

# Application of Near-Infrared Spectroscopy to determine the Juvenile–Mature Wood transition in Spanish conifers used in construction.

Antonio Ruano Sastre, Juan Ignacio Fernandez-Golfín Seco, Mariola Sanchez González.

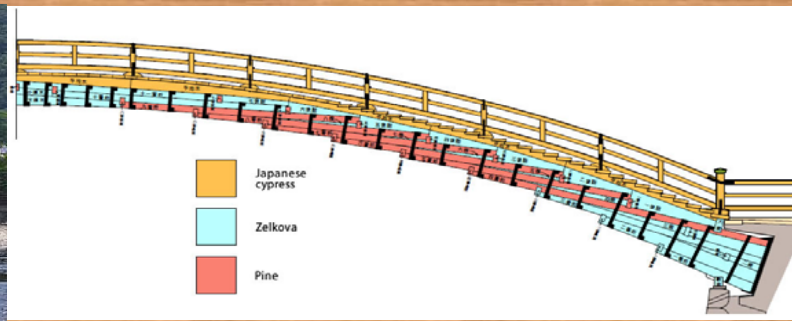
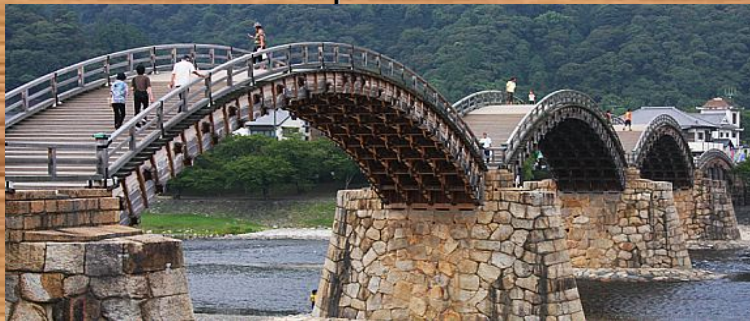


INIA-CIFOR. Ctra. de La Coruña, km. 7,5. 28040-Madrid  
Inside the project RTA2014-0005 of CIFOR-INIA



# 1. Wood use in construction

- Oldest and most used building material
  - Strength
  - Workability
  - Availability
- Wood advantages in current world problems
  - Renewable
  - Lowest carbon footprint when processed
  - Carbon sequestration



## Slide 2

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**M1** The arch ribs are made of keyaki wood and pine, which have high working strength, while the covering and handrail are hinoki wood, a species of cypress

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## 2. Wood problems in construction

- Product variability (Species, within species and along the tree)
  - Physical
  - Chemical
  - Mechanical
- Variation in radial and vertical direction, earlywood and latewood and along the length of the same ring
  - Climate
  - Site
  - Silviculture
  - Genotype
  - ...
- Shorter rotations implies ↑ proportion of Juvenile wood

### 3. Juvenile wood

- “Still imperfect wood, present in the inner part of the bole near the pith, in which wood characteristics undergo rapid and progressive changes in successively older growth rings”
- Many names depending on tree position and development
- Juvenile wood from the upper part of the bole is different of the one on the lowest part: “physiological aging”

## 4. Juvenile wood characteristics

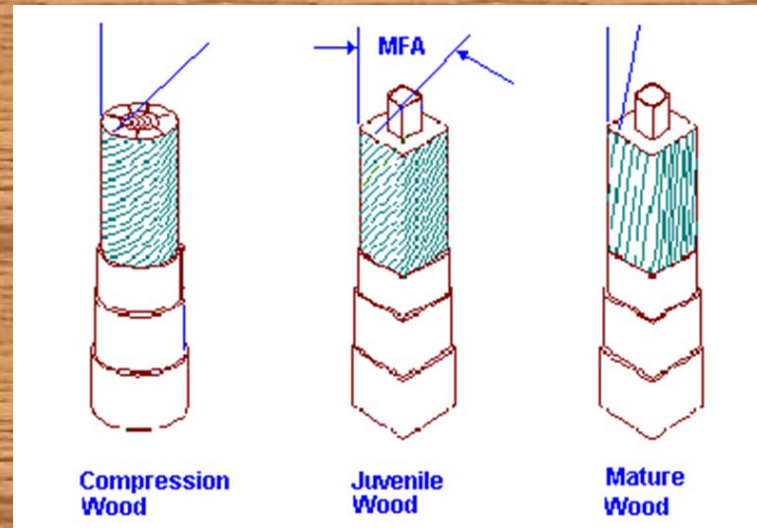
- Lower

- Tracheid length
- Lumen diameter
- Wall thickness
- Density
- Specific gravity
- Transverse shrinkage
- Stiffness
- Cellulose/lignin ratio

- Higher

- Spiral grain
- Microfibril angle

- Not determinant: wide growth rings and high levels of compression wood



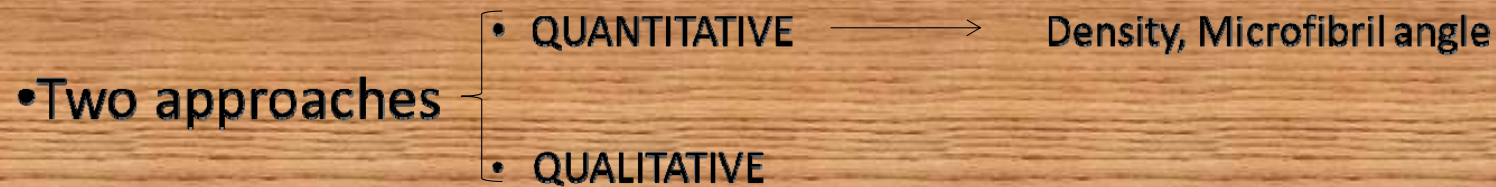
## 5. Problems of Juvenile wood

- Deep negative effect on properties
- Drying distortions
  - Spring
  - Bow
  - Twist
- Lower possibility of final use and economic return
- Problems in kilns



## 5. FT-NIRS for detecting Juvenile Wood

- Cores at two heights and disks every two meters along the bole
- Bruker MPA analyzer using the external fiber optic probe



- Weighing the idea of using hyperspectral NIRs

**Thank you very much for your attention**

**Any question or remark will be appreciated**