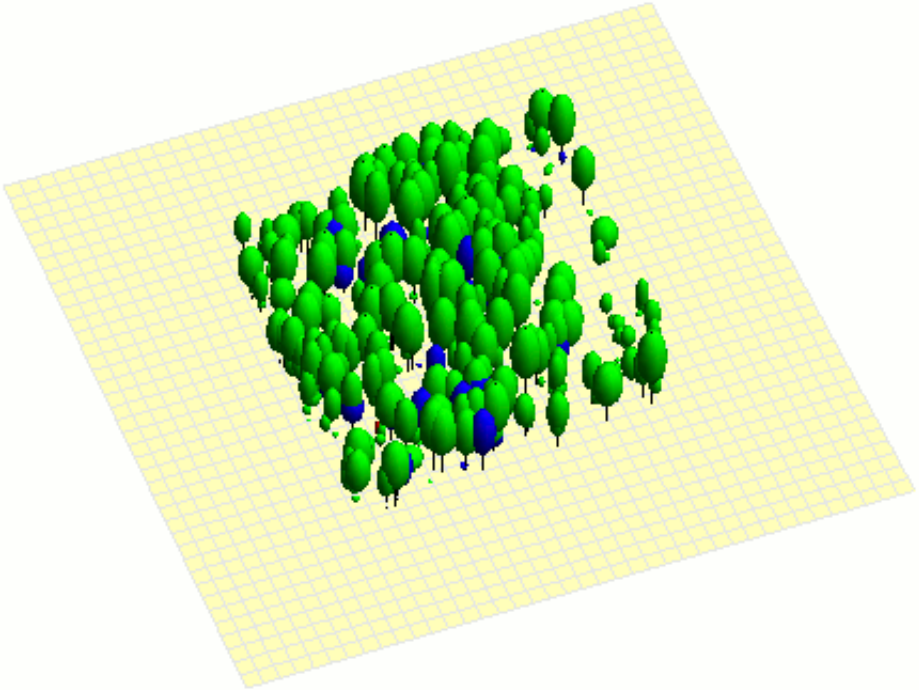
The Capsis project

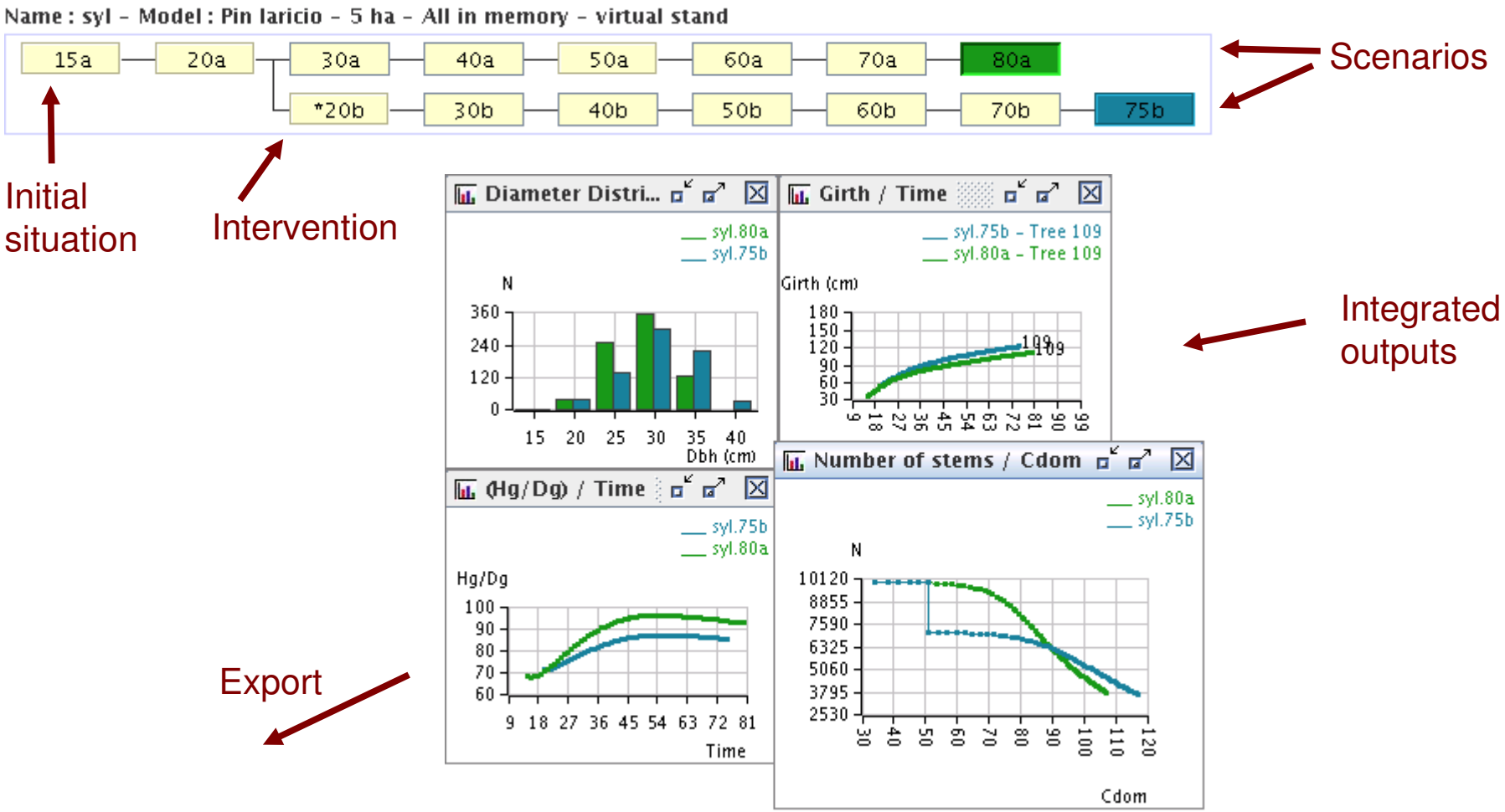
François de Coligny, INRA AMAP



Capsis

Computer Aided Projection for Strategies In Sylviculture

Objectives : Build a **software platform** to **integrate** many forest growth, yield and dynamics models **for** forestry modellers, forestry managers and education



Example 1: the Ventoux project

Evolution of artificial Pine stands towards mixed stands (pines, beech, silver fir) on the Mont-Ventoux (mediterranean mountain)

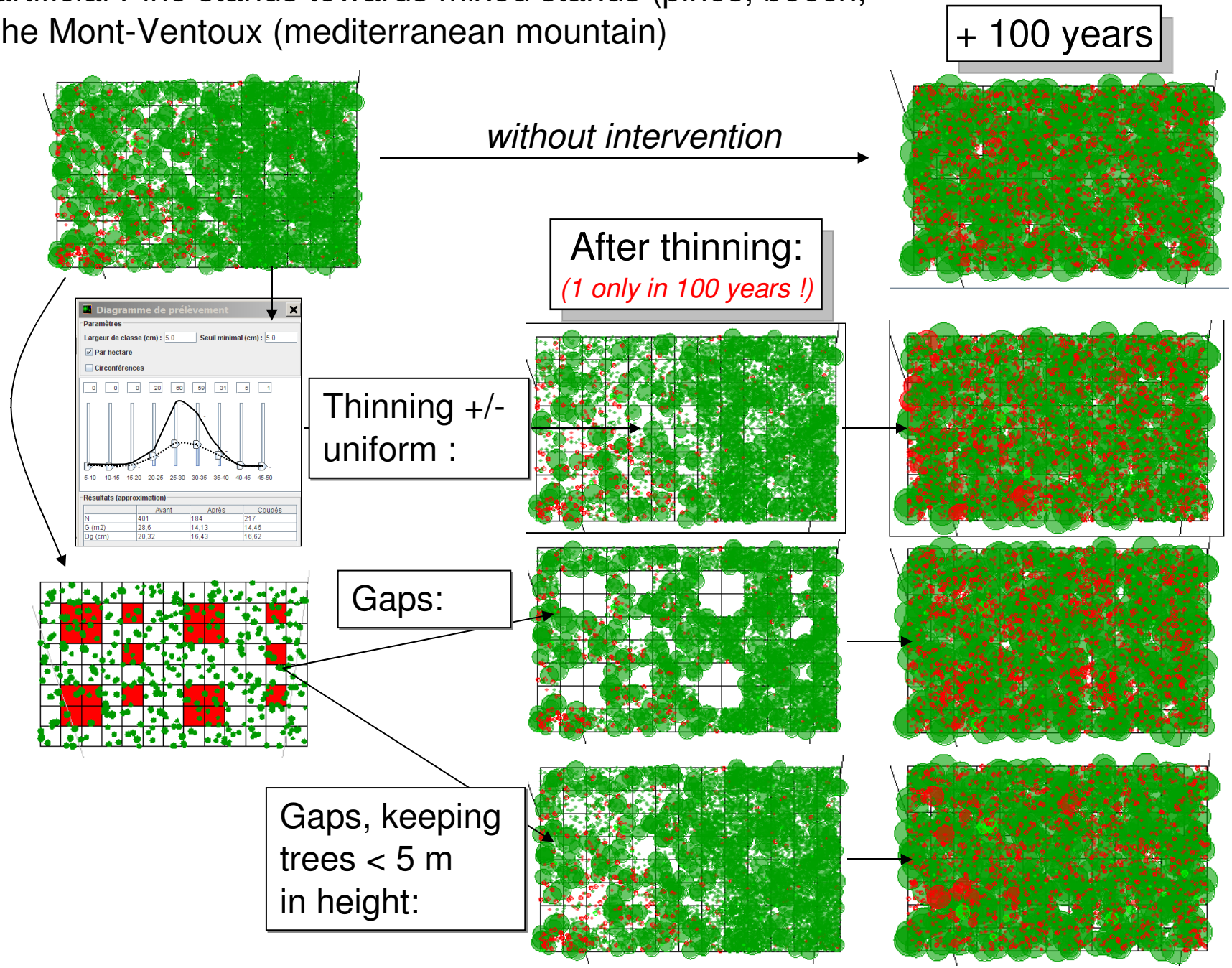


Figure 3 : Évolution sur 100 ans d'une plantation (1,04 ha) de Pin noir (en vert) en début de colonisation par le Hêtre (en rouge), sans intervention ou après une intervention unique : coupe uniforme selon un diagramme de prélèvement réglé manuellement (taux prélève dans chaque classe de diamètre), ouverture de trouées (positionnées manuellement) où tout est coupé, et variante où la régénération de moins de 5 m est épargnée dans les trouées.

The Ventoux project 2/3

Realistic sylvicultural scenario and evolution over 100 years

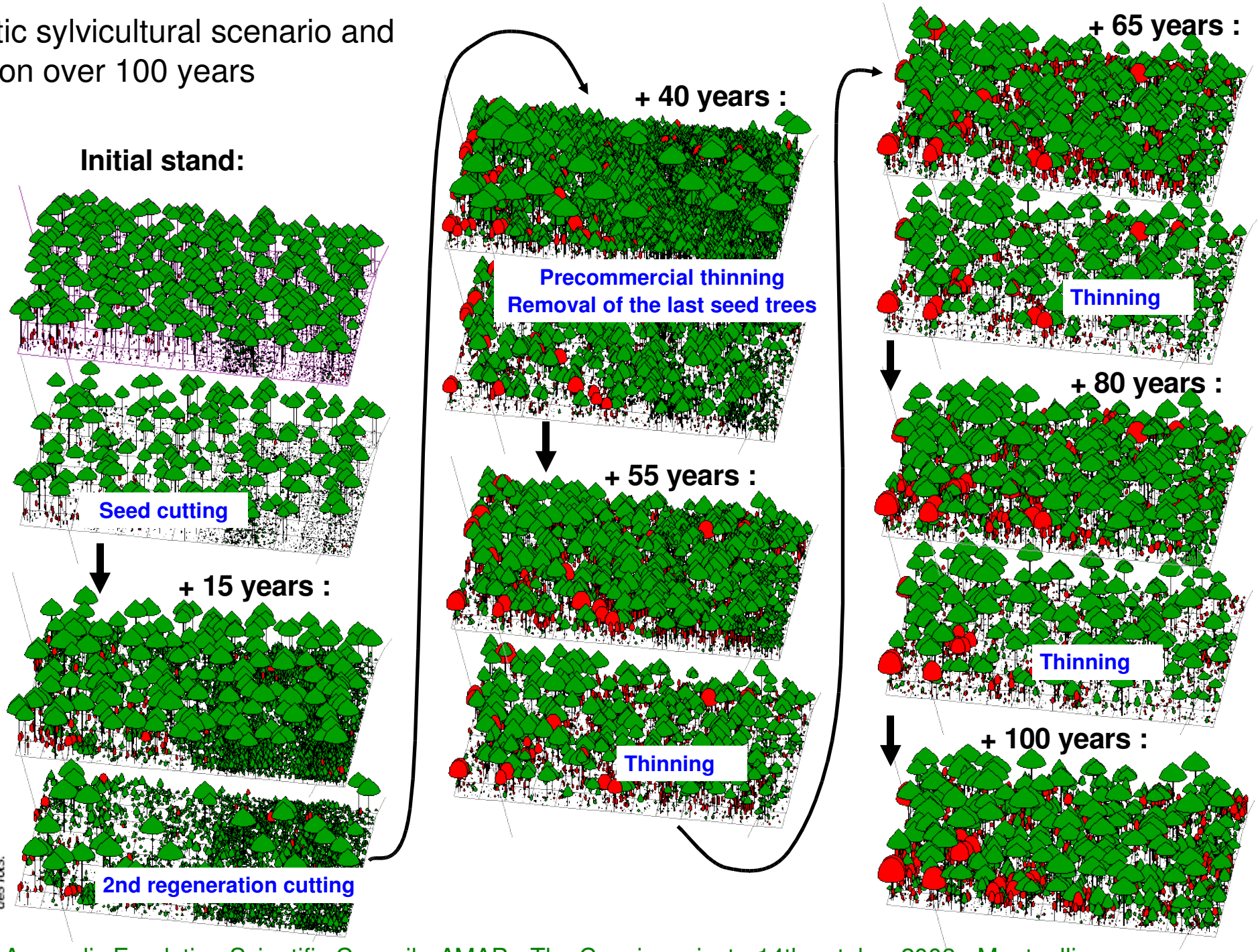
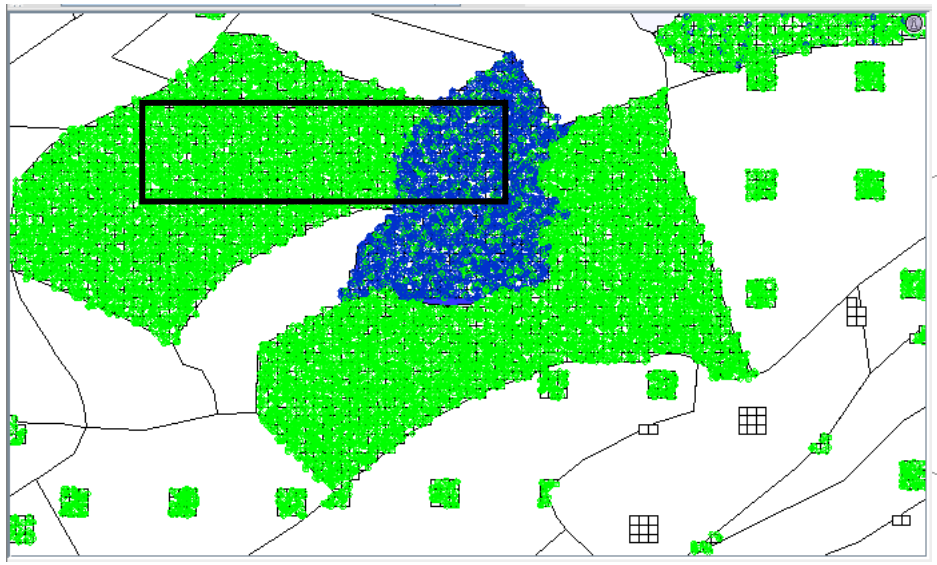
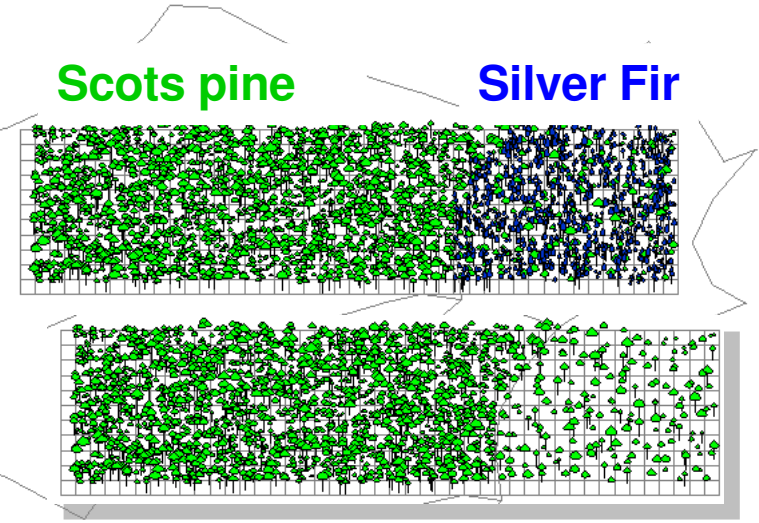


Figure 7 : Simulation d'un scénario sylvicole complet réaliste et évolution sur 100 ans d'une plantation de Pin noir (en vert) en cours de colonisation par le Hêtre (en rouge) : régénération par coupes progressives du couvert de Pin, qui bénéficie autant au Hêtre qu'aux semis de Pin ; dépressage unique, à l'occasion duquel la proportion des deux essences peut être en partie modifiée (mais le dynamisme du Hêtre et sa faculté à rejeter ne permettent pas de l'éliminer, même si on souhaite favoriser au maximum le Pin) ; éclaircies, en nombre limité compte tenu de la nécessité d'offrir un volume suffisant à chaque intervention pour favoriser la vente des lots.

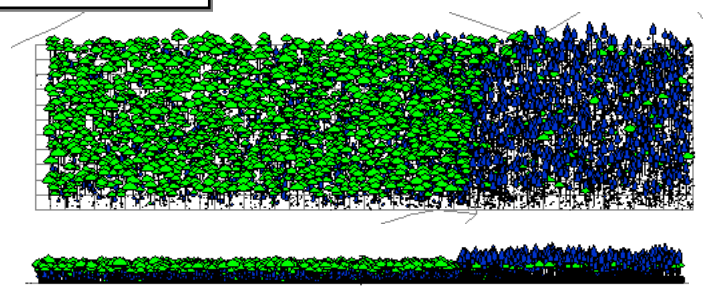
The Ventoux project 3/3

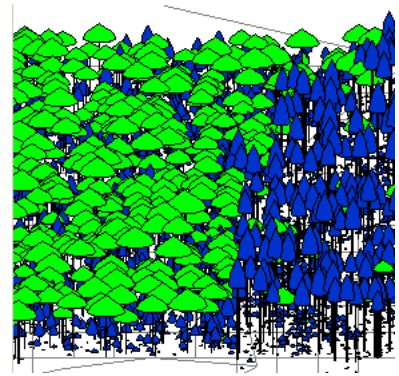
Simulating the colonization of an old Scots pine plantation next to a Silver fir stand



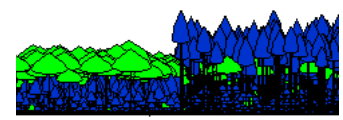


+ 50 years:

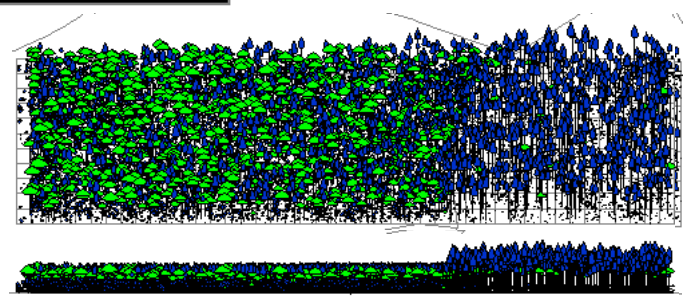


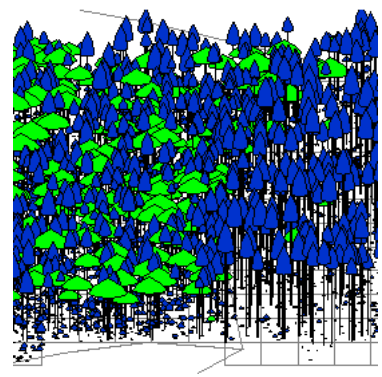


In the fir stand, the pine population remains very scarce and still tends to decrease. Conversely a high level of fir regeneration is rising under the light canopy of the pine stand which is finally overtopped.



+ 100 years:





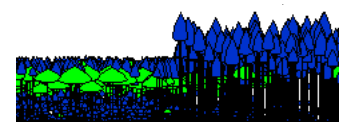


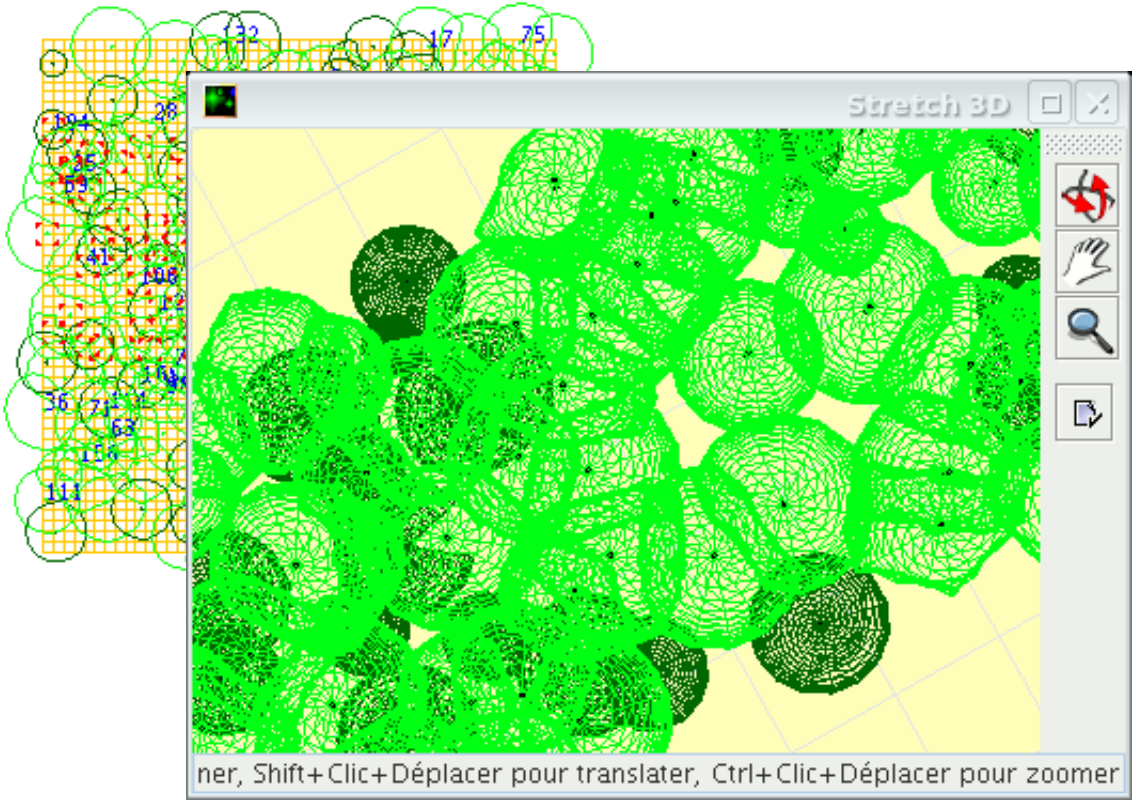
Figure 8 : Simulation de la colonisation d'une vieille plantation de Pin sylvestre (en vert) qui jouxte une sapinière (en bleu) : alors que la présence du Pin dans la sapinière reste très faible et tend à se réduire, la régénération de Sapin se développe massivement sous le couvert clair de la futaie de Pin et cette essence finit par supplanter le Pin.

Grégoire Vincent, Marilyne Laurans, Cécile Madelaine, Lucile Soler, Jean Dauzat - AMAP,
Degi Harja Asmara - ICRAF

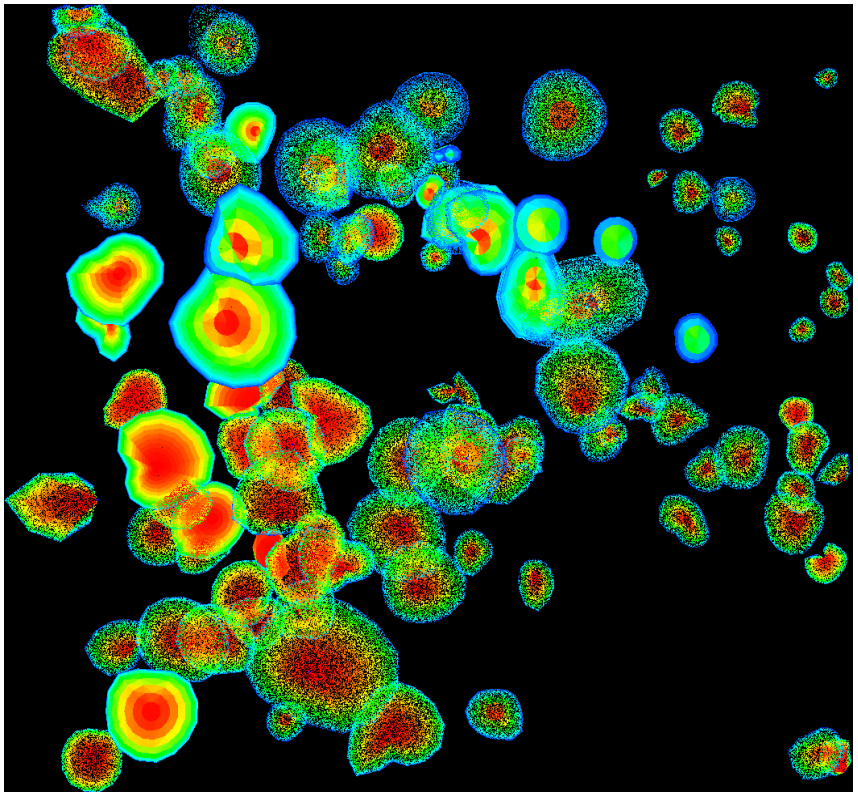
Example 2: the Stretch project

Stretch : Spatialy explicit individual based simulator

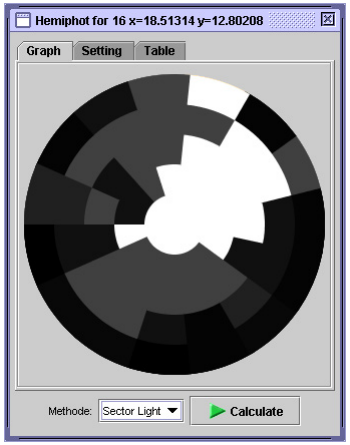
Generic, multi species
Radiative balance -> crown shapes deformation

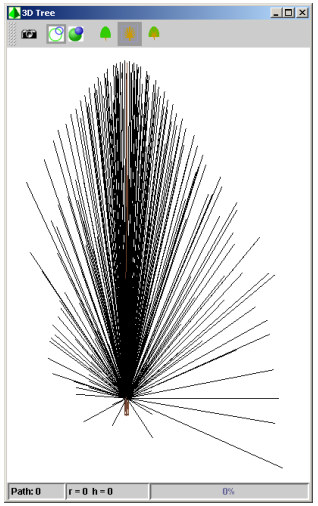


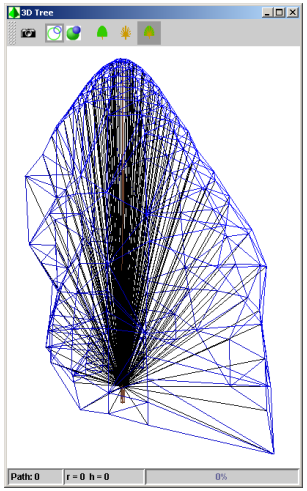
Mir Musc Radbal



SLIM







Capsis projects

Since 1999

About 40 growth and yield models integrated

with many partnerships in France and abroad

Modèle	Type	Auteur	Institut
AMAPsim v0.2	Special	Y. Caraglio, C. Meredieu, L. Sai...	Cirad/Inra
Afocelpa v1.0	MAID	Christine Deleuze, Olivier Pain	Afocel
Afocelpp v1.0	MAID	Christine Deleuze, Olivier Pain	Afocel
Alisier v2.0	Demogenetic	Sylvie Oddou-Muratorio	CGAF
Bidasoa v1.0	Fish	Jacques Labonne	Inra
Bimodal v0.9	Continuous	Alain Franc	Inra
CA1 v1.0	MAID	François Courbet	INRA - URFM
Cytisus v1.0	Demopastoral	Estelle Chambon-Dubreuil	Inra
DynaClim v1.0	Hybride	Hendrik Davi	INRA
Dynet v1.0	Fish	Bruno Parisi	Inra
Eucalypt v1.0	MAID	Laurent Saint-André	Cirad-Forêt
FIESTA v1.0	MADD	Philippe Dreyfus	INRA
Fagacees-Sylvestris v1.0	MAID	Gregory Deceliere	Cemagref
Fagacées v2.0	MAID	J.F. Dhôte, P. Vallet	LERFoB (INRA-ENGREF)
Fire Paradox v1.0	Wildland fire	Oana Vigy, Eric Rigaud	INRA, ENSMP
GenLoader v0.1	MADD	François de Coligny	Inra
Guppy v1.0	Fish	Jacques Labonne	Inra
Hi-sAFe vBeta 1.0	Agroforestry	Isabelle Lecomte	INRA-SYSTEM
IFN-CA v1.0	Modèle par classe d'âge	Antoine Colin	IFN
ISGM v1.0	Stand level model for even-age...	Tang ShouZheng, Hong LingXia	CAF
Ivy v1.0	DDTM	Art Groot, Jean-Pierre Saucier	Canadian Forest Service - MNRFP Que...
JackPine v1.0	Crobas (A. Makela)	Robert Schneider	UQAM
Karite v1.0	Demogenetic	Pierre Dubus	Cirad
Lemoine v1.0	Stand level model for even-age...	Bernard Lemoine, Céline Mere...	INRA
Loxodonta v2.0	Generic Demogenetic	Philippe Dreyfus	INRA
Luberon v2.0	Demogenetic	Les François d'Avignon	INRA
MaddModel (Technical) v1.0	MADD	François de Coligny	Inra
Mangrove v1.0	Mixed	Christophe Proisy	IRD
Migration v1.0	Forest trees migration	Annabelle Amm	INRA URFM
Mountain v2.1	MADD	Benoît Courbaud	Cemagref
Mustard v1.0	Stand based model	Céline Meredieu, Thierry Labb...	INRA / Cemagref
NRG v1.0	MADD	Philippe Dreyfus	INRA
NZ1 v1.0	DITM	Dave Pont, Andrew Gordon	Scion NZ Forest Research Institute Limi...
OakPine1 (Individual Based Spatia...	MADD	Thomas Pérot	Cemagref
OakPine2 v1.0	MAID (Individual Based)	Thomas Pérot	Cemagref
PNN v1.0	MAID	Philippe Dreyfus	INRA
PP3 v1.0	MAID	Philippe Dreyfus, B. Lemoine, C...	INRA
PRadiata v1.0	DITM	Dave Pont	Forest Research
Paletuviers v1.0	Heterogene	Patrick Heuret, Marilyne Laurans	Inra / Cirad
Pin laricio v1.0	MAID	C. Meredieu	Cemagref - IDF - INRA
Pin sylvestre v1.0	MAID	T. Perot - S. Perret - C. Meredi...	Cemagref
Presage v1.0	MADD	Sylvain Turbis	MRN-DRF
Prunus v1.0	Seed dispersal consequences	Cristina Garcia	Estacion Biologica de Donana (C.S.I.C.)
QS1 v1.0	MP-MAID	Jean-François Dhôte	INRA - ENGREF
Quercus v2.0	Demogenetic	Sophie Gerber	INRA
Regelight v1.0	MADD	Alexandre Piboule	LERFOB
Regix v1.0	Stand level model for short rota...	Olivier Pain	FCBA
Samare v1.0	MADD	Sylvain Turbis	MRNF-DRF
Samsara v1.0	MADD	Benoît Courbaud	Cemagref
Sapin v1.0	Training	Francois de Coligny	Inra
Sexi Bridge v1.0	MADD	Degi H Asmara	ICRAF-IRD
Simsys v1.0	Agroforestry	Marilyne Laurans	Cirad
Stretch v1.1	IBM, with crown deformations	Lucile Soler, Degi Harja Asmara	IRD
TransPop v1.0	Demogenetic	Sylvie Oddou	INRA
TransPopRege v1.0	Demogenetic	Sylvie Oddou	INRA
Ventoug v2.0	MADD	Philippe Dreyfus	INRA
Ventoux v2.0	MADD	Philippe Dreyfus	INRA

The Capsis web site

Capsis
UMR Cirad - CNRS - INRA - IRD - Université Montpellier II
bot**A**nique et bioinfor**M**atique de l'**A**rchitecture des **P**lantes
(AMAP)

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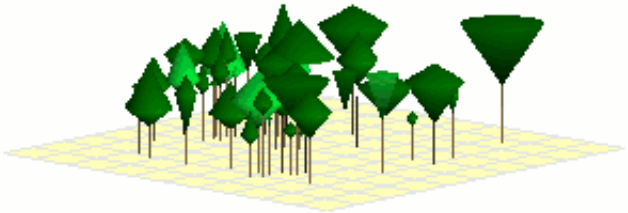
- Screenshots
- Notes
- Links-Access

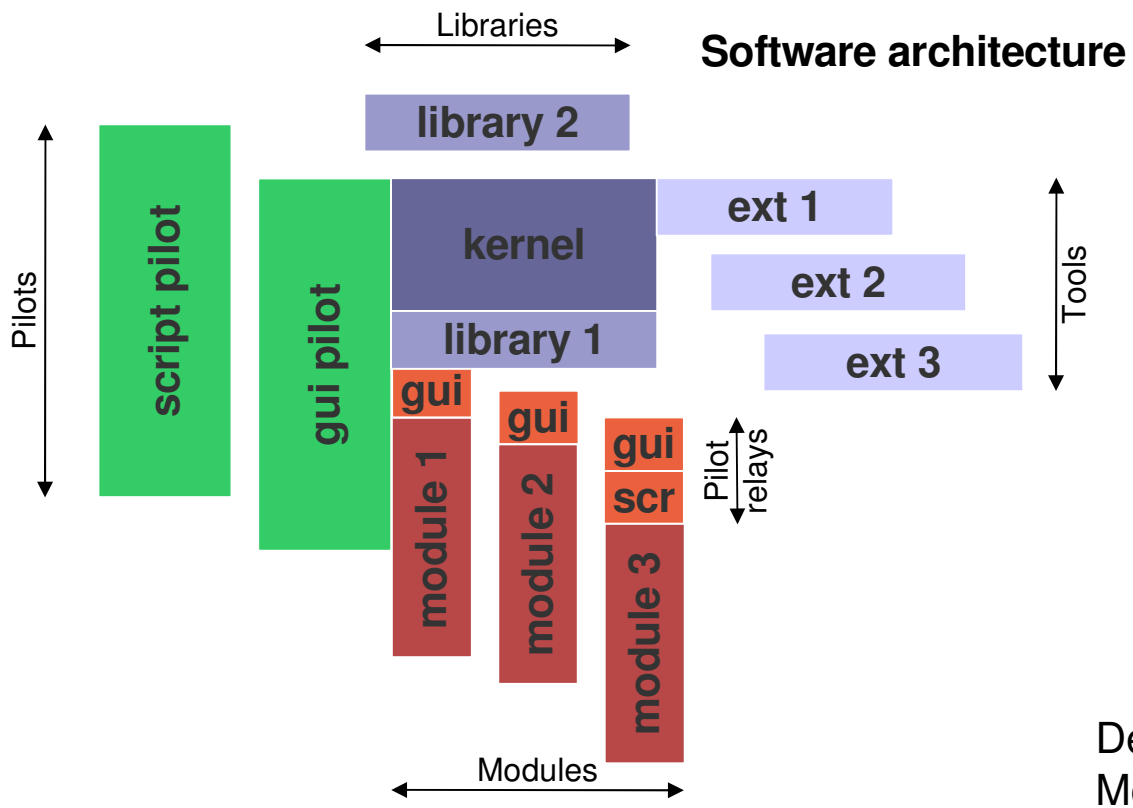
Français

Capsis is a simulation platform for forestry growth / dynamics models. It is a tool for forestry researchers, forest managers and educational purposes.

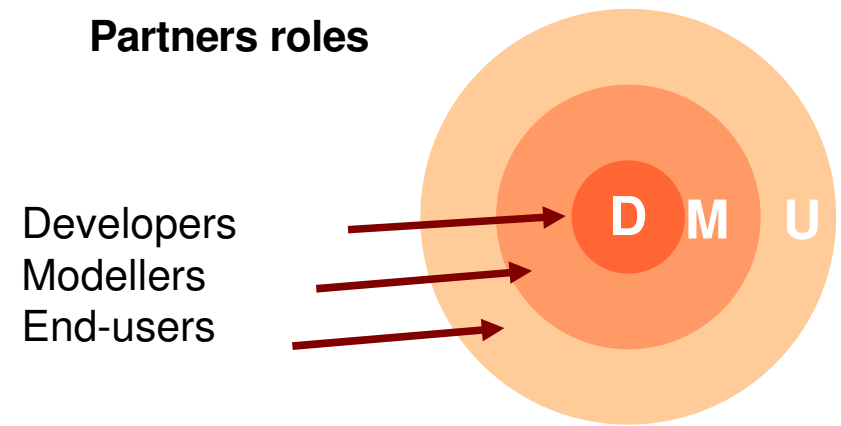


The next Capsis meeting will take place in Montpellier on june 17th.	2.6.2008
Robert Schneider (UQAM) spent two weeks in Montpellier (19-30 may) to integrate within Capsis his JackPine model based on the Crobas / PipeQual model by Annikki Makela (University of Helsinki, Finland). JackPine was ported from the MatLab environment.	2.6.2008
The 2008 Capsis modellers training session took place in Montpellier on february, 13-14 with 10 trainee modellers.	3.3.2008
The graphical Extension Manager (in the Tools menu) was enhanced. It is now possible to manage extensions compatibility for all kinds of extensions either with a veto system or by creating an exhaustive list of compatibility for a given model. The built-in compatibility system is still available by default. See the documentation page > Technical files entry for more information.	26.10.2007
Mathieu Fortin and Sylvain Turbis organised a training session on Capsis and the SaMARE model for 13 people outside the Department of Natural Resources and Wildlife on September 12 in Quebec City. The trainees were from timber companies, consulting firms and forest cooperatives from several regions of Quebec where Maple is present.	22.10.2007

The Capsis project organisation



Partners roles



Clear participation rules

- **The common part is free (LGPL) [green, blue]**
- **The Capsis Charter (extract)**
  Modellers develop themselves their models
  The resulting modules belong to their authors
  The source codes are shared in the community...

The Capsis community:
Developers + Modellers **co-dévelop** together

Transfer actions

Some transfers from the Capsis web site...

22 oct 2007 : **Mathieu Fortin** and **Sylvain Turbis** organised a training session on Capsis and the SaMARE model for 13 people outside the Department of Natural Resources and Wildlife on September 12 in Quebec City. The trainees were from **timber companies**, **consulting firms** and **forest cooperatives** from several regions of Quebec where Maple is present.

20 août 2007 : On June 7th 2007, **Céline Meredieu** and **Thierry Labbé** (INRA Bordeaux) presented Capsis and the PP3 module to foresters. Thirty three participants came from **CASFA, CPFA, CRPF, GOFOGARGPF Sud-Landes, Groupama, ONF, SODEF**. This session was jointly **organised by INRA, CRPF Aquitaine and ONF**. The presentation began by the context of the Sylvogène project (Pôle de compétitivité Industrie et Pin du futur) with Sebastien Drouineau (CRPF). Then Céline Meredieu presented Capsis and theorical and conceptual information about the PP3 project. Dominique Merzeau (CPFA), Sebastien Drouineau (CRPF) and Didier Canteloup (ONF) showed how to use Capsis/PP3 for various applications. (...)

15 jan 2007 : On January 10th, **Mathieu Fortin** and **Sylvain Turbis** (Ministère des Ressources Naturelles et de la Faune (MRNF), Québec, Canada) presented Capsis and the Samare module to **foresters from MRNF region 06 and 07**. Four of the seven participants came from the region 06 (BR06, UG61, UG62, UG64), and the three others were from the region 07 (BR07, UG71, UG72) (BR ? regional office, UG ? management unit). (...)

28 nov 2006 : On October 17th, **Thomas Pérot** and **Sandrine Perret** (Cemagref Nogent sur Vernisson) organized a second session to transfer to the French Forestry Office (ONF) the Laricio and Sylvestris modules. Two of the three participants came from the **ONF DT Centre Ouest**, and the third was from the **ONF DT RD based at Fontainebleau**. (...)

29 juin 2006 : In Orleans, training session by **Patrick Vallet** to the Fagacees model and how to use it in the Capsis platform for the colleagues of the **French Forestry Office (ONF)**. The session was **organized by Sandrine Verger (ONF-DT Centre-Ouest)** and welcomed 12 participants (12.6.2006).

Recent publications

Labonne, J., Ravigné, V., Parisi, B., and Gaucherel, C. **2008**. Linking dendritic networks structure to population demogenetics : the downside of connectivity. Oikos : 1479-1490.

Hong L.X., Tang S.Z., Li H.K., Li Y.C., de Coligny F., **2008**. Integrated Stand Growth model (ISGM) and its Application. In: Fourcaud T, Zhang XP, eds. Plant Growth Modeling and Applications. Proceedings of PMA06. Los Alamitos, California: IEEE Computer Society, pp. 223-230.

de Coligny F., **2008**. Efficient Building of Forestry Modelling Software with the Capsis Methodology. In: Fourcaud T, Zhang XP, eds. Plant Growth Modeling and Applications. Proceedings of PMA06. Los Alamitos, California: IEEE Computer Society, pp. 216-222.

Perot T., S. Perret, C. Meredieu et C. Ginisty, **2007**. "Prévoir la croissance et la production du Pin sylvestre : le module Sylvestris sous Capsis 4." Revue Forestiere Francaise 59(1): 57-84.

Goreaud F., Alvarez I., Courbaud B., and de Coligny F., **2006**. Long-Term Influence of the Spatial Structure of an Initial State on the Dynamics of a Forest Growth Model: A Simulation Study Using the Capsis Platform. Simulation 2006 82: 475-495.

Vallet P., **2005**. Impact de différentes stratégies sylvicoles sur la fonction "puits de carbone" des peuplements forestiers. Modélisation et simulation à l'échelle de la parcelle. Thèse de doctorat. Engref, Nancy. 195 p + annexes.

Goreaud F., de Coligny F., Courbaud B., Dhôte J.-F., Dreyfus P., Pérot T., **2005**. La modélisation : un outil pour la gestion et l'aménagement en forêt. Vertigo 6(2). 12 pp.

Integrated modules: various types

IBM
Fagacées
Fasy
OakPine1 (*new*)

IBM + Spatialized
Cytisus
Fiesta / NRG
Mountain
Paletuviers
Presage
Quercus
Regelight
Samsara
Selva
Sexi
Simsys
TranspopRege

Diameter class
CA1, Luberon
Eucalypt
IfnCa
Laricio
NZ1
PNN
PP3
QS1
Sylvestris
Transpop

Diameter class + Spatialized
Alisier
Dynaclim
Ventoux, Ventoug

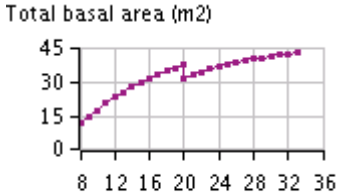
Fish
Bidasoa
Dynet
Guppy

Stand level
ISGM
Lemoine (*new*)

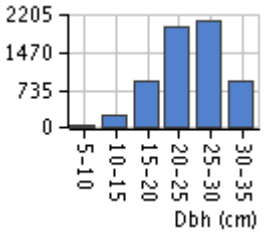
AgroForestry
HiSafe

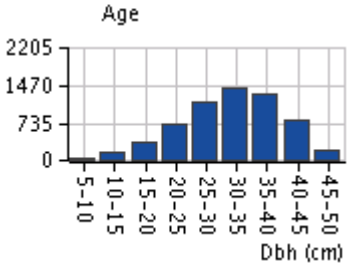
Forestry models

Stand level models:

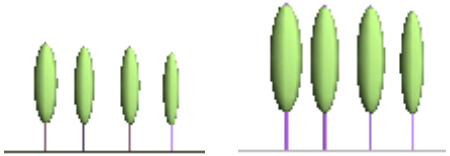


Distribution models:

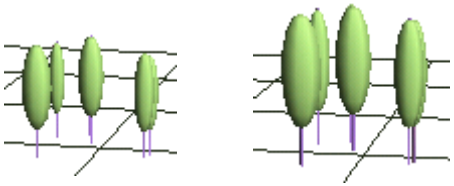




Individual based models:



Spatialized models:



Various types of stand growth and yield models

... and also Mixt models:

Process-based + growth and yield
Distribution + spatial structure
Individual based + genetics ...