PV CLIMATE TOOL CONCEPT NOTE

Estimation of baseline and project emissions and removals in rangelands

Version 1.0

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Contents

1   Summary

The proposed tool will be integrated into the PV Climate Agriculture and Forestry Carbon Benefit Assessment Methodology (**PM001**)[1] to provide approaches for estimating changes in woody biomass, non-woody biomass, deadwood and litter in PV Climate project areas under baseline and project scenarios. The tool is aimed at projects operating in rangelands. Procedures for using in-situ measurements, process-based models validated with in-situ measurements, and (where appropriate) the use of conservative default values, will be provided to determine values for the following parameters that are used to estimate climate benefits following **PM001**:

$BR_{WB,a,y}$ Net GHG removals in aboveground woody biomass under the baseline scenario for project area *a* up to year *y* (t CO_2e)

$BR_{NB,a,y}$ Net GHG removals in aboveground non-woody biomass under the baseline scenario for project area *a* up to year *y* (t CO_2e)

$BR_{BG,a,y}$ Net GHG removals in belowground biomass under the baseline scenario for project area *a* up to year *y* (t CO_2e)

$BR_{LI,a,y}$ Net GHG removals in litter under the baseline scenario for project area *a* up to year *y* (t CO_2e)

$BR_{DW,a,y}$ Net GHG removals in dead wood under the baseline scenario for project area *a* up to year *y* (t CO_2e)

$PR_{WB,a,y}$ Net GHG removals in aboveground woody biomass under the project scenario for project area *a* up to year *y* (t CO_2e)

$PR_{NB,a,y}$ Net GHG removals in aboveground non-woody biomass under the project scenario for project area *a* up to year *y* (t CO_2e)

$PR_{BG,a,y}$ Net GHG removals in belowground biomass under the project scenario for project area *a* up to year *y* (t CO_2e)

$PR_{LI,a,y}$ Net GHG removals in litter under the project scenario for project area *a* up to year *y* (t CO_2e)

$PR_{DW,a,y}$ Net GHG removals in dead wood under the project scenario for project area *a* up to year *y* (t CO_2e)

The proposed tool will be applicable to project interventions in grassland, shrubland, savanna, woodland, forestland and other ecosystems where native vegetation is grazed by wild and/or domestic herbivores - where project interventions either increase the carbon stored in biomass, or reduce the rate of reduction of carbon stored in biomass through activities such as grazing management, fire management and land restoration. Where possible, procedures will also be provided that are applicable to other land cover types and project activities.

2   Relationship to Existing Approaches

PLAN VIVO METHODOLOGIES

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[1] PM001 Plan Vivo Agriculture and Forestry Project Carbon Benefit Assessment Methodology, Version 1.0. PV Climate Methodology. Available from: https://www.planvivo.org/pm001

The tool will be referenced in relevant sections of the following approved PV Climate Modules:

PU001 Estimation of baseline and project GHG removals by carbon pools in Plan Vivo projects[2]

PU002 Estimation of baseline and project GHG emissions from carbon pools in Plan Vivo projects[3]

The scope of these modules, and additional procedures that will be provided by the proposed tool are summarised below. Where possible the tool will be integrated with approved modules and tools within **PM001**, for example for determining a baseline scenario, and accounting for leakage and uncertainty. If deviations are necessary, alternative procedures will be developed. Tools that are under development for use of models validated by measurements and for determining whether land is degraded and degrading may also be applied within the proposed tool.[4]

Baseline Removals

PU001 allows the use of the following approaches for estimating baseline removals in biomass:

Woody biomass

i.   Measurements in matched control areas, following the procedures in **AR-TOOL14** v4.2.[5]
ii.   Modelling of tree growth and stand development, following the procedures described in **AR-TOOL14** v4.2 Section 8.2; or
iii. Assuming no change in woody biomass carbon stocks if the conditions in **AR-TOOL14** v4.2 Section 5 are met.

Non-woody biomass

i.   Modelling of vegetation growth, following the procedures in an approved tool, or applying clearly conservative growth estimates.
ii.   Measurements in matched control areas.

Deadwood and litter

i.   Measurements in matched control areas, following the procedures in **AR-TOOL12** v3.1 Section 6.1 and 7.1.[6]
ii.   Default factors, following the procedures in **AR-TOOL12** v3.1 Section 6.2 and 7.2.

The procedures for estimating baseline removals in woody biomass were developed for afforestation and reforestation projects, and may not be well suited to application in rangelands.

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[2] PU001 Estimation of Baseline and Project GHG Removals by Carbon Pools in Plan Vivo Projects, Version 1.0. PV Climate Module. Available from: https://www.planvivo.org/pu001
[3] PU002 Estimation of Baseline and Project GHG Emissions from Carbon Pools in Plan Vivo Projects, Version 1.0. PV Climate Module Available from: https://www.planvivo.org/pu002
[4] PV Climate Module Revision Concept Note. Available from: https://www.planvivo.org/Handlers/Download.ashx?IDMF=557917c0-a26a-4800-b2fc-4642844766f4
[5] AR-TOOL14 Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities. Available from: https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-14-v2.1.0.pdf/history_view
[6] AR-TOOL12 Estimation of carbon stocks and change in carbon stocks in dead wood and litter in A/R CDM project activities. Available from: https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-12-v1.1.0.pdf/history_view

The proposed tool will therefore provide some or all of the following:

- Procedures for measurement of carbon stocks in woody biomass, non-woody biomass, deadwood and litter carbon pools in rangeland areas that build on established sampling approaches such as the Land Degradation Surveillance Framework[7];
- Matching criteria to be used for identifying appropriate control plots in rangeland areas;
- Dynamic baseline procedures for estimating baseline biomass removals in matched control areas;
- Procedures for using process-based or empirical modelling of biomass removals under the baseline scenario; and
- Procedures and guidance for conservative estimation of baseline scenario changes in biomass for project activities other than afforestation, reforestation and agroforestry; such as grazing management, fire management and land restoration.

Expected Project Removals

PU001 allows the use of the following approaches for estimating expected project removals in biomass:

Woody biomass
   i.   Modelling of tree growth and stand development, following the procedures in **AR-TOOL14** v4.2 Section 8.2

Non-woody biomass

   i.   Modelling of vegetation growth, following the procedures in an approved tool, or applying clearly conservative growth estimates.

Deadwood and litter

   i.   Default factors, following the procedures in **AR-TOOL12** v3.1 Section 6.2 and 7.2.

PU001 does not include any procedures or guidance on modelling expected changes in biomass, or default factors that could be applied outside of afforestation and reforestation projects. The proposed tool will address these gaps by providing some or all of the following:

- Procedures for using process-based and/or empirical modelling to estimated expected biomass removals; and
- Procedures and guidance for conservative estimation of expected changes in biomass for project activities such as grazing management, fire management and land restoration.

Actual Project Removals

PU001 allows the use of the following approaches for estimating actual project removals in biomass:

Woody biomass

   i.   Measurements within the project area following the procedures in **AR-TOOL14** v4.2

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[7] Land Degradation Framework Field Manual. Available from: https://worldagroforestry.org/output/land-degradation-surveillance-framework-field-manual

ii.   Modelling of tree growth and stand development, following the procedures in **AR-TOOL14** v4.2 Section 8.2 with results validated following an approved tool

Non-woody biomass

i.   Measurements within the project area
ii.   Modelling of vegetation growth with results validated following an approved tool

Deadwood and litter

i.   Measurements in project areas, following the procedures in **AR-TOOL12** v3.1 Section 6.1 and 7.1.
ii.   Default factors, following the procedures in **AR-TOOL12** v3.1 Section 6.2 and 7.2.

The procedures for in-situ measurement of changes in biomass were developed for afforestation and reforestation projects and may not be suitable for rangelands. A proposed revision to **PU001** will add a tool for use of models validated by measurements in PV Climate projects.

The proposed tool will provide some or all of the following:

- Procedures for measurement of carbon stocks in woody biomass, non-woody biomass, deadwood and litter carbon pools in rangeland areas that build on established sampling approaches such as the Land Degradation Surveillance Framework;
- Guidance on use of models validated by measurements for estimating changes in biomass carbon pools in rangeland systems.
- Procedures and guidance for conservative estimation of project scenario changes in biomass for project activities such as grazing management, fire management and land restoration.

Baseline and Project Emissions from Biomass

PU002 refers to procedures for estimation of baseline and project emissions from biomass in forest protection projects in the PV Climate Tool **PT002** Estimation of Climate benefits from REDD in community-managed forests,[8] but there are no tools approved by Plan Vivo for estimating baseline emissions from biomass under other project interventions.

The approaches described above for estimating baseline biomass removals, may also be applicable for estimation of baseline biomass emissions enabling an extension of the scope of **PU002** beyond forest protection activities.

OTHER METHODOLOGIES

In the development of this concept note, the following methodologies and tools approved for use in other GHG programmes were reviewed:

Verified Carbon Standard

VM0026 Methodology for Sustainable Grassland Management (SGM), v1.1[9]

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[8] PT002 Estimation of Carbon Benefits from REDD in Community Managed Forest, Version 2.0. PV Climate Tool. Available from: https://www.planvivo.org/pt002
[9] VM0026 Methodology for Sustainable Grassland Management. Available from: https://verra.org/methodologies/vm0026-methodology-for-sustainable-grassland-management-sgm-v1-0/

VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing, v1.0[10]

VM0042 Methodology for Improved Agricultural Land Management, v2.0[11]

VM0047 Afforestation, Reforestation and Revegetation, v1.0[12]

Aspects of these methodologies will inform the development of procedures in the proposed tool, with adaptations where appropriate to facilitate implementation in the PV Climate project context.

Where possible, the sampling and analysis approaches in the tool will align with established protocols such as with the Land Degradation Surveillance Framework (LDSF) – an indicator framework that enables systematic and science-based assessment and monitoring of soil and ecosystem health at scale, which has been applied across a broad range of ecosystems in over 40 countries.

3   Scope and Applicability

The proposed tool will include procedures for the estimation of expected and actual project biomass emissions or removals. It will therefore be possible to apply the tool to generate fPVCs, rPVCs and vPVCs.

The tool will be applicable globally to estimate baseline and project biomass emissions or removals from project interventions in rangelands that either increase the carbon stored in biomass and/or soils, or reduce the rate of loss of biomass and/or SOC through activities such as grazing management, fire management, and land restoration. Where possible, procedures will also be provided that are applicable to other land cover types and project activities.

It is expected that the tool will be applied by PV Climate projects that operate in rangelands, such as the Pastures, Conservation and Climate Action, Mongolia[13] and rangeland management projects that are currently registered or under development in Kazakhstan, and Northern Kenya.

4   Baseline Scenario and Additionality

The proposed tool will applied within **PM001**, so the procedures for describing the baseline scenario and demonstrating additionality will follow **AR-TOOL02**,[14] unless this is not consistent with the procedures developed, in which case an alternative will be provided.

5   Quantification of Carbon Benefits

The proposed tool will be applied within **PM001**, so the procedures for potential and actual leakage emissions will follow PV Climate Module **PU004** Estimation of GHG emissions from leakage in Plan

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[10] VM0032 Methodology for the Adoption of Sustainable Grasslands through Adjustment of Fire and Grazing. Available from: https://verra.org/methodologies/vm0032-methodology-for-the-adoption-of-sustainable-grasslands-through-adjustment-of-fire-and-grazing-v1-0/

[11] VM0042 Methodology for Improved Agricultural Land Management. Available from: https://verra.org/methodologies/vm0042-methodology-for-improved-agricultural-land-management-v2-0/

[12] VM0047 Afforestation, Reforestation and Revegetation. Available from: https://verra.org/methodologies/vm0047-afforestation-reforestation-and-revegetation-v1-0/

[13] https://www.planvivo.org/pastures-conservation-climate-action

[14] AR-TOOL02 Combined tool to identify the baseline scenario and demonstrate additionality in A/R CDM project activities, Version 1.0. CDM Tool. Available from: https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-02-v1.pdf/history_view

Vivo projects,[15] and procedures for calculation of carbon benefits will follow the equations in **PM001** with the uncertainty adjustment defined following PV Climate Module **PU005** Estimation of uncertainty of carbon benefit estimates in Plan Vivo projects.[16] If the procedures developed are not consistent with these existing methodology elements, alternatives will either be integrated into the tool or provided through updates to the existing methodology or modules.

An overview of the procedures for estimating the carbon baseline, and expected and actual project emissions and removals, is provided below. Compliance of the proposed approaches with the PV Climate Methodology Requirements[17] is summarised in Table 1.

Carbon Baseline

Some or all of the following options for quantifying baseline emissions/removals from biomass will be included in the tool:

- **Dynamic baseline procedures** – involving in-situ measurements of biomass and/or proxy measures in matched control areas.
- **Process-based or empirical modelling** – using models parameterised with environmental and activity data that represents the baseline scenario for the project area(s).
- **Conservative defaults** – describing conditions under which it is conservative to assume no change in biomass carbon stocks under the baseline scenario and/or sources from which conservative estimates of changes in biomass can be derived.

Expected Project Emissions/Removals

Some or all of the following options for estimating expected emissions/removals from biomass will be included in the tool:

- **Process-based or empirical modelling** – using models parameterised with environmental and activity data that represents the project scenario(s).
- **Conservative defaults** – describing sources from which conservative estimates of changes in biomass can be derived under different environmental conditions and management interventions.

Actual Project Emissions/Removals

Some or all of the following options for measuring acutal emissions/removals from biomass will be included in the tool:

- **In-situ measurement** – directly measuring change in biomass in the project area(s) with efficient sampling and analysis approaches.
- **Process-based or empirical modelling** – using models parameterised with environmental and activity data that represents the project scenario(s) with results validated with in-situ measurements

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[15] PU004 Estimation of GHG Emissions from Leakage in Plan Vivo Projects, Version 1.0. PV Climate Module. Available from: https://www.planvivo.org/pu004

[16] PU005 Estimation of Uncertainty of Carbon Benefit Estimates in Plan Vivo Projects, Version 1.1. PV Climate Module. Available from: https://www.planvivo.org/pu005

[17] V Climate Methodology Requirements. Available from : https://www.planvivo.org/pv-climate-documentation

- **Conservative defaults** – describing sources from which conservative estimates of changes in biomass can be derived for under different environmental conditions and management interventions.

Table 1 Justification for compliance with PV Climate Methodology Requirements

Methodology Requirement Type	Summary of Compliance
1.1 Methodology Structure	• The tool will be prepared using the latest template provided by Plan Vivo.
1.2 Uncertainty	• When sampling approaches are used, uncertainty will be estimated using the Equation 1 in PU005 Section 5.1.1; or an alternative approach for estimating sampling uncertainty at a 90% confidence level. • For model-based approaches, the tool will include procedures for estimating model error at a 90% confidence level and reporting this as a percentage of the carbon benefit derived from the biomass pool.
1.3 Quantifying Emissions and Removals	• The tool will only be used to quantify changes in biomass carbon stocks. • All procedures will be consistent with international good practices in greenhouse gas accounting. • All data, parameters, assumptions and calculations will be fully described and justified.
1.4 Measurements and Sampling	• All procedures that involve measurements will apply established approaches for sample collection and analysis that minimise measurement error.
1.5 Models, Default Factors and Proxies	• Only publicly available models will be applied, and procedures will include requirements to demonstrate that models have been appropriately calibrated to the project conditions, and to ensure that models are applied in a manner that minimises potential for over-estimation of carbon benefits. • Any default values used will be sourced from reliable peer-reviewed literature that is appropriate to the scope of application. • Proxy values will only be used if there is robust evidence that they are strongly correlated to the parameter they represent.
2.1 Applicability Conditions	• The tool will have global application and the project interventions it can be applied to will be specified. • It will be possible to apply the tool to generate fPVCs, rPVCs and vPVCs.
2.2 Carbon Pools and Emission Sources	• The tool will be applicable to projects where at least one biomass carbon pool has been identified as a significant carbon pool following the procedures in **PM001** that require application of **AR-TOOL04**.[18]
2.3 Baseline Scenario and Additionality	• The tool be will applied within **PM001**, so the procedures for describing the baseline scenario and demonstrating additionality will follow **AR-TOOL02.**

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[18] AR-TOOL04 Tool for testing significance of GHG emissions in A/R CDM project activities, Version 1.0. CDM Tool. Available from:https://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-amtool-04-v1.pdf/history_view

2.4 Carbon Baseline	• The tool will describe approaches for estimating annualised baseline emissions/removals from biomass, based on the identified baseline scenario. • The tool will include approaches for updating carbon baselines where appropriate.
2.5 Project Emissions and Removals	• The tool will describe approaches for estimating annual emissions/removals from biomass carbon pools under the project scenario. • The tool will include indicators and procedures for estimating project emissions/removals in each verification period.
2.6 Harvesting	• Biomass carbon stocks may fluctuate in areas where trees are harvested. The tool will therefore apply an average carbon stock approach to estimating changes in biomass when there is tree harvesting with even-aged management and cap carbon benefits from changes in biomass at the minimum post-harvest carbon benefit when there is partial felling.
2.7 Leakage	• The tool will be applied within **PM001**, so the procedures for accounting for leakage will follow **PU005.**
2.8 Calculation of Carbon Benefits	• Calculation of carbon benefits will follow the procedures in **PM001**.

6 Development Team

The tool will be developed by a consortium of technical service providers with experience in the development and implementation of methodologies for carbon standards:

- **TLLG** supported the Plan Vivo Foundation with the development of Version 5 of the Plan Vivo Standard including the Plan Vivo Methodology Requirements. They also led the development of PM001 and the associated modules and tools and contributed to the VCS Methodology for Avoided Forest Degradation through Fire Management (VM0029).
- **TerraCarbon** developed the VCS Methodology for Improved Agricultural Land Management (VM0042) that includes assessment of changes in soil organic carbon in agricultural land and emission reductions from livestock management and the VCS Methodology for Afforestation, Reforestation and Revegetation (VM0047) that includes approaches for dynamic baseline setting that could potentially be applied to avoided conversion of grasslands.
- **Natural State** is pioneering a range of measurement, reporting and verification (MRV) approaches that integrate remote sensing and ground-based monitoring, to provide a robust and cost-effective way to assess the carbon impact of grassland management projects, including below-ground carbon, as well as measuring the biodiversity and ecosystem benefits.

Individuals involved in the development of the tool will include:

- **Nicholas Berry** (TLLG)- the lead author of PM001 and all the associated modules and tools. A chartered forester with a PhD in Tropical Forest Ecology. He is also the chair of the Plan Vivo Technical Advisory Committee and has been providing technical support to Plan Vivo projects since 2008. He has played a leading role in the last two updates of the Plan Vivo Standard, and development of the Plan Vivo Methodology requirements. He has previously developed methodologies for reduced emissions from deforestation and forest degradation, improved

agricultural land management, and grassland management that have been approved by Plan Vivo and VCS.

- **Jaclyn Kachelmeyer** (TerraCarbon) - supports the evaluation, design, and implementation of nature-based carbon projects with a primary focus on agricultural soil projects. Her background includes work in soil health, carbon storage research, and conservation of working lands. Jaclyn holds a Master of Environmental Management from the Yale School of the Environment and a Bachelor of Arts in Geography and International Relations from the University of Texas.

- **Jenny Langan-Farmer** (Natural State) - a land use specialist, with over 15 years of diverse experience as both a practitioner and research scientist evaluating land use impacts and carbon market opportunities. She has specialised expertise in measuring and modelling soil carbon and greenhouse gas emissions from land use and land use change, and experience with environmental and social impact assessment, ecosystem service assessment, and grassland, agroforestry and conservation projects within sub-Saharan Africa. She has supported the early-stage development of carbon methodologies, recent updates to the methodology guidance of the new Plan Vivo Standard and evaluation of VCS methodology approaches for agroforestry projects.

The consortium will also receive input from a methodology development working group comprised of stakeholders with an interest in the development of approaches for the assessment of carbon benefits from SOC in Plan Vivo projects, and scientists from the Centre for International Forestry Research and World Agroforestry (CIFOR-ICRAF) involved in the development of the Land Degradation Surveillance Framework (LDSF).