Historical Anatomy of Sacred Statuary in Brazil: Wood Anatomy and Physical Properties

João Carlos Ferreira de Melo Júnior *

Wood was a principal source material used in the making of sacred statuary in Brazil during the 16th and 19th centuries. Artisans used timber in the sacred carpentry based on the singular properties of the wood and the locally available forestry bioresources. The present study aimed to evaluate the wood species used in sacred statuary and to show how some wood properties relate to this carpentry. Based on original data and specialized literature, the results demonstrate the use of 17 preferred wood species, with *Cedrela* sp. (Meliaceae) as the most notable. This wood species presents low density, texture, and secondary metabolites that facilitate manual work and protect against xylophagous attack. Additionally, the sweet odor of this wood symbolizes sacred knowledge. Hence it can be concluded that cedar is a historically important wood for the making of sacred statuary in all Brazilian regions.

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*Contact information: Post Graduate Program in Health and Environmental, and Cultural Heritage and Society, University of the Region of Joinville (Univille), Rua Paulo Malschitzki, 10 – Zona Industrial Norte, Joinville, SC 89219-501, Brazil; *Corresponding author: joao.melo@univille.br*

The use of wood is an ancient practice that combines symbolic, traditional, and technological aspects in many countries (Stanciu *et al*. 2024). Sacred wood sculptures are present in many cultures around the globe, with important examples in Europe (Macchioni *et al*. 2014), Africa (Hassaan 2016), Asia (Banerjee *et al*. 2008), Oceania (Koenig *et al*. 2007), and the Americas (Lisboa 1994). Wood sculptures in Brazil are strongly linked to the Christian religious tradition. The making of such wood sculptures began in the second half of the 16th century with the arrival of Portuguese religious orders and, with them, artisans attracted by gold mining. In addition to the sculptors that came from Portugal, wood carpentry and its original techniques merged with local knowledge about the diversity of trees and with the characteristics of the population in each place occupied by these artisans (Fabrino 2012).

Cultural Timber in Sacred Statuary

Data on the use of wood species in the traditional carpentry of sacred sculptures in Brazil are from original data and a database available in the Zenodo repository (Melo Júnior *et al*. 2025). Scientific and vernacular names, as well as the geographical distribution of taxa, follow the Brazilian flora database (BFG 2021). Wood properties were extracted from catalogs of Brazilian woods (BSF 2025).

A total of 354 sacred sculptures from across Brazil were examined, in which 42 wood species, 32 genera, and 17 botanical families were identified (Fig. 1). Angiosperms account for 88.2% of the botanical families, whereas gymnosperms represent 11.8%. The family Meliaceae is the most prominent, both in species diversity (six species) and in the number of sacred sculptures (261 sculptures, 73.7%). Five genera belonging to this family

were recorded (*Cabralea*, *Cedrela*, *Entandrophragma*, *Guarea*, and *Trichilia*). Fabaceae is the second most representative family (24 sculptures, 6.8%), comprising seven genera (*Albizia*, *Dalbergia*, *Hymenaea*, *Machaerium*, *Melanoxylum*, *Myroxylon*, and *Plathymenia*) and eight distinct taxa. Lauraceae ranks third, with three genera (*Aniba*, *Nectandra*, and *Ocotea*) and three distinct taxa, totaling 12 occurrences (3.4%). The fourth most representative family is Pinaceae, exotic to the Brazilian flora, whose species *Pinus sylvestris* and *Pinus nigra* occur in 12 sculptures (3.4%). In fifth place is Araucariaceae, a gymnosperm family native to Brazil, represented by a single species, *Araucaria angustifolia*, recorded in 9 sculptures (2.5%). Together, these five families account for 268 of the 354 sculptures studied, representing 89.8% of all occurrences.

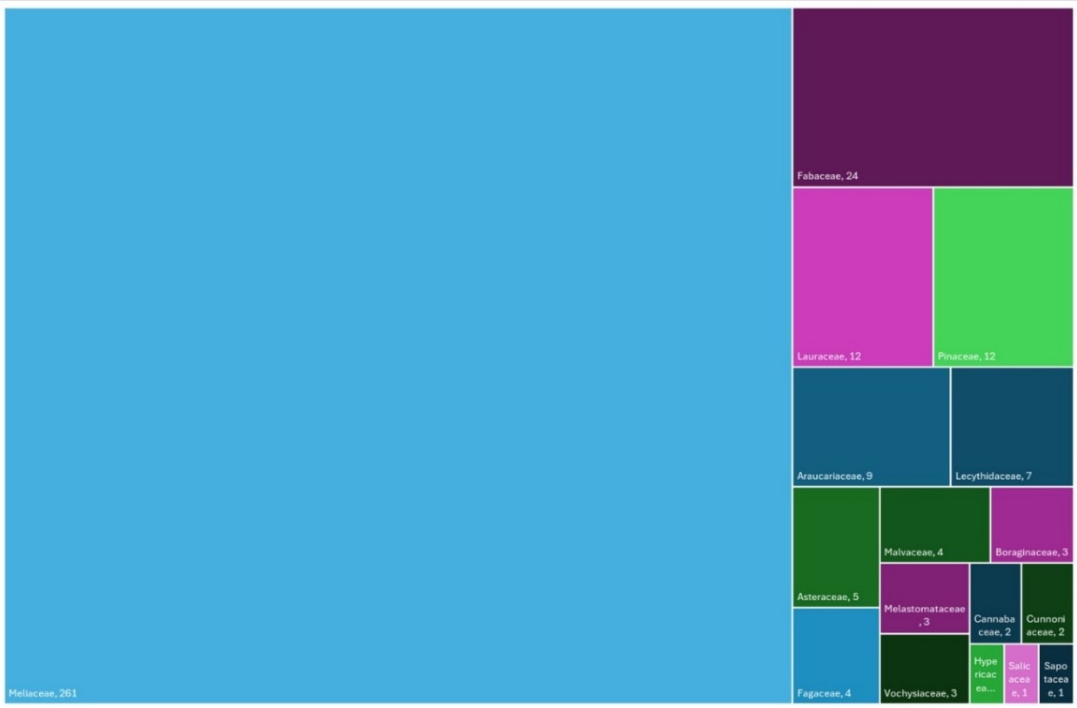

Fig. 1. Diversity of families of wood species used in the carpentry of sacred sculptures in Brazil

Among the most used species in sacred sculptures, 10 species account for 343 occurrences (96.9%), underscoring the technical and cultural selectivity involved in wood choice. The most prevalent is *Cedrela* sp. (including all generic occurrences, *Cedrela odorata*, *Cedrela fissilis*, and *Cedrela aff. odorata*), with 261 records (73.7%) and widespread use in all Brazilian geographic regions. Following this are *Pinus* sp. (including *P. sylvestris* and *P. nigra*, 12 occurrences); *Nectandra*/*Ocotea* (11); *Plathymenia reticulata* (10); *Araucaria angustifolia* (9); *Dalbergia* spp. (8); *Cariniana* sp. and its species (7); *Miconia* sp., *Moquiniastrum polymorphum,* and *Castanea* sp. / *Castanea sativa* (3 for each).

Regarding the botanical origin of the woods employed, 95.8% are native to the Brazilian flora, and 4.2% are exotic. Among the exotic species, notable examples include *P. sylvestris* and *P. nigra* (Pinaceae), both originating from the Northern Hemisphere; *Tilia* sp. (Malvaceae), native to temperate regions of Europe and Asia; *Quercus* sp. (Fagaceae), corresponding to Northern Hemisphere oaks; *Castanea sativa* (Fagaceae), of

European origin; and *Bombax* sp. (Malvaceae), likely native to tropical regions of Africa or Asia.

Wood Properties and Traditional Sacred Carpentry

The species most frequently used in Brazilian sacred carpentry, especially those of the genus *Cedrela* (cedar) (Fig. 2), share a set of highly favorable physical and mechanical properties. Cedar wood has distinct growth rings (semi-porous ring), vessels with an average tangential diameter between 100 and 200 μm; frequency of 5 to 20 vessels per mm², simple perforation plates, non-septate fibers with thin to thick walls, diffuse axial parenchyma, scarce and vasicentric paratracheal parenchyma, also arranged in marginal or apparently marginal bands, rays 1 to 3 cells wide and heterogeneous, prismatic crystals present. One of the most notable attributes is the wood's workability, that is, the ease with which it can be cut, carved, sculpted, and sanded. Species such as *C. odorata* have long fibers, straight to moderately interlocked grain, and a medium to fine texture, which enable detailed work with manual or rudimentary tools. Homogeneous coloration and good receptivity to pigments, varnishes, and gilding are additional essential qualities. The pinkish or light-brown heartwood of cedar allows for a uniform visual finish and facilitates the polychromy process, fundamental to the aesthetics of Baroque and Neoclassical sacred art (Lisboa 1994).

Fig. 2. Examples of 18th-century Brazilian sacred statuary in cedar (*Cedrela* sp. – Meliaceae). Caption: A - Our Lady Teacher; B - Saint Joseph of Botas; C - Saint Michael the Archangel; and D - Saint Sebastian.

Another decisive factor is wood density. The species most employed generally fall within a medium density range (between 0.40 and 0.70 g/cm³ at air-dry moisture), providing an ideal balance between lightness and strength (BSF 2025). Very dense woods would be more challenging to work and excessively heavy for the liturgical handling of sculptures. Conversely, very light woods may exhibit low durability or increased susceptibility to biological degradation. In general, species of the genus *Cedrela* possess medium basic density, ranging from 0.50 to 0.60 g/cm³ in *C. fissilis* and from 0.39 to 0.40 g/cm³ in *C. odorata*. Cedar woods also exhibit good dimensional stability, with low rates of warping, cracking, or deformation after drying, ensuring the structural longevity of sculptures even in environments subject to humidity fluctuations. Their moderate resistance to xylophagous insects, especially termites and woodborers, is also valued.

Some species, such as those of the genus *Cedrela*, contain natural oils (cedrol) that provide insect-repellent properties (Creydt *et al*. 2021). In the context of religious sculpture, wood transcends its structural function and assumes symbolic, theological, and material significance that guides its selection and use. Cedar wood, with its pleasant aroma, is associated with the divine presence, reinforcing its connection to the sacred, like the use of other aromatic woods in religious contexts (Buriti and Melo Júnior 2025).

Conclusion

Regional availability, wood properties, and traditions of use all play an important role in perpetuating these materials within the technical repertoires of master carvers. Wood selection for Brazilian sacred art was not random, but somewhat grounded in technical and empirical criteria that combined mechanical efficiency, durability, aesthetic potential, and symbolic meaning, aligned with devotional practices and the biocultural resources recognized by artisans of the time.

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