SIMANFOR

User's manual

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16/04/23

Instituto Universitario de Investigación
iuFOR GESTIÓN FORESTAL SOSTENIBLE

- Introduction
- Webpage: first steps
- Developing the forest inventory
- Models
- Creating silvicultural scenarios
- Results

Before to start

SIMANFOR is a tool that allows the simulation of forest management alternatives.

SIMANFOR is free to use and accessible at https://www.simanfor.es, just requires previous registration.

SIMANFOR is a tool under continuous development, so you can find new functionalities on the webpage that are not explained in this manual (under development status) and maybe with errors not solved yet.

SIMANFOR has some documentation not available on the website (at the moment), but you can access them through this GitHub repository. Here you can find this manual divided into chapters, allowing you to use that tool faster, and also additional information that allows SIMANFOR users to develop their initial steps with the simulator in an easier way (inventories already adapted, scripts to plot results…).

If you want to develop your model to implement it on SIMANFOR or you are looking for simulations with a huge amount of data, you can write to our support team and we will explain to you how to do it, as the webpage is not the only way to use SIMANFOR. In addition, you can write your doubts and suggestions to the SIMANFOR support team using the next email:

simanfor.data@forest.uva.es

SIMANFOR

Introduction

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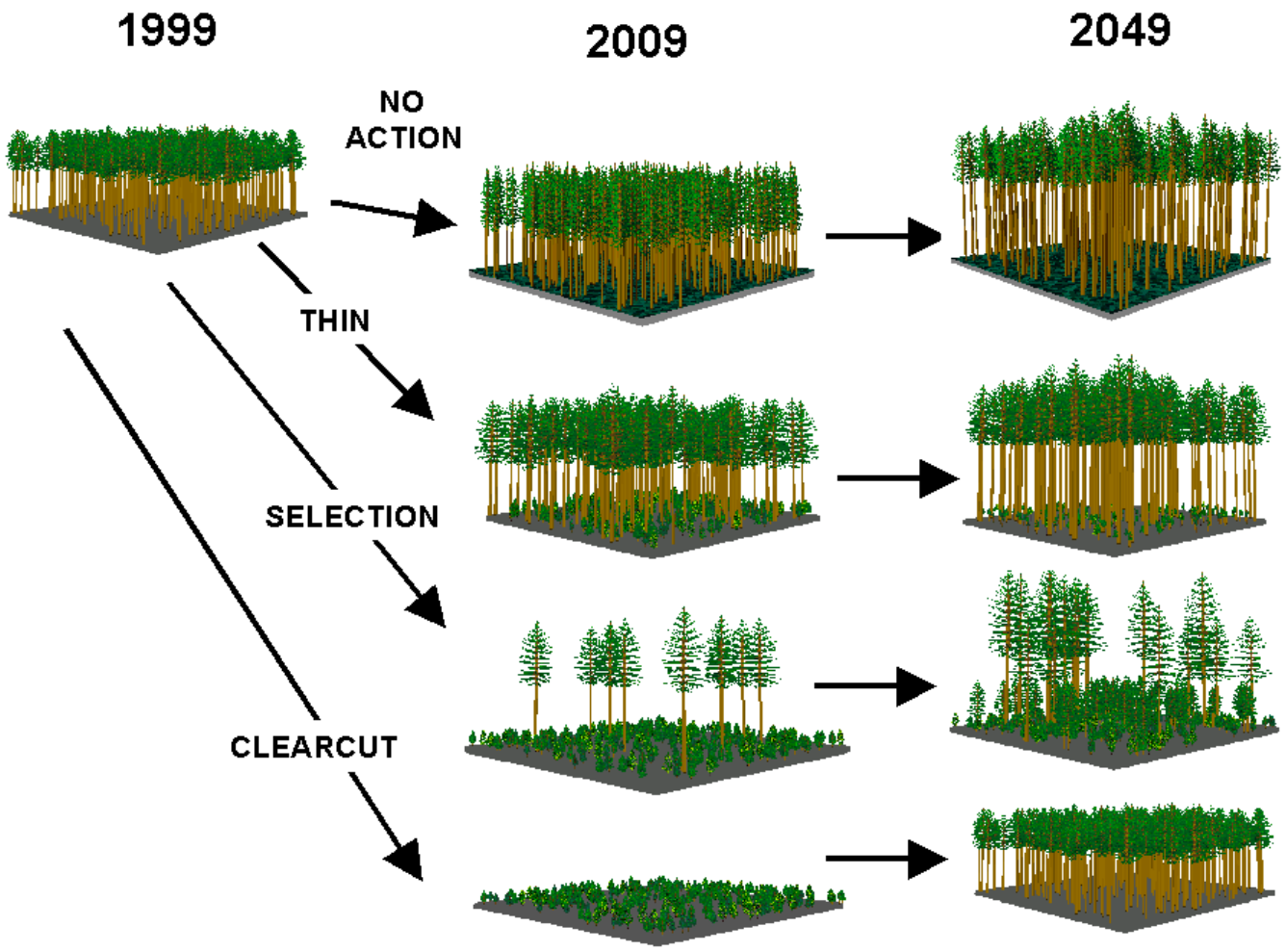
- Forest modelling
- What is SIMANFOR?
- How SIMANFOR works?
- SIMANFOR website and resources
- Study cases

Forest modelling

To define a forest model we can use resources like [“Glosario Técnico Forestal de la SECF”](), where a model is defined as “An abstract representation of objects and situations from the real world, having the purpose to characterize a phenomenon or simulate processes and predict their results, i.e., quantitative models that use al mathematical equations.”

From that explanation, we can deduce that forest modelling is the abstract representation of a forest stand that let us know its evolution under different scenarios.

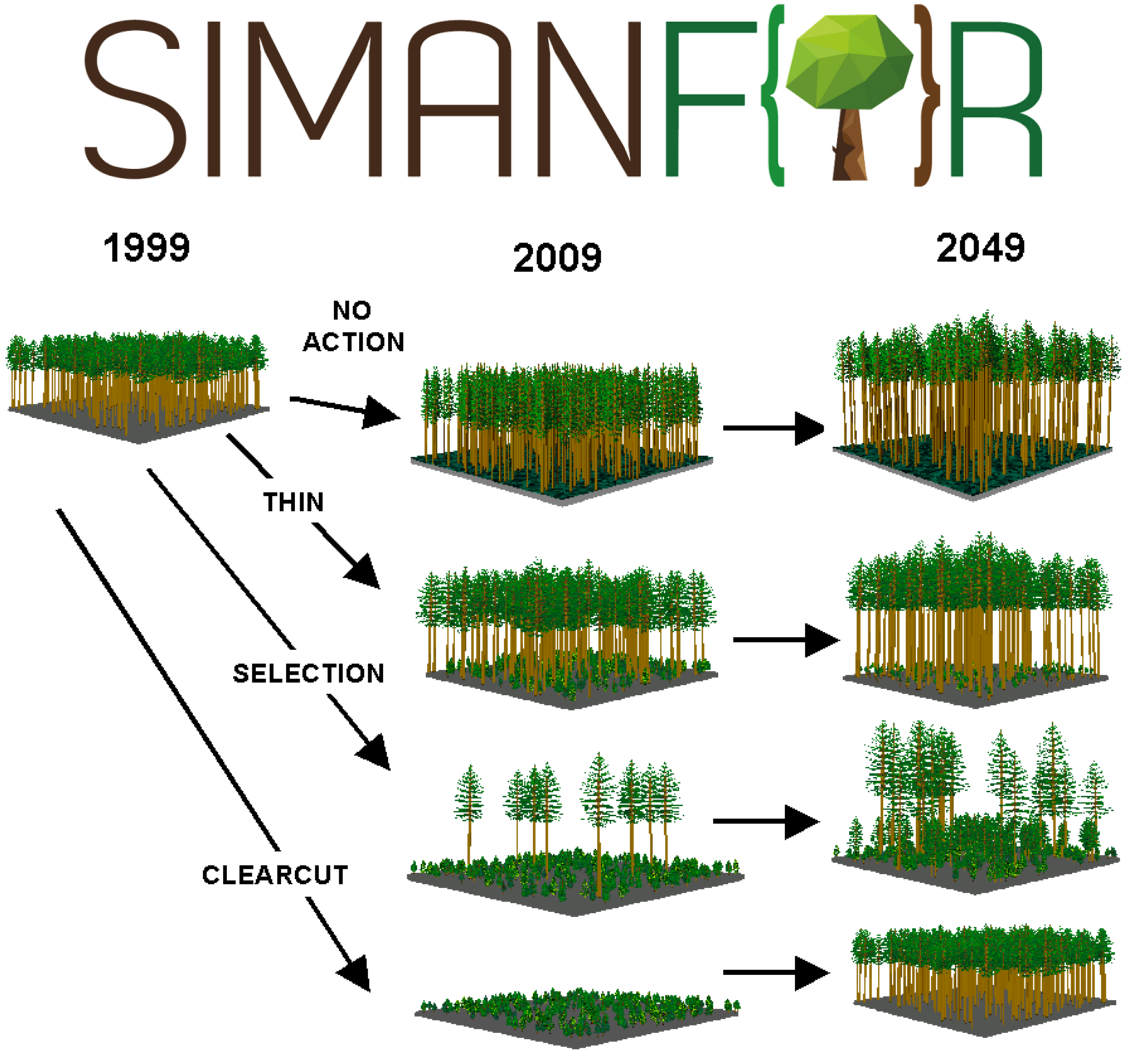


What is SIMANFOR?

What is SIMANFOR?

SIMANFOR is a tool that allows the simulation of forest management alternatives.

Remembering the idea of forest modelling and model, the main strength of SIMANFOR is to provide their users with a tool that allows predicting the effect of a certain silvicultural over a forest stand, hiding the calculation part (previously programmed) and providing useful information to the taking decisión process.

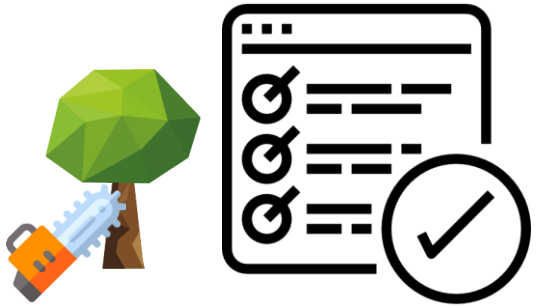


What is SIMANFOR?

SIMANFOR has the structure shown in the image, where:

- The inventories are the data given to the simulator by the user
- The scenarios are the list of processes we want to simulate, including projections (growth) and harvests (silvicultural activities).
- The models are part of the simulator and they are already programmed by the support team of SIMANFOR
- The results given by SIMANFOR are files that include information regarding the evolution of each plot under a given silvicultural scenario

INVENTORY



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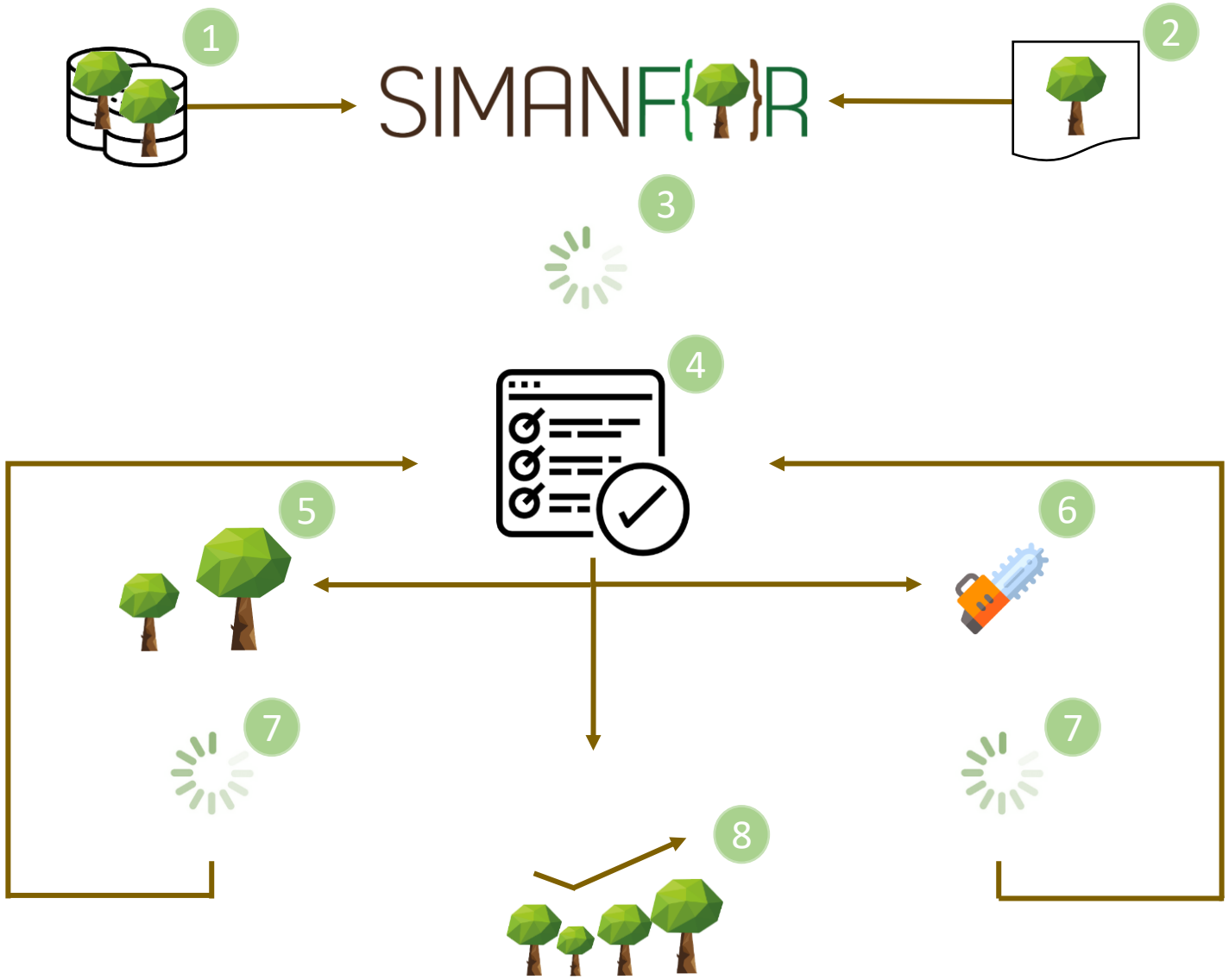
RESULTS

How SIMANFOR works?

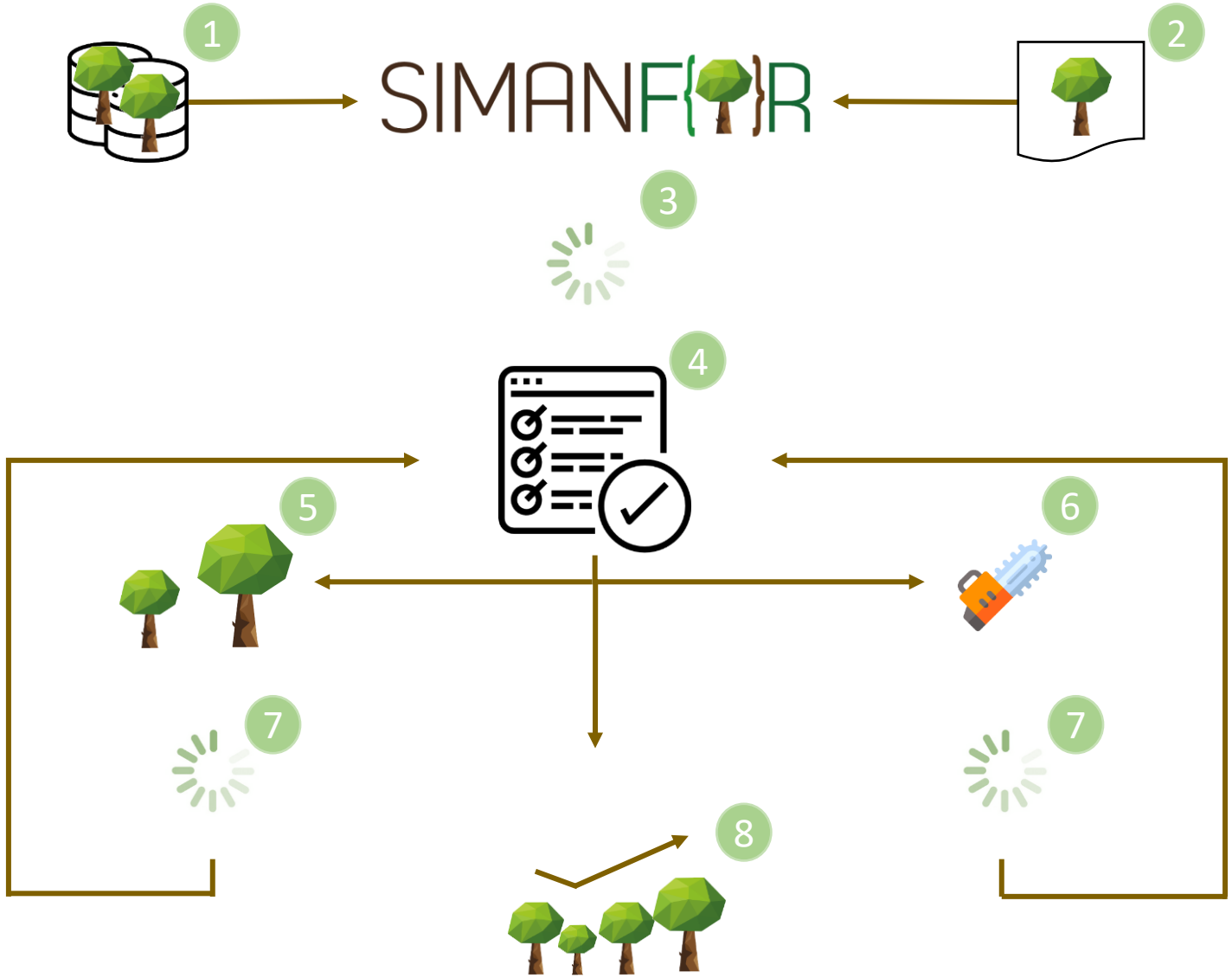
How SIMANFOR works?



How SIMANFOR works?

When we run a simulation, the SIMANFOR internal workflow is the one shown in the image:

1. The user provides an inventory with its data.
2. The user chooses a forest model to run their simulations.
3. The information is loaded on SIMANFOR and an initializing process starts, needed to input the missing variables of the initial inventory provided by the user.



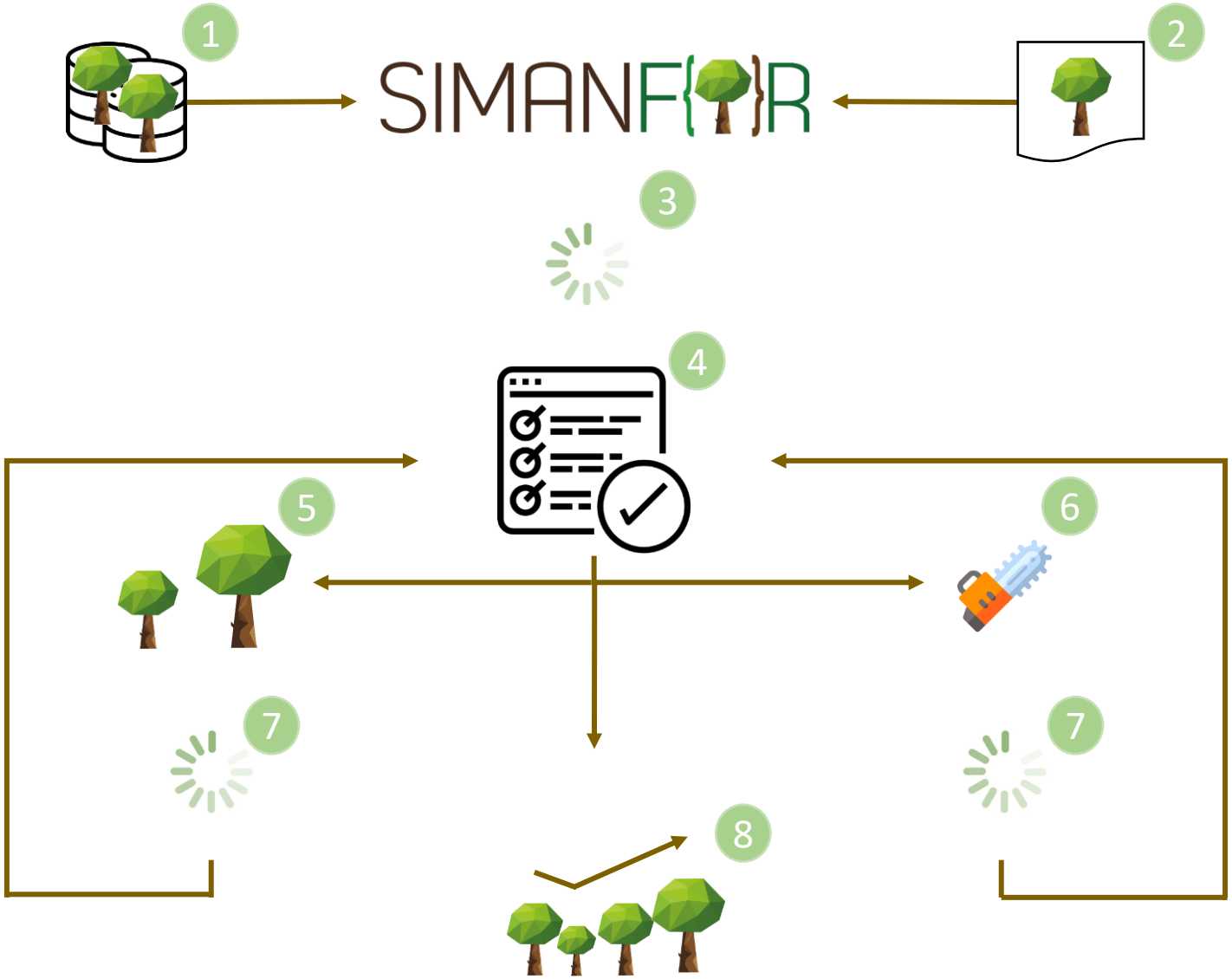
How SIMANFOR works?

4 Having the inventory completed with more variables, SIMANFOR starts to read the silvicultural scenario provided by the user. On that point, the processes to apply can be:

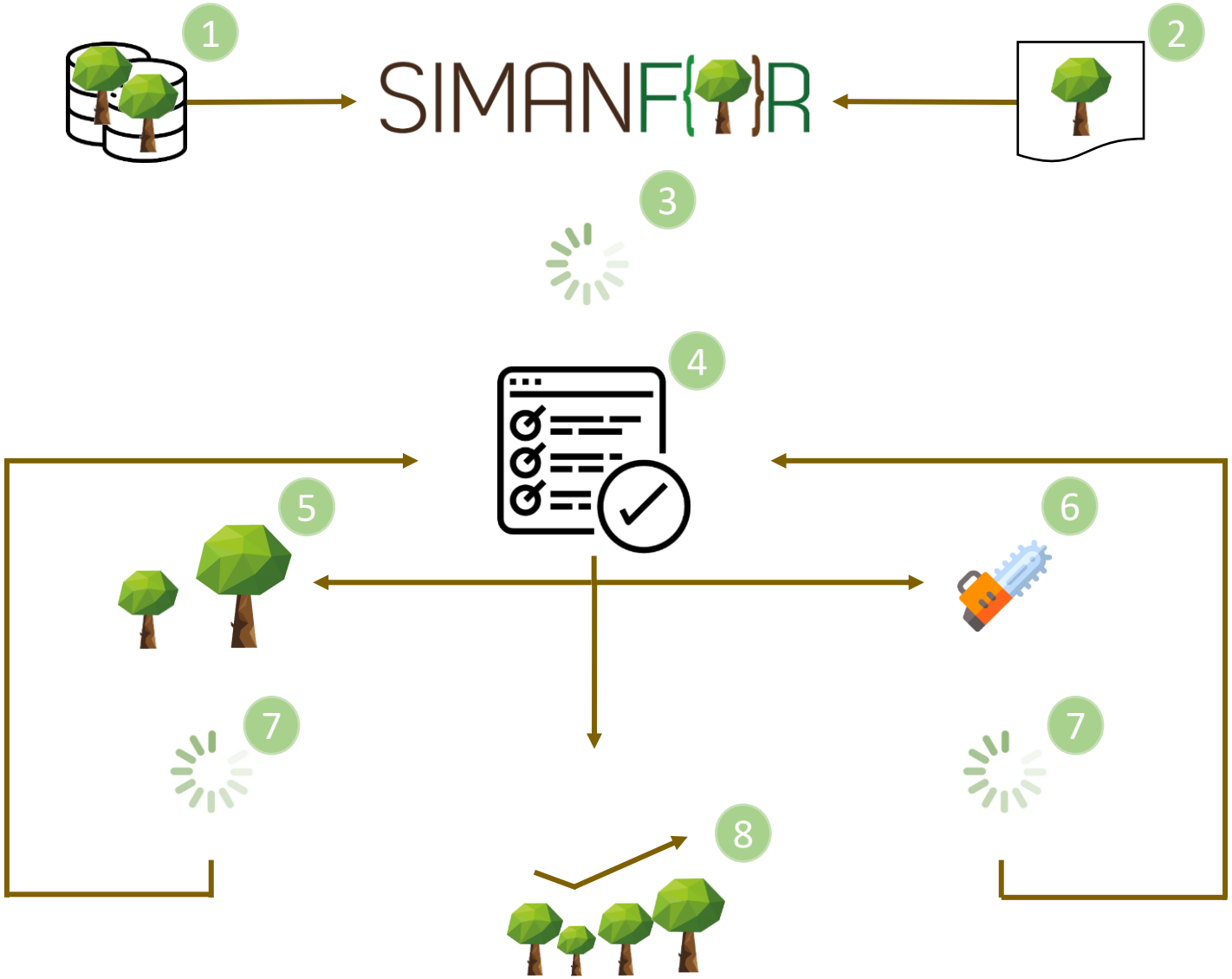
5 Projections, applying mortality, growth and ingrowth submodels on our data.

6 Harvests, where part of the trees are extracted following a certain type, criteria and intensity set by the user.

7 After each process, the simulator recalculates the variables of each tree and stand., recording the information of the new situation.



How SIMANFOR works?



4 At the end of each process, SIMANFOR reads and applies the following step of the silvicultural scenario.

8 When all the steps are done, the results of each of the processes (projection, harvest) are written in a single file for each plot.

SIMANFOR website and resources

SIMANFOR website and resources

SIMANFOR is a free tool available at:

http://www.simanfor.es/

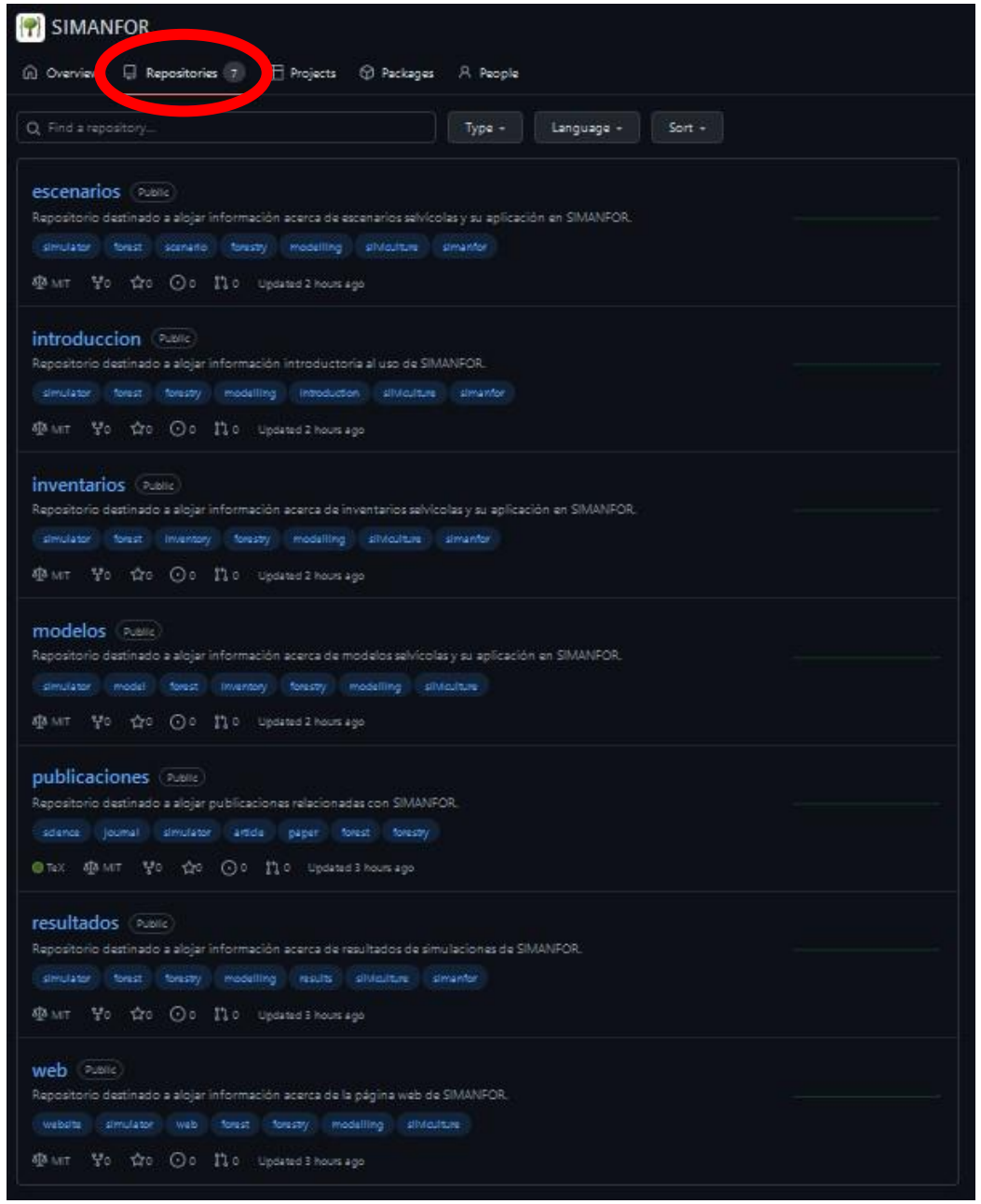
Its website has a friendly visual interface for users, but with some limitations to créate new models, modify the actual ones or developing massive simulations. For any of these points, we recommend contacting the SIMANFOR support team at:

simanfor.data@forest.uva.es

SIMANFOR website and resources

In addition to its website, different training contents were developed about SIMANFOR, such as the guide manual you are reading, a guide to using the webpage, and explanations about inventories, scenarios, models… and other contents related to the simulator, available at:

https://github.com/simanfor

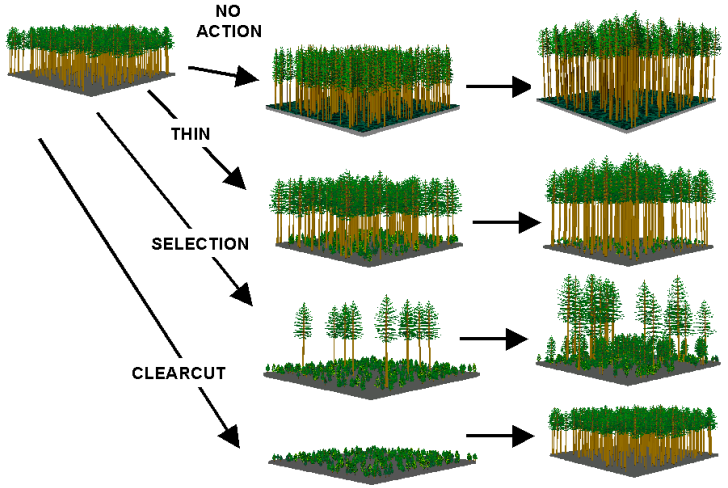


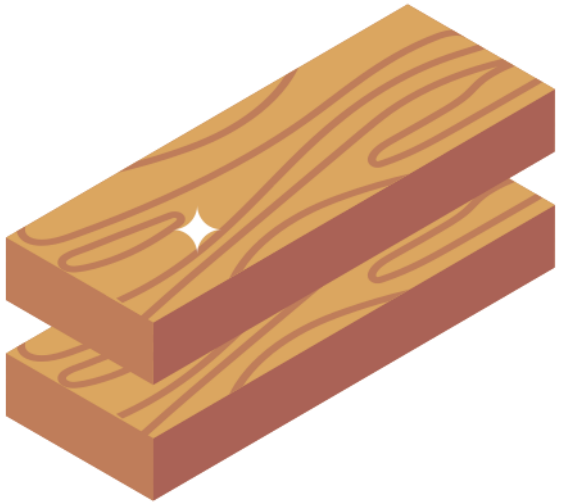
Study cases

Study cases

In this repository, you will find information about different research studies that have been developed by using SIMANFOR. However, SIMANFOR applications for non-research fields are diverse, like:

- Study silvicultural alternatives for a specific stand
- Development of silvicultural guides
- Forest management plans
- Studies about the economic profitability of wood, non-wood resources and ecosystem services provided by forests
- Wood products quantification and classification
- Studies about carbon stock and storage





SIMANFOR

Webpage: first steps

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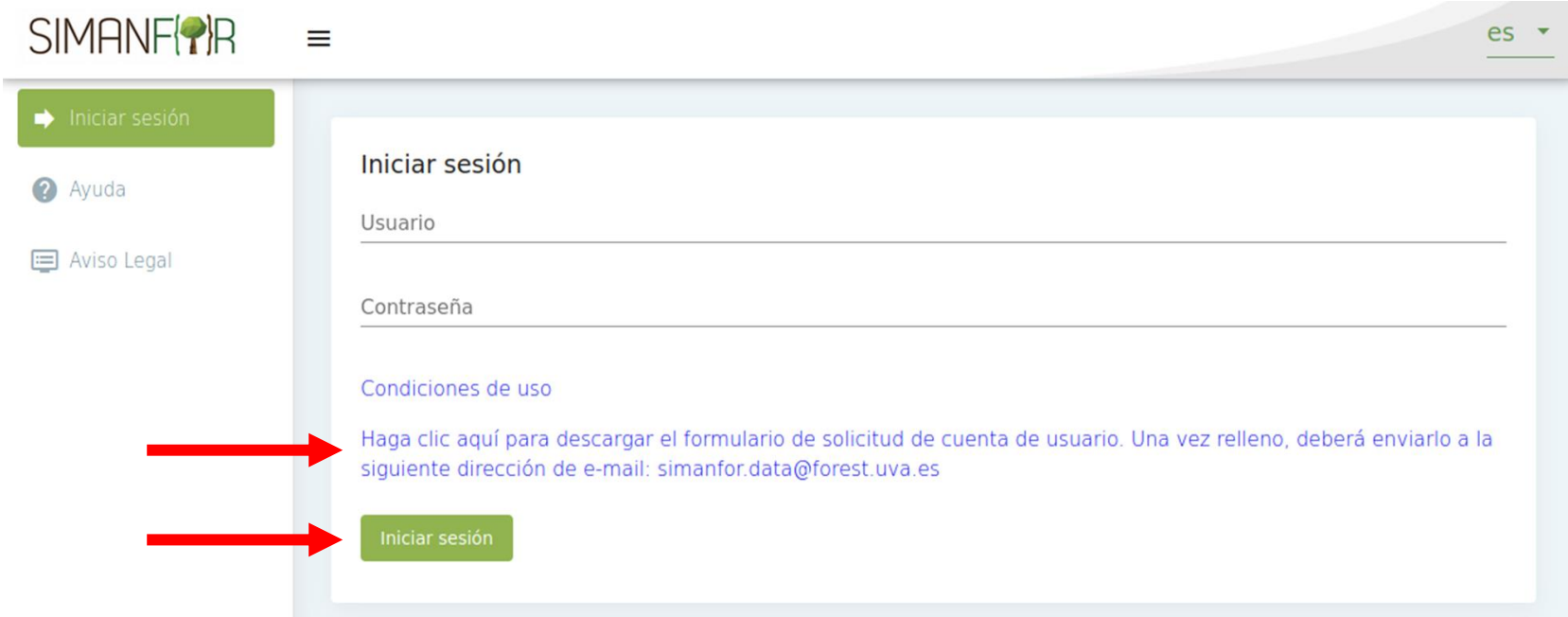
- SIMANFOR registration and login
- Language
- Main structure
- Inventories
- Models and parametrizations
- Scenarios
- Results
- Help and external resources

SIMANFOR registration and login

SIMANFOR registration and login

That's the main screen of SIMANFOR. You have to register yourself if you didn't do it before and after that login.

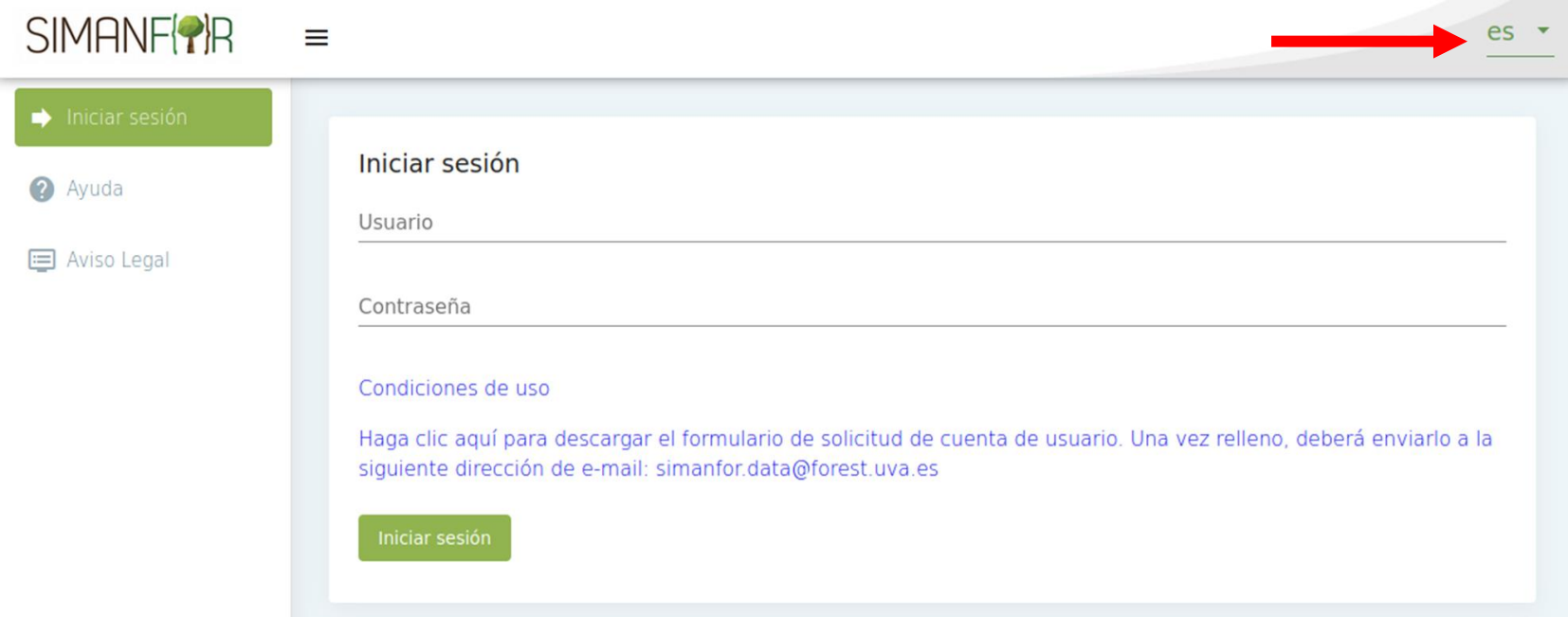


Languages

Languages

Just in case you didn't see it, on the upper-right part of the website there is a menú with the different languages available. Some of them are not complete, and the texts without a translation will be shown on English by default. Available languages are:

- en: English
- es: Spanish
- gl: Galician
- fr: French
- pt: Portuguese
- vi: Vietnamese

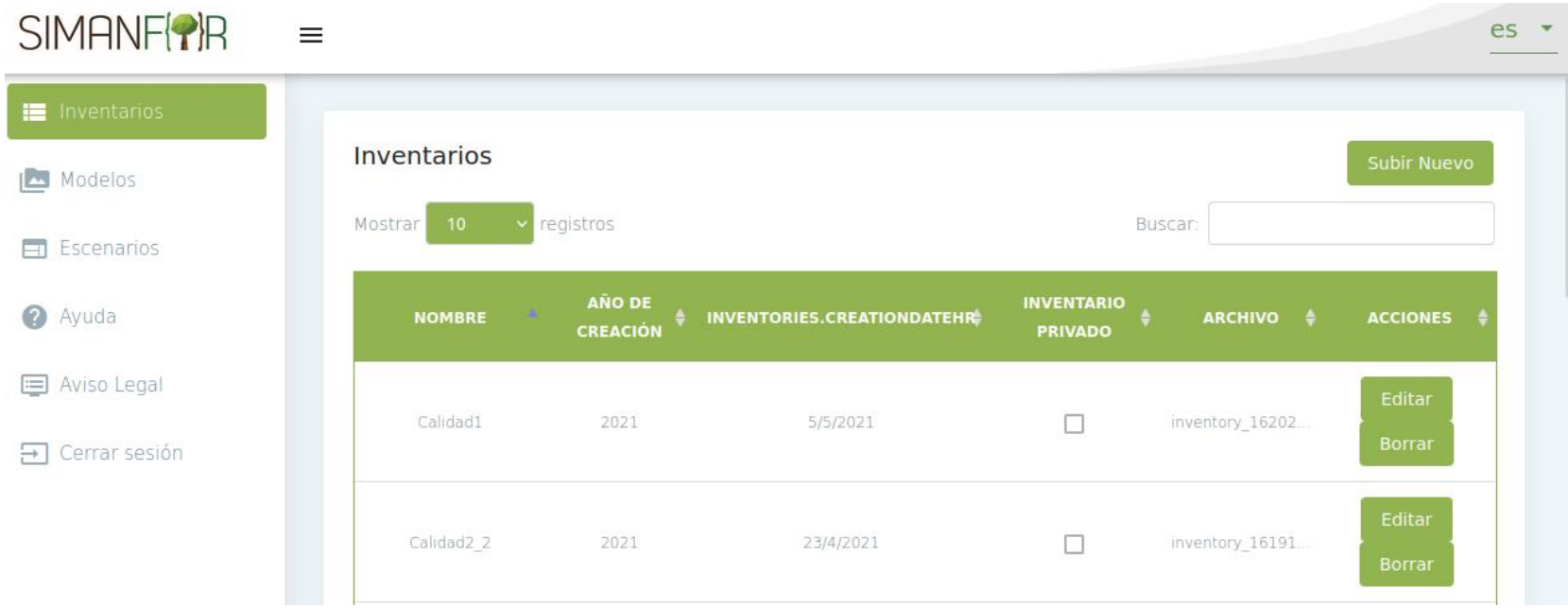


Main structure

Main structure

Once we are registered on SIMANFOR, that's the interface you will find.

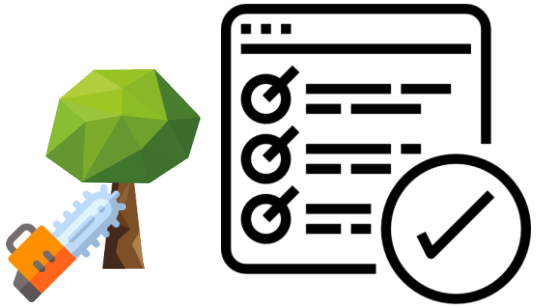
The most important information blocks are "Inventories", "Models" and "Scenarios". We Will explore their contents, but first of all, let's take a look at the main SIMANFOR structure.



INVENTORY

Inventories are the starting data that users provide to the simulator. We will have to upload our own files in order to use them. Here you can find some example files, templates and a more detailed explanation about inventories.

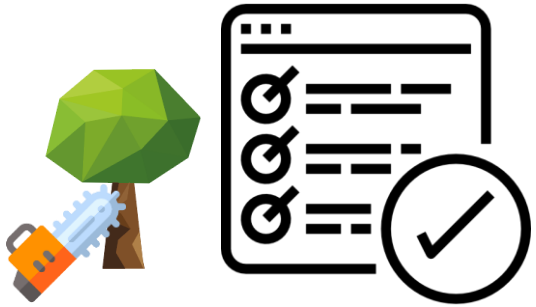
INVENTORY



SCENARIO

The scenarios are the processes we want to simulate, both projections (tree/stand growth) and harvests (silvicultural activities). forestry). If you want to know how to create them, here you have a tutorial.

INVENTORY

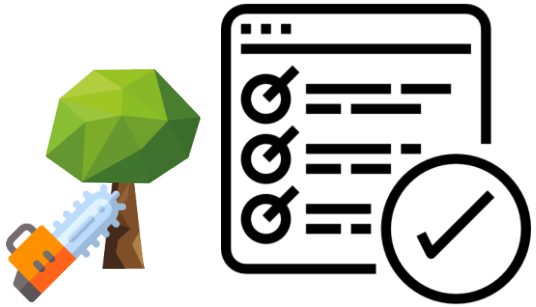


SCENARIO

SIMANFOR

The models and their parametrizations are part of the simulator and are programmed by the SIMANFOR technical team. If you want to create a new one or you have any suggestions, you can contact us at the following address: simanfor.data@forest.uva.es
If you want to know more about the models, here is a detailed explanation.

INVENTORY



SCENARIO

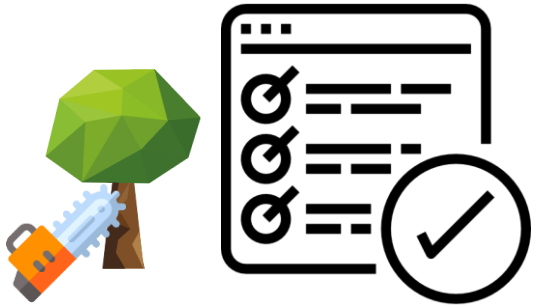
SIMANFOR

By providing the forest inventory and the silvicultural scenario, SIMANFOR will return a file for each plot with the results of the simulation (you can download it in the scenarios tab). If you want to know more about the results, here we explain it to you.

RESULTS

Remember that picture, it is the basic core of the simulator.

INVENTORY



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Inventarios

INVENTORY

SCENARIO

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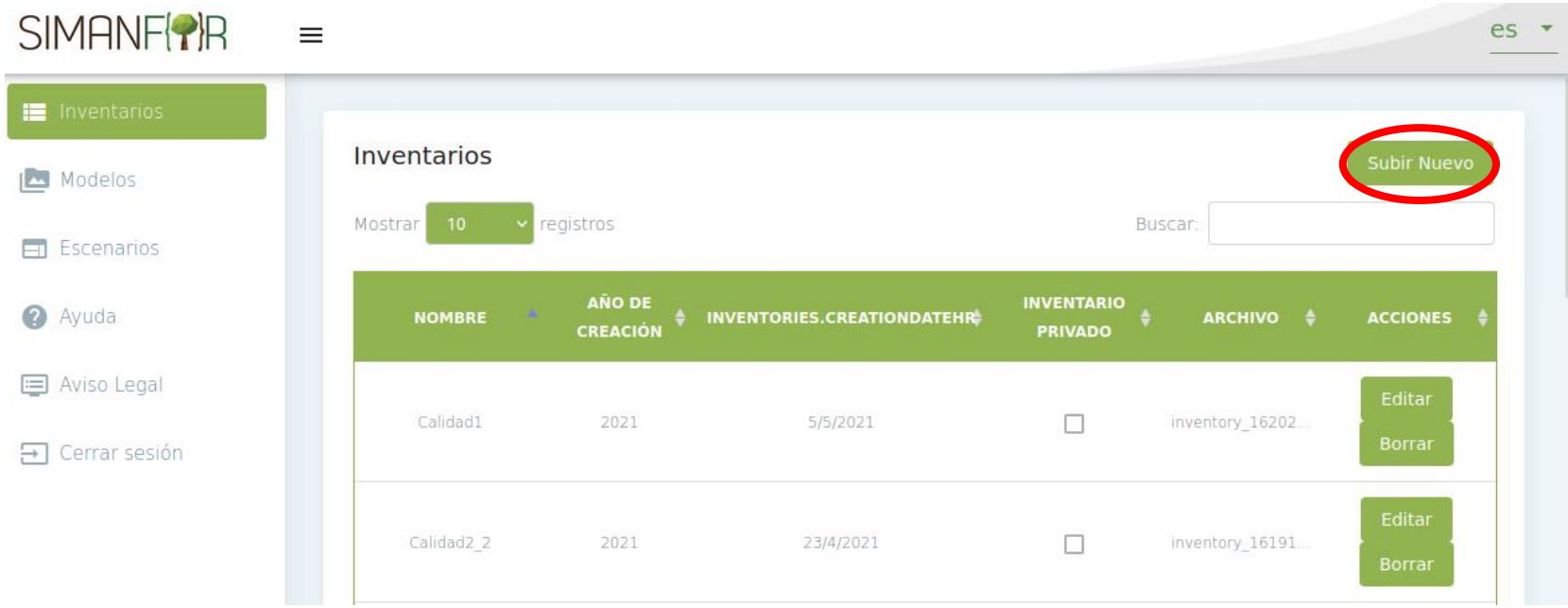
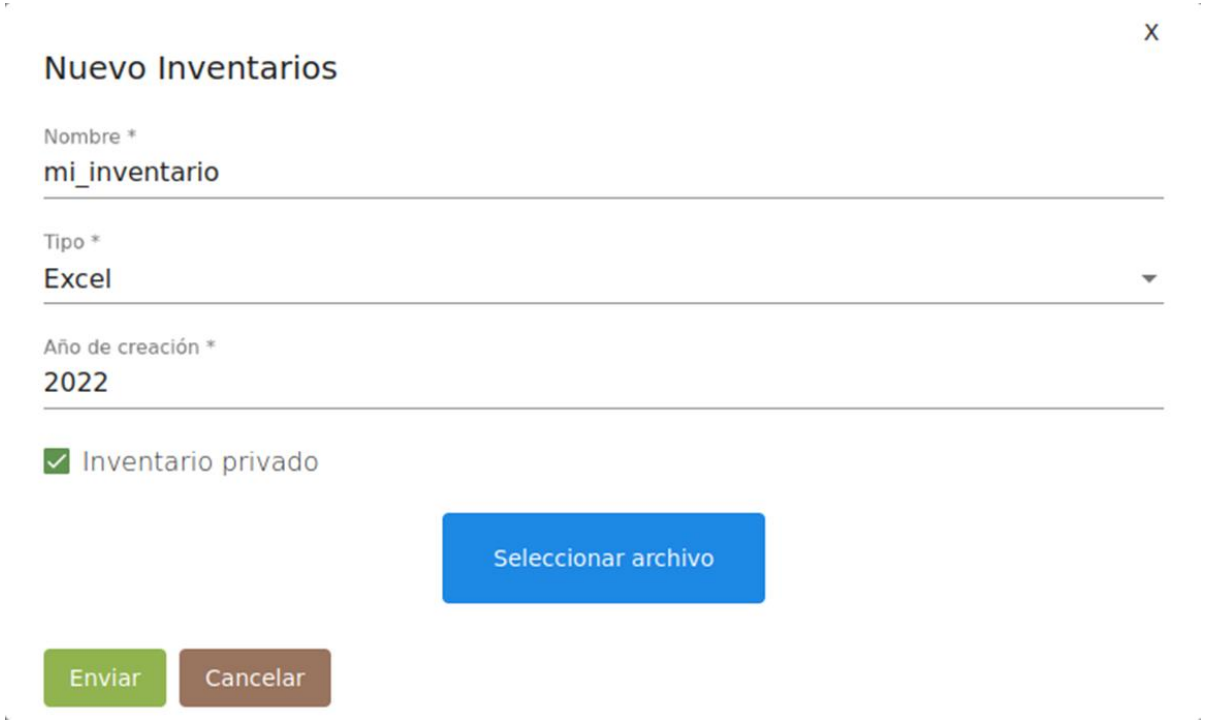
RESULTS

Inventarios

Click on the inventory tab. You will see several inventories created by other users (this is something we need to fix). You must upload your own inventory previously created (here is a tutorial that explains how to do it). To do so, click on "Upload New".



These are the fields to fill in. Give it a name you will easily identify later (species name, inventory code...) and select a file from your computer (although SIMANFOR accepts other formats, by the moment only .xlsx files can be uploaded). When you are ready, click on "send".



Models and parametrizations

INVENTORY

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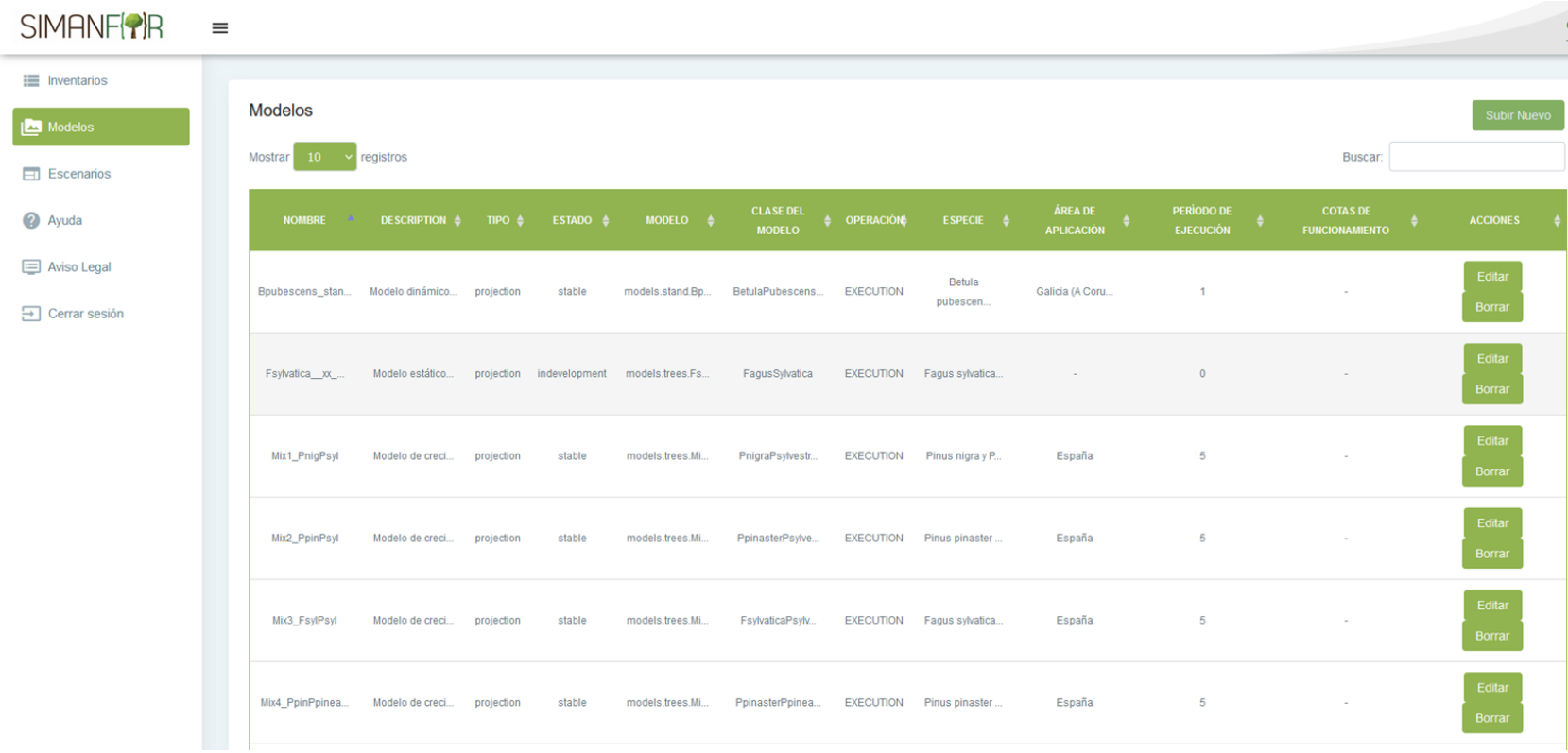
Models and parametrizations

This is the model's menu. Here you can see all the models already programmed in SIMANFOR. These models have been programmed by the SIMANFOR technical team, so if you want to create your own model, modify an existing one or ask any questions you can contact us at:

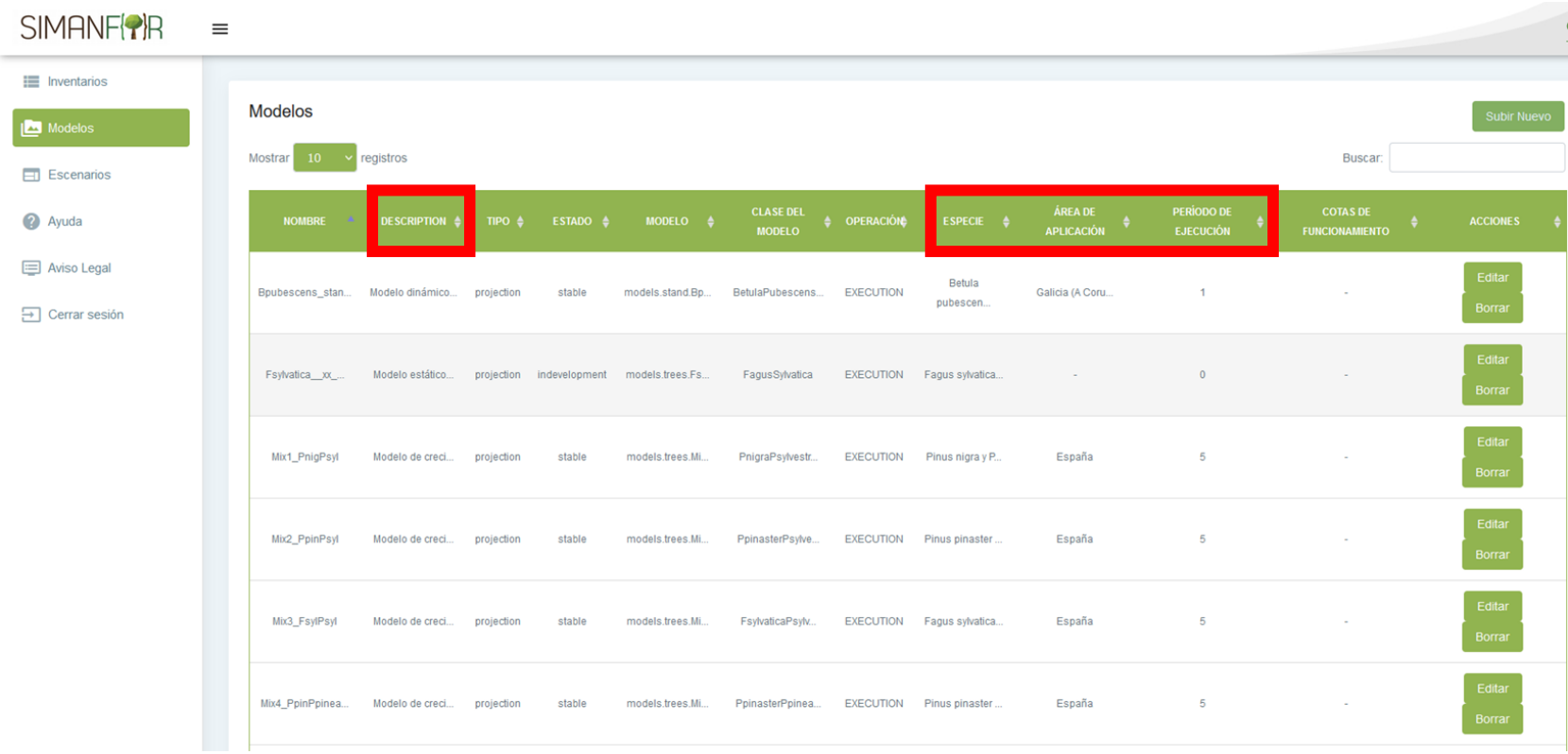
simanfor.data@forest.uva.es



NOMBRE	DESCRIPTION	TIPO	ESTADO	MODELO	CLASE DEL MODELO	OPERACIÓN	ESPECIE	ÁREA DE APLICACIÓN	PERÍODO DE EJECUCIÓN	COTAS DE FUNCIONAMIENTO	ACCIONES
Bpubescens_stan...	Modelo dinámico...	projection	stable	models.stand.Bp...	BetulaPubescens...	EXECUTION	Betula pubescen...	Galicia (A Coru...	1	-	Editar Borrar
Fsylvatica__xx_...	Modelo estático...	projection	indevelopment	models.trees.Fs...	FagusSylvatica	EXECUTION	Fagus sylvatica...	-	0	-	Editar Borrar
Mix1_PnigPsyl	Modelo de creci...	projection	stable	models.trees.Mi...	PnigraPsylvestr...	EXECUTION	Pinus nigra y P...	España	5	-	Editar Borrar
Mix2_PpinPsyl	Modelo de creci...	projection	stable	models.trees.Mi...	PpinasterPsylve...	EXECUTION	Pinus pinaster ...	España	5	-	Editar Borrar
Mix3_FsylPsyl	Modelo de creci...	projection	stable	models.trees.Mi...	FsylvaticaPsylv...	EXECUTION	Fagus sylvatica...	España	5	-	Editar Borrar
Mix4_PpinPpinea...	Modelo de creci...	projection	stable	models.trees.Mi...	PpinasterPpinea...	EXECUTION	Pinus pinaster ...	España	5	-	Editar Borrar

Models and parametrizations

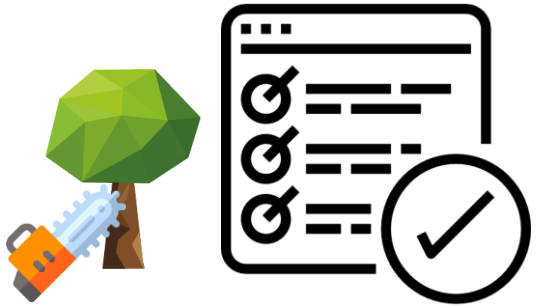
In addition to the name that identifies it, you should look at its description (where it explains what type of model it is), the species and location for which it was designed, and the execution period (important, as we will use it to build our forestry scenario). This window is merely informative, but if you want to know more about the SIMANFOR models here is a more detailed explanation.



NOMBRE	DESCRIPTION	TIPO	ESTADO	MODELO	CLASE DEL MODELO	OPERACIÓN	ESPECIE	ÁREA DE APLICACIÓN	PERÍODO DE EJECUCIÓN	COTAS DE FUNCIONAMIENTO	ACCIONES
Bpubescens_stan...	Modelo dinámico...	projection	stable	models.stand.Bp...	BetulaPubescens...	EXECUTION	Betula pubescen...	Galicia (A Coru...	1	-	Editar Borrar
Fsylvatica__xx_...	Modelo estático...	projection	indevelopment	models.trees.Fs...	FagusSylvatica	EXECUTION	Fagus sylvatica...	-	0	-	Editar Borrar
Mix1_PnigPsyl	Modelo de creci...	projection	stable	models.trees.Mi...	PnigraPsylvestr...	EXECUTION	Pinus nigra y P...	España	5	-	Editar Borrar
Mix2_PpinPsyl	Modelo de creci...	projection	stable	models.trees.Mi...	PpinasterPsylve...	EXECUTION	Pinus pinaster ...	España	5	-	Editar Borrar
Mix3_FsylPsyl	Modelo de creci...	projection	stable	models.trees.Mi...	FsylvaticaPsylv...	EXECUTION	Fagus sylvatica...	España	5	-	Editar Borrar
Mix4_PpinPpinea...	Modelo de creci...	projection	stable	models.trees.Mi...	PpinasterPpinea...	EXECUTION	Pinus pinaster ...	España	5	-	Editar Borrar

Scenarios

INVENTORY



SCENARIO

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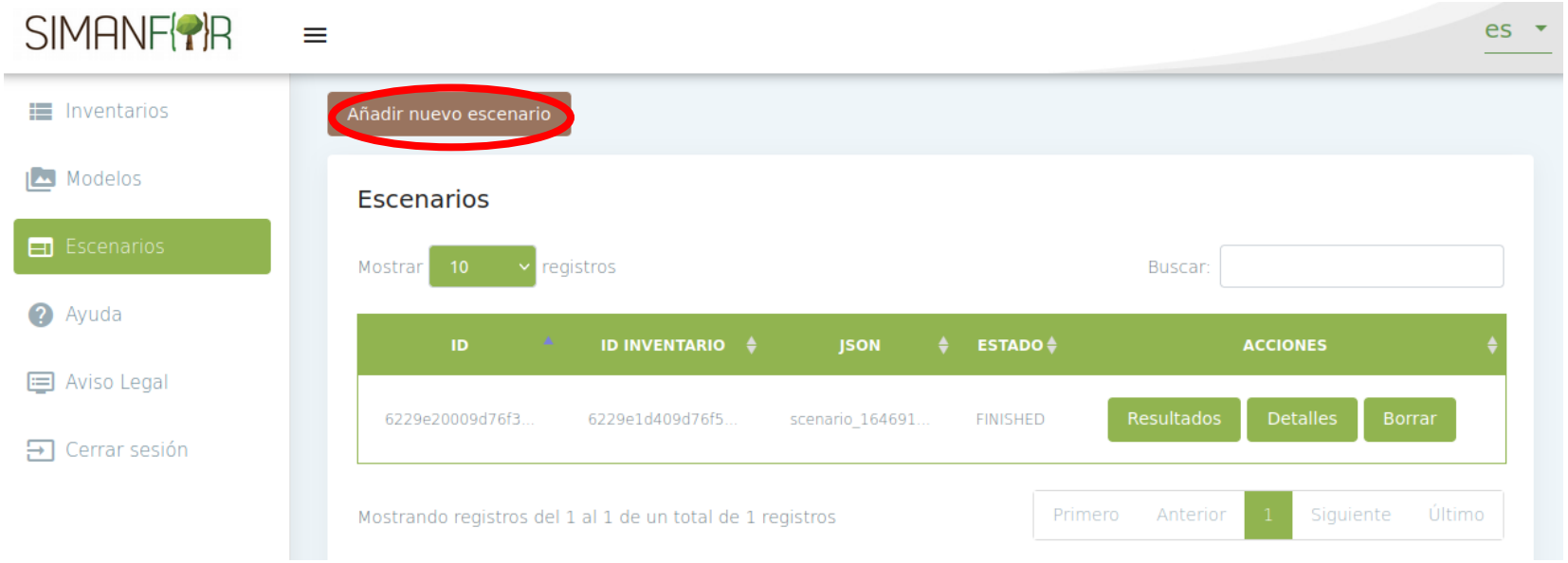
Scenarios

This is the main view of the scenarios.
As you can see, I have already created one, and I will explain how to do it.

Scenarios

Click on "Add new scenario“ to create a new one.

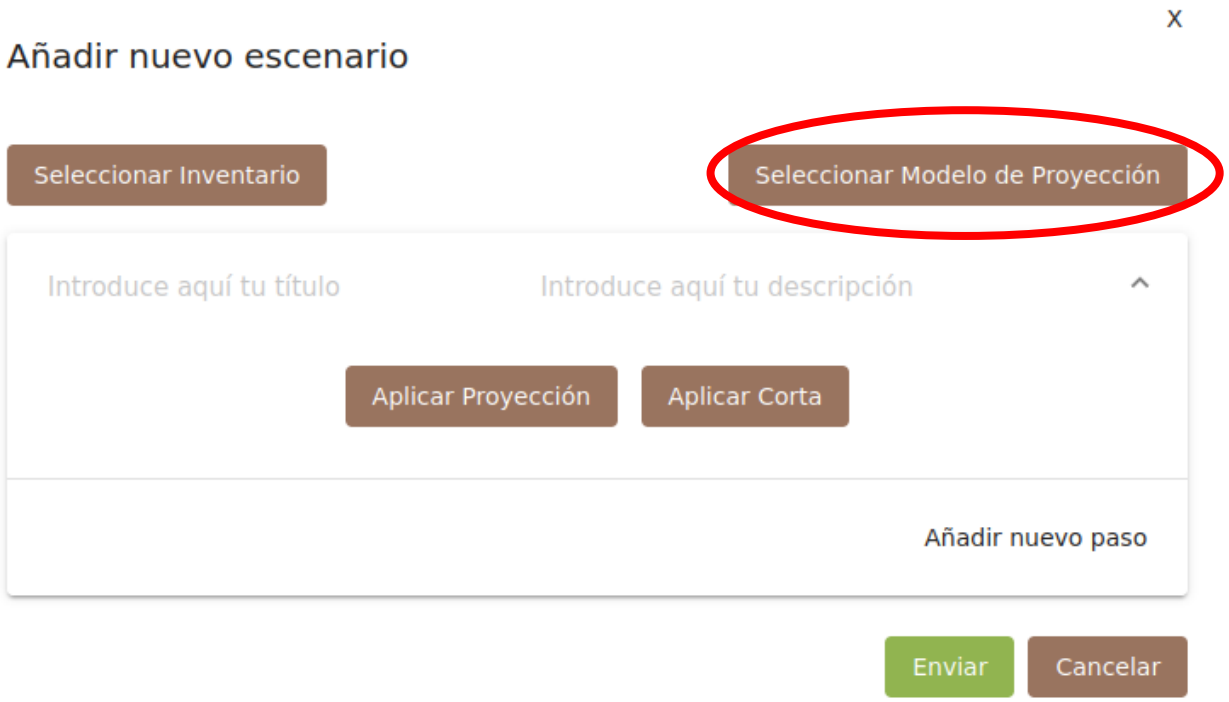


This will be the scenario creator screen. We are going to add the inventory that we have previously uploaded to the web in the "Select Inventory" tab.

IMPORTANT! Remember that even if other inventories are displayed, you must use your own inventories, otherwise the simulation will not work.

Here you can look for your inventories. Once you locate it, click on “Select”.

You will return to the scenario creator screen, and now it is time to choose the projection model.
To do this, click on "Select Projection Model".



Here we can search for the model we are going to use and click on "Select". It is important to check the description column beforehand to ensure that the model chosen meets your necessities.

Great! Now we can set up our scenario.

The scenarios are the actions we want to apply to our forest stand. To do this, we simply choose the interventions we want to apply following a chronological order and labelling them, so that will help us to remember what we are doing at each step.

In "Apply Projection" we can make to grow our stand, while in "Apply Harvest" we can make a silvicultural intervention. Let's go with the first option.

I have selected "Apply Projection", and now we are going to configure the growth of our plot.

In the section highlighted in the image, we must enter the time we want to make our stand grows.

WARNING! Each model has a different execution time, check it first in the "Models" tab or in its descriptive sheet and apply the corresponding value.

These fields are interesting when we have several plots in our data inventory. We won't get complicated, we'll leave it empty, but if you want to know how to use them you can check it out here.

Once configured, we can finish setting the scenario or "Add new step" to continue creating our scenario.

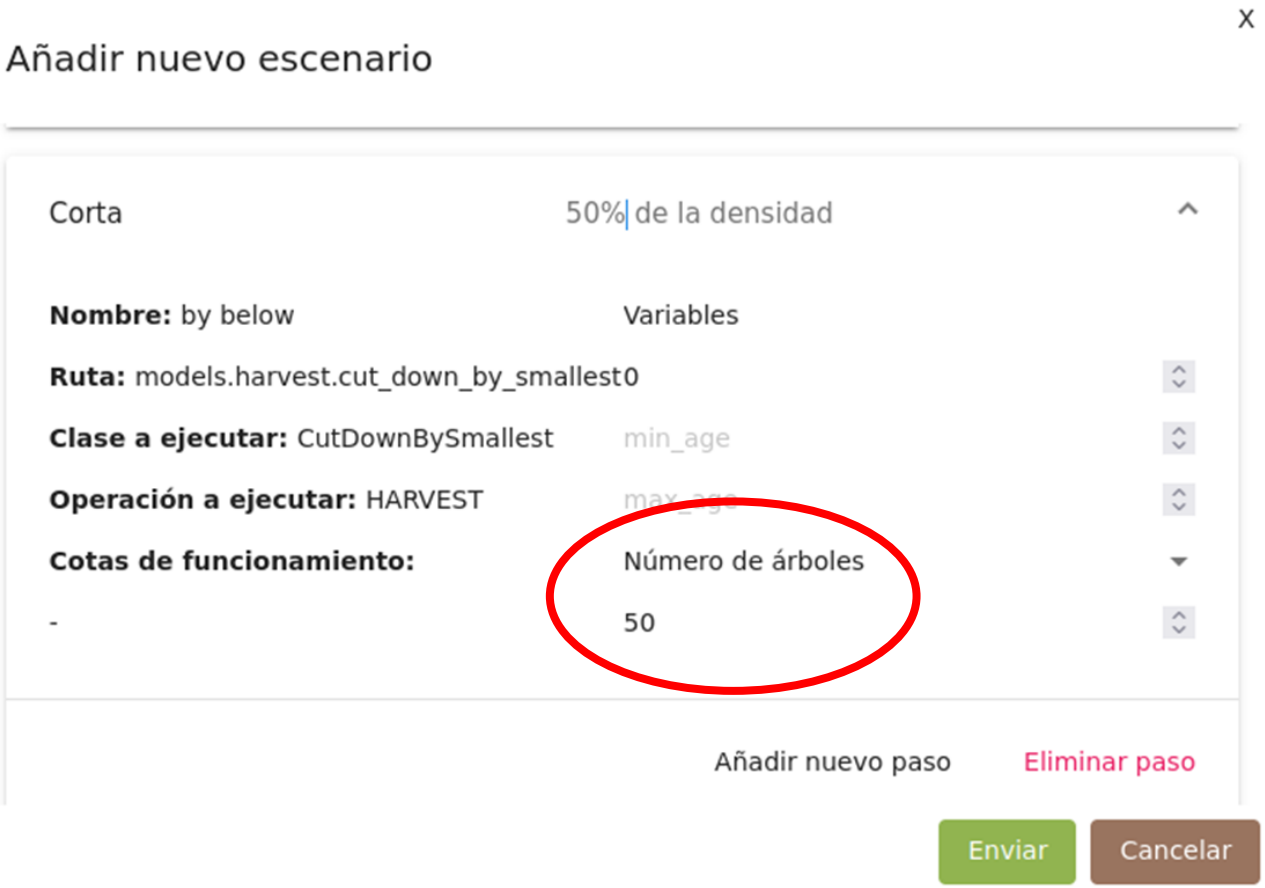
We will find these two options again. Let's now see how to set up the harvests in "Apply Harvest" option.

SIMANFOR allows three types of harvests:

- By above, where larger trees are removed first
- By below, where smaller trees are removed first
- Systematic, where trees of all sizes are removed equally

Choose the harvest type you prefer and then click on "Select".

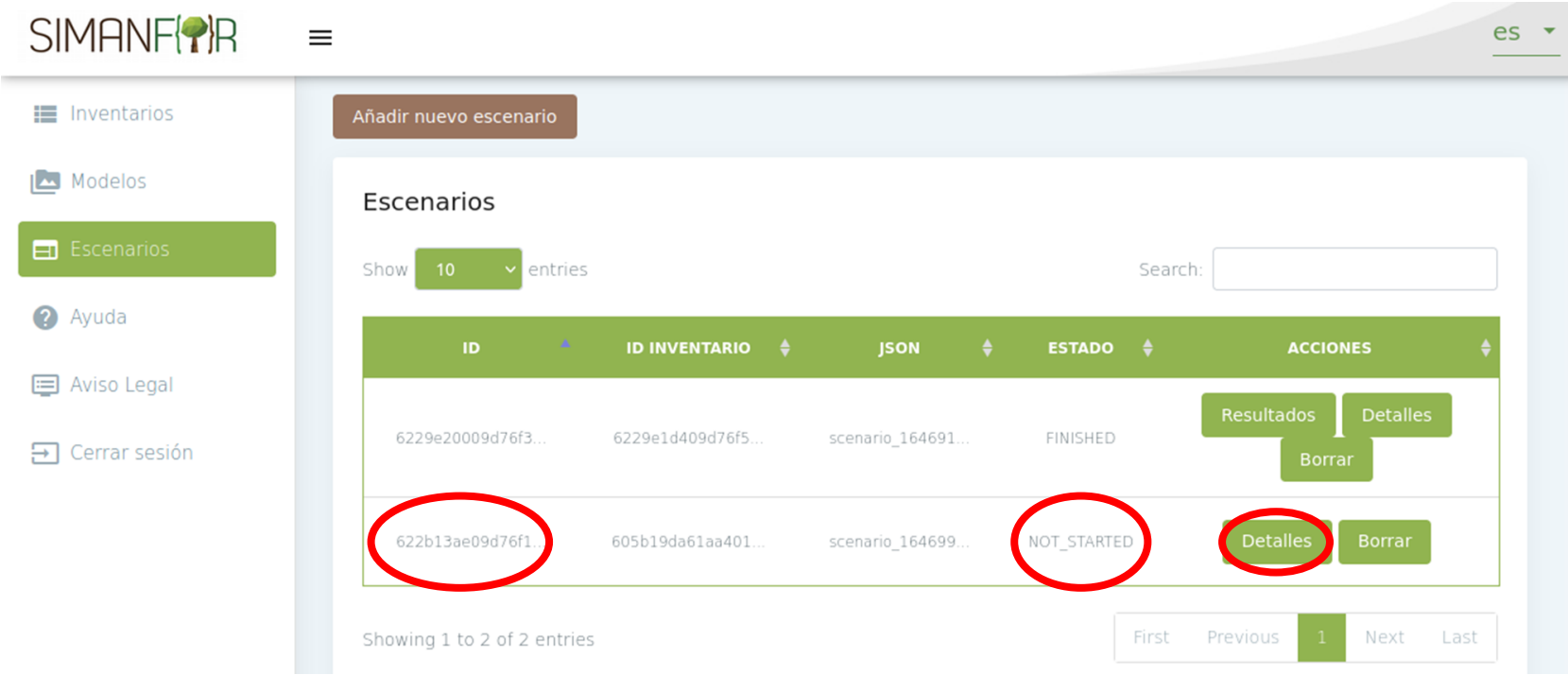
Let's continue to set up the harvest.
Now, you must select the harvest criteria (number of trees, basal area or volume) and the intensity (%). This refers to the percentage of the stand you want to remove. In the example, we are going to remove 50% of the trees in the stand.
If you are unclear about the concepts related to the harvest, here we explain them in more detail.



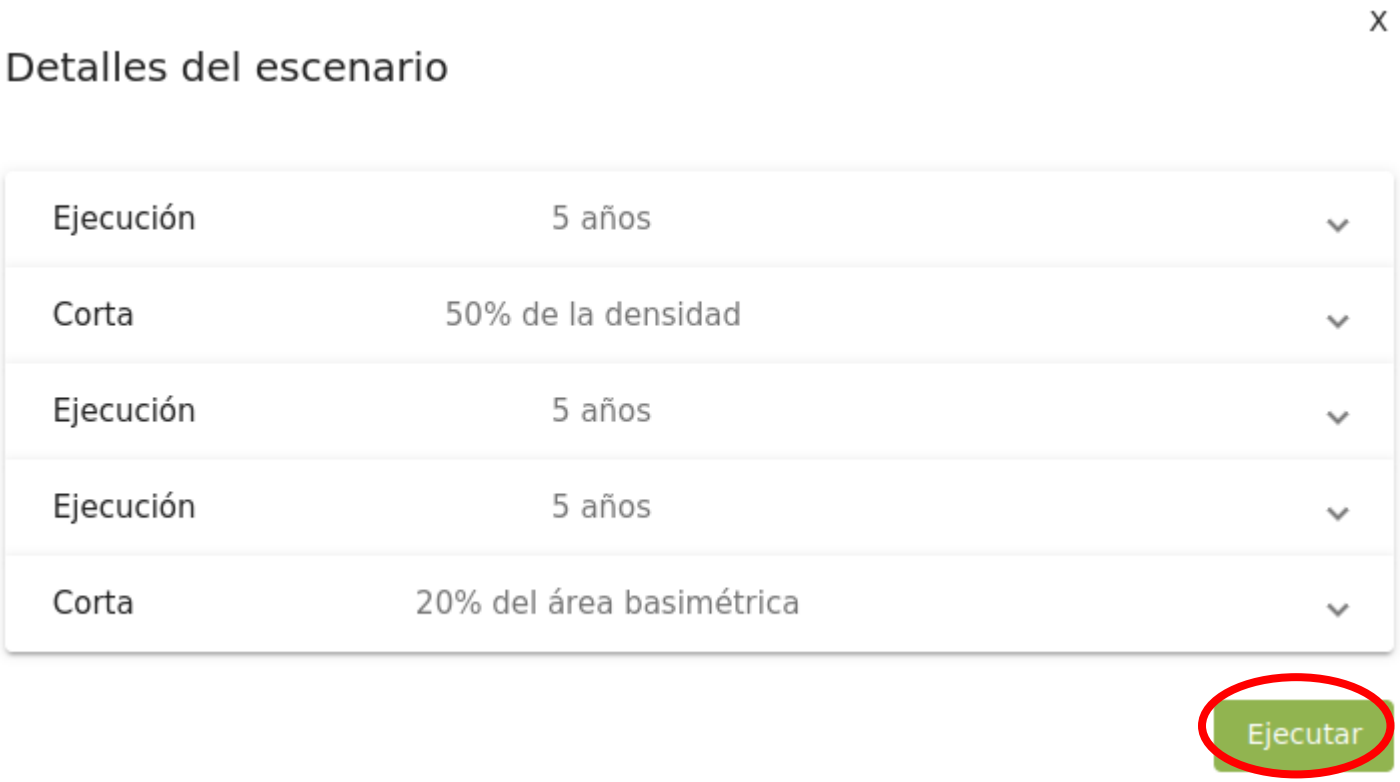
Again, these fields can be left empty.
Check how to set them here if it is needed.

Continue to set up your scenario and write in the necessary comments to recognize what you are going to do in each section. When you have it done, click on "Send“ to register your scenario.

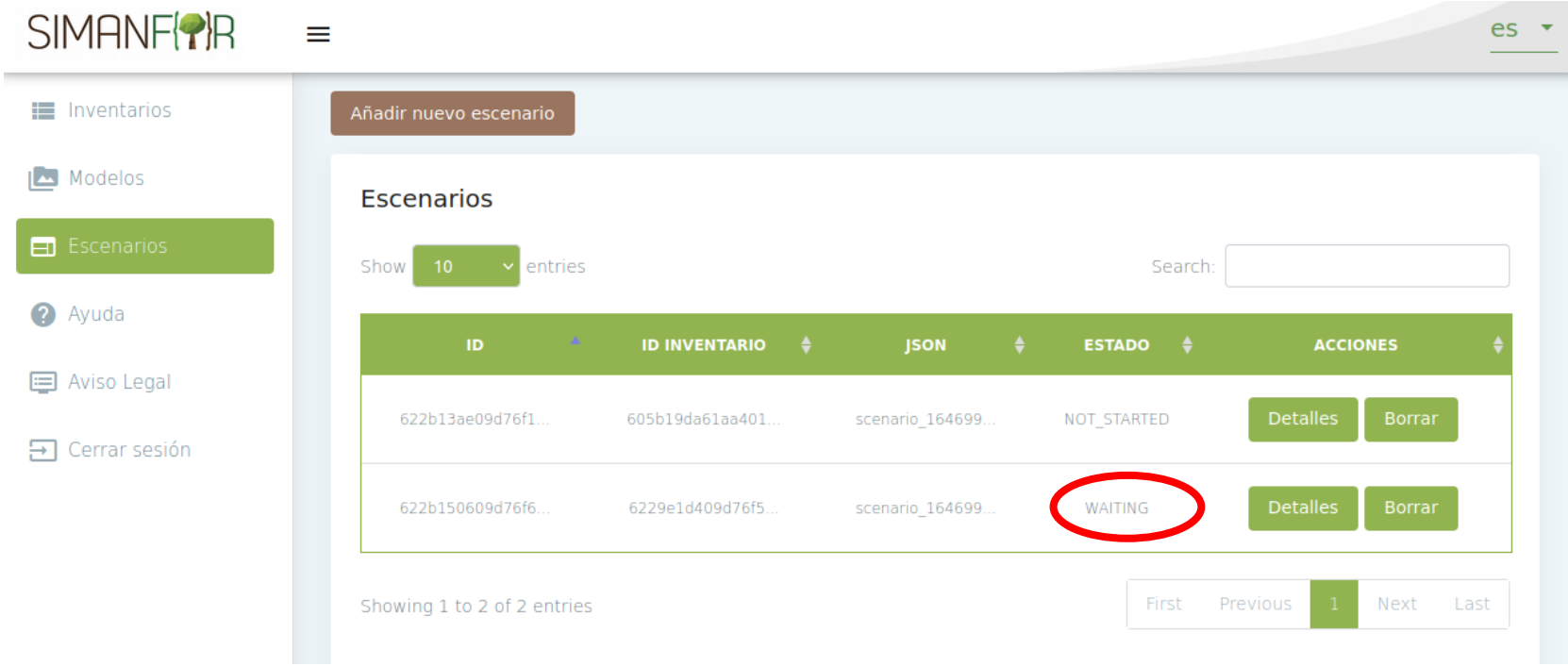
Done! You will see that a unique ID has been created for that scenario, which status is "NOT_STARTED".
Now click on "Details" to view its contents and execute it.



Click “Run” to start the simulation.



You will see that the status of your scenario has changed to "WAITING", which means that the simulation is running.
If this process takes too long, refresh the website (press F5).

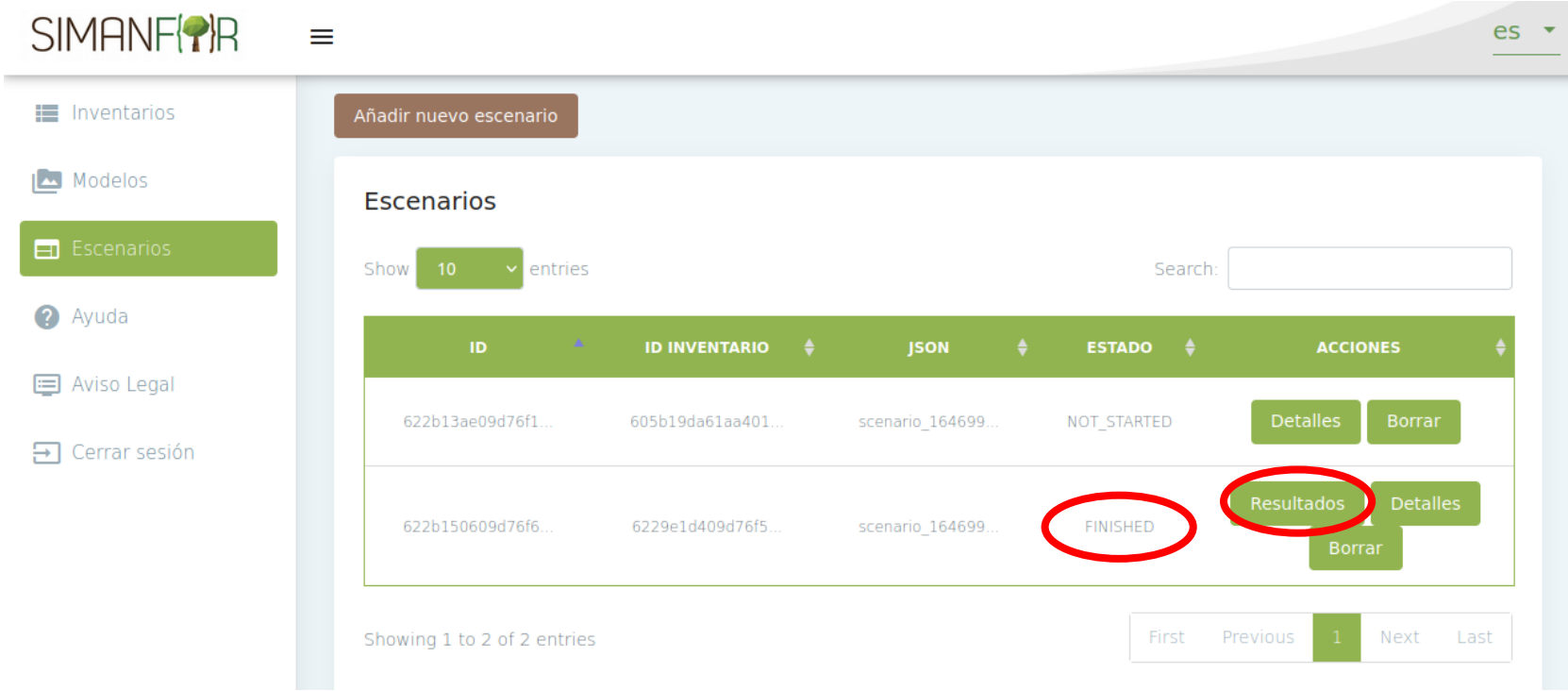


The "Status" column has changed to "FINISHED".

Ready!

Click on "Results" to download the file.

Note: if an empty .zip is downloaded, then open the scenario and run it again. If it still doesn't work, check your scenario, you probably made a mistake (probably you choose the wrong inventory or the wrong model).



Results

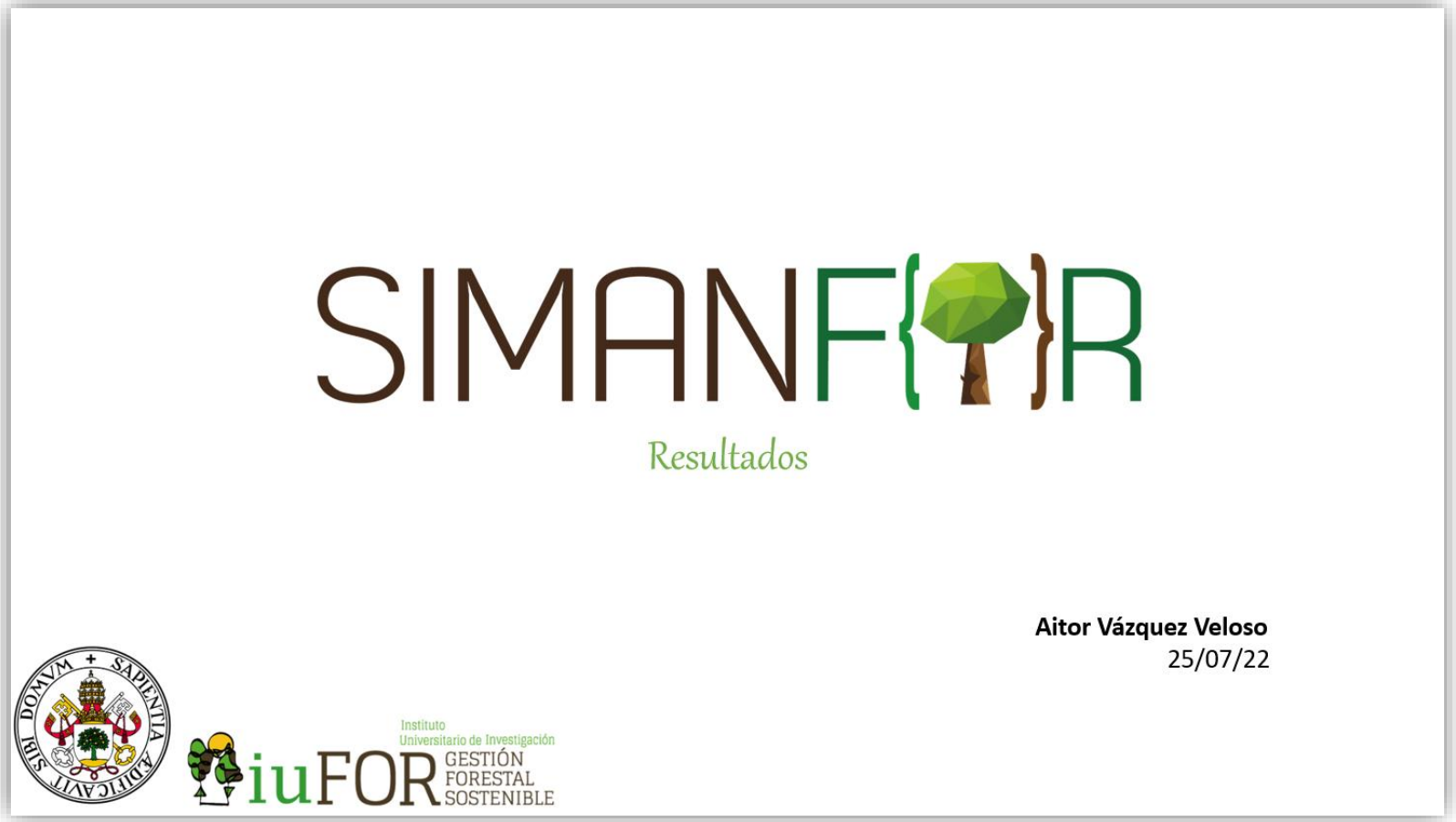
INVENTORY

SCENARIO

SIMANFOR

RESULTS

We have a specific tutorial where we explain what information is obtained in the results and how to interpret it, so we will not repeat the explanation here.



Help and external resources

Help and external resources

In the "Help" section you can find some information about SIMANFOR. However, I recommend that you do your searches in this GitHub repository, as we have developed a lot of explanatory content that we have hosted here to make it easier to download, manage and update.

SIMANFOR

Preparing our data inventory

Instituto Universitario de Investigación
iuFOR GESTIÓN FORESTAL SOSTENIBLE

- Inventory templates
- Variables explanation
- How to create your inventory using yield table data
- How to create your inventory using SFNI data
- How to add more than one plot to your inventory
- Example inventories

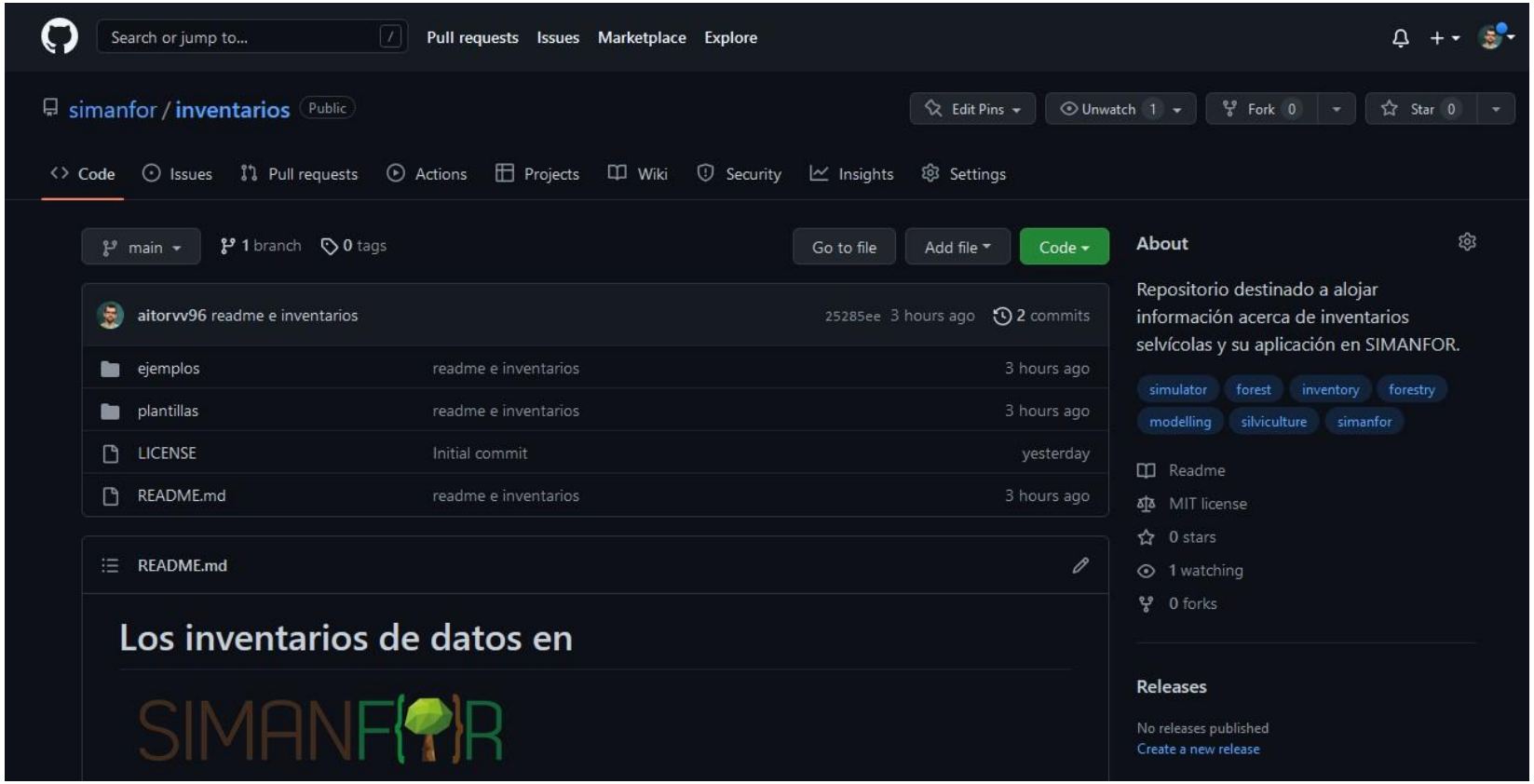
Inventory templates

Inventory templates

Each SIMANFOR model requires certain input variables. However, in these inventory templates we have compiled the most important ones (depending on the model, if you provide more information another extra variables can be calculated, please check its data sheet).

In this repository you can download, modify and upload them to SIMANFOR to start your simulation.

Later, I will show you how to include your data in them, but first let's define some of the more complex variables.



Variables explanation

Variables explanation

The inventory templates are available in 3 languages (Spanish, English and Galician). All of them are Excel files with 3 sheets; in the sheet "Metadata" you can see the explanation of the variables used by the simulator (the ones used in the template are marked in yellow, look for the plot and tree variables from row 70 onwards).

We will explain some of them in detail, although remember that you can check the "Metadata" sheet or external sources such as the Glosario Técnico Forestal de la SECF.

In this repository you will find a cheatsheet for basic tree calculations, a cheatsheet for basic stand calculations, and an R script with test data to apply them.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
70																				
71		**ID_especie_principal**		Código identificador de la especie principal según el criterio del Inventario Forestal Nacional de España																
72		**ID_Inventario**		Código identificador de inventario, extraído del inventario inicial																
73		**ID_Parcela**		Código identificador de parcela, extraído del inventario inicial																
74		**ID_sp1**		Código identificador de la especie 1 en masas mixtas, según el criterio del IFN (Inventario Forestal Nacional (España))																
75		**ID_sp2**		Código identificador de la especie 2 en masas mixtas, según el criterio del IFN (Inventario Forestal Nacional (España))																
76		**Factor_de_expansion**		Factor de expansión de la parcela																
77		**Anho**		Año en el que transcurre el proceso de simulación																
78		**T**		Edad promedio de la parcela (años)																
79		**Proporcion_sp1**		Proporción de la especie 1 para masas mixtas (%)																
80		**Proporcion_sp2**		Proporción de la especie 2 para masas mixtas (%)																
81		**N**		Densidad de la parcela (nº pies/ha)																
82		**N_sp1**		Densidad (N) de la especie 1 por hectárea (nº trees/ha) en masas mixtas																
83		**N_sp2**		Densidad (N) de la especie 2 por hectárea (nº trees/ha) en masas mixtas																
84		**N_extraido**		Volumen, en nº de pies, extraídos por la corta (%)																
85		**N_muerto**		Nº de pies muertos tras una ejecución (nº pies/ha)																
86		**N_incorporado**		Nº de pies incorporados a la parcela tras una ejecución (nº pies/ha)																
87		**G**		Área Basimétrica de la parcela (m2/ha)																

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
249																				
250																				
251		**estado**		Estado del árbol (M = muerto; C = cortado; I = incorporado)																
252		**ID_inventario**		Código identificador de inventario, extraído del inventario inicial																
253		**ID_parcela**		Código identificador de parcela, extraído del inventario inicial																
254		**ID_arbol**		Código identificador de árbol, extraído del inventario inicial																
255		**especie**		Especie, siguiendo la codificación del Inventario Forestal Nacional de España																
256		**t**		Edad del árbol (años)																
257		**rumbo**		Rumbo, calculado desde el centro de la parcela hasta el árbol en cuestión, en grado centesimales. La medición se hace partiendo del norte y en el sentido de las agujas del reloj																
258		**distancia**		Distancia, calculada desde el centro de la parcela hasta el árbol en cuestión (m)																
259		**factor_expansion**		Factor de expansión																
260		**dbh_1**		Diámetro normal, medida 1 (cm)																
261		**dbh_2**		Diámetro normal, medida 2 (cm)																
262		**dbh**		Diámetro normal medio (cm)																
263		**h**		Altura del árbol (m)																
264		**h_tocon**		Altura del tocón (m)																
265		**corteza_1**		Espesor de corteza, medida 1 (cm)																
266		**corteza_2**		Espesor de corteza, medida 2 (cm)																
267		**corteza**		Espesor de corteza medio (cm)																
268		**g**		Área basimétrica (cm2)																

Parcelas *(plots)*:

- **Inventory_ID**: inventory code, where source of data is recommended to be included
- **Plot_ID**: plot code (has to be the same as the code of the trees contained in it)
- **Main_species_ID**: code of the main/dominant species of the plot (as there may be several species). For this, we will use the coding of the SNFI (search for it here, appendix 12)
- **Year**: you can leave it blank or put the year in which the data was taken

- **T**: is the average age of the plot (years).
- **Ho**: is the dominant height of the plot (m). It is calculated by averaging the height of the 100 tallest trees in the plot (Note: each tree is equivalent to a certain number of trees per hectare (expansion factor), so this must be taken into account):

$$Ho = (expan_1 \cdot h_1 + expan_2 \cdot h_2 + \ldots + expan_n \cdot h_n)/100$$

where:
- expan: expansion factor of the tree
- h: tree height (m)

- **N**: is the plot density (trees/ha). Note: the expansion factor must be taken into account:

$$N = expan_1 + expan_2 + \ldots + expan_n$$

- **G**: is the basal area of the plot (m2 /ha). Note: the expansion factor and the units have to be taken into accounte:

$$G = (expan_1 \cdot g_1 + expan_2 \cdot g_2 + \ldots + expan_n \cdot g_n)/10000$$

where:
- g: tree basal area (cm^2)

PiesMayores *(trees)*:

- **Inventory_ID**: inventory code, where it is recommended to put the source of the data (equal to plot sheet)
- **Plot_ID**: plot code (has to be the same as the code of the plot to which it belongs)
- **Tree_ID**: tree code within the plot
- **species**: species code. We will use the coding of the SNFI, as in the Plots sheet (look for it here, appendix 12).

expan: is a variable representing the number of trees at hectare level represented by each tree in our sample plot. It is used to extrapolate the values to the hectare. Let's take an example where the area of my plot is 600 m^2:

$$expan = A_{ha} / A_{plot} = 10000\ m^2 / 600\ m^2 = 16{,}67$$

where:

- A_{ha} : hectare area (m^2)
- A_{plot}: plot area (m^2)

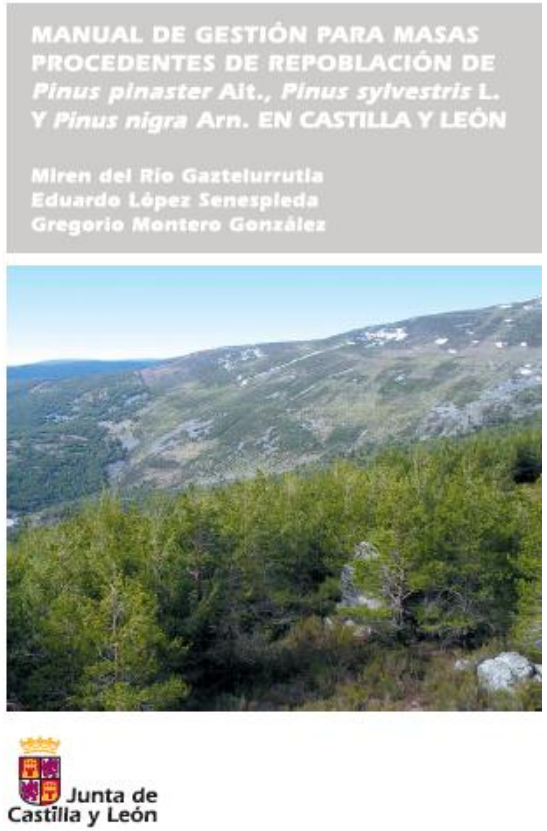
- **dbh**: diameter at breast height (cm)
- **h**: total height (m)
- **g**: tree basal area (cm^2):

$$g = \pi \cdot (dbh/2)^2$$

How to create your inventory using yield table data

To develop that example the next book will be used:
Del Río, M., López-Senespleda, E., Montero, G. (2006). Manual de gestión para masas procedentes de repoblación de *Pinus pinaster* Ait., *Pinus sylvestris* L. y *Pinus nigra* Arn. en Castilla y León. Junta de Castilla y León, Consejería de Medio Ambiente.

You will find the yield tables for all 3 species in this repository, but you can use this as a guide to obtain reference data from other publications.



How to create your inventory using yield table data

On page 30 we find the yield tables for *Pinus pinaster* under different site qualities.

On each of them, initial stand characteristics are different (first row; each one corresponding to its site quality) and different silviculture will be applied to each type of stand (notice how the density (N) is reduced in the following rows, this indicates that trees are being cut).

To create our inventory we will use only the initial data (first row), the silvicultural activities will be used in the scenario section.

Tabla 2:
Guías de densidad observada por calidades de estación. Para aquellos rangos de edades y calidades de estación en los que no se dispone de datos se presentan los valores estimados en gris o blanco.

Calidad de estación 12

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m^2/ha)	V (m^3/ha)
20	5,5	1.485	4,8	10,0	11,6	28
30	8,2	989	7,5	15,8	19,4	69
40	10,4	784	9,7	20,0	24,5	108
50	12,0	679	11,3	22,9	27,9	141
60	13,2	618	12,4	25,0	30,2	167

Calidad de estación 15

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m^2/ha)	V (m^3/ha)
20	6,8	1.189	6,1	13,0	15,7	46
30	10,3	792	9,5	19,8	24,3	106
40	13,0	628	12,2	24,6	29,8	162
50	15,0	544	14,2	28,0	33,5	209
60	16,5	495	15,7	30,4	36,0	245

Calidad de estación 18

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m^2/ha)	V (m^3/ha)
20	8,2	992	7,5	15,8	19,4	68
30	12,3	661	11,6	23,5	28,6	148
40	15,6	524	14,8	29,0	34,5	223
50	18,0	453	17,2	32,9	38,5	285
60	19,8	413	18,9	35,6	41,2	333

Calidad de estación 21

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m^2/ha)	V (m^3/ha)
20	9,6	851	8,8	18,4	22,7	92
30	14,4	567	13,6	27,0	32,4	194
40	18,2	449	17,4	33,1	38,7	289
50	21,0	389	20,2	37,5	43,0	367
60	23,1	354	22,2	40,6	45,8	428

Calidad de estación 24

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m^2/ha)	V (m^3/ha)
20	10,9	745	10,2	21,0	25,7	119
30	16,4	496	15,6	30,4	36,0	244
40	20,8	393	19,9	37,1	42,6	360
50	24,0	340	23,1	42,0	47,1	456
60	26,4	310	25,5	45,4	50,1	531

How to create your inventory using yield table data

We are going to transcribe the inventory into the Excel template designed for yield tables. If you do not remember the meaning of a variable, go back and refresh your explanation.

We will start with the codes:

- **Inventory_ID**: inventory code, in this case I selected the document reference (avoid spaces, accents and symbols)
- **Plot_ID**: plot code (I selected the site quality to distinguish the origin of the data and to compare).
- **Main_species_ID**: code of the main species of the plot. *Pinus pinaster* has the code 26, you can look it up here (Appendix 12).

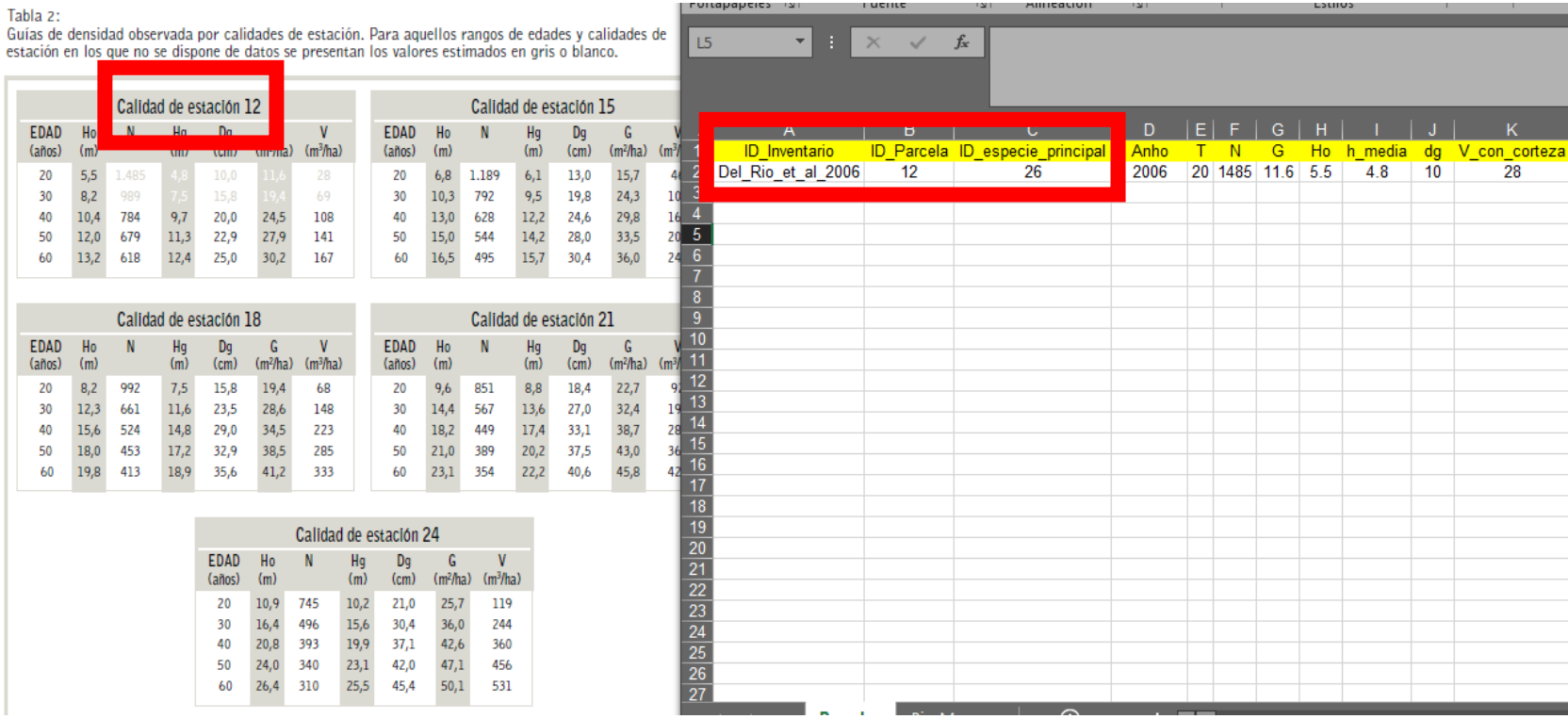


Tabla 2:
Guías de densidad observada por calidades de estación. Para aquellos rangos de edades y calidades de estación en los que no se dispone de datos se presentan los valores estimados en gris o blanco.

Calidad de estación 12

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	5,5	1.485	4,8	10,0	11,6	28
30	8,2	989	7,5	15,8	19,4	69
40	10,4	784	9,7	20,0	24,5	108
50	12,0	679	11,3	22,9	27,9	141
60	13,2	618	12,4	25,0	30,2	167

Calidad de estación 15

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V
20	6,8	1.189	6,1	13,0	15,7	4
30	10,3	792	9,5	19,8	24,3	10
40	13,0	628	12,2	24,6	29,8	16
50	15,0	544	14,2	28,0	33,5	20
60	16,5	495	15,7	30,4	36,0	24

Calidad de estación 18

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	8,2	992	7,5	15,8	19,4	68
30	12,3	661	11,6	23,5	28,6	148
40	15,6	524	14,8	29,0	34,5	223
50	18,0	453	17,2	32,9	38,5	285
60	19,8	413	18,9	35,6	41,2	333

Calidad de estación 21

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V
20	9,6	851	8,8	18,4	22,7	9
30	14,4	567	13,6	27,0	32,4	19
40	18,2	449	17,4	33,1	38,7	28
50	21,0	389	20,2	37,5	43,0	36
60	23,1	354	22,2	40,6	45,8	42

Calidad de estación 24

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	10,9	745	10,2	21,0	25,7	119
30	16,4	496	15,6	30,4	36,0	244
40	20,8	393	19,9	37,1	42,6	360
50	24,0	340	23,1	42,0	47,1	456
60	26,4	310	25,5	45,4	50,1	531

ID_Inventario	ID_Parcela	ID_especie_principal	Anho	T	N	G	Ho	h_media	dg	V_con_corteza
Del_Rio_et_al_2006	12	26	2006	20	1485	11.6	5.5	4.8	10	28

How to create your inventory using yield table data

Year variable can be filled with the book publication date (you can leave it empty), and the rest of the variables I have copied from the first row of the table.

In this case, the units of the yield table and those used by SIMANFOR are the same, however, it is important to check the units of each variable in the "Metadata" tab to avoid miscalculations.

Tabla 2:
Guías de densidad observada por calidades de estación. Para aquellos rangos de edades y calidades de estación en los que no se dispone de datos se presentan los valores estimados en gris o blanco.

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	5,5	1.485	4,8	10,0	11,6	28
40	10,4	784	9,7	20,0	24,5	108
50	12,0	679	11,3	22,9	27,9	141
60	13,2	618	12,4	25,0	30,2	167

Calidad de estación 15

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	6,8	1.189	6,1	13,0	15,7	4
30	10,3	792	9,5	19,8	24,3	10
40	13,0	628	12,2	24,6	29,8	16
50	15,0	544	14,2	28,0	33,5	20
60	16,5	495	15,7	30,4	36,0	24

Calidad de estación 18

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	8,2	992	7,5	15,8	19,4	68
30	12,3	661	11,6	23,5	28,6	148
40	15,6	524	14,8	29,0	34,5	223
50	18,0	453	17,2	32,9	38,5	285
60	19,8	413	18,9	35,6	41,2	333

Calidad de estación 21

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	9,6	851	8,8	18,4	22,7	9
30	14,4	567	13,6	27,0	32,4	19
40	18,2	449	17,4	33,1	38,7	28
50	21,0	389	20,2	37,5	43,0	36
60	23,1	354	22,2	40,6	45,8	42

Calidad de estación 24

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	10,9	745	10,2	21,0	25,7	119
30	16,4	496	15,6	30,4	36,0	244
40	20,8	393	19,9	37,1	42,6	360
50	24,0	340	23,1	42,0	47,1	456
60	26,4	310	25,5	45,4	50,1	531

L5

	A	B	C								
1	ID_Inventario	ID_Parcela	ID_especie_princip	Anho	T	N	G	Ho	h_media	dg	V_con_corteza
2	Del_Rio_et_al_2006	12	26	2006	20	1485	11.6	5.5	4.8	10	28

How to create your inventory using yield table data

Although one plot is enough, I have copied the data for all the site qualities. All you have to do for this is to repeat this process and fill in the data in a new Excel row.

We already have the "Parcela" *(plots)* sheet filled, and you may have noticed a small detail... and that is that we have no tree data. This is a problem, however, the templates in the "Yield_Tables" folder are set up to create a series of trees automatically, take a look at them.

IMPORTANT! If in addition to plot data you have tree data, each tree must have associated to it the code of the plot (Plot_ID) to which it belongs, otherwise the data will be mixed.

Tabla 2:
Guías de densidad observada por calidades de estación. Para aquellos rangos de edades y calidades de estación en los que no se dispone de datos se presentan los valores estimados en gris o blanco.

Calidad de estación 12

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	5,5	1.485	4,8	10,0	11,6	28
30	8,2	989	7,5	15,8	19,4	69
40	10,4	784	9,7	20,0	24,5	108
50	12,0	679	11,3	22,9	27,9	141
60	13,2	618	12,4	25,0	30,2	167

Calidad de estación 15

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	6,8	1.189	6,1	13,0	15,7	46
40	13,0	628	12,2	24,6	29,8	162
50	15,0	544	14,2	28,0	33,5	209
60	16,5	495	15,7	30,4	36,0	245

Calidad de estación 18

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	8,2	992	7,5	15,8	19,4	68
40	15,6	524	14,8	29,0	34,5	223
50	18,0	453	17,2	32,9	38,5	285
60	19,8	413	18,9	35,6	41,2	333

Calidad de estación 21

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	9,6	851	8,8	18,4	22,7	92
40	18,2	449	17,4	33,1	38,7	289
50	21,0	389	20,2	37,5	43,0	367
60	23,1	354	22,2	40,6	45,8	428

Calidad de estación 24

EDAD (años)	Ho (m)	N	Hg (m)	Dg (cm)	G (m²/ha)	V (m³/ha)
20	10,9	745	10,2	21,0	25,7	119
40	20,8	393	19,9	37,1	42,6	360
50	24,0	340	23,1	42,0	47,1	456
60	26,4	310	25,5	45,4	50,1	531

L13

	A	B	C	D	E	F	G	H	I	J	K
1	ID_Inventario	ID_Parcela	ID_especie_principal	Anho	T	N	G	Ho	h_media	dg	V_con_cortez
3	Del_Rio_et_al_2006	15	26	2006	20	1189	15.7	6.8	6.1	13	46
4	Del_Rio_et_al_2006	18	26	2006	20	992	19.4	8.2	7.5	15.8	68
5	Del_Rio_et_al_2006	21	26	2006	20	851	22.7	9.6	8.8	18.4	92
6	Del_Rio_et_al_2006	24	26	2006	20	745	25.7	10.9	10.2	21	119

How to create your inventory using yield table data

If you have covered the plot data, then you will see that this sheet has covered itself. For each plot 9 trees are created that try to represent different standard trees that we could find in the stand (you can click on each cell and you will see how they have been calculated).
Although this is a major simplification of the stand, it will be useful as an example to practice and see the results.

Note: if you enter more than 5 plots, then drag the contents of the cells of the "PiesMayores" *(trees)* sheet so that it autocompletes. If you use less than 5 plots, then delete the contents of the excess tree rows, otherwise the simulator will give you an error.

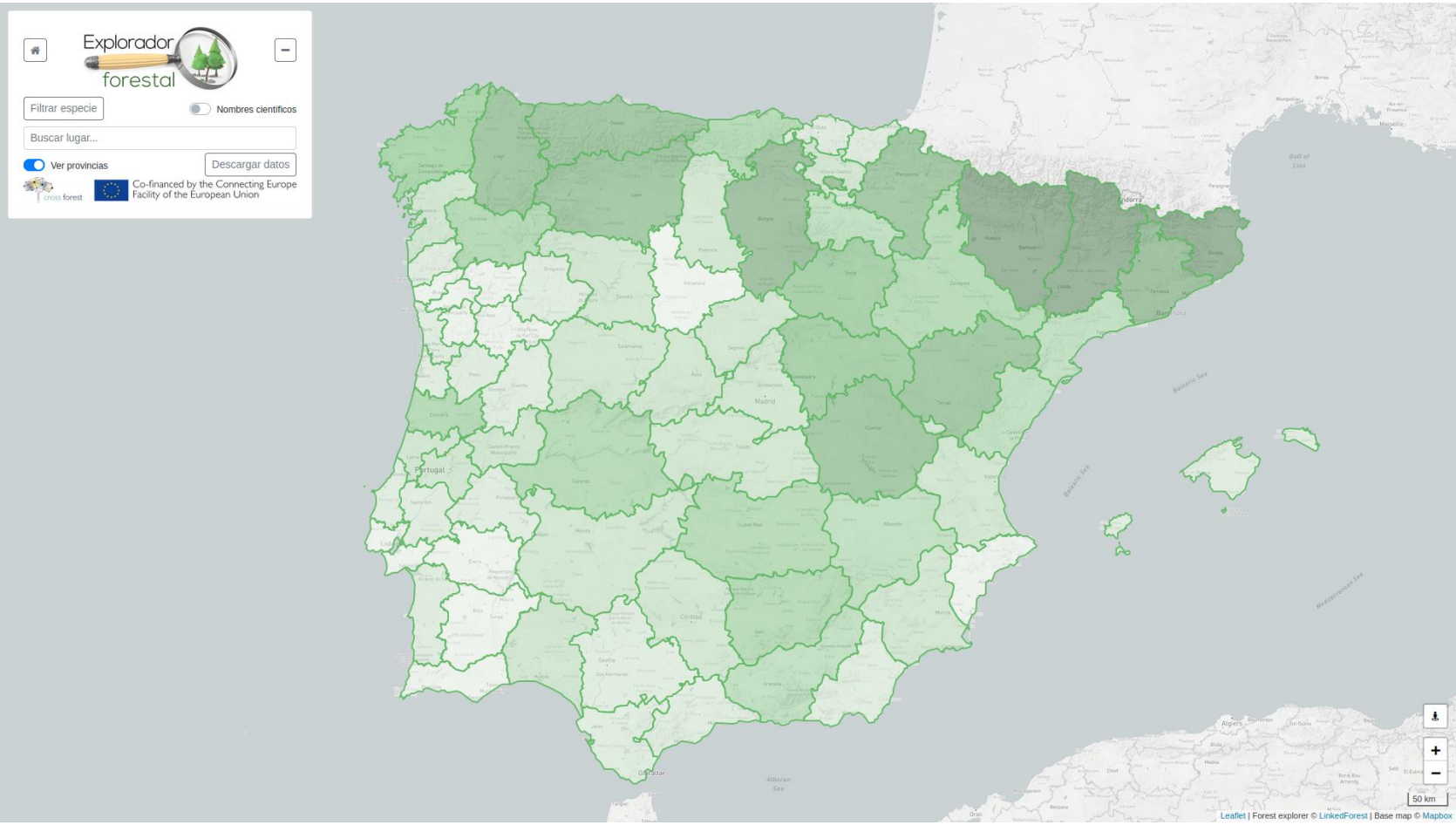
	A	B	C	D	E	F	G	H
1	ID_Inventario	ID_Parcela	ID_arbol	especie	factor_expansion	dbh	h	g
2	Del_Rio_et_al_2006	12	1	26	165.0	10.0	4.8	78.1
3	Del_Rio_et_al_2006	12	2	26	165.0	10.0	5.5	78.1
4	Del_Rio_et_al_2006	12	3	26	165.0	10.0	4.1	78.1
5	Del_Rio_et_al_2006	12	4	26	165.0	12.0	4.8	112.5
6	Del_Rio_et_al_2006	12	5	26	165.0	12.0	5.5	112.5
7	Del_Rio_et_al_2006	12	6	26	165.0	12.0	4.1	112.5
8	Del_Rio_et_al_2006	12	7	26	165.0	8.0	4.8	50.0
9	Del_Rio_et_al_2006	12	8	26	165.0	8.0	5.5	50.0
10	Del_Rio_et_al_2006	12	9	26	165.0	8.0	4.1	50.0
11	Del_Rio_et_al_2006	15	1	26	132.1	13.0	6.1	132.0
12	Del_Rio_et_al_2006	15	2	26	132.1	13.0	6.8	132.0
13	Del_Rio_et_al_2006	15	3	26	132.1	13.0	5.4	132.0
14	Del_Rio_et_al_2006	15	4	26	132.1	15.6	6.1	190.1
15	Del_Rio_et_al_2006	15	5	26	132.1	15.6	6.8	190.1
16	Del_Rio_et_al_2006	15	6	26	132.1	15.6	5.4	190.1
17	Del_Rio_et_al_2006	15	7	26	132.1	10.4	6.1	84.5
18	Del_Rio_et_al_2006	15	8	26	132.1	10.4	6.8	84.5
19	Del_Rio_et_al_2006	15	9	26	132.1	10.4	5.4	84.5
20	Del_Rio_et_al_2006	18	1	26	110.2	15.8	7.5	195.6
21	Del_Rio_et_al_2006	18	2	26	110.2	15.8	8.2	195.6

How to create your inventory using SFNI data

How to create your inventory using SFNI data

To provide SNFI data to SIMANFOR we can use the ForestExplorer, which will allow us to view all the inventory plots and select the one that best suits our needs.

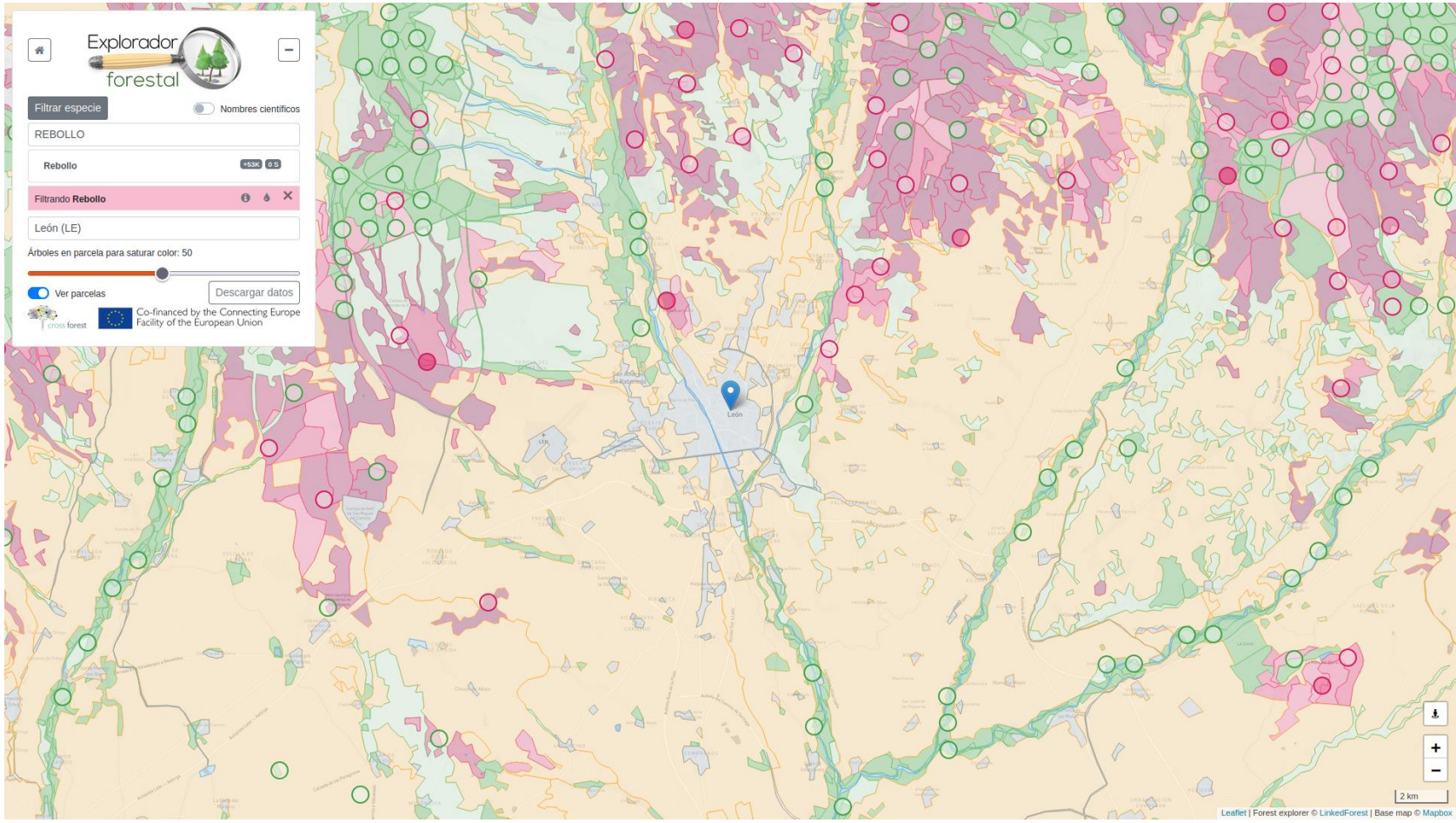
Here you will find templates to create your inventory from the SNFI data.



How to create your inventory using SFNI data

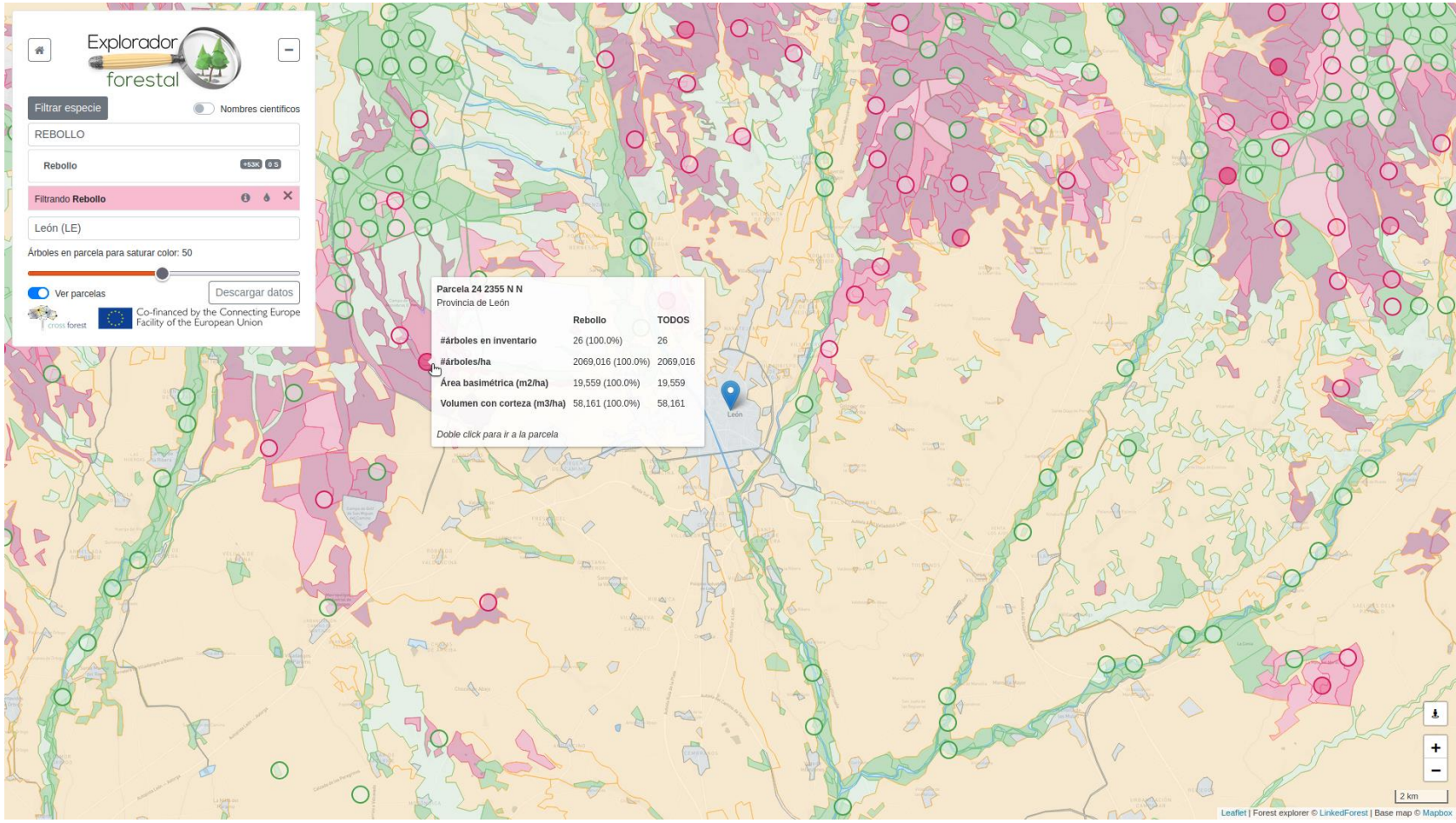
In its search bars we can filter the plots by species and location. In my case, I am going to look for plots of Pyrenean oak (*Quercus pyrenaica*) in the province of León.

As you can see in the image, the pink plots are the ones where the species we are looking for is present (you can change the colour)

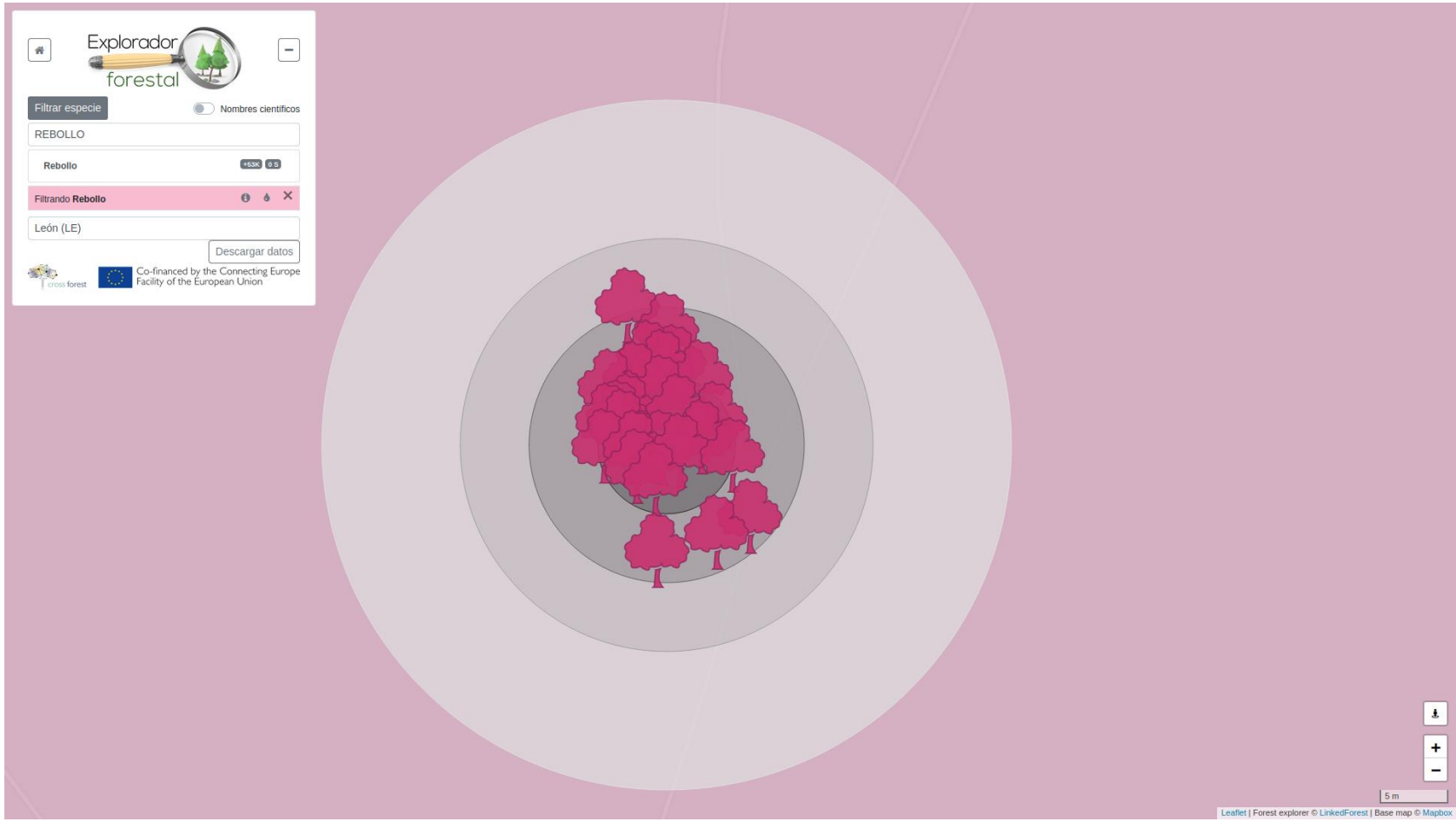


If we place the mouse over one of them, then a window with the plot information will be displayed. On the example shown:

- **Código de parcela *(plot code)***: 24_2355_N_N, where 24 is the INE code of the province, 2355 is the plot number within the province, and N_N refers to the plot type.
- **#árboles en inventario *(trees in the inventory)***: number of trees of the target species and totals
- **#árboles/ha *(tres/ha)***: plot density extrapolated to the hectare level
- **Área basimétrica *(basal area)* (m2/ha)**: basal area of the target and total species
- **Volumen con corteza *(volumen over bark)* (m3/ha):** volume of wood over bark of the target and total species



Double-clicking on the plot will zoom in and out, allowing you to see the arrangement of the trees within the plot.
In this case all the trees are Pyrenean oaks, but if we had a different species, then the picture would change.

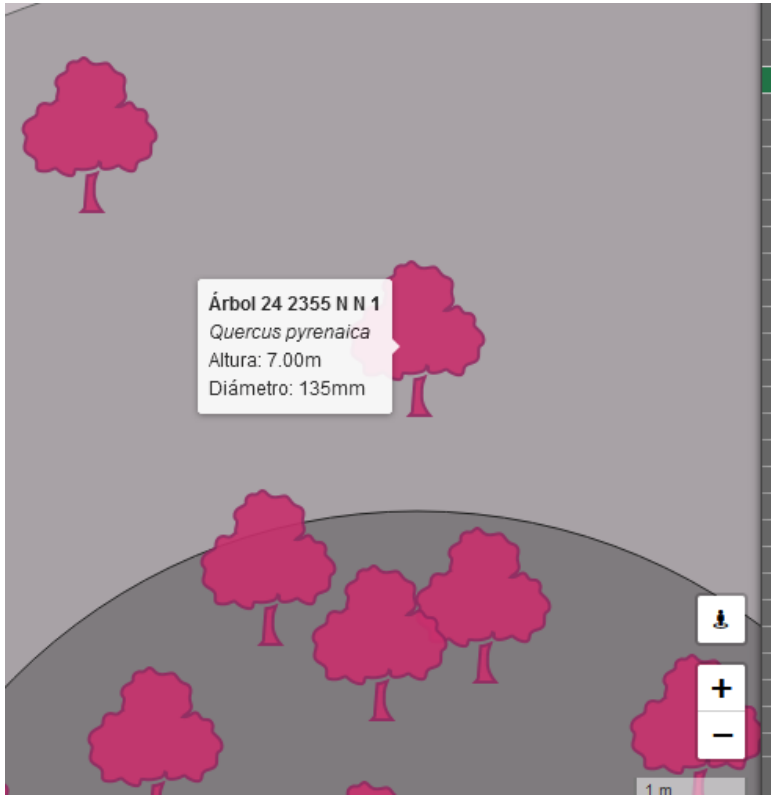


By placing the mouse over each tree, we can visualize its information. For the example shown:

- **Código del árbol *(tree code)***: 24_2355_N_N_17 is the tree code, where 24_2355_N_N is the plot code and 17 is the tree code inside the plot
- **Especie *(species)***: "Rebollo" *(Pyrenean oak)* is the common name of the tree. If we actívate the option "Nombres científicos" *(Scientific names)*, then "*Quercus pyrenaica*" should be shown
- **Altura *(height)***: shows the tree height (meters)
- **Diámetro *(diameter)***: shows the mean normal diameter (the SNFI has 2 records) (millimetres)

With this information, we can build our inventory. To do this we will write the following information on the sheet "**PiesMayores**" *(trees)*:

- **Tree_ID**: code of the tree within the plot (just the last number is needed)
- **species**: SFNI species code (search here, appendix 12)
- **dbh**: diameter at breast height. Note: write it in cm, not in mm
- **h**: total height in m

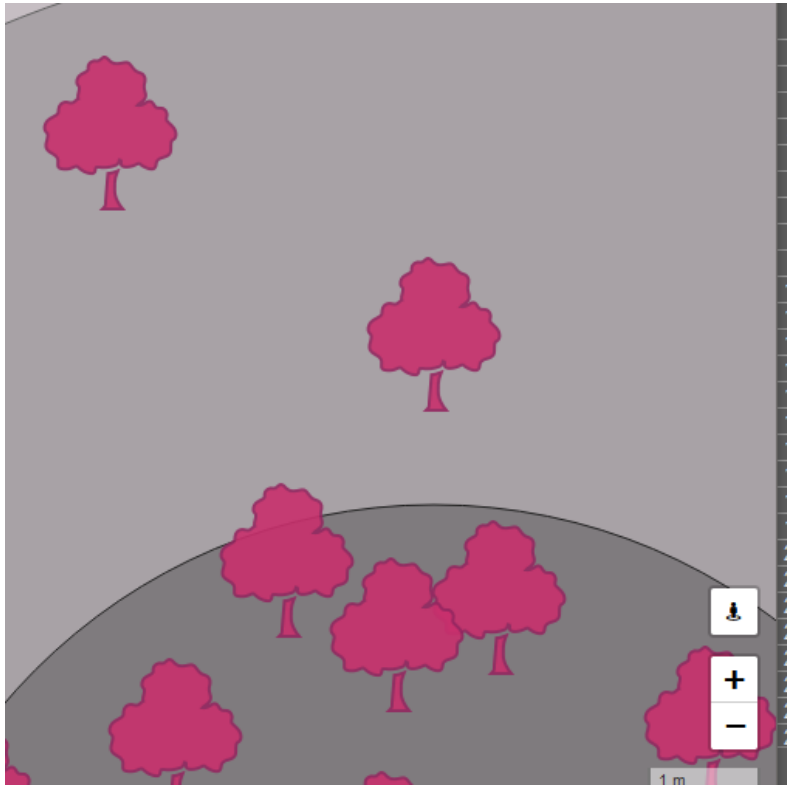


	A	B	C	D	E	F	G	H
1	ID_Inventario	ID_Parcela	ID_arbol	especie	factor_expansion	dbh	h	g
2	IFN	24_2355_N_N	1	43	31.8	13.5	7.0	143.1
3	IFN	24_2355_N_N	2	43	127.3	16.3	8.5	208.7
4	IFN	24_2355_N_N	3	43	127.3	8.7	8.0	59.4
5	IFN	24_2355_N_N	4	43	127.3	13.5	8.0	143.1
6	IFN	24_2355_N_N	5	43	127.3	7.8	5.5	47.8
7	IFN	24_2355_N_N	6	43	31.8	14.4	9.5	162.9
8	IFN	24_2355_N_N	7	43	127.3	10.0	6.0	78.5
9	IFN	24_2355_N_N	8	43	31.8	12.9	9.0	130.7
10	IFN	24_2355_N_N	9	43	31.8	16.3	10.0	208.7
11	IFN	24_2355_N_N	10	43	127.3	7.6	4.0	45.4
12	IFN	24_2355_N_N	11	43	14.1	15.8	10.5	196.1
13	IFN	24_2355_N_N	12	43	127.3	14.1	9.0	156.1
14	IFN	24_2355_N_N	13	43	127.3	10.0	6.5	78.5
15	IFN	24_2355_N_N	14	43	127.3	14.5	8.0	165.1
16	IFN	24_2355_N_N	15	43	127.3	12.3	8.5	118.8
17	IFN	24_2355_N_N	16	43	31.8	19.9	8.0	311.0
18	IFN	24_2355_N_N	17	43	127.3	14.8	7.0	172.0
19	IFN	24_2355_N_N	18	43	127.3	10.6	5.0	88.2
20	IFN	24_2355_N_N	19	43	127.3	8.4	6.0	55.4
21	IFN	24_2355_N_N	20	43	127.3	9.5	8.0	70.9
22	IFN	24_2355_N_N	21	43	127.3	10.9	6.5	93.3
23	IFN	24_2355_N_N	22	43	127.3	9.0	7.5	63.6
24	IFN	24_2355_N_N	23	43	31.8	15.3	9.0	183.9
25	IFN	24_2355_N_N	24	43	127.3	12.6	7.0	124.7
26	IFN	24_2355_N_N	25	43	127.3	10.8	7.0	91.6
27	IFN	24_2355_N_N	26	43	127.3	8.9	7.5	62.2

Parcelas | PiesMayores

Once you start to cover that data, g column will be autocompleted:

- **expan**: as the minimum inventoried dbh is different on each concentric circle, we will use that information to calculate the expansion factor, following that rule:
  - IF dbh < 12.5, expan = 127.32
  - IF dbh < 22.5, expan = 31.83
  - IF dbh < 42.5, expan = 14.15
  - IF dbh >= 42.5, expan = 5.09
- **g**: tree basal area, directly calculated from dbh (cm^2)
- **Inventory_ID** and **Plot_ID**: inventory and plot codes. Obtained from "Parcelas" *(plots)* sheet



	A	B	C	D	E	F	G	H
1	ID_Inventario	ID_Parcela	ID_arbol	especie	factor_expansion	dbh	h	g
2	IFN	24_2355_N_N	1	43	31.8	13.5	7.0	143.1
3	IFN	24_2355_N_N	2	43	127.3	16.3	8.5	208.7
4	IFN	24_2355_N_N	3	43	127.3	8.7	8.0	59.4
5	IFN	24_2355_N_N	4	43	127.3	13.5	8.0	143.1
6	IFN	24_2355_N_N	5	43	127.3	7.8	5.5	47.8
7	IFN	24_2355_N_N	6	43	31.8	14.4	9.5	162.9
8	IFN	24_2355_N_N	7	43	127.3	10.0	6.0	78.5
9	IFN	24_2355_N_N	8	43	31.8	12.9	9.0	130.7
10	IFN	24_2355_N_N	9	43	31.8	16.3	10.0	208.7
11	IFN	24_2355_N_N	10	43	127.3	7.6	4.0	45.4
12	IFN	24_2355_N_N	11	43	14.1	15.8	10.5	196.1
13	IFN	24_2355_N_N	12	43	127.3	14.1	9.0	156.1
14	IFN	24_2355_N_N	13	43	127.3	10.0	6.5	78.5
15	IFN	24_2355_N_N	14	43	127.3	14.5	8.0	165.1
16	IFN	24_2355_N_N	15	43	127.3	12.3	8.5	118.8
17	IFN	24_2355_N_N	16	43	31.8	19.9	8.0	311.0
18	IFN	24_2355_N_N	17	43	127.3	14.8	7.0	172.0
19	IFN	24_2355_N_N	18	43	127.3	10.6	5.0	88.2
20	IFN	24_2355_N_N	19	43	127.3	8.4	6.0	55.4
21	IFN	24_2355_N_N	20	43	127.3	9.5	8.0	70.9
22	IFN	24_2355_N_N	21	43	127.3	10.9	6.5	93.3
23	IFN	24_2355_N_N	22	43	127.3	9.0	7.5	63.6
24	IFN	24_2355_N_N	23	43	31.8	15.3	9.0	183.9
25	IFN	24_2355_N_N	24	43	127.3	12.6	7.0	124.7
26	IFN	24_2355_N_N	25	43	127.3	10.8	7.0	91.6
27	IFN	24_2355_N_N	26	43	127.3	8.9	7.5	62.2

Parcelas | PiesMayores | ...

That's the inventory we will get as an example.

Now, let's look at how to fill the "Parcelas" *(plots)* sheet.

ID_Inventario	ID_Parcela	ID_arbol	especie	factor_expansion	dbh	h	g
IFN	24_2355_N_N	11	43	14.1	15.8	10.5	196.1
IFN	24_2355_N_N	9	43	31.8	16.3	10.0	208.7
IFN	24_2355_N_N	8	43	31.8	12.9	9.0	130.7
IFN	24_2355_N_N	24	43	31.8	14.4	9.5	162.9
IFN	24_2355_N_N	16	43	31.8	19.9	8.0	311.0
IFN	24_2355_N_N	1	43	31.8	13.5	7.0	143.1
IFN	24_2355_N_N	23	43	31.8	15.3	9.0	183.9
IFN	24_2355_N_N	24	43	127.3	12.6	7.0	124.7
IFN	24_2355_N_N	2	43	127.3	16.3	8.5	208.7
IFN	24_2355_N_N	26	43	127.3	8.9	7.5	62.2
IFN	24_2355_N_N	22	43	127.3	9.0	7.5	63.6
IFN	24_2355_N_N	21	43	127.3	10.9	6.5	93.3
IFN	24_2355_N_N	25	43	127.3	10.8	7.0	91.6
IFN	24_2355_N_N	3	43	127.3	8.7	8.0	59.4
IFN	24_2355_N_N	4	43	127.3	13.5	8.0	143.1
IFN	24_2355_N_N	5	43	127.3	7.8	5.5	47.8
IFN	24_2355_N_N	7	43	127.3	10.0	6.0	78.5
IFN	24_2355_N_N	10	43	127.3	7.6	4.0	45.4
IFN	24_2355_N_N	12	43	127.3	14.1	9.0	156.1
IFN	24_2355_N_N	13	43	127.3	10.0	6.5	78.5
IFN	24_2355_N_N	15	43	127.3	12.3	8.5	118.8
IFN	24_2355_N_N	14	43	127.3	14.5	8.0	165.1
IFN	24_2355_N_N	17	43	127.3	14.8	7.0	172.0
IFN	24_2355_N_N	20	43	127.3	9.5	8.0	70.9
IFN	24_2355_N_N	19	43	127.3	8.4	6.0	55.4
IFN	24_2355_N_N	18	43	127.3	10.6	5.0	88.2

The first columns that we should fill are the ones highlighted in yellow:

- **Inventory_ID**: inventory code, where it is recommended to put the source of the data (when filled in, it is auto-filled in the trees sheet)
- **Plot_ID**: plot code, which is extracted from the Forest Explorer (when filled in, it is auto-filled in the trees sheet)
- **Main_species_ID**: code of the main species of the plot (as there may be several species). For this, we will use the coding of the SNFI (look it up here, Appendix 12)

	A	B	C	D	E	F	G	H	I	J	K
1	ID_Inventario	ID_Parcela	ID_especie_principal	Anho	T	N	G	Ho	h_media	dg	V_con_corteza
2	IFN	24_2355_N_N	43		20	2624.288	0.3	10.0			

We will see that some variables will be covered automatically (check that they have used the data from all the trees, it is an Excel function):

- **N**: is the density of the plot (trees/ha)
- **G**: is the basal area of the plot (m^2/ha)

	A	B	C	D	E	F	G	H	I	J	K
1	ID_Inventario	ID_Parcela	ID_especie_principal	Anho	T	N	G	Ho	h_media	dg	V_con_corteza
2	IFN	24_2355_N_N	43		20	2624.288	0.3	10.0			

Lastly, we have two important fields missing:

- **T**: is the average age of the plot. Since the SNFI only provides it for some more homogeneous plots (i.e., plantations), let's cover the cell with a value that we think may be correct (this is NOT correct, we should discard the plot, but let's do it to have some example data and to be able to continue the explanation)
- **Ho**: is the dominant height of the plot in m. It is calculated by averaging the height of the 100 tallest trees in the plot (NOTE, each tree is equivalent to a a certain number of trees at the hectare level (expansion factor), so this must be taken into account)

	A	B	C	D	E	F	G	H	I	J	K
1	ID_Inventario	ID_Parcela	ID_especie_principal	Anho	T	N	G	Ho	h_media	dg	V_con_corteza
2	IFN	24_2355_N_N	43		20	2624.288	0.3	10.0			

How to add more than one plot to your inventory

How to add more than one plot to your inventory

This section is only to remind you that the codes of the sheet "Parcelas" *(plots)* and "PiesMayores" *(trees)* must match (see the image). If this is not the case, then the simulator cannot link the trees to the correct plot.

The same tree code can be repeated on different plots, but not on the same plot (see the image).

DON'T MESS IT UP!

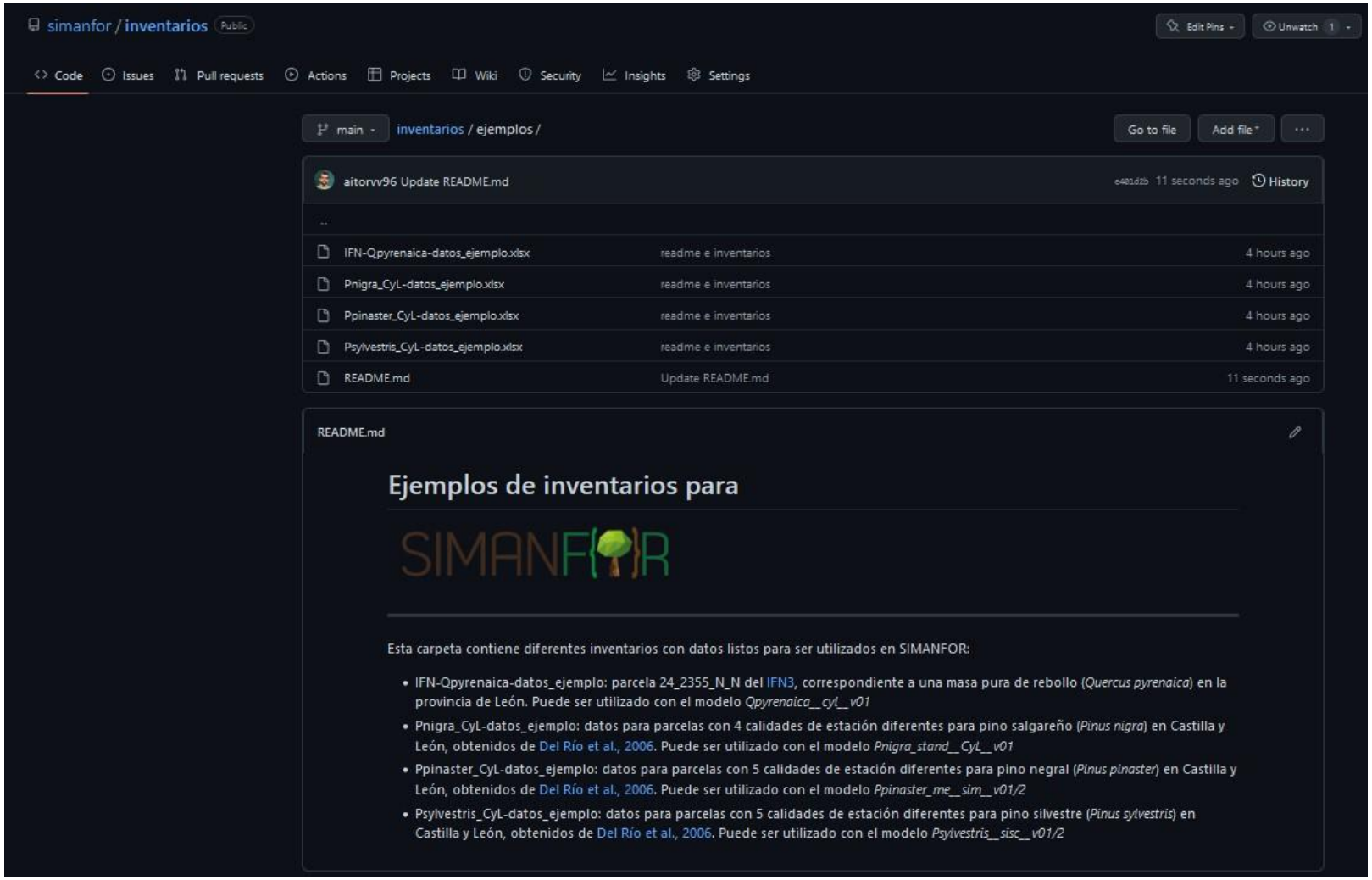
ID_Inventario	ID_Parcela	_especie_principal	Anho	T	N	G	Ho	h_media	dg	V_con_cortez
Del_Rio_et_al_2006	12	26	2006	20	1485	11.6	5.5	4.8	10	28
Del_Rio_et_al_2006	15	26	2006	20	1189	15.7	6.8	6.1	13	46
Del_Rio_et_al_2006	18	26	2006	20	992	19.4	8.2	7.5	15.8	68
Del_Rio_et_al_2006	21	26	2006	20	851	22.7	9.6	8.8	18.4	92
Del_Rio_et_al_2006	24	26	2006	20	745	25.7	10.9	10.2	21	119

ID_Inventario	ID_Parcela	ID_arbol	especie	factor_expansion	dbh	h	g
Del_Rio_et_al_2006	12	1	26	165.0	10.0	4.8	78.1
Del_Rio_et_al_2006	12	2	26	165.0	10.0	5.5	78.1
Del_Rio_et_al_2006	12	3	26	165.0	10.0	4.1	78.1
Del_Rio_et_al_2006	12	4	26	165.0	12.0	4.8	112.5
Del_Rio_et_al_2006	12	5	26	165.0	12.0	5.5	112.5
Del_Rio_et_al_2006	12	6	26	165.0	12.0	4.1	112.5
Del_Rio_et_al_2006	12	7	26	165.0	8.0	4.8	50.0
Del_Rio_et_al_2006	12	8	26	165.0	8.0	5.5	50.0
Del_Rio_et_al_2006	12	9	26	165.0	8.0	4.1	50.0
Del_Rio_et_al_2006	15	1	26	132.1	13.0	6.1	132.0
Del_Rio_et_al_2006	15	2	26	132.1	13.0	6.8	132.0
Del_Rio_et_al_2006	15	3	26	132.1	13.0	5.4	132.0
Del_Rio_et_al_2006	15	4	26	132.1	15.6	6.1	190.1
Del_Rio_et_al_2006	15	5	26	132.1	15.6	6.8	190.1
Del_Rio_et_al_2006	15	6	26	132.1	15.6	5.4	190.1
Del_Rio_et_al_2006	15	7	26	132.1	10.4	6.1	84.5
Del_Rio_et_al_2006	15	8	26	132.1	10.4	6.8	84.5
Del_Rio_et_al_2006	15	9	26	132.1	10.4	5.4	84.5
Del_Rio_et_al_2006	18	1	26	110.2	15.8	7.5	195.6
Del_Rio_et_al_2006	18	2	26	110.2	15.8	8.2	195.6

Example inventories

Example inventories

Inside this folder you will find example inventories. Have a look at the README deployed on this page and you will see a recommendation about the model that better fits each inventory.



SIMANFOR

Models

Instituto Universitario de Investigación iuFOR GESTIÓN FORESTAL SOSTENIBLE

- Model typologies on SIMANFOR
- Names of the models
- Model's content
- Use recommendations

Model typologies on SIMANFOR

SIMANFOR is a tool that allows the use of forest models efficiently and easily.
To define the forest models terms we can use resources like the Glosario Técnico Forestal de la SECF, where they define the following terms:

model: an abstract representation of objects and events from the real world to characterize a phenomenon or to simulate processes and predict their results, i.e., quantitative models that use as relationships mathematical equations.

stand model: stand dynamics models

stand dynamics models: a simulation model for forest stands that predicts the evolution of stand variables (growth, mortality, regeneration and changes related to the stand). Note: model inputs used to be stand variables like species, density, age, site quality and silvicultural treatments; the outputs use to be tables with the density and volumes classified by diametric classes and wood products for a reference age

To the previous ones should be added:

- individual tree model

Forest stand simulation model that predicts the evolution of the variables of each tree that makes up the stand and the stand itself (compared to stand models, these use and calculate larger tree variables)

On the other hand, these individual tree models can use the position of the tree in the plot for their calculations, including the calculation of variables such as competition. In this case, we are speaking about distance-dependent models, while distance-independent models are those that do not include the position of the tree in the plot for their calculations.

It is also important to note whether the models were developed for a single species (pure) or for a certain species mixture (mixed).

Finally, it is also necessary to make a point regarding the models' ability to project calculations over time. We talk about dynamic models when they are able to predict tree or stand growth and therefore project their state at a future point in time; static models do not include growth calculations, and therefore only allow calculations to be made for a known point in time.

Knowing these concepts, you will now be able to better understand the models included in SIMANFOR.

Model typologies on SIMANFOR

SIMANFOR can use different model typologies:

- Distance-independent single-tree dynamic models for pure stands
- Distance-independent single-tree dynamic models for mixed stands
- Distance-independent single-tree static models for pure stands
- Distance-independent single-tree static models for mixed stands
- Dynamic models for pure stands
- Static models for pure stands

Moreover, SIMANFOR includes 3 different harvest typologies:

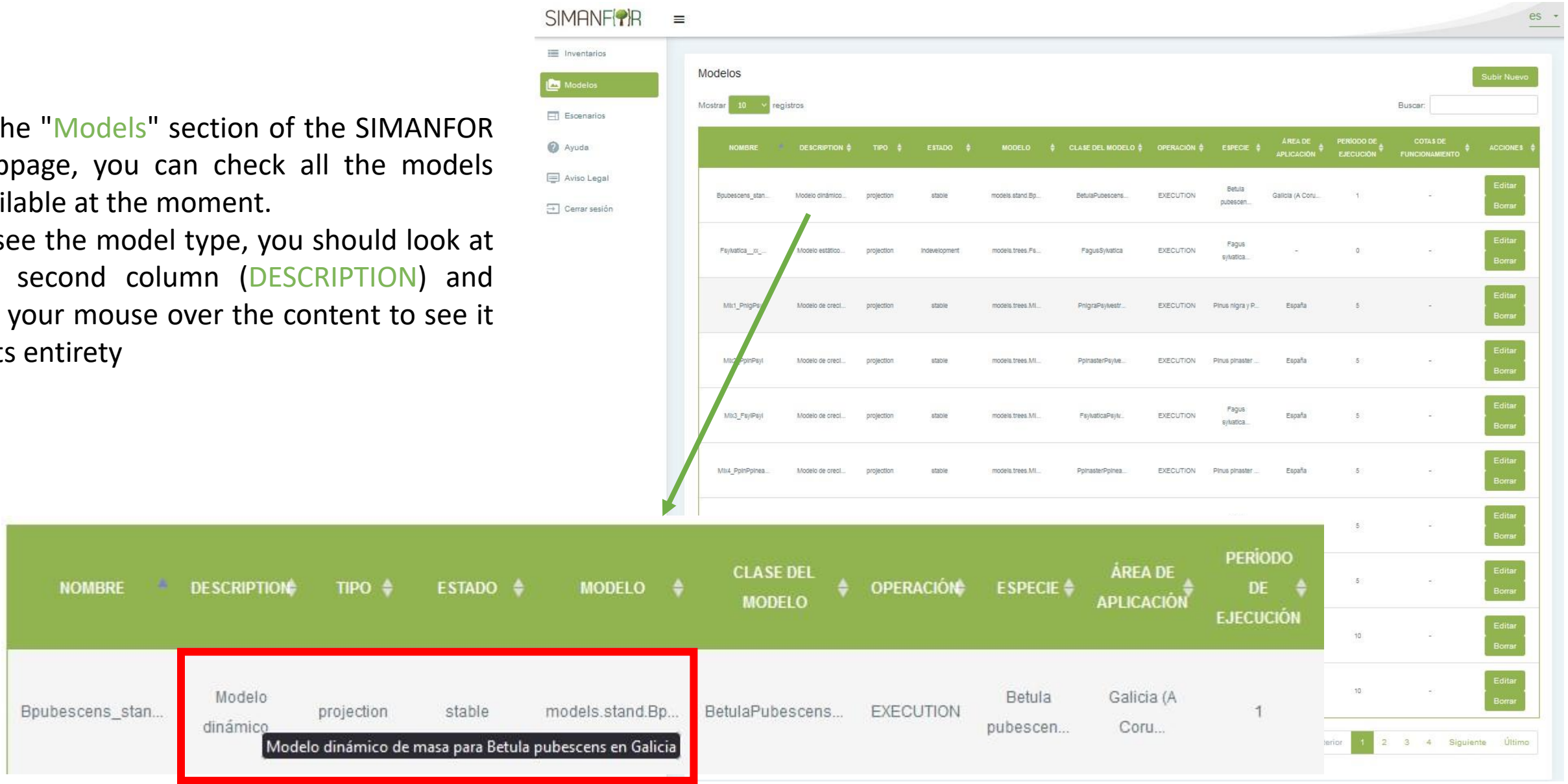
- Systematic harvest model
- By below harvest model
- By above harvest model

Model typologies on SIMANFOR

SIMANFOR uses the same model (structure and calculation workflow) with different parametrizations depending on the locations and species we want to work with, as their behaviour is not the same.

Model typologies on SIMANFOR

In the "Models" section of the SIMANFOR webpage, you can check all the models available at the moment.
To see the model type, you should look at the second column (DESCRIPTION) and put your mouse over the content to see it in its entirety



Names of the models

Names of the models

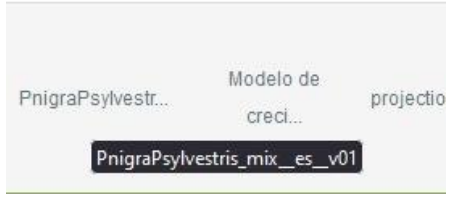
The model's names available on SIMANFOR use a common criteria to be named:

- Species name
- Location where it was fitted
- Version
- *To remark stand or mix models (the rest are individual-tree pure models)

On the right, you can see some examples.

Ppinaster_me__sim__v02

Bpubescens_stand__gal__v01



PnigraPsylvestris_mix__ es__v01

Model's content

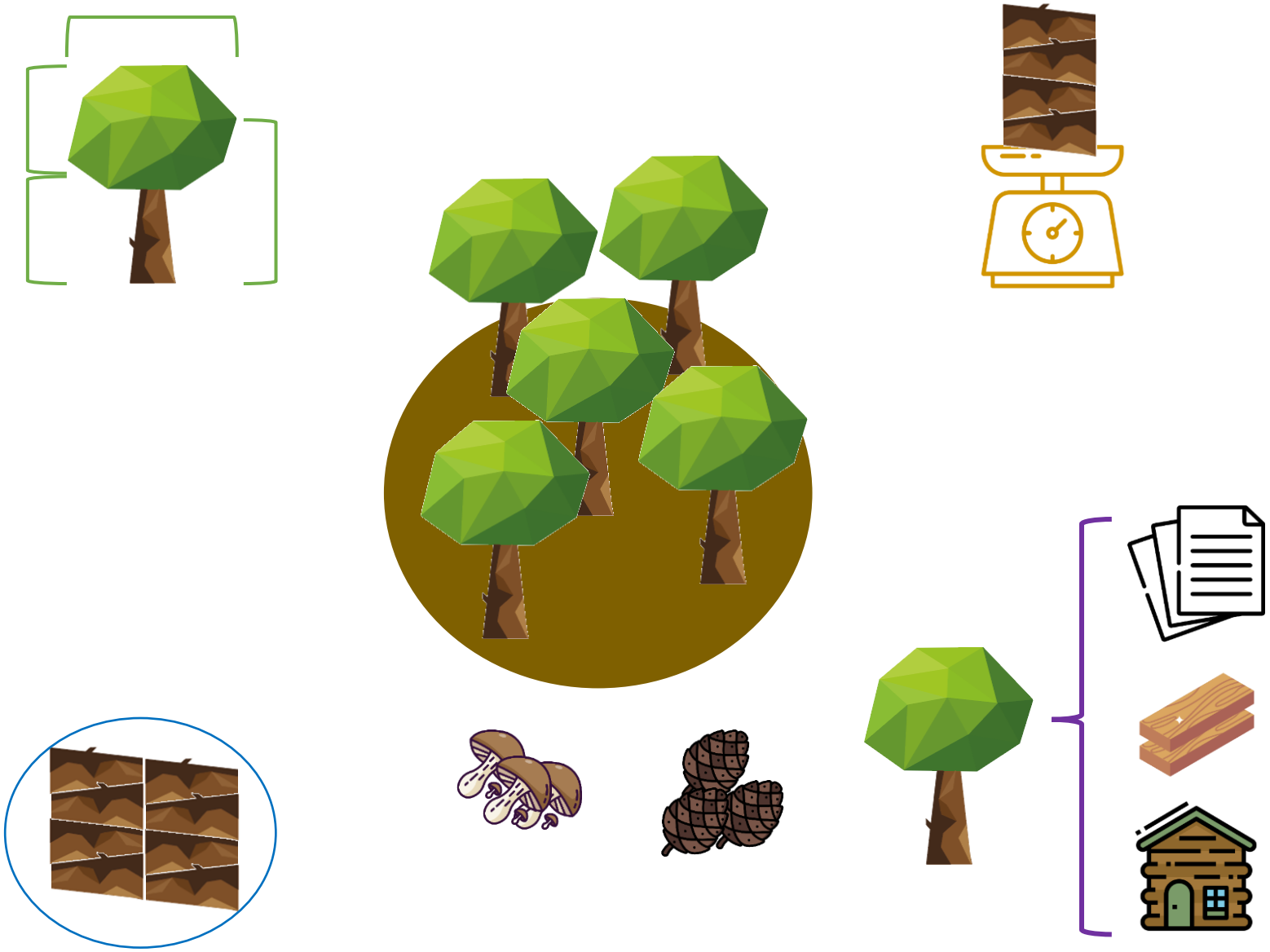
Model's content

The content of forestry models varies from one model to another depending on the information (equations for calculation) available for each parametrization (species and location).

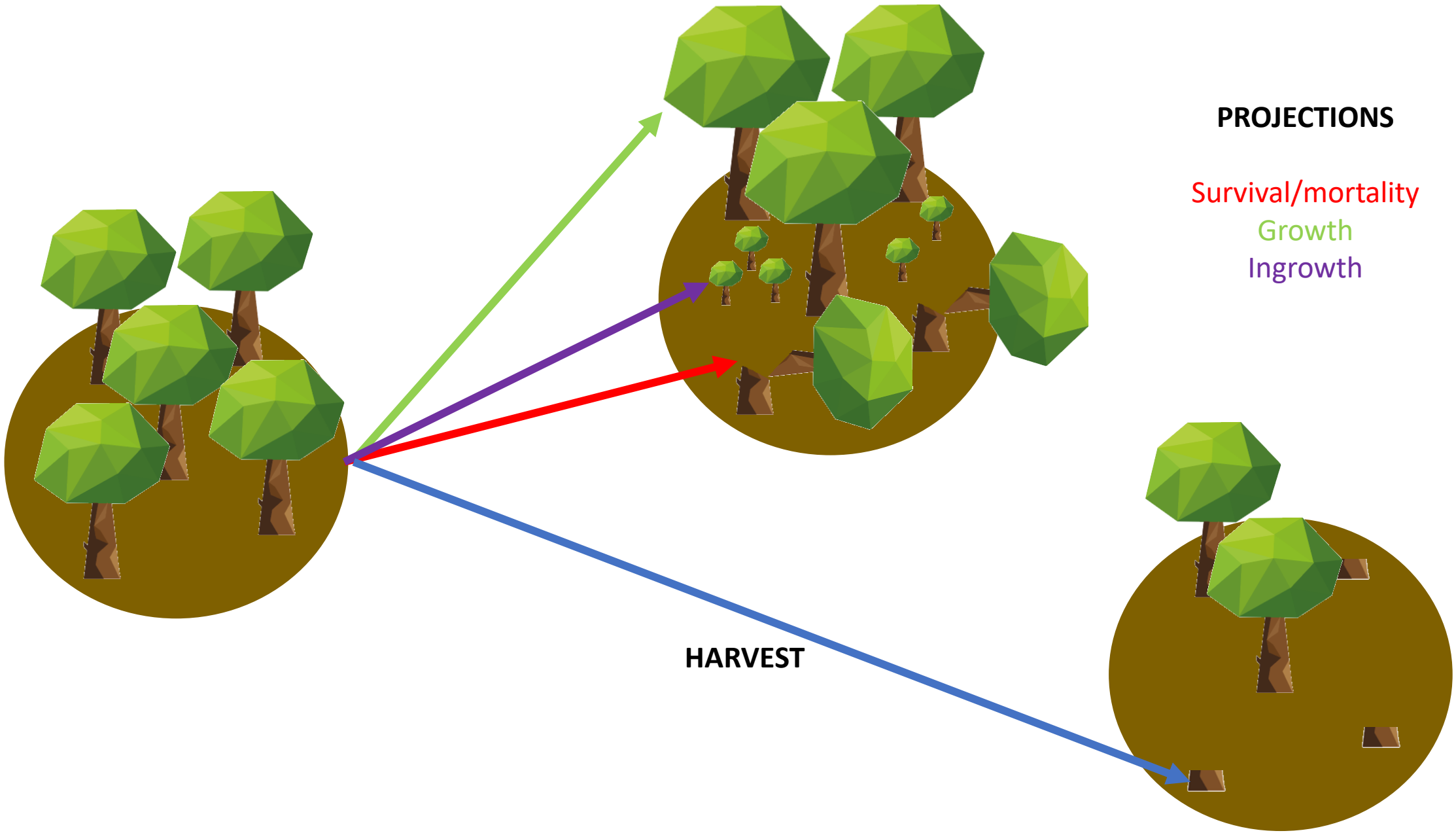
However, each model has a description sheet associated with it, which you can find here by searching for the model name.

All models include calculations of static variables (for a certain moment in time), including crown variables, volume over/under bark, biomass for different tree sections, wood products classification according to their industry destination, and even non-timber forest products such as pine nuts or mushrooms.

In addition to this, the dynamic models include 3 fundamental calculations (next page).



Model's content



PROJECTIONS

The equations that allow the projections to be made are (following this order):

- Survival/mortality

Sub-model that determines whether a tree is still alive or not at the time to be projected (acts on its expansion factor; that sub-model may not be available)

- Growth

Sub-model that determines, after estimating mortality, the growth of every single tree (mandatory for dynamic models)

- Ingrowth

Sub-model the estimates, after mortality and growth estimations, how many trees will be incorporated into the stand (that sub-model may not be available)

HARVESTS

Each stand model has its harvest sub-models (always systematic, since there is no tree data), while for individual tree models, the harvests are applied on the expansion actor and are classified as follows:

- Harvest type (choose the type of trees to cut)
  - Systematic: it cuts the same proportion of each tree
  - By above: it cuts the bigger tres of the plot
  - By below: it cuts the smaller tres of the plot

- Harvest criteria (variable to which the harvest intensity is applied)
  - Number of trees: harvest intensity applied to the plot density
  - Basal area: harvest intensity applied to the plot basal area
  - Volume: harvest intensity applied to the plot volume

- Harvest intensity (%)

The harvest intensity fix the percentage of trees to extract

That's the contents of each model, but… how are they included in the simulator?

Nice question!

Although it is beyond the scope of this manual, I would like to give a brief overview of this issue. SIMANFOR consists of a large set of files, most of them programmed in Python language, interconnected and with different functionalities. Within this ecosystem of code are the models that we can see on the website. In them, each calculation is composed of one or several equations extracted from scientific articles and programmed in Python language, which will use the data from your inventory to make calculations and, in turn, provide this information to the following equations of the model, EXCITING!

All the equations that make up each model are listed in their data sheets. If you want to create, modify or design your own model, just contact us.

$$d_{i5} = e^{-0{,}37110+0{,}2525*\ln(d*10)+0{,}7090*\ln(\frac{cr+0{,}2}{1{,}2})+0{,}9087*\ln SI-0{,}1545*\sqrt{G}-0{,}0004*\frac{bal^2}{\ln d*10}}/10$$

$$h_{i5} = e^{3{,}1222-0{,}4939*\ln(d_{i5}*10)+1{,}3763*\ln SI-0{,}0061*bal+0{,}1876*\ln(cr)}/100$$

```python
def growth(self, time: int, plot: Plot, old_tree: Tree, new_tree: Tree):
    """
    Tree growth function.
    A function that updates dbh and h by using growth equations, and also update age, g, and v to the new situation.
    Source:
        Doc.: Lizarralde I (2008). Dinámica de rodales y competencia en las masas de pino silvestre (Pinus sylvestris L.)
        y pino negral (Pinus pinaster Ait.) de los Sistemas Central e Ibérico Meridional. Tesis Doctoral. 230 pp
        Ref.: Lizarralde 2008
    """

    try:  # errors inside that construction will be announced

        if old_tree.specie == Model.specie_ifn_id:  # specie condition

            new_tree.sum_value('tree_age', time)

            if plot.si == 0:
                dbhg5: float = 0
            else:
                dbhg5: float = math.exp(-0.37110 + 0.2525 * math.log(old_tree.dbh * 10) + 0.7090 * math.log(
                    (old_tree.cr + 0.2) / 1.2) + 0.9087 * math.log(plot.si) - 0.1545 * math.sqrt(
                    plot.basal_area) - 0.0004 * (old_tree.bal * old_tree.bal / math.log(old_tree.dbh * 10)))
            new_tree.sum_value("dbh", dbhg5 / 10)


            if dbhg5 == 0:
                htg5: float = 0
            else:
                htg5: float = math.exp(3.1222 - 0.4939 * math.log(dbhg5 * 10) + 1.3763 * math.log(
                plot.si) - 0.0061 * old_tree.bal + 0.1876 * math.log(old_tree.cr))
            new_tree.sum_value("height", htg5 / 100)

            new_tree.add_value('basal_area', math.pi*(new_tree.dbh/2)**2)  # update basal area (cm2)

            self.vol(new_tree, plot)  # update volume variables (dm3)

    except Exception:
        self.catch_model_exception()
```

Use recommendations

Use recommendations

Before selecting the model that better fits with your study case you should check their model sheet, where different information about the model and its content is summarized, and some useful recommendations are included to guarantee that the model will run smoothly:

- Name of the model
- Species, code and application área
- Model type
- Variables needed on the initial inventory
- Recommended execution time

SIMANFOR

Modelo para *Pinus pinaster mesogeensis*
Sistema Ibérico Meridional (España)

Modelo

Ppinaster_me_sim_v02

Descripción del modelo

- Especie: *Pinus pinaster* Ait. subsp. *mesogeensis*
- Código del Inventario Forestal Nacional Español (IFN): 26
- Área geográfica: Sistema Ibérico Meridional
- Área geográfica (administrativa): Soria, Guadalajara, Cuenca y Teruel

Tipo de modelo

- Categoría: crecimiento
- Nivel del modelo: modelo de árbol individual independiente de la distancia
- Forma fundamental: monte alto
- Forma principal: regular
- Composición: pura
- Origen: natural y seminatural

Requisitos y recomendaciones de uso

- Requisitos del inventario inicial: edad, altura dominante y área basimétrica de parcela; expan y dbh de árboles
- Ámbito geográfico: Sistema Ibérico Meridional, zonas limítrofes y lugares de características similares (asumiendo ciertas diferencias)
- Tipo de masa: masas puras, resinadas o no
- Tiempo de ejecución recomendado: ejecuciones de 5 años (ecuaciones de supervivencia, crecimiento y masa incorporada desarrolladas bajo este criterio)
- Índice de Sitio calculado para una edad de referencia de 80 años

Figure 1: *Pinus pinaster*

Figure 2: Detalles de *Pinus pinaster*

Figure 3: Regiones de procedencia de *Pinus pinaster* en España

1

SIMANFOR

Creating silvicultural scenarios

Instituto Universitario de Investigación
iuFOR GESTIÓN FORESTAL SOSTENIBLE

- References
- Silvicultural scenarios on SIMANFOR – Part 1
- Silvicultural scenarios on SIMANFOR – Part 2
- Scenarios comparison

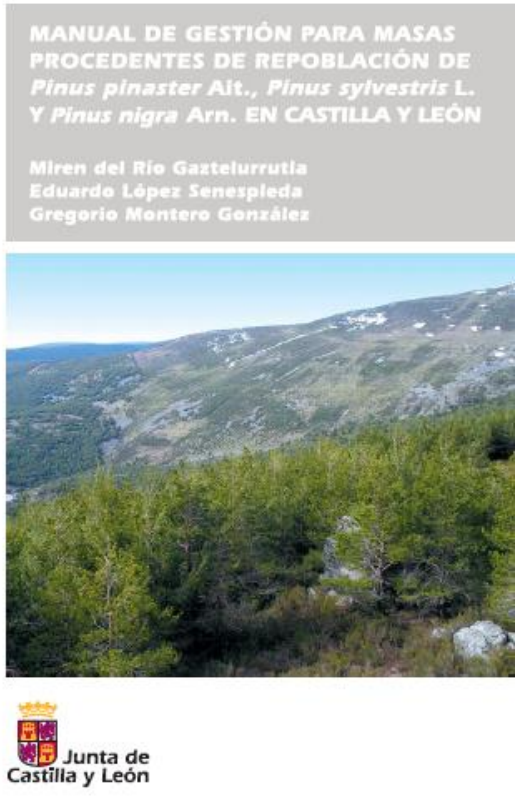
In this document, we will **NOT** teach how to use the SIMANFOR website, but we will teach how to design your scenario within SIMANFOR.

To learn how to use the SIMANFOR website you can check the material available here.

References

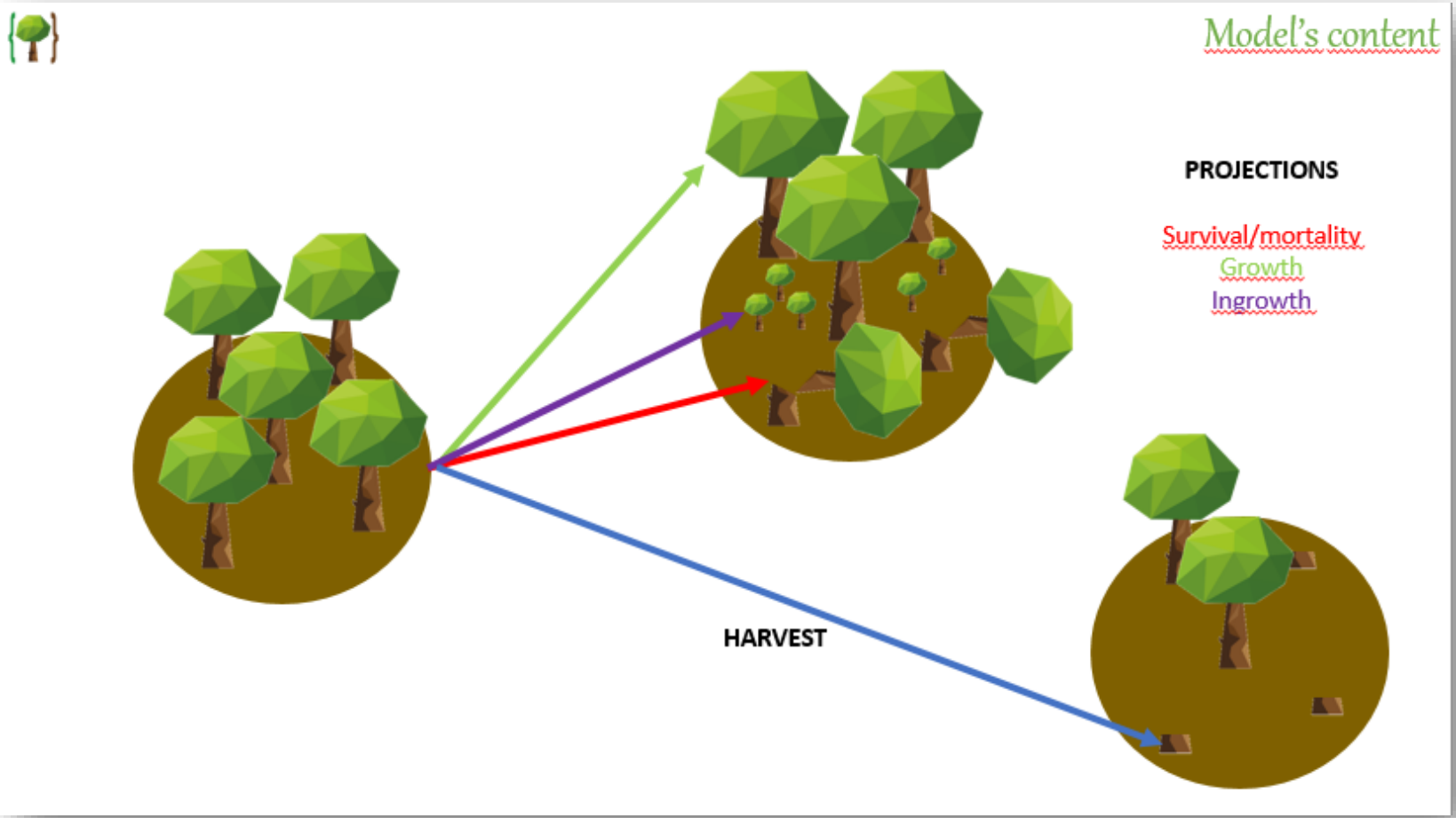
The silvicultural scenarios are all the treatments we want to apply to our stand during forest management. In Spain, it's common that public administration publishes some silvicultural reference manuals ("management recipes") to the most common species on their región, following different management objectives. Here you can check those of Asturias, Galicia, Cataluña and Castilla y León.

Another interesting piece of information is the bibliography like "Compendio de Selvicultura Aplicada en España", where you can find information about the silviculture of the forestry species like *Pinus pinaster* subsp. *mesogeensis* or *P. sylvestris*, among others.



Silvicultural scenarios on SIMANFOR – Part 1

In this document, we will not explain how the harvests and projections work. If you want to know more about that, here you can find it.
On the right, you have a summary just to refresh the information related to that topic.



The silvicultural scenario we will create in SIMANFOR is available at Del Río et al. (2006). It is focused on *Pinus pinaster* pure stands and at site quality 12 (page 38).
This is an example that can be applied to the sample inventory data, extracted from this document following the procedure explained here.

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m^2/ha	V m^3/ha	N pies/ha	Dg cm	V m^3/ha	N pies/ha	Dg cm	G m^2/ha	V m^3/ha
40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
80	14,6	400	32,5	33,1	201,8							

Let's get down the business!

First of all, let's identify how many silvicultural activities we need to carry out. If we analyze the information, we can count a total of 5 activities, although maybe not all of them need to be applied.

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

1 • ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.

2 • 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.

3 • 50 años: 2ª clara por lo bajo.

4 • 65 años: 3ª clara por lo bajo.

5 • Turno: 80 años.

			Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
	Edad años	Ho m	N pies/ha	Dg cm	G m^2/ha	V m^3/ha	N pies/ha	Dg cm	V m^3/ha	N pies/ha	Dg cm	G m^2/ha	V m^3/ha
2	40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
3	50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
4	65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
5	80	14,6	400	32,5	33,1	201,8							

1. Precommercial thinning

For stands larger than 1.500 trees/ha it is recommended to apply precommercial thinning. As our initial density is 1.485 trees/ha, that activity is not needed.

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

1
- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m^2/ha	V m^3/ha	N pies/ha	Dg cm	V m^3/ha	N pies/ha	Dg cm	G m^2/ha	V m^3/ha
40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
80	14,6	400	32,5	33,1	201,8							

2. Thinning

Following the guide, we establish that:

- **Application age**: 40 years
- **Harvest type**: semi-systematic. Since there are no semi-systematic harvest operations, we shall carry out that harvest type by applying two consecutive harvest operations, the first one systematic and the second one by below
- **Harvest criteria and intensity**: this value is extracted from the table, let's see how to calculate it…

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 2 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m^2/ha	V m^3/ha	N pies/ha	Dg cm	V m^3/ha	N pies/ha	Dg cm	G m^2/ha	V m^3/ha
2 40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
80	14,6	400	32,5	33,1	201,8							

2. Thinning

Harvest criteria and intensity:

The harvest criteria are chosen according to the available information in the table. In that case, we know N (density), G (basal area) and V (volume), so we can use any possible criteria. On the other hand, the harvest intensity is estimated by calculating the percentage (%) of the stand extracted for the selected criteria. Let's look at an example:

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 2 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

			Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
	Edad años	Ho m	N pies/ha	Dg cm	G m^2/ha	V m^3/ha	N pies/ha	Dg cm	V m^3/ha	N pies/ha	Dg cm	G m^2/ha	V m^3/ha
2	40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
	50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
	65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
	80	14,6	400	32,5	33,1	201,8							

2. Thinning

Harvest criteria and intensity:

Assuming that the chosen harvest criterio are N (density). The intensity is the extracted percentage of N, so it could be calculated in several ways:

- Using the information on "masa extraída" *(extracted trees)* and "masa antes de la clara" *(stand before thinning)*, it would be enough to calculate:

$$(575/1.500)\cdot 100 = 38{,}3\%$$

- Another possibility is to use the information from the "masa principal antes / después de la clara" *(stand before/after thinning)*, where the extracted percentage is the difference between the total (100%) and the part of the stand that remains on the field (ratio):

$$(100 - (925/1.500))\cdot 100 = 38{,}3\%$$

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m²/ha	V m³/ha	N pies/ha	Dg cm	V m³/ha	N pies/ha	Dg cm	G m²/ha	V m³/ha
40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
80	14,6	400	32,5	33,1	201,8							

2. Thinning

Harvest criteria and intensity:

- Occasionally you may come across cases where the tables are more concise, however, as these tables do not usually take into account trees that die and are incorporated into the stand, harvest intensity can be estimated as the lost density between two stand statuses:

$$(100 - (925/1.500))\cdot 100 = 38{,}3\%$$

*Note: this can be done using N because it does not take into account dead and incorporated trees; this calculation cannot be replicated with G and V, as they are variables that increase in value with the growth of the trees

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m²/ha	V m³/ha	N pies/ha	Dg cm	V m³/ha	N pies/ha	Dg cm	G m²/ha	V m³/ha
40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
80	14,6	400	32,5	33,1	201,8							

2. Thinning

All right, that's it. As SIMANFOR isn't able to apply semi-systematic harvests, the only thing left is to divide the process into two steps. The first activity would look like this:

- **Application age**: 40 years
- **Harvest type**: systematic
- **Harvest criteria and intensity:**

  38,3/2 = 19,1% de N

We're almost there, but for this case, it's not going to be so easy…

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m^2/ha	V m^3/ha	N pies/ha	Dg cm	V m^3/ha	N pies/ha	Dg cm	G m^2/ha	V m^3/ha
40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
80	14,6	400	32,5	33,1	201,8							

2. Thinning

On the semi-systematic harvest, we would extract 38,3% of the trees in the stand, i.e., 575 trees. By dividing that process into two steps, we are extracting 575/2 = 287,5 tres per step (of course in the real world is not possible to extract half a tree but remember that this is a simulation…). Therefore, the second intervention would look like this:

- **Application age:** 40 years
- **Harvest type**: by below
- **Harvest criteria and intensity:**

(287,5/(1500-287,5))·100 =
(287,5/1212,5)·100 =
23,7% de N

That was a bit difficult, but if you think about it, it makes sense…

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m^2/ha	V m^3/ha	N pies/ha	Dg cm	V m^3/ha	N pies/ha	Dg cm	G m^2/ha	V m^3/ha
40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
80	14,6	400	32,5	33,1	201,8							

3. Thinning

- **Application age**: 50 years
- **Harvest type**: by below
- **Harvest criteria and intensity**: we have already seen how it is calculated in the previous case… for this case, the thinning can be applied following different combinations (the result Will be the same):
  - 40,5% of N
  - 30,8% of G
  - 31,2% of V

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 3 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m²/ha	V m³/ha	N pies/ha	Dg cm	V m³/ha	N pies/ha	Dg cm	G m²/ha	V m³/ha
40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
3 50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
80	14,6	400	32,5	33,1	201,8							

4. Thinning

- **Application age**: 65 years
- **Harvest type**: by below
- **Harvest criteria and intensity:**
  - 27,3% of N
  - 22,1% of G
  - 22,5% of V

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 4 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m^2/ha	V m^3/ha	N pies/ha	Dg cm	V m^3/ha	N pies/ha	Dg cm	G m^2/ha	V m^3/ha
40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
4 65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
80	14,6	400	32,5	33,1	201,8							

5. Rotation

The silvicultural rotation is the final harvest, which is applied to the whole amount of tres remaining on the field.
After this, the table would not provide us with information about the status of the stand after thinning (every variable would be 0) nor about the extracted stand (it would be the same as the status of the stand before thinning).

Knowing that it is not necessary to apply it, assuming that the information of the extracted timber at the final thinning is the one marked in red.

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- 5 Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m^2/ha	V m^3/ha	N pies/ha	Dg cm	V m^3/ha	N pies/ha	Dg cm	G m^2/ha	V m^3/ha
40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
5 80	14,6	400	32,5	33,1	201,8							

Summary

Harvest	Age (years)	Type	Criteria	Intensity (%)
Prec. Thinning	20	Not applied to our stand		
Thinning	40	Systematic	N	19,1
Thinning	40	By below	N	23,7
Thinning	50	By below	N	40,5
Thinning	65	By below	N	27,3
Rotation	80	Not neccesary		

CALIDAD DE ESTACIÓN 12

Esquema selvícola:

- ≈20 años: cuando la densidad inicial sea superior a 1.500 pies/ha, clareo acompañado de podas bajas en todos los pies.
- 40 años: 1ª clara semisistemática con clara baja entre calles. Cuando no se haya realizado clareo, poda baja en todos los pies.
- 50 años: 2ª clara por lo bajo.
- 65 años: 3ª clara por lo bajo.
- Turno: 80 años.

		Masa principal antes de la clara				Masa extraída			Masa principal después de la clara			
Edad años	Ho m	N pies/ha	Dg cm	G m^2/ha	V m^3/ha	N pies/ha	Dg cm	V m^3/ha	N pies/ha	Dg cm	G m^2/ha	V m^3/ha
40	10,4	1.500	13,4	21,1	92,8	575	12,1	29,4	925	14,2	14,6	63,4
50	12,0	925	19,2	26,9	135,7	375	16,7	42,4	550	20,8	18,6	93,2
65	13,6	550	26,9	31,2	178,0	150	24,2	40,1	400	27,8	24,3	137,9
80	14,6	400	32,5	33,1	201,8							

Well, this is the information that we will have to include on SIMANFOR in order to create our scenario. It may be tedious the first time, but later you will see that it is simpler than it seems.

Now, let's créate this scenario in SIMANFOR.

Summary

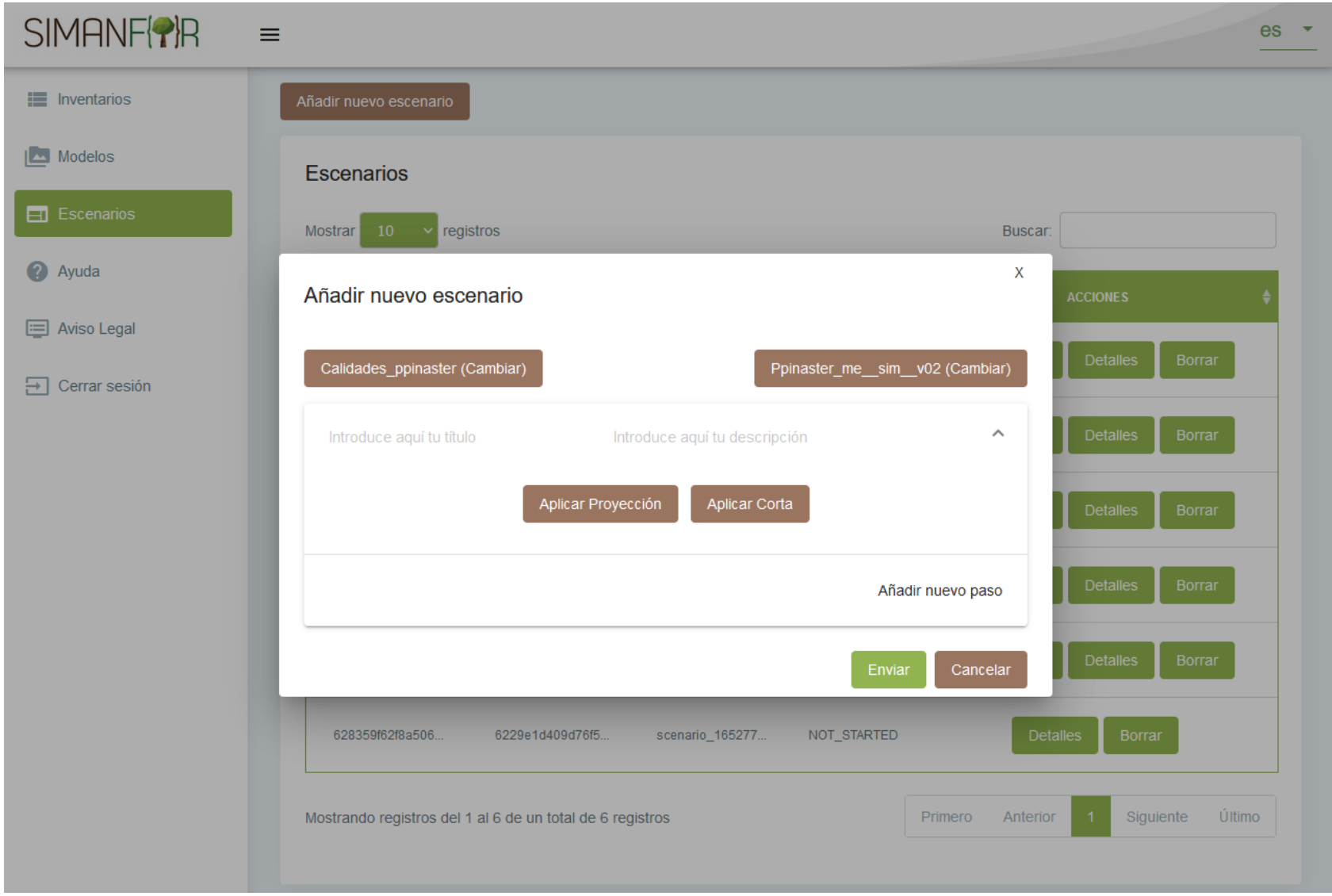
Harvest	Age (years)	Type	Criteria	Intensity (%)
Prec. Thinning	20	Not applied to our stand		
Thinning	40	Systematic	N	19,1
Thinning	40	By below	N	23,7
Thinning	50	By below	N	40,5
Thinning	65	By below	N	27,3
Rotation	80	Not neccesary		

Silvicultural scenarios on SIMANFOR – Part 1

We will use site quality data for *Pinus pinaster* obtained from Del Río et al. (2006) and the model for the same species, whose data sheet can be checked here.

This is the preview of the website after selecting the inventory and model.

Note: remember that here we explain how to create a scenario in SIMANFOR.



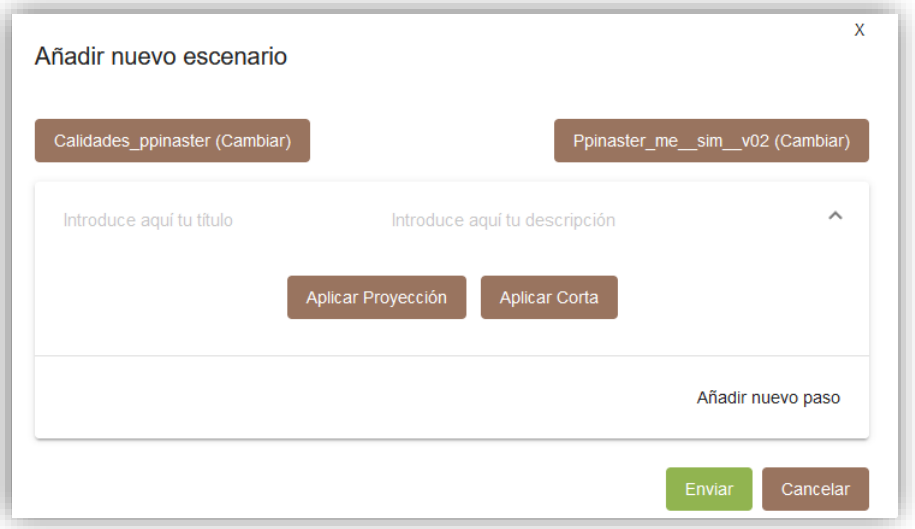
Silvicultural scenarios on SIMANFOR – Part 1

To refresh our memory, the initial age of our plot is 20 years. At the same age, thinning should be applied, but we have seen that it is not necessary in our study case.

Taking that into account, the next activity is at 40 years, so we must project 20 years of growth. To do this, each model has a default value for growth (look for it in the ints data sheet), which in SIMANFOR we call "projection time". In our study case, the projection time is 5 years.

Knowing this, let's Schedule 4 projections of 5 years for our stand to reach the age of 40 years.

Harvest	Age (years)	Type	Criteria	Intensity (%)
Prec. Thinning	20	Not applied to our stand		
Thinning	40	Systematic	N	19,1
Thinning	40	By below	N	23,7
Thinning	50	By below	N	40,5
Thinning	65	By below	N	27,3
Rotation	80	Not neccesary		

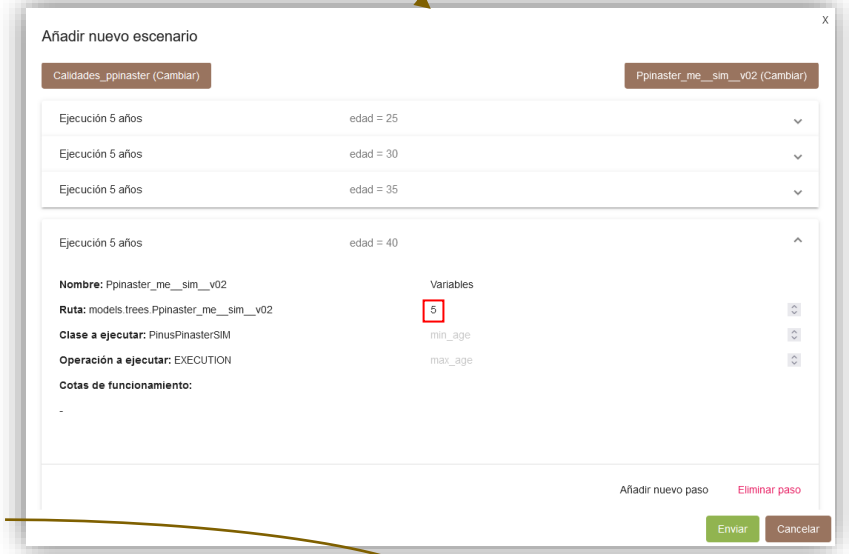


Silvicultural scenarios on SIMANFOR – Part 1

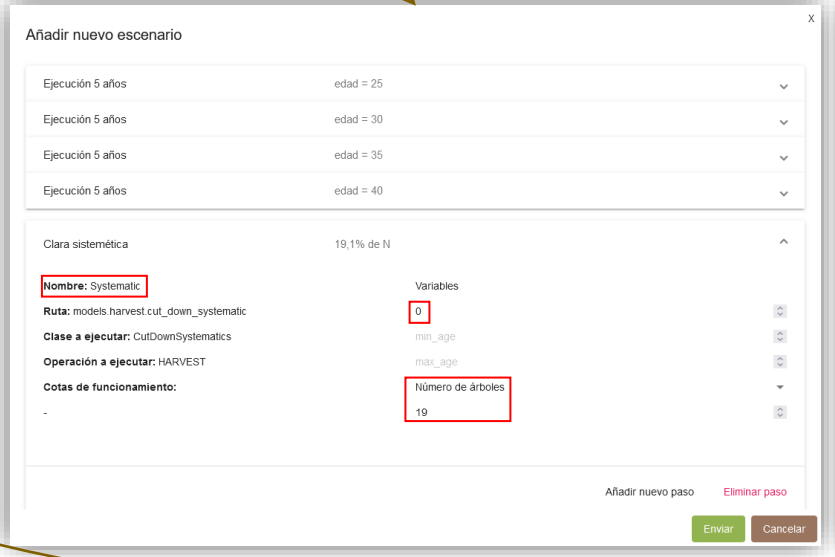
To do that we apply 4 projections with "time" (projection time) = 5 years. Now, our plot is 40 years old and it is time to apply a silvicultural activity.

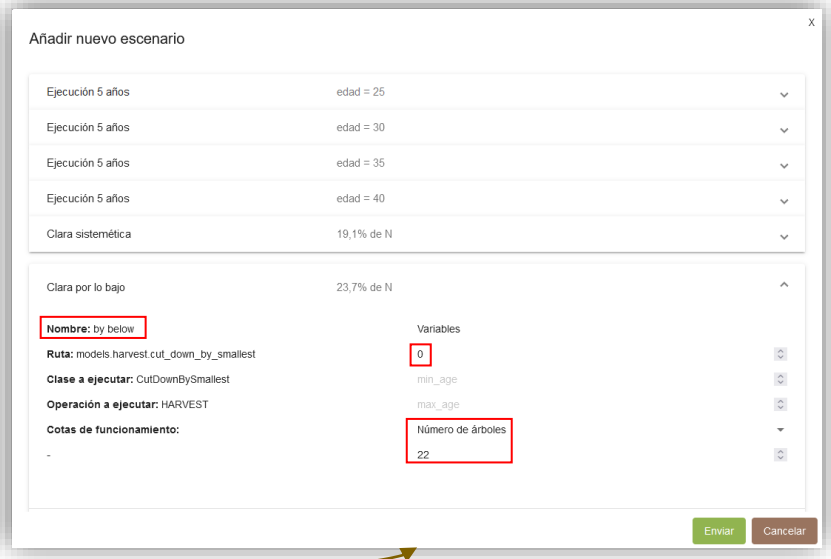
When adding a new step we select "Apply harvest", and we will first select "Systematic" harvest type, setting run time 0, harvest criteria "Number of trees", and intensity 19% (no decimal allowed).

Next, we add a new step where we Will apply a harvest by below, removing 24% of the trees.



Harvest	Age (years)	Type	Criteria	Intensity (%)
Prec. Thinning	20	Not applied to our stand		
Thinning	40	Systematic	N	19,1
Thinning	40	By below	N	23,7
Thinning	50	By below	N	40,5
Thinning	65	By below	N	27,3
Rotation	80	Not neccesary		



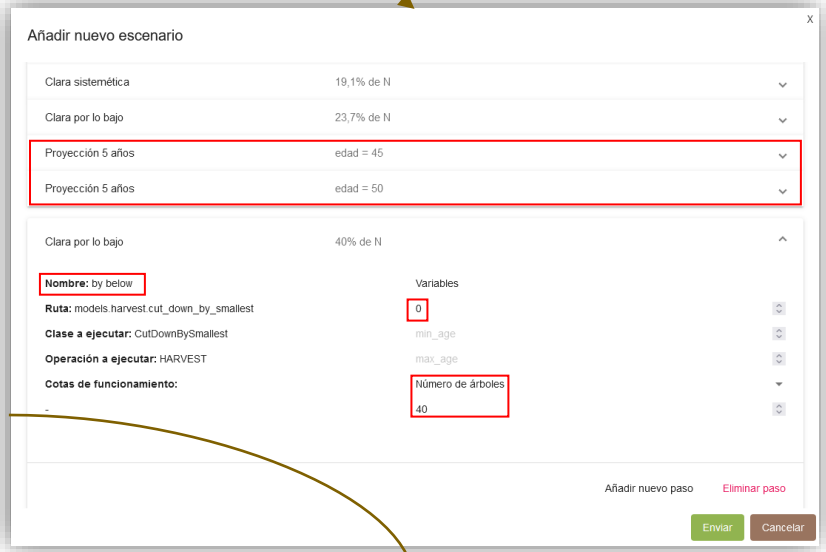


Silvicultural scenarios on SIMANFOR – Part 1

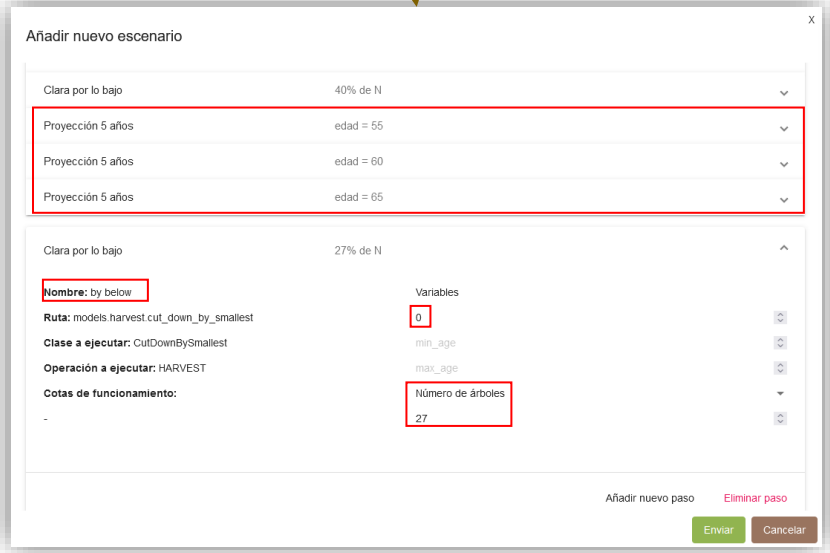
The next activity is at 50 years of age, so we will need to make two 5-year projections and then apply a harvest by below 40% of N.

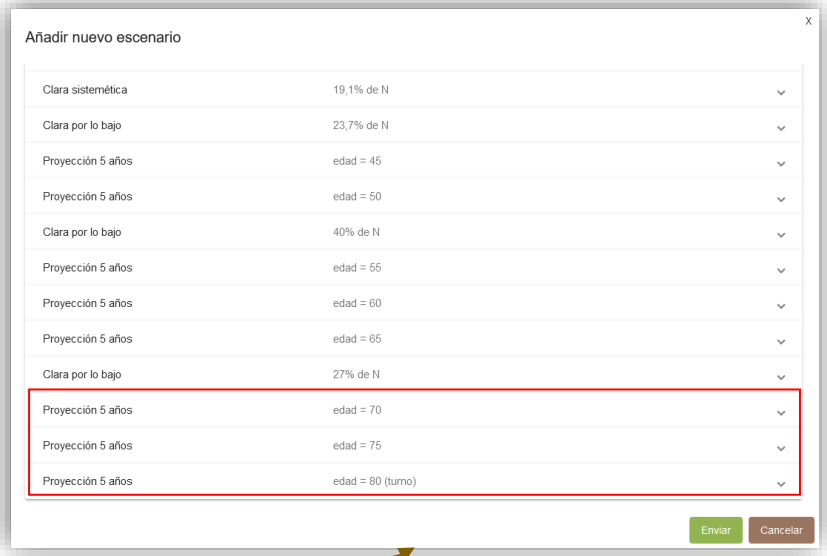
Then we will have the next activity at age 65, which will be a thinning by below 27% of N, so we need to apply before that 3 5-year projections.

Finally, we have a rotation age of 80 years age. As we said, it is not necessary (nor recommended) to apply a harvest to extract 100% of the tres, so it Will only be necessary to make 3 5-year projections to reach the rotation age.



Harvest	Age (years)	Type	Criteria	Intensity (%)
Prec. Thinning	20	Not applied to our stand		
Thinning	40	Systematic	N	19,1
Thinning	40	By below	N	23,7
Thinning	50	By below	N	40,5
Thinning	65	By below	N	27,3
Rotation	80	Not neccesary		

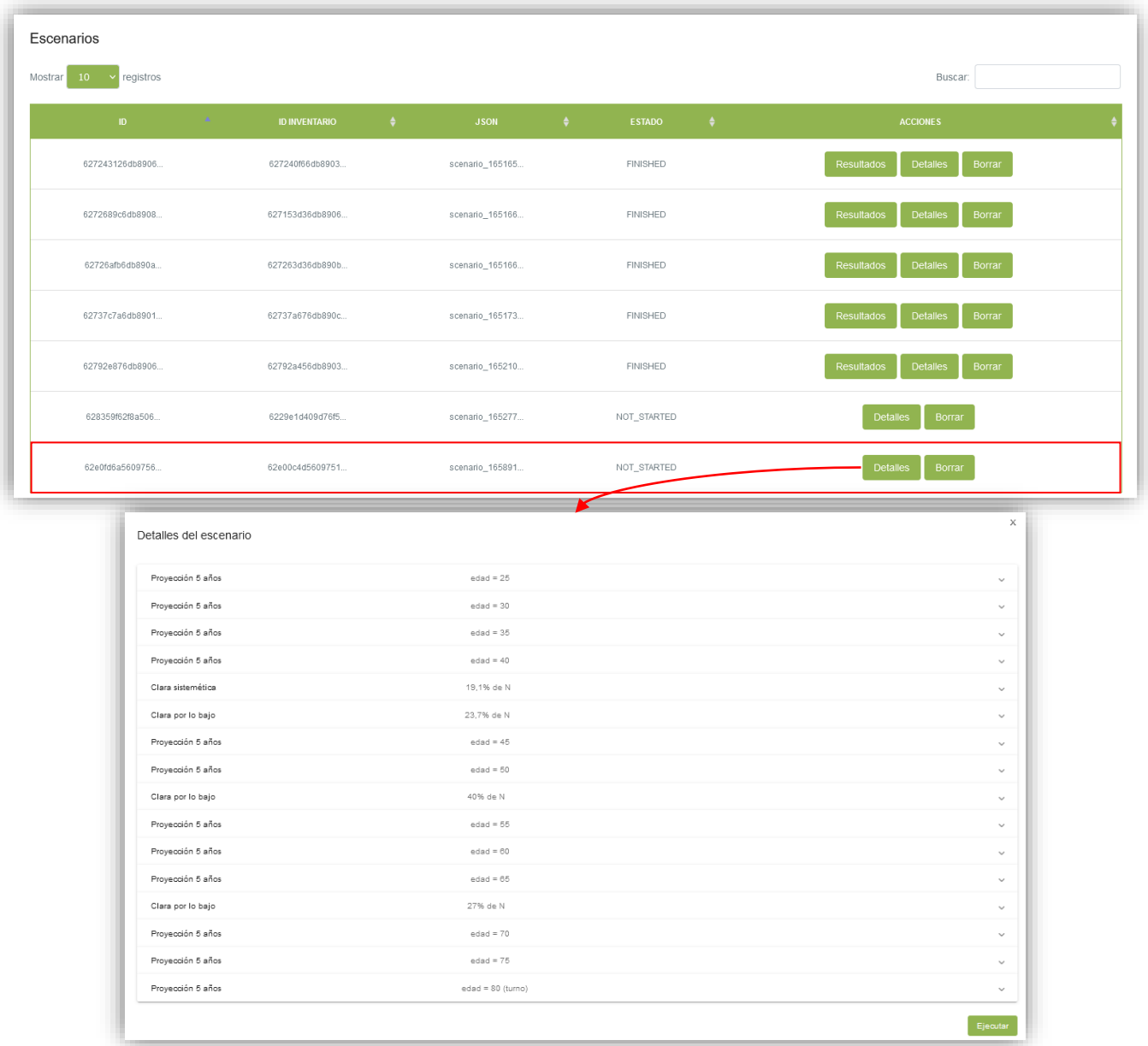




Done!

We can click on the "details" tab to check that we have not skipped any step and run the scenario. If you want to know how to interpret the results, we explain it here.

Note: if you don't get any result, run it again, sometimes the connection fails… computer stuff…

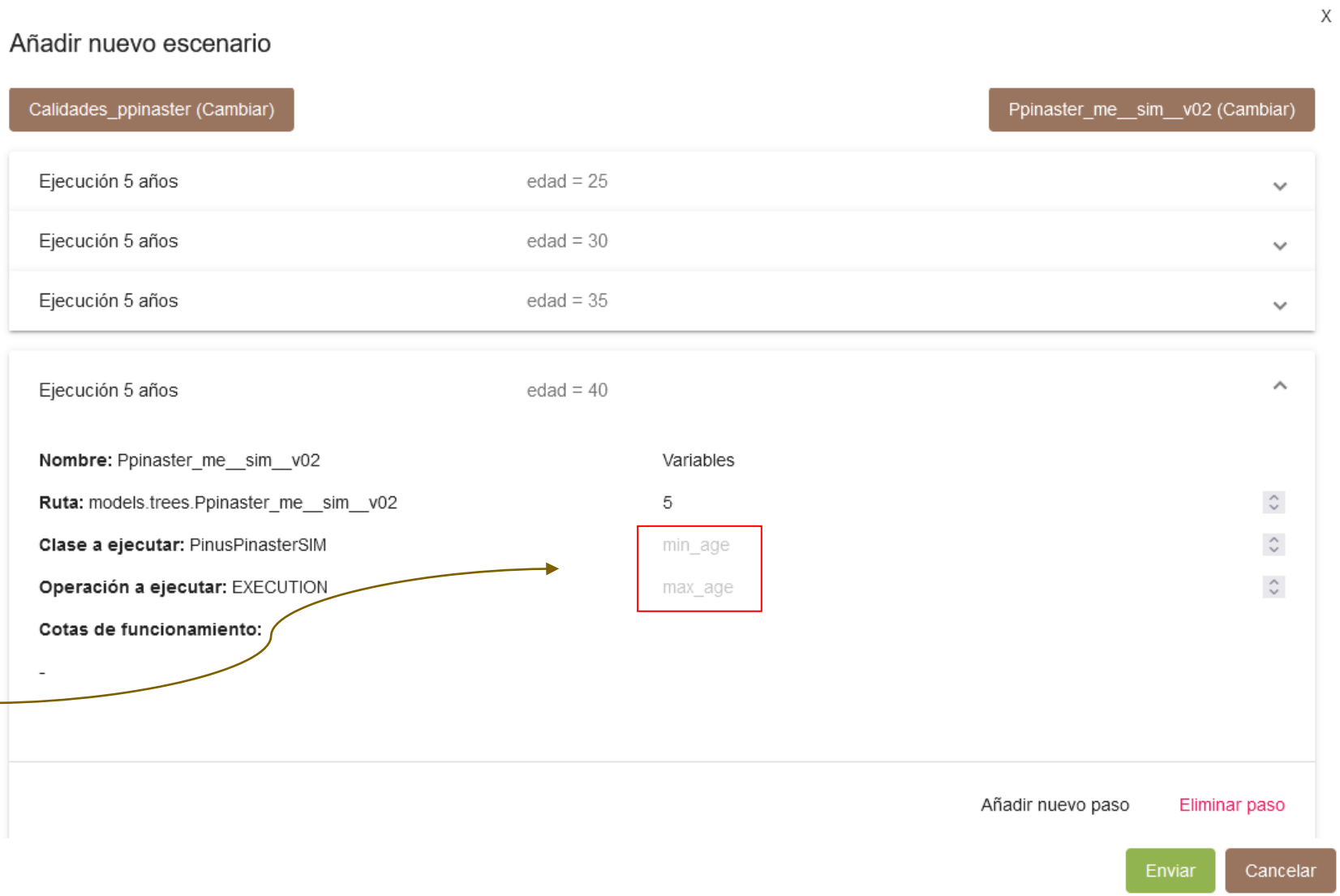


Silvicultural scenarios on SIMANFOR – Part 2

Silvicultural scenarios on SIMANFOR – Part 2

In the previous section, we have seen how to set up a silvicultural scenario in SIMANFOR for a single plot or many plots with the same age, but… have you ever thought about what happens if we try to simulate plots with different ages? We would have to create a scenario for each one of them taking into account their starting age so that each activity would be applied at the same age for each case, and this would be very tedious…

To make it easier, some variables determine the máximum and mínimum age that a plot must have for the projection or harvest to be applied, let's see how they work.



Silvicultural scenarios on SIMANFOR – Part 2

We Will use as an example the same silvicultural scenario as in the previous section, and as input data we will use 4 plots with different ages (20, 32, 41 and 47 years old).

As you can already guess, if we want to apply the first harvest at 40 years, the projections we have to apply will be different for each case, and we should even not apply the 40-year thinning to the last plots…
It looks like it's getting complicated, let's see how to manage it.

Harvest	Age (years)	Type	Criteria	Intensity (%)
Prec. Thinning	20	Not applied to our stand		
Thinning	40	Systematic	N	19,1
Thinning	40	By below	N	23,7
Thinning	50	By below	N	40,5
Thinning	65	By below	N	27,3
Rotation	80	Not neccesary		

Silvicultural scenarios on SIMANFOR – Part 2

To understand where each plot has to start running, we will expand our summary table by introducing the projections.

Process	Age (years)	Type	Criteria	Intensity (%)
Prec. Thinning	20		Not applied	
Projection	20 to 25		5 years	
Projection	25 to 30		5 years	
Projection	30 to 35		5 years	
Projection	35 to 40		5 years	
Thinning	40	Systematic	N	19,1
Thinning	40	By below	N	23,7
Projection	40 to 45		5 years	
Projection	45 to 50		5 years	
Thinning	50	By below	N	40,5
Projection	50 to 55		5 years	
Projection	55 to 60		5 years	
Projection	60 to 65		5 years	
Thinning	65	By below	N	27,3
Projection	65 to 70		5 years	
Projection	70 to 75		5 years	
Projection	75 to 80		5 years	
Rotation	80		Not neccesary	

Silvicultural scenarios on SIMANFOR – Part 2

Now, let's mark the part of the scenario where each of the plots should start the simulation.

Note: you may have noticed that when the age is not a multiple of 5 there is a mismatch. We Will place the plots on the stage with a margin of 3 years (above and below) the stage age, assuming those 3 years as an "error" (it is not a big deal, this can be a problem in fast-growing species, but their growth sub-models are usually designed for shorter projection times).

Plots

20

32

41

47

Process	Age (years)	Type	Criteria	Intensity (%)
Prec. Thinning	20		Not applied	
Projection	20 to 25		5 years	
Projection	25 to 30		5 years	
Projection	30 to 35		5 years	
Projection	35 to 40		5 years	
Thinning	40	Systematic	N	19,1
Thinning	40	By below	N	23,7
Projection	40 to 45		5 years	
Projection	45 to 50		5 years	
Thinning	50	By below	N	40,5
Projection	50 to 55		5 years	
Projection	55 to 60		5 years	
Projection	60 to 65		5 years	
Thinning	65	By below	N	27,3
Projection	65 to 70		5 years	
Projection	70 to 75		5 years	
Projection	75 to 80		5 years	
Rotation	80		Not neccesary	

Silvicultural scenarios on SIMANFOR – Part 2

More…

What we want to do in this section is to apply the same silvicultural scenario for plots in different initial ages. We already know where each one has to start running, how do we tell SIMANFOR? We will use the mínimum and máximum age variables, but first, we are going to put the reference age at which each intervention begins and ends as a guide.

	Process	Age (years)	Type	Criteria	Intensity (%)	Standard initial plot age (years)	Minimum age (years)	Maximum age (years)	Standard final plot age (years)
20	Prec. Thinning	20		Not applied		20			20
	Projection	20 to 25		5 years		20			25
	Projection	25 to 30		5 years		25			30
32	Projection	30 to 35		5 years		30			35
	Projection	35 to 40		5 years		35			40
41	Thinning	40	Systematic	N	19,1	40			40
	Thinning	40	By below	N	23,7	40			40
	Projection	40 to 45		5 years		40			45
47	Projection	45 to 50		5 years		45			50
	Thinning	50	By below	N	40,5	50			50
	Projection	50 to 55		5 years		50			55
	Projection	55 to 60		5 years		55			60
	Projection	60 to 65		5 years		60			65
	Thinning	65	By below	N	27,3	65			65
	Projection	65 to 70		5 years		65			70
	Projection	70 to 75		5 years		70			75
	Projection	75 to 80		5 years		75			80
	Rotation	80		Not neccesary		80			-

Silvicultural scenarios on SIMANFOR – Part 2

For the first activity at 20 years, the minimum age will be the age value from which thinning will be applied on the plot. Similarly, the máximum age will be the age value from which thinning will NOT be applied (that step will be skipped). For this purpose, we are going to rescue the "error" value of 3 years we introduce before, establishing the minimum age for thinning as 17 years and the maximum age as 23 years.

Process	Age (years)	Type	Criteria	Intensity (%)	Standard initial plot age (years)	Minimum age (years)	Maximum age (years)	Standard final plot age (years)
20 Prec. Thinning	20		Not applied		20	17	23	20
Projection	20 to 25		5 years		20			25
Projection	25 to 30		5 years		25			30
32 Projection	30 to 35		5 years		30			35
Projection	35 to 40		5 years		35			40
41 Thinning	40	Systematic	N	19,1	40			40
Thinning	40	By below	N	23,7	40			40
Projection	40 to 45		5 years		40			45
47 Projection	45 to 50		5 years		45			50
Thinning	50	By below	N	40,5	50			50
Projection	50 to 55		5 years		50			55
Projection	55 to 60		5 years		55			60
Projection	60 to 65		5 years		60			65
Thinning	65	By below	N	27,3	65			65
Projection	65 to 70		5 years		65			70
Projection	70 to 75		5 years		70			75
Projection	75 to 80		5 years		75			80
Rotation	80		Not neccesary		80			-

Silvicultural scenarios on SIMANFOR – Part 2

Following the same criteria, we are going to apply them to all the processes we have in our scenario.

Note: Please note that thinning processes do not advance in time, so the minimum and maximum ages are maintained in the next process.

Process	Age (years)	Type	Criteria	Intensity (%)	Standard initial plot age (years)	Minimum age (years)	Maximum age (years)	Standard final plot age (years)
20 Prec. Thinning	20		Not applied		20	17	23	20
Projection	20 to 25		5 years		20	17	23	25
Projection	25 to 30		5 years		25	22	27	30
32 Projection	30 to 35		5 years		30	27	32	35
Projection	35 to 40		5 years		35	32	37	40
41 Thinning	40	Systematic	N	19,1	40	37	42	40
Thinning	40	By below	N	23,7	40	37	42	40
Projection	40 to 45		5 years		40	37	42	45
47 Projection	45 to 50		5 years		45	42	47	50
Thinning	50	By below	N	40,5	50	47	52	50
Projection	50 to 55		5 years		50	47	52	55
Projection	55 to 60		5 years		55	52	57	60
Projection	60 to 65		5 years		60	57	62	65
Thinning	65	By below	N	27,3	65	62	67	65
Projection	65 to 70		5 years		65	62	67	70
Projection	70 to 75		5 years		70	67	72	75
Projection	75 to 80		5 years		75	72	77	80
Rotation	80		Not neccesary		80	-	-	-

Silvicultural scenarios on SIMANFOR – Part 2

We've got it!

We only need to write the scenario in SIMANFOR, and in this way, we will be able to use the same scenario for an inventory with plots of different ages.

I recommend that you first make a table like the one we have prepared here to avoid mistakes, as this can sometimes lead to confusión.

Corta	Edad (años)	Tipo	Criterio	Intensidad (%)	Edad estándar inicial de la parcela (años)	Edad minima (años)	Edad máxima (años)	Edad estándar final de la parcela (años)
Prec. Thinning	20		Not applied		20	17	23	20
Projection	20 to 25		5 years		20	17	23	25
Projection	25 to 30		5 years		25	22	27	30
Projection	30 to 35		5 years		30	27	32	35
Projection	35 to 40		5 years		35	32	37	40
Thinning	40	Systematic	N	19,1	40	37	42	40
Thinning	40	By below	N	23,7	40	37	42	40
Projection	40 to 45		5 years		40	37	42	45
Projection	45 to 50		5 years		45	42	47	50
Thinning	50	By below	N	40.5	50	47	52	50
Projection	50 to 55							

Proyección 5 años edad = 25

Nombre: Ppinaster_me__sim__v02 Variables

Ruta: models.trees.Ppinaster_me__sim__v02 5

Clase a ejecutar: PinusPinasterSIM 17

Operación a ejecutar: EXECUTION 23

Cotas de funcionamiento:

Clara sistemática 19,1% de N

Nombre: Systematic Variables

Ruta: models.harvest.cut_down_systematic 0

Clase a ejecutar: CutDownSystematics 37

Operación a ejecutar: HARVEST 42

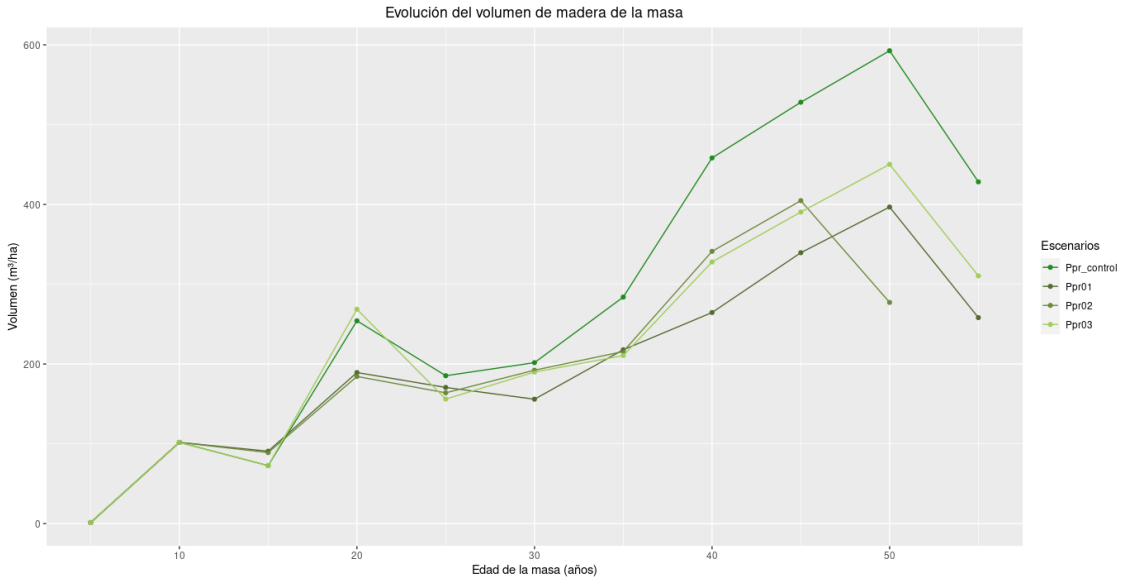
Cotas de funcionamiento: Número de árboles

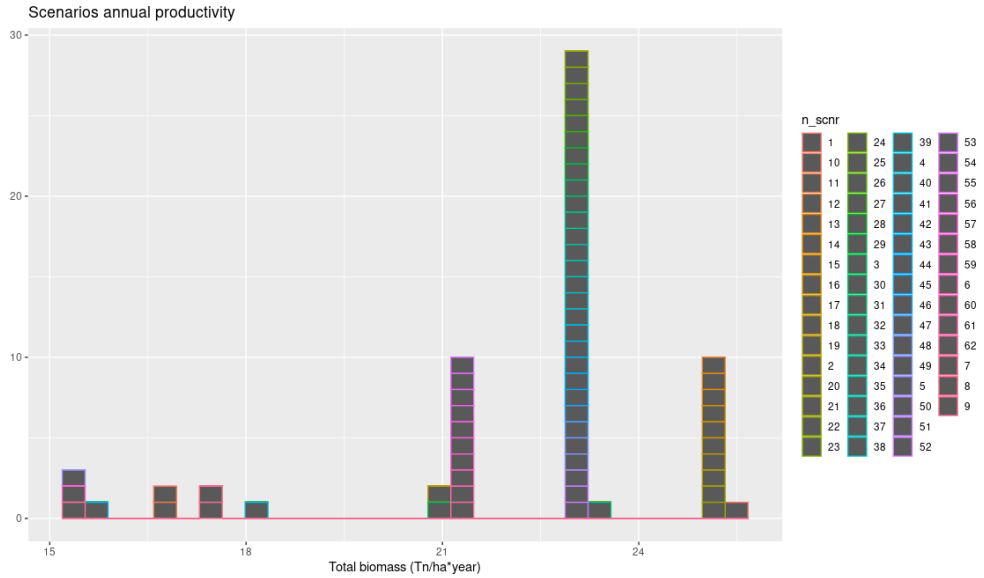
- 19

Scenarios comparison

Scenarios comparison

Finally, once we have applied the same scenario to several plots or different scenarios on the same plot, it is interesting to draw our results and compare them. In this repository, you have a R script that allows you to load the SIMANFOR results and compare them graphically. Go ahead and try it! I'm sure you will discover interesting things from your results.





SIMANFOR

Results

Instituto Universitario de Investigación iuFOR GESTIÓN FORESTAL SOSTENIBLE

- Yield table
- Description
- Metadata
- Scenario information
- Plot information
- Trees information
- Announcements

Yield table

Yield table

When we open the results file we are located in the “Summary” sheet, where we have a yield table like this.

			Zona de estudio					Inventario		Del_Rio_et_al_2006							
			Monte					Parcela		12							
			Composición específica					Modelo		Ppinaster_me__sim__v02							
			Fecha simulación		2022-07-28 11:54:07			Escenario		test							
			Masa antes de la corta			Masa extraída			Masa después de la corta				Masa muerta			Masa incorporada	
Edad (años)	Ho (m)	N (pies/ha)	dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	dg (cm)	V (m3/ha)	N (pies/ha)	dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	dg (cm)	V (m3/ha)	N (pies/ha)	G (m2/ha)
20	4.8	1485	10.1	11.91	28.52												
25	5.99	1523.96	12.64	19.12	56.67								2.87	4.69	0.01	41.82	0.36
30	7.11	1520.86	15.08	27.16	94.28								3.1	2.54	0.01	0	0
35	8.15	1517.39	17.38	35.98	141.34								3.47	3.26	0.01	0	0
40	9.13	1513.35	19.54	45.39	196.96	579.21	24	67.74	934.14	20.24	30.05	129.22	4.04	3.93	0.02	0	0
45	10.08	932.07	22.51	37.08	173.73								2.07	10.57	0.06	0	0
50	11.05	929.69	24.71	44.59	226.23	376.53	22.99	81.17	553.17	25.82	28.96	145.06	2.37	6.79	0.05	0	0
55	12	552.04	28.17	34.41	185.28								1.12	6.23	0.01	0	0
60	12.99	550.79	30.48	40.18	231.67								1.26	12.74	0.09	0	0
65	13.93	549.38	32.7	46.14	282.53	149.98	30.61	67.85	399.4	33.45	35.1	214.68	1.41	13.79	0.13	0	0
70	14.85	398.49	35.76	40.03	258.85								0.9	4.06	0.01	0	0
75	15.79	397.5	38.03	45.15	307.73								1	4.33	0.01	0	0
80	16.69	396.39	40.23	50.37	360.15								1.11	4.61	0.01	0	0

Resumen | Descripción | Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inventariados

Yield table

At the top you will find important information about the origin of these results, so easily you can remember how the file was created.

The first 3 fields Will only be filled in if you provide this information to the initial inventory (not essential), the other fields are created automatically.

Zona de estudio		Inventario	Del_Rio_et_al_2006
Monte		Parcela	12
Composición específica		Modelo	Ppinaster_me__sim__v02
Fecha simulación	2022-07-28 11:54:07	Escenario	test

		Masa antes de la corta				Masa extraída			Masa después de la corta				Masa muerta			Masa incorporada	
Edad (años)	Ho (m)	N (pies/ha)	dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	dg (cm)	V (m3/ha)	N (pies/ha)	dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	dg (cm)	V (m3/ha)	N (pies/ha)	G (m2/ha)
20	4.8	1485	10.1	11.91	28.52												
25	5.99	1523.96	12.64	19.12	56.67								2.87	4.69	0.01	41.82	0.36
30	7.11	1520.86	15.08	27.16	94.28								3.1	2.54	0.01	0	0
35	8.15	1517.39	17.38	35.98	141.34								3.47	3.26	0.01	0	0
40	9.13	1513.35	19.54	45.39	196.96	579.21	24	67.74	934.14	20.24	30.05	129.22	4.04	3.93	0.02	0	0
45	10.08	932.07	22.51	37.08	173.73								2.07	10.57	0.06	0	0
50	11.05	929.69	24.71	44.59	226.23	376.53	22.99	81.17	553.17	25.82	28.96	145.06	2.37	6.79	0.05	0	0
55	12	552.04	28.17	34.41	185.28								1.12	6.23	0.01	0	0
60	12.99	550.79	30.48	40.18	231.67								1.26	12.74	0.09	0	0
65	13.93	549.38	32.7	46.14	282.53	149.98	30.61	67.85	399.4	33.45	35.1	214.68	1.41	13.79	0.13	0	0
70	14.85	398.49	35.76	40.03	258.85								0.9	4.06	0.01	0	0
75	15.79	397.5	38.03	45.15	307.73								1	4.33	0.01	0	0
80	16.69	396.39	40.23	50.37	360.15								1.11	4.61	0.01	0	0

Resumen | Descripción | Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inventariados

Yield table

The area in the box is a classic yield table, showing the age and dominant height evolution of the stand, as well as relevant information before and after each thinning process, and also information on the extracted trees by thinning.

SIMANFOR			Zona de estudio					Inventario		Del_Rio_et_al_2006							
			Monte					Parcela		12							
			Composición específica					Modelo		Ppinaster_me__sim__v02							
			Fecha simulación			2022-07-28 11:54:07		Escenario		test							
			Masa antes de la corta				Masa extraída			Masa después de la corta				Masa muerta			Masa incorporada	
Edad (años)	Ho (m)	N (pies/ha)	dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	dg (cm)	V (m3/ha)	N (pies/ha)	dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	dg (cm)	V (m3/ha)	N (pies/ha)	G (m2/ha)
20	4.8	1485	10.1	11.91	28.52												
25	5.99	1523.96	12.64	19.12	56.67								.87	4.69	0.01	41.82	0.36
30	7.11	1520.86	15.08	27.16	94.28								.1	2.54	0.01	0	0
35	8.15	1517.39	17.38	35.98	141.34								.47	3.26	0.01	0	0
40	9.13	1513.35	19.54	45.39	196.96	579.21	24	67.74	934.14	20.24	30.05	129.22	.04	3.93	0.02	0	0
45	10.08	932.07	22.51	37.08	173.73								.07	10.57	0.06	0	0
50	11.05	929.69	24.71	44.59	226.23	376.53	22.99	81.17	553.17	25.82	28.96	145.06	.37	6.79	0.05	0	0
55	12	552.04	28.17	34.41	185.28								.12	6.23	0.01	0	0
60	12.99	550.79	30.48	40.18	231.67								.26	12.74	0.09	0	0
65	13.93	549.38	32.7	46.14	282.53	149.98	30.61	67.85	399.4	33.45	35.1	214.68	.41	13.79	0.13	0	0
70	14.85	398.49	35.76	40.03	258.85								.9	4.06	0.01	0	0
75	15.79	397.5	38.03	45.15	307.73									4.33	0.01	0	0
80	16.69	396.39	40.23	50.37	360.15								.11	4.61	0.01	0	0

Resumen | Descripción | Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inventariados

Yield table

Finally, SIMANFOR offers some “extras” to these classical yield tables, such as information on dead and ingrowth trees (when the model has such sub-models), and even information on the mushroom, pinyon or other non-timber products production (if the model has such sub-models and we provide the necessary data, see data sheets).

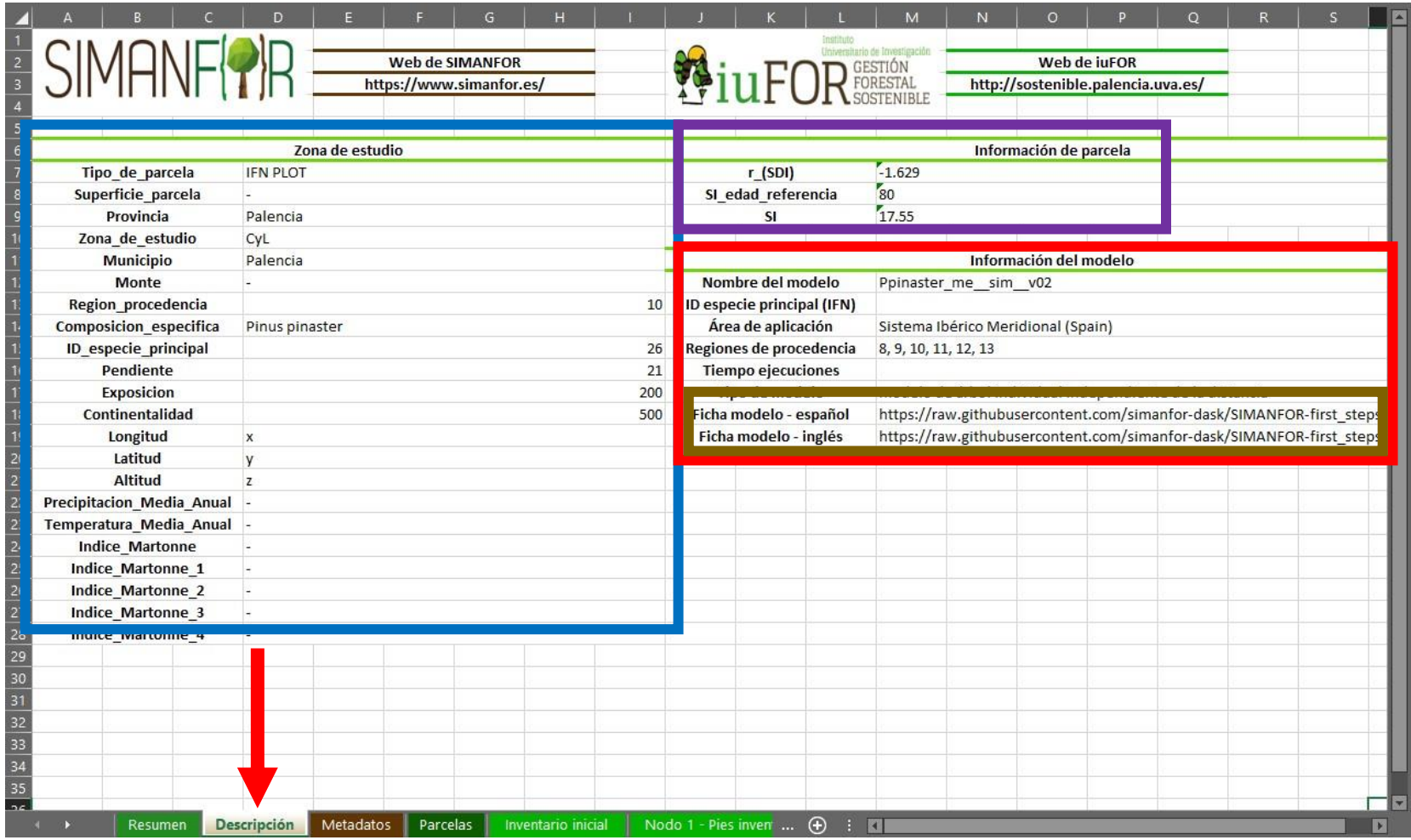
1	SIMANFOR			Zona de estudio					Inventario		Del_Rio_et_al_2006							
2				Monte					Parcela		12							
3				Composición específica					Modelo		Ppinaster_me__sim__v02							
4				Fecha simulación		2022-07-28 11:54:07			Escenario		test							
5																		
6				Masa antes de la corta			Masa extraída			Masa después de la corta				Masa muerta			Masa incorporada	
7	Edad (años)	Ho (m)	N (pies/ha)	dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	dg (cm)	V (m3/ha)	N (pies/ha)	dg (cm)	G (m2/ha)	V (m3/ha	N (pies/ha)	dg (cm)	V (m3/ha)	N (pies/ha)	G (m2/ha)
8	20	4.8	1485	10.1	11.91	28.52												
9	25	5.99	1523.96	12.64	19.12	56.67								2.87	4.69	0.01	41.82	0.36
10	30	7.11	1520.86	15.08	27.16	94.28								3.1	2.54	0.01	0	0
11	35	8.15	1517.39	17.38	35.98	141.34								3.47	3.26	0.01	0	0
12	40	9.13	1513.35	19.54	45.39	196.96	579.21	24	67.74	934.14	20.24	30.05	129.22	4.04	3.93	0.02	0	0
13	45	10.08	932.07	22.51	37.08	173.73								2.07	10.57	0.06	0	0
14	50	11.05	929.69	24.71	44.59	226.23	376.53	22.99	81.17	553.17	25.82	28.96	145.06	2.37	6.79	0.05	0	0
15	55	12	552.04	28.17	34.41	185.28								1.12	6.23	0.01	0	0
16	60	12.99	550.79	30.48	40.18	231.67								1.26	12.74	0.09	0	0
17	65	13.93	549.38	32.7	46.14	282.53	149.98	30.61	67.85	399.4	33.45	35.1	214.68	1.41	13.79	0.13	0	0
18	70	14.85	398.49	35.76	40.03	258.85								0.9	4.06	0.01	0	0
19	75	15.79	397.5	38.03	45.15	307.73								1	4.33	0.01	0	0
20	80	16.69	396.39	40.23	50.37	360.15								1.11	4.61	0.01	0	0

Resumen | Descripción | Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inventariados

Description

Description

The second sheet is “Description”, where you can find information about the study area (variables that you have to provide to the simulator), plot information that doesn’t vary (as Site Index) and information related to the model you used. In the last section, you will also find links to the model’s data sheet, both Spanish and English, where you can find more information.



SIMANFOR

Web de SIMANFOR
https://www.simanfor.es/

iuFOR Instituto Universitario de Investigación GESTIÓN FORESTAL SOSTENIBLE

Web de iuFOR
http://sostenible.palencia.uva.es/

Zona de estudio	
Tipo_de_parcela	IFN PLOT
Superficie_parcela	-
Provincia	Palencia
Zona_de_estudio	CyL
Municipio	Palencia
Monte	-
Region_procedencia	10
Composicion_especifica	Pinus pinaster
ID_especie_principal	26
Pendiente	21
Exposicion	200
Continentalidad	500
Longitud	x
Latitud	y
Altitud	z
Precipitacion_Media_Anual	-
Temperatura_Media_Anual	-
Indice_Martonne	-
Indice_Martonne_1	-
Indice_Martonne_2	-
Indice_Martonne_3	-
Indice_Martonne_4	-

Información de parcela	
r_(SDI)	-1.629
SI_edad_referencia	80
SI	17.55

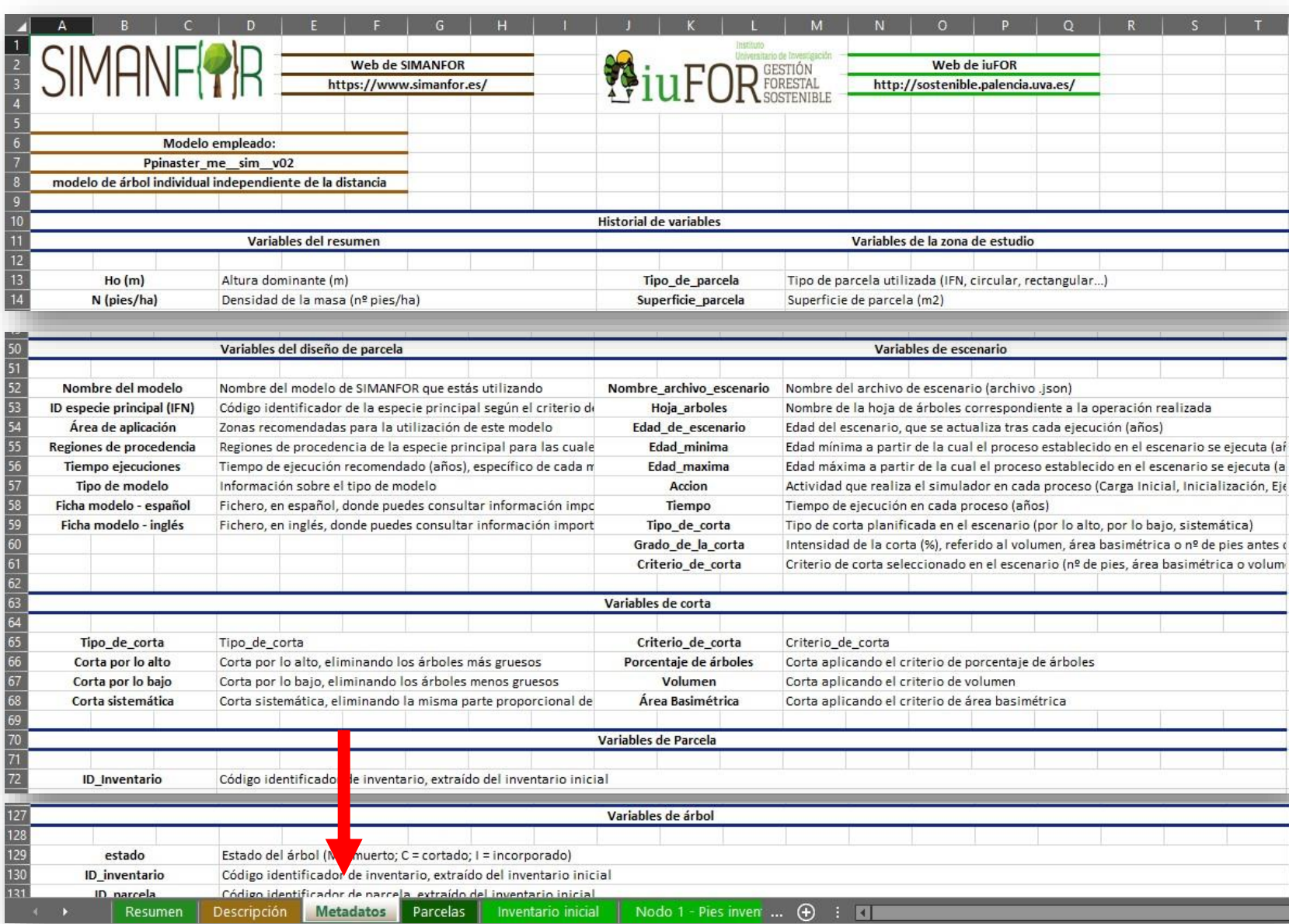
Información del modelo	
Nombre del modelo	Ppinaster_me__sim__v02
ID especie principal (IFN)	
Área de aplicación	Sistema Ibérico Meridional (Spain)
Regiones de procedencia	8, 9, 10, 11, 12, 13
Tiempo ejecuciones	
Ficha modelo - español	https://raw.githubusercontent.com/simanfor-dask/SIMANFOR-first_steps
Ficha modelo - inglés	https://raw.githubusercontent.com/simanfor-dask/SIMANFOR-first_steps

Resumen | Descripción | Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inven ...

Metadata

Metadata

The third sheet is very important: metadata. This sheet contains all the variables that you can find in the results file, grouped according to the sheet where you can find them. Do not hesitate to check it when you have doubts about the meaning of a variable or the units in which it is shown.



Web de SIMANFOR	https://www.simanfor.es/	Web de iuFOR	http://sostenible.palencia.uva.es/

Modelo empleado:
Ppinaster_me__sim__v02
modelo de árbol individual independiente de la distancia

Historial de variables

Variables del resumen		Variables de la zona de estudio	
Ho (m)	Altura dominante (m)	Tipo_de_parcela	Tipo de parcela utilizada (IFN, circular, rectangular...)
N (pies/ha)	Densidad de la masa (nº pies/ha)	Superficie_parcela	Superficie de parcela (m2)

Variables del diseño de parcela		Variables de escenario	
Nombre del modelo	Nombre del modelo de SIMANFOR que estás utilizando	Nombre_archivo_escenario	Nombre del archivo de escenario (archivo .json)
ID especie principal (IFN)	Código identificador de la especie principal según el criterio d	Hoja_arboles	Nombre de la hoja de árboles correspondiente a la operación realizada
Área de aplicación	Zonas recomendadas para la utilización de este modelo	Edad_de_escenario	Edad del escenario, que se actualiza tras cada ejecución (años)
Regiones de procedencia	Regiones de procedencia de la especie principal para las cuale	Edad_minima	Edad mínima a partir de la cual el proceso establecido en el escenario se ejecuta (aí
Tiempo ejecuciones	Tiempo de ejecución recomendado (años), específico de cada m	Edad_maxima	Edad máxima a partir de la cual el proceso establecido en el escenario se ejecuta (a
Tipo de modelo	Información sobre el tipo de modelo	Accion	Actividad que realiza el simulador en cada proceso (Carga Inicial, Inicialización, Eje
Ficha modelo - español	Fichero, en español, donde puedes consultar información impo	Tiempo	Tiempo de ejecución en cada proceso (años)
Ficha modelo - inglés	Fichero, en inglés, donde puedes consultar información import	Tipo_de_corta	Tipo de corta planificada en el escenario (por lo alto, por lo bajo, sistemática)
		Grado_de_la_corta	Intensidad de la corta (%), referido al volumen, área basimétrica o nº de pies antes
		Criterio_de_corta	Criterio de corta seleccionado en el escenario (nº de pies, área basimétrica o volum

Variables de corta

Tipo_de_corta	Tipo_de_corta	Criterio_de_corta	Criterio_de_corta
Corta por lo alto	Corta por lo alto, eliminando los árboles más gruesos	Porcentaje de árboles	Corta aplicando el criterio de porcentaje de árboles
Corta por lo bajo	Corta por lo bajo, eliminando los árboles menos gruesos	Volumen	Corta aplicando el criterio de volumen
Corta sistemática	Corta sistemática, eliminando la misma parte proporcional de	Área Basimétrica	Corta aplicando el criterio de área basimétrica

Variables de Parcela

ID_Inventario	Código identificado de inventario, extraído del inventario inicial

Variables de árbol

estado	Estado del árbol (M muerto; C = cortado; I = incorporado)
ID_inventario	Código identificador de inventario, extraído del inventario inicial
ID_parcela	Código identificador de parcela, extraído del inventario inicial

Resumen | Descripción | Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inven ...

Scenario information

Scenario information

The fourth sheet, “Plots”, includes both the information on the silvicultural scenario and the plot.

The first column refers to the name of the file containing the forestry scenario (you can skip it, it has uses that are not interesting on the web); the second red box contains all the silvicultural scenarios. This is interesting, as it can be used as a guide to check why different variables have changed.

Nombre_archivo_escenario	Hoja_arboles	Edad_de_escenario	Edad_minima	Edad_maxima	Accion	Tiempo	Tipo_de_corta	Grado_de_la_corta	Criterio_de_corta	ID_Inventario	ID_Parcela
DelRio2006.json	Inventario inicial	20	0	0	Carga Inicial	0	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 1 - Pies inventariados	20	-	-	Inicialización	0	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 2 - Pies inventariados	25	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 3 - Pies inventariados	30	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 4 - Pies inventariados	35	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 5 - Pies inventariados	40	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 6 - Pies inventariados	40	-	-	Corta	0	Corta sistemática	19.1	Porcentaje de árbo	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 7 - Pies inventariados	40	-	-	Corta	0	Corta por lo bajo	23.7	Porcentaje de árbo	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 8 - Pies inventariados	45	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 9 - Pies inventariados	50	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 10 - Pies inventariados	50	-	-	Corta	0	Corta por lo bajo	40.5	Porcentaje de árbo	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 11 - Pies inventariados	55	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 12 - Pies inventariados	60	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 13 - Pies inventariados	65	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 14 - Pies inventariados	65	-	-	Corta	0	Corta por lo bajo	27.3	Porcentaje de árbo	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 15 - Pies inventariados	70	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 16 - Pies inventariados	75	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 17 - Pies inventariados	80	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12

Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inventariados | Nodo 2 - Pies in

Plot information

Plot information

In the “Plots” sheet, next to the forestry scenario information, you will find all the interesting variables that SIMANFOR has been able to calculate with your data. The variables are ordered in such a way that those related to the basal área are followed by the diameter variables, then the height variables, and so on… until the end.

Remember that you can check their meaning and units on the metadata sheet.

ID_Inventario	ID_Parcela	Anho	T	N	N_extraido	N_muerto	N_incorporado	G	g_maxima	g_minima	g_medio	G_extraida	G_muerta	G_incorporada	dbh_maximo	dbh_minimo	dbh_medio	dg	Do	Seccion_
Del_Rio_et_al_2006	12	2006	20	1485				11.6										10		
Del_Rio_et_al_2006	12	2006	20	1485		0	0	11.91	112.48	49.99	80.2				11.97	7.98	9.97	10.1	11.97	112.48
Del_Rio_et_al_2006	12	2011	25	1523.96		2.87	41.82	19.12	168.75	86.59	125.49		0	0.36	14.66	10.5	12.53	12.64	14.66	168.75
Del_Rio_et_al_2006	12	2016	30	1520.86		3.1	0	27.16	232.21	129.66	178.55		0	0	17.19	12.85	14.97	15.08	17.19	232.21
Del_Rio_et_al_2006	12	2021	35	1517.39		3.47	0	35.98	301.72	177.5	237.12		0	0	19.6	15.03	17.28	17.38	19.6	301.72
Del_Rio_et_al_2006	12	2026	40	1513.35		4.04	0	45.39	376.29	228.55	299.94		0	0	21.89	17.06	19.45	19.54	21.89	376.29
Del_Rio_et_al_2006	12	2026	40	1224.3	19.1	0	0	36.72	376.29	228.55	299.94	19.1	0	0	21.89	17.06	19.45	19.54	21.89	376.29
Del_Rio_et_al_2006	12	2026	40	934.14	23.7	0	0	30.05	376.29	232.48	321.69	18.17	0	0	21.89	17.2	20.17	20.24	21.89	376.29
Del_Rio_et_al_2006	12	2031	45	932.07		2.07	0	37.08	461.94	293.91	397.84		0.02	0	24.25	19.34	22.44	22.51	24.25	461.94
Del_Rio_et_al_2006	12	2036	50	929.69		2.37	0	44.59	554.12	359.74	479.6		0.01	0	26.56	21.4	24.65	24.71	26.56	554.12
Del_Rio_et_al_2006	12	2036	50	553.17	40.5	0	0	28.96	554.12	450.59	523.49	35.05	0	0	26.56	23.95	25.79	25.82	26.56	554.12
Del_Rio_et_al_2006	12	2041	55	552.04		1.12	0	34.41	659.53	538.36	623.33		0	0	28.98	26.18	28.15	28.17	28.98	659.53
Del_Rio_et_al_2006	12	2046	60	550.79		1.26	0	40.18	772.32	630.48	729.54		0.02	0	31.36	28.33	30.45	30.48	31.36	772.32
Del_Rio_et_al_2006	12	2051	65	549.38		1.41	0	46.14	890.19	724.65	839.79		0.02	0	33.67	30.38	32.67	32.7	33.67	890.19
Del_Rio_et_al_2006	12	2051	65	399.4	27.3	0	0	35.1	890.19	737.95	878.81	23.92	0	0	33.67	30.65	33.45	33.45	33.67	890.19
Del_Rio_et_al_2006	12	2056	70	398.49		0.9	0	40.03	1019.82	843.76	1004.48		0	0	36.03	32.78	35.76	35.76	36.03	1019.82
Del_Rio_et_al_2006	12	2061	75	397.5		1	0	45.15	1156.05	952.59	1135.76		0	0	38.37	34.83	38.02	38.03	38.37	1156.05
Del_Rio_et_al_2006	12	2066	80	396.39		1.11	0	50.37	1297.05	1062.75	1270.82		0	0	40.64	36.78	40.22	40.23	40.64	1297.05

Resumen | Descripción | Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inven ...

Trees information

Trees information

After the “Plot” sheet you Will find several tabs with tree information. Each of them refers to a process carried out in the silvicultural scenario, therefore, it allows you to access the information of each of the tres in a specific process of the scenario, knowing its evolution in detail.

IMPORTANT! In the second column of the plots sheet, you will find a “guide” that Will tell you, about each of the processes carried out in the simulator, in which tab you can find the information about the tres.

Nombre_archivo_escenario	Hoja_arboles	Edad_de_escenario	Edad_minima	Edad_maxima	Accion	Tiempo	Tipo_de_corta	Grado_de_la_corta	Criterio_de_corta	ID_Inventario	ID_Parcela
DelRio2006.json	Inventario inicial	20	0	0	Carga Inicial	0	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 1 - Pies inventariados	20	-	-	Inicialización	0	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 2 - Pies inventariados	25	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 3 - Pies inventariados	30	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 4 - Pies inventariados	35	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 5 - Pies inventariados	40	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 6 - Pies inventariados	40	-	-	Corta	0	Corta sistemática	19.1	Porcentaje de árbol	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 7 - Pies inventariados	40	-	-	Corta	0	Corta por lo bajo	23.7	Porcentaje de árbol	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 8 - Pies inventariados	45	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 9 - Pies inventariados	50	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 10 - Pies inventariados	50	-	-	Corta	0	Corta por lo bajo	40.5	Porcentaje de árbol	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 11 - Pies inventariados	55	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 12 - Pies inventariados	60	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 13 - Pies inventariados	65	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 14 - Pies inventariados	65	-	-	Corta	0	Corta por lo bajo	27.3	Porcentaje de árbol	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 15 - Pies inventariados	70	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 16 - Pies inventariados	75	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12
DelRio2006.json	Nodo 17 - Pies inventariados	80	-	-	Ejecución	5	-	-	-	Del_Rio_et_al_2006	12

Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inventariados | Nodo 2 - Pies in

Trees information

The first sheet, “Initial inventory”, is the original data. It simply shows your initial inventory, so you will have it available if you need to review it.

ID_invent	ID_parcela	ID_arbol	TREE_ID_I	TREE_ID_I	TREE_ID_I	TREE_ID_c	especie	t	factor_exp	dbh_1	dbh_2	dbh	h	h_tocon	corteza_1	corteza_2	corteza	g	g_
12	1	6	0	0	0	0	26	28	14.15			31.75	15.5	0				791.73	
12	1	14	0	0	0	0	26	28	14.15			28.85	15	0				653.7	
12	1	22	0	0	0	0	26	28	14.15			28.35	14.5	0				631.24	
12	1	24	0	0	0	0	26	28	14.15			28.3	15	0				629.02	
12	1	3	0	0	0	0	26	28	14.15			27.8	14	0				606.99	
12	1	11	0	0	0	0	26	28	14.15			26.25	15	0				541.19	
12	1	25	0	0	0	0	26	28	14.15			26.2	15	0				539.13	
12	1	34	0	0	0	0	26	28	14.15			25.85	14.5	0				524.82	
12	1	8	0	0	0	0	26	28	14.15			25.8	15.5	0				522.79	

Descripción | Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inventariados

Trees information

From now on, we start the so-called "Nodes", which represent each of the internal computational processes that the simulator goes through.
"Node 1" shows the "Initialization" of the simulator, where SIMANFOR uses the tree and plot information provided to input all the missing variables and to know the status of the plot at that initial moment (here it is explained in more detail).

From there, each sheet shows the results of a projection or a harvest.

ID_inventario	ID_parcela	ID_arbol	estado	especie	t	rumbo	distancia	factor_expansion	dbh	h	g	bal	g_ha	circunferencia_normal	esbeltez	cr	lcw
Del_Rio_et_al_2006	12	1		26				165	9.97	4.8	78.11	5.57	1.29	31.33	48.13	0.53	1.61
Del_Rio_et_al_2006	12	2		26				165	9.97	5.5	78.11	6.86	1.29	31.33	55.15	0.52	1.6
Del_Rio_et_al_2006	12	3		26				165	9.97	4.1	78.11	8.15	1.29	31.33	41.11	0.53	1.61
Del_Rio_et_al_2006	12	4		26				165	11.97	4.8	112.48	0	1.86	37.6	40.11	0.55	1.94
Del_Rio_et_al_2006	12	5		26				165	11.97	5.5	112.48	1.86	1.86	37.6	45.96	0.54	1.93
Del_Rio_et_al_2006	12	6		26				165	11.97	4.1	112.48	3.71	1.86	37.6	34.26	0.54	1.94
Del_Rio_et_al_2006	12	7		26				165	7.98	4.8	49.99	9.43	0.82	25.06	60.16	0.52	1.28
Del_Rio_et_al_2006	12	8		26				165	7.98	5.5	49.99	10.26	0.82	25.06	68.94	0.51	1.28
Del_Rio_et_al_2006	12	9		26				165	7.98	4.1	49.99	11.08	0.82	25.06	51.39	0.52	1.29

Descripción | Metadatos | Parcelas | Inventario inicial | Nodo 1 - Pies inventariados

PROJECTIONS

In the image, we can see a node on which a projection was made. If we look at the status column we will see that in some cases it appears empty (these are the trees of the plot on which the survival, growth, ingrowth and remaining variables update have been applied, i.e., the trees on the field); M code means dead trees, and I code means incorporated tres to the stand. From M and I trees, the only interesting column in the expansión factor, that allows us to know what part of our original tree has died/incorporated.

Note: take a close look, to visually represent this with this status coding trees were duplicated

ID_inventario	ID_parcela	ID_arbo	estado	especie	t	rumbo	distancia	factor_expansion	dbh	h	g	bal	g_ha	circunferencia_normal	esbeltez	cr	lcw
Del_Rio_et_al_2006	12	1		6				164.76	2.59	6.08	124.48	8.34	2.05	39.55	48.29	0.48	1.98
Del_Rio_et_al_2006	12	2		6				164.76	2.58	6.9	124.26	12.44	2.05	39.52	54.86	0.46	1.96
Del_Rio_et_al_2006	12	3		6				164.76	2.58	5.23	124.3	10.39	2.05	39.52	41.57	0.48	1.99
Del_Rio_et_al_2006	12	4		6				164.9	4.66	5.99	168.75	0	2.78	46.05	40.88	0.5	2.33
Del_Rio_et_al_2006	12	5		6				164.9	4.65	6.8	168.52	5.56	2.78	46.02	46.4	0.48	2.3
Del_Rio_et_al_2006	12	6		6				164.9	4.65	5.15	168.59	2.78	2.78	46.03	35.16	0.5	2.33
Del_Rio_et_al_2006	12	7		6				178.32	0.51	6.22	86.75	14.49	1.55	33.02	59.15	0.46	1.64
Del_Rio_et_al_2006	12	8		6				178.32	0.5	7.06	86.59	17.58	1.54	32.99	67.26	0.44	1.63
Del_Rio_et_al_2006	12	9		6				178.32	0.5	5.35	86.65	16.04	1.55	33	50.93	0.46	1.65
Del_Rio_et_al_2006	12	1	M	6				0.24	.97	4.8	78.11	5.57	1.29	31.33	48.13	0.53	1.61
Del_Rio_et_al_2006	12	2	M	6				0.24	.97	5.5	78.11	6.86	1.29	31.33	55.15	0.52	1.6
Del_Rio_et_al_2006	12	3	M	6				0.24	.97	4.1	78.11	8.15	1.29	31.33	41.11	0.53	1.61
Del_Rio_et_al_2006	12	4	M	6				0.1	1.97	4.8	112.48	0	1.86	37.6	40.11	0.55	1.94
Del_Rio_et_al_2006	12	5	M	6				0.1	1.97	5.5	112.48	1.86	1.86	37.6	45.96	0.54	1.93
Del_Rio_et_al_2006	12	6	M	6				0.1	1.97	4.1	112.48	3.71	1.86	37.6	34.26	0.54	1.94
Del_Rio_et_al_2006	12	7	M	6				0.62	7.98	4.8	49.99	9.43	0.82	25.06	60.16	0.52	1.28
Del_Rio_et_al_2006	12	8	M	6				0.62	7.98	5.5	49.99	10.26	0.82	25.06	68.94	0.51	1.28
Del_Rio_et_al_2006	12	9	M	6				0.62	7.98	4.1	49.99	11.08	0.82	25.06	51.39	0.52	1.29
Del_Rio_et_al_2006	12	1	I	6				0	2.59	6.08	124.48	0	0	31.33	48.13	0.53	1.61
Del_Rio_et_al_2006	12	2	I	6				0	2.58	6.9	124.26	0	0	31.33	55.15	0.52	1.6
Del_Rio_et_al_2006	12	3	I	6				0	2.58	5.23	124.3	0	0	31.33	41.11	0.53	1.61
Del_Rio_et_al_2006	12	4	I	6				0	4.66	5.99	168.75	0	0	37.6	40.11	0.55	1.94
Del_Rio_et_al_2006	12	5	I	6				0	4.65	6.8	168.52	0	0	37.6	45.96	0.54	1.93
Del_Rio_et_al_2006	12	6	I	6				0	4.65	5.15	168.59	0	0	37.6	34.26	0.54	1.94
Del_Rio_et_al_2006	12	7	I	6				13.94	0.51	6.22	86.75	0	0.12	25.06	60.16	0.52	1.28
Del_Rio_et_al_2006	12	8	I	6				13.94	0.5	7.06	86.59	0	0.12	25.06	68.94	0.51	1.28
Del_Rio_et_al_2006	12	9	I	6				13.94	0.5	5.35	86.65	0	0.12	25.06	51.39	0.52	1.29

Parcelas | Inventario inicial | Nodo 1 - Pies inventariados | Nodo 2 - Pies inventariados

HARVESTS

In the nodes where a harvest has been made, we have a similar situation. If we look at the status column we will see that we have empty cells (where the corresponding part of its expansión factor has already been extracted) and others with a C indicating that this tree was cut. Again, just the column expansión factor is interesting to know what proportion of the tree was extracted in this process.

Note: please note that the tres have been duplicated to represent it with this status coding. At harvests, this only happens when we apply systematic harvests, as it is applied on all tres in the plot equally. When we apply thinning by above/below, then the situation changes (see next page).

ID_inventario	ID_parcela	ID_arbo	estado	especie	t	rumbo	distancia	factor_expansion	dbh	h	g	bal	g_ha	circunferencia_normal	esbeltez	cr	lcw
Del_Rio_et_al_2006	12	1		6				132.51	19.58	9.3	301.16	14.96	3.99	61.52	47.5	0.35	2.88
Del_Rio_et_al_2006	12	2		6				132.5	19.44	10.26	296.74	22.92	3.93	61.07	52.78	0.32	2.81
Del_Rio_et_al_2006	12	3		6				132.51	19.54	8.14	299.73	18.95	3.97	61.37	41.67	0.34	2.88
Del_Rio_et_al_2006	12	4		6				133.01	21.89	9.13	376.29	0	5	68.76	41.7	0.39	3.28
Del_Rio_et_al_2006	12	5		6				133	21.78	10.04	372.7	10	4.96	68.44	46.08	0.35	3.2
Del_Rio_et_al_2006	12	6		6				133.01	21.87	7.98	375.58	5	5	68.7	36.49	0.38	3.29
Del_Rio_et_al_2006	12	7		6				142.6	17.2	9.63	232.48	26.85	3.32	54.05	55.96	0.31	2.48
Del_Rio_et_al_2006	12	8		6				142.58	17.06	10.65	228.55	33.46	3.26	53.59	62.41	0.29	2.42
Del_Rio_et_al_2006	12	9		6				142.59	17.16	8.43	231.17	30.17	3.3	53.9	49.12	0.31	2.49
Del_Rio_et_al_2006	12	1	C	6				31.28	19.58	9.3	301.16	0	0.94	61.52	47.5	0.35	2.88
Del_Rio_et_al_2006	12	2	C	6				31.28	19.44	10.26	296.74	0	0.93	61.07	52.78	0.32	2.81
Del_Rio_et_al_2006	12	3	C	6				31.28	19.54	8.14	299.73	0	0.94	61.37	41.67	0.34	2.88
Del_Rio_et_al_2006	12	4	C	6				31.4	21.89	9.13	376.29	0	1.18	68.76	41.7	0.39	3.28
Del_Rio_et_al_2006	12	5	C	6				31.4	21.78	10.04	372.7	0	1.17	68.44	46.08	0.35	3.2
Del_Rio_et_al_2006	12	6	C	6				31.4	21.87	7.98	375.58	0	1.18	68.7	36.49	0.38	3.29
Del_Rio_et_al_2006	12	7	C	6				33.67	17.2	9.63	232.48	0	0.78	54.05	55.96	0.31	2.48
Del_Rio_et_al_2006	12	8	C	6				33.66	17.06	10.65	228.55	0	0.77	53.59	62.41	0.29	2.42
Del_Rio_et_al_2006	12	9	C	6				33.66	17.16	8.43	231.17	0	0.78	53.9	49.12	0.31	2.49

Nodo 4 - Pies inventariados | Nodo 5 - Pies inventariados | Nodo 6 - Pies inventariados

HARVESTS

When we apply thinning by above/below, the simulator orders the trees from highest to lowest or vice versa and extracts trees taking into account the expansion factor until the percentage requested by the scenario is satisfied. In this situation, the totality of some tres and part of one tree is extracted, leaving the latter tres duplicated:

- In the first row marked, where the status is empty, we can see the expansion factor remaining in the plot
- In the second row marked, where the status is C, we can see the expansion factor that was deleted by the cut

ID_inventario	ID_parcela	ID_arbo	estado	especie	t	rumbo	distancia	factor_expansion	dbh	h	g	bal	g_ha	circunferencia_normal	esbeltez	cr	lcw
Del_Rio_et_al_2006	12	1		6				132.51	9.58	9.3	301.16	14.96	3.99	61.52	47.5	0.35	2.88
Del_Rio_et_al_2006	12	2		6				132.5	9.44	10.26	296.74	22.92	3.93	61.07	52.78	0.32	2.81
Del_Rio_et_al_2006	12	3		6				132.51	9.54	8.14	299.73	18.95	3.97	61.37	41.67	0.34	2.88
Del_Rio_et_al_2006	12	4		6				133.01	21.89	9.13	376.29	0	5	68.76	41.7	0.39	3.28
Del_Rio_et_al_2006	12	5		6				133	21.78	10.04	372.7	10	4.96	68.44	46.08	0.35	3.2
Del_Rio_et_al_2006	12	6		6				133.01	21.87	7.98	375.58	5	5	68.7	36.49	0.38	3.29
Del_Rio_et_al_2006	12	7		6				137.61	17.2	9.63	232.48	26.85	3.2	54.05	55.96	0.31	2.48
Del_Rio_et_al_2006	12	7	C	6				4.99	17.2	9.63	232.48	0	0.12	54.05	55.96	0.31	2.48
Del_Rio_et_al_2006	12	8	C	6				142.58	17.06	10.65	228.55	0	3.26	53.59	62.41	0.29	2.42
Del_Rio_et_al_2006	12	9	C	6				142.59	17.16	8.43	231.17	0	3.3	53.9	49.12	0.31	2.49

Nodo 5 - Pies inventariados | Nodo 6 - Pies inventariados | Nodo 7 - Pies inventariados

Announcements

Each of the SIMANFOR models has a specific execution time (you can check it in its respective sheet), so if you enter an erroneous value SIMANFOR Will notify you in the "Summary" sheet to modify it.

In addition, the harvests execution time must always be 0, as they do not represent a projection in time, and SIMANFOR Will notify you if you have not done it right.

On the other hand, the code of the main species in the inventory must match the code of the model to be used (look for it here, appendix 12). If this is not the case, you will be notified so that you can review it and modify the code or change the model used.

1	SIMANFOR			Zona de estudio		CyL			Inventario		ifn3					
2				Monte		Bosque Modelo			Parcela		1					
3				Composición específica		Pinus pinaster			Modelo		Pradiata_stand__gal__v01					
4				Fecha simulación		2021-04-13 13:34:08			Escenario		Experimento Claras					
5	TEN CUIDADO! Los valores de tiempo de tus ejecuciones no se corresponden con los del modelo! Revisa la hoja de parcelas para más información															
6			Masa antes de la corta				Masa extraída			Masa después de la corta				Masa muerta		
7	Edad (años)	Ho (m)	N (pies/ha)	Dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	Dg (cm)	V (m3/ha)	N (pies/ha)	Dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	Dg (cm)	V (m3/ha)
8	10	14	1793,13	13,94	27,38	150,7										
9	15	21,02	1632,34	18,49	43,85	358,07	163,23	22,26	50,19	1469,11	18,03	37,5	307,88	160,79	13,94	14,31
10	20	26,63	1311,03	21,87	49,23	505,65	516,06	11,27	50,56	794,97	26,57	44,08	455,09	158,07	18,03	35,8
11	25	30,92	704,2	30,94	52,93	626,44	704,2	30,94	626,44	0	0	0	0	90,76	26,57	57,41

1	SIMANFOR			Zona de estudio		CyL			Inventario		ifn3					
2				Monte		Bosque Modelo			Parcela		1					
3				Composición específica		Pinus pinaster			Modelo		Pradiata_stand__gal__v01					
4				Fecha simulación		2021-04-13 13:34:08			Escenario		Experimento Claras					
5	TEN CUIDADO! El valor de tiempo para las cortas que has planificado no es correcto! Revisa la hoja de parcelas para más información															
6			Masa antes de la corta				Masa extraída			Masa después de la corta				Masa muerta		
7	Edad (años)	Ho (m)	N (pies/ha)	Dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	Dg (cm)	V (m3/ha)	N (pies/ha)	Dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	Dg (cm)	V (m3/ha)
8	10	14	1793,13	13,94	27,38	150,7										
9	15	21,02	1632,34	18,49	43,85	358,07	163,23	22,26	50,19	1469,11	18,03	37,5	307,88	160,79	13,94	14,31
10	20	26,63	1311,03	21,87	49,23	505,65	516,06	11,27	50,56	794,97	26,57	44,08	455,09	158,07	18,03	35,8
11	25	30,92	704,2	30,94	52,93	626,44	704,2	30,94	626,44	0	0	0	0	90,76	26,57	57,41

1	SIMANFOR			Zona de estudio		CyL			Inventario		ifn3					
2				Monte		Bosque Modelo			Parcela		1					
3				Composición específica		Pinus pinaster			Modelo		Pradiata_stand__gal__v01					
4				Fecha simulación		2021-04-13 13:34:08			Escenario		Experimento Claras					
5	TEN CUIDADO! Estás intentando utilizar un inventario en el que la especie principal es diferente a la del modelo. Revisa el escenario y haz los cambios oportunos antes de ejecutar el simulador de nuevo.															
6			Masa antes de la corta				Masa extraída			Masa después de la corta				Masa muerta		
7	Edad (años)	Ho (m)	N (pies/ha)	Dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	Dg (cm)	V (m3/ha)	N (pies/ha)	Dg (cm)	G (m2/ha)	V (m3/ha)	N (pies/ha)	Dg (cm)	V (m3/ha)
8	10	14	1793,13	13,94	27,38	150,7										
9	15	21,02	1632,34	18,49	43,85	358,07	163,23	22,26	50,19	1469,11	18,03	37,5	307,88	160,79	13,94	14,31
10	20	26,63	1311,03	21,87	49,23	505,65	516,06	11,27	50,56	794,97	26,57	44,08	455,09	158,07	18,03	35,8
11	25	30,92	704,2	30,94	52,93	626,44	704,2	30,94	626,44	0	0	0	0	90,76	26,57	57,41

Announcements

Each of the SIMANFOR models is oriented to perform calculations on one or several species (you can check it in their respective sheets). However, our data inventory may contain tres of other species. In these cases, SIMANFOR Will detect the species different to the main one, highlighting them in red in the tree results sheets (image on the right) and will not perform the specific calculations of the model on these trees (volume, biomass, survival, growth…). This avoids mistakes in the predictions.

When a harvest is applied, these trees are involved in the process.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF
1	ID inventario	ID parcela	ID árbol	estado	especie	factor expansión	d	h	t	h tocón	g	bal	g/ha	circunferencia normal	esbeltez	cr	lcw	hcb	hlcw	v con corteza	v sin corteza	v de corteza	v/ha	v sierra gruesa	v sierra	v sierra cánter	v trituración	wsw	wb2_t	wtbl	wr	wt
2	12	1	1		26	31,83	20,9	14	28	0	343,07	9,571	1,092	65,6593	66,9856	0,352	3,006	9,0787	10,602	222,3114	148,5249	73,7864	7,076	0	0	136,8234	209,7525	87,9957	5,3395	14,905	22,34	130,58
3	12	1	2		26	31,83	13,15	10,5	28	0	135,813	26,877	0,432	41,3119	79,8479	0,336	1,912	6,9748	7,9849	68,6757	44,0981	24,5776	2,186	0	0	0	62,6576	27,6483	1,2459	5,0874	6,0933	40,0748
4	12	1	3		26	14,15	27,8	14	28	0	606,987	2,9036	0,859	87,3363	50,3597	0,367	4,025	8,8656	10,44	385,4553	262,7825	122,6728	5,454	0	0	282,6653	363,68	160,882	13,082	28,892	49,715	252,57
5	12	1	4		26	31,83	19,25	13	28	0	291,039	16,599	0,926	60,4757	67,5325	0,342	2,771	8,551	9,9024	176,4571	116,9994	59,4577	5,617	0	0	66,906	164,7615	70,6371	4,124	12,316	17,739	104,816
6	12	1	5		26	31,83	19,8	13	28	0	307,908	13,688	0,98	62,2035	65,6566	0,349	2,859	8,4665	9,8381	186,3119	123,7806	62,5313	5,93	0	0	70,6425	173,9631	74,9737	4,5056	13,148	19,197	111,824
7	12	1	6		26	14,15	31,75	15,5	28	0	791,73	0	1,12	99,7456	48,8189	0,364	4,556	9,8637	11,659	550,0972	379,4879	170,6093	7,784	0	181,531	302,407	523,0734	226,912	19,857	39,322	72,156	358,247
8	12	1	7		26	31,83	14,65	11,5	28	0	168,564	25,408	0,537	46,0243	78,4983	0,333	2,116	7,6765	8,8022	92,4432	59,9448	32,4983	2,943	0	0	0	84,6358	36,7538	1,7491	6,5363	8,2488	53,2881
9	12	1	8		26	14,15	25,8	15,5	28	0	522,792	5,2679	0,74	81,0531	60,0775	0,352	3,682	10,05	11,799	368,6221	250,582	118,0401	5,216	0	0	265,4759	350,5133	146,3	10,347	24,297	40,324	221,268
10	12	1	9		26	31,83	12,75	12,5	28	0	127,676	27,728	0,406	40,0553	98,0392	0,321	1,822	8,4857	9,7057	76,7102	49,3525	27,3577	2,442	0	0	0	69,2039	28,8462	1,1307	4,7356	5,5877	40,3002
11	12	1	10		26	31,83	15,65	13	28	0	192,362	23,659	0,612	49,1659	83,0671	0,327	2,237	8,752	10,055	118,3536	77,3305	41,0231	3,767	0	0	0	108,3866	45,589	2,1523	7,6184	9,9266	65,2862
12	12	1	11		21	14,15	26,25	15	28	0	541,19	0	0	82,47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	12	1	12		26	31,83	14,85	13	28	0	173,198	24,856	0,551	46,6527	87,5421	0,324	2,12	8,7856	10,08	106,96	69,6266	37,3335	3,405	0	0	0	97,9525	40,8003	1,8252	6,7452	8,5685	57,9392
14	12	1	13		21	14,15	23,25	14	28	0	424,56	0	0	73,04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	12	1	14		21	14,15	28,85	15	28	0	655,7	0	0	90,63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	12	1	15		26	31,83	17	13	28	0	226,98	21,632	0,723	53,4071	76,4706	0,331	2,435	8,6949	10,012	138,8363	91,2473	47,589	4,419	0	0	0	127,1443	54,3077	2,791	9,2306	12,519	78,8481
17	12	1	16		26	127,32	8,8	1	28	0	60,8212	32,488	0,774	27,646	11,3636	0,39	1,376	0,6096	0,6938	3,186	1,8808	1,3052	0,406	0	0	0	0	2,7646	0,3528	2,0035	1,9757	7,0965
18	12	1	17		26	31,83	22,2	13,5	28	0	387,076	7,2312	1,232	69,7434	60,8108	0,36	3,213	8,6388	10,117	241,0439	161,5915	79,4524	7,672	0	0	152,2759	226,2279	97,7524	6,4539	17,145	26,458	147,809
19	12	1	18		21	31,83	21,9	13	28	0	376,68	0	0	68,8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	12	1	19		26	31,83	17,3	13	28	0	235,062	20,883	0,748	54,3496	75,1445	0,333	2,48	8,6737	9,9954	143,6014	94,4962	49,1052	4,571	0	0	54,4483	131,5081	56,3546	2,9487	9,6129	13,148	82,0644
21	12	1	20		26	31,83	18,55	13,5	28	0	270,258	17,525	0,86	58,2765	72,7763	0,337	2,657	8,9506	10,354	170,4547	112,8237	57,631	5,426	0	0	62,7811	159,9775	66,8557	3,6711	11,302	15,989	97,8175
22	12	1	21		26	31,83	19,6	13	28	0	301,719	15,638	0,96	61,5752	66,3265	0,344	2,825	8,5232	9,8813	182,6985	121,2926	61,4059	5,815	0	0	69,2725	170,5892	73,381	4,3642	12,842	18,658	109,245
23	12	1	22		26	14,15	28,35	14,5	28	0	631,242	1,1203	0,893	89,0642	51,1464	0,368	4,096	9,1703	10,823	414,2542	283,0433	131,2109	5,862	0	0	295,1957	390,4906	171,364	13,912	30,235	52,522	268,034
24	12	1	23		26	14,15	24,2	13,5	28	0	459,961	6,0077	0,651	76,0265	55,7851	0,363	3,507	8,6009	10,088	284,6851	192,0186	92,6665	4,028	0	0	179,8456	270,5496	117,317	8,4623	20,943	33,698	180,42
25	12	1	24		26	14,15	28,3	15	28	0	629,018	2,0135	0,89	88,9071	53,0035	0,362	4,069	9,5664	11,278	426,7398	291,7715	134,9683	6,038	0	0	297,1039	402,8278	174,34	13,835	30,112	52,263	270,55
26	12	1	25		26	14,15	26,2	15	28	0	539,129	3,7625	0,763	82,3097	57,2519	0,358	3,76	9,6264	11,323	367,7622	250,0763	117,6858	5,204	0	0	266,8286	347,1549	148,107	10,86	25,18	42,102	226,248
27	12	1	26		26	127,32	11,15	11	28	0	97,6427	30,398	1,243	35,0288	98,6547	0,325	1,609	7,4265	8,4703	52,2766	33,214	19,0626	6,656	0	0	0	44,5657	20,073	0,742	3,4695	3,8366	28,1211
28	12	1	27		26	31,83	21,05	13	28	0	348,012	8,4633	1,108	66,1305	61,7577	0,361	3,055	8,3126	9,7204	209,6667	139,9028	69,7639	6,674	0	0	135,6976	195,7699	85,3375	5,4608	15,154	22,792	128,745
29	12	1	28		21	31,83	20,9	13,5	28	0	343,07	0	0	65,66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	12	1	29		26	31,83	19,9	14	28	0	311,026	12,698	0,99	62,5177	70,3518	0,345	2,853	9,1769	10,676	202,2483	134,652	67,5963	6,438	0	0	124,4755	190,8228	79,3279	4,5774	13,302	19,47	116,678
31	12	1	30		26	31,83	20,1	13	28	0	317,309	11,688	1,01	63,146	64,6766	0,353	2,908	8,4079	9,7934	191,7959	127,5599	64,236	6,105	0	0	72,7218	179,0836	77,3965	4,7235	13,615	20,024	115,758
32	12	1	31		26	127,32	8,7	1	28	0	59,4468	33,262	0,757	27,3319	11,4943	0,389	1,359	0,6115	0,6953	3,1165	1,8383	1,2782	0,397	0	0	0	0	2,6985	0,3404	1,9511	1,9134	6,9033
33	12	1	32		26	31,83	12,5	10,5	28	0	122,719	28,531	0,391	39,2699	84	0,332	1,814	7,0128	8,0142	62,2777	39,8463	22,4314	1,982	0	0	0	54,3713	24,8373	1,0625	4,5229	5,2859	35,7086
34	12	1	33		26	31,83	15,3	13	28	0	183,854	24,271	0,585	48,0664	84,9673	0,325	2,186	8,7692	10,068	113,3006	73,9103	39,3903	3,606	0	0	0	103,7591	43,4594	2,0047	7,2289	9,3166	62,0096
35	12	1	34		26	14,15	25,85	14,5	28	0	524,821	4,5253	0,743	81,2102	56,0928	0,36	3,722	9,2838	10,91	346,6766	235,3249	111,3517	4,906	0	0	260,0856	326,7896	140,969	10,41	24,406	40,544	216,329
36	12	1	35		26	31,83	18,05	13	28	0	255,885	20,069	0,815	56,7057	72,0222	0,335	2,59	8,6505	9,9779	155,8526	102,8671	52,9855	4,961	0	0	59,0935	145,5227	61,6469	3,3691	10,608	14,81	90,4333
37	12	1	36		26	14,15	22,7	13	28	0	404,708	6,6585	0,573	71,3142	57,2687	0,365	3,301	8,2588	9,679	242,5231	162,6949	79,8283	3,432	0	0	156,9625	226,4486	100,105	6,9215	18,054	28,163	153,244
38	12	1	37		26	31,83	19,7	12,5	28	0	304,805	14,668	0,97	61,8894	63,4518	0,35	2,853	8,1277	9,4334	177,5693	117,8206	59,7488	5,652	0	0	69,2191	164,7694	72,3988	4,4345	12,994	18,926	108,754
39	12	1	38		26	127,32	9,2	11	28	0	66,4761	31,641	0,846	28,9027	119,565	0,322	1,326	7,4559	8,4928	36,0788	22,6124	13,4664	4,594	0	0	0	28,5441	13,3671	0,4057	2,2211	2,2379	18,2318
40	12	1	39		26	31,83	20,25	14	28	0	322,062	10,663	1,025	63,6173	69,1358	0,349	2,909	9,1131	10,628	209,1664	139,4302	69,7362	6,658	0	0	128,7333	197,3501	82,3078	4,8351	13,852	20,446	121,44
41	12	1	40		26	127,32	12,15	12	28	0	115,942	28,922	1,476	38,1704	98,7654	0,322	1,742	8,1395	9,2979	67,1676	43,0242	24,1435	8,552	0	0	0	58,9233	25,4014	0,9718	4,2345	4,8813	35,489
42	12	1	41		26	31,83	12,95	11,5	28	0	131,713	27,309	0,419	40,6836	88,8031	0,328	1,867	7,7241	8,8385	72,8681	46,8399	26,0281	2,319	0	0	0	64,4213	28,3144	1,1873	4,9097	5,837	40,2483
43	12	1	42		26	31,83	16,5	13	28	0	213,825	22,354	0,681	51,8363	78,7879	0,33	2,362	8,7153	10,027	131,0667	85,9587	45,1079	4,172	0	0	0	120,029	50,9848	2,5412	8,613	11,514	73,6524
44	12	1	43		26	31,83	13,25	11,5	28	0	137,887	26,438	0,439	41,6261	86,7925	0,33	1,912	7,7023	8,8219	76,1595	49,0352	27,1243	2,424	0	0	0	67,3313	29,7196	1,2759	5,1776	6,2241	42,3972
45	12	1	44		26	31,83	18,4	13	28	0	265,904	18,385	0,846	57,8053	70,6522	0,338	2,644	8,6024	9,9414	161,735	106,8951	54,8399	5,148	0	0	61,3239	151,0151	64,2024	3,5786	11,091	15,629	94,501
46	12	1	45		26	31,83	18,3	12,5	28	0	263,022	19,232	0,837	57,4911	68,306	0,34	2,638	8,2549	9,5306	154,0308	101,6696	52,3613	4,903	0	0	60,0435	142,9276	61,9469	3,5179	10,952	15,392	91,8083
47	12	1	46		26	31,83	14,05	12	28	0	155,04	25,944	0,494	44,1394	85,4093	0,328	2,02	8,0626	9,2395	88,8968	57,5324	31,3644	2,83	0	0	0	81,1702	34,5394	1,5338	5,932	7,3361	49,3413
48	12	1	47		26	31,83	15,8	13	28	0	196,067	23,035	0,624	49,6372	82,2785	0,328	2,26	8,7345	10,041	120,5517	78,82	41,7317	3,837	0	0	0	110,3995	46,5181	2,2177	7,7889	10,196	66,7203
49	12	1	48		26	31,83	12,6	12	28	0	124,69	28,134	0,397	39,5841	95,2381	0,323	1,808	8,1192	9,2825	72,0491	46,2702	25,779	2,293	0	0	0	65,7868	27,4323	1,0894	4,6073	5,4053	38,5344

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