2012 IUFRO CONFERENCE DIVISION 5 FOREST PRODUCTS

INTERNATIONAL UNION OF FOREST RESEARCH ORGANIZATIONS

8 › 13 JULY'12 - ESTORIL CONGRESS CENTRE, LISBON, PORTUGAL

FINAL PROGRAM, PROCEEDINGS AND ABSTRACTS BOOK

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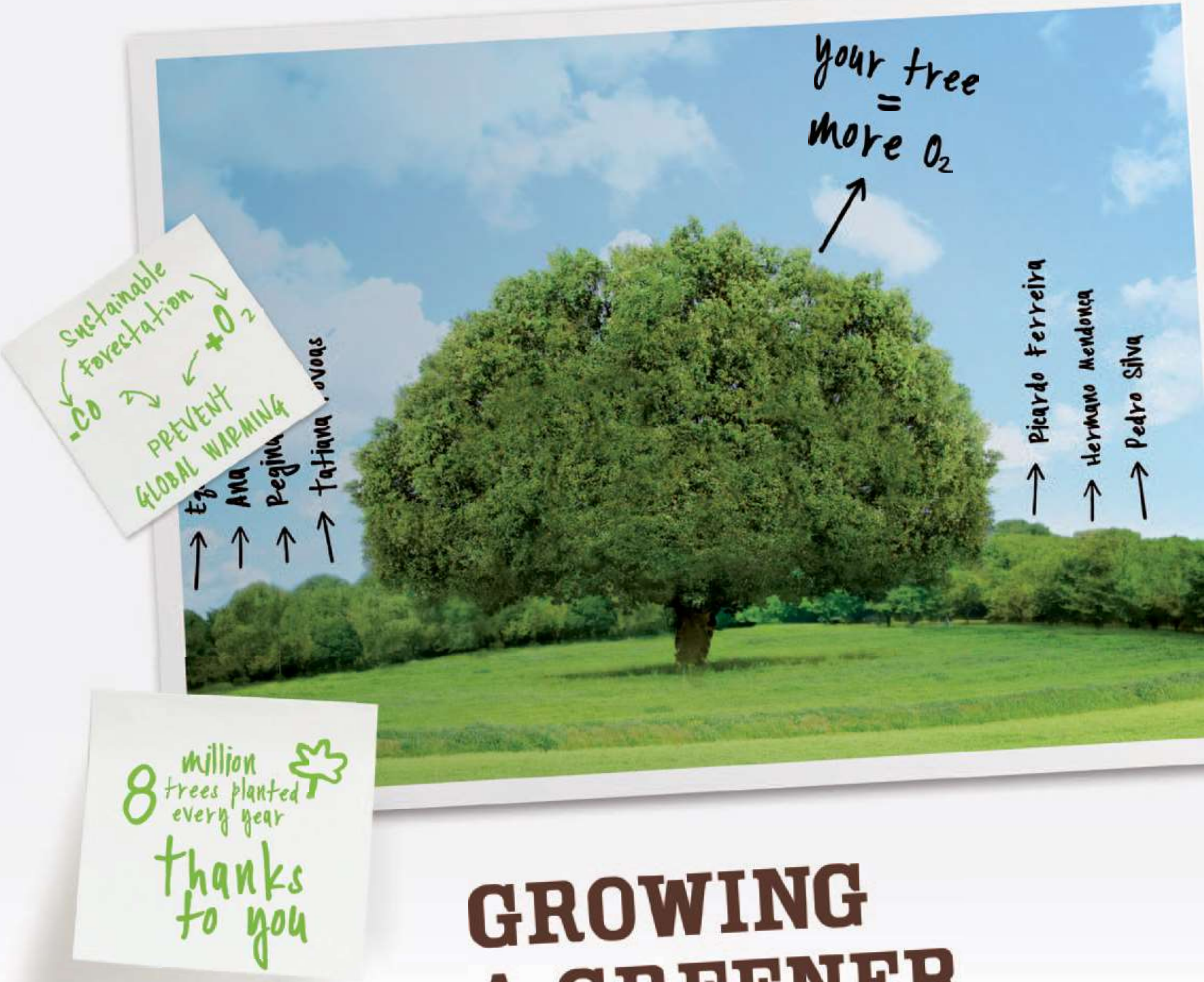

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WELCOME MESSAGE
from IUFRO Division 5 Coordinator and Conference Chairman


Dear friends and colleagues,

The IUFRO Forest Products conference is an important scientific meeting for the IUFRO Division 5 research community and others, being held every 4-5 years for several years now. On behalf of IUFRO Division 5 (Forest Products), we as respectively, Coordinator of IUFRO Division 5 and conference Chairman, are delighted to welcome you to this 2012 All Division 5 conference in Estoril, Portugal. We are honored that the IUFRO conference has the support not only of The Instituto Superior de Agronomia (ISA) and The Forest Research Centre (CEF) within The Technical University of Lisbon, but also from several major national and international sponsors and scientific organisations.

Planning for this conference has been building steadily over the last two years since the local hosts won the bid to host this meeting, and has involved a considerable amount of coordination and hard work from the International Organizing Committee and the professional conference organizer appointed by the Local Organizing Committee. The week's conference proceedings would not have been possible without the passionate efforts of all concerned. Also, we do recognize all D5 Unit Coordinators and deputies. Without your expertise and the time you have spent to organize the sessions this conference would not have been possible. Thanks to you the IUFRO Division 5 is rather unique by having a regular Forest Products Conference. Besides being a gathering of many of the world's forest products scientists (not necessarily IUFRO members alone) under one roof to foster networking and useful contacts among your peers, the conference gives opportunities to present new findings/technologies overall that would be beneficial to society. It is a platform to contribute directly to the overall structure and goals of D5 and to help influence IUFRO policy through participation at its research unit business meetings.

This is designated as a "Green Conference" and you may have noted that the 5 conference themes take into account also the relevant thematic areas of the 2010-2014 IUFRO Strategy. The conference will address these issues affecting forest products in its various technical sessions and by keynote speakers: Forests for People; Resources for the Future; Bioenergy; Forest and Climate Change and Wood in Construction. This is a unique opportunity for you to consider linking your on-going research and presentations to both the conference themes and also contribute to the current 8 thematic areas of the 2010-2014 IUFRO Strategy. Scientific progress in forest products research is advancing with new tools and technology for research, novel areas of research encompassing areas of nanoscience, molecular biology, biotechnology and genetics, bioenergy, environmental aspects – the buzz words that are fast becoming the mainstay of forest products research in the 21st century. Nevertheless, traditional wood technology research continues to be relevant and impact upon the future well-being of the global environment.

IUFRO – The International Union of Forest Research Organizations – is a non-profit, non-governmental international network of forest research scientists, and is a major organization with wide networks of internationally recognized researchers sharing common grounds – to foster global cooperation in forest-related research and promote understanding of technical, economic and social aspects of its research and utilization of forests and their multiple wood and non-wood resources. IUFRO members are thus encouraged, through their research activities, to continually help make IUFRO more visible globally in forest science and promote science-based knowledge to a wider audience in line with the goals of the current IUFRO Strategy. We would similarly encourage non-member delegates to consider joining IUFRO and contribute to the goals of D5 and IUFRO overall.

As you will take this opportunity during the conference week to interact and develop international cooperation, and also to be part of the IUFRO network, we wish all delegates a most fruitful and eventful conference.

Andrew Wong
Coordinator, IUFRO D5
University Malaysia Sarawak
Kota Samarahan, Sarawak, Malaysia

Pekka Saranpää
Conference Chair
Deputy Coordinator, IUFRO D5
Finnish Forest Research Institute, Vantaa, Finland

DIVISION 5
FOREST PRODUCTS

PRODUITS FORESTIERS - PRODUCTOS FORESTALES - HOLZ UND ANDERE FORSTPRODUKTE

Coordinator: Andrew Wong, Malaysia
Deputies: Jamie Barbour, United States; Dave Cown, New Zealand; Pekka Saranpää, Finland

5.01.00 Wood quality
Qualité du bois
Calidad de la madera
Holzqualität
C Pekka Saranpää, Finland
D Pauline Fernández, Chile
D Jianxiong Lu, China
D Elspeth MacDonald, United Kingdom
D Katsuhiko Takata, Japan

5.01.04 Wood quality modelling
Modélisation de la qualité du bois
Modelación de la calidad de madera
Modellierung der Holzqualität
C Jean-Michel Leban, France
D Joseph Gril, France
D Heli Peltola, Finland
D Christine Todoroki, New Zealand

5.01.07 Tree ring analysis
Analyse des cernes
Análisis de anillos de crecimiento
Jahrringanalyse
C Margaret Devall, United States
D Paolo Cherubini, Switzerland

5.01.08 Understanding wood variability
Comprendre la variabilité du bois
Entender la variabilidad de la madera
Holzvariabilität verstehen
C Barbara Lachenbruch, United States
D Paul McLean, United Kingdom
D John Moore, New Zealand

5.02.00 Physiomechanical properties of wood and wood based materials
Propriétés physiomécaniques et utilisations du bois et des matériaux dérivés du bois
Propiedades fisiomecánicas y aplicaciones de la madera y de materiales compuestos en base a madera
Physiomechanische Eigenschaften und Anwendungen von Holz und Holzwerkstoffen
C Xiping Wang, United States
D John Moore, New Zealand
D Lihai Wang, China

5.02.01 Non-destructive evaluation on wood and wood-based materials
Evaluation non déstructive du bois et des matériaux dérivés du bois
Evaluación no destructiva de madera y materiales compuestos en base a madera
Nicht zerstörende Evaluierung von Holz und Holzwerkstoffen
C Xiping Wang, United States
D Roger Meder, Australia
D Houjiang Zhang, China

5.02.02 Fundamental properties of wood and wood-based materials
Propriétés fondamentales du bois et des matériaux dérivés du bois
Propiedades fundamentales de madera y materiales compuestos en base a madera
Grundlegende Eigenschaften von Holz und Holzwerkstoffen
C Hongmei Gu, United States
D Raquel Goncalves, Brazil

5.03.00 Wood protection
Protection du bois
Protección de la madera
Holzschutz
C Donatien Pascal Kamdem, United States
D Gyu-Hyeok Kim, Korea (Rep)
D Adya P. Singh, New Zealand
D Andrew Wong, Malaysia

5.03.05 Biological resistance of wood
Résistance biologique du bois
Resistencia biológica de la madera
Biologische Beständigkeit von Holz
C Nasko Terziev, Sweden
D Jinzhen Cao, China
D Sung-Mo Kang, Korea (Rep)

5.03.06 Wood protection for quarantine, food packing and trade in wood
Protection du bois dans la quarantaine, l'emballage et le commerce du bois
Protección de la madera para cuarentena, embalaje de alimentos y comercio de maderas
Holzschutz zur Erfüllung von Quarantäne-, Lebensmittelverpackungs- und Holzhandelsvorschriften
C Magdalena Kutnik, France
D Hugh Bigsby, New Zealand
D Donatien Pascal Kamdem, United States

5.03.07 Wood protection under tropical environments
Protection du bois sous les tropiques
Protección de la madera bajo condiciones tropicales
Holzschutz in den Tropen
C Marie-France Thevénon, France
D Osvaldo Encinas, Venezuela
D Andrew Wong, Malaysia

5.03.10 Protection of cultural artefacts
Protection des artefacts culturels
Protección de objetos culturales
Schutz von Kulturgegenständen
C Wibke Unger, Germany
D Geoffrey F. Daniel, Sweden
D Donatien Pascal Kamdem, United States
D Marie-France Thevénon, France

5.03.11 Protection by surfacing and finishing
Protection du bois par le revêtement et la finition
Proteger la madera con recubrimientos y acabados
Holzschutz durch Beschichtung und Finish
C Philippe Gerardin, France
D Andre Merlin, France
D Martino Negri, Italy

5.04.00 Wood processing
Transformation du bois
Transformación de la madera
Holzbearbeitung
C Marius Barbu, Romania
D Mihaela Campean, Romania
D Jegatheswaran Ratnasingam, Malaysia

5.04.06 Wood drying
Séchage des bois
Secado de la madera
Holztrocknung
C Diego Elustondo, Canada
D Agron Bajraktari, Republic of Kosovo
D Süleyman Korkut, Turkey
D Gan Kee Seng, Malaysia

5.04.07 Adhesives and gluing
Collage des bois
Adhesivos y encolado
Holzverleimung
C Hui Pan, United States
D Warren Grigsby, New Zealand
D Shujun Li, China
D Tohmura Shin-ichiro, Japan

5.04.08 Sawing, milling and machining
Sciage et usinage
Aserrado y maquinado
Sägen und Holzbearbeitung
C Roger Hernandez, Canada
D Pierre-Jean Meausoone, France
D Takeshi Ohuchi, Japan

5.04.13 Industrial engineering, operations analysis and logistics
Ingénierie industrielle, analyse des opérations, et logistique
Ingeniería industrial, análisis de operaciones y logística
Industrielle Verarbeitung, Verfahrenstechnik und Logistik
C Henry Quesada-Pineda, United States
D Omar Espinoza, United States
D Roger Moya Roque, Costa Rica

5.05.00 Composite and reconstituted products
Composites et produits reconstitués
Materiales compuestos y productos reconstituidos
Verbundwerkstoffe und Leimholzprodukte
C S. Salim Hiziroglu, United States
D Marius Barbu, Romania
D Zhiyong Cai, United States
D Tatsuya Shibusawa, Japan

5.06.00 Properties and utilization of plantation wood
Propriétés et utilisation du bois provenant des plantations
Propiedades y utilización de madera proveniente de plantaciones
Eigenschaften und Verwendung von Plantagenholz
C Roger Meder, Australia
D Yafang Yin, China

5.06.01 Utilization of dry area timber
Utilisation du bois provenant des terres sèches
Utilización de madera proveniente de zonas áridas
Verwendung von Holz aus Trockengebieten
C Nick Pasiecznik, France
D George Muthike, Kenya

5.06.02 Utilization of planted teak
Utilisation du teck provenant des plantations
Utilización de madera de teca proveniente de plantaciones
Verwendung von Teakholz aus Plantagen
C P.K. Thulasidas, India
D vacant

5.06.03 Utilization of planted eucalypts
Utilisation de l'eucalyptus provenant des plantations
Utilización de madera de eucaliptus proveniente de plantaciones
Verwendung von Eukalyptusholz aus Plantagen
C Jose Nivaldo Garcia, Brazil
D Roger Meder, Australia
D Yongdong Zhou, China

5.07.00 Energy and chemicals from forest biomass
Energie et produits chimiques de la biomasse forestière
Energía y productos químicos de la biomasa forestal
Energie und chemische Produkte aus forstlicher Biomasse
C vacant
D Hyeun-Jong Bae, Korea (Rep)
D Fuxiang Chu, China
D Alan Rudie, United States

5.10.00 Forest products marketing and business management
Commercialisation des produits forestiers et développement de l'entreprise
Comercialización de productos forestales y gestión de empresas
Vermarktung von Forstprodukten und Betriebsführung
C Eric Hansen, United States
D Paul Dargusch, Australia
D Rob Kozak, Canada
D Toshiaki Owari, Japan
D Anne Toppinen, Finland
D Richard Vlosky, United States

5.10.01 Wood culture
Culture du bois
Cultura de la madera
Holzkultur
C Howard N. Rosen, United States
D Victoria Asensi Amoros, France
D Monlin Kuo, United States
D Yang Ping, Japan
D Jinling Su, China
D Mario Tomazello Filho, Brazil

5.11.00 Non-wood forest products
Produits forestiers non-ligneux
Productos forestales no leñosos
Nichtholz-Forstprodukte
C A.L. "Tom" Hammett, United States
D James Chamberlain, United States
D Madhav Karki, Nepal
D Pawel Staniszewski, Poland
D Paul Vantomme, Italy

5.11.02 Medicinal forest products
Produits forestiers médicinaux
Productos forestales medicinales
Waldprodukte in der Medizin
C Carsten Smith Olsen, Denmark
D Giridhar A. Kinhal, Nepal

5.11.03 Edible forest products
Produits forestiers comestibles
Productos forestales comestibles
Nahrungsmittel aus dem Wald
C Susan J. Alexander, United States
D Sarah W. Workman, United States

5.11.05 Bamboo and rattan
Bambou et rotin
Bambú y ratán
Bambus und Rattan
C Jinhe Fu, China
D Johan Gielis, Belgium
D Lay Thong Hong, Malaysia

5.12.00 Sustainable utilization of forest products
Utilisation durable des produits forestiers
Utilización sostenible de productos forestales
Nachhaltige Verwendung von Walderzeugnissen
C Robert Deal, United States
D Ying Hei Chui, Canada
D Choi Don Ha, Korea (Rep)

5.14.00 Forest products education
Formation en matière de produits forestiers
Educación en productos forestales
Ausbildung im Bereich der Walderzeugnisse
C Rupert Wimmer, Germany
D Aldo Ballerini, Chile
D Jamie Barbour, United States
D Sudipta Dasmohapatra, United States

BEST POSTER AWARDS

The Scientific Committee wishes to encourage scientists to display outstanding posters during the IUFRO Division 5 conference.

An Awarding Body will evaluate all the posters exhibited during the poster sessions, based upon the following selection criteria:

1. Presentation: layout (attractiveness, legibility, creativity)
2. Content: innovative ideas and value of subject matter
3. Presenter's ability to convey the message

The awards will be presented at the Conference dinner, on July 11 and consist of a certificate and a gift sponsored by 3DCork – www.3dcork.com

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REGISTRATION DESK

DAY	TIME
Sunday, July 8	14h-18h00
Monday, July 9	08h-18h00
Tuesday, July 10	08h-18h00
Wednesday, July 11	08h-13h00
Thursday, July 12	08h-18h00
Friday, July 13	08h-16h00

TECHNICAL VISITS JULY 11

Departure time: 12h15

Technical Visit 1 - Corticeira Amorim

Technical visit 2 - Espirra Estate (Portucel Soporcel Group)

Technical visit 3 - Industrial Plant "About the future" (Portucel Soporcel Group)

Technical visit 4 - Companhia das Lezírias

Technical visit 5 - Pinhal de Leiria

not carefully kiln dried. As an alternative to financial reasons along with the country being a sunbelt, the present study was aimed at constructing solar kiln and thereafter drying refractory hardwoods up to 10% moisture content (MC) target. Under separate charges/ loads, the experiment consisted of refractory lesser used timbers of 38 years old plantation grown Eucalyptus cloeziana and planks from undated mature trees of 2 native hardwood species (Cordyla africana and Brachystegia spiciformis). Eucalyptus timbers are generally known for tendency to develop checks and in Mozambique the trees are mainly used for transmission poles. Brachystegia spiciformis is nearly the country most abundant growing wood stock and its use has been restricted to railway sleepers/ties. Of the three tested species, Cordyla africana timber is relatively unknown in the sector, though sparse uses in furniture are reported. The performance of solar kiln drying was assessed in terms of drying rate and quality of dried boards. Preliminary results show that 25 mm thick boards of the three species with an average initial/green MC of 45% needed at least 30 sunny days with mid-day temperatures above 30oC to reach 10 % MC. Analysis on deformations such as bow, crook, twist and cup were in acceptable range and prong tests revealed low residual stress of the dried boards. Based on this outcome, solar kin dryers may constitute an alternative cheap and reliable option to dry satisfactorily refractory timbers in Mozambique.

Keywords: Brachystegia spiciformis; Cordyla Africana; Eucalyptus cloeziana; refractory hardwoods; solar kiln

OP072

Drying Behaviour of Rubberwood at High Temperature

*[1]SIK Huei Shing, [2]SARANI Zakaria, [3]CHOO Kheng Ten and [2]SAHRIM Ahmad
1 Forest Research Institute Malaysia, Kepong 52109 Selangor, Malaysia
2 Faculty of Science and Technology, National University of Malaysia, Bangi 43300 Selangor, Malaysia
3 Integral Wood Sdn. Bhd., 42000 Klang, Selangor, Malaysia
*Corresponding author: E-mail: sik@frim.gov.my

A renew interest on drying wood at high temperature in the last few decades is principally attributed to the advantage of accelerated drying which directly resulted in reduction in drying time and energy consumption, and improvement in some drying-associated problems such as reduction in warping. High temperature (HT) drying of softwoods such as plantation grown radiata pine and other southern pines has long been practised in countries like Australia, New Zealand and in the United States. Commercial high-temperature drying methods of light hardwood such as rubberwood and/ or other tropical hardwoods are a nonentity. The study on the effect of high temperature treatment on rubberwood was conducted at a dry bulb temperature (DBT) range of 100°C to 150°C using a laboratory drying chamber. The control temperature was set at 60°C. Each treatment consisting of 40 samples of furniture dimension stocks measuring 30mm (T) x 100mm (W) x 600 mm (L) were used in the study. The respective initial DBT settings were maintained throughout each experiment. During the drying process, wet bulb temperatures were gradually reduced to induce drying at different moisture content stages. All test pieces were dried from the green condition (with initial moisture content at an average of 68%) until the average moisture content for each drying run was reduced down to approximately 6-8% based on estimated oven-dried weight. Results showed that the drying times of rubberwood decreased exponentially with the increment of drying temperature (R2= 0.9912). Typically, flatsawn samples dried faster than quartersawn samples during drying at 60°C and 100°C respectively. However, both the flatsawn and quartersawn samples showed similar drying time when drying were carried out at more than 100°C, i.e. 120-150°C employed in this study. This shows that drying rubberwood of mixed-sawn type can be better controlled during high temperature drying to achieve uniformity drying and subsequently quality fast throughput.

Keywords: flatsawn, quartersawn, moisture content, density

OP073

Influence of Wood Steam Drying Process on Fracture Toughness and Shear Yield Strength Determination

Jacek Baranski, Maciej A. Wierzbowski, Kazimierz Orlowski
Gdansk University of Technology, Gdansk, Poland – Faculty of Mechanical Engineering
jbaransk@pg.gda.pl

Results of fracture toughness (specific work of fracture) and shear yield strength of steam kiln–dried wood simultaneously determined on the basis of cutting power measurement are presented. Wood species, namely oak (Quercus robur L.) and pine (Pinus sylvestris L.) from the northern part of Pomerania region in Poland, were subject of steam kiln–drying process in a laboratory kiln, specially designed and manufactured for the Gdansk University of Technology. While the colour changes have been observed directly after process, changes in mechanical properties have to be measured. The samples, after drying, were subject of examination during cutting tests on the modern narrow-kerf frame sawing machine PRW15M. Measurements of cutting power for steam dried and air dried samples, as a reference, allowed to reveal the effect of wood steam drying on mechanical properties of wood. It has been recognized that steam wood drying causes a decrease of the mechanical properties of the wood such as: fracture toughness and shear yield strength. Those mechanical properties were determined on the basis of the modern fracture mechanics.

Keywords: wood properties, wood drying methods

OP074

New opportunities for a traditional wood product: Chestnut square edge logs with wane and its mechanical properties in green state

Alberto CAVALLI, Davide MANNOZZI, Marco TOGNI
DEISTAF - Department of Agricultural and Forest Economics, Engineering, Sciences and Technologies, University of Florence, Italy.
alberto.cavalli@unifi.it

The square edge logs with wane are full logs edged on four sides maintaining boxed heart and an approximately central pith according to specific grading rules. This product is a traditional structural component, called in Italian "Uso Fiume". Such elements are produced using principally Silver fir (Abies alba, Mill.), Spruce (Picea abies, Karst.) and Chestnut (Castanea sativa, Mill.), and they have been widely used in Italian buildings over the time, in substitution to structural sawn timber, principally for roofing.

The square edged logs with wane production and use offer several benefits: energy saving during production, easy and cheap manufacturing process (theoretically possible by hand tools), easy installation due to the not-rounded cross section and possibility to use traditional mechanical connections, less rough material required to obtain structural elements with the same nominal section of traditional sawn timber and similar mechanical properties in comparison to it. Nowadays in Europe only the use of Spruce and Silver Fir square edged logs with wane is accepted, because no ETAG (European Technical Approval Guideline) nor CUAP (Common Understanding of Assessment Procedure) are available for Chestnut. In December 2011 a CUAP, containing the requirements for the strength grading, physical and mechanical properties determination for Chestnut, has been drafted and it is waiting for the final endorsement, opening new opportunities in the chestnut products employment. One of the major drawbacks, that raise this product production price, is that for the large cross section materials the seasoning time is long, due to the very low permeability of the heartwood, also in the south Europe climatic conditions (up to 2-3 years for the larger cross section). One of the most important consequence is that those products are often installed in green state.

In order to assess the green chestnut square edged logs with wane fitness for use, 49 logs were collected in Liguria Region. The nominal cross section, that is the cross section defined by the rectangle circumscribing the piece of timber at mid-length, varies from 120x120 mm2 to 230x240 mm2. The whole length and the central third of the logs were graded separately, the average and characteristic physical and mechanical properties were determined according to the CUAP draft specifications and standard requirements (EN 408, EN 384, ISO 3131): density, local modulus of elasticity (MOE) and modulus of rupture (MOR). The high average moisture content (around 48) affected only the MOE value reducing it at the average one of 9600 MPa. The registered MOR characteristic value of 28 MPa is the same one reported by the Standard UNI 11035:2010-2 (Visual strength grading rules and characteristics values for structural timber population) for the Italian Chestnut structural timber of equivalent nominal cross section determined at the 12% of moisture content. Additionally the possible use of the dynamic longitudinal MOE for the static MOE and MOR prediction was investigated.

Acknowledgements: the research has been performed under the grants of Department of Agriculture, Tourism and Culture - Mountain Policies and Wildlife Service, Liguria Region – Italy.

Keywords: Structural timber, Chestnut, Square edged logs with wane.

OP075

What do we know about the effects of silviculture and genetics on branches/knots?: Douglas-fir as a case study

David Briggs[1], Keith Jayawickrama[2], Eini Lowell3,
Doug Maguire[2], Eric Turnblom[1], Terrance Ye[2]
1 School of Environmental and Forest Science, University of Washington, Seattle, WA.
2 College of Forestry, Oregon State University, Corvallis, OR.
3 USFS Pacific Northwest Experiment Station, Portland, OR.
dbriggs@u.washington.edu

The number, diameter, and inclination of tree branches, which become knots in logs and products are important determinants of quality and value along the market chain. In the forest, branch characteristics can either be ignored until the grading system and markets determine quality and value, or they can be silviculturally manipulated or subject to genetic selection to improve quality and value.

Branching traits are under weak to moderate genetic control. At the low end of heritability is branch size, so that it is more effective to control this trait with initial spacing and stand density management thanby genotype. Frequency of ramicorn branches has the strongest control and is related to the propensity of second flushing. Incidence of forking is less heritable than ramicorns but the economic impact is stronger; both forking and ramicorn branching are actively scored and selected against in tree improvement programs since they cause quality degrade. Marked variation is observed in young progeny tests in the number of branches (and thereby number of knots) but this trait is not currently scored.

To promote stem growth, silviculturists often either plant at wide spacing or use early thinning and fertilization but these practices slow crown recession, promote faster branch growth, and increase branch lifeleading to large branch diameter and low value. Alternatively, they can either employ pruning or density management to accelerate branch death through crown recession to reduce branch diameter but with a sacrifice of stem growth . Trade-offs are inevitable and silviculturists need to be well informed to find the most economically attractive approach for a stand.

Models are presented for describing and predicting the effect of initial spacing, thinning, and fertilization on branch size and distribution in coastal Douglas-fir growing in the Pacific Northwest of North America; the potential exists to do the same for forking and ramicorn branching breeding values. Product recovery equations and simulated milling can be applied to assess the economic performance of alternative silvicultural regimes. Many of these components have been incorporated into growth and yield models or into software for post-processing output from growth models. These tools can be used to manage and assess the tree-to-product chain value.

There are economic factors that typically limit the manipulation of branch traits to less than the biological maxima. The relatively high cost of operational Douglas-fir planting stock and of precommercial thinning dictate that initial planting density is generally kept within a fairly narrow range (720 to 1100 stems/hectare). The time and intensity of thinning are also often dictated by cost and market forces (demand for small sawlogs). Intense selection against ramicorn branching will result in some reduction of potential growth gain.

OP076

Regulation of seasonal changes in cambial activity in trees

Ryo Funada[1], Shahanara Begum[1, 2], Yusuke Yamagishi[1],
Widyanto Dwi Nugroho[1, 3], Kayo Kudo[1], Tomoko Okada[1],
Sri Nugroho Marsoem[3], Yuichiro Oribe[4], Satoshi Nakaba[1]
1 Faculty of Agriculture, Tokyo University of Agriculture and Technology, Fuchu-Tokyo, Japan
2 Faculty of Agriculture, Bangladesh Agricultural University, Mymensingh, Bangladesh
3 Faculty of Forestry, Gadjah Mada University, Yogyakarta, Indonesia
4 Tohoku Regional Breeding Office, Forestry and Forest Products Research Institute, Takizawa-Iwate, Japan
funada@cc.tuat.ac.jp

Wood has been used for thousands of years as a raw material for timber, furniture, pulp and paper, chemicals, medicines and fuels. In addition, since wood is a major carbon sink, it is expected to play an important role in removing the excess of atmospheric CO2 that is