

Plantes virtuelles: Méthodes et outils

C. FOURNIER

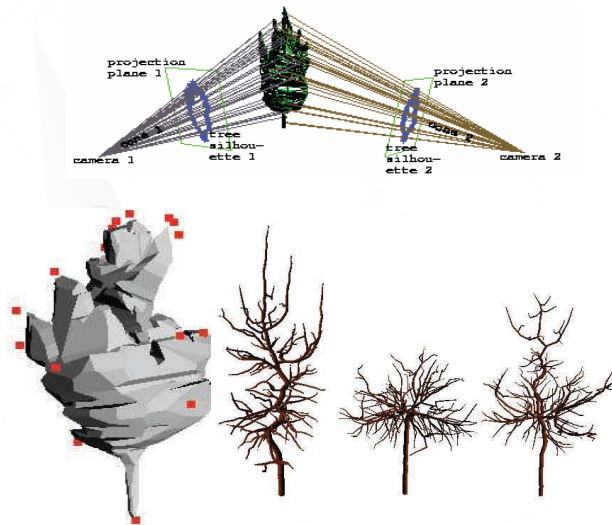
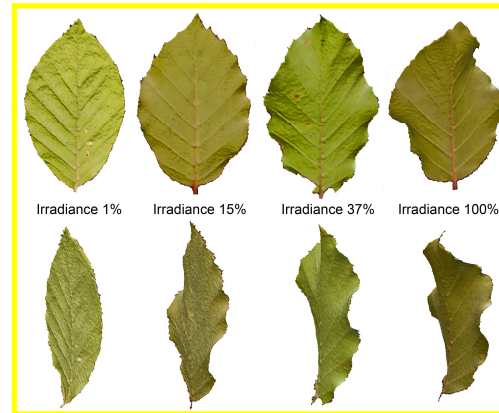


Des outils pour quoi ?

- ▶ Acquisition et reconstruction
- ▶ Modélisation et Formalisation
- ▶ Simulation dynamique
- ▶ Couplage



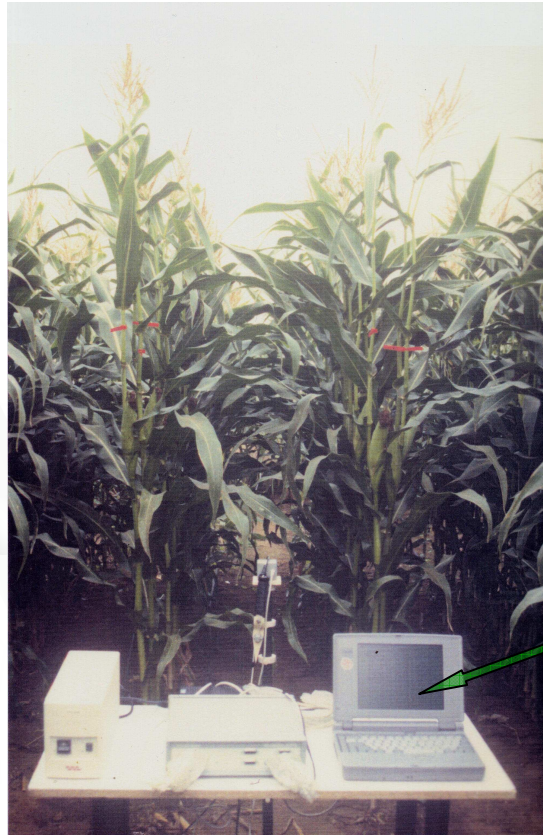
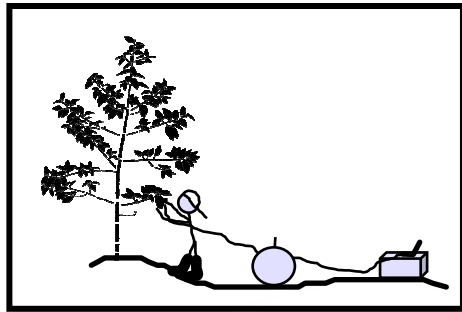
Acquisition directe automatique laser scanner 3D/ photos



[Tan,07]



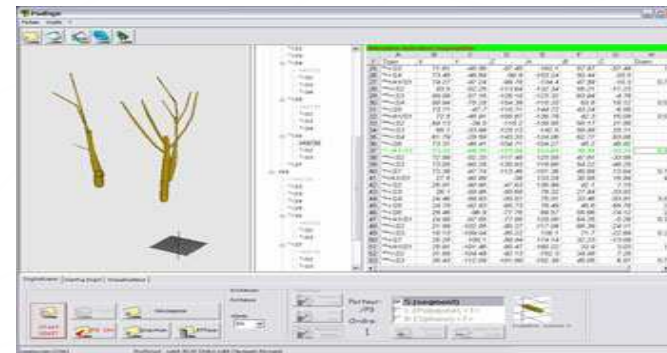
Acquisition directe manuelle : digitalisation



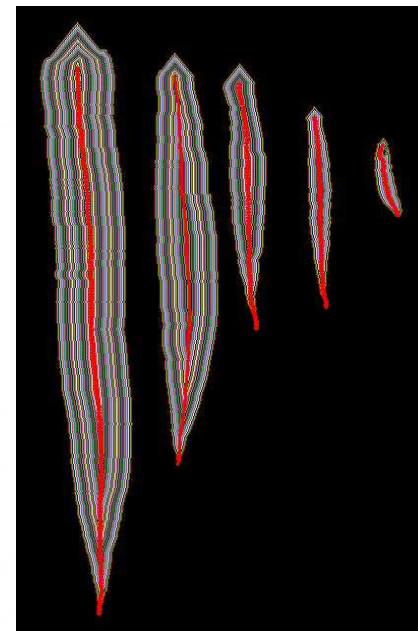
transmitter

receiver

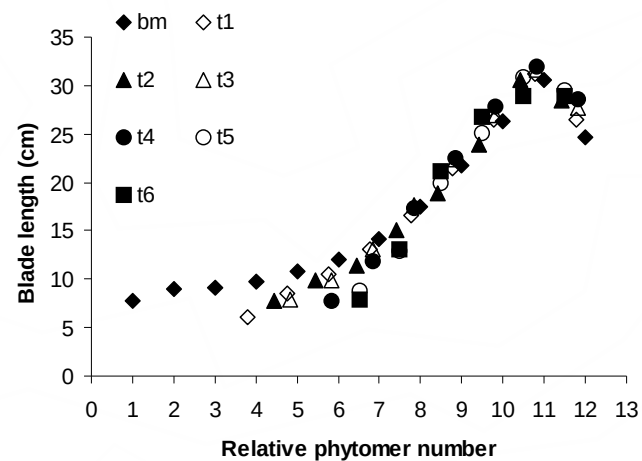
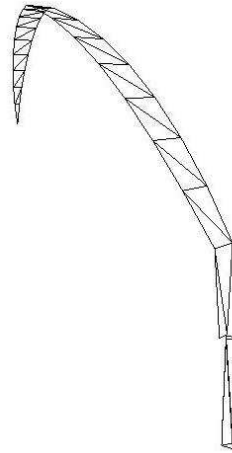
software



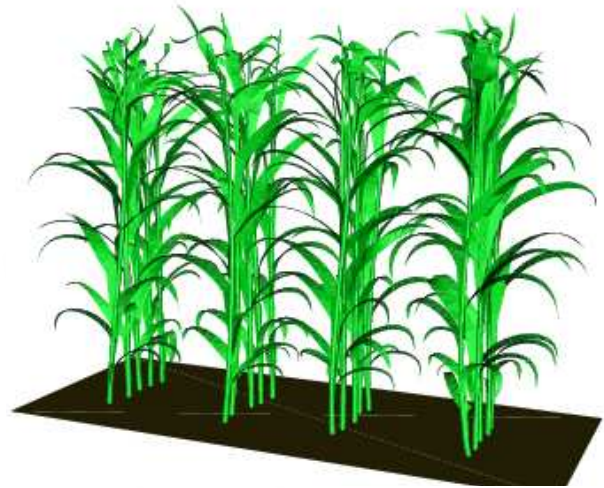
Digitalisation a partir de photos



Mesures complémentaires /reconstruction



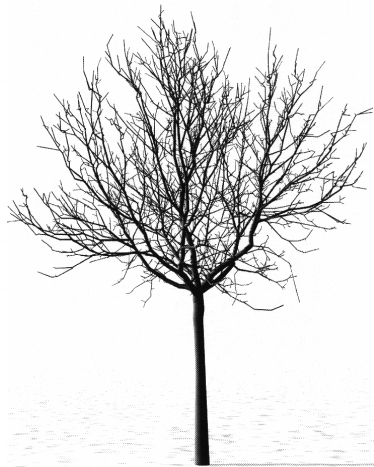
Plantes réelles vs. Plantes digitalisées



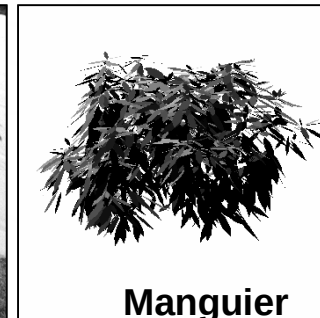
Sorghum
(Drouet, 1998)
Maize



Wheat
(Saint-Jean and Ljutovac, 1999)



'Grand' noyer (8 m)

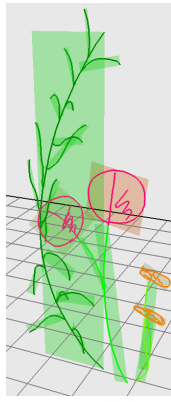
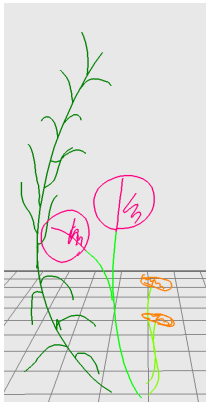


Manguier

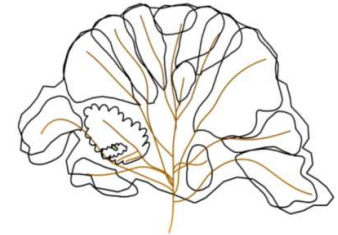
INRA, Piaf



Sketching : dessin assisté par ordinateur



[Ijiri,06]

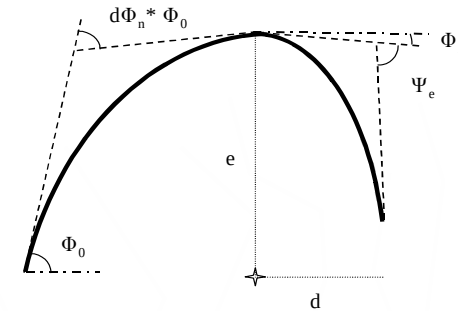
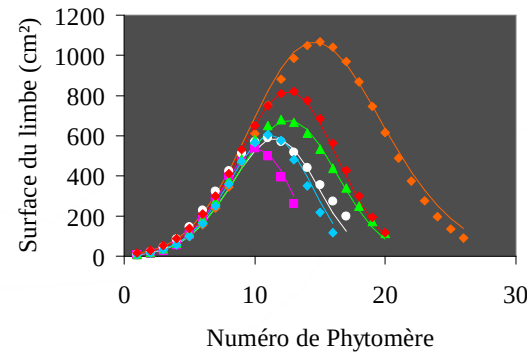


Boudon 08

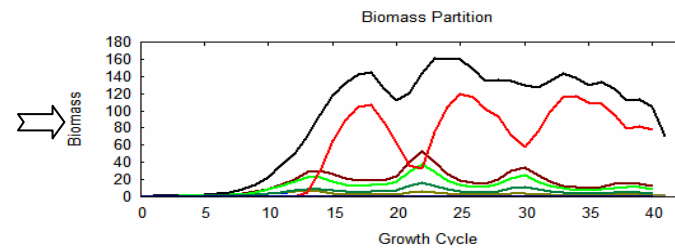
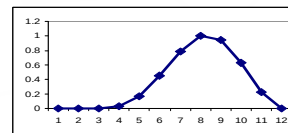
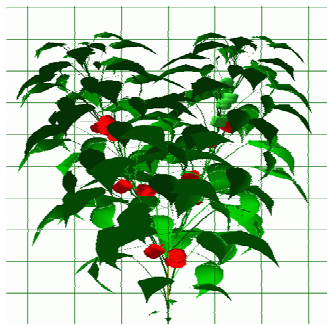
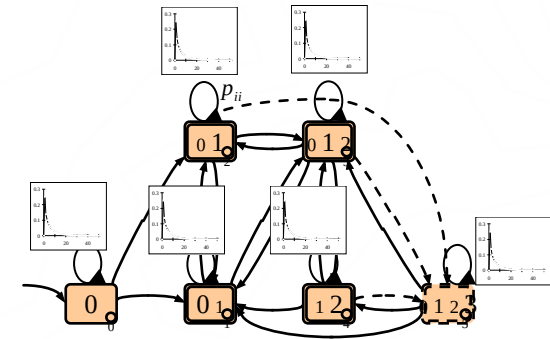
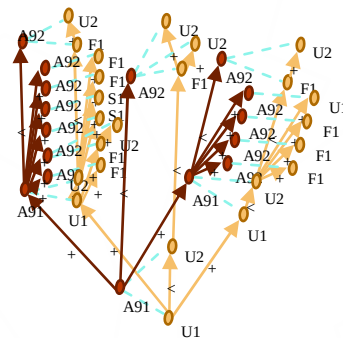


Modélisation : outils d'analyse

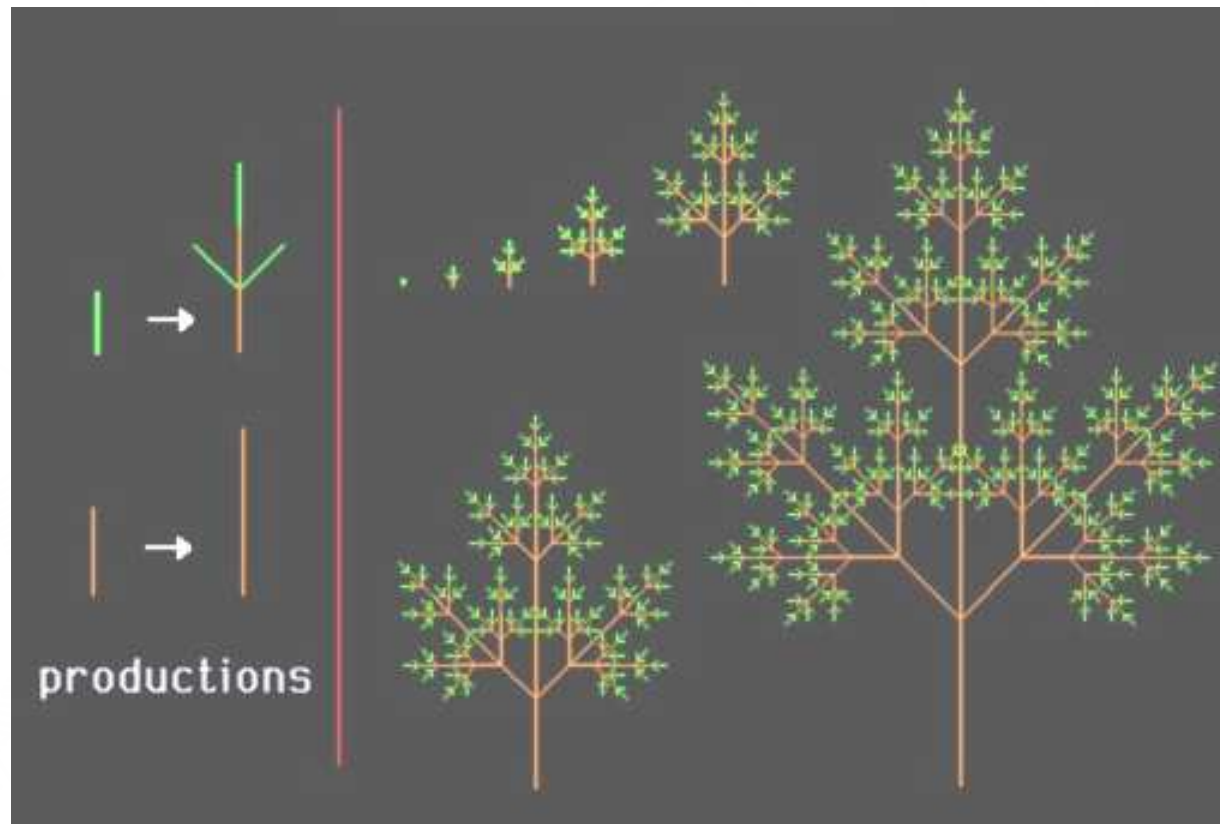
Outils
classiques
(R, Excell,
mathlab)



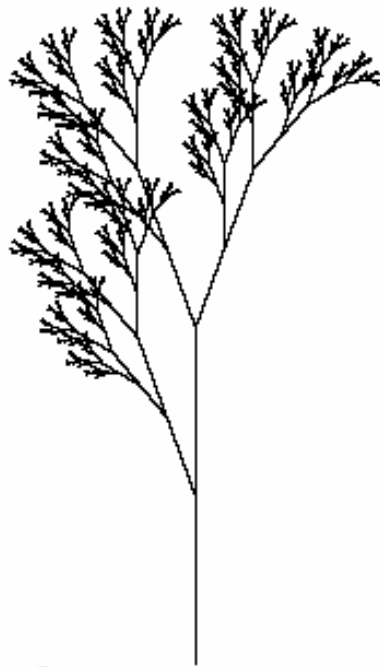
VPlants(A
MAPmod)



Approche L-Système



Application



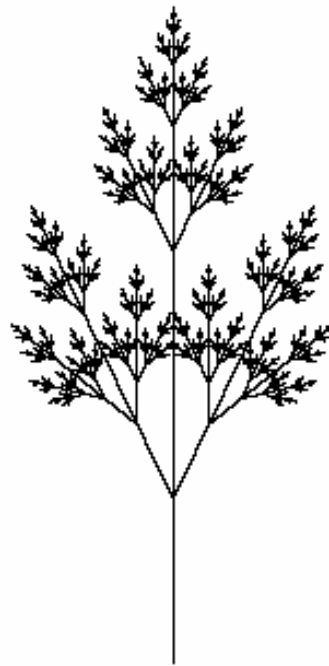
d

$n=7, \delta=20^\circ$

X

$X \rightarrow F[+X]F[-X]+X$

$F \rightarrow FF$



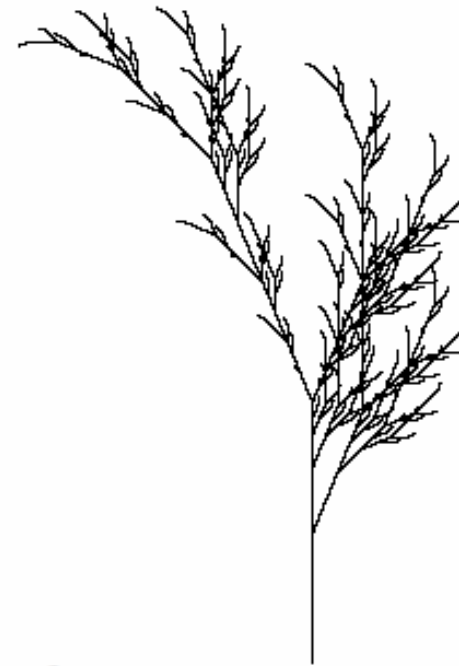
e

$n=7, \delta=25.7^\circ$

X

$X \rightarrow F[+X][-X]FX$

$F \rightarrow FF$



f

$n=5, \delta=22.5^\circ$

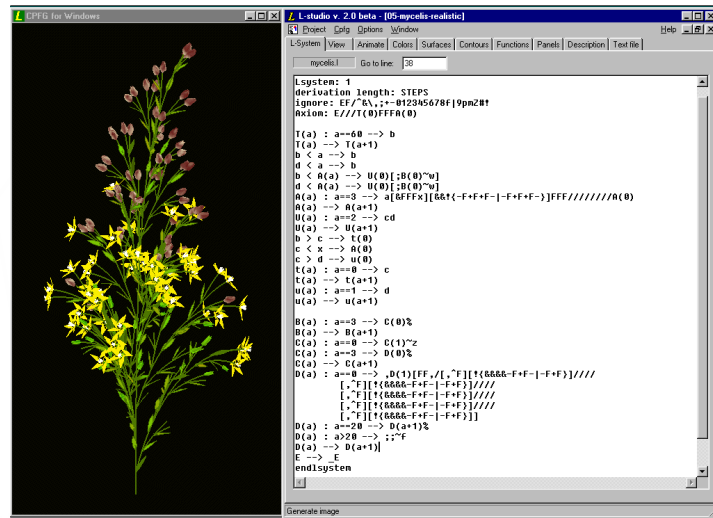
X

$X \rightarrow F-[[X]+X]+F[+FX]-X$

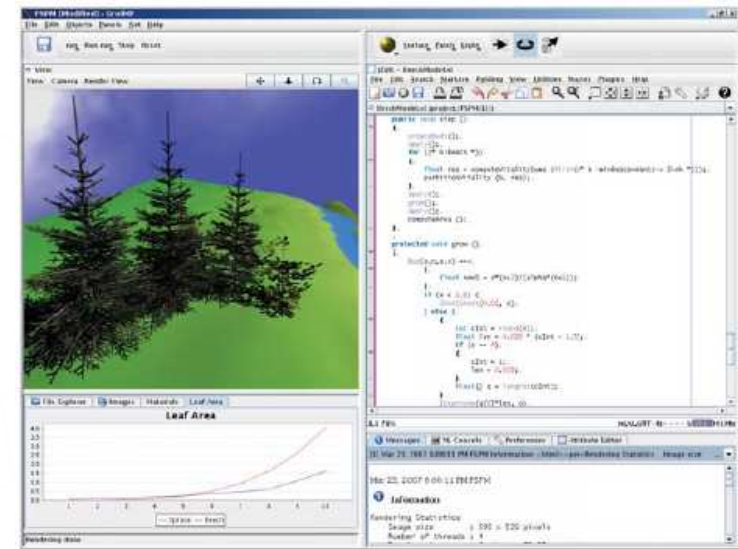
$F \rightarrow FF$



Simulation



Prusinkiewicz et. al., LStudio



Kniemeyer et. al., GroIMP

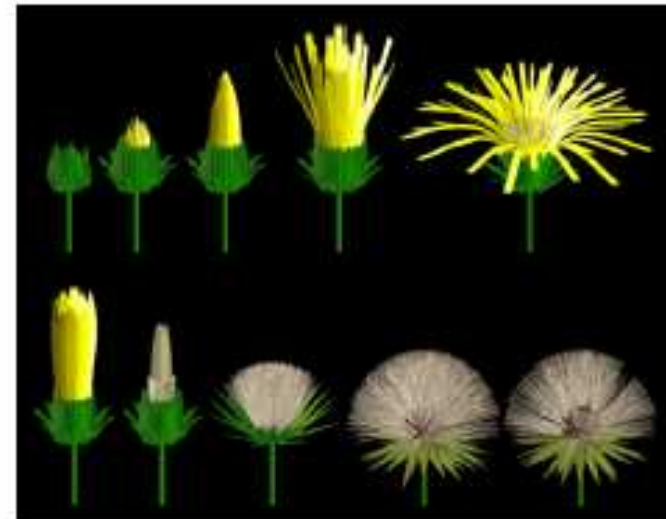
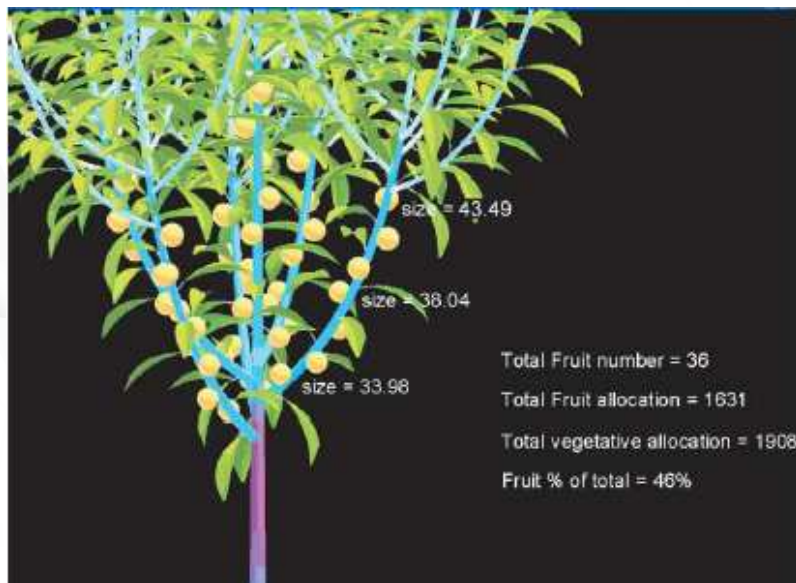
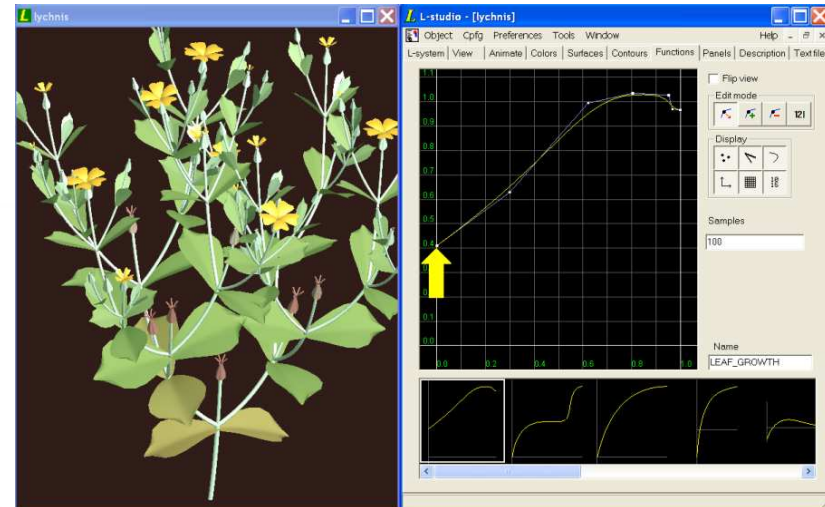


Barczy, AMAPSim

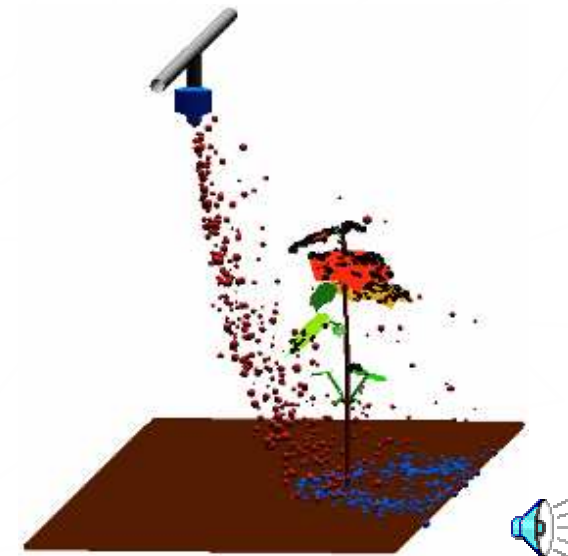
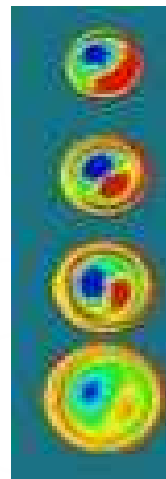
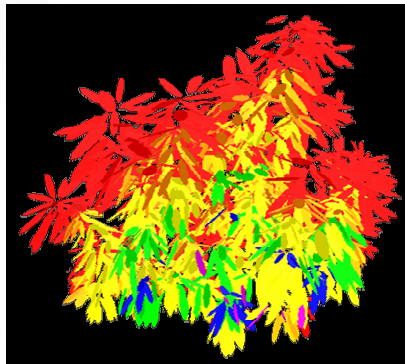
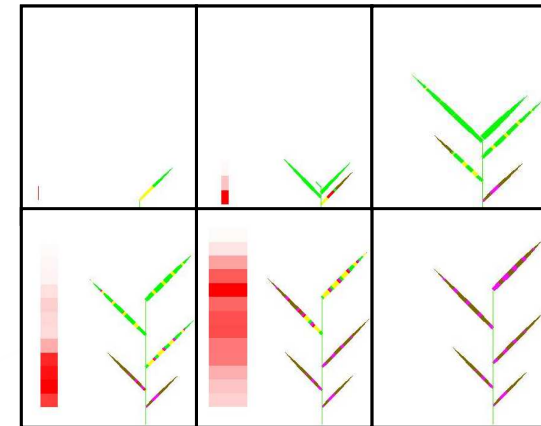
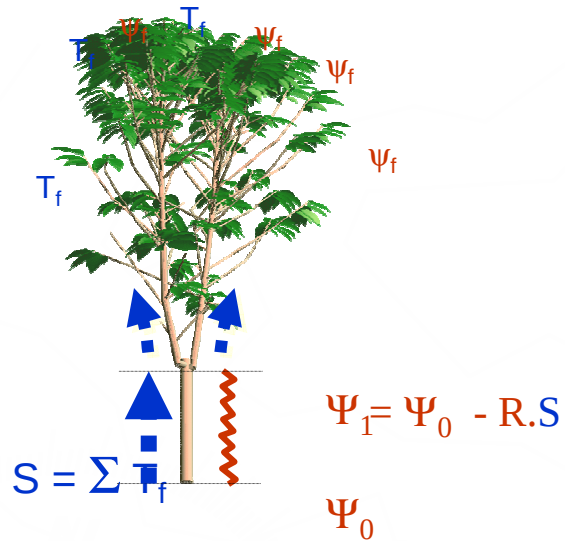


Principales fonctionnalités

- ▶ Langage proche du modèle
- ▶ Simplicité d'installation
- ▶ Richesse et ergonomie des outils de représentation 3D
- ▶ Prise en charge de la boucle de simulation
- ▶ Bibliothèque d'exemples pédagogiques
- ▶ interactivité



Simulation : au-delà de la dynamique de développement



Plateforme : coupler les modèles

Package Manager

Dataflow

Widgets

Component

Python Interpreter

OpenAlea

The screenshot displays the OpenAlea software interface. On the left, the 'Package Manager' window lists various components like 'Catalog.Model', 'Catalog.Python', 'Demo.Stand.Forestry', 'Geometric Operator', 'My Package', 'PlantGL Objects', 'PlantGL Visualization', 'plot3D', 'viewerDisplay', 'PlantGLDresser', 'PlotTools', 'Py Package: PlotTools', 'fractalysis.engine', 'pydrop', and 'r'. The main workspace shows a 'Stand description file' dataflow graph with components like 'fread', 'csv2objjs', 'len', 'Spatial Distribution', 'Stand Positioner', 'Tree Shape', 'PGL Dresser', 'Scene', and 'plot3D'. A 'Figure 0' window shows a 'spatial distribution' plot of blue dots. A 'PlantGL 3D Viewer' window shows a 3D visualization of green trees. A 'Python Interpreter' window at the bottom shows a list of coordinates and a command to print the first element of the 'stand_data' list. Arrows point from the labels to their respective components: 'Package Manager' to the left sidebar, 'Dataflow' to the main graph, 'Widgets' to the 'Figure 0' and 'PlantGL 3D Viewer' windows, 'Component' to the 'DataPool' window, 'Python Interpreter' to the bottom window, and 'OpenAlea' to the overall interface.

Example

Graphical model

Visual representation of a model

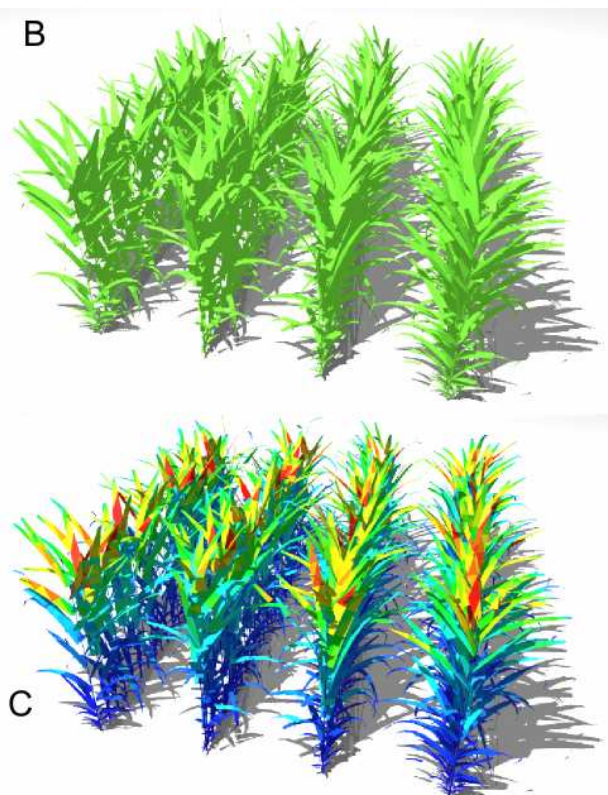
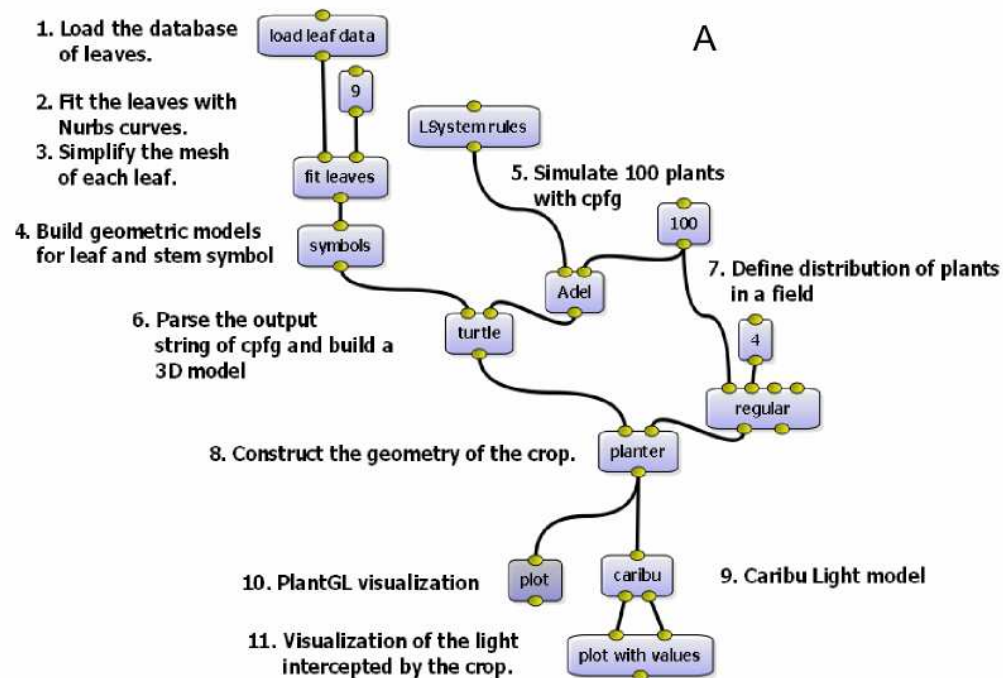
Connect components in a directed graph

Data flow through edges

Model of computation

Functional (deterministic)

Lazy evaluation



Bilan

- ▶ Offre riche 'en pyramide' sur les différents thèmes
 - Acquisition > Simulation > Modélisation > plateformes
 - Communauté française active (AMAP, VPlants, PIAF, Digiplant,...)

- ▶ Outils centrés sur le développement
 - Enjeux : multi-processus et multi-échelle
 - Méthodologie de couplages multiples (cohérence, précision...)

