2022 World Wood Day Online Symposium & The 4th

IUFRO Forest Products Culture Colloquium

ABSTRACT BOOKLET

March 21st-22nd(GMT)

2022 World Wood Day Virtual Symposium & The 4th

IUFRO Forest Products Culture Colloquium

Date: 21-22 March, 2022

Theme

Trees and Non-Wood Forest Products: Challenges, Opportunities and Sustainability

Since ancient times, trees have been faithful life saviors to humanity: Biblical accounts of Noah's highly constructed wooden ark from selected felled tree species have saved human and animal lives during the great flood! The multiple use of wood products from different tree species continue to satisfy people's need for useful materials for centuries through different human civilizations, from which various cultural attachments to various wood and non-wood products and artifacts have been known from historical records. Among the most recent cultural experience for wood products seems to be the mass use of wood in building construction, the tall (multi-storey) mass timber residential and commercial buildings emerging in some parts of the temperate regions though not yet present in the tropics. Many more novel wood and non-wood products will be available in time that expands human needs, and these will be unique to different societies and hence unique cultural uses of such products.

We depend on forest trees also for tackling global climate change,

to arrest global warming, as forests (especially trees) are super-efficient natural carbon sinks converting atmospheric carbon dioxide to form wood of trees while releasing oxygen during this photosynthesis. It costs about 38 trillion dollars to create oxygen for 6 months for all human beings on earth, but trees do it for free! Also nations need to replenish degraded forest landscapes by reforestation of importance also for mitigating global climate change. Among the world's forest resources, the threats and challenges to the sustainability in the tropical forests takes precedence. The COP26 agenda hopes to convince global leaders to reform their governance of forest landscapes for climate friendly goals besides being merely traditional production forests.

Many challenges confront forest managers and timber trade and consumers, among which are: Controlling logging especially of tropical forests, forest governance and policies, research and educational programs focusing on the value of trees and forests to the environment and climate stability, efficient use of forest resources, sustaining cultural values of various forest products and artifacts for future generations, the involvement of rural and indigenous communities in forest management, role of forests in water quality, combating illegal logging and restoration of degraded forest landscapes, and trees also provide refuge for human health, wellness and spirituality via various forest recreation. These and several other issues concerning the importance of trees and forests are also opportunities to be harnessed to fulfill global needs for a greener society where global climate change would be mitigated (via increased forest cover) while greater use is made also of substitution forest products (instead of alternative metal, concrete and plastic products).

Topics

1. Historical Utilization and Cultural Values of Trees and Non-Wood Forest Products
2. Challenges and Opportunities for Trees and Non-Wood Forest Products
3. Construction and Buildings Including Wood Durability and Protection Needs
4. Building Components, Furniture, Musical Instruments, Artifacts Manufacturing and Design
5. Education on Sustainable Forests, Forest Products Utilization and Culture
6. Wood Products and Wood Biotechnology (IAWS Special Session)

CATALOGUE

2022 World Wood Day Online Symposium Program

Date: 21st-22nd March (GMT)

Monday, 21st March 2022		
TIME	SUBJECT	SPEAKER
08:00-08:30	Welcome Remarks	
	Topic 5: Education on Forest Sustainability, Forest Products Utilization and Culture Chair: Dr. Elisabeth Johann, Austrian Forest Association / Coordinator of IUFRO Research Unit 9.03.02 Forest Culture	
08:30-09:05	Keynote- Bridging the Gap between Public and Professional Perceptions of Forests and Trees: Enhancing Social and Cultural Literacy in Education and Research.	John Parrotta USDA Forest Service, Research & Development / IUFRO President
09:05-09:25	Forests and People for Change: The Role of Communication in Environmental Governance	Michiko Karisa M. Buot University of the Philippines Los Baños – Forestry Development Cente
09:25-09:45	Wood in Sport Equipment - Heritage, Present, Perspective	Francesco Negro DISAFA, University of Torino, Italy
09:45-10:05	Biophysical Assessment of the Plant Bioresources of Northern Negros Natural Park, Negros Island, Philippines	Aragon A. Dechimo Jr. Philippine Normal University Visayas Campus/ University of the Philippine Los Baños
10:05-10:20	Coffee Break	
10:20-10:40	Towards Efficient Wood Use – Practical Education as a Tool to Imagine Wood Cascading Potentiality	Saara Kantele Studio Kantele/ Aalto University
10:40-11:00	Online Advocacies and Education for Forests and Wood Conservation	Mayumi Kara M. Buot University of the Philippines Los Baños
11:00-11:20	Plant Bioresource Utilization by Local communities of Northern Negros Natural Park, Negros Island, Philippines	Aragon A. Dechimo Jr. Philippine Normal University Visayas Campus/ University of the Philippine Los Baños
11:20-11:40	Implementation of the Course "Wood Culture" in the Education of Forestry Students	Elena Vladimirova University of New Brunswick
11:40-12:40	Lunch	
	Topic 3: Construction and Buildings Including Wood Durability and Protection Needs Chair: Dr. Pekka Saranpää, Principal Scientist, Natural Resources Institute Finland (Luke) / Coordinator of IUFRO Division 5 Forest Products	
12:40-13:15	Keynote- Wooden buildings / Constructions – An Overview	Michael Grabner University of Natural Resources and Life Sciences, Vienna (BOKU)
13:15-13:35	Wood Structure Sustainability: A Case Study of Rajwada Palace, Indore, Central India	Sangeeta Gupta Botany Division, Forest Research Institute, Dehradun

13:35-13:55	Diversity of Wood-Inhabiting Fungi on Stakes Exposed in Field Test Site in Korea	Sae-Min YOON National Institute of Forest Science
13:55-14:15	Biodeterioration Resistance of Nigerian Grown *Artocarpus Altilis* Wood to *Xylaria Polymorpha* and *Sclerotium Rolfsii* attack (White and Brown rot fungus)	Olusola Samuel Areo Forestry Research Institute of Nigeria, Ibadan
14:15-14:35	Natural Durability of 20 Brazilian Wood Species after 30 Years in Ground Contact	Fernando Nunes Gouveia Brazilian Forest Service - SFB
14:35-14:55	Structural Properties and Potential Utilization of Lesser-used Hardwoods from Sarawak	Andrew Nyorik Nibu / Andrew H. H. Wong Sarawak Forestry Corporation, Forest Department Sarawak, Malaysia / International Wood Culture Society (IWCS)
14:55-15:10	Coffee Break	
	Topic 6: Wood Products and Wood Biotechnology (IAWS Special Session) Chair: Prof. Siqun Wang, University of Tennessee / IAWS Academy Board Chair	
15:10-15:45	Keynote- Digital Wood Anatomy - from Tradition into the Future	Gerald Koch Thuenen Institute of Wood Research
15:45-16:05	Preparation of Cellulose-based Electrospun Nanofibrous Air Filter for Efficient Particulate Matter Removal	Qijun Zhang Institute of Urban Environment, Chinese Academy of Sciences
16:05-16:25	Lignin Complexity and Flexibility: How and Why Do Grasses Produce Lignins Different from Woods?	Yuki Tobimatsu Research Institute for Sustainable Humanosphere, Kyoto University
16:25-16:45	Investigating Interlocked and Spiral Grain with X-ray Microtomography	David Collings University of Western Australia
16:45-17:05	Biochemicals and Functional Materials from Tree Barks	Ning Yan University of Toronto
17:05-17:25	Viscoelastic Behavior of Modified Wood	Andreja Kutnar University of Primorska & InnoRenew CoE
17:25-17:40	Coffee Break	
17:40-18:00	Pushing the Envelope on Wood Products	Scott Renneckar FIAWS, Department of Wood Science, University of British Columbia, Canada
18:00-18:20	Nanostructured Carbon Materials Derived from Tannin as Electrodes for Supercapacitors and Beyond	Jimena Castro Gutiérrez CNRS Université de Lorraine, France
18:20-18:40	Recycling Wood Products – It's Easy, Right?	Mark IRLE Ecole Supérieure du Bois
18:40-19:00	Moisture-induced Stress and Distortion of Wood: A Numerical and Experimental Study of Wood's Drying and Long-term Behaviour	Sara Florisson Uppsala University
19:00-19:20	*Pinus Radiata* Plantations Grown in NZ and Wood Products Derived from it - Past, Present and Future	Bernadette Nanayakkara Scionresearch

Tuesday, 22nd March 2022		
TIME	**SUBJECT**	**SPEAKER**
	Topic 2: Challenges and Opportunities for Trees and Non-Wood Forest Products Chair: Prof. Chunping Dai, Department of Wood Science, University of British Columbia	
08:00-08:35	Forest Protection for Climate Change Mitigation	Salleh Mohd. Nor IUFRO Former President
08:35-08:55	Some Threatened Woody Plant Species in Forests Over Limestone in the Philippine Islands	Inocencio E. Buot Jr. University of the Philippines Los Baños
08:55-09:15	Non-Wood Forest Products: Kenaf Development in Pahang, Malaysia – Challenges, Opportunities and Sustainability.	Mohd Za'im Bin Mohd Nor National Kenaf and Tobacco Board, Malaysia
09:15-09:30	Coffee Break	
09:30-09:50	The Socioecological Production Landscapes (SEPLs) of the Philippines: Status, Problems and Future Directions	Anne Frances V. Buhay University of the Philippines Los Baños
09:50-10:10	Factors influencing vegetation structure in forests over limestone in Samar Island Natural Park	Inocencio E. Buot, Jr.*, Elaine Loreen C. Villanueva, Marjorie D. delos Angeles and Ren Divien R. Obeña University of the Philippines Los Baños
10:10-10:30	The Role of Indigenous Food Plants on Household Food Security Among Farm Families in Ilocos Norte, Philippines	Rodel T. Utrera Mariano Marcos State University
10:30-10:50	Opportunities and Challenges for the Development of Global Bamboo Construction Sector	Kewei Liu International Bamboo and Rattan Organisation
10:50-11:50	Lunch	
	Topic 4: Building Components, Furniture, Musical Instruments, Artifacts and Design Chair: Prof. Andreja Kutnar, University of Primorska, Andrej Marušič Institute / Director of InnoRenew CoE	
11:50-12:25	Keynote- Adding Value & Local Capacity at the Forest Source: A Path to Sustainability	Scott Landis GreenWood
12:25-12:45	Investigation of Shear Performance of Light Frame Wall Sheathed with Structural Particleboard	Chul-Ki Kim Wood Engineering Div., National Institute of Forest Scienc
12:45-13:05	From Craftsmen to Artists: Engaging and Empowering Philippine Woodcarvers	Consuelo Dl. Habito University of the Philippine Open University
13:05-13:25	Neapolitan Wood Caftsmanship of the 18th Century: Discovering Ancient Technologies in Lutherie	Martino Quintavalla DEIB- Politecnico di Milano

13:25-13:45	Forest – A Designer's Perspective	Saara Kantele Studio Kantele / Aalto University
13:45-14:05	The Wooden Mouthpiece: A Significant Element of the Alphorn Sound	Mike Maurer Klingendes Museum Bern
14:05-14:25	Historical & Contemporary Approaches to the Daxophone	Daniel Fishkin The Cooper Union for Art & Science University of Virginia
14:25-14:45	Wood artists and artisans in Egypt during the New kingdom (18th Dynasty, 1550-1292 BC). A study case about the objects from the intact tomb of Kha (overseer of works) and his wife Merit conserved in the Museo Egizio of Turin (Italy)	Maria Victoria Asensi Amorós & Takao Itoh Xylodata SARL / Kyoto University
14:45-15:00	Coffee Break	
	Topic 1: Historical Utilization and Cultural Values of Trees and Non-Wood Forest Products Chair: Dr. Péter Szabó, Institute of Botany of the Czech Academy of Sciences in Brno, Czech Republic/Carson Fellow, Rachel Carson Center, Germany	
15:00-15:35	Keynote- Historical Utilization of Trees and Woods and Contemporary Cultural Values	Ian D. Rotherham Advanced Wellbeing Research Centre
15:35-15:55	The Concept and Cultural Characteristics of Shira-Wood	Guang-jie Zhao & Chao Li Beijing Forestry University / Zhejiang Sci-Tech University
15:55-16:15	Wood Identification of Pagoda in Japan	Misao Yokoyama Kyoto University
16:15-16:35	Philippine Native Trees: Raw Materials of Century Old Wood Structures, Ecclesiastical Museum Collection and Immovable Woodcrafts in Several Churches in Bohol Provinces	Jennifer M. Conda Department of Science and Technology – Forest Products Research and Development Institute
16:35-16:55	Wooden finds suggest a sustainable forestry in prehistoric Hallstatt, Austria	Michael Grabner University of Natural Resources and Life Sciences, BOKU, Vienna, Austria
16:55-17:15	The Underutilized Yams (Dioscoreaceae) for Food and Feed Source: Ethnobotanical Evidences from Ilocos Norte, Luzon, Philippines	Menisa A. Antonio Mariano Marcos State University
17:15-17:35	Pitch oil production – an intangible cultural heritage in Central Europe	Johannes Tintner University of Natural Resources and Life Sciences, Vienna
17:35-17:55	Cultural Treasure of the Philippines: the glory of a bamboo dance, Tinikling	Merites M. Buot University of the Philippines Los Baños
17:55-18:15	Ecological stabilization of raw earth by adding additives based on non-timber forest products: Case of Parkia biglobosa seets and Vitellaria paradoxa nuts	Edmond Codjo ADJOVI & KOTO TAMOU Bio Ché issou National University of Sciences, Technologies, Engineering and Mathematics
18:15-18:30	Coffee Break	

18:30-18:50	Tree bark in the textiles of the Neolithic lakeshore settlements in south-western Germany	Sebastian Million State Office for Cultural Heritage Preservation in the Stuttgart Regional Council
18:50-19:10	Traditional use of wood in Mediterranean island	Giovanna Sala Department of Agricultural, Food and Forest, University of Palermo
19:10-19:30	Lord of the Forest, Barong and Calonarang: Purification in Bali via Wooden Mask Performance	Kathy Foley University of California Santa Cruz
19:30-19:40	Phytochemical and In vitro Antioxidant and Antimicrobial Activity of Indigenous Vegetables of Ilocos Norte	Maingelline B. Vivit Mariano Marcos State University
19:40-19:50	Historical Utilization, Cultural Significances and Ethnobotanical Uses of Cedrus deodara (Roxb. ex D. Don) G. Don in North India	Upasna Sharma Forest Research Institute (FRI), Dehradun, India

Abstract

Historical Utilization and Cultural Values of Trees and Non-Wood Forest Products

Historical Utilization of Trees and Woods and Contemporary Cultural Values

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Abstract

Ancient woods and forest landscapes in the UK are the result of long-term utilization and management. The heritage resulting from this usage is now well-established and examples are presented to support this assertion. This historical utilization is associated with contemporary cultural values with both tangible and intangible biocultural heritage. As traditional management reduced and in many cases ceased during the twentieth century, there has been progressive loss of traditional knowledge and cultural memories. These landscapes and their trees result from interactions of people and nature over centuries to generate eco-cultural heritage resources. Abandonment leads to inevitable successional changes in associated ecology alongside the loss of cultural memories and resulting cultural severance. The latter becomes a major driver of ecological change and biodiversity decline.

The paper presents a regionally-based case-study of woodland eco-cultural landscapes and the associated biocultural resources. The evidence includes site archaeology, archival sources, oral histories, and ecological field survey including 'worked' trees and botanical indicators. Such breadth of information is used to develop detailed time-lines from Domesday to the twenty-first century for individual sites.

Site assessments and evaluations are used to evaluate contemporary site management which is often undertaken as nature conservation projects. It is suggested that lack of recognition of biocultural heritage leads to inad-

vertent and unknowing damage to both archaeology and biocultural heritage of worked trees and vegetation. Finally, it is argued that a lack of accepted evaluation processes or effective kite-marking for sustainable forest products presents significant problems. Furthermore, whilst this case study is in England the wider issues apply Europe-wide and irreplaceable heritage is being compromised and eroded.

Ecological stabilization of raw earth by adding additives based on non-wood forest products: Case of *Parkia biglobosa* seets and *Vitellaria paradoxa* nuts

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Abstract

The facings of earthen walls in the conditions of their commissioning are subject to water infiltration by capillarity, humidity and a weakening of the compressive strength. With the aim of developing processes for ecological stabilized raw earth bricks and at lower energy cost to improve the mechanical characteristics and durability of raw earth constructions, this work studies the reuse of wastewater from the processing of *parkia biglobosa* seets and *vitellaria paradoxa* nuts as stabilizers.

To this end, decoctions of *parkia biglobosa* seets and *vitellaria paradoxa* nuts were added to the raw earth in defined proportions and then chemical, mineralogical, mechanical and durability characterization tests were carried

out. The results revealed that the two extracts consist of the same sugars but in different proportions. As well; *vitellaria paradoxa* nuts extract and *parkia biglobosa* seets decoction improve the material's compressive strength by 20% and 80% respectively, and its behavior in water by 4 and 8 times.

Keywords: raw earth, organic additive, adobe, extract, decoction, *vitellaria paradoxa*, *parkia biglobosa*, sustainability

The Underutilized Yams (Dioscoreaceae) for Food and Feed Source: Ethnobotanical Evidences from Ilocos Norte, Luzon, Philippines

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Abstract

Much of our underutilized and neglected species can be harnessed to diversify the food base for household food security, health and nutrition. Through a key informant (KI) interview and actual forest walk, we documented the species and ethnobotanical evidences on the use of Dioscoreaceae in the Province of Ilocos Norte, the northwest province in the Luzon Island, Philippines.

There were 10 taxa of Dioscoreaceae plants, belonging to nine species and two genera, documented. This is an update on the digital checklist of family Dioscoreaceae in the Philippines, which listed only two species growing in Ilocos Norte. Nine taxa are edible, two of which (*Dioscorea hispida* and *Tacca leontopetaloides*) are reported toxic but could be consumed after

processed and detoxified appropriately. *Dioscorea luzonensis* and *D. hispida* are the top species in terms of utilization as food. *D. esculenta var. spinosa* and some varieties of *D. alata* are used as boiled feedstuff for hogs in some of the study sites. Other documented uses are: laundry starch to stiffen fabrics and linens and medicinal remedy for skin problems. Majority of the informants gather the plants from the wild, process and sell them, giving income supplements to the families. Ethnobotanical data such as the locals' ethnotaxonomic practice of identifying toxic and edible species, long history of continued utilization dating back to the olden times of their forefathers, presence of traditional knowledge and practices in processing, detoxifying and cooking, developed dishes/recipes, and local terminologies associated with the plants confirm that these occupy an important position in the lives and subsistence of the locals. Wild gathering of the yams has made them more resilient, especially during lean periods and crises such as the current COVID pandemic. It likewise perpetuated the values of frugality and hard work among them.

Cultural Treasure of the Philippines: The Glory of a Bamboo Dance, Tinikling

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Abstract

One of the cultural treasures that attests the close association of the Filipinos with the biodiversity in the environment is in the area of Philippine dance. Our dance culture in the different region of the country can best

exemplify the challenges and the triumphs of our people. *Tinikling*, a dance using bamboo, is our national symbol representing the challenges in the farm as experienced by the rice farmers. Bamboo is essential in the Filipino lives with its numerous uses. Leaping, hopping, skipping are prevalent movements in *Tinikling*. Other countries, a 4/4 tempo is used but in the Philippines we sustain the use of the $3/4$ tempo. There is a need to explain fully the variation for better appreciation. This current paper would like to 1) describe the different characteristics of the dance movements; 2) compare the distinguishing characteristic of Philippine *Tinikling* with other countries, and 3) provide interest in dance education and dance culture at the community level. Secondary data of published dance notations were used for the analysis. Being a dancer and a dance teacher helps the movement analysis to be done. Dance educator has to awaken the interest of people by re-introducing exciting and authentic movements which feature the educational, functional and cultural values of dance using bamboo implements.

Philippine Native Trees: Raw Materials of Century Old Wood Structures, Ecclesiastical Museum Collection and Immovable Woodcrafts in Several Churches in Bohol Provinces

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Abstract

Philippines is known for various culture and traditions, customs and beliefs

and prehistorical places. Of these are the old churches in Bohol Province. The six churches namely: Immaculate Conception Parish (Baclayon), Saint Anthony the Abbot Parish (Carmen), Our Lady of Assumption Parish (Dauis), St. Paul the Apostle (Inabanga), Holy Trinity Parish (Loay) and San Isidore the Farmer Parish (Tubigon) housed a total of 538 wooden structures, ecclesiastical museum collection and other immovable crafts. To preserve these treasures, the National Historical Commission of the Philippines (NHCP) together with Forest Products Research and Development Institute identified the wood species composition of all the items for a restoration and renovation project. The items identified were made from 23 tree species under 19 genera and 14 families. Eighteen of these were native to the Philippines while 5 were introduced/plantation species. The native species were molave (*Vitex parviflora* A. Juss.), almon (*Shorea* almon Foxw.), mayapis (*Shorea palosapis* Merr.), batikuling group (*Litsea* sp.), tindalo (*Afzelia rhomboidei* (Blanco) S. Vidal), kamagong group (*Diospyros* sp.), lauan group (*Shorea* sp.), apitong group (*Dipterocarpus* sp.), apitong (*Dipterocarpus* sp.), yakal group (*Shorea* sp.), narra (*Pterocarpus* indicus Willd., ipil (*Instia bijuga* (Colebr.) O. Kuntze), nato group (*Palaquim* sp.), malugai (*Pometia pinnata* J.R.Forst. & G.Forst), kamatog (*Sympetalandra densiflora* (Elmer) Steenis, malasaging group (Aglaia sp.), dungao/sambaluan group (*Astronia* sp.), makaasim group (*Syzygium* sp.), bagalunga (*Melia azedarach* L.). Based on the assessment, they are being used by the ancestors primarily because they are pioneer species, abundantly growing in Bohol province and known to have hard to moderately hard wood. The previous restoration of the churches explained the presence of introduced/plantation wood species in some of the items identified.

Lord of the Forest, Barong and Calonarang: Purification in Bali via Wooden Mask Performance

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Abstract

This presentation will detail the making and use of wooden masks of Barong, a Balinese leonine protective figure, and Calonarang, a demonic widow witch, discussing how these masks are carved, magically charged, and presented in performance. The historical meeting of these two different figures in a dance drama form in the 19th Century brought local versions of the pan-Hindu-Buddhist lion as a figure of exorcism into confrontation with a manifestation of the Hindu Creatrix/Destroyer Durga, a furious/tantric goddess linked to sorcery, disease, and healing. In the twentieth century this genre evolved beyond its ritual temple manifestation into a tourist show with the collaboration of German artist/cultural facilitator Walter Spies and local Balinese chorographers like I Made Kredek, making these figures fashionable in European world fairs and multiple tourist shows in Bali.

The figures are localized representations of ideas that are important in a wider area of Asia and seem historically linked to treating pandemics of cholera and smallpox and even the current Covid. These sacred wooden masks that sit in the Siwa (Shiva) Temple by the cemetery/cremation ground are important faces in Balinese thinking representing *rwa bhineda* (two in opposition), the Balinese equivalent of yin-yang.

The presentation will note features that relate to Buddhist-Daoist lions, martial art training, and northern ports on Bali (which had relationship with Chinese culture) and the Hindu Goddess Durga as manifestation of danger

and disease (associated with both Indian sources and the turbulent Southern Ocean). How the Barong/Lion as "Lord of the Forest" links to local thinking about forests and their protective power and what woodworkers do in creating "holy" masks to counter disaster, show how wood plays an important intellectual as well as pragmatic part in this mask rituals done once a year in most villages. The *Calonarang* dance drama and its protective masks display the Balinese belief that wood is good.

Wooden Finds Suggest a Sustainable Forestry in Prehistoric Hallstatt, Austria.

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Abstract

Due to the perfect conservation of all organic materials within the prehistoric salt mines of Hallstatt, Austria, large amounts of wooden finds, which are rare at other archaeological sites, have been excavated here. A substantial number of wooden items was investigated by applying wood species identification and tree ring analyses.

We determined 15 different wood species: fir (Abies alba), spruce (Picea abies), larch (Larix decidua), yew (Taxus baccata), beech (Fagus sylvatica), maple (Acer spp.), ash (Fraxinus excelsior), oak (Quercus spp.), alder (Alnus glutinosa), Sorbus species (rowanberry, whitebeam, true service tree, wild service tree) (Sorbus spp.), hazel (Corylus avellana), linden (Tilia spp.), willow (Salix spp.), woolly Snowball (Viburnum lantana), elm (Ulmus spp.).

The mine timber is dominated by spruce and fir. Furthermore, beech, maple, ash and larch were found. The bins and buckets were dominated by fir. A similar picture was also found for the lighting chips - almost exclusively made of fir wood. For the tools, shovels and spoons more hardwood was found: beech, ash, maple and oak. The carved wooden hollow ware was dominated by maple and alder.

Based on the findings of the wood identification, on special findings like the overgrown stumps and the tree ring measurements we discuss the Bronze Age wood use, forest utilization and management. Our findings allow for important insights into prehistoric forest management. Thus, we were able to: i) demonstrate that the stem of fir tree was used in its entirety, ii) to reconstruct the stem utilization scheme for fir, iii) identify seasonal activity patterns as the harvesting of trees during the dormant season, and iv) exclude large scale clear cutting.

In conclusion, it is clearly evident that the Bronze Age Hallstatt mining community possessed sophisticated foresting and wood working skills.

Tree Bark in the Textiles of the Neolithic Lakeshore Settlements in South-western Germany

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Abstract

In the Neolithic of south-west Germany, not only stone, flint, clay or wood are important raw materials, but also tree bark. From several excavations

in waterlogged settlements in Baden-Württemberg, around 2200 textiles were recovered. These were encountered in settlements that date from the Neolithic until the Bronze Age. The main number of textiles came to light in the lakeshore settlement of Hornstaad-Hörnle, which burnt down in autumn 3910 BCE. Former analysis of the plant material on the textiles of these sites found linum (Linum usitatissimum), but also a high percentage of tree bast, mainly of the lime tree (*Tilia*) (i.e., Körber-Grohne and Feldtkeller 1998). However, a comprehensive overview on the textiles in Baden-Württemberg was lacking so far. This was the main aim of the interdisciplinary THEFBO project (www.thefbo.de), financed by the German Federal Ministry of Education and Research (BMBF). Further aims were to register the preservation conditions, study the technical properties of modern tree bast and to determine the plant material used for textiles.

This talk focuses on the taxonomic identifications of tree bast in textiles from Neolithic lakeshore settlements. During the project, a reference collection of modern barks was compiled. The focus was on those tree species, which are proven to have grown in the Neolithic, according to archaeobotanical and dendrological analyses. From these, stained microscopic thin sections of the transversal and tangential view were produced. Within the project, a first synthesis of tree bark features was described for eight species. The comparison of different bark parameters made differentiation between the species possible. Lime has i.e., a unique pattern of wide phloem ray dilatation and tangential rows of phloem fibers. Using this reference collection, archaeological tree bast material was determined.

Literature

Körber-Grohne, U., Feldtkeller, A., 1998. Pflanzliche Rohmaterialien und Herstellungstechniken der Gewebe, Netze, Geflechte sowie anderer Produkte aus den neolithischen Sieldungen Hornstaad, Wangen, Allensbach und Sipplingen am Bodensee, in: Landesamt für Denkmalpflege (Ed.), Sied-

lungsarchäologie im Alpenvorland V, Forschungen und Berichte zur Vor- und Frühgeschichte in Baden-Württemberg. Theiss, Stuttgart, pp. 131–242.

Traditional Use of Wood in Mediterranean Island

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Abstract

This work is a review of traditional uses of wood in Sicily, despite the long tradition in the use of wood in this region, the Italian texts focusing on wood almost never make reference to Sicily. This island in the central position in the Mediterranean Basin is frequently cited for its reduced forest cover, which led to an underestimation of the central role played by wood in the history of local communities. This research highlights the use of the widespread and diversified of many tens of woody species growing on the island. The accurate information available on the specific uses of wood from certain Sicilian woody species clearly testifies to the profound knowledge and high level of skills acquired not only by local craftsmen's associations (carpenters, cabinet-makers, shipwrights, etc.) but also by local farmers and other woodworking sectors. The analysis of the historical use and the decreasing availability of timber in this region indirectly informs us about the gradual shrinkage of entire wooded areas or the fast decline of certain forest tree species. This type of contribution highlights the need to enhance traditional knowledge on the uses of local forest resources as an important, yet neglected, part of traditional Ecological Knowledge.

Pitch Oil Production – an Intangible Cultural Heritage in Central Europe

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Abstract

Pitch oil production from Scots pine (*Pinus sylvestris* L.) resinous wood is an intangible cultural heritage in the Central European region including the Czech Republic, Northern Austria and South Eastern Germany, and is related to traditions in Finland and Southern France. The heating of wood in small kilns also fueled by wood produces liquid for collection. Our detailed investigations of three pitch oil kilns in Upper Austria led to the discovery of relationships to the production of pine and birch tar in Fennoscandia and black pine tar production in Western Anatolia. Our measurements of temperatures at the bases of the kilns revealed a slow temperature rise. We predicted maximum temperatures based on infrared spectra, and measured overall temperatures in the range of 250 °C to 650 °C. With gas chromatographic analyses of pitch oil, we detected a dominant proportion of resin components and only a minor proportion of compounds attributable to pyrolytic transformation of solid wood mass. In most pitch oil samples, the extractives comprised 90 %. Most samples were similar and only the first samples at the starting outflow were systematically dominated by pyrolysis products. Tar runoff from a traditional circular charcoal kiln for charcoal production – used as a reference – had a strongly different composition, with a high proportion of pyrolysis compounds.

Wood Identification of Pagoda in Japan

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Abstract

Most famous and the oldest pagoda is the five-story pagoda (Gojyunoto) of Horyu-ji temple, it is known that they were originally made of Japanese cypress in the 7th century. And many pagodas in Japan including the five-story, three-story and two-story forms are also made of wood, however, wood species of each pagoda were unknown.

Wood selection varies region, era and architectural style, therefore we investigated some major pagoda, for example, Koyasunoto of Kiyomizu-dera temple, Kyoto, and Gojyunoto of Motoyama-ji temple, Kagawa under their conservation and identified wood species each building members of each floor of pagoda.

By wood identification of each building members, it is clarified they are several wood species are used not only Japanese cypress (Chamaecyparis obtusa Endl.)

In this paper, architectural features of these pagoda and their construction and re-construction background from the perspective of wood selection will be reported.

The Concept and Cultural Characteristics of Shira-Wood

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Abstract

In order to expound the concept and basic cultural characteristics of shira-wood, this paper firstly discussed the narrow and broad concepts of shira-wood based on its anatomical and sensory characteristics. In the broad concept of shira-wood, the long cultural history of shira-wood utensil was summarized. Based on the transformation process of the Buddha statues from hardwood to softwood, this paper discussed the generation path of shira-wood culture and its turning point. Taking concept culture as the main line, the structure characteristics of shira-wood culture was expounded. Finally, the main differences between shira-wood culture and Hongmu culture were compared. In sum: 1) Narrow concept: softwood that texture has the anatomical characteristic of fine, the visual characteristic of purity and the tactile characteristic of soft. Broad concept: wood with narrow concept characteristics in softwood and hardwood. 2) The generation path of shira-wood culture is the transformation of materials for Buddha statues from hardwood to softwood, which is from white sandalwood to camphorwood and to Japanese hinoki core wood, and finally to Japanese hinoki log. The appearance of Japanese hinoki log was a turning point in the formation of the concept of shira-wood culture. 3) The utensil culture of shira-wood involves hunting tools, architecture, furniture, boats, sacrificial tools, musical instruments, farming tools, toys, tableware, fishing tools, shoes, and other items of cultural life. 4) The conceptual culture of shira-wood includes four aspects, namely, fine-purity, frugality-inclusive,

softness-intimacy, and simplicity. 5) The different characteristics of shi-ra-wood culture and Hongmu culture is that they had two distinct value orientation and aesthetic consciousness, on the viewpoints of fine and coarse texture, light and heavy color, low and high density, and simple and complex texture.

KEY WORDS: shira-wood; texture; shira-wood culture; generation path; utensil culture; concept culture

Historical Utilization, Cultural Significances and Ethnobotanical Uses of *Cedrus deodara* (Roxb. ex D. Don) G. Don in North India

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Abstract

Since the ancient times plant lives are associated with human beings in various ways. They have been utilized by humans for fulfilling their basic needs such as; for shelters, foods, medicines and fuels etc. The present paper compiles the usage of wood and properties of *Cedrus deodara* (Roxb. ex D. Don) G. Don commonly referred as "The Himalayan Cedar or Devdar". The plant is native to Himalayan regions and grows at altitudes of 1500 – 3000 meters. In India, it is frequently found in northern and north eastern region of the country viz., Jammu Kashmir, Himachal Pradesh, Uttarakhand,

Arunachal Pradesh and Darjeeling region of West Bengal. The tree is recognized as National tree of Pakistan and state tree of Himachal Pradesh (a northern state in India). In India, the tree is devoted to Lord "Shiva" and the name "Devdar" is derived from *"Dev* meaning *God* and *Dar* meaning *wood*". Therefore, it is treated as the wood of God. During the period of Harappa Civilization, the wood of tree was used in making coffins which reflect the knowledge of Harappans about durability of Deodar. In Pakistan and India, during the British colonial period, deodar wood was used extensively for construction of door shutters, door and window frames, flush doors, furniture, cabinet making, block board, packing cases, railway sleepers, lorry bodies, dunnage pallets, pile mines, beams, rafters, cooling towers, battery separators, sports and athletic good, drawing equipment, jute and textile mill accessories, poles used for telecommunication lines, public buildings, bridges, canals and railway cars. Oldest temples in northern India are found to be constructed with Cedar wood. The architecture i.e. "Katha Kuni; Pahadi Shaili" of Hills made up of Deodar are famous among northern states of India. Local people are aware about insecticidal and weedicidal properties of tree and hence make use of almost every part of the tree. There are uncountable ethno medicinal benefits obtained from the tree. Plant extracts are used to treat rheumatism, ulcers, bone fracture, cracks in sole feet, snakebites, skin diseases and body aches and many more. Therefore, the plant is of immense importance to the mankind and worth considering for scientific studies.

Phytochemical and *In vitro* Antioxidant and Antimicrobial Activity of Indigenous Vegetables of Ilocos Norte

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Abstract

Indigenous plants are excellent sources of vitamins, minerals, and phytochemicals. However, sample processing affects the phytoconstituents and health benefits of plants. In this study, the antioxidant activity of the raw, boiled, steamed, and dried *Broussonetia luzonica, Champereia manillana, Telosma procumbens, Momordica cochinchinensis; Tetrastigma harmandii, Solanum pimpinellifolium, Poikilospermum suaveolens*, and *Dioscorea esculenta* was determined thru 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity. The antimicrobial activity was tested against *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Micrococcus luteus*, and *Candida albicans*. Moreover, total phenolics (TPC) and flavonoids content (TFC) of the indigenous plant extracts were assessed using Folin-Ciocalteu and Aluminum chloride method, respectively, to determine the corresponding effect on the biological activities of the indigenous plants.

TPC and TFC of the raw, boiled, steamed, and dried IVs ranged from 3.60 to 273.97, 4.50-188.52, 4.40-149.66; and 3.44-63.22, 4.89-63.85, 0-61.47, 4.06-164.75µg/mL in gallic acid and quercetin equivalents, respectively. Radical scavenging activity ranged from 0-90.11, 0.60-88.81, 0-91.49 and 0-93.19%. The effect of the preparation methods on TPC, TFC, and antioxidant activity was significant ($p < 0.01$) in all the indigenous vegetables. However, the increase or decrease in the amount depends on the plant species. Moreover, correlation analysis showed that the TPC and TFC are

not related to the antioxidant activity. Furthermore, steamed *C. manillana* leaf tops showed high activity against *S. aureus* while mild activity against *S. aureus* and *M. luteus* was observed using the dried extract. Thus, results show that indigenous vegetables are healthy and could be a possible source of functional foods. The preparation method would also serve as the basis to obtain high antioxidants and possess antibacterial activity.

Keywords: indigenous vegetables, antioxidant activity, antimicrobial activity, total phenolic content and total flavonoid content

Challenges and Opportunities for Trees and Non-Wood Forest Products

Forest Protection for Climate Change Mitigation

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Abstract

The world is faced with a number of major problems that forest can play a major role in mitigating them. The United Nations Sustainable Development Goals provide a framework for addressing these problems. A major problem is climate change. Forests are a major sequester of carbon besides other ecosystems. However, forests, especially tropical forests with their fast growth can sequester carbon more efficiently. Fast growing forest plantations in the tropics are much better sequester of carbon than natural forests. The use of new technologies such as DNA tracing can enhance effectiveness of forest monitoring. Thus, besides protection, what is more important is true sustainable forest management of forests for efficient carbon sequestration.

The Socioecological Production Landscapes (SEPLs) of the Philippines: Status, Problems and Future Directions

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Abstract

The dominance of human activities resulting to rapid urbanization and so-

cio-economic growth during the Anthropocene epoch, results to overutilization of natural resources. The anthropocentric perspective prevailing at this time, disrupts the traditional harmonious human-nature relationship in socioecological production landscapes (SEPLs) known as *satoyama* landscapes in Japan. This is 3 adversely affecting biodiversity and hence, ecosystem services in surrounding communities in the Philippines and beyond. This paper provides an overview of the SEPLs in the Philippine context. This reviews and further the inquiry initiated by Buot and Osumi in 2004, which identified some *satoyama* landscapes in the Philippines. The objectives of this paper are to present an updated list of socio-ecological production landscapes (SEPLs) in the Philippines; determine their status and problems; analyze their role in sustainable development and map future directions to sustain harmonious human-nature relationship that would result to overflowing ecosystem services. Local and international scientific literature on the status and problems of the identified SEPLs in the Philippines were reviewed.

In addition to the three types identified by Buot and Osumi (2004), nine more are included in this paper. The prevailing problems observed were exploitation of natural resources due increasing population of migrants in the uplands, as an effect of poverty. Simultaneously, the indigenous sustainable practices weaken with the aging population while the youth lack interest in farming, leading to biodiversity and cultural erosion among SEPLs in the Philippines. In order to sustain the harmonious interaction of human and nature, strategic steps are discussed in this paper including

strengthening institutional partnerships, empowering our indigenous communities, identifying site-specific indicators of resilience and ensuring good governance and equitable sharing of resources. These actions are interconnected with the purpose of conserving biodiversity and cultural harmony in the Philippine SEPLs.

Keywords: *Socioecological Systems, Production Landscapes, Satoyama, Biodiversity, Sustainable Development, Indigenous farming systems*

Factors influencing vegetation structure in forests over limestone in Samar Island Natural Park

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Abstract

Inventory studies on forests over limestone are critically important in understanding forest dynamics and in managing the complex forests landscape. However, there is lack of comprehensive inventory in Samar Island National Park (SINP) forests over limestone, a nominee to the UNESCO World Natural Heritage List. Thus, a study was conducted in SINP inland forests over limestone. The study aims firstly, to discuss the woody vegetation structure in Paranas and Taft forests of the SINP and secondly, it predicts the environmental factors affecting the characteristic physiognomy and ecology of Paranas and Taft forests using ordination analysis. Standard vegetation techniques were used and a total of eighteen 20m x 20m plots were established to assess the tree species (⩾1m tall). The line intercept method was used within each plot to assess the plants in the understory. Plant abundance data were recorded and computed. Soil samples were collected while climate data were obtained from the Philippines' Weather Bureau. To identify the major plant communities, cluster analysis was done using the relative basal area of trees per plot. Subsequently, a canonical

correspondence analysis was done to pinpoint which environmental variables influenced the plant data sets. A total of 3,595 tree individuals in 72 species, under 46 genera in 35 families, were found in the sampling plots of Paranas and Taft in SINP. Cluster analysis revealed 3 vegetation clusters named after the dominant species: 1) Shorea-Manilkara-Walaceodendron Cluster, 2) Shorea and Hancea Cluster and 3) Shorea-Manilkara-Hancea Cluster. Canonical correspondence analysis identified elevation as having greater influence in the variation of the relative basal area of the species. Other factors affecting variation include, disturbance and soil nutrients like phosphorus, chlorine, and potassium.

Some Threatened Woody Plant Species in Forests Over Limestone in the Philippine Islands

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Abstract

Forests over limestone phenomena are geomorphologic features that result from the dissolution of a layer or layers of soluble bedrock, usually carbonate rock. Extensive areas of tropical forest over limestone occur in Southern Mexico, Central America, the Caribbean, in Southeast Asia, including the Philippines. In the Philippines alone, there is roughly 35,000 km2 of forest over limestone surface. Generally, plants experience more stresses in this type of forest, due to shallow soil substrates, high temperature and other limiting factors. Hence, unique plants abound and expected to possess secondary metabolites potentially for medicine, food, etc. How-

ever, information on this is quite lacking.

A combined field work and comparative literature review was done, and results revealed important threatened woody plant species under various threat categories of the International Union for the Conservation of Nature (IUCN) and that of the Philippines' Department of Environment and Natural Resources (DENR) in the forests over limestone in Samar Island Natural Park, Mount Tabunan in Cebu, Mount Lantoy Key Biodiversity Area in Cebu, and in Verde Island Passage in Batangas. The top ten (10) important species are noted in this paper; 4 critically endangered, 2 endangered and 4 vulnerable species. **I. Critically endangered** (**CR**): *Diospyros longiciliata Merr., Cynometra cebuensis Seidenschwarz*, F., *Tectona philippinensis* Benth. & Hook. f., *Shorea polysperma* (Blanco) Merr. **II. Endangered** (**EN**): *Cinnamomum cebuense Kosterm., Vitex parviflora Juss.* **III. Vulnerable** (**VU**): *Agathis philippinensis* Warb., *Aquilaria cumingiana* (Decne) Ridley, *Cinnamomum mercadoi* S.Vidal, Dipterocarpus gracilis Blume.

Results indicated human activities, like overharvesting (e.g. resin of *Agathis* and *Aquilaria*), cutting of branches and removal of barks (e.g. *Cinnamomum*), illegal logging (e.g. *Shorea, Dipterocarpus*, etc.), indiscriminate cutting due expanding coastal tourism in the case of *Tectona* and associates along Verde Island Passage, triggered the continued decline of populations of these threatened species, most of which are endemics and can only be found in the Philippines. They are valuable sources of wood and non-wood products among the forests over limestone communities. They also serve as food/shade plants and perching materials for local fauna and forest pollinators sustaining life cycles and ecosystem dynamism. There is an urgent need for massive education and awareness campaign in local government units and village sectors and communities to enhance wise utilization and conservation, hence, preventing the eventual loss of these botanical treasure.

Opportunities and Challenges for the Development of Global Bamboo Construction Sector

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Abstract

Since 1990s, bamboo has evolved as a contemporary building material in original forms as well as reconstituted forms in more than 50 countries across the world. The modern bamboo construction sector has made a great progress in the past 30 years. Although both modern round bamboo and engineered bamboo structures can meet all the basic requirements of modern buildings, the uptake of these materials in mainstream construction markets remains highly limited. The presentation will demonstrate that there are still a number of challenges that need to be overcome before bamboo architecture can become fully integrated into large-scale modern construction. Achieve carbon neutrality goals to battle with climate change opens up new market opportunities for countries rich in bamboo resources. A series of efforts to speed up the development of national regulations, incentives, standards etc. is boosting the sector.

Non-Wood Forest Products: Kenaf Development in Pahang, Malaysia – Challenges, Opportunities and Sustainability

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Abstract

Kenaf, or botanical name as *Hibicus cannabinus*, is a member of the Malvaceae family. It is a biennial herbaceous plant with a life cycle of 3 to 4 months and grows in warm climate with an optimum temperature of 25°C. Malaysia's average temperature ranges from 23-33°C, hence it is in the optimal temperature range for the cultivation of kenaf. Research found that kenaf can grow well in most areas in Malaysia where the soil is suitable and there is sufficient rainfall. Nevertheless, Malaysia was chosen to grow kenaf commercially because there is no big seasonal variation in growing season. Kenaf can be grown multiple times throughout the year (potentially up to 3 times per year) in Malaysia, as compared to temperate areas where there are limited opportunities. More recent research and development work has demonstrated the plant's suitability for the use of in building materials, adsorbents, textiles, livestock feed, and fibres in new and recycled plastics. The kenaf plants has been advocated by some as an alternative to wood pulp for paper manufacture. Kenaf is one of the potential raw materials to use for pulp and wood composites in Pahang, Malaysia as an alternative solution to sustain the raw materials due to shortage supply of wood. Kenaf as know fast growing crops and renewable plant to be good alternative to wood. Kenaf plantation in Pahang, Malaysia started on 2010, mostly in land cultivated with paddy and kenaf as crops rotation. Kenaf cultivation can increase the income of the rural community, as well as depend on the income of paddy and other cash crops. In 2021, 649 hectares was cultivated that involves 511 smallholders in Pahang, Malaysia.

The Role of Indigenous Food Plants on Household Food Security Among Farm Families in Ilocos Norte, Philippines

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Abstract

Indigenous and traditional edible plant species, usually referred to as indigenous food plants (IFPs), are threatened by extinction and are disappearing at an alarming rate, posing serious threats to food security and agricultural production especially in areas that depend on them for food and livelihood.

This study was undertaken to determine the role of indigenous food plants (IFPs) to the household food security among farm families in seven upland and remote municipalities of Ilocos Norte province, Philippines. Information on the IFP's socioeconomic importance and ethnobotany were generated for the 46 IFPs identified.

The identified IFPs are important plant genetic resources contributing to food sufficiency, nutrition, and among income supplements in the study sites. Ethnobotanical data indicate that the plants have developed an integral part of the people's daily diet. IFPs can be consumed either through their roots or tubers, stalks, leaves, tops/sprouts, and inflorescence, fruits or seeds. Of the 46 plants identified, 33 species are consumed mainly as vegetable dishes, either as salad, sauteed dish or viand cooked with fish paste or coconut milk (guinataan). Others were used as secondary ingredient, flavouring spice or as garnishing to vegetable, fish or meat. Root crops are prepared into delicacies, either boiled or cooked with coconut milk. The ripe fruits of some IFPs are also eaten raw, used to flavour fish *sinigang*, or

used as raw material for wine making while some canes are used for tying and furniture making

Recognizing the benefits of these IFPs, the upland communities conserve them through in situ conservation and conservation by use. Additionally, the Mariano Marcos State University (MMSU) collected available germplasm and maintains them as living plants and seeds. To prevent further genetic erosion and consequently protect the IFPs from extinction, collaborative efforts and interventions among various stakeholders should be instituted and strengthened.

Construction and Buildings Including Wood Durability and Protection Needs

Wooden Buildings / Constructions – An Overview

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Abstract

Building with wood has accompanied mankind for a very long time. Even in prehistoric times, it can be assumed that people found shelter not only in caves but also in shelters made of twigs and branches. The online database "oldestwoodenobjects.net" holds therefore an own category "buildings / constructions". The database, which started in 2017 based on a World Wood Day Grant, is collecting scientifically dated wooden artefacts, i.e. by dendrochronology or radiocarbon. At the moment 92 buildings from Europe, Northern America and Asia are listed.

The talk will give an overview on the time axis as well as on the main building types around the globe – based on the data base and own results.

Remnants of simple shelters were found in Germany dating back 370.000 years (Bilzingsleben). A clearer structure can be seen at a Tipi in Northern America dated to 9625 BCE (C14). Buildings made completely out of wood based on piles can be found in Europe starting from about 4500 BCE (C14, Resnikov prekop, Slovenia). Later on, huge post buildings were built on land, which can be seen just by archeological excavations. An example is a farmhouse in northern Germany dendro-dated to 62.

In Asia stone buildings with wooden constructions (roof, ceiling), which are still intact, can be found from 420 (C14) onwards. In Bethlehem the oldest wooden pieces in a church date at 525 (C14); in France in a fortress at 681 (dendro).

Looking at buildings completely made of wood, in Japan the Horyu-ji Tem-

ple built in 607 can be found. The Shôsô-in Shôsô (Nara, Japan) dated to 756 is a block construction. This construction type can be found in well-constructions since 5196 BCE (C14) in the Czech Republic and Germany.

Since the end of the Viking era buildings with roof or ceiling construction are still existing in Europe – for example the stave churches in Norway and Denmark (1060; dendro), or a church in Austria (1135, dendro).

Fascinating timber construction can be found up to now, mainly as post constructions.

Biodeterioration Resistance of Nigerian Grown *Artocarpus Altilis* Wood to *Xylaria Polymorpha* and *Sclerotium Rolfsii* attack (White and Brown rot fungus)

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Abstract

Nigeria wood based industries are facing a severe shortage and scarcity of choice timber species and to meet this demand led to the introduction of (LUS) *artocarpus altilis* into timber market as an alternative wood species necessitated the need to evaluate its durability of wood in service in order to curtail deterioration by bio-deteriorating agents. Four *A. altilis* trees from Southwest zones of Nigeria were purposively selected and felled based on maturity (45±0.5 years). Billets (500cm) were obtained from (10% base, 50% middle and 90% top) of merchantable height of each tree and partitioned into centrewood, innerwood and outerwood along the radial

plane. Wood samples were inoculated with *Xylaria polymorpha* and *Sclerotium rolfsii* for 20 weeks in an accelerated durability test (ADT) using ASTM D-2017 standard. Analysis of variance at α0.05 was used for analysis. The result shows that *A. altilis* wood species is resistant to fungus attack, with an average weight loss of white and brown rot fungi 4.70±2.12g and 5.47±2.89g, respectively. Axially, white rot degraded wood by 4.49±2.12%, 4.76±2.48% and 4.85±1.79% and brown rot degraded wood by 5.31±2.53%, 5.58±2.90% and 5.51±2.04% at the base, middle and top respectively. The highest WL of 6.58±2.97% was obtained for innerwood. Analysis of variance showed that there was no significant difference in the weight loss of wood obtained from the 3 different sampling height positions and across the plane axis for the species. The effect of interaction between sampling height, radial position and fungi shows insignificant difference existed. However, according to the ASTM D-2017 (2008) classification for categorizing the resistance of wood species to decay fungi; however, wood samples of *A.altilis* species could be rated resistant (R).

Natural Durability of 20 Brazilian Wood Species after 30 Years in Ground Contact

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Abstract

This study aimed to assess the natural durability of 20 Amazonian wood species after 30 years in ground contact in an experimental field test at National Forest of Tapajós, Pará state - Brazil. Heartwood samples with a

cross-section of 5 × 5 cm and 50 cm of length were half-buried in soil and inspected every year for decay. The species were classified according to natural durability following the classification method proposed by Findlay. After 30 years in ground test, six species were classified as Perishable, seven as Non-durable, three as Durable and four as Very durable, namely: *Trichilia lecointei, Lecythis pisonis, Pseudopiptadenia suaveolens*, and *Dipteryx odorata* (Very durable), *Protium tenuifolium,Dinizia excelsa*, and *Ormosia paraensis* (Durable), *Endopleura uchi, Goupia glabra, Pouteria egregia, Tachigali chrysophylla, Tachigali paraensis, Vatairea sericea*, and *Vochysia maxima* (Non-durable) and *Chrysophyllum lucentifolium, Couratari oblongifolia, Didymopanax morototoni, Lueheopsis duckeana, Sterculia excelsa*, and *Xylopia nitida* (Perishable).

Wood Structure Sustainability: A Case Study of Rajwada Palace, Indore, Central India

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Abstract

India has long been admired for its architecture that is an amazing confluence of knowledge, art and fine craftsmanship. As one of the oldest and most diverse civilizations of the world, one can find stunning temples, forts, palaces and monuments made in wood, across the length and breadth of the country. Being naturally occurring material, construction using it was the order of the day for centuries till the other materials began to gain popularity.

Rajwada, is a historical Residential palace in the city of Indore, Madhya Pradesh, Central India. This seven storied palace serves as a fine example of royal grandeur of Holkars of the Maratha Empire. It was built in 1766 and later the southern part was rebuilt in the years 1811–1833 after being damaged by fire. The palace faced maximum destruction during 1984 riots. The lower three stories of the palace are constructed with stone while the upper four floors are made of wood and thus they are more prone to fire.

A team of Architects, Civil Engineers and Wood Scientists were given the task to rebuild this building using the same material & finishes, while adhering to the seismic structural requirements, mandatory today. Forest Research Institute, Dehradun was approached for consultancy on wood, and thus the authors carried out the study.

The upper three Wooden floors of the Palace were found to be facing major problem of Outside Tilting, Open Joints of columns and beams, Longitudinal fractures at places with bigger nails, Centre Sagging of beams, Borer and termite attack and Bio deterioration of wood.

The woods used in Rajwada palace were examined through both random and selective sampling method. Over 100 samples were examined on site and 8 wood samples were brought for lab testing. Over 95% of the wood used in the Palace is Teak (*Tectona grandis*). Besides Teak, *Hardwickia binata* (Anjan), *Anogeissus acuminata* (Yon) and *Pterocarpus marsupium* (Bijasal) were used at different places. The highly deteriorated woods of the beams at third floor were of miscellaneous wood species. The presentation shall deal with the choice of different woods for different purposes and the probable reasons for failure of the wooden structure.

Structural Properties and Potential Utilization of Lesser-used Hardwoods from Sarawak

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Abstract

In many parts of the primary native forests of Sarawak, extensive logging of traditional commercial wood species has created secondary (degraded) native forests proliferated with emergent fast-grown pioneer lesser-used hardwoods with plantation potential such as *Azadirachta excelsa* (local name: sentang), *Duabanga moluccana* (sawih), *Endospermum* spp. (terbulan), Ilex cissoidea (aras), *Neolamarckia cadamba* (kelempayan) and *Octomeles sumatrana* (binuang). These hardwoods, unlike those dwindling supplies of commercial Sarawak hardwoods, are relatively less dense and light coloured, of perceived lesser biological durability and lesser structural properties although such information about these Sarawak-grown hardwood are scattered. Therefore, a comprehensive study is made on the basic mechanical properties (modulus of rupture, modulus of elasticity, compressive stress parallel to grain, shear stress parallel to grain, hardness, internal bond gluing) and wood density (specific gravity, basic density) of tree stems of these 6 hardwoods conditioned to 12% wood moisture content and compared with green and air dry conditions of the wood. Results revealed that unlike the representative commercial Sarawak hardwood such as Dark Red Meranti (*Shorea* spp., fam. *Dipterocarpacea*) included for

comparison, all structural properties of the 6 lesser-used hardwoods are relatively low. Nevertheless, these lesser-used hardwoods with appropriate processing technology, can provide sufficient wood structural properties for a number of wood products, as illustrated in this paper, and have tremendous potential in sustaining the Sarawak wood processing industry in the near future.

Keywords: Lesser-used hardwoods, secondary forest, Sarawak, mechanical properties, wood density, wood products

Diversity of Wood-Inhabiting Fungi on Stakes Exposed in Field Test Site in Korea

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Abstract

Fungal deterioration of wood is regarded as the main limiting factor to use wood in exterior construction. In order to protect wood from the deterioration, the primary step is to accumulate information on fungi inhabited wood species mainly used in construction. This study was conducted to investigate the fungal diversity in 5 Korean wood species including *Pinus densiflora*, *Larix kaempferi*, and 3 *Quercus* spp. (i.e., *Q. rubura, Q. serrata*, and *Q. variabilis*). Five stakes of each wood species were collected from a field test site at *Jeoung-seon*, Korea, and small flakes were removed from the stakes. They were then placed on the selective media to isolate basidiomycetes, ascomycetes, and *zygomycetes*. Identification of pure-cultured fungi was conducted based on morphological and molecular biological

characteristics. As a result, a total of 306 isolates, including 22 basidiomycetes, 16 ascomycetes, and 14 *zygomycetes* were obtained from 5 wood species. The results showed that fungal diversity was significantly different depending on the wood species. The dominant species in *P. densiflora* were 2 basidiomycetes (*Peniophora incarmata* and *Peniophora* sp.), 1 ascomycete (*Fusarium graminearum*), and 2 *zygomycetes* (*Cunninghamella elegans* and *Gongronella butleri*). In *L. kaempferi*, *Mycena* sp. *Cochliobolus* sp., and *Mucor fragilis* held a majority of basidiomycete, ascomycete, and zygomycete, respectively. In *Quercus* spp., 4 basidiomycetes (*Irpex lacteus, Phlebia acerina, Schizophyllum commune*, and *Sistotrema brinkmannii*), 3 ascomycetes (*Alternaria alternate, Alternaria* sp., and *Curvularia protuberata*), and 3 zygomycetes (*C. elegans*, *G. butleri*, and *Mucor moelleri*) were dominantly isolated. Most species obtained in this study were previously reported as wood-inhabiting fungi in Korea, while *Curvularia protuberate* (ascomycete) and *G. butleri* (zygomycete) were new to wooden substrate in Korea, and a brown-rot fungus *Fibroporia gossypium* and a white-rot fungus *Peniophora limitata* were new to Korea.

Building Components, Furniture, Musical Instruments, Artifacts and Design

Adding Value & Local Capacity at the Forest Source: A Path to Sustainability

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Abstract

Tool use has long been considered a unique and defining human characteristic. We now know that this trait is also shared by chimpanzees and other hominids, as well as elephants, dolphins and perhaps even rodents. But it still appears that none of our closest "relatives" in the animal kingdom use tools to create furniture, art and other artifacts of their own design, so this remains an exclusively "human" attribute.

At the same time, our very human reliance on trees and forest resources for fuel, shelter and the creation of our made environment has deep roots in human enterprise. From the ancient Egyptians and Romans to the more recent European settlement of North America and the modern timber industry, humans have historically related to forests as an extractive resource—not unlike gas and oil.

The notable exceptions are often to be found where people reside in or around forests and have the capacity and incentive to protect and manage those forests for their own benefit and future survival. This is especially important today in some of the most threatened tropical forest communities in the world, where both greater capacity and incentives are so desperately needed. GreenWood is dedicated to this purpose: "Adding Value and Local Capacity at the Forest Source." In the rest of my presentation, I will share three very different examples of how we have pursued this mission in three different tropical environments—Peru, Honduras and Puerto Rico—through our development over the last three decades of three very

different creative woodworking enterprises, all of them designed to provide a path to a more sustainable forest future.

Wood Artists and Artisans in Egypt During the New Kingdom (18th Dynasty, 1550-1292 BC). A Study Case About the Objects from the Intact Tomb of Kha (overseer of works) and His Wife Merit Conserved in the Museo Egizio of Turin (Italy)

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Abstract

On February 15, 1906, the Italian archaeological mission, led by the director of Museo Egizio, Ernesto Schiaparelli, discovered the shaft of a tomb which had been sealed by a landslide. The shaft led down to one of the greatest archaeological discovery in Egypt, the intact burial assemblage of two upper-class individuals, the "director of works" Kha and his wife Merit, who lived during the XVIII Dyn. (around 1400 B.C.). Schiaparelli was granted permission to bring the 440 objects found in the tomb to Turin, leaving only a few objects in Cairo, and since then the grave goods of Kha and Merit is exhibited at the Museo Egizio.

The Museo Egizio entrusted us with the analysis and scientific study of wooden objects as part of a multidisciplinary research programme, titled "TT8 Project", aiming to publish the first full study of the grave goods of Kha for the bicentennial of the Museo Egizio in 2024. It is a unique opportunity to observe a well dated and localized collection and we use different techniques to make our samples. From the in situ observation with a dino

light and the micro samples making, to the observation with different microscopes and even a synchrotron, we present here our first results.

Historical & Contemporary Approaches to the Daxophone

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Abstract

For *Historical & Contemporary Approaches to the Daxophone*, **The Daxophone Consort** takes the audience on a tour of the daxophone. In this workshop, the audience will learn about the material properties of the instrument, such as those of wood and amplification, and be introduced various aspects of performance practice. The Consort also will demonstrate other music made with a daxophone by its notable practitioners in the instrument's short history, such as its inventor Hans Reichel and its Japanese champion, Kazuhisa Uchihashi.

Daniel Fishkin, Cleek Schrey, and Ron Shalom comprise the U.S.'s only extant daxophone consort. The daxophone is a thin wooden strip played with a bow, which was created by the German improviser/inventor Hans Reichel in 1987. The instrument's sound, somewhere between a cello and badger, ranges from furtive gurgles and delicate whistles to wild screams. The trio develops realizations of historical experimental music, commissions new work, and generates new pieces. Collaborators have included the viola da gamba consort Science Ficta, composer Alvin Lucier, and experimental vocalists Judith Berkson and Shelley Hirsch.

From Craftsmen to Artists:
Engaging and Empowering Philippine Woodcarvers

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Abstract

In the early days, there was a huge chasm dividing crafts people/ woodcarvers from sculptors from the Philippines. Renowned Philippine sculptor like Napoleon Abueva and other artists like him have earned their distinction for having learned their craft from Fine Arts institutions whereas woodcarvers who have been carving all their lives remain as the unknown and lowly woodcarver. Since 2013, there has been several activities that have empowered the lowly woodcarver to up their game and be recognized for their work. The University of the Philippines Open University established the first woodcarving competition participated on by woodcarvers from the three known towns in the Philippines that have earned a reputation for their woodcarving of religious images and altars, furniture, and folksy Philippine scenes. Workshops participated on by woodcarvers were organized with the help of artists while competitions became annual events. In recent years, despite the threat of the covid-19 pandemic, the woodcarvers have dared to compete in prestigious national art competitions. The local government units of the woodcarving towns have supported local woodcarving events with certificates and cash prizes. Some of the winners were given chances to join international wood carving events hosted by the World Wood Day and the IWCS. The woodcarvers now enjoy the recognition of their craft and their artistry, and continue to reap the benefits of collaboration among fellow artists, engagement with their community and the recognition bestowed by international organizations such as WWD and IWCS.

Forest – A Designer's Perspective

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Abstract

Forests have ecological, economic and social values and they are justly a highly topical theme. The forest is a widely studied subject in Finland, especially from the standpoints of the forest industry and ecology. A designer is an important link between the material source and the end product or service. Nonetheless, a comprehensive and topical designer's point of view is missing.

This study addresses this gap by aiming to understand the multiple values of the forests and wood as material for the design practices. The scope is on Finnish forests and designers. The research is based on novel studies and empirical evidence and applies the information gathered to the artistic design process. The research question is: how can I as a designer respect forests and wood as a material and apply this understanding to my design?

The research utilizes a wide variety of source material. Firstly, the literature includes ecology, forest and materials science, and art. Secondly, documented forest trips and conversations with specialists are used as a source of knowledge. The methods include subjective observation, semi-structured interviews, and research-based design. Furthermore, the wood material is studied by harvesting and researching a grey alder and using it holistically in design practices utilizing also fibre-based biomaterials. The knowledge gathered thorough the process is reflected in a series of furniture and objects from Finnish wood species and recycled wood materials. The series reflects peasant traditions and utilizes novel technologies.

The study demonstrated that it is worth for a designer to gather forest and wood knowledge firsthand as well as utilize local tradition and experience-based knowledge. Forests seem to be dignified entities with an important role in the world. However, the modern forest relationship appeared problematic, while multiple possibilities for more balanced relationship appear.

Investigation of Shear Performance of Light Frame Wall Sheathed with Structural Particleboard

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Abstract

Korean wooden construction market has continued to grow, and the number of constructions has been kept steadily 10,000 houses per year since 2011. However, light-frame construction, of which members are imported material, has been built mostly. Therefore, the National Institute of Forest Science develops a structural particleboard (PB), which is made of domestic wood to substitute for imported OSB used as a structural sheathing plate in light-frame construction. To investigate whether structural PB could be used as sheathing material of light-frame wall or not, shear resistance of light-frame wall sheathed with structural PB compared with that of light-frame wall sheathed with OSB. Two light-frame walls having 2.44 (length)x2.44 (height) m per each sheathing plate were prepared. The 2x6 SPF lumbers with grade of 2 were used for frame, and the stud spacing was set to 610 mm. Sheathing plates were installed for each frame by driving 8d nails into the inside and the outer of plate at intervals of 300 and 150 mm,

respectively. Shear resistance was evaluated using hysteresis curve by applying a quasi-static load (ISO 16670 protocol) according to ASTM E2126. Shear strengths of wall sheathed with OSB and PB were 7.9 and 8.6 kN/m, respectively. It was confirmed that secant shear modulus for OSB and PB walls at 40% of the maximum load was 2.4 and 3.0 kN/m, respectively. In addition, ductility was shown as 8.4 and 9.5 in OSB and PB walls, respectively. It was confirmed that shear resistance of PB wall was higher than that of OSB wall. From the results in this study, it is considered that structural PB manufactured using domestic wood can be used for sheathing material of light-frame construction, and it is expected that it can contribute to the national carbon stocks.

The Wooden Mouthpiece: A Significant Element of the Alphorn Sound

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Abstract

The mouthpiece is elementary in determining the sound of the Alphorn. I will try to talk about the historic evolution, construction, shapes and different types of wood used in mouthpiece making.

I shall illustrate the presentation with pictures from a mouthpiece manufacture, and show different kinds of mouthpieces.

Neapolitan Wood Craftsmanship of the 18th Century: Discovering Ancient Technologies in Lutherie

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Abstract

Musical instruments construction is a tradition that lasts since many centuries in Italy. Golden-age Neapolitan lutherie of XVIII century in particular, is one of the most representative for plucked stringed instruments such as the modern mandolin and guitar. Iconic 1700's instruments are very sought after to play again but the very rare original ones are fragile objects whose use is a risk factor for their conservation and the actual trend is that of making accurate copies that are played in the place of the originals. A drawback of this approach however, is that an accurate reproduction of the geometry does not guarantee per-se the same sound. The large variability of the mechanical properties and density of wood in fact, implies that two instruments sharing the very same geometry can show a very different acoustic response.

In our research, we have investigated the making techniques and technologies in use in the 18th century and their implications in the design and manufacturing of mandolins. Based on the analysis of some original instruments, we began to realize a philological reconstruction of the 1784 Filano mandolin of the collection of the *Castello Sforzesco di Milano*, a rare example in good state of conservation. Our work is supported by advanced nondestructive techniques such as x-ray tomography, acoustic radiation and accelerometric measurements, as well as elemental analyses on the surface coatings. These analyses will allow to identify the wood species and their density, as well as to perform dendrochronology analyses and infer

their mechanical and acoustical properties. By means of this approach, we aim at realizing a faithful replica that recovers not only the original aspect and geometry, but also the acoustic response of the original instrument. Once finished, this replica will be available to musicians and researchers interested in ancient music.

Education on Forest Sustainability, Forest Products Utilization and Culture

Bridging the Gap between Public and Professional Perceptions of Forests and Trees: Enhancing Social and Cultural Literacy in Education and Research

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Abstract

The sustainable management of forests fundamentally depends on the choices that people make, shaped by perceptions of the relative importance of forest-related environmental, economic, social and cultural values. Current approaches to forestry education at all levels, including public education, places a strong emphasis on the biophysical and economic aspects of forest ecosystems, forest management and utilization of forest products. While these are essential, they may not be sufficient to ensure strong public support and enthusiasm for forest conservation and sustainable utilization of wood and non-wood forest products. In this presentation, I will make a case for a greater emphasis on the social factors, as well as the cultural and spiritual motivations that affect how people view forests and their management in different socioecological contexts. Such an expanded understanding of the diversity of beliefs and perspectives that motivate people to appreciate and value (or not) the multiple goods and services that forest and trees provide can improve our forest conservation and management actions as well as enhance public education and long-term support for sustainable forest management.

Online Advocacies and Education for Forests and Wood Conservation

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Abstract

The Philippines is undergoing serious forest degradation, mostly in the form of deforestation and land use conversion mainly due to the fast growing impoverished population. The forests cater to many of the human needs such as; food, water, fuel security, and wood for shelter. With the steady decline of forests, the animals living there will also lose their homes and migrate to the cities or places that the general public live in. This will cause the pop-up of many different diseases like Dengue, Malaria, etc. and consequently death of humans. This paper aims to high light the need for general awareness of people about wood or forest advocacies.

The paper focused on investigating three organizations with online advocacies on forest and wood conservation with high number of followers: The Haribon Foundation, Earth Day Network Philippines INC., and Forest Foundation Philippines. Results showed that the Haribon Foundation has three projects while Earth Day Network Philippines has six, and the Forest Foundation Philippines has two. The Haribon Foundation has projects such as Adopt-a-Seedling and Nurture-a-Tree; while Earth Day Network Philippines has Eco-Agriculture, ALARM-GAUP (Assessment of Land and Resource Management and Generating Advancement for Upland Peoples), and LUCID(Social justice implications of land use change in the Philippine uplands: Analysis of the Socio-Economic Drivers and Impacts on the Land and its People), and Forest Landscape Grant Programs, supporting activities for the protection and sustainable management of forests in the Foundation's fo-

cal landscapes like Sierra Madre, Palawan, Samar and Leyte, Bukidnon, and Misamis Oriental of the Forest Foundation Philippines; and Forest Foundation Philippines has two grant programs, one scholarship program, and two conservation fund projects. These online platforms of the three organizations earned digital community followers reacting and commenting from time-to-time. Forest Foundation Philippines earning the highest number of likes, 60,815 followed by Haribon Foundation with 39,541, and Earth Day Network Philippines with 14,096. The more information an advocacy page presents, as to what they are doing and how they impact society, the more followers or volunteers they have. These online platforms help the masses gain quick knowledge as to how to reforest the lands. Learning is evidenced by the comments left by the reader on the page. Comments like “thanks for this great information on how to plant talisay plant”, (@denmark carja guillermo); “Hi. Where can I buy forest tree samplings?”, (@Ela) are proofs of understanding, learning, and willingness to participate and be more involved on the part of the reader. Hopefully these are translated into forest rehabilitation/restoration initiatives and wise wood utilization and conservation.

Key words:
Advocacy, Education, Reforestation, Forest degradation

Forests and People for Change: The Role of Communication in Environmental Governance

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Abstract

Various sectors are marginalized through the digital divide hence, the call to educate and bring appropriate support to such groups are important. This divide is present within the forest sector of the Philippines, especially the forest-dependent communities. Recognizing their integral role in forest management, efforts have been made towards empowering the local people with basic knowledge on environmental laws and policies through environmental communication. Moreover, improved communication and information access is proved to be directly related to social and economic development. Hence, the paper aimed to examine the role of communication in environmental governance. The media curated were communication materials and projects implemented by the University of the Philippines Los Baños - Forestry Development Center where the roles of communication as policy advocate and mediator were explored. Through stakeholder analysis, it was found that partners were from government agencies, private institutions, non-government organizations, the academe, and research centers. The message developed was science-based forest and natural resources management, focusing on advocacies such as Non-Timber Forest Products utilization, reforestation technologies, forest certification, and sustainable watershed management. Media identified for policy advocacy were information, education, and communication campaigns on new media such as social media and webinar series, and print media such as technical bulletin and policy brief. Events such as policy consultations, policy and technical fora, and round table discussions highlight the role of communication as

mediator by bringing various stakeholders together. These efforts applied science-based, strategic communication which resulted to communication of advocacy as well as increased participation of various stakeholders. However, not all marginalized groups were reached hence, it is recommended to use the programmatic information and communication technology (ICT) approach that prioritizes the marginalized sector and facilitates programs that will address their ICT needs through extension services.

Biophysical Assessment of the Plant Bioresources of Northern Negros Natural Park, Negros Island, Philippines

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Abstract

Until now, it is difficult to secure data sets on plant bioresources in Northern Negros Natural Park which are critical in planning for management initiatives and strategies for biodiversity conservation. This study aims to 1) assess the plant bioresources along the elevational gradient of Northern Negros Natural Park, 2) analyze the environmental factors influencing plant bioresource distribution. Standard vegetation analysis and household survey were utilized in the data collection processes. Secondary data from

the park office and that of the LGU were also availed of. Results showed 242species, 72 families of 78 tree species, 90 shrubs small trees and fern species, and 37 epiphytes. About 112 species had been reported threatened, 35 of which are Philippine endemics. There were three altitudinal zones identified using the cluster analysis: Zone I for plots within 643 to 1023 meter elevation; Zone II for plots found within 881 to 1182 meter elevation; and Zone III for plots within 985 to 1441 meter elevation. The elevation gradient sub-montane had the highest diversity (H'= 4.809) followed by the montane (H'= 3.37) and Lowland (H' =3.528) respectively. Species abundance in each altitudinal zones and elevation gradients is not correlated with environmental factors (N, P, Altitude, Slope, and proximity to human disturbance) other than soil pH which had a negative correlation and potassium with positive correlation. These results provided important biophysical data in understanding the present landscape and in crafting strategic interventions and management plans to sustain biodiversity and ecosystem services.

Key words: *Protected Area, Biophysical Assessment, Elevational Gradient, Plant Bioresource Distribution, Northern Negros Natural Park*

Plant Bioresource Utilization by Local communities of Northern Negros Natural Park, Negros Island, Philippines

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Abstract

Ethnobotanical data as an important component to a holistic analysis of a protected area in aid of planning for management initiatives and strategies for biodiversity conservation is seldom utilized due to its rarity or absence in Northern Negros Natural Park. This study aims to 1) determine the plant bioresource utilization of the local communities in Northern Negros Natural Park, and 2) determine the Institutional Management Regime for Northern Negros Natural Park. The data gathering involved household survey, key informant interview, and focus group discussions. The secondary data were also accessed from the office of the protected area superintendent and the local government units. Results showed that 51 species were collected and used for food (26%), ornamental (24%), herbal or medicinal value (19%) construction (12%), commercial (9%), charcoal and fuel wood (8%) and craft (3%) of the 643 households from 11 cities and municipalities covered by the protected area. The results also showed that threats like housing and settlement and annual and non-perennial timber crop cultivation were recorded high. The “context” and “planning” components were the strength of the protected area management scoring 64% and 53.8% respectively per Management Effectiveness Tracking Tool (METT) analysis.

There is only one clear law utilized in the regulation of bioresource harvesting in the protected area, the Republic Act 11038 or also known as the Expanded National Integrated Protected Area System (ENIPAS). Other than that, village and cooperative-imposed policies were applied to regulate bioresource use and harvesting. These results provided a vital socioeconomic and institutional understanding of the landscape ready for the interventions and management plans to address the issues that concerns bioresource utilization in the protected area.

Key words: *Protected Area, Socioeconomic Assessment, Institutional Assessment, Management Effectiveness Tracking Toll Analysis, Ethnobotany and Northern Negros Natural Park*

Towards Efficient Wood use – Practical Education as a Tool to Imagine Wood Cascading Potentiality

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Abstract

What can we learn from possibilities of recycling wood waste by educational means? How could we teach cascading design in practice, a field, means of which are not yet fully revealed?

The construction waste is a massive unutilised opportunity that will be more and more relevant source of material in near future due to new EU-regulation and increase of virgin material and waste management costs. By using the harvested wood more efficiently, including the means of cas-

cading, we can decrease the pressure on forests as material source and contribute to their role in climate change mitigation and the maintenance of ecosystem services. This paper looks into the educational means to conduct relevant information about wood cascading possibilities, challenges and possible implementations. It also looks into challenges of practical methods of teaching cascading, generally more theoretical topic.

The paper looks into the themes through a case study, Aalto University's course Re-imagining Wood Waste that took place in Otaniemi, Finland at 2021. The course was run by professor Mark Hughes and designer–architect Saara Kantele and is part of Nordic Waste Wood for good collaboration. The scope of the course was to create a holistic approach on wood cascading through: knowledge of wood and forests life cycle, and cascading possibilities, creating new approaches and applying them on practice. Material used was demolition waste wood. The motivated multidisciplinary student group worked as pairs with both engineering and design background.

The paper shows that the educational approach managed to tackle different relevant aspects of demolition wood cascading, and create new value to material through practical learning. The students concentrated on very different angles of the topic, thus the course work as a whole forms a comprehensive image of demolition wood challenges and possibilities in different scales and stages of cascading.

Wood in Sport Equipment - Heritage, Present, Perspective

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Abstract

Sport has a vital role in human culture. Many sports boast century-long traditions and are practiced worldwide, contributing to well-being, self-identity formation, entertainment, etc. The socio-cultural meaning of sport fully emerges during the Olympic Games that promote some of the highest human values, among which equality, inclusion, and respect.

Wood has traditionally been used to build sport equipment, including both tools and playing courts. Nowadays, the use wood is out-of-date in some sports, for instance in tennis, where it has been replaced by synthetic, high-performing materials. Nonetheless, in several sports wood remains the choice material for making equipment used from beginner to professional level. To mention some examples, wood is today used to make baseball bats, table tennis racquets, surf boards, gymnastic still rings, skis and snowboards, horse jumping obstacles, basketball courts, cycling tracks, etc. The wide range of applications is reflected by the use of several wooden species: for instance, sugar maple and ash for baseball bats, Siberian pine for velodromes; balsa and walnut for table tennis racquets. Similarly, several wood-based engineered products are used, such as solid wood for mountain bike obstacles, plywood for artistic gymnastic floors, Medium Density Fiberboard for table tennis tables, hardwood flooring for basketball, etc.

The oral presentation intends to provide an overview of the above topic by illustrating the book *Wood in Sport Equipment - Heritage, Present. Perspective.* The book will be published as the final outcome of the same-named

project funded by the World Wood Day Foundation in 2021.

Note: at the time of the Symposium the book will be in advanced editing phase, since it will be made available online in April 2022.

Implementation of the Course "Wood Culture" in the Education of Forestry Students

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Abstract

This piece of work introduces the "Wood Culture" course offered for the undergraduate and graduate students in the Faculty of Forestry & Environmental Management at the University of New Brunswick, Canada. Interdisciplinary programs in Forestry help students understand the forest through many theoretical and practical courses. These courses cover forest and wildlife ecology, soil chemistry, forest economics sociology & statistics, hydrology, management and others. Participating in indoor classrooms and outdoor laboratories students learn different aspects of tree growth and development. The course that teaches students about the anatomical structure, properties, and products is called "Wood Technology". The students usually take in the fourth year of their studies. This course contains a couple lectures about engineered wood products that are made from lumber, veneer, strands, and fibres. In the process of learning, students study the forest and wood in depth, however, they lack a broader vision of the various aspects of the use of wood. So, it was decided to add materials

about the culture of wood utilization to the course syllabus. Thereby, students get acquainted with the concept of “Wood culture” and learn about the various uses of wood in history and nowadays. Materials used in the lectures include the following topics: Lore, Legend and Belief about trees, Wood as a Renewable resource, Architecture in Wood, Sacred Buildings, Living with Wood, Wood in Transport, Rural Craft and Industry, Artistry in Wood, Wood in Action, and others. In addition, a separate directed study course "Wood Culture" is offered for Master’s students, resulting in a positive learning process. It is expected that the knowledge gained from Wood Culture will open a window for students to master understanding of wood, educate them a love of using wood, and help them become successful in their careers.

Wood Products and Wood Biotechnology

(IAWS Special Session)

Wood Anatomy - from Tradition into the Digital Future

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Abstract

The knowledge about recognition and utilization of commercial timbers is of prime importance to forestry, timber trade and wood industry as well as private consumers for the assessment of wood quality and utilisation. Furthermore, wood identification is important in enforcing the control of illegal logging according to the requirements of international regulations, e.g. European Timber Regulation, USA Lacey Act, or Illegal Logging Prohibition Act in Australia and CITES policies.

A valuable support for computer-aided wood identification is introduced and provided by the new developed Apps *macroHOLZdata* and *CITESwoodID*. The Apps enable the user to identify trade timbers and CITES protected species by means of macroscopic wood structural features.

In addition, the App *macroHOLZdata* allows access to a data pool with timber specific information on properties, utilization, and other relevant characteristics of the timbers, i.e., data on biological, physical and mechanical properties, wood machining, wood processing, and appropriate end uses. Both Apps for smartphones and tablets are freely available in four language versions (App Store® and Google Play®) and serve as visual (illustrations) and textual (descriptions) identification aid to all institutions and persons involved in wood science. The modern digital systems may also constitute very useful applications for professionals in forestry, wood industry and the wood products market, architecture, engineering, etc., as well as wood enthusiasts. Fundamental developments in the scientific field of wood anatomy will also be forthcoming by the design of automated

identification systems (deep learning or machine learning). The first portable digital systems are currently available and several basic studies has been published in this rapidly moving field of computer-assisted wood identification using neural network methods. The very dynamic progress in the field of modern wood anatomy and digital wood identification will be presented.

Notes: The App *CITESwoodID* is already downloadable; the App *macroHOLZdata* will be published in March

Investigating Interlocked and Spiral Grain with X-ray Microtomography

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Abstract

Interlocked and spiral grain are examples of wood grain that run in non-vertical orientations. The developmental mechanisms that generate these grain patterns likely involve the slow rotation of fusiform initials within the vascular cambium, but how these mechanisms function at a cellular level remains unclear. Clarification of these developmental pathways may come through assessing grain at the cellular level across large areas of wood, but such experiments are difficult using traditional serial sectioning. To overcome these limitations, wood samples were assessed by X-ray computed microtomography (µCT) with the Skyscan 1172 system. µCT generates large data sets at near cellular resolution that can be resliced and reoriented in ImageJ. Furthermore, reconstructed tangential longitudinal

sections processed through the *DIRECTIONALITY* plug-in, which uses a Fast Fourier Transform to measure dominant alignments within an image, give direct measurements of wood grain. We demonstrated µCT's applicability to grain measurements in multiple systems. African mahogany (*Khaya*) exhibits interlocked grain with grain oscillations of more than 20^{o} measured with µCT. Grain changed at locally constant rates separated by locations where grain change abruptly reversed. Image segmentation of cross sections identified vessels whose orientations were more variable than fibres, and which typically deviated further from vertical at locations where grain change reversed. Moreover, reversal locations for vessels were shifted ~400 µm towards the pith compared to the fibres. A model is proposed to explain interlocked grain development and the origin of these differences. Additionally, µCT demonstrated links between compression wood formation and spiral grain development in 8 month-old radiata pine saplings. The normal development of progressively steeper left-handed spiral grain in vertically grown trees was inhibited by the formation of compression wood on the lower sides of tilted trees. These results demonstrate a previously unidentified link exists between compression wood formation and the inhibition of spiral grain development.

Moisture-induced Stress and Distortion of Wood: A Numerical and Experimental Study of Wood's Drying and Long-term Behaviour

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Abstract

In the past twenty years, with the introduction of cross laminated timber, wood has become increasingly popular as a structural material. This, together with an increased computational power of the desktop computer has created a renewed interest in the three-dimensional computational modelling of the moisture-dependent mechanical behaviour of timber elements. Such models can contribute to the understanding of the long-term behaviour of timber structures and to the development of building standards to maintain a save transport, work, and living environment. In order to obtain realistic results with such models, calibration and validation is of essence.

A three-dimensional finite element model is presented that can describe the nonlinear-transient moisture flow and moisture-induced stress and deformations associated with wood for a wide range of engineering applications. The model is developed in a finite element and computer-aided engineering software that has strong computational abilities, an extended graphical interface, and advanced tools for pre- and postprocessing. To create more flexibility, the theory that is used to describe the constitutive models, the wood's fibre orientation, and boundary conditions are implemented in so-called user-subroutines. The numerical model was both calibrated and validated with three applications that cover the field of wood drying and long-term behaviour of wood. The beam elements studied in

each application showed complex three-dimensional stress and deformation states influenced by varying climate, fibre orientation, and heartwood and sapwood areas. The area within the cross section of the timber beams, where the annual rings aligned with the exchange surface, seemed especially prone to high tension stress related to the tangential material direction. Dependent on whether the beam experienced desorption or adsorption, this stress state varied between tension and compression, respectively. By including the heartwood and sapwood area to the cross section, well know phenomena such as stress reversal and casehardening could be detected within the cross section during drying.

Nanostructured Carbon Materials Derived from Tannin as Electrodes for Supercapacitors and Beyond

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Abstract

The main objective of the thesis was to produce biosourced electrodes for supercapacitors (SCs), which are energy storage devices capable of delivering high power, making them suitable for applications in electric vehicles, as back-up devices or in hybrid systems with batteries. Another objective was to reduce the environmental impact related to the synthesis of materials, generally using hazardous substances. The first approach was therefore to use a biosourced carbon precursor such as mimosa tannin, which is currently extracted industrially from tree barks and used by the leather and wood industries, among others. It would thus be possible to add further value to this wood by-product. The second strategy aimed at developing an

original, “green” mechanosynthesis method, which ultimately uses only tannin, water and a non-hazardous surfactant. The materials thus produced, mesoporous carbons (MCs) with ordered or disordered mesopores (OMCs or DMCs, respectively), were physically or chemically (KOH) activated in order to test them as SC electrode materials. The in-depth characterization of these materials led to a better understanding of the effect of the order and connectivity of the micro-mesoporous structure on the development of textural properties by the different activation processes and on the electrochemical performance of the SC in aqueous and organic electrolytes.

The characterization also revealed that the tannin-derived MCs can be appropriate for applications beside those of energy storage, for example, as molecular sieve for hydrocarbon separation, as catalysts for the production of vanillin, or, as part of a real-time detector of traces of volatile organic compounds in indoor air.

The results of this study prove that a wood by-product such as tannin is an excellent precursor for the production of model porous carbon materials that are useful for fundamental and applied studies in the fields of energy and environment.

Recycling Wood Products – It’s Easy, Right?

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Abstract

It is often quoted that wood-based products have minimal environmental impacts compared to other materials-based products because wood comes

from a renewable resource and it can be recycled at end-of-life. Although this is true, recycling wood is not as easy as many people might think. Regulations and the changing mix of wood products in current waste streams are bringing in to question the economics of recycling; what would happen to the environmental credentials of forest products if they could not be recycled?

This paper will highlight the challenges that the wood recycling sector is currently facing and the different research being conducted to resolve these challenges.

Viscoelastic Behavior of Modified Wood; Creep, Densification, Time-dependent Deformation

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Abstract

Wood modification by thermo-hydro-mechanical densification enables increase of wood density without structural fracturing of the cell walls and leads to increased mechanical properties. Physical and mechanical properties of densified wood have been studied extensively, while the time depended behavior under long term load exposure was studied to the limited extend. In construction, however, wood normally is exposed to long-term loading, which may lead to creep deformation and reduction of load-bearing capacity. The presentation will be focusing on the time-dependent deformation of densified wood under bending in various environmental conditions. Furthermore, the influence of the parameters of

the modification treatment on the creep properties of densified wood will be discussed.

Pushing the Envelope on Wood Products

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Abstract

Wood products research has entered a new golden age with a series of breakthroughs in expanding the properties of wood. This comes on the heels of advances in biotechnology, nanotechnology and new manufacturing methods relevant to woody residue transformation and processing. At the same time, demand for natural and renewable content in manufactured materials is increasing in order to lower the carbon intensity of products and meet urgent climate action goals. This talk will discuss how innovative wood products and utilization of product residues is advancing the replacement of synthetic chemicals and materials that have larger carbon footprints. The use of wood as the ultimate framework for advanced materials, the ideas of synthetic biology to transform pulp mills into chemical factories of the future, the processing of nanocellulose with 3-D printing technology, along with the careful transformation of lignin into thermoplastics and interesting carbon structures will be described in the talk.

Lignin Complexity and Flexibility: How and Why Do Grasses Produce Lignins Different from Woods?

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Abstract

Monocotyledonous grasses have evolved unique cell wall structures distinctively different from those of typical wood species, i.e., eudicots (hardwood) and gymnosperms (softwood). As a prime example, grasses produce lignins highly decorated by hydroxycinnamates (p-coumaroylates and ferulates) and flavonoid tricin units by incorporating grass-specific lignin monomers, i.e., γ-acylated monolignols and a flavone tricin, alongside canonical monolignols for cell wall lignification, which contrasts typical eudicot and gymnosperm species that utilize monolignols as sole lignin monomers. Currently, it remains largely unknown how such grass-specific lignin monomers are biosynthesized and function in grass cell walls. Moreover, how the existence of the grass-specific lignin decorations affects the utility of grass biomass remains poorly understood. In this context, our group has been investigating the biosynthesis of the grass-specific lignin monomers and exploring bioengineering approaches to produce transgenic grass plants with altered lignin decoration units. In this presentation, I will briefly summarize our recent findings regarding the biosynthesis of the lignin-associated hydroxycinnamates and flavonoid tricin in rice, a model grass species and an economically important grass crop, and structure and property characterizations of transgenic rice plants that produce cell walls lacking grass-specific lignin decorations. Deepening our understanding of the biosynthesis and properties of grass cell walls may contribute to better understanding of the nature and evolution of wood cell walls.

Biochemicals and Functional Materials from Tree Barks

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Abstract

There is a growing interest in deriving chemical products and functional materials from renewable feedstock to lower our reliance on fossil fuel while reducing environmental impact. Over the years, we have developed biorefinery pathways that can convert tree barks into a variety of bio-based adhesives, resins, polyols, and foams via extraction and chemical function-alization. By taking advantage of the distinctive properties of lignin, we have used bark-derived lignin containing nanofibril cellulose as functional materials for applications in biocomposites, energy storage devices, and gas sensors with excellent performance. An overview of these findings will be presented.

Preparation of Cellulose-based Electrospun Nanofibrous Air Filter for Efficient Particulate Matter Removal

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Abstract

Particulate matter (PM) pollution has become a global environmental issue because it poses threat to public health. To protect individuals from PM exposure, one common method is using air filters for indoor air purification.

However, conventional air filters have various drawbacks, such as high air resistance, the filters are not fabricated with environmentally friendly technology, and they cannot be easily regenerated. In this work, a new electrospun poly (vinyl alcohol) (PVA)/ cellulose nanocrystals (CNCs) composite nanofibrous filter was developed. The CNCs improved the filtration performance by increasing the surface charge density of the electrospinning suspension and thereby reducing diameter of fibers. High $PM_{2.5}$ removal efficiency was achieved (99.1%) with low pressure drop (91 Pa) at a relatively high airflow velocity (0.2 m s^{-1}), under extremely polluted condition ($PM_{2.5}$ mass concentration >500 μg m^{-3}). The integral effect of various electrospinning suspension properties on filtration performance was also investigated using response surface methodology. With a face-centered central composite design, the operating parameters for fabricating PVA/CNCs air filters were optimized, and the optimum conditions were a suspension concentration of 7.34% and a CNCs percentage of 20%. Additionally, the water-soluble PVA/CNCs composite was converted to be completely water-resistant when the electrospun material was heated at 140 ^{o}C for only 5 min. Our results revealed that increased crystallinity is the key factor for improving the aqueous stability, and CNCs provided additional nucleation sites for PVA crystallization during both electrospinning and heating process. The heated filters were effectively regenerated by water washing and the filtration performance was satisfactorily maintained. Because both PVA and CNCs are nontoxic and biodegradable, no organic solvents or crosslinking agents were used in the whole fabrication process, and the heating process is facile, the method proposed in this work for fabricating electrospun PVA/CNCs nanofibrous filters is environmentally friendly and cost-effectively.

Pinus radiata plantations grown in NZ and wood products derived from it - past, present and future

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Abstract

NZ has shown enormous success in the domestication of Pinus radiata, and it is considered as a model for other plantation species. Combination of improved breeds, silviculture strategies, and optimal site conditions, Pinus radiata plantations can yield mean annual increments of 25 m3/ha/yr, or even more, in relatively shorter rotations of 25-30 years. In addition, Pinus radiata is very pliant silviculturally and produces a versatile wood, capable of meeting a wide range of products, including appearance and structural lumber, panel products, engineered wood products and pulp and paper. However, variability, both within and between stems, coupled with a reduced rotation age and a higher proportion of juvenile wood, are challenges that the industry is facing.

Wood quality has been one of Scion's leading traditional areas of focus. As a result, it has accumulated a large amount of information on genetics, environment and silviculture (GxExS) effects on Pinus radiata wood properties, which subsequently have been incorporated into tree average wood property models (density, stiffness and spiral grain).

Traditionally, wood property measurements have focussed on average values or proportions of variation, which obscures the absolute variations that exist within stems. Scion's new tools, such as DiscBot, can characterise the realistic variability of wood properties such as density, acoustic velocity, spiral grain, and wood chemistry, within the entire stem, unlike stem aver-

age wood properties. These wood property distribution maps can be used to predict end-product properties such as stiffness, strength and stability, which are vital for structural timber, by simulation-based modelling. This approach links forest management decisions to product recovery, and can be used to determine the impact of different combinations of GxExS on end-product quality.

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