# The Capsis project

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# Objectives of Capsis

## Meaning

Computer-Aided Projection for Strategies In Silviculture

## Objectives

Simulate the consequences of the forest management by using the scientific knowledge

Build a software platform to integrate many forest growth, yield and dynamics models

## For who

Forestry modellers, forestry managers and education

# Forestry models

**Various types of models**

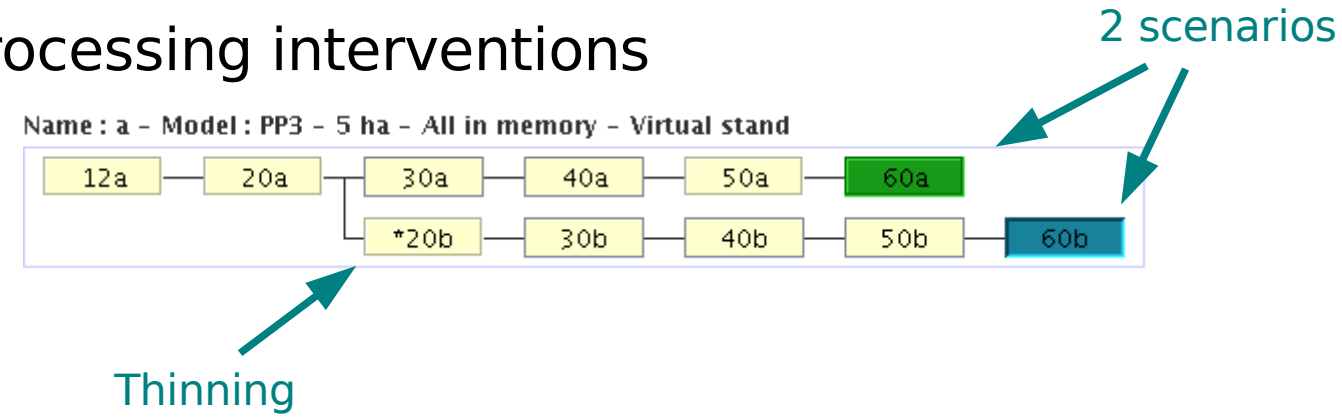
- Empirical models (statistics) :
  - Stand models,
  - Tree models, spatially explicit or not
- Architectural (topology, geometry)
- Gap models
- Process-based models (functionnal)
- Structure-Function...

# The Capsis common methodology 1/2

From an initial situation (real or virtual),

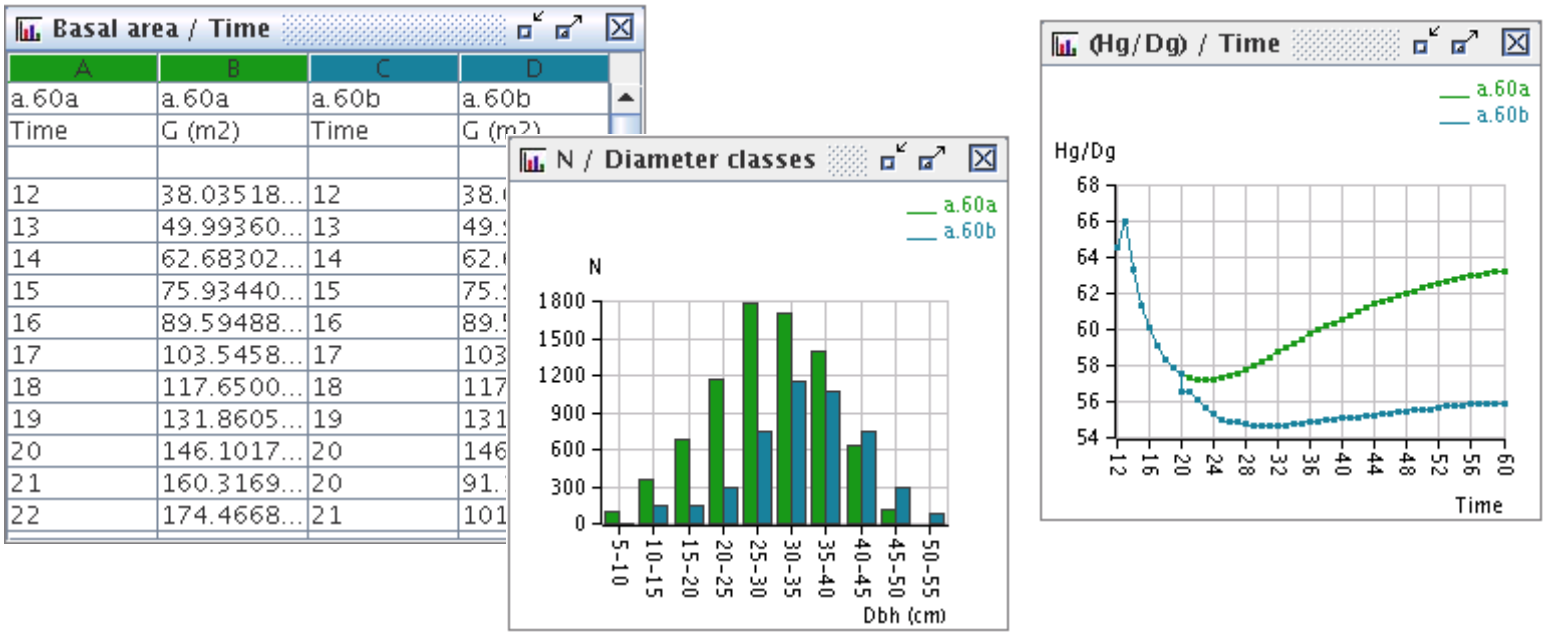

create silvicultural scenarios by running an evolution model...


... and processing interventions



# The Capsis common methodology 2/2

Use internal tools to check the result



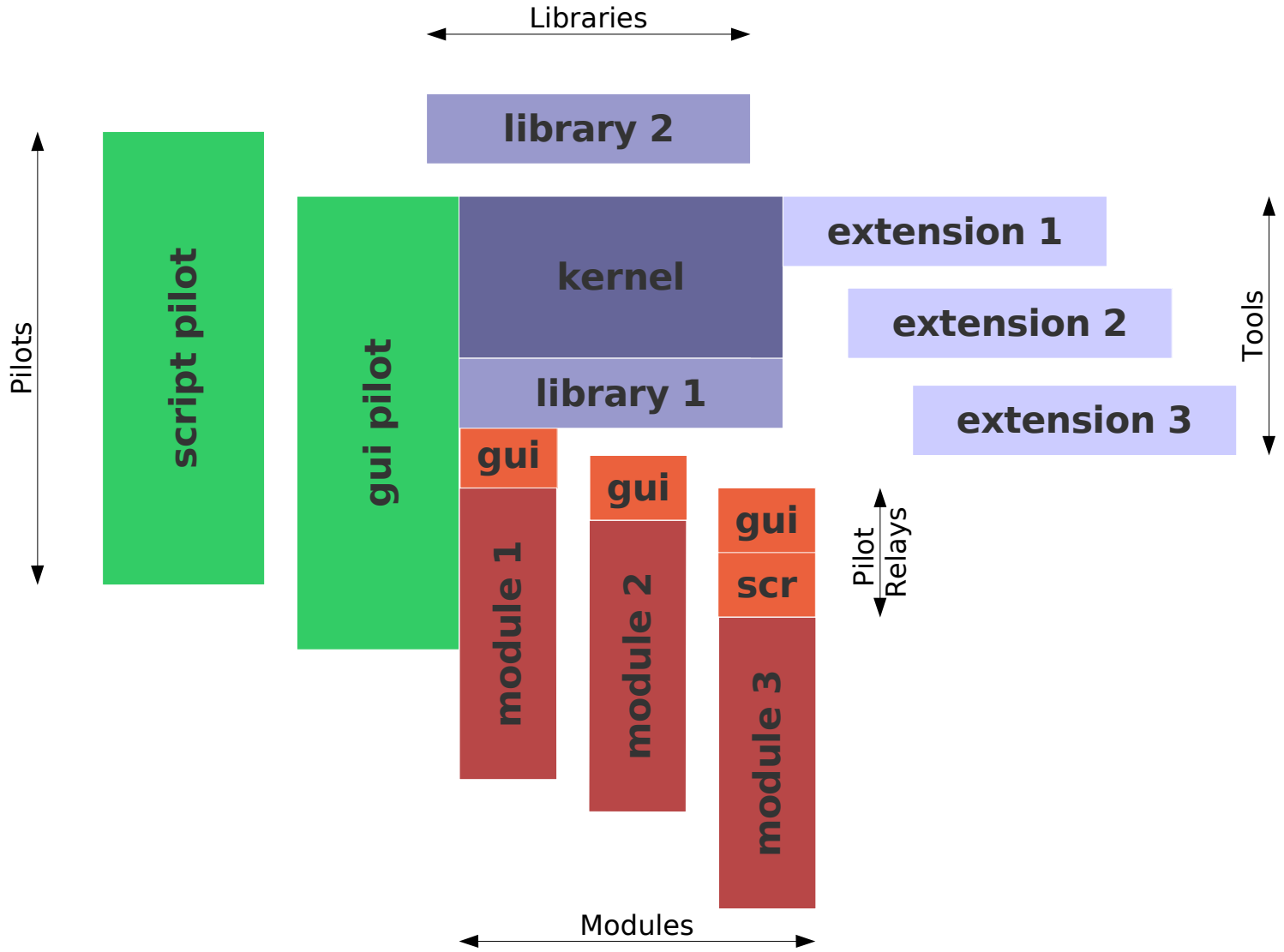

Export data easily to analyse the results in other analysis tools

# Capsis : a technical solution

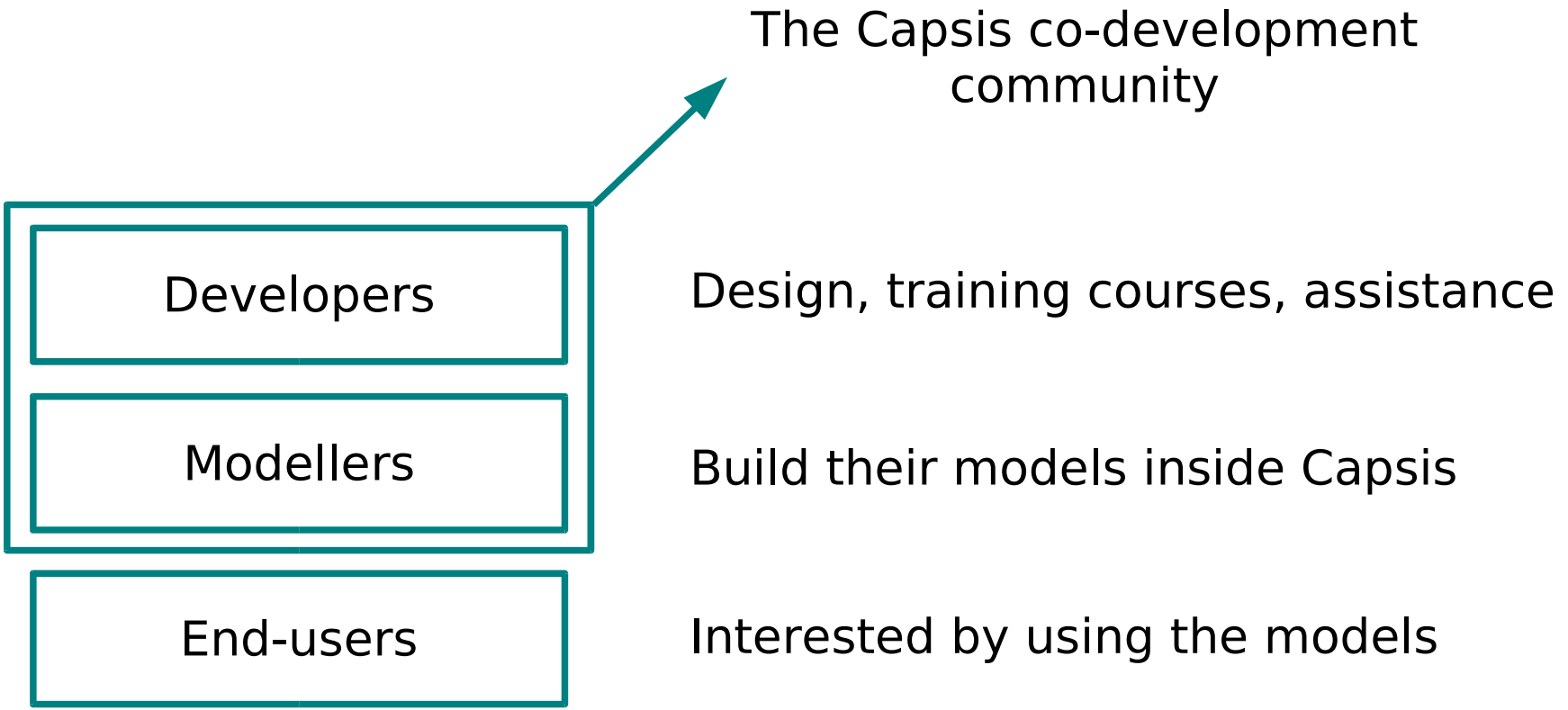
- Different kinds of models
- Object oriented architecture
- Libraries, modules, extensions
- Stable and evolutive
- Interactive or not (for long simulations)
- Java language : clean and simple, robust, powerful
- Multi operating systems : Windows, Linux (...)

- And... co-development

# Software architecture



# Organisation : actors and roles




**The modellers are in charge of the development of their models inside the platform**

# Charter and Licence

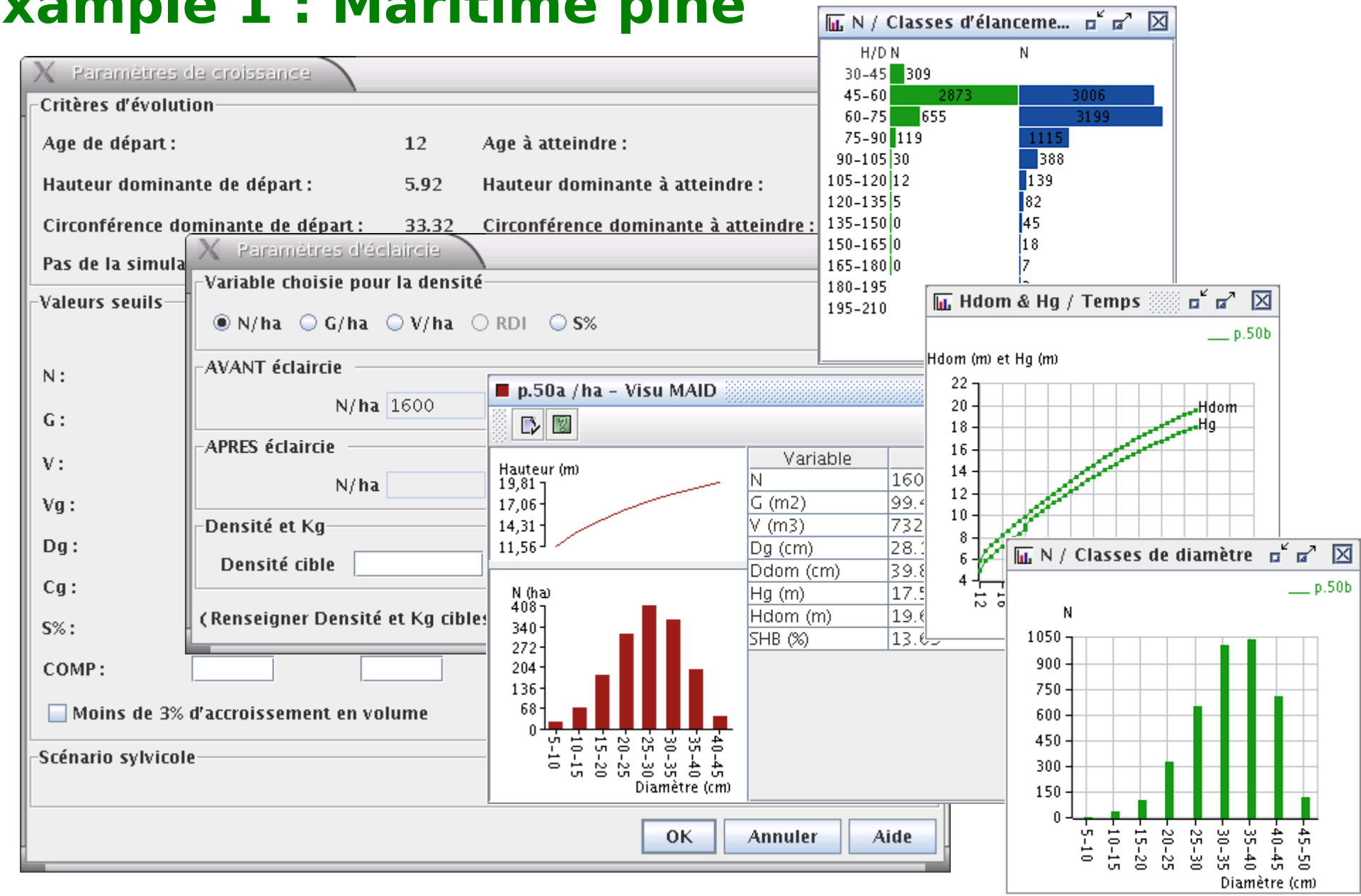
## The Capsis charter : rules inside the community

- Modellers develop their models
- They can get help from the developers
- All the source codes are shared in the community
- Mutual respect of intellectual property...

## The Lesser General Public Licence for distribution

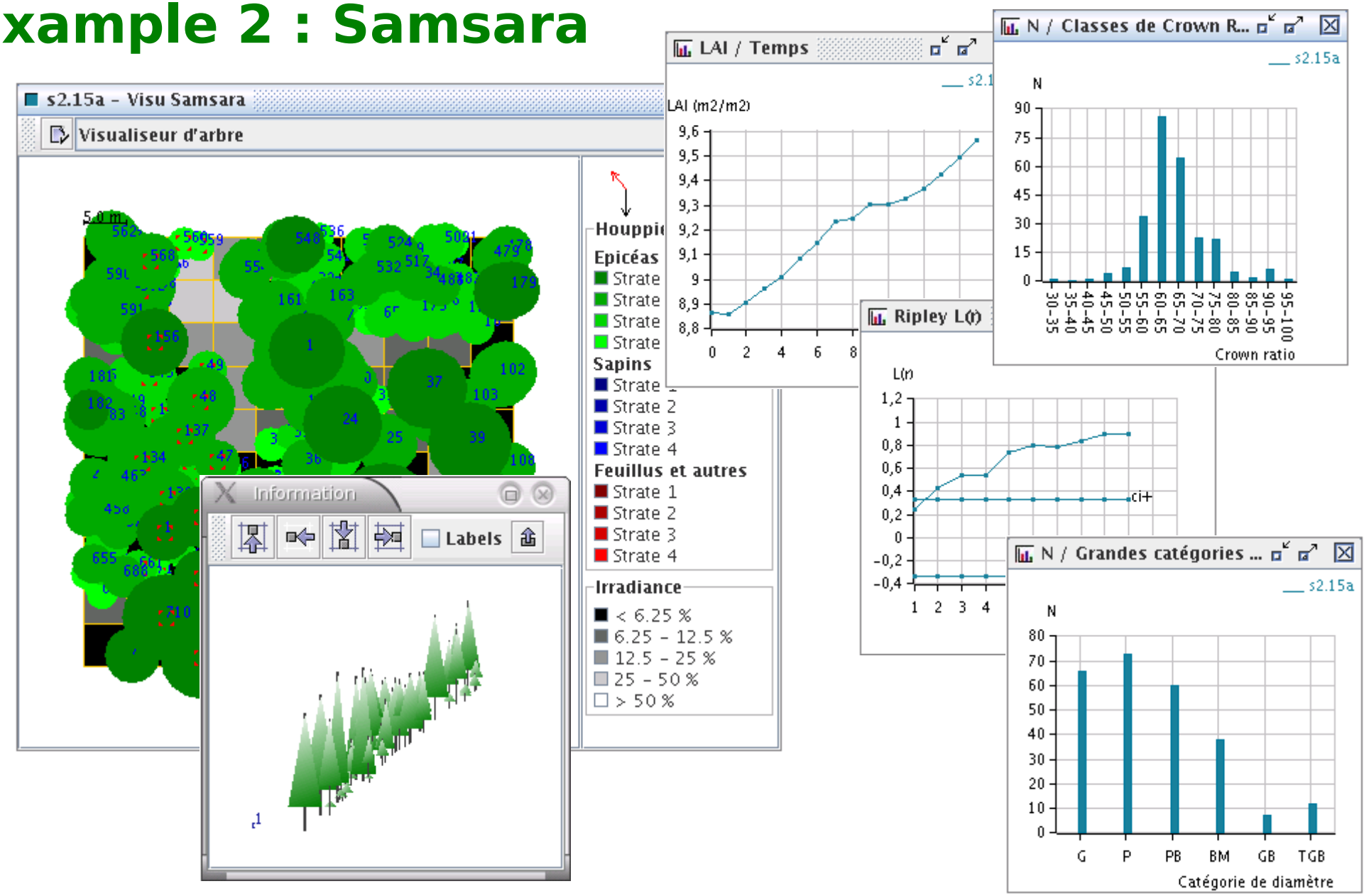
- Everything but the models is LGPL
- Modellers choose a licence for their models
- Facilitates partnerships

# Example 1 : Maritime pine

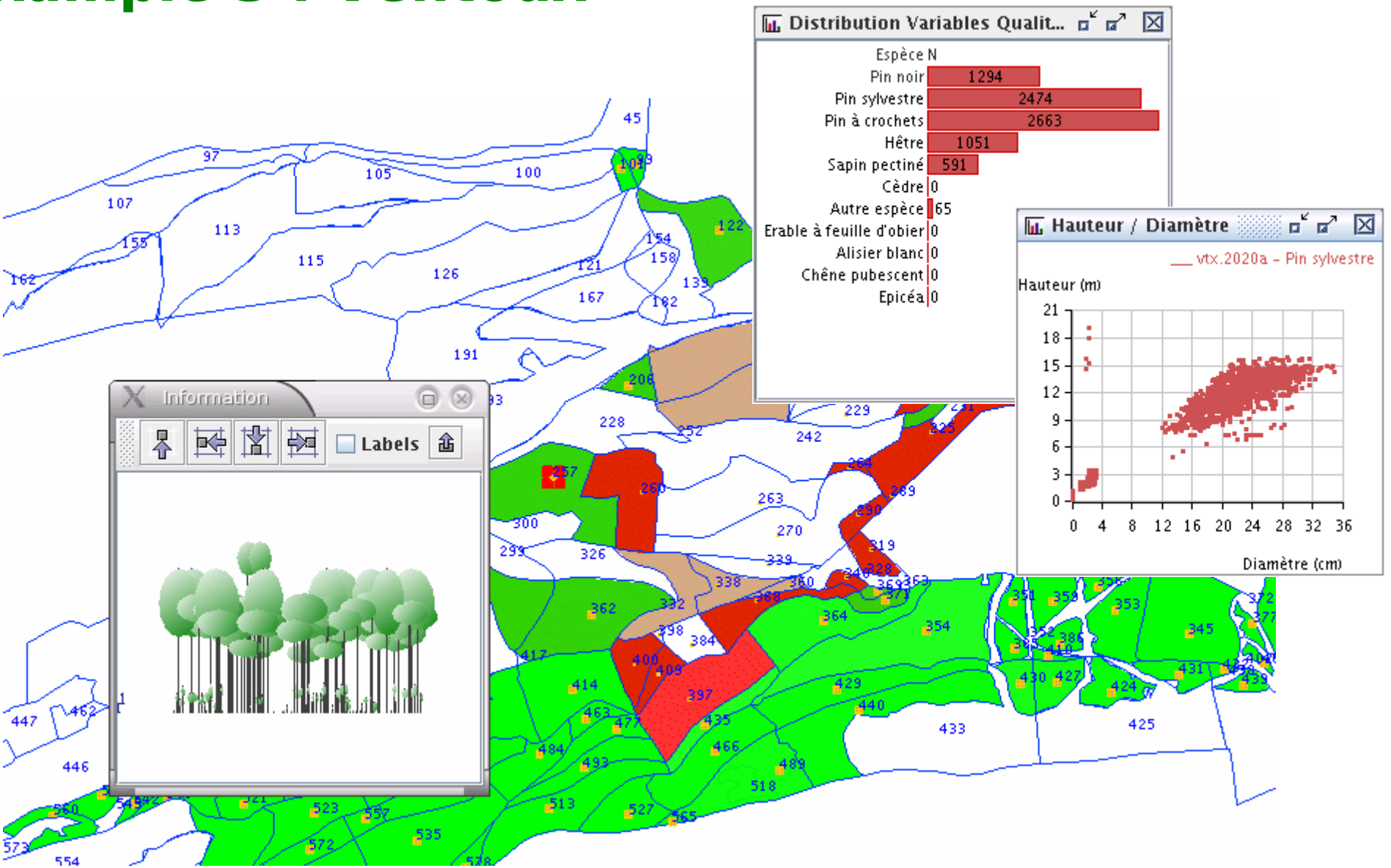


Several species, individual-based, spatially explicit, slope, radiative balance, dynamics

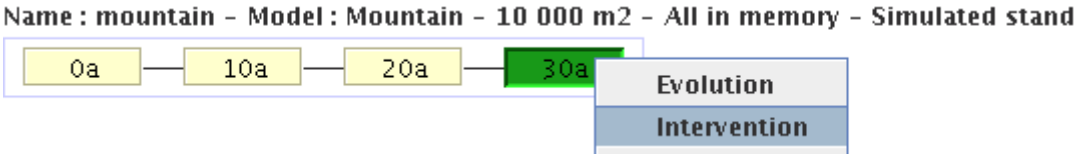
# Example 2 : Samsara



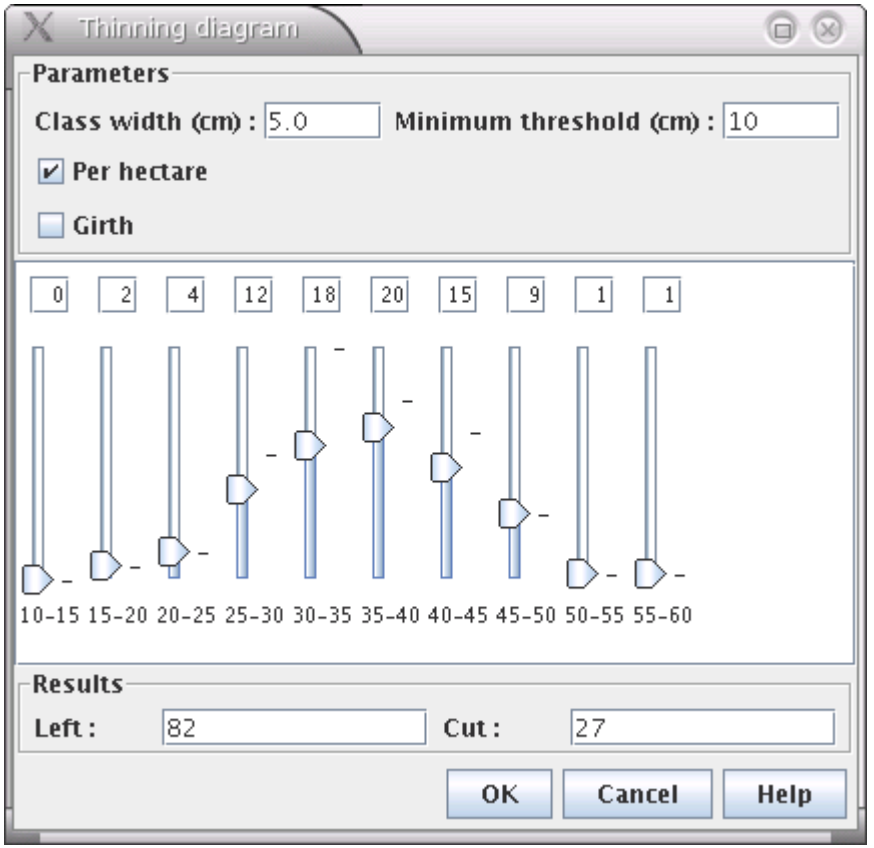
# Example 3 : Ventoux



# Interventions 1/3

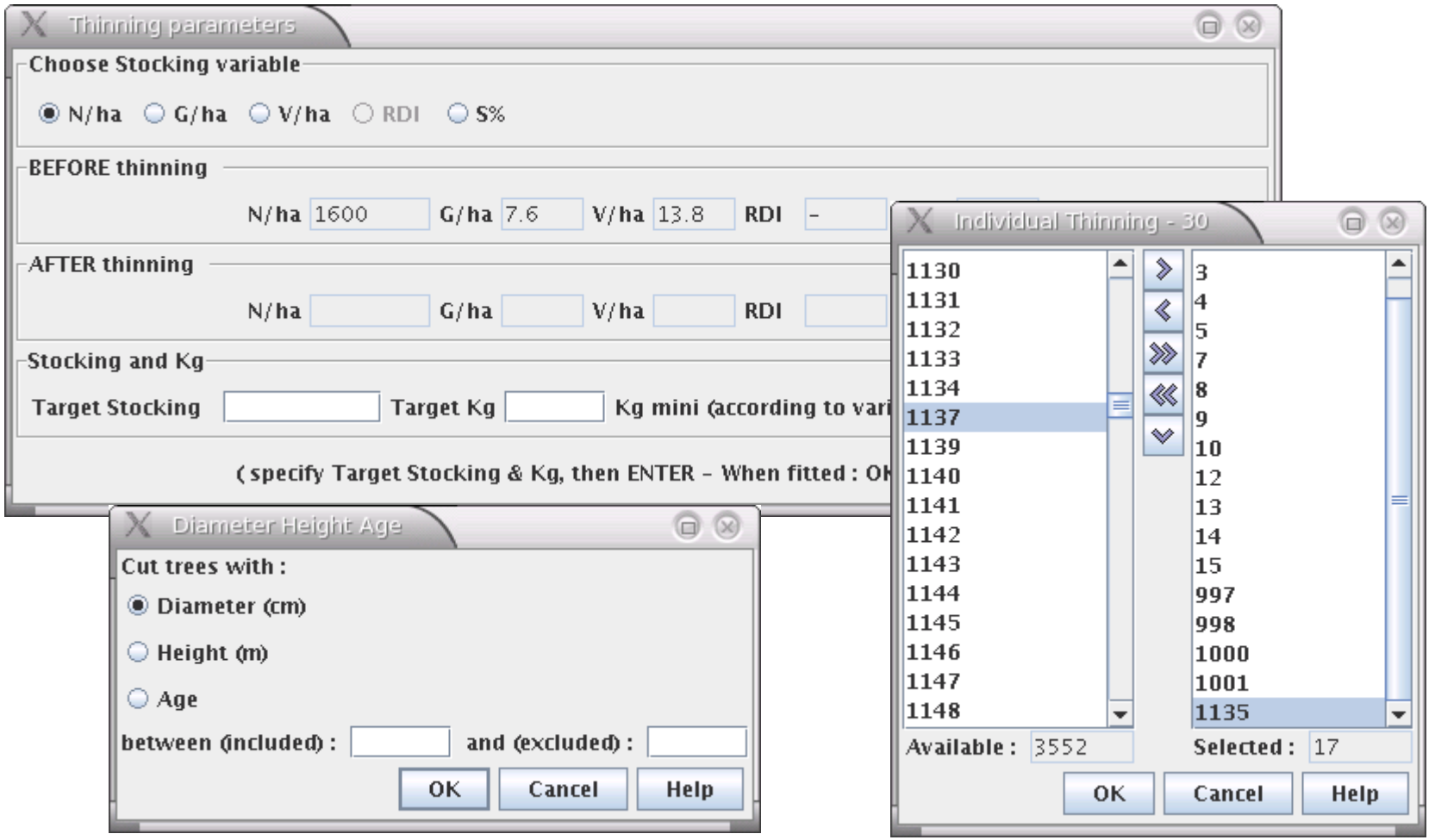



Example : **thinning diagram**
- Thinning mecanism through an interactive diagram
- Compatible with trees and cohorts-based models
- Class width / min threshold / per hectare / dbh or girth



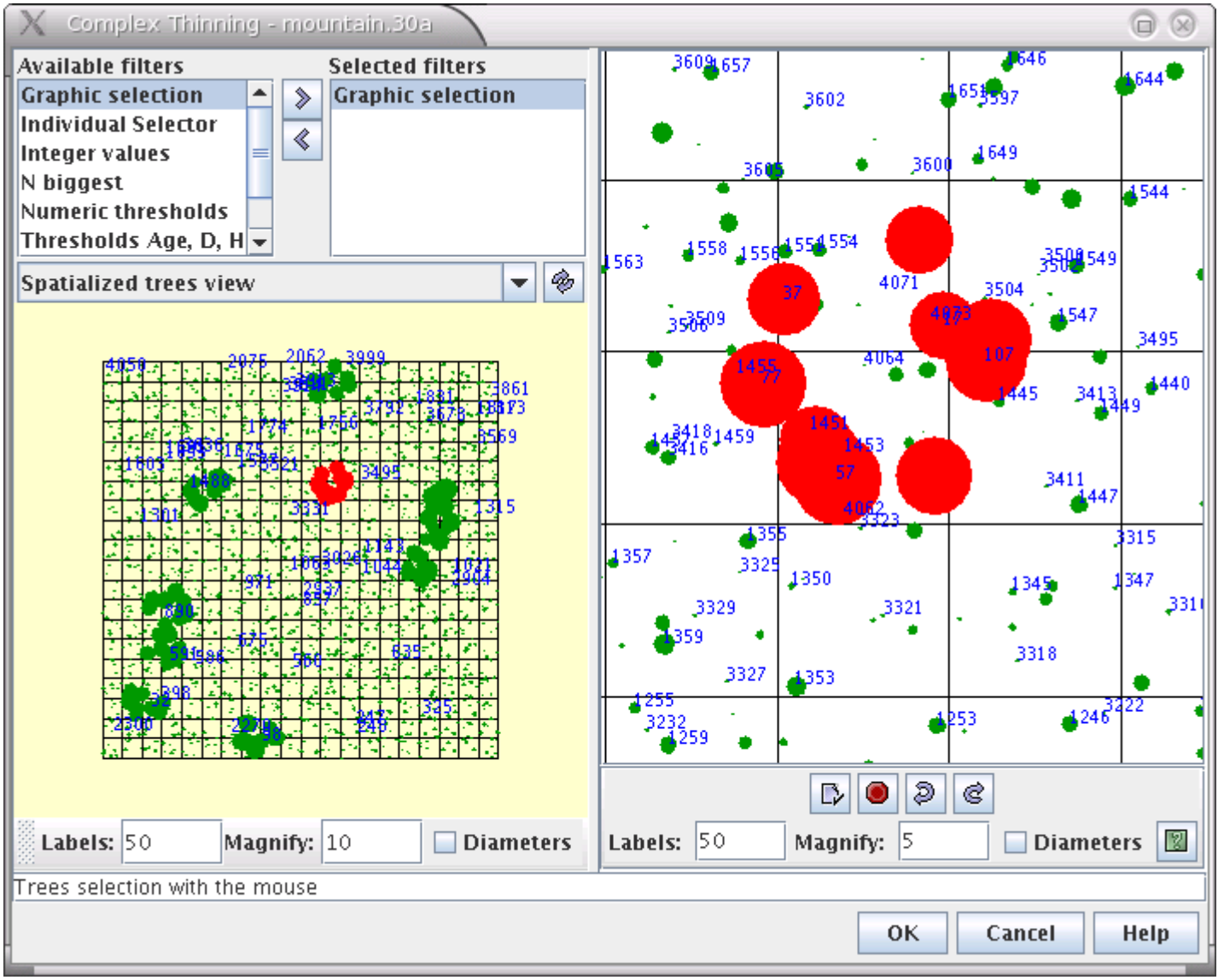
# Interventions 2/3

Various other methods

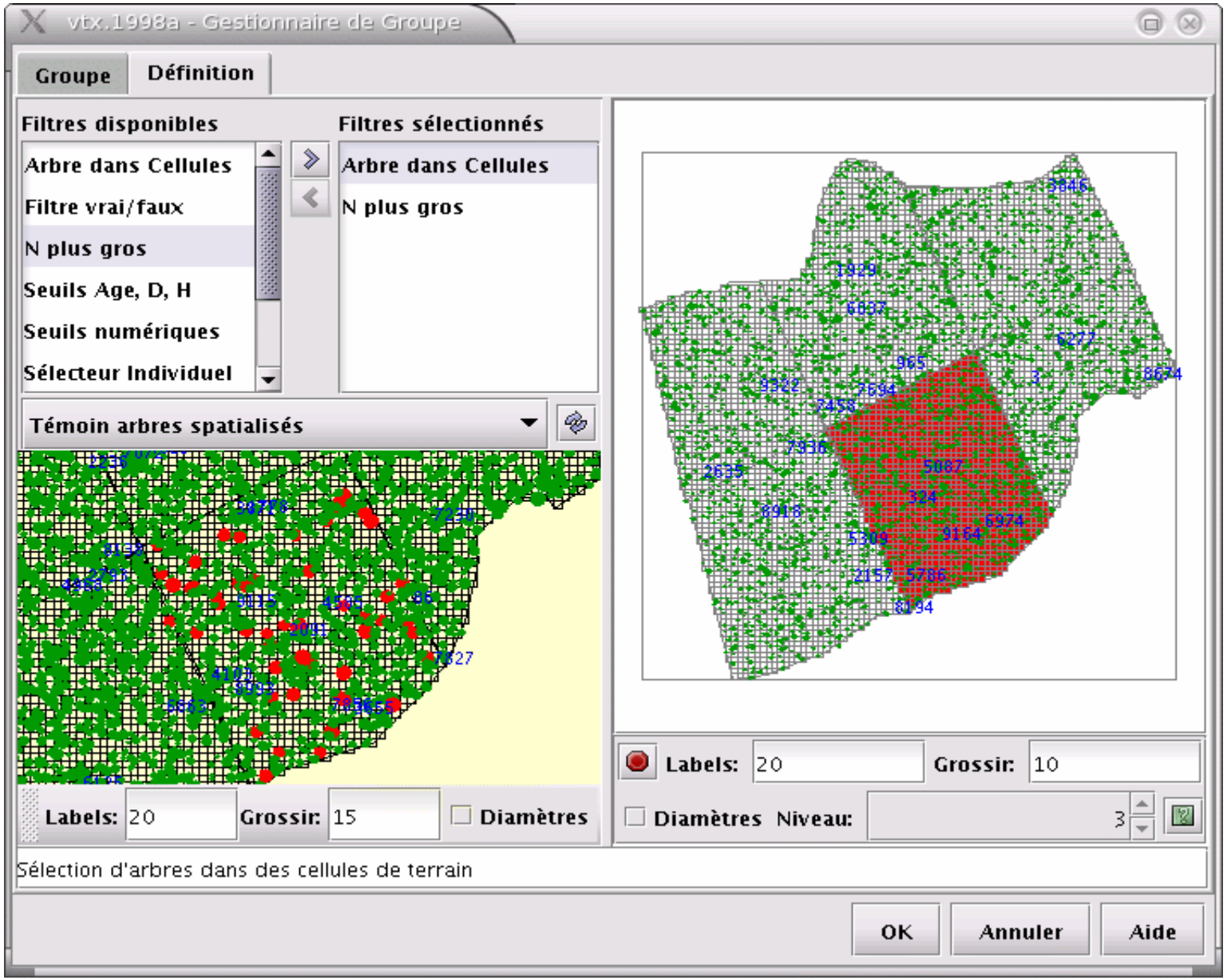


# Interventions 3/3

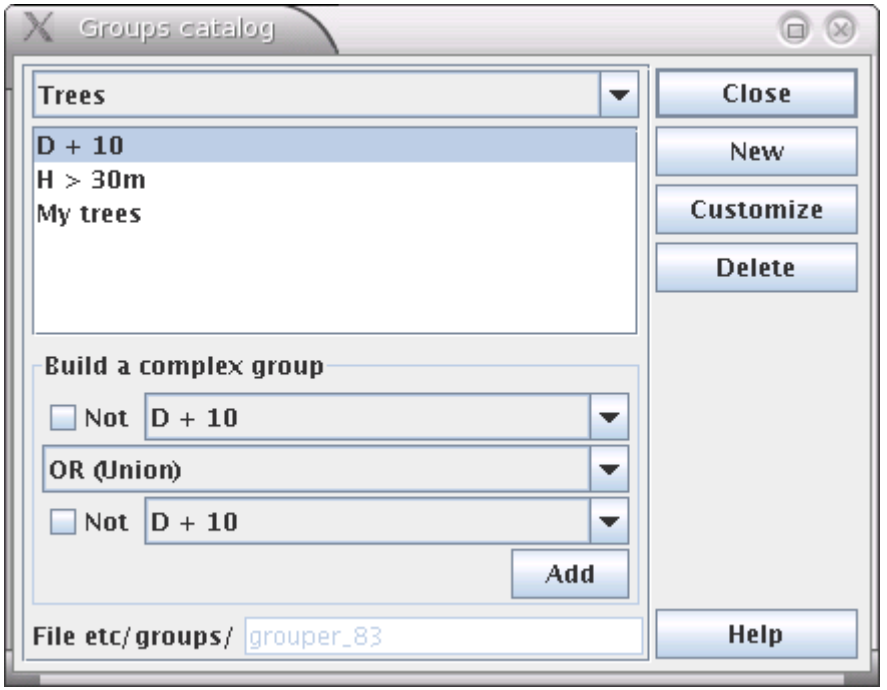
Use of selection filters to cut trees



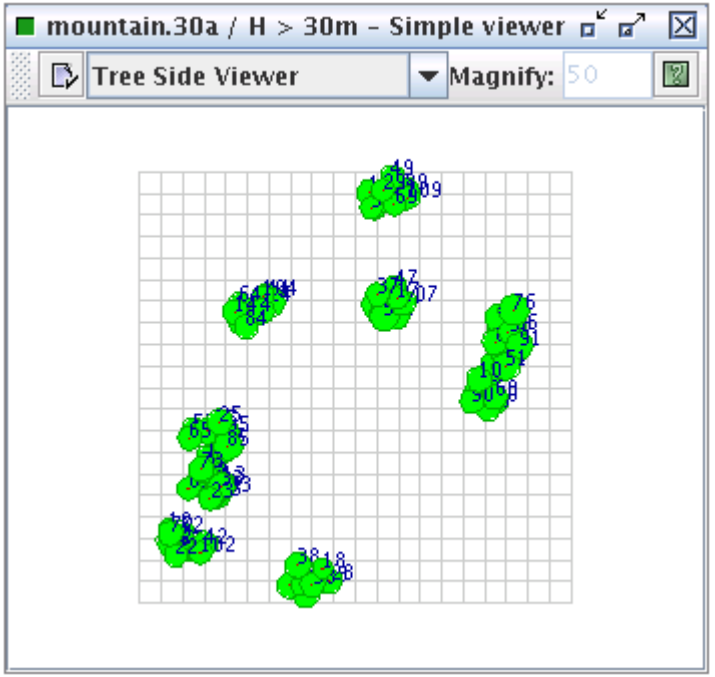
# Groups creation



# Group Catalog, Group chooser



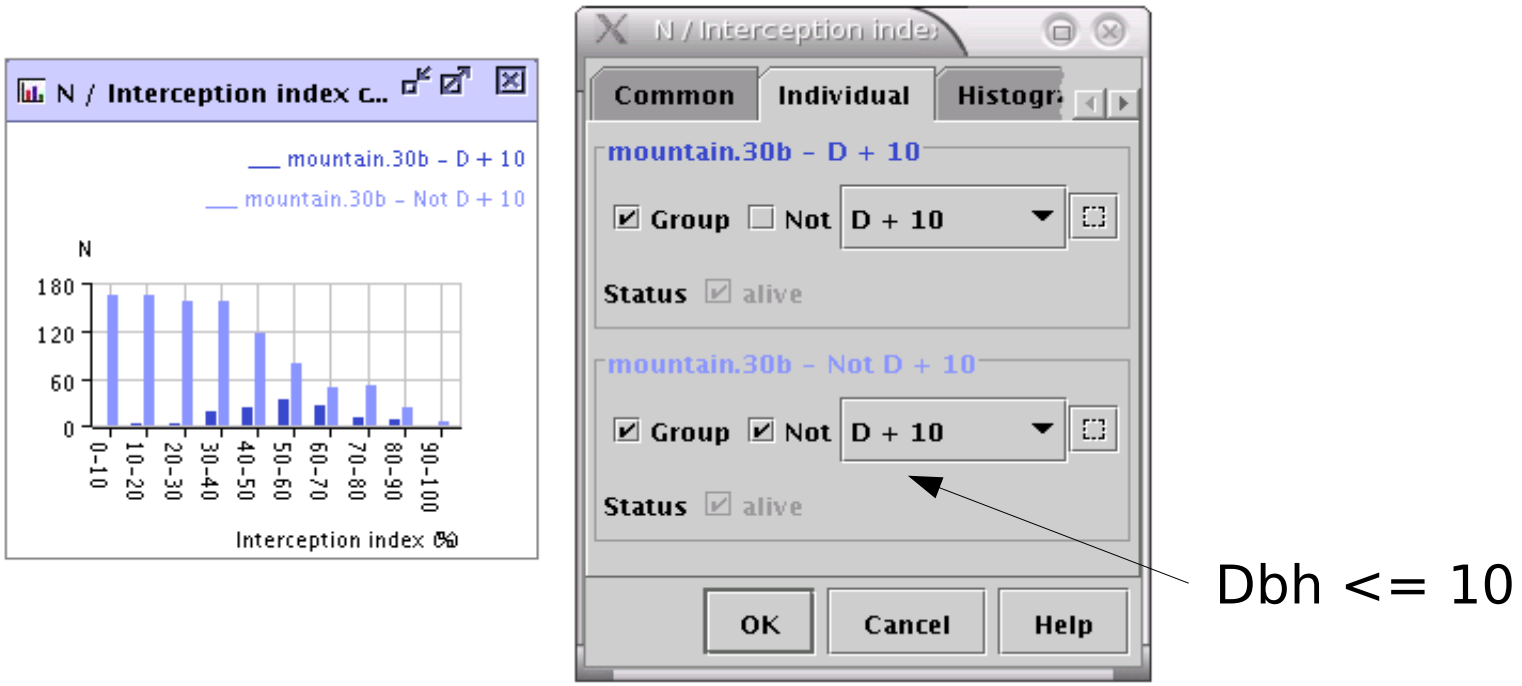

1. Manage the groups from the group catalog




2. Select the groups in the group-related tools


3. The name of the group appears in the caption or title bar

# Using groups

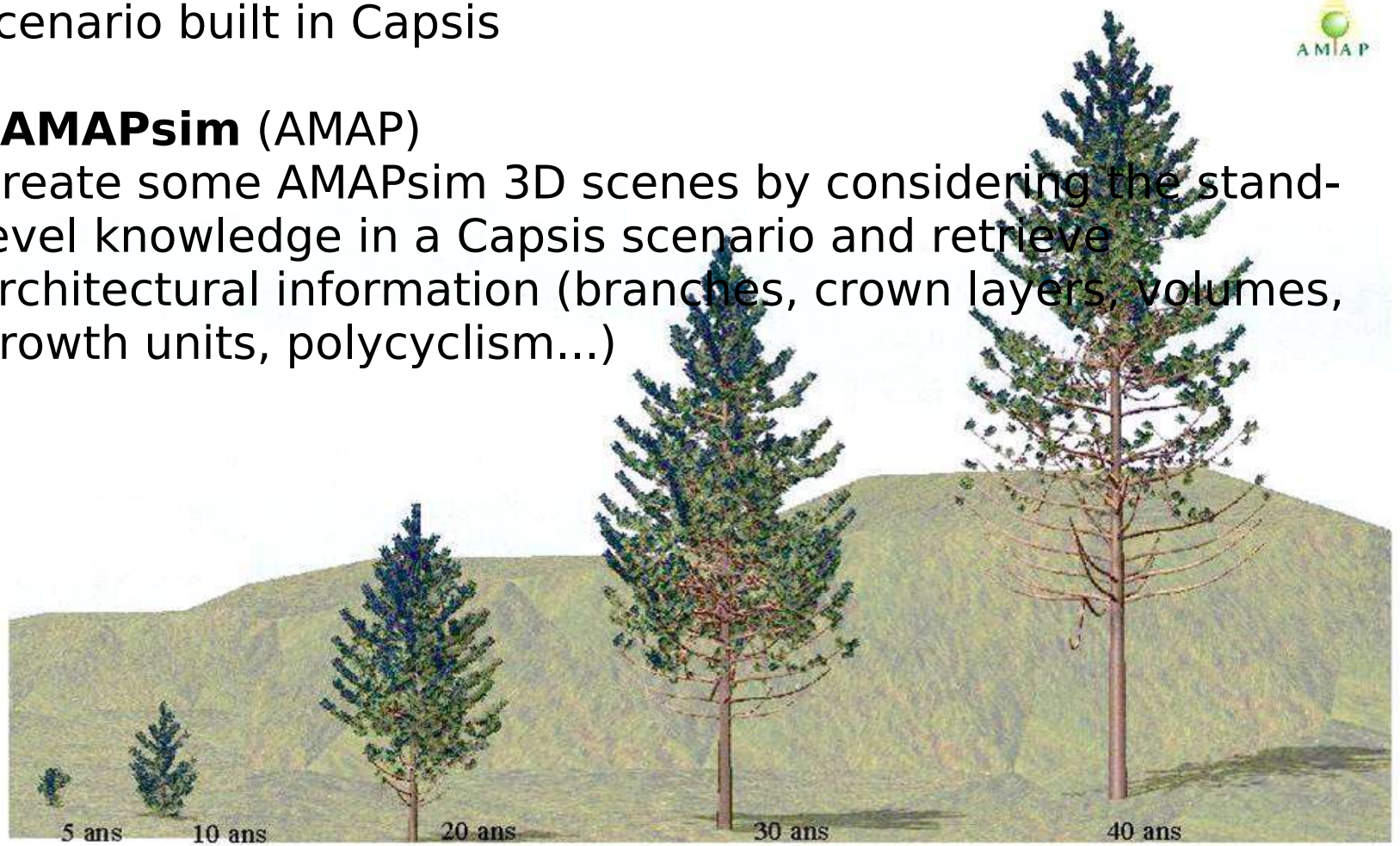



Groups are usable in some of the capsis extensions
- Graphs, viewers, interventions (ex: cut > 10cm...)
- Group complementary
- Groups are built by combining selection filters
- Complex groups with AND / OR are also groups

# Connections with other simulators

- **ForestGales** (Forestry Comission, UK)
Maritime pine, breaking and overturning risk for a silvicultural scenario built in Capsis

- **AMAPsim** (AMAP)
Create some AMAPsim 3D scenes by considering the stand-level knowledge in a Capsis scenario and retrieve architectural information (branches, crown layers, volumes, growth units, polycyclism...)



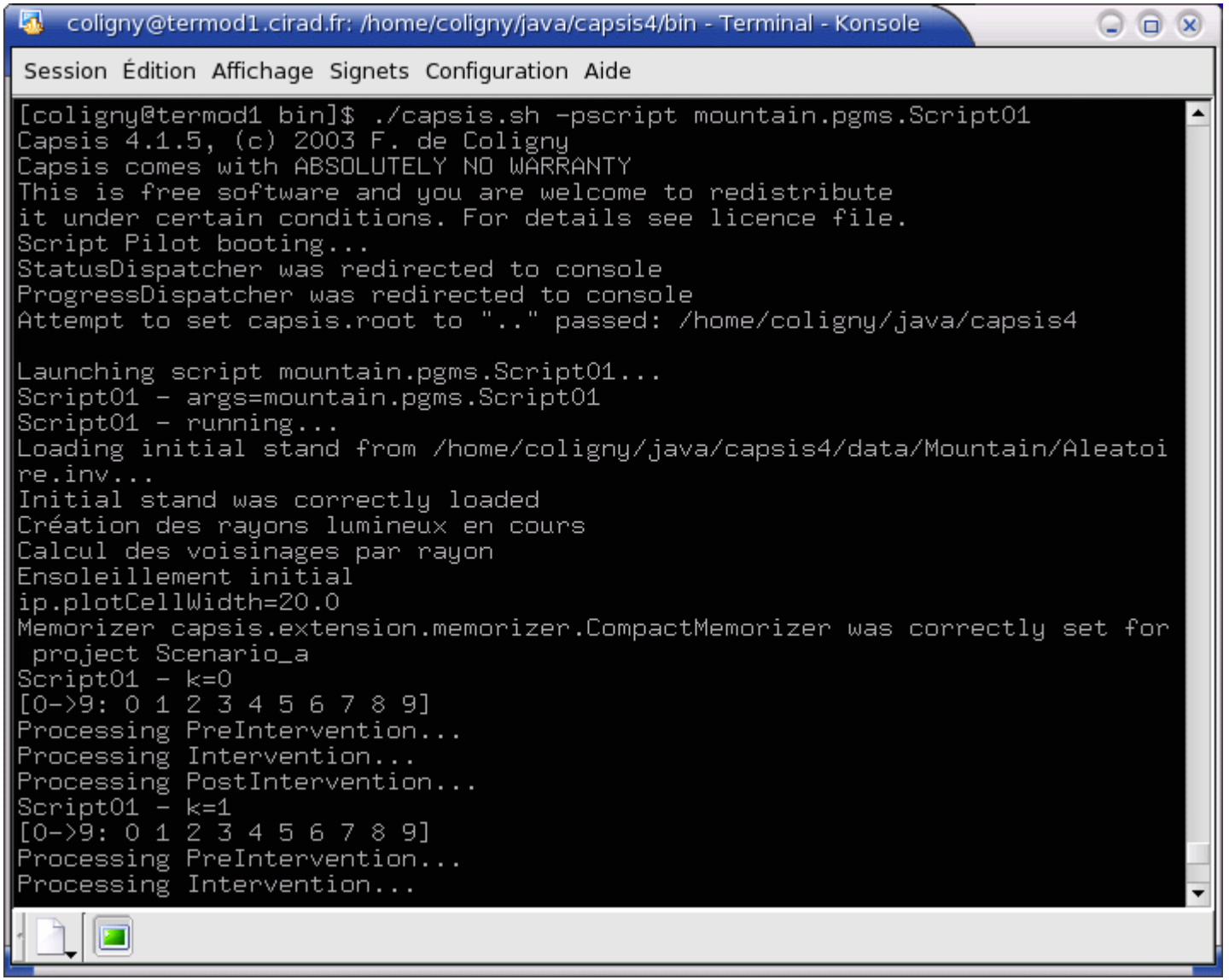
# Connections with other simulators 2/2

- **SVS** (USDA, USA)
Stand Visualization System : Capsis scenes -> 3D scenes

- **STICS** (INRA)
Part of the SAFE Agroforestry European project : connection with the STICS crop model for the agronomic part

...

# Script mode for repetitive simulations



# The models under Capsis 1/2

| Model name | Kind / Species | Corresponding author(s) |
|---|---|---|
| mountain | Spruce | B. Courbaud (Cemagref) |
| selva | Tropical, genetics | S. Gourlet-Fleury, G. Cornu (Cirad) |
| ventoux | Heterogeneous | Ph. Dreyfus (INRA) |
| pnn | Pinus nigra nigricans | Ph. Dreyfus (INRA) |
| eucalypt | Eucalyptus in Congo | L. Saint-André (Cirad) |
| pp3 | Maritime pine | C. Meredieu (INRA) |
| laricio | Corsican pine | S. Perret (Cemagref) |
| sexi | Tropical | G. Vincent (IRD), D. Harja (ICRAF, Indonesia) |
| hisafe | Agroforestry, STICS | I. Lecomte (INRA) |
| ventouG | Heterogeneous, genetics | Ph. Dreyfus (INRA) |
| fiesta / nrg | Pinus halepensis | Ph. Dreyfus (INRA) |
| bimodal | Continuous | A. Franc (INRA) |
| qs1 | Quercus petraea | J.-F. Dhôte, Ph. Dreyfus (INRA) |
| fagacees | Oak and Beech | J.-F. Dhôte, P. Vallet (INRA) |
| alisier | Sorbus torminalis and Oak | S. Oddou-Muratorio (INRA) |
| regelight | Regeneration | A. Piboule (ONF) |
| ca1 | Cedrus atlantica | F. Courbet (INRA) |
| mangrove | Mangrove | Ch. Proisy (IRD-AMAP) |
| samsara | Spruce, Fir, Broadleaved | B. Courbaud (Cemagref) |
| luberon | Cedrus atlantica, genetics | F. Courbet, F. Lefevre (INRA) |

# The models under Capsis 2/2

| Model name | Kind / Species | Corresponding author(s) |
|---|---|---|
| quercus | Quercus petraea, genetics | S. Gerber (INRA) |
| bidasoa | Fish dynamics, genetics | J. Labonne (INRA) |
| presage | Forests in Quebec | S. Turbis, D. Mailly (MRNFP, Canada) |
| pradiata | Radiata pine | D. Pont (Forest Research, New Zealand) |
| sylvestris | Scots pine | S. Perret, T. Perot (Cemagref), C. Meredieu (INRA) |
| transpop | Transitionnal populations | Sylvie Oddou-Muratorio (INRA) |
| cytisus | Scotch broom, grass, sheep | Estelle Chambon-Dubreuil (INRA) |
| paletuviers | Avicennia, Rhizophora | Patrick Heuret (INRA-AMAP), Marilyne Laurans (Cirad-AMAP) |
| simsys | Agro-foresterie tropicale | Marilyne Laurans (Cirad-AMAP) |
| nz1 | Pin radiata | Dave Pont, Andrew Gordon (ENSIS) |
| fasy | Fagacees (Oak) + Sylvestris (Scots pine) | Gregory Deceliere (Cemagref |

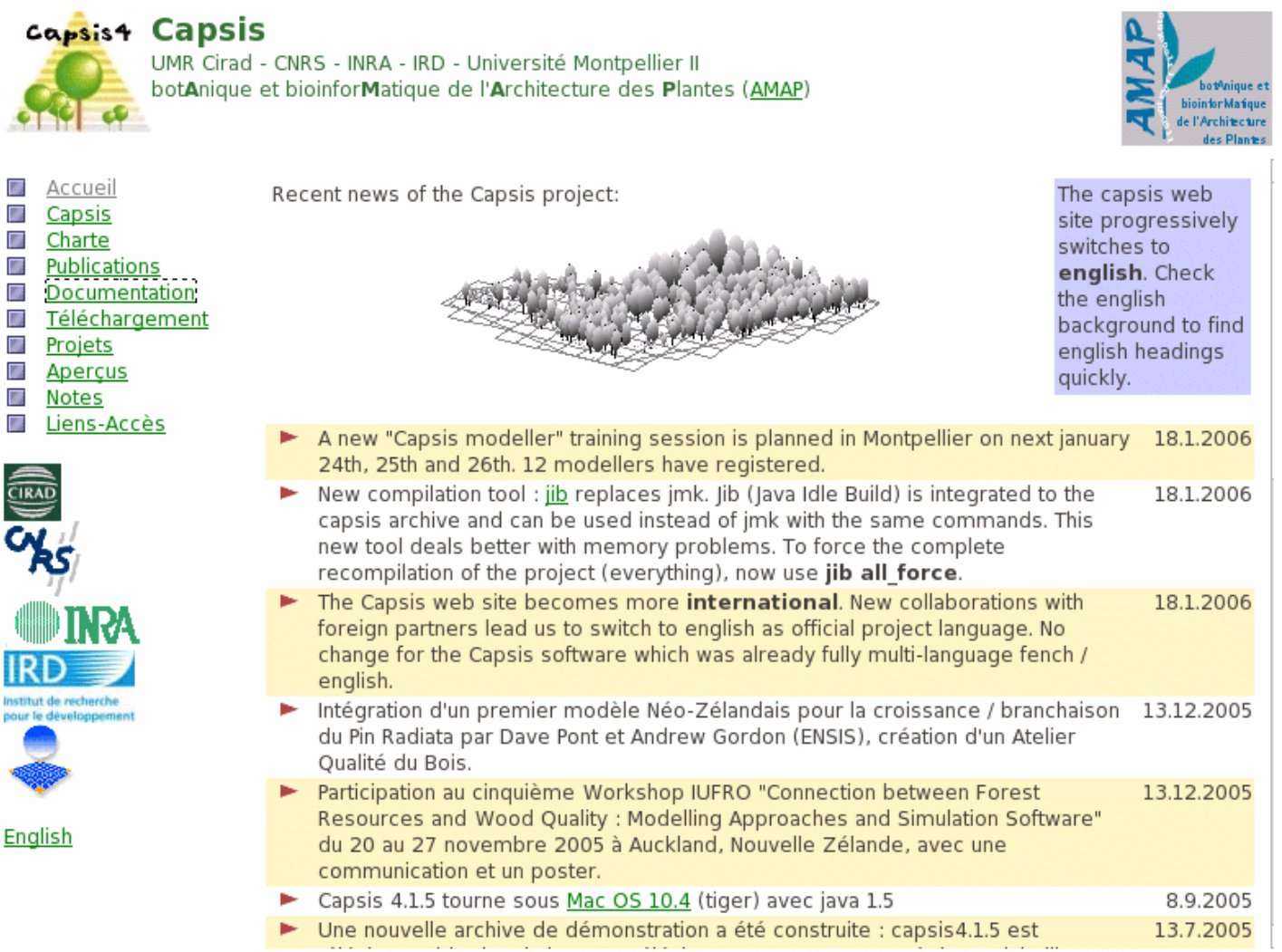
## The libraries under Capsis

| Name | Type | Corresponding author |
|---|---|---|
| spatial | Virtual stand and spatial analysis | F. Goreaud (Cemagref) |
| biomechamics | Internel structure / wind | Ph. Ancelin (Cemagref) |
| genetics | genetics for individuals and cohorts | Ch. Pichot (INRA) |
| economics | Economics | Ch. Orazio (IEFC) |
| delaunay | Delaunay triangulation | A. Piboule (ONF) |

# Documentation

http://capsis.free.fr

Online doc and tutorial (english + french) / Reference manual / The Capsis web site with a documentation page (english + french)



# Partnerships

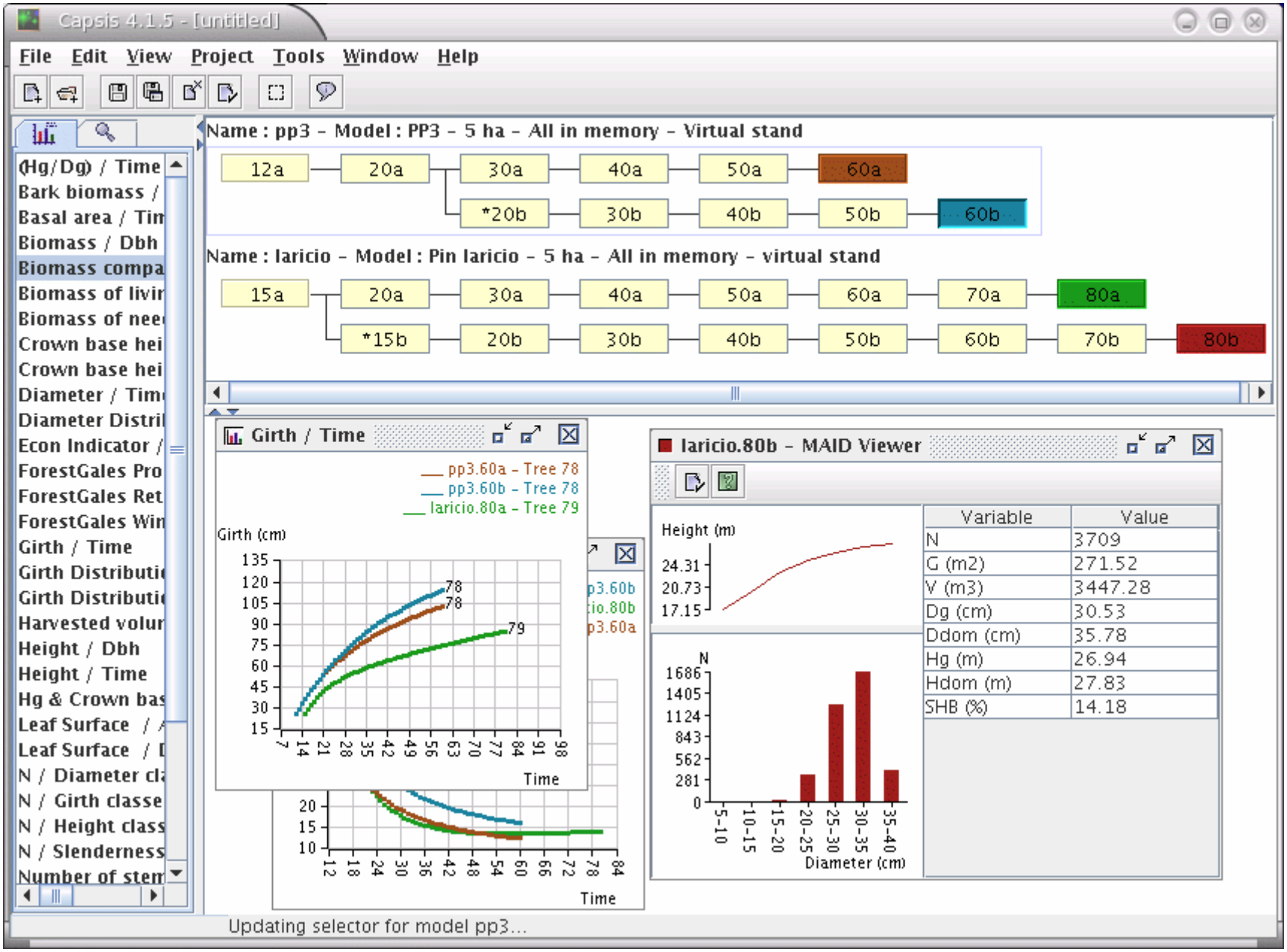
## With french institutes

- INRA, Cirad, Cemagref, ENGREF, ONF...

## And abroad

- Canada : MNRFP (Québec) + Canadian Forest Research
- New Zealand : ENSIS (ex Forest Research)
- China : Submission of a PRA project : «  Development of Integrated Tools for Eco-Engineering  », Thierry Fourcaud (Cirad), LU YuanChang (CAF)

# Capsis User Interface (Linux, english)



# From forestry to multi-themes ?

**Advantages**

- General framework
- Could be used for other simulation domains
- Some experiments in fish dynamics
- Seems possible

**Implies**...

- requests from interested partners
- a split in two or more projects ?
- more people ?
- a decision (investment)

# The Bidasoa project: fish in Capsis...