



CAFE Decision Support System for Multiobjective Planning of Sustainable Forest Management

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UPV
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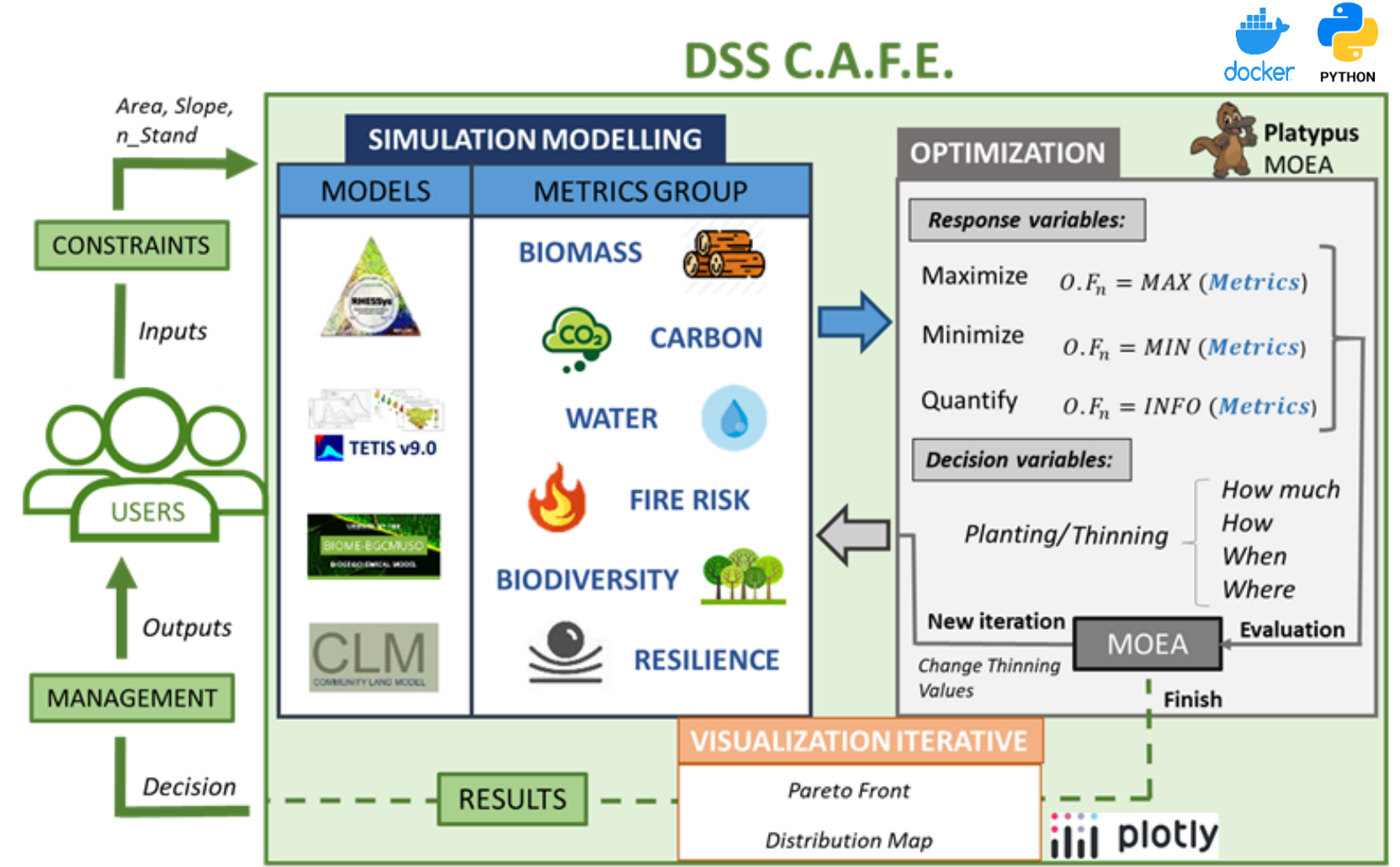


The project *LIFE RESILIENT FORESTS – Coupling water, fire and climate resilience with biomass production from forestry to adapt watersheds to climate change* is co-funded by the LIFE Programme of the European Union under contract number LIFE 17 CCA/ES/000063.



What is CAFE?

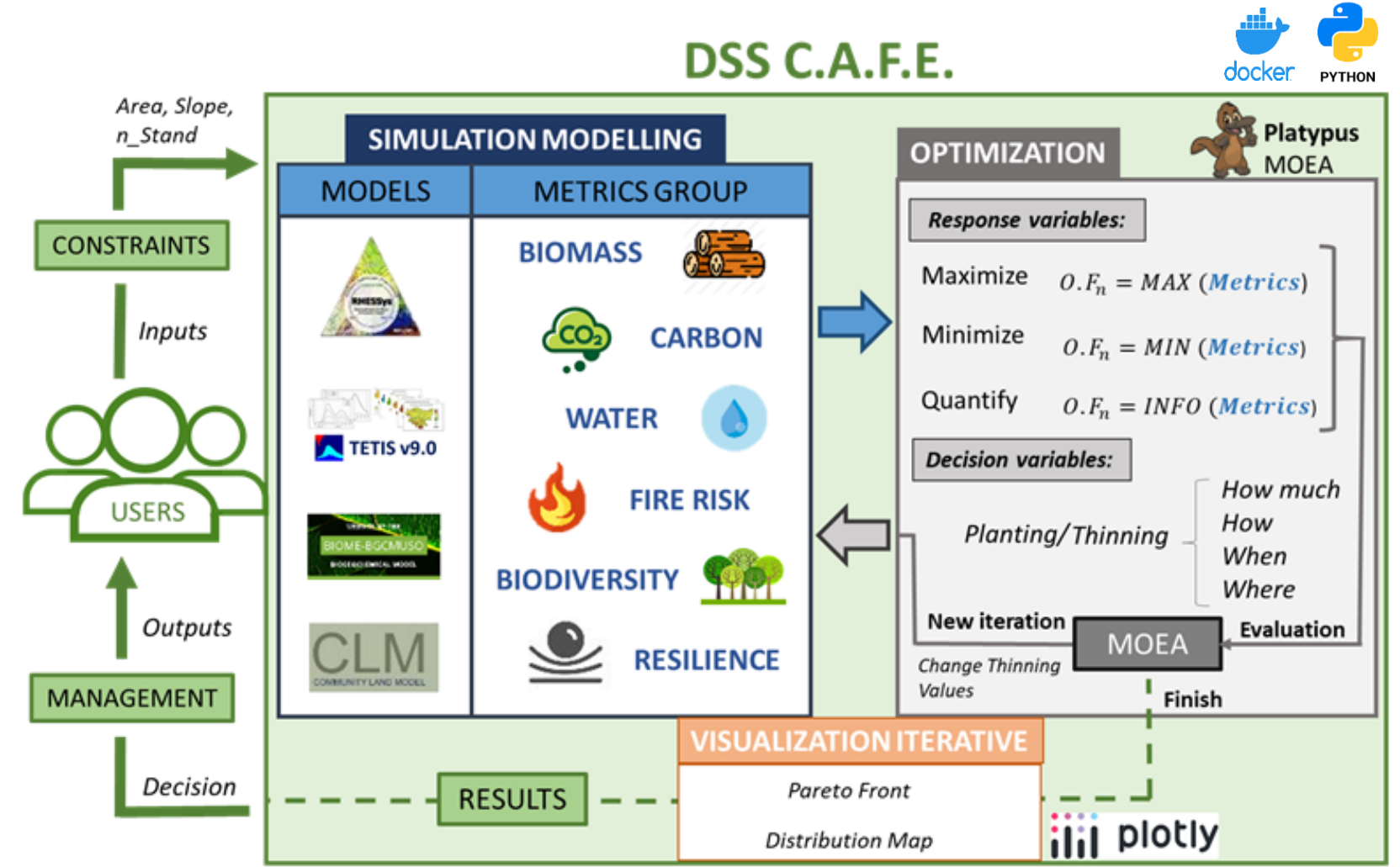
- 1- Multi-Objective Decision Support System (**MODSS**) for forest management
- 2- C.A.F.E. (Carbon, Aqua, Fire & Eco-resilience) combines **eco-hydrological simulation**¹ and **optimization**² with multi-objectives evolutionary algorithms (MOEA)
- 3- Provides the **optimal management plan** and **quantification** of the multiple **ecosystem services**.





What is CAFE?

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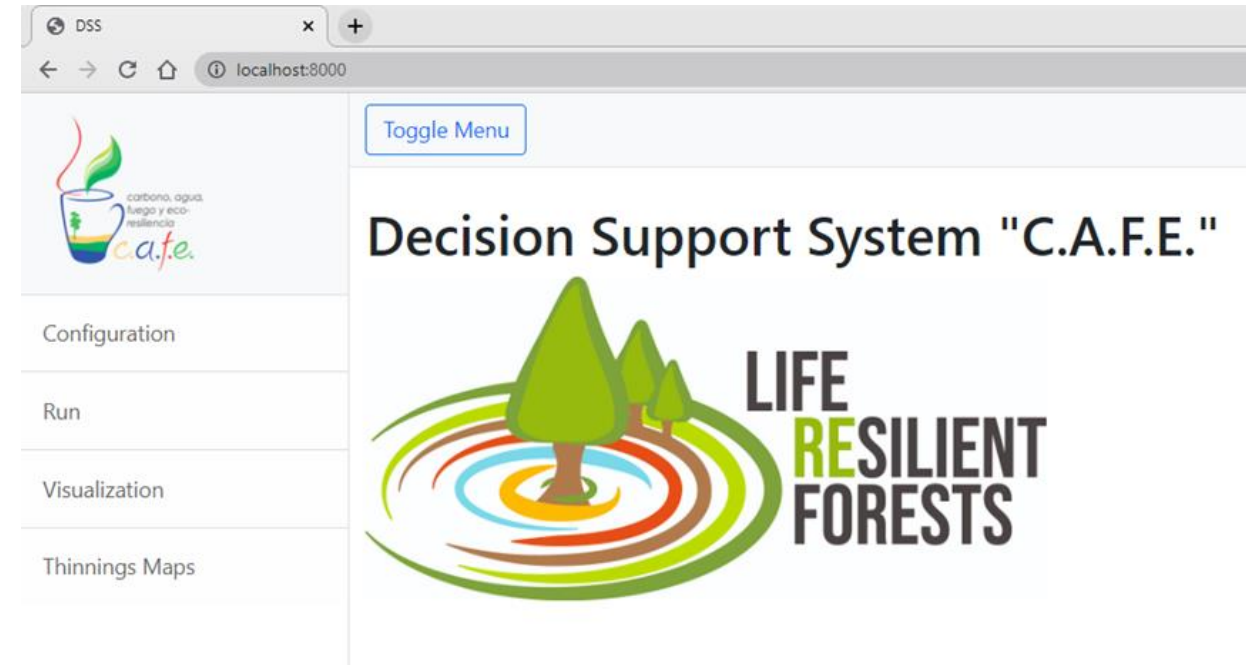
How to install it?

1. Install Linux on Windows with WSL (<https://learn.microsoft.com/en-us/windows/wsl/install>)
2. Download and install Docker (<https://www.docker.com/products/docker-desktop/>)
3. Download DSS CAFE (<https://www.resilientforest.eu/dss-tool/>)
4. Unzip folder "dss_app-tar.gz.tar".
5. Execute (double click): **Windows_install_dockerCAFE.exe**



How to start the DSS?

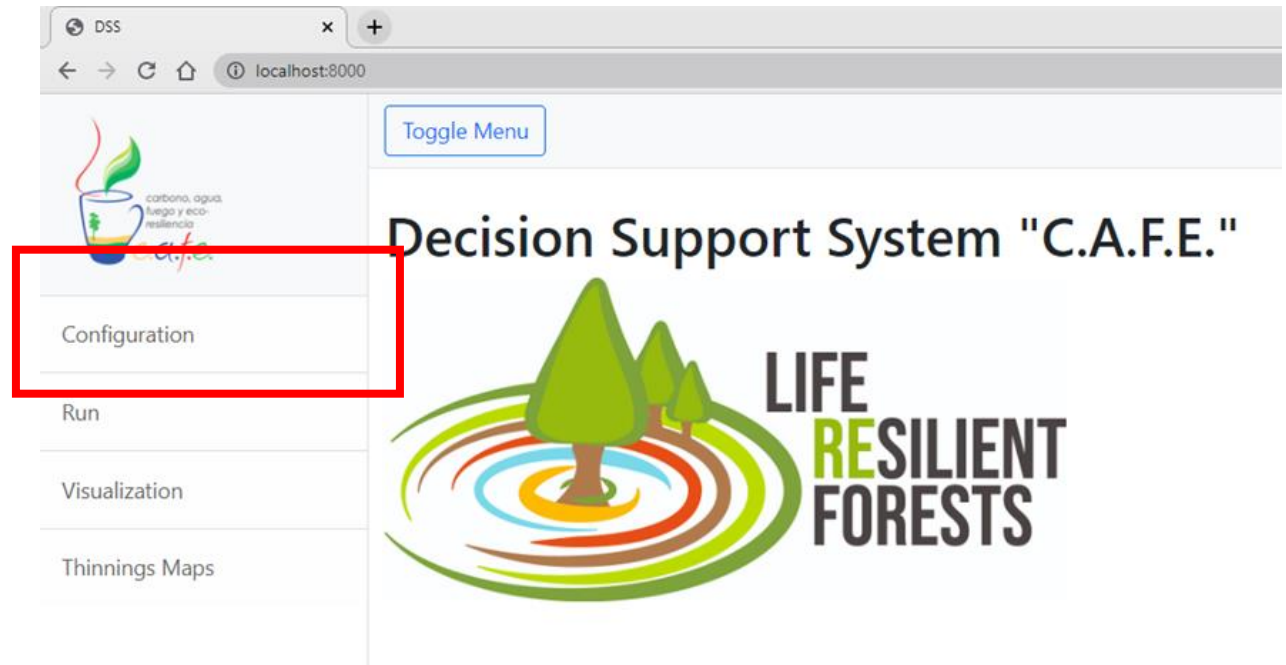
1. Execute (double click): **Windows_run_dockerCAFE.exe**
2. Write in the open terminal (cmd): **python app.py**
3. Write in the web browser: **Localhost:8000**





How to configure the tool?

1. Go to the **Configuration** tab (first option on the left panel).

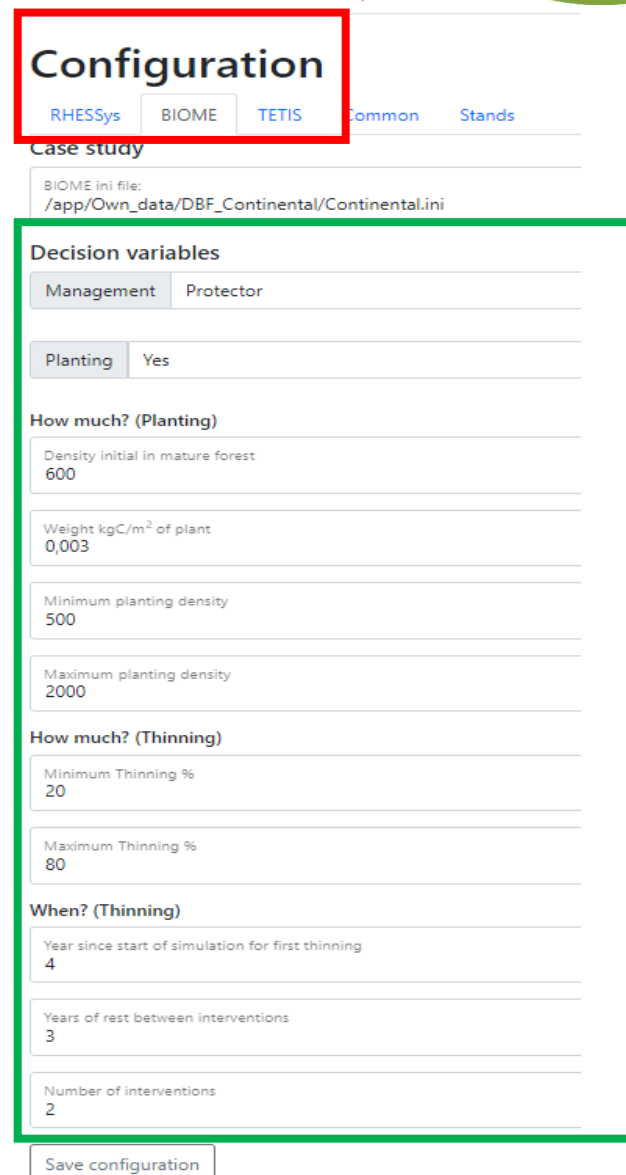




How to configure the tool?

1. Go to the Configuration tab (first option on the left panel).
2. Select and enter the section of the **model** you want to use: RHESSys, BIOME or TETIS.

" Here, you configure the **parameters** related to the **management** that the manager wants to plan and that the DSS has to answer (Decision Variables)".



The screenshot shows the 'Configuration' tab selected in the top navigation bar. Below it, the 'Case study' section displays the BIOME ini file path: /app/Own_data/DBF_Continental/Continental.ini. The 'Decision variables' section is highlighted with a green border and contains several sub-sections: 'Management' (with 'Protector' selected), 'Planting' (with 'Yes' selected), 'How much? (Planting)' (with fields for Density initial in mature forest: 600, Weight kgC/m² of plant: 0,003, Minimum planting density: 500, and Maximum planting density: 2000), 'How much? (Thinning)' (with fields for Minimum Thinning %: 20 and Maximum Thinning %: 80), and 'When? (Thinning)' (with fields for Year since start of simulation for first thinning: 4, Years of rest between interventions: 3, and Number of interventions: 2). A 'Save configuration' button is located at the bottom right.

Configuration

RHESSys BIOME TETIS Common Stands

Case study

BIOME ini file:
/app/Own_data/DBF_Continental/Continental.ini

Decision variables

Management Protector

Planting Yes

How much? (Planting)

Density initial in mature forest
600

Weight kgC/m² of plant
0,003

Minimum planting density
500

Maximum planting density
2000

How much? (Thinning)

Minimum Thinning %
20

Maximum Thinning %
80

When? (Thinning)

Year since start of simulation for first thinning
4

Years of rest between interventions
3

Number of interventions
2

Save configuration



How to configure the tool?

1. Go to the Configuration tab (first option on the left panel).
2. Select an enter the section of the model you want to use: RHESSys, BIOME or TETIS.

" Here, you configure the parameters related to the management that the manager wants to plan and that the DSS has to answer (Decision Variables)".

3. Enter the **Common** section to select the **metrics to optimise** (maximise or minimise) or only quantify (info).

"Here, you select the goods and services that you are interested in managing and that the model used can calculate (Response Variables)".

Configuration

RHESSys BIOME TETIS **Common** Stands

Operational costs

Price of cut individual tree (€/tree)
0,46

Price of wood extraction (€/ha)
1100

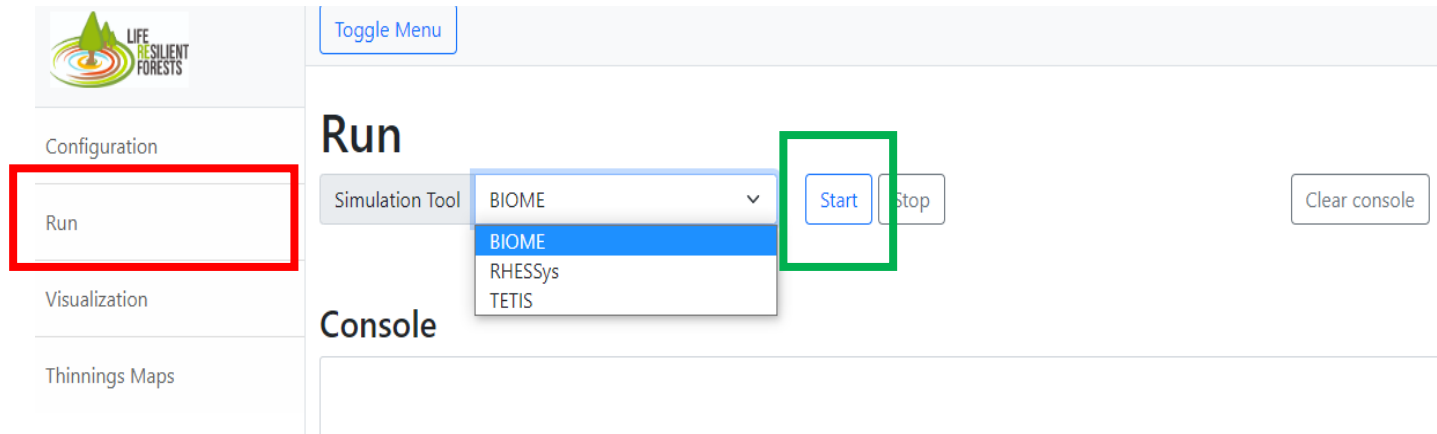
Metrics

	Optimization type			Models
<input checked="" type="checkbox"/> Biomass	<input checked="" type="radio"/> Maximize	<input type="radio"/> Minimize	<input type="radio"/> Info	RHESSys, Biome, Tetis
<input checked="" type="checkbox"/> Wood	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	Biome
<input checked="" type="checkbox"/> Carbon	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	RHESSys
<input checked="" type="checkbox"/> SoilCarbon	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	Biome
<input checked="" type="checkbox"/> Respiration	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	RHESSys, Biome
<input checked="" type="checkbox"/> NEP	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	Biome
<input checked="" type="checkbox"/> Transpiration	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	Biome, Tetis
<input checked="" type="checkbox"/> Evaporation	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	Tetis
<input checked="" type="checkbox"/> StreamFlow	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	RHESSys
<input checked="" type="checkbox"/> Water	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	Tetis
<input checked="" type="checkbox"/> SurfaceWater	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	RHESSys, Biome
<input checked="" type="checkbox"/> Percolation	<input checked="" type="radio"/> Maximize	<input type="radio"/> Minimize	<input type="radio"/> Info	RHESSys, Biome, Tetis
<input checked="" type="checkbox"/> DeepMoisture	<input type="radio"/> Maximize	<input type="radio"/> Minimize	<input checked="" type="radio"/> Info	Biome



How to run the tool?

1. Go to the **run** tab (second option on the left panel).
2. Select the configured model in the drop-down menu.
3. Click on the **Start** button



The screenshot shows the user interface of the LIFE RESILIENT FORESTS tool. On the left, a vertical menu contains four options: 'Configuration', 'Run', 'Visualization', and 'Thinnings Maps'. The 'Run' option is highlighted with a red rectangular border. The main area of the interface is titled 'Run' and features a 'Simulation Tool' dropdown menu. This menu is open, displaying a list of models: 'BIOME', 'BIOME', 'RHESSys', and 'TETIS'. The first 'BIOME' entry is highlighted with a blue background. To the right of the dropdown menu, there are two buttons: 'Start' and 'Stop'. The 'Start' button is highlighted with a green rectangular border. Further to the right, there is a 'Clear console' button. The interface also includes a 'Toggle Menu' button at the top right and a 'LIFE RESILIENT FORESTS' logo in the top left corner of the main panel.



How do I build a case study?

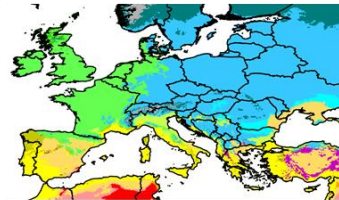
Option 1: Potential cases (Null modelling level)

Option 2: Adjusted cases (Low-medium modelling level) (0,1,2)

Option 3: Real cases (Advanced modelling level) (3)

Adjust to own case

Climate



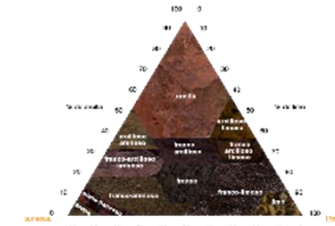
1

Change series to local weather station

0

change local information:
Latitude, elevation and
average temperature

Soil



2

Change soil parameters:
Depth
Bulk density
Texture

Species



3

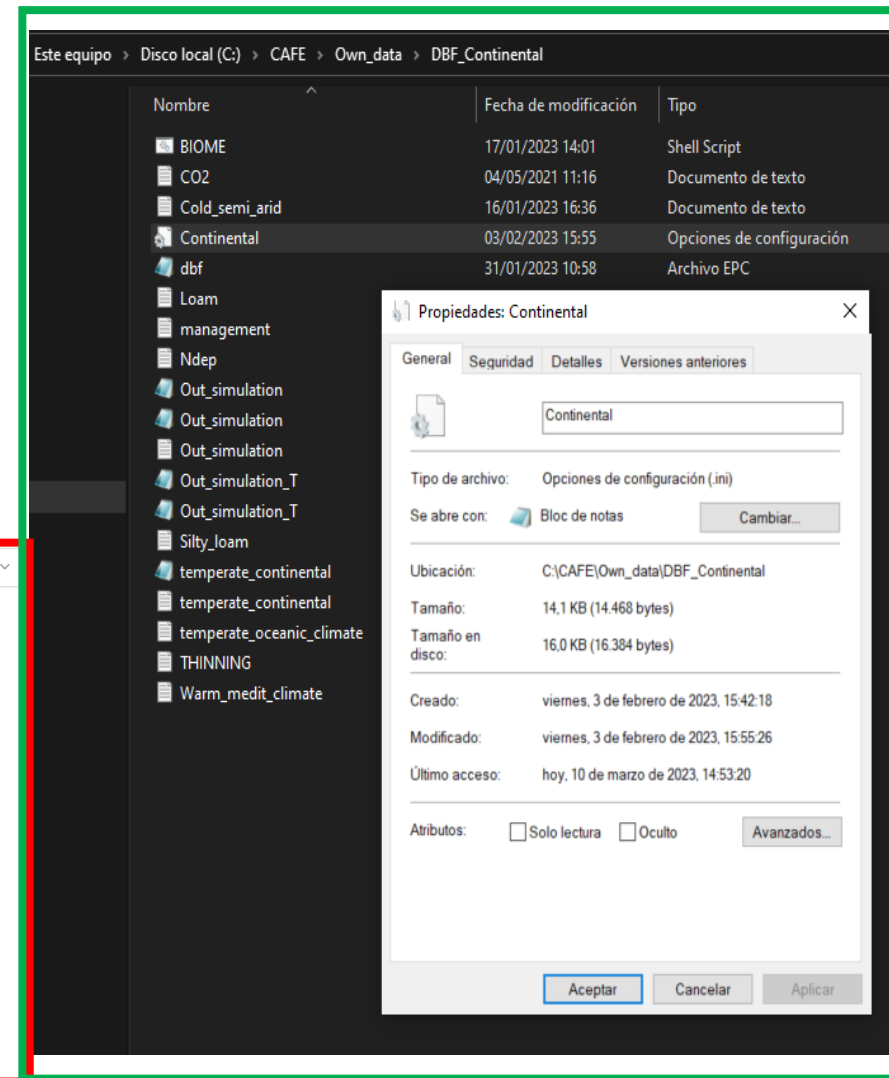
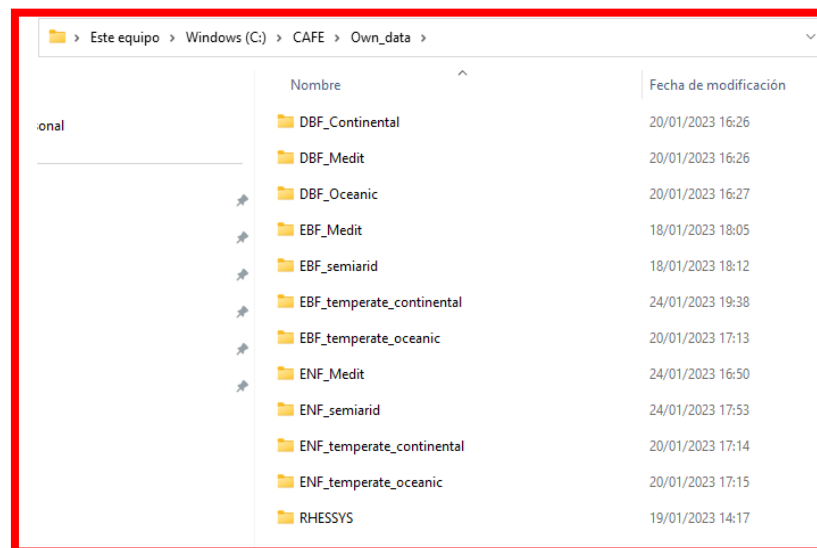
Change veg parameters:
...



How do I build a case study?

Option 1: Potential cases (Null modelling level)

1. Select the potential cases found inside the folder downloaded from the DSS "EU_PotentialForests".
2. Copy selected case to folder **C:/CAFE/Own_data**.
3. Search for file names to be entered in the model paths. In the case of BIOME, the file ".ini" has to be searched.





How do I build a case study?

Option 2: Adjusted cases (Low-medium modelling level) (Annex 3.2)

To adjust the potential case to a particular case, you can modify the site characteristics

- First: **Local latitude and elevation information.** (Low)
- Second: Change weather series to a local weather station. (Medium)
- Third: Modify soil parameters such as depth or actual textures. (Medium)

Oceanic: Bloc de notas	
Archivo Editar Ver	
BBGCMuSo simulation	
MET_INPUT	
temperate_oceanic_climate.txt	(filename) met file name
2	(int) number of header lines in met file
0	(int) number of simdays in last simyear (truncated year: <= 365)
RESTART	
1	(flag) 1 = read restart; 0 = dont read restart
0	(flag) 1 = write restart; 0 = dont write restart
enf_temperate_oceanic.endpoint	(filename) name of the input restart file
enf_temperate_oceanic1.endpoint	(filename) name of the output restart file
TIME_DEFINE	
20	(int) number of simulation years
1901	(int) first simulation year
0	(flag) 1 = spinup run; 0 = normal run
6000	(int) maximum number of spinup years
CO2_CONTROL	
1	(flag) 0=constant; 1=vary with file
290.0	(ppm) constant atmospheric CO2 concentration
CO2.txt	(filename) name of the CO2 file
NDEP_CONTROL	
1	(flag) 0=constant; 1=vary with file
0.000200	(kgN/m2/yr) wet+dry atmospheric deposition of N
Ndep.txt	(filename) name of the N-dep file
SITE	
181.0	(m) site elevation
43.30	(degrees) site latitude (- for S.Hem.)
0.20	(DIM) site shortwave albedo
15.00	(Celsius) mean annual air temperature
9.96	(Celsius) mean annual air temperature range
0.50	(prop.) proportion of NH4 flux of N-deposition



How do I build a case study?

Option 2: Adjusted cases (Low-medium modelling level) (Annex 3.2)

To adjust the potential case to a particular case, you can modify the site characteristics

- First: Local latitude and elevation information. (Low)
- Second: **Change weather series** to a local weather station. (Medium)
- Third: Modify soil parameters such as depth or actual textures. (Medium)

1	year	yday	Tmax	Tmin	Tday	prcp	VPD	srad	daylen
2			(degC)	(degC)	(degC)	(cm)	(Pa)	(Wm-2)	(s)
3	2000	1	-1.28	-7.28	-2.93	0	138.46	175.61	30438
4	2000	2	-4.34	-10.34	-5.99	0	112.36	177.35	30492
5	2000	3	-2.56	-8.56	-4.21	0	126.96	177.62	30551
6	2000	4	-0.5	-6.5	-2.15	0	145.9	177.66	30614
7	2000	5	-0.25	-6.25	-1.9	0	148.35	178.12	30681
8	2000	6	1.43	-4.57	-0.22	0	165.8	177.97	30752
9	2000	7	1.23	-4.77	-0.42	0	163.64	178.59	30828
10	2000	8	-0.27	-6.27	-1.92	0	148.15	180.65	30907
11	2000	9	-3.52	-9.52	-5.17	0.13	118.89	148.54	30991
12	2000	10	-1.86	-7.86	-3.51	0	133.14	184.05	31079
13	2000	11	0.57	-5.43	-1.08	0.1	156.66	148.72	31171
14	2000	12	1.39	-4.61	-0.26	0.03	165.37	148.88	31266
15	2000	13	2.51	-3.49	0.86	0	177.93	184.73	31366
16	2000	14	0.65	-5.35	-1	0	157.49	186.92	31469
17	2000	15	0.71	-5.29	-0.94	0.89	158.12	151.64	31575
18	2000	16	-3.05	-9.05	-4.7	1.16	122.79	157.18	31686
19	2000	17	-5.78	-11.78	-7.43	0.62	101.63	160.86	31800
20	2000	18	-0.57	-6.57	-2.22	0.13	145.22	161.06	31917
21	2000	19	-3.52	-9.52	-5.17	0.05	118.89	163.39	32038
22	2000	20	0.82	-5.18	-0.83	0	159.27	201.48	32161
23	2000	21	-0.39	-6.39	-2.04	0	146.97	203.9	32289
24	2000	22	-0.86	-6.86	-2.51	0	142.42	205.7	32419
25	2000	23	-2.91	-8.91	-4.56	0	123.97	208.17	32552
26	2000	24	-7.01	-13.01	-8.66	0	93.18	211.49	32688
27	2000	25	-7.25	-13.25	-8.9	0	91.61	213.29	32827
28	2000	26	-5.69	-11.69	-7.34	0	102.27	214.57	32969
29	2000	27	-6.63	-12.63	-8.28	0	95.72	216.74	33114
30	2000	28	-11.28	-17.28	-12.93	0	68.4	220.04	33261



How do I build a case study?

Option 3: Real cases (Advanced modelling level)

-Finally: Once the previous steps have been completed, it would be necessary to modify vegetation parameters to adapt them to a specific species.

Folder	.EPC file	Climate	Potential forest	Example species
DBF_Medit	dbf	Warm_medit	Dediduous Mediterranean quercus (i.e. Quercus faginea)	Quercus faginea
DBF_Oceanic	dfb	temperate_oceanic	Decidous tempreate oceanic forest (i.e. Quercus robur)	Quercus, Fagus, Acer
DBF_Continental	dfb	temperate_continental	Decidous tempreate continental forest (i.e. Quercus robur)	Quercus, Fagus, Acer
EBF_Medit	ebf	Warm_medit_climate	Evergreen Mediterranean forest (i.e. Quercus ilex)	Quercus ilex, broadleaf shrub
EBF_semiarid	ebf	Cold_semiarid	Evergreen semiarid Mediterranean forest (i.e. Quercus ilex)	Quercus ilex, broadleaf shrub
EBF_Continental	ebf	temperate_continental	Evergreen temperate continental forest (i.e. Quercus ilex)	Quercus ilex, broadleaf shrub
EBF_Oceanic	ebf	temperate_oceanic	Evergreen tempreate oceanic forest (i.e. Quercus ilex)	Quercus ilex, broadleaf shrub
ENF_Medit	enf	Warm_medit	Evergreen Mediterranean conifera forest (Pinus pinaster, P. nigra, etc)	Pinus pinaster, P. nigra
ENF_semiarid	enf	Cold_semiarid	Evergreen Semiarid Mediterranean conifera forest (Pinus halepensis, P. pinaster etc)	Pinus halepensis, P. pinea
ENF_Oceanic	enf	temperate_oceanic_climate	Evergreen tempreate oceanic conifer forest (Pinus radiata, Pinus pinaster)	Pinus radiata, P. pinaster, P. sylvestris
ENF_Continental	enf	temperate_continental	Evergreen tempreate continental conifer forest (Pinus radiata, Pinus pinaster)	Pinus radiata, P. pinaster, P. sylvestris
Acacia	ebf	temperate_oceanic		Acacia
Eucalyptus	ebf	temperate_oceanic		Eucalyptus



www.resilientforest.eu
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Thanks!

Project Partners



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