Land-use Planner

An interactive economic tool to support responsible land-use planning

Step 3

Development of land use scenarios

EUREDD Facility

EFI

3

Scenarios

3.1. Introduction to the scenarios

At this stage, the Land-use Planner enables you to project the future. While during the preceding stages you needed to define the initial condition of your area, the scenarios will enable you to plan the possible development trajectories for your area based on various land-use changes. There could be a wide range of scenarios: continuation of current trends; planned gradual changes; or even complete disruption. The general aim of this work is to compare the economic, social and environmental implications of various land-use strategies for your area.

Defining the scenarios

The choice of scenarios is totally up to you and should reflect the stakeholders' priorities and their medium/long-term vision. We recommend that the scenarios be related to important political decisions and the land-use choices that the actors wish to study and debate.

Do various groups of actors disagree on the choices for managing your area and developing industries? If so, you can develop several scenarios to consider these different visions.

In addition, defining the scenarios is never set in stone. You can begin with simple and diametrically opposed scenarios. Further to a dialogue with the stakeholders and the analysis of the results, you can develop more elaborate scenarios seeking to combine various objectives and reflecting the compromises reached among various groups of actors. At any point in your work, you can return to the scenarios and adjust them.

In this manual, based on the Blue River Basin example, we illustrate the development of three simple scenarios. A 'baseline scenario' will act as a benchmark for establishing the others. A fourth scenario, more elaborate and combining various actions, will be shown at the end of the chapter. The Land-use Planner enables you to compare up to five scenarios simultanously. However, it will generally be easier for you to make comparative analyses with two or three scenarios.

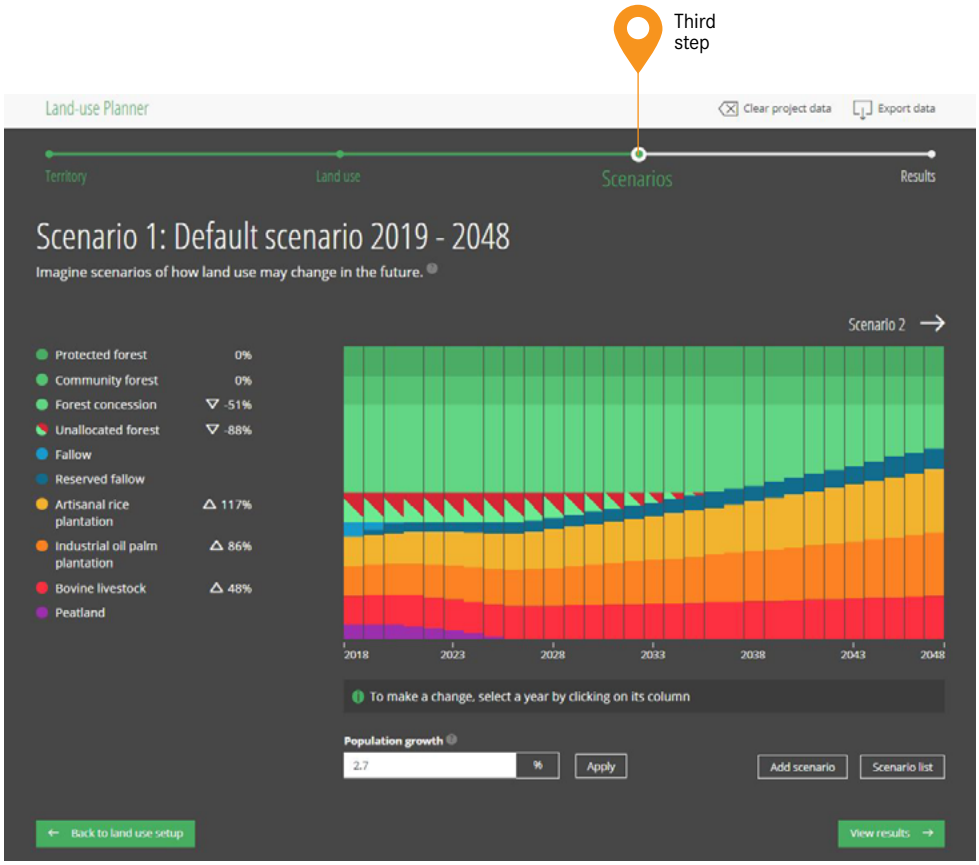
The facilitator's role

When introducing the scenarios, the facilitator should adapt to the audience. Firstly, he or she should insist on the crucial role of this step given that it is at this point that the groups will present their aspirations. If the audience is active and participatory, the facilitator will have a passive role, listening and taking into consideration the remarks made during the outreach session. If the audience expects a demonstration of the tool, the facilitator will need to define the scenarios that will represent each of their aspirations or interests. During the discussion, it is also possible to create a scenario by consensus, which will consider the aspirations of various groups.

3.2. First scenario: a baseline scenario

When you reach this point of the Land-use Planner for the first time, you will see a first scenario, which the tool proposes by default. This initial scenario simply projects the initial land uses into the future without any other evolution than the ageing of perennial crops (with consequences on yields) and the impact of demographic growth (impact on surface areas).

You can adjust this initial scenario presented by default if you wish. For example, you can introduce one or several land-use changes to create the desired baseline scenario, before comparing it with others.



Reading the evolution of each land use over time

The page showing the first baseline scenario consists of two main sections.

On the left, you will find the list of land uses, those previously defined during the land-use stage. Note the appearance, shown in dark blue, of the 'Reserved fallow' land use (see page 46).

On the right is a graph showing the evolution of the land uses over time.

On the vertical axis, the proportion of the surface area of each of the land uses is represented by segments. The colours match those used in the key.

The horizontal axis shows the simulated duration. Each column corresponds to one year.

Initial guidance relating to the impact of the scenario

To the right of the list of land uses, the triangles pointing up or down respectively refer to an increase or decrease in production (for crops) or in carbon (for forests) for each land use, for this scenario, for the study period. This gives you a first glance at the impact of this scenario on the main productions: to what extent does agricultural production increase, or by contrast, decrease, during the period if we keep the scenario as it is? In what proportion would we anticipate a reduction or increase in carbon stocks in forests? If the figure that appears is 0%, this simply means that the situation is stable for this specific crop or this forest.

By default, we therefore note that in our example there is a decrease in forest cover (in green) and an increase in agricultural land (in yellow, orange and red).

An initial explanation is the impact of demographic growth on the population's nutritional needs. As a result, there is a growing demand for arable land, to the detriment of forest land.

Impact of demographic growth

The Land-use Planner automatically projects the impact of demographic growth on lands dedicated to certain crops. All crops that have been defined as important for food security (see chapter 2) see their surface increase in proportion to the rate of demographic growth. By contrast, lands where other crops are grown change by half of this rate. For example, for banana plantations characterised as important for food security, if the demographic growth is 2% per year, those surfaces growing bananas will also grow by 2% per year over the period considered. If these plantations were not deemed important for local food security (for example, if the bananas are produced for export), these surfaces would only grow by 1% per year by default.

The Land-use Planner slightly simplifies the definition of the initial scenario in order not to underestimate the impact of demographic growth. However, this chapter will explain how you can cancel, reduce or increase these effects manually for each land use.

In our Blue River Basin example, we had a demographic growth rate of 3%, close to the actual rates observed in rural areas of central Africa. This rate was set when defining the area (see the 'Population growth' paragraph in the 'Area' section on page 7). However, you can adjust the rate here for this baseline scenario. You can also set it differently for each scenario if you wish. As a matter of fact, it may be that the political choices on housing in the area differ among the scenarios. As a result, you can estimate that future demographic growth will not be the same in all your scenarios.

If we change our rate of demographic growth, for example, from 3% to 2.5%, this will have as a direct consequence a reduction in the expansion of certain crops and the appearance of 'reserved fallow'.

At the end of the study period, from 2018 to 2048, we see:

- a general loss in forest cover in the area
- an increase in the size of artisanal rice plantation, specifically for the food security needs of the local population

The possible appearance of fallow lands

Fallow lands may appear in your baseline scenario even if you have not previously specified them in chapter 2. As a matter of fact, this fallow land appears when you have an itinerant crop on your area. In our Blue River Basin example, we had rice crops characterised as having a 'maximum years in place' of five years and a 'minimum fallow years' of five years (see chapter 2). Therefore, every year, a fifth of the rice crop land is displaced and leaves behind fallow lands that cannot be cultivated again for five years. For each year, the Land-use Planner distinguishes between, on one hand the available fallow lands (fallow lands that have reached the defined age of maturity), and on the other, the unavailable fallow lands (too young, named 'reserved fallow').

Competition between land uses

The expansion of certain crops necessarily means a reduction of land available for one or more other uses, considering that the total area does not change over time. When you manually increase the extent of a specific land use, you can choose which other uses will be 'sacrificed' (and in which proportion). For more explanation on the above, see page 51 in this chapter.

When the Land-use Planner automatically applies extensions of cultivated lands as a result of demographic growth, the first land uses to be converted (or 'sacrificed') are the following, in this order:

- available fallow lands
- bare land (category that covers any remaining land that has not been attributed a specific use during the preceding stage, see chapter 2)

- forests, beginning with the forests with the lowest carbon density. It is believed that, for a given region, the densest forests and those richest in carbon tend to be those that are less accessible or furthest away from the deforestation fronts, although numerous exceptions exist.

Therefore, crop expansion due to demographic growth will occur progressively and will only reach forest cover after completely using up the preceding categories (fallow lands and bare land).

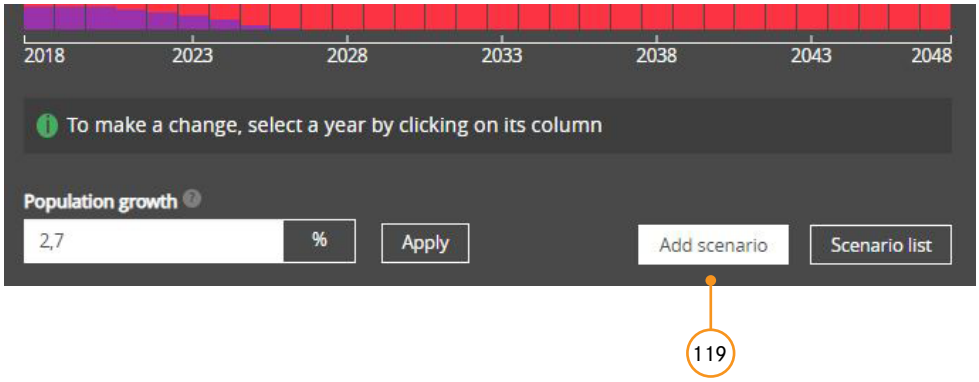
This type of conversion is far from ideal in any context but allows an initial, quick consideration of the effect of population growth on the competition between land uses. You can manually correct these effects (see pages 51-52 in this chapter).

As a result, consider: does this first scenario, automatically offered by the Land-use Planner, simply considering the evolution of the population and the age of the plantations, reflect a possible, realistic future for your area? Would this even be a probable scenario, in the absence of any intervention or proactive policy, and failing any unexpected external shock?

It will undoubtedly be useful for you to keep this baseline scenario, often considered as a 'business as usual' scenario, as a benchmark for comparison with other scenarios where changes in land use are voluntarily introduced. You can also choose to adjust this first scenario using the actions described for the other scenarios below. You may make these adjustments if you believe that the projected trend requires changes to better reflect the 'business as usual' trend.

3.3. Creating a new scenario

You can create a new scenario based on the baseline or 'business as usual' scenario. To do so, you must copy this scenario and then edit it.



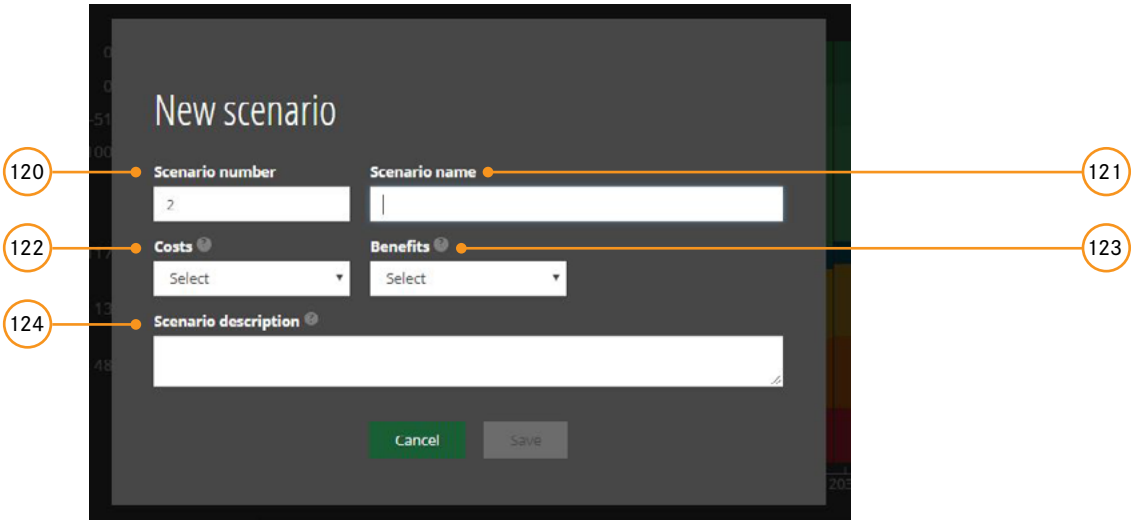
119. Add a scenario

To add a scenario, click 'Add scenario' below the graph.

A new window appears. Below is a list of all the steps for filling it in.

3.4. Second scenario: crop expansion

In our example, the second scenario will consist of the expansion of a crop.



120. Scenario number

This number automatically increases based on the preceding scenario number.

Here, we leave the automatic value at `2`

121. Scenario name

The choice of name is up to you. Enter a short scenario name that that captures the aspirations of one group of actors.

For our example, we will create a very simple case, with a rice crop expansion policy. We name our scenario `Rice crop expansion`

122. Costs

These costs correspond to measures and policies that are needed to implement a specific scenario. They can include public spending on technical support to farmer organisations, investments in land tenure security, development of monitoring and traceability systems, research and development, capacity building, communication and transaction costs in financial mechanisms.

They do not include the direct costs of farming that were accounted for earlier (see chapter 2). For each scenario, give a general indication of the magnitude of the crosscutting costs: either negligible, low, moderate, high or very high (0%, 10%, 20%, 35% and 50% of all farming costs, respectively).

For our example, we select *Moderate* from the drop-down menu.

123. Benefits

The direct benefits of farming and land uses have been calculated earlier and should not be repeated here (see chapter 2).

If certain scenarios would bring additional benefits to society, as opposed to other scenarios, you can specify the magnitude of these benefits for those scenarios: either negligible, low, moderate, high or very high (0%, 10%, 20%, 35% and 50% of all farming benefits, respectively).

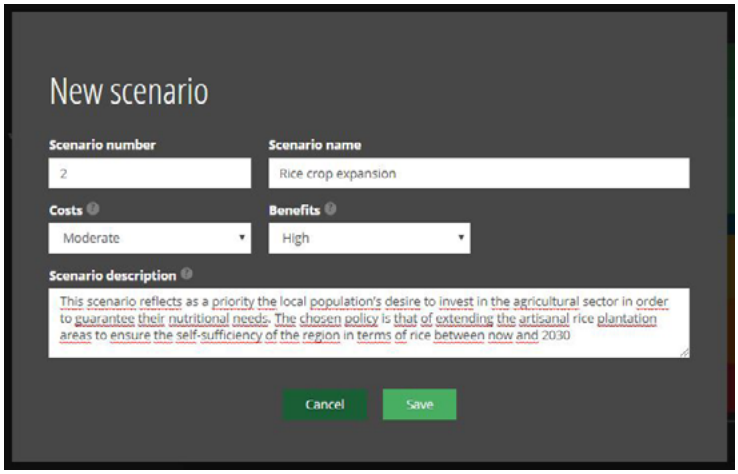
For our example, we select *High* from the drop-down menu.

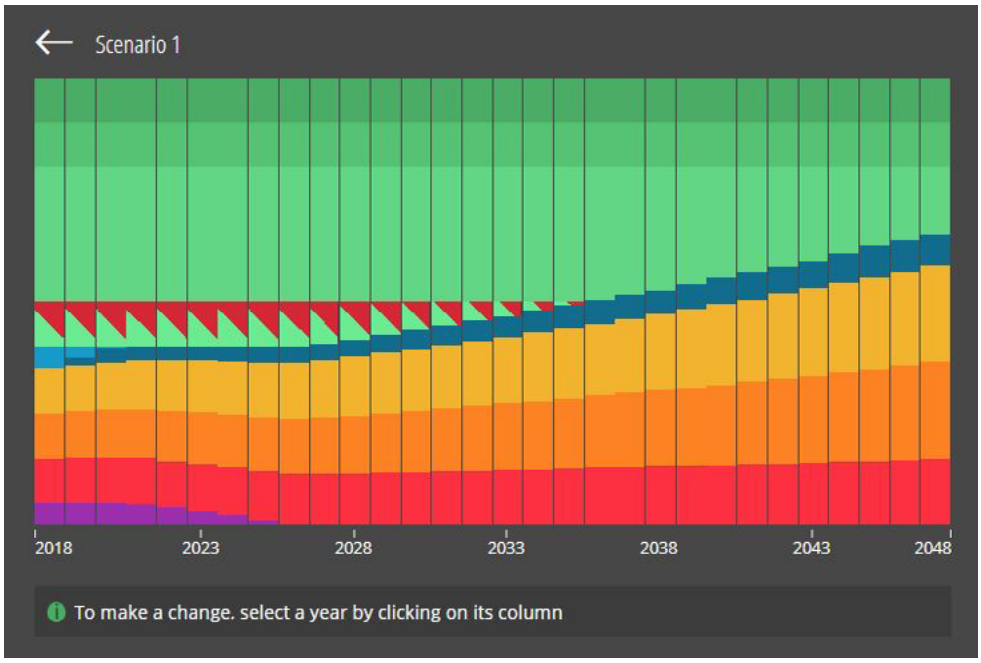
124. Scenario description

Write a short description of the scenario.This will be included in the project's final report, which can be produced by the Land-use Planner. In this description, we recommend that you re-establish the main events and land-use choices of your area specific to this scenario.

For our example, we describe the 'Rice crop expansion' scenario in the Blue River Basin in the following manner: 'This scenario reflects as a priority the local population's desire to invest in the agricultural sector in order to guarantee their nutritional needs. The chosen policy is that of extending the artisanal rice plantation lands to ensure the self-sufficiency of the region in terms of rice between now and 2030'.

Next, click *Save*





What you see of the second, newly created scenario is at first no different to the baseline scenario. You must now make specific changes to this new scenario.

To make any change, click on the year when the change is expected, or at least the year when the change will begin.

In our example, we decided in this scenario to increase the land dedicated to rice culture to achieve self-sufficiency by 2030. Achieving this objective will require significant investments in rice crops from the beginning of the study period, so from 2018. Therefore, we click on the column for the year 2018, which causes us to zoom into the land-use statuses for this year before making a change.

Go to the land use for which the extent must be increased and click on the pen logo to make a change.

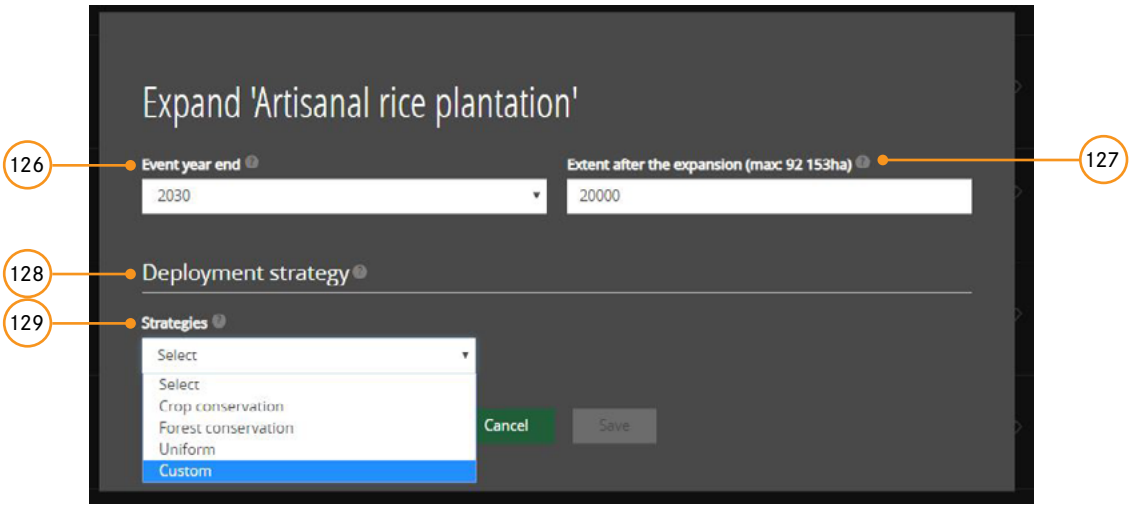
In our example, we click ‘Rice’, which is shown in yellow.

125. ‘Expand’ option

You will then have the option to improve, expand or replace the current land use.

In this example, we click ‘Expand’.

A new window then appears.



126. Event year end

Changing land use on a wide scale takes time. Choose a year by which the change of land use may realistically be achieved based on the year that you selected to begin this change.

In our example, we select 2030, the date by which it is hoped that self-sufficiency in rice will be achieved.

127. Size after the expansion (max: 100 000 ha)

Increase the initial size up to the total estimated after completion of the expansion.

For example, enter *20 000*

128. Deployment strategy

Select the types of land use that will be converted in order to make space for new or expanding land uses.

129. Strategies

For more guided planning, use the forest or crop conservation strategies. You have the option of changing all the data.

The ‘Crop conservation’ strategy will at first aim to convert fallow lands into agricultural lands, followed by ‘other’ land uses and forest lands. Agricultural lands will be converted last.

The ‘Forest conservation’ strategy ensures that the integrity of the forest cover is preserved as a priority.

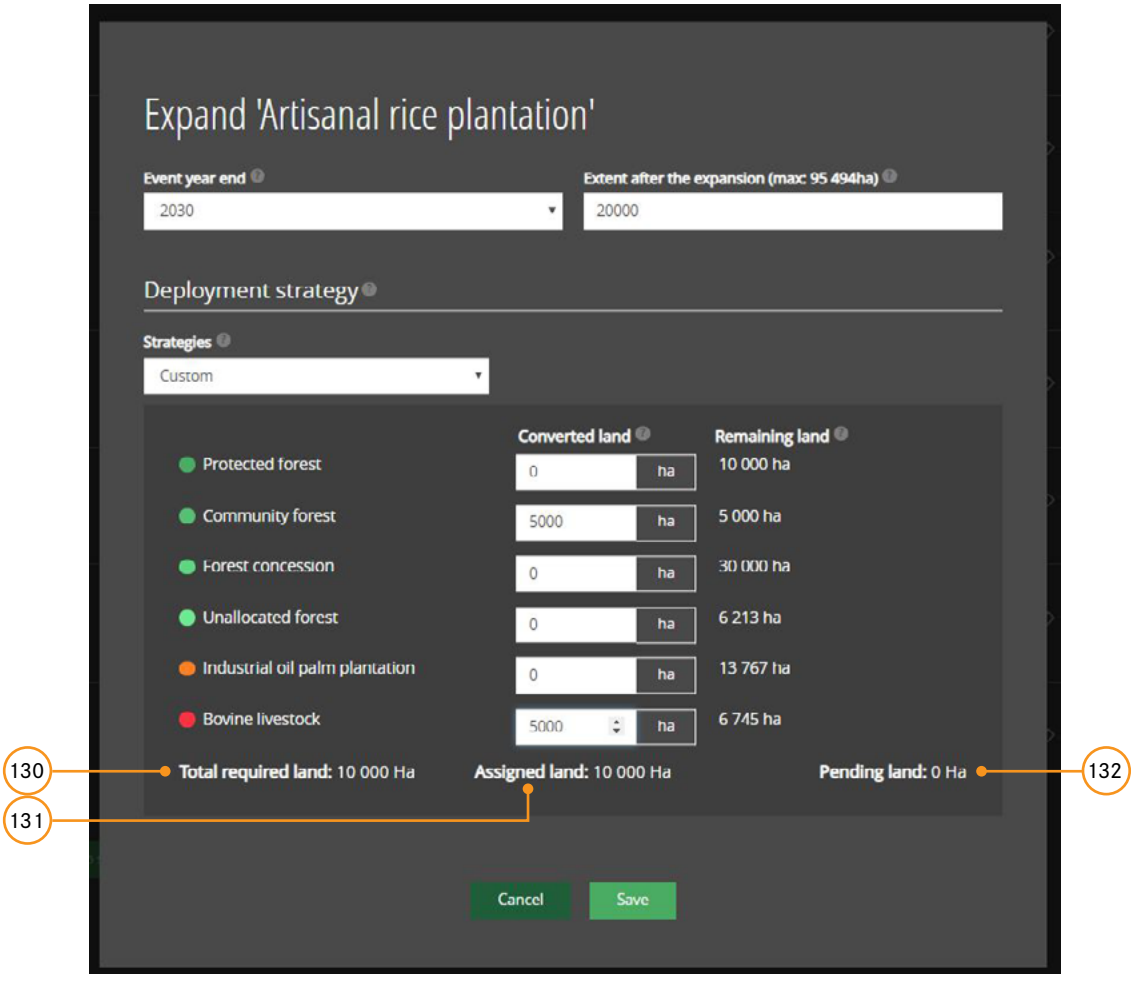
The ‘Uniform’ strategy offers you a uniform deployment over all land uses. They will therefore all be affected by the new/expanded land use in the same way.

The ‘Custom’ strategy allows you to freely determine which land uses will be affected.

In our example, we think we will need 10 000 hectares to allow the desired rice crop expansion. To control the type of expansion, we can choose to convert fallow lands into plantations and/or use less land for bovine production. The expansion can therefore be split into two zones:

Converted zone: this column represents the surface (in hectares) of each land use that will be converted into the new or expanding land use.

In our example, we indicate in this column that 5 000 hectares of what was originally community forest will be converted and 5 000 hectares of bovine livestock lands will be converted.



130. Total required land

This is the land necessary for the desired expansion added to the initial surface of this land use.

131. Assigned land

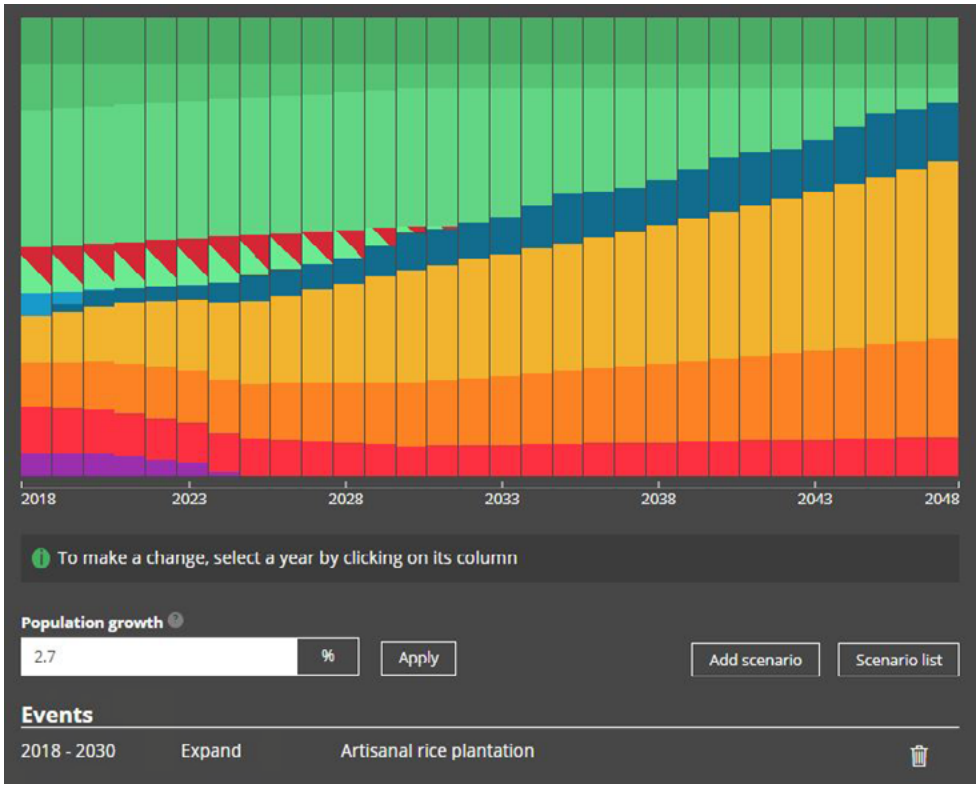
This is the land assigned for the desired expansion of the use, resulting from the conversion of one or more land uses.

132. Remaining land

This is the land that is yet to be assigned in order to reach the total desired land use expansion.

In this case, half of the original community forest land is converted (5 000 ha converted, 5 000 ha remaining), as well as half of the land for bovine livestock (5 000 ha converted, 5 000 ha remaining).

Once you have assigned all of the required land, click ‘Save’.



The event ‘Expand’ for the artisanal rice plantation is added below the land-use bar. A new graph for this first change in the scenario is shown.

You can see:

The consequent (and in this case, desired) increase in the land used for artisanal rice plantations.

Note that the effect of demographic growth on this crop, indicated as important for food security, increases the expansion event and therefore a surface greater than the 20 000 initially desired is expected by the end of the scenario.

Given that this crop remains an itinerant crop, you will see the creation of fallow land as a result.

This first ‘simple’ crop expansion scenario is completed. In this same scenario, you can repeat the action to expand other crops, or even introduce other events that we will explain through the other scenarios below.

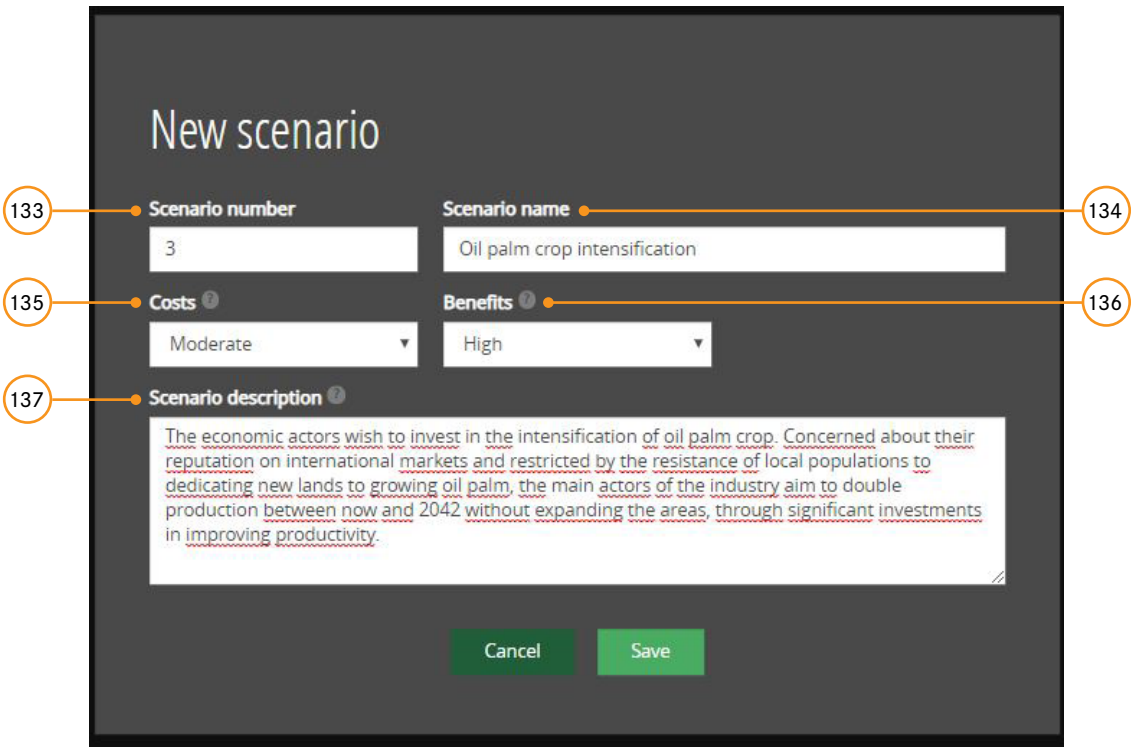
Note

To observe the evolution (stable, positive or negative) of each land use in more detail, move the cursor over the graph and choose a year by clicking on it.

3.5. Third scenario: crop intensification

To create a third scenario, you should restart from the baseline or 'business as usual' scenario. To do so, you must copy this scenario and then edit it. Click 'Add scenario' at the bottom of the graph.

In our example, we will generate the intensification of the oil palm crop.



133. Scenario number

This number automatically increases based on the preceding scenario number.

In this case, we leave the automatic value at *3*

134. Scenario name

The choice of name is up to you. Enter a short scenario name that represents the perspective of one group of actors.

For our example, we name our scenario *Oil palm crop intensification*

135. Costs

For an explanation of how these costs are calculated, see pages page 49.

For our example, we select *Moderate* from the drop-down menu.

136. Benefits

For an explanation of how these benefits are calculated, see page 49.

For our example, we select *High* from the drop-down menu.

137. Scenario description

Similarily to the second scenario, rice crop expansion, you should write a short description of the scenario. This will be included in the project's final report, which can be produced by the Land-use

Planner. In this description, we recommend that you outline the main events and land-use choices of your area specific to this scenario.

For our example, we describe the 'Oil palm crop intensification' scenario in the Blue River Basin in the following manner:

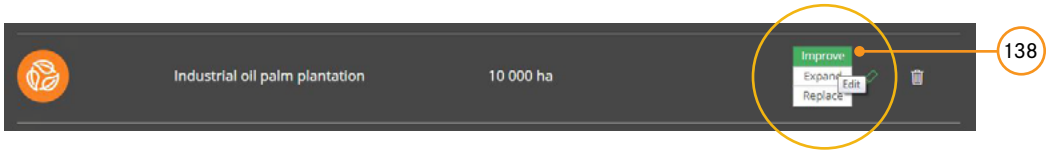
'The economic actors wish to invest in the intensification of oil palm crop. Concerned about their reputation on international markets and restricted by the resistance of local populations to dedicating new lands to growing oil palm, the main actors of the industry aim to double production between now and 2042 without using extra land, through significant investments in improving productivity.'

The impact of agricultural intensification on deforestation

The increase in agricultural productivity does not always lead to a reduction of agricultural pressure on nearby forests. Intensification leading to an increase in agricultural production can increase the profitability and re-investment capacity with the effect of encouraging the expansion of agriculture and therefore an increased deforestation, especially if there is a high mobility of the workforce.

This is especially the case with crops destined to export, where demand is potentially always greater than local supply. As a result, prices do not significantly drop when production increases.

This type of unplanned deforestation phenomenon is therefore to be considered in agricultural intensification scenarios.

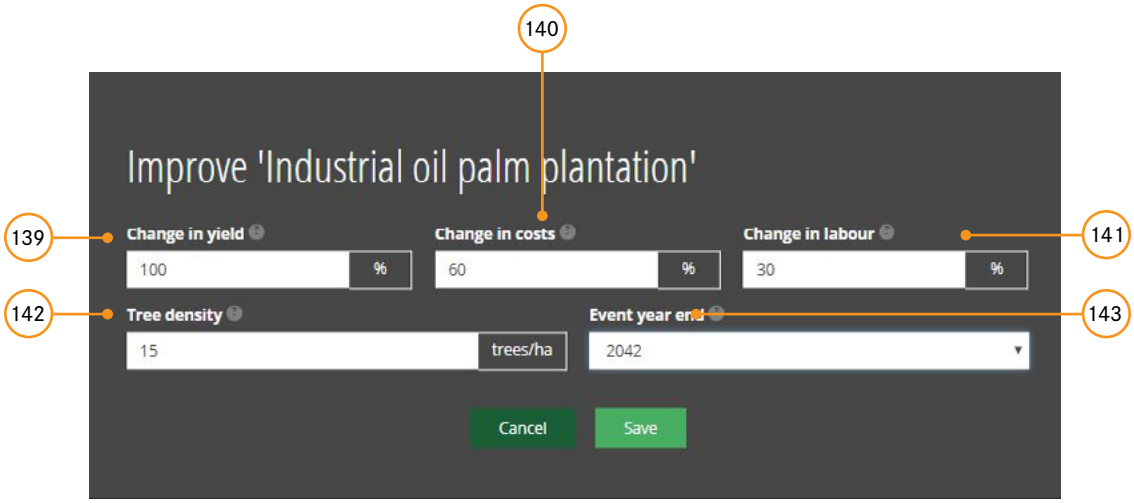


138. Improvement in oil palm plantations

Oil palm plantations can be improved by intensifying the plantation (increasing density), which will enable yields per hectare to increase.

The 'Improve' function allows you to carry out this objective.

A new window will then appear, which enables you to enter the scenario's settings.



139. Change in yield

A percentile increase or decrease in the original yield.

To double productivity, enter an increase of *100* %.

140. Change in costs

A percentile increase or decrease in the non-labour costs necessary to achieve the increase or decrease in productivity.

For our example, we enter *60* %.

141. Change in labour

A percentile increase or decrease in labour costs that are necessary to achieve the increase or decrease in productivity.

For our example, we enter *30* %.

142. Tree density

This setting allows you to change the density of the trees. It is calculated by the number of trees per hectare. One tree counts for 1.8 tCO2. Trees can bring a range of 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 *2* trees/ha.

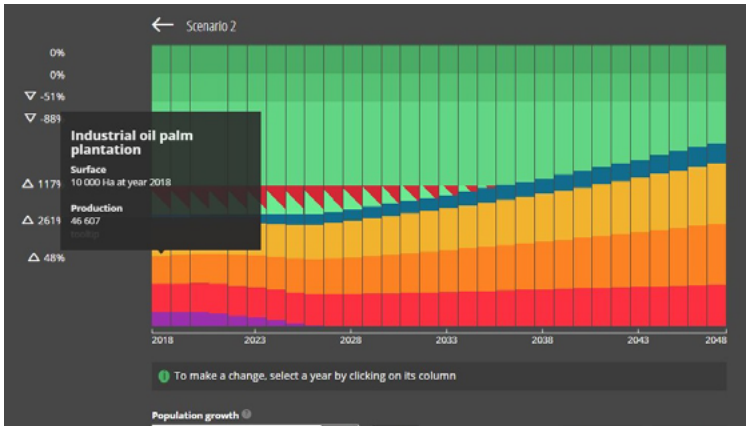
143. Event year end

Changing land use on a wide scale takes time. Choose a year in the future when you think that this land-use change will realistically be completed.

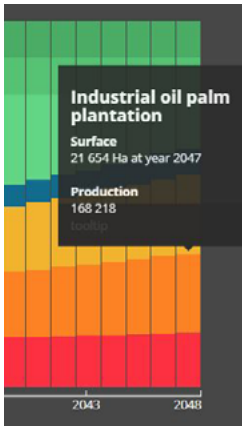
For our intensification of oil palm example, we select *2042*

Next click ‘Save’.

The result of this ‘improvement’ will not be visible in terms of change in the extent of this land use (or on the land-use bar). However, you will be able to observe it in the production improvement, by moving your cursor over the various years of the scenario.



Yield in 2018



Yield in 2047

3.6. Fourth scenario: zero-deforestation policy

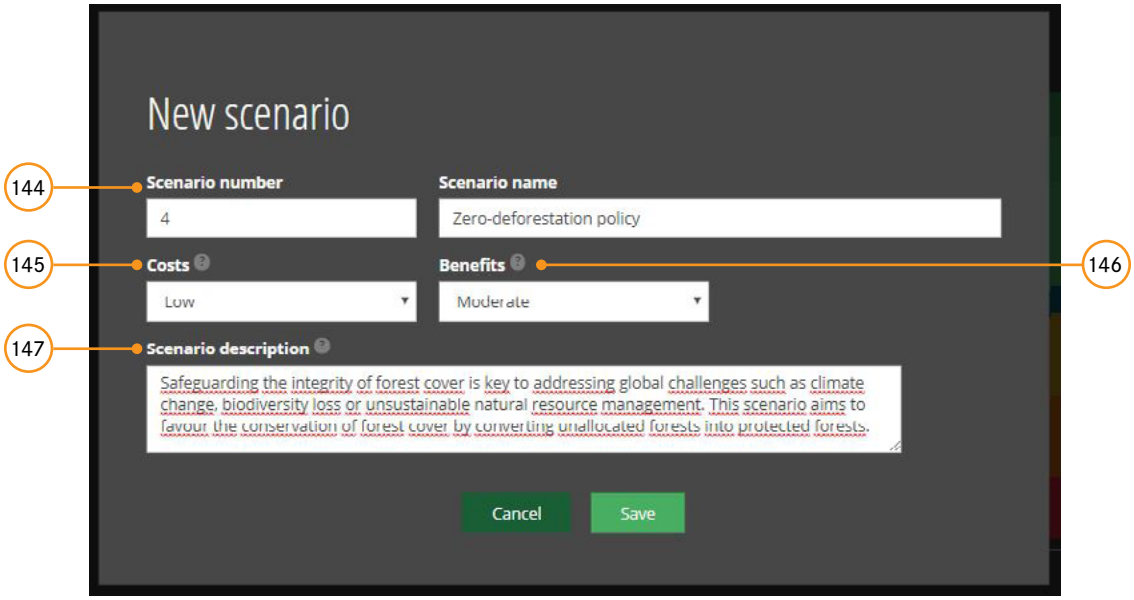
Safeguarding the integrity of forest cover is key to addressing global challenges such as climate change and biodiversity loss. It is also essential to natural resource management, among others.

This scenario aims to favour the conservation of forest cover by converting unallocated forests into protected forests.

However, production aims must be taken into account in order to propose a realistic scenario that is agreeable to multiple stakeholders.

To create this fourth scenario, you should restart from the baseline or 'business as usual' scenario. To do so, you must copy that scenario and then edit it. Click 'Add scenario' below the graph.

A new window will then open.



In our example, we will create the zero-deforestation policy.

144. Scenario number

This number automatically increases based on the preceding scenario number.

Here, we leave the automatic value at *4*

145. Costs

For an explanation of how these costs are calculated, see page 49.

For our example, we select *Low* from the drop-down menu.

146. Benefits

For an explanation of how these benefits are calculated, see page 49.

For our example, we select *Moderate* from the drop-down menu.

147. Scenario description

Similarily to the second and third scenarios, you should write a short description of the scenario.This will be included in the project's final report, which can be produced by the Land-use Planner. In this

description, we recommend that you outline the main events and land-use choices of your area specific to this scenario.

For our example, we describe the ‘zero-deforestation policy’ scenario in the case of the Blue River Basin in the following manner: ‘Safeguarding the integrity of forest cover is key to addressing global challenges such as climate change, biodiversity loss or unsustainable natural resource management. This scenario aims to favour the conservation of forest cover by converting unallocated forests into protected forests.’

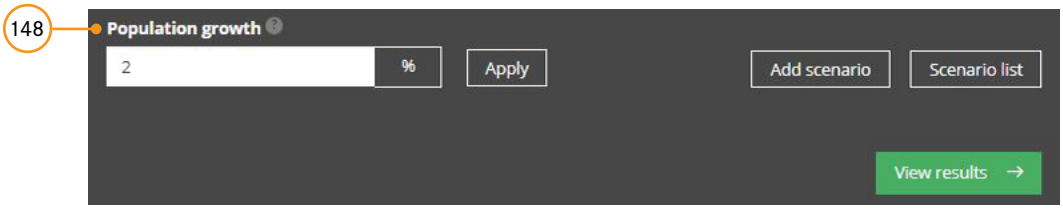
Next, click ‘Save’.

Events to create

As a result of the implementation of a ‘zero-deforestation’ policy, we could imagine the local population’s concern about reduced employment opportunities that could result in a rural exodus.

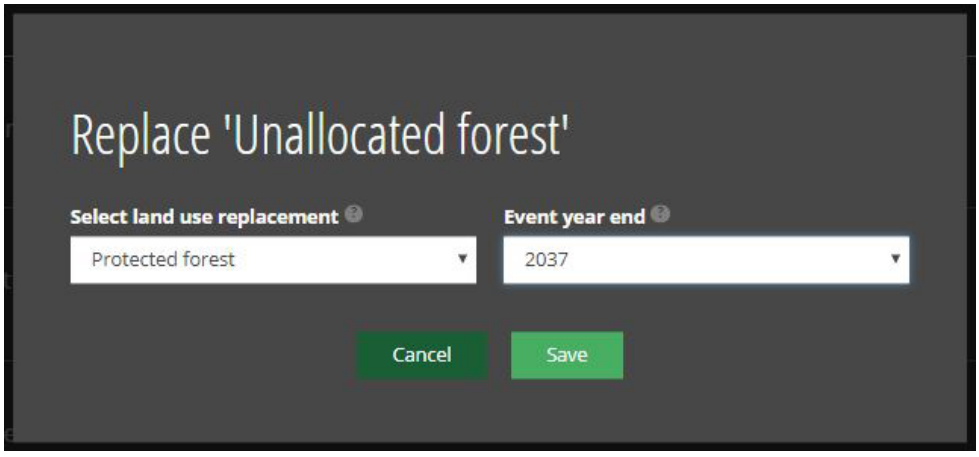
148. Population growth

The first consequence would be to reduce the population growth from 2.7 to 2%.

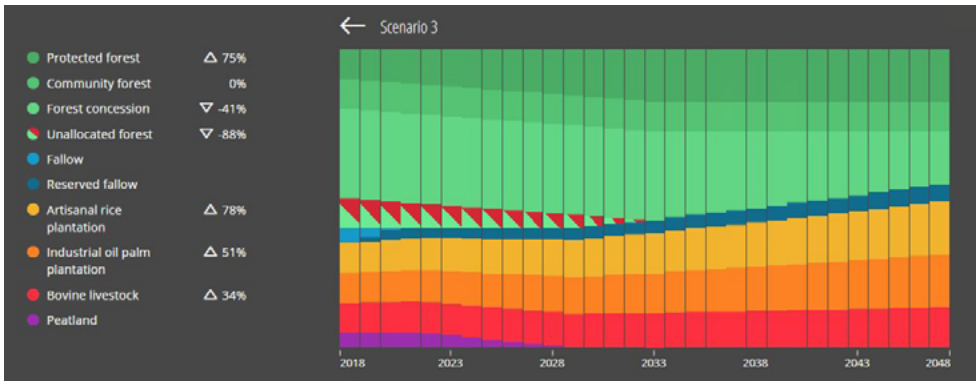


Secondly, certain groups of actors will propose that unallocated forests be replaced by protected forests (third editing option). To do so, click on the column representing the current year. Go to the unallocated forests. By clicking the pen option, you will be able to select the ‘Replace’ option:

A new window then appears, which will enable you to choose the new land use from a drop-down menu, as well as the event year end when this change will have realistically occurred.



Next, click ‘Save’.



Scenario interpretation

By observing the intermediate result, we can confirm the increase in protected forests, which has replaced the unallocated forests.

However, we notice that even when intending to secure the land covered by forest, fallow land has nibbled away at the edge of the forest. Therefore we ask the following question:

How do we avoid the phenomenon of reserved fallow land, which seems to be a factor in the reduction of forest cover?

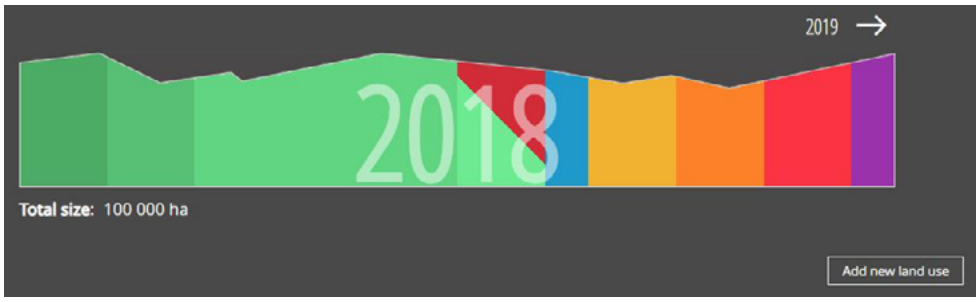
One solution may be to replace oil palm plantations with forest plantations (creation of secondary artificial forest).

Another solution would also be to remove the rice crops and turn them into forest but is it credible and possible? The facilitator will now play the role of a mediator and present a consensus scenario based on everyone's aspirations. You should also take into account the possible technical restrictions that make it difficult to implement a zero-deforestation policy in this area.

'Add a new land use' option

Outside the scope of our Blue River Basin example developed in this manual, you will notice the 'Add a new land use' option:

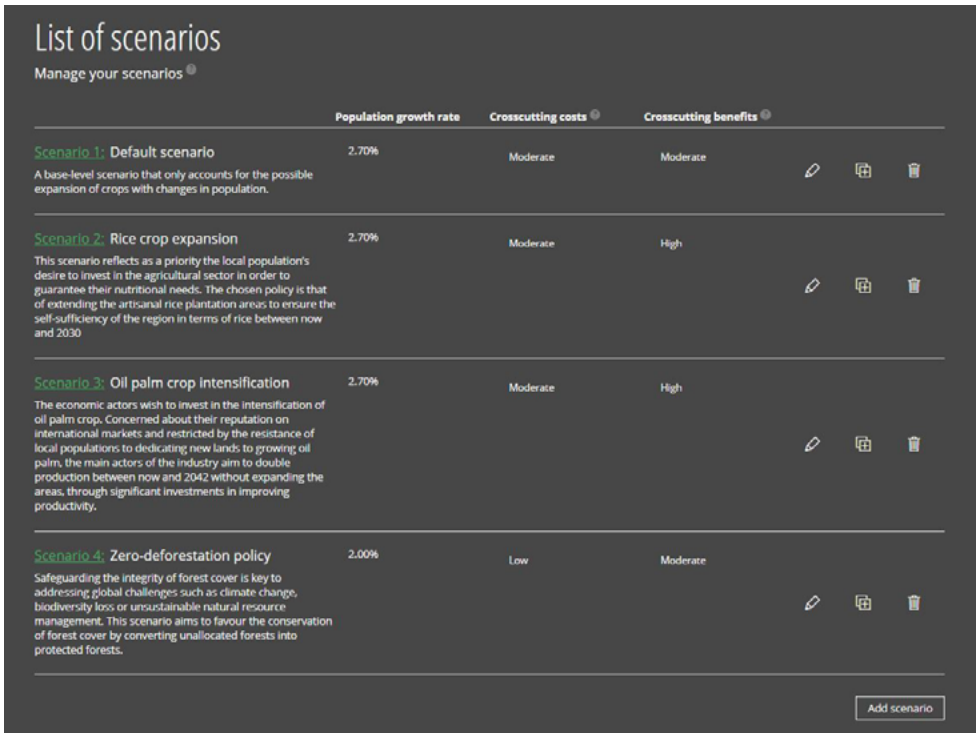
Click 'Add a new land use' below and to the right of the graph:



You will then be asked to define a new land use, following the same method as replacing a land use with a new use, through the deployment method.

3.7. Scenario list

At the bottom-right of each scenario, you can see a list of the scenarios by clicking ‘Scenario list’.



The list of scenarios enables you to make an overall comparison before viewing the results.

It is the perfect time to carry out a review of all the scenarios and their relevance. You can also make sure that each scenario matches the priorities of all the stakeholder groups. At this point, it is important to make sure that participants understand the scenarios.

Once these checks have been performed, click ‘View results’, at the bottom-right of the window.

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).