Validation of the X-ray Densitometry Method for Wood Density Determination of *Acacia seyal* Species

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Introduction

Wood density is a variable influencing many of the technological and quality properties of wood. It is the single most important physical property. Determining the wood density values is important for the end use of wood. The X-ray technique, traditionally applied for softwood species to assess the wood quality properties, due to its simple and relatively uniform wood structure. In the other hand very limited information is available about the validation of using this technique for hardwood species. The suitability of using X-ray technique for the determination of hardwood wood density has a special significance in country like Sudan where only a few timbers are well known. This will not only save the time consumed by using the traditional methods but it will also enhance the investigations of the great number of the lesser known and utilized species, the matter which will fill the huge gap on information of hardwood species growing in Sudan.

The current study aimed to evaluate the validation of using the X-ray densitometry technique to determine the wood density of *Acacia seyal* var. *seyal*. To achieve this aim, a total of thirty trees were collected randomly from four states in Sudan. The wood density was determined using the air dry gravimetric method as well as the X-ray densitometry method in order to assess the validation of X-ray technique in wood density determination.

Materials and Methods

Materials:

The wood raw materials were collected from two rainfall zones in Sudan. Each zone was represented by 15 trees collected randomly from 5 natural stands located in two different states. The location and characterization of the study areas are summarised in Figure 1, while sampling procedure is presented in Figure 2.

Methods:

Air dry density:

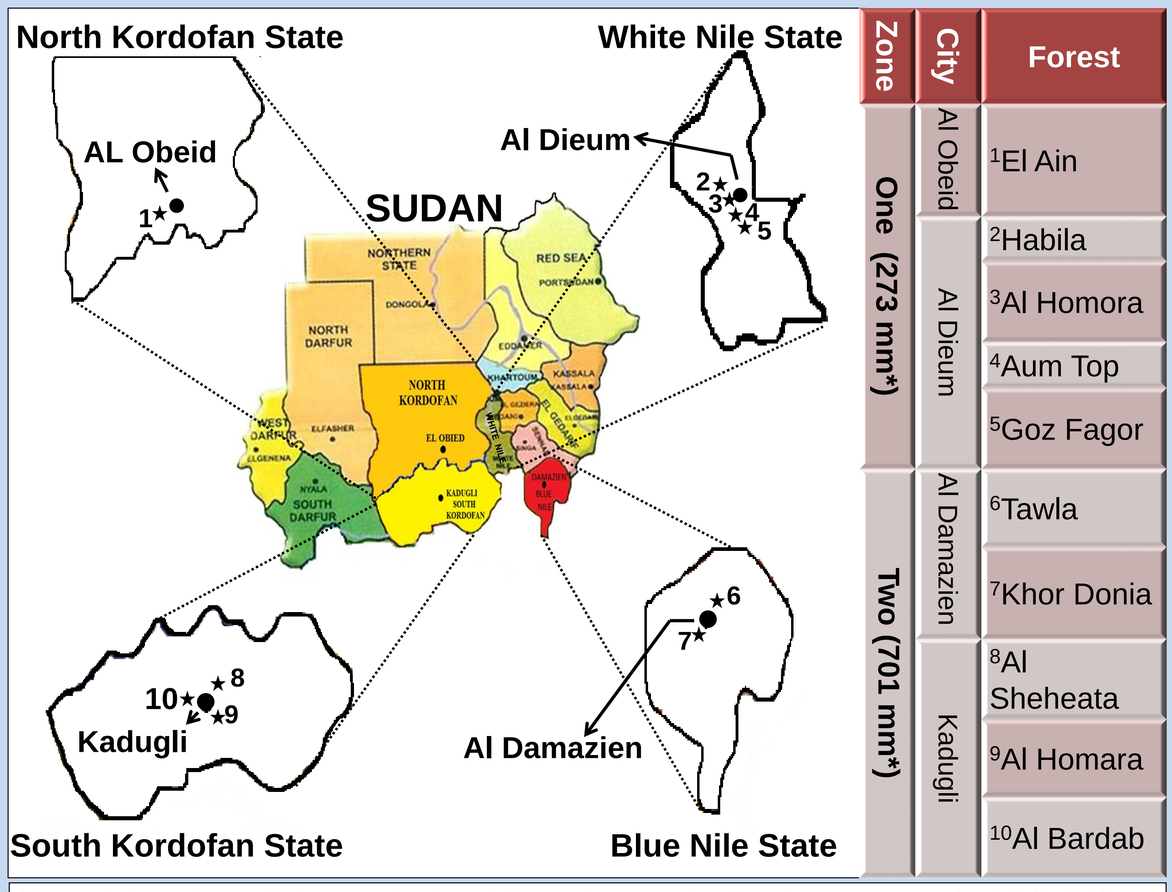
The air dry gravimetric method was conducted on the basic of DIN 52 182 (ANONYMOUS 1991). Wood specimens were taken from three portions representing the distance from pith to bark (10 %, 50 % and 90 %). Then were conditioned to a constant mass at 20 °C air temperature and 65 % relative humidity. The specimens' weight was measured using a sensitive digital balance. The volume was measured using micro caliper. The air dry density was calculated as air dry density divided by air dry volume.

X-ray density:

The X-ray densitometry method described in SCHWEINGRUBER (1988) was adopted to measure the density. Below is an illustration of the X-ray densitometry method.

X-ray densitometry methodology:

1. Wood samples glue in wooden supports,
2. Fiber angles measurement using DENDROSCOPE,
3, 4. Thin cross-sections (laths) cutting using double parallel circular saws,
5. The resulted 1.20 ± 0.05 mm thickness laths,
6. Wood radiographic image and
7. Density measurement using DENDRO 2003.



Zone	City	Forest
One (273 mm*)	Al Obeid	[1]El Ain
	Al Dieum	[2]Habila
		[3]Al Homora
		[4]Aum Top
		[5]Goz Fagor
Two (701 mm*)	Al Damazien	[6]Tawla
		[7]Khor Donia
	Kadugli	[8]Al Sheheata
		[9]Al Homara
		[10]Al Bardab

Figure 1: Location and characterization of the study areas (*= Zone's mean annual rainfall of 10 years from 2000 to 2009)

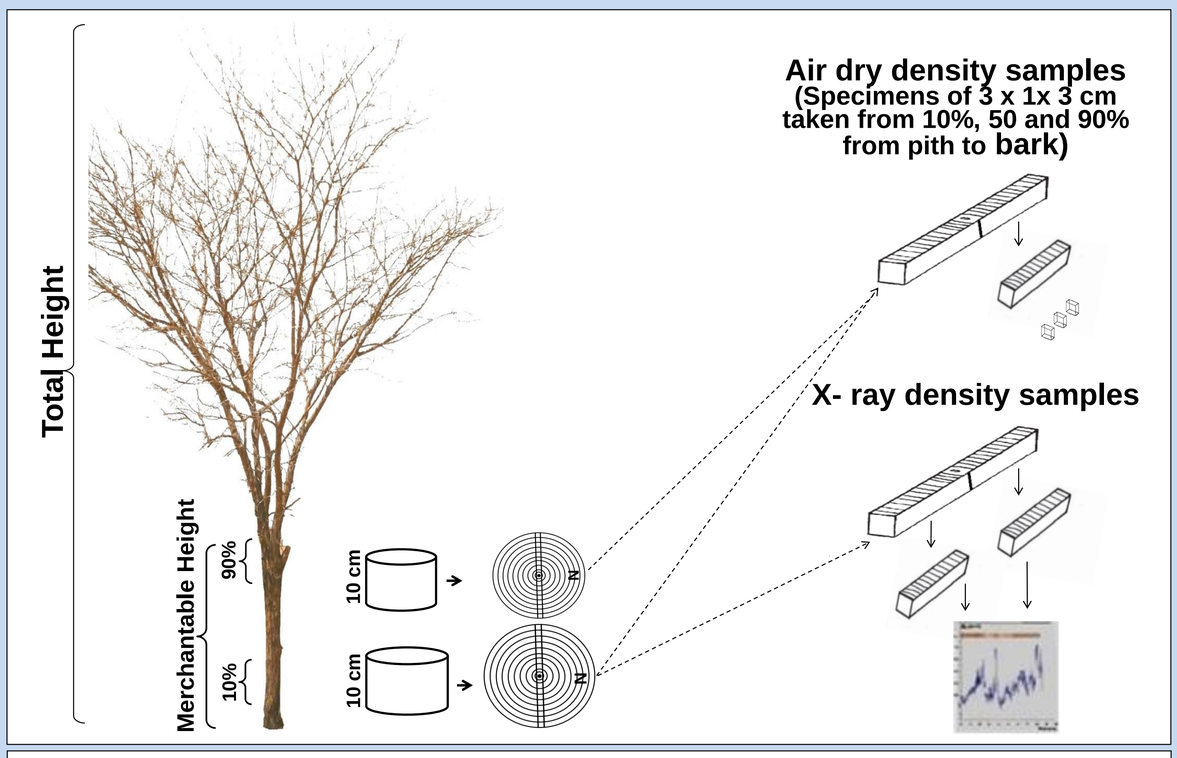


Figure 2: Sampling Procedure

Results

The result reveals no significant differences between the air dry density values and X-ray density values. In both case the wood density follows the increasing trend from pith to bark. This result confirms the validation of using the X-ray technique for *Acacia seyal* var.*seyal* wood density and its radial trend determination. It also promotes the suitability of using this method for other hardwood species. Figure 3 and 4 represent the study species air dry density vs. X-ray density pox plots as over all mean values as well as portions from pith to bark, respectively.

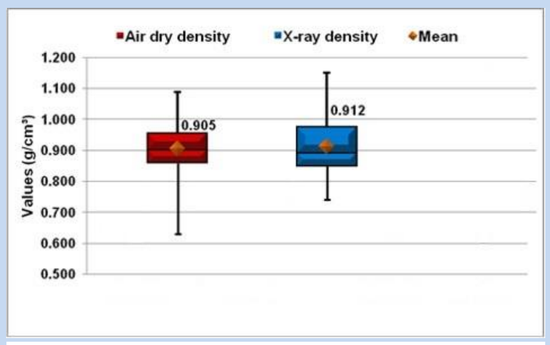


Figure 3: Air dry density vs. X-ray density pox plots (over all mean)

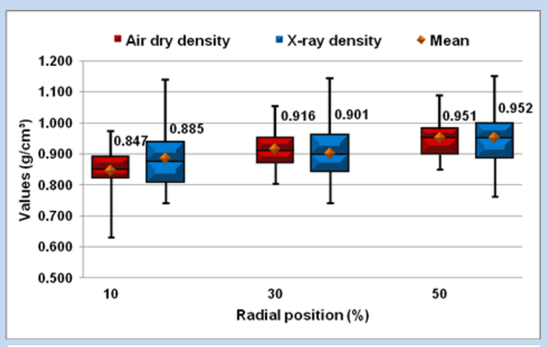


Figure 4: Air dry density vs. X-ray density pox plots (radial portions means)

References

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