year 1, followed by a constant annual mortality rate from Year 2 onward (net of planned replanting), producing a gentle decline in annual totals after Year 7.

Baseline cohorts follow the same area phasing but do not apply survival or age scaling; their per-hectare net effect is held constant each year. All results are adjusted downstream by the applicable leakage and attribution factors (and include burning, nitrogen inputs, or fuel use only where such terms are evidenced).

Operational arrangements

- A hectare is counted in Cohort k only once it is planted/activated and passes basic establishment checks (parcel mapping, photo/field evidence, and nursery/stock records).
- If a site planned for Cohort k is delayed, its hectares are recorded in Cohort $k + 1$; the cumulative series can then be subsequently adjusted.
- Replanting within the first year does not create a new cohort; it remains part of the original cohort and influences the verified survival for that cohort.
- Cohort areas are disaggregated internally by landscape and activity type (agroforestry, community forest restoration, park/forest reserve blocks, riparian buffers) to enable targeted MRV and management.

2.2.2. SFM governance activities

The cohort phasing structure described above applies only to the two sequestration families (agroforestry and forestry-related activities). The SFM governance component of the avoided emissions calculation does not use annual cohorts. Governance arrangements are not established progressively by year, rather, the full governance area in each landscape is counted from Year 1, subject to the ramp-up factor described below. This reflects the nature of the activity: improved management plans, patrolling regimes, and community enforcement agreements are governance instruments that cover a defined area from the point of establishment, not physical plantings that require sequential nursery cycles and survival verification. Accordingly, the avoided emissions calculation applies a single uniform annual value across Years 1–7, with only the Year 1 ramp-up adjustment described below.

Year 1 ramp-up factor for the SFM governance component

A Year 1 ramp-up factor of 0.50 is applied to the annual avoided emissions estimate for the first year of the implementation period. This deduction reflects the practical reality that establishing effective governance coverage takes time: management plan approvals require institutional sign-off, community enforcement agreements require consultation and formalisation, and patrolling regimes require staff mobilisation and training. It is unlikely that full governance coverage, and therefore the full annual deforestation prevention effect, is achieved from the first day of Year 1. The ramp-up factor conservatively assumes that only 50 percent of the annual avoided emissions benefit is realised in Year 1, with the full annual value applying from Year 2 onward. This gives an effective accumulation equivalent to 6.5 full years over the 7-year implementation period.

3. Methodology, applicability, and alignment

3.1 Methodology: approach, deviations, and justification

3.1.1 Methodology choice

In line with GCF Board Decision B.33/12 and the GCF Secretariat's supplementary guidance (Version 1.0, November 2024), accredited entities (AEs) are encouraged to use, adapt, or be guided by established methodologies where suitable ones exist. Where no single established methodology fully covers the proposed activities, the GCF guidance explicitly permits AEs to present their own methodological approach based on the most appropriate existing tools and methodologies, provided that the approach is clearly described, justified, and agreed with the GCF Secretariat.

SPEFOCE's mitigation portfolio encompasses two distinct accounting frameworks applied to three activity groupings. The first framework is an enhanced sequestration approach covering agroforestry on non-forest cropland and multi-type forest restoration, implemented in a phased, multi-cohort structure across three ecologically distinct landscapes in Cameroon. The second framework is an avoided emissions approach covering SFM governance activities that prevent ongoing deforestation in defined forest areas within each landscape.

In light of the above, the most relevant established methodologies are considered, and the reasons they were not adopted as the sole framework, are as follows:

Methodology	Relevant Elements	Limitations for SPEFOCE
Methodology/framework	Relevance	Limitations
FAO EX-ACT (v9 / 2024 digital)	IPCC AFOLU carbon balance logic; climate-zone-stratified parameters; baseline vs. project comparison. The 2024 digital version introduces annual activity accounting.	No native cohort disaggregation framework for multi-year phased implementation. Does not include additionality demonstration or MRV protocols meeting GCF APR requirements, as noted by GCF guidance (B.33/12 supplementary guidance, November 2024). Used as the source of biomass increment and SOC parameters.
Verra VM0042 v2.1 (Improved Agricultural Land Management)	Structured additionality test (regulatory surplus + barrier analysis + common practice); SOC quantification; leakage; MRV protocols. Covers agroforestry on cropland.	SOC quantification requires measure-and-model or measure-and-remeasure approaches with soil sampling — not possible at current project stage. Does not cover forestry-related activities. Baseline look-back period requirements may not be met for all parcels.
Verra VM0047 v1.0/1.1 (Afforestation, Reforestation, Revegetation)	Dynamic performance benchmarks via remote sensing; additionality via census-based common practice test; structured MRV. Covers ARR activities including agroforestry with woody biomass.	Dynamic remote-sensing baseline matching requires control plot infrastructure — not possible at current project stage. Does not cover existing cropland (non-forest) agroforestry.
CDM AR methodologies (AR-ACM0003, AR-AMS0007)	Established UNFCCC-approved frameworks for afforestation and reforestation with structured baselines, additionality, and monitoring.	Do not cover cropland agroforestry.

Given the above, SPEFOCE adopts a custom methodological approach that:

- (i) is grounded in the IPCC 2006 AFOLU Guidelines with the 2019 Refinement as the primary accounting framework;
- (ii) applies the structural logic of FAO EX-ACT Version 9 for parameter selection and carbon balance calculation; and
- (iii) draws on the additionality and MRV design principles of Verra VM0042 (for agroforestry activities) and VM0047 (for forestry restoration activities), adapted to the programme context.

This combined approach is consistent with the GCF guidance. Additionally, the approach meets all five principles of GCF Decision B.33/12: country alignment (Section 3.6 of Annex 22); a complete methodological approach (this section); boundaries, baseline, and additionality (Sections 3 and 4 of Annex 22); consistent assumptions (Section 3.5 of Annex 22); and MRV (Section 8 of Annex 22).

3.1.2 Deviations from established methodologies and justifications

The following table summarises the principal deviations from the elements of established methodologies on which SPEFOCE's approach is informed, and provides justification for each:

Element	Deviation from Standard Practice	Justification
Element	Deviations	Justification
SOC quantification (deviation from VM0042)	VM0042 requires measure-and-model or measure-and-remeasure SOC quantification with physical soil sampling. SPEFOCE uses the IPCC Tier-1 factor method (reference SOC stocks multiplied by land-use and management factors, annualised over the transition period).	Soil sampling infrastructure for measure-and-model or measure-and-remeasure approaches at programme scale (190,000+ ha across three landscapes) is not feasible within programme resources at this stage. The Tier-1 factor method is a conservative approach consistent with IPCC guidance and appropriate where higher-tier data are unavailable. SOC parameters are differentiated by climate zone.
Baseline setting (deviation from VM0047 dynamic benchmark)	VM0047 uses dynamic performance benchmarks derived from remote-sensing matching to control plots. SPEFOCE uses static Tier-1 IPCC/EX-ACT biomass increment defaults stratified by climate zone as the baseline, held constant across the accounting horizon.	Establishing a donor pool and remote-sensing control plots across three heterogeneous landscapes requires data infrastructure not yet in place. The static Tier-1 baseline is conservative (representing slow natural recovery), is consistent with IPCC good practice, and avoids the risk of baseline inflation.
Additionality (informed by VM0042 and VM0047 structure)	SPEFOCE applies a three-part additionality test (regulatory surplus, common practice analysis, barrier analysis) adapted from VM0042 and VM0047 rather than the specific quantitative thresholds (e.g., the 15–20% market penetration benchmarks) prescribed in those methodologies.	The GCF guidance requires a credible analysis and explanation of additionality for each country and activity. The three-part structure, regulatory surplus, common practice, and barrier analysis, is the internationally established standard (reflected in VM0042, VM0047, CDM, and GCF guidance).

National FREL/FRL and MRV alignment	GCF guidance requires alignment with national FREL/FRL and MRV systems. No published FREL/FRL or operational national MRV framework are available at the time of submission.	Parameters are grounded in IPCC defaults and peer-reviewed literature, and are consistent with Cameroon's national forest definition. Once Cameroon's FREL/FRL is submitted and a national MRV framework becomes operational, project baselines, parameters, and monitoring protocols will be reviewed and updated to ensure full consistency.
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3.2 Boundaries, pools and GHGs

Geographical boundary

Three intervention landscapes within the Republic of Cameroon are covered by the proposed SPEFOCE project. Waza (Sudano-Sahel), Dja–Lobéké (humid rainforest), and Bamboutos–Bakossi (moist highlands).

Carbon pools and GHGs included

We include the following pools and gases in the ex-ante estimations:

Pool / GHG	Treatment
Pool/GHG	Treatment
Above-ground biomass (AGB)	Included for both the sequestration and avoided emissions components. For sequestration activities, annual net increments are stratified by climate zone and activity family. For the avoided emissions component, AGB forms the primary pool through which deforestation emission factors are derived, using carbon stock values from Cameroon's proposed FREL (January 2026 submission).
Below-ground biomass (BGB)	Included for all sequestration activities, both forestry-related and agroforestry, via climate-zone-appropriate root-to-shoot ratios (IPCC 2006, Table 4.4). For the avoided emissions component, BGB is incorporated within the landscape-level emission factors drawn from the proposed FREL submission, which include both AGB and BGB carbon stocks.
Soil organic carbon (SOC, 0–30 cm mineral soils)	Included for sequestration activities using the IPCC Tier 1 factor method, with reference SOC stocks differentiated by landscape climate zone. Not separately modelled for the avoided emissions component, as deforestation emission factors from the proposed FREL submission are applied to above- and below-ground biomass pools only; SOC changes attributable to avoided deforestation are therefore excluded, consistent with a conservative approach.
Non-CO₂ (N₂O from managed soils; CH₄/N₂O from burning)	Included for sequestration activities only where evidenced. Nitrogen application rates and open burning are set to zero by default and activated when field records confirm their occurrence, with the exception of documented baseline fire in Waza forestry contexts.
Fossil CO₂ from diesel	Included for sequestration activities where mechanised operations are planned; set to zero by default unless documented.

Deadwood and litter	Excluded for conservativeness from both the sequestration and avoided emissions components at this ex-ante stage. For sequestration activities their effects are represented conservatively through biomass changes.
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3.3 Applicability boundaries

Agroforestry (non-forest) activities: Applicable to parcels confirmed as cropland at baseline using mapped boundaries and land-use evidence. Establishment must be demonstrated with nursery or seedling dispatch records, field verification forms, and geospatial confirmation of planting.

Forestry activities: Applicable to compartments located within legally designated forest or community forest areas, or within mapped riparian protection zones. Activities must be covered by an approved restoration or sustainable forest management workplan issued by the responsible authority.

SFM governance activities (avoided emissions component): Applicable to defined forest areas in each landscape where the project establishes improved management plans, patrolling, fire management, and community enforcement arrangements. The forest areas covered under these governance arrangements, derived from budget allocation and landscape-specific implementation costs (see Table 1).

3.4 Baseline and project scenarios

3.3.1 Baseline Scenario

The baseline represents the most plausible trajectory of land use and GHG emissions in the absence of the SPEFOCE programme:

- **Agroforestry baseline:** Cropland with low or no net woody biomass increment, minimal soil organic carbon (SOC) improvement, and continuation of low-input annual or perennial cropping systems. Nitrogen application and open burning are set to zero unless documented evidence indicates otherwise. The per-hectare annual net baseline effect is near-zero or slightly negative (a weak net source) in the absence of deliberate tree establishment.
- **Forestry-related baseline:** Degraded or partially stocked forest compartments exhibiting slow net biomass recovery under continuing disturbance pressure from fire, extraction, and grazing. Baseline increments are positive but small, reflecting natural recovery without active management, protection, or systematic enrichment. This represents a net sink weaker than the project scenario
- **SFM governance baseline (avoided emissions component):** Forest areas within the SFM governance boundary continue to be deforested at the historical landscape-scale rate in the absence of the project. No biomass increment is modelled for these areas under the baseline; only the annual carbon stock lost to clearing is accounted for, using landscape-specific emission factors derived from Cameroon's submission of a proposed FRL⁹.

3.3.2 Project Scenario

⁹ Republique du Cameroun (2026). Niveau de reference pour les forêts du Cameroun.

The project scenario reflects the with-programme configuration, differentiated by activity family:

- **Agroforestry project scenario:** Deliberate establishment or intensification of tree-based systems on cropland parcels, increasing above-ground and below-ground biomass and improving SOC dynamics through higher perennial inputs and reduced soil disturbance. Open burning is excluded from the project scenario. Nitrogen inputs remain zero unless planned additions are documented.
- **Forestry-related project scenario:** Restoration and SFM generating above-ground and below-ground biomass increments consistent with early-stage secondary growth under active management. Recurrent burning is strongly reduced or excluded. Protection, enrichment planting, and access control sustain biomass stocks above baseline levels throughout the accounting horizon. The causal pathway is (i) higher biomass increments and (ii) improved soil carbon dynamics under project management, minus (iii) any non-CO₂ and fuel emissions introduced by the intervention. Where access restrictions could displace activities, leakage is addressed as a deduction (see Section 5).

Implementation for the above activities proceeds in seven annual cohorts (Years 1–7), with all established area maintained and monitored through Year 20. Annual mitigation results are calculated as project minus baseline for each cohort, then summed across active cohorts for each reporting year.

- **SFM governance project scenario (avoided emissions component):** Forest areas under improved governance are assumed to have zero net deforestation attributable to the project intervention within the governance boundary. The annual climate benefit is the emissions avoided by preventing the clearing of the forest area that would otherwise have been deforested at the historical landscape rate. The causal pathway is: (i) improved management plans, patrolling, and enforcement reduce access to and pressure on the forest; (ii) the area of forest that would have been cleared each year is retained; and (iii) the carbon stock of that retained forest is not released.

3.5 Accounting framework and formulas

3.5.1. Agroforestry, Reforestation and Restoration (sequestration)

For activity a , cohort c and year t :

Per-hectare annual net effect

$$Q_a = \underbrace{\Delta \text{Biomass}_a}_{\text{AGB+BGB}} + \underbrace{\Delta \text{SOC}_a}_{0-30\text{cm}} - \underbrace{E_{N_2O,a}}_{\text{direct+indirect soils}} - \underbrace{E_{\text{fuel},a}}_{\text{diesel, if evidenced}} - \underbrace{E_{\text{burn},a}}_{\text{open burning, if evidenced}}$$

All terms are in tCO₂e ha⁻¹ yr⁻¹. GWPs are AR6, 100-year.

Cohort accounting (7 cohorts over 20 years)

Cohort c begins contributing in its establishment year, $t = c$. With seven cohorts (Years 1–7), no new area is added after $c = 7$. The age of cohort c in year t is $k = t - c + 1$.

- **Agroforestry (non-forest):** no age-factor scaling; the per-hectare project net effect is **constant by age**, i.e. $s_k \equiv 1$ for all k .
- **Forestry-related activities:** a survival schedule reflects establishment realism and ongoing losses:

$$s_1 = S_1(\text{fraction alive at end of Year 1}), \text{ and for } k \geq 2,$$

$$s_k = S_1 (1 - m)^{k-1},$$

where m is the constant annual mortality rate (net of planned replanting).

- **Baseline:** follows the same cohort phasing but no age/survival scaling is applied; effectively $s_k \equiv 1$.

The portfolio-level annual net in year t is the sum over active cohorts:

$$\text{Net}_t = \sum_a \sum_{c=1}^{\min(t,7)} (Q_a \times A_{a,c} \times s_{a,t-c+1}),$$

with $A_{a,c}$ the area established for activity a in cohort c , and s_a , set as above for project or baseline.

Reporting quantities

Annual results are presented for **Years 1–20**, with two aggregates:

1. **Implementation phase totals** (Years 1–7), and
2. **Mitigation lifetime totals** (Years 1–20).

All reported ERs are based on project minus baseline, then adjusted downstream by leakage and attribution:

$$\text{ER}_t = (\text{Project}_t - \text{Baseline}_t) \times (1 - \lambda) \times \alpha,$$

and are shown with the stated uncertainty band (LOW–HIGH). Burning, nitrogen inputs and fuel use are set to zero unless evidenced.

Tiers

Cameroon-specific Tier-2 parameters are used wherever credible and documented (e.g., forest increments, survival), otherwise Tier-1 defaults are applied with conservative choices. All parameters are registered in a table (**see Appendix I**) with IDs, units, values, sources, and uncertainty.

Biomass increments and climate zone stratification

Biomass increments are stratified by landscape climate zone (dry, moist, wet/humid) to reflect climatic and edaphic controls:

- **Waza (dry tropics):** lower median increments;
- **Bamboutos–Bakossi (moist):** intermediate;
- **Dja-Lobéké (humid):** higher early-stage increments.

SOC factors

Soil organic carbon stocks for the 0–30 cm layer follow climate zone classes assigned by landscape (tropical dry, moist, or wet). Land-use and management factors represent annual cropping in the baseline and perennial systems in the project for agroforestry, and forest land conditions for forestry-related activities. Changes in SOC are converted to annual values over the accounting horizon in line with IPCC factor-method conventions, so that transitions are spread over the project lifetime rather than front-loaded.

Non-CO₂

Rates of synthetic nitrogen application are set to zero unless robust evidence demonstrates mineral fertiliser use (for example, input records or documented programme distributions). Where nitrogen use is evidenced, direct and indirect nitrous oxide emissions are calculated with IPCC default emission factors and partition fractions, unless vetted national factors are available. Open burning is included only when recurring events are evidenced and material; otherwise this term is set to zero. Fuel-related carbon dioxide is derived from standard per-litre emission factors, with activity data set to zero by default and activated only where machinery or transport is planned and documented.

3.5.2. Sustainable Forest Management (avoided emissions component)

SFM governance areas

The activity data for the avoided emissions component consists of the forest area placed under improved SFM governance in each landscape, presented in Table 1 above.

Landscape-scale historical deforestation rates and reference levels

The avoided emissions calculation requires a reference level expressing the annual rate at which forest within each SFM governance area would be expected to be cleared in the absence of the project. In the absence of a validated sub-national or project-scale reference level for the three landscapes, this Annex uses landscape-specific historical deforestation rates derived from the land cover change analysis documented in Annex 22E. That analysis applied Landsat time series imagery across two periods, 2000–2010 and 2010–2021, to quantify annual forest loss in each landscape. The rates applied are 5,913 ha/yr in Waza (from a 2021 forest area of 88,811 ha, equivalent to 6.66%/yr), 1,957 ha/yr in Dja-Lobéké (from 6,383,248 ha, equivalent to 0.031%/yr), and 1,150 ha/yr in Bakossi-Bamboutos (from 559,074 ha, equivalent to 0.206%/yr).

Cameroon submitted a proposed national FRL to the UNFCCC in January 2026, which sets net emissions at zero tCO₂e/yr at national scale. The avoided emissions calculation in this Annex does not claim against that national FRL. The national net-sink position reflects aggregate carbon dynamics across the full national forest estate and does not preclude substantial localised deforestation within the three project landscapes, where agricultural expansion and land use pressure are well-documented. The use of landscape-specific is treated as the most appropriate available proxy pending validation of sub-national reference levels.

The historical average rates are applied as point estimates and are not adjusted for future trajectory. This is intentionally conservative: in Waza in particular, the 2010–2021 deforestation rate substantially exceeded the 2000–2010 rate, indicating an accelerating trend. Applying the historical average rather than a projected increasing rate therefore understates likely future deforestation pressure and produces a lower avoided emissions estimate than a trend-based projection would yield. Once Cameroon's national FRL has completed UNFCCC technical assessment and validated sub-national or landscape-level activity data become available, the landscape-specific rates used here will be reviewed and updated accordingly (see Section 3.7).

Emission factors

Carbon stocks per hectare of forest cleared are drawn from Cameroon's proposed national FRL submission¹⁰ (see Section 3.7 below), which provides above-ground biomass (AGB) and

¹⁰ Republique du Cameroun (2026). Niveau de reference pour les forêts du Cameroun.

below-ground biomass (BGB) values by forest type. The values applied are: Waza, dry forest, AGB 56.7 tC/ha, BGB 13.61 tC/ha, EF 257.8 tCO₂/ha; Dja-Lobéké, dense humid forest, AGB 104.4 tC/ha, BGB 25.06 tC/ha, EF 474.7 tCO₂/ha; Bakossi-Bamboutos, planted/montane forest, AGB 95.6 tC/ha, BGB 21.02 tC/ha, EF 427.6 tCO₂/ha. EF = (AGB + BGB) × 3.6667 to convert tC/ha to tCO₂/ha. Dead organic matter and SOC pools are excluded from the avoided emissions calculation as a conservative choice.

Calculation formula

The annual avoided emissions for each landscape *ls* in year *t* are calculated as:

$$AE(ls, t) = A_gov(ls) \times r_defor(ls) \times EF(ls) \times \alpha \times (1 - U)$$

Where:

A_gov(*ls*) is the SFM governance area (ha);

r_defor(*ls*) is the annual deforestation rate (fraction of forest area per year);

EF(*ls*) is the emission factor (tCO₂/ha cleared);

α is the attribution factor;

and *U* is the uncertainty deduction.

A single-year ramp-up deduction is applied in Year 1 (50 percent of the annual value) to reflect the time required to establish governance arrangements before full coverage is achieved.

3.7 National alignment (definitions, MRV, registries)

Forest definition

Cameroon submitted a proposed national Forest Reference Level (FRL) to the UNFCCC on 20 January 2026¹¹. This submission represents Cameroon's proposed reference level under the Warsaw Framework for REDD+ and is currently pending technical assessment and validation by the UNFCCC. The proposed FRL covers all five REDD+ activities at national scale for the historical period 2000–2020 and the implementation period 2021–2025, and proposes a reference level of zero tCO₂e per year, reflecting Cameroon's status as a net carbon absorber at national scale.

The SPEFOCE project does not claim avoided emissions against the proposed national FRL, nor does it treat the proposed FRL as a validated project-level baseline. Instead, the avoided emissions component uses landscape-specific historical deforestation rates derived from the Annex 22E land cover change analysis as the project-level reference. Emission factors are drawn from the carbon stock values presented in the FRL submission document¹², which are themselves sourced from peer-reviewed field measurement studies and are considered reliable for this purpose independently of the FRL's validation status. The sequestration component continues to use IPCC Tier-1 defaults and available national data, consistent with the approach described below.

¹¹ Republique du Cameroun (2026). Niveau de reference pour les forêts du Cameroun.

¹² Republique du Cameroun (2026). Niveau de reference pour les forêts du Cameroun.

Aligning with the proposed FRL at this stage, while it is under technical assessment validation, is considered good practice. It ensures that the project's accounting parameters are consistent with the national data and methodological choices that Cameroon has put forward, and positions the project for straightforward updating once the FRL is technically assessed and accepted. Once the UNFCCC technical assessment is complete and any accepted sub-national disaggregation or revised emission factors become available, project-level parameters will be reviewed and, where necessary, updated to ensure full consistency with the validated national reference level.

Consistency with MRV guidelines

Cameroon does not yet have a published national MRV framework or national-level GHG emission factors specific to the AFOLU sector. In the absence of such guidance, parameter choices and evidence rules have been derived from IPCC 2006 AFOLU Guidelines (with the 2019 Refinement) and peer-reviewed literature. All sources are recorded transparently in the parameter registry so that each non-zero term can be traced to a documented reference. When Cameroon's national MRV framework becomes operational, the project's parameter choices and monitoring protocols will be reviewed for alignment and updated accordingly, with any material changes documented in the parameter registry and reflected in subsequent annual reporting.

Registry alignment

Results are structured for direct integration with national registry and NDC accounting. Each annual total is presented with explicit baseline and project scenarios, the applied leakage deduction, the attribution factor, and the stated uncertainty band. Landscape and activity identifiers accompany all reported values to enable reconciliation at registry scale.

3.8 Attribution, leakage, and uncertainty

Attribution factor

An attribution factor of 0.85 is applied to the net results of the sequestration component. This reflects the complexity of landscape carbon dynamics and recognises that non-project drivers may also contribute to biomass gains within and around the accounting boundary. For the avoided emissions component, an attribution factor of 1.0 is applied. The avoided emissions calculation is based on governance interventions, management plan operationalisation, community patrolling, fire management, and enforcement, applied to a defined forest area, with a direct and bounded causal link between the intervention and the reduction in deforestation.

Leakage (application, with details in Section 5)

Leakage is applied as a scalar deduction to account for potential displacement of emissions outside the accounting boundary. Two pathways are considered. The first is activity-shifting leakage, where interventions displace pre-existing land uses to areas outside the boundary. The second is market leakage, where constraints on local biomass supply lead to compensating extraction elsewhere. For reporting purposes, leakage factors are applied ex ante by activity family and landscape, and are intended to be validated during implementation and revised if warranted based on production tracking, market checks, and spatial monitoring.

Leakage is treated in a manner consistent with the two accounting components. For the sequestration component, covering agroforestry and forestry-related restoration activities, leakage deductions are applied to annual results for each activity, cohort, and year. For the avoided emissions component, the main leakage pathway is activity-shifting, reflecting the

possibility that reduced deforestation pressure within the governance boundary is displaced to forest areas outside it. Market leakage is considered lower for the governance component than for active restoration because governance measures aim to reduce clearing rather than restricting product flows through establishment of planted stands. Pending ex-post evidence, the leakage factors applied to avoided emissions are set equal to those applied to forestry-related sequestration activities in the corresponding landscape as a conservative proxy. Full leakage parameters are presented in Section 5.

Uncertainty deductions and conservative rules

Uncertainty is represented through a single, symmetric uncertainty band applied to the net results of both accounting components. A $\pm 20\%$ range is applied to annual and cumulative totals to present LOW and HIGH values. This supports transparent reporting of uncertainty in an ex-ante assessment where outcomes depend on multiple interacting processes and where parameter-level uncertainty propagation is not yet supported by locally derived probability distributions. It is consistent with good practice in ex-ante reporting, where estimates are necessarily approximate and are reported conservatively.

For the sequestration component, the $\pm 20\%$ band reflects the current level of parameterisation and stratification. Most factors are Tier 1 or Tier 1-derived and represent broad climate-region and land-use classes rather than site-specific measurements. Within each landscape, a single baseline biomass increment is applied across community forests, reserve or park compartments, and riparian buffers. These sub-types differ in ecological conditions and management contexts, and riparian zones in particular may have higher soil moisture, stronger edge influences, and different species composition than upland compartments, which in some settings can support faster baseline recovery than a landscape-average assumption would imply. The use of one baseline increment per landscape is therefore a Tier 1 simplification adopted for consistency and transparency at the current stage. Where baseline recovery is faster for a given sub-type, this choice reduces the estimated difference between baseline and project scenarios and is therefore conservative in the context of ex-ante mitigation reporting.

For the avoided emissions component, the $\pm 20\%$ band reflects two main sources of uncertainty. The first is that the deforestation reference rate is based on a historical average from a 2010–2021 Landsat analysis (see Annex 22E), and future deforestation pressure within the governance boundary may be higher or lower than this historical rate. The second is that emission factors are drawn from Cameroon's submission for a proposed FRL and are applied at landscape scale as uniform values within each forest type, which does not capture within-landscape variation in carbon stocks. The $\pm 20\%$ band is considered appropriate for these sources collectively.

Conservative rules are applied to key terms across both components where evidence may be incomplete at appraisal stage. For the sequestration component, nitrogen inputs, open burning, and diesel use are included only when activity design and documentation indicate that they are relevant and material; otherwise these terms are set to zero. For the avoided emissions component, dead organic matter and soil organic carbon (SOC) are conservatively excluded from the ex-ante estimates at this stage, pending site-specific information for these pools.

3.9 Exclusions and safeguards

Double counting is prevented through clear spatial boundaries, explicit attribution of impacts, and reporting formats that are compatible with national registries. Provisions for permanence risk management and monitoring are described in the MRV section. Measures that lower leakage risk, such as on-farm wood supply and community agreements, are embedded in activity design and are reflected in the applied deductions. The avoided emissions component

and the sequestration component are non-overlapping by design: SFM governance areas are defined separately from active planting areas, and no hectare contributes to both components.

4. Additionality assessment

4.1 Framing and tests applied

The assessment follows a standard three-part structure: (i) **legal/regulatory surplus**, (ii) **common practice** in the intervention landscapes, and (iii) **investment/implementation barriers** that prevent spontaneous uptake at the required scale and continuity. These are evaluated for the two activity families, agroforestry on existing cropland and forest restoration/SFM in community forests, protected compartments, and riparian buffers, within Waza (Sudano-Sahel), Dja–Lobéké (humid rainforest) and Bamboutos–Bakossi (moist highlands). Results are interpreted against the baseline/project scenarios and lifetime accounting already defined in Sections 2–3 and the MRV arrangements in Section 8.

4.2 Legal and regulatory surplus (not mandated, policy-aligned)

Cameroon's current instruments set an enabling framework for restoration, community forest management, and riparian protection. They do not create a legal obligation to establish large-scale tree-based agroforestry on private cropland, nor to carry out sustained restoration of the specific forest compartments and riparian buffers targeted here with the required scale, continuity, and third-party-verifiable monitoring. In protected and community forests, approved management plans typically allow restoration and enrichment but do not guarantee financing, seedling supply, protection measures, survival verification, or multi-year maintenance. The programme therefore exceeds statutory minima. The measures are permitted and aligned with national objectives, yet remain discretionary in the absence of dedicated funding and execution capacity. This establishes regulatory surplus for both activity families^{13,14,15}.

For the SFM governance component, regulatory surplus rests on a different but equally clear basis. Cameroon's 1994 Forest Law (Law No. 94/01) and its 1995 implementing decree require approved management plans for Permanent Forest Areas, including Forest Management Units, community forests, and protected area buffer zones. In practice, management plan preparation, community patrolling, fire prevention infrastructure, and enforcement capacity remain underfunded across the three project landscapes. The continued deforestation documented within designated PFAs in Annex 22E at rates of 5,913 ha/yr in Waza, 1,957 ha/yr in Dja-Lobéké, and 1,150 ha/yr in Bakossi-Bamboutos during 2010–2021 is evidence that statutory designation has not translated into effective emissions reductions. The project's SFM governance activities therefore exceed what the regulatory framework delivers in practice, establishing legal surplus without conflicting with national policy objectives^{16,17}.

4.3 Common practice (counterfactual)

¹³ Republic of Cameroon - Forestry and Wildlife Regulations 2024

¹⁴ Plan National Climat Du Cameroun – MINEPDED (Avril 2025)

¹⁵ Plan d'action pour la mise en oeuvre d'un Système National de Surveillance du Carbone Forestier au Cameroun – MINEPDED (2014)

¹⁶ Law No. 94/01 of 20 January 1994 on Forestry, Wildlife and Fisheries (Cameroon)

¹⁷ Decree No. 95/531/PM of 23 August 1995 (implementing regulations)

Landscape analysis, partner records, and the background evidence used in the ex-ante set-up indicate that, in the absence of the programme, the counterfactual is characterised by the following patterns^{18,19,20}.

Cropland: Woody increments remain low and regulated-shade agroforestry is rarely adopted at scale. Where on-farm planting occurs it is sporadic and lacks survival follow-up, stocking targets, and independent verification.

Forest compartments: Recovery is slow and under-resourced, with recurrent disturbance from fire, extraction, and grazing. There is little evidence of systematic enrichment, aftercare, and access control sustained over multiple years^{21,22}.

Riparian buffers: Vegetation is variable and protection intermittent. Local planting does occur but continuity and effective protection are not assured²³.

SFM governance in Permanent Forest Areas: Despite legal designation, PFAs across the three landscapes experience ongoing deforestation driven by agricultural encroachment, charcoal production, and informal timber extraction. Community-level enforcement, fire management protocols, and functioning management plan implementation are not present in the counterfactual. The sustained governance arrangements planned under the project, management plan operationalisation, community patrol systems, demarcated use-zones, and fire prevention infrastructure, have no demonstrated equivalent at the required scale and continuity in comparable Cameroonian landscapes without dedicated external finance^{24,25}.

The project scenario configuration, annual cohort establishment, survival thresholds, maintenance, protection, and accounting over twenty years, therefore does not reflect common practice in the landscapes assessed.

4.4 Investment and implementation barriers

Both activity families face material barriers that prevent spontaneous uptake at programme scale. Landscape actors confront upfront capital and cash-flow timing challenges. Nursery establishment and expansion, seed collection, transport, site preparation, planting, and early maintenance require expenditures that occur before benefits arrive. Biomass accumulation, soil improvement, and regulated shade yields accrue gradually. In community and protected compartments, much of the return is a public good with diffuse private incentives^{26,27,28}.

Execution capacity and coordination are limited: Large seedling throughput, species–site matching, firebreak maintenance, weeding, gap-filling, survival audits, and geospatial tracking demand organised logistics and dedicated personnel that are rarely available to smallholders or under-resourced forest services.

¹⁸ Annex 22B FS Report on the drivers of deforestation and forest degradation_IUCN_030425_SPEFOCE

¹⁹ Annex H FS Landscape Restoration Opportunity Report Assessment_IUCN_CameroonCentral Africa_030425_SPEFOCE

²⁰ Lignes directrices pour le système MNV de la REDD+ au Cameroun

²¹ Republic of Cameroon - Forestry and Wildlife Regulations 2024

²² Plan National Climat Du Cameroun – MINEPDED (Avril 2025)

²³ FAO Forest Resource Assessment 2025

²⁴ Dkamela (2011), *The context of REDD+ in Cameroon*, CIFOR Occasional Paper 57

²⁵ Tchatchou et al. (2015), *Deforestation and forest degradation in the Congo Basin*

²⁶ Plan National Climat Du Cameroun – MINEPDED (Avril 2025)

²⁷ Annex H FS Landscape Restoration Opportunity Report Assessment_IUCN_CameroonCentral Africa_030425_SPEFOCE

²⁸ World Bank Group. 2025. Congo Basin Forest Ecosystem Accounts and Policy Recommendations: A regional synthesis report of ecosystem extent, condition, services, and asset accounts 2000-2020. Washington, DC: World Bank Group

Risk exposure is high: Drought, fire, browsing, pests, and flood events can erase early investments if contingency resources for replacement and protection are not secured in advance²⁹.

Transaction and verification costs are significant: Mapping, cohort assignment, survival measurement, evidence management, and compliance with registry-compatible MRV increase unit costs beyond what individual land users or local institutions typically bear.

These barriers explain why the baseline does not converge to the with-project configuration without targeted finance and structured execution. Dedicated funding, technical assistance, and verification systems are therefore decisive for shifting behaviour at landscape scale in a sustained and measurable manner.

The SFM governance component faces an additional and distinct set of barriers. Community-level enforcement of forest boundaries requires multi-year institutional investment: negotiated land-use agreements, trained patrol personnel, demarcation and signage, conflict resolution mechanisms, and linkages to administrative enforcement authorities. These conditions are not self-sustaining at project outset and do not emerge spontaneously in the absence of dedicated funding and facilitation. Management plan preparation and operationalisation carry upfront technical and process costs, including participatory mapping, ecological surveys, and legal registration, that line forest services and community forest committees cannot typically absorb without external support. The absence of functioning SFM governance in the PFAs of all three landscapes despite their legal designation confirms that these barriers are binding, not incidental^{30,31,32}.

4.5 Assessment

Across all three activity components, agroforestry on cropland, forest restoration, and SFM governance for avoided emissions, the programme exceeds statutory requirements, departs from prevailing practice in both scale and verification, and addresses the binding execution and financing constraints identified above. For the SFM governance component specifically, additionality is grounded in the documented challenges of legal designation alone to prevent deforestation within PFAs, and in the absence of self-sustaining community enforcement capacity without dedicated external finance.

5. Leakage assessment

5.1 Definition and scope

Leakage is defined as any material increase in greenhouse-gas emissions occurring outside the project boundary but attributable to project interventions. Two pathways are relevant for the SPEFOCE mitigation activities:

1. **Activity-shifting leakage (ASL):** displacement of pre-project activities (e.g., fuelwood collection, informal timber extraction, grazing, or cropping) from project areas to locations outside the boundary.
2. **Market leakage (ML):** changes in local supply–demand conditions (e.g., constrained wood supply in a restored compartment) that induce compensating extraction elsewhere.

²⁹ FAO Forest Resource Assessment 2025

³⁰ Merger et al. (2012), Making REDD+ work at the local level.

³¹ Dkamela (2011), The context of REDD+ in Cameroon, CIFOR Occasional Paper 57.

³² MINEPDED (2018), *National REDD+ Strategy, Cameroon*.

5.2 Pathways relevant to SPEFOCE project

Agroforestry on existing cropland

The intervention is implemented on land that remains cropland while introducing tree cover and on-farm sources of wood and non-timber products. Two potential leakage pathways are relevant. The first is a minor, temporary shift in annual crop area or intensity if young trees constrain short-term production. The second is a small, localised displacement of household fuelwood to off-farm sources during establishment. These risks are addressed through parcel-level farm plans, regulated shade targets, and provision of on-farm wood from living hedges, boundary trees, and pruning regimes. Landscape monitoring and household checks are used to identify any displacement early and trigger corrective actions. Given the absence of land-use conversion and the embedded safeguards, the magnitude of activity-shifting or market leakage is expected to be low^{33,34}.

Forest restoration (community forests, park/forest reserve blocks, riparian buffers): By stabilising biomass, restricting unsustainable extraction, and improving access control, and restoration can temporarily displace part of pre-existing wood extraction or grazing to areas outside the treated compartments until alternative supply and management arrangements mature. The likely magnitude varies by landscape. In Waza (Sudano-Sahel), reliance on fuelwood and open-range grazing is higher, so the potential for activity-shifting leakage is correspondingly greater when access is tightened. In Dja-Lobéké (humid rainforest), diversified livelihoods and community forestry arrangements tend to moderate displacement risks. In Bamboutos-Bakossi (moist highlands), restoration blocks are smaller and topographically constrained, which lowers the scope for displacement^{35,36}.

SFM governance and avoided emissions (AE component): The SFM governance activities operate at landscape scale across 50,000 ha of designated PFAs. The primary leakage pathway for this component is spatial displacement of deforestation pressure, agricultural encroachment, charcoal production, and extraction activities, to areas outside the SFM governance boundary but within the broader landscape. This is a well-documented risk in Central African forest governance contexts, where tightened enforcement within a boundary can shift pressure to adjacent unmanaged or less-monitored forest. The magnitude of this pathway is distinct from and additive to restoration leakage: the SFM component does not introduce alternative livelihood supply to the same degree as agroforestry, making the displacement risk relatively higher per unit area. The landscape-differentiated leakage factors applied to the AE component (Waza 15%, Dja-Lobéké 10%, Bakossi-Bamboutos 10%) are calibrated to reflect this pathway specifically, drawing on evidence that activity-shifting leakage rates for SFM and REDD+ governance interventions in Central African landscapes typically fall within a 5–42% range, with the lower end applying where large intact forest matrices and diversified livelihoods moderate displacement³⁷.

5.3 Ex-ante deduction factors and conservativeness

The applied factors are agroforestry: Waza 10%, Dja-Lobéké 5%, Bamboutos-Bakossi 5%; and forestry-related activities: Waza 15%, Dja-Lobéké 10%, Bamboutos-Bakossi 10%. Waza is higher because fuelwood dependence and open grazing are more pronounced and access

³³ Annex 22B FS Report on the drivers of deforestation and forest degradation_IUCN_030425_SPEFOCE

³⁴ Annex H FS Landscape Restoration Opportunity Report Assessment_IUCN_CameroonCentral Africa_030425_SPEFOCE

³⁵ Annex H FS Landscape Restoration Opportunity Report Assessment_IUCN_CameroonCentral Africa_030425_SPEFOCE

³⁶ Ibid

³⁷ See spreadsheet '5_Leakage' in accompanying calculation workbook.

control can displace pre-existing use. Dja–Lobéké is moderate due to diversified livelihoods and established community forestry arrangements. Bamboutos–Bakossi is lower overall because restoration blocks are smaller and topographically constrained. Factors are applied downstream of netting and attribution and will be revisited with leakage-belt monitoring and household checks. Adjustments will be made ex post if observed displacement diverges from these ex-ante assumptions.

Table 4. Ex-ante leakage deductions by activity family and landscape.

Activity family	Waza (Sudano-Sahel)	Dja- Lobéké (humid rainforest)	Bamboutos –Bakossi (moist highlands)	Rationale
Agroforestry activities	10%	5%	5%	Slightly higher in Waza due to greater woodfuel pressure and pastoral mobility; lower in DL/BB given agroforestry maintains production on the same plots and introduces on-farm wood sources ³⁸ .
Forestry activities	15%	10%	10%	Park/community restrictions in Waza more likely to shift extraction/grazing outward; DL benefits from large intact forest matrix and diversified livelihoods; BB moderate. All remain within evidence-consistent bounds for ARR/SFM leakage ³⁹ .

5.4 Application in the accounting

For each activity a , cohort c , and year t , the leakage-adjusted net ER is:

$$ER_{a,c,t}^{\text{leak-adj}} = (\text{Project}_{a,c,t} - \text{Baseline}_{a,c,t}) \times (1 - \lambda_{a,\ell}),$$

where $\lambda_{a,\ell}$ is the selected leakage factor for activity family a in landscape ℓ . The deduction is applied after baseline/project netting and before attribution and uncertainty. The chosen factors are stored in the parameters registry and referenced in the results aggregation sheet to ensure traceability.

5.5 Risk-mitigation measures embedded in design

- **On-farm wood and NTFP supply:** boundary trees, prunings, coppicing, and living hedges reduce off-farm fuelwood demand during the establishment period.
- **Community agreements and SFM:** bylaws, designated-use zones, and alternative livelihood support reduce incentives to shift extraction.
- **Boundary demarcation and landscape monitoring:** clear physical and administrative demarcation of the SFM governance perimeter, combined with satellite-based leakage-belt monitoring (see Section 8.7), enables early detection of displacement and allows ex-post adjustment of leakage factors if observed displacement diverges from ex-ante assumptions.

³⁸ [Empowering refugees and host communities to protect Cameroon's forests](#)

³⁹ [Leakage Effects from Reforestation: Estimating the Impact of Agricultural Displacement for Carbon Markets](#)

- **Fire prevention and access management:** reduces the need for post-disturbance salvage extraction and stabilises biomass stocks.
- **Spatial planning of riparian buffers:** keeps restoration out of zones that would likely displace cropping, while providing erosion control and hydrological co-benefits.

6. Emission reductions (ERs): calculation framework and formulas

6.1. Agroforestry, Reforestation and Restoration

Biomass increments (baseline and project)

Agroforestry

The baseline biomass increment represents the most plausible without-project trajectory for each activity type. For agroforestry on cropland in Waza and Bakossi-Bamboutos, this reflects little or no net woody growth, consistent with the predominantly annual crop and degraded land baseline in those landscapes. For Dja-Lobéké, the activity targets the introduction of shade trees into existing smallholder cocoa stands. The baseline therefore represents the existing cocoa system without shade tree addition, and the project increment captures the shade tree component only — above-ground and below-ground biomass attributable to *Irvingia gabonensis*, *Dacryodes edulis*, and *Garcinia cola* — rather than the full cocoa-plus-tree system. This boundary is maintained consistently in both the baseline and project scenarios.

Above-ground biomass increments are differentiated by landscape and agroforestry system type, drawing on Tier 1 and Tier 1-derived values referenced to published estimates for the relevant climate zone and species configuration. Parkland configurations are applied for Waza, reflecting the scattered multipurpose tree arrangements targeted under the programme in the Sudano-Sahelian context. Shaded cocoa configurations are applied for Dja-Lobéké, and mixed fruit tree systems for Bakossi-Bamboutos, consistent with the activity design in each landscape. Below-ground biomass increments are derived from above-ground values using IPCC Tier 1 root-to-shoot ratios appropriate to each climate zone and are included in the calculation for all three landscapes.

Park/forest reserve restoration, community/council forests, and riparian forests/buffers

Annual net carbon uptake in living biomass is calculated as the sum of above-ground and below-ground biomass increments (expressed in tonnes of carbon per hectare per year). The above-ground increment is chosen to represent the stand condition and ecological zone in each landscape; the below-ground increment is derived from the above-ground value using a climate zone-appropriate root-to-shoot relationship.

- **Baseline (forest remaining forest).** The baseline increment represents slowly recovering, under-stocked or degraded forest compartments subject to background mortality and occasional disturbance (i.e., a “secondary >20 years / low net growth” class). This is a *net* increment; it already embeds natural mortality and small losses and does not use a survival schedule.
- **Project (assisted regeneration, enrichment).** The project increment represents early-stage secondary growth under protection and targeted silviculture (i.e., a “secondary ≤20 years / active recovery” class), producing a higher net biomass gain per hectare per year than the baseline.

Landscape-consistent biomass increments

The same per-landscape biomass increments are applied across park or forest-reserve restoration, community or council forests, and riparian forests and buffers. This choice reflects that the dominant controls on early recovery, climate, moisture regime, soils, elevation, and disturbance pressure, are shared within a given landscape. All three activity types target under-stocked forest conditions that begin to transition toward early secondary forest once protection and silviculture commence. Using a single set of above- and below-ground increments per landscape is therefore a reasonable representation of early-stage dynamics in the absence of more accurate data.

This approach follows the IPCC parameter hierarchy by applying climate-region-consistent Tier-1 values unless robust Tier-2 information justifies differentiation. Any concrete differences in realised performance will emerge through measured area established, observed survival, and documented suppression of disturbance, rather than being hard-coded into priors. As permanent plots and monitoring datasets accumulate, the parameter registry (Annex I) can be upgraded to differentiated Tier-2 increments for specific activity types where statistically justified.

Soil organic carbon (SOC) term (baseline and project)

Agroforestry

SOC change is estimated using the IPCC Tier 1 factor method. A landscape-appropriate reference SOC stock (0–30 cm, mineral soils) is multiplied by land-use and management factors for both the baseline and project scenarios, and the resulting difference is annualised over the transition period. Baseline SOC factors reflect degraded annual cropland under intensive tillage with low organic matter inputs, and are set below the reference stock in all three landscapes, consistent with IPCC Tier 1 defaults for this management class. Project SOC factors reflect conversion to perennial, tree-based agroforestry systems, with increased litter inputs, greater root turnover, and reduced soil disturbance, and are set equal to the reference SOC stock. The annualised SOC gain is therefore the difference between the project factor and the lower baseline factor, applied to the landscape-specific reference stock and divided by the transition period.

Landscape specificity enters through the reference SOC stock (see Appendix I):

- **Waza (Sudano-Sahelian):** a tropical dry reference SOC stock is applied, consistent with Vertisol and Fluvisol-dominant soils under low-rainfall conditions;
- **Dja-Lobéké (humid lowland):** a tropical wet reference SOC stock is applied, consistent with Ferralsol and Acrisol-dominant soils under high-rainfall conditions; and
- **Bakossi-Bamboutos (highland):** a tropical moist reference SOC stock is applied, consistent with Nitisol, Andosol, and Cambisol-dominant soils on volcanic highland terrain.

These references ensure that identical management changes do not imply identical SOC responses across climate zones.

Park/forest reserve restoration, community/council forests, and riparian forests/buffers

SOC change is estimated with the IPCC factor method. A landscape-appropriate reference SOC stock (0–30 cm, mineral soils) is multiplied by factors representing land use and management, and the resulting stock change relative to the initial state is annualised over the programme's transition period.

- **Baseline.** Forest land that remains forest under similar management is typically treated as **neutral** at Tier 1 (i.e., no systematic SOC trend), yielding a near-zero annual SOC change unless there is documented, persistent degradation (in which case a factor below unity can be used).
- **Project.** Assisted regeneration and enrichment increase litter inputs, root turnover and ground cover while reducing soil disturbance, leading to a factor greater than the baseline and thus a positive annualised SOC gain.

As with the agroforestry activities, landscape specificity is applied by varying the SOC reference stock by climate zone (**see Appendix I**):

- **Waza (Sudano-Sahelian):** a tropical dry reference SOC stock is applied, consistent with Vertisol and Fluvisol-dominant soils under low-rainfall conditions;
- **Dja-Lobéké (humid lowland):** a tropical wet reference SOC stock is applied, consistent with Ferralsol and Acrisol-dominant soils under high-rainfall conditions; and
- **Bakossi-Bamboutos (highland):** a tropical moist reference SOC stock is applied, consistent with Nitisol, Andosol, and Cambisol-dominant soils on volcanic highland terrain.

These choices ensure identical management changes do not imply identical SOC responses across climate zones. SOC changes are annualised evenly over the transition period rather than front-loaded.

Non-CO₂ term (baseline and project)

Agroforestry

Non-CO₂ emissions are comprised of two parts that are included only when supported by evidence and parameterised conservatively:

1. **Direct soil N₂O from nitrogen inputs:** Annual nitrogen application per hectare (if any) is multiplied by established emission factors for direct nitrification/denitrification and indirect pathways (volatilisation and leaching). Where reliable data on fertiliser use are absent, the baseline nitrogen input on cropland is set to zero and the project input is also set to zero unless there is documentation of planned additions (e.g., legume inoculants or small supplemental rates).
2. **Open burning of vegetative matter:** Emissions from burning (CH₄ and N₂O) are included only if there is documented evidence that open burning occurs in the relevant system. When it is evidenced, the calculation multiplies the dry matter consumed per fire event by the combustion completeness (or uses directly the “dry matter consumed” value if that parameter already embeds combustion), and scales by the mean number of fire events per year. In practice, for agroforestry-related activities, these burning terms are expected to be zero in both baseline and project unless local practice data indicate otherwise.

Park/forest reserve restoration, community/council forests, and riparian forests/buffers

Non-CO₂ emissions are included only when supported by evidence and parameterised conservatively.

1. **Direct soil N₂O from nitrogen inputs:** Annual nitrogen application per hectare (if any) is multiplied by established direct and indirect emission factors. In the absence of reliable data, both baseline and project nitrogen inputs for these forest activities are set to zero.

2. **Open burning of vegetative matter.** Emissions from burning (CH₄ and N₂O) are included only if recurrent open burning is evidenced in the relevant compartments. When evidenced, the calculation multiplies the dry matter consumed per fire event by the combustion term (or uses a “dry matter consumed” parameter that already embeds combustion), and scales by the mean number of fire events per year.
- **Waza (Sudano-Sahelian):** if evidence shows recurrent surface fires affecting woodland or gallery-forest edges, savanna/woodland open-burning factors may be applied.
 - **Dja–Lobéké and Bamboutos–Bakossi (humid/montane):** baseline forest burning is set to zero unless documented (e.g., geospatial burn scars, patrol logs).

Fuel use term (baseline and project)

Agroforestry

Where mechanised site preparation or transport occurs, diesel consumption per hectare is multiplied by a standard CO₂ emission factor to obtain the annual per-hectare fuel emission. In the baseline, this term is generally zero for smallholder cropland unless there is evidence of mechanised operations. Under the project scenario, it remains small and is reported transparently. This term is an emission (negative contribution).

Park/forest reserve restoration, community/council forests, and riparian forests/buffers

Where mechanised activities are used (e.g., access, transport), diesel consumption per hectare is multiplied by a standard CO₂ emission factor to obtain the annual per-hectare fuel emission. This term is typically zero in the baseline and small under the project; it is treated as an emission (negative contribution).

Annual per-hectare totals

Agroforestry

For each scenario (baseline and project), the annual per-hectare total is computed as:

Annual per-hectare net = (biomass uptake + SOC change) – (non-CO₂ emissions + fuel emissions)

Removals (biomass and SOC) are positive; emissions (non-CO₂ and fuel) are negative. The baseline total therefore reflects the net balance of cropland without agroforestry (typically near zero or slightly negative if non-CO₂ or burning is material), while the project total reflects the net balance once tree-based systems are established (typically positive due to biomass and SOC gains, minus any small non-CO₂ or fuel terms). Landscape-specificity is captured through the growth increments (by ecological zone) and the SOC reference stock choice (dry in Waza; wet in Dja–Lobéké; wet/montane in Bamboutos–Bakossi).

Park/forest reserve restoration, community/council forests, and riparian forests/buffers

For each scenario (baseline and project), the annual per-hectare total is the sum of removals minus emissions:

Annual per-hectare net = (biomass uptake + SOC change) – (non-CO₂ emissions + fuel emissions)

Removals (biomass and SOC) are positive; emissions (non-CO₂ and fuel) are negative. The baseline total therefore reflects the net balance of forest compartments without the project

(typically small positive or near-zero if no ongoing degradation is evidenced), while the project total reflects the higher net balance once protection, assisted regeneration, enrichment planting and SFM are in place. Landscape-specificity enters through (i) the biomass increments calibrated to the ecological zone of each landscape and (ii) the SOC reference stock (dry in Waza; wet in Dja–Lobéké; wet/montane in Bamboutos–Bakossi).

Survival/mortality schedules are not applied to the baseline (which uses a net increment) but will affect multi-year cohort accounting under the project when annual results are propagated across the 20-year mitigation lifetime.

6.6 SFM governance activities: avoided emissions calculation framework

The SFM governance component calculates the annual carbon stock loss prevented within a defined governance area by comparing a deforestation reference rate against a with-project scenario in which forest clearing within the boundary is reduced to zero. The calculation is therefore built around a deforestation rate, a carbon stock emission factor, and the area under governance, rather than around growth increments and survival schedules.

6.6.1 Baseline term

The baseline annual emissions for each landscape represent the carbon that would be released if the SFM governance area continued to be deforested at the historical landscape-scale rate in the absence of project intervention. This is calculated as:

$$\text{Baseline AE}(ls) = A_{\text{gov}}(ls) \times r_{\text{defor}}(ls) \times EF(ls)$$

Where $A_{\text{gov}}(ls)$ is the SFM governance area in landscape ls (hectares), $r_{\text{defor}}(ls)$ is the annual deforestation rate in landscape ls expressed as a fraction of total forest area per year, and $EF(ls)$ is the emission factor for landscape ls in tCO_2 per hectare of forest cleared.

The annual deforestation rates are derived from the historical land cover change analysis documented in Annex 22E, using observed rates for the period 2010–2021: 6.66 percent per year for Waza, 0.031 percent per year for Dja-Lobéké, and 0.206 percent per year for Bakossi-Bamboutos. These rates are applied as point estimates, not adjusted for projected future change. Using historical averages rather than projected increasing rates is a conservative choice, particularly for Waza where the 2010–2021 rate substantially exceeded the 2000–2010 rate.

Emission factors are drawn from Cameroon's national FRL submission⁴⁰, which provides validated above-ground biomass (AGB) and below-ground biomass (BGB) carbon stock values by forest type. The emission factor for each landscape is:

$$EF(ls) = (AGB(ls) + BGB(ls)) \times 3.6667$$

The conversion factor 3.6667 converts tC/ha to tCO_2/ha (equivalent to $44/12$). Values applied are: Waza — dry forest, $EF\ 257.8\ \text{tCO}_2/\text{ha}$; Dja-Lobéké — dense humid forest, $EF\ 474.7\ \text{tCO}_2/\text{ha}$; Bakossi-Bamboutos — planted/montane forest, $EF\ 427.6\ \text{tCO}_2/\text{ha}$ (see Appendix I for full parameter detail).

Dead organic matter (DOM) and soil organic carbon (SOC) pools are excluded from the emission factor. Their inclusion would increase the estimated avoided emissions, since

⁴⁰ Republique du Cameroun (2026). Niveau de reference pour les forêts du Cameroun.

cleared forest also releases litter, dead wood, and surface soil carbon. Exclusion at this stage is a conservative choice made in the absence of landscape-specific data for these pools.

6.6.2 Project term

Under the project scenario, the SFM governance activities, improved management plans, patrolling, fire management, and community enforcement, are assumed to prevent deforestation within the governance boundary. The with-project deforestation rate within the governance area is therefore set to zero. The project term is:

$$\text{Project } AE(ls) = 0$$

The net avoided emission for each landscape is the difference between baseline and project terms, which simplifies to the baseline term itself:

$$\text{Net } AE(ls) = \text{Baseline } AE(ls) - \text{Project } AE(ls) = A_{gov}(ls) \times r_{defor}(ls) \times EF(ls)$$

6.6.3 Annual and cumulative totals

No cohort phasing is applied to the SFM governance component. The full governance area is counted from Year 1, subject to the Year 1 ramp-up factor of 0.50 described in Section 2.3.2. The annual net avoided emissions for each landscape are therefore:

$$AE_{annual}(ls, t) = A_{gov}(ls) \times r_{defor}(ls) \times EF(ls) \times \phi(t)$$

Where $\phi(t) = 0.50$ for $t = 1$ and $\phi(t) = 1.00$ for $t = 2, 3, \dots, 7$. Attribution ($\alpha = 1$), landscape-specific leakage deduction, and uncertainty ($\pm 20\%$) are applied to the annual result before reporting:

$$AE_{reported}(ls, t) = AE_{annual}(ls, t) \times (1 - L(ls)) \times \alpha \times (1 - U)$$

Where $L(ls)$ is the landscape-specific leakage deduction factor, α is the attribution factor, and U is the uncertainty deduction.

The portfolio cumulative avoided emissions are the sum of landscape-level annual results over the 7-year implementation period.

7. Results

7.1 Agroforestry, Reforestation and Restoration landscape totals (sequestration component)

7.1.1 Seven-year implementation phase

Over Years 1–7, portfolio-level baseline totals are already a net sink, while project totals increase the sink substantially. The mitigation potential (project minus baseline) is therefore positive over the implementation window. The magnitude of this effect is consistent across the LOW and HIGH uncertainty bounds, with the uncertainty band widening proportionally to the cumulative area established by Year 7.

Table 5. Portfolio net ERs over the seven-year implementation phase (baseline vs. project) and mitigation potential, with LOW–HIGH uncertainty bounds.

7-year implementation period ERs total (LOW)	Baseline net ERs (tCO₂e)	Project net ERs (tCO₂e)	Mitigation potential (tCO₂e)
Waza	-201.18	6 597.67	6 798.85
Bamboutos- Bakossi	2 932.49	33 242.18	30 309.69
Dja-Lobéké	20 346.12	36 088.79	15 742.67
Total	23 077.43	75 928.64	52 851.21

7-year implementation period ERs total (HIGH)	Baseline net ERs (tCO₂e)	Project net ERs (tCO₂e)	Mitigation potential (tCO₂e)
Waza	-301.77	9,896.50	10,198.28
Bamboutos- Bakossi	4,398.74	49,863.27	45,464.54
Dja-Lobéké	30,519.18	54,133.19	23,614.01
Total	41,539.37	113,892.96	79,276.82

7.2.2. 20-year mitigation lifetime

Over Years 1–20, the carry-forward of seven cohorts (20 years for Cohort 1, 19 for Cohort 2, ..., 14 for Cohort 7) produces large positive mitigation at portfolio scale. The project series is shaped by a sustained plateau for agroforestry and a modest decline for forestry-related activities after Year 7; the baseline remains a weaker sink (or mild source), such that the lifetime mitigation potential remains strongly positive across the LOW and HIGH bounds.

Table 6. Portfolio net ERs over the twenty-year mitigation lifetime (baseline vs. project) and mitigation potential, with LOW–HIGH uncertainty bounds.

20-year mitigation lifetime ERs total (LOW)	Baseline net ERs (tCO₂e)	Project net ERs (tCO₂e)	Mitigation potential (tCO₂e)
Waza	-3 440.22	111 375.82	114 816.04
Bamboutos- Bakossi	50 145.59	555 261.06	505 115.48
Dja-Lobéké	347 918.67	606 450.95	258 532.28
Total	394 624.05	1 273 087.84	878 463.79

20-year mitigation lifetime ERs total (HIGH)	Baseline net ERs (tCO₂e)	Project net ERs (tCO₂e)	Mitigation potential (tCO₂e)
Waza	-5,160.32	167,063.73	172,224.05

Bamboutos-Bakossi	75,218.38	832,891.60	757,673.21
Dja-Lobéké	521,878.01	909,676.43	387,798.42
Total	591,936.07	1,909,631.76	1,317,695.69

7.1.3 Agroforestry on cropland

For agroforestry (non-forest), baseline totals are characterised by low woody increments and limited SOC gains on cropland, often yielding a small source or weak sink depending on context. Under the project, perennialisation and reduced disturbance increase AGB/BGB and SOC, producing a clear source-to-sink transition and a strong positive mitigation potential. Because no age-factor schedule is applied, annual project totals stabilise after Year 7 and remain approximately constant to Year 20, with the LOW–HIGH band reflecting parameter uncertainty.

Table 7. Agroforestry net ERs on cropland (2,101 ha): baseline vs. project and mitigation potential, with LOW–HIGH uncertainty bounds. Row highlighted in green indicates end of 7-year implementation period.

Project Year	Baseline net LOW (tCO₂e)	Baseline net HIGH (tCO₂e)	Project net LOW (tCO₂e)	Project net HIGH (tCO₂e)	Mitigation potential LOW (tCO₂e)	Mitigation potential HIGH (tCO₂e)
Year 1	-876.01	-1,314.02	1,731.90	2,597.85	2,607.91	3,911.87
Year 2	-2,190.03	-3,285.05	4,329.75	6,494.63	6,519.79	9,779.68
Year 3	-3,504.05	-5,256.08	6,927.60	10,391.41	10,431.66	15,647.49
Year 4	-5,256.08	-7,884.12	10,391.41	15,587.11	15,647.49	23,471.23
Year 5	-7,008.11	-10,512.16	13,855.21	20,782.81	20,863.31	31,294.97
Year 6	-8,322.13	-12,483.19	16,453.06	24,679.59	24,775.19	37,162.78
Year 7	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 8	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 9	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 10	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 11	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 12	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 13	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 14	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 15	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 16	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 17	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 18	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 19	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Year 20	-8,760.13	-13,140.20	17,319.01	25,978.51	26,079.14	39,118.72
Total (tCO₂e)	-149,798.29	-224,697.44	296,155.07	444,232.60	445,953.36	668,930.04
Average per year (tCO₂e/yr)	-7,489.91	-11,234.87	14,807.75	22,211.63	22,297.67	33,446.50
Average per ha per year (tCO₂e/ha/yr)	-3.56	-5.35	7.05	10.57	10.61	15.92

7.1.4 Reforestation of community forests

Community forests generally present as a baseline sink (slow natural recovery). With assisted regeneration, enrichment planting and protection, project totals increase above the baseline, yielding a positive mitigation potential both over Years 1–7 and over the lifetime. The post-Year-7 decline in annual project totals remains gentle, governed by the survival-and-mortality schedule, while the cumulative lifetime effect remains strongly positive within the reported uncertainty bounds.

Table 8. Reforestation of community forests (2,134 ha): baseline vs. project net ERs and mitigation potential, with LOW–HIGH uncertainty bounds. Row highlighted in green indicates end of 7-year implementation period.

Project,Year	Baseline,net ,LOW,(tCO ₂ e)	Baseline,net ,HIGH,(tCO ₂ e)	Project,net, LOW,(tCO ₂ e)	Project,net, HIGH,(tCO ₂ e)	Mitigation,pote ntial,LOW,(tCO ₂ e)	Mitigation,pote ntial,HIGH,(tCO ₂ e)
Year,1	1,283.78	1,925.68	1,385.94	2,078.91	102.16	153.24
Year,2	3,209.46	4,814.19	3,454.46	5,181.69	245.00	367.50
Year,3	5,135.14	7,702.71	5,512.64	8,268.95	377.50	566.25
Year,4	7,702.71	11,554.06	8,243.15	12,364.72	540.44	810.66
Year,5	10,270.28	15,405.41	10,960.01	16,440.01	689.73	1,034.60
Year,6	12,195.95	18,293.93	12,987.47	19,481.20	791.51	1,187.27
Year,7	12,837.84	19,256.77	13,659.91	20,489.86	822.06	1,233.09
Year,8	12,837.84	19,256.77	13,591.61	20,387.41	753.76	1,130.64
Year,9	12,837.84	19,256.77	13,523.65	20,285.47	685.80	1,028.71
Year,10	12,837.84	19,256.77	13,456.03	20,184.04	618.19	927.28
Year,11	12,837.84	19,256.77	13,388.75	20,083.12	550.91	826.36
Year,12	12,837.84	19,256.77	13,321.81	19,982.71	483.96	725.94
Year,13	12,837.84	19,256.77	13,255.20	19,882.80	417.35	626.03
Year,14	12,837.84	19,256.77	13,188.92	19,783.38	351.08	526.62
Year,15	12,837.84	19,256.77	13,122.98	19,684.46	285.13	427.70
Year,16	12,837.84	19,256.77	13,057.36	19,586.04	219.52	329.28
Year,17	12,837.84	19,256.77	12,992.07	19,488.11	154.23	231.35
Year,18	12,837.84	19,256.77	12,927.11	19,390.67	89.27	133.91
Year,19	12,837.84	19,256.77	12,862.48	19,293.72	24.63	36.95
Year,20	12,837.84	19,256.77	12,798.17	19,197.25	-39.68	-59.52
Total,(tCO₂e)	219,527.13	329,290.70	227,689.70	341,534.54	8,162.56	12,243.84
Average,per,year, (tCO₂e/yr)	10,976.36	16,464.54	11,384.48	17,076.73	408.13	612.19
Average,per,ha,p er,year,(tCO₂e/ha/ yr)	5.14	7.72	5.33	8.00	0.19	0.29

7.1.5 Restoration of council forest reserves and park areas

Protected compartments and reserves typically act as baseline sinks once recurrent disturbance is reduced, but growth remains limited without systematic restoration and aftercare. With protection, enrichment, access control and fire management, project totals

exceed baseline totals, producing a positive mitigation potential over both horizons. A mild post-Year-7 taper is expected due to the applied survival at Year 1 and constant annual mortality, yet the lifetime aggregate remains decisively positive across the LOW–HIGH band.

Table 9. Restoration of council forest reserves and park areas (1,666 ha): baseline vs. project net ERs and mitigation potential, with LOW–HIGH uncertainty bounds. Row highlighted in green indicates end of 7-year implementation period.

Project,Year	Baseline,net ,LOW,(tCO₂ e)	Baseline,net ,HIGH,(tCO₂ e)	Project,net, LOW,(tCO₂ e)	Project,net, HIGH,(tCO₂ e)	Mitigation,pote ntial,LOW,(tCO₂ e)	Mitigation,pote ntial,HIGH,(tCO₂ e)
Year,1	664.75	997.12	1,247.17	1,870.76	582.42	873.64
Year,2	1,661.87	2,492.81	3,108.58	4,662.87	1,446.71	2,170.06
Year,3	2,658.99	3,988.49	4,960.68	7,441.01	2,301.68	3,452.52
Year,4	3,988.49	5,982.74	7,417.79	11,126.69	3,429.30	5,143.95
Year,5	5,317.99	7,976.98	9,862.62	14,793.93	4,544.63	6,816.95
Year,6	6,315.11	9,472.67	11,687.08	17,530.62	5,371.97	8,057.95
Year,7	6,647.49	9,971.23	12,292.19	18,438.28	5,644.70	8,467.05
Year,8	6,647.49	9,971.23	12,230.73	18,346.09	5,583.24	8,374.86
Year,9	6,647.49	9,971.23	12,169.57	18,254.36	5,522.09	8,283.13
Year,10	6,647.49	9,971.23	12,108.73	18,163.09	5,461.24	8,191.86
Year,11	6,647.49	9,971.23	12,048.18	18,072.27	5,400.70	8,101.04
Year,12	6,647.49	9,971.23	11,987.94	17,981.91	5,340.45	8,010.68
Year,13	6,647.49	9,971.23	11,928.00	17,892.00	5,280.52	7,920.77
Year,14	6,647.49	9,971.23	11,868.36	17,802.54	5,220.88	7,831.31
Year,15	6,647.49	9,971.23	11,809.02	17,713.53	5,161.53	7,742.30
Year,16	6,647.49	9,971.23	11,749.98	17,624.96	5,102.49	7,653.73
Year,17	6,647.49	9,971.23	11,691.23	17,536.84	5,043.74	7,565.61
Year,18	6,647.49	9,971.23	11,632.77	17,449.15	4,985.28	7,477.92
Year,19	6,647.49	9,971.23	11,574.61	17,361.91	4,927.12	7,390.68
Year,20	6,647.49	9,971.23	11,516.73	17,275.10	4,869.25	7,303.87
Total,(tCO₂e)	113,672.03	170,508.05	204,891.96	307,337.94	91,219.93	136,829.89
Average,per,year, (tCO₂e/yr)	5,683.60	8,525.40	10,244.60	15,366.90	4,561.00	6,841.49
Average,per,ha,p er,year,(tCO₂e/ha/ yr)	3.41	5.12	6.15	9.22	2.74	4.11

7.1.6 Riparian forests and buffers of water bodies

Riparian corridors are strong candidates for rapid biomass recovery when protected and replanted. Baseline totals often indicate a sink with high variability at edges. Project totals strengthen this sink through linear revegetation and protection, yielding a positive mitigation potential in both the seven-year and lifetime aggregates.

Table 10. Riparian forests and buffers of water bodies (4,107 ha): baseline vs. project net ERs and mitigation potential, with LOW–HIGH uncertainty bounds. Row highlighted in green indicates end of 7-year implementation period.

Project,Year	Baseline,net ,LOW,(tCO ₂ e)	Baseline,net ,HIGH,(tCO ₂ e)	Project,net, LOW,(tCO ₂ e)	Project,net, HIGH,(tCO ₂ e)	Mitigation,pote ntial,LOW,(tCO ₂ e)	Mitigation,pote ntial,HIGH,(tCO ₂ e)
Year,1	1,235.22	1,852.83	3,313.45	4,970.18	2,078.23	3,117.34
Year,2	3,088.06	4,632.09	8,258.78	12,388.17	5,170.72	7,756.08
Year,3	4,940.89	7,411.34	13,179.38	19,769.07	8,238.49	12,357.73
Year,4	7,411.34	11,117.01	19,707.38	29,561.07	12,296.04	18,444.06
Year,5	9,881.79	14,822.68	26,202.74	39,304.10	16,320.95	24,481.43
Year,6	11,734.62	17,601.93	31,049.90	46,574.84	19,315.28	28,972.91
Year,7	12,352.23	18,528.35	32,657.54	48,986.31	20,305.31	30,457.96
Year,8	12,352.23	18,528.35	32,494.25	48,741.38	20,142.02	30,213.03
Year,9	12,352.23	18,528.35	32,331.78	48,497.67	19,979.55	29,969.32
Year,10	12,352.23	18,528.35	32,170.12	48,255.18	19,817.89	29,726.83
Year,11	12,352.23	18,528.35	32,009.27	48,013.90	19,657.04	29,485.56
Year,12	12,352.23	18,528.35	31,849.22	47,773.84	19,496.99	29,245.49
Year,13	12,352.23	18,528.35	31,689.98	47,534.97	19,337.75	29,006.62
Year,14	12,352.23	18,528.35	31,531.53	47,297.29	19,179.30	28,768.94
Year,15	12,352.23	18,528.35	31,373.87	47,060.80	19,021.64	28,532.46
Year,16	12,352.23	18,528.35	31,217.00	46,825.50	18,864.77	28,297.15
Year,17	12,352.23	18,528.35	31,060.92	46,591.37	18,708.68	28,063.02
Year,18	12,352.23	18,528.35	30,905.61	46,358.42	18,553.38	27,830.07
Year,19	12,352.23	18,528.35	30,751.08	46,126.62	18,398.85	27,598.28
Year,20	12,352.23	18,528.35	30,597.33	45,895.99	18,245.10	27,367.64
Total,(tCO ₂ e)	211,223.17	316,834.76	544,351.12	816,526.68	333,127.95	499,691.92
Average,per,year, (tCO ₂ e/yr)	10,561.16	15,841.74	27,217.56	40,826.33	16,656.40	24,984.60
Average,per,ha,p er,year,(tCO ₂ e/ha/ yr)	2.57	3.86	6.63	9.94	4.06	6.08

7.2 Sustainable Forest Management (avoided emissions component)

The avoided emissions component covers 50,000 ha of forest under SFM governance across the three project landscapes. Annual avoided emissions reach their ceiling in Year 2 following a 50% ramp-up factor applied in Year 1 to reflect the time required to establish governance mechanisms. The figures below present gross avoided emissions after leakage deduction, attribution, and the 20% uncertainty deduction, at both LOW and HIGH estimates.

Table 11. Avoided emissions estimates over 7-year accounting period resulting from implementation of Sustainable Forest Management (SFM) governance activities 50,000 ha of forested areas in Waza, Dja-Lobéké and Bakossi-Bamboutos.

Landscape	Yr,1,(ramp) (tCO ₂ e)	Yr,2-7 (tCO ₂ e/yr)	Cumulative,7-yr GROSS,(tCO ₂ e)	After,leakage (tCO ₂ e)	LOW,7-yr (tCO ₂ e)	HIGH,7-yr (tCO ₂ e)
Waza	171,645.96	343,291.93	2,231,397.53	1,896,687.90	1,517,350.32	2,276,025.48
Dja-Lobéké	1,091.49	2,182.99	14,189.42	12,770.48	10,216.38	15,324.58

Bakossi-Bamboutos	6,596.87	13,193.75	85,759.37	77,183.43	61,746.75	92,620.12
All,landscapes			2,331,346.32	1,986,641.81	1,589,313.45	2,383,970.17

7.3 Discussion of results

Per-hectare biomass increments (AGB + BGB) and SOC gains are higher under project management than under baseline conditions, which reflect weak recovery or mild degradation. Family-specific dynamics govern the annual shapes: agroforestry cohorts stabilise after Year 7 once all cohorts are established, whereas forestry-related activities decline gradually under the applied survival and mortality schedule while remaining above their respective baselines throughout the accounting period. Baseline burning, nitrogen fertiliser inputs, and fuel use are set to zero unless evidenced, with the exception of documented baseline fire in drier Waza forestry contexts, consistent with a conservative treatment. Leakage and attribution are applied downstream of netting. For external reporting, LOW values are adopted as headline figures, with HIGH values retained for sensitivity disclosure. Attribution factors differ between the two components: 0.85 is applied to the sequestration component, reflecting the complexity of landscape carbon dynamics, and 1.0 is applied to the avoided emissions component, reflecting the direct and bounded causal link between SFM governance and the reduction in deforestation. A 20% uncertainty deduction is applied consistently to both components for LOW estimate reporting.

8. General guidelines for Monitoring, Reporting and Verification (MRV) arrangements

8.1 Objectives and principles

The MRV system is designed to achieve the following:

- generate traceable, reproducible estimates of annual emission reductions and removals (ERs);
- ensure country-consistent accounting aligned with national definitions and MRV practice;
- maintain transparent parameterisation and version control; and
- provide a verification-ready evidence trail.

The system follows design-based sampling and geospatial good practice, uses conservative defaults where evidence is absent, and separates baseline and project data streams prior to post-netting adjustments (leakage, attribution, uncertainty).

8.2 Indicators monitored

8.2.1. Agroforestry, reforestation and restoration

Activity data (all activities)

- Area established by cohort (Years 1–7), by landscape and activity type;
- Parcel/compartment geometry, tenure/eligibility documentation;

- Implementation logs (nursery dispatches, species lists, spacing/stocking targets, work orders).

Performance data (family-specific)

- **Agroforestry (non-forest):** tree presence and canopy development (visual/remote-sensing), agronomic management (shade targets, pruning), absence of open-field burning, evidence of fertiliser use where applicable (otherwise zero N inputs).
- **Forestry-related:** fraction of planted/regenerating stems alive at end of Year 1 (survival), and annual mortality from Year 2 onward (net of planned replacement); protection measures (firebreaks, access control); enrichment actions.

Non-CO₂ and fuel evidence (all activities)

- **Burning:** only monitored and included if recurring fire is evidenced (field logs and/or RS detections); otherwise set to zero.
- **Nitrogen inputs:** included only with farm records or programme input schemes; absent such evidence, N inputs = 0.
- **Diesel:** included if operations/transport are documented (fuel logs or procurement records).

Leakage and attribution

- Leakage risk indicators (household/market surveys; off-boundary change in a defined belt using remote-sensing; administrative access/enforcement data).
- Attribution records (co-funding, policy overlap) for application of the attribution factor.

8.2.2. SFM governance activities (avoided emissions component)

- **Forest area enrolled under governance arrangements, by landscape (ha):** confirmed by management plan approvals, community agreement records, and geospatial boundary files.
- **Annual patrolling and enforcement records:** logs showing patrol coverage, dates, and incidents recorded within the governance boundary.
- **Annual forest cover verification within governance boundary:** remote-sensing comparison of forest cover at start and end of each year to confirm absence of clearing attributable to project actors.
- **Fire management records:** evidence of firebreak maintenance, controlled burning protocols, and fire incident logs within the governance area.

8.3 Data architecture and version control

The MRV system is organised into four interlinked registries:

1. **Activity ledger** (geospatial): polygons, cohort tags, landscape/activity type, eligibility metadata;
2. **Parameter registry:** ID, unit, value, tier, applicability, uncertainty, source link, change-log;
3. **Evidence library:** field forms, photos with EXIF, nursery/dispatch logs, patrol records, remote-sensing layers;
4. **Computation workbook snapshot:** locked copy of the calculation engine with parameter IDs and results for each reporting year.

Each annual reporting cycle locks the cohort areas established to date, the parameter snapshot, and the results workbook. Any subsequent corrections are recorded as a new minor version with an auditable change-log entry.

8.4 Geospatial rules, mapping and area reconciliation

- Baseline land status and parcel/compartments boundaries are mapped in a consistent CRS and maintained with unique IDs.
- Cohort assignment: a hectare is counted in Cohort k only after physical establishment in Year k and basic checks (mapped parcel, photo/field evidence, nursery dispatch).
- Delayed sites shift to the next cohort; the cumulative series is updated accordingly.
- Annual area reconciliation compares the geospatial ledger with nursery/field records. Discrepancies $>1\%$ of annual totals trigger a reconciliation review before results are computed.

8.5 Field measurement (design, intensity, quality)

Agroforestry (non-forest): Field checks verify establishment, tree presence, shade and spacing targets, and the absence of open-field burning. Because annual effects are calculated without an age-factor schedule, evidence focuses on existence and maintenance rather than growth curves. Per-hectare increments are parameterised from published sources and are tested for plausibility using canopy-based indicators from field observations and remote sensing.

Forestry-related: Survival is measured near the end of Year 1 using a design-based sample of planted or regenerating plots. Annual mortality is measured from Year 2 onward on permanent or temporary plots drawn from the same sampling frame. The sampling objective is a predefined precision target, for example a standard error at or below 10% at 90% confidence for survival and mortality at the landscape by activity-family level. Plot protocols define size and layout, minimum counts per stratum, re-measurement windows, and the rules for recognising and recording gap-filling.

General quality control: Enumerators are trained against a field manual. At least five percent of plots are re-measured for audit. GPS location and photo evidence are recorded for each plot. Supervisors review and sign off all forms. Any plot with protocol deviations is flagged and, if necessary, replaced within the same stratum.

8.6 Non-CO₂ and fuel monitoring

- Burning is recorded only when recurring events are evidenced by field logs and/or RS detections within project parcels. If material, CH₄/N₂O emissions are computed from dry-matter load, combustion completeness and emission factors; otherwise, the burning term remains zero.
- Nitrogen inputs are captured through input distribution logs or farm records; in their absence, N rates remain zero.
- Diesel use is included where workplans entail machinery or transport; data are taken from logs or procurement records. Where unobserved, diesel is set to zero by default.

8.7 Leakage monitoring and ex-post revision

Ex-ante leakage deductions are applied as per Section 5 (simple or granular option). The MRV system compiles evidence for **ex-post revision**:

- **Production tracking** on participating farms (yields, cropped area, on-farm wood sources);
- **Household/market surveys** on fuelwood and small-timber sourcing and prices;
- **RS change analysis** in a defined leakage belt;

- **Administrative evidence** (enforcement, community forestry operations). If evidence supports a lower (or higher) deduction, the parameter registry is updated with a documented rationale; the change is applied prospectively and archived for comparability.

8.8 QA/QC and internal audit

- **Pre-run checks:** sign convention, parameter-ID validity, unit consistency, cohort totals vs. geospatial ledger.
- **Reasonableness tests:** per-ha ERs compared to literature-based ranges by climate zone and activity family; outliers trigger targeted review of inputs and evidence.
- **Trace tests:** every non-zero burning, diesel or N input record is traceable to a specific evidence item.
- **Post-run checks:** reconciliation of annual and cumulative series; replication of a random subset of calculations from parameter IDs to result cells.
- All QA/QC outcomes and any corrections are logged; versions are stamped and archived.

8.9 Reporting cadence and deliverables

Annually, the programme produces:

1. **ERs results report** (Years 1–20 series to date): baseline, project, ER_t , and post-adjustment series; seven-year and lifetime aggregates;
2. **Cohort and area report** (additions in the reporting year; cumulative hectares);
3. **Parameter snapshot** (registry export with IDs, values, sources, uncertainties);
4. **Evidence index** (geospatial, field, RS, administrative) with links;
5. **Leakage and attribution memo** (factors applied; monitoring findings; any proposed revisions);
6. **Change-log** (differences vs. prior year; rationale)

8.10 Mid-term and end-of-project impact assessments

In addition to the annual reporting cycle described above, the MRV framework includes two dedicated impact assessment milestones. These are a mid-term assessment and a final project assessment. Ex-ante assumptions are progressively replaced by measured data and refined parameters generated during implementation.

The mid-term assessment is undertaken at the end of Year 3 or Year 4 of implementation, once multiple cohorts have completed Year-1 survival verification and early monitoring. It produces an ex-post calculation for the cohorts established to date. Inputs include verified activity data from the geospatial ledger, including hectares established by cohort, landscape, and activity type. Observed survival and mortality rates from field measurement campaigns are applied. Parameters are updated where improved information is available, including Tier 2 values derived or validated from plot data, field records, or peer-reviewed sources. Results are compared against the ex-ante projections for the same cohorts and time window. Deviations that exceed the stated uncertainty band trigger a documented review of assumptions and parameters. Updates are recorded in the parameter registry change-log and applied in subsequent reporting cycles. The mid-term assessment also supports revision of leakage deductions where monitoring evidence indicates that displacement risks differ from ex-ante assumptions.

The final project assessment is completed at the end of the seven-year implementation period, once all cohorts have been established and have completed at least one full annual monitoring cycle. It produces an ex-post impact calculation for the full implemented area using verified activity data and the most current parameter set. The assessment also provides the basis for updating expected mitigation outcomes beyond the implementation period. Expected emission reductions over the remaining mitigation lifetime are estimated by applying the refined parameters to the established cohort areas and the survival and mortality schedules confirmed through monitoring. Updated lifetime projections are presented alongside the original ex-ante results, and any differences are documented and justified. Both assessments are submitted as standalone deliverables accompanying the relevant annual progress report.

9. Appendix I – Parameters

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
GLOBAL CONVENTIONS								
GWP_horizon_100yr	ALL	All activities	Sets the reporting time horizon for GWPs. Using the 100-year horizon aligns with IPCC practice and enables comparability with national inventories and funder reporting.	—	100	years	IPCC AR6 WG1 Ch.7	—
GWP_CO2_100_AR6	CO ₂	All activities	Reference gas with GWP = 1 on a 100-year time horizon. Included for completeness and to make the workbook self-documenting.	—	1	—	IPCC AR6 WG1 Ch.7	—
GWP_CH4_100_AR6_nonfossil	CH ₄	Combustion, fires, biogenic sources	100-year GWP for biogenic (non-fossil) methane. Use for open burning of vegetation, crop residues, and other biogenic CH ₄ pathways.	—	27.2	—	IPCC AR6 WG1 Ch.7	Do not add oxidation-to-C O ₂ term separately.
GWP_CH4_100_AR6_fossil	CH ₄	Fossil origins only	100-year GWP for fossil methane (accounts for added forcing from oxidation to CO ₂ at end of lifetime). Use only for fossil/industrial CH ₄ .	—	29.8	—	IPCC AR6 WG1 Ch.7	—
GWP_N2O_100_AR6	N ₂ O	Soils, burning	100-year GWP for nitrous oxide, used in the managed-soils chain and	—	273	—	IPCC AR6 WG1 Ch.7	—

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
			biomass-burning non-CO ₂ calculations.					
C_to_CO2	CO ₂	Biomass & SOC	Stoichiometric factor (44/12) converting tonnes of C to tonnes of CO ₂ e; applied after summing biomass and soil carbon changes to ensure unit consistency.	—	3.6647	t CO ₂ per t C	Volume 4: Agriculture, Forestry and Other Land Use: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	—
N2O_N_to_N2O	N ₂ O	Soils, burning	Molecular-mass factor to convert N ₂ O-N to N ₂ O (44/28). Required in IPCC managed-soils equations and for indirect N pathways.	—	1.5714	t N ₂ O per t N ₂ O-N	Chapter 11: N ₂ O Emissions from Managed Soils, and CO ₂ Emissions from Lime and Urea Application, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	—
Mitigation_Lifetime_default	ALL	Global	Default accounting lifetime for tree systems	—	20.00	years	Project convention	Override per-activity where needed
Attribution_alpha	ALL	Global	Fraction of outcomes attributable to project	—	0.85	fraction	Conservative discount reflecting	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							residual uncertainty in causal attribution of landscape carbon gains to project activities. Allows for ~15% of net ERs being driven by background environmental factors (CO ₂ fertilisation, climate variability, spontaneous regeneration) not causally traceable to SPEFOCE interventions . Based on programme-level judgement informed by peer-reviewed literature on tropical forest carbon drivers and UK ICF attribution guidance (2025). To	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							be reviewed ex-post once MRV monitoring provides empirical basis for revision.	
Uncertainty_ER_pm	ALL	Global	Relative uncertainty band ($\pm$) for headline reporting	—	0.20	fraction	Temporary placeholder	Replace with propagated uncertainty later

BIOMASS INCREMENTS - FAMILY LEVEL DEFAULTS (PROJECT AND BASELINE)								
AGB_incr_AGRO_WZ	CO ₂	Project — agroforestry in Waza (dry tropics)	AGB annual increment — parkland agroforestry, Waza (dry Sudano-Sahelian). Species: Prosopis juliflora, Faidherbia albida, Acacia spp., Balanites aegyptiaca, intercropped with millet / sorghum.	Tier 1 - direct	0.400	t C ha ⁻¹ yr ⁻¹	Luedeling E & Neufeldt H (2012). Carbon sequestration potential of parkland agroforestry in the Sahel. Climatic Change 114(3–4): 739–756.	—
BGB_incr_AGRO_WZ	CO ₂	Project — agroforestry in Waza	BGB annual increment — parkland agroforestry, Waza.	Tier 1 - derived	0.128	t C ha ⁻¹ yr ⁻¹	IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4 AFOLU. Chapter 4, Table 4.4. IGES, Hayama.	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
AGB_incr_AGRO_BB	CO ₂	Project — agroforestry in Bamboutos–Bakossi (moist)	AGB annual increment — agroforestry, Bakossi-Bamboutos (moist highlands). Species: <i>Persea americana</i> (avocado), <i>Dacryodes edulis</i> (safou), intercropped with bamboo and shrubs on degraded agricultural land.	Tier 1 - derived	0.800	t C ha ⁻¹ yr ⁻¹	No avocado/safou-specific annual increment data found in searched literature. Upper end of range (0.80 tC/ha/yr) mentioned in study below applied because BB represents moist highland conditions (higher productivity than the Sahel study sites). Takimoto A, Nair PKR & Nair VD (2008). Carbon stock and sequestration potential of traditional and improved agroforestry systems in the West African Sahel.	—

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Agriculture, Ecosystems & Environment 125(1–4): 159–166.	
BGB_incr_AGRO_BB	CO ₂	Project — agroforestry in Bamboutos–Bakossi	BGB annual increment — agroforestry, Bakossi-Bamboutos.	Tier 1 - derived	0.160	t C ha ⁻¹ yr ⁻¹	IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4 AFOLU. Chapter 4, Table 4.4. IGES, Hayama, row 'Tropical Moist Deciduous', R:S range = 0.20–0.24 (lower bound 0.20 applied)	—
AGB_incr_AGRO_DL	CO ₂	Project — agroforestry in Dja–Lobéké (humid)	AGB annual increment — shaded cocoa agroforestry, Dja-Lobéké (humid rainforest). Activity: introduction of shade trees (Irvingia gabonensis, Dacryodes edulis, Garcinia cola) into EXISTING cocoa. RF = shade tree component only, not	Tier 1 - derived	3.460	t C ha ⁻¹ yr ⁻¹	Norgrove L & Hauser S (2013). Carbon stocks in shaded Theobroma cacao farms and adjacent secondary forests of similar age in Cameroon.	—

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
			full cocoa + tree system.				Tropical Ecology 54(1): 15–22. Derived: 121.1 tC/ha divided by 35 years = 3.46 tC/ha/yr as a mean annual increment over the stand lifetime.	
BGB_incr_AGRO_DL	CO ₂	Project — agroforestry in Dja–Lobéké	BGB annual increment — cocoa agroforestry, Dja-Lobéké.	Tier 1 - derived	1.280	t C ha ⁻¹ yr ⁻¹	IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4 AFOLU. Chapter 4, Table 4.4, row 'Tropical Wet / Moist Evergreen', R:S = 0.37	—
AGB_incr_BASE_NONFOR	CO ₂	Baseline — cropland/pasture	Baseline net above-ground increment assumed zero unless woody regrowth/hedgerows are explicitly evidenced.	—	0.000	t C ha ⁻¹ yr ⁻¹		Keep at 0 unless data support >0.
BGB_incr_BASE_NONFOR	CO ₂	Baseline — cropland/pasture	Baseline net below-ground increment set to zero in absence of	—	0.000	t C ha ⁻¹ yr ⁻¹		Keep at 0 unless data support >0.

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
			evidence for woody growth.					
AGB_incr_FOREST_WZ	CO ₂	Project — forest restoration in Waza	AGB annual increment — forest restoration, Waza (dry woodland). Target vegetation: assisted regeneration of Acacia/Balanites/Prosopis woodland.	Tier 1 - derived	1.290	t C ha ⁻¹ yr ⁻¹	Poulsen JR, Clark CJ & Bolker BM (2013). Tropical forest ecosystem recovery from logging and wildlife harvest. Philosophical Transactions of the Royal Society . Results section (Table 2 / Figure 2): Conversion to C: 2.58 × 0.50 (standard biomass carbon fraction per IPCC) = 1.29 tC/ha/yr.	
BGB_incr_FOREST_WZ	CO ₂	Project — forest restoration in Waza	BGB annual increment — forest restoration, Waza. R:S = 0.332 (existing workbook).	Tier 1 - derived	0.428	t C ha ⁻¹ yr ⁻¹	IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4 AFOLU.	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Chapter 4, Table 4.4, Tropical Dry, R:S lower bound = 0.32.	
AGB_incr_FOREST_BB	CO ₂	Project — forest restoration in Bamboutos–Bakossi	AGB annual increment — forest restoration, Bakossi-Bamboutos (moist highlands). Sub-activities: (i) Eucalyptus plantation on degraded montane forest; (ii) native montane forest restoration. Note: bamboo riparian treated separately in Section D.	Tier 1 - derived	3.210	t C ha ⁻¹ yr ⁻¹	Githiru M et al. (2023). Recovery of aboveground biomass, soil carbon stocks and species diversity in tropical montane secondary forests of East Africa. Forest Ecology and Management 548: 121240. Conversion to C: 6.42 × 0.50 = 3.21 tC/ha/yr.	
BGB_incr_FOREST_BB	CO ₂	Project — forest restoration in Bamboutos–Bakossi	BGB annual increment — forest restoration, BB. Existing R:S = 0.232.	Tier 1 - derived	0.642	t C ha ⁻¹ yr ⁻¹	IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4 AFOLU. Chapter 4, Table 4.4, row 'Tropical	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Wet / Moist Evergreen', R:S = 0.37	
AGB_incr_FOREST_DL	CO ₂	Project — forest restoration in Dja–Lobéké	AGB annual increment — forest restoration, Dja-Lobéké (dense humid rainforest). Sub-activities: community forest restoration, park/reserve restoration, riparian bamboo (see also Section D).	Tier 1 - derived	2.410	t C ha ⁻¹ yr ⁻¹	Poulsen JR, Clark CJ & Bolker BM (2013). Tropical forest ecosystem recovery from logging and wildlife harvest. Philosophical Transactions of the Royal Society. Conversion to C: 4.82 × 0.50 = 2.41 tC/ha/yr.	
BGB_incr_FOREST_DL	CO ₂	Project — forest restoration in Dja–Lobéké	BGB annual increment — forest restoration, Dja-Lobéké.	Tier 1 - derived	0.892	t C ha ⁻¹ yr ⁻¹	IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4 AFOLU. Chapter 4, Table 4.4, Tropical Wet/Moist Evergreen (humid), R:S = 0.37	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
AGB_incr_BASE_FOR_WZ	CO ₂	Baseline — forest (Waza)	AGB annual increment — baseline degraded forest, Waza. Represents unmanaged woodland under continuing disturbance pressure (slow/no active recovery).	Tier 1 - direct	0.752	t C ha ⁻¹ yr ⁻¹	EX-ACT Technical Guidelines for Version 9 (2022). FAO / CIMMYT, Rome. Table B-1: Net Annual Increments (NAI) by forest type and climate zone. Conversion: 1.6 × 0.47 (EX-ACT combined BCEF×wood density×C fraction) = 0.752 tC/ha/yr	
BGB_incr_BASE_FOR_WZ	CO ₂	Baseline — forest (Waza)	BGB annual increment — baseline degraded forest, Waza.	Tier 1 - derived	0.241	t C ha ⁻¹ yr ⁻¹	IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4 AFOLU. Chapter 4, Table 4.4, Tropical Dry, R:S lower bound = 0.32.	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
AGB_incr_BASE_FOR_BB	CO ₂	Baseline — forest (Bamboutos–Bakossi)	AGB annual increment — baseline degraded forest, Bakossi-Bamboutos. Represents moist highland woodland under slow/degraded recovery.	Tier 1 - direct	0.423	t C ha ⁻¹ yr ⁻¹	EX-ACT Technical Guidelines for Version 9 (2022). FAO / CIMMYT, Rome. Table B-1. Conversion: 0.9 × 0.47 = 0.423 tC/ha/yr	
BGB_incr_BASE_FOR_BB	CO ₂	Baseline — forest (Bamboutos–Bakossi)	BGB annual increment — baseline degraded forest, BB.	Tier 1 - derived	0.085	t C ha ⁻¹ yr ⁻¹	IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4 AFOLU. Chapter 4, Table 4.4, Tropical Moist Deciduous, R:S = 0.20 (lower bound).	
AGB_incr_BASE_FOR_DL	Biomass (AGB)	Dja–Lobéké; forestry-related activities (community forests; reserves/parks; riparian forests) — baseline	AGB annual increment — baseline mature/degraded forest, Dja-Lobéké. Represents older secondary or degraded humid forest under BAU (no project).	Tier 1 - derived	1.210	t C ha ⁻¹ yr ⁻¹	Poulsen JR, Clark CJ & Bolker BM (2013). Philosophical Transactions of the Royal Society. Conversion: 2.58 × 0.50	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							= 1.29 tC/ha/yr. Rounded down to 1.21 to match EX-ACT BCF convention (1.29 × 0.47/0.50 = 1.21).	
BGB_incr_BASE_FOR_DL	Biomass (BGB)	Dja-Lobéké; forestry-related activities — baseline	BGB annual increment — baseline forest, Dja-Lobéké.	Tier 1 - derived	0.448	t C ha ⁻¹ yr ⁻¹	IPCC (2006). 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Vol. 4 AFOLU. Chapter 4, Table 4.4, Tropical Wet/Moist Evergreen, R:S = 0.37	

----- SOC (SOIL ORGANIC CARBON) -----

SOC_ref_TROP_DRY	SOC (mineral soils, 0–30 cm)	Waza and other tropical-dry zones	Reference SOC stock for tropical dry mineral soils (0–30 cm). Applied to Waza landscape. Dominant soils: Vertisols and Fluvisols (classified as High Activity Clay, HAC, in IPCC scheme).	Tier 1	38	t C/ha	IPCC (2006). 2006 Guidelines for National GHG Inventories, Vol. 4 AFOLU, Chapter 2, Table 2.3. IGES, Hayama.	
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Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
SOC_ref_TROP_MOIST	SOC (mineral soils, 0–30 cm)	Tropical moist zones (e.g., parts of central Cameroon)	Reference SOC stock for tropical moist mineral soils (0–30 cm). Applied to Bakossi-Bamboutos landscape (montane/moist highlands). Dominant soils: Nitisols, Andosols (volcanic), Cambisols.	Tier 1	88	t C/ha	IPCC (2006). 2006 Guidelines for National GHG Inventories, Vol. 4 AFOLU, Chapter 2, Table 2.3. IGES, Hayama.	
SOC_ref_TROP_WET	SOC (mineral soils, 0–30 cm)	Tropical wet zones (e.g., Dja–Lobéké)	Reference SOC stock for tropical wet mineral soils (0–30 cm). Applied to Dja- Lobéké landscape (humid rainforest). Dominant soils: Ferralsols, Acrisols (Low Activity Clay, LAC, in IPCC scheme).	Tier 1	60	t C/ha	IPCC (2006). 2006 Guidelines for National GHG Inventories, Vol. 4 AFOLU, Chapter 2, Table 2.3. IGES, Hayama.	
SOC_factor_base_FOR	SOC factor	Forest land (baseline & project where land remains forest)	Dimensionless factor for forest land relative to SOC reference. Tier-1 default is 1.00 (no reduction vs native reference).	Tier 1	1	—	IPCC (2006). 2006 Guidelines for National GHG Inventories, Vol. 4 AFOLU, Chapter 4 (Forest Land). Section 4.2.3.2, Step 5 note.	
SOC_factor_proj_FOREST	SOC factor	Project forest (enrichment/restorat ion)	Factor for managed/restored forest; Tier-1 default	Tier 1	1	—	IPCC (2006). 2006 Guidelines	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
			equal to baseline forest where no significant SOC change is assumed.				for National GHG Inventories, Vol. 4 AFOLU, Chapter 4 (Forest Land). Section 4.2.3.2, Step 5.	
SOC_factor_base_NONFOR_WZ	SOC factor	Baseline cropland (annual, intensive tillage, low residue inputs)	Relative stock change factor for land use	Tier 1	0.53	—	IPCC (2006). 2006 Guidelines for National GHG Inventories, Vol. 4 AFOLU, Chapter 5 (Cropland), Table 5.5.	
SOC_factor_base_NONFOR_BB	SOC factor	Baseline cropland (annual, intensive tillage, low residue inputs)	Relative stock change factor for land use	Tier 1	0.44	—	IPCC (2006). 2006 Guidelines for National GHG Inventories, Vol. 4 AFOLU, Chapter 5 (Cropland), Table 5.5.	
SOC_factor_base_NONFOR_DL	SOC factor	Baseline cropland (annual, intensive tillage, low residue inputs)	Relative stock change factor for land use	Tier 1	0.44	—	IPCC (2006). 2006 Guidelines for National GHG Inventories, Vol. 4 AFOLU,	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Chapter 5 (Cropland), Table 5.5.	
SOC_factor_proj_AGRO	SOC factor	Project agroforestry (former cropland)	Relative stock change factor for land use	Tier 1	1	—	IPCC (2006). 2006 Guidelines for National GHG Inventories, Vol. 4 AFOLU, Chapter 5, Table 5.5.	

----- NON-CO2 (NITROGEN MODULE; USE ONLY IF APPLICABLE) -----

N_rate_base	N ₂ O	Baseline non-forest cropland	Annual synthetic nitrogen input rate applied to cropland under baseline management. Drives direct and indirect N ₂ O in the IPCC soils chain.	Tier 1	5.1	kg N/ha/yr	FAO Statistical Yearbook 2025 — inorganic fertiliser N per cropland ha (Cameroon)	Paste crop-specific value if available; otherwise retain national mean.
N_rate_proj	N ₂ O	Project (agroforestry on former cropland)	Planned annual synthetic N input under the project scenario. If the design avoids mineral fertiliser (e.g., relies on mulching/fixation), this remains zero.	Tier 2	0	kg N/ha/yr	Project design (FP Output 1.2)	Set >0 only if micro-dosing or similar is introduced and evidenced.
N_rate_base_AGRO	N ₂ O	Baseline — AGRO lands	Baseline nitrogen application rate for cropland targeted by agroforestry. Zero reflects assumed absence of mineral N in smallholder	Tier 2	0	kg N/ha/yr	Project design (FP Output 1.2)	Update if farm surveys show mineral N use.

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
			baseline unless records show otherwise.					
N_rate_base_FOREST	N ₂ O	Baseline — FOREST compartments	Baseline nitrogen application rate on forest land; typically zero given no fertilisation of protected/community compartments.	Tier 2	0	kg N/ha/yr	Project design (FP Output 1.2)	Keep at zero unless fertilisation is documented.
N_rate_proj_AGRO	N ₂ O	Project — AGRO lands	Project nitrogen application rate on agroforestry plots. Remains zero where fertiliser is not planned.	Tier 2	0	kg N/ha/yr	Project design (FP Output 1.2)	Increase only if fertiliser plans are formally adopted.
N_rate_proj_FOREST	N ₂ O	Project — FOREST compartments	Project nitrogen application rate in forest restoration (field operations). Typically zero; nursery inputs excluded.	Tier 2	0	kg N/ha/yr	Project O&M plans; IPCC 2006 Ch.11 (method)	Confirm no field-level fertilisation.
EF1	N ₂ O	Managed soils (direct)	Direct emission factor for N ₂ O-N per unit N applied to soils. Used with N rates to calculate direct N ₂ O.	Tier 1	0.01	kg N ₂ O-N/kg N	Chapter 11: N ₂ O Emissions from Managed Soils, and CO ₂ Emissions from Lime and Urea Application, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse	Default Tier 1.

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Gas Inventories	
Frac_GASF	N ₂ O	Managed soils (volatilisation)	Fraction of applied N that volatilises as NH ₃ /NO _x , leading to indirect N ₂ O after deposition.	Tier 1	0.11	kg N/kg N	Chapter 11: N ₂ O Emissions from Managed Soils, and CO ₂ Emissions from Lime and Urea Application, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	Default Tier 1.
EF4	N ₂ O	Atmospheric deposition	Emission factor for indirect N ₂ O from redeposition of volatilised N.	Tier 1	0.01	kg N ₂ O-N/kg N	Chapter 11: N ₂ O Emissions from Managed Soils, and CO ₂ Emissions from Lime and Urea Application, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse	Default Tier 1.

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Gas Inventories	
Frac_LEACH	N ₂ O	Managed soils (leaching/runoff)	Fraction of applied N that leaches or runs off, driving indirect N ₂ O formation off-site.	Tier 1	0.24	kg N/kg N	Chapter 11: N ₂ O Emissions from Managed Soils, and CO ₂ Emissions from Lime and Urea Application, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	Default Tier 1.
EF5	N ₂ O	Leached N	Emission factor for indirect N ₂ O-N from leached/runoff N.	Tier 1	0.011	kg N ₂ O-N/kg N	Chapter 11: N ₂ O Emissions from Managed Soils, and CO ₂ Emissions from Lime and Urea Application, 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse	Default Tier 1.

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Gas Inventories	

----- FUEL AND OTHER INPUTS (USE ONLY IF APPLICABLE) -----

Diesel_L_per_ha_BASE_Agro	CO ₂	Baseline diesel — AGRO	Diesel intensity per hectare in baseline agro lands (field ops/transport). Zero where mechanisation is absent.	AD (activity data)	0	L/ha/yr	<u>Project activity data; method ref. CDM TOOL33</u>	Replace with measured values if available.
Diesel_L_per_ha_PROJ_Agro	CO ₂	Project diesel — AGRO	Diesel intensity per hectare in project agroforestry operations.	AD	0	L/ha/yr	<u>Project activity data; method ref. CDM TOOL33</u>	Document nursery/transport if material.
Diesel_L_per_ha_BASE_FOREST	CO ₂	Baseline diesel — FOREST	Diesel intensity per hectare in baseline forest compartments (patrol/harvest transport where relevant).	AD	0	L/ha/yr	<u>Project/park records; method ref. CDM TOOL33</u>	Replace with logs if available.
Diesel_L_per_ha_PROJ_FOREST	CO ₂	Project diesel — FOREST	Diesel intensity per hectare in restoration operations.	AD	0	L/ha/yr	<u>Project O&M plans; method ref. CDM TOOL33</u>	Update post-procurement if machinery used.
Diesel_L_per_ha_BASE	CO ₂	Generic baseline	Generic baseline diesel intensity where family-specific rows are not used.	AD	0	L/ha/yr	FAO/sector context; project survey	Keep at 0 absent evidence; prefer family-specific rows.
Diesel_L_per_ha_PROJ	CO ₂	Generic project	Generic project diesel intensity where family-specific rows are not used.	AD	0	L/ha/yr	Project practice sheets	Enter if mechanisation planned.
EF_fuel	CO ₂	Fuel combustion CO ₂	CO ₂ emission factor per litre diesel combusted (tank-to-wheel).	Tier 1	0.00268	t CO ₂ /L	UK Government GHG Conversion	Align density assumptions with local fuel specs.

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Factors 2025 (diesel)	

# ----- FIRE / BURNING (INCLUDE ONLY WHERE MATERIAL) -----								
Fire_DM_load_BASE_FOR_PARK_SAV	NONCO2	FOREST_PARK in savanna	DM consumed per fire in park/reserve woodland/grass-dominated compartments (mid/late dry season typical)	Tier 1	7	t DM ha ⁻¹ event ⁻¹	Chapter 2: Generic Methodologies Applicable to Multiple Land-Use Categories: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories ("Savanna" mean 7.0; mid/late burns up to 10.0).	
Fire_events_per_yr_BASE_FOR_PARK_SAV	NONCO2	FOREST_PARK in savanna	Mean fire occurrence per ha per year (proxy from regional BA fractions 0.2–0.5 yr ⁻¹)	Tier 1	0.35	events ha ⁻¹ yr ⁻¹	<u>Africa BA literature & satellite records show frequent burning.</u>	
Fire_DM_load_BASE_COMMUNITY_SAV	NONCO2	COMMUNITY forests in savanna	DM consumed per fire in savanna woodlands (mid/late dry season)	Tier 1	4.6	t DM ha ⁻¹ event ⁻¹	Chapter 2: Generic Methodologies Applicable to Multiple Land-Use	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Categories: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories "All savanna woodlands (mid/late dry season burns)".	
Fire_events_per_yr_BASE_COMMUNITY_SAV	NONCO2	COMMUNITY forests in savanna	Mean fire occurrence per ha per year	Tier 1	0.35	events ha ⁻¹ yr ⁻¹	As above; <u>community blocks in savanna typically experience similar anthropogenic fire pressure.</u>	
Fire_DM_load_BASE_RIPARIAN_SAV	NONCO2	RIPARIAN in savanna	DM consumed per fire in moister riparian corridors (often early-season burns)	Tier 1	2.6	t DM ha ⁻¹ event ⁻¹	Chapter 2: Generic Methodologies Applicable to Multiple Land-Use Categories: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas	

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Inventories "All savanna woodlands (early dry season burns)".	
Fire_events_per_yr_BASE_RIPARIAN_SAV	NONCO2	RIPARIAN in savanna	Mean fire occurrence per ha per year (lower than uplands due to moisture breaks)	Tier 1	0.15	events ha ⁻¹ yr ⁻¹	<u>Riparian areas are less flammable; reduced frequency justified by hydrological buffering.</u>	
Fire_DM_load_BASE_FOR_PARK_RF	NONCO2	FOREST_PARK in rainforest	DM consumed per fire event	Tier 1	0	t DM ha ⁻¹ event ⁻¹	Use 0 unless burning is evidenced. (If evidence emerges, see "optional" below.)	
Fire_events_per_yr_BASE_FOR_PARK_RF	NONCO2	FOREST_PARK in rainforest	Annual fire occurrence	Tier 1	0	events ha ⁻¹ yr ⁻¹	<u>Default 0.00; rare wildfire in humid rainforest.</u>	
Fire_DM_load_BASE_COMMUNITY_RF	NONCO2	COMMUNITY forests in rainforest	DM consumed per fire event	Tier 1	0	t DM ha ⁻¹ event ⁻¹	As above.	
Fire_events_per_yr_BASE_COMMUNITY_RF	NONCO2	COMMUNITY forests in rainforest	Annual fire occurrence	Tier 1	0	events ha ⁻¹ yr ⁻¹	As above.	
Fire_DM_load_BASE_RIPARIAN_RF	NONCO2	RIPARIAN in rainforest	DM consumed per fire event	Tier 1	0	t DM ha ⁻¹ event ⁻¹	As above.	
Fire_events_per_yr_BASE_RIPARIAN_RF	NONCO2	RIPARIAN in rainforest	Annual fire occurrence	Tier 1	0	events ha ⁻¹ yr ⁻¹	As above.	
Combustion_complete	CH ₄ +N ₂ O	Open burning calculations	Fraction of available dry matter oxidised during burning. If DM represents "consumed DM", set	Tier 1	0.9	fraction	Chapter 2: Generic Methodologies Applicable to	Document assumption in text.

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
			to 1 to avoid double counting.				Multiple Land-Use Categories: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	
EF_CH4_burn	CH ₄	Open burning	Methane emission factor per tonne dry matter burned.	Tier 1	6.8	kg CH ₄ /t DM	Chapter 2: Generic Methodologies Applicable to Multiple Land-Use Categories: 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories	Adjust if residue type differs materially.
EF_N2O_burn	N ₂ O	Open burning	Nitrous oxide emission factor per tonne dry matter burned.	Tier 1	0.2	kg N ₂ O/t DM	Chapter 2: Generic Methodologies Applicable to Multiple Land-Use Categories: 2019 Refinement to the 2006 IPCC	Adjust if residue type differs materially.

Param_ID	Pool_or_GHG	Applicability	Description	Tier	Value	Unit	Source	Notes/To-Do
							Guidelines for National Greenhouse Gas Inventories	

# ----- SURVIVAL / ESTABLISHMENT (PROJECT-SIDE) -----								
Survival_Y1	CO ₂ (biomass)	All plantings/regeneration	Fraction of planted/regenerating stems alive at end of Year 1. Governs early-stage biomass accrual realism.	Tier 1	0.85	fraction	Project placeholder; SFM plans	Replace with MRV survival plot data.
Annual_Mortality_after_Y1	CO ₂ (biomass)	All plantings/regeneration	Annual mortality rate applied from Year 2 onward (net of replacement planting). Currently included for conservativeness. Target should be zero with systematic replanting included in SFM plan.	Tier 1	0.005	fraction/yr	Project placeholder; SFM plans	Target should be zero with replanting included in SFM plan

