# Carbon Benefits Project: Modelling System

## *Exercise 1 Introducing Agroforestry*

***Exercise One*** **Estimating the GHG impact of an agro-forestry project using the Simple Assessment**

Goal: To determine if project interventions (land management activities) provide a carbon/GHG benefit relative to the baseline scenario ('business as usual'). E.g., do the land management interventions lead to an increase in carbon stocks in soils and biomass and/or a reduction in GHG emissions?

### *Background information*

For this example exercise, we will focus on Western Kenya. The goals of many SLM projects in this region are to: decrease soil erosion, improve food security and diversify the agricultural economy. Our hypothetical example is a project which aims to do all of these things in an area of the Kakamega Forest through the introduction of agroforestry (see the power point presentation for details).
As the project manager you are producing a report at the end of the project period (10 years). Though in this instance we are conducting the analysis at the end of the project period, it may also be done at the beginning of a project, as a projection of what would happen over the project period.

For this short exercise we will only consider the introduction of agroforestry in smallholder areas. A more detailed exercise is available on request.

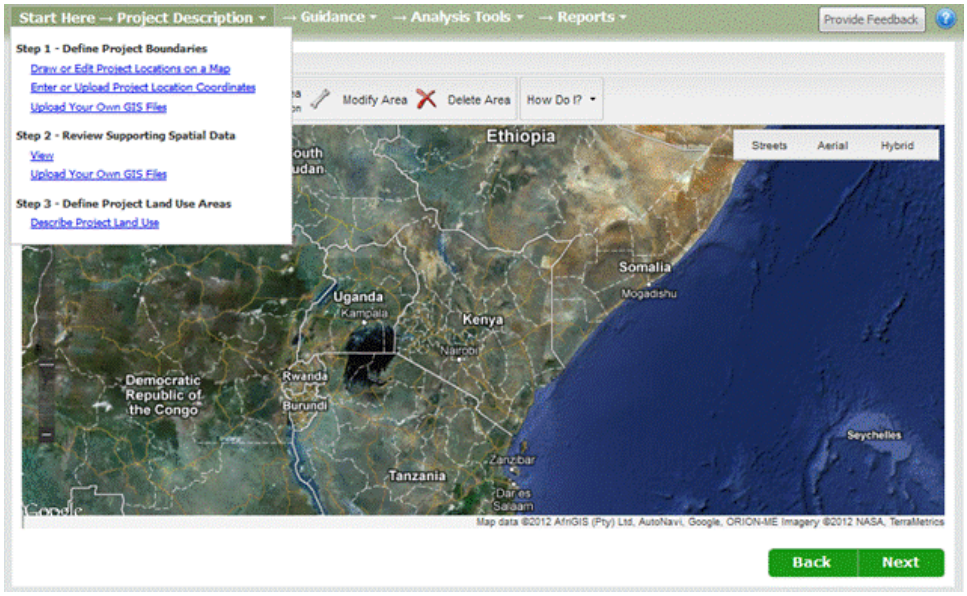
*TIPS*

1. Click on the help icon in the top right hand corner  for further help
2. Double click in the white boxes in the tables to activate the dropdown menus
3. Give the system time to work, if you think it is not doing anything check the connection status at the top of the page.
4. Make sure you click on the save buttons after entering data for each land use category.
5. If you need to remind yourself of how much land is in each land use category go to 'Project Description>Step 3> Describe project land use
6. In the Simple and Detailed Assessments, data for the initial land use, baseline and project scenarios may be entered in any order. For example, you don't need to enter all of the initial land use data before going to the baseline or project scenarios. Similarly, you might complete Stage 1 within a land use category and come back to enter Stage 2 at another time.

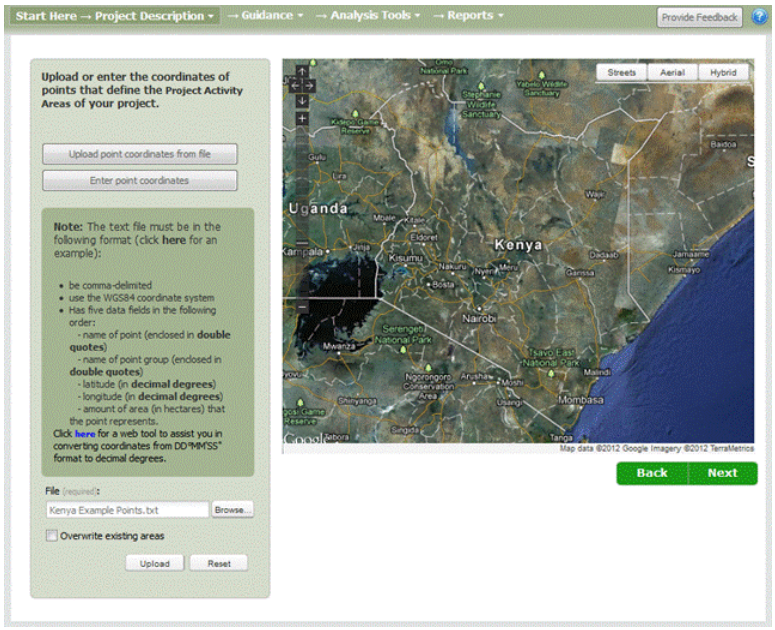
*Project Description*

For this exercise points where project land management activities are taking place have already been defined for you in Step 1 of the Simple Assessment 'Project Description'. You can upload the points from the file provided. To upload the file take these steps:

1) **<u>Uploading project activity area points</u>**: Click on the "Start Here – Project Description" link on the toolbar and select the option "Enter or Upload Project Location Coordinates" as seen below:



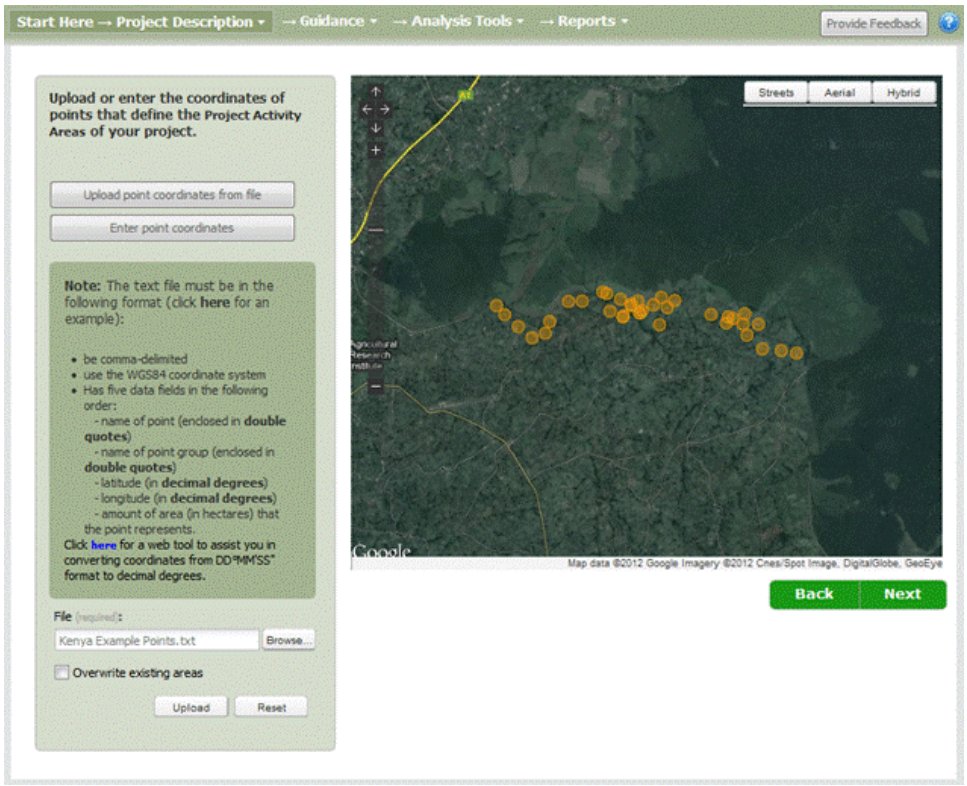

Then click on the button labeled "Upload Point Coordinates from a File". You should see a form that looks like this:



Click on the “Browse” button and locate the provided file named “Kenya Example Points.txt”. It will be on the USB stick in the folder called ‘Exercises > GIS files’. **You need to locate the ZIP file using the ‘File (required):’** box
This file contains the point locations, names, group identification and area associated with each point. Here is an example of the file contents:

```
"Agroforestry point 1","Introduced Agroforestry",0.287387,34.813994,0.2
"Agroforestry point 2","Introduced Agroforestry",0.286564,34.816293,7.5
"Agroforestry point 3","Introduced Agroforestry",0.286401,34.816253,8.6
"Agroforestry point 4","Introduced Agroforestry",0.287054,34.819153,3.8
"Agroforestry point 5","Introduced Agroforestry",0.288314,34.817681,8.9
…
```

Note the file must have a ‘.txt’ extension, must be comma delimited, and must meet the content and format requirements described on the page. Click on the “Upload” button to upload the points. You should then see a page that looks like this:

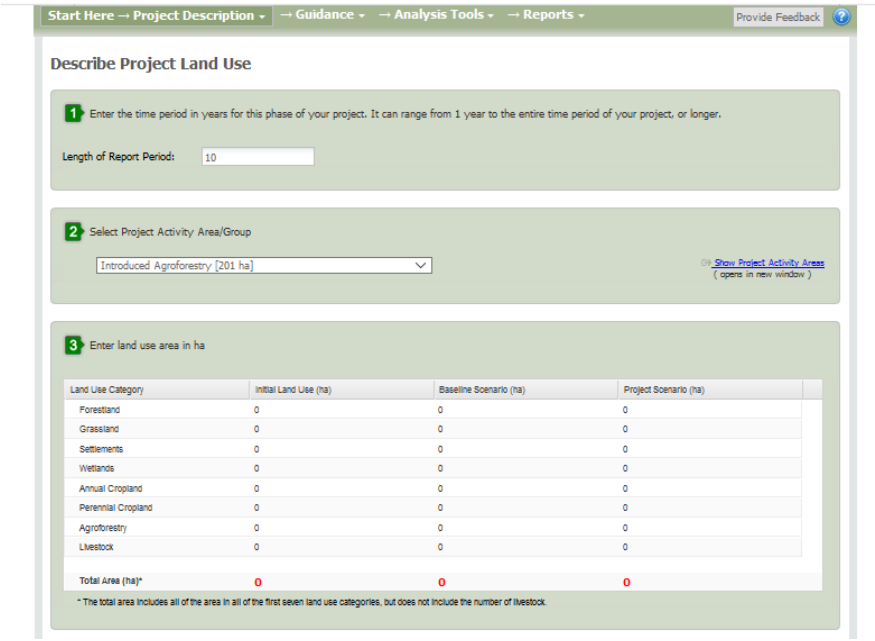



Your project activity areas are now ready for you to continue with the exercise. Please keep in mind that this project is speculative and hypothetical, for demonstration purposes, and is designed to feature land use and management that is both relatively common in the region but also helps instruct the user on aspects of data entry for the CBP Modelling toolkit.

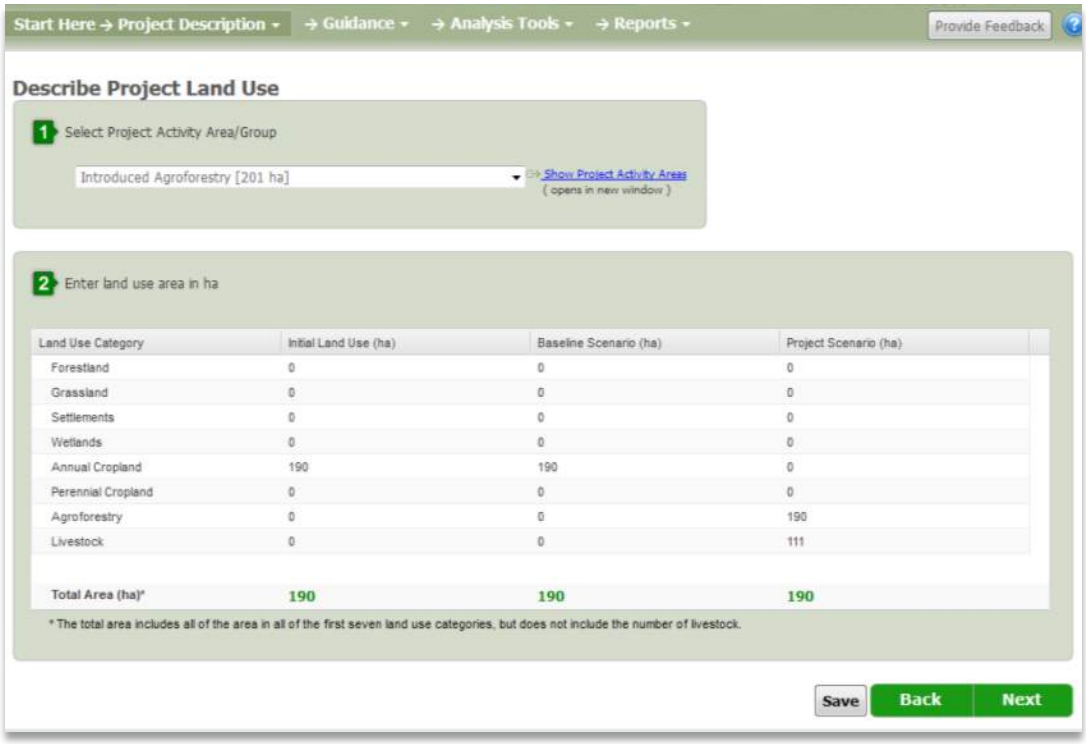
The point locations, named “Introduced Agroforestry,” represent households that will diversify their operations during the project by converting annual cropland into agroforestry and livestock. All the points have been put into a single group called “Introduced Agroforestry”.

The area (number of hectares) for each land use category (forestland, grassland, annual cropland, etc.) for each Project Activity Area need to be entered under Step 3 in the Project Description, for the initial, baseline and project scenarios.

At this point you should click on the “Start Here -> Project Description” link on the toolbar and select “Describe Project Land Use” under step 3. You may examine the underlying spatial data under step 2 if you wish before proceeding with these steps. You should see a page that looks like this:




1. Set the ‘Length of report period’ to 10 years.
2. In Step 2 and select the Project Activity Group “Introduced Agroforestry.”
3. In Step 3, enter the land areas in the table as described for this project and click ‘Save’:
   In this Project Activity Group, 190 ha were in annual cropland at the beginning of the project (Initial land use). In the baseline scenario, 190 ha remain in cropland. In the project scenario, the annual cropland is all converted to agroforestry and 111 head of livestock are also added (note that livestock are added as number of animals, not hectares, if you hover over the word ‘livestock’ a note appears to tell you this).




4. You have now entered land areas for all Project Activity Areas and Groups, so you may continue to the Simple Assessment.

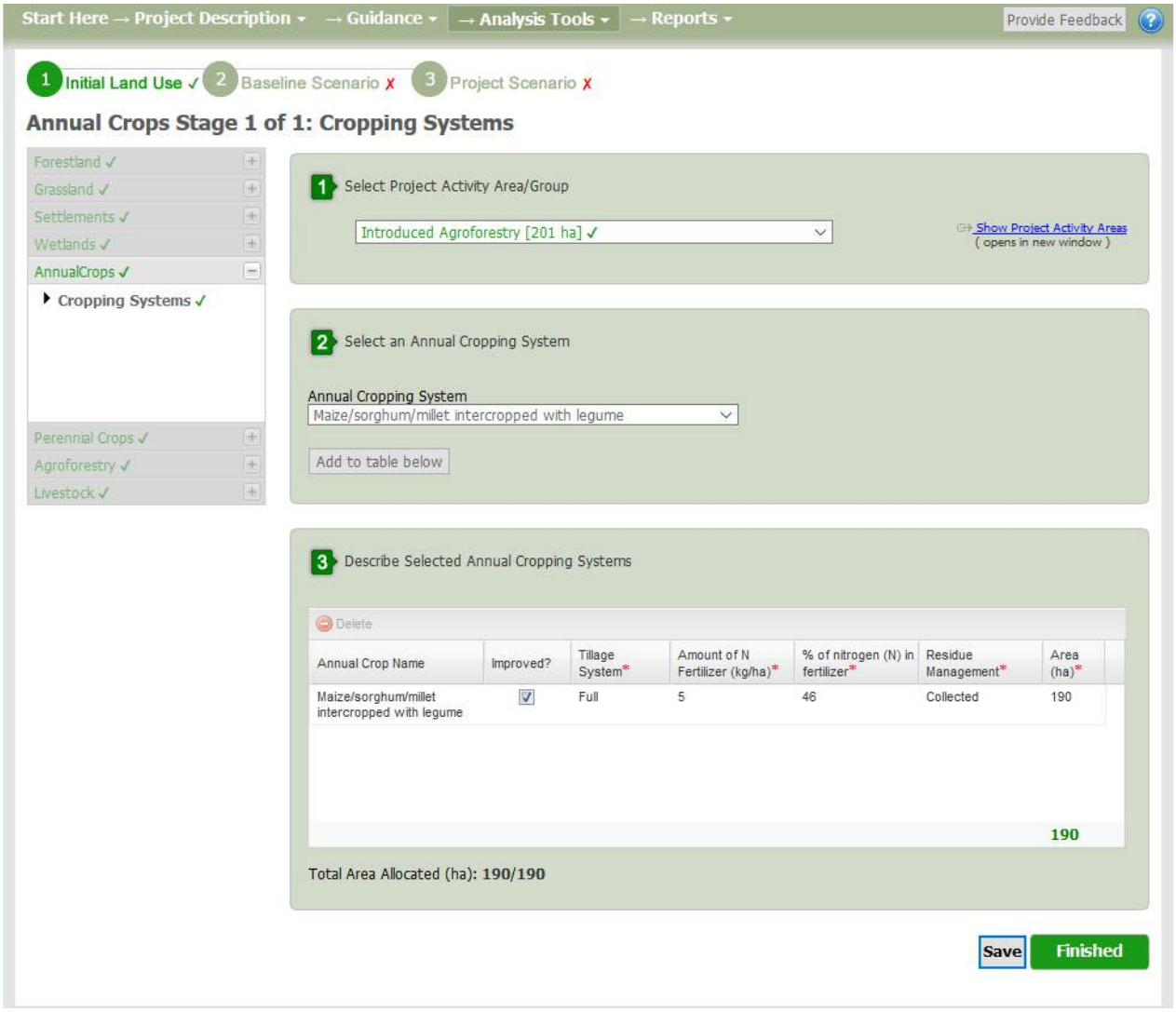
**INITIAL LANDUSE**

*Analysis Tools > Simple Assessment > Initial Land Use*

*Hover over 'Analysis Tools' in the top menu and click on 'Simple Assessment' then click on*


From the menu of land use categories on the left hand side choose:
Annual Crops

1. Select *Cropping Systems*
2. In Step 1, select Project Activity Area "Introduced Agroforestry"
3. In Step 2, select the annual cropping system "Maize/sorghum/millet intercropped with legume" and then *Add to table below*
4. In Step 3, describe the selected annual cropping system as follows:
    a. Improved: Check (hover over the word improved for a definition)
    b. Tillage System: Full
    c. Amount of N Fertilizer (kg/ha): 5
    d. % of nitrogen in fertilizer: 46
    e. Residue management: Collected
    f. Area (ha): 190
5. Click *Save* and then *Finished*




Congratulations you have now described the initial land use in all of the areas where the project is working!

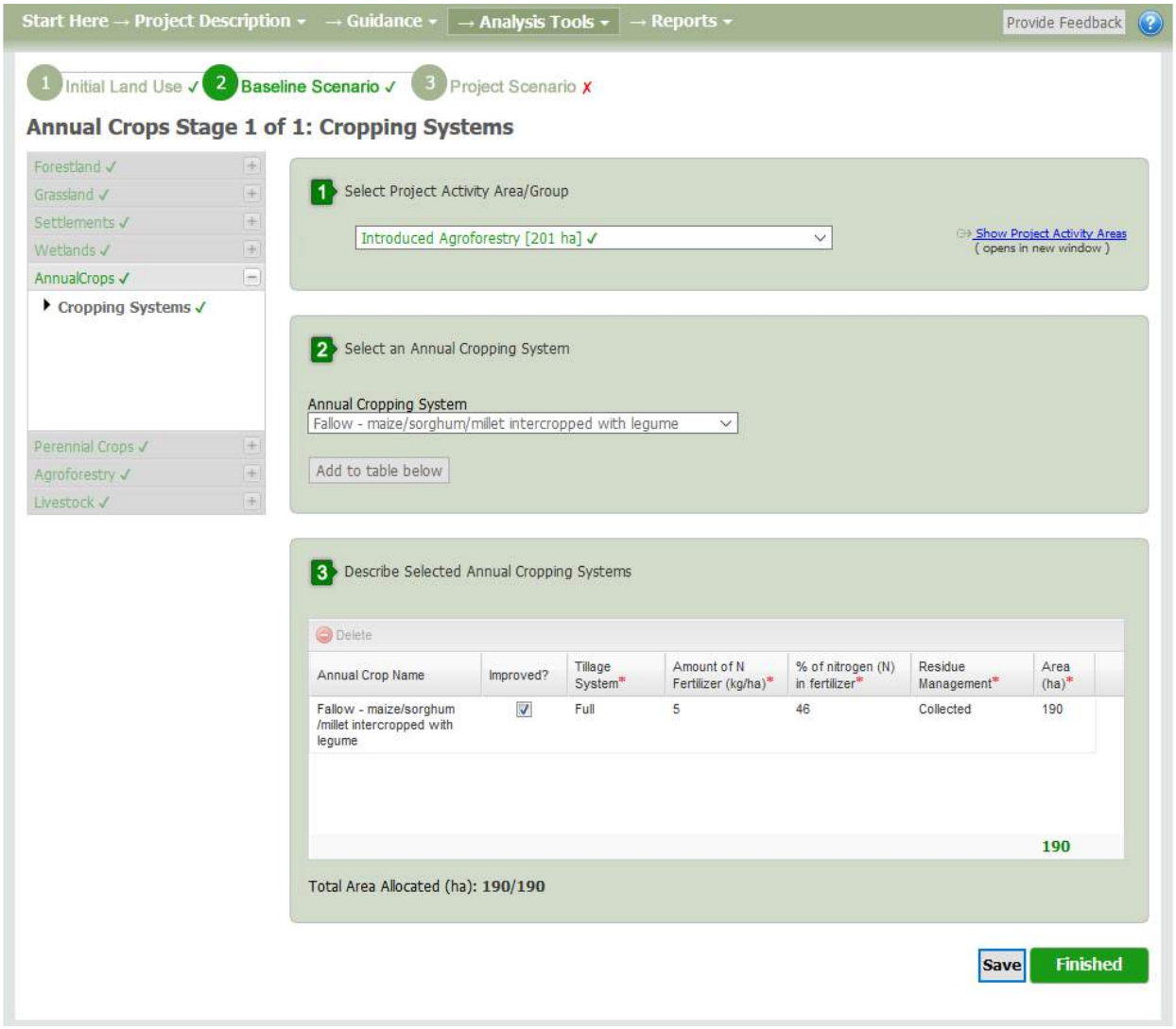
**BASELINE SCENARIO**

Click on


*Analysis Tools > Simple Assessment > Baseline Scenario*

Annual Crops

1. In Step 1, select Project Activity Area "Introduced Agroforestry"
2. In Step 2, select the annual cropping system "Maize/sorghum/millet intercropped with legume" and then *Add to table below*
3. In Step 3, describe the selected annual cropping system as follows:
    a. Improved: Check
    b. Tillage System: Full
    c. Amount of N Fertilizer (kg/ha): 5
    d. % of nitrogen in fertilizer: 46
    e. Residue management: Collected
    f. Area (ha): 190
4. Click *Save*




Congratulations you have now described the Baseline Scenario in all of the areas where the project is working!

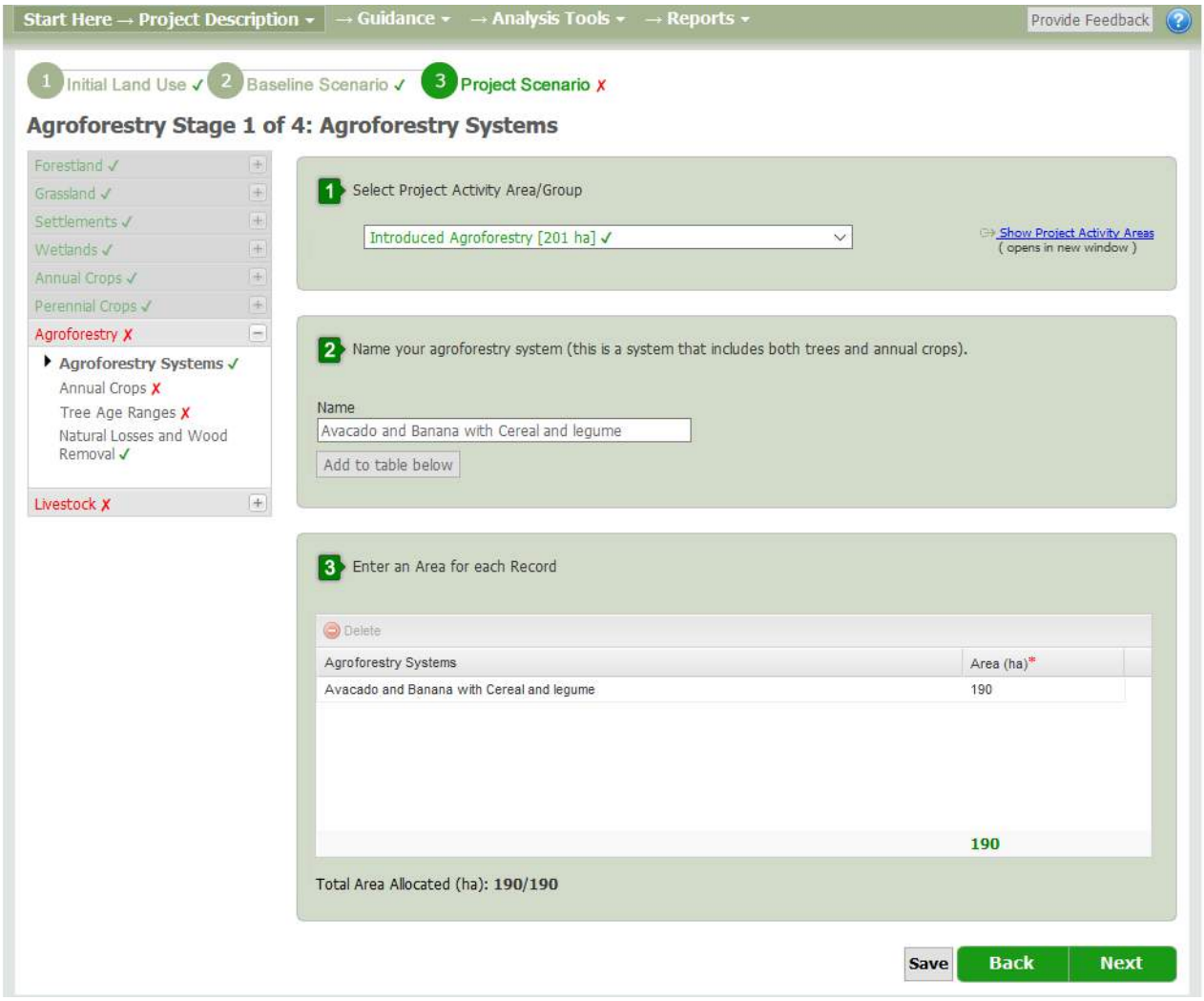
**PROJECT SCENARIO**

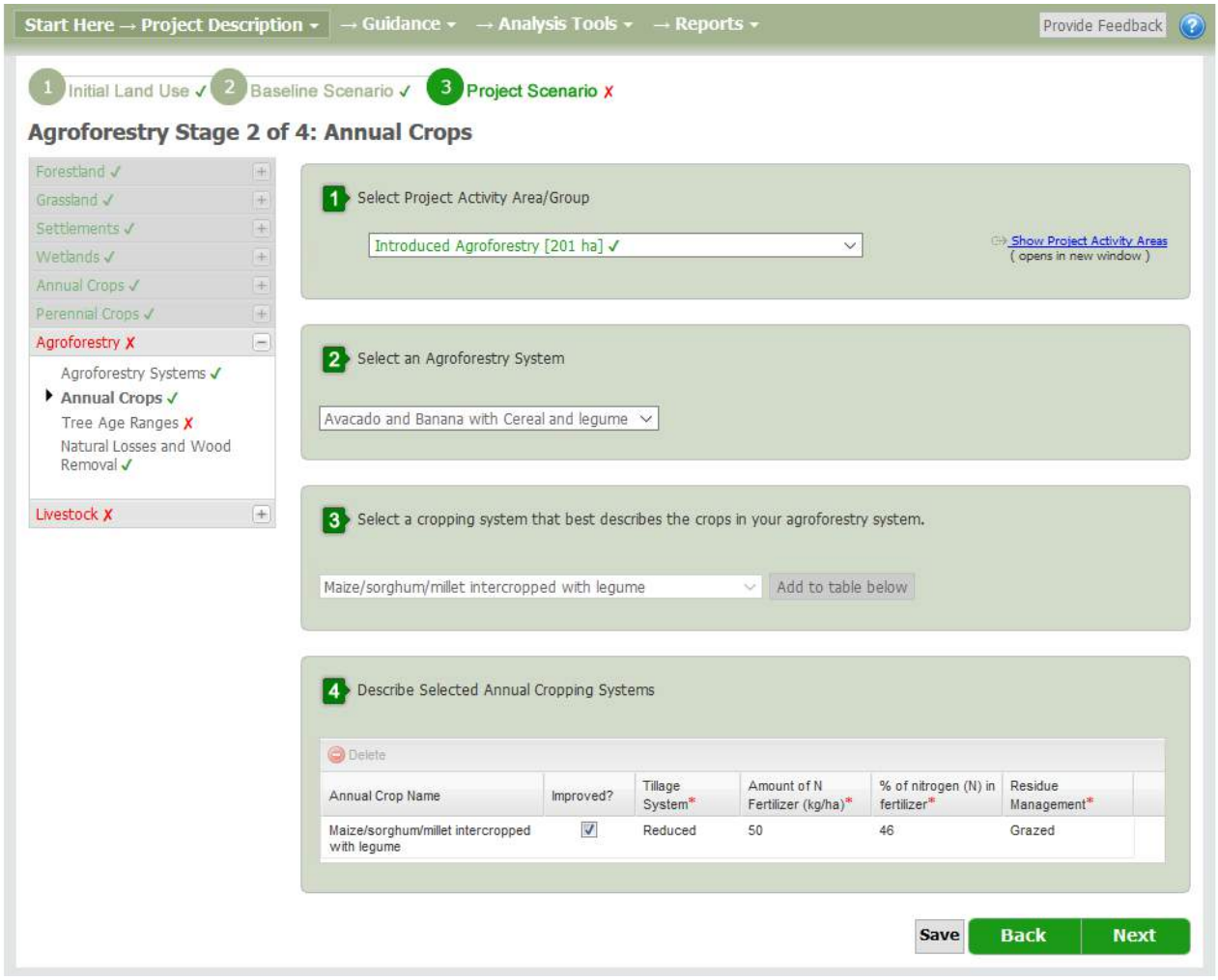
Click on

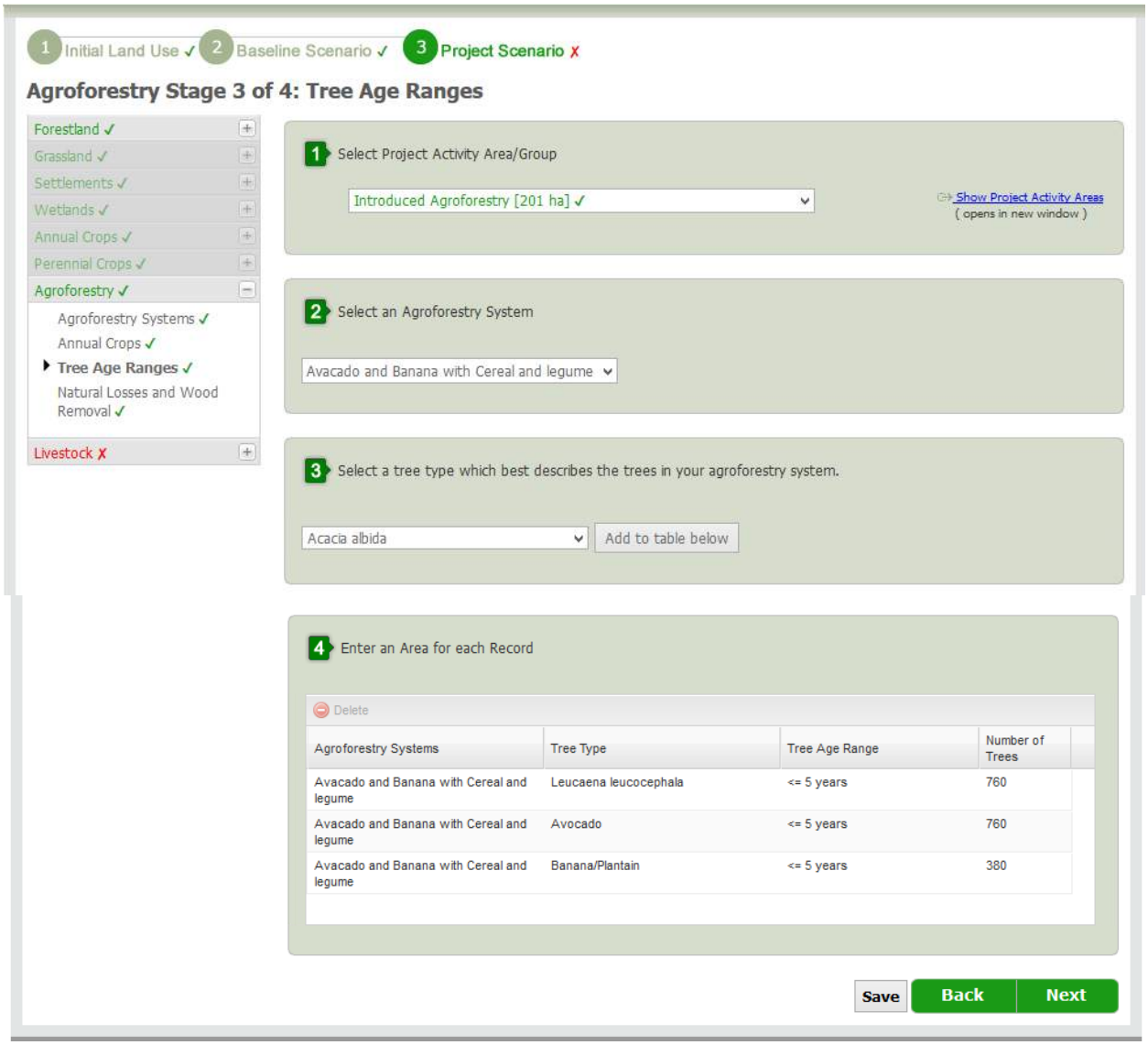

*Analysis Tools > Simple Assessment > Project Scenario*

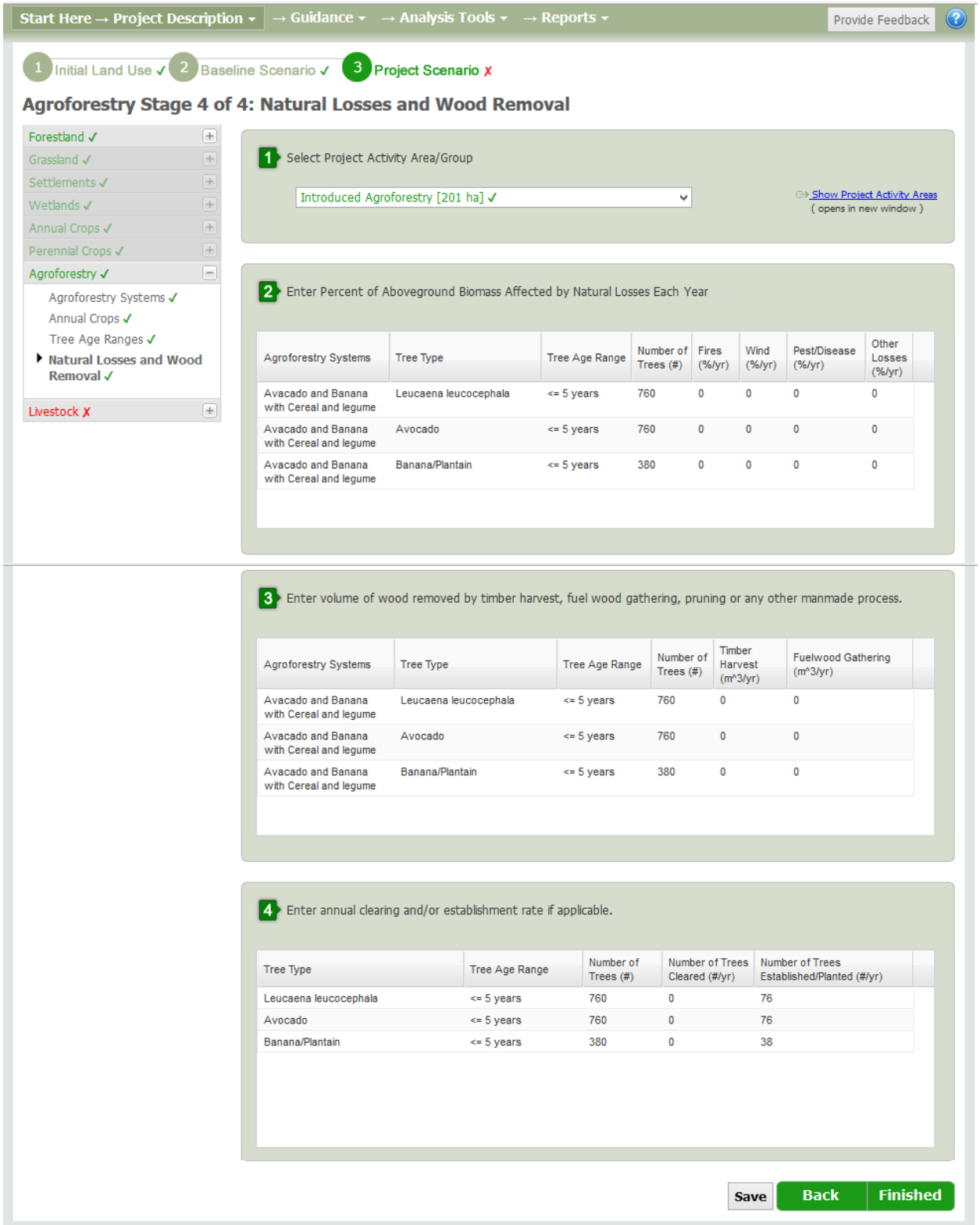
Agroforestry

1. Select *Agroforestry Systems*
2. In step 1, select Project Activity Area "Introduced Agroforestry"
3. In step 2, name the agroforestry system "Avocado and Banana with cereal and legume" (you will have to type this in) and assign the area (190 ha).
4. Click *Save* and then *Next* to go to *Annual Crops*
5. In step 1, select Project Activity Area "Introduced Agroforestry"
6. In step 2, select the agroforestry system you created on the previous page
7. In step 3, select the cropping system that best represents the annual cropping system in the agroforestry system "Maize/sorghum/millet intercropped with legume"
8. In Step 4, describe the selected annual cropping system as follows:
    a. Improved: Check
    b. Tillage System: Reduced
    c. Amount of N Fertilizer (kg/ha): 50
    d. % of nitrogen in fertilizer: 46
    e. Residue management: Grazed
9. Click *Save* and then *Next* to go to *Tree Age Ranges*
10. In step 2, select the agroforestry system
11. In step 3, select the following tree types represented in the agroforestry system and *Add to table below*: Leucaena leucocephala, Avocado, Banana/Plantain
12. In step 3, select *Tree Age Range* "<= 5 years" for all 3 tree types and assign number of trees for each tree type: Leucaena leucocephala (760), Avocado (760), Banana/Plantain (380)
13. Click *Save* and then *Next* to go to *Natural Losses and Wood Removal*.
14. In step 2, enter percent per year of aboveground biomass affected by natural losses (0 for each category for all tree types)
15. In step 3, enter volumes of wood removed for all forest types by timber harvest (0 for all types) and for fuelwood gathering: Leucaena leucocephala (10 $m^3$/yr), Avocado (10 $m^3$/yr), Banana/Plantain (5 $m^3$/yr)
16. In step 4, under number of trees established/planted enter Leucaena leucocephala (76), Avacado (76) and Banana/Plantain (38).
17. Click *Save* and then *Finished*.


Start Here → Project Description
→ Guidance
→ Analysis Tools
→ Reports
Provide Feedback
1 Initial Land Use ✓
2 Baseline Scenario ✓
3 Project Scenario ✗
Agroforestry Stage 1 of 4: Agroforestry Systems
Forestland ✓
Grassland ✓
Settlements ✓
Wetlands ✓
Annual Crops ✓
Perennial Crops ✓
Agroforestry ✗
Agroforestry Systems ✓
Annual Crops ✗
Tree Age Ranges ✗
Natural Losses and Wood Removal ✓
Livestock ✗
1 Select Project Activity Area/Group
Introduced Agroforestry [201 ha] ✓
Show Project Activity Areas
( opens in new window )
2 Name your agroforestry system (this is a system that includes both trees and annual crops).
Name
Avacado and Banana with Cereal and legume
Add to table below
3 Enter an Area for each Record
Delete
Agroforestry Systems
Area (ha)*
Avacado and Banana with Cereal and legume
190
190
Total Area Allocated (ha): 190/190
Save
Back
Next

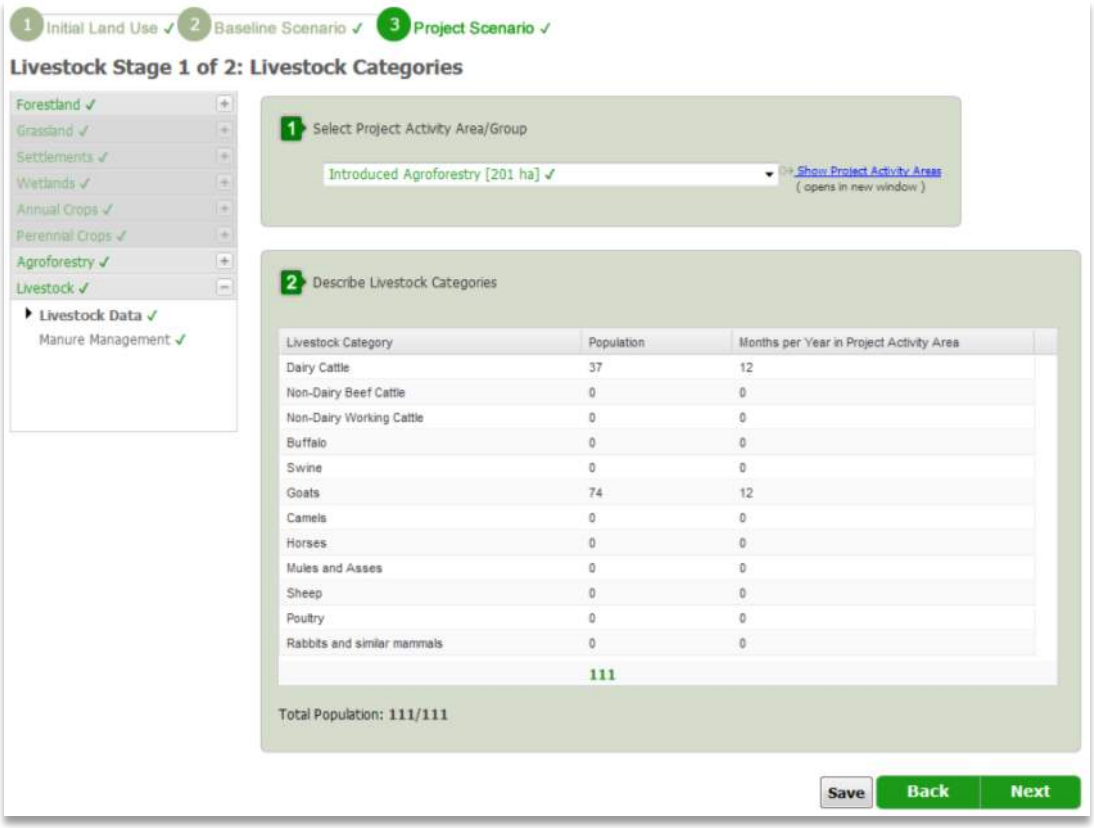

Start Here → Project Description
→ Guidance
→ Analysis Tools
→ Reports
Provide Feedback
1 Initial Land Use ✓
2 Baseline Scenario ✓
3 Project Scenario ✗
Agroforestry Stage 2 of 4: Annual Crops
Forestland ✓
Grassland ✓
Settlements ✓
Wetlands ✓
Annual Crops ✓
Perennial Crops ✓
Agroforestry ✗
Agroforestry Systems ✓
Annual Crops ✓
Tree Age Ranges ✗
Natural Losses and Wood Removal ✓
Livestock ✗
1 Select Project Activity Area/Group
Introduced Agroforestry [201 ha] ✓
Show Project Activity Areas
( opens in new window )
2 Select an Agroforestry System
Avacado and Banana with Cereal and legume
3 Select a cropping system that best describes the crops in your agroforestry system.
Maize/sorghum/millet intercropped with legume
Add to table below
4 Describe Selected Annual Cropping Systems
Delete
Annual Crop Name
Improved?
Tillage System*
Amount of N Fertilizer (kg/ha)*
% of nitrogen (N) in fertilizer*
Residue Management*
Maize/sorghum/millet intercropped with legume
Reduced
50
46
Grazed
Save
Back
Next

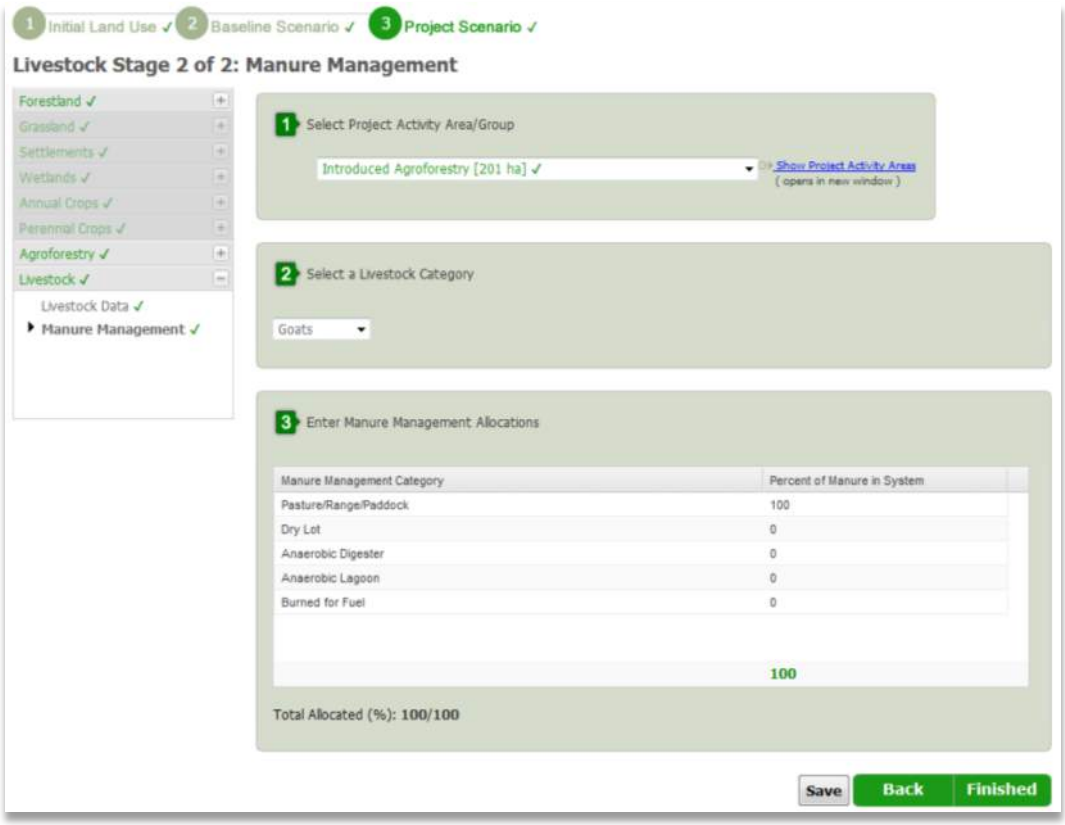

1 Initial Land Use ✓
2 Baseline Scenario ✓
3 Project Scenario ✗
Agroforestry Stage 3 of 4: Tree Age Ranges
Forestland ✓
Grassland ✓
Settlements ✓
Wetlands ✓
Annual Crops ✓
Perennial Crops ✓
Agroforestry ✓
Agroforestry Systems ✓
Annual Crops ✓
Tree Age Ranges ✓
Natural Losses and Wood Removal ✓
Livestock ✗
1 Select Project Activity Area/Group
Introduced Agroforestry [201 ha] ✓
Show Project Activity Areas
( opens in new window )
2 Select an Agroforestry System
Avacado and Banana with Cereal and legume
3 Select a tree type which best describes the trees in your agroforestry system.
Acacia albida
Add to table below
4 Enter an Area for each Record
Delete
Agroforestry Systems
Tree Type
Tree Age Range
Number of Trees
Avacado and Banana with Cereal and legume
Leucaena leucocephala
<= 5 years
760
Avacado and Banana with Cereal and legume
Avocado
<= 5 years
760
Avacado and Banana with Cereal and legume
Banana/Plantain
<= 5 years
380
Save
Back
Next

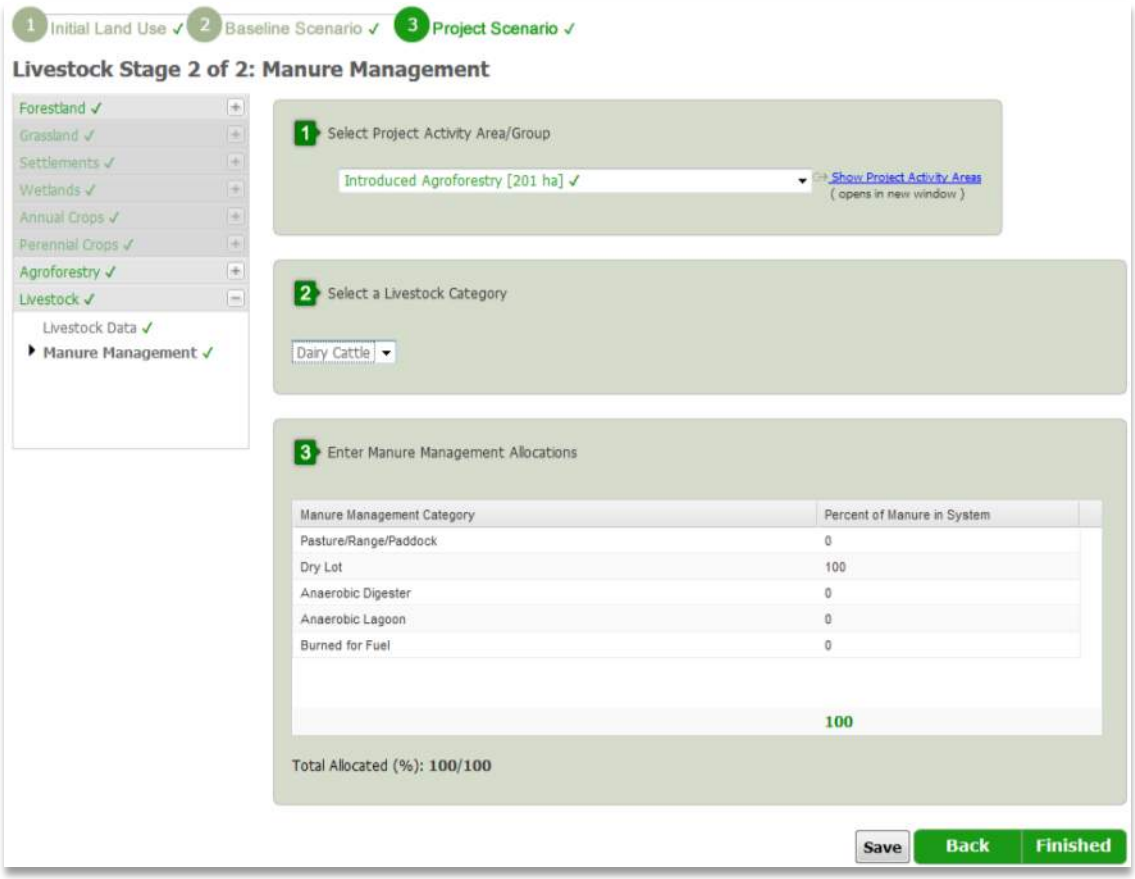

Start Here → Project Description
→ Guidance
→ Analysis Tools
→ Reports
Provide Feedback
1 Initial Land Use ✓
2 Baseline Scenario ✓
3 Project Scenario ✗
Agroforestry Stage 4 of 4: Natural Losses and Wood Removal
Forestland ✓
Grassland ✓
Settlements ✓
Wetlands ✓
Annual Crops ✓
Perennial Crops ✓
Agroforestry ✓
Agroforestry Systems ✓
Annual Crops ✓
Tree Age Ranges ✓
Natural Losses and Wood Removal ✓
Livestock ✗
1 Select Project Activity Area/Group
Introduced Agroforestry [201 ha] ✓
Show Project Activity Areas
( opens in new window )
2 Enter Percent of Aboveground Biomass Affected by Natural Losses Each Year
Agroforestry Systems | Tree Type | Tree Age Range | Number of Trees (#) | Fires (%/yr) | Wind (%/yr) | Pest/Disease (%/yr) | Other Losses (%/yr)
Avacado and Banana with Cereal and legume | Leucaena leucocephala | <= 5 years | 760 | 0 | 0 | 0 | 0
Avacado and Banana with Cereal and legume | Avocado | <= 5 years | 760 | 0 | 0 | 0 | 0
Avacado and Banana with Cereal and legume | Banana/Plantain | <= 5 years | 380 | 0 | 0 | 0 | 0
3 Enter volume of wood removed by timber harvest, fuel wood gathering, pruning or any other manmade process.
Agroforestry Systems | Tree Type | Tree Age Range | Number of Trees (#) | Timber Harvest (m^3/yr) | Fuelwood Gathering (m^3/yr)
Avacado and Banana with Cereal and legume | Leucaena leucocephala | <= 5 years | 760 | 0 | 0
Avacado and Banana with Cereal and legume | Avocado | <= 5 years | 760 | 0 | 0
Avacado and Banana with Cereal and legume | Banana/Plantain | <= 5 years | 380 | 0 | 0
4 Enter annual clearing and/or establishment rate if applicable.
Tree Type | Tree Age Range | Number of Trees (#) | Number of Trees Cleared (#/yr) | Number of Trees Established/Planted (#/yr)
Leucaena leucocephala | <= 5 years | 760 | 0 | 76
Avocado | <= 5 years | 760 | 0 | 76
Banana/Plantain | <= 5 years | 380 | 0 | 38
Save
Back
Finished

Livestock

1. Select *Livestock Data*
2. In step 1, select Project Activity Area “Introduced Agroforestry”
3. In step 2, enter the population and months per year livestock are in the Project Activity Area: Dairy Cattle (37 head, 12 months per year), Goats (74 head, 12 months per year)
4. Click *Save* and then *Next* to go to *Manure Management*
5. In step 2, select livestock category “Goats”
6. In step 3, enter percent in each manure management system: 100% in Pasture/Range/Paddock
7. Click Save
8. Go back to step 2 and select livestock category “Dairy Cattle”
9. In step 3, enter percent in each manure management system: 100% in Dry Lot
18. Click *Save* and then *Finished*.

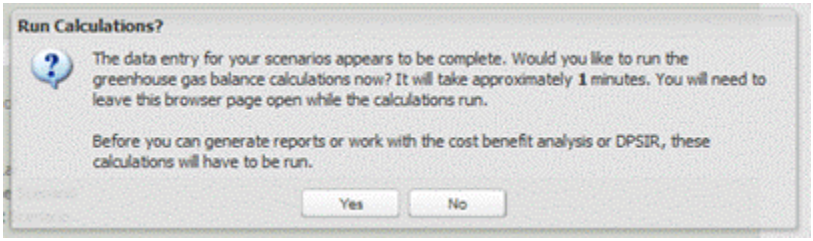



1 Initial Land Use ✓ 2 Baseline Scenario ✓ 3 Project Scenario ✓
Livestock Stage 2 of 2: Manure Management
Forestland ✓
Grassland ✓
Settlements ✓
Wetlands ✓
Annual Crops ✓
Perennial Crops ✓
Agroforestry ✓
Livestock ✓
Livestock Data ✓
Manure Management ✓
1 Select Project Activity Area/Group
Introduced Agroforestry [201 ha] ✓
Show Project Activity Areas
( opens in new window )
2 Select a Livestock Category
Goats
3 Enter Manure Management Allocations
Manure Management Category
Percent of Manure in System
Pasture/Range/Paddock 100
Dry Lot 0
Anaerobic Digester 0
Anaerobic Lagoon 0
Burned for Fuel 0
100
Total Allocated (%): 100/100
Save
Back
Finished


1 Initial Land Use ✓ 2 Baseline Scenario ✓ 3 Project Scenario ✓
Livestock Stage 2 of 2: Manure Management
Forestland ✓
Grassland ✓
Settlements ✓
Wetlands ✓
Annual Crops ✓
Perennial Crops ✓
Agroforestry ✓
Livestock ✓
Livestock Data ✓
Manure Management ✓
1 Select Project Activity Area/Group
Introduced Agroforestry [201 ha] ✓
Show Project Activity Areas
( opens in new window )
2 Select a Livestock Category
Dairy Cattle
3 Enter Manure Management Allocations
Manure Management Category
Percent of Manure in System
Pasture/Range/Paddock 0
Dry Lot 100
Anaerobic Digester 0
Anaerobic Lagoon 0
Burned for Fuel 0
100
Total Allocated (%): 100/100
Save
Back
Finished

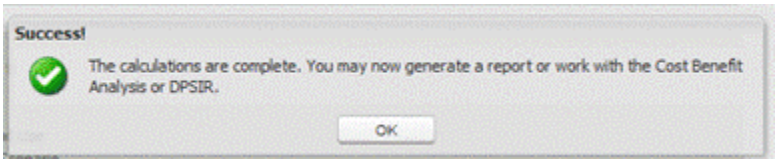
*Review Report Document*

At this point you have completed your data entry for this example. You should see a popup window that looks like this:

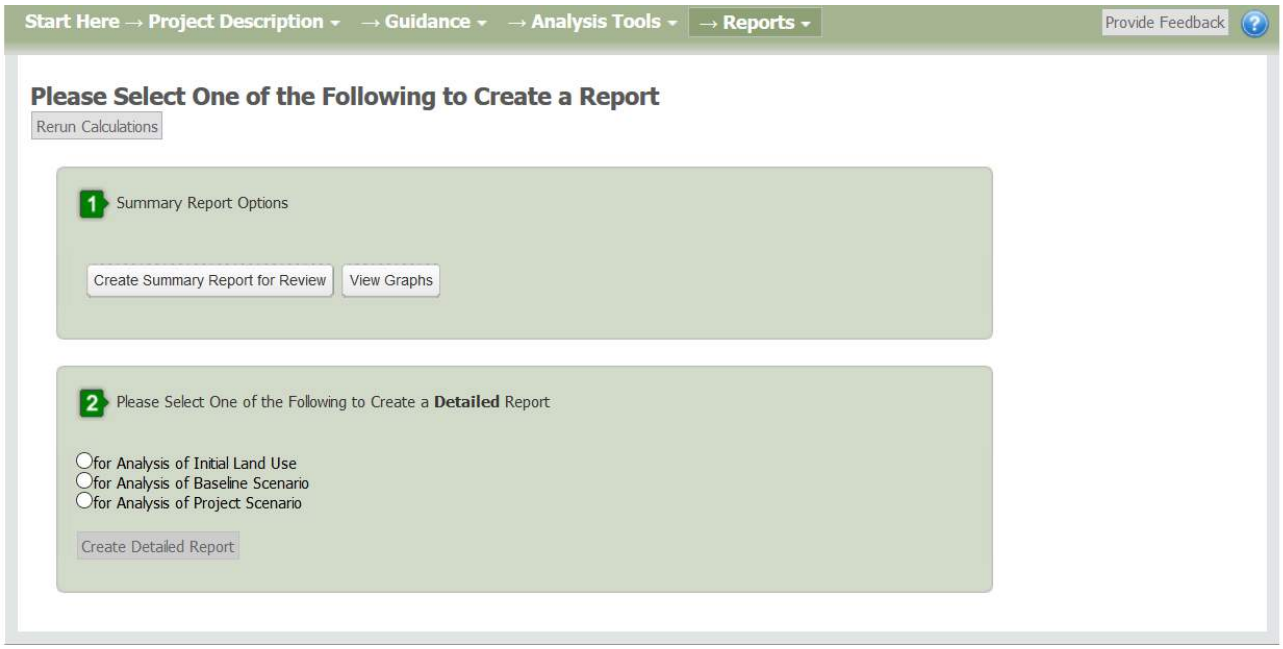



Running the calculations for your project can take from as little as a minute to up to several minutes, depending on the size and complexity of your project. Increasing land use complexity and large intervention areas (over 100,000 ha) may lead to calculation run times longer than 10 minutes. If several users are running calculations at the same time then this can lead to longer run times as well.

Click on the "Yes" button to run the calculations. In approximately 1 minute you should see a window that looks like this:




Click on the "OK" Button and you may now generate a report. Click on the "Reports" link on the toolbar. You should see a page that looks like this:



Then click on the “Create Summary Report for Review” button.

To generate a Detailed Report showing results of individual equations, in step box 2 select one of the Assessment Steps (Initial Land Use, Baseline Scenario, Project Scenario) and click on the “Create Detailed Report”.

This example scenario is now complete.