Land-use Planner

An interactive economic tool to support responsible land-use planning

Step 2

Definition of land use

EUREDD Facility

EFI

2

Land use

2.1. Introduction to the land uses

This stage of the tool aims to define the initial state of your area: to a certain extent, this provides a record of what is included in your area for the first year of your project. You should define this area by adding each important type of land use, one after the other. You can do so by clicking on one of the six land-use icons and dragging it to the space that represents the area.

You do not need to describe all of your area's different types of vegetation and crops in detail. However, it is important to properly describe the land uses that particularly interest you in your planning process: which crop(s) are really affected by planning and development choices? Which choices will be those that interest stakeholders?

For example, if you know that you would like to test scenarios with various methods of cultivating oil palm while comparing it to the opportunities offered by cocoa, you should seek to properly describe these uses at this point. On the other hand, it may not be useful to specify all the existing crop types if you do not wish to focus on this sector. You could even skip defining the zones (lakes, zones designated for infrastructure, etc.) that will be identical in all your scenarios (step 3) and that will not be affected by crop development.

It comes down to striking a balance between diversity and simplicity. We recommend that you choose a maximum of 12 different land uses. You must also take into account that significantly rugged surfaces are unsuitable for cultivation. They may be characterised as 'forest' or 'other', with a strong probability that the use of these zones will not change. The remaining zones will be recorded as bare land if they remain undefined when moving to the following step (step 3, Scenarios). This bare land must be defined as 'other'.

The Land-use Planner offers six main land-use types through the six main icons: forest, perennial crop, annual crop, fallow, livestock, as well as the 'other' category for all other land uses that do not fit in any of the preceding categories. You can therefore use the 'other' category to include wetlands, bare land or even zones occupied by certain rural infrastructures if you wish to include them for the purpose comparing scenarios.

You can select several land uses for a single category. For example, you can specify several forest types to distinguish between a production forest (such as a forest concession), a conservation forest (such as a protected area) or even a community forest. You can also plan different entries to distinguish various modes of production within one crop (for example, between conventional and organic crops).

The special case of forest plantations: when the management method for quick-growing forest plantations for timber production appears to fit more into perennial crops than natural forests, you can categorise them as 'perennial crop' rather than 'forest'. Alternatively, forest plantations whose main purpose is not timber production, but for example carbon sequestration, may be better described using the 'forest' category.

You can associate one land use with another. For example, if cocoa is intercropped in rubber plantations, you can drag the 'perennial crop' icon (which will allow us to define our cocoa) into a zone already identified as rubber.

2.2. Land cover and land use

According to the Food and Agriculture Organization of the United Nations (1998), land cover refers to 'the observed (bio)physical cover on the Earth's surface' and therefore the type of use (or non-use) made of the land by humankind. A landscape mosaic therefore identifies the consistent types of environment (for example: developed zones, agricultural zones, forests or moors, wetlands, and so forth.)

Land use refers to the socioeconomic use of land (for example, agriculture, forestry, conservation, recreation or residential purposes).

During this step of the Land-use Planner, the main purpose is to define the land uses (specifically the forest land and agricultural land).

2.3. Help during this stage

Land cover maps

To help describe your area with reliable and precise surface estimates, at this stage, it will be useful to refer to land cover or land-use maps available for your area. You can also refer to the geospatial information available online, for example the Global Forest Watch platform (http://www.globalforestwatch.org/).

Various types of spatial data may help you with this analysis. This could include land-use data from a Geographic Information System (GIS) and land cover data from the analysis of satellite imagery (vegetation maps).

You will often be able to identify land-use types from these maps, such as forest concessions, plantations, protected areas or even mining permits. Satellite imagery analysis will allow you to identify forest lands, sometimes with a distinction between primary and secondary forests, crop lands and urban zones.

The land cover and/or use categories shown on these maps must not necessarily restrict your choices in the Land-use Planner. The maps may act as a guide, specifically in terms of surface for the main categories (for example agriculture and forest), but you can also define more specific categories or sub-categories in the Land-use Planner. For example, within agricultural land, you can estimate the surface dedicated to cocoa or to rubber culture.

That said, it is sometimes wise to stay as close as possible to the pre-defined planning categories used in cartography. This is the case when you wish to use the Land-use Planner to accompany an official land management process. As a general rule, it will always be useful to be able to establish a link between your land-use types in the Land-use Planner and the categories found on planning maps for your area.

The use of worksheets

In order to properly convey the ecological, economic and social value of each land use, data collection sheets (worksheets) are available. They will act as a guide to observing the land and will aid your data collection. For more details, please see the data collection sheets available here (under the tab 'Resources').

2.4. How to start

Do you know roughly how many land uses you would like to define in your area? Have you made a list of these uses, ideally not exceeding 12 items? If the answers are yes, you are ready to define these different land uses, one after the other.

The first time you enter the ‘Land use’ step, you will find a bar symbolically representing your area. It will be completely empty and can be filled in using the coloured icons shown above.

The definition of the land-use types in the area is completed by dragging the icons onto the land-use bar shown here.

The land-use bar is a schematic and symbolic representation of the area. It does not constitute a cartographic representation but indicates the extent and proportion of each of the defined uses. It also allows you to see at a glance the space yet to be defined.

2.5. The different types of land use provided

Forest

Perennial crops

Annual crops

Livestock

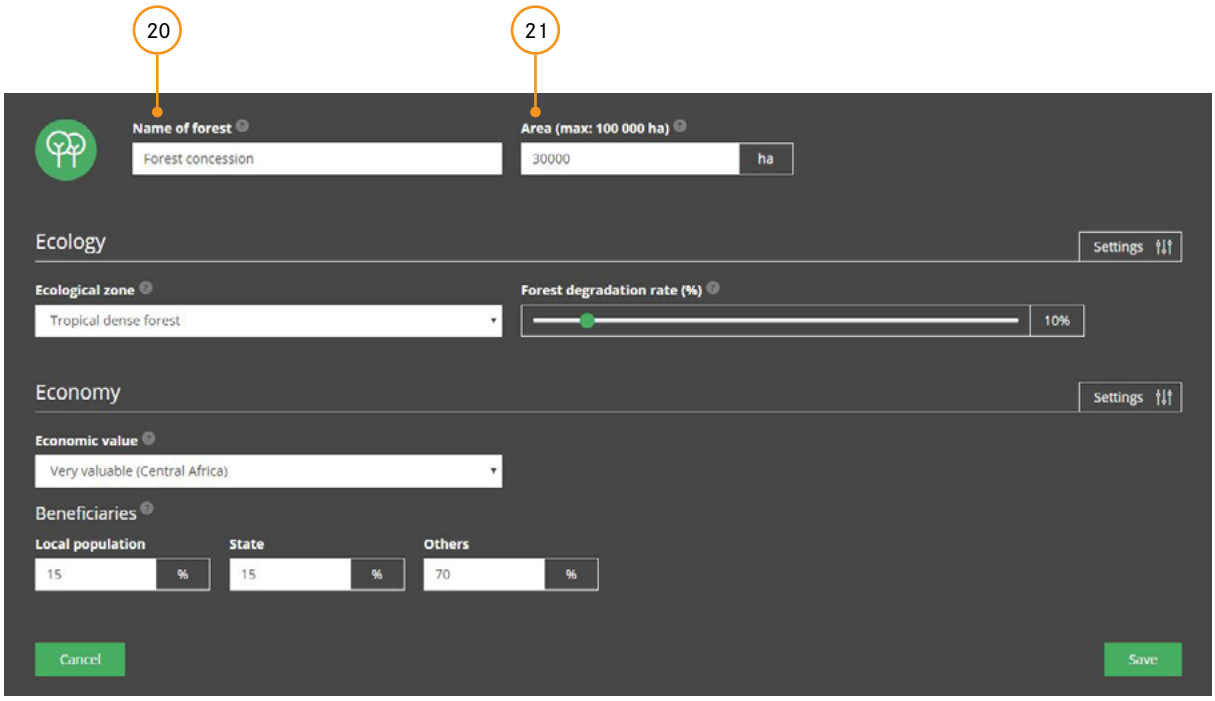
Fallow

Other

Forest

If you wish to differentiate between various types of forest, begin with a first forest type that you want to isolate from the rest of the analysis.

As a first step, enter the name or the type of forest followed by its extent:



20. Name of forest

Label this type of forest with a short name. The choice of name is up to you.

For example, the name may refer to the ecological quality of this land use or its ownership status. In the case of a production forest managed under a concession regime, indicate for example

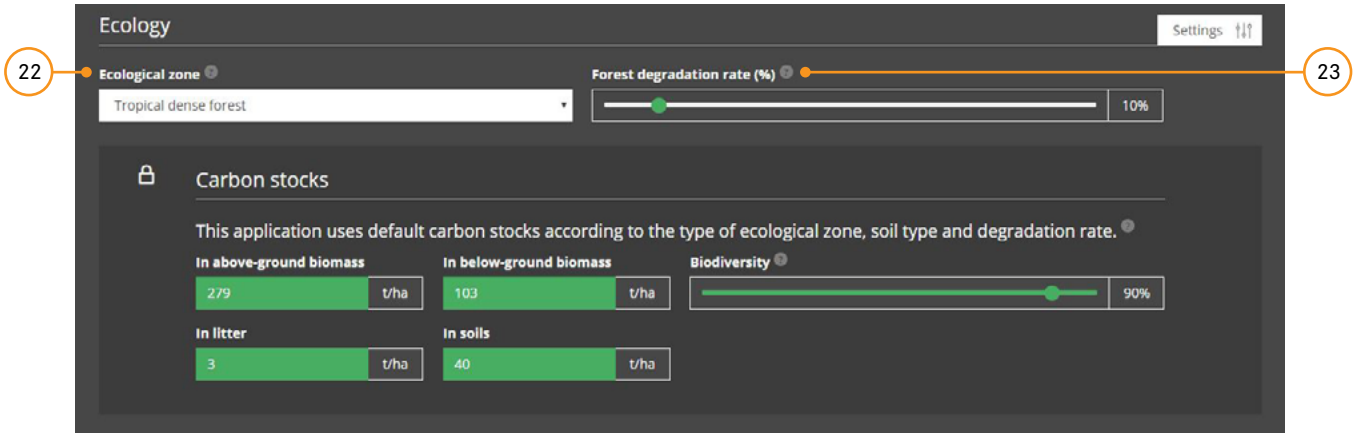
Forest concession

21. Extent

Enter the extent of this specific land use in hectares.

30 000 ha

Once you have indicated the name and size of this type of forest, the rest of the window comprising the 'Ecology' and 'Economy' sections appears.



Ecology

22. Ecological zone

A drop down menu allows you to confirm or choose the type of ecological environment associated with this type of forest: tropical dense forest, or tropical mountain system, etc. These choices help you to fully describe the estimated forest carbon stocks for this type of forest.

By default, the zone selected in step 1 when choosing the ecological zone, will appear here:

Tropical dense forest

23. Forest degradation rate (%)

The percentage of forest degradation is used to adjust carbon stocks and biodiversity. The default value, 0% degradation, relates to the biodiversity and carbon values of an intact natural forest. To change the forest degradation rate, drag the cursor along the horizontal bar.

In the case of a forest concession, indicate for example

10%

You can separate degradation in terms of carbon from that of biodiversity. To do so, click on the 'Settings' icon to adjust the carbon stocks (while the degradation rate in % will no longer affect biodiversity). You can replace the default values (taken from the IPCC) with adjusted data based on the features of your area of interest, expressed in tonnes of carbon per hectare (tC/ha). 1 tC = 3.67 t CO2.

How do you estimate the degradation rate?

For biodiversity, you should generally refer to local actors' knowledge of the land or local studies. Failing these, use objective information and the guidance of the Convention on Biological Diversity (www.cbd.int).

For carbon, you will also find guidance in the literature on forest degradation. You can also apply criteria based on knowledge of the land paired with common sense. In the case of forest concessions, for example, you can use a relative degradation rate depending on the types of concession. For example, in general a certified concession will entail a lower forest degradation rate than a non-certified concession with less restrictive management plans and forest exploitation methods.

If you are unsure what rate of degradation to apply, here you can make some initial estimates and then tweak them together with the actors involved in the planning process.

Carbon stocks

The default carbon stocks values can be modified by clicking on 'Settings'. The pop-up window on the previous page of this Manual will appear.

On carbon dioxide and other greenhouse gases

The sequestration, or conversely, the emission, of greenhouse gases is an important element to consider when calculating the costs and benefits of the various land-use scenarios. As the user, you control how much importance you place on this aspect. You can effectively vary the price per tonne of carbon dioxide equivalent (tCO2e) during the results stage.

The sequestration of carbon in biomass and the earth is systematically taken into account for all land uses (forests, crops, etc.), except for livestock areas, with default values that can be adjusted by the user. For crops, in addition to the carbon stocks of the crop itself (related to the biomass contained in the plantations), additional carbon stocks are included if there are trees on these farms (as the user, you enter the average number of trees per hectare) - see the box below on 'trees on farm'. Sequestration also occurs when fallow lands become forests, if they are not reused for agriculture.

Greenhouse gas emissions are taken into account in two ways by the Land-use Planner:

They result from changes in land use or from changes in the carbon stocks over time, when land with high carbon stocks gives way to land uses with a lower carbon content. This is the case, for example, when a forest becomes agricultural land. This can also be the case when an intact forest becomes a degraded forest.

Greenhouse gas emissions also result from certain forms of livestock farming, as well as certain wetlands and peatlands. This includes various greenhouse gases (specifically methane) that are included in tCO2e (default data or your own data).

For the sake of simplicity, the Land-use Planner only offers the option to include these greenhouse gas emissions for the categories 'livestock' and 'other land uses' (particularly to take into account peatlands). Emissions linked to annual crops, such as rice culture, are therefore not taken into account in this version of the tool. For more information on the methods for calculating carbon equivalent emissions, please refer to the following page from the IPCC website:
http://www.ipcc.ch/ipccreports/tar/wg3/index.php?idp=115

On trees outside of forests, trees on farms

For trees included on cultivated land, a benefit of 1.8 tCO2 per tree is accounted for, regardless of the age and type of tree. This is the carbon equivalent of approximately one tonne of dry wood. Trees on farms can also bring other advantages, such as soil fertility, fruit, pest control, wood and increased land security. An average value of 2 USD/tree/year is taken into account for this group of possible benefits.

Economy

24. The economic value

The economic value includes all forest goods and services, including timber products, bush meat and watershed protection. Only the carbon value is not taken into account here. The Land-use Planner calculates it separately and will take it into account in the final results.

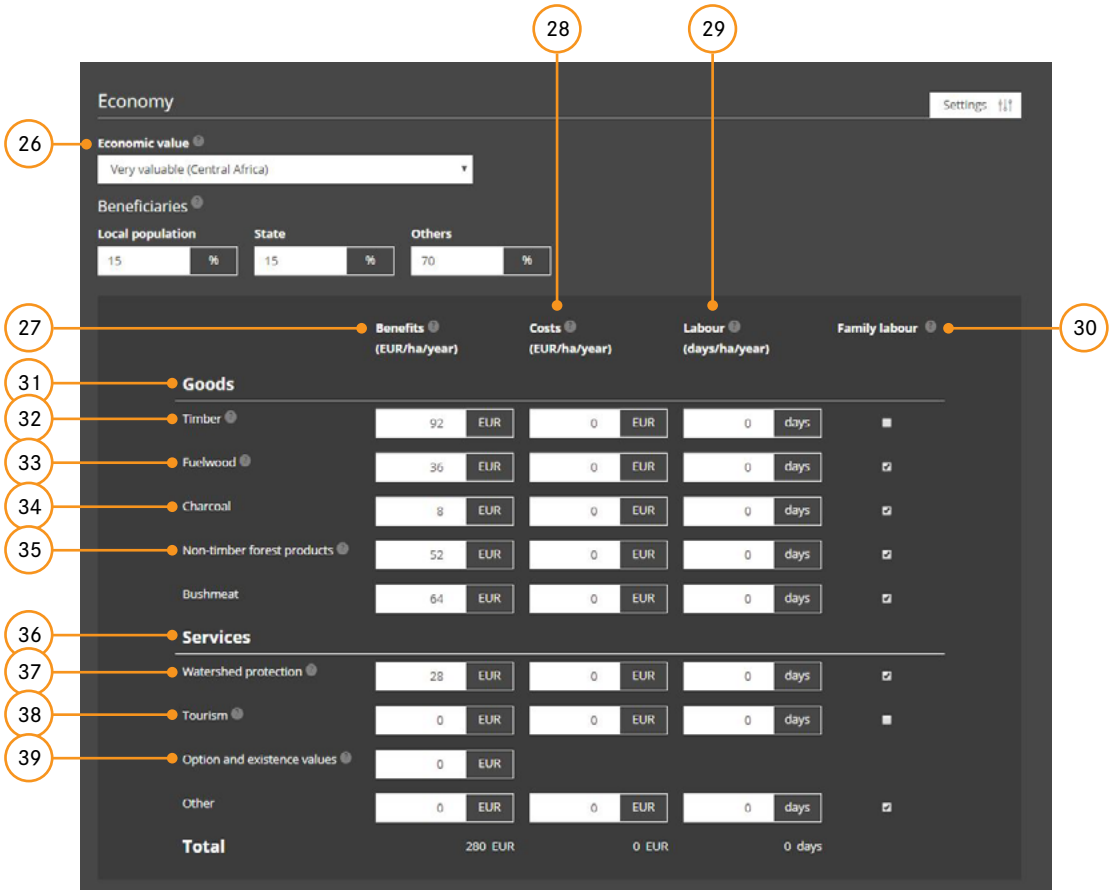
In the drop-down menu, the default average value is 71 EUR/ha/year. This was estimated in the context of West Africa (Côte d'Ivoire) using the values generally stated in studies on the ecosystemic services of tropical forests. You can modify this data. The economic values ‘weak’, ‘high’ and ‘very high’ correspond to 50%, 200% and 400% of the ‘average value’ respectively.

In our example, we choose the value:

Very valuable (Central Africa)

25. Settings

If you would like to enter data specific to the area, click on ‘Settings’. The following calculation table will appear:



26. Beneficiaries

Land-use beneficiaries are split into three main stakeholder groups: the local population, the State (notably through taxation) and other actors. Other actors can include external investors, economic actors from the private sector, other governments or the wider international community. For each defined land use, the distribution among all the groups must be entered.

For our example, the following distribution is proposed:

Local population	*15%*	State	*15%*	Others	*70%*

27. Benefits

To estimate the annual benefits per hectare, you must estimate the quantity of each product (such as timber) or service (such as watershed protection) generated by this forest each year, then divide its value by the size of the forest in hectares.

We keep all the default values of the goods and services described (below).

28. Costs

This is the annual cost per hectare, expressed in the selected currency, to produce the forest goods and services listed here (for example, fuel costs related to forest management). It does not include the cost of labour.

We keep all the default values of the goods and services described (below).

29. Labour

This represents the number of days worked, formally and informally, for example, collecting fuelwood, per hectare per year to produce the forest goods and services.

We keep all the default values of the goods and services described (below).

30. Family labour

Tick the box if the work is mostly done by family members (or any unpaid work).

We keep all the default values of the goods and services described (below).

Goods

31. Timber

Timber goods include those produced by industrial logging and by informal small-scale or artisanal logging.

We keep all the default values.

32. Fuelwood

In regions where people depend entirely on fuelwood for energy, rural populations use on average 0.5 tonnes of fuelwood per person per year (at EUR 25 per tonne), while urban populations tend to use charcoal (at EUR 150 per tonne). The price of fuelwood is location-specific and can vary considerably.

We keep all the default values.

33. Charcoal

Charcoal is obtained by the slow and incomplete combustion of wood. It is used mainly in urban areas of developing countries. Charcoal is light and thus easily transportable. Its combustion, easily controlled, does not produce dirty or too unpleasant smokes.

We keep all the default values.

34. Non-timber forest products

Non-timber forest products are those such as fruit, medicinal plants, construction material or fodder. The value of non-timber forest products in tropical forests is estimated to be between EUR 13 and 60 per ha/year.

We keep all the default values.

35. Bushmeat

Wild animal products most often sold on local markets.

We keep all the default values.

Services

36. Watershed protection

Forest cover helps protect watersheds by regulating runoff and limiting soil erosion. For example, forested watersheds reduce sedimentation in hydropower dams, which minimises power cuts to industries and homes during droughts. It is estimated that the average value of watershed services provided by forests is 8 EUR/ha/year, varying between 1 and 26 euros.

We keep all the default values.

37. Tourism

One of the main economic benefits from tourism is the entrance fees to forest parks and reserves.

We keep all the default values.

38. Option and existence values

The option value corresponds to the value given to the conservation of an asset for its future use. The existence value reflects the benefit of knowing that a particular environmental resource (such as a forest) exists. These values are difficult to estimate. As an example, an option value of 3 EUR/ha has been estimated for Cameroonian forests.

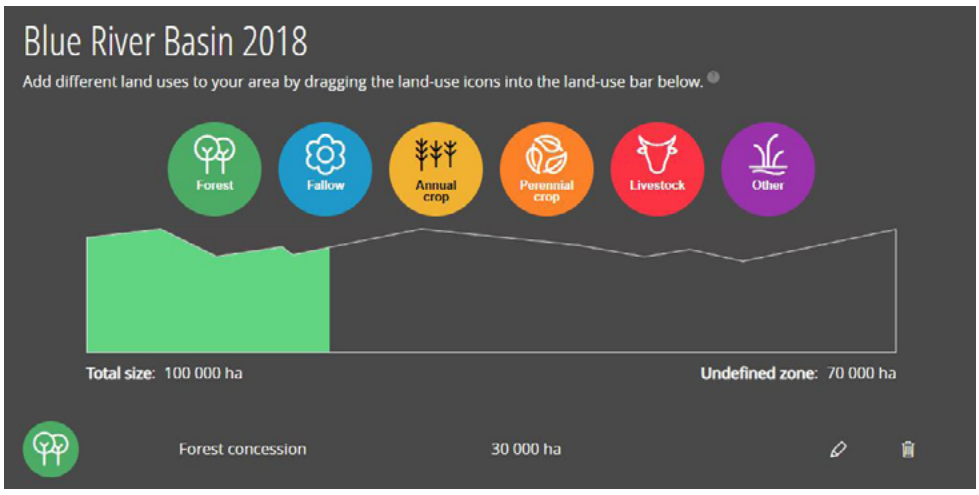
We keep all the default values.

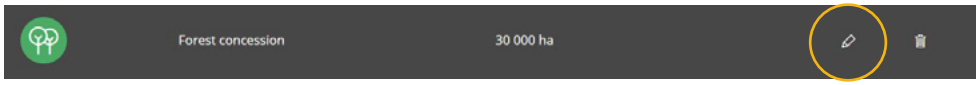
39. Others

Other types of ecosystem services can be entered here, such as services related to the protection of specific and fragile environments (peatlands, mangroves, land with high conservation value, UNESCO world heritage cultural landscapes, etc.)

We keep all the default values.

Confirm the entered values by clicking ‘Save’ to take into account this first land use and have the option to add others. Doing so confirms the completion of the first zone included in the area, as a proportion of its total surface.





Editing a pre-defined land use

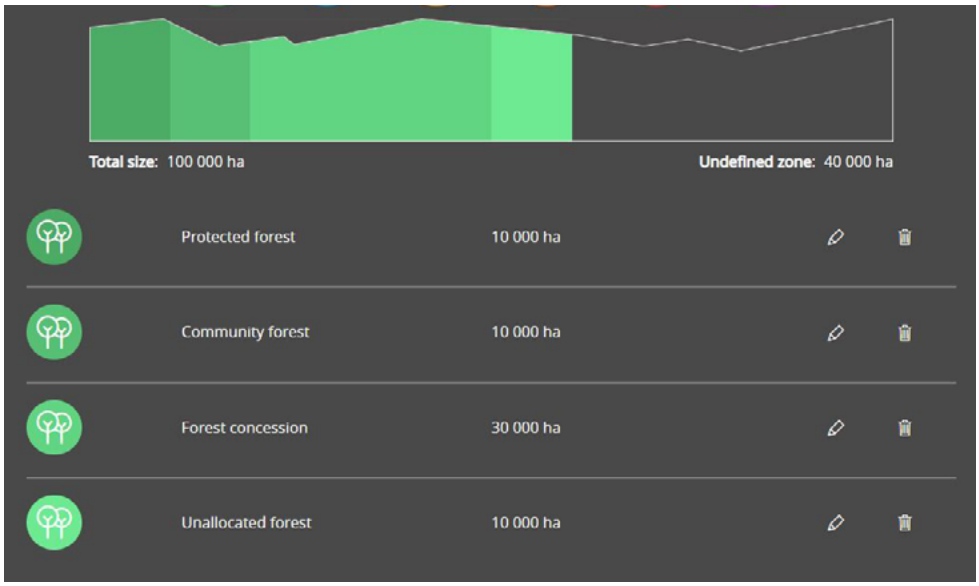
You can modify each of the land uses to go back to the initial values, in the list of uses, by clicking on ‘Edit’.

Click on the pen on the right hand side in the window, in the described land-use line.

Are the area's forests used for other purposes than timber production? For example, a protected zone?

If this is the case, add the ‘forest’ use once more to the land-use bar.

Then follow the steps as before. You can define the types of forest in which you are interested. In addition to the previously mentioned examples, you can include community forest land in the land-use bar, characterised by the most important benefits for the local population. You must save each use entered. It is often useful to fully describe the main categories of forests in your area as it is likely that it will be on this type of land that transformations (changes of use) are most likely to occur. As a matter of fact, it is in forest lands that fallow land is most likely to appear.

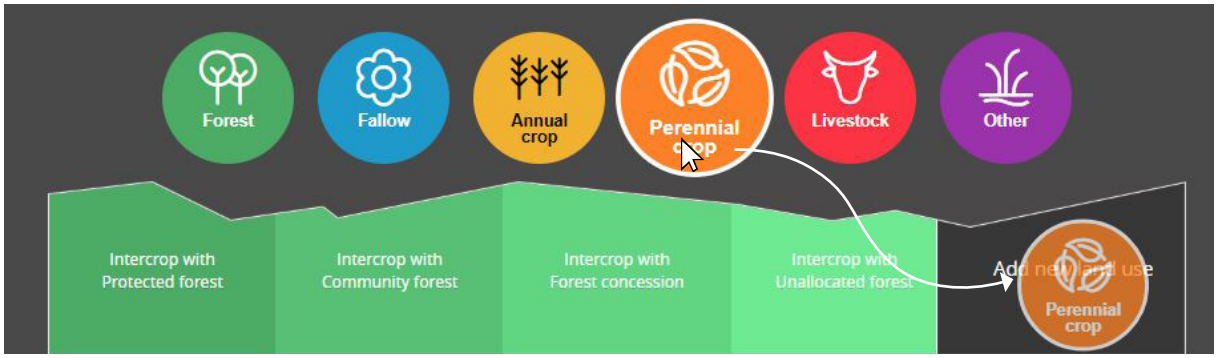


Defining various forest uses provides a glimpse of the various forest categories that generally exist in tropical forests.

The next step is describing the other land uses that make up your area.

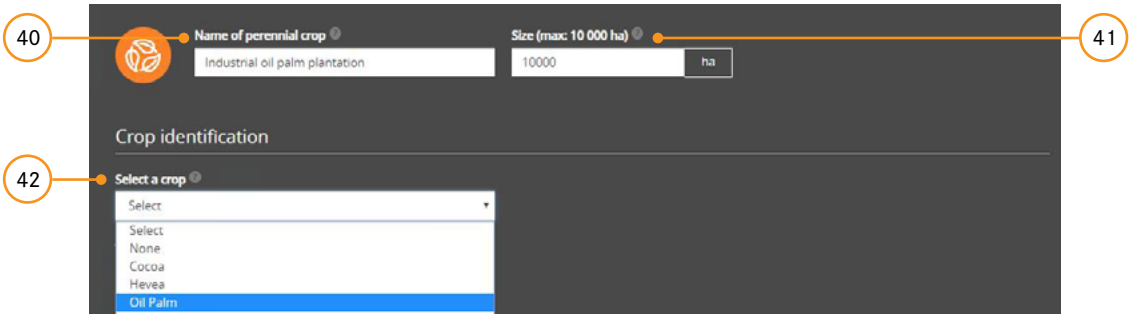
Perennial crops

Field observation of the types of perennial crops can be carried out using data collection sheets (worksheets).



Drag the perennial crops icon to the land-use bar and begin to define this land use.

Here, we will use oil palm culture as an example, which we had identified as an important crop for the area illustrating this manual (**the Blue River Basin**):



As a first step, enter the name or the type of the crop followed by its size:

40. Name of perennial crop

Label this perennial crop with a short name. The name choice is up to you.

For example, the name may refer to the quality of this land use or its ownership status. In the case of an industrial oil palm plantation, indicate for example

Industrial oil palm plantation

41. Size

Enter the extent of this specific land use in hectares.

10 000 ha

Crop identification

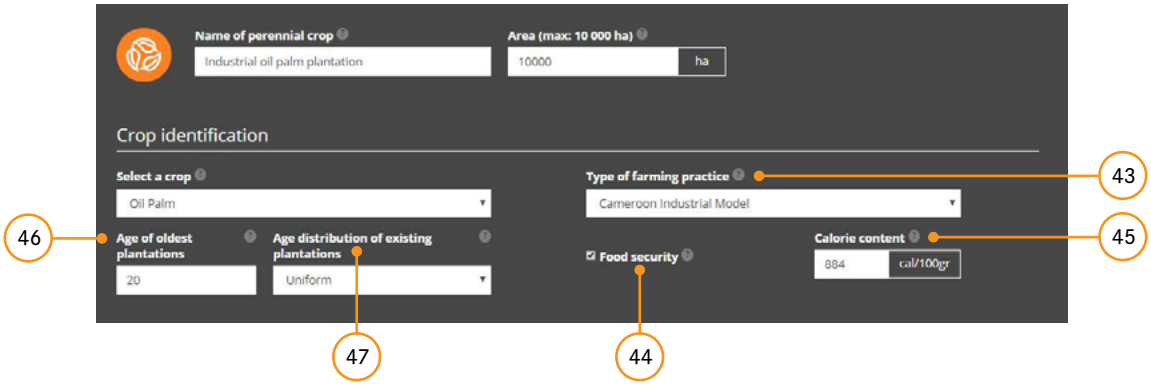
42. Select a crop

The drop-down menu offers the most common perennial crops, for which databases have been compiled (by EFI). We recommend that you check and adjust the default values in the following information windows if necessary.

Because of the wide variety of possible crops, not all are listed. If the desired crop does not appear in this list, select 'none' and continue. The list of crops will be updated regularly.

If you have chosen the crop type

Oil palm a new window will appear on the right of the screen and ask you to define the type of farming practice:



43. Type of farming practice

When you select a type of farming practice, the Land-use Planner fills in specific production data compiled by EFI. We strongly recommend that you check and adjust the default values if necessary. If the farming practice of your choice does not appear in the list, choose 'none' and continue. The list will be updated regularly.

In our Blue River Basin example, our choice lies with an oil palm farming practice observed in Cameroon:

Cameroon Industrial Model

44. Food security

Tick the 'Food security' box if the crop is important to the local diet, or if its disappearance would pose a risk to food security in your area.

A window regarding its calorie content then appears.

45. Calorie content

The nutritional value of the crop is estimated based on its calorie content, expressed in calories per 100 grams (cal/100g). For reference, fresh fruit and green vegetables typically contain around 50 cal/100g on average, grains between 100 and 350 cal/100g, nuts around 600 cal/100g and vegetable oils around 880 cal/100g.

In our example, we can keep or adjust the default value offered for oil palm *884* cal/100gr.

46. Age of oldest plantations

The age of a plantation has a strong influence on its productivity. Enter the age of the oldest plantations of this crop that exist in your area (not the average age of the plantations).

In our example, the oldest plantations are 20 years old, so we enter *20* to state the age of these plantations.

47. Age distribution of existing plantations

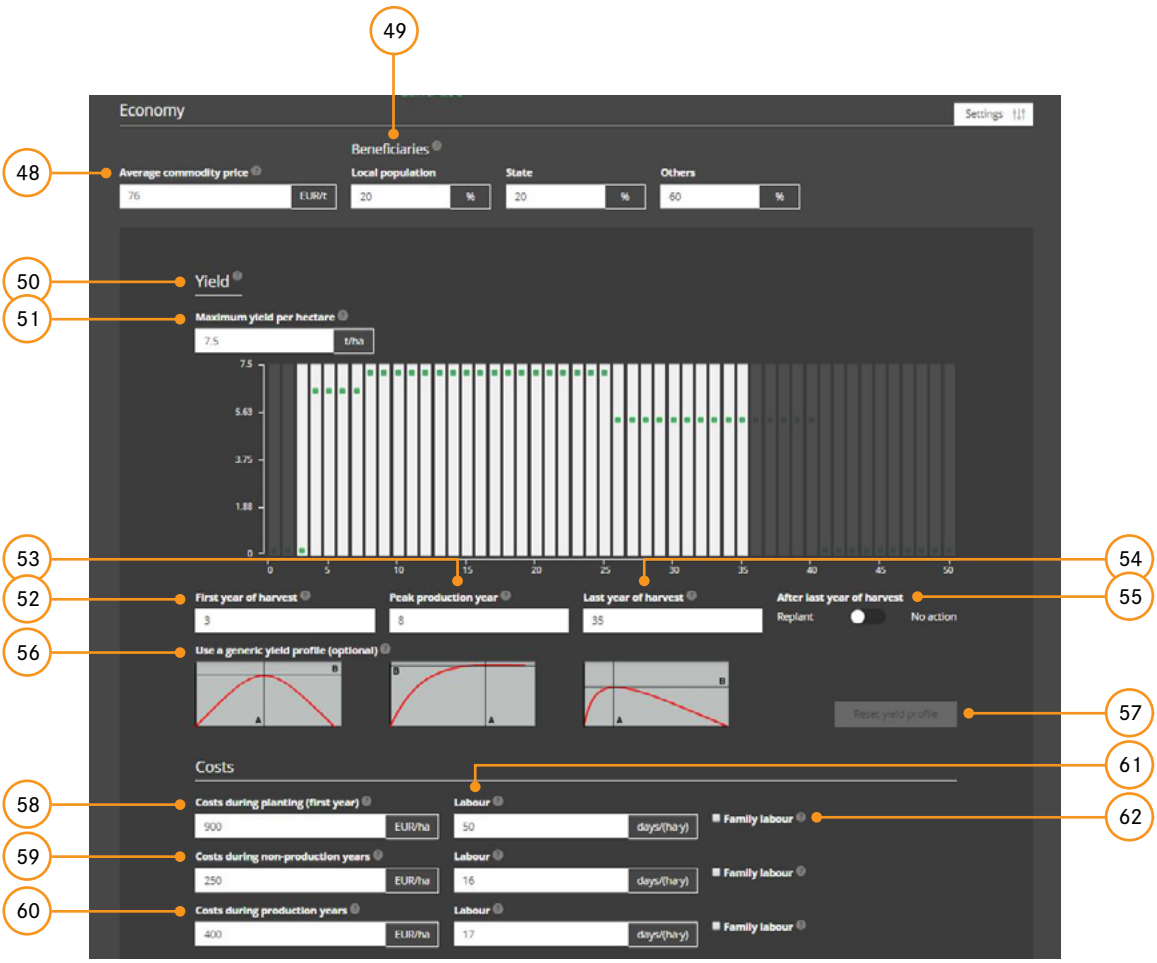
Considering all land covered by these plantations in your area, choose the type of age distribution, ranging from very young (less than three years old for the majority of plantations) to very old (more than 20 years old for the majority of plantations).

By default, the Land-use Planner proposes a uniform distribution, meaning that all age groups are present in similar proportions.

The age distribution impacts productivity calculations, given the large productivity variations based on the plantation's age.

If the plantations on your area are similar in age, choose

Uniform



Economy

48. Average commodity price

The selling price is the price received for one tonne of produce. We recommend that you use the local price (the price on leaving the farm or price on a local market) to avoid including benefits collected by other actors outside the area (for example on international markets).

At this point, we check that the average price for the product proposed by the Land-use Planner is realistic

76 EUR/t

49. Beneficiaries

Land-use benefits are divided among three main groups of stakeholders: the local population, the State (notably through taxation) and other actors. Other actors can include external investors, other governments or the wider international community.

For our example, the following distribution is proposed:

Local population	*20%*	State	*20%*	Others	*60%*

For more details on the ‘Economy’ settings, click ‘Settings’.

A window on yields will appear, which allows you to adjust the default values.

50. Yield

Input the productivity data of the perennial crop from the year it is planted to the last year of production (yield profile).

An adjustable yield profile will appear if the yield for the crop and the farming practices are known.

Otherwise, (1) enter key parameters below (including the maximum yield and the peak production year); (2) consider using one of the three generic yield profiles; and (3) manually adjust the profile in the main graph.

51. Maximum yield per hectare

Enter the maximum yield, in tonnes per hectare per year.

For crops producing only a few kilograms per hectare, convert into a fraction of a tonne (for example, 0.08 t/ha for a crop producing 80 kilograms per hectare).

For the oil palm in our Blue River Basin example, we enter

7,5 t/ha

52. First year of harvest

How many years do you need to wait for the newly-planted crop to start producing? For example, it takes about seven years to start extracting latex from a new rubber plantation.

For our example, we enter

3

53. Peak production year

How many years after planting will you reach your maximum yield?

For our example, we enter

8

54. Last year of harvest

The last year of harvest is when the farmer decides it is no longer worth harvesting, which can be before the plant stops producing. Oil palms, for example, become too high for smallholders to continue harvesting after 25 years.

For our example, we enter

35

55. After the last harvest

Following the last harvest, the farmer has two options. He/she may decide to replant, in which case a new production cycle begins. Otherwise, the plantation is abandoned and no action takes place.

In our Blue River Basin example, we leave the cursor on ‘Replant’.

56. Generic yield profile (optional)

These three generic yield profiles show how crop productivity may evolve over time. Choose the profile most relevant to this crop.

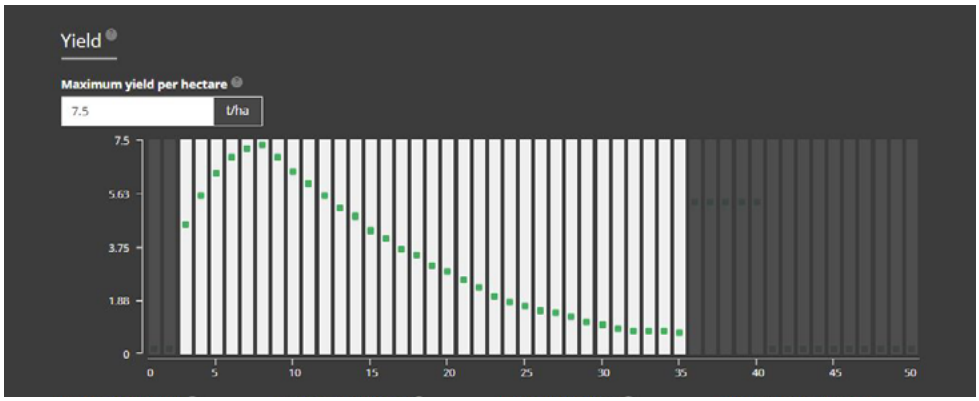
For our example, we choose the third profile offered (on the right).

57. Reset yield profile

By clicking 'Reset yield profile', you can customise the yield based on detailed knowledge of the annual yields of the crop concerned.

In our example, we can then adjust the profile to reflect a production that continues for 35 years, until the year of the last harvest.

For this, we can adjust year by year by clicking on the green squares and adjusting them on the yield graph.



Costs

58. Costs during planting

These costs include those associated with the land preparation for planting and the production or purchase of seeds or seedlings.

For our example, we enter

900 EUR/ha

59. Costs during non-production years

These costs include those associated with crops management (fertilisers, weeding, pest control, etc.) and the cost of potential insurance during the years preceding production.

For our example, we enter

250 EUR/ha

60. Costs during production years

In addition to plantation maintenance, these costs include charges related to the harvest itself.

For our example, we enter

400 EUR/ha

61. Labour

The days worked annually per hectare in relation to this land use.

For our example, we enter:

For work involved during the first year [50] days/ha/year.

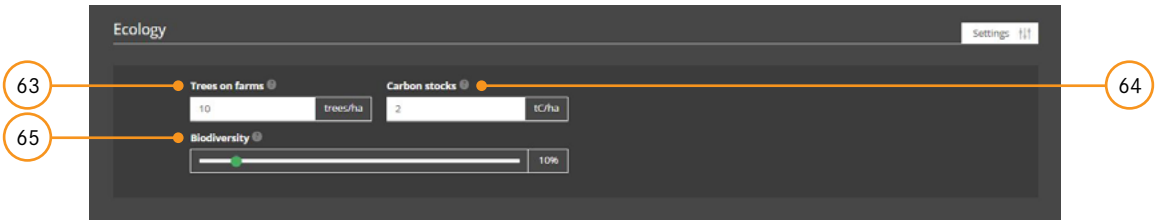
For work involved during non-production year [16] days/ha/year.

For work involved during production years [17] days/ha/year.

62. Family labour

Tick this box if the work is mostly done by family members (or any unpaid work).

For our example, we left these boxes unticked, given the wage-earning nature of this type of work on industrial plantations.



Ecology

The ecology section for perennial crops allows you to take into account:

63. Trees on farms

For trees on farms, a benefit of 1.8 tCO2 per tree is accounted for, regardless of the age and type of tree. This is the carbon equivalent of around one tonne of dry wood. Trees on farms can also bring other advantages, such as soil fertility, fruits, pest control, wood and increased land security.

An average value of 2 EUR /tree/year is taken into account for this group of possible benefits.

For our example, we enter

[10] trees/ha

64. Carbon stocks

You can replace the default values (taken from the IPCC) with your own data, expressed in tonnes of carbon per hectare (tC/ha). 1tC = 3.67 tCO2.

For more detail, please see the information in ‘On carbon and other greenhouse gases’ on page 14.

For our example, we enter

[2] tC/ha

65. Biodiversity

The Land-use Planner expresses the status of biodiversity as a percentage of that found in an intact, natural forest. If local surveys are unavailable, use subjective information and guidance from the Convention on Biological Diversity (www.cbd.int). To change the forest degradation rate, drag the cursor along the horizontal bar.

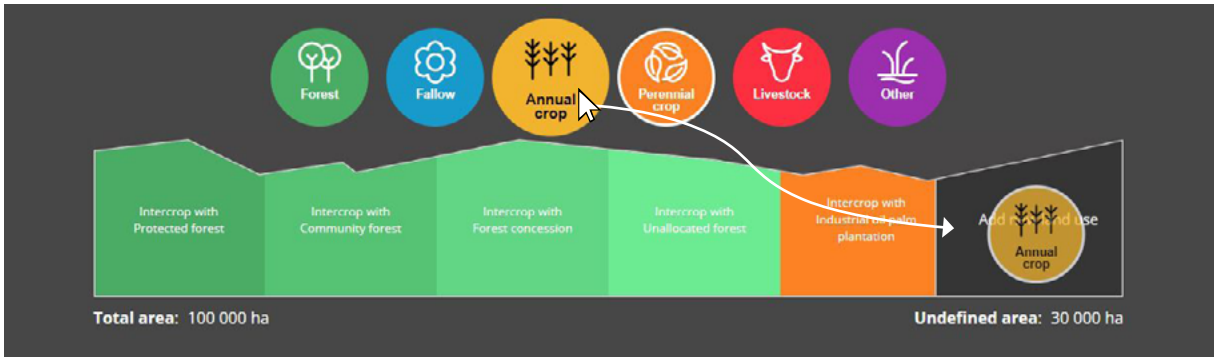
For our example, we dragged the cursor to [10] % for one crop.

Next, click ‘Save’.

At this point, forest lands and the industrial oil palm plantation are defined in the land-use bar.

Annual crops

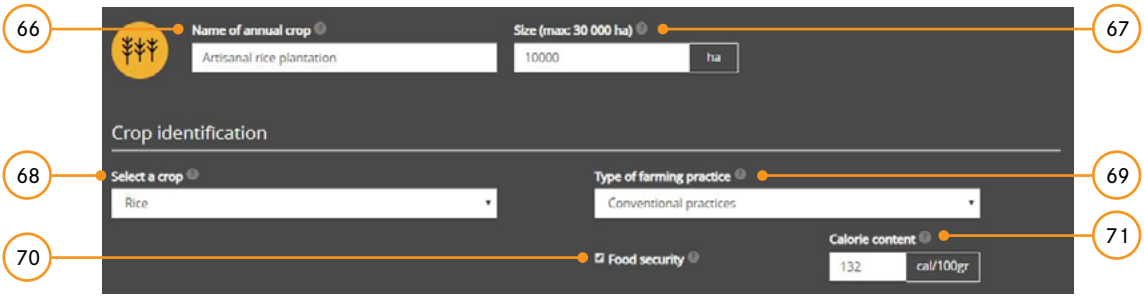
Several types of annual crops are shown in the Land-use Planner. Field observation of the types of annual crops can be carried out by using data collection sheets (worksheets).



Drag the annual crops icon to the land-use bar and begin to define this land-use.

In our example, as indicated in chapter 1, the annual artisanal rice crop is grown.

As a first step, enter the name or the type of the crop cultivated and its size:



66. Name of annual crop

Label this land use with a short name. The name choice is up to you.

For example, the name can refer to the ecological quality of this land use or its ownership status.

In our example, for artisanal rice plantations, we enter

Artisanal rice plantation

67. Size

Enter the extent of this specific land use in hectares.

10 000 ha

Crop identification

68. Select a crop

When you select a type of crop from the drop-down menu, the Land-use Planner fills in crop data compiled by EFI. We recommend that you check and adjust the default values if necessary.

The variety of possible crops means that not all crops are listed. If the crop does not appear in the list, choose ‘none’ and continue.

The list of crops will be updated regularly.

When you have chosen the crop type, which is *Rice* in our example, a new window will appear on the right of the screen and ask you to define the type of farming practice.

69. Type of farming practice

When you select a type of farming practice, the Land-use Planner fills in specific production data compiled by EFI. We recommend that you check and adjust the default values if necessary.

If the farming practice of choice does not appear in the list, select ‘none’ and continue. The list will be updated regularly.

In our Blue River Basin example, the choice focuses on a typical model from the Congo Basin:

Conventional practices

70. Food security

Tick the ‘Food security’ box if the produce is important to the local diet, or if its disappearance would pose a risk to food security in your area.

A window regarding its calorie content then appears.

71. Calorie content

The nutritional value of the crop is estimated based on its calorie content, expressed in calories per 100 grams (cal/100g). For reference, fresh fruit and green vegetables typically contain around 50 cal/100g on average, grains between 100 and 350 cal/100g, nuts around 600 cal/100g and vegetable oils around 880 cal/100g

In our example, we can keep or adjust the default value offered for rice

132 cal/100gr

Economy

72. Average commodity price

The selling price is the price received for one tonne of produce. We recommend that you use the local price (the price on leaving the farm or price on a local market) to avoid including benefits collected by other actors outside the area (for example on international markets).

At this point, we check that the average price for the product proposed by the Land-use Planner is realistic

300 EUR/t

73. Beneficiaries

Land-use benefits are divided among three main groups of stakeholders: the local population, the State (notably through taxation) and other actors.

Other actors can include external investors, other governments or the wider international community.

For our example, the following distribution is proposed:

Local population	*90%*	State	*10%*	Others	*0%*

For more details on the 'Economy' settings, click 'Settings'.

A window on the details of the crop will appear, which allows you to adjust the default values.

74. Itinerant crop

Tick this box if this is a shifting culture system.

75. Maximum years in place

How many years will the crop be cultivated on the same piece of land before the land is fallowed?

In our example, we enter *5*

76. Minimum fallow years

How many years will the land remain fallow before being cultivated again in practice?

In our example, we enter *2*

77. Average yield

In our example, we enter *0,95* t/(ha/year).

78. Costs

These are the costs borne by farmers ranging from the land preparation to harvests to the management of the plantations.

For our example, we enter *80* EUR/ha/year.

79. Labour

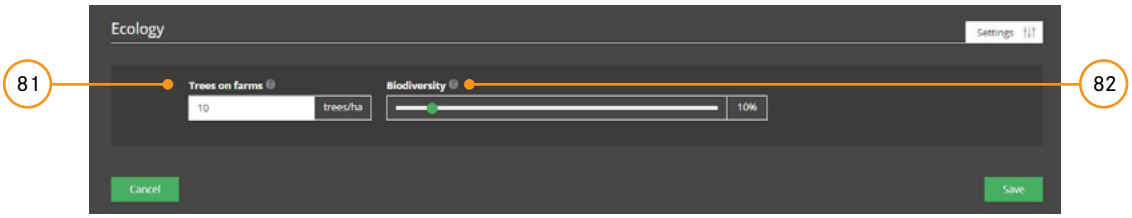
The days worked annually per hectare in relation to this land use.

For our example, we enter *60* days/(ha/year).

80. Family labour

Tick this box if the work is mostly done by family members (or any unpaid work).

For our example, we untick this box, given the wage-earning nature of this type of work on industrial plantations.



Ecology

The ecology section for annual crops allows you to take into account the trees on farms and the biodiversity.

81. Trees on farms

For trees included on farms, a benefit of 1.8 tCO2 per tree on a farm is accounted for, regardless of the age and type of tree. This is the carbon equivalent of around one tonne of dry wood. Trees on farms can also bring other advantages, such as soil fertility, fruits, pest control, wood and increased land security.

An average value of 2 EUR /tree/year is taken into account for this group of possible benefits.

For our example, we enter *10* tree/ha.

82. Biodiversity

The Land-use Planner expresses the status of biodiversity as a percentage of that found in an intact, natural forest. If local surveys are unavailable, use subjective information and guidance from the Convention on Biological Diversity (www.cbd.int).

To change the level of degradation in annual crop lands, drag the cursor along the horizontal bar. On this type of land use, it is highly probable that the biodiversity level is very low compared to forest lands that are less affected.

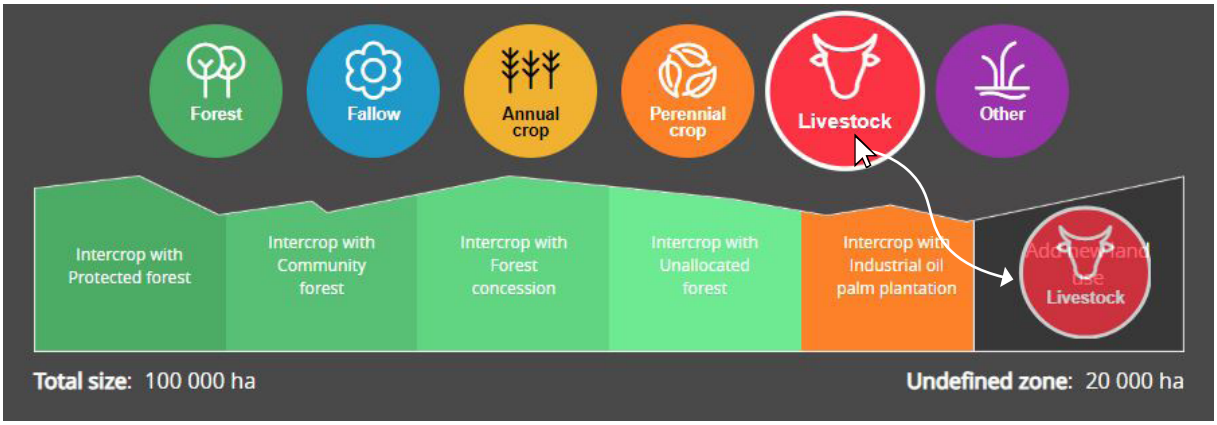
For our example, we dragged the cursor to *10* %.

Next, click ‘Save’.

At this point, in our example, forest lands, the industrial oil palm plantation and the artisanal rice crop are defined in the land-use bar.

Livestock

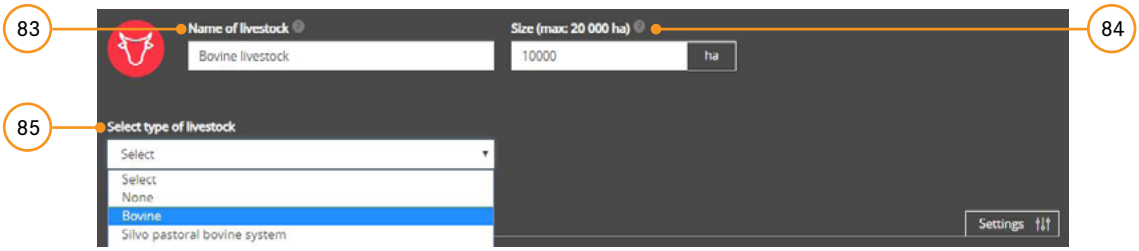
Several types of livestock farming are described in the Land-use Planner. Field observation of the types of livestock can be carried out using data collection sheets (worksheets).



Drag the livestock icon to the land-use bar and begin to define this land use.

In our example, bovine livestock will be the subject of this land use.

As a first step, enter the name or the type of the livestock followed by its size:



83. Name of livestock

Label this type of livestock farming with a short name. The choice of name is up to you.

In our example, where bovine livestock are raised in our area, we enter *Bovine livestock*

84. Size

Enter the extent of this specific land use in hectares.

10 000 ha

85. Selection of type of livestock

For our example, we select *Bovine*

Economy

86. Number of animals

Total number of animals grazing on the land that corresponds to this use.

For our example, we enter *1000* heads.

87. Livestock density: The number of animals per hectare

This information will be automatically filled in by the Land-use Planner by dividing the number of animals by the surface area.

88. Benefits per animal

Benefits include revenues from animal products (such as dairy and wool) and the value of the animal when slaughtered.

Aggregate all benefits and estimate the average annual benefit per animal.

For our example, we enter *220* EUR/head/year.

89. Beneficiaries

Land-use benefits are divided among three main groups of stakeholders: the local population, the State (notably through taxation) and other actors. Other actors can include external investors, other governments or the wider international community.

For our example, the following distribution is proposed:

Local population	*90%*	State	*10%*	Others	*0%*

For more details on the 'Economy' settings, click 'Settings'. At this point, two additional drop-down menus will appear, one for the costs per animal and one for labour days per animal.

90. Costs per animal

This option allows you to estimate the total annual cost for maintaining this livestock per animal (on average).

Do not include labour costs here, but in the next box.

For our example, we enter *70*

91. Labour days per animal

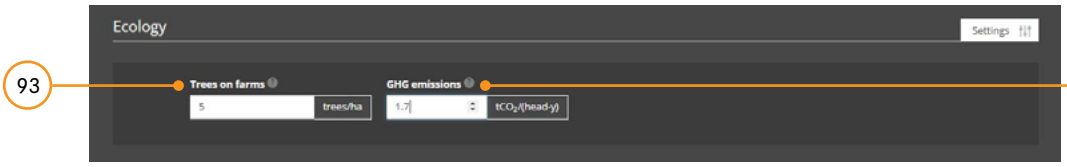
This refers to the number of days worked annually per hectare in relation to this land use.

For our example, we enter *10* days/head.

92. Family labour

Tick this box if the work is mostly done by family members (or any unpaid work).

For our example, we untick this box, given the wage-earning nature of this type of work on industrial livestock farms.



Ecology

The ecology section for livestock allows you to take into account the trees on farms and the greenhouse gas emissions.

93. Trees on farms

For trees included on farms, a benefit of 1.8 tCO2 per tree on a farm is accounted for, regardless of the age and type of tree. This is the carbon equivalent of around one tonne of dry wood. Trees on farms can also bring other advantages, such as soil fertility, fruits, pest control, wood and increased land security.

An average value of 2 EUR/tree/year is taken into account for this group of possible benefits.

For our example, we enter 5 trees/ha.

94. Greenhouse gas emissions

Specific land uses, such as livestock farming or degraded peatlands and wetlands can cause greenhouse gas (GHG) emissions.

Please note that GHG emissions are expressed in tonnes of CO2 equivalent (while carbon stocks are expressed in tonnes of carbon).

The main sources of emissions from livestock are: the production and transformation of fodder; the animal's digestion (source of methane, a gas 25 times more powerful than CO2 in terms of global warming potential); the decomposition of manure; and the transport of animal products.

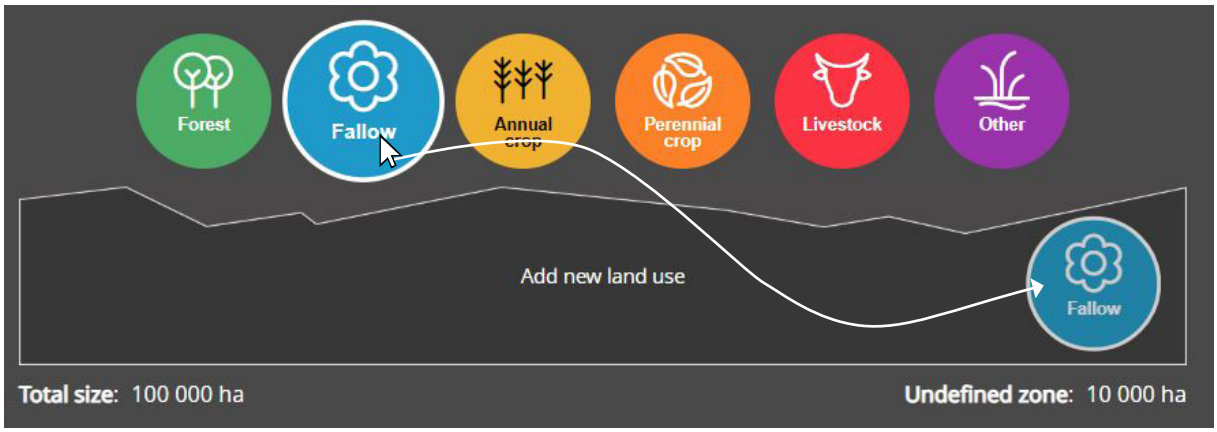
For our example, we enter 1.7 tCO2-eq/head/year.

Next, click 'Save'.

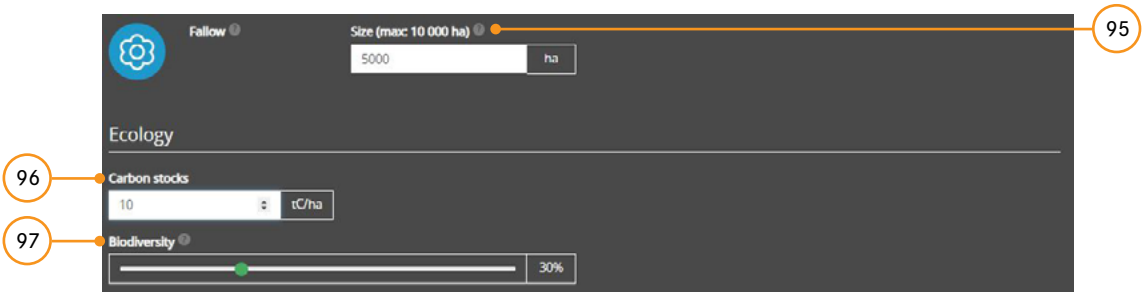
At this point, in our example, forest lands, the industrial oil palm plantation, the artisanal rice crop and the livestock are defined in the land-use bar.

Fallow

Fallow land is land that was previously cultivated and is likely to be used for agricultural purposes again in the future.



If it is not used after a period of 20 years, the tool assumes that mature fallows are transformed into forests, and adds this surface to the forest category with the lowest carbon content.



95. Size

For our example, we enter 5000 ha.

Ecology

The ecology section for fallow lands allows you to take into account the carbon stocks and the biodiversity.

96. Carbon stocks

For our example, we enter 10 tCO2/ha.

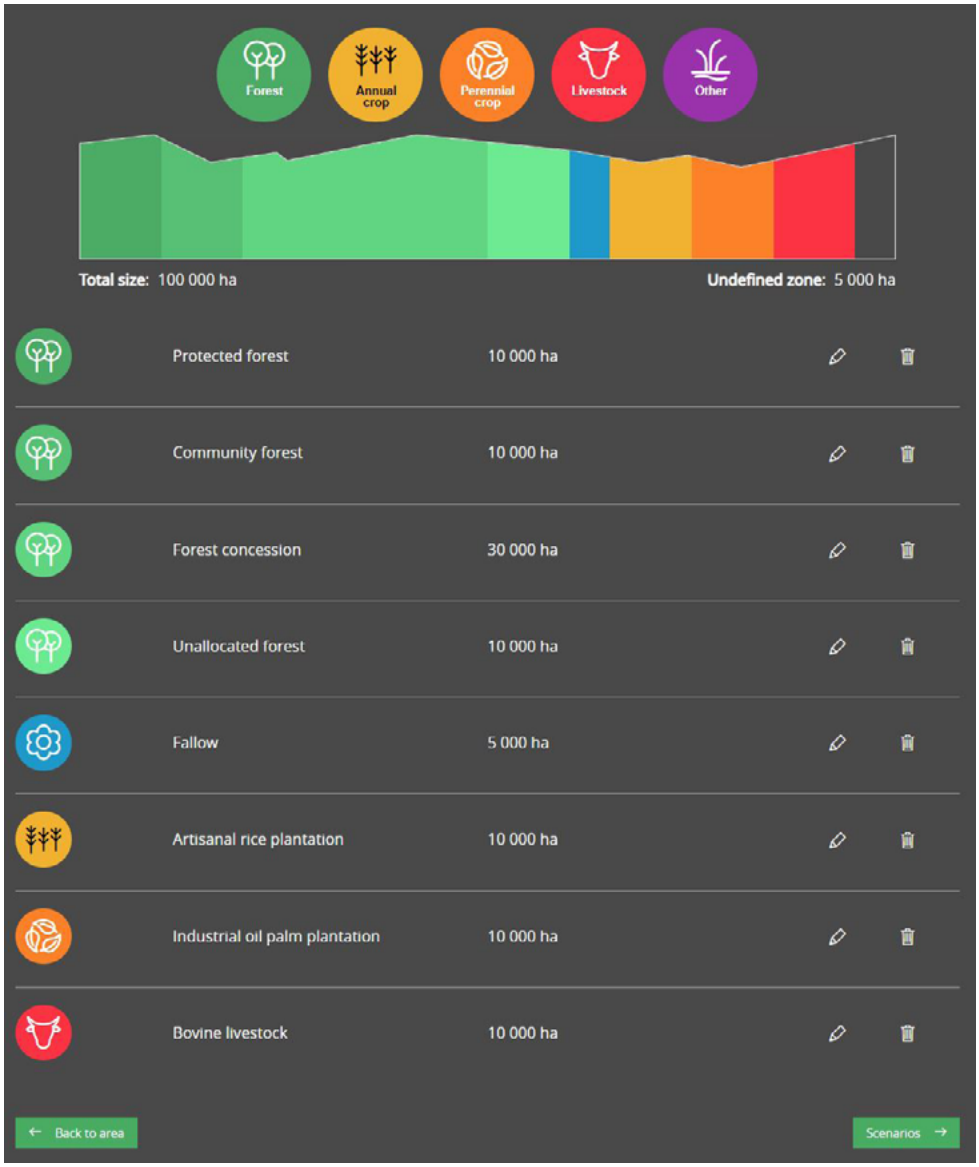
97. Biodiversity

The Land-use Planner expresses the status of biodiversity as a percentage of that found in an intact, natural forest. If local surveys are unavailable, use subjective information and guidance from the Convention on Biological Diversity (www.cbd.int). To change the level of degradation of fallow lands, drag the cursor along the horizontal bar on low biodiversity values.

For our example, we dragged the cursor to 30 %.

Next, click 'Save'.

At this point, in our example, forest lands, the industrial oil palm plantation, the artisanal rice crop, the livestock and the fallow lands are defined in the land-use bar.



Other

If your area includes land uses that are not forests, annual or perennial crops, livestock or fallow lands, you can categorise them as ‘other’.

These uses can include for example peatlands, bare land or infrastructures. To do so, drag the ‘other’ icon to the land-use bar.

98. Name of land use

Label this land use with a short name. The name choice is up to you.

For example, the name can refer to the ecological quality of this land use or its ownership status

In the case of a peatland for example, enter *Peatland*

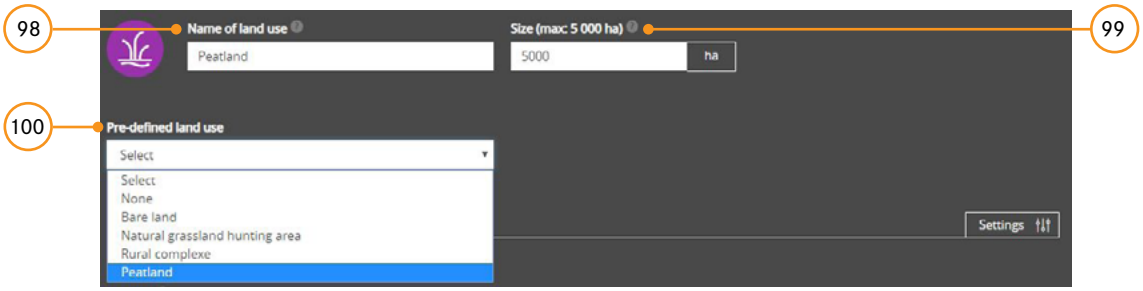
99. Size

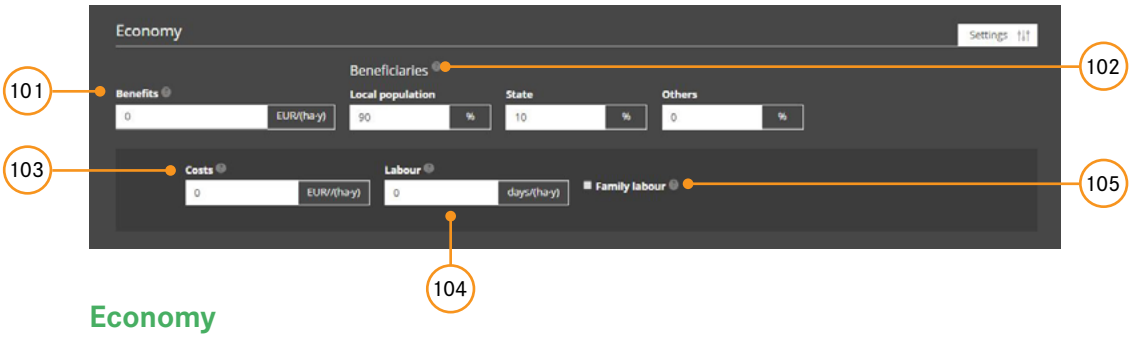
Enter the extent of this specific land use in hectares.

5000 ha

100. Pre-defined land use

Select the land use from the drop-down list. If the land use of your area does not correspond to any of the uses shown in the list, select ‘none’.





Economy

101. Benefits

By default, the Land-use Planner considers that 'other' land uses do not generate any benefits. You can change this value if necessary, based on the land use you are defining.

In our example, we maintained the benefits at 0 EUR/ha/year, as we estimate that peatlands generate no benefits.

102. Beneficiaries

Land-use beneficiaries are split into three main groups of stakeholders: the local population, the State (notably through taxation) and other actors. Other actors can include external investors, other governments or the wider international community.

For our example, we suggest the following distribution:

Local population	*90%*	State	*10%*	Others	*0%*

For more details on the 'Economy' settings, click 'Settings'.

103. Costs

For our example, we entered *0* EUR/ha/year.

104. Labour

For our example, we entered *0* EUR/ha/year.

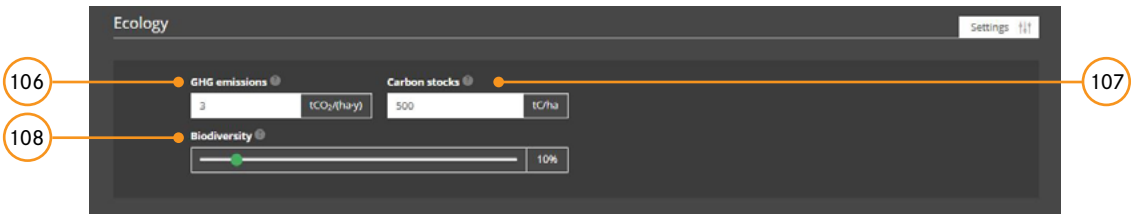
105. Family labour

Tick this box if the work is mostly done by family members (or any unpaid work).

For our example, we choose to untick this box.

Ecology

The ecology section for other land uses enables you to take into account the GHG emissions, carbon stocks and the biodiversity.



106. GHG emissions

For our example, we enter 3 tCO2-equivalent/ha/year.

107. Carbon stocks

You can edit the carbon stocks value that appears in the Land-use Planner by default, which is based on the IPCC values.

For our example, we enter 500 tC/ha.

108. Biodiversity

The Land-use Planner expresses the status of biodiversity as a percentage of that found in an intact, natural forest. If local surveys are unavailable, use subjective information and guidance from the Convention on Biological Diversity (www.cbd.int). To change the level of degradation in your land use, drag the cursor along the horizontal bar. For a man-made zone (for example, infrastructure), we would enter 0%.

For our example, we kept the value 10 %.

Next, click ‘Save’.

At this point, all land uses are defined.

Do not forget to save the work you have done up to this point by clicking ‘Export data’. A new .lup file is created, which replaces the previously-saved file.

If you are happy that this summary properly represents your area, you can then move to the following stage by clicking on ‘Scenarios’ at the bottom of the page.

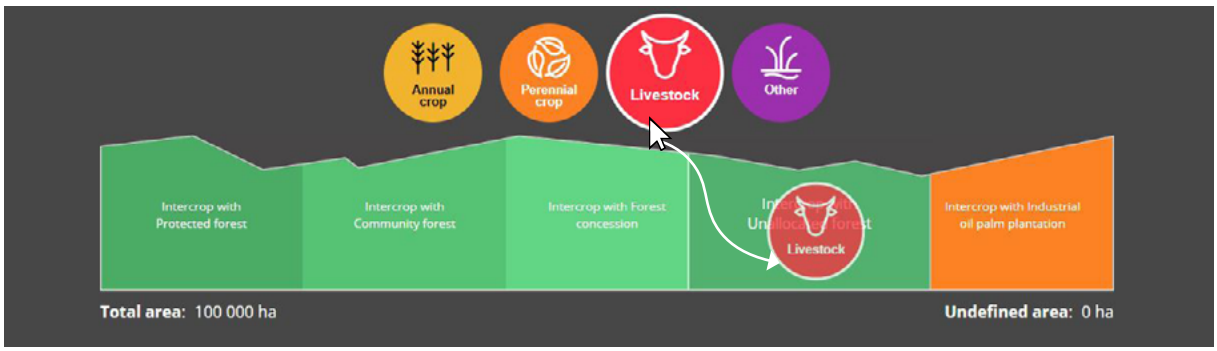
Intercrops

In certain cases, several uses are made of a single part of the area. The Land-use Planner allows you to combine two different land uses on the same portion of your area for a more precise representation.

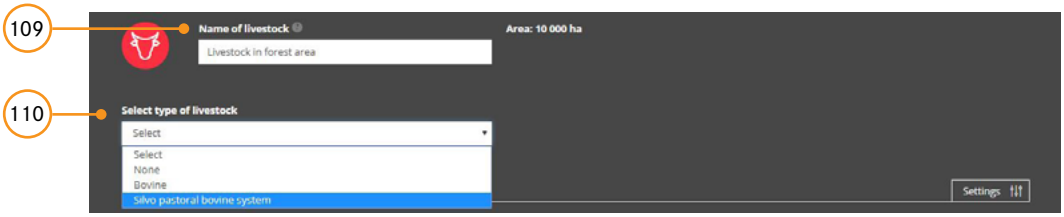
For example, your area may consist of unallocated forest - or other land uses - which is coupled with bovine livestock farming.

A double land use can therefore be represented by integrating a new 'livestock' land use to the existing 'Unallocated forest'.

To do so, drag the 'livestock' land use to the existing 'Unallocated forest' land use.



You must therefore define the 'Livestock' land use, which will be inserted into the original 'Unallocated forest' land use.



109. Name of the livestock

For our example, we enter *Livestock in forest land*

110. Selection of type of livestock

We chose a 'Silvo pastoral bovine system'.

Economy

111. Number of animals

For our example, we enter *1000* heads.

112. Livestock density

The number of animals per hectare.

This information will be automatically filled in by the Land-use Planner by dividing the number of animals by the surface area.

113. Benefits per animal

Benefits include revenues from animal products (such as dairy and wool) and the value of the animal when slaughtered.

Aggregate all benefits and estimate the average annual benefit per animal.

For our example, we enter *220* EUR/head/year.

114. Beneficiaries

Land-use benefits are divided among three main groups of stakeholders: the local population, the State (notably through taxation) and other actors. Other actors can include external investors, other governments or the wider international community.

For our example, the following distribution is proposed:

Local population	*90%*	State	*10%*	Others	*0%*

For more details on the 'Economy' settings, click 'Settings'. At this point, two additional drop-down menus will appear, one for the costs per animal and one for labour days per animal.

115. Costs per animal

This option allows you to estimate the total annual cost for maintaining this livestock per animal (on average).

Do not include labour costs here, but in the next box.

For our example, we enter *70* EUR/(head/year).

116. Labour days per animal

This refers to the days worked annually per hectare in relation to this land use.

For our example, we enter *10* days/head.

117. Family labour

Tick this box if the work is mostly done by family members (or any unpaid work).

For our example, we untick this box, given the wage-earning nature of this type of work on industrial livestock farms.

Ecology

118. GHG emissions

Specific land uses, such as livestock farming or degraded peatlands and wetlands can cause greenhouse gas (GHG) emissions.

Please note that GHG emissions are expressed in tonnes of CO2 equivalent (while carbon stocks are expressed in tonnes of carbon).

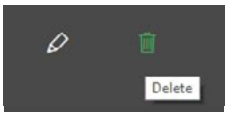
The main sources of emissions from livestock are: the production and transformation of fodder; the animal's digestion (source of methane, a gas 25 times more powerful than CO2 in terms of global warming potential); the decomposition of manure; and the transport of animal products.

For our example, we enter 1.7 tCO2-eq/head/year

Next, click 'Save'.

A new representation of the area now shows the double use of land to take into account the agro-pastoral system in an unallocated forest land.

If you need to modify any of the uses to tweak their details, click on ‘Edit’ on the right hand side of the use.



To delete a land use, click ‘Delete’ on the right hand side of the use.

Once these details are included, if you are happy that this summary properly represents your area, you can then move to the following stage by clicking ‘Scenarios’ at the bottom of the page.

It is also important to note that you do not necessarily need to completely define your area if you simply wish to concentrate on specific portions of it. By doing so, the following steps will simply consider the undefined portions ‘without effect’.

Reminder

At any time while working on your project, you can save a .lup work file to safeguard the work carried out up to that point.

- Click Export data to save the current work file.
- You can restart with an empty project by clicking Clear project data
- Click Upload project and select the previously-saved work file to resume the study at the point at which it was saved (Export data).