CAFE Decision Support System for Multiobjective Planning of Sustainable Forest Management

María González Sanchis, Javier Pérez Romero y Antonio del Campo

UPV
23/03/2023

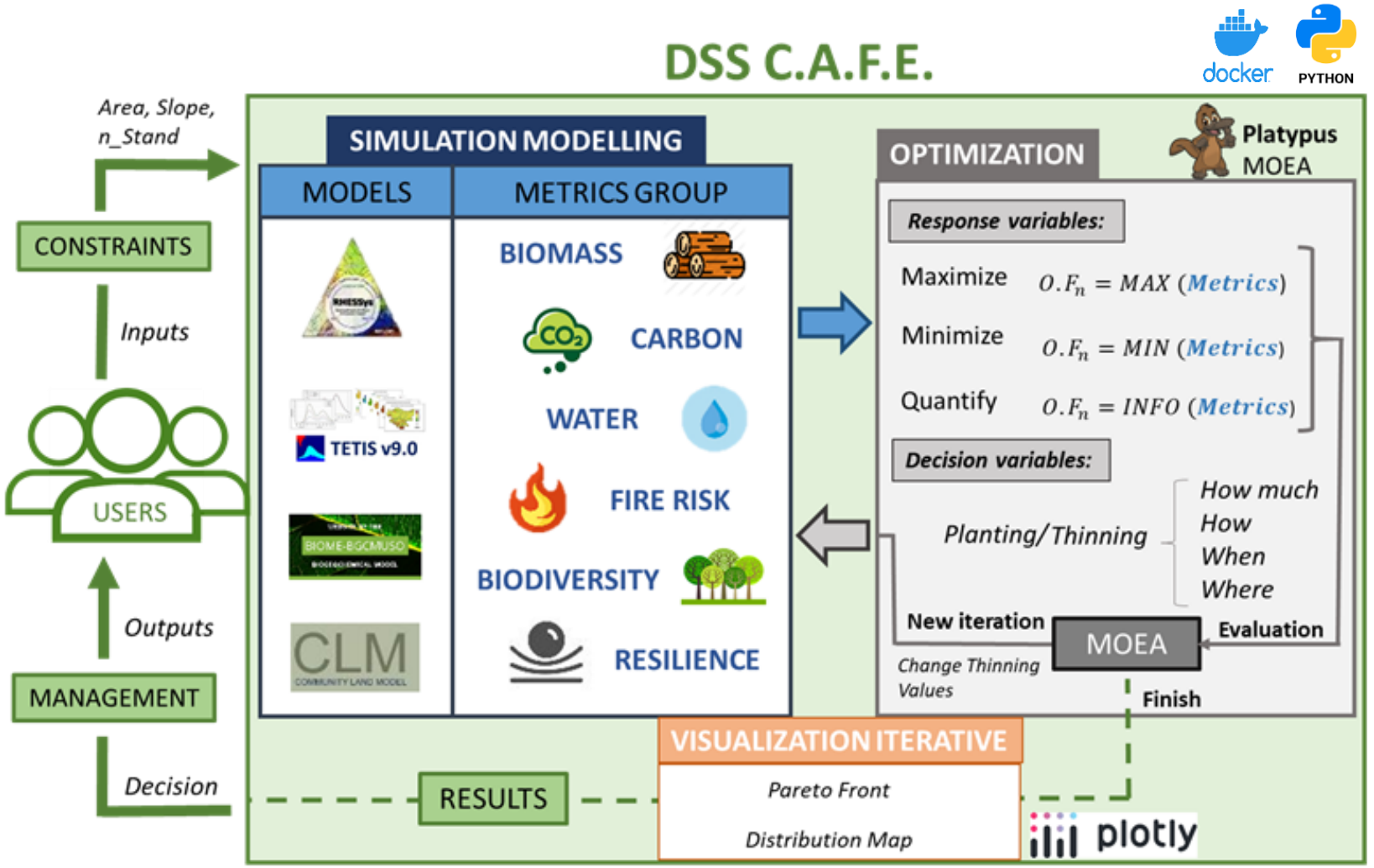
The project *LIFE RESILIENT FORESTS – Coupling water, fire and climate resilience with biomass production from forestry to adapt watersheds to climate change* is co-funded by the LIFE Programme of the European Union under contract number LIFE 17 CCA/ES/000063.

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**.

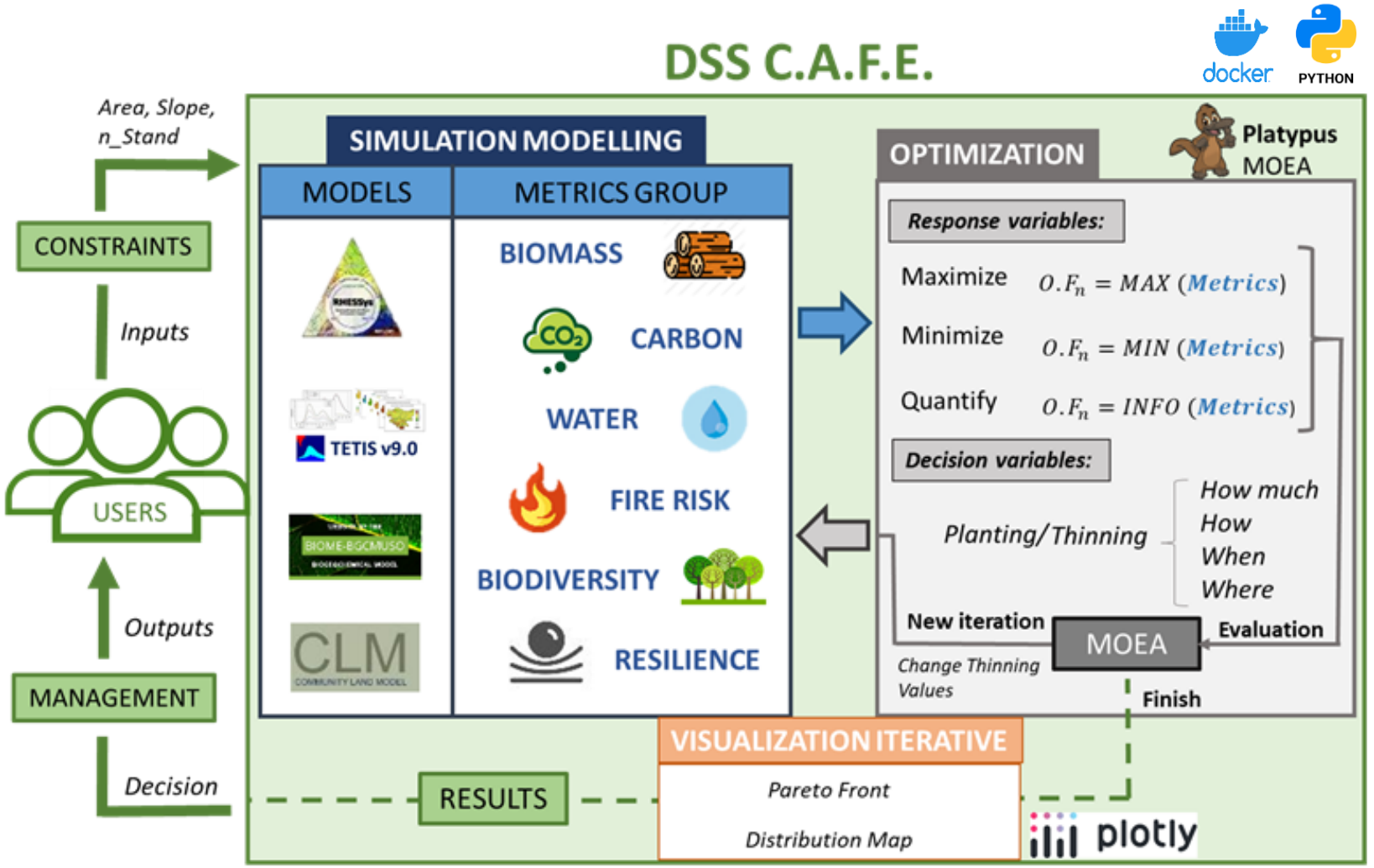


What is CAFE?

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**.

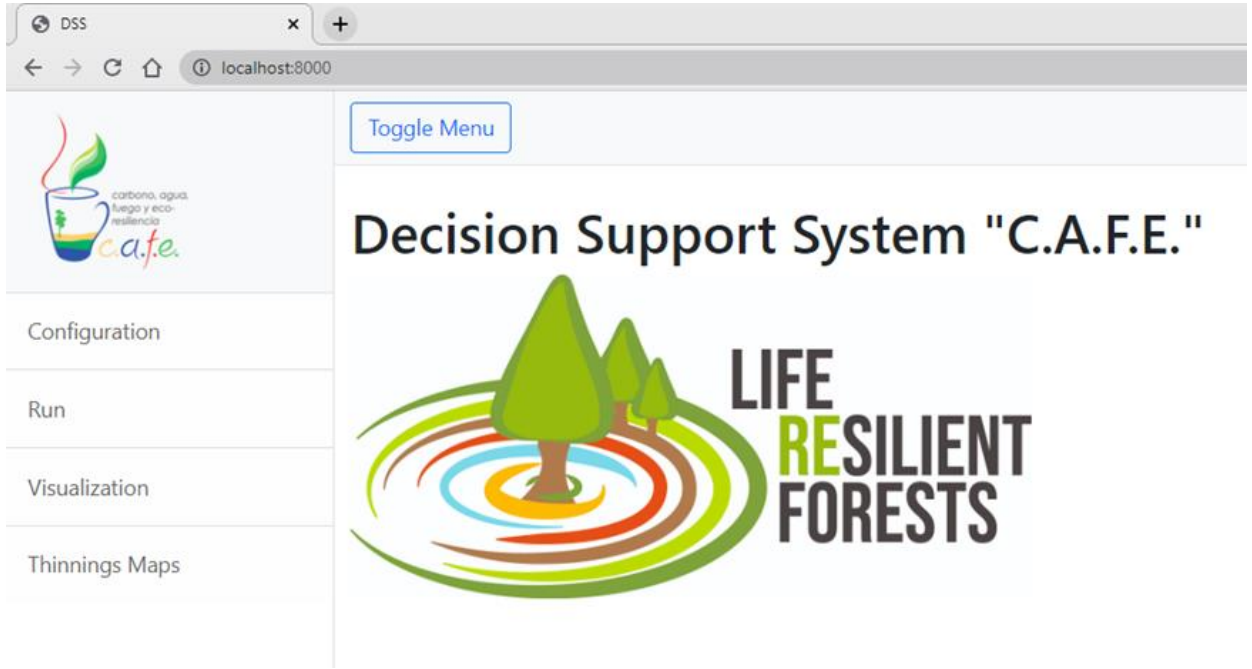


How to install it?

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**

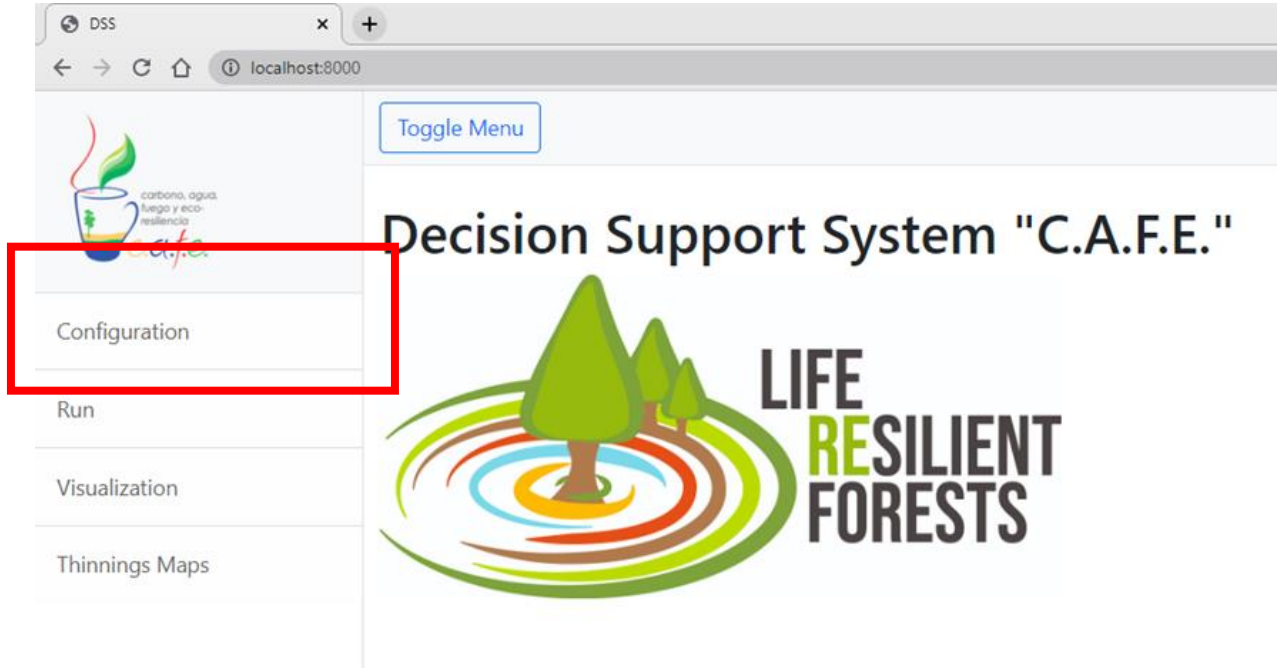
How to start the DSS?

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?

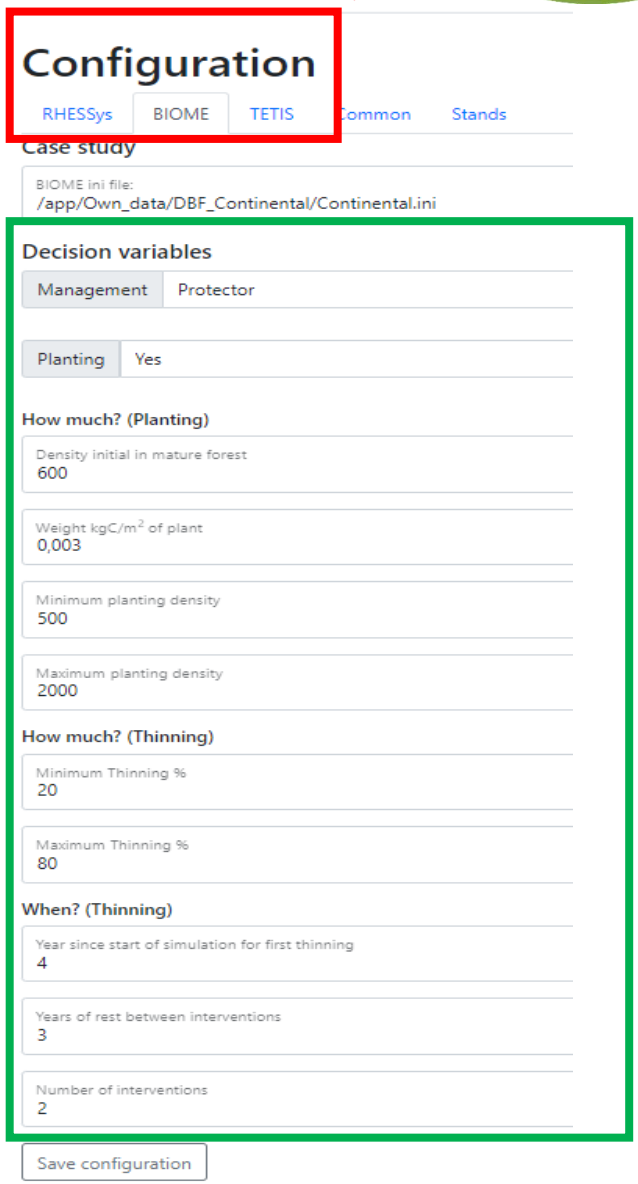
1. Go to the Configuration tab (first option on the left panel).



How to configure the tool?

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



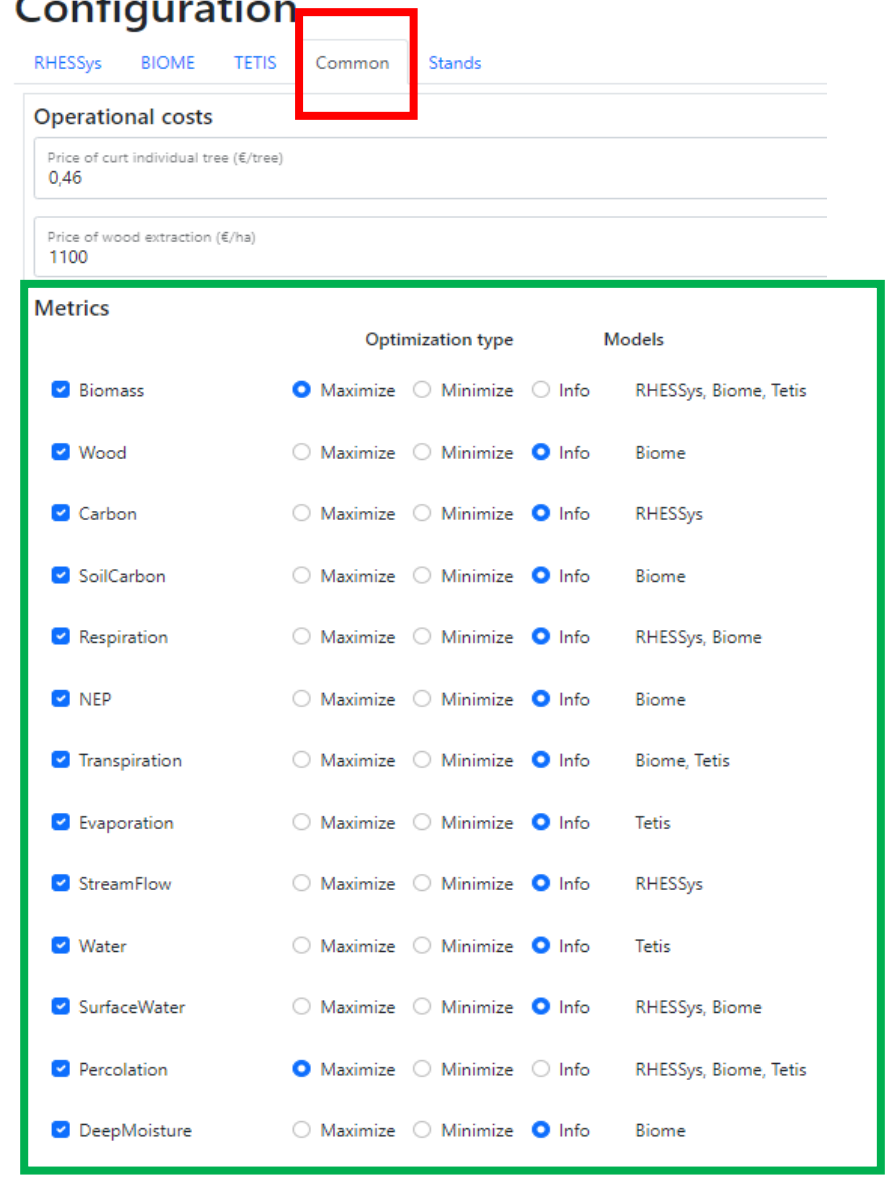
How to configure the tool?

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)".

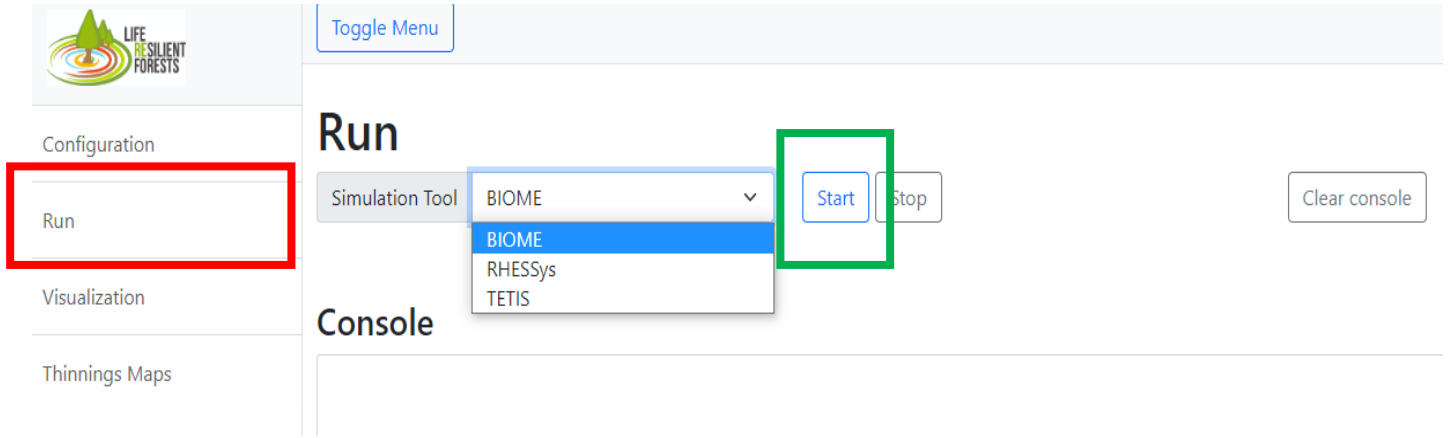
3. **Enter the Common section to select the metrics to optimise (maximise or minimise) or only quantify (info).**

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



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



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)

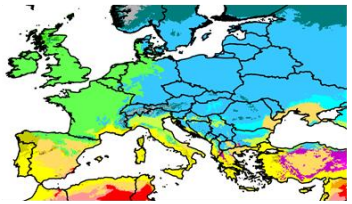
Option 3: Real cases (Advanced modelling level) (3)

Adjust to own case

0

change local information:
Latitude, elevation and average temperature

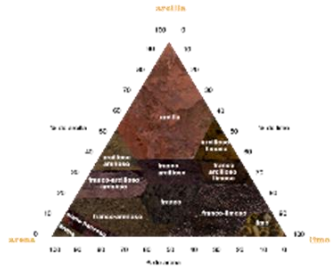
Climate



1

Change series to local weather station

Soil



2

Change soil parameters:
- Depth
- Bulk density
- Texture

Species

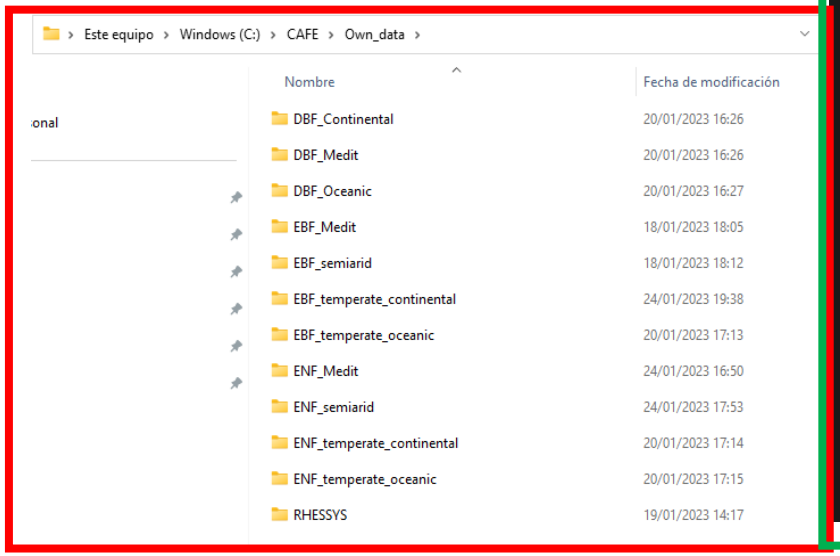
3

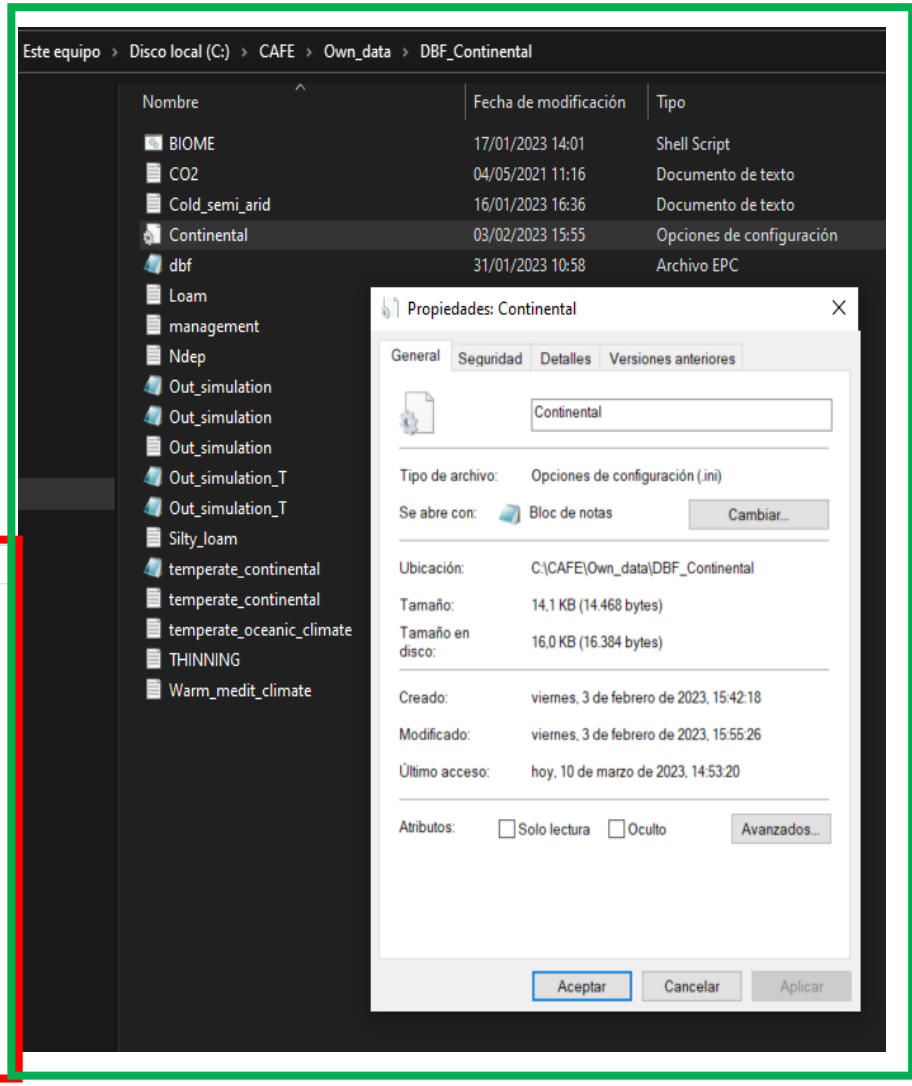
Change veg parameters:
...

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?

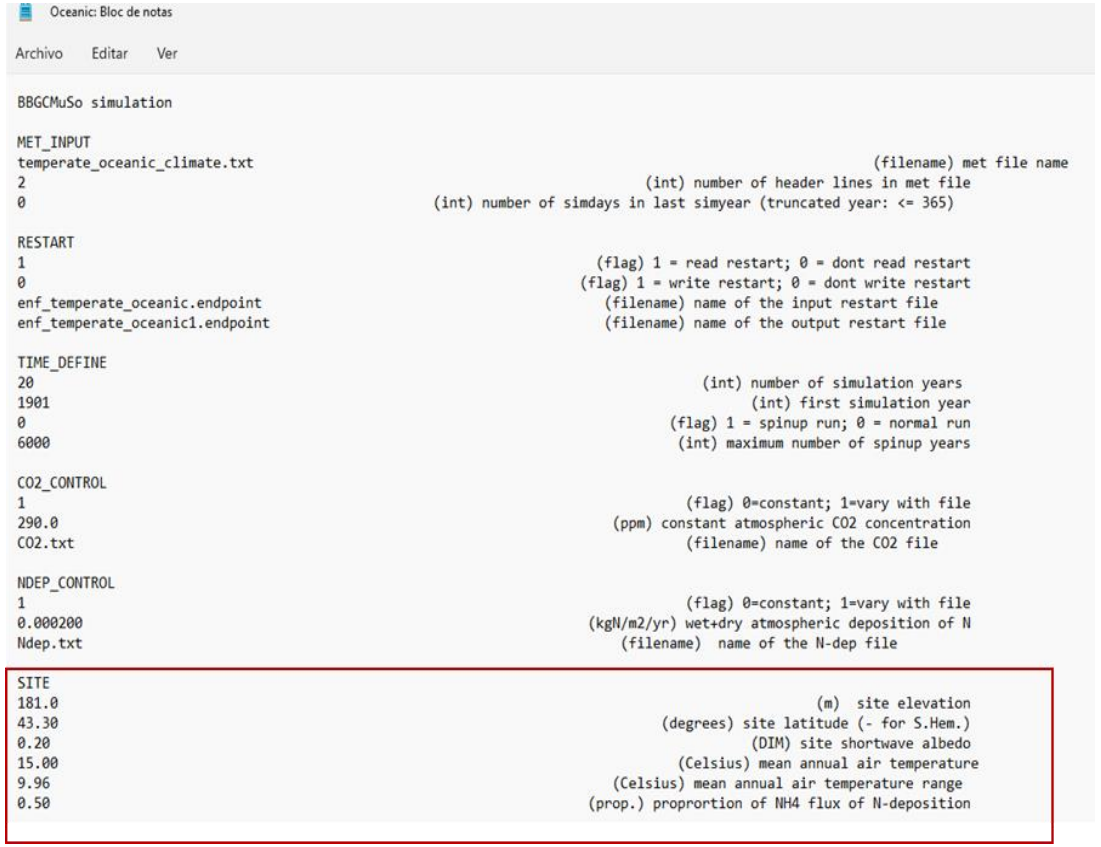
Option 2: Adjusted cases (Low-medium modelling level) (Annex 3.2)

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.) proprortion of NH4 flux of N-deposition
```

How do I build a case study?

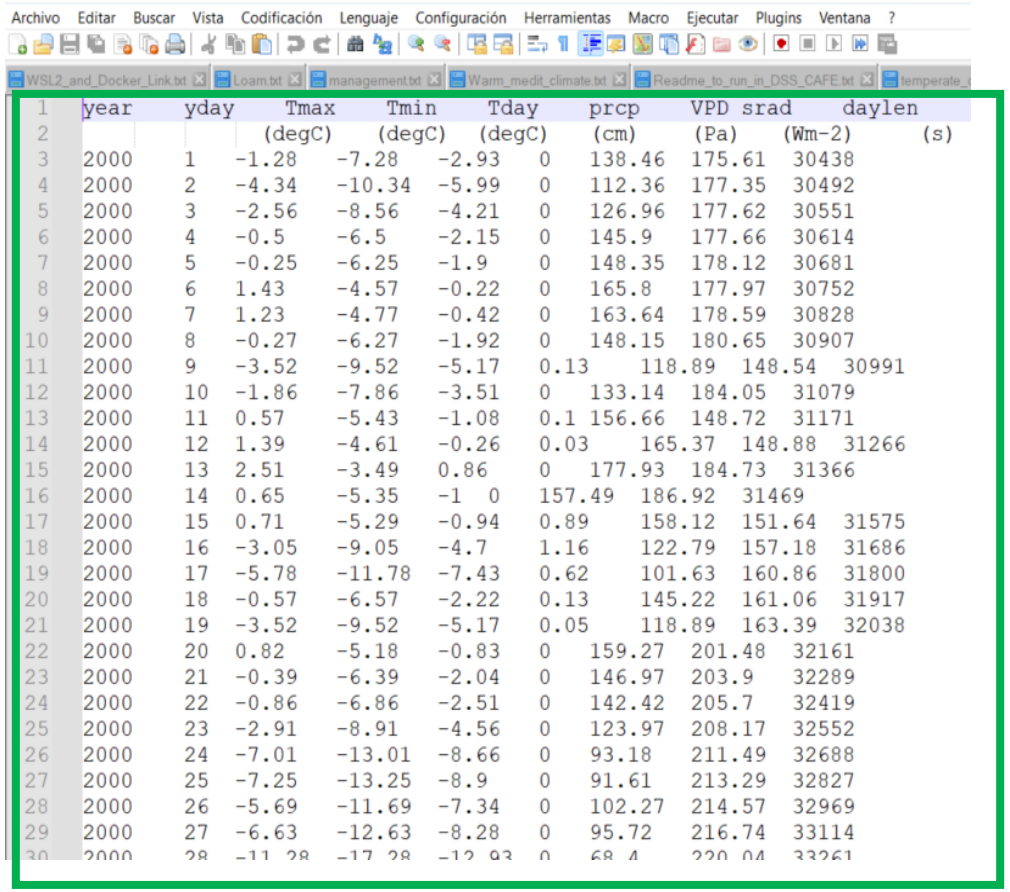
Option 2: Adjusted cases (Low-medium modelling level) (Annex 3.2)

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)



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

How do I build a case study?

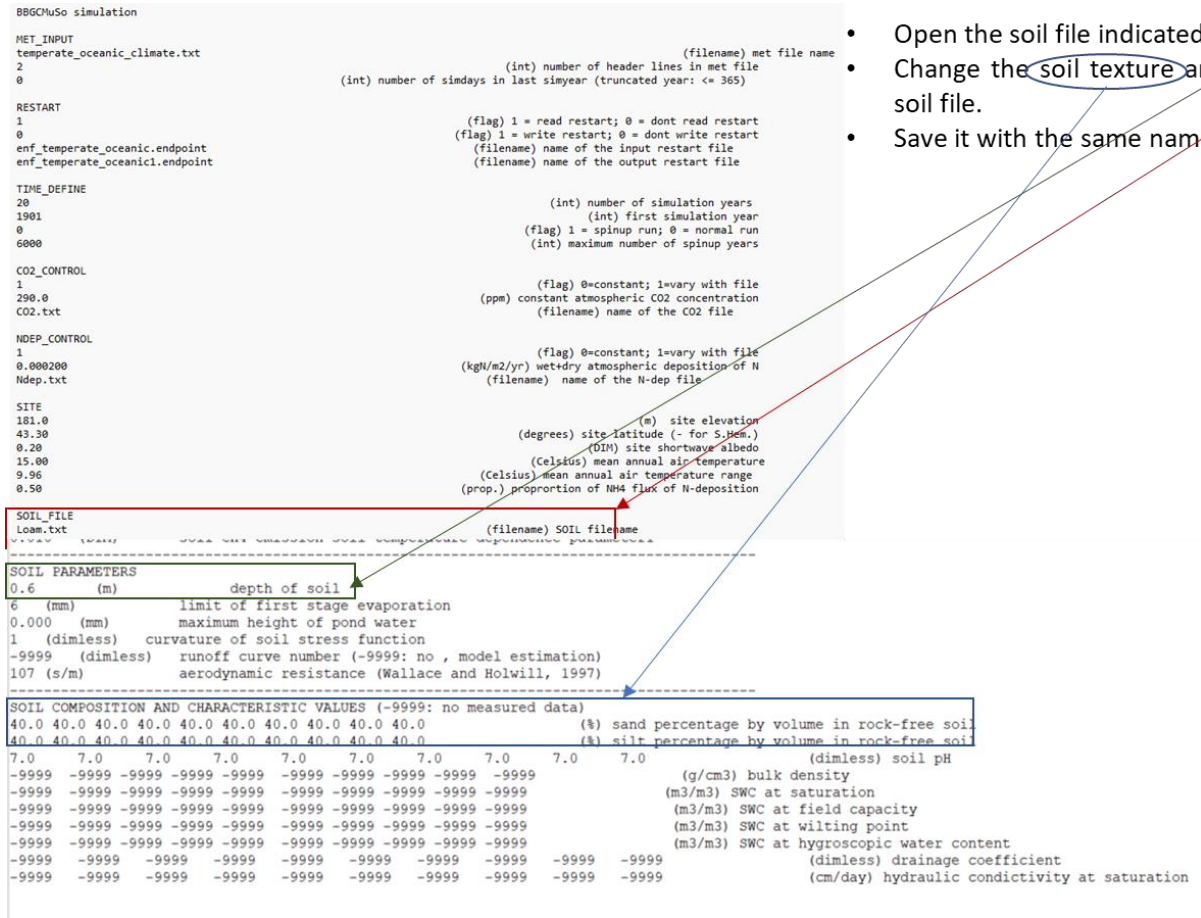
Option 2: Adjusted cases (Low-medium modelling level) (Annex 3.2)

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)



- Open the soil file indicated in the .ini file.
- Change the soil texture and depth in the soil file.
- Save it with the same name.

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
@LIFE_RESILIENT
info@resilientforest.eu

Thanks!

Project Partners

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.