

# The American Carbon Registry™

Wetlands Restoration

Accounting for the GHG Benefits of Pocosin Restoration

Version 1.0

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39	METHODOLOGY DESCRIPTION

### 40 **A1. SCOPE**

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This methodology accounts for the GHG emission reductions from rewetting previously drained 42 pocosins. Pocosins are defined as freshwater wetlands, often shrub-dominated, on organic soils in the 43 44 Atlantic coastal plain of the southeastern United States that are seasonally saturated primarily through 45 precipitation. The baseline scenario assumes continuation of the pre-existing drained state, and ongoing 46 emissions from the soil organic carbon (peat) pool associated with drainage. Leakage is excluded from accounting via an applicability condition stipulating the absence of any productive land use (that could 47 be displaced or result in commodity shortages) in the project area within two years prior to the project 48 49 start date.

50

## 51 A2. APPLICABILITY CONDITIONS

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53 General applicability conditions for this methodology are:

- 541. The project area has been free of any land use that could be displaced outside the project area55(e.g. agriculture) for two or more years prior to project start date;
- The project area is a previously-drained pocosin. Throughout this document, "drained" is
   defined as subject to a lowering of water table due to deliberate hydrological manipulation, e.g.
   through ditching and diking;
- Project activity involves re-wetting previously drained wetlands, in which rewetting is defined as
   raising the elevation of the average annual water table in drained wetland by partially or
   entirely reversing the pre-existing drained state;
- Any areas of soil disturbance associated with implementation of the project activity are less than
  3% of the project area;
- 64 5. N-fertilizers are not used in the with-project scenario;
- 65 6. No timber harvest is expected to occur in the baseline or with-project scenarios;
- The project activity and project area meet all eligibility requirements set by the currently
   governing versions of the American Carbon Registry Standard and American Carbon Registry
   Forest Carbon Project Standard.
- A baseline reference site must be identified and accessible on which one or more parameters
  are monitored in the baseline scenario. Parameter-specific criteria to demonstrate the
  appropriateness of a baseline reference site are detailed in Table 4.
- 72 Use of this methodology also requires that applicability conditions specific to the chosen accounting
- 73 approach are met, as well as similarity criteria demonstrating the validity of one or more selected
- 74 baseline reference sites (see Section A4 below).

## 76 A3. POOLS AND SOURCES

- 77
- 78 Carbon pools
- 79 Table 1. Carbon pools accounted for in the project boundary.

Carbon pools	Included / Optional /	Justification / Explanation of choice	
	Excluded		
Above-ground biomass	Included (includes	Required as the project activity may result in	
carbon	trees and woody	increased mortality or decreased growth and	
	shrubs)	recruitment	
Below-ground biomass	Included (includes	Required as the project activity may result in	
carbon	trees and woody	increased mortality or decreased growth and	
	shrubs)	recruitment	
Herbaceous vegetation	Included/Excluded	Must be included when using the flux approach	
Dead wood	Excluded	Conservatively excluded (pool is expected to be	
		greater in the project scenario with potentially	
		higher mortality and lower decomposition due to	
		flooding)	
Harvested wood products	Excluded	Excluded per applicability condition	
Litter / Forest Floor	Included (treated as a	Component of largest pool expected to be subject	
	component of soil	to change with the project activity	
	organic carbon)		
Soil organic carbon	Included	Largest pool expected to be subject to change	
		with the project activity	

- 81 Emission sources
- 82 Emissions of  $CO_2$  are included through monitoring the carbon pools above.

- 83 Emissions of N<sub>2</sub>O and CH<sub>4</sub> are excluded as insignificant<sup>1</sup>, also a conservative treatment as more fires are
- 84 expected to occur in the drained baseline scenario.

## 86 A4. METHODOLOGY SUMMARY

87

88 The methodology centers on two different approaches for estimating belowground emissions: (1) a

- 89 stock change approach which estimates emissions from net surface level change (due to subsidence,
- 90 accretion and root dynamics), and (2) a flux approach which models emissions as a function of one or
- 91 more proxy variables (e.g., water table level, temperature, etc.) that are demonstrated to be
- significantly correlated with belowground emissions. One or the other approach may be used, provided
- 93 approach-specific applicability conditions are met.
- 94 The methodology is simplified by exclusion of leakage from accounting (explained above) and by
- 95 accounting for uncertainty as a step in the derivation of parameter values (i.e. uncertainty is not
- 96 accounted separately and deducted in final calculations as in other methodologies). Uncertainty is
- 97 accounted in this way for all parameters driving differences between with-project and baseline scenario
- 98 emissions, which include surface elevation change, above- and belowground biomass, proxy
- 99 (independent) variables and emissions (dependent variable) modeled as a function of proxy variable(s).
- 100 Also, in all accounting steps throughout this methodology, sources/sinks collectively amounting to less
- 101 than 3% of total ex-ante estimate of net emission reductions may be excluded from accounting.
- 102 Monitoring is conducted in the project area and in a valid baseline reference site that matches
- 103 conditions expected in the project area in the absence of the project activity (i.e. rewetting) (see Table
- 4). Either net surface elevation change (stock change approach) or one or more proxy variables (flux
- approach) are monitored to estimate emissions from belowground. Trees and woody shrubs are
- 106 monitored on permanent sample plots to assess and account for any detected differences in stock
- 107 change due to growth/recruitment/mortality between the project area and the baseline reference site.
- 108 Accretion/litterfall is monitored either as an undifferentiated component of net surface elevation
- 109 change (stock change approach) or by monitoring net surface elevation change (flux approach).
- 110
- 111 Unintentional (natural) fire is conservatively excluded from accounting. Where unintentional burns
- 112 occur in the project area, it is assumed that equal emissions occur in the baseline (i.e. net zero).
- 113 Intentional fires (e.g., prescribed burns) in the project area are monitored and emissions accounted.
- 114

<sup>&</sup>lt;sup>1</sup> Richardson et al. 2014. Impacts of Peatland Ditching and Draining on Water Quality and Carbon Sequestration Benefits of Peatland Restoration. Final Report. Duke University Wetlands Center for the US Fish and Wildlife Service and The Nature Conservancy.

- 115 As explained above, two approaches are provided for estimating net greenhouse gas emissions in the
- baseline and with-project cases: Stock Change and Flux. One approach must be selected and used for
- 117 the entire project crediting period.
- 118 The Stock Change approach may be employed if the following applicability conditions are met (note that
- 119 conditions related to measurement and monitoring apply equally to the project and baseline cases, as
- 120 measurement and monitoring are carried out in the project area and in a representative baseline
- 121 reference site):

122	1.	Net surface elevation change measured using Rod Surface Elevation Tables (RSETs), Real Time
123		Kinematic (RTKs) satellite-based approaches or other appropriate technologies;
124	2.	Clear and detailed rules and procedures for determining surface level are documented in field
125		standard operating procedures and adhered to;
126	3.	Bulk density in top 10 cm is monitored; the top layer being the aerated labile portion from which
127		emissions are expected to be sourced, and as well is a conservative value as it's the lowest bulk
128		density throughout the peat profile. The top 10 cm should also capture the majority of root
129		biomass, and permit estimation of emissions from surface level change resulting from root
130		expansion/mortality. Bulk density samples must include soil organic carbon, belowground
131		biomass (fine and coarse roots) and litter.
132	4.	Baseline reference site has been subject to drainage/hydrological alteration for at least 10 years
400		

- (to minimize influence of new root growth and expansion on surface elevation and bulk density)
  Repeat measurements of surface elevation change are made at the same water table level (+/-
- 135 10% of level at t = 0) or same season, preferably in the dry season;
- 136 6. In with-project case, initial surface elevation level is measured no less than 12 months after re137 wetting takes place (after initial swell has occurred);
- 138 7. In both the project area and baseline reference site, no significant erosion or sedimentation
  139 expected to occur (flat terrain, no river flow over project area);
- 140 8. In both the project area and baseline reference site, no significant compaction expected to
  141 occur and procedures will be in place to safeguard against compaction resulting from surface
  142 elevation measurements in the field.
- 143
- 144 Note that the Stock Change approach treats soil organic carbon, belowground (root) biomass and litter
   145 as a single source/sink. No root expansion and related swelling is expected in the with-project re-wetted
- 146 case, and subsidence due to root die back is treated as an emission (assuming emissions from
- 147 belowground biomass mortality occur at the time of measurable subsidence).

- The Flux approach may be employed where a regression equation correlating one or more proxyvariables to belowground emissions meeting the following applicability conditions is available:
- 151 1. Peer-reviewed;
- 152 2. Empirically-based specifically, derived from flux chamber studies;

153 154	3.	Flux chambers capture gas exchange from the soil organic carbon, belowground biomass, litter
155	4	Relationship between proxy variable and emissions must be significant at $P < 0.05$ and unbiased
156		(i.e. with minimal trend in residuals);
157	5.	The study site from which proxy relationship developed must be on pocosins or former pocosins
158		(as defined in Section A1);
159	6.	Relationship incorporates one or more proxy variables that are:
160		a. measured ex post in a valid baseline reference site,
161		b. measured ex post in the project area (e.g., precipitation, temperature), and/or
162		c. modeled in the project area on the basis of driver variables monitored ex post in the
163		project area (e.g., water table modeled from monitored precipitation);
164	7.	Uncertainty in predicted emissions (dependent variable) is known and calculated as the root
165		mean squared error (RMSE).
166		
167	The sa	ne relationship must be used in both the project and baseline cases. The regression may be
168	revised	based on new data, provided it meets the above requirements.
169		
170	Accour	iting using each approach is summarized in the following diagrams, which demonstrate key
171	param	eters and calculation flow. The diagrams are intended only to provide a high level view of the
172	metho	dology structure. Operation of the methodology follows measurement and calculation
173	proced	ures detailed in Sections C, D and E below.
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#### 186 Figure 1. Overview of accounting using the stock change approach.



- 198 Figure 2. Overview of accounting using the flux approach.
- 199



201 Monitoring procedures are reviewed in the tables below, which, as for the diagrams above, are intended

as an overview and to draw distinctions in requirements between the two accounting approaches. Note

- 203 that for both the stock change and flux approaches, a baseline reference site is required to monitor
- 204 parameters in the baseline scenario.
- 205 Table 2. Monitoring for the stock change approach/

Parameter	General monitoring of baseline scenario	General monitoring of project scenario
Net surface	Monitored on baseline reference site	Monitored on project area via direct
elevation	via direct measurement of permanent	measurement of permanent sample
change; ∆SE	sample points	points
Aboveground	Monitored on baseline reference site	Monitored on project area via direct
biomass carbon;	via direct measurement on permanent	measurement on permanent sample
AGB	sample plots	plots

Area of	Monitored in project area via aerial	Monitored in project area via aerial
unintentional	imagery and management records	imagery and management records
fire; A <sub>burn_unint</sub>		

#### 207 Table 3. Monitoring for the flux approach.

Parameter	General monitoring of baseline	General monitoring of project	
	scenario	scenario	
Proxy variable(s)	Either monitored via direct	Monitored via direct measurement in	
significantly	measurement in a valid baseline	the project area	
correlated with	reference site, monitored via direct		
emissions: Proxy	measurement in the project area, or		
A. B. etc	modeled in the project area (e.g. using		
, , , , , , , , , , , , , , , , , , ,	a hydrologic model) on the basis of		
	one or more monitored, directly-		
	measured driver variables (e.g.		
	precipitation) in the project area.		
Surface elevation	Monitored on baseline reference site	Monitored on project area via direct	
change due to	via direct measurement of permanent	measurement of permanent sample	
accretion/litterfall;	sample points	points	
$\Delta SE_{Acc}$ (optional)			
Above- and	Monitored on baseline reference site	Monitored on project area via direct	
belowground	via direct measurement on permanent	measurement on permanent sample	
biomass carbon;	sample plots	plots	
ABGB			
Area of intentional	N/A	Monitored in project area via aerial	
fire; A <sub>burn_int</sub>		imagery and management records	
Surface elevation	N/A	Monitored in the project area in the	
change due to		planned burn area via direct	
intentional fire;		measurement of sample points	
$\Delta SE_{burn_int,wp,t}$		immediately prior to and after the	
		burn	
Area of	Monitored in project area via aerial	Monitored in project area via aerial	
unintentional fire;	imagery and management records	imagery and management records	
A <sub>burn_unint</sub>			
Surface elevation	Monitored in the project area via	Monitored in the project area via	
change due to	direct measurement of sample points	direct measurement of sample points	
unintentional fire;	in the burn area and outside the burn	in the burn area and outside the burn	
$\Delta SE_{burn\_unint,wp,t}$	area after the burn	area after the burn	

208

#### 209 Baseline reference site similarity criteria

210 Operation of this methodology requires that one or more baseline reference sites be identified on which

211 to monitor a range of parameters in the baseline scenario. The table below outlines similarity criteria

- that must be met to demonstrate the validity of a baseline reference site, and details similarity criteria
- values for an existing baseline reference site at Pocosin Lakes National Wildlife Refuge.

#### 214 Table 4. Baseline reference site similarity criteria.

Baseline reference site similarity criterion	Net surface elevation change; ΔSE	Surface elevation change due to accretion/litterfall; ΔSE <sub>Acc</sub>	Aboveground biomass carbon; AGB and Above- and belowground biomass carbon; ABGB	Proxy variable(s) significantly correlated with belowground emissions; Proxy A, B, etc	Pocosin Lakes NWR baseline reference site <sup>2</sup>
Drained freshwater wetland on organic soils in the coastal plain of southeast Virginia, North Carolina or South Carolina, formerly with pocosin vegetation	yes	yes	yes	Yes	yes
Not subject to significant erosion, sedimentation or soil compaction	yes	yes	N/A	N/A	monitored
Not subject to significant sustained flooding above average annual water table or fire	yes	yes	yes	N/A	monitored
Mean bulk density of top 10 cm of peat at project start date	Within +/- 20% of mean bulk density in project area	N/A	N/A	N/A	0.2 g cm <sup>-1</sup>

<sup>&</sup>lt;sup>2</sup> Thompson, G.S., R.T. Belcher and R.B. Atkinson. 2003. Soil biochemistry in Virginia and North Carolina Atlantic white cedar swamps. In: Atkinson, R.B., R.T. Belcher, D.A. Brown, and J.E. Perry, eds. Atlantic White Cedar Restoration Ecology and Management, Proceedings of a Symposium, May 31-June 2, 2000, Christopher Newport University, Newport News, VA.

Dolman, J.D. and S.W. Buol. 1967. A Study of Organic Soils (Histosols) in the Tidewater Region of North Carolina. North Carolina Agricultural Research Service Technical Bulletin 181, 52 p.

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Baseline reference site similarity criterion	Net surface elevation change; ΔSE	Surface elevation change due to accretion/litterfall; ΔSE <sub>Acc</sub>	Aboveground biomass carbon; AGB and Above- and belowground biomass carbon; ABGB	Proxy variable(s) significantly correlated with belowground emissions; Proxy A, B, etc	Pocosin Lakes NWR baseline reference site <sup>2</sup>
Mean percent carbon of top 10 cm of peat at project start date	Within +/- 20%, in relative terms, of mean percent organic matter in project area	N/A	N/A	N/A	42 %
Mean peat depth at project start date	Equal to or less than mean peat depth in project area	N/A	N/A	N/A	1.0 – 2.0 m
Average annual water level at project start date	Within +/-20% of average annual water level in project area prior to project start (i.e. prior to rewetting of project area)	N/A	Within +/-20% of average annual water level in project area prior to project start (i.e. prior to rewetting of project area)	N/A	- 60 to -100 cm
Length of time subject to drainage/hydrological alteration prior to project start <sup>3</sup>	Within +/-20% of length of time subject to drainage/ hydrological	N/A	N/A	N/A	≥20 years

<sup>&</sup>lt;sup>3</sup> Note that both the project area and baseline reference site must have been subject to drainage/hydrological alteration for at least 10 years per applicability condition for the stock change approach

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Baseline reference site similarity criterion	Net surface elevation change; ΔSE	Surface elevation change due to accretion/litterfall; ΔSE <sub>Acc</sub>	Aboveground biomass carbon; AGB and Above- and belowground biomass carbon; ABGB	Proxy variable(s) significantly correlated with belowground emissions; Proxy A, B, etc	Pocosin Lakes NWR baseline reference site <sup>2</sup>
	alteration prior to project start in project area				
Vegetation: Successional stage, tree and shrub species composition, stem density and diameter distribution	N/A	Similar to project area immediately prior to project start	Similar to project area immediately prior to project start	N/A	General description of vegetation on PLNWR reference site
Value of proxy variable at project start date	N/A	N/A	N/A	Not outside of range of measured values from which regression derived	[Too be added]

215

216

217

- Baseline reference sites should ideally be selected to have stable management through the project 219 220 crediting period, however, should the baseline reference site become invalid (due to non-compliance 221 with similarity criteria, e.g. if it becomes subject to a burn or flooding) at any time during the project 222 crediting period, a new valid baseline reference site may be selected to replace the former, or the 223 existing baseline reference site may be reconfigured to comply with the similarity criteria. Different 224 baseline reference sites may be used for different parameters. Multiple baseline reference sites may be 225 used for a single parameter, in which case the similarity criteria are assessed for the composite area. 226 227 228 229 230
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239	Β.
240	<b>BOUNDARIES, ADDITIONALITY AND</b>
241	PERMANENCE

### 243 **B1. PROJECT GEOGRAPHIC BOUNDARY**

- The project boundary shall be defined at the beginning of a proposed project activity and shall remain
- fixed through the project crediting period. The project activity may contain more than one discrete area of land.
- For all discrete land areas included in the project boundary, the following will be provided:
- 248 Unique identifier for each discrete parcel of land;
- Geo-referenced GIS shapefile of the land parcel boundary;
- 250 Details of ownership and land use rights holder.
- 251
- 252 Further guidance is provided in the project area parameter table in Section E.

253

## **B2. PROJECT TEMPORAL BOUNDARY**

- 255 The project crediting period is the time period for which GHG emission reductions generated by the
- project are accounted and eligible for issuance as ERTs. The project must have a robust monitoring plancovering this period.
- 258 The start of the crediting period is marked by the start of the project activity, i.e. at the onset of rewetting.
- 259 The crediting period shall be for 20 years, and may be renewed following governing ACR requirements.

260

## 261 **B3. ADDITIONALITY**

The project activity must demonstrate additionality applying the ACR's three-pronged additionality test: beyond regulatory requirements, beyond common practice, and facing at least one of three implementation barriers (financial, technological, or institutional).

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## **B4. METHOD OF ASSURANCE OF PERMANENCE**

To ensure permanence of credited emission reductions, the project will apply the ACR Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination.

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278	С.
279	Stock change approach:
280	Baseline and with-project scenarios

## **C.1 Baseline accounting**

282				
283	$GHG_{BSL,t} = \Delta BG_s$	$GHG_{BSL,t} = \Delta BG_{stock\_bsl,t}$		
284				
285	Where:			
286 287	$GHG_{BSL,t}$	Annual greenhouse gas emissions in the baseline in monitoring interval e $CO_2 e \ yr^{-1}$	ending in year t; t	
288 289 290	$\Delta BG_{stock\_bsl,t}$	Annual change in the soil organic carbon and belowground biomass and the stock change method in the baseline scenario in monitoring interval e $CO_2e \ yr^{-1}$	litter pools using ending in year t; t	
291				
292 293 294	Note that change in aboveground biomass carbon stocks in the baseline is accounted in parameter $\Delta AGB_{wp}$ (derived in Section C.2.2 below) which represents the net of baseline and with project changes in aboveground biomass carbon stocks.			
295				
296	C.1.1 Emi	ssions from belowground in the baseline		
297 298 299	Emissions from inferred from n respiration) fro	belowground are estimated from net surface level change. Note that the let surface level change, $\Delta BG_{stock\_bsl}$ , covers net emissions (due to sequest m soil organic carbon, belowground biomass and litter.	e emission ration and	
300				
301	$\Delta BG_{stock\_bsl,t} = (A)$	A - Aburn_unint,wp,t) * - ΔSE <sub>bsl,t</sub> * (1/x) * 10 * BD <sub>wp,t-x</sub> * C% <sub>soil,wp</sub> * 44/12	Equation 2	

302 Where:

303 304 305	$\Delta BG_{stock\_bsl,t}$	Annual change in the soil organic carbon and belowground biomass and litter pools using the stock change method in the baseline scenario in monitoring interval ending in year t; t $CO_2e$ yr <sup>-1</sup>
306	$\Delta SE_{bsl,t}$	Mean net surface elevation change (subsidence + accretion + root
307		expansion/mortality) in the baseline reference site in monitoring interval ending in
308		year t; mm

- 309 BD<sub>wp,t-x</sub> Mean dry bulk density in the project area at time t-x; g cm<sup>-3</sup>
- 310 %C<sub>soil,wp</sub> Percentage of soil organic C in the project area; %

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311	44/12	Ratio of molecular weight of CO <sub>2</sub> to carbon, t CO <sub>2</sub> -e t C <sup>-1</sup>
312	A	Project area; ha
313 314	$A_{burn\_unint,wp,t}$	Area of unintentional burn in the project area occurring in monitoring interval ending in year t; ha
315	t	1, 2, 3, t years elapsed since the project start date
316	x	Number of years in monitoring interval; years
317		
318 319 320 321	The net surface e incorporates unc value (see param and soil organic c	elevation change term is monitored in a valid control site. Parameter $\Delta SE_{bsl,t}$ ertainty where the half width of the 90% confidence interval exceeds 10% of the mean eter table). Bulk density is monitored and includes litter, belowground biomass (roots) carbon.
322		
323		
324	C.2 Wit	h-project Accounting
325		
326	$GHG_{WP,t} = \Delta BG_{stoc}$	$k_{wp,t}$ + Net $\Delta AGB_{wp,t}$ Equation 3
327		
328	Where:	
329 330	GHG <sub>WP,t</sub> A	Annual greenhouse gas emissions in the project scenario in monitoring interval ending in rear t; t $\rm CO_2e~yr^{-1}$
331 332	ΔBG <sub>stock_wp,t</sub> A	Annual change in the soil organic carbon and belowground biomass pool using the stock change method in the project scenario in monitoring interval ending in year t; t CO <sub>2</sub> e yr <sup>-1</sup>
333 334	Net∆AGB <sub>wp,t</sub> A n	Annual net change in aboveground biomass carbon stocks in the project scenario in nonitoring interval ending in year t; t $\rm CO_2e~yr^{-1}$
335		
336		
337	C.2.1 Emis	sions from belowground in the project

Emissions from belowground are estimated from net surface level change. Note that the emission
 inferred from net surface level change, ΔBG<sub>stock\_bsl</sub>, covers net emissions (due to sequestration and

340	respiration) from soil organic carbon, belowground biomass and litter.			
341				
342	$\Delta BG_{stock\_wp,t} = (A -$	$A_{burn\_unint,wp,t}$ ) * - $\Delta SE_{wp,t}$ * (1/x) * 10 * $BD_{wp,t-x}$ * $C_{soil,wp}$ * 44/12 Equation 4		
343	Where:			
344 345 346	$\Delta BG_{stock\_wp,t}$	Annual change in the soil organic carbon and belowground biomass pool using the stock change method in the project scenario in monitoring interval ending in year t; t $CO_2e \ yr^{-1}$		
347 348	$\Delta SE_{wp,t}$	Mean net surface elevation change (subsidence + accretion + root expansion/mortality) in the project area in monitoring interval ending in year t; mm		
349	BD <sub>wp,t-x</sub>	Mean dry bulk density in the project area at time t-x; g cm <sup>-3</sup>		
350	%C <sub>soil</sub> Percentage of soil organic C in the project area; %			
351	44/12 Ratio of molecular weight of CO <sub>2</sub> to carbon, t CO <sub>2</sub> -e t C <sup>-1</sup>			
352	A Project area; ha			
353 354	Aburn_unint,wp,t Area of unintentional burn in the project area occurring in monitoring interval ending in year t; ha			
355	t	1, 2, 3, t years elapsed since the project start date		
356	x	Number of years in monitoring interval; years		
357				
358 359 360	The net surface elevation change term must be monitored in the project area. Parameter $\Delta SE_{wp,t}$ incorporates uncertainty where the half width of the 90% confidence interval exceeds 10% of the mean value (see parameter table).			
361 362	Bulk density is measured at the project start and every 10 years and includes litter, belowground biomass (roots) and soil organic carbon.			
363				
364				
365	C.2.2 Emiss	sions from aboveground biomass in the project		
366	Emissions from aboveground biomass (in trees and shrubs) in the project, NetΔAGB <sub>wp</sub> , represent net			

emissions from aboveground biomass (i.e. net of baseline and with project) resulting from stock change
in the project case relative to a baseline reference site. This term is set equal to zero if there is no
significant difference in stock change between the project and the baseline reference site.

370 Step 1

371 372 373 374	Measure change in stocks of aboveground biomass in the project area and in a baseline reference site. Stock change in aboveground biomass is measured on permanent sample plots, and represents the net of biomass increment, recruitment and mortality. Calculate mean annual change in stocks of aboveground biomass in the project area, $\Delta AGB_{wp}$ , and in a baseline reference site, $\Delta AGB_{bsl}$ .			
375				
376	$\Delta AGB_{wp,t} = ($	$\frac{1}{n} \times \sum_{j=1}^{n} \left( (AGB_{wp,j,t} - AGB_{wp,j,t-x}) * \left(\frac{1}{x}\right) \right)$	Equation 5	
377				
378	Where:			
379 380	$\Delta AGB_{wp,t}$	Mean annual change in aboveground biomass carbon stocks in the projemonitoring interval ending in year t; t $CO_2e$ ha <sup>-1</sup> yr <sup>-1</sup>	ect area in	
381	AGB <sub>wp,j,t</sub>	Aboveground biomass carbon stocks in the project area in plot j at time	t; t CO₂e/ha	
382	AGB <sub>wp,j,t-x</sub>	Aboveground biomass carbon stocks in the project area in plot j at time	t-x; t CO₂e/ha	
383	j	1, 2, 3 n sample plots		
384	x	Number of years in monitoring interval; years		
385				
386				
387	$\Delta AGB_{bsl,t} = ($	$\frac{1}{n} \times \sum_{j=1}^{n} \left( (AGB_{bsl,j,t} - AGB_{bsl,j,t-x}) * \left(\frac{1}{x}\right) \right)$	Equation 6	
388				
389	Where:			
390 391	$\Delta AGB_{bsl,t}$	Mean annual change in aboveground biomass carbon stocks in the base area in monitoring interval ending in year t; t $CO_2e$ ha <sup>-1</sup> yr <sup>-1</sup>	line reference	
392 393	$AGB_{bsl,j,t}$	Aboveground biomass carbon stocks in the baseline reference area in p $\mathrm{CO}_2\mathrm{e}/\mathrm{ha}$	lot j at time t; t	
394 395	AGB <sub>bsl,j,t-x</sub>	Aboveground biomass carbon stocks in the baseline reference area in $\ensuremath{p}$ CO_2e/ha	lot j at time t-x; t	
396	j	1, 2, 3 n sample plots		
397	х	Number of years in monitoring interval; years		

399

Step 2

400 If  $\Delta AGB_{wp,t}$  is not equal to  $\Delta AGB_{bsl,t}$  (significantly different using an unpaired t test at P <0.05), then net 401 emissions from aboveground biomass carbon are equal to the difference in stock change between the 402 baseline reference site and the project area. Note that this term can be less than zero, where growth in 403 the project area exceeds that in the baseline reference site, e.g., due to tree and shrub planting efforts 404 conducted as part of the project activity. 405  $Net\Delta AGB_{wp,t} = ((\Delta AGB_{bsl,t} + UNC_{\Delta AGB, bsl,t}) - (\Delta AGB_{wp,t} - UNC_{\Delta AGB, wp,t})) * (A - A_{burn_{unint}, wp,t})$ 406 407 Equation 7 408 409 Where: 410 Annual net change in aboveground biomass carbon stocks in the project area in Net∆AGB<sub>wp,t</sub> monitoring interval ending in year t; t CO<sub>2</sub>e yr<sup>-1</sup> 411 412  $\Delta AGB_{wp,t}$ Mean annual change in aboveground biomass carbon stocks in the project area in 413 monitoring interval ending in year t; t CO<sub>2</sub>e ha<sup>-1</sup> yr<sup>-1</sup> 414  $\Delta AGB_{bsl,t}$ Mean annual change in aboveground biomass carbon stocks in the baseline reference area in monitoring interval ending in year t; t CO<sub>2</sub>e ha<sup>-1</sup> yr<sup>-1</sup> 415 416 Half width of 90% confidence interval exceeding 10% of the mean annual change in UNC<sub>∆AGB,wp,t</sub> 417 aboveground biomass carbon stocks in the project area in monitoring interval ending in year t; t CO<sub>2</sub>e ha<sup>-1</sup> yr<sup>-1</sup> 418 419 UNC<sub>AAGB,bsl,t</sub> Half width of 90% confidence interval exceeding 10% of the mean annual change in 420 aboveground biomass carbon stocks in the baseline reference area in monitoring interval ending in year t; t CO<sub>2</sub>e ha<sup>-1</sup> yr<sup>-1</sup> 421 422 А Project area; ha 423 Area of unintentional burn in the project area occurring in monitoring interval ending in Aburn unint, wp, t 424 year t; ha 425 t 1, 2, 3, ... t years elapsed since the project start date 426 If  $\triangle AGB_{wp,t}$  is not significantly different than  $\triangle AGB_{bsl,t}$ , then 427 428  $Net\Delta AGB_{wp,t}=0$ 

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## 430 **C.2.3 Emissions from fire in the project**

#### 431 Unintentional burns

432 Where unintentional burns occur in the project area, emissions from those burns are assumed, 433 conservatively, to be equal in the project and baseline scenarios. Emissions from unintentional burns in the project area are excluded from accounting by delineating the area of the burn, parameter Aburn unint, wp.t, 434 435 consulting aerial imagery and assigning zero net emissions to the area for the monitoring interval spanning 436 the burn (i.e. from the monitoring event immediately prior to the burn to the monitoring event immediately after the burn); see equations 2 and 4 above. Plans for intentional burns (e.g. prescribed 437 438 burns) in the project area, that predate their implementation, must be recorded in management records 439 to distinguish unintentional burns (on the absence of management records). Any sample plots/points for 440 surface elevation and/or aboveground biomass located within the area of an unintentional burn in the project area, will not be used to calculate net change in surface elevation, ΔSE<sub>wp,t</sub>, or change in 441 442 above ground biomass stocks,  $\Delta AGB_{wp,t}$ , in the project area for the monitoring interval spanning the burn 443 (i.e. from the monitoring event immediately prior to the burn to the monitoring event immediately after 444 the burn). Note that if an unintentional burn has occurred, the first monitoring event following the fire 445 must occur after completion of the first growing season following the fire.

446

#### 447 Intentional burns

448 Emissions from the belowground and aboveground biomass pools resulting from intentional burns in the

449 project are captured through monitoring parameters ΔSE<sub>wp,t</sub> and ΔAGB<sub>wp,t</sub>. referencing measurements

450 collected at all sample plots/points for surface elevation and/or aboveground biomass located within the

451 project area.

453	
454	
455	
456	
457	
458	
459	
460	
461	D.
462	Flux approach:
463	Baseline and with-project scenarios
464	

## 465 **D.1 Baseline Accounting**

466			
467	$GHG_{BSL,t} = \Delta BG_{f}$	lux_bsl,t	Equation 8
468			
469	Where:		
470 471	GHG <sub>BSL,t</sub>	Annual greenhouse gas emissions in the baseline in monitoring interval $CO_2e\ yr^{-1}$	ending in year t; t
472 473 474	$\Delta BG_{flux\_bsl,t}$	Annual emissions from the soil organic carbon and belowground biomas and net emissions from herbaceous biomass using the flux method in the scenario in monitoring interval ending in year t; t CO <sub>2</sub> e yr <sup>-1</sup>	ss and litter pools le baseline
475			
476 477 478	Note that chan parameter ΔAB project change	ge in above- and belowground biomass carbon stocks in the baseline is a GB <sub>wp</sub> (derived in Section D.2.2 below) which represents the net of baseliss in above- and belowground biomass carbon stocks.	accounted in ine and with
479			
480			
481	D.1.1 Em	issions from belowground in the baseline	
482			
483 484 485 486 487 488	Emissions from emission inferr organic carbon respiration) fro baseline refere parameter ΔAB	belowground are estimated as a function of one or more proxy variable ed from the proxy variable(s), $\Delta BG_{flux\_bsl}$ , covers emissions (due to respira , belowground biomass and litter and net emissions (due to sequestration m herbaceous biomass. Sequestration via accretion of peat/litterfall is n nce site. Sequestration in belowground (root) biomass is assessed separ GBwp.	es. Note that the ation) from soil on and nonitored in a ately, as part of
489			
490	$\Delta BG_{flux_{bsl,t}} = f_t$ (	Proxy A <sub>bsl,t</sub> , Proxy B <sub>bsl,t</sub> )* A - Acc <sub>bsl,t</sub>	Equation 9
491	Where:		
492 493 494	$\Delta BG_{flux\_bsl}$	Emissions from the soil organic carbon and belowground biomass and li emissions from herbaceous biomass using the flux method in the baseli time t: t $CO_2e$ yr <sup>-1</sup>	itter pools and net ne scenario at

495 496 497 498	$f_{ m t}$ (Proxy A <sub>bsl,t</sub> , I	Proxy B <sub>bsl,t</sub> ,)	Regression equation correlating one or more emissions from the soil organic carbon and b litter pools and net emissions from herbaceou ha <sup>-1</sup> yr <sup>-1</sup>	e proxy variables to elowground biomass and us at time t; output in t CO2e
499	Proxy A <sub>bsl,t</sub>	Mean value of	proxy variable A in the baseline at time t; unit	s unspecified
500	Proxy B <sub>bsl,t</sub>	Mean value of	proxy variable B in the baseline at time t; unit	s unspecified
501	etc			
502	A	Project area; h	а	
503 504	Acc <sub>bsl,t</sub>	Sequestration the baseline	in the belowground pool via peat accretion/litte e scenario in year t; t CO₂e yr⁻¹ (if applicable)	rfall using the flux method in
505				
506 507	Note that the c root mean squa	output of the reg ared error (RMS	ression equation incorporates uncertainty, de E) of the regression (see parameter table).	rived in proportion to the
508				
509 510 511	The proxy varia area, or modele variable(s), the	able(s) can be eit ed in the project model(s) must l	ther measured in a valid baseline reference sit t area. If using a model (e.g. a hydrologic mode be:	e, measured in the project el) to estimate the proxy
512	1. Peer-re	eviewed		
513 514 515	<ol> <li>Empirio</li> <li>Incorpo precipi</li> </ol>	cally-based orate one or mo tation)	re driver variables that are monitored ex post	in the project area (e.g.
516 517	The value(s) of confidence inte	parameter(s) Pr erval exceeds 10	roxy A <sub>bsl,t</sub> etc. incorporate uncertainty where th % of the mean value (see parameter table).	he half width of the 90%
518				
519 520 521	Note that the c unintentional fir cannot exceed	cumulative emise res in the project the total initial si	sions over time from $\Delta BG_{flux_{bsl}}$ , from both soil representations area (assumed to occur equally in the baselin tock in that pool, $BG_{wp,t=0}$ , derived below.	espiration and from e and project scenarios),
522				
523	$BG_{wp,t=0} = A * PI$	D <sub>wp,t=0</sub> * 10,000 *	* BD <sub>wp,t=0</sub> * C% <sub>soil</sub> * 44/12	Equation 10
524	Where:			
525	BG <sub>wp,t=0</sub>	Total stocks	in the soil organic carbon and belowground bi	omass and litter pools in the

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526		project area at time t=0; t CO₂e
527	PD <sub>wp,t=0</sub>	Mean peat depth in the project area at time t=0; m
528	BD <sub>wp,t=0</sub>	Mean dry bulk density in the project area at time t=0; g cm <sup>-3</sup>
529	%C <sub>soil</sub>	Percentage of soil organic C; %
530	44/12	Ratio of molecular weight of CO <sub>2</sub> to carbon, t CO <sub>2</sub> -e t C <sup>-1</sup>
531	А	Project area; ha
532	t	1, 2, 3, t years elapsed since the project start date
533	10,000	Converts result to units of metric tons
534		
535	Therefore,	
536	if	
537	$\sum_{t=0}^{t} \Delta BG_{flux_{bsl},t}$	+ $\sum_{t=0}^{t} \Delta BG_{burn\_unint,wp,t} > BG_{wp,t=0}$
538 539 540	Then, if	
541	$BG_{wp,t=0} - \sum_{t=1}^{t}$	$\sum_{0}^{-1} \Delta BG_{\text{flux}_{\text{bsl}},t} - \sum_{t=0}^{t-1} \Delta BG_{\text{burn}_{\text{unint},\text{wp},t}} > 0$
542 543 544	Then	
545 546	$\Delta BG_{flux_{bsl},t} = BG_{flux_{bsl},t}$	$G_{wp,t=0} - \sum_{t=0}^{t-1} \Delta BG_{flux_{bsl},t} - \sum_{t=0}^{t-1} \Delta BG_{burn\_unint,wp,t}$
547 548	Otherwise para	meter $\Delta BG_{flux_{bsl,t}}$ is equal to zero.
549 550	Parameter ∆BG scenario in yea	G <sub>burn_unint,wp,t</sub> , emissions from soil organic carbon from unintentional fire in the project r t, is derived in Section 5.2.3 below.
551		
552	Accretion/litterfa	all
553 554 555	Sequestration i reference site u accounting.	n the belowground pool is estimated from accretion/litterfall, monitored in a baseline using a soil horizon marker. Note that it is optional to include this parameter in
556		

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557	$Acc_{bsl,t} = (A - A_{burn\_unint,t}) * \Delta SE_{Acc,bsl} * (1/x) * 10 * BD_{wp,t} * C_{soil,wp} * 44/12$ Equation 11				
558	Where:				
559 560	Acc <sub>bsl,t</sub>	Annual sequestration in the belowground pool via peat accretion/litter method in the baseline scenario in monitoring interval ending in year t	all using the flux ; t CO₂e yr⁻¹		
561 562	$\Delta SE_{Acc,bsl,t}$	Mean surface elevation change due to accretion/litterfall in the base site in monitoring interval ending in year t; mm	line reference		
563	BD <sub>wp,,t</sub>	Mean dry bulk density in the project area at time t; g cm <sup>-3</sup>			
564	%C <sub>soil,wp</sub>	Percentage of soil organic C in the project area; %			
565	44/12	Ratio of molecular weight of CO <sub>2</sub> to carbon, t CO <sub>2</sub> -e t C <sup>-1</sup>			
566	A	Project area; ha			
567 568	Aburn_unint,t	Area of unintentional burn in the project area occurring in monitoring in year t; ha	nterval ending in		
569	t	1, 2, 3, t years elapsed since the project start date			
570	x	Number of years in monitoring interval; years			
571	10	Converts result to units of metric tons			
572					
573 574 575	The surface elevat must be monitore the half width of t	ion change due to accretion/litterfall, $\Delta SE_{Acc,bsl,t}$ , and dry bulk density, d in the baseline reference site. Parameter $\Delta SE_{Acc,bsl,t}$ incorporates unc he 90% confidence interval exceeds 10% of the mean value (see parameter $\Delta SE_{Acc,bsl,t}$ )	BD <sub>bsl,t</sub> , terms ertainty where neter table).		
576					
577					
578					
579	D.2 Wit	h-project Accounting			
580					
581	$GHG_{WP,t} = \Delta BG_{flux_v}$	$v_{p,t} + Net\Delta ABGB_{wp,t} + \Delta BG_{burn_int,wp,t}$	Equation 12		
582					
583	Where:				

584 585	GHG <sub>WP,t</sub>	Annual greenh CO₂e yr⁻¹	nouse gas emissions in the project in monitoring interva	al ending in year t; t
586 587 588	$\Delta BG_{flux\_wp,t}$	Annual emission and net emission monitoring interesting the second secon	ons from the soil organic carbon and belowground bior ions from herbaceous biomass using the flux method in erval ending in year t; t CO <sub>2</sub> e yr <sup>-1</sup>	nass and litter pools າ the project in
589 590	$Net\Delta ABGB_{wp,t}$	Annual net cha monitoring inte	ange in above- and belowground biomass carbon stoc erval ending in year t; t CO2e yr <sup>-1</sup>	ks in the project in
591 592	$\Delta BG_{burn_int,wp,t}$	Emissions fron tCO2-e yr <sup>-1</sup>	n soil organic carbon from intentional fire in the proje	ct scenario in year t;
593				
594				
595	D.2.1 Em	issions fro	om belowground in the project	
596				
597 598 599 600 601 602 603	Emissions fron emission infer organic carbor respiration) fro project area. S ΔABGB <sub>wp</sub> .	n belowground a red from the pro n, belowground l om herbaceous l equestration in	are estimated as a function of one or more proxy varia bxy variable(s), ΔBG <sub>flux_bsl</sub> , covers emissions (due to res biomass and litter and net emissions (due to sequestra biomass. Sequestration via accretion of peat/litterfall i belowground (root) biomass is assessed separately, as	bles. Note that the piration) from soil ation and is monitored in the s part of parameter
604	$\Delta BG_{flux_wp,t} = f_t$ (	Proxy A <sub>wp,t</sub> , Pro	xy B <sub>wp,t,</sub> ) * A-Acc <sub>wp,t</sub>	Equation 13
605	Where:			
606 607	$\Delta BG_{flux\_wp,t}$	Change in the flux method in	soil organic carbon and belowground biomass and litte the project in year t; t CO <sub>2</sub> e yr <sup>-1</sup>	er pools using the
608 609 610 611	$f_{ m t}$ (Proxy A <sub>bsl,t</sub> ,	Proxy B <sub>bsl,t,</sub> )	Regression equation correlating on or more proxy version from the soil organic carbon and belowground bioma and net emissions from herbaceous biomass at time ha <sup>-1</sup> yr <sup>-1</sup>	ariables to emissions iss and litter pools t; output in t CO2e
612	Proxy A <sub>wp,t</sub>	Mean value of	proxy variable A in the project area at time t; units ur	specified
613	Proxy B <sub>wp,t</sub>	Mean value of	proxy variable B in the project area at time t; units ur	specified
614	etc			

615 A Project area; ha	15 A	Project area; ha
------------------------	------	------------------

616Accwp,tSequestration in the belowground pool via peat accretion/litterfall using the flux method in617the project scenario in year t; t CO2e yr-1

618

619 Note that the output of the regression equation incorporates uncertainty, derived in proportion to the 620 root mean squared error (RMSE) of the regression (see parameter table).

621 The proxy variable(s) must be monitored in the project area. The value(s) of parameter(s) Proxy A<sub>wp,t</sub> etc.

622 incorporate uncertainty where the half width of the 90% confidence interval exceeds 10% of the mean

623 value (see parameter table).

624

As for the baseline, cumulative emissions over time from  $\Delta BG_{flux_wp}$ , from both soil respiration and from

unintentional and intentional fires in the project area, cannot exceed the total initial stock in that pool,

627 BG<sub>wp,t=0</sub>, derived above.

628 Therefore,

629 if

630 
$$\sum_{t=0}^{t} \Delta BG_{flux_{wp},t} + \sum_{t=0}^{t} \Delta BG_{burn\_unint,wp,t} + \sum_{t=0}^{t} \Delta BG_{burn\_int,wp,t} > BG_{wp,t=0}$$

631

632 Then, if

Then

633

$$634 \qquad BG_{wp,t=0} - \sum_{t=0}^{t-1} \Delta BG_{flux_{wp},t} - \sum_{t=0}^{t-1} \Delta BG_{burn\_unint,wp,t} - \sum_{t=0}^{t-1} \Delta BG_{burn\_int,wp,t} > 0$$

- 635
- 636 637

638  $\Delta BG_{flux_{wp},t} = BG_{wp,t=0} - \sum_{t=0}^{t-1} \Delta BG_{flux_{wp},t} - \sum_{t=0}^{t-1} \Delta BG_{burn\_unint,wp,t} - \sum_{t=0}^{t-1} \Delta BG_{burn\_int,wp,t}$ 

639

 $640 \qquad \text{Otherwise parameter } \Delta BG_{flux\_wp,t} \text{ is equal to zero.}$ 

641

642 Parameters  $\Delta BG_{burn_int,wp,t}$ , emissions from soil organic carbon from intentional fire in the project

scenario in year t, and  $\Delta BG_{burn\_unint,wp,t}$ , emissions from soil organic carbon from unintentional fire in the

644 project scenario in year t, are derived in Section 5.2.3 below.

645

646

648	Accretion/litterfall		
649 650	Sequestration in the belowground pool is estimated from accretion/litterfall, monitored using a soil horizon marker. Note that it is optional to include this parameter in accounting.		
651			
652	Acc <sub>wp,t</sub> = (A - A <sub>burr</sub>	$\Delta_{\text{unint},t}$ * $\Delta SE_{\text{Acc,wp}}$ * (1/x) * 10 * BD <sub>wp,,t</sub> * C% <sub>soil,wp</sub> * 44/12 Equation 14	
653	Where:		
654 655	Acc <sub>wp,t</sub>	Annual sequestration in the belowground pool via peat accretion/litterfall using the flux method in the project scenario in monitoring interval ending in year t; t CO <sub>2</sub> e yr <sup>-1</sup>	
656 657	$\Delta SE_{Acc,wp,t}$	Mean surface elevation change due to accretion/litterfall in the project in monitoring interval ending in year t; mm	
658	BD <sub>wp,t</sub>	Mean dry bulk density in the project area at time t; g cm <sup>-3</sup>	
659	%C <sub>soil</sub>	Percentage of soil organic C in the project area; %	
660	44/12	Ratio of molecular weight of CO <sub>2</sub> to carbon, t CO <sub>2</sub> -e t C <sup>-1</sup>	
661	A	Project area; ha	
662 663	$A_{burn\_unint,t}$	Area of unintentional burn in the project area occurring in monitoring interval ending in year t; ha	
664	t	1, 2, 3, t years elapsed since the project start date	
665	x	Number of years in monitoring interval; years	
666	10	Converts result to units of metric tons	
667			
668 669 670	The surface elevation change due to accretion/litterfall, $\Delta SE_{Acc,wp,t}$ , and dry bulk density, BD <sub>wp,t</sub> , terms must be monitored in the project area. Parameter $\Delta SE_{Acc,wp,t}$ incorporates uncertainty where the half width of the 90% confidence interval exceeds 10% of the mean value (see parameter table).		
671			

# D.2.2 Emissions from above- and belowground biomass in the project

Emissions from above- and belowground biomass (in trees and shrubs) in the project, Net $\Delta$ ABGB<sub>wp</sub>, represent net emissions from above- and belowground biomass (i.e. net of baseline and with project) 677 resulting from stock change in the project case relative to a baseline reference site. This term is set equal

to zero if there is no significant difference in stock change between the project and the baseline reference

679 site.

680 Step 1

681 Measure change in stocks of above- and belowground biomass in the project area and in a baseline

reference site. Stock change in above- and belowground biomass is measured on permanent sample
 plots, and represents the net of biomass increment, recruitment and mortality.

684 Note that in this treatment emissions due to mortality of belowground biomass (coarse roots) are

double counted, as they are also included in the term, ΔBG<sub>flux</sub>. This treatment is conservative, as

emissions from die-off of root biomass are expected to be greater in the project (flooded) scenario, than

in the baseline, and importantly, simplifies monitoring and accounting (i.e. avoids the need to separately

688 track belowground biomass increment, recruitment and mortality).

689 Calculate mean annual change in stocks of above- and belowground biomass in the project area,

690  $\triangle ABGB_{wp}$ , and in a baseline reference site,  $\triangle ABGB_{bsl}$ .

691

692 
$$\Delta ABGB_{wp,t} = \left(\frac{1}{n}\right) * \sum_{j=1}^{n} \left( (ABGB_{wp,j,t} - ABGB_{wp,j,t-x}) * \left(\frac{1}{x}\right) \right)$$
Equation 15

693

- 694 Where,
- 695 $\Delta ABGB_{wp,t}$ Mean annual change in above- and belowground biomass carbon stocks in the project696area in monitoring interval ending in year t; t CO2e ha<sup>-1</sup> yr<sup>-1</sup>
- 697ABGBwp,j,tAbove- and belowground biomass carbon stocks in the project area in plot j at time t; t698CO2e ha-1
- 699ABGBwp,j,t-xAbove- and belowground biomass carbon stocks in the project area in plot j at time t-x; t700CO2e ha<sup>-1</sup>

701 j 1, 2, 3 ... n sample plots

702 x Number of years in monitoring interval; years

703

704

705

707
$$\Delta ABGB_{boll,t} = \left(\frac{1}{n}\right) * \sum_{j=1}^{n} ((ABGB_{boll,j,t} - ABGB_{boll,j,t-x}) * (\frac{1}{x}))$$
Equation 16708709Where:710 $\Delta ABGB_{boll,t}$ Mean annual change in above- and belowground biomass carbon stocks in the baseline  
reference area in monitoring interval ending in year t; t  $CO_{2}e ha^{-1} yr^{-1}$ 712 $ABGB_{boll,t}$ Above- and belowground biomass carbon stocks in the baseline reference area in plot j  
at time t; t  $CO_{2}e ha^{-1}$ 718 $ABGB_{boll,t}$ Above- and belowground biomass carbon stocks in the baseline reference area in plot j  
at time t; t  $CO_{2}e ha^{-1}$ 714 $ABGB_{boll,t,x}$ Above- and belowground biomass carbon stocks in the baseline reference area in plot j  
at time t-x; t  $CO_{2}e ha^{-1}$ 716j1, 2, 3 ... n sample plots717xNumber of years in monitoring interval; years718719Step 2719Step 2719ff  $AABGB_{wp,t}$  is not equal to  $\Delta ABGB_{boll,t}$  (significantly different using a unpaired t test at P <0.05), then net  
emissions from above- and belowground biomass carbon are equal to the difference in stock change  
between the baseline reference site and the project area. Note that this term can be less than zero,  
where growth in the project area exceeds that in the baseline reference site, e.g. due to tree and shrub  
planting efforts conducted as part of the project atcivity.725Net $\Delta ABGB_{wp,t} = ((\Delta ABGB_{bol,t} + UNC_{\Delta ABGB,bol,t}) - (\Delta ABGB_{wp,t} - UNC_{\Delta ABGB,wp,t})) *( $(A - A_{burn_min,t})$   
Equation 17726Where:727Net $\Delta ABGB_{wp,t}$ 728Mean annual change in above- and belowground bi$ 

734 $\Delta ABGB_{bsl,t}$ Mean annual change in above- and belowground biomass carbon stocks in the baseline735reference area in monitoring interval ending in year t; t CO<sub>2</sub>e ha<sup>-1</sup> yr<sup>-1</sup>

736 737 738	UNC∆ABGB,wp,t	Half width of 90% confidence interval exceeding 10% of the mean annual change in above- and belowground biomass carbon stocks in the project area at time t; t $CO_2e$ ha <sup>-1</sup> yr <sup>-1</sup>	
739 740 741	<b>UNC</b> <sub>AABGB,bsl,t</sub>	Half width of 90% confidence interval exceeding 10% of the mean annual change in above- and belowground biomass carbon stocks in the baseline reference area at time t; t $CO_2e$ ha <sup>-1</sup> yr <sup>-1</sup>	
742	A	Project area; ha	
743 744	$A_{burn\_unint,t}$	Area of unintentional burn in the project area occurring in monitoring interval ending in year t; ha	
745	t	1, 2, 3, t years elapsed since the project start date	
746			
747	If $\Delta ABGB_{wp,t}$ is not significantly different than $\Delta ABGB_{bsl,t}$ , then		
748	$Net\Delta ABGB_{wp,t}=0$		
749			
750			

## 751 **D.2.3 Emissions from fire in the project**

752 Unintentional burns

753 Where unintentional burns occur in the project area, emissions from those burns are assumed, 754 conservatively, to be equal in the project and baseline scenarios.

755 Net emissions from the above- and belowground biomass pool, and from accretion, resulting from unintentional burns in the project area are excluded from accounting by delineating the area of the burn, 756 757 parameter A<sub>burn unint</sub>, consulting aerial imagery; see equations 11, 14 and 17 above. Plans for intentional 758 burns (e.g. prescribed burns) in the project area, that predate their implementation, must be recorded in 759 management records to distinguish unintentional burns (on the absence of management records). Any 760 sample points/plots for peat accretion/litterfall and above- and belowground biomass located within the area 761 of an unintentional burn in the project area, will not be used to calculate mean surface elevation change 762 due to accretion/litterfall,  $\Delta SE_{Acc,wp,t}$  and change in above- and belowground biomass stocks,  $\Delta ABGB_{wp,t}$ , in 763 the project area for the monitoring interval spanning the burn (i.e. from the monitoring event immediately 764 prior to the burn to the monitoring event immediately after the burn). Note that if an unintentional burn 765 has occurred, the first monitoring event following the fire must occur after completion of the first growing 766 season following the fire. Emissions from the belowground pool,  $\Delta BG_{flux_wp,t}$ , estimated applying a 767 regression based on flux chamber measurements, do not consider the emissions from fire and are 768 calculated for the entire project area, using all proxy variable data, as usual.

769 770 771 772 773 774 775 776 777	Although emissions from unintentional fire are excluded from accounting, peat emissions from unintentional fire are tracked to update the threshold on emissions from the belowground pool; equations 10 and 13 above. Emissions from belowground (due to oxidation of peat) from unintentional burns, $\Delta BG_{burn\_unint,wp,t}$ , are monitored by sampling surface elevation of peat in the burned area, $A_{burn\_unint,wp,t}$ , and areas outside the burned area , after the burn takes place, to assess the depth of peat removed by the fire. Parameter $\Delta SE_{burn\_unint,wp,t}$ incorporates uncertainty where the half width of the 90% confidence interval exceeds 10% of the mean value (see parameter table).		
778			
779	Where:		
780 781	$\Delta BG_{burn\_int,wp,t}$	Emissions from soil organic carbon from intentional fire in the project scenario in year t; $tCO_2$ -e	
782 783	$\Delta SE_{burn\_unint,wp,t}$	Mean surface elevation change due to unintentional fire in the project area at time t; mm	
784	BD <sub>wp,t-x</sub>	Mean dry bulk density in the project area at time t-x; g $cm^{-3}$	
785	CF	Combustion factor for peatlands (IPCC 2006GL) = 0.5; dimensionless	
786 787	EF *	Emission factor for all temperate ecosystems (IPCC 2006GL) = 1.569; t CO <sub>2</sub> e emitted t dry matter burned <sup>-1</sup>	
788 789	$A_{burn\_unint,wp,t}$	Area of unintentional burn in the project area occurring in monitoring interval ending in year t; ha	
790	t	1, 2, 3, t years elapsed since the project start date	
791	10	Converts result to units of metric tons	

- 792
- 793 Intentional burns

Net emissions from the belowground (due to reduced accretion/litterfall rate) and above- and belowground biomass pools resulting from intentional burns in the project are captured through monitoring parameters  $\Delta SE_{Acc,wp,t}$  and  $\Delta ABGB_{wp,t}$ . referencing measurements collected at all sample plots/points for surface elevation and/or above- and belowground biomass located within the project area.

Emissions from belowground (due to oxidation of peat) from intentional burns, ΔBG<sub>burn\_int,wp,t</sub>, are
 monitored by sampling the planned burn area, using temporary surface level markers to assess emission

801 802 803	of peat. Peat level is assessed from the markers immediately prior to and after the burn takes place. The actual intentional burned area, A <sub>burn_int,wp,t</sub> , is determined after the burn takes place by consulting aerial imagery.		
804 805	Parameter $\Delta SE_{bu}$ exceeds 10% of t	<sub>rn_int,wp,t</sub> incorporates uncertainty where the half width of the 90% confidence interval the mean value (see parameter table).	
806			
807	$\Delta BG_{burn_int,wp,t} = A$	$burn_{int,wp,t} * - \Delta SE_{burn_{int,wp,t}} * 10 * BD_{wp,t-x} * CF * EF $ Equation 19	
808			
809	Where:		
810 811	$\Delta BG_{burn\_int,wp,t}$	Emissions from soil organic carbon from intentional fire in the project scenario in year t; $tCO_2$ -e	
812 813	$\Delta SE_{burn\_int,wp,t}$	Mean surface elevation change due to intentional fire in the project area at time t; mm	
814	BD <sub>wp,t-x</sub>	Mean dry bulk density in the project area at time t-x; g cm <sup>-3</sup>	
815	CF	Combustion factor for peatlands (IPCC 2006GL) = 0.5; dimensionless	
816 817	EF 1	Emission factor for all temperate ecosystems (IPCC 2006GL) = 1.569; t CO <sub>2</sub> e emitted * t dry matter burned <sup>-1</sup>	
818	Aburn_int,wp,t	Actual (not planned) area of intentional burn in the project area in year t; ha	
819	t	1, 2, 3, t years elapsed since the project start date	
820	10	Converts result to units of metric tons	
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832	DATA AND PARAMETERS
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## 834 Data and Parameters Available at Validation

#### 835

Data / Daramatar	A
Data / Parameter	A
Data unit	Hectare (ha)
Description	Project area
Justification of choice of data	Delineation of the project area may use a combination of GIS
or description of measurement	coverages, ground survey data, remote imagery (satellite or
methods and procedures	aerial photographs), or other appropriate data.
applied	
Treatment of uncertainty	Any imagery or GIS dataset must be georegistered referencing
	corner points, clear land marks, or other intersection points.
Comments	None

Data / Parameter	%C <sub>soil_wp</sub>
Data unit	%
Description	Percentage of soil organic C
Justification of choice of data or description of measurement methods and procedures applied	<ul> <li>Percentage of soil organic C</li> <li>Soil carbon shall be determined for an aggregate sample (e.g., from 4 systematically-distributed 10 cm cores or auger samples) collected within a sample plot located within the project area. This sample shall be thoroughly mixed and sieved through a 2 mm sieve to remove all non-organic material &gt; 2 mm.</li> <li>Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance-specific, sampling, measurement and estimation (e.g., allometric equations) procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness.</li> <li>Stratification may be employed to improve precision, but is not required. Estimates generated must:</li> <li>1. Be demonstrated to be un-biased and derived from representative sampling</li> <li>2. Sampling error quantified with 90% confidence</li> <li>3. Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)</li> <li>Determination of the soil organic carbon fraction (or percent soil organic carbon) should follow established laboratory procedures, such as those found in:</li> <li>Nelson, D.W., and L.E. Sommers. 1982. Total carbon, organic carbon, and organic matter. p. 539–580. In A.L. Page et al. (ed.) Methods of soil Analysis. Part 2. 2nd ed. Agron. Monogr.</li> <li>9. ASA and SSSA, Madison, WI.</li> </ul>
	organic carbon (TOC) in soils and sediments. U.S.

	Environmental Protection Agency, Washington, DC, EPA/600/R-02/069 (NTIS PB2003-100822), 2002.
Treatment of uncertainty	None
Comments	The soil organic carbon fraction is sampled prior to validation and shall be used in both the baseline and with project scenario for the length of the project. Used in stock change approach only.

Data / Parameter $f_{tt}$ (Proxy At, Proxy Bt,)         Data unit       output in t CO <sub>2</sub> e ha-1 yr-1         Description       Regression equation correlating one or more proxy v emissions from the soil organic carbon and below/org	
Data unit         output in t CO2e ha-1 yr-1           Description         Regression equation correlating one or more proxy we missions from the soil organic carbon and belowers	
Description Regression equation correlating one or more proxy we emissions from the soil organic carbon and below/org	
biomass and litter pools and net emissions from herb	variables to ound baceous
Justification of choice of data or description of measurement methods and procedures applied The flux approach may be employed where a regres equation correlating one or more proxy variables to belowground emissions meeting the following applica conditions is available: 1. Peer-reviewed 2. Empirically-based – specifically, derived from flux studies 3. Flux chambers capture gas exchange from the soi carbon, belowground biomass, litter and herbaceous pools 4. Relationship between proxy variable and emission significant at P < 0.05 and unbiased (i.e., with minim residuals) 5. The study site from which proxy relationship deve must be on pocosins or former pocosins (as defined A1); 6. Relationship incorporates one or more proxy varia are: a. measured ex post in the project area (e.g. precipit temperature), and/or c. modeled in the project area on the basis of driver v monitored ex post in the project area (e.g. water tabl from monitored precipitation) 7. Uncertainty in predicted emissions (dependent var known and calculated as the root mean squared error The same relationship must be used in both the proj baseline cases. The regression may be revised base data, provided it meets the above requirements.	chamber il organic svegetation ns must be hal trend in eloped t in Section ables that te, tation, variables le modeled triable) is for (RMSE) fect and ed on new

Treatment of uncertainty	The output of the regression equation incorporates uncertainty where the half width of the (approximate) 90% confidence interval exceeds 10% of the predicted value, by: In the baseline scenario, subtracting from the predicted dependent variable value the following term: root mean squared error (RMSE) of the regression * 1.67 minus 10% of the dependent variable value. In the project scenario, adding to the predicted dependent variable value the following term: RMSE of the regression * 1.67 minus 10% of the dependent variable value
Comments	If the value of any proxy variable is outside the range of values for which the relationship with emissions was determined, the emission value is set equal to the corresponding lowest or highest estimated emission value for that range. Used in flux approach only.

Data / Parameter	PD <sub>wp,t=0</sub>
Data unit	Meter (m)
Description	Mean peat depth in the project area at time t=0
Justification of choice of data or description of measurement methods and procedures applied	Peat depth is measured in the project area using line transects whereby peat depth is measured at an approximate predetermined interval (e.g., 200 m). Peat depth is determined by inserting a depth rod (or series of connected depth rods) until mineral soil/bedrock is reached/the rod meets firm resistance. A minimum of two depths should be taken at each sampling point at least 1 m apart.
	Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance- specific, sampling, measurement and estimation procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness. Stratification may be employed to improve precision, but is not required. Estimates generated must: 1. Be demonstrated to be un-biased and derived from representative sampling 2. Sampling error quantified with 90% confidence 3. Peat depth shall be measured at a minimum of 20 different points. 4. Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)
Treatment of uncertainty	None
Comments	Used in flux approach only. Peat depth is used to determine a cap on potential emissions when utilizing the flux method. As such, peat depth is sampled prior to validation and may be used for the length of the project.

## 841 Data and Parameters Monitored

Data / Parameter	Aburn_int,wp,t
Data unit	На
Description	Actual (not planned) area of intentional burn in the project area in year t
Description of measurement methods and procedures to be	Monitored in project area via aerial imagery and management records.
applied	The actual intentional burned area, A <sub>burn_int,wp,t</sub> , is determined after the burn takes place by consulting aerial imagery.
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years, or following a fire.
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Any imagery or GIS dataset must be georegistered referencing corner point, clear land marks, or other intersection points.
Calculation method	Not applicable
Treatment of uncertainty	It is assumed that area bounds are known exactly.
Comments	Used in flux approach only.

Data / Parameter	Aburn_unint,t
Data unit	ha
Description	Area of unintentional burn in the project area occurring in monitoring interval ending in year t
Description of measurement methods and procedures to be applied	Monitored in project area via aerial imagery and management records.
	The actual unintentional burned area, A <sub>burn_unint,t</sub> , is determined after the burn takes place by consulting aerial imagery. Plans for intentional burns (e.g. prescribed burns) in the project area, that predate their implementation, must be recorded in management records to distinguish unintentional burns (on the absence of management records).
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years, or following a fire.
Monitoring equipment	Not applicable
QA/QC procedures to be applied	Any imagery or GIS dataset must be georegistered referencing corner point, clear land marks, or other intersection points.
Calculation method	Not applicable
Treatment of uncertainty	It is assumed that area bounds are known exactly.
Comments	

Data / Parameter	ABGB <sub>bsl,j,t</sub>
Data unit	t CO <sub>2</sub> e/ha
Description	Above- and belowground biomass carbon stocks in the baseline reference area in plot j at time t

Description of measurement methods and procedures to	Monitored on baseline reference site via direct measurement on permanent sample plots.
	Procedures to monitor biomass carbon stocks, include trees and woody shrubs, shall reference a minimum dbh or basal diameter which is fixed for the project crediting period. The default carbon fraction used to estimate carbon from biomass shall be 0.47 t C t-1 d.m. in line with the IPCC default (IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3).
	<ul> <li>Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance-specific, sampling, measurement and estimation (e.g., allometric equations) procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness.</li> <li>Stratification may be employed to improve precision, but is not required. Estimates generated must: <ol> <li>Be demonstrated to be un-biased and derived from representative sampling</li> <li>Sampling error quantified with 90% confidence</li> <li>Biomass carbon stocks shall be estimated on a minimum of 20 plots.</li> <li>Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)</li> <li>Estimation factors (e.g. allometric equations) are demonstrated to be robust in application to the project circumstances.</li> </ol> </li> </ul>
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years, or following a fire.
Monitoring equipment	Measuring tape, DBH (or diameter) tape
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Calculation method	Not applicable
Treatment of uncertainty	Uncertainty is accounted for in the parameter $UNC_{\Delta ABGB, bsl, t}$
Comments	Used in flux approach only.
	Allometric equations and root to shoot ratios shall be peer reviewed, published in a scientific journal or government publication, relevant for the geographic area where the project occurs, and appropriate for the species/vegetation type found in the project area.

Data / Parameter	ABGBwp,j,t
Data unit	t CO <sub>2</sub> e/ha
Description	Above- and belowground biomass carbon stocks in the project area in plot j at time t
Description of measurement methods and procedures to be applied	Monitored on project area via direct measurement on permanent sample plots.
	Procedures to monitor biomass carbon stocks, include trees and woody shrubs, shall reference a minimum dbh or basal diameter which is fixed for the project crediting period. The default carbon fraction used to estimate carbon from biomass shall be 0.47 t C t-1 d.m. in line with the IPCC default (IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3).
	<ul> <li>Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance-specific, sampling, measurement and estimation (e.g., allometric equations) procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness.</li> <li>Stratification may be employed to improve precision, but is not required. Estimates generated must: <ol> <li>Be demonstrated to be un-biased and derived from representative sampling</li> <li>Sampling error quantified with 90% confidence</li> <li>Biomass carbon stocks shall be estimated on a minimum of 20 plots.</li> <li>Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)</li> </ol> </li> </ul>
	5. Estimation factors (e.g. allometric equations) are demonstrated to be robust in application to the project circumstances.
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Measuring tape, DBH (or diameter) tape
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Calculation method	Not applicable
Treatment of uncertainty	Uncertainty is accounted for in the parameter $UNC_{\Delta ABGB,wp,t}$
Comments	Used in flux approach only.
	Allometric equations and root to shoot ratios shall be peer reviewed, published in a scientific journal or government publication, relevant for the geographic area where the project

occurs, and appropriate for the species/vegetation type found in the project area.
Any sample plots for above- and belowground biomass carbon stocks located within the area of an unintentional burn in the project area, will not be used to calculate $\Delta ABGB_{wp,t}$ in the project area for the monitoring interval spanning the burn (i.e., from the monitoring event immediately prior to the burn to the monitoring event immediately after the burn).

Data / Parameter	AGB <sub>bsl,j,t</sub>
Data unit	t CO <sub>2</sub> e/ha
Description	Aboveground biomass carbon stocks in the baseline reference area in plot j at time t
Description of measurement methods and procedures to be applied	Monitored on baseline reference site via direct measurement on permanent sample plots.
	Procedures to monitor biomass carbon stocks, include trees and woody shrubs, shall reference a minimum dbh or basal diameter which is fixed for the project crediting period. The default carbon fraction used to estimate carbon from biomass shall be 0.47 t C t-1 d.m. in line with the IPCC default (IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3).
	<ul> <li>Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance-specific, sampling, measurement and estimation (e.g., allometric equations) procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness.</li> <li>Stratification may be employed to improve precision, but is not required. Estimates generated must: <ol> <li>Be demonstrated to be un-biased and derived from representative sampling</li> <li>Sampling error quantified with 90% confidence</li> <li>Biomass carbon stocks shall be estimated on a minimum of 20 plots.</li> <li>Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)</li> <li>Estimation factors (e.g. allometric equations) are demonstrated to be robust in application to the project circumstances.</li> </ol> </li> </ul>
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Measuring tape, DBH (or diameter) tape

QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Calculation method	Not applicable
Treatment of uncertainty	Uncertainty is accounted for in the parameter $\text{UNC}_{\Delta\text{AGB,bsl,t}}$
Comments	Used in stock change approach only.
	Allometric equations shall be peer reviewed, published in a scientific journal or government publication, relevant for the geographic area where the project occurs, and appropriate for the species/vegetation type found in the project area.

Data / Parameter	AGB <sub>wp,j,t</sub>
Data unit	t CO <sub>2</sub> e/ha
Description	Aboveground biomass carbon stocks in the project area in plot j at time t
Description of measurement methods and procedures to be applied	<ul> <li>Monitored on project area via direct measurement on permanent sample plots.</li> <li>Procedures to monitor biomass carbon stocks, include trees and woody shrubs, shall reference a minimum DBH or basal diameter which is fixed for the project crediting period. The default carbon fraction used to estimate carbon from biomass shall be 0.47 t C t-1 d.m. in line with the IPCC default (IPCC 2006 INV GLs AFOLU Chapter 4 Table 4.3).</li> <li>Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance-specific, sampling, measurement and estimation (e.g., allometric equations) procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness.</li> <li>Stratification may be employed to improve precision, but is not required. Estimates generated must: <ol> <li>Be demonstrated to be un-biased and derived from representative sampling</li> <li>Sampling error quantified with 90% confidence</li> <li>Biomass carbon stocks shall be estimated on a minimum of 20 plots.</li> <li>Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)</li> <li>Estimation factors (e.g. allometric equations) are demonstrated to be robust in application to the project circumstances.</li> </ol> </li> </ul>

Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Measuring tape, DBH (or diameter) tape
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Calculation method	Not applicable
Treatment of uncertainty	Uncertainty is accounted for in the parameter UNC <sub>ΔAGB,wp,t</sub>
Comments	Used in stock change approach only. Allometric equations shall be peer reviewed, published in a scientific journal or government publication, relevant for the geographic area where the project occurs, and appropriate for the species/vegetation type found in the project area.
	Any sample plots for aboveground biomass carbon stocks located within the area of an unintentional burn in the project area, will not be used to calculate $\triangle AGB_{wp,t}$ in the project area for the monitoring interval spanning the burn (i.e., from the monitoring event immediately prior to the burn to the monitoring event immediately after the burn).

Data / Parameter	BD <sub>wp,t</sub>
Data unit	g cm <sup>-3</sup>
Description	Mean dry bulk density in the project area at time t

Description of measurement methods and procedures to	Monitored in the project area using temporary or permanent sample plots.
ре арршео	Bulk density is defined as the dry weight of the fine soil fraction, litter, and roots of the core divided by the core volume. Bulk density shall be sampled to a depth of 10 cm. Where roots impede coring, cut roots along the outside perimeter of the sampling ring.
	For bulk density determination, sample cores of known volume are collected in the field and oven dried to a constant weight at 105 C (for a minimum of 48 hours). The total sample is then weighed, then any coarse rocky (i.e., non-organic) fragments (>2 mm) are sieved and weighed separately.
	Because coarse (>2mm) rocky fragments occupy space in the soil profile in which carbon is not stored, the volume in the bulk density equation is the volume of the core. Discounting this volume, as in traditional bulk density calculations, would overestimate soil carbon stocks when applied to a volume that does not distinguish between coarse and fine fractions.
	Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance- specific, sampling, measurement and estimation (e.g., allometric equations) procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness. Stratification may be employed to improve precision, but is not required. Estimates generated must: 1. Be demonstrated to be un-biased and derived from representative sampling 2. Sampling error quantified with 90% confidence 3. Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)
Frequency of monitoring/recording	This parameter shall be sampled prior to validation and every ten years.
Monitoring equipment	Bulk density may be sampled using a variety of equipment.
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.

Calculation method	The bulk density of the soil core is estimated as: Where:
	$BD_{sample} = \frac{ODW - RF}{CV}$
	BD <sub>sample</sub> = Bulk density of the < 2 mm fraction, in grams per cubic centimeter (g/cm3)
	ODW = Oven dry mass total sample in grams CV = Core volume in cm3
	RF = Mass of coarse fragments (> 2 mm) in grams
Treatment of uncertainty	None
Comments	

Data / Parameter	Proxy A <sub>bsl,t</sub>
Data unit	units unspecified
Description	Mean value of proxy variable A in the baseline at time t. The proxy variable is a measurable variable that is significantly correlated with belowground GHG emissions.
Description of measurement methods and procedures to be applied	Either monitored via direct measurement in a valid baseline reference site, monitored via direct measurement in the project area, or modeled in the project area (e.g., using a hydrologic model) on the basis of one or more monitored, directly- measured driver variables (e.g., precipitation) in the project area.
	<ul> <li>When using a model (e.g., a hydrologic model) to estimate the proxy variable(s), the model(s) must be:</li> <li>1. Peer-reviewed</li> <li>2. Empirically-based</li> <li>3. Incorporate one or more driver variables that are monitored ex post in the project area (e.g., precipitation)</li> </ul>
	<ul> <li>When the variable is direct measured:</li> <li>Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance-specific, sampling, measurement and estimation procedures for measuring and sampling the proxy variable are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness. Stratification may be employed to improve precision, but is not required. Estimates generated must:</li> <li>1. Be demonstrated to be un-biased and derived from representative sampling</li> <li>2. Sampling error quantified with 90% confidence</li> <li>3. Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)</li> </ul>
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.

Monitoring equipment	Not specified
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Calculation method	Not applicable
Treatment of uncertainty	The value of parameter Proxy A <sub>bsl,t</sub> incorporates uncertainty where the half width of the 90% confidence interval exceeds 10% of the mean value, as: If the parameter is positively correlated with belowground emissions (from soil organic carbon and belowground biomass and litter pools and net emissions from herbaceous), the value is equal to the mean value minus the amount of the half width of the 90% confidence interval exceeding 10% of the mean value. If the parameter is negatively correlated with belowground emissions (from soil organic carbon and belowground biomass and litter pools and net emissions from herbaceous), the value is equal to the mean value plus the amount of the half width of the 90% confidence interval exceeding 10% of the mean value. The 90% confidence interval is calculated referencing sample error (variance) for measured variables, or referencing model error for modeled variables.
Comments	Used in flux approach only.

Data / Parameter	Proxy A <sub>wp,t</sub>
Data unit	units unspecified
Description	Mean value of proxy variable A in the project area at time t. The proxy variable is a measurable variable that is significantly correlated with belowground GHG emissions.
Description of measurement methods and procedures to	Monitored via direct measurement in the project area.
be applied	Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance- specific, sampling, measurement and estimation procedures for measuring and sampling the proxy variable are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness. Stratification may be employed to improve precision, but is not required. Estimates generated must: 1. Be demonstrated to be un-biased and derived from representative sampling 2. Sampling error quantified with 90% confidence 3. Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)

Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Not specified
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Calculation method	Not applicable
Treatment of uncertainty	The value of parameter Proxy A <sub>wp,t</sub> incorporates uncertainty where the half width of the 90% confidence interval exceeds 10% of the mean value, as: If the parameter is positively correlated with belowground emissions (from soil organic carbon and belowground biomass and litter pools and net emissions from herbaceous), the value is equal to the mean value plus the amount of the half width of the 90% confidence interval exceeding 10% of the mean value. If the parameter is negatively correlated with belowground emissions (from soil organic carbon and belowground biomass and litter pools and net emissions from herbaceous), the value is equal to the mean value minus the amount of the half width of the 90% confidence interval exceeding 10% of the mean value. The 90% confidence interval exceeding 10% of the mean value. The 90% confidence interval is calculated referencing sample error (variance).
Comments	Used in flux approach only.

Data / Parameter	$\Delta SE_{Acc,bsl,t}$
Data unit	Millimeters (mm)
Description	Mean surface elevation change due to accretion/litterfall in the baseline reference site in monitoring interval ending in year t
Description of measurement methods and procedures to be applied	Monitored on baseline reference site via direct measurement of permanent points.
	Procedures to monitor surface elevation change due to accretion/litterfall shall use a reference plane, such as a soil horizon or feldspar marker.
	Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance- specific, sampling, measurement and estimation procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness. Stratification may be employed to improve precision, but is not required. Estimates generated must: 1. Be demonstrated to be un-biased and derived from representative sampling 2. Sampling error quantified with 90% confidence
	3. Accuracy of measurements and procedures is ensured

	through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Soil horizon/feldspar marker and measuring device which can accurately measure length in mm.
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Calculation method	For each sample point, change in surface elevation is calculated as measured surface elevation above horizon marker at time t minus measured surface elevation above horizon marker at time t-x (x = length of monitoring interval in years); i.e. net accretion is a positive value. Mean change in surface elevation is calculated from the sample point-level change values. Measurements of surface elevation above horizon marker are made in mm.
Treatment of uncertainty	Parameter value incorporates uncertainty by being calculated as the mean value plus the amount of the half width of the 90% confidence interval exceeding 10% of the mean value.
Comments	Used in flux approach only.

Data / Parameter	ΔSE <sub>Acc,wp,t</sub>
Data unit	mm
Description	Mean surface elevation change due to accretion/litterfall in the
	project in monitoring interval ending in year t

Description of measurement methods and procedures to	Monitored on project area via direct measurement of permanent points.
be applied	Procedures to monitor surface elevation change due to accretion/litterfall shall use a reference plane, such as a soil horizon or feldspar marker.
	Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance- specific, sampling, measurement and estimation procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness. Stratification may be employed to improve precision, but is not required. Estimates generated must: 1. Be demonstrated to be un-biased and derived from representative sampling 2. Sampling error quantified with 90% confidence 3. Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Soil horizon/feldspar marker and measuring device which can
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Calculation method	For each sample point, change in surface elevation is calculated as measured surface elevation above horizon marker at time t minus measured surface elevation above horizon marker at time t-x (x = length of monitoring interval in years); i.e. net accretion is a positive value. Mean change in surface elevation is calculated from the sample point-level change values. Measurements of surface elevation above horizon marker are made in mm.
Treatment of uncertainty	Parameter value incorporates uncertainty by being calculated as the mean value minus the amount of the half width of the 90% confidence interval exceeding 10% of the mean value.
Comments	Used in flux approach only.
	Any sample points for surface elevation located within the area of an unintentional burn in the project area, will not be used to calculate net change in surface elevation due to accretion/litterfall, $\Delta SE_{Acc,wp,t}$ , in the project area for the monitoring interval spanning the burn (i.e., from the monitoring event immediately prior to the burn to the monitoring event immediately after the burn).

Data / Parameter	$\Delta SE_{bsl,t}$
Data unit	mm
Description	Mean net surface elevation change (subsidence + accretion + root expansion/mortality) in the baseline reference site in monitoring interval ending in year t
Description of measurement methods and procedures to be applied	Monitored on baseline reference site via direct measurement of permanent sample points.
	Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance- specific, sampling, measurement and estimation procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness. Stratification may be employed to improve precision, but is not required. Estimates generated must: 1. Be demonstrated to be un-biased and derived from representative sampling
	<ol> <li>Sampling error quantified with 90% confidence</li> <li>Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)</li> </ol>
	The change in surface elevation shall be determined using either RTK (high precision) GPS , Rod Surface Elevation Table (RSET) or other appropriate technology. Measurements shall be taken at the same time of year (i.e., +/- 6 week) when water table levels are similar. Use of RTK GPS should follow established field procedures, such as those found in:
	US Geological Survey. 2012. Topographic mapping RTK GPS standard operating procedures. Unpublished protocols. USGS, Western Ecological Research Center, San Francisco Bay Estuary Field Station, Vallejo, CA.
	as those found in: Cahoon, D. R., J. C. Lynch, B. C. Perez, B. Segura, R. Holland, C. Stelly, G. Stephenson, and P. Hensel. 2002. A device for high precision measurement of wetland sediment elevation: II. The rod surface elevation table. Journal of Sedimentary Research. Vol. 72, No. 5. pp. 734-739.
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	RTK GPS, RSET station, or other appropriate technology
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.

Calculation method	For each sample point, change in surface elevation is calculated as measured surface elevation at time t minus measured surface elevation at time t-x ( $x =$ length of monitoring interval in years); i.e. net subsidence is a negative value and net accretion is a positive value. Mean change in surface elevation is calculated from the sample point-level change values. Measurements of surface elevation are made in meters above sea level (masl) to four decimal points (1/10 mm), where possible.
	as the mean value plus the amount of the half width of the 90% confidence interval exceeding 10% of the mean value.
Comments	Used in stock change approach only.
	The Stock Change approach may be employed if the following applicability conditions are met: 1. Net surface elevation change measured using RSETs or
	2. If using RSETs, clear and detailed rules for determining surface level are documented in field standard operating procedures and adhered to
	3. Bulk density in top 10 cm is monitored; the top layer being the labile portion from which emissions are expected to be sourced, and as well is a conservative value as it's the lowest bulk
	density throughout the peat profile. Bulk density samples must include soil organic carbon, belowground biomass (roots) and litter
	4. Repeat measurements of surface elevation change are made at the same water table level (+/- 10% of level at t = 0), at the same time as bulk density samples are taken, preferably in the dense
	5. In with-project case, initial surface elevation level is measured 6-12 months after re-wetting takes place (after initial
	swell has occurred)
	(flat terrain, no river flow over project area)
	7. No significant compaction expected to occur and procedures will be in place to safeguard against compaction resulting from surface elevation measurements in the field
	8. Must locate reference datum (bottom of peat) if using the SET approach
	Note that the Stock Change approach treats soil organic
	No root expansion and related swelling is expected in the with-
	project re-wetted case, and subsidence due to root die back is
	biomass mortality at the time of measurable subsidence).
	9. Baseline reference site has been subject to
	drainage/hydrological alteration for at least 10 years (to
	on surface elevation and bulk density)

Data / Parameter	ΔSE <sub>wp,t</sub>
Data unit	mm
Description	Mean net surface elevation change (subsidence + accretion + root expansion/mortality) in the project area in monitoring interval ending in year t
Description of measurement methods and procedures to be applied	Monitored on project area via direct measurement of permanent sample points.
	Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance- specific, sampling, measurement and estimation procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness. Stratification may be employed to improve precision, but is not required. Estimates generated must: 1. Be demonstrated to be un-biased and derived from representative sampling
	<ol> <li>Sampling error quantified with 90% confidence</li> <li>Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)</li> </ol>
	The change in surface elevation shall be determined using either RTK GPS (high precision), Rod Surface Elevation Table (RSET) or other appropriate technology. Measurements shall be taken at the same time of year (i.e., +/- 6 week) when water table levels are similar. Use of RTK GPS should follow established field procedures, such as these found in:
	US Geological Survey. 2012. Topographic mapping RTK GPS standard operating procedures. Unpublished protocols. USGS, Western Ecological Research Center, San Francisco Bay Estuary Field Station, Vallejo, CA. Use of RSETs should follow established field procedures, such
	as those found in: Cahoon, D. R., J. C. Lynch, B. C. Perez, B. Segura, R. Holland, C. Stelly, G. Stephenson, and P. Hensel. 2002. A device for high precision measurement of wetland sediment elevation: II. The rod surface elevation table. Journal of Sedimentary Research. Vol. 72, No. 5. pp. 734-739.
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	RTK GPS, RSET station, or other appropriate technology
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.

Calculation method	For each sample point, change in surface elevation is calculated as measured surface elevation at time t minus measured surface elevation at time t-x (x = length of monitoring interval in years); i.e. net subsidence is a negative value and net accretion is a positive value. Mean change in surface elevation is calculated from the sample point-level change values. Measurements of surface elevation are made in meters above sea level (masl) to four decimal points (1/10 mm), where possible.
Treatment of uncertainty	Parameter value incorporates uncertainty by being calculated as the mean value minus the amount of the half width of the 90% confidence interval exceeding 10% of the mean value.
Comments	<ul> <li>Burget in stock change approach only. The Stock Change approach may be employed if the following applicability conditions are met:</li> <li>1. Net surface elevation change measured using RSETs or RTKs</li> <li>2. If using RSETs, clear and detailed rules for determining surface level are documented in field standard operating procedures and adhered to</li> <li>3. Bulk density in top 10 cm is monitored; the top layer being the labile portion from which emissions are expected to be sourced, and as well is a conservative value as it's the lowest bulk density throughout the peat profile. Bulk density samples must include soil organic carbon, belowground biomass (roots) and litter</li> <li>4. Repeat measurements of surface elevation change are made at the same water table level (+/- 10% of level at t = 0), at the same time as bulk density samples are taken, preferably in the dry season</li> <li>5. In with-project case, initial surface elevation level is measured 6-12 months after re-wetting takes place (after initial swell has occurred)</li> <li>6. No significant erosion or sedimentation expected to occur (flat terrain, no river flow over project area)</li> <li>7. No significant compaction expected to occur and procedures will be in place to safeguard against compaction resulting from surface elevation measurements in the field</li> <li>8. Must locate reference datum (bottom of peat) for the SET approach.</li> <li>Note that the Stock Change approach treats soil organic carbon, belowground biomass and litter as a single source/sink. No root expansion and related swelling is expected in the with-project rece, and subsidence due to root die back is treated as an emission (assuming emissions from belowground biomass mortality at the time of measurable subsidence).</li> <li>9. Baseline reference site has been subject to drainage/hydrological alteration for at least 10 years (to preclude significant influence of new root growth and expansion on surface elevation and bulk density)</li> <li>Any sample points for sur</li></ul>
	calculate net change in surface elevation, $\Delta SE_{wp,t}$ , in the project area for the monitoring interval spanning the burn (i.e., from the

	monitoring event immediately prior to the burn to the monitoring event immediately after the burn).

Data / Parameter	ΔSE <sub>burn_int,wp,t</sub>
Data unit	mm
Description	Mean surface elevation change due to intentional fire in the project area at time t
Description of measurement methods and procedures to be applied	Monitored in the project area in the planned burn area via direct measurement of permanent sample points immediately prior to and after the burn. Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance- specific, sampling, measurement and estimation procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness. Stratification may be employed to improve precision, but is not required. Estimates generated must: 1. Be demonstrated to be un-biased and derived from representative sampling 2. Sampling error quantified with 90% confidence 3. Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control
	and outlined in the monitoring plan)
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Measuring Tape
QA/QC procedures to be applied	Standard quality control / quality assurance (QA/QC) procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.
Calculation method	For each sample point, change in surface elevation is calculated as measured surface elevation after burn minus measured surface elevation before burn; i.e. elevation change due to fire is expected to be a negative value. Mean change in surface elevation is calculated from the sample point-level change values. Measurements of surface elevation are made in meters above sea level (masl) to four decimal points (1/10 mm), where possible.
Treatment of uncertainty	Parameter value incorporates uncertainty by being calculated as the mean value minus the amount of the half width of the 90% confidence interval exceeding 10% of the mean value.
Comments	Used in flux approach only.

Data / Parameter	$\Delta SE_{burn\_unint,wp,t}$
Data unit	mm
Description	Mean surface elevation change due to unintentional fire in the project area at time t
Description of measurement methods and procedures to be applied	Monitored in the project area via direct measurement of permanent sample points in the burn area and outside the burn area immediately after the burn.
	Acknowledging the wide range of valid monitoring approaches, and that relative efficiency and robustness are circumstance- specific, sampling, measurement and estimation procedures for measuring are not specified in the methodology and may be selected by project proponents based on capacity and appropriateness. Stratification may be employed to improve precision, but is not required. Estimates generated must: 1. Be demonstrated to be un-biased and derived from representative sampling 2. Sampling error quantified with 90% confidence 3. Accuracy of measurements and procedures is ensured through employment of quality assurance/quality control (QA/QC) procedures (to be determined by the project proponent and outlined in the monitoring plan)
	The change in surface elevation shall be determined using either RTK GPS (high precision), Rod Surface Elevation Table (RSET) or other appropriate technology. Use of RTK GPS should follow established field procedures, such as those found in: US Geological Survey. 2012. Topographic mapping RTK GPS standard operating procedures. Unpublished protocols. USGS, Western Ecological Research Center, San Francisco Bay Estuary Field Station, Vallejo, CA. Use of RSETs should follow established field procedures, such as those found in: Cahoon, D. R., J. C. Lynch, B. C. Perez, B. Segura, R. Holland, C. Stelly, G. Stephenson, and P. Hensel. 2002. A device for high precision measurement of wetland sediment elevation: II. The rod surface elevation table. Journal of Sedimentary Research. Vol. 72, No. 5. pp. 734-739.
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	RTK GPS, RSET station, or other appropriate technology
applied	procedures for forest biomass/soil inventory including field data collection and data management shall be applied. Use or adaptation of QA/QCs already applied in national forest monitoring, or available from published handbooks, or from the IPCC GPG LULUCF 2003, is recommended.

Calculation method	Mean change in surface elevation is calculated as the mean surface elevation in the burned area minus the mean surface elevation in the unburned area; i.e. elevation change due to fire is expected to be a negative value. Measurements of surface elevation are made in meters above sea level (masl) to four decimal points (1/10 mm), where possible.
Treatment of uncertainty	Parameter value incorporates uncertainty by being calculated as the mean value minus the amount of the half width of the 90% confidence interval exceeding 10% of the mean value.
Comments	Used in flux approach only.

Data / Parameter	UNC∆ABGB,bsl,t
Data unit	t CO <sub>2</sub> e/ha/yr
Description	Half width of 90% confidence interval exceeding 10% of the mean annual change in above- and belowground biomass carbon stocks in the baseline reference area in monitoring interval ending in year t
Description of measurement methods and procedures to be applied	Not applicable as parameter is calculated.
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Not applicable as calculated parameter.
QA/QC procedures to be applied	Not applicable as parameter is calculated

Calculation method	Parameter UNC ABGB, bsl,t is calculated as
	$UNC_{\Delta ABGB, bsl, t} = \left(\frac{1}{x}\right) * 1.67 *$
	$\sqrt{\left(\mathcal{V}ar_{ABCBbelic} + \mathcal{V}ar_{ABCBbelis-w} - 2 * \mathcal{C}av_{ABCBbelis}_{ABUPAUP = S} * \sqrt{\mathcal{V}ar_{ABCBbelis}} * \sqrt{\mathcal{V}ar_{ABCBbelis-w}}\right) * \binom{1}{2}}$
	$-10\% * \left(\frac{1}{n}\right) * \sum_{j=1}^{n} \left( (ABGB_{bsl,j,t} - ABGB_{bsl,j,t-x}) * \left(\frac{1}{x}\right) \right)$
	Where, ABGB <sub>bsl,j,t</sub> Above- and belowground biomass carbon stocks in the baseline reference area in plot j at time t; t CO <sub>2</sub> e/ha ABGB <sub>bsl,j,t-x</sub> Above- and belowground biomass carbon stocks in the baseline reference area in plot j at time t-x; t CO <sub>2</sub> e/ha Var <sub>ABGB,bsl,t</sub> Variance in above- and belowground biomass carbon stocks in the baseline reference area at time t; dimensionless
	Var <sub>ABGB,bsl,t-x</sub> Variance in above- and belowground biomass carbon stocks in the baseline reference area at time t-x; dimensionless
	Cov <sub>ABGB,bsl,t_ABGB,bsl,t-x</sub> Covariance in above- and belowground biomass carbon stocks in the baseline reference area at times t and t-x; dimensionless
	J 1, 2, 3 I Sample plots
	t 1, 2, 3, t years elapsed since the project start date
Treatment of uncertainty	None
Comments	Used in flux approach only.

Data / Parameter	UNC_ABGB,wp,t
Data unit	t CO <sub>2</sub> e/ha/yr
Description	Half width of 90% confidence interval exceeding 10% of the mean annual change in above- and belowground biomass carbon stocks in the project area in monitoring interval ending in year t
Description of measurement methods and procedures to be applied	Not applicable as parameter is calculated.
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Not applicable as calculated parameter.
QA/QC procedures to be applied	Not applicable as parameter is calculated

Calculation method	Parameter UNC
	$UNC_{\Delta ABGB,wp,z} = \left(\frac{1}{x}\right) * 1.67 *$
	$\sqrt{\left(Var_{ABCBwp,z} + Var_{ABCBwp,z-x} - 2 * Cov_{AECBwp,z} \right)} * \sqrt{Var_{AECBwp,z-x}} * \sqrt{Var_{AECBwp,z-x}} * \sqrt{Var_{AECBwp,z-x}} * \left(\frac{1}{r}\right)}$
	$-10\% * \left(\frac{1}{n}\right) * \sum_{j=1}^{n} \left( (ABGB_{wp,jz} - ABGB_{wp,jz-x}) * \left(\frac{1}{y}\right) \right)$
	Where, ABGB <sub>wp,j,t</sub> Above- and belowground biomass carbon stocks in the project area in plot j at time t; t CO <sub>2</sub> e/ha ABGB <sub>wp,j,t-x</sub> Above- and belowground biomass carbon stocks in the project area in plot j at time t-x; t CO <sub>2</sub> e/ha Var <sub>ABGB,wp,t</sub> Variance in above- and belowground biomass carbon stocks in the project area at time t; dimensionless Var <sub>ABGB,wp,t-x</sub> Variance in above- and belowground biomass carbon stocks in the project area at time t-x; dimensionless Cov <sub>ABGB,wp,t-x</sub> Covariance in above- and belowground biomass carbon stocks in the project area at times t and t-x; dimensionless j 1, 2, 3 n sample plots x Number of years in monitoring interval; years t 1, 2, 3, t years elapsed since the project start date
Treatment of uncertainty	None
Comments	Used in flux approach only.

Data / Parameter	UNC <sub>∆AGB,bsl,t</sub>
Data unit	t CO <sub>2</sub> e/ha/yr
Description	Half width of 90% confidence interval exceeding 10% of the mean annual change in aboveground biomass carbon stocks in the baseline reference area in monitoring interval ending in year t
Description of measurement methods and procedures to be applied	Not applicable as parameter is calculated.
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Not applicable as calculated parameter.
QA/QC procedures to be applied	Not applicable as parameter is calculated
Calculation method	Parameter UNC <sub>AGB,bsl,t</sub> is calculated as
	$UNC_{\Delta AGB, bsl, t} = \left(\frac{1}{x}\right) * 1.67 *$ $(v_{\alpha r_{AGB, bsl, t}} + v_{\alpha r_{AGB, bsl, t-x}} - 2 * Cov_{AGB, bsl, t} + \sqrt{v_{\alpha r_{AGB, bsl, t-x}}} * \sqrt{v_{\alpha r_{AGB, bsl, t-x}}} * \left(\frac{1}{x}\right) * \left(\frac{1}{x}\right)$
	$-10\% * \left(\frac{1}{n}\right) * \sum_{j=1}^{n} \left( (AGB_{bsl,j,t} - AGB_{bsl,j,t-x}) * \left(\frac{1}{x}\right) \right)$
	Where, AGB <sub>bsl,j,t</sub> Aboveground biomass carbon stocks in the baseline reference area in plot j at time t; t CO <sub>2</sub> e/ha AGB <sub>bsl,j,t-x</sub> Aboveground biomass carbon stocks in the baseline reference area in plot j at time t-x; t CO <sub>2</sub> e/ha Var <sub>AGB,bsl,t</sub> Variance in aboveground biomass carbon stocks in the baseline reference area at time t; dimensionless Var <sub>AGB,bsl,t-x</sub> Variance in aboveground biomass carbon stocks in the baseline reference area at time t-x; dimensionless Cov <sub>AGB,bsl,t-x</sub> Covariance in aboveground biomass carbon stocks in the baseline reference area at time t-x; dimensionless Cov <sub>AGB,bsl,t-AGB,bsl,t-x</sub> Covariance in aboveground biomass carbon stocks in the baseline reference area at times t and t-x; dimensionless j 1, 2, 3 n sample plots x Number of years in monitoring interval; years t 1, 2, 3, t years elapsed since the project start date
Treatment of uncertainty	None
Comments	Used in stock change approach only.

Data / Parameter	UNC∆AGB,wp,t
Data unit	t CO <sub>2</sub> e/ha/yr
Description	Half width of 90% confidence interval exceeding 10% of the mean annual change in aboveground biomass carbon stocks in the project area in monitoring interval ending in year t

Description of measurement methods and procedures to be applied	Not applicable as parameter is calculated.
Frequency of monitoring/recording	Monitoring shall be conducted at least every five years, or prior to each verification event if less than five years.
Monitoring equipment	Not applicable as calculated parameter.
QA/QC procedures to be applied	Not applicable as parameter is calculated
Calculation method	Parameter UNC <sub>AGB,wp,t</sub> is calculated as
	$UNC_{\Delta AGB,wp,t} = \left(\frac{1}{x}\right) * 1.67 *$
	$\sqrt{\left(Var_{AGBnp,t} + Var_{AGBnp,t-x} - 2 \times Cav_{AGBmp,t} \right)} \times \sqrt{Var_{AGBnp,t-x}} \times \sqrt{Var_{AGBnp,t-x}} \times \sqrt{Var_{AGBnp,t-x}} \times \left(\frac{1}{n}\right)$
	$-10\% * \left(\frac{1}{n}\right) * \sum_{j=1}^{n} \left( \left(AGB_{wp,j,t} - AGB_{wp,j,t-x}\right) * \left(\frac{1}{x}\right) \right)$
	Where, AGB <sub>wp,j,t</sub> Aboveground biomass carbon stocks in the project area in plot j at time t; t $CO_2e/ha$
	AGB <sub>wp,j,t-x</sub> Aboveground biomass carbon stocks in the project
	Var <sub>AGB,wp,t</sub> Variance in aboveground biomass carbon stocks in the project area at time t <sup>*</sup> dimensionless
	Var <sub>AGB,wp,t-x</sub> Variance in aboveground biomass carbon stocks in the project area at time t-x. dimensionless
	Cov <sub>AGB,wp,t_AGB,wp,t-x</sub> Covariance in aboveground biomass carbon stocks in the project area at times t and t-x; dimensionless j 1, 2, 3 n sample plots
	x Number of years in monitoring interval; years
	t 1, 2, 3, t years elapsed since the project start date
Treatment of uncertainty	None
Comments	Used in stock change approach only.

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854	<b>CALCULATION OF ERTs</b>	
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#### **F1. CALCULATION OF ERTs** 856 857 858 Net accounting of GHG emission reductions is produced in Equation X below. 859 $NER_t = GHG_{BSL,t} - GHG_{WP,t} - GHG_{LK,t}$ Equation 20 860 Where: 861 NER<sub>t</sub> Annual net greenhouse gas emission reductions in monitoring interval ending in year t; t 862 CO<sub>2</sub>e yr<sup>-1</sup> 863 GHG<sub>BSL,t</sub> Annual greenhouse gas emissions in the baseline in monitoring interval ending in year t; t CO<sub>2</sub>e yr<sup>-1</sup> 864 865 Annual greenhouse gas emissions in the with-project case in monitoring interval ending GHG<sub>WP,t</sub> 866 in year t; t CO<sub>2</sub>e yr<sup>-1</sup> 867 GHG<sub>LK,t</sub> Annual greenhouse gas emissions due to leakage in monitoring interval ending in year t; t 868 CO<sub>2</sub>e yr-1 869 Notes: 870 $GHG_{LK,t}$ = zero for all years, per applicability condition stipulating the absence of any productive • land use in the project area within two years prior to the project start date. 871 872 873 $ERT_t = NER_t * (1-BUF)$ Equation 21 874 875 Where: 876 877 ERT,t Number of Emission Reduction Tonnes at time t 878 NER<sub>t</sub> Annual net greenhouse gas emission reductions in monitoring interval ending in year t; t 879 CO<sub>2</sub>e yr<sup>-1</sup> 880 BUF The non-permanence buffer deduction as calculated by the ACR Tool for AFOLU Non-881 Permanence Risk Analysis and Buffer Determination (BUF will be set to zero if an ACR approved insurance product is used); fraction 882