Session 2

[Wednesday 3rd period 1.5 hours - Main Hall]

An introduction to wood culture: building on the past

Speakers

Speaker:
Howard Rosen

Topic:
The Evolution of Wood Culture in the United States of America

Speaker:
Sangeeta Gupta

Topic:
History and Current Status of Wood Culture in India

Speaker:
Andrea Klein

Topic:
The Treasure of Special Stem Assortments- Lost Knowledge of the Past

Speaker:
V Ramakrishnan

Topic:
The Fourth Dimension of Wood

The Evolution of Wood Culture in the United States of America

Howard Rosen[1]

Abstract

Wood Culture is an interdisciplinary science area which provides a better understanding of the use and social aspects of wood from a cultural perspective. The study of wood culture can provide positive publicity for wood as a sustainable and environmentally friendly material. In the United States (US), there has been a rich history of forest products use since the early settlers came in the 17th century. Forest products have been a major strategic asset and are critical to the social, economic, and ecological well being of the United States. US history includes trees removal for farmland and significant production of timber products, such as log homes, train trestles, fences, and bridges. The management and procurement of wood products was significantly impacted by the formation of the US Forest Service in 1905 under President Teddy Roosevelt. A rich history of wood culture in art, literature, poetry, and drama developed as a result of the importance of forest products to the US economy.

The US is a wood oriented country, ranking third of all countries in volume of standing forest timber. Abundant forest resources and prudent forest management have allowed U.S. industry to make wood the single largest material resource of industrial production. Approximately 330 million metric tons of wood is harvested annually in the United States, which is by far the world's largest industrial timber-producing nation. The focus of this presentation is on the rich history of wood culture in the US and the use of forest products in the development of the country.

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The evolution of wood culture in the United States of America

Howard N. Rosen , PhD, USA
International Wood Culture Society
US Forest Service, Research Use Sciences

Presented at the *Rediscovering Wood: The Key to a Sustainable Future* Conference

Bangalore, India October 19, 2011

Agra, India February 1969

Wood Culture Definition:

The human use of and activities with wood, as well as attitudes toward wood, wood products and wood-related environments

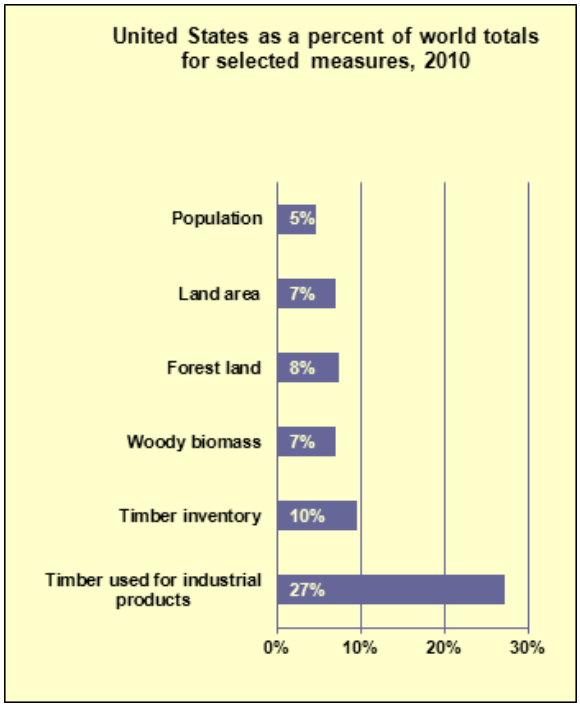
"The value and the way we use wood in our society"

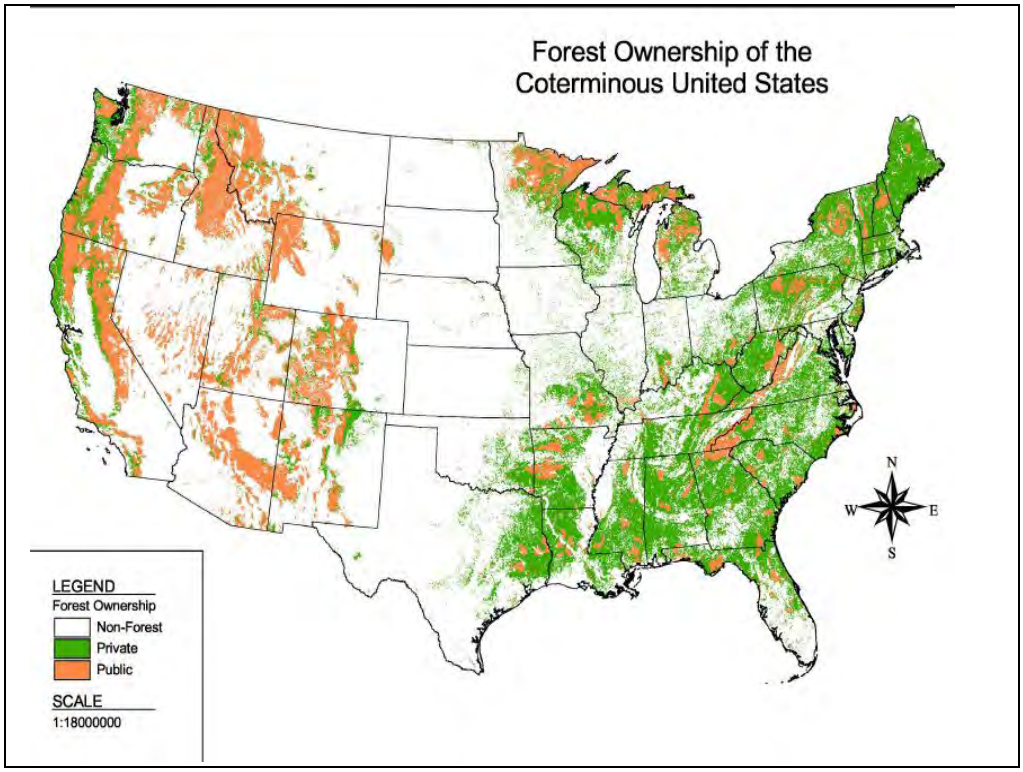
Positive Forest Products Publicity

- Wood - the environmental material
- Wood - the sustainable material
- Wood use - the gateway to a sustainable future for mankind

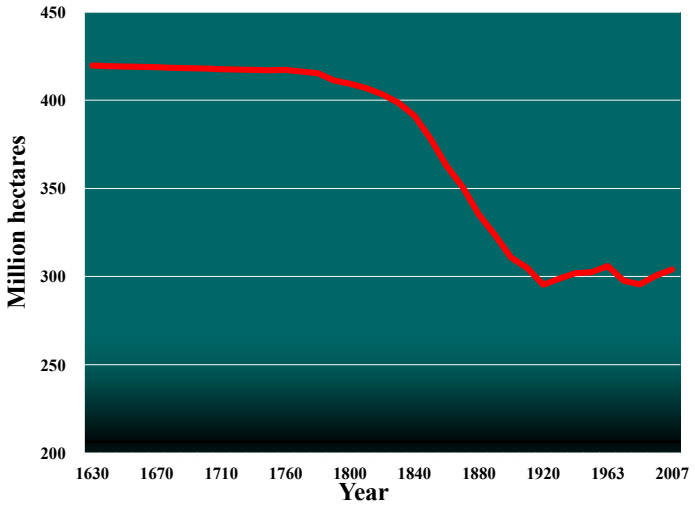
United States Basic Facts

- Population of 312 million people
- Third country in volume of standing timber
- Timber growth still exceeds harvest
- Per capita yearly consumption of wood and fiber products in U.S. (1.8 cu. met.) is 4 times world average
- Use 25% of all energy generated in the world
- Approximately 3% of energy use is from wood or woody biomass

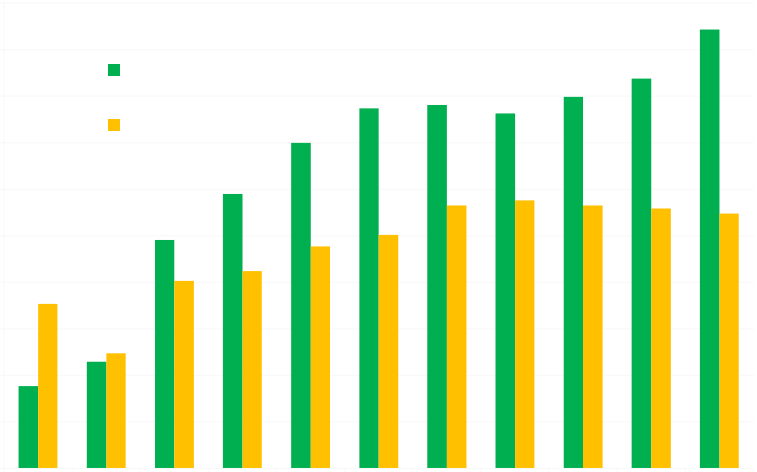


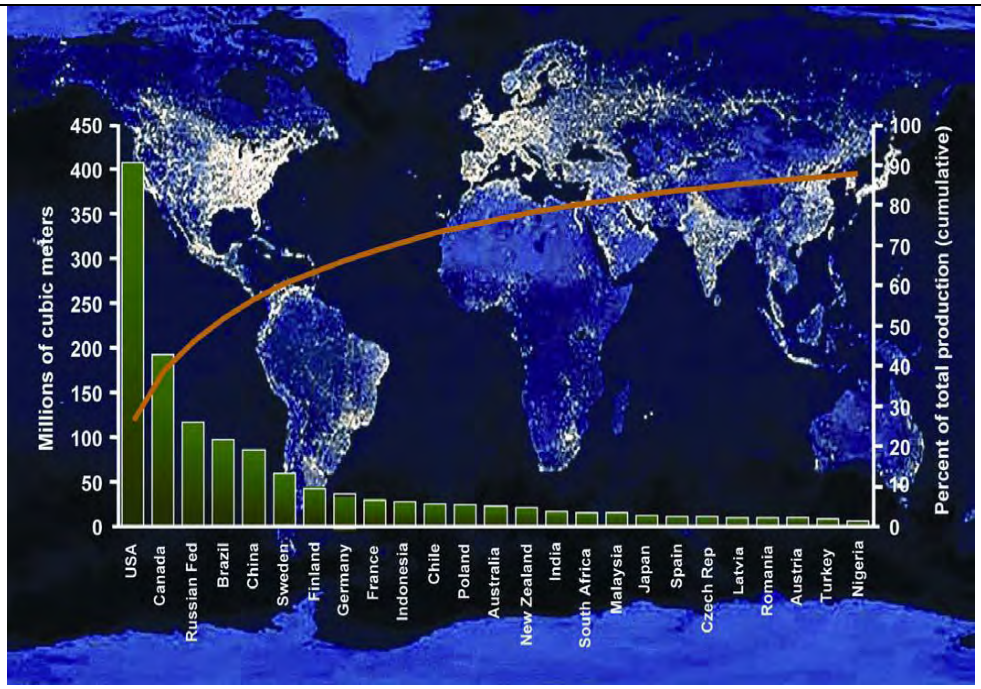


U.S. forest land area



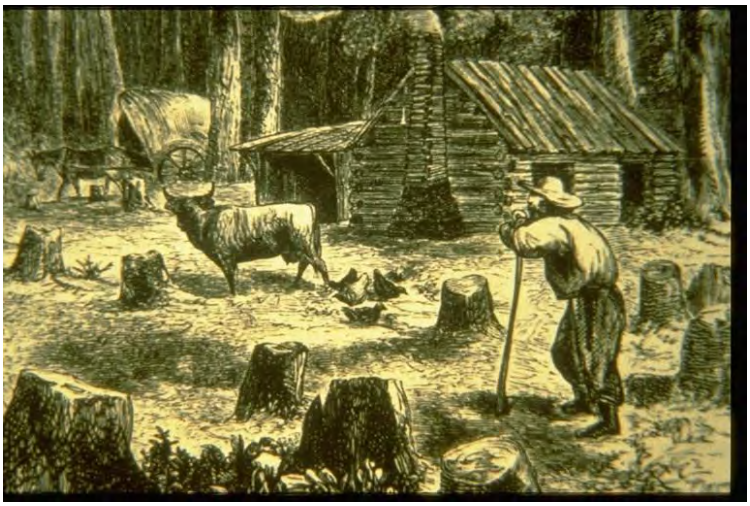
Growth-removals of US Forests





Early English settlers in 1607 at Jamestown, Virginia

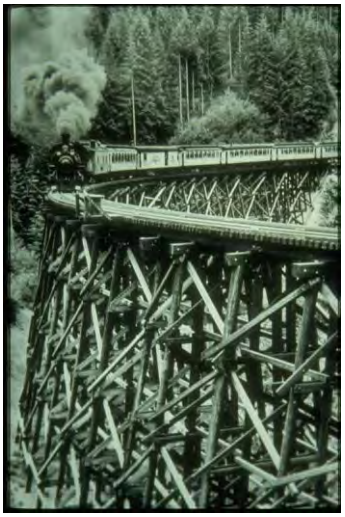
Early Clearing of forests and use of wood



Early uses of timber:

fences

railroad trestles



Harvesting

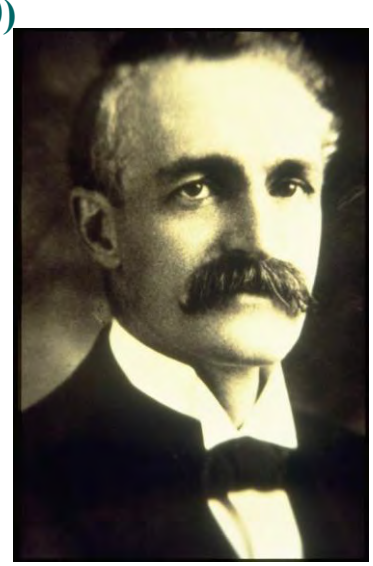
Old

Modern

Devastation from clear cutting and fires in early 1900's

Gifford Pinchot (1865-1946) First Chief of the US Forest Service (1905-1910)

Spoke forcefully of the need for conservation as "wise-use." Federal forests should be open and accessible to all citizens.



Teddy Roosevelt (1858-1919) President of US (1901-09)

Pinchot was helped mightily in his efforts through his friendship with Teddy Roosevelt, the first "Conservation President." Roosevelt had a profound effect on the conservation history of the nation.

Literature and Folk Lore – Paul Bunyan and Babe the Blue Ox

Solid Wood Products

Cedar Chest

Birds-eye Maple Guitar

Walnut Gun Stock

Composite Products

I-joists/Glulam

Engineered wood products

Wood plastic Composites

The Carbohydrate Economy

(Cellulosic Biorefinery)

International Union of Forest Research Organizations (IUFRO)

5.10.01 Wood Culture Working Party

Wood Culture is an interdisciplinary science area which provides a better understanding of the use and social aspects of wood from a cultural perspective. Research in Wood Culture improves people's relationship with nature and opens new ways to understand wood from an economic, environmental, and social value perspective.

IUFRO All Division 5 Conference Lisbon, Portugal; July 8-13, 2012

- Session Title: Importance of Wood Culture on Tomorrow's Resources (2 sessions)

  Coordinators: Howard Rosen (US) & Mario Tomazello (Brazil)

- Session Title: Cultural Artefacts—Production and Protection
- Coordinators: Wibke Unger (Germany) & Howard Rosen (US)

- Web address: **http://www.iufro.2012.org**

International Wood Culture Society (IWCS)

is a non-profit, non-governmental, international network of wood enthusiasts, dedicated to the research, education and promotion of wood culture started in 2007 in the United States.

Acknowledgement of their financial support for this talk

History and Current Status of Wood Culture in India

Sangeeta Gupta[2]

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International conference on Art and Joy of Wood
19-22 October, Bangalore, India

HISTORY AND CURRENT STATUS OF WOOD CULTURE IN INDIA

Dr. Sangeeta Gupta
FOREST RESEARCH INSTITUTE
DEHRADUN, INDIA
guptas@icfre.org

In India, **Forest Research Institute** (**FRI**), Dehradun is the premier Institute that has been carrying out **Research** in almost all disciplines of **Wood Science** since past **100 years**

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FRI has been rendering yeomen service to the entire nation through inputs on identification, properties, uses, seasoning & preservation of timbers.

Regular clients:

- **Defense/ Customs/ Port Trust of India**
- **Central Bureau of Investigation (CBI)/Police /Anti-corruption Bureau/ Vigilance Dept.**
- **National Tests Houses/ Forensic Labs**
- **Railways**
- **Housing Corporations**
- **Sports Authority of India**

- **Archaeological Survey of India**
- **B.S. Institute of Palaeobotany**
- **National Botanical Research Institute**
- **Timber based Industries**
- **Bureau of Indian Standards**
- **Handicrafts**
- **Forest Departments**
- **Electricity Boards**

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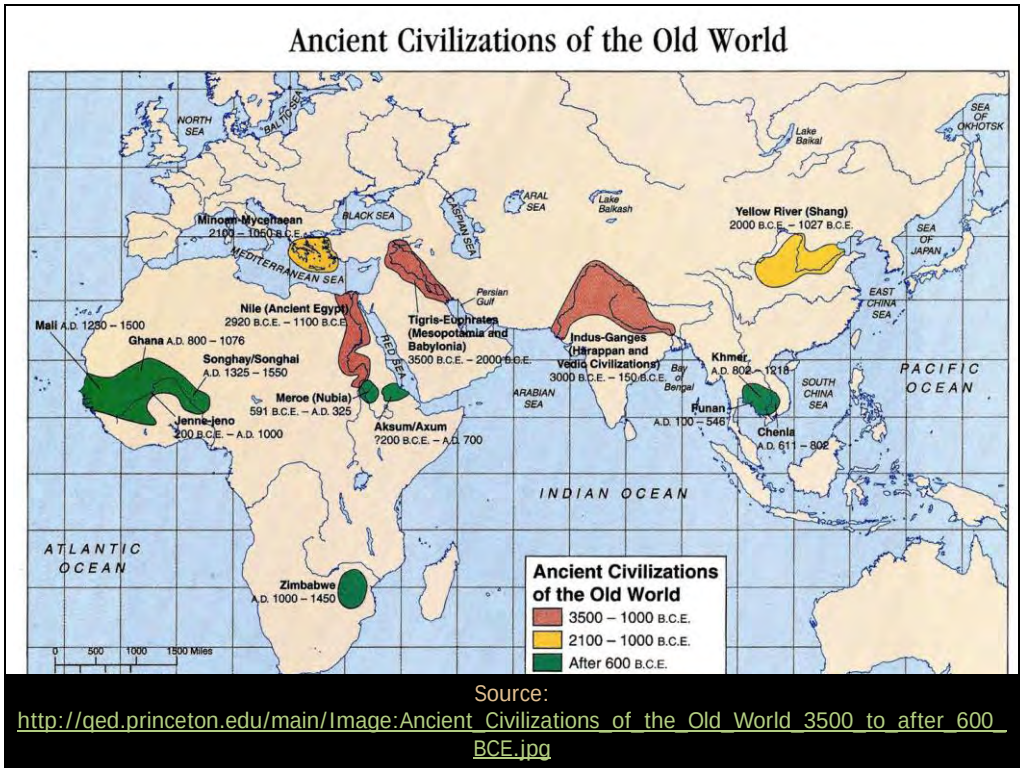

Source: http://qed.princeton.edu/main/Image:Ancient_Civilizations_of_the_Old_World_3500_to_after_600_BCE.jpg

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- **Ancient civilization of Erstwhile India:~ 5000 years.**
- **Written information on wood : ~ 3500 years**

  Ancient literature - Vedas, Upanishads & Puranas
  Religious text - Ramayana & Mahabharatha

- **Explorations in India started in 1784 by Asiatic Society.**
- **Explorations and excavations later increased after the founding of the Archaeological Survey of India in 1861.**

Vedas/Puranas (second millenium BC)

Written record of domestic & religious life of people

- existence of a class of artisans-Vaddhaki (carpenters)
- instructions on choice and handling of wood for boat & ship building
- strong and durable timbers for making thrones of Kings
- mentions about seasoning properties of different timbers
- Woods for sculptures of dieties *Calotropis gigantea* (Erukku) wood root –Ganesha , *Diospyros ebenum* (Black ebony)-Krishna

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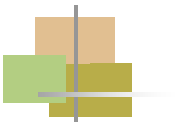
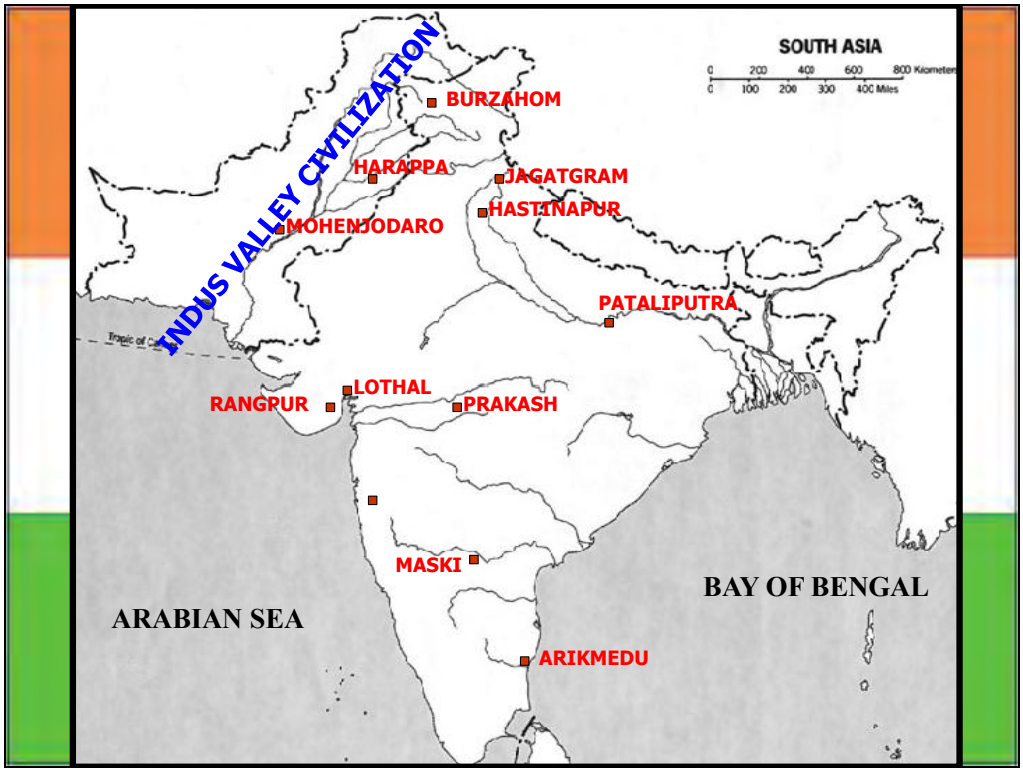


PRE-HISTORIC
2500 BC-100 AD



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Neolithic site - 2375-1535 BC

Burzahom, Kashmir

Burnt material consisted charred twigs of ***Parrotia jacquemontiana***, ***Prunus***, ***Juniperus*** etc.

Parrotia twigs for wicker work & ***Prunus*** flakes for mud plaster are still used in that area.

IMMORTAL TRADITIONS

Ref: Purkayastha & Lal, 1976

2500-1750 BC
Bronze - Age Sites

INDUS VALLEY CIVILIZATION

Knowledge about Indus Valley Civilization comes from study of the excavated towns of-

- Harappa, Mohenjodaro, now in Pakistan
- Lothal, Rangpur, Surkotada, Dholavira, Kalibangan and Rakhigarhi in India.

2500-2000 BC

HARAPPA: BRONZE-AGE SITE

I. Wood remains of a coffin - ***Cedrus deodara*** **(Deodar)** & ***Dalbergia latifolia*** **(Rosewood)**.

Harappans were-

- Well acquainted with the use of **durable and scented** woods for making coffins
- Wood availability.
- Trade connections with the northern & southern regions

Ref: Chowdhury & Ghosh, 1946

2000 BC: **HARAPPA** ….contd.

II. ***Zizyphus* sp.** used as a mortar for pounding grains.

Timber known for **shock absorbing property**. The tree still grows around Harappa.

III. ***Pinus roxburghii & Cedrus deodara*** for house- building.

All are well-known commercial timbers of the present day.

KNOWLEDGE OF WOOD PROPERTIES

2350-2200 BC

Lothal, Gujarat - port town

First tide dock of the world constructed for berthing and servicing of ships.

- Boat building technology in India- 3rd Millennium BC.
- Wooden artifacts- ***Acacia chundra,*** ***Albizia* sp., *Adina cordifolia,* *Tectona grandis,* *Soymida febrifuga*** & one ***Lauraceae*** **wood**
- ***Acacia chundra-*** best timber for dock works Substitute of lignum vitae (***Guiacum officinale***) of South America.

(Ref: Rao & Lal, 1983 & Rao, 1987)

Ancient Lothal as envisaged by Archaeological Survey of India

KNOWLEDGE OF MERINE WOOD PROPERTIES

2000 BC

Rangpur, Gujarat

- Charred remains of *Pterocarpus santalinus, Soymida febrifuga and Tamarix sp. Acacia sp., Albizia sp.,* were found.
- Well known woods for construction and agricultural implements.
- Presence of ***Pterocarpus santalinus*** (Red sander) is unusual as it now occurs only in Andhra Pradesh.

Ref: Ghosh & Lal 1963

1700 BC - 800 BC

Chalcolithic site (Copper age)

HASTINAPUR: Charcoal remains of ***Dalbergia sissoo & Holarrhena antidysentrica*****.** Both woods have high calorific value.
(Ref: Chowdhury & Ghosh, 1955).

MASKI: charcoal remains of ***Acacia*** sp. & ***Chloroxylon swietenia***. At present best woods for charcoal & fuel purposes
(Ghosh & Chowdhury, 1957)

Knowledge of Calorific value of woods

200 -300 BC

KARLA CAVES, MAHARASHTRA -

Ceiling of ***Tectona grandis*** (2200 years)- apparently sound but its cellulose and crystalline nature had considerably reduced

(Chowdhury et al.,1967)

PATALIPUTRA- Ashoka's palace wooden Pillars (2250-350 years old) of ***Shorea robusta* (Sal).**
Most popular timber for constructional purposes. The good state of preservation of the wood which remained in the ground for over 20 centuries reflects upon the durability of this timber

(Ghosh & Lal, 1958)

KNOWLEDGE OF WOOD DURABILITY

100-200 AD

Dravidians pre- medieval site: Arikmedu

- Woods of ***Diospyros*** sp., ***Mimusops*** sp. & ***Heritiera*** sp.
- ***Diospyros*** sp. used for turnery & carving work.
- ***Mimusops*** sp. & ***Heritiera sp.*** are strong and durable timbers used for boat building, construction & agricultural implements
- All the three are at present well known commercial timbers of India.

200- 300 AD- Early Historic

KALSI, Dehradun: Asvamedha site-
Shorea- for sacrificial stand -strength
Terminalia- for boiling blood or flesh-excellent fuel wood
***Mangifera* (Mango)-** used for lighting 'homa' fire
Cinnamomum- as substitute for true cinnamon.

Mango & Cinnamon still used for yagna

Timeless and Immutable Indian customs.

Ref: Ghosh & Lal, 1961

Wood culture after 5th Century AD can be seen in temples, palaces, artifacts as well as in written records

700 – 1100 AD

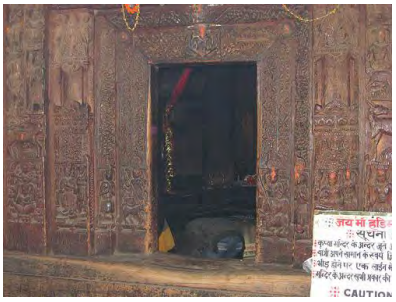
Temples of Chamba, H.P.
Constructed mainly of ***Cedrus deodara*** wood

Source: S.M.Sethi

1100-1200 AD

Mrikula Devi Temple, Lahaul

1553 AD



Hidamba Devi wooden temple, Manali, H.P.

The sanctum is covered with a 3-tiered roof constructed of narrow wooden planks of ***Cedrus deodara***, one over the other.

Intricate carving on Deodar wood

16-18th century AD

Padmanabhapuram Palace, Kerala 16-18th centuries

- ***Tectona grandis*** beams
- Interiors carvings on ***Dalbergia latifolia***
- Ceiling of ***Swietenia mahogany***.
- ***Artocarpus heterophyllus*** columns.

(Source: Srinivasan, 2004)

16-18th century AD

Malawala Palace, Hyderabad built in **1724** Woodwork of ***Tectona grandis***. The palace has a library with a ***Juglans regia*** carved roof.

Source for photo & text: Hyderabad Heritage structures

Tipu's Palace, Bangalore constructed in 1791, is a two-storeyed structure with pillars, arches and balconies built in ***Tectona grandis*** wood.

14-16th Century AD

Four headed and ten handed deity

Deity with child

All sculptures of ***Madhuca*** species – very strong & durable timber even in contact with soil & water.

16th-18th century AD

TEMPLE CHARIOT - The octagonal chariot made of ***Shorea robusta & Tectona grandis***. from Tamil Nadu, South India.

Source for photo & text: National Museum, New Delhi

House **Boats-*Artocarpus hirsutus* (anjili), Teak, Deodar & Bamboo** interiors-**walnut** carvings

Sculpture-***Ficus*** species -a non-durable timber but very easy to work

Indian music has an accumulated heritage of centuries. Origin can be traced back to Vedic days (~2500 BC).

Saraswati Veena

Sarangi

Shehnai

Flute

Tabla

Dholak

Harmonium

Dotara

Tanpura

Woods used- ***Tectona grandis, Dalbergia sissoo, Toona ciliata, Dalbergia latifolia, Artocarpus heterophyllus, Juglans regia, Diospyros ebenum, Swietenia sp & Bamboo.***

MYSTICAL JOY OF WOOD

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ERA OF MODERN WOOD SCIENCE

19 th century AD

Establishment of FRI Xylarium, 1878 (DDw)

WRITTEN RECORDS:

1858: 'TIMBER TREES'- Dr. E. Balfour
1881:'A MANUAL OF INDIAN TIMBERS'
- J.S. Gamble

Dealt physical & gross features, properties and USES of 1450 woods

Knowledge of uses came from LOCALS

Forest Research Institute Xylarium (DDw)-Collections

1877-1899

EXCELLENT SCIENTIFIC WISDOM ON WOOD USAGE

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FOREST RESEARCH INSTITUTE (FRI)

CELEBRATED CENTENARY IN 2006

20 th century AD

One of the Asia's biggest Wooden Hall at FRI, made of *Tectona grandis* (Teak)

Roof of *Pinus roxburghii*

C.S. of *Cedrus deodara*
704 years:1215-1919
Diameter:1.4m

Floor of *Pterocarpus macrocarpus*

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CURRENT STATUS

Indian Woods: ~ 1600 tree species

- **276 commercial timber species (IS:1150)**
- **99 Rare & threatened Trees (**Red Data Book, 1990**).**
- **4 under CITES: *Pterocarpus santalinus, Taxus wallichiana, Aquilaria malaccensis, Araucaria araucana***
- **~85 medicinally exploited woods (**Wealth of India)
- **Mega diverse country with 16 different forest types and tremendous wood diversity-**
  - All colors varying from light buff to jet black
  - Lightest to heaviest
  - Sweetest to most foul smelling
  - Beautifully figured.
  - Naturally durable woods

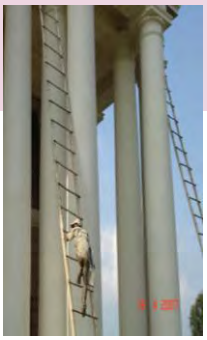
INDIAN STANDARDS ON TIMBER ~300
(listing woods suitable for different purposes)

- **Indian standard for doors and windows shutters and Frames. IS 12896: 1990**
- **Timbers for Cooling towers – specification. IS 2372: 1991**
- **Specification for wooden Sleepers for Railway track. IS 10394**
- **Specification for Wooden Cross Arms. IS 2203: 1976.**
- **Timbers for Aircraft Construction. IS 1898: 1990.**
- **Indian timbers for furniture and cabinets. IS 13622: 1993**
- **Timbers used in instrument industry. IS 7047: 1973**
- **Specification for timber for use in coal mines. IS 4424: 1967**
- **Specification for willow clefts for cricket bats. IS 4422:1985**
- **Timber species suitable for wooden packaging. IS 6662: 2008.**
- **Design of Structural Timber in Building-Code of Practice. IS**
- **Wooden handles for hand Hammers-specification. IS 4953:89**
- **Pencil slats-Specification. IS 3084:1989**

BAMBOO

- Used from time immemorial.
- Vedic craftsman used it for baskets & construction works
- Referred as 'the cradle to coffin timber'
- 140 species 19 genera
- Covers 13% of forest area.

CCA TREATED BAMBOO HUT BUILT IN 1955 AT FRI



Pre-Fab Houses
Mat Board
Corrugated sheets
Doors/Windows

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INDIAN STANDARDS ON BAMBOO

IS 7344:1974 Specification for bamboo tent

IS 9096:2006 Preservation of Bamboo for structural purposes- Code of Practice.

IS 13958:1994 Specification for Bamboo Mat Board for general purposes.

IS 14588:1999 Specification for Bamboo Mat Veneer Composite for general purposes.

IS 15476:2004 Indian Standards on Specification for Bamboo Mat Corrugated Sheet.

IS 22156:2004 Bamboo structural design

IS 22157:2004 Bamboo physical and mechanical properties

IS 1902:1993 Code of practice for preservation of bamboo and cane for non-structural purposes

IS 6874:1973 Methods of test for round bamboos

PRESENT WOOD CULTURE SCENARIO IN INDIA

- **SCENARIO:**
  DEMAND OF WOOD MUCH MORE THAN SUPPLY
- **CONCERNS:**
  - ILLICIT FELLING AND TRADE
  - PESTS TRADED ALONG WITH IMPORTED TIMBERS
  - TIMBER QUALITY
  - INAPPROPRIATE SUBSTITUTION OF WOOD (with high energy materials like aluminum/steel or eco-damaging like plastics)
- **RATIONALITY:**
  - SCIENTIFIC UTILIZATION
  - SHIFT FROM SOLID WOOD TO WOOD SUBSTITUTES
  - GOVERNMENT INTERVENTION: FOREST & INDUSTRIAL POLICY

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PRESENT WOOD CULTURE SCENARIO IN INDIA

- **SUSTAINABILTY CHALLENGES:**
  - FOREST CERTIFICATION
  - TIMBER MANAGEMENT POLICIES- Formulation & Implementation
  - WOOD ALTERNATIVES (natural fibres from crops/ bamboo)
  - TIMBER IN STRUCTURAL/CONSTRUCTIONAL ENGINEERING
  - EDUCATION/AWARENESS

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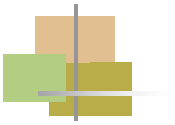
GOVERNMENT INTERVENTIONS FOR SUSTAINABLE FORESTRY

- In India, Scientific management of Forests dates back to 1864.
- Complete ban on felling of trees from natural forests since 1996.
- Ban on usage of wood in construction works of Central Public Works Department (CPWD).
- National Working group constituted to frame guidelines on 'Forest certification' for timber and Non-timber forest products.
- Launching of Green India Mission (GIM - one of the 8 missions of India's National Action Plan) in 2008. Targets 20 million ha to be afforested by 2020.
- Subsidy on plantation of sandalwood. 'Grower is the owner' policy adopted.

GOVERNMENT POLICIES FOR ENHANCING TIMBER IMPORTS



- Compulsory licensing removed on import of plywood, veneer, paper etc.
- Import duty reduced on wood logs.
- Investment ceiling raised to Rs. 300 million.
- Reduction of income tax & corporate taxes.
- Excise duty reduced to 16% on all wood based products.
- Custom duties concessions on machinery for production of wood substitutes.

Source: Federation of Plywood & Paper Industry


Considering the social awareness and Government policies in the right direction the future of wood culture in India is sustainable
'USING WOOD IS GOOD, USING LOCALLY GROWN WOOD IS BETTER'
18 4 2007


Thank You

The Treasure of Special Stem Assortments- Lost Knowledge of the Past

Michael Grabner and Andrea Klein[3]

Abstract

In former times, there was a huge knowledge of the advantage and proper usage of "abnormal" growth patterns and the utilization of all parts of the tree. People of numerous crafts were ambitiously searching for curved and bended tree stems, branch-stem junctions of specific angles and root-stem junctions.

They were aware of the disadvantages and the loss of strength resulting from cutting out or bending wood for curved timber used in shipbuilding or in many other woodworks. The stiffness of branch-stem junctions for handles or other tools will never be reached by any other manmade wood junction. The high tensile strength one may want to achieve for curved designs will nowhere be higher than by using root-stem junctions.

This used to be general knowledge since ancient times. Even Bronze Age tool handles were made out of branch-stem junctions. In Hallstatt, Austria, it was evident, that people working in the salt mines were carefully selecting the trees where the tool handles were cut out.

Due to the process of industrialization and the wish for standardization and fast processing, hardly any wood deviating from a more or less straight design is used any more. This means, that just a small amount of the mechanical potential is used by humans. This might furthermore lead to a replacement of wood. It is important to realize that there is a specific application for every habitus, for every part of a tree and for every tree species. Being aware of this, you will get out the highest performance of wood for every application.

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The treasure of special stem assortments – lost knowledge of the past

Andrea Klein and Michael Grabner
University of Natural Resources and Life Sciences Vienna, Austria

special stem assortments

Due to the ongoing industrialization and the wish for standardization and fast processing, hardly any wood deviating from a more or less straight design is used any more.

- certain mechanical potentials are not used
- replacement of wood in specialized objects

special stem assortments

Onomatologia forestalia from 1772 to 1780 about „crooked trees“:

„They have something excellent, which belongs to them, and what straight trees do not have ….. If you have crooked oak trees or other trees, they can comfortably be used for arches. What makes those crooked assortments so valuable is, that every piece has to have its own specific crook ….. with one word, it is not always a fault, if trees are crooked, because many carpentry or wainwrights work require this crooked shape…..“ (after R. Peesch, 1966)

special stem assortments

If we look for the basic wood utilisation, we realize, that the tree can be utilised in the same shape as it was growing in the forest (R. Peesch, 1966).

special stem assortments

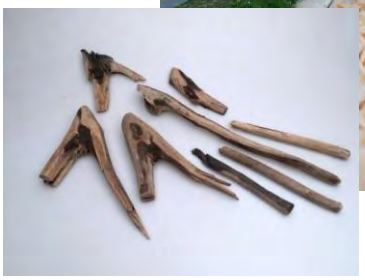
Stone Age….

Exhibition in the Austrian Open Air Museum

special stem assortments

Bronze Age, in Hallsatt, Austria…

Wooden tool handles:



Natural History Museum Vienna

special stem assortments

Bronze Age, in Hallsatt, Austria…

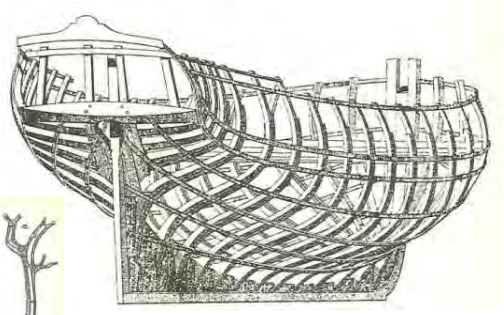
Wooden bins:

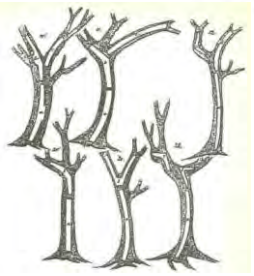
Natural History Museum Vienna

special stem assortments

Shipbuilding in he 18th and 19th century

Wasa, Stockholm





Radkau and Schäfer, 1987

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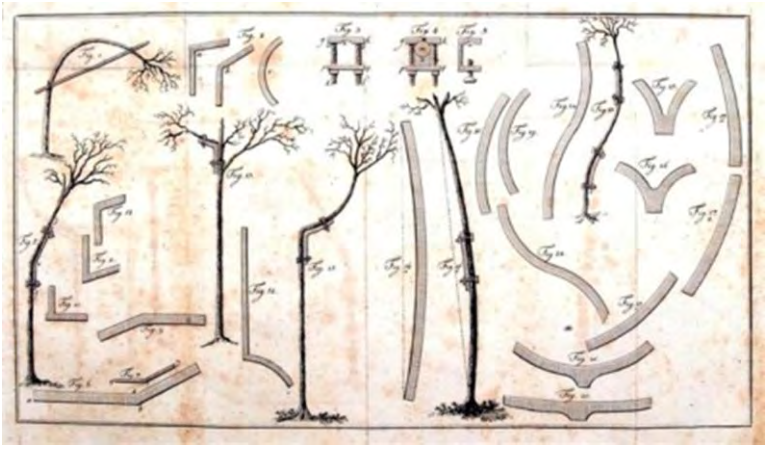
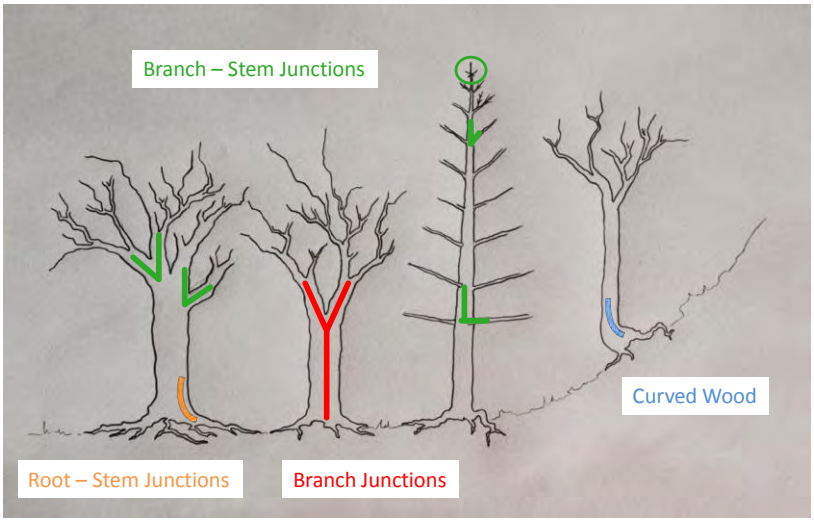
Shipbuilding in he 18th and 19th century



Becker, 1804: About culture, artificial cultivation and felling of wood for ship building

special stem assortments

What else was made out of special stem assortments?



special stem assortments

CURVED TREE STEMS

„Tree stems deviating from a straight form, are less strong because, if you want to cut out straight beams you will cut fibres.“ (Knuchel 1954)

BUT….

If you want to gain curved beams, you loose strength by cutting it out of a straight tree stem.

special stem assortments

CURVED TREE STEMS ….in housing STUDYING OLD PICTURES

Burgenland, Austria, build in 1829
Svoboda, 1975

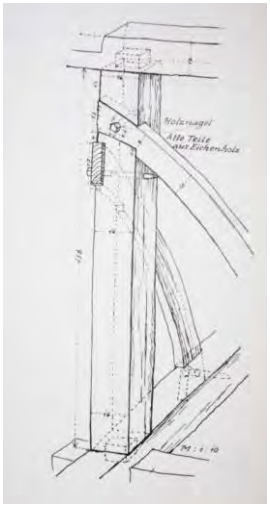
Wooden barn in Upper Austria
Svoboda, 1978

Aschaffenburg, Framework from the 15th century
Deutscher Volkskundekongress, 1965

special stem assortments

CURVED TREE STEMS **….in housing STUDYING OLD DRAWINGS**

Burgenland, Austria; Simon, 1981



special stem assortments

CURVED TREE STEMS **….in housing STUDYING OPEN AIR MUSEUMS**

Open Air Museum Stübing

special stem assortments

BOKU

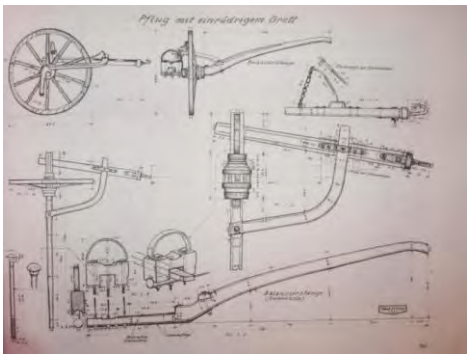
CURVED TREE STEMS ….in agriculture

Carriage,
Museum Gutensein, Austria

Hay fork

Plough, Burgenland Austria, Simon 1981

Frame for carrying grain, Museum Gutenstein, Austria



special stem assortments

BOKU

CURVED TREE STEMS ….further usage

Squeezing grapes,
Museum Gutenstein, Austria

Water duct to the wheel, Tirol, Austria, Svoboda 1978

special stem assortments

ROOT – STEM JUNCTION

special stem assortments

ROOT – STEM JUNCTION

Wenzel Repro Vogel, 1996

special stem assortments

ROOT – STEM JUNCTION ….for skids

Skids in the Austrian Open Air Museum and the Museum Gutenstein, Austria

special stem assortments

ROOT – STEM JUNCTION ….some examples

Austrian Open Air Museum and the Museum Gutenstein, Austria

Benches

Rainwater gutter

wain

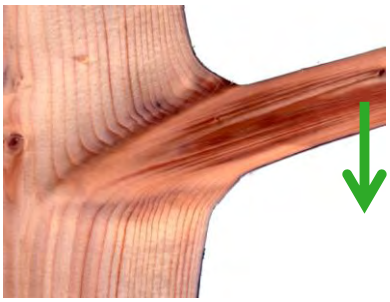
horse collar

special stem assortments

BRANCH – STEM JUNCTION

special stem assortments

BRANCH – STEM JUNCTION

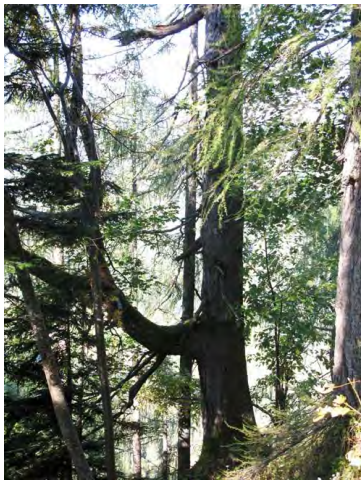


The connection between the stem and the branch has to bear not only its dead load, but also the weight of snow, wind, fruits,….

The natural shape optimization and the fiber orientation lead to a homogeneous strain distribution and therefor to a strong connection. Furthermore, the failure of the connection does not appear suddenly but in steps (Buksnowitz et al, 2010).

special stem assortments

BRANCH – STEM JUNCTION ….for construction



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BRANCH – STEM JUNCTION ….for tool handles

Museum Gutenstein, Austria

special stem assortments

BRANCH – STEM JUNCTION ….for bearing loads

Austrian Open Air Museum Stübing

special stem assortments

BRANCH – STEM JUNCTION ….for small objects

Austrian Open Air Museum and the Museum Gutenstein, Austria

pipe

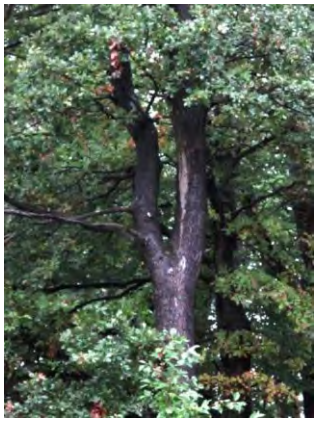
Standpipe

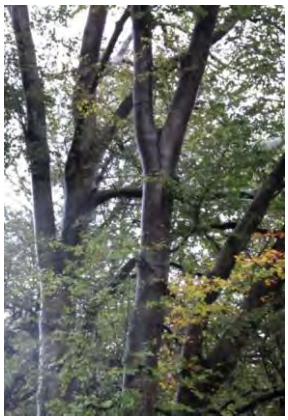
sputterer

Walking sticks

special stem assortments

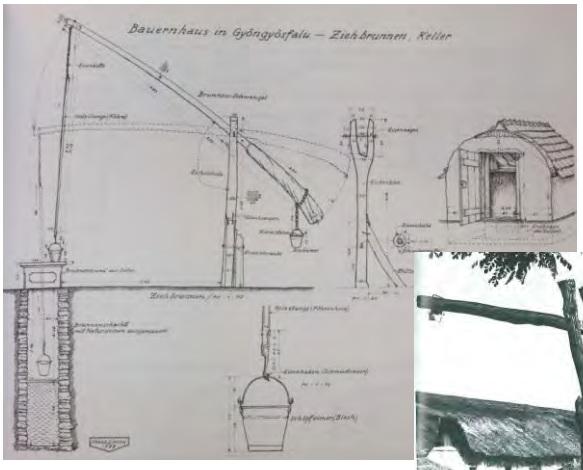
BRANCH JUNCTION





special stem assortments

BRANCH JUNCTION ….for construction



Drawing well in Burgenland, Austria
Simon 1981 and Svoboda 1975

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BRANCH JUNCTION ….for agriculture and others

Austrian Open Air Museum and the Museum Gutenstein, Austria

grinding unit

leader

stilt

skid

catapult

special stem assortments

BCKU

BRANCH JUNCTION ….for agriculture and others

Austrian Open Air Museum and the Museum Gutenstein, Austria

Door opener

Rake handle

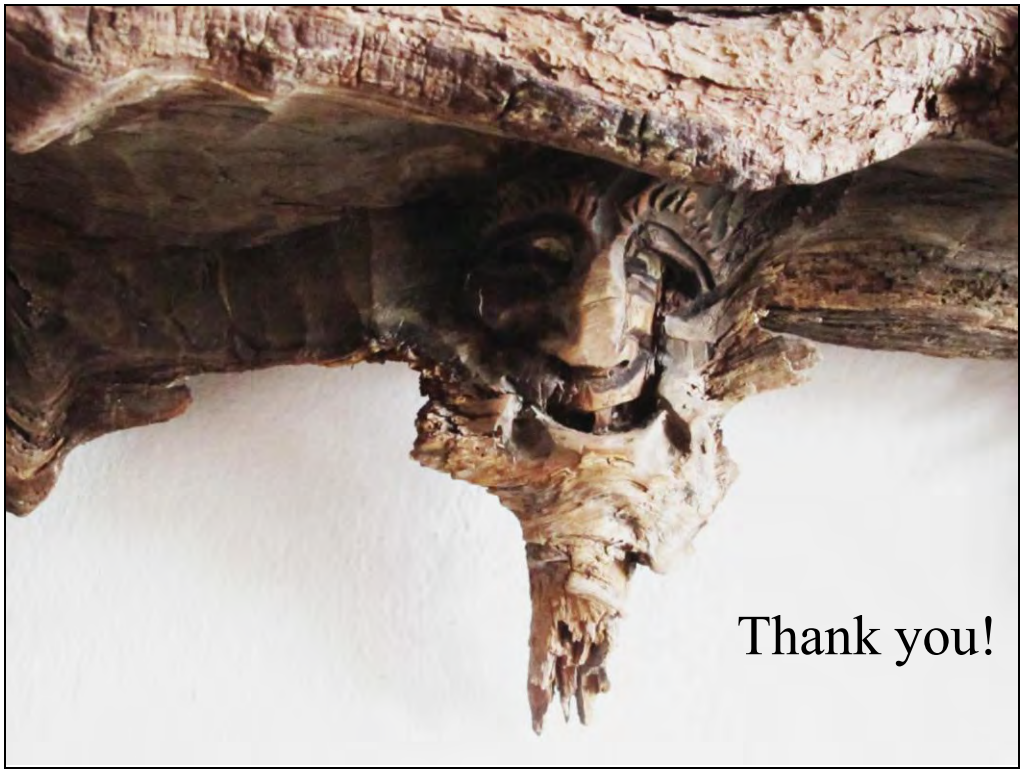
breaking grain

Shaker in a mill

wain

special stem assortments

It is important to realize that there is a specific application for every habitus, for every part of a tree and for every tree species.



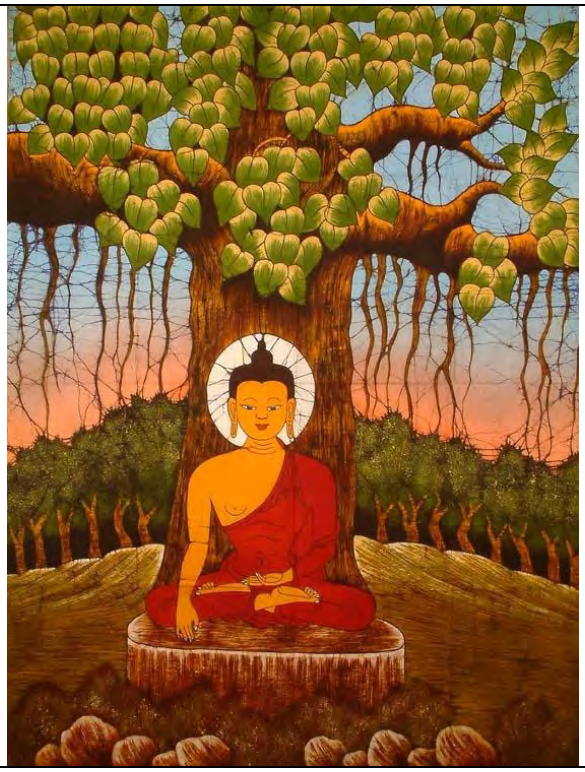
The Fourth Dimension of Wood

V Ramakrishnan[4]

[4] Chairman, Leitz Tooling Systems India Pvt. Ltd., (ramu@leitzindia.com)

The *fourth dimension* of Wood

What is the *fourth dimension?*



J.B. Priestley's 'Delight'. It reads:

"Apart from sawing and splitting and knocking a nail in here and there, I have had little to do with wood, yet I never go where wood is being worked, never stand near a carpenter or cabinet maker, without feeling at least a trickle of delight.

To handle newly planed wood, even to look at it or smell it, is to receive a message that life can still be in good heart. The very shavings are crisp confirmation. There is a mystery here.

Is it because wood, no matter how chopped and trimmed and planed, somehow remains alive? I put my hand on the desk on which I am writing now, it is almost as if my palm fell on the shoulder of a brother.

Into this patient material have passed rain and sun, steely mornings in March, the glow of October: it has lived as some secret part of us still lives. And notice how few men who work with wood seem unhappy, defeated. When we write about a carpenter, we call it ***the New Testament*** ".