



Developing Land Use Scenarios for Projects in the CBP Tools

Table of Contents

Introduction	1
Example Land Use Scenario	1
How the GHG Balance of SLM Projects is Calculated	2
• <i>Stock comparisons</i>	3
• <i>Growth and loss equations</i>	3
• <i>Annual emissions</i>	3
Example Land Use Scenario	3
<i>Focus only on Land Use and Management that would change in your Project</i>	3
<i>Steps in Building Scenarios</i>	4
Land Use, Land Cover, Land Management and Land Condition	7
<i>Land Cover</i>	7
<i>Land Use</i>	7
<i>Land Management</i>	7
<i>Land Condition</i>	7

Introduction

This tutorial will guide you through how to translate the sustainable land management activities in your project into the activity data required for the CBP tools. For definitions of terms, please see the Glossary or Frequently Asked Questions.

Example Land Use Scenario

This tutorial uses as an example based on a GEF project implemented by a team of scientists, foresters, agronomists and extension specialists led by Dr. Patrick Gicheru at the Kenya Agricultural Research Institute (KARI) in Nairobi and in collaboration with colleagues in other branches of the Kenya government. It is based in Kenya's Yala River watershed, as shown in the areas below:

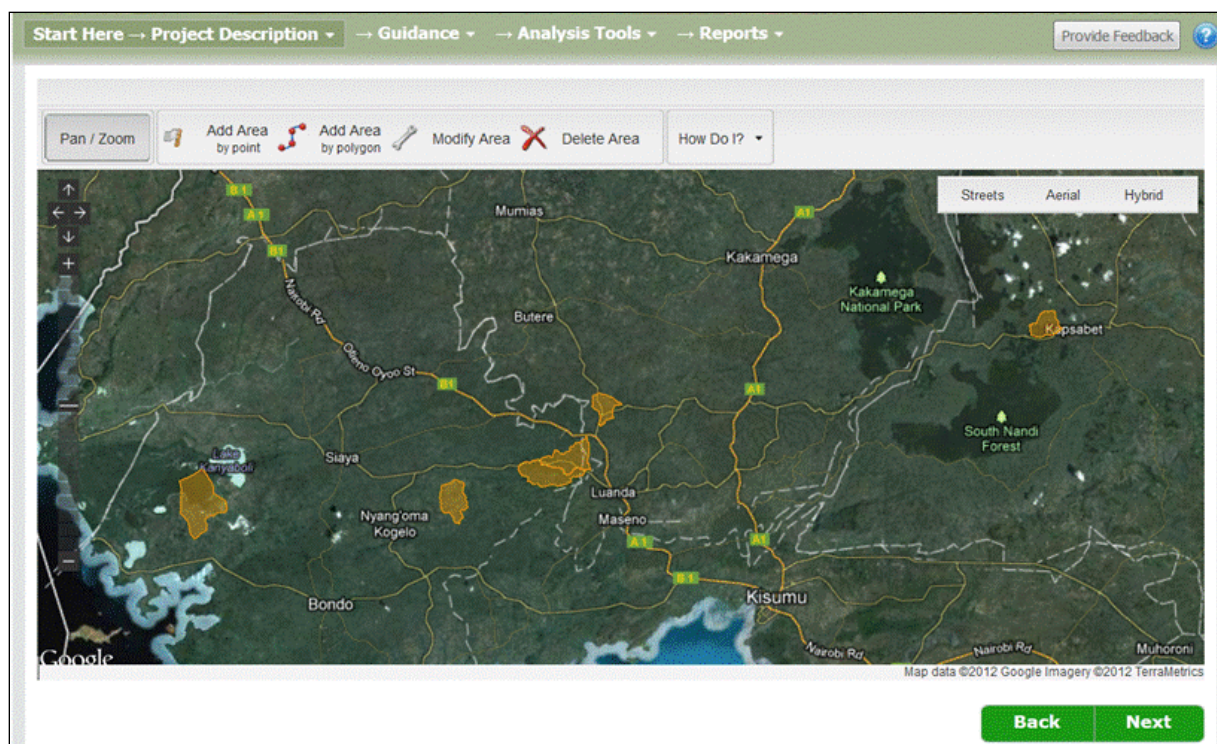


Figure 1. Project Activity Areas for the Detailed Assessment Example.

The aim of this example project is to improve food security, protect water quality, and improve quality of life for residents by reforesting degraded land, preventing soil erosion, and avoiding further deforestation in the watershed. The specific land management changes intended to achieve these goals are reforestation, introduction of agroforestry, diversification of livestock species and breeds and cropping intensification.

How the GHG Balance of SLM Projects is Calculated

The CBP toolkit aims to estimate the likely carbon/GHG benefit from sustainable land management (SLM) projects by comparing the greenhouse gas (GHG) balance from the project area under “business as usual” conditions against the likely GHG flux balance if the project’s SLM practices were implemented. The “business as usual” condition is what we refer to as the **Baseline Scenario**. The SLM activities under the project are the **Project Scenario**.

Calculating the GHG flux for either the Baseline or Project Scenarios requires an understanding of the land use and management at the start of the project period. For example, to calculate the change in soil carbon stock over the life of the project, the system must know the soil management activities and land use conditions before the project was implemented as well as at the end. Similarly, annual land use activities that generate greenhouse gases must be compared at the start and end of the project period under either the baseline or project scenarios. Examples include but are not limited to deforestation,

burning crop residues, timber harvesting, and raising livestock. Therefore in addition to describing the Baseline and Project scenarios, the user must describe the land use at the start of the project, which we term the **Initial Land Use**.

The GHG flux calculations are broken down into three categories:

- **Stock comparisons:** Soil organic carbon change is calculated by comparing the stocks at the beginning and end of the project period. The stocks at the beginning and the end of the report period are calculated, and then the stock at the end of the period is subtracted from the stock at the beginning. If the carbon stock at the end is larger than the stock at the beginning, the result is a negative value. This indicates a **carbon sequestration**. A positive value indicates a net loss of carbon from the soil and therefore an emission to the atmosphere. Annual GHG flux is calculated by dividing the stock change by the report period (in years).
- **Growth and loss equations:** Examples are biomass from forests, silvipasture, agroforestry, woody perennial crops and trees in settlements. Tree growth is calculated on an annual basis based on the expected area planted in trees and age classes for that year. Likewise, deforestation or woody plant clearing losses are calculated annually based on activity data the user enters into the tools and the expected area lost in a given year. Tree growth is given a negative value (carbon sequestration), and tree losses due to clearing, timber harvesting and fuelwood gathering are given a positive value (an emission to the atmosphere). The two are added and the resulting value represents the net tree growth and loss for the project. A negative value indicates a net **carbon sequestration**. A positive value indicates a net emission to the atmosphere. Annual flux is calculated by dividing the change by the report period.
- **Annual emissions:** Certain land use activities are always calculated as emissions and have no possible carbon sequestration potential. These include nitrous oxide and methane from burning forest or crop residues, nitrous oxide and methane from raising livestock, nitrous oxide from applying synthetic fertilizer such as urea to crops, carbon dioxide from draining and cultivating organic/peatland soils, or methane produced by growing wetland rice. The emissions from these activities are calculated using default (or user-provided) emissions factors for these activities. The total for the project period is calculated by multiplying the annual emissions by the report period.

The overall GHG flux balance is calculated by adding all of these calculations together. Totals are always expressed in metric tonnes (megagrams) and area values are in hectares.

Example Land Use Scenario

Focus only on Land Use and Management that would change in your Project:

When developing a land use scenario for an SLM project, it is critically important that users evaluate only the land use activities that would change as part of the project. Users may expect that they need to describe and enter in to the system all of the land management in their project area, however that is not

necessary. The GHG flux from an area is tightly linked to the land use and management in that area. If the land use and land management doesn't change, then the GHG flux is unlikely to change very much. Therefore the user doesn't need to address those land use changes as part of the project.

Consider the following two examples:

Livestock: In the tutorial examples, the project introduces new dairy and non-dairy cattle breeds and swine into the project area. The area already has thousands of head of cattle, goats, and poultry. Those livestock counts are unlikely to change as a result of the project activities. The project area would support additional livestock under the project with the fodder produced in new, innovative annual cropping and agroforestry systems that are part of the project. Therefore, only the new cattle and swine introduced in the project area need to be addressed in the scenarios.

Rangeland stabilization/reforestation: The project area contains thousands of hectares of degraded rangeland that area residents would like to either stabilize or reforest. The project activities, however, are only intended to address a portion of that area (2000 ha) due to limited resources, with the expectation that other rangelands in the area would be stabilized or reforested after the infusion of new, innovative practices. Therefore only the project activities affecting that 2000 ha should be considered in the scenarios.

Avoided deforestation: The project area contains thousands of hectares of forestland that area residents would like to protect and bring under sustainable forest management. The project activities, however, are only intended to address about 1000 ha due to limited resources, with the expectation that deforestation may be reduced after the project ends due to infusion of new practices into the area.

Conversion of annual cropland to agroforestry: The project area contains thousands of hectares of annual cropland, primarily in a maize-legume rotation. In order to help improve people's livelihoods, increase food production, and increase revenue-generating crops, the project intends to convert 4000 ha from maize-legume to a rotation with maize, legumes and napier grass (a cut and carry fodder) with an agroforestry component, and also convert 1000 ha to perennial cropland. Therefore the scenarios should only address those areas converted to new land management practices.

Steps in Building Scenarios:

Following are the steps users may follow in constructing the Initial Land Use, Baseline Scenario and Project Scenario for an SLM project.

- 1) Determine the ***period of time*** over which you wish to assess the greenhouse gas balance of project activities. This is also called the ***report period***, because it is the time period used to calculate the greenhouse gas flux calculated in the reports and graphs. This may be the same as the length of your project but it can be longer or shorter.

- 2) Describe the **Initial Land Use** and management at the start of the project (year 0 before any changes are implemented).
- 3) Build a **Baseline Scenario** of how land cover, land use, land management and land condition in the project area would change if the project were not implemented. To build a baseline scenario you could assume current practices continue as they are or use knowledge of existing trends and policies in the area (for example plans to deforest, reforest, promotion of certain crops and cropping practices etc.). You can also use knowledge of how land cover, use and management changes in areas adjacent to or similar to your project area. The baseline scenario is hypothetical, it is your best estimate of what the land would be like in the absence of the project.
- 4) Build a **Project Scenario** showing how land cover, land use, land management and land condition in the project area would change if the project were implemented/. If the project is already in place and you wish to analyze the greenhouse gas balance of the project, then the Project Scenario should be based on actual changes. The system allows you to look at what might happen in your project area if the project activities go ahead (using an estimate of how land cover and management might change due to your project) or to do an analysis using actual data collected throughout the project (how land cover and land management have changed during your project).

This example project runs for 10 years, and contains the following management scenarios:

Table 1. Land Use areas for the tutorial example.

<u>Land Use Category</u>	<u>Initial Land Use</u>	<u>Baseline Scenario</u>	<u>Project Scenario</u>
Forestland	1010	10	1960
Grassland	2000	2500	1000
Settlements	250	300	275
Wetlands	0	0	25
Annual Cropland	5000	5450	0
Perennial Cropland	250	250	1000
Agroforestry	0	0	4250
Livestock Number	0	500	2000

The report period is 10 years for this example. The total land area to be treated in the project is 8,510 ha, even though the total area within the project region is much larger. This is because the project managers don't know exactly where the project activities will occur, only a general idea where they would like them to occur. The land use transitions are as follows:

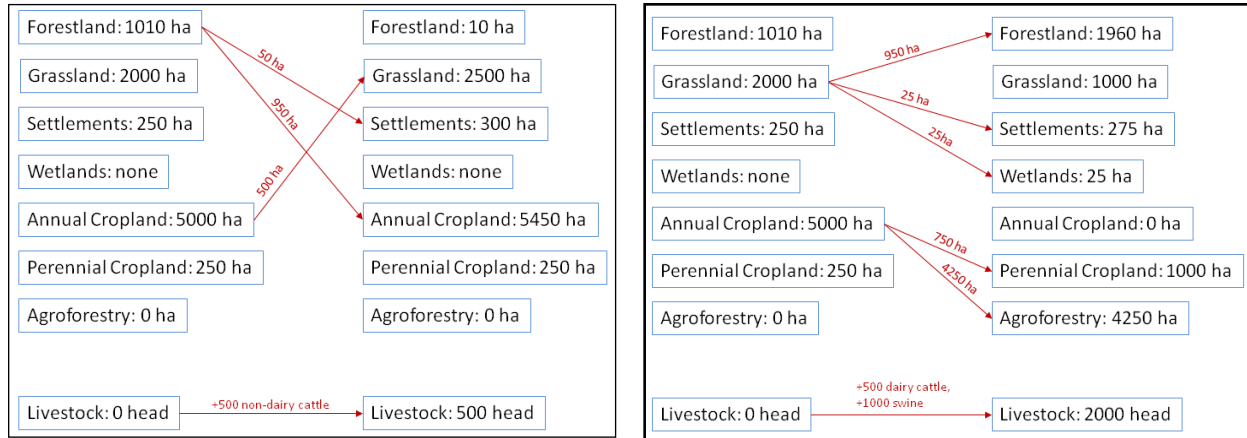


Figure 2. Baseline Scenario (left) and project scenario (right) land use transitions for the Detailed Assessment example.

For a project like this where land use transitions involve the loss or gain of areas with woody biomass such as forests, silvipasture, agroforestry, perennial cropland or trees in settlements, users must quantify the yearly loss rates or the planting/establishment in these systems. In forested systems we refer to this as the deforestation rate (where wooded areas are cleared) or the afforestation/reforestation rate (where non-wooded areas are replanted to trees). In other non-forest land use categories with woody biomass (silvipasture, agroforestry, perennial cropland, settlements) we refer to this as the clearing rate (where wooded areas are cleared) or the planting/establishment rate (where non-wooded areas are planted or where the tree density in already-wooded areas increases).

For this tutorial example, we use the following clearing and planting/establishment rates:

<u>Land Use Category</u>	<u>Initial Land Use</u>	<u>Baseline Scenario</u>	<u>Project Scenario</u>
Forestland (area)	deforestation rate: 100 ha/yr	deforestation rate: 100 ha/yr	reforestation rate: 95 ha/yr
Grassland/Silvipasture (area)	no change	no change	planting rate: 50 ha/yr
Settlements (# trees)	planting rate:	planting rate:	275
Perennial Cropland (area)	no change	no change	planting rate:
Agroforestry (# trees)	no change	no change	planting rate:

Land Use, Land Cover, Land Management and Land Condition

In this tutorial we use the terms land use, land cover, land management and land condition throughout. It is important for users developing scenarios to understand the difference between these terms and how they are applied in the tools:

Land Cover refers to the type of vegetation or human-made features that are found on the land. Examples of land cover include different forest types, different types of grassland or desert, or different types of human settlements such as areas with tree plantings compared with those that are covered with pavement and buildings, having little vegetation.

Land Use is defined by the IPCC as “the total of arrangements, activities, and inputs that people undertake in a certain land cover type”. For the purposes of compiling greenhouse gas inventories, the many different types of land use are broadly classified by the IPCC into eight land use categories: Forestland, Grassland, Annual Cropland, Settlements, Wetlands, Perennial Cropland, Agroforestry and Livestock. For definitions of these land use categories please see the glossary in the help section of these tools.

Land Management refers to the specific ways land is used for economic activities. For example, different types of land management applied to Forestland include timber harvesting, fuel wood harvesting, deforestation, reforestation/Afforestation and protected reserves managed for watershed protection or wildlife habitat. Land management applied to annual cropland refers to the cropping systems (also called crop rotations) grown on the land, the types of tillage used, fertilizer applications, irrigation and other activities.

Land Condition refers to the overall status of land and its suitability for economic activities and is often considered a general indicator of ecosystem health. For example, the IPCC classifies the land condition of grasslands into four categories: improved, nominal/native, moderately degraded, and severely degraded. Wetlands are classified as drained and un-drained.