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Tree Ring Research – Understanding Changing Environments

By Kaisu Makkonen-Spiecker, Freiburg, Germany

The 7th International Conference on Dendrochronology – Cultural Diversity, Environmental Variability – took place in Beijing, China from 11 to 17 June 2006. More than two hundred presentations and around 100 posters covered all aspects of tree ring research including chemical and physical properties of tree rings; the biological basis of tree rings; climatology and hydrology; ecology; geology; the development of methods and models; archaeology and cultural studies as well as interdisciplinary studies. Special attention was given to the different uses of tree ring analysis in meteorology, geosciences and history.

Tree rings are a unique data source covering a wide range in space and time. Tree rings serve as environmental archives as they reflect environmental conditions and their changes. They allow a detailed reconstruction of tree growth – trunk, branches, roots and even needles. In times of fast environmental changes these archives become increasingly important. Consequently, the amount, length and quality of dendrochronologies is increasing all over the world, as possibilities to use them get continuously better and historical dendrochronology is linked to climatology, ecology and wood biology.

Studies of tree ring **chronologies of thousands of years** are used for long-term meteorological observations, for example, giving evidence of temperature and precipitation developments over the centuries. This is of great help for understanding changes in biodiversity.

The **variety of innovative applications** of dendrochronology for historical purposes shows that this is far more than a dating method. Dendro-provenancing is useful for identifying where the wood used in historical buildings, for example, comes from and which samples come from the same tree.

Dendroecology was defined as the science that uses tree rings dated to their exact year of formation to analyze temporal and spatial relationships between living organisms and their environment. Dendroecology is applied in many fields such as wildfire dynamics, insect dynamics, forest stand dynamics, forest management, environmental quality, human disturbances as well as in wildlife ecology.

Photo by Gerda Wolfrum, IUFRO Headquarters

In geosciences, dendroecology is also becoming increasingly important in reconstructing earth surface processes as it facilitates, among other things, the dating of land surfaces and the reconstruction of variable hydrological conditions in soils.

In all, tree ring research helps to understand environmental conditions and mechanisms of tree reaction. However, there is still a **huge potential for interdisciplinary cooperation** which is not yet exploited on an international level. This cooperation should lead to a more comprehensive understanding and provide more realistic and reliable information for decision support in the future.

Photo by Kaisu Makkonen-Spiecker: Conference Co-Chairs (from right): Peter Brown, President of the TRS, Qi-Bin Zhang, Institute of Botany, Chinese Academy of Sciences, and Heinrich Spiecker, President of the ATR.

The conference was organized and hosted by the Institute of Botany, Chinese Academy of Sciences in conjunction with IUFRO Working Party 5.01.07, Tree Ring Analysis under the auspices of the Tree-Ring Society (TRS) and the European Association for Tree-Ring Research (ATR). It was also sponsored by the National Natural Science Foundation of China (NSFC), the Chinese Academy of Sciences and the Past Global Changes (PAGES). Nearly 300 scientists from 35 countries participated. Rovaniemi, Finland, was agreed to be the venue of the next international conference of dendrochronology to be held in 2010. Full report.

What does it mean?

By Renate Prüller, Coordinator SilvaVoc and Michèle Kaennel Dobbertin, Coordinator IUFRO 6.03.02

Dynamic disciplines such as tree-ring science are fruitful grounds for newly emerging concepts , for which printed or online definitions may be outdated or not available yet. This is why this month's definitions were taken from the mouth of the very experts who stand for them.

If you would also like to contribute your expert knowledge, join the IUFRO Directory of Experts (http://www.wsl.ch/forest/risks/iufro/)and help IUFRO make expert knowledge available!

stable isotope dendrochronology
An application of dendrochronology that uses stable (non radioactive) isotopic compositions of tree-ring wood and cellulose to reconstruct past environmental conditions, for example historical atmospheric temperatures, or to study the effects of environmental changes (climate, air pollutants or increasing carbon dioxide) on trees. Commonly analyzed stable isotopes include carbon, oxygen, hydrogen and in wood nitrogen and sulfur. *(Rolf Siegwolf, Head, Stable Isotopes Research Group, Paul Scherrer Institute, Switzerland)*

dendroprovenancing
Technique based on tree-ring analysis used to identify the geographic origin of timber and historical wooden objects. *(Niels Bonde, Research Lab for Natural Science and Dendrochronology, National Museum Copenhagen, Denmark)*

crossdating
The procedure of matching variations in ring widths or other ring characteristics among tree-ring series, allowing the identification of the exact year in which each tree ring was formed. Crossdating is accomplished in a three-level hierarchy: (1) within series from an individual tree, (2) among series from an individual site, and (3) between sites to establish a regional signal. Crossdating is considered by most dendro-scientists as the fundamental principle of dendrochronology in its classical definition, but dendro-scientists also recognize the usefulness of counting rings when crossdating is not possible. *(Henri D. Grissino-Mayer, University of Tennessee, Knoxville, USA)*

More scientific summaries and definitions

Heads of European National Forest Research Institutes Meet in Latvia

The 2nd meeting of directors of European forest research institutes took place in Riga from 3-4 July. IUFRO as a global platform for forest research coordination was represented by Executive Director Peter Mayer. The directors, whose institutes, to a large extent, are IUFRO members, primarily discussed matters relevant in the context of the European Union.

The meeting presented an opportunity to report about the global Director's Forum in Brisbane and to promote the Washington Meeting (18-20 April 2007) of IUFRO 6.06.00 *Management of forest research* entitled "Forest Research Management in an Era of Globalisation" . The meeting will be a key meeting for directors discussing forest research management on the global level for the future.

Furthermore, IUFRO has also offered to contribute to a planned science forum in the frame of the Forest Action Plan on EU level.

Congratulations! IUFRO Distinguished Service Awards presented to Dennis Dykstra and Klaus von Gadow


Dennis Dykstra

Dennis Dykstra was active as coordinator of IUFRO Units and, since 1996, of IUFRO Division 3 from 1982-2005. With hands-on experience gathered in five countries on four continents, Dennis showed himself a dedicated and responsible leader. His expertise and international relations contributed widely to the achievement of the aims of IUFRO.

Klaus von Gadow served as Division 4 Coordinator from 1996 to 2005. During these two terms of office he showed a high degree of direction and leadership in his Division. His experience in forest management gathered during more than 20 years in South Africa and the United States made him a great expert in his field. He carried this interest and expertise over to IUFRO.


Klaus v Gadow

Traditional and Novel Approaches in Poplar and Willow Science

By Brian Stanton, Greenwood Resources, USA, Coordinator of IUFRO Working Party 2.08.04 Poplars and Willows

The Fourth International Poplar Symposium - *"Meeting the Needs of a Growing World through Poplar and Willow Science: Combining Traditional and Novel Approaches in the Genomic Era"* - was held in Nanjing, China, June 5-9, 2006. The symposium was hosted by Nanjing Forestry University and was sponsored by IUFRO units 2.08.04 and 7.01.04. Current findings in poplar and willow science were presented in plenary and contributed paper sessions in four thematic areas:

1) Advances and Applications in Poplar and Willow Genomics and Biotechnology,
2) Advances In Conventional Poplar Breeding and Gene Conservation,
3) Using Poplars and Willows to Provide Ecosystem Services and Bioenergy, and
4) Poplars in a Changing World: Understanding Responses to Climate Change.

Significant findings reported during the symposium were as follows:

Genomics and Biotechnology – A report on the large number of genes encoding enzymes and proteins involved in secondary wall biosynthesis suggested selection for retention of duplicated genes in the Populus genome. It was also reported that the Populus genome of approximately 45,555 genes has undergone three separate genome-wide duplication events in its evolutionary past, the most recent of which was reported to have occurred 8-12 million years ago. Studies of Populus transformation in China noted effective control of insect attack and tolerance of soils with high salt contents. Preliminary findings were presented that showed gene flow from transgenic plantations may not be as overriding a consideration as originally envisioned in the risk assessment of this technology in northern China. A modeling exercise reported that sterility genes provide high levels of transgene containment, even in cases where sterility may be incomplete.

Poplar Breeding - The value of non-recurrent hybridization when used in support of developing operational programs was detailed in the continuous turnover of elite varietal pools when evolving pathogen virulence is a concern. There is an increasing realization of the need to integrate molecular tools with rapid selection and screening programs for a range of products and ecosystem services. A status report was made on the extensive breeding program being conducted for *Populus deltoides* and its hybrids for wood production and agro-forestry programs in the lower reaches of the Yangtze River. A statistical framework was presented for characterizing morphological variation in allometrical traits; the intent is to define ideotypes that display optimal resource-use efficiency. – Chromosome-doubling methodologies for both male and female gametes for the efficient production of high-yield, triploid *Populus tomentosa* varieties were reported. This effort will accelerate triploid breeding for yield and wood quality.

Photo by Brian Stanton. Delegates inspecting a Populus deltoides propagation nursery in Jiangsu Province. Rooted sets - two-year-old roots stock supporting coppiced one-year-old sprouts are lifted from nurseries and used in establishing poplar plantations and agro-forestry projects ensuring good survival rates.

Ecosystem Services – Silvicultural systems were described for several ecosystem services including streamside stabilization, habitat restoration, and agro-forestry production. Reports also detailed the significant role that Populus is now playing in the remediation of industrial sites contaminated with heavy metals, organic solvents, etc. Transgenic varieties were reported to have enhanced potential to remove environmental pollutants. It was reported that a wide variety of Populus endophytes could improve the efficiency of phyto-remediation.

Climate Change - The effect of climate change was detailed in the molecular responses of salt- and drought-stressed genotypes of *Populus euphratica* as well as the phenological response of Populus hybrids to changes in carbon dioxide and ozone levels. Tanscriptional activity also revealed the effect of a carbon-enriched atmosphere on protein metabolism, lignin biosysnthesis, and cell wall thickening in aspen.

Abstracts from the International Poplar Symposium IV will soon be available at the: **WEBSITE**

IUFRO Meetings

*The following list of meetings is not complete. For a full list of IUFRO events, please visit our **online calendar.** Find more details on the **homepages** of IUFRO Units involved.*

6-20 September 2006
International Training Workshop on Bamboo Industrial Processing Technologies and Machines
Zhejiang, China
By MOST, INBAR, INFORTRACE, co-sponsered by IUFRO RG 5.11.00 Non-wood Forest Products
Contact: Zhu Zhaohua or Jin Wei at zhzhu(at)inbar.int ; Wjin(at)inbar.int
http://www.inbar.int/news/tc0603.htm

14-17 September 2006
Vom Nutzen der Waldbäume – nachwachsende Rohstoffe abseits des Gewohnten (In German)
Baden Austria
Organized by the Austrian *Lebensministerium* and others. Co-sponsored by IUFRO RG 6.07.00 Forest and Woodland History. **Contact:** Johann Kiessling, johann.kiessling(at)lebensministerium.at

27 September 2006
Business Meeting of IUFRO RG 8.03.00 Natural Disasters
Niigata, Japan
During the INTERPRAEVENT Congress in Niigata from 25-29 September.
Contact: Gernot Fiebiger
Gernot.Fiebiger(at)die-wildbach.at

8 October 2006
2006 CRIWI – IUFRO WP 5.02.01 Joint Seminar on Non-destructive Testing of Wood
Beijing, China
Contact: Xiping Wang, USDA Forest Products Laboratory, Email: xwang(at)fs.fed.us, Fax: +1-608-231-9508,

25-27 October 2006
ForestXchange – International Conference on Knowledge Management and Transfer
Freiburg, Germany
Co-organised by IUFRO Task Force "Communicating Forest Science" and IUFRO Units 6.06.01, 6.06.02, and 6.15.00.
The Task Force will also hold a pre-conference meeting from 22-24 October.
Contact: Roderich v. Detten, info(at)forestxchange.org, Tel: +49-761-4018-214
http://www.forestxchange.org/

1-3 November 2006
Encuentro Andino Amazónico – Iberoamerican Forest and Environmental Law
Bogotá, Colombia
Organized by ECOVERSA, IUFRO WP 6.13.01
Sponsored by INWENT
Contact: gsanclemente(at)ecoversa.org

11-13 December 2006
Workshop on Non-Destructive Testing of Wood Products
Universidad Del Bio-Bio, Concepción, Chile
Co-sponsored by IUFRO Division 5
Contact: Erik Baradit, ebaradit(at)ubiobio.cl

11-14 April 2007
Joint Australasian Forest Genetics and IUFRO Southern Pine Working Group Conference
Hobart, Tasmania, Australia
Co-sponsored by IUFRO WP 2.02.20
Contact: Harry Wu, Harry.Wu(at)ensisjv.com
http://www.crcforestry.com.au/atgconference.pdf

21-23 May 2007
9th International Conference on Woodfiber-Plastic Composites
Madison, Wisconsin, USA
Hosted by: USDA Forest Service, Forest Products Laboratory, Forest Products Society
Co-sponsored by IUFRO RG 5.05.00 Composite and reconstituted products
E-mail: conferences(at)forestprod.org
http://www.forestprod.org/conf2007.html

29 July – 2 August 2007
Complex Stand Structures and Associated Dynamics: Measurement Indices and Modeling Approaches
Sault Ste. Marie, Ontario, Canada
IUFRO WP 4.01.02 Growth models for tree and stand simulation
Contact: Peter Newton, peter.newton(at)nrcan.gc.ca,
http://www.iufrosault.org/

19-23 August 2007
International Symposium on Forest Soils and Ecosystem Health: Linking Local Management to Global Change Challenges
Sunshine Coast, Queensland, Australia
Co-sponsored by IUFRO WP 8.01.03 Forest Soils
Contact: Tim Blumfield, t.blumfield(at)griffith.edu.au
http://www.griffith.edu.au/conference/isfs2007/

Publications

Forests and Human Health: Assessing the Evidence.
Colfer, C.J.P.; Sheil, D.; Kishi, M. 2006. Bogor, Indonesia, Center for International Forestry Research (CIFOR). CIFOR Occasional Paper No. 45. 111 p.
http://www.iufro.org/science/divisions/division-6/60000/60200/publications/

UNECE/FAO Forest Products Annual Market Review, 2005-2006
Available via the Timber Committee and European Forestry Commission homepage:
http://www.unece.org/trade/timber/Welcome.html
The review covers forest products market and policy developments in the UNECE region of Europe, North America and Eastern Europe, Caucasus and Central Asia.