

International Conference
Modeling Forest Production
Scientific Tools - Data Needs and Sources
Validation and Application
Final Program



Organizing Committee

Hubert Hasenauer Conference Chairman
Annikki Mäkelä Conference Chairwoman
Andreas Scholton Office Manager

Scientific Advisory Board

Hank Bartelink Department of Environmental Sciences,
Wageningen University, the Netherlands

Harold E. Burkhard College of Forestry and Wildlife Resources,
Virginia Tech, USA

Klaus v. Gadow Institute of Forest Growth,
University of Göttingen, Germany

Herbert Hager Institute of Forest Ecology,
University of Natural Resources Vienna, Austria

Pertti Hari Department of Forest Ecology,
University of Helsinki, Finland

Norbert Kräuchi Swiss Federal Institute WSL
Birmensdorf, Switzerland

Joe Landsberg Landsberg Consulting, Australia

Manfred Lexer Institute of Silviculture,
University of Natural Resources Vienna, Austria

Marcus Lindner European Forest Institute, Finland

Jari Liski Department of Forest Ecology
University of Helsinki, Finland

Denis Loustau National Institute of Agricultural Research, France

Yadvinder Malhi Geosciences, University of Edinburgh, UK

Robert A. Monserud PNW and RM Research Stations,
Portland, USA

Frits Mohren Forest Ecol. and Forest Management,
Wageningen University, The Netherlands

Hans Pretzsch Forest Yield Science
Technical University Munich, Germany

Friedrich Schmitz Federal Ministry of Consumer Protection, Food and Agriculture, Bonn,
Germany

Hubert Sterba Institute of Forest Growth Research,
Univ. of Natural Resources Vienna, Austria

Margarida Tome Institute of Agriculture, Technical University of Lisbon, Portugal

Harry Valentine USDA Forest Service, Northeastern Research Station, USA

Timo Vesala Department of Physical Sciences, University of Helsinki, Finland

Final Program

for the International Conference

Modeling Forest Production

Scientific Tools - Data Needs and Sources – Validation and Application

19. – 22. April 2004

Department of Forest and Soil Sciences

University of Natural Resources and Applied Life Sciences

Peter Jordan-Straße 82, 1190 Vienna, Austria

18. 4. 2000 – Sunday:

16:00 – 18:00 **Registration and Icebreaker at the**
Wilhelm Exner Haus Peter Jordan Str. 82
University of Natural Resources and Applied Life Sciences

19. 4. 2000 – Monday:

8:00 – 9:00 **Registration**

Opening Ceremony

Room: EH02

9:00 – 9:05 Opening remarks by the Conference Chairman
Hubert Hasenauer

9:05 – 9:20 Welcome and Official Opening of the Conference
Univ.Prof. Dr. Martin Gerzabek
Pro-Rector University of Natural Resources and Applied Life Sciences

Univ.Prof. Dr. Hubert Sterba
Head of the Department of Forest- and Soil Sciences

Dr. Peter Mayer
IUFRO Executive Secretary

9.20-9.30 Introduction to the meeting by the chair of the IUFRO WP 4.01.09
Prof. Dr. Annikki Mäkelä

Session 1: Models and measurement of canopy gas exchange:

Moderator: Annikki Mäkelä

9:30 – 10:15 **Belinda Medlyn**, University of New South Wales, Australia
Canopy Models to assess NPP and GPP

10:15 - 11:00 **Dave Hollinger**, USDA Forest Service, USA

Within and between season variation in measures of forest carbon exchange as derived from eddy covariance measurements

11:00 – 11:30 *Coffee break*

Moderator: Harry Valentine

11:30 – 11:55 **Paul C. Stoy, G.G. Katul, M.B.S. Siquera, J. Juang, H.R. McCarthy, A.C.Oishi and R. Oren.** Duke University, USA.
Wavelet applications for modeling net ecosystem exchange at multiple time scales in a pine and a hardwood forest

11:55 – 12:20 **Ebba Dellwik and Teis N. Mikkelsen,** Denmark
Implementation of the optimal stomatal control formulation into a single layer model

12:20 – 12:45 **Timo Vesala, T. Suni, Ü. Rannik, P. Keronen, T. Markkanen, S. Sevanto, T. Grönholm, M. Kulmala, R. Ojansuu, A. Uotila, J. Sevula, A. Mäkelä, J. Pumpanen, P. Kolari, F. Berninger, H. Ilvesniemi, E. Nikinmaa, P. Hari.** University of Helsinki, Finland
Unaltered surface fluxes of CO₂, H₂O and O₃ after thinning of a boreal coniferous forest

12:45 – 14:00 *Lunch break*

14:00 – 14:30 *Coffee*

Moderator: Andrew Robinson

14:30 – 14:55 **A. Ibrom, A. Oltchev, R. Clement, K. Morgenstern, P. Jarvis and G. Gravenhorst.** Georg-August-Universität, Göttingen, Germany (UK, Canada)
Reduction of forest canopy gross photosynthesis rates at fair weather conditions: A modelling analysis

14:55 – 15:20 **Akihiko Ito,** Frontier Research System for Global Change, Japan
Environmental control of water and CO₂ fluxes through a cool -temperate deciduous broad-leaved forest: Analysis with a process-based model

15:20 – 15:45 **Vygodskaya, A.V. Oltchev, J.A. Kurbatova, A.V. Varlagin.** Severtsov Institute for Evolution and Ecology Problems, Russia (Germany)
Gross primary production (GPP) of unmanaged over-mature spruce forests at Southern European Taiga: eddy covariance measurements and modelling approach.

15: 45 – 16:15 *Coffee break*

Moderator: Margarida Tome

16:15 – 16:40 **Hans Verbeeck, R. Samson, F. Verdonck, R. Lemeur.** Ghent University, Belgium
Testing a coupled carbon and water exchange model: uncertainty, sensitivity and goodness-of-fit

- 16:40 – 17:05 **Sebastien Lafont, S. Evans, J. Pellenq, T. Randle, P. Henshall, C. Arcangeli.**
NERC Centre for Terrestrial Carbon Dynamics, U.K.
ForestETP, a process model for carbon and water fluxes in forest ecosystems:
model validation and application
- 17:05 – 17:30 **Grassi G., Nardino M., Magnani F.** Università degli Studi di Bologna, Italy
Can we model the response of canopy GPP and WUE to drought and leaf
development? The relevance of changes in photosynthetic capacity.

Poster Session

Room EH05

17:30 – **Poster session begins**

Each Poster has been numbered (see Appendix)

All poster presenters are requested to stand at their poster for 1 to 2
hours to introduce their work and answer questions

Poster presenters should have their poster ready before for 17:30 o'clock.

Poster Specifications:

Each Poster has been allotted, one side of a poster board, 1.2 m in width by 1.5 m
in height. Posters can be attached to the poster board using thumbtacks or pins.

Sandwiches and drinks are available to round up a long day !

**The drinks are sponsored by the Austrian Ministry of Forestry and
Agriculture & Water and Environment, Thanks.**



Das Lebensministerium

20. 4. 2004 Tuesday

Room: EH02

Session 2: Stand growth and productivity, data needs and sources

Moderator: Timo Vesala

- 8:45 – 9:30 **Miko Kirschbaum**, CSIRO Forestry and Forest Products, Australia
Long-term trends in forest production
- 9:30 – 10:15 **Marcel van Oijen, and M.G.R. Cannell**, CEH, U.K.
Bridging data needs and availability
- 10:15 – 10:40 **Yukihiro Chiba**, Forestry and Forest Products Research Institute, Japan
Production and carbon storage of “hanging litter” in forest stands

10:40 – 11:15 Coffee break

Session 2 A: Validation

Moderator: Ana Amaro

- 11:15 – 11:40 **Andrew Robinson, R. Duursma and R. Froese**. University of Idaho, USA
Quantitative tools for model validation
- 11:40 – 12:05 **Ana Amaro and M. Costa**. Instituto Superior de Gestão, Portugal
The effects of uncertainty on the model quality: a nonlinear difference equation based dominant height eucalyptus stand model.
- 12:05 – 12:30 **Rupert Seidl, M.J. Lexer, D. Jäger and K. Hönninger**. University of Natural Resources Vienna, Austria
Evaluating accuracy and generality of a modified forest patch model
- 12:30 – 12:55 **Stephan A. Pietsch, H. Hasenauer**. Institute of forest growth research, University of Natural Resources Vienna, Austria
Validation of BGC-Model Predictions vs. Terrestrial Data: Experiences and Problems

12:55 – 14:00 Lunch break

14:00 – 14:15 Coffee

Session 2 B: Models of stand productivity

Moderator: Chad Oliver

- 14:15 – 14:40 **Remko Duursma, J.D. Marshall and A.P. Robinson**. University of Idaho, USA
Use of a simple carbon balance model for prediction of conifer forest growth across complex terrain in North Idaho, USA
- 14:40 – 15:05 **Pertti Hari**, University of Helsinki, Finland
Carbon and nitrogen fluxes in a forest ecosystem

15:05 – 15:30 **Federico Magnani, M. Borghetti, R.C. Dewar and J. Grace.** University of Bologna, Italy (France, U.K.)
Age-related patterns of forest carbon exchange: mechanisms and implications at the individual tree, ecosystem and global level

15:30 – 15:55 **Harry T. Valentine and A. Mäkelä.** USDA Forest Service, USA (Finland)
A Process-based Formulation of an Empirical Model

15:55 – 16:20 Coffee break

Session 2 C: Models and applications of stand productivity

Moderator: Denis Loustau

16:20 – 16:45 **Russell K. Monson, A.A. Turnipseed and S. Burns.** University of Colorado, USA
Interannual variation in carbon sequestration in a subalpine pine-spruce-fir forest

16:45 – 17:10 **Petra Lasch, F.W. Badeck, C. Fürstenau, D. Jäger, M.J. Lexer, M. Lindner, F. Suckow.** Potsdam Institute of Climate Change Research, Germany
Analysis of Adaptive Forest Management Practices under Climate Change

17:10 – 17:35 **Elemer Briceno-Elizondo, M. Lexer, D. Jäger, H. Peltola, J. Garcia, H. Väisänen and S. Kellomäki,** University of Joensuu, Finland (Austria)
Regional impact assessment on forest production and carbon sequestration under climate change - A Finnish case study

17:35 – 17:45 Coffee Break

Moderator: Keith Moser

17:45 – 18:10 **Alexander Komarov, O. G. Chertov, A.V. Mikhailov, M.A. Nadporozhskaya, S.S. Bykhovets and E.V. Zubkova.** Russian Academy of Sciences, Russia
EFIMOD - an attempt of application of individual-based model of carbon turnover in forest ecosystems at different scales

18:10 – 18:35 **Oleg Chertov, A. Komarov, M. Nadporozhskaya.** Academy of Sciences, Pushchino, Moscow Area, Russia
On theoretical approaches for soil organic matter simulators as components of forest ecosystem models

FREE EVENING

21. 4. 2004 Wednesday

Room: EH02

Session 3: Regional productivity, inventory data and remote sensing

Moderator: Hubert Hasenauer

- 8:45 – 9:30 **Steve Running**, University of Montana, USA
Remote sensing and modeling
- 9:30 – 10:15 **Michael Köhl**, Dresden University of Technology, Germany
The use of forest inventory data
- 10:15 – 10:40 **Martha Chiesi, F. Maselli, M. Bindi, L. Fibbi, P. Cherubini, E. Arlotta, G. Tirone, G. Matteucci, and G. Seufert**. IBIMET-CNR, Italy (Switzerland)
Integration of ground-based and remote sensing data to simulate forest carbon fluxes in a Mediterranean area

10:40 – 11:00 Coffee break

Moderator: Michael Hauhs

- 11:00 – 11:25 **Tatjana Koukal and W. Schneider**, BOKU, Austria
Remote Sensing Data in the Inventory of High-Structured Forests in Mountainous Regions
- 11:25 – 11:50 **Gherardo Chirici, P. Corona, F. Maselli, D. Travaglini, and M. Marchetti**.
University of Florence, Italy
Assessing productive efficiency of forest ecosystems on a national scale in Italy integrating remotely sensed data and GIS modeling
- 11:50 – 12:15 **Ari Pussinen, M. Lindner, J. Liski, M.J. Schelhaas and S. Zaehle**. European Forest Institute, Finland (Germany)
Forest resource development in Europe under changing climate
- 12:15 – 12:40 **Andreas Huth, P. Köhler**. Center of Environmental Research Leipzig-Halle
Modelling production and dynamics of tropical rain forests - the models FORMIX3 and FORMIND

12:40 – 13:40 Lunch break

13:40 – 14:00 Coffee

Moderator: Federico Magnani

- 14:00 – 14:40 **Frits Mohren**, Forest Ecology and Forest Management Group (FEM),
Dept. of Environmental Sciences, University Wageningen, The Netherlands
- 14:40 – 15:05 **Robert A. Monserud, S. Huang and Y. Yang**, USDA Forest Service, USA
(Canada)

Gross Primary Production of Lodgepole Pine Stands in Alberta

15:05 – 15:30 **Rainer Joosten**, Ministry of Environmental of North Rhine-Westphalia, Germany
Modelling of the carbon accumulation in beech forests based upon inventory data and with regard to the biomass and nutrient export through an intensified harvesting

15:30 – 15:55 **Warren Keith Moser and M. Hansen**, USDA Forest Service, USA
The influence of diversity upon productivity in Central (USA) Hardwoods: Lessons from the Forest Inventory and Analysis dataset

15:55 – 16:30 *Coffee*

Moderator: Marcus Lindner

16:30 – 16:55 **Aleksi Lehtonen, J. Liski, R. Mäkipää, T. Eggers, P. Muukkonen, T. Palosuo and M. Peltoniemi**, Finnish Forest Research Institute, Finland
Carbon budget of Finnish forests from 1920 to 2000

16:55 – 17:20 **Frederic Raulier, P.Y. Bernier and D. McKenney**, Canadian Forest Service, Canada
Scaling estimates of net primary productivity across spatial and temporal scales

17:20 – 17:45 **Denis Loustau, A. Bosc, A. Colin, M. Bakker, C. Meredieu, M. Déqué, E. Cloppet, D. Arrouays, C. Le Bas, N. Saby, G. Pignard, N. Hamza, C. Francois, E. Dufrêne, H. Davi, K. Soudani, J. Ogée, N. Viovy, A. Granier and N. Breda**, INRA, France
Modelling the regional impacts of climate change on wood production and carbon storage in the plains French forests: results from the CARBOFOR project

17:45 – 18:10 **Roeland Samson, H. Verbeeck and R. Lemeur**, Ghent University, Belgium
Modelling carbon and water fluxes between forest and atmosphere along a latitudinal gradient in Europe

19:00 –24:00 **Dinner at a Viennese Winery (Heurigenlokal) in Vienna.**
After the tour, the bus will bring us directly to a Winery to enjoy the food, wine and music.

Heuriger Fuhrgassl-Huber
Neustift am Walde 68
1190 Wien
Tel: 4401405

22. 4. 2004 Thursday

Room: EH05

Session 4: Models and overviews

Moderator: Hubert Sterba

- 8:45 – 9:10 **Michael Hauhs**, BITÖK, Germany
Theoretical and Practical Aspects of Interactive Forest Growth Models
- 9:10 – 9:35 **Margarida Tomé, P. Soares, J. Tomé, C. Araújo**, Instituto Superior de
Agronomia, Portugal
Hybridizing a whole stand process-based model with an individual tree growth and
yield model for *Eucalyptus globulus* in Portugal
- 9:35 – 10:00 **Chadwick D. Oliver and J.B. McCarter**, Yale University, USA
Addressing data and model limitations of an integrated, landscape model (LMS)
applied to multiple ecosystems by monitoring and validation using a “Continuous
Quality Improvement” (CQI) approach
- 10:00 – 10:25 **Sergey.I Chumachenko, V.N. Korotkov, M.M. Palenova, V.V. Zobkov and D.V.
Politov**, All-Russian Research Institute for Silviculture and Mechanization of
Forestry, Russia
Model FORRUS-S: simulation of dynamics of forest ecosystems

10:25 – 11:00 Coffee break

Session 5: Summary and final discussion

Moderator: Bob Monserud

- 11:00 – 11:45 **Panel discussion: keynote speakers**
- 11:45 – 12:45 **GENERAL DISCUSSION**
- 12:45 – 13:00 **CLOSING (Annikki Mäkelä and Hubert Hasenauer)**
- 13:00 – 14:00 Lunch break**
14:00 – 14:30 Coffee

Appendix: Poster Program in Room EH05

- Each Poster has been numbered (see numbers below)
- All poster presenters are requested to stand at their poster for 1 to 2 hours to introduce their work and answer questions
- Poster presenters should have their poster ready until 17:30.

Poster Specifications:

Each Poster has been allotted, one side of a poster board, 1.2 m in width by 1.5 m in height. Posters can be attached to the poster board using thumbtacks or pins.

A. Canopy processes

1. **Catia Arcangeli and S. Evans**
Modeling canopy rainfall interception at the daily time step using the Gash analytical model
2. **Inge Jonckheere, B. Muys and P. Coppin**
Optimalisation of in-situ LAI determination by means of forest stand models
3. **Oleg Panferov, A. Ibrom and G. Gravenhorst**
Application of different models of individual tree crowns for 3-D description of radiation and photosynthesis in forest stands
4. **Katarína Merganicová, S.A. Pietsch, H. Hasenaeur**
Assessing the Energy, Water, Carbon and Nitrogen Flux within Old-Growth Forest Ecosystems
5. **Nardino M., Grassi G., Magnani F.**
Carbon, water and energy exchanges over a young reforestation

B. Tree/stand growth and structure

6. **Matteo Campioli, R. Samson, H. Verbeeck and R. Lemeur**
Development and implementation of an assimilates allocation submodel in the dynamic vegetation model FORUG
7. **Ann Abbott and A. Robinson**
Developing, improving, and linking tree-level models of crown dynamics for the North Idaho Variant of the Forest Vegetation Simulator
8. **José Tomé, L. Fontes, P. Soares, M. Tomé, A. Cortiçada, S. Faias, C. Araújo**
Development of a 3-PG type model for *Eucalyptus globulus* in Portugal
9. **Petteri Vanninen and A. Mäkelä**
Carbon budget for individual scots pine trees: effects of size, competition and site fertility on growth allocation
10. **Paula Soares and M. Tomé**
Analysis of the effectiveness of biomass expansion factors to estimate stand biomass
11. **Dietmar Jäger, W. Rammer, M.J. Lexer**

A 3-dimensional physiology-based forest patch model

12. Tero Kokkila, A. Franc and A. Mäkelä

A comparison of spatial and non-spatial process-based growth models

13. A. Weiskittel, D. Maguire

Simulating the effects of foliage age class structure and vertical foliage distribution on Douglas-fir tree and stand productivity

C. Aspects of productivity at regional / catchment scale

14. Otto Eckmüller

Tree Height from Airborne Laser-Scanning Data

15. Luzi Bernhard

Assessing surfaces of daily meteorological variables over Switzerland

16. Miina Rautiainen and P. Stenberg

Mapping of LAI using spectral vegetation indices

17. Jennifer Pellenq, S. Lafont, S. Evans, T. Randle, P. Henshall and C. Arcangeli

Validation of a fully 3D coupled water and carbon balance model for forest ecosystems at the catchment scale: ForestETP-3D

18. Akihiko Ito

Model evaluation of forest productivity in the western Circum-Pacific region

19. Gueric Le Maire, H. Davi, K. Soudani, C. Francois, E. Dufrêne

Simulation of carbon dioxide fluxes and stocks in a large managed temperate forest over one year

20. Georgis Xenakis, M. Mencuccini, D. Ray

Assessing productivity of Scots pine across Scotland using a modified, spatial version of the process model 3-PG

21. Thomas Wutzler

The spatial distribution of carbon pools in relation with stand composition and site conditions

22. Pedro José Pérez-Martínez

Relationships between changes of growth and nutrition: analyses based on spatio-temporal approach of Finnish dataset

23. Vacchiano Giorgio, E. Lingua, R. Motta

Evaluating Stand Density Index in Southern Piedmont Silver Fir (*Abies alba* Mill.) stands

24. Georges Herbert Chekuimo Tagne

Fractal patterns in species distributions of some british scarce plants

25. Mikko Peltoniemi, S. Monni, A. Lehtonen, J. Liski, P. Muukkonen, R. Mäkipää, T. Palosuo, I. Savolainen, S. Syri

Uncertainties in the inventory based carbon budget of forests and soils in Finland 1920-2000

26. Nadejda Tchebakova, E. Parfenova

Siberian phytomass and production in a changing climate

27. Anton M. Loukianov, A.V. Mikhailov, A.S. Komarov, O.G. Chertov

Carbon exchange in the forest soils of the Russian North-West using results of simulation modelling

28. M.M. Palenova, V.N. Korotkov, Yu.L. Nesterenko, S. I. Chumachenko

Model FORRUS: using Russian forest inventory data

29. Sergey I. Chumachenko, V.V. Zobkov

Model FORRUS-S:3D visualization of modeling results

30. Dmitri V. Politov, M.M. Belokon, M.M. Palenova, S.I. Chumachenko

Genecological database of Norway and Siberian spruces in population genetic studies and ecomodeling

31. Alexey Mikhailov, I. Pripulina, G. Andrienko, N. Andrienko, P. Gatalsky, O. Chertov, A. Komarov

Effects of nitrogen deposition on forest ecosystems in central European Russia: Results from simulation modelling

E. Empirical stand growth models

32. Susana Miguel Barreiro, M. Tomé, P. Soares, J. Tomé

Modelling growth of eucalyptus even-aged stands of unknown age

33. Daniel Mailly, M. Gaudreault, S. Turbis

Basal area increment in black spruce stands as predicted by various measures of competition

34. Sebastian Hein, J.-F. Dhôte

Growth Response and Productivity of Mixed Stands with Beech [*Fagus sylvatica* L.] and Oak [*Quercus spec.*] in Northern France

35. Joana Amaral Paulo, M. Tomé, J. Costa Lima

Modelling growth and cork yield of cork oak trees in the juvenile stage

36. F. Bravo

Modelling Maritime pine forest stand dynamic from experimental and inventory data

37. Marek Metslaid, T. Ilisson, M. Vicente, E. Nikinmaa, K. Jögiste

Growth of advance regeneration of Norway spruce after clearcut: model analysis

38. Jeong-Ho Seo, K. von Gadow

A new approach for evaluating the competition status of trees growing in a multi-species forest

39. Nuray Misir, M. Misir, H. Yavuz

Modeling individual diameter growth model for Crimean pine

40. B K Bala, M. A Martin, M. A. Hossain

Modeling of Forest Dynamics of the Sunderbans

F. Effects of forest management on productivity

41. Richard Petritsch

Incorporating forest management options within BGC-models

42. O. Pain, C. Deleuze

Restoration of beech resource in Lorraine region through conversion of coppices with beech standards

43. Hannu Hökkä, S. Kojola, T. Penttilä, H. Salminen

Modelling forest production with alternative management schedules in Scots pine dominated drained peatland stands in Finland – a simulation study

44. Jeong-Ho Seo, F. Vileko, S. Sanchez Orois, S. Kunth, K. von Gadow

A case study of forest management planning for Norway Spruce (*Picea abies*) stands using modified accelerated Simulated Annealing

45. Ion-Catalin Petritan, N.-V. Nicolescu

Modeling of diameter-height relationship and diameter class distribution in two even-aged European beech stands subject to cleaning-respacing of different intensities

46. Inigo Lizarralde, A. Bravo-Oviedo, F. Bravo

Assessment of opportunity costs of leaving died trees in Scots Pine in Northern Spain

47. Hannes Böttcher

Quantification of Global Carbon Sequestration and Release Potential of Forestry Activities

48. Warren Keith Moser, R.L. Busby

Productivity in a low-density longleaf pine forest: Cost comparisons of historical selective cutting vs. projected moderate- and high-growth even-aged management on a hunting plantation

49. Terhi Kaipainen, A. Pussinen, M. Lindner, J. Liski

Changing rotation length in actual forests - effects on the development of age-class structure, carbon stocks and feelings

50. Andreas Huth, B. Hahn-Schilling

Simulation of stand development in selectively harvested Peat Swamp Forests of Malaysia using FORMIX3

51. Cornelia Fürstenau, F.-W. Badeck, D. Jäger, P. Lasch, M. Lexer, M. Lindner, F. Suckow

Assessing the Impact of Silvicultural Strategies on Forest Ecosystem Functions under Changing Climate

52. Petra Lasch, F.-W. Badeck, C. Fürstenau, M. Lindner, F. Suckow

Forest Growth Model 4C: Validation of the Management and Assortment Modules Using Data and Models from Growth and Yield Science

53. Sergey I. Chumachenko, M.M. Palenova, V.N. Korotkov

Model FORRUS-S: forecast production and biodiversity characteristics of forest ecosystems at different scenarios of forest management

54. Lalit Basnet

Development of community forest & family farm enterprises in Nepal for sustainable rural development

G. Wood quality

55. Anu Kantola, S. Mattila

Modelling tree structure and biomass of Norway spruce (*Picea abies* [L.] Karst.) by MOTTI and PipeQual

56. G. Deckmyn, T. Randle, S. Evans

Refined pipe theory for mechanistic modelling of wood development

57. Falk-Juri Knauff

Modelling of Timber Quality with Tragic

58. A.J. Petutschnigg, H. Katz

A log-linear model to predict lumber quality depending on quality parameters of logs