The Journey of Xylarium Bogoriense

Forest Products Research and Development Center
Research, Development and Innovation Agency
The Ministry of Environment and Forestry

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Foreword

Indonesia is rich in biodiversity, one of which is the biodiversity of wood from trees that dominantly grows in forests. It is about 4,000 tree species grow in Indonesia's tropical forests. Biodiversity must be preserved to provide sustainable natural benefits. Research, Development and Innovation Agency is one of scientific authority in the environment and forestry fields that contribute to maintaining and documenting the diversity of Indonesian tropical forest wood species exclusively only, through the Xylarium Bogoriense wood collections. Xylarium Bogoriense has been conceived since 1914. This was a smart move and an extraordinary effort considering that the old era, technology, transportation, and other facilities were not as developed as they are today. Only with a very high commitment and dedication, they can successfully collect wood species from all over Indonesia and arrange them in a wood library which recognizes as Xylarium Bogoriense.

I am proud of the action taken by forest products research and development center who were responsive to collect and reserve the Xylarium Bogoriense wood collection as invaluable assets. The wood collection is now developed by following the demands of current technology and information advancements. Various efforts and processes were carried out in a structured manner to successfully deliver Xylarium Bogoriense as the largest number of wood collections in the world. Xylarium Bogoriense has now become one of the feelings of pride of the nation and it is recognized worldwide.

On this occasion, I would especially like to thank the Minister of Environment and Forestry, Dr. Siti Nurbaya who has provided support and direction for the development of Xylarium Bogoriense and provided the opportunity to introduce Xylarium Bogoriense in the various national and international forums. I hope that the information presented in this book will provide a clear vision of the collection and could extract various benefits from Xylarium Bogoriense data and information as well as inspire others to develop another phenomenal research works.

Bogor, October 2019

Director General of Research, Development and Innovation Agency
Dr. Ir. Agus Justianto, MSc.

Foreword

For ordinary people, hearing the term 'Xylarium Bogoriense' certainly arises a series of questions. What is Xylarium? what are its benefits? How important is it? and so on. Likewise, when I initially joined the big family of Forest Products Research and Development Center, FOERDIA. As time went by, I fully realized how valuable is the Xylarium Bogoriense. It is a source of scientific references for researchers, academics, and practitioners in the field of wood science. Xylarium is an invaluable asset for storing collections and documenting the diversity of Indonesian wood species. For years, Xylarium Bogoriense has not been a priority to be developed. The number of specimens is left stagnant in the world number four with wood specimens were around 67,000 pieces. It is ironic for a country that has a large tropical forest. This condition triggered the effort decision to increase Xylarium Bogoriense wood collection to achieve the largest wood collection in the world. When determination and intention have been rolled out, there were many opportunities and supports from various stakeholders. Private and public sectors were very supportive of collecting wood to achieve the largest wood collection in the world. Last year, it has proven that positive support from various parties led Xylarium Bogoriense to be the largest number of wood collection in the world with 203,908 authentic specimens comprise of 3,668 wood species. Furthermore, the additional wood collection provides more data and information for AIKO-KLHK development by the center. AIKO-KLHK made by Forest Products and Development Center enhances wood identification time from 1–2 weeks into seconds.

The development of Xylarium Bogoriense received appreciation and support from the leadership of the Ministry of Environment and Forestry. On September 28, 2018, in Yogyakarta, the Minister of Environment and Forestry, Dr. Siti Nurbaya carved a signature on the 193-year-old Litchi chinensis piece of wood as a sign of the Number 1 wood collection in the world. Also, on the same occasion, Ir. Joko Widodo, President of the Republic of Indonesia, was pleased to attend and launch Xylarium Bogoriense together with the Forest Management Units National Festival and Forestry Business Exhibition in 2018. It was an honorable moment when the top leader of the country provides such great attention.

With all due respect, It was specifically expressed appreciation to the predecessors Mr. Oey Djoen Seng, Mr. Iding Kartasudjana, Ir. Y.I. Mandang and Dra. Sri Rulliaty who has dedicated their knowledge and thought to the end of their lives in the building and developing the Xylarium Bogoriense. The targets have been achieved and it will be a great benefit to the country and it will continuously flow to the next generation and developing science and technology, especially in the field of Wood Anatomy.

Bogor, October 2019

Director of Forest Products Research and Development Center
Dr. Ir. Dwi Sudharto, M.Si.

Overview of Xylarium Bogoriense Journey

Wood species from Indonesian forests were largely diverse constitute about 4,000 species, then authentic wood collection species are very useful to study. Since 1914, Forest Products Research and Development Center has been collected wood specimens from all around Indonesia and has initiated Xylarium Bogoriense 1914 as the wood library for major Indonesian wood species. Xylarium Bogoriense was initially constructed by Dutch researchers and officers including L.G. Den Berger, C.A. Backer, A.J. Kostermans, F.A. Endert, A. Plaas, K. Heine, and Tohrenaar who wrote the various book. Their writing is still a reference for current wood scientists. These efforts have been continually rolled out by Indonesian researchers who have dedicated themselves throughout their lives, including Iding Kartasudjana, Ir. Y.I. Mandang, and Dra. Sri Rulliaty, MSc. Furthermore, wood anatomy researchers and observers from various regions in Indonesia continued to the development of wood anatomy science by performing a scientific network of the Indonesian Wood Anatomy Association (ASAKI) in 2013.

The Xylarium Bogoriense wood specimens were collected in a unique form that is trapezoidal to facilitate observations from three sections: cross (X), radial (R), and tangential (T) sections which were arranged neatly on wooden shelves based on their families. Xylarium Bogoriense is also equipped with a sample preparation room and observation room to support the wood identification process. Also, the xylarium database, which was conventionally written, has been digitally compiled in a database system which makes it easy to find and use them as references and identification keys. Since it was built in 1914 until the beginning of 2018, the number of Xylarium Bogoriense wood specimens was 67,864, consisting of 110 families, 785 genera and 3,667 species. In 2018, the collection ranked fourth in the world after Leiden-Netherlands Xyarium (125,000 specimens), USDA Forest Product Laboratory in the USA (105,000 specimens), and the Royal Museum of Central Africa in Belgium (69,000 specimens).

Along with the rising awareness of the importance of wood collection as documentation of the Indonesian wood species diversity, the Forest Product Research and Development Center synergizes and collaborates with relevant private and public agencies in the central and regional levels to enrich the number of authentic wood specimen collections from all over Indonesia. These efforts have been shown by continuous support from various stakeholders by sending wood specimens to the center. Wood collection specimens, data, and information have brought Xylarium Bogoriense as the largest Xylaria in the world. It is the largest wood authentic collection among 184 Xylaria in 60 countries with a collection of 194,000 specimens in September 2018. Appreciations have come from various parties in Indonesia, including the Minister of Environment and Forestry and the President of the Republic of Indonesia. Great appreciation has also been conveyed by Prof. Pieter Baas, a senior wood anatomist, who currently served as the chief editor of the IAWA Journal (International Association of Wood Anatomists). As of October 2019, the Xylarium Bogoriense wood collection has reached 203,809 specimens.

Xylarium Bogoriense also collected wood specimens come from other countries totaling of 2,815 specimens from Africa, Australia, Austria, Belgium, Brazil, British Borneo, Canada, Chile, Ceylon, Cuba, England, Gabon-Gold Coast, Honduras, Indo-China, India, Japan, Kenya, Korea, Kyushu Meguro, New South Wales, South Africa, Malaysia, New Zealand, Philippines, Poland, Suriname, Sweden, Texas-USA, Taiwan, Thailand, Singapore, Pakistan, Norwegian, Queensland and Vietnam.

Throughout its journey, data and information of the wood collection in Xylarium Bogoriense has become a reference for wood identification. Accurate and valid data and information of wood species collection have led the center to be one of laboratory test for wood identification to support stakeholders include wooden based industries, entrepreneurs, academics, students, and government agencies (Forest Services, BP2HP, BKSDA, National Parks, Police, and Prosecutors' Office). The information of identified wood species is mostly inline with the information on the nature and the use of the wood.

In the future, Xylarium Bogoriense will be continuously developed in every aspect, including facilities, data and information enrichment, strengthening the system, method development, as well as creativity development in science, technology, and innovations in the field of wood anatomy and lignocellulosic materials such as rattan, bamboo, and palmae. For this aspect of utilization, Xylarium Bogoriense data and information have been used as the main basis.

AIKO-KLHK innovation is a computer vision-based wood identification system that can identify wood species in seconds using an android smartphone. Currently, AIKO-KLHK application system can recognize 823 of Indonesian traded wood species. Not only that, but AIKO-KLHK also provides a variety of information on wood quality, conservation status based on LHK, CITES and IUCN regulations, classes grouping of timber trade, and recommendations for use of wood as well as information on the origin of the geographical location of wood based on the proximity of wood anatomy features.

This book of the Xylarium Bogoriense journey is full of information and documentation of "heroic" efforts and full of the dedication of Xylarium development. Hopefully, the information in this book can deliver the information and inspire the researchers, decision-makers and related stakeholders, as well as move forward in developing Xylarium Bogoriense. We convey to all those who have contributed actively in writing the book of Xylarium Bogoriense journey. Happy reading.

Innovative regard

Bogor, October 2019

Authors

Table of Contents

1. History and Research Traces of Xylarium Bogoriense

a. History of Xylarium Bogoriense

Indonesia is a mega biodiversity country with its vast tropical forest (126 million ha) and has an abundant number of wood species (± 4.000 species). For the development of science, technology, and the documentation of Indonesian biodiversity, wood species need to be collected in the wood library (xylarium). Xylarium is a building or room where the specimen of woods is collected, registered, managed, treated and provided for various parties. The development history of Xylarium Bogoriense is divided into some important periods.

The beginning of the Xylarium and the history of wood specimens collection

The collection of wood specimens and their herbarium materials have begun since 1915 by two different type of collectors:

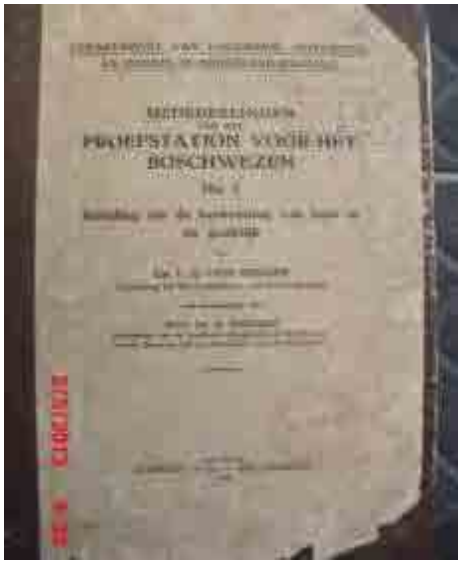
1. Researchers: L. G. Den Berger, C.A. Backer, A. J. Kostermans, F. A. Endert, A. Plaas, K. Heine, and Tohrenaar.
2. Regional forestry officials called Bosch Opzichter, Mandoor, BW [Forest Police], Commisaaris, Houtvester, Mantri, Panglong Opneemer, Panglong Opzichter, and Administrature.

Period 1920–1945 *Boschbouw Proefstation v.h. Boschwezen*

Collecting wood specimens and herbarium materials was started by "*Boschbouw Proefstation van het Boschwezen*" as a forerunner to the establishment of the Forestry Research and Development Agency, Bogor (June 23, 1915).

Several research projects that also include wood sample specimens:

- *Preanger houtsoorten* (Beekman, 1920) : **78 wood species**
- *Inleiding tot herkening van hout in de praktijk* (Den Berger, 1922)
- *Belangrijke houtsoorten van Nederlandsch-Indie* (Den Berger, 1925) : **60 wood species**
- *Houtsoorten der Culturgebieden van Java en Sumatra Oostkust* (Den Berger, 1926)
- *Determinatietabel voor houtsoorten van Malesie tot op familie of geslacht* (Den Beger, 1949)



Period 1945–1960

In this period, there was no research on wood anatomy because of the Dutch researcher Dr. Ir. L.G. Den Berger returned to his home country without any replacement.

Period 1960–1980

- Softwood identification (Soewarsono 1965): Eight important genus of softwood (Pinus, Agathis, Araucaria, Libocedrus, Dacrydium, Phylocladus, Podocarpus, dan Taxus)
- Wood anatomy of Indonesian Meranti (Saraar, 1976): Meranti (*Shorea* spp.) could be differentiated into three groups i.e. red meranti (Rubroshorea), white meranti (*Anthoshorea*), and yellow meranti (*Richetia*)
- The collection of wood samples was continued by P3HH researchers, which were carried out integrally with the material collected for research on wood basic properties.

Daun jarum wood

Kayu daun lebar

Period 1980–now

The description of 127 wood species from several regions:

- Maluku, East Kalimantan, Sulawesi, Aceh, and West Kalimantan by: Mandang *et al.* (1986–2000)
- Jambi (Mandang dan Krisdianto, 2001)
- Jawa Barat (Rulliaty, 1988), (Mandang *et al.* 2001), dan (Krisdianto, 2007)
- Hibiscus and Artocarpus (Artistien & Mandang, 2002), and Aromadendron (Mandang & Artistien, 2003)

The description of lesser-known wood timbers:

64 wood species belong to family Aceraceae, Alangiaceae, Bignoniaceae, Burceraceae, Caesalpiniaceae, Casuarinaceae, Atiscaceae, Dilleniaceae, Erythroxylaceae, Euphorbiaceae, Flacourtiaceae, Guttiferae, Icacinaceae, Juglandaceae, Meliaceae, Moraceae and Myristicaceae (Mandang, 1990–1994; Dewi 2007).

The beginning of research on the least-known timbers, the wood species that have not been covered in the book of PROSEA 5(1), 5(2), dan 5(3) which contains major commercial timbers, minor commercial timbers, and the lesser-known timbers.

b. Scientist Traces in Developing Xylarium Bogoriense

Iding Kartasudjana (Curator)

Dedicated to Forest Products R&D Center from 1955 to 1986

1. Indonesian Wood Atlas Volume I and II
2. Indonesian commercial timber, properties and its potential uses
3. Maintaining and caring wood collection
4. Applying the botanical name in the register book and wood specimens

Ir. Yance Ikwartus Mandang

The legendary Indonesian wood anatomist who served his entire career from 1977 to 2008. After his retirement, he took a Bachelor's degree in Informatics at STIKOM Binaniaga Bogor to continue digitizing Xylarium Bogoriense and determination key for wood identification. The wood identification key software has been used nationally for the process of identifying wood.

1. Indonesian Wood Atlas volume II and III
2. Finding wood species for pencil material
3. Anatomical properties of wood from several provinces (9 scientific papers)
4. Anatomical properties of lesser-known wood species from Aceraceae to Moraceae family (5 scientific papers)
5. Wood fossil from West Java (2 scientific papers)
6. Medicinal wood (4 scientific papers)
7. Digitizing xylarium databases and developing wood identification key
8. The first Indonesian researcher who first discovered and carried out research on wood fossils in Indonesia (other than Dutch and Japanese, who discovered wood fossil in Indonesia)
9. Initiated the formation of Indonesian Wood Anatomy Association (ASAKI) to complete the database of anatomical characteristics of Indonesian wood species.
10. Initiated the revision of current commercial timber classification

Dra. Sri Rulliaty, M.Sc
(Plant Anatomy Lead Researcher)

Dedicated her scientific career until the end of his life at the Forest Products R&D Center from 1982 to 2016.

1. Indonesian Wood Atlas volume IV
2. Comparative wood anatomy of *Gluta renghas* and *Melanorhoea wallichii*
3. Wood anatomy and fiber quality (5 scientific papers)
4. Wood anatomy of the least-known wood species (5 scientific papers)
5. Anatomical properties of bamboos (4 scientific papers)
6. Digitizing the Xylarium database
7. Xylarium renovation

The two previous curators who have important roles in the development of Xylarium Bogoriense:

No	Curator	Achievement
1	L.G. Den Berger 1920-1942	1) Establishing Xylarium starting from collecting wood samples from 1917 to 1926 in many regions of Java, Lampung, West Kalimantan, and East Kalimantan 2) Published 5 books on wood anatomy/identification 3) Published 2 articles on wood fossils
2	Oey Djoen Seng 1942-1960	1) Studied specific gravity of 3001 Indonesian wood species 2) Maintaining and caring wood collection 3) Implemented the revision of botanical name on register book and wood specimens

c. Xylarium Bogoriense Curator

No	Kurator	Karya
1	L.G. Den Berger 1920–1942	1. Establishing Xylarium starting from collecting wood samples between 1917-1926 from many regions in Java, Lampung, West Kalimantan dan East Kalimantan Timur 2. Published 5 books on wood anatomy and identification 3. Published 2 articles on wood fossils
2	Oey Djoen Seng 1942–1960	1. Assessed the specific gravity of 3,001 Indonesian wood species 2. Maintaining and caring wood collection 3. Applying the revision of botanical name in the register books and wood samples
3	Iding Kartasujana 1960–1988	1. Indonesian Wood Atlas Vol. 1-2 2. Indonesian commercial timbers, properties and uses 3. Maintaining and caring wood collection 4. Applying the revision of botanical name in the register books and wood samples
4	Y.I. Mandang 1988–2002	1. Indonesian Wood Atlas Vol. II-III 2. Anatomical properties of wood from several provinces in Indonesia (9 articles) 3. Anatomical properties of lesser-known timbers from Aceraceae to Moraceae (5 articles) 4. Wood fossils from West Java (2 articles) 5. Wood anatomy of medicinal wood species (4 articles) 6. Digitalized Xylarium database
5	Sri Rulliaty 2002–2016	1. Indonesian Wood Atlas Vol. IV 2. Anatomical properties of Gluta renghas and Melanorhoea wallichii 3. Wood anatomy and fiber quality (5 articles) 4. Wood anatomy of the least-known species 5. Anatomical properties of Bamboos (4 articles) 6. Digitalized Xylarium Database 7. Xylarium renovation

d. Declaration of Indonesian Wood Anatomy Association (ASAKI)

Indonesian wood anatomists from various institutions declared the Indonesian Wood Anatomy Association (ASAKI) in 2013. The declaration signed by the representative from Forest Products Research and Development Center, FORDA and several universities in Indonesia.

e. Current Curators Xylarium Bogoriense

Head of Laboratory: **Dr. Ratih Damayanti** (joined since 2007, as Head of Lignocellulose Anatomy Laboratory since 2017)

Scientists : Andianto, S.Hut. M.Si (since 2006)
Dr. Krisdianto (since 1998)
Listya Mustika Dewi, S. Hut., M.FES. (since 2011)

Technician : Tutiana (since 2004)
Maman (since 2019)

General : Ida & Romi Iskandar

Current Xylarium Bogoriense curator's achievement:

1. The book "Equivalent Timber Names in ASEAN" as collaboration result with all ASEAN countries
2. The book "Commercial Timber Classification"
3. Xylarium Bogoriense No. 1 in the world
4. Xylarium Bogoriense Rearrangement
5. The development of Automatic Wood Identification System (AIKO-KLHK)
6. Laboratory development for wood fossil sample preparation
7. Adding collections of bamboo, rattan, and palmae
8. Adding collections of lignocellulose macerated fibers
9. 3D Animated video of "The Wisdom of Tree's Life"
10. 3D Animated video "Wood Anatomy and Quality'
11. Renovation of Xylarium Bogoriense and Lignocellulose Anatomy laboratory
12. Development of an integrated database of Xylarium Bogoriense
13. Barcoding all wood specimens in Xylarium Bogoriense


PROGRAM INSENTIF RISET TERAPAN
Direktorat Jenderal Pendidikan Tinggi
Departemen Pendidikan Nasional
2009
KEHIDUPAN POHON
PENYUSUN
Ratih Damayanti
Sri Rulliaty
Jasni
NARASUMBER
Prof. Dr. Soenarto Prawirohatmodjo
Dr. Supriyanto, DEA
ANIMATOR
Yohan Pribadi
INSIGHT INDOMEDIA
DVD
DIVX


KEHIDUPAN POHON
DVD ini mengajak kita untuk mengenal dan mencintai pohon, serta menyadari bahwa pohon adalah makhluk hidup yang sangat dibutuhkan oleh semua organisme
Pusat Penelitian dan Pengembangan Keteknikan Kehutanan dan Pengolahan Hasil Hutan
Badan Litbang Kehutanan Kementrian Kehutanan
DVD
DIVX


PROGRAM INSENTIF RISTEK
Tahun 2010
RISTEK
ANATOMI DAN IDENTIFIKASI KAYU
Penyusun:
Ratih Damayanti, S.Hut, MSi
Dra. Sri Rulliaty, MSc
Prof. (Ris). Gustan Pari
Dian Anggraini Indrawan, S.Hut.MM
Tutiana
Narasumber:
Prof. Soenardi Prawirohatmodjo
Prof. I Ketut N. Pandit
Ir. Yance I. Mandang
Prof. Ibnam Wahyudi
Animator:
CV. INSIGHT INDOMEDIA
DVD
STEREO


Mempelajari Anatomi Kayu dapat memperkuat perasaan estetika karena manusia akan disadarkan adanya keberadaan struktur jaringan yang serba teratur yang dibuat Sang Pencipta, baik pada tingkatan organisme tumbuhan yang berlainan maupun korelasi yang mengagumkan antara struktur dan fungsinya sehingga menjadikan anatomi sebagai bidang penelitian yang patut dihargai
Saat ini, kegiatan yang dominan dalam ilmu anatomi tumbuhan adalah identifikasi kayu. Identifikasi kayu merupakan langkah pertama yang harus dilakukan untuk mencapai pemanfaatan kayu yang efisien. Secara ekonomi, pengetahuan ini sangat penting untuk mengenal atau mengidentifikasi jenis-jenis kayu yang digunakan dalam perdagangan, termasuk untuk menentukan nilai kayu tersebut. Ilmu anatomi juga mendukung perkembangan ilmu pengetahuan lainnya, seperti ilmu-ilmu botani, paleontologi, ethnologi, forensik, arkeologi dan juga sejarah
Permasalahannya, bagi sebagian besar mahasiswa, mata kuliah pengenalan dan identifikasi kayu masih dianggap sesuatu yang sangat rumit dan sulit dipahami, sehingga cenderung dihindari, termasuk oleh calon peneliti, calon dosen, hingga petugas pemeriksa kayu di lapangan yang secara langsung bertugas untuk melakukan identifikasi kayu. Hal ini disebabkan karena kurangnya alat peraga yang mampu mengejawantahkan wujud dan struktur kayu secara jelas, rinci dan menarik. VCD ini dibuat untuk mempermudah dalam mempelajari struktur anatomi dan identifikasi kayu
VCD 'Anatomi dan Identifikasi Kayu' ini merupakan rangkaian dari VCD seri 1 –mengenal 'Kehidupan Pohon'
Kayu Pasang
Kayu Kerung
Kayu Pulat
Kayu Jati

2. Wood Collection and Information System of Xylarium Bogoriense

a. Wood Specimen Collection up to July 2018

Xylarium Bogoriense until July 2018 has 67,864 wood collection from most regions in Indonesia which are belong to 110 family, 785 genera, and 3,667 species. The collections are in the form of a trapezoid, disk, thin slides, beams, macro slides (scrubbed small blocks), rattan and bamboo, wood fossils, and macerated fibers.

b. Specimen Collection form

Trapezoid

The trapezoid collection is a trapezoid-shaped wooden collection measuring 5x2x10 cm. Trapezoidal form is a cross-sectional representation (transversal, X), radial cross-section (radial, R), and tangential (tangential, T). Trapezoid-shaped wood collection taken from cylindrical pieces of tree trunks.

Trapezoid wood collections are given an authentic number drawn at a cross-section according to the collection number and recorded species name, family and specific gravity in the radial or tangential portion.

Trapezoid wood collection is placed in a drawer that has been divided into family groups.

Wooden disk

Wooden disk is a collection of wood cut from a tree trunk and numbered according to the trapezoid collection number.

This disk collection is an authentic collection of known species identified from the herbarium specimens. The disk collection still includes bark as a reference to the tree species.

Microscopic slides

Microscopic slide is a collection for a thin section of wood samples resulting from thin slices of wood using a microtome knife, with a thickness of 5-20 microns. The incision results that have been stained with safranin and which are not stained are glued in a glass object for observation under a microscope.

In one slide, there are three incision results, namely the cross-section (X), tangential (T) and radial (R). Microscopic slides show the microscopic characteristics of a wood species.

Macroscopic slides

Macroscopic slide is a collection of solid wood specimens that have been scrubbed so that the surface is smooth for macroscopic observation. The surface of the wood that has been scrubbed reveals a clearer macro picture so that the anatomical properties can be observed. Macroscopic scrubbing slides generally show a cross-section (X), but sometimes also other surfaces to show the characteristics of specific wood species.

Foreign wood collection

Foreign wood collection are solid wood collections from exchanges with Xylaria from other countries. Overseas wood collections are stored on separate shelves and used as a reference to identify imported wood from other countries.

The current foreign wood collection is 2,815 specimens from Africa, Australia, Austria, Belgium, Brazil, British Borneo, Canada, Chile, Ceylon, Cuba, England, Gabon-Gold coast, Honduras, Indo-China, India, Japan, Kenya, Korea, Kyushu Meguro, New South Wales, South Africa, Malaysia, New Zealand, Philippines, Poland, Suriname, Sweden, Texas, USA, Taiwan, Thailand, Singapore, Pakistan, Norway, Queensland and Vietnam.

Wooden board

Wooden board collection is a collection of solid wood sawn board shape that has been planned. The wood collection is partly taped to the wall of laboratory building and most of it is the collection of Xylarium Bogoriense.

Bamboo collection

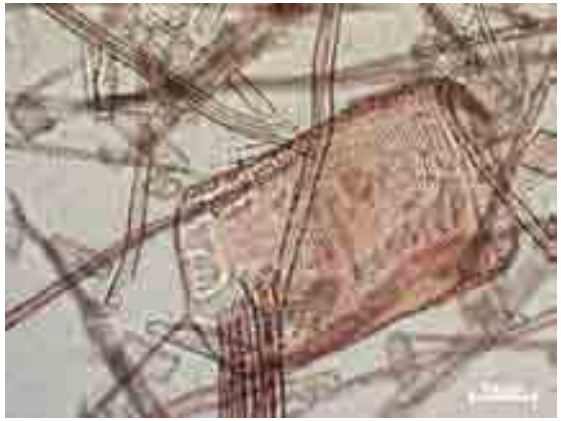
Since October 2016, the collection of bamboo and rattan has begun for the Xylarium Bogoriense collection by Dr. Ratih Damayanti. Until now, 223 specimens have been collected from 50 species of bamboo.

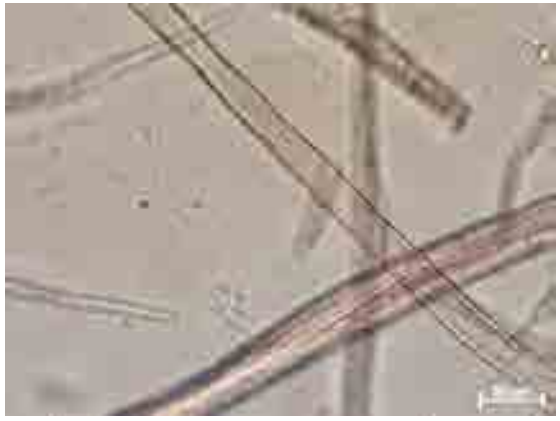
Herbarium is included in making xylarium wood collections

Wood fossil collection

Wood fossil sample preparation equipment, the modification results of Anatomy research team in 2017.

Macerated fibers collection



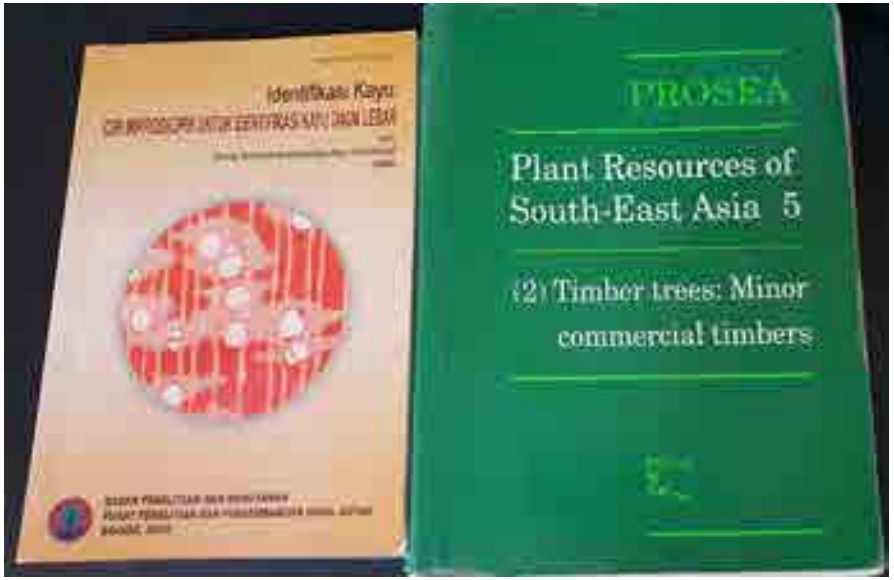


c. Preparation and Wood Sectioning Room

d. Observation Room

Reference books:

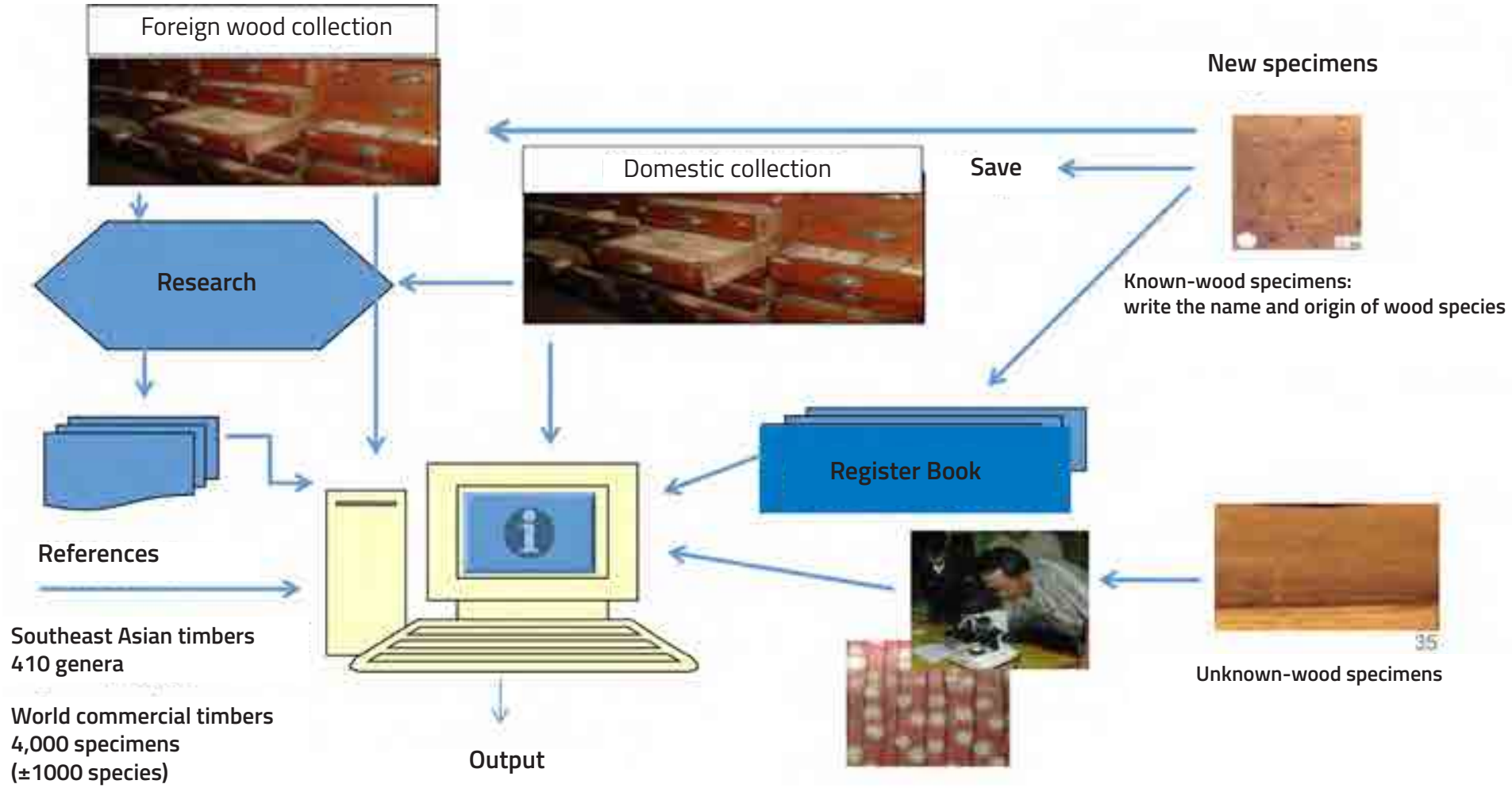
- IAWA List of Microscopic features for hardwood identification
- PROSEA 5 (1)-(3)
- Guideline for wood identification in the field
- Guideline for lesser-known wood identification



e. Wood Samples Preparation Workshop

f. Xylarium Bogoriense Information System

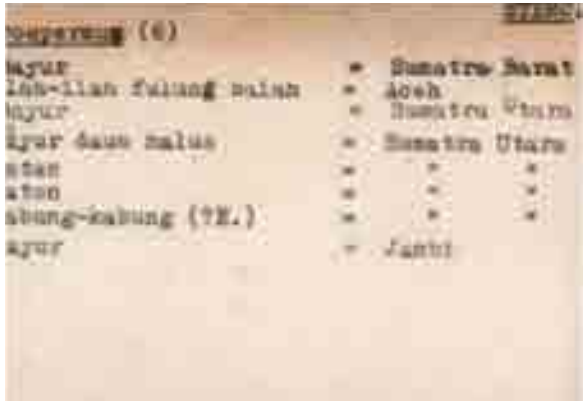
The flow of Xylarium Bogoriense Information System



Software Making Process

- The database was created using Microsoft Access 2003
- The program was written in MS Visual Basic 6

Xylarium Database – Conventional



Register book

Authentic wood collection:

- Collector
- Collection date
- Origin of the sample
- Herbarium number
- Wood collection number
- Local name
- Family
- Botanical name
- Speccific gravity
- Durability class
- Strength class

Xylarium Database – Digital

The database was re-written in 1980s

The digital database on the process of adding specimens and contributors is available at

http:/xylariumindonesia.pustekolah.org

The digital database can be accessed at

http:/xylarium.pustekolah.org/

Database Design

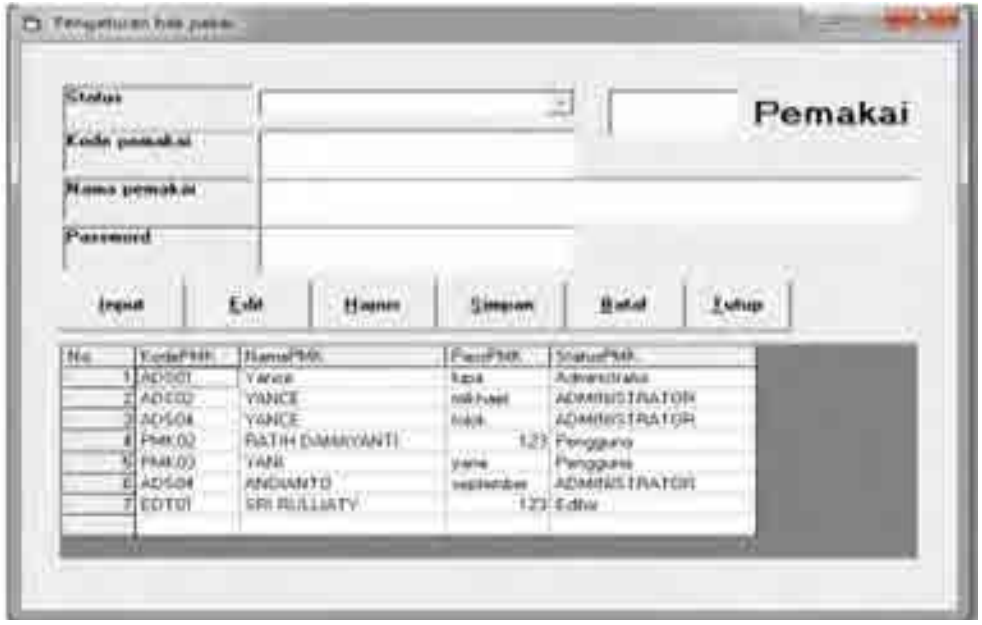
Sample address table	Domestic collection table	Foreign collection table	References table	Anatomical characteristics table
Collection number	Collection name	Sender	Author	ID
Scientific name	Herbarium name	Country origin	Year	Scientific name
Family	Local name	Sample number 1	Title	Anatomical characteristics
Drawer number	Scientific name	Sample number 2	Keywords	Author
Sample condition/form	Family	Scientific name	Media	Reference
	Origin of the sample	Family		Macroscopic image
	Collector			
	Collection date			

Data Collection

No	Software tools	Data resources	Entry number
1	Identification of South-east Asian timber	PROSEA Books, Indonesian Wood Atlas	410 genera
2	Identification of world commercial timber	Oxford (Wilkins,AP. 1967)	4000 specimens
3	Data tracking of storage address of wood collection	Xylarium Bogoriense	39162+
4	Data tracking of domestic wood collection	Xylarium Bogoriense wood collection register	39162+
5	Data tracking of foreign wood collection	Xylarium Bogoriense wood collection register	3000
6	Data tracking of wood anatomy references	IAWA Journal	1091+unlimited


SISTEM INFORMASI XYLARIUM BOGORIENSE


Kelola Data Kayu Asia Tenggara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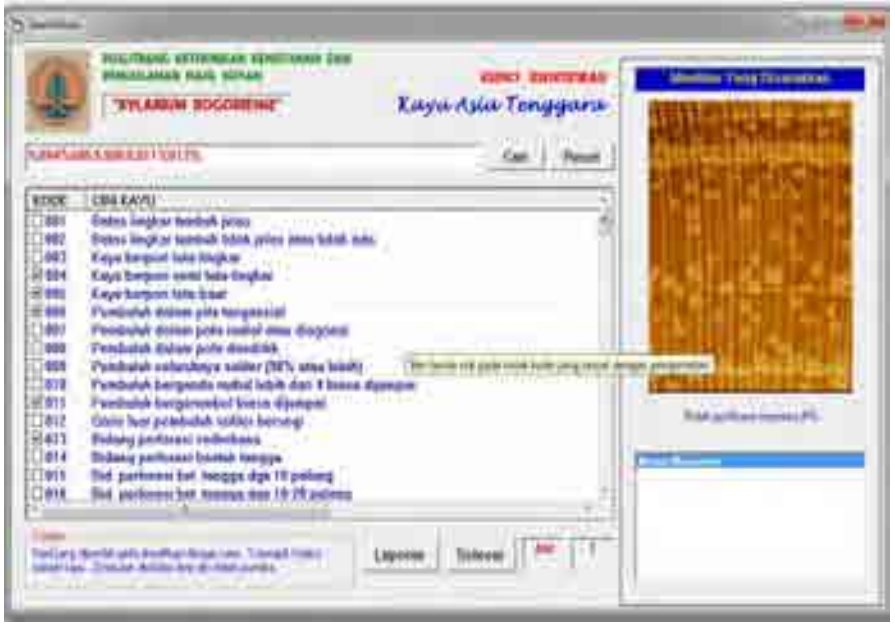
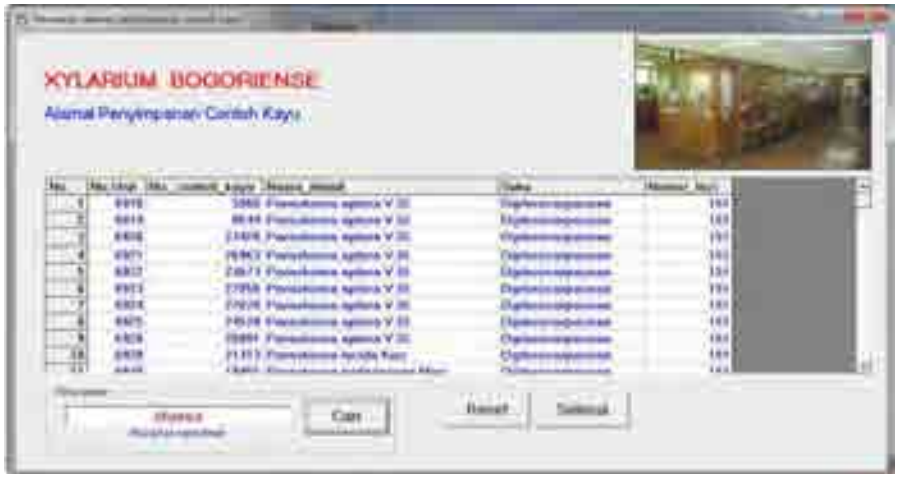
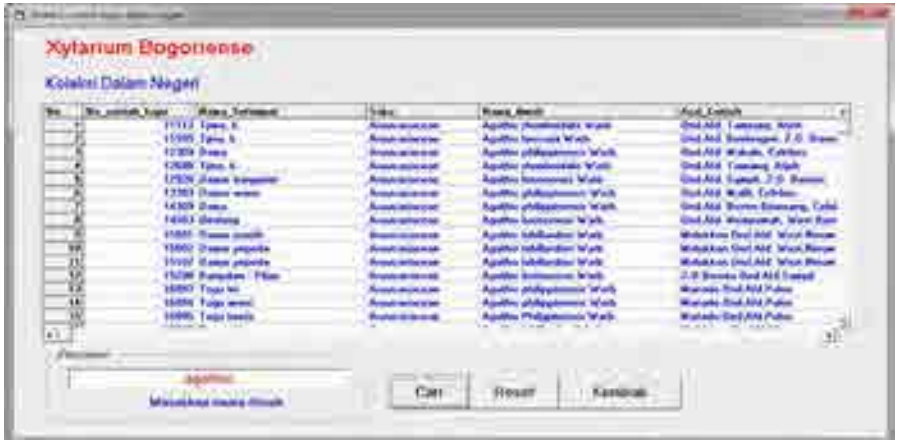
Hapus
Simpan
Batal
Tutup


Kayu Asia Tenggara


XYLARIUM BOGORIENSE
Alamat Penyimpanan Contoh Kayu
Cari
Reset


XYLARIUM BOGORIENSE
Koleksi Luar Negeri
Cari
Reset
Kembali


Xylarium Bogoriense
Koleksi Dalam Negeri
Cari
Reset
Kembali


XYLARIUM BOGORIENSE
Pustaka Anatomi Tumbuhan
Cari
Reset
Kembali

3. Towards Xylarium Number One in The World

a. Global Xylaria

Xylarium Bogoriense has been listed in the Xylariorum index, Institutional wood collection of the world since Edition I (1957), Edition II (1967), Edition III (1988) to Edition IV (2010). Xylarium Bogoriense has also been recorded in the 2006 Indonesian Herbariorum Index where most of the collections contained pairs of herbarium material which are stored and maintained by the Department of Botany, Forest Research Center in Bogor. Each sample of wood is recorded in the book register. The information recorded includes the collection number (wood sample number), accompanying herbarium number, origin of the sample, local name, botanical name, ethnicity, collector's name, and collection date.

Global Xylaria

No	Country	Xylaria
1	Brasil	18
2	Germany	9
3	UK	9
4	USA	18
5	China	7
6	The Neherland	7
7	Australia	6
8	Japan	5
9	India	4
10	Canada	3
11	Malaysia	3
12	Indonesia	1
13	Phillipine	1

Global Xylaria: 177 Xylarium in 60 Countries

Map

In July 2018, Xylarium Bogoriense wood collection was counted 67,864 specimens from almost all regions in Indonesia which are grouped into 110 families, 785 genera, and 3,667 species. In 2018, Indonesia was still ranked 4th in the world after Leiden-the Netherlands with 125,000 specimens, USDA's Forest Product Laboratory in the USA as many as 105,000 specimens and The Royal Museum of Central Africa in Belgium as many as 69,000 specimens.

b. Process to Become Number One

The process towards number 1 in the world was pursued through coordination and holding a Forum Group Discussion (FGD). It was emphasized the importance of Xylaria wood collection and the spirit of nationalism to carve out history as well the existence of the nation globally. Intensive FGD and socialization were conducted in various regions in Indonesia such as in Medan, Bogor, Pekanbaru, Tarakan, Samarinda, Pontianak, Makassar, Palangkaraya, Surabaya, Bandung, and Semarang. The socialization involved forestry services, tertiary institutions, wood industry associations, Forest Concession, Forest Plantation Industries, and Working Units of the Ministry of Environment and Forestry in the regions.

Sosialization

Presentation of AIKO-KLHK and Xylarium Bogoriense in front of the Minister of Environment and Forestry during her working visit to BP2LHK Manado Manado, January 11, 2018

The Minister strongly supports the efforts to develop the Automatic Wood Identification Tools and encourages the addition of wood species data from all over Indonesia to strengthen the wood database.

FGD on the draft regulation and Non Tax Government Income (PNBP) mechanism and the strategy of wood collection addition Bogor, 19 March and 23 July 2018

The FGD was attended by the Director of Industrial Technology Development, The Ministry of Research and High Education, the Director of Contribution and Distribution of Forest Products, Director General of Sustainable Forest Management, The Ministry of Environment and Forestry, Informatics Research Center-Indonesia Institute of Sciences, Legal Bureau of the Ministry of Environment and Forestry, Head of Legal Subdivision and Organization of FOERDIA Secretariat.

Discussion with Director General of Sustainable Forest Management, The Ministry of Environment and Forestry

Jakarta, 1 August 2018

Director-General of Sustainable Forest Management provided official support on wood collection by publishing circulated letters to forest concession, forest management unit and associations.

Discussion with the Director of Industrial Technology Development of Kemenristekdikti Serpong, 3 August 2018

Discussion with the Director of Industrial Technology Development, Kemenristekdikti and Xylarium Bogoriense representatives concluded that there will be plan for a joint hearing with Director General of Research and Development to obtain official support from the Ministry of Research, Technology and Higher Education on August 16, 2018. The discussion decided that there will be strategic actions as follows: the socialization and development plan of Xylarium Bogoriense to became number one in the world No. 1 World; Launching automatic wood identification tools on September 23, 2018 at the FMU Festival in Yogyakarta; and the possibility to attract Mr. President who will attend the event to launch the Xylarium Bogoriense and Automatic Wood Identification System. It was then counting down to the targeted date.

Discussion with Forest Concession Company Association (APHI)

Jakarta, 10 August 2018

It was declared that APHI will be one of the users of the Automatic Wood Identification System. APHI strongly supports the development of Xylarium Bogoriense wood specimen collections as a basis for developing automatic wood identification system. The Automatic Wood Identification System will be useful for field officer in determining the wood species to enhance the validity of documents.

Discussion with Director General of Strengthening Research and Development, The Ministry of Research Technology and Higher Education Jakarta, 16 August 2018

A letter of support was issued from the Director-General of Research and Development of the Ministry of Research, Technology and Higher Education to the Chancellor of all Higher Education Institutions in Indonesia who have faculties/departments/forestry study programs to involve students in collecting wood collections for Xylarium Indonesia and may build Xylarium in each University.

Safari socialization and support for the development of Xylarium Bogoriense wood specimens were carried out in various regions in Indonesia.

Medan, 21 August 2018

Bogor, 28 August 2018

Pekanbaru, 29 August 2018

Makassar, 3 September 2018

Pontianak, 4 September 2018

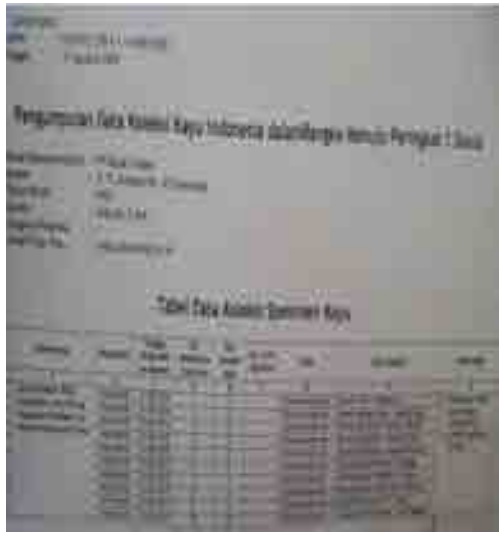
Samarinda, 4 September 2018

Palangkaraya, 4 September 2018

Tarakan, 4 September 2018

Forest Services and Perhutani (Government Enterprises) of East Jawa, Central Jawa and West Jawa 10–14 September 2018

Wood collection



PT Ratah Timber

Inhutani Enterprise

PT Erna Djuliawati

Riau University

East Jawa Forest Services

PT Meranti Sakti Indonesia

Tadulako University

The List of Wood Specimen Addition since 3rd August 2018

No	Wood Samples Sources	Specimen
1	UPT KPH Wilayah VII Gunung Tuan Sumatera Utara	29
2	PT Inhutani IV Unit Sumatera Utara	35
3	Inhutani IV Pekanbaru Riau	62
4	Dinas Kehutanan UPT Kesatuan Pengelolaan Hutan Wilayah III Provinsi Sumatera Utara	141
5	PT Ratah Timber	100
6	UPT KPH Wilayah XVI Gunung Sitoli	92
7	UPT KPH Wilayah I Stabat Sumatera utara	112
8	PT Musi Hutan Persada Sumatera Selatan	550
9	UPT KPH Wilayah V Labuhan Batu Sumatera Utara	121
10	UPT KPH Wilayah X Padangsidampuan Sumatera Utara	104
11	Universitas Riau Kampus Bina Widya Kota Pekanbaru	3
12	UPT KPH Wilayah XI Sumatera Utara	125
13	Balai Litbang LHK Makasar	14
14	PT Meranti Sakti Indonesia Tarakan Kalimantan Utara	504
15	UPT KPH Wilayah II Pematang Siantar Sumatera Utara	100
16	PT Toba Pulp Lestari	120
17	KPH Wilayah XII Tarutung Tapanuli Utara Sumatera Utara	20
18	UPT KPH Wilayah XIII Doloksanggul Sumatera Utara	123
19	UPT KPH Wilayah XIV Sidikalang Sumatera Utara	51
20	Kementerian Pertanian Badan Karantina Pertanian Kelas II Palu	1430
21	Balai Litbang LHK Banjar Baru Kalimantan Selatan	130
22	PT Intraca Hutan Lestari Kalimantan Utara	36

No	Wood Samples Sources	Specimen
23	PT Inhutani I Industri Juata Wilayah Tarakan	132
24	UPT KPH Wilayah IX Panyabungan Mandailingnatal Sumatera Utara	96
25	PT Sarmiento Parakantja Timber Kalimantan tengah	156
26	PT Inhutani I Wilayah Tarakan	179
27	PT Inhutani I UMH Meraang Kalimantan Timur	207
28	Universitas Pattimura Fakultas Pertanian Jurusan Kehutanan Ambon	201
29	Fakultas Kehutanan Universitas Tanjungpura Pontianak	49
30	PT Intracawood mfg Menteng Jakarta Pusat	91
31	PT Inhutani I Wilayah Tarakan VI	205
32	PT Inhutani I Labanan UMH Tepian Buah	81
33	PT Yotefa Sarana Timber Teluk Bintuni Papua Barat	112
34	KPH Bandung Selatan BKPH Gunung Halu	65
35	KPH Bandung Selatan BKPH Banjaran	130
36	KPH Bandung Selatan BKPH Tambagruyung Timur	152
37	KPH Bandung Selatan BKPH Ciwidey	122
38	KPH Bandung Selatan BKPH Pangalengan	159
39	KPH Bandung Selatan BKPH Ciparay	115
40	KPH Bandung Selatan BKPH Rajamandala	150
41	PT Gruti Medan	1000
42	PT Inhutani I Wilayah Tarakan IV	199
43	PT Inhutani I Wilayah Tarakan V	171
44	PT Inhutani I Unit Sambarata	465

No	Wood Samples Sources	Specimen
45	Puslitbang Hutan Penelitian Pasir Awi	844
46	Puslitbang Hutan Penelitian Pasir Hantap	942
47	Puslitbang Hutan Penelitian KHDTK Haurbentes	525
48	Puslitbang Hutan Penelitian KHDTK Cikampek	836
49	Puslitbang Hutan Penelitian Dramaga	900
50	BPPLHK Manado	556
51	PT ITCI Kayan Hutani Kalimantan Utara	350
52	PT Kayan Makmur Sejahtera Kalimantan Utara	464
53	PT Inhutani I Wilayah Tarakan III	220
54	BPHP Wilayah I Banda Aceh	400
55	PT Bumi Andalas Permai Palembang Sumatera Selatan	112
56	PT Trisetia Intiga (Korindo) Pangkalanbun Kalimantan Tengah	508
57	PT Hutani I Kalimantan Abadi Permai Tarakan Kalimantan Utara	396
58	Perum Perhutani Jawa Barat dan Banten BKPH Tasikmalaya KPH Tasikmalaya RPH Cineam, RPH Cisayong	1000
59	BPPLHK Palembang	1269
60	PT Wirakarya Sakti Sinarmas Forestry Kota Jambi	15
61	KPH Indramayu	1017
62	BPPTP DAS Solo	1021
63	Perhutani Majalengka	1016
64	HPH Dwima Grup Palangkaraya Kalimantan Tengah (PT Dwimajaya Utama, Hutan Mulya, Kayu Waja, Carus Indonesia, Hutan Domas Raya, Sikatan Wana Raya, Fitamaya Asmafara, Graha Sentosa Permai dan PT Piranti Utama)	71

No	Wood Samples Sources	Specimen
65	PT Sinar Belantara Indah Pekanbaru	8
66	Dinas Kehutanan UPT KPH Kerinci Unit I Provinsi Jambi	6
67	Dinas Kehutanan UPT KPH Wilayah IV Sumatera Utara	6
68	PT Adimitra Lestari Samarinda Kalimantan Timur	750
69	BPPLHK Palembang	288
70	PT Erna Djuliawati Kabupaten Seruyan Provinsi kalimantan Tengah	88
71	BPPLHK Aeknauli Sumatera Utara	1000
72	PT Anugrah Rimba Makmur Medan Sumatera Utara	1000
73	Perum Perhutani KPH Banten BKPH Bayah, Sobang, Cikeusik	731
74	PT Surya Hutani Jaya Samarinda Utara Kalimantan Timur	36
75	PT Widya Artha Perdana Berau Kalimantan Timur	528
76	PT Sari Bumi Kusuma Kalimantan Tengah	650
77	Dishut Jatim No 17	210
78	Dishut Jatim No 60 Usman Malangkab	75
79	Dishut Jatim No 60 PT Mustika Bahana Jaya	100
80	Dishut Jatim No 78 UD Sumber Urif	100
81	Dishut Jatim No 78 Pardat Jaya	75
82	Dishut Jatim No 78 UD Jati Murni	26
83	Dishut Jatim N0 33	216
84	Dishut Jatim No 27	192
85	Dishut Jatim No 62 PT Mustika Bahana Jaya	140
86	Dishut Jatim No 62 UD Jaya Fatoni	127
87	Dishut Jatim No 73 UD Mahkota	52

No	Wood Samples Sources	Specimen
88	Dishut Jatim No 73 Jata Mulyo 60	60
89	Dishut Jatim No 73 UD Mekar Jaya	102
90	Dishut Jatim No 113	94
91	Dishut Jatim No 109	200
92	Dishut Jatim No 120	110
93	Dishut Jatim No 26 PT Mahakam Mandiri Makmur	50
94	Dishut Jatim No 26 PT Dwi Rimba Agung	65
95	Dishut Jatim No 26 PT Sinar Kayu Abadi	25
96	Dishut Jatim No 26 RBL	27
97	Dishut Jatim No 83 PT Plywood Kayu Lestari	51
98	Dishut Jatim No 83 Jaya Pinus	52
99	Dishut Jatim No 83 CV Jago Marsani	58
100	Dishut Jatim No 100	80
101	Dishut Jatim No 31	196
102	Dishut jatim No 46 Bangkalan	194
103	Dishut Jatim No 69	200
104	Dishut Jatim No 85 UD Mundi Karya	50
105	Dishut Jatim No 85 UD Handoyo	132
106	Dishut Jatim No 101 (PT Sumber Graha 57, PT Sumber Layu 25, Pengrajin Doni 25)	107
107	Dishut Jatim 103 KJ NGW	100
108	Dishut Jatim No 25 PT Alas Petaka Makmur	211
109	Dishut jatim No 81 UD Suwito	183
110	Dishut Jatim No 81 Enggal Jaya	80
111	Dishut Jatim No 89	257

No	Wood Samples Sources	Specimen
112	Dishut Jatim No 07	237
113	Dishut Jatim No 30 PT Kayu Multiguna Indonesia (KMI) Gresik	185
114	Dishut Jatim No 97 PT Multi Manao Indonesia	50
115	Dishut Jatim No 97 PT Wijaya Perkasa indah	100
116	Dishut Jatim No 116	66
117	Dishut Jatim No 88 PT Alam inrotama	100
118	Dishut Jatim No 55 ITJ Dampit Malang	131
119	Dishut Jatim No 63	250
120	Dishut Jatim No 23 Royal Jaya	146
121	Dishut Jatim No 38 Banyuwangi (Perusahaan Kayu Mas 27, CV Sumber Alam 84, UD Melati 128)	239
122	Dishut Jatim No 112	100
123	Dishut Jatim No 108	100
124	Dishut Jatim No 119	101
125	Dishut Jatim No 87 CV Purba	75
126	Dishut Jatim No 19 Bojonegoro	172
127	Dishut Jatim No 64 CV Mirai dan UD Kama Jaya	230
128	Dishut Jatim No 45 IIC	234
129	Dishut Jatim No 06	131
130	Dishut Jatim No 123	97
131	Dishut Jatim No 42 (CV S Kayu 25, PT Aneka Timber Forture 48, CV Maju jaya 125)	198
132	Dishut Jatim No 94 Karya Putra	196
133	Dishut Jatim No 125 Adiguna	94

No	Wood Samples Sources	Specimen
134	Dishut Jatim No 86 (UD Dafa Putra 102, PT Alam Inrotama 50, UD Rimba Jati 49)	201
135	Dishut Jatim No 98 (PT Serba Guna Prima 25, PGM Banjarejo 25, Doni Kayu Pengrajin 23)	73
136	Dishut Jatim 115	75
137	Dishut Jatim 122 (Sulastri NGW, Yusuf NGW, PT Perhutani Wahana Industri 21)	71
138	Dishut Jatim No 106 (PT Sumber Graha 45, PT Jati Mulyo 28)	73
139	Dishut Jatim No 129 (X 60, PT Gloster Furniture 26, CV Kartika Graha 25)	111
140	Dishut Jatim No 53 RDM Malangkab	199
141	Dishut Jatim No 111 (PK HC NGW 25, UD Utama NGW 25, UD JA NGW 25, CV Dwi Arta NGW 25)	100
142	Dishut jatim No 49 UD Makmur Jaya Kabupaten Sampang	195
143	Dishut Jatim No 52 UD Mebel Mapan Kabupaten Sumenep	225
144	Dishut Jatim No 52 UD Melisa Kabupaten Pamekasan	100
145	Dishut Jatim No 20 Tohi Tindo	225
146	Dishut Jatim No 105 (SAA NGW 75, KJ NGW 25)	100
147	Dishut Jatim No 34 PT KJP	175
148	Dishut Jatim No 121 UD Ragam Karya	100
149	Dishut Jatim No 11	245
150	Dishut Jatim No 46 (PT Timber Kreasi 126, UD Mutiara Indah Kabupaten Pamekasan 25, UD Jati Indah Kabupaten Pamekasan)	176
151	Dishut Jatim No 22 (CSG 122, Intertren 90)	212
152	Dishut Jatim No 44 CV Wana Gemilang 30, CV Jasa Mitra 52, Rimba Kusuma 29, PT Surya 25, PT Java tectona 77)	213
153	Dishut Jatim No 28 (Prima Jaya 50, PT Sentosa kayu Indah 50, PT Tulus Tri Tunggal Gresik 70, X 75)	245
154	Dishut Jatim No 50 (UD Al barokah 100, UD Makmur Jaya 103)	203
155	Dishut Jatim 117 SKN MGT	100
156	Dishut Jatim No 124 (LMJ 51, Sengon Indah Jaya 46)	97
157	Dishut Jatim No 114 PT WCN	122
158	Dishut Jatim No 107 (UD Dwi Jati 55, Sengon Indah Jaya 48, X 123)	226
159	Dishut Jatim No 51 UD Jaya Bersama Kabupaten Sumenep	196
160	Dishut Jatim No 82 UD Zalzabilla 126 dan UD Budi Karya 79	205
161	Dishut Jatim No 91 (UD Sumber Urif 67, Fajar Jaya 56, Karya Putra 75)	173
162	PT Jati dharma Indah Plywood Industri Nabarua Nabire Papua	26
163	Dishut Jatim No 21 Malindo 33, Evolindo 27 , Surya Intan Mandiri 54	114
164	Dishut Jatim No 29 KMI 157, Multi Guna 58	215
165	Dishut Jatim No 65	198
166	Dishut jatim No 76 Muhamad Sowami 100, Koerodin 98	198
167	Dishut Jatim No 48 IIC	206
168	Dishut Jatim No 61 PT Mustika Bahana Jaya	210
169	Dishut Jatim No 08	250
170	Dishut Jatim No 59 Ponco Kusumo malangkab	202
171	Dishut Jatim No 54 RDM 130, BKJ 48	177

No	Wood Samples Sources	Specimen
172	Dishut Jatim No 71 (CV Sumber Pinus 25, CV Jati Makmur 50, Yoga Manunggal jati 45, UD Linda Jaya 54, UD Kembang Jaya 25	199
173	Dishut Jatim No 95 (Jati unggul 41, Karya Putra 150	191
174	Dishut Jatim No 04	210
175	Dishut Jatim No 98 UD Duta Jaya	200
176	Dishut Jatim No 35 SMP 50, SMIP 75, Iguana 50	175
177	Dishut Jatim No 09	250
178	Dishut Jatim No 66 PT WCN, CV Amanah, UD Sumber Agung	204
179	Dishut Jatim No 110	198
180	Dishut Jatim No 13	398
181	Dishut Jatim No 02	205
182	Dishut Jatim No 68 UD Hasil Rimba 81, Mukti Makmur 54	135
183	Dishut Jatim No 70 PT Kediri Wood Industri 157, PT Wono Jati Wijoyo 50	202
184	Dishut Jatim No 41 PT Jamrud MJ 50, PT Berau 50, PD Wono Agung 54, CV Sumber Makmur 30	184
185	Dishut Jatim No 03	172
186	Dishut Jatim No 32 KMIN	212
187	Dishut Jatim No 57 ALS Lawang Malangkab	177
188	Dishut Jatim No 74 UD Sumber Urif 95, Fajar Jaya 116	211
189	Dishut Jatim No 37 UD Jati Lulus 75, CV Wisma Jaya 50, CV Anugerah 24, Indah Karya 25	203
190	Dishut Jatim No 15 PWI	311
191	Dishut Jatim No 79 UD Jati Karya 119, UD Rimba Jati 76	195
192	Dishut Jatim No 118 UD Ragam Karya 207	207

No	Wood Samples Sources	Specimen
193	Dishut Jatim No 16 PWI	286
194	Dishut Jatim No 67 CV Mira Alam 70, PT Mustika Bahana 60, CV Sylva Agro 25	110
195	Dishut Jatim No 77 CV Jati Indah 75, CV Cahaya Gemilang 46, Jati Sari 60	182
196	Dishut Jatim No 75 UD Sumber Urif 55, UD Sumber Reteka 50, UD Wahyu Abadi 113	218
197	Dishut Jatim No 40 PT Bina Satria 85, PT Sejahtera Usaha Bersama 124	209
198	Dishut Jatim No 104 UD Jati Luhur 26, UD Marga Jati 28, UD Tri Rejeki 50, UD Selendang 25, UD Sinar Jepara 53	182
199	Dishut Jatim No 80 UD Purnama Jati 77, UD Bahagia 85	162
200	Dishut Jatim No 10	248
201	Dishut Jatim No 12 syamsul	138
202	Dishut Jatim No 102 PT Kaya Raya 96, UD Budi Karya 52, Vano Jaya Abadi 31	179
203	Dishut Jatim No 96 Jati Purnama 75, UD Suwito 54, CV Jati Makmur 50, PT Serbaguna 25	204
204	Dishut Jatim No 93 PT SMS	168
205	Dishut Jatim No 72 UD Jati Diri 104, Muhamad Sowami 50, UD Nizam Putra 58	212
206	Dishut Jatim No 18 SRP	211
207	Dishut Jatim No 99 Nugraha Fancy 51, UD Nikita Jaya 172	223
208	Dishut Jatim No 43 DCS 100, CV Cahaya Mulya 25, DIF 75	200
209	Dishut Jatim No 56 JYW 50, BRK 100	150
210	Dishut Jatim No 58 BSW 100, TJY 100	200
211	Dishut Jatim No 14 KHM 200, KWO 100	300

No	Wood Samples Sources	Specimen
212	Dishut Jatim No 24 CV Dwi Arta Berjaya 27, PT Gema Lestari Indonesia 25, CV Cipta Karya 50, PT Moulding Utama Semesta 25, PT Idub Sufi Wahyu Abadi 25, PT Agung Kharisma Jaya Abadi 25	202
213	Dishut Jatim No 92 PT Profil Indah Kharisma 100, PT Sinar Mas Arta Raya Terang 100	200
214	Dishut Jatim No 39 UD Sentral	186
215	Dishut Jatim No 84 CV Purbha	225
216	Dishut Jatim No 36 CV Indo Raya 50, PT Web 50, PT APL 100	200
217	Dishut Jatim No 47 IIC 196, UD Jaya Bersama 50	246
218	Dishut Jatim No 05	210
219	Balai Litbang LHK Makasar	476
220	Perum Perhutani KPH Kendal	840
221	Balai Litbang LHK Manokwari	120
222	Balai Penelitian dan Pengembangan Teknologi Hasil Hutan Bukan Kayu Lombok Barat	789
223	KPH Kendal RPH Jati Sari BKPH Subah	165
224	Pekalongan Barat Slawi	1182
225	Pekalongan Barat KPH Balapulang	427
226	Balai Litbang Teknologi Perbenihan Tanaman Hutan Bogor	1000
227	Fakultas Pertanian Universitas Riau Jurusan Kehutanan Berdasarkan No Karung 1-47	4536
228	Perhutani KPH Bogor BKPH Bogor	250
229	Perhutani KPH Bogor BKPH Jasinga-Leuwiliang	249
230	Perhutani KPH Bogor BKPH Parung Panjang	250
231	Perhutani KPH Bogor BKPH Jonggol	250
232	BPPLHK Aeknauli Sumatera Utara	1004
233	ITB Kampus Jatinangor	3
234	Perum Perhutani Jawa Tengah dan Timur KPH Blora 3 (BLR)	350
235	Perum Perhutani Jawa Tengah dan Timur KPH Jember 1 (JBR)	358
236	Perum Perhutani Jawa Tengah dan Timur KPH Jatirogo 4 (JTR)	282
237	Perum Perhutani Jawa Tengah dan Timur KPH Bondowoso 1 (BWO)	347
238	Perum Perhutani Jawa Tengah dan Timur KPH Jatirogo 3 (JTR)	227
239	Perum Perhutani Jawa Tengah dan Timur KPH Banyuwangi Barat 2 (BWB)	300
240	Perum Perhutani Jawa Tengah dan Timur KPH Jatirogo 2 (JTR)	383
241	Perum Perhutani Jawa Tengah dan Timur KPH Semarang 2 (SMG)	321
242	Perum Perhutani Jawa Tengah dan Timur KPH Probolinggo 2 (PBO)	356
243	Perum Perhutani Jawa Tengah dan Timur KPH Banyuwangi Utara 2 (BWU)	350
244	Perum Perhutani Jawa Tengah dan Timur KPH Banyuwangi Utara 3 (BWU)	335
245	Perum Perhutani Jawa Tengah dan Timur KPH Nganjuk 3 (NGJ)	230
246	Perum Perhutani Jawa Tengah dan Timur KPH Tuban (TBN)	70
247	Perum Perhutani Jawa Tengah dan Timur KPH Banyuwangi Selatan 2 (BWS)	312
248	Perum Perhutani Jawa Tengah dan Timur KPH Tuban 1 (TBN)	344

No	Wood Samples Sources	Specimen
249	Perum Perhutani Jawa Tengah dan Timur KPH Bojonegoro 3 (BJN)	400
250	Perum Perhutani Jawa Tengah dan Timur KPH Banyuwangi Selatan 3 (BWS)	106
251	Perum Perhutani Jawa Tengah dan Timur KPH Gundih	269
252	Perum Perhutani Jawa Tengah dan Timur KPH Lawu DS 1	418
253	Perum Perhutani Jawa Tengah dan Timur KPH Balapulang 3 (BLP)	350
254	Perum Perhutani Jawa Tengah dan Timur KPH Padangan 1 (PDG)	172
255	Perum Perhutani Jawa Tengah dan Timur KPH Banyuwangi Barat 3 (BWB)	255
256	Perum Perhutani Jawa Tengah dan Timur Puslitbang Cepu 3	220
257	Perum Perhutani Jawa Tengah dan Timur KPH Nganjuk 1 (NGJ)	361
258	Perum Perhutani Jawa Tengah dan Timur KPH Jember 2 (JBR)	250
259	Perum Perhutani Jawa Tengah dan Timur KPH Purwadadi 5	30
260	Perum Perhutani Jawa Tengah dan Timur Puslitbang cepu	300
261	Perum Perhutani Jawa Tengah dan Timur KPH Blora 2 (BLR)	355
262	Perum Perhutani Jawa Tengah dan Timur KPH Tuban 2 (TBN)	309
263	Perum Perhutani Jawa Tengah dan Timur KPH Telawa 2 (TLW)	335
264	Perum Perhutani Puslitbang Cepu 2	258
265	Perum Perhutani Jawa Tengah dan Timur KPH Pati 3 (PTI)	300
266	Perum Perhutani Jawa Tengah dan Timur KPH Kedu Selatan 1 (KDS)	345
267	Perum Perhutani Jawa Tengah dan Timur KPH Mojokerto 3 (MJK)	356
268	Perum Perhutani Jawa Tengah dan Timur KPH Gundih 2 (GDH)	296
269	Perum Perhutani Jawa Tengah dan Timur KPH Semarang 1 (SMG)	253
270	Perum Perhutani Jawa Tengah dan Timur KPH Parengan 5 (PRG)	83
271	Perum Perhutani Jawa Tengah dan Timur Puslitbang Cepu 1	153
272	Perum Perhutani Jawa Tengah dan Timur KPH Banyuwangi Utara 1 (BWU)	354
273	Perum Perhutani Jawa Tengah dan Timur KPH Gundih 1 (GDH)	359
274	Perum Perhutani Jawa Tengah dan Timur KPH parengan 7 (PRG)	102
275	Perum Perhutani Jawa Tengah dan Timur KPH Kedu Selatan 3 (KDS)	304
276	Perum Perhutani Jawa Tengah dan Timur KPH Madiun 2 (MDN)	328
277	Perum Perhutani Jawa Tengah dan Timur KPH Blora 1 (BLR)	352
278	Perum Perhutani Jawa Tengah dan Timur KPH Bojonegoro 2 (BJN)	218
279	Perum Perhutani Jawa Tengah dan Timur KPH Probolinggo 3 (PBO)	170
280	Perum Perhutani Jawa Tengah dan Timur KPH Kedu Selatan 2 (KDS)	377
281	Perum Perhutani Jawa Tengah dan Timur PHT PLB Dikarung	115

No	Wood Samples Sources	Specimen
282	Perum Perhutani Jawa Tengah dan Timur KPH Randublatung 6 (RBT)	50
283	Perum Perhutani Jawa Tengah dan Timur KPH Cepu 3 (CPU)	390
284	Perum Perhutani Jawa Tengah dan Timur KPH Saradan 1 (SRD)	284
285	Perum Perhutani Jawa Tengah dan Timur KPH Cepu 2 (CPU)	320
286	Perum Perhutani Jawa Tengah dan Timur KPH Madiun 3 (MDN)	375
287	Perum Perhutani Jawa Tengah dan Timur KPH Pekalongan Barat 2 (PKB)	343
288	Perum Perhutani Jawa tengah dan Timur KPH Telawa 3 (TLW)	338
289	Perum Perhutani Jawa Tengah dan Timur KPH Pati 1 (PTI)	350
290	Perum Perhutani Jawa tengah dan Timur KPH Jati Rogo 1 (JTR)	302
291	Perum Perhutani Jawa Tengah dan Timur KPH Banyuwangi Selatan 3 (BWS)	347
292	Perum Perhutani Jawa Tengah dan Timur KPH Saradan 3 (SRD)	237
293	Perum perhutani Jawa Tengah dan Timur KPH Cepu	277
294	Perum Perhutani Jawa Tengah dan Timur KPH Pekalongan Barat 3 (PKB)	314
295	Perum Perhutani Jawa Tengah dan Timur KPH Saradan 2 (SRD)	279
296	Perum Perhutani Jawa Tengah dan Timur KPH Banyumas Timur 1 (BYT)	96
297	Perum Perhutani Jawa Tengah dan Timur KPH Padangan 3 (PDG)	321

No	Wood Samples Sources	Specimen
298	Perum Perhutani Jawa Tengah dan Timur KPH Parengan 4 (PRG)	48
299	Perum Perhutani Jawa Tengah dan Timur KPH Kebonharjo 1 (KBH)	283
300	Perum Perhutani Jawa tengah dan Timur KPH Mojokerto 1 (MJK)	327
301	Perum Perhutani Jawa Tengah dan Timur KPH Blitar 2 (BLT)	61
302	Perum Perhutani Jawa Tengah dan Timur KPH Randublatung 7 (RDB)	84
303	Perum perhutani Jawa Tengah dan Timur KPH Randublatung 8 (RDB)	52
304	Perum Perhutani Jawa Tengah dan Timur KPH Jember 3 (JBR)	371
305	Perum Perhutani Jawa Tengah dan Timur KPH Padangan (PDG)	160
306	Perum Perhutani jawa Tengah dan Timur KPH Padangan 4 (PDG)	427
307	Perum Perhutani Jawa Tengah dan Timur KPH Probolinggo 1 (PBO)	464
308	PT Salaki Summa Sejahtera Padang	502
309	Balitbang THH Bukan Kayu Lombok Barat NTB	259
310	Perum Perhutani Puslitbang Cepu 4	80
311	Perum Perhutani Jawa Tengah dan Timur KPH Lawu DS 2 (LWU)	419
312	Perum Perhutani Jawa Tengah dan Timur PHT SMG	107
313	Perum Perhutani Jawa Tengah dan Timur KPH Bondowoso 3 (BWO)	121

No	Wood Samples Sources	Specimen
314	Perum Perhutani Jawa Tengah dan Timur KPH Padangan 2 (PDG)	314
315	Perum Perhutani Jawa Tengah dan Timur KPH Pasuruan 3	275
316	Perum Perhutani Jawa Tengah dan Timur KPH Lawu DS	139
317	Perum Perhutani Jawa Tengah dan Timur KPH Tuban (TBN)	74
318	Perum Perhutani Jawa Tengah dan Timur KPH BWS	24
319	Perum Perhutani Jawa Tengah dan Timur KPH Pasuruan 4	207
320	Perum Perhutani Jawa Tengah dan Timur KPH Pasuruan 5	147
321	Perum Perhutani Jawa Tengah dan Timur KPH Pasuaruan 1	148
322	Perum Perhutani Jawa Tengah dan Timur KPH Madiun 4 (MDN)	275
323	Perum Perhutani Jawa Tengah dan Timur KPH Madiun1 (MDN)	180
324	Perum Perhutani Jawa Tengah dan Timur KPH Pasuruan 2	76
325	Perum Perhutani Jawa Tengah dan Timur KPH Tuban 4	47
326	Perum Perhutani Jawa Tengah dan Timur KPH Blitar 3 (BLT)	97
327	Perum Perhutani Jawa Tengah dan Timur KPH Saradan (SRD)	208
328	Perum Perhutani Jawa Tengah dan Timur KPH Parengan (PRG)	14
329	Perum Perhutani Jawa Tengah dan Timur KPH Jember (JBR)	33
330	Perum Perhutani Jawa Tengah dan Timur KPH Pasuruan 1	158
331	Perum Perhutani Jawa Tengah dan Timur KPH Blitar 1 (BLT)	92
332	Perum Perhutani Jawa Tengah dan Timur KPH Nganjuk 2 (NGJ)	411
333	Balai Litbang LHK Makasar (MKS)	272

No	Wood Samples Sources	Specimen
334	PT Inhutani IV Unit Sumatera utara Aceh	17
335	Tim Xylarium Siantar Fakultas Pertanian Universitas Simalungan Pematang Siantar	15
336	Dr. Eng. Hotmatua Daulay (Direktur PPTI Kemenristekdikti)	10
337	CV Makmur Jaya Tasik Malaya	6
338	Papua	557
339	Perhutani Parengan	348
340	Dishut Jatim (PHPL) di Jakarta	3
341	Supartini, S.Hut. M.Sc (Balai Besar Litbang Ekosistem Hutan Dipterocarpaceae, Samarinda)	3
342	Perum Perhutani KPH Kedu Selatan 2	338
343	Balai Litbang Perbenihan Tanaman Hutan Bogor	1500
344	KPH Sukabumi BKPH Jampang Kulon	100
345	KPH Sukabumi BKPH Cikawang	301
346	KPH Sukabumi BKPH Sagaranten	299
347	KPH Sukabumi BKPH Lengkong	300
348	KPH Ciamis RPH Gadung	1098
349	KPH Kuningan BKPH Luragung	1048
350	KPH Garut	738
351	BPPTA	129
352	PT Riau Andalas Pulp and Paper Pangkalan Kerinci Pekanbaru	563
353	KPH Purwakarta RPH Kutapohaci	770
354	PT Telaga Bakti PSD	7
355	BKPH Pamanukan RPH Tegal Tangkil	150

No	Wood Samples Sources	Specimen
356	KPH Purwakarta RPH	1034
357	KPH Garut	246
358	BKPH Cikiong	352
359	BKPH Sadang	230
360	BPPTA	418
361	BKPH Kali Jati	238
362	RPH Tegal Tangkil BKPH Pamanukan	90
363	KPH Balangket PKPH Subang	220
364	BKPH Pangkalan	52
365	TPK	51
366	BKPH Sumedang	666
367	BKPH Garut	356
368	BKPH Bogor	1265
369	BKPH Cianjur	538
370	MEC	7
371	PT Inhutani I BKPH Batu Mentawir	9
372	KPH Banten	51
373	KPH Pekalongan	72
374	KPH Sumedang	216
375	RPH Banas Banten BKPH Congcang	36
376	PT Sarjatim KPH Kalteng	6
377	PT Ernadjuliawati Kabupaten Seruyan BKPH Kalteng	369
378	PT Inhutani I KPH Gowa	30
379	KPH Bandung Selatan	119
380	Dishut Jatim	23
381	RPH Ciboleng KPH Pekalongan	281
382	BPPATK	187
383	KPH Balitbang Riau	5
384	Persatim KPH Kalimantan Tengah	18
385	Fakultas Riau	722
386	KPH Samarinda	175
387	Balai Penelitian Kupang KPH Nusa Tenggara Timur	107
388	KPH Pekalongan	565
389	RPH Cimanggu BKPH Tambangruyung Timur KPH Bandung Selatan	30
390	Balai Penelitian Kupang KPH Nusa Tenggara Timur	199
391	KPH Banten RPH Lebak	105
392	BKPH Sukadagara Selatan KPH Cianjur RPH Takadak	403
393	KPH Pelita	107
394	Jamaludin KPH Jambi	63
395	PT Sarminto Prakansa KPH Kalimantan Tengah	23
396	KHDK Cikampek	36
397	Balai Penelitian Palu	21
398	KPH UNB	6
399	KPH Kayu Rakyat	430
400	PT Teluk Nauli KPH Sibolga	998
401	Supartini, S.Hut. M.Sc (Balai Besar Litbang Ekosistem Hutan Dipterocarpaceae, Samarinda)	462
402	KPH Randublatung RPH Jawa Tengah	563
403	Dr. Ir. Dwi Sudharto, M.Si. (Kapus Litbang Hasil Hutan)	3
Total		105984

Species Verification and Numbering of Incoming Wood Specimen

Wood specimens came into Forest Products Research and Development Center

Wood specimens were arranged in transition rack for fumigation

Wood specimens were ready for data and species verification

Coding of wood specimen

Numbering, verification, and grouping of incoming wood specimens








c. Mangunan Declaration

Declaration of Xylarium Bogoriense as the largest wood collection in the world by the Minister of Environment and Forestry, Dr. Siti Nurbaya on 28 September 2018.

The declaration was held in front of the President of Republic of Indonesia Ir. Joko Widodo in Mangunan Yogyakarta.

At the time of Mangunan Declaration, the number of specimens in Xylarium Bogoriense was 193,395 specimens. In December 2019, the wood collection increased to 203,908 specimens which are consist of 2,815 overseas collections, 98,600 old collections, and 102,493 new collections (wooden block and disk). These numbers belong to 110 family, 785 genera, and 3,668 species.

XYLARIUM BOGORIENSE PERINGKAT NO 1 DI DUNIA

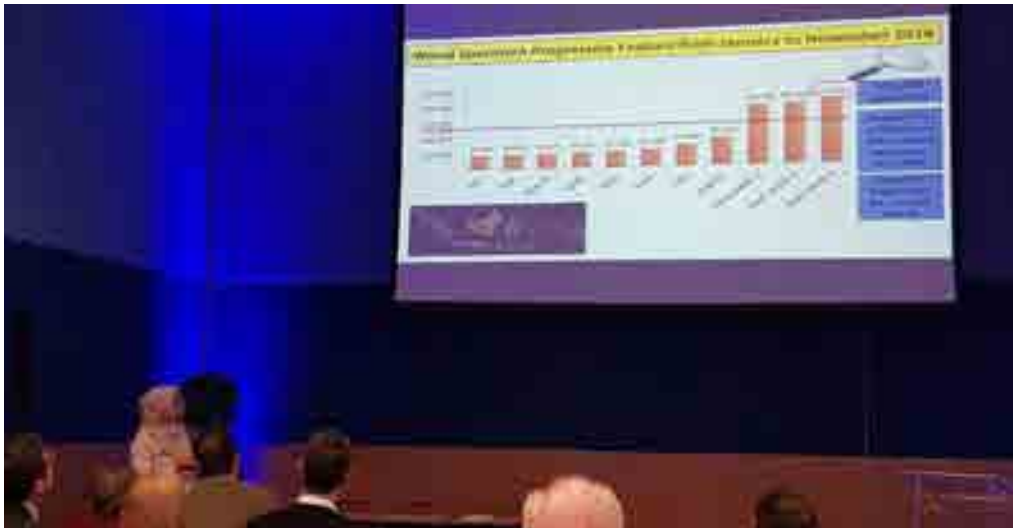
(177 XYLARIUM DI 60 NEGARA)

Prof. Pieter Baas – Senior Wood Anatomist – Chief Editor IAWA (International Association of Wood Anatomists) Journal saat menyampaikan ucapan selamat kepada Xylarium Bogoriense

Transition wooden rack for incoming wood specimens from place of origin for fumigation and verification

Xylarium Bogoriense was promoted as the number 1 xylaria in the world in Indonesian Pavilion, COP 24, Katowice, Poland, 3 December 2018

Xylarium Bogoriense was promoted as the largest xylaria in the world in IUFRO Internasional Conference, Curitiba, Brasil, 30 September 2019



d. Current Recognition

Xylarium Bogoriense's achievements to become No. 1 in the world has pushed the increasing number of national and international visits, including the opening of opportunities for cooperation. Visits came from various countries such as Korea (Yeungnam University), Japan (Kyoto University), India, Sweden, USA (USFS), Africa, and Sweden (Swedish University of Agricultural Science). Some initiation collaboration came from Indonesian Custom, Informatics Research Center of Indonesian Institute of Sciences, RISH-Kyoto University, and USAID for the development of Xyalrium Bogoriense and Wood Identification Systems.

第391回生存圏シンポジウム
木の文化と科学18
東アジアにおける
木材研究･材鑑調査室の現状
日時：2019年2月21日（木）
場所：京都大学楽友会館
（京都市左京区吉田二本松町）
木の文化と科学 XVIII
本シンポジウムでは中国・インドネシアの若手の木材研究者の中でも近年活躍されている女性研究者たちから、"東アジアにおける木材研究の現状"や、"各国の材鑑調査室の現状"などについて講演いただきます。
14:10～14:50
Dr. Juan Guo
(Research Institute of Wood Industry, Chinese Academy of Forestry, China)
"Wood Collection of Chinese Academy of Forestry: Overview of Wood Identification and Cell Wall Structures in the past 10 years"
14:50～15:30
Dr. Zhai Shengcheng
(College of Materials Science and Engineering, Nanjing Forestry University, China)
"Establish a mutual promotion system of wood market based on xylarium -- a case of xylarium development in Nanjing Forestry University"
15:30～16:10
Dr. Ratih Damayanti
(Forest Products Research and Development Center Ministry of Environment and Forestry, Indonesia)
"Indonesian ligno-cellulose collection 'Xylarium Bogoriense': Conserving the bio-diversities through research and development
16:20～16:50
パネルディスカッション
「女性研究者の現状とこれから」
司会　恒次祐子先生（東京大学）
聴講無料
問合せ先：京都大学 生存圏研究所 バイオマス形態情報分野
0774-38-3634
lbmi-sympo@rish.kyoto-u.ac.jp

4. Xylarium Bogoriense: Roles and Benefits

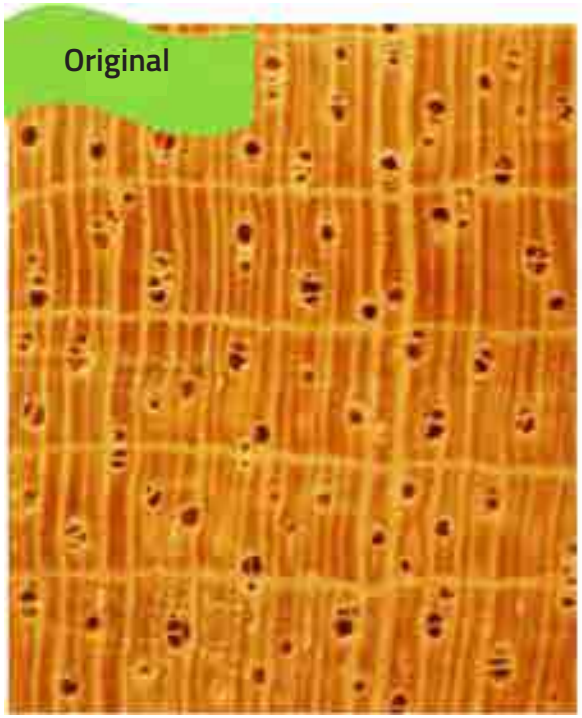
- Material reference for timber identification, law enforcement, customs, wood industry, practitioners and academics.
- As supporting research: DNA species, nanostructure, bioactive content, nano-cellulose, paleobotany, development of automatic wood identification tools.
- Sources of information on local names, scientific names, species diversity, and distribution of wood species.
- Integrated of wood image data from various regions in Indonesia that can be a reference in the collection and mapping of wood species in Indonesia to support the development of science and technology and commercial interests.
- Developed of a cloud-based database of macro anatomical structure image of Indonesian timber (Ligno-Indo).

a. Wood Identification Reference

Industry: Each wood species of wood has a different character, so the correct wood identification will give appropriate processing methods information including for workmanship, drying, and preservation.



Health: To anticipate fake raw materials so health benefits more optimum



Pasak bumi

Bidara laut

Paleobotany: To identify fossil wood and analysis of current and past plant distribution

One of the fossil wood samples which displayed in Manggala Wanabakti Forestry Museum area

Identification of Fossil wood from the Cemoro River - Sragen Regency, Central Java (Andianto, Lelana dan Ismanto, 2010)

Bulkhead fiber is a special characteristic that is only owned by the species of *Gluta wallichii* (Hook.f.) Ding Hou in *Anacardiaceae*

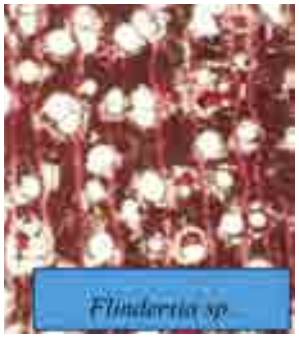
Wood Fossil specimen from Jambi

Wood fosil of *Dryobalanoxylon* sp.

Archaeology : To Identify wood species that used in ancient objects (boats and ancient buildings), restoration of a wooden structure building that requires same wood species.

Wood identification of an ancient boat in Bojonegoro in 2005 (Mandang dan Martono, 2007)

- The Boat body is made from teak wood but the peg is made of fine guava (*Flindersia* sp. -Rubiaceae).
- South east Celebes (Muna): The teak and guava growing in the same place (area).
- This boat Allegedly has sailed across the Sulawesi sea, down Bengawan Solo river then sank in Bojonegoro. The ship sank due to boat damage (use of wood species for peg which is wrong and not durable).



Bio-Forensic : Tracking the wood origin, preventing illegal timber trade

Petugas Kantor Pelayanan Utama Bea dan Cukai Tipe A Tanjung Priok mendata muatan 15 kontainer kayu jenis sonokeling dan eboni di Pelabuhan Tanjung Priok, Jakarta, Jumat (11/1). Kayu-kayu tersebut akan diekspor ke China oleh PT AFI. Ekspor ini diduga melanggar aturan kepabeanan. Potensi kerugian negara akibat kegiatan ini sebesar Rp 16 miliar.

Wood Identification Testing As a Service to Community

Wood Identification Testing is the first service that have an accreditation in Indonesia for ISO/IEC 17025: 2008.

SERTIFIKAT AKREDITASI

LP-410-IDN

Pusat Penelitian dan Pengembangan Hasil Hutan

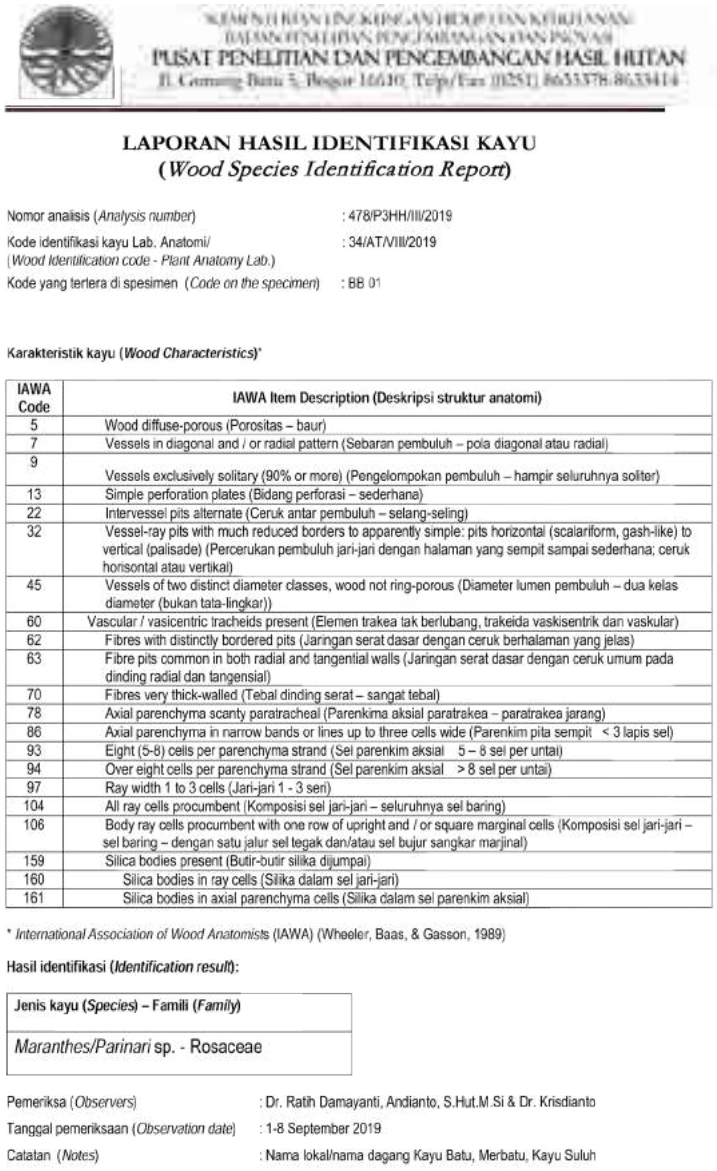
Jl. Gunung Batu No. 5, Bogor 16610, Jawa Barat

LABORATORIUM PENGUJI

SNI ISO/IEC 17025:2008 (ISO/IEC 17025:2005)
Persyaratan Umum Untuk Kompetensi Laboratorium Pengujian dan Laboratorium Kalibrasi

Komite Akreditasi Nasional

Prof. Dr. Bambang Prasetya
Ketua



PUSAT PENELITIAN DAN PENGEMBANGAN HASIL HUTAN

LAPORAN HASIL IDENTIFIKASI KAYU
(*Wood Species Identification Report*)

Nomor analisis (*Analysis number*) : 478/P3HH/III/2019
Kode identifikasi kayu Lab. Anatomi/ (*Wood Identification code - Plant Anatomy Lab.*) : 34/AT/VIII/2019
Kode yang tertera di spesimen (*Code on the specimen*) : BB 01

Karakteristik kayu (***Wood Characteristics***)*

IAWA Code	IAWA Item Description (Deskripsi struktur anatomi)
5	Wood diffuse-porous (Porositas – baur)
7	Vessels in diagonal and / or radial pattern (Sebaran pembuluh – pola diagonal atau radial)
9	Vessels exclusively solitary (90% or more) (Pengelompokan pembuluh – hampir seluruhnya soliter)
13	Simple perforation plates (Bidang perforasi – sederhana)
22	Intervessel pits alternate (Ceruk antar pembuluh – selang-seling)
32	Vessel-ray pits with much reduced borders to apparently simple: pits horizontal (scalariform, gash-like) to vertical (palisade) (Percerukan pembuluh jari-jari dengan halaman yang sempit sampai sederhana; ceruk horisontal atau vertikal)
45	Vessels of two distinct diameter classes, wood not ring-porous (Diameter lumen pembuluh – dua kelas diameter (bukan tata-lingkar))
60	Vascular / vasicentric tracheids present (Elemen trakea lak berlubang, trakeida vaskisentrik dan vaskular)
62	Fibres with distinctly bordered pits (Jaringan serat dasar dengan ceruk berhalaman yang jelas)
63	Fibre pits common in both radial and tangential walls (Jaringan serat dasar dengan ceruk umum pada dinding radial dan tangensial)
70	Fibres very thick-walled (Tebal dinding serat – sangat tebal)
78	Axial parenchyma scanty paratracheal (Parenkima aksial paratrakea – paratrakea jarang)
86	Axial parenchyma in narrow bands or lines up to three cells wide (Parenkim pita sempit < 3 lapis sel)
93	Eight (5-8) cells per parenchyma strand (Sel parenkim aksial 5 – 8 sel per untai)
94	Over eight cells per parenchyma strand (Sel parenkim aksial > 8 sel per untai)
97	Ray width 1 to 3 cells (Jari-jari 1 - 3 seri)
104	All ray cells procumbent (Komposisi sel jari-jari – seluruhnya sel baring)
106	Body ray cells procumbent with one row of upright and / or square marginal cells (Komposisi sel jari-jari – sel baring – dengan satu jalur sel tegak dan/atau sel bujur sangkar marjinal)
159	Silica bodies present (Butir-butir silika dijumpai)
160	Silica bodies in ray cells (Silika dalam sel jari-jari)
161	Silica bodies in axial parenchyma cells (Silika dalam sel parenkim aksial)

* *International Association of Wood Anatomists* (IAWA) (Wheeler, Baas, & Gasson, 1989)

Hasil identifikasi (***Identification result***):

Jenis kayu (*Species*) – Famili (*Family*)
Maranthes/Parinari sp. - Rosaceae

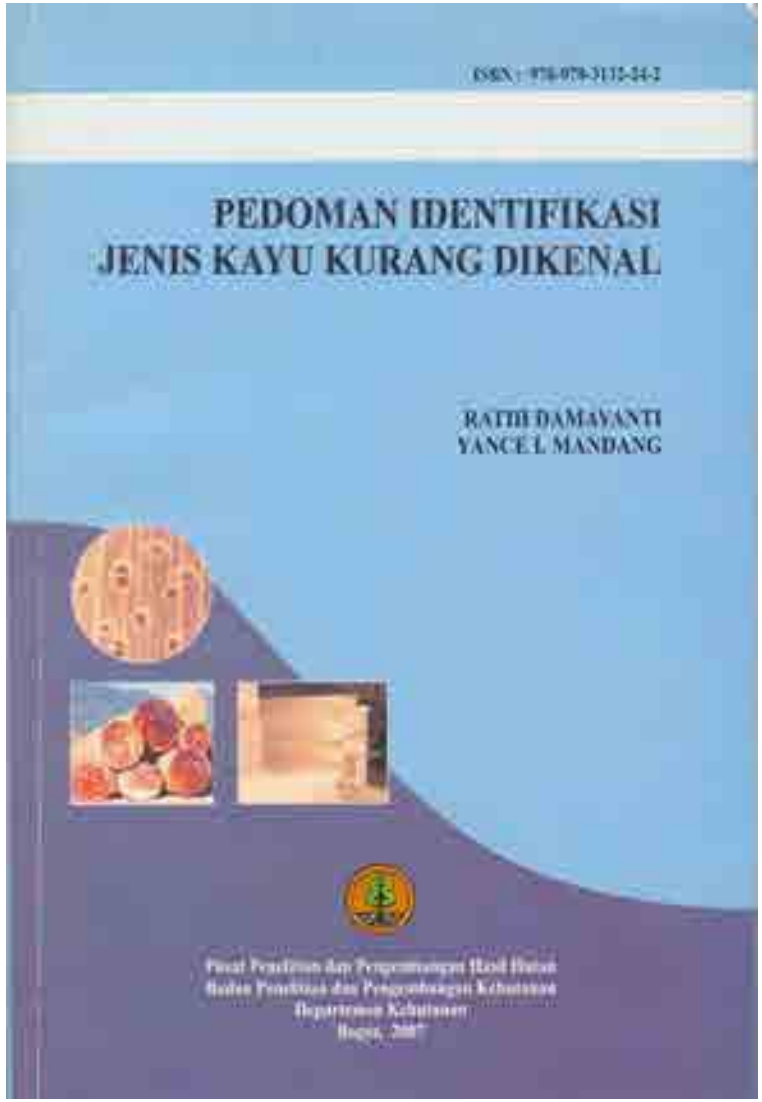
Pemeriksa (*Observers*) : Dr. Ratih Damayanti, Andianto, S.Hut.M.Si & Dr. Krisdianto
Tanggal pemeriksaan (*Observation date*) : 1-8 September 2019
Catatan (*Notes*) : Nama lokal/nama dagang Kayu Batu, Merbatu, Kayu Suluh

Hasil identifikasi kayu hanya berlaku untuk sampel uji yang telah diamati di laboratorium.

Wood Species Identification Service

The iIdentification of wood species is carried out by standard procedures based such as making and observing wood preparations then compare the wood characteristics of unknown wood species by wood that has known its botanical name. Currently, the identification process is assisted by using a computer that allows the wood identification system to be carried out more quickly and accurately.

Forestry : Supports the development of science and technology, supports studies on the quality and use of wood, references for students, industry, customs, and officers in the field, grouping of Indonesian trade timber for determining trade wood tax.



b. Resolving Legal Cases

- Smuggling log sonokeling and Ebony through the Port of Tanjung Priok.
- The smuggling of ramin and other wood species listed in CITES, among other "pacar" wood from Central Sulawesi.
- The use of wood species that are not according to specifications by construction companies.
- Timber theft in the Salak-Halimun National Park.
- The diversity of fossil wood in the western part of Java during the Pliocene period.
- Wood identification of an ancient boat from border of Bengawan Solo river, Bojonegoro, East Java.
- The case of supplying fishing boats in Wakatobi in the year 2017.
- Illegal logging in TN. Meru Betiri in 2019.

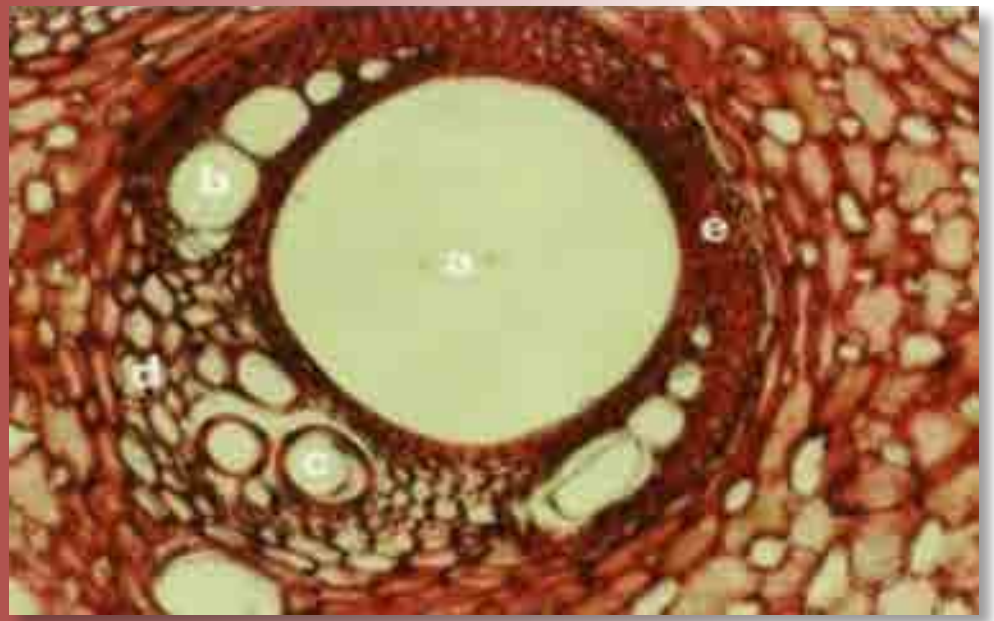
c. Wood Anatomical Structures for Batik Pattern

Koompassia excelsa,
***Dendrocalamus* sp.,**
Michelia alba

d. Xylarium Bogoriense for Research

Anatomical research activities (wood, rattan and bamboo) as data input to the xylarium information system

- The Base Characteristic and Use of Wood Origin Papua
- The Base Characteristic and Use of Wood Origin Kalimantan
- The Base Characteristic and Use of Wood Origin Sumatera
- The Base Characteristic and Use of Wood Origin Jawa
- The Base Characteristic and Use of Rattan
- The Base Characteristic and Use of Bamboo



e. Anatomical Properties of Bamboo and Rattan

- Anatomical description of 8 species of bamboo by Rulliaty (2003-2011) namely *Bambusa vulgaris Schrad*, *Gigantochloa atter*, *B. maculata*, *G. atriviolacea*, *G. apus*, *G. pseudoarundinacea*
- Rulliaty et al (2012) have also researched on *Gigantochloa robusta* and *Dendrocalamus asper*
- Anatomical description of rattan is carried out on the species of *Calamus manan*, *C. scipionum*, *C. caesius* and *Daemonorops crinatus* (Rulliaty, 1996).
- Rattan: epidermis, basis parenchyma and several vascular bundles. Vessel bonding: metaxylem (a), phloem (b), protoxylem (c), axial parenchyma (d), and file fibers (e)

f. Xylarium Bogoriense for Timber Trade Classification

Classification in SK 163/2003

- In 1950-1970: 400 species of timber were traded as trade wood and rise nearly tripled in 2016 (1,044 species according to the License Information Unit Database).
- The classification of commercial wood as the basis for implementing of forestry tax is regulated by Minister of Forestry Decree No. 163 / Kpts-II / 2003
- The Classification of Wood Species as the Basis for Imposition Forestry Taxes; but only accommodates 121 commercial timber groups which include 186 species/genus. Some weaknesses have been identified in this decree.
- New criteria are needed to enable the classification of currently traded timber and for all wood in general.
- The assessment was carried out on wood specimens in the 1915 Xylarium Bogoriense collection.

Group of Shorea (Commercial 1):
31 member of commercial wood)

***Agathis* sp.**

Group of Mixture (Commercial 2):
55 member of commercial wood)

***Pterospermum* sp.**

Group of Ebony (Fancy 1):
3 member of commercial wood)

***Diospyros* sp.**

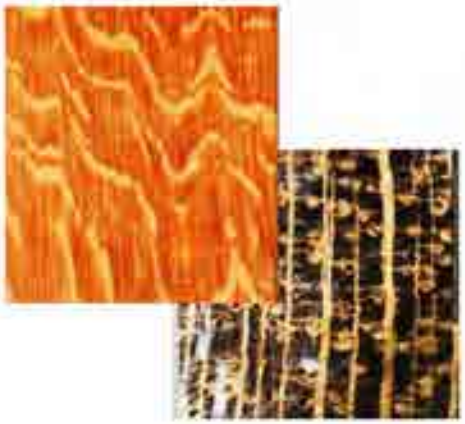
Group of Fancy Wood (Fancy 2):
32 member of commercial wood)

Sendok-sendok

No	Commercial Class	Number of Species	%
1	Class of Fancy Commercial 1	40	5
2	Class of Fancy Commercial 2	320	39
3	Class of Commercial 1	53	6
4	Class of Commercial 2	208	25
5	Class of Commercial 3	202	25
	Total	823	100

Wood Species Sample of Fancy Commercial I

Ulin
(*Eusideroxylon zwageri* Teijsm. & Binn end.)



Ringgit dareh (*Carallia borneensis*)
Oliver Syn (*Carallia brachiata*)

Eboni bergaris
(*Diospyros celebica* Bakh.)

Wood Species Sample of Fancy Commercial II

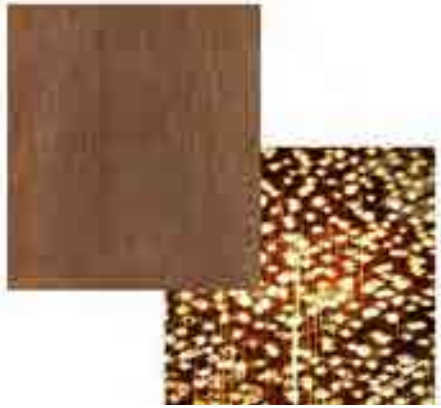
Kempas
(*Koompassia malaccensis* Maing.ex.Benth.)

Bedaru
(*Calophyllum dasypodum* Miq.)

Cempaka
(*Michelia champaga* Linn.)

Wood Species Sample of Commercial I

Babi kurus
(*Crudiari picolade* Witt.)



Balau
(*Shorea atrinervosa* Sym.)

Bangkirai tanduk
(*Hopea dyeri* Heim.)

Wood Species Sample of Commercial II

Durian
(*Durio griffithii* (Masters) Bakh.)

Hatikakatu
(*Diospyros papuana* Valetonex Bakh.)

Katuko
(*Parashorea lucida* (Miq.) Kurz)

Wood Species Sample of Commercial III

Arang-arang
(*Diospyros siamang* Bakh.)

Balamijuk
(*Diospyros hasseltii* Zoll.)

Gadeper
(*Mangifera gedebe* Miq.)

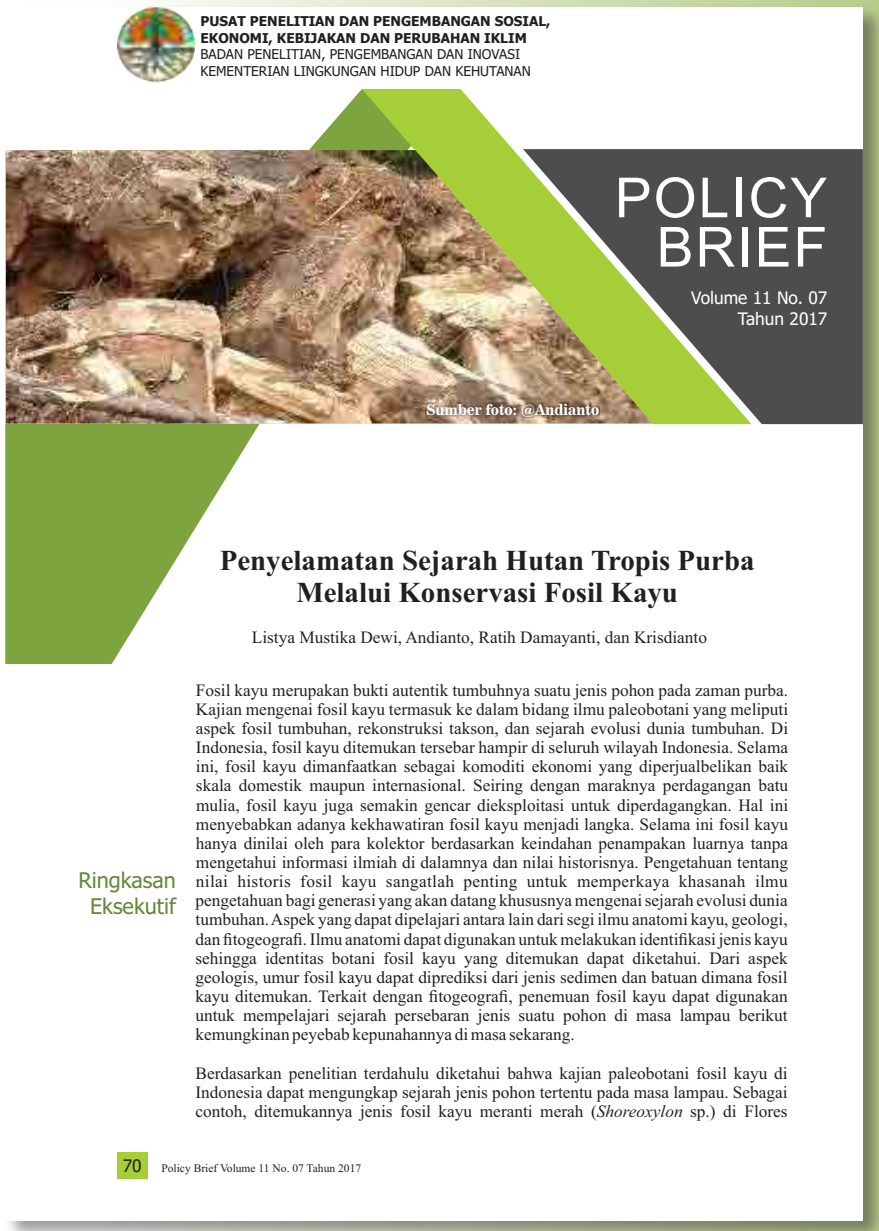
The atmosphere of the Indonesian Trade Timber Grouping Activity

Discussion on Indonesian Timber Trade Grouping, Jakarta, December 16, 2018

g. Xylarium Bogoriense's Support on Government Policies

- Classification of Indonesian Trade Timber Species with policy support to revise SK 163/2003 on Indonesian Trade Timber Classification (Policy Brief 2018: Revise the Grouping of Indonesian Trade Timber Species as Basis for the Imposition of Forestry Fees (Minister of Forestry Decree Number 163 / Kpts-II / 2003)

- Conservation of Tropical Fossil wood for policies on the establishment and development of wood fossil conservation areas in Indonesia (Policy Brief 2018: Saving the History of Ancient Tropical Forests through Conservation of Fossil wood)



PUSAT PENELITIAN DAN PENGEMBANGAN SOSIAL, EKONOMI, KEBIJAKAN DAN PERUBAHAN IKLIM
BADAN PENELITIAN, PENGEMBANGAN DAN INOVASI
KEMENTERIAN LINGKUNGAN HIDUP DAN KEHUTANAN

POLICY BRIEF

Volume 11 No. 07
Tahun 2017

Sumber foto: @Andianto

Penyelamatan Sejarah Hutan Tropis Purba Melalui Konservasi Fosil Kayu

Listya Mustika Dewi, Andianto, Ratih Damayanti, dan Krisdianto

Ringkasan Eksekutif

Fosil kayu merupakan bukti autentik tumbuhnya suatu jenis pohon pada zaman purba. Kajian mengenai fosil kayu termasuk ke dalam bidang ilmu paleobotani yang meliputi aspek fosil tumbuhan, rekonstruksi takson, dan sejarah evolusi dunia tumbuhan. Di Indonesia, fosil kayu ditemukan tersebar hampir di seluruh wilayah Indonesia. Selama ini, fosil kayu dimanfaatkan sebagai komoditi ekonomi yang diperjualbelikan baik skala domestik maupun internasional. Seiring dengan maraknya perdagangan batu mulia, fosil kayu juga semakin gencar dieksploitasi untuk diperdagangkan. Hal ini menyebabkan adanya kekhawatiran fosil kayu menjadi langka. Selama ini fosil kayu hanya dinilai oleh para kolektor berdasarkan keindahan penampakan luarnya tanpa mengetahui informasi ilmiah di dalamnya dan nilai historisnya. Pengetahuan tentang nilai historis fosil kayu sangatlah penting untuk memperkaya khasanah ilmu pengetahuan bagi generasi yang akan datang khususnya mengenai sejarah evolusi dunia tumbuhan. Aspek yang dapat dipelajari antara lain dari segi ilmu anatomi kayu, geologi, dan fitogeografi. Ilmu anatomi dapat digunakan untuk melakukan identifikasi jenis kayu sehingga identitas botani fosil kayu yang ditemukan dapat diketahui. Dari aspek geologis, umur fosil kayu dapat diprediksi dari jenis sedimen dan batuan dimana fosil kayu ditemukan. Terkait dengan fitogeografi, penemuan fosil kayu dapat digunakan untuk mempelajari sejarah persebaran jenis suatu pohon di masa lampau berikut kemungkinan peyebab kepunahannya di masa sekarang.

Berdasarkan penelitian terdahulu diketahui bahwa kajian paleobotani fosil kayu di Indonesia dapat mengungkap sejarah jenis pohon tertentu pada masa lampau. Sebagai contoh, ditemukannya jenis fosil kayu meranti merah (*Shoreoxylon* sp.) di Flores

70 Policy Brief Volume 11 No. 07 Tahun 2017

h. Wood Anatomy Knowledge Transfer

Sucofindo, BP2HP (Wood grader), Wood Industry, BKSDA and Customs.

5. The Future of Xylarium Bogoriense

With the development of research and development in the field of Wood Anatomy, the database of anatomical characteristics of wood has also increased. Until 1949, the description of anatomical characteristics was only available for 139 species. At present, data on the anatomical characteristics of wood are recorded as many as 433 genera originating from various publications starting from internal and external Xylarium Bogoriense. However, anatomical characteristics data of 158 genera are still needed to complete it. As the collection of wood samples from the Papua region and small or bordered islands are very limited and almost zero, the additional timber collection will be prioritized from those areas.

Since 1985, accompanying herbarium materials have been stored at the Herbarium of Research and Development Center for Nature Conservation in Bogor. In the future, the herbarium needs to be managed in an integrated manner with the wood collection in Xylarium Bogoriense so that the identification references are more comprehensive.

Further development that will be carried out is the strengthening of the xylarium information system and updating the data. Wood identification database needs to be completed with anatomical characteristics of 158 genera (577 species) from the least known wood species group. Every year should be targeted investigation on at least 20 wood species, thus the database completion could be completed within 29 years.

This can be accelerated by increasing the target to 100 species per year so that it will be completed within 6 years. That matter can be achieved with the synergy and collaboration of researchers/cross-institutional wood anatomists.

Future R&D activities related to Xylarium Bogoriense that need to be developed are:

- R & D on wood density data of Xylarium Bogoriense wood collection as one of the factors to calculate the carbon content stored in wood and wood products.
- Analysis of climate change patterns that have occurred (350 years back) through analysis of growth ring (analysis of nitrogen isotopes or oxygen) as well as to predict future patterns of climate change (Dendrochronology).
- R & D to obtain data and information on the diversity and distribution of wood species. This can be used for mapping the potency of wood species and as a reference in the development of potential local wood species or local mainstay which have strategic uses as well as efforts to mitigate and reduce deforestation.
- Development of Xylarium Bogoriense data as a basis for optimizing the utilization of wood species according to their potential use, thus increasing the efficiency of raw material utilization by reducing waste and decrease the pressure on forest resources.
- Quantification analysis of authentic wood specimens as carbon deposits.
- Xylarium development on every big island in Indonesia.

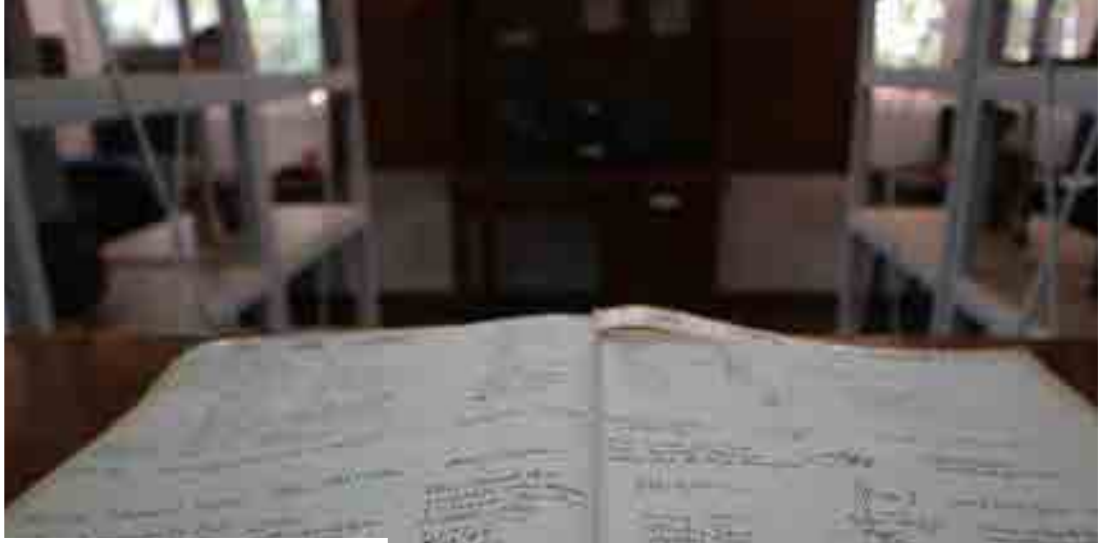
Xylarium Bogoriense's new face

Xylarium Bogoriense has renovated, in Desember 2019

Anatomy Lignoselulosa Laboratory

Theater room

Xylarium Bogoriense










KAYU DALAM NEGERI

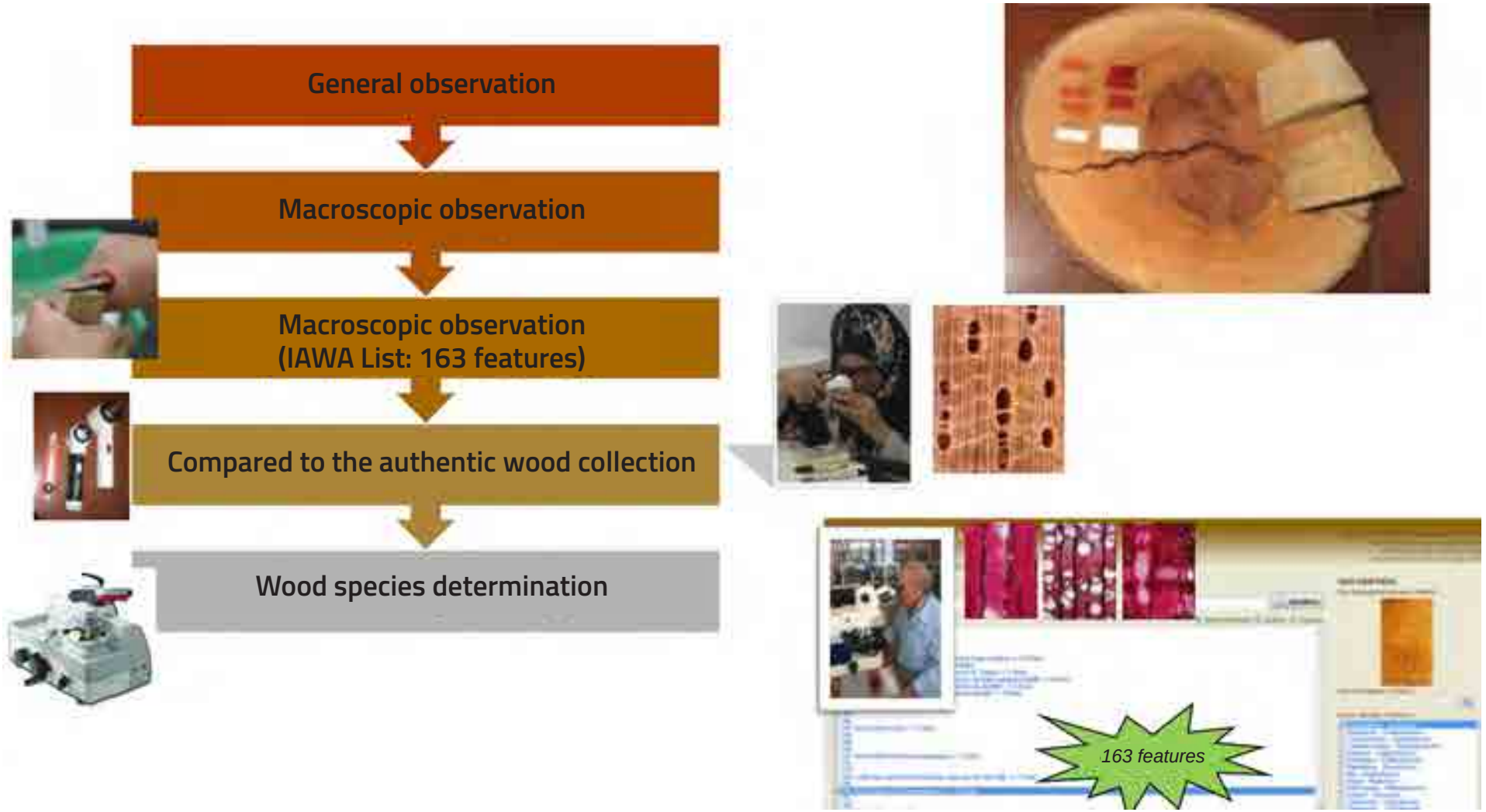




Xylarium Bogoriense's bamboos and rattans collection

6. Automatic Wood Identification System (AIKO-KLHK)

a. Conventional Wood Identification Methods



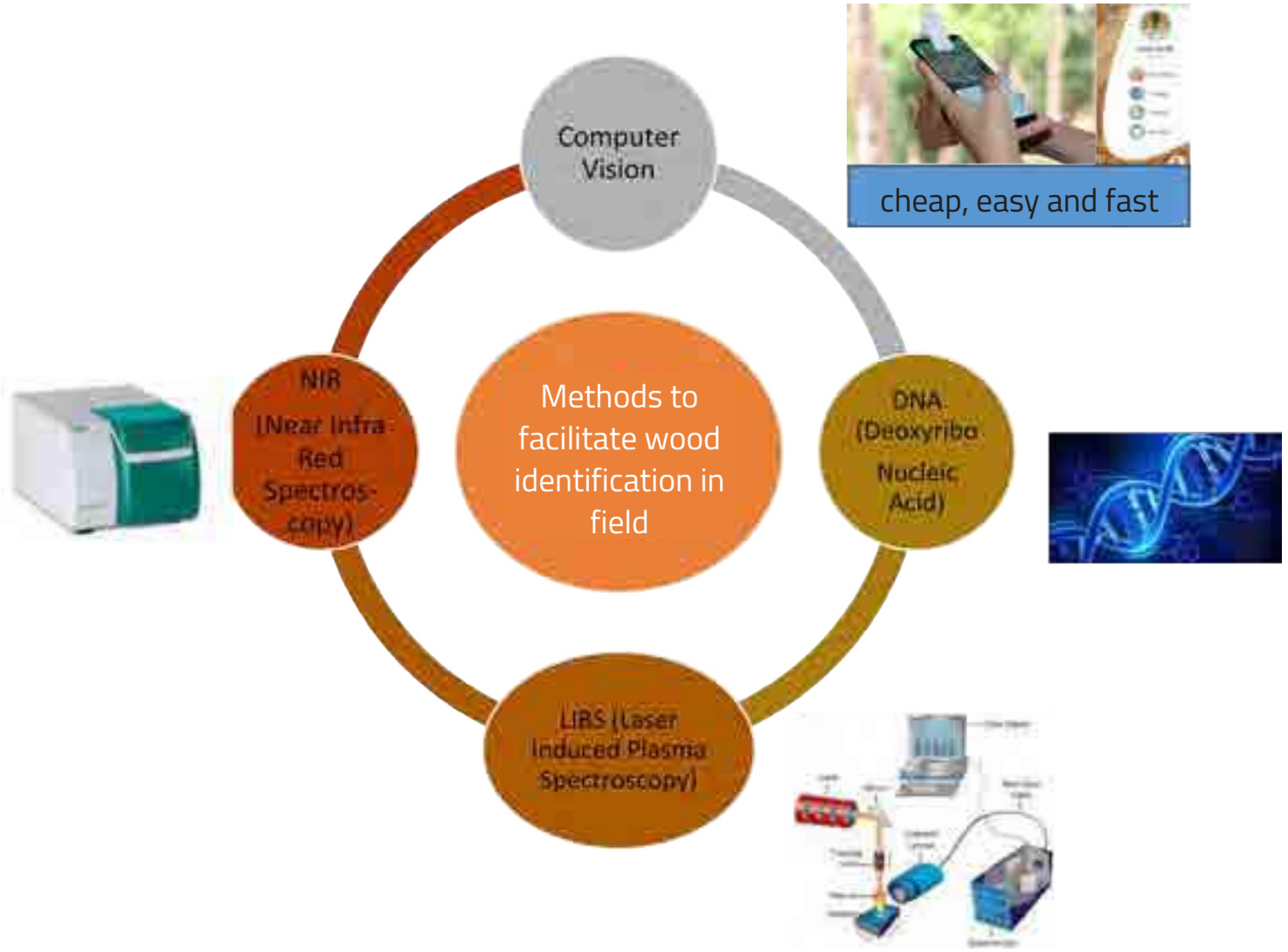
Need 1 - 2 weeks!!!

Depend on the difficulty levels and the samples condition

The limitation of existing science, technology, and human resource capacity have caused the process of wood identification to date can only be undertaken by experienced and trained researchers or officers.

No tolerance for errors in wood identification

b. Current Technology for Wood Identification



c. Development of Automatic Wood Identification System

2006 – 2007: Research topic of IPB University Master Student under the supervision of Dra Sri Rulliaty, M.Sc.

2010-2012

Method to identify wood by artificial neural network; research cooperation between Forest Products Research Development Center with STMIK Palembang (Dr. Gasim Alkaf)

30 wood species from different five geographic locations: R ,G, B, grey scale, contras, energy, homogenity, entropy, standard correlation, standar deviation

- Identification result: 100% (Training data) .
- Identification result: 98% (Testing data)
- **Based on the results of the preliminary study, we believe that this research will succeed.**

Scanning 24 x magnification

1st Generation of AIKO

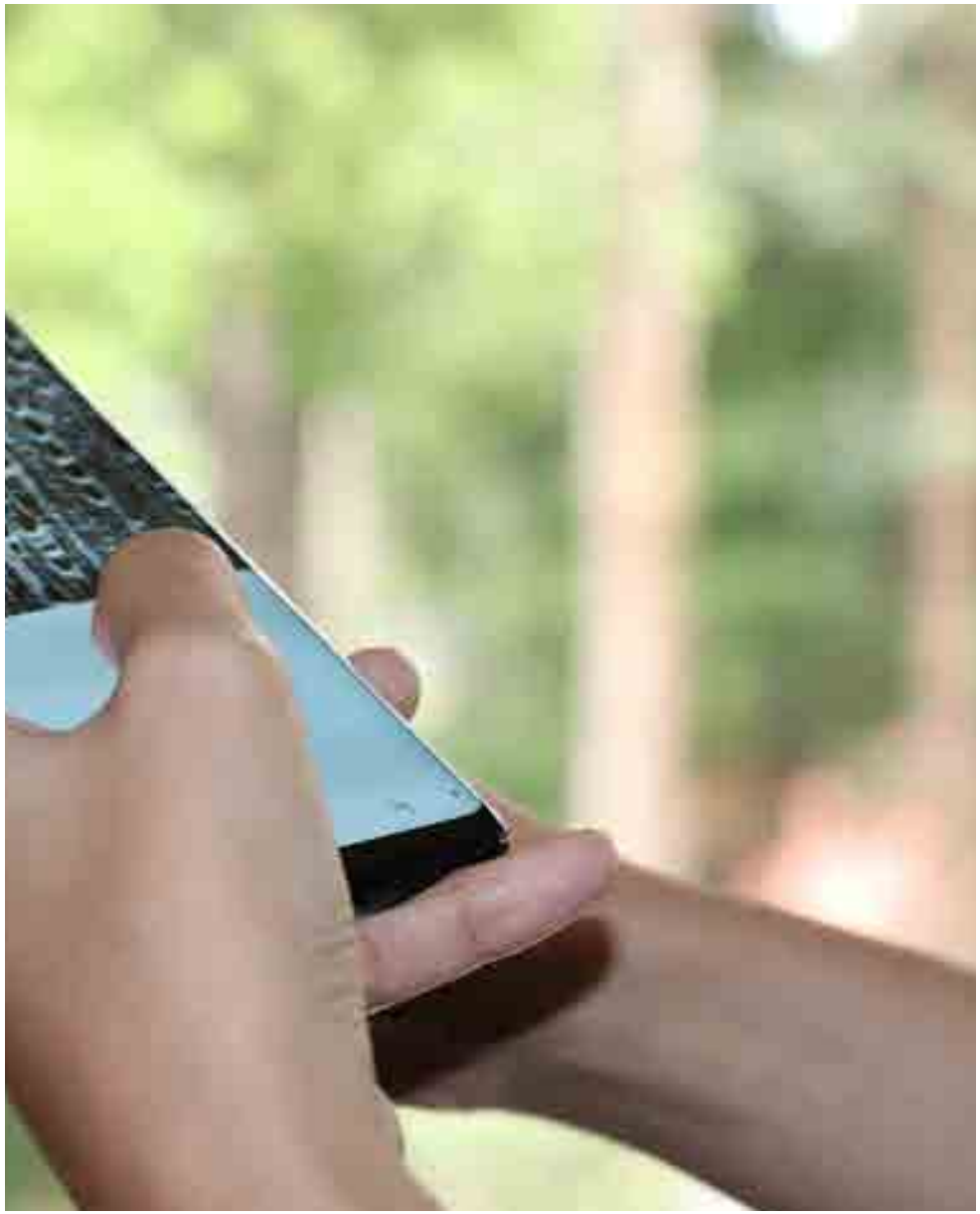
Collaborative research between Research Center for Informatics, Indonesian Institute of Sciences (LIPI) and Forest Products Research and Development Center (FORDA); funded by Program INSINAS Kemenristekdikti

2nd Generation of AIKO

AIKO - KLHK (2019)

d. AIKO-KLHK Excellencies

- Contain 823 wood species according to 'Pengelompokan Jenis Kayu Perdagangan Indonesia (Classification of Indonesian Commercial Timber) 2017' book, including the wood species in Forestry Minister Decree No. 163/Kpts-II/2003
- Provide the information of the origin of geographical locations based on the similarity of images to wood species from certain location
- Shorten time in wood identification previously 1 day - 4 weeks to seconds
- Giving objective wood identification result with more comprehensive information: botanical name, family, similarity of images to wood species from certain location, trade name, commercial timber classification, specific gravity, strength class, durability class, conservation status (CITES, IUCN and Environment & Forestry Minister Decree), references used, potential utilization, and option of results according to the further highest similarity of wood anatomical structure.
- Web and Android-based for data management and Android-based for wood identification)
- Searching facility available and provides wood details including macroscopic images
- Online and offline option
- Portable, easy to use
- Helping in improving the performance of timber industries
- Helping to accelerate the process of environmental and forestry law enforcement
- Free to use and already available in Google Play Store
- Ensuring the accuracy and increasing the credibility of V-legal Document in SVLK (Indonesian Timber Legality Assurance System)
- it can be integrated with SIPUHH online.




Indonesian
LEGAL
Wood


Indonesian
LEGAL
Wood
Common and
Names
Scientific

e. Launching of AIKO - KLHK

AIKO-KLHK was launched for the public by the Secretary-General of Environment and Forestry Ministry on behalf of Minister Environment and Forestry on 29 August 2019 in the event of 'Gelar Kebangsaan' in Manggala Wana Bakti, Jakarta.

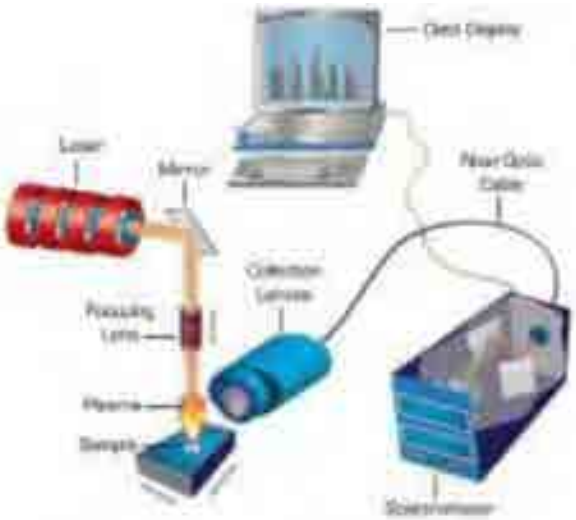
f. AIKO Improvement – Answering the Challenges

- The automatic wood identification system is enhanced to differ wood origin (from plantation or natural forest) or geographic locations
- Development of a system to allow to identify the time when the trees are cut --- carbon dating.

g. Future Collaboration:

- Carbon dating: Oxygen Isotop (RISH-Kyoto University)
- Research cooperation with Forest Product Laboratory USDA and University of Wisconsin through 'Development of Wood Identification System and Timber Tracking Database to Support Legal Trade' Peer Cycle 8 USAID project.

Near Infra Red



Laser Induced Plasma Spectroscopy

Concluding Remarks

Our gratitude goes to the leaders and management of the Ministry of Environment and Forestry, stakeholders, researchers, academics, who have supported the development of Xylarium Bogoriense to date. In particular, we extend our appreciation to Kemenristekdikti, Perhutani, Riau University, Tadulako University, Simalungun University, Hasanuddin University, Forestry Services throughout Indonesia, especially the East Java Province Forestry Service, INHUTANI, APHI, timber industries, all offices of Research, Development and Innovation Agency, Ministry of Environment and Forestry, and other parties for their support and participation in the collecting and manufacturing of wood specimens so that we are able to write a history of delivering Xylarium Bogoriense to Xylarium No. 1 World.

Now and in the future, we do expect support and input in the management of Xylarium Bogoriense, which is now widely known even internationally. Collection of authentic specimens of Xylarium Bogoriense must continue to be added, especially wood species from small islands and border areas. The Xylarium management and information system is also constantly being updated to be a reference and also for the initiation of the development of Xylaria on major islands in Indonesia and a reference for the management of Xylarium in the world.

Mangunan, Yogyakarta, 28 September 2018


BLI KLHK
Dengan Rahmat Tuhan Yang Maha Esa
DEKLARASI
Xylarium Bogoriense No. 1 Dunia
Menteri Lingkungan Hidup dan Kehutanan RI
Dr. Ir. Siti Nurbaya, M.Sc.

The Journey of Xylarium Bogoriense

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