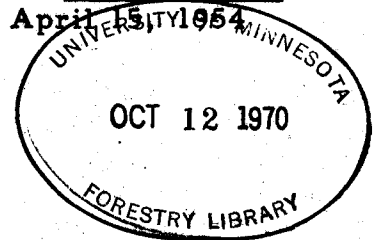




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WETWOOD IN BALSAM POPLAR

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The occurrence of a wetwood condition in the genus *Populus* has been recognized for approximately twenty years. The term "wetwood" was introduced in the literature in 1937(2). Since that time work has been done on this phenomenon by a number of investigators. Bacteria were found to be associated with the wetwood condition in all of these studies.

The purpose of the present study was to determine if there were differences in physical properties between wetwood and the sapwood and heartwood of balsam poplar (*Populus balsamifera*) based upon a study of moisture content, specific gravity, compression strength, toughness strength, and presence of bacteria. The study was based on a sample of 18 trees from 2 areas, one near Roseau and the other near Cloquet, Minnesota.

Wetwood appears in balsam poplar as an irregular zone contained in the xylem of the tree between the normal sapwood and normal heartwood. It is characterized visually by a darkened appearance of the wood, a watersoaked condition, and chemically by pH indicators -- wetwood being slightly basic, sapwood being slightly acidic, and heartwood being essentially neutral.

The results of moisture content and specific gravity determinations from sapwood, wetwood and heartwood zones of each of the 18 trees are set forth in Table 1.

Table 1 Balsam Poplar Wood Moisture Content and Specific Gravity Determinations.

	Moisture Content (Per cent of oven dry weight)		Specific Gravity	
	Range	Average	Range	Average
Sapwood	77-187	122	.28-39	.35
Wetwood	133-250	186	.29-39	.35
Heartwood	100-216	150	.29-42	.34

Statistical analyses showed that there was a significant difference in moisture content between sapwood and wetwood, sapwood and heartwood, and between wetwood and heartwood. Wetwood had the highest moisture content followed by heartwood, with sapwood having the lowest moisture content. There was no significant difference in specific gravity between any two of the zones compared.

A comparison of compression and toughness strengths was made only between heartwood and sapwood since it was not possible to obtain wetwood samples which were large enough for testing. The results of these tests are set forth in Table 2.

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(2) Crandall, B.S., Carl Hartley and R.W. Davidson. 1937. Wetwood. *Phytopath.* 27:126.

Table 2. Compression and Toughness Strength Tests of Balsam Poplar Wood.*

	Compression Strength (Pounds per square inch)		Toughness Strength (Inch-pounds)	
	Range	Average	Range	Average
Sapwood	1652-2854	2308	55-240	166
Heartwood	1245-2238	1792	16-161	68

* This material was tested at a moisture content of 7.5 to 8.5 per cent.

Statistical analyses showed that there was a significant difference between the compression strength of sapwood and heartwood, and between the toughness strengths of sapwood and heartwood. The heartwood was very brittle and failed in toughness tests with a brash type of break.

Comparative differences in physical properties related to geographical location were also noted. These differences may have been due to site, age, or rate of growth since these factors were different in the two locations. Nine of the trees from Roseau, Minnesota, were on a heavy gumbo type soil, were approximately 70 years old, and were located in a corner of an 80-acre wooded pasture. The 9 trees from Cloquet, Minnesota, were on a sandy ridge on the edge of a spruce swamp and were approximately 50 years old. The results of a comparison between these 2 samples are set forth in Table 3. Moisture content and specific gravity determinations include sapwood, wetwood and heartwood; compression and toughness test determinations include sapwood and heartwood only.

Table 3. Effect of Geographical Location on Physical Properties of Balsam Poplar Wood.

	Trees from Roseau		Trees from Cloquet	
	Range	Average	Range	Average
Moisture content	77-207	134	108-250	172
Specific Gravity	.30-.42	.36	.28-.41	.34
Compression Strength	1245-2765	2056	1545-2854	2045
Toughness Strength	39-240	104	15-161	70

Statistical analyses showed that there were significant differences in moisture content, specific gravity and toughness strength in wood from the two locations, but no difference in compression strength.

Isolations to determine the presence of bacteria were made from the heartwood, wetwood and sapwood zones of each tree. The results based on a total of 270 isolations from each zone are set forth in Table 4.

Table 4. Bacterial Isolations (Percentages of total isolations from each zone which contained bacteria, fungi, or were sterile).

	Sapwood	Wetwood	Heartwood
Bacteria	54.4	92.5	68.3
Fungi	1.7	2.2	10.4
Sterile	43.9	5.3	21.3

The following conclusions concerning balsam poplar wood were drawn from the samples analyzed in this study:

- (1) Wetwood contained more water per unit volume of wood than did sapwood or heartwood, and heartwood contained more water than did sapwood.
- (2) There was no difference in specific gravity between sapwood, heartwood, and wetwood.
- (3) Heartwood was weaker than sapwood in both compression and toughness strength.
- (4) There were differences in the physical properties of wood from 2 different locations. These differences may have been due to site, age, rate of growth, and a number of other factors not investigated in this study.
- (5) Bacteria were more prevalent in the wetwood zone than in the heartwood or sapwood zones, and more prevalent in the heartwood zone than in the sapwood zone.