



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

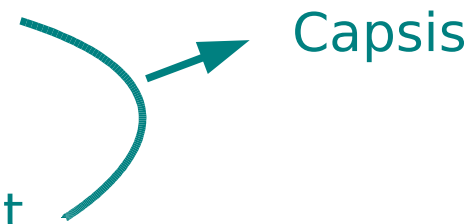
For who

Forestry modellers, forestry managers and education

Forestry models

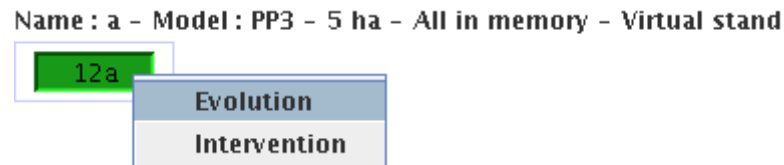
Various types of models

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

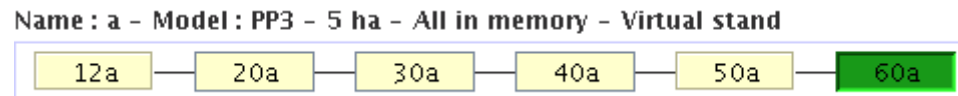


The Capsis common methodology 1/2

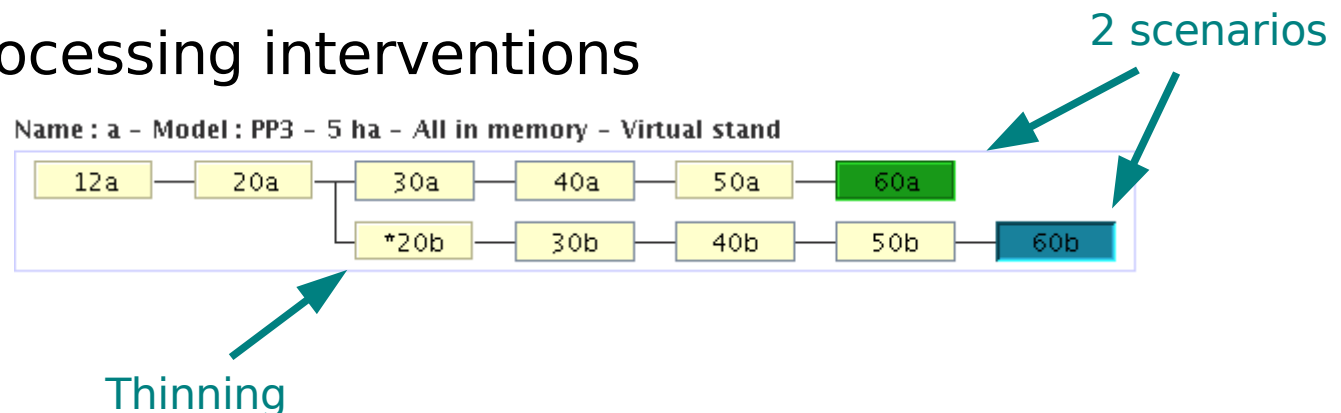
From an initial situation (real or virtual),



create silvicultural scenarios by running an evolution model...

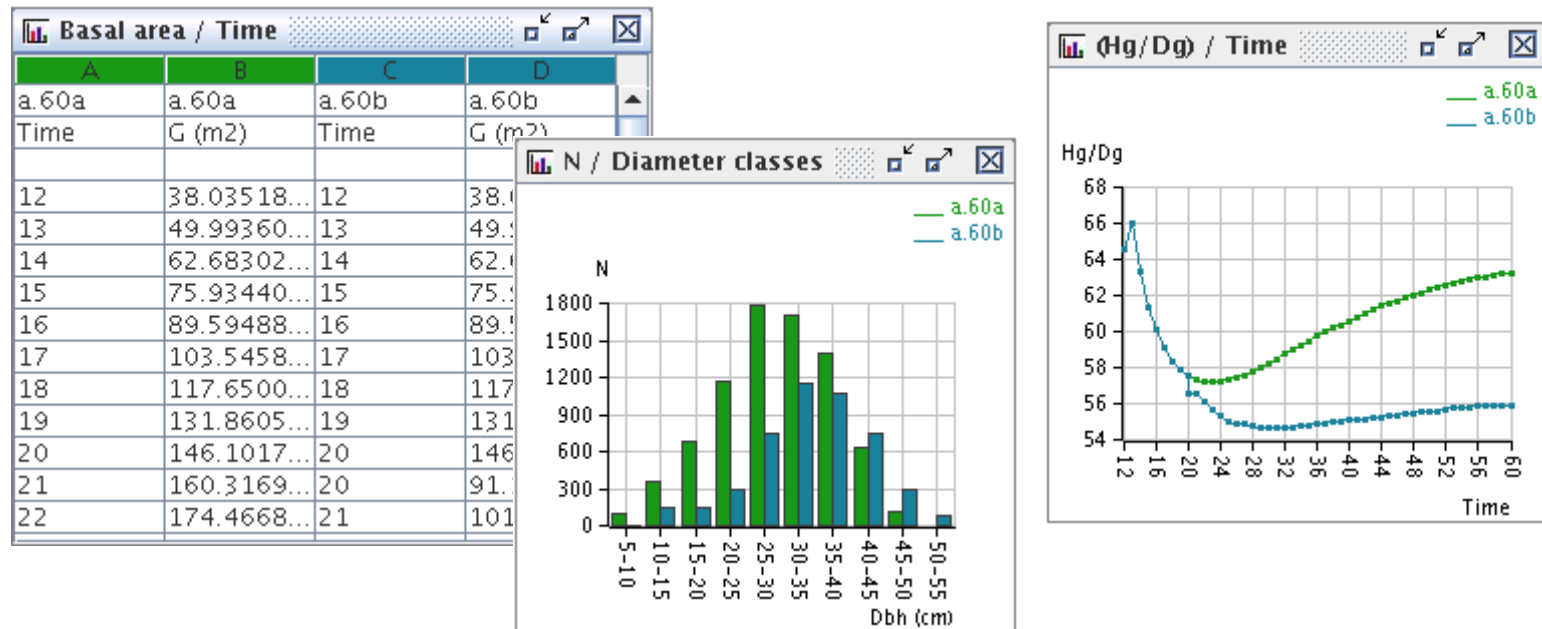


... and processing interventions



The Capsis common methodology 2/2

Use internal tools to check the result



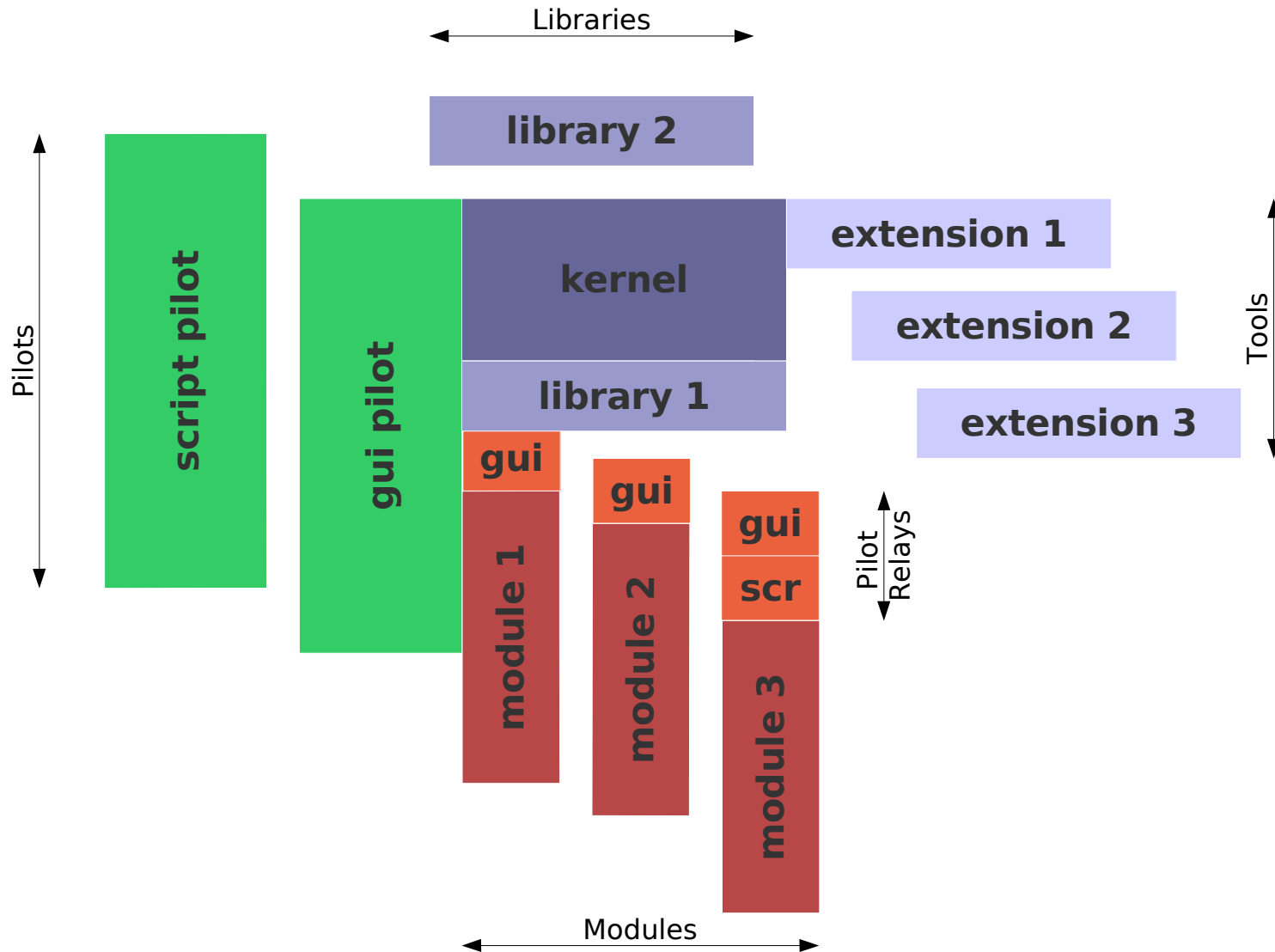
Export data easily to analyse the results in other analysis tools

Capsis : a technical solution

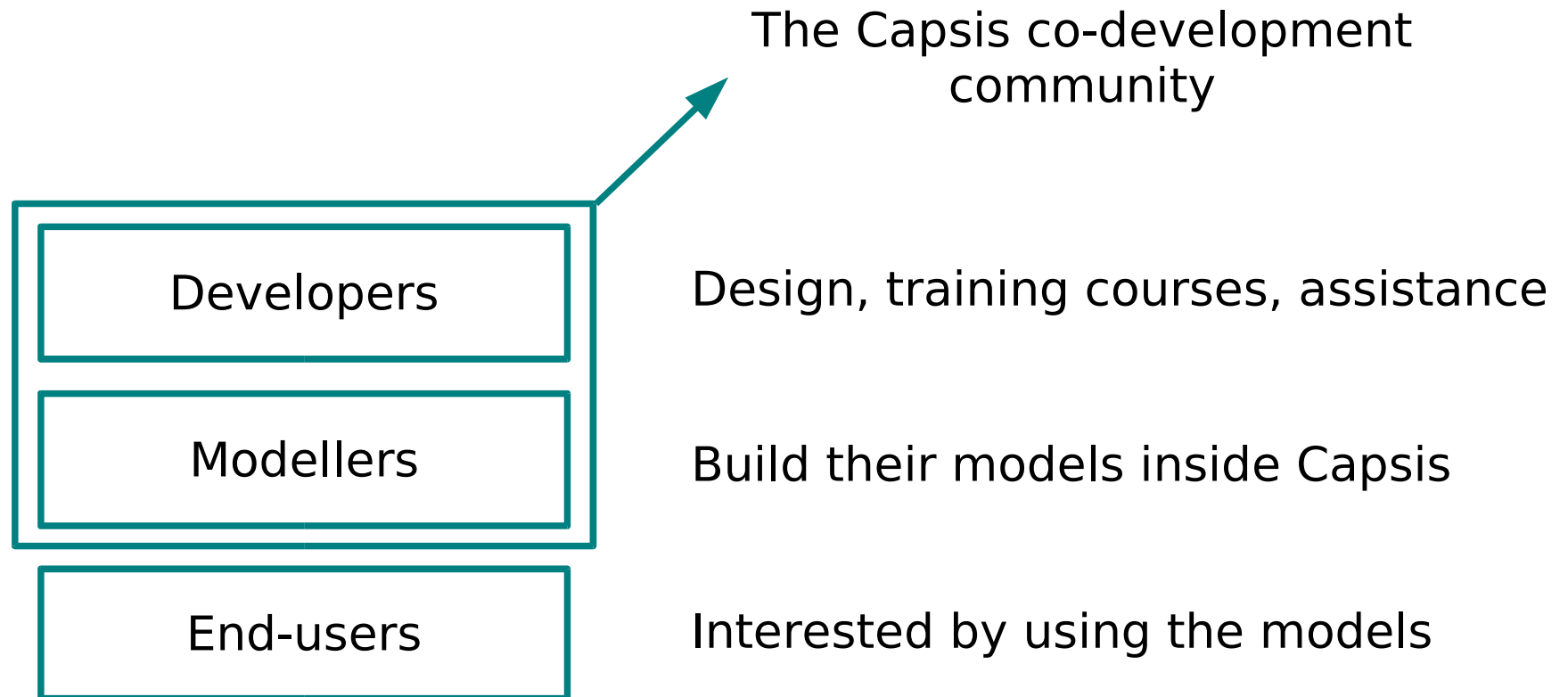
- Different kinds of models
- Object oriented architecture
- Libraries, modules, extensions
- Stable and evolutive
- Interactive or not (for long simulations)
- Java language : clean and simple, robust, powerful
- Multi operating systems : Windows, Linux (...)

- 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

Paramètres de croissance

Critères d'évolution

Age de départ : 12 Age à atteindre :
 Hauteur dominante de départ : 5.92 Hauteur dominante à atteindre :
 Circonférence dominante de départ : 33.32 Circonférence dominante à atteindre :
 Pas de la simulation :

Valeurs seuils

N :
 G :
 V :
 Vg :
 Dg :
 Cg :
 S% :
 COMP :
 Moins de 3% d'accroissement en volume

Scénario sylvicole

Paramètres d'éclaircie

Variable choisie pour la densité

N/ha G/ha V/ha RDI S%

AVANT éclaircie

N/ha : 1600

APRES éclaircie

N/ha :

Densité et Kg

Densité cible :

(Renseigner Densité et Kg cibles)

p.50a / ha - Visu MAID

Variable	
N	1600
G (m ²)	99.4
V (m ³)	732
Dg (cm)	28.1
Ddom (cm)	39.8
Hg (m)	17.5
Hdom (m)	19.6
SHB (%)	13.6

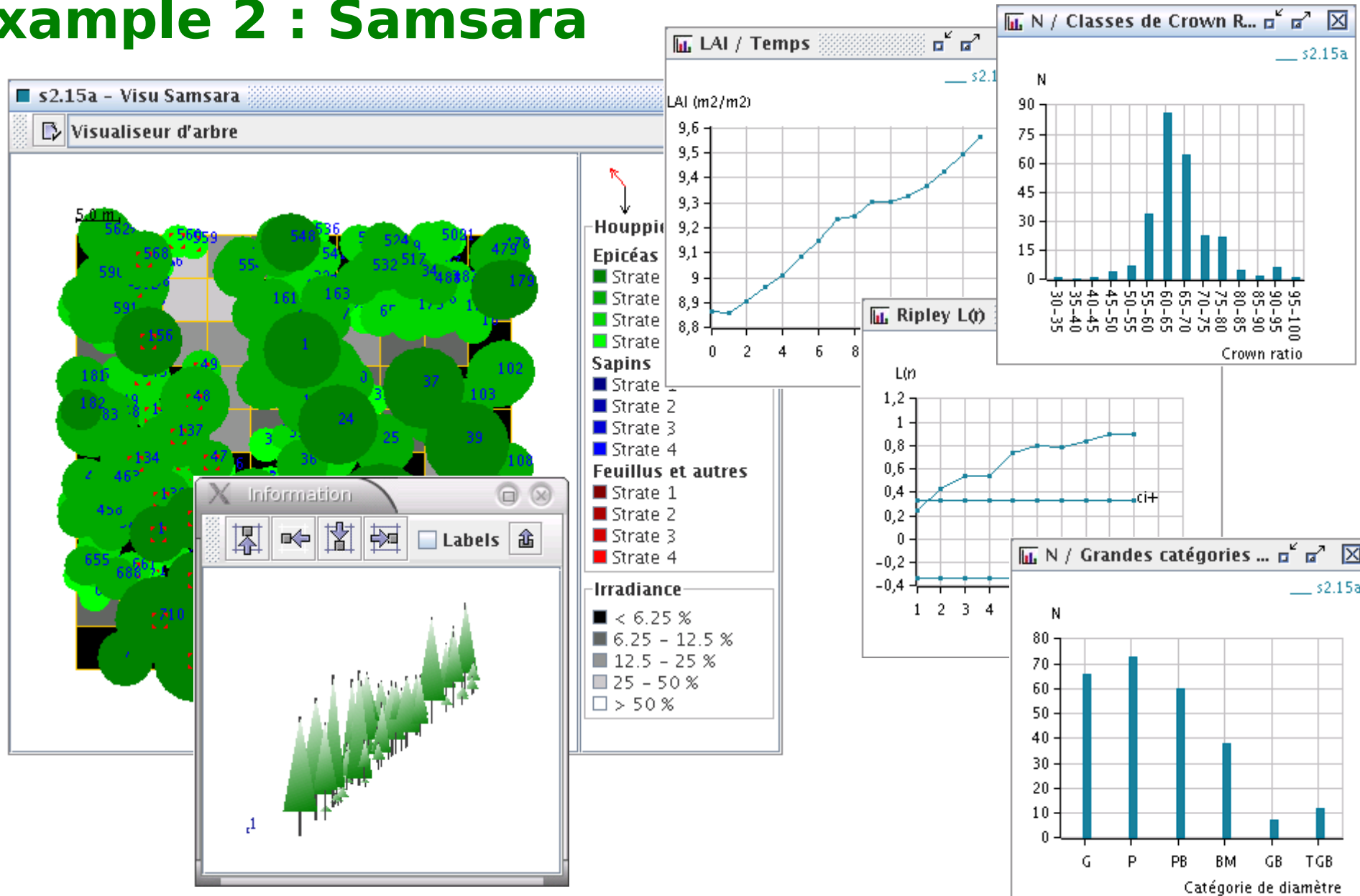
N / Classes d'élancement

H/D N	N
30-45	309
45-60	2873
60-75	655
75-90	119
90-105	30
105-120	12
120-135	5
135-150	0
150-165	0
165-180	0
180-195	0
195-210	0

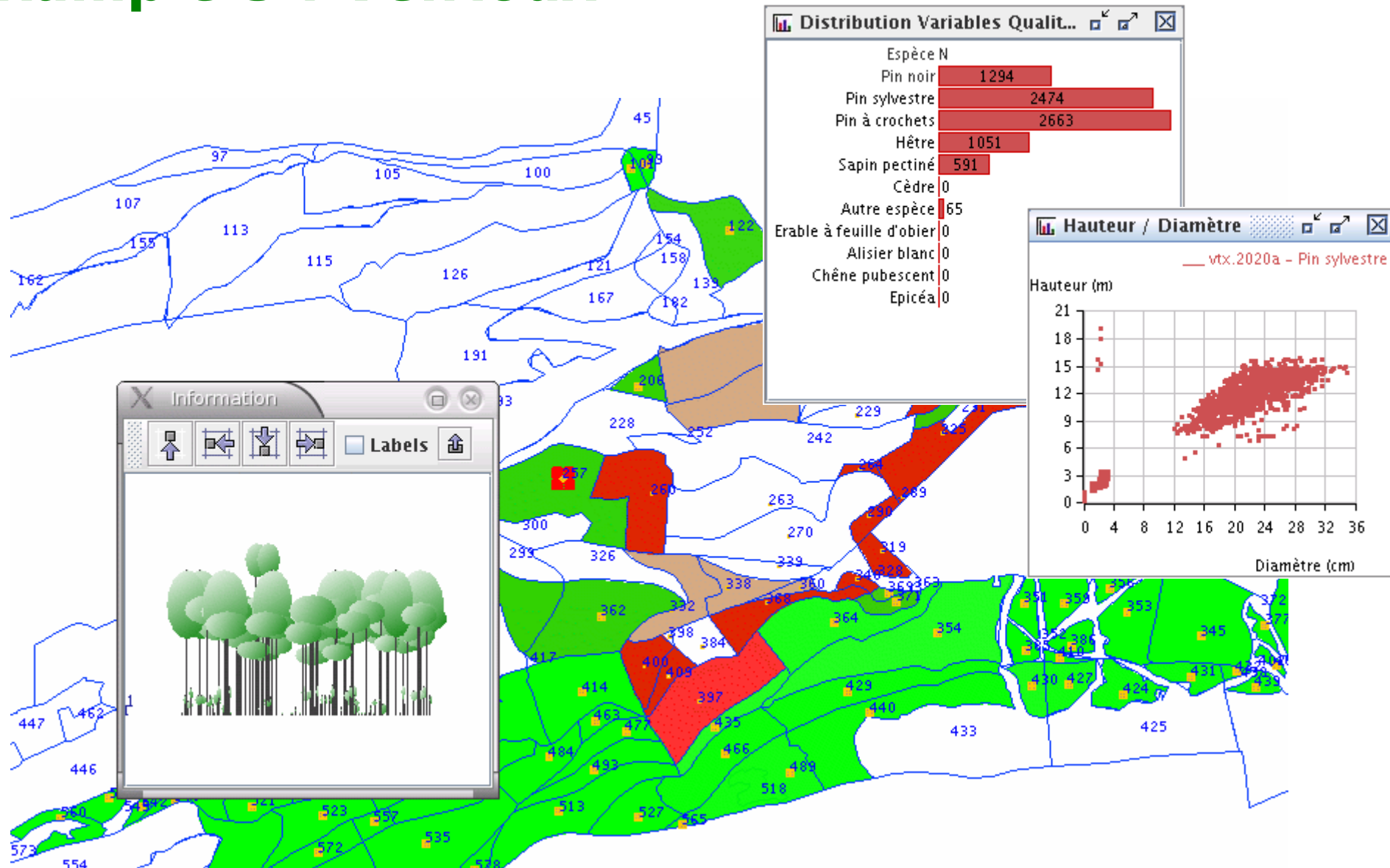
Hdom & Hg / Temps

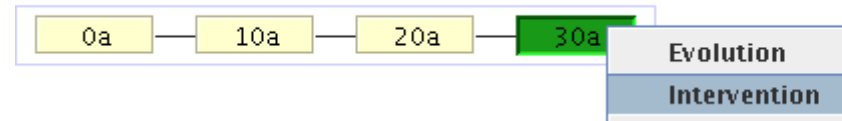
N / Classes de diamètre

Example 2 : Samsara



Example 3 : Ventoux

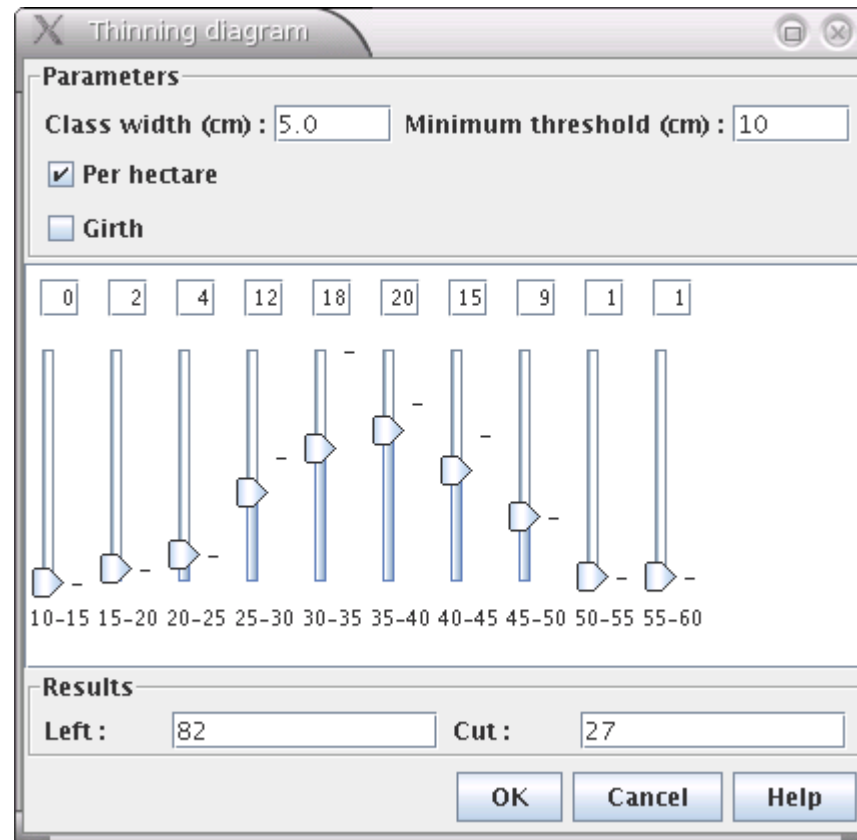




Interventions 1/3

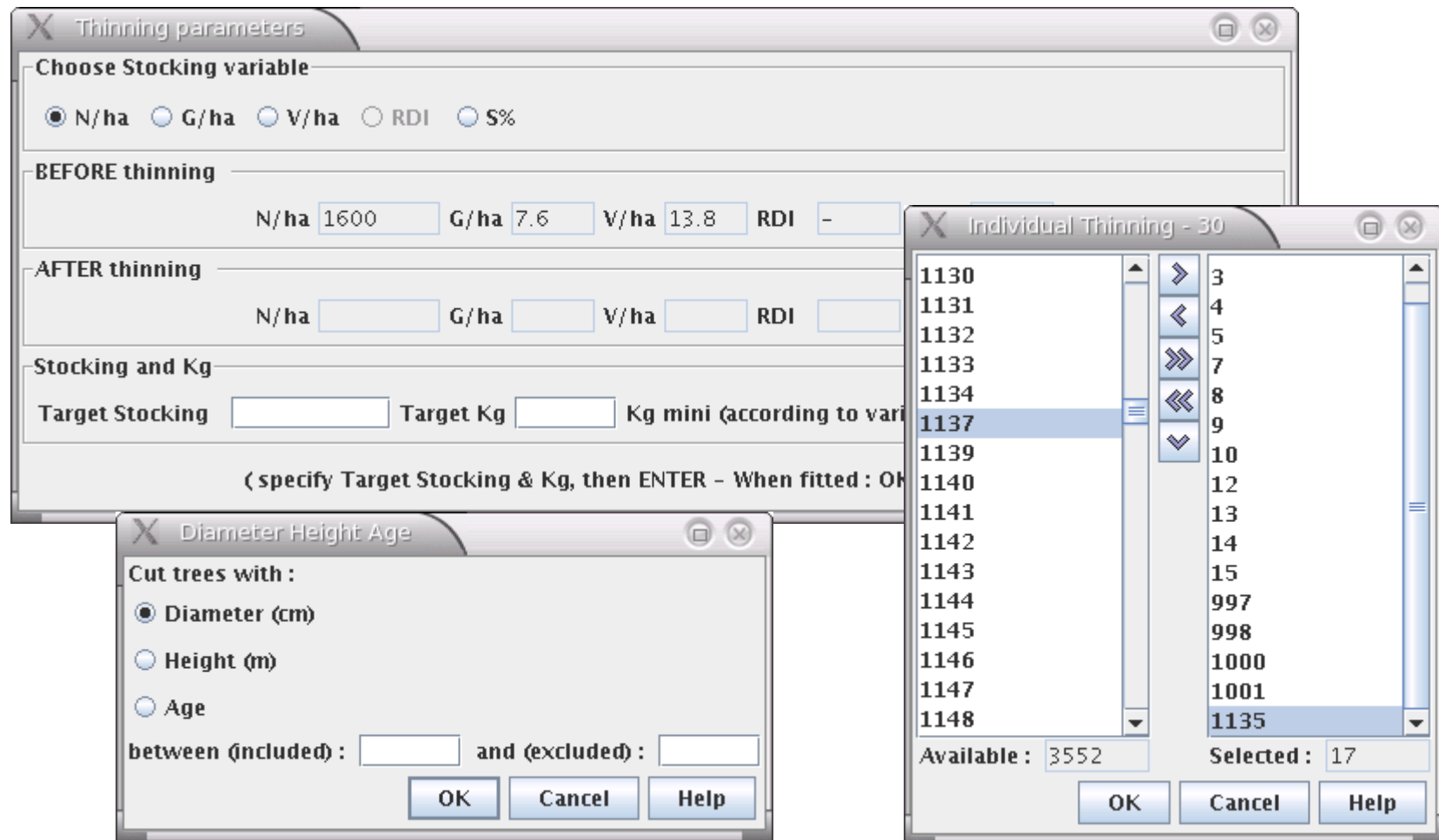
Example : **thinning diagram**

- Thinning mechanism through an interactive diagram
- Compatible with trees and cohorts-based models
- Class width / min threshold / per hectare / dbh or girth



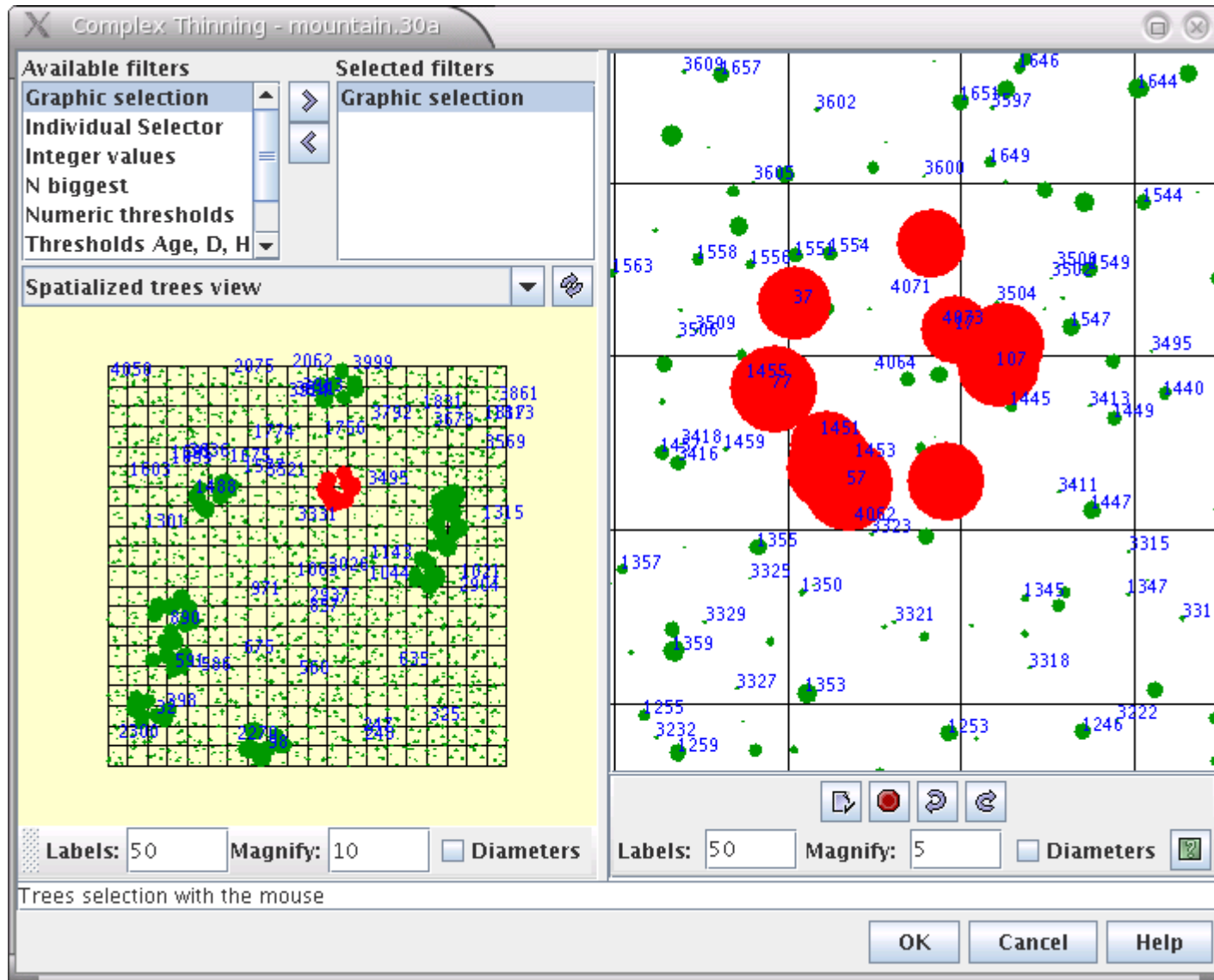
Interventions 2/3

Various other methods

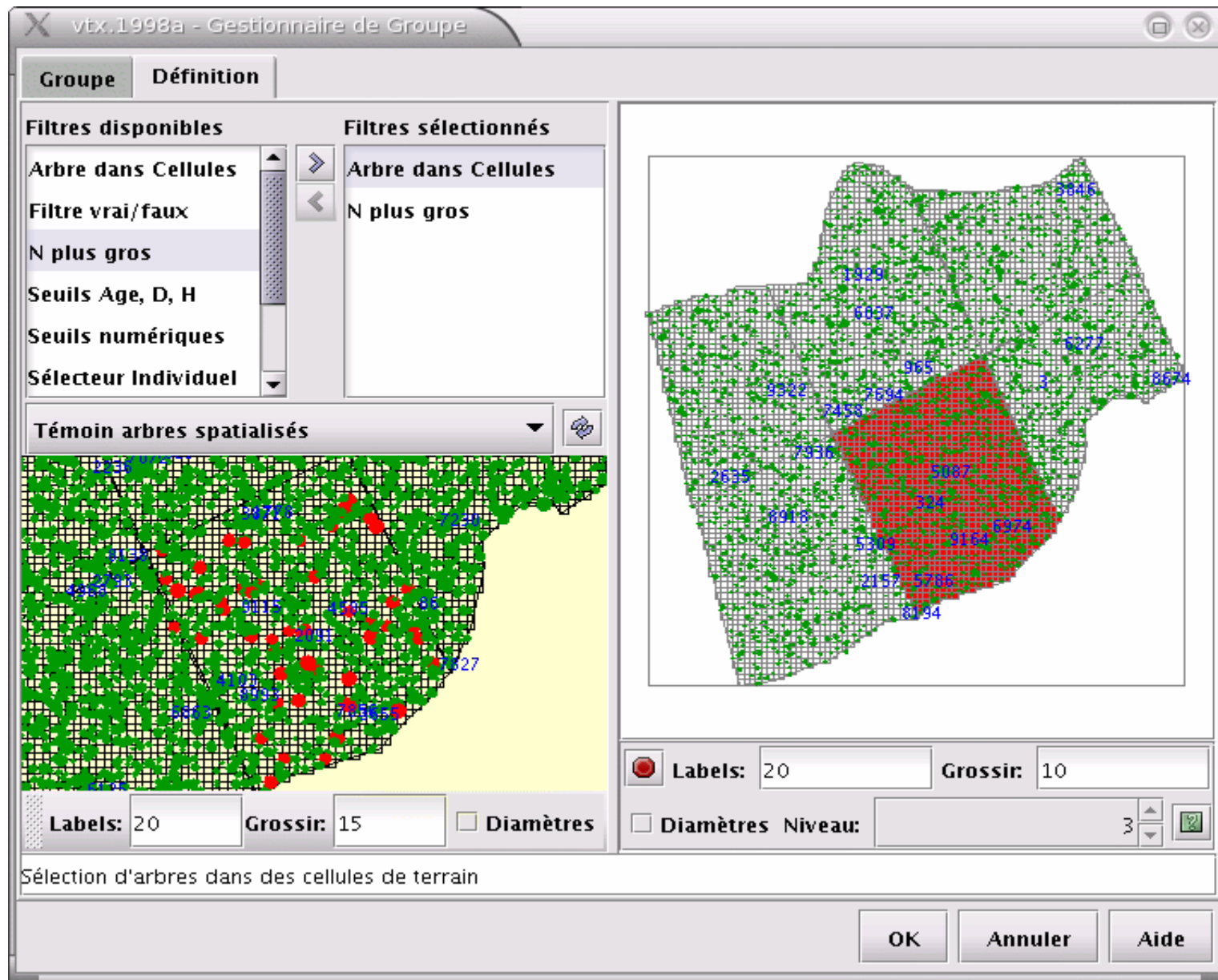


Interventions 3/3

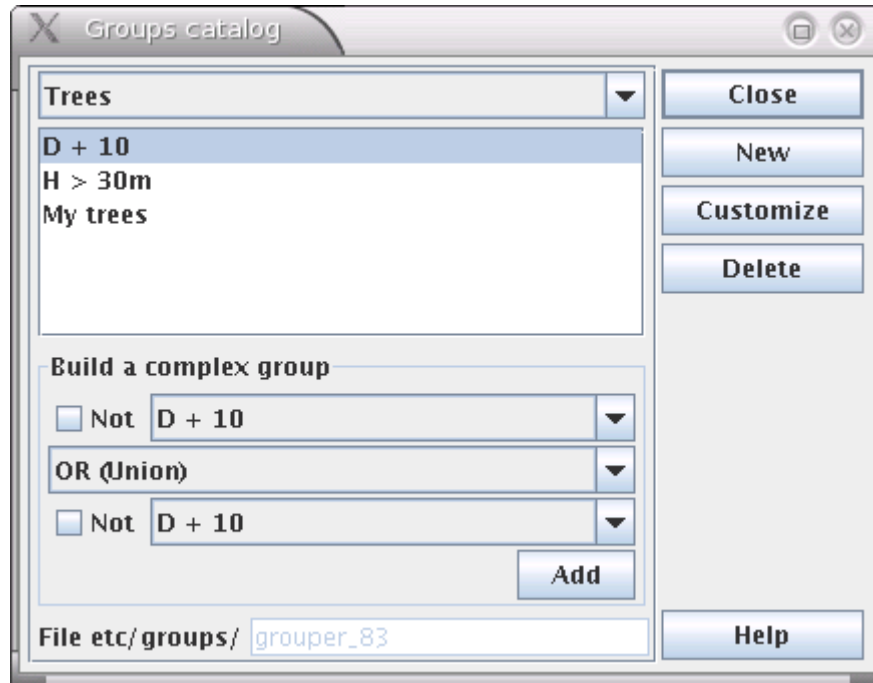
Use of selection filters to cut trees



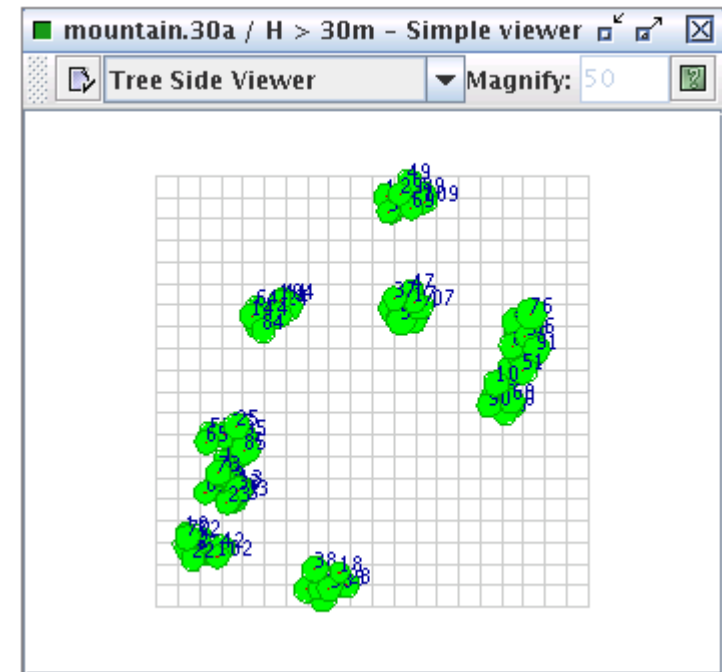
Groups creation



Group Catalog, Group chooser



1. Manage the groups from the group catalog

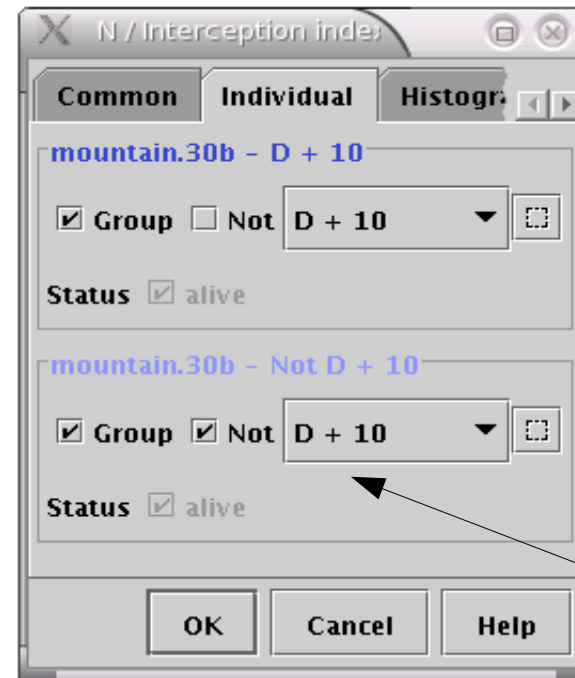
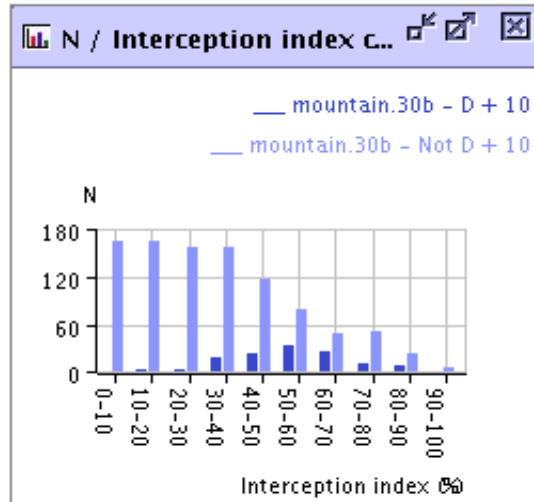


2. Select the groups in the group-related tools



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

Using groups



Dbh <= 10

- 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

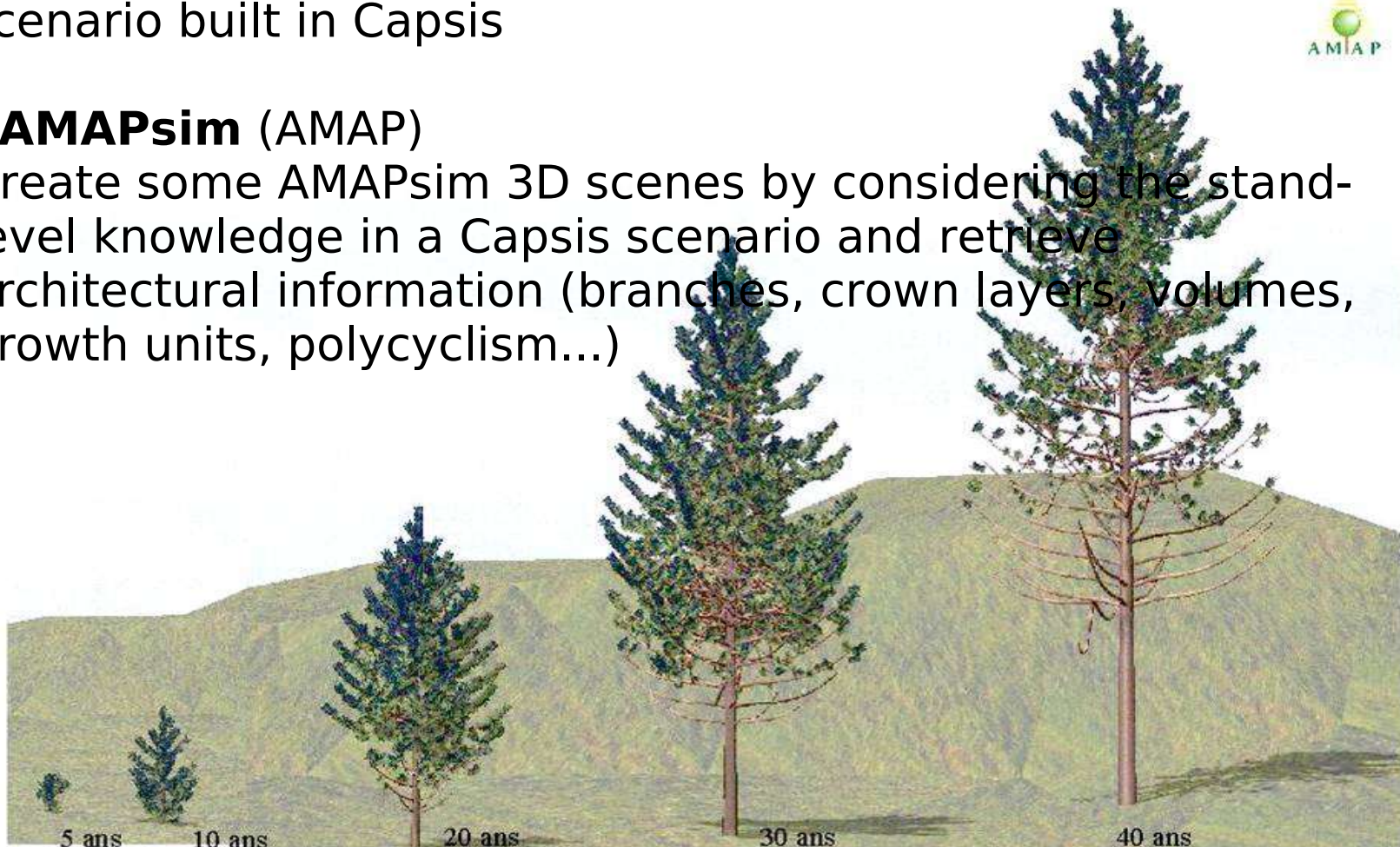
- **ForestGales** (Forestry Commission, UK)

Maritime pine, breaking and overturning risk for a silvicultural scenario built in Capsis



- **AMAPsim** (AMAP)

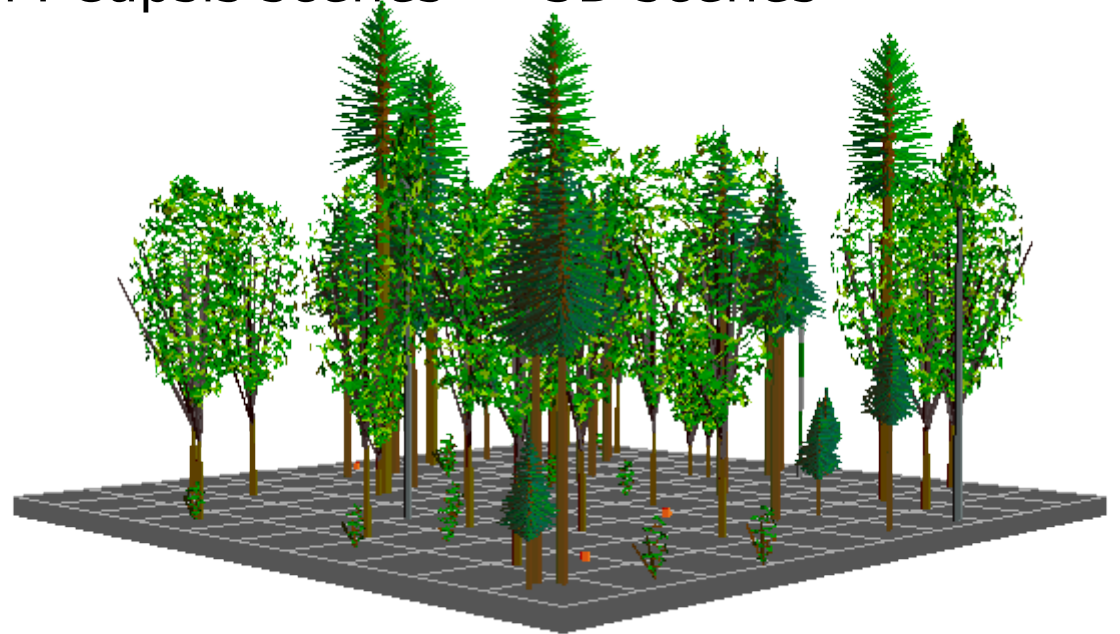
Create some AMAPsim 3D scenes by considering the stand-level knowledge in a Capsis scenario and retrieve architectural information (branches, crown layers, volumes, growth units, polycyclism...)



Connections with other simulators 2/2

- **SVS** (USDA, USA)

Stand Visualization System : Capsis scenes -> 3D scenes

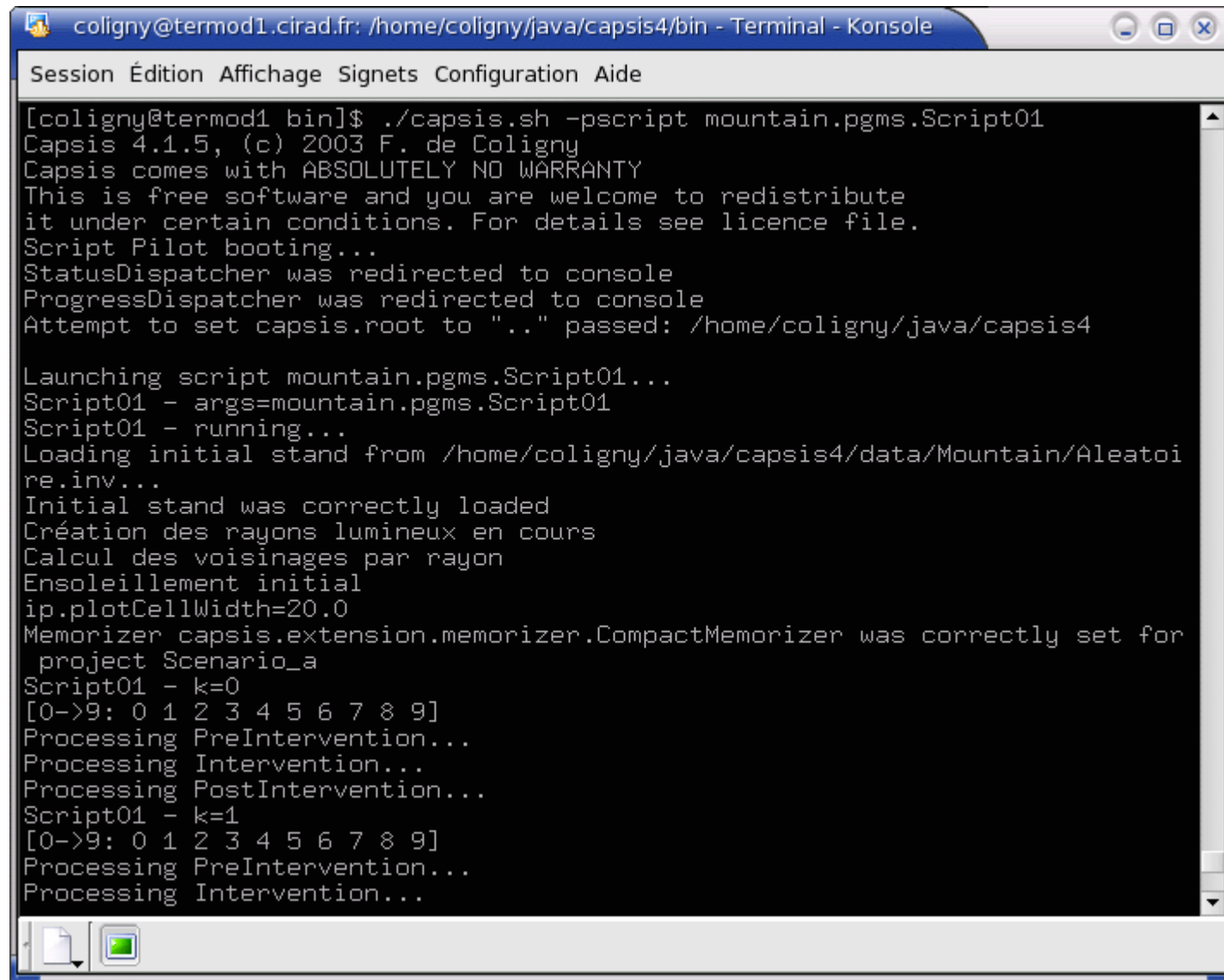


- **STICS** (INRA)

Part of the SAFE Agroforestry European project : connection with the STICS crop model for the agronomic part

...

Script mode for repetitive simulations



```
coligny@termod1.cirad.fr: /home/coligny/java/capsis4/bin - Terminal - Konsole
Session Édition Affichage Signets Configuration Aide
[coligny@termod1 bin]$ ./capsis.sh -pscript mountain.pgms.Script01
Capsis 4.1.5, (c) 2003 F. de Coligny
Capsis comes with ABSOLUTELY NO WARRANTY
This is free software and you are welcome to redistribute
it under certain conditions. For details see licence file.
Script Pilot booting...
StatusDispatcher was redirected to console
ProgressDispatcher was redirected to console
Attempt to set capsis.root to ".." passed: /home/coligny/java/capsis4

Launching script mountain.pgms.Script01...
Script01 - args=mountain.pgms.Script01
Script01 - running...
Loading initial stand from /home/coligny/java/capsis4/data/Mountain/Aleatoir
e.inv...
Initial stand was correctly loaded
Création des rayons lumineux en cours
Calcul des voisinages par rayon
Ensoleillement initial
ip.plotCellWidth=20.0
Memorizer capsis.extension.memorizer.CompactMemorizer was correctly set for
project Scenario_a
Script01 - k=0
[0->9: 0 1 2 3 4 5 6 7 8 9]
Processing PreIntervention...
Processing Intervention...
Processing PostIntervention...
Script01 - k=1
[0->9: 0 1 2 3 4 5 6 7 8 9]
Processing PreIntervention...
Processing Intervention...
```

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)
bidasoia	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)
biomechanics	Internal 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)



Capsis

UMR Cirad - CNRS - INRA - IRD - Université Montpellier II
botanique et bioinformatique de l'Architecture des Plantes ([AMAP](#))



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Recent news of the Capsis project:



The capsis web site progressively switches to **english**. Check the english background to find english headings quickly.

- ▶ A new "Capsis modeller" training session is planned in Montpellier on next january 24th, 25th and 26th. 12 modellers have registered. 18.1.2006
- ▶ New compilation tool : [jib](#) replaces [jmk](#). Jib (Java Idle Build) is integrated to the capsis archive and can be used instead of [jmk](#) with the same commands. This new tool deals better with memory problems. To force the complete recompilation of the project (everything), now use **jib all_force**. 18.1.2006
- ▶ The Capsis web site becomes more **international**. New collaborations with foreign partners lead us to switch to english as official project language. No change for the Capsis software which was already fully multi-language french / english. 18.1.2006
- ▶ Intégration d'un premier modèle Néo-Zélandais pour la croissance / branchaison du Pin Radiata par Dave Pont et Andrew Gordon (ENSIS), création d'un Atelier Qualité du Bois. 13.12.2005
- ▶ Participation au cinquième Workshop IUFRO "Connection between Forest Resources and Wood Quality : Modelling Approaches and Simulation Software" du 20 au 27 novembre 2005 à Auckland, Nouvelle Zélande, avec une communication et un poster. 13.12.2005
- ▶ Capsis 4.1.5 tourne sous [Mac OS 10.4](#) (tiger) avec java 1.5 8.9.2005
- ▶ Une nouvelle archive de démonstration a été construite : capsis4.1.5 est 13.7.2005



Institut de recherche pour le développement



[English](#)

Partnerships

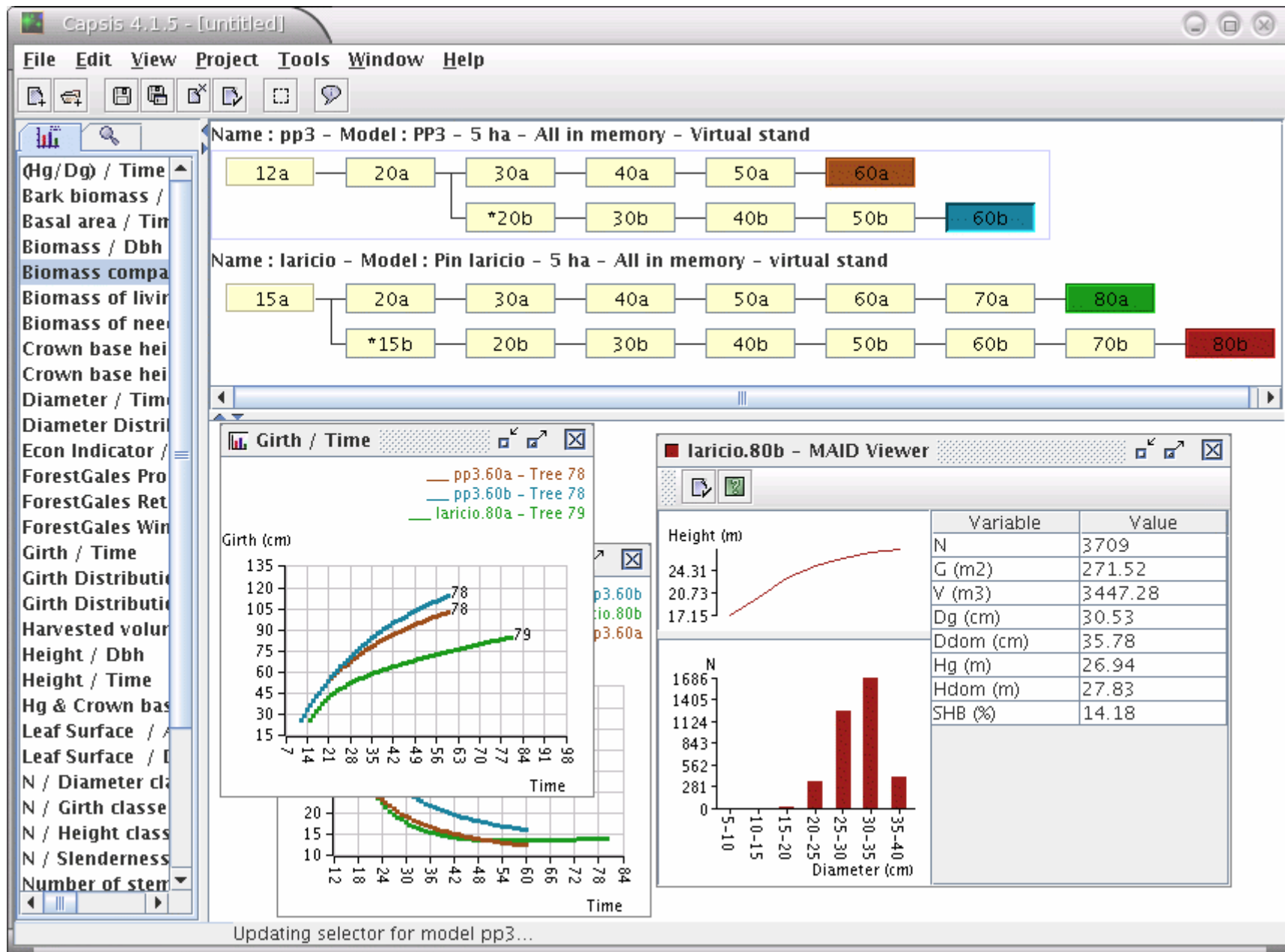
With french institutes

- 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...

Capsis 4.1.5 - [untitled]

Fichier Editer Afficher Projet Outils Fenêtre Aide

Nom : b - Modèle : Bidasoa - 25 ha - Tout en mémoire - /home/coligny/java/capsis4/data/Bidasoa/BidasoaFull

0a 1a 2a 3a 4a 5a 6a 7a 8a

Page 1 Page 2 Page 3 Page 4 Page 5

Nombre de poisson / ...

Nombre de poisson / ...

Nombre de poisson / ...

Inspecteur

Champ	Valeur
Age	17
AlleleParameters	capsis.lib.genetic...
BirthReachId	642
Consanguinity	-1.0
CreationDate	75
DispersalProba	0.5
FishStand	BidStand_89
FishStand	BidStand_89
ForkLength	9.916943
GeneticsVersion	2.0
GenoSpecies	fario
Genotype	capsis.lib.genetic...
Genotyped	<input checked="" type="checkbox"/>
GlobalConsanguin...	-1.0
GrowthReachId	44
Id	134918
Impl	capsis.lib.genetic...
JustMigrated	<input type="checkbox"/>
JustMoved	<input type="checkbox"/>
JustSpawned	<input type="checkbox"/>

trouçon / ...

Caractéristiques du b...

Variables	Valeur	Unité
Date	89	mois
Surface d...	6.726064...	km ²
Longueur ...	855038.0	m
superficie ...	305.1227	Ha
FishWater...	3051227	
FishWater...	2440981	
FishWater...	1830736	
FishWater...	1220490	
FishWater...	762806	
Capacité ...	366147	
Capacité ...	91536	

Visu Bidasoa

Inspecteur

Ouverture de Caractéristiques du bassin versant...