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Presettlement Pinus tadea Mississippi Valley Alluvial Plain of the Monroe County, Arkansas Area

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GENERAL NOTES

Presettlement *Pinus taeda* in the Mississippi Valley Alluvial Plain of the Monroe County, Arkansas Area

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Introduction

Loblolly pine (*Pinus taeda*) is the most dominant conifer in the southeastern United States (Baker and Langdon, 1990). However, loblolly pine was conspicuously absent from virtually the entire Mississippi Valley Alluvial Plain during presettlement times. A map (Fig. 1) of the native distribution of loblolly from Baker and Langdon (1990) identifies 2 exceptions to this gap–a narrow strip of land (Macon Ridge) in northeastern Louisiana corresponding to Quaternary-period braided stream terraces left by the ancestral Arkansas River and a small pocket of braided stream terraces from the ancestral Missouri and Mississippi rivers in Arkansas (Saucier, 1974). Unlike Macon Ridge (a noticeably elevated landform), the Arkansas terraces are flat to very gently rolling plains subject to frequent, long-term and large-scale inundation (at least before modern drainage and flood control projects).

Although many hectares of Mississippi Valley Alluvial Plain have been planted in conifers during the last century, the pine found in the Monroe County, Arkansas area is of natural and prehistoric origin. Between 1815 and 1842, General Land Office surveyors traversed this area and reported abundant pine. Soon afterward, portions of the study area became the property of the American Land Company, which offered them for sale (American Land Company, 1844). A quarter-section (64.8 ha) in Township 1 North, Range 1 West (T1N R1W) was described as "...all post oak and pine glade, wet and boggy. Worth nothing" and a different parcel in T2S R1W was similarly recounted as a "...poor post oak and pine glade, very wet and boggy" (American Land Company, 1844, pp. 11, 16). Decades later, botanist Roland Harper journeyed through eastern Arkansas and reported a "good deal" of loblolly pine in Monroe County east of Brinkley; he further noted that "...this was the only place where I saw this pine between Little Rock and Memphis" (Harper, 1914, pp. 43-44). As the 20th Century progressed, this region was drained and/or cleared for lumber, agriculture, pasture, and home sites, but many of the marginal areas reverted to forest cover after other land use practices failed (Harrison, 1954).

Indeed, modern ecological investigation shows that the pine-dominated forests of the area arose from an unusual suite of environmental conditions driven largely by soils and disturbance regimes (Arkansas Natural Heritage Commission, 2002). These site conditions also support several endangered plant and animal species, which in turn has led to growing conservation efforts in the area. For example, the Arkansas Natural Heritage Commission recently purchased a number of small tracts in Monroe County in part to protect some of the second-growth remnants of the pine-dominated portions of this landscape. To improve our understanding of the complex interactions that produced this unique area, this paper describes the presettlement vegetation patterns reported in the public land survey records with additional materials from other historical descriptions.

Materials and Methods

From the GLO survey notes (Daniels, 2000), I analyzed all or part of 14 townships in east-central Arkansas for the abundance and distribution of tree species, ecological communities, and any other natural features. The study area encompasses most of eastern and central Monroe County and portions of Lee, Phillips, and St. Francis counties, an area of approximately 130,000 hectares (Fig. 2). Throughout the region, soils tend to be poorly or somewhat poorly drained and wet throughout much of the winter and spring. Locally, soils of the Foley-Calhoun-Bonn and Lafe-Bonn complex are of particular interest, as their high levels of sodium and magnesium help to structure the complex mosaic of unique plant communities (Arkansas Natural Heritage Commission, 2002).

Most information for this paper is derived from the individual trees used by the surveyors to witness their efforts. GLO surveyors recorded the names, diameters, distance, and bearings of 2 to 4 witness trees at each section, quarter-section, and meander corner on an approximately 1.61 km by 1.61 km lattice throughout the study region. In addition, surveyors also recorded the name, diameter, and distance from corner of 1 to 3 line trees for each 1.61 km of section line established.

Species identifications in the GLO and other forms of historical plant records are often only approximate at best, and often the common (surveyor-given) name is vague and

may represent multiple species, making identification sometimes no more precise than genus (MacRoberts et al., 1997; Bragg, 2002). For continuity, taxonomic identifications provided by the surveyors will primarily follow the interpretations of Bragg (2002) with modifications based on regional species occurrences.

Results and Discussion

Evidence of Human Influence.– In the study area, very few indications of Euroamerican settlement were given in the GLO survey notes, suggesting that little environmental modification had occurred immediately before and during the surveying period of 1815 to 1842. Some of the later resurveys (conducted in the 1840s) mention roads or trails, which is not surprising given that Monroe County was along one of the major routes between Memphis and Little Rock. A handful of pioneers and their clearings (sometimes called "improvements") were also reported in the 1840s resurveys, indicating that permanent settlement and subsistence agriculture had begun. There is virtually no mention of other forms of land clearing or disturbance, which suggests that the vegetation patterns reported by the GLO surveyors should be consistent with the virgin forests of the region.

Numerous openings identified as prairies were reported throughout the study area. Undoubtedly, many of these represent grasslands of natural origin, maintained by extreme site conditions unfavorable for tree growth. Other, more transitory grasslands may have been kept open by frequent fires, perhaps set by Native Americans and Euroamerican hunters. There is no direct evidence that any of these openings were the abandoned remnants of Native American agricultural practices. However, there are locations from the nearby Crowley's Ridge area where Indian fields were still being specifically identified by the GLO surveyors in the 1810s and 1820s.

Taxonomic Abundance.– The GLO records produced 3,458 trees from about 40 taxa (Table 1). Individuals labeled white oak (probably *Quercus alba* and/or *Quercus michauxii*) comprised 18.05% of witness trees, followed by black oak (various *Quercus* spp.; 16.14%), hickory (*Carya* spp.; 10.47%), elm (*Ulmus* spp.; 6.30%), and pine (probably loblolly; 5.67%). No other single taxon contributed more than 5% of the total number of witness trees, and 4 were represented by a lone tree. Because of biases in how they were chosen, the frequencies in Table 1 do not directly translate to species dominance. However, witness tree counts broadly reflect the patterns of taxonomic abundance in the Monroe County study area during the historical surveying period. In other words, infrequently reported species were probably not common on the landscape (or were too small on average to be regularly used as witness trees).

Black oak was not more precisely defined than *Quercus* spp. in Table 1 because of known issues with the GLO surveyors' identification of the taxon compared to modern interpretations. Contemporarily, black oak is *Quercus velutina*, but this species is most prominent in drier, rockier hills and slopes in parts of northern Arkansas and the central United States and is increasingly uncommon as one heads southward or onto the major floodplains (Sargent, 1947). Bragg (2003) also reported unusually high levels of black oak in the GLO survey records from Ashley County, Arkansas, suggesting that a wide range of oaks were probably lumped into the black oak group. In addition to some *Quercus velutina*, other probable taxa placed into this group by the surveyors may include southern red oak (*Quercus falcata*), cherrybark oak (*Quercus pagoda*), Shumard oak (*Quercus shumardii*), Nuttall oak (*Quercus nuttallii*), and perhaps even water oak (*Quercus nigra*).

Pine was not identified to species in the GLO work conducted in Arkansas, although only two distinct species (*Pinus taeda* and *Pinus echinata*) are native to the state. The best available evidence suggests that the pines the surveyors encountered were loblolly. For example, Harper (1914) reported only loblolly pine in his travels through this part of Arkansas. Shortleaf pine, though common in the uplands of presettlement Arkansas (including the nearby Crowley's Ridge), fares much more poorly than loblolly on wet sites and is very rarely found in bottomlands. However, the presence of loblolly pine in this portion of Arkansas is also highly unusual (Grimmett, 1989).

Witness Tree Size.– For a region with extensive poor soils, a surprising number of very large trees was found (Table 2). As an example, the largest witness tree was a 203 cm diameter white oak found in T1N R1W by one of the first surveyors to traverse the area. Oaks and baldcypress (*Taxodium distichum*) dominated the big witness trees, with only a few other taxa exceeding 100 cm in diameter. Baldcypress witness trees were particularly large, averaging 86 cm in diameter with a maximum of 183 cm (Table 1). Baldcypress also constituted 35% of the largest trees recorded in the GLO notes of the study area (Table 2). However, given the commercial interest in baldcypress during the early 19th Century, it is not surprising that large cypress trees were noted (Bragg, 2003). Only 1 pine exceeded 100 cm in diameter–most were less than 50 cm (Fig. 3). Unlike some of the hardwood species that showed an affinity for better quality locations, pine was most prevalent in the poor to moderate sites. Therefore, it is noteworthy that a species like loblolly that usually reaches a very large size on low terraces only infrequently exceeded 50 cm in diameter (Table 1, Fig. 3).

On average, most (74.7%) witness trees ranged from 12 to 51 cm in diameter (Table 1, Fig. 3). Some taxa provided very small diameter witness trees–down to 3 cm (elm) and 5 cm (white oak), although most exceeded 10 cm. These

minimums do not reflect the true distribution of small diameter stems on the landscape because surveyors avoided diminutive individuals. This bias by omission arose in part because surveyors needed to scribe a lot of information on the boles (a difficult task on a small tree), and small diameter trees were also considered more prone to mortality, given the degree of bark injury inflicted upon them. Small tree bias also means that species that rarely exceed 12 cm in maximum diameter are almost never used as witness corners, even though they may be fairly common across the landscape.

Other Surveyor Observations on Pine.– The GLO notes of the study region recorded numerous areas as "pine woods" or "pine land", suggesting that loblolly was the dominant overstory species in some stands. More often, pine was reported as mixed with oak and other hardwoods, sometimes with prominence given to pine (i.e., pine was listed first) or as a subordinate (e.g., "oak and pine"). In these areas, it is not unusual to see "huckleberry" (*Vaccinium* spp.), "briers" (possibly *Rubus* or *Smilax* spp.), and "swamp spice" (probably *Lindera benzoin*) listed by the surveyors as understory associates.

Loblolly plantations in the Mississippi Valley Alluvial Plain can be successful if they are not flooded too frequently or for too long of a duration. It is rare to see much natural regeneration under these plantations, although loblolly and other conifers have shown some ability to naturalize in the region under certain conditions. Nevertheless, the surveyors reported abundant natural loblolly pine regeneration in portions of Monroe County, indicating the potential for long-term persistence of loblolly pine in this seasonally flooded alluvial landscape. For instance, in 1820 deputy surveyor Nicholas Rightor identified the undergrowth in T2S R1W as "small Pine [and] Huckleberry". Another surveyor, John Garretson, frequently reported "oak and pine bushes" in the portions of T4N R2W where pine was a prominent species. Presumably, "bushes" referred to thickety patches of oak and pine regeneration, possibly stunted by long-term overstory suppression, repeated fire injury, or severe soil conditions.

Conclusions

In presettlement times (before 1850), this portion of Monroe County was a complex mosaic of hardwood swamps and flatwoods, scattered prairies and other openings, and occasional conifer-dominated stands. In a landscape covered with bottomland oaks, gums, hickories, other hardwoods, and baldcypress swamps, loblolly pine-dominated communities are unexpected elements of structural, functional, and compositional diversity. Thus, modern-day analogs of these loblolly pine forests are not artifacts of recent human influence, but rather self-replacing components of the ecosystem.

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Table 1. Probable species and diameter attributes of the witness trees collected from the Monroe County, Arkansas, study area.

GLO surveyor name	Probable taxa	Number of witness trees	% total witness trees	Min. diam. (cm)	Ave. diam. (cm)	Standard deviation (cm)	Max. diam. (cm)
White (W.) oak	*Quercus alba, Q. michauxii*	624	18.05	5	48	21.3	203
Black (B.) oak	*Quercus* spp.	558	16.14	10	46	21.3	127
Hickory	*Carya* spp.	362	10.47	8	33	10.9	76
Elm	*Ulmus* spp.	218	6.30	3	28	13.5	122
Pine	*Pinus taeda*	196	5.67	8	43	19.3	127
Sweetgum	*Liquidambar styraciflua*	162	4.68	8	46	21.3	122
Post oak	*Quercus stellata, Q. michauxii*	152	4.40	8	48	19.8	102
Pin oak	*Quercus nigra, Q. phellos, Q. nuttallii*	151	4.37	8	36	19.6	127

Table 1. Continued.

GLO surveyor name	Probable taxa	Number of witness trees	% total witness trees	Min. diam. (cm)	Ave. diam. (cm)	Standard deviation (cm)	Max. diam. (cm)
Gum	*Nyssa* spp., *Liquidambar*	150	4.34	15	48	21.6	122
Overcup oak	*Quercus lyrata*	116	3.35	10	43	20.8	102
Red (R.) oak	*Quercus falcata, Q. pagoda*	93	2.69	8	46	21.8	122
Tupelo (white) gum	*Nyssa aquatica*	91	2.63	15	43	18.0	102
Ash	*Fraxinus* spp.	75	2.17	10	36	18.8	97
Maple	*Acer* spp.	75	2.17	10	30	11.2	61
Dogwood	*Cornus florida*	67	1.94	8	18	5.3	30
Black gum	*Nyssa sylvatica*	58	1.68	8	36	13.5	76
Willow oak	*Quercus phellos*	45	1.30	15	41	15.2	76
Cypress	*Taxodium distichum*	36	1.04	15	86	45.2	183
Swamp white oak	*Quercus michauxii*	32	0.93	18	48	20.8	102
Pecan	*Carya illinoensis*	29	0.84	10	33	17.3	91
Persimmon	*Diospyros virginiana*	26	0.75	8	25	9.4	51
Hackberry	*Celtis laevigata*	24	0.69	10	28	13.7	76
P. oak	*Q. stellata, Q. nigra, Q. phellos Q. michauxii, Q. nuttallii*	21	0.61	10	43	13.2	76
Sassafras	*Sassafras albidum*	21	0.61	10	25	9.7	51
Horn beme	*Carpinus caroliniana*	8	0.23	8	15	4.1	20
Locust	*Gleditsia* spp., *Robinia pseudoacacia*	8	0.23	13	28	13.2	51
Mulberry	*Morus rubra*	7	0.20	10	23	7.6	36
Oak	*Quercus* spp.	7	0.20	25	46	9.1	51
Privey (white or red)	*Forestiera acuminata*	7	0.20	10	15	3.0	20
Cottonwood	*Populus deltoides, Populus heterophylla*	6	0.17	25	38	13.0	53
Honey locust	*Gleditsia triacanthos, Gleditsia aquatica*	6	0.17	20	33	21.3	76

Table 1. Continued.

GLO surveyor name	Probable taxa	Number of witness trees	% total witness trees	Min. diam. (cm)	Ave. diam. (cm)	Standard deviation (cm)	Max. diam. (cm)
Swamp oak	*Quercus michauxii, Q. nuttallii*	6	0.17	51	61	12.4	76
Ironwood	*Ostrya virginiana*	5	0.14	13	18	3.8	23
Boxelder (maple ash)	*Acer negundo*	4	0.12	23	30	6.4	38
Water oak	*Quercus nigra*	3	0.09	30	38	11.7	51
Willow	*Salix nigra*	3	0.09	15	28	10.7	36
Prickle sumac	*Aralia spinosa, Zanthoxylum clava-herculis*	2	0.06	10	13	3.6	15
Haw	*Crategus* sp.	1	0.03	13	13	–	13
Holly	*Ilex opaca*	1	0.03	36	36	–	36
Black walnut	*Juglans nigra*	1	0.03	56	56	–	56
Red bud	*Cercis canadensis*	1	0.03	15	15	–	15
						TOTAL:	**3,458**

Table 2. Trees greater than 102 cm in diameter by surveyor names for the Monroe County, Arkansas, study area.

Surveyor name	Diameter (cm)	Township & Range	Year
White oak	203	1N 1W	1815
Cypress	183	4N 2W	1842
Cypress	183	4N 2W	1842
Cypress	152	4N 2W	1842
Cypress	152	4N 2W	1842
White oak	140	2S 1E	1820
Cypress	137	4N 2W	1842
Black oak	127	1S 2W	1819
Black oak	127	2S 1E	1820
Black oak	127	2S 1W	1820
Black oak	127	3N 1W	1816
Cypress	127	2S 1E	1820
Cypress	127	3S 1W	1825

Table 2. Continued.

Surveyor name	Diameter (cm)	Township & Range	Year
Cypress	127	3S 1W	1825
Cypress	127	3S 1W	1825
Cypress	127	3S 1W	1825
Pin oak	127	3S 1W	1825
Pine	127	1S 1W	1815
Black oak	122	2S 1E	1820
Cypress	122	1S 2W	1819
Elm	122	3S 1W	1825
Gum	122	1S 1E	1815
Red oak	122	1S 1E	1815
Sweetgum	122	3S 1W	1825
White oak	122	1S 1E	1815
White oak	122	1S 2W	1819
White oak	122	4N 2W	1842
Black oak	114	1N 1W	1815
White oak	114	1S 1W	1815
Black oak	112	3N 2W	1842
Sweetgum	112	4N 2W	1842

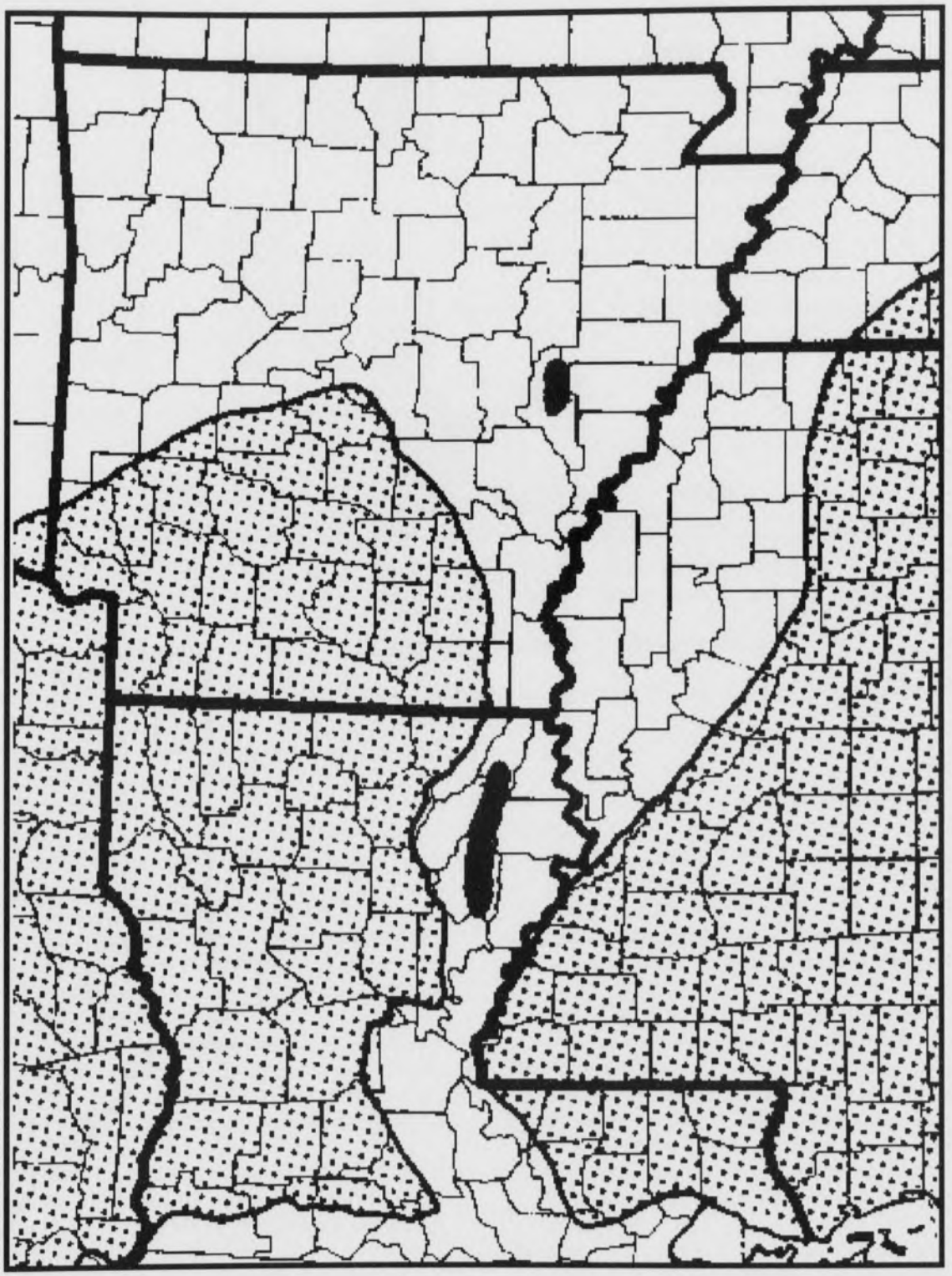

Fig. 1. Natural distribution of loblolly pine in the lower Mississippi River Valley indicated by the stippled pattern. The 2 dark shaded areas are the Monroe County, Arkansas, study area (north) and Macon Ridge in Louisiana (south). Figure adapted from Baker and Langdon (1990).

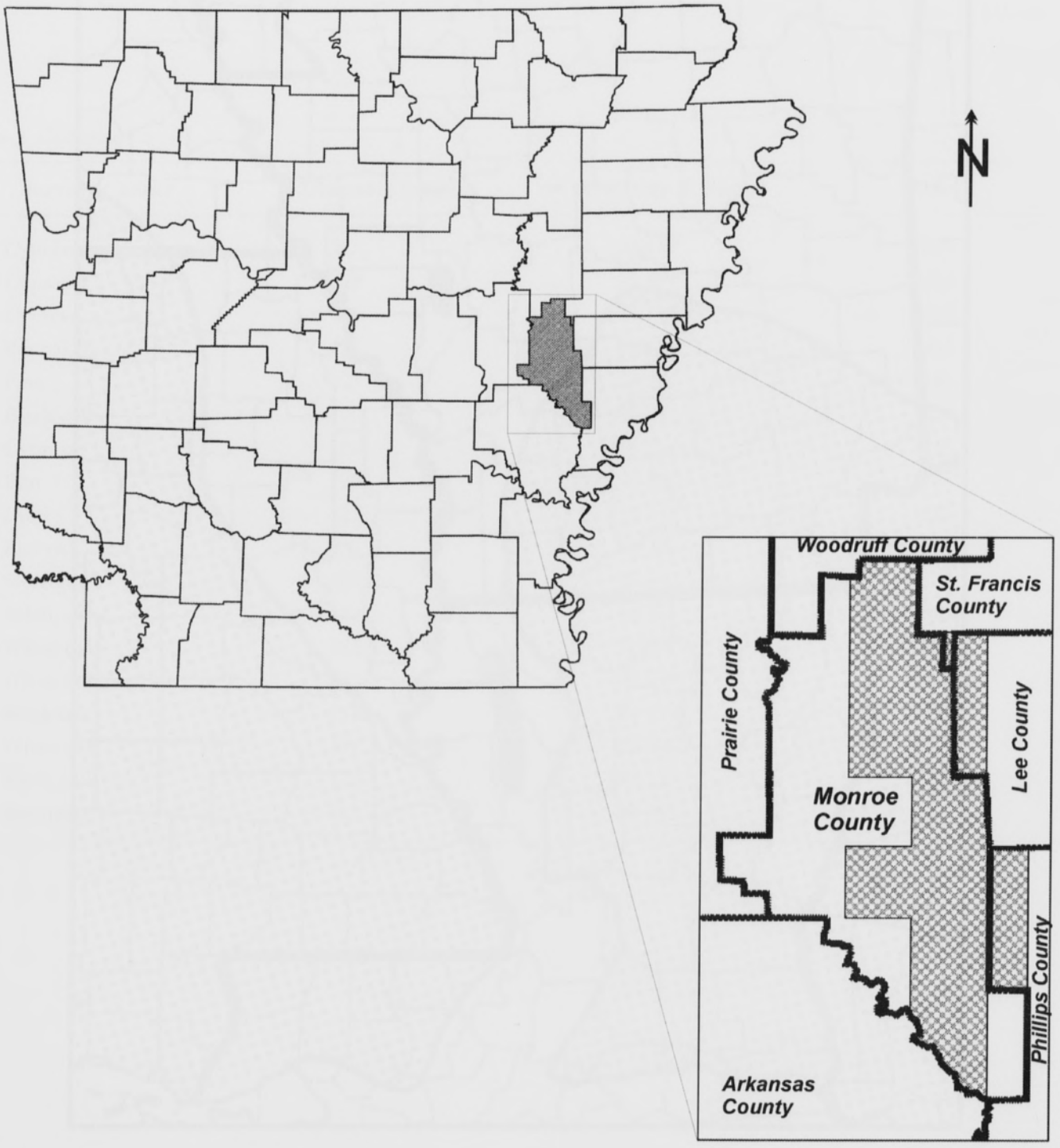

Fig. 2. Study area map. Shaded area in inset map approximates the townships selected for this analysis.

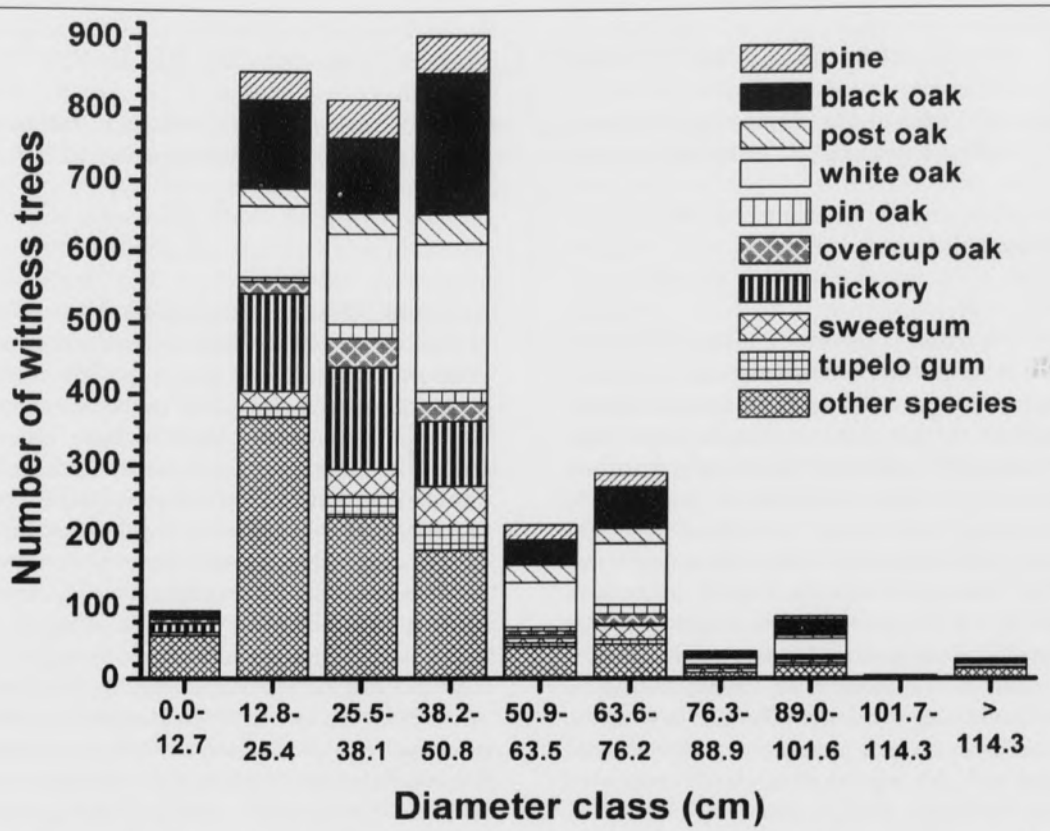

Fig. 3. Diameter distribution by major species or species group as identified by GLO surveyors in the Monroe County, Arkansas, area.

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