

“Building with bio-based materials: Best practice and performance specification”



Performance of *Eucalyptus globulus* single family house in Spain after 15 years exposure.

Example of building with bio-based materials.

Lorenzo, David, Juan Fernández-Golfín, Manuel Touza, Manuel Guaita, Alfonso Lozano

■ SUMMARY

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- 2.- PERFORMANCE AND WOOD SERVICE LIFE.
- 3.- PERFORMANCE OF EUCALYPTUS GLOBULUS SINGLE FAMILY HOUSE.
- 4.- CONCLUSIONS.

1.- INTRODUCTION

- Across Europe is very common to find **wooden houses**. Most of these houses used **softwood** species such as: fir, spruce, larch and pine.
- In Spain wooden houses, became more and more popular since 90's, when sawn and glue-laminated wood were utilized for building wooden structures.
- This material is made in a lot of cases of **softwood** species from central and northern European origin and production. It's not common to find examples of hardwood species used in wooden houses.
- This presentation show an example of a wooden house built using a local **hardwood** species.



1.- INTRODUCTION

- Wood species selected to build the single family house is ***Eucalyptus globulus***, a no native tree that was introduced from Australia in north Spain and Portugal in the middle of the **XIX** century.
- During the first decades eucalyptus was used in different **industrial applications**: Sleepers, stakes, ships, civil construction, etc.
- From the **XX** century Eucalyptus plantations were expanded rapidly due the **pulp industry** destination.
- Nowadays this is main destination as well as another industrial uses: Sawn wood , glue-lam, flooring carpentry, etc.



2.- PERFORMANCE AND WOOD SERVICE LIFE

- **Uses classes:** 1, 2, 3, 4 and 5.
- **Wood species:** Durability and treatability.
- **Climatic conditions:** Climate and local climate.
- **Design details:** Distance from ground, sheltering,...
- **Position and thickness:** Horizontal/vertical.
- **Maintenance:** Coatings.



3.- PERFORMANCE OF EUCALYPTUS GLOBULUS HOUSE IN SPAIN

- **Timber house:** Single family house
- **Construction year:** 2002 (15 years)
- **Use classes:** 1, 2, 3.1 and 3.2
- **Wood species:** *Eucalyptus globulus Labill* (blue gum)
- **Wood type:** Sawn and glue-lam wood heartwood
- **Details design:** Sheltering, distance from ground, etc.
- **Preservative Treatment:** No
- **Coating:** Natural oil



3.- PERFORMANCE OF EUCALYPTUS GLOBULUS HOUSE IN SPAIN

- **Climate conditions** (rain, sun, etc.) is a key factor in the performance of exterior wooden structures, affecting strongly the durability and susceptibility to decay.

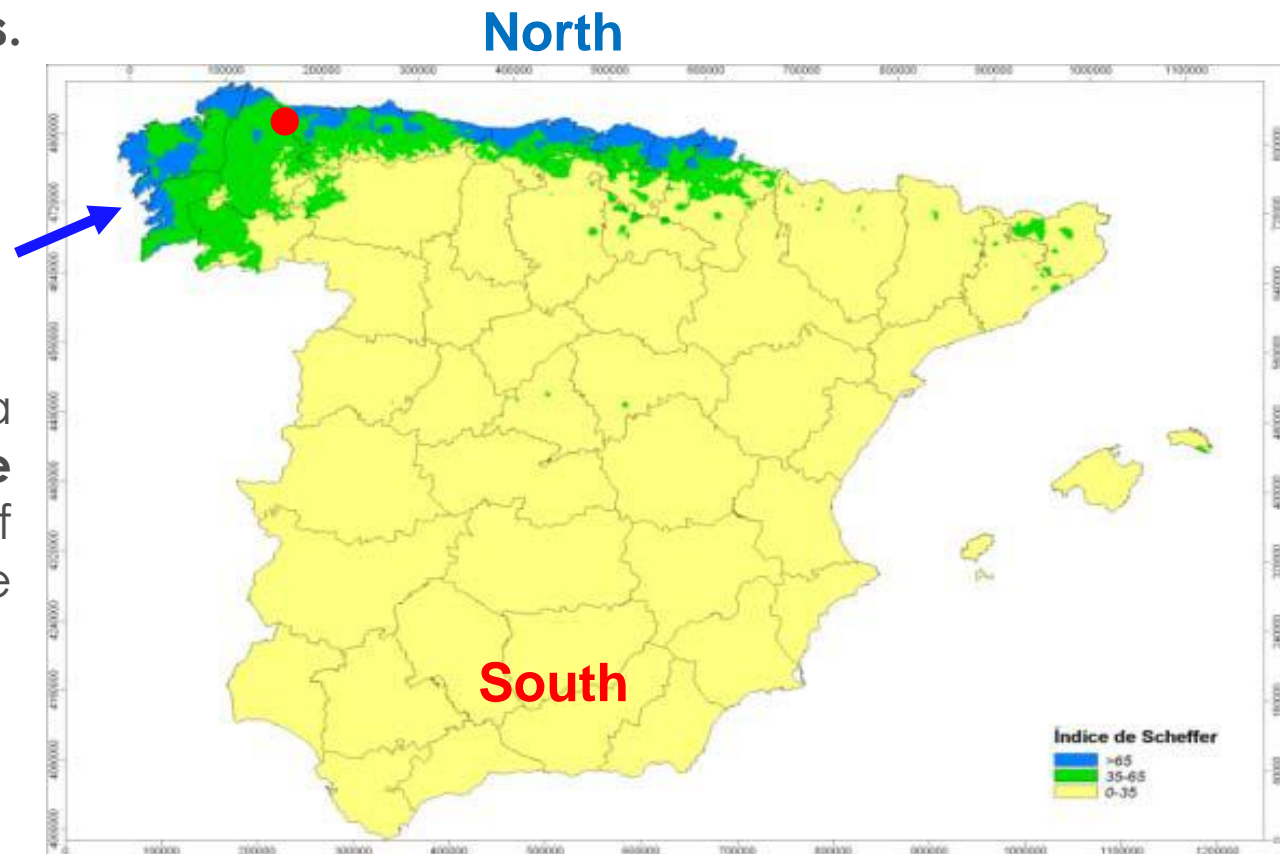
- There is a high variability of the **climate conditions in Spain** due to different **rainfall and temperatures.**

North climate:

- Rainy: Wet, high RH.

- Warm:

- Winds: South-west
The house is located in a **valley** with high **relative humidity**, most days of the year there are frequent **fogs**.



3.- PERFORMANCE OF EUCALYPTUS GLOBULUS HOUSE IN SPAIN

- *Eucalyptus globulus* **heartwood** is characterized by its high natural durability EN 350:2016:

N°	Scientific name	Code acc. to EN 13556	Common name	Origin	Density/ kg/m ³ at 12 % MC	Durability of heartwood			Treatability		Sap wood width	Additional data / information when available
						Fungi	Anobius	Termites	Heartwood	Sapwood		
11	<i>Eucalyptus globulus</i> Labill.		X: Blue gum E: Southern Blue Gum F: Eucalyptus bleu D: Blauer Eucalyptus	Galicia (Sp)	750-800-900	(2)	D	S	n/a	n/a		

- So using only **heartwood** it does not require preventive preservative treatment (even in use class 3) to achieve a good performance.



3.- PERFORMANCE OF EUCALYPTUS GLOBULUS HOUSE IN SPAIN

- The single family house was built in 2002, using entirely **sawn** and **glue-lam** *Eucalyptus globulus* **heartwood** in all elements of the house:
 - Structural elements: Pillars, beams,...
 - Facade: Walls, cladding,...
 - Roof, water spouts,...
 - Flooring and decking
 - Stairs,...
 - Windows, doors, galleries, carpentries,...



3.- PERFORMANCE OF EUCALYPTUS GLOBULUS HOUSE IN SPAIN

- Regarding **design details**, the objective of the design is avoid prolonged time of wetness in the wood elements.
 - The house is **raised** from ground more than **1m**.
 - The **structural supports** are protected from the **rain**.
 - **Perimeter eaves** around the house that protect above south and west exposed facades from **driven rain**.
 - The **end of main beams** (end grain) is physically protected.
 - The **horizontal face** of main beams have physical protection.
 - The **decking** in the gallery around the house has been designed with a separation of 1.5 cm to avoid water traps and drying fast.



3.- PERFORMANCE OF EUCALYPTUS GLOBULUS HOUSE IN SPAIN

North facade

- **No Driven rain:** No exposed facade
- **Distance from ground:** > 2m.
- **Sheltering:** Eaves an front porch.
- **Good performance:** Without moulds, decays, etc.



3.- PERFORMANCE OF EUCALYPTUS GLOBULUS HOUSE IN SPAIN

East facade

- **No Driven rain:** No exposed facade
- **Distance from ground:** Foundation > 1m.
- **Sheltering:** Eaves.
- **Good performance:** Without moulds, decays, etc.



3.- PERFORMANCE OF EUCALYPTUS GLOBULUS HOUSE IN SPAIN

South facade (exposed)

- **Driven rain**
- **Distance from ground:** > 50 cm.
- **Sheltering:** Eaves and porch.
- **Good performance:** Without moulds, decays, etc.



3.- PERFORMANCE OF EUCALYPTUS GLOBULUS HOUSE IN SPAIN

West facade (exposed)

- **Driven rain**
- **Distance from ground:** > 2 m.
- **Sheltering:** Eaves and gallery.
- **Good performance:** Without moulds, decays, etc.



3.- PERFORMANCE OF EUCALYPTUS GLOBULUS HOUSE IN SPAIN

- All wooden elements were finally coating with **natural oil**.
- It is worth pointing out that all **joins** between structural glue lam eucalyptus components have been assembled with **traditional techniques** and without using **metallic elements**, so the only structural material used in this house is **wood**.



4.- CONCLUSIONS

- After 15 years from the construction in 2002, this single family house built in north Spain, using entirely Sawn and glue-lam ***Eucalyptus globulus* heartwood** in all elements, **without preservatives** and considering very well **details design**, has nowadays a perfect performance.
- The **performance** in all wooden elements (interior and exterior) is perfect, without appearance of: moulds, wood disfiguring fungi, decays, wood destroying insect attacks, aesthetics or other pathological processes and continues to serve their original purpose.
- This house constitutes a prime example of the versatility of this **hardwood** in structural, carpentry and decorative wood elements.
- And it is a perfect example of “**building with bio-based materials, best practice and good performance**”.





THANK YOU VERY MUCH FOR YOUR KIND ATTENTION!

David Lorenzo
davidlorenzofouz@gmail.com

