

# ECOLOGICAL MODELLING

An International Journal on  
**ECOLOGICAL MODELLING AND  
SYSTEMS ECOLOGY**



Editor-in-chief  
**Brian D. Fath**

Special Issue of the 4th International Symposium on Plant Growth Modeling, Simulation, Visualization and Applications (PMA'12)

Guest Editors

Kang Mengzhen, Dumont Yves, Guo Yan and Fourcaud Thierry

## CONTENTS

(Abstracts/contents list published in: Biological Abstracts, Cambridge Scientific Abstracts, Elsevier BIOBASE/Current Awareness in Biological Sciences, Current Contents AB & ES, Ecological Abstracts, Ecology Abstracts, Environment Abstracts, Environmental Periodicals Bibliography (EPB); Also covered in the abstract and citation database SCOPUS®.  
Full text available on ScienceDirect®.

### Special Issue of the 4th International Symposium on Plant Growth Modeling, Simulation, Visualization and Applications (PMA'12)

#### Guest Editors: Kang Mengzhen, Dumont Yves, Guo Yan and Fourcaud Thierry

Editorial of the Special Issue of the 4th International Symposium on Plant Growth Modeling, Simulation, Visualization and Applications (PMA'12)	1
T. Fourcaud (Montpellier, France), M. Kang (Beijing, China), Y. Dumont (Montpellier, France) and Y. Guo (Beijing, China) .....	
AMAPstudio: An editing and simulation software suite for plants architecture modelling	3
S. Griffon and F. de Coligny (Montpellier, France) .....	
Parametrization of five classical plant growth models applied to sugar beet and comparison of their predictive capacity on root yield and total biomass	
C. Baey (Châtenay-Malabry, France), A. Didier, S. Lemaire, F. Maupas (Paris, France) and P.-H. Cournède (Châtenay-Malabry, France) .....	11
SUNLAB: A functional-structural model for genotypic and phenotypic characterization of the sunflower crop	
F. Kang, P.-H. Cournède (Châtenay-Malabry, France), J. Lecoeur (Stein, Switzerland) and V. Letort (Châtenay-Malabry, France) .....	21
Modeling the 3D structure and rhythmic growth responses to environment in dioecious yerba-mate	
F. Takeshi Matsunaga, M. Rakocevic and J.D. Brancher (Londrina, Brazil) .....	34
Light interception efficiency of apple trees: A multiscale computational study based on MAppleT	
D. Da Silva (Montpellier, France), L. Han (Weifang, China) and E. Costes (Montpellier, France) .....	45
Resource competition modulates the seed number-fruit size relationship in a genotype-dependent manner: A modeling approach in grape and tomato	
M. Prudent (Dijon, France), Z.W. Dai (Villeneuve d'Ornon, France), M. Génard, N. Bertin, M. Causse (Avignon, France) and P. Vivin (Villeneuve d'Ornon, France) .....	54
A modeling approach to determine the importance of dynamic regulation of plant hydraulic conductivities on the water uptake dynamics in the soil-plant-atmosphere system	
G. Lobet (Louvain-la-Neuve, Belgium), L. Pagès (Avignon, France) and X. Draye (Louvain-la-Neuve, Belgium) .....	65
Calibration and evaluation of ArchiSimple, a simple model of root system architecture	
L. Pagès, C. Bécel (Avignon, France), H. Boukcm (Montferrier-le-Lez, France), D. Moreau (Dijon, France), C. Nguyen (Villeneuve d'Ornon, France) and A.-S. Voisin (Dijon, France) .....	76
Plant diversity and drought: The role of deep roots	
M. Lindh, L. Zhang (Umeå, Sweden), D. Falster (New South Wales, Australia), O. Franklin (Laxenburg, Austria) and Å. Brännström (Umeå, Sweden and Laxenburg, Austria) .....	85
Towards a model of spray-canopy interactions: Interception, shatter, bounce and retention of droplets on horizontal leaves	
G.J. Dorr, D.M. Kempthorne, I.C. Mayo (Brisbane, Australia), W.A. Forster, J.A. Zabkiewicz (Rotorua, New Zealand), S.W. McCue, J.A. Belward, I.W. Turner and J. Hanan (Brisbane, Australia) .....	94
Phloem transport in trees: A generic surface model	
D. Sellier and J.J. Harrington (Rotorua, New Zealand) .....	102
Hyperbolic features of the circadian clock oscillations can explain linearity in leaf starch dynamics and adaptation of plants to diverse light and dark cycles	
F.G. Feugier and A. Satake (Sapporo, Japan) .....	110
A new probabilistic canopy dynamics model (SLCD) that is suitable for evergreen and deciduous forest ecosystems	
J.Sainte-Marie (Vandoeuvre-lès-Nancy, France and Champenoux, France), L.Saint-André (Champenoux, France and Montpellier, France), Y. Nouvellon (Montpellier, France and São Paulo, Brazil), J.-P. Laclau (Montpellier, France and Botucatu, Brazil), O. Roupsard (Montpellier, France and Turrialba, Costa Rica), G. le Maire (Montpellier, France), N. Delpierre (Orsay, France), A. Henrot and M. Barrandon (Vandoeuvre-lès-Nancy, France) .....	121
LEAFC3-N photosynthesis, stomatal conductance, transpiration and energy balance model: Finite mesophyll conductance, drought stress, stomata ratio, optimized solution algorithms, and code	
J. Müller, A. Eschenröder and O. Christen (Halle (Saale), Germany) .....	134
An ecophysiological model analysis of yield differences within a set of contrasting cultivars and an F1 segregating population of potato ( <i>Solanum tuberosum</i> L.) grown under diverse environments	
M.S. Khan, X. Yin, P.E.L. van der Putten and P.C. Struijk (Wageningen, The Netherlands) .....	146
Improving performance of Agro-Ecological Zone (AEZ) modeling by cross-scale model coupling: An application to japonica rice production in Northeast China	
Z. Tian, H. Zhong (Shanghai, China), L. Sun (Laxenburg, Austria, London, UK and College Park, USA), G. Fischer, H. van Velthuizen (Laxenburg, Austria) and Z. Liang (Shanghai, China) .....	155
Data assimilation to reduce uncertainty of crop model prediction with Convolution Particle Filtering	
Y. Chen and P.-H. Cournède (Châtenay-Malabry, France) .....	165
How changes in the dynamic of crop susceptibility and cultural practices can be used to better control the spread of a fungal pathogen at the plot scale?	
Y. Mammeri (Amiens, France), J.B. Burie, M. Langlais (Bordeaux, France) and A. Calonne (Villeneuve d'Ornon, France) .....	178
Direct and apparent compensation in plant-herbivore interactions	
A. Lebon (Montpellier, France), L. Mailleret (Sophia Antipolis, France), Y. Dumont (Montpellier, France) and F. Grognard (Sophia Antipolis, France) .....	192



0304-3800 (2014) 1024 290-1-Y

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)**ScienceDirect**