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CLASSIFICATION AND PROTECTION STATUS OF REMNANT NATURAL PLANT COMMUNITIES IN ARKANSAS

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ABSTRACT

A classification and inventory of Arkansas’s remaining tracts of relatively undisturbed vegetation was initiated in 1979. Based on extensive literature surveys and field work, the classification includes five physiognomic classes, 17 cover classes, and 48 cover types, arranged hierarchically. High quality examples of ten of the cover types have been located in designated wilderness or state natural areas, where they are protected by law, while an additional three occur in research natural areas or Forest Service special interest areas. The remaining 33 cover types have no known long-term protection. Lands having wilderness, state natural area, research natural area, or special management area status total nearly 51,000 acres in the state. No more than one-tenth of this area, however, supports vegetation in relatively undisturbed condition.

INTRODUCTION

Natural, relatively undisturbed plant communities are invaluable for a number of reasons. They serve as control areas or “bench marks” for ascertaining natural rates of nutrient cycling, productivity, and soil erosion; as storehouses of information concerning species interactions; as genetic reservoirs for commercially valuable and presently unutilized plants and animals; as testing grounds for basic ecological laws and principles; and in many other ways not easily duplicated elsewhere (Franklin and Trappe, 1968; Moir, 1972; and Jenkins, 1976).

While preservation of outstanding natural areas has long been a primary goal of many organizations and agencies, it was not until recently that such efforts were directed more towards the entire spectrum of natural diversity than just to those species or communities having obvious appeal (Humke et al., 1975). Within this spectrum of natural diversity, some components — such as immature shrubland pine and oak-hickory forests — are so well-represented on the landscape that special protection efforts are not warranted, while others — including unplowed prairies and old-growth forests — have been so diminished that complete elimination of some types is a possibility. Setting aside high quality examples of these threatened types is currently of high priority to The Nature Conservancy, state natural area programs, and others.

Efforts to preserve selected natural plant communities have been underway in Arkansas for more than 20 years, dating to the establishment of Big Lake Research Natural Area in 1959. Only two programs, however, have emphasized community protection per se, the natural area program of the Arkansas Natural Heritage Commission and the research natural area program of the federal government. Nonetheless, portions of Arkansas’s statutory wilderness areas, scenic and special interest areas, and certain private lands also provide some protection for high quality natural plant communities.

Therefore, no comprehensive assessment of the types of natural communities protected on such areas has been available, nor has there been any information regarding types lacking protection. The classification system and analysis of protection status presented here represent an attempt to address these needs.

METHODS AND MATERIALS

A thorough search of the literature pertaining to the natural vegetation of Arkansas and adjacent states was completed in 1979. An initial working classification was prepared by listing and comparing the vegetations reported or likely to occur in the state. Field surveys were then undertaken to validate actual occurrence of these types in Arkansas and to collect basic stand data.

One hundred and twenty leads to putatively little-disturbed or otherwise exemplary plant communities were located and surveyed in two field seasons. Communities were surveyed in each of the natural divisions of Arkansas and in two-thirds of the counties. Standardized data collection included estimation of canopy cover by each species (Daubenmire, 1968), determination of degree and types of disturbance, and estimation of the extent of each plant community. Where feasible, canopy cover was estimated within a square, 400 m² plot placed within a representative portion of the community, being careful to avoid crossing obvious environmental discontinuities. In many cases, particularly where a tree canopy was monospecific or nearly so, the cover type (defined below) could be determined by simple inspection and the canopy cover estimated over the stand as a whole. In these cases, and where physical conditions were prohibitive, sample plots were not employed.

Stand types were considered of high quality and worthy of protection on the basis of several criteria: Forests with no extensive timber removal in the last 60 years, no extensive grazing, no open growth form trees, and predominance of long-lived tree species; and prairies with no plowing, overgrazing, and herbicidal treatment. Other types of vegetation were judged on the basis of relative amounts of various kinds of disturbance. In instances where all known examples of a vegetation type had been properly recently disturbed, the least disturbed stands were regarded as worthy of preservation.

All stands considered of high quality were classified according to the scheme explained below. Stand data were entered into the files of the Arkansas Natural Heritage Inventory Program.

RESULTS

Classification

Attempts to provide a statewide listing or classification of major vegetation in Arkansas were made previously by Turner (1937) and Foti (1974). A number of other publications, including Putnam and Bull (1932), Society of American Foresters (1954), Clark (1974), Dale and Kuroda (1978), and Bedinger (1979), provide classifications of the vegetation of particular regions or habitats within Arkansas. These studies were drawn upon extensively in developing the current classification system.

This system places emphasis upon vegetation types represented on the landscape by old-growth, little-disturbed, or "virgin" stands, and by certain other rare or previously little-known types; as such, it
focuses attention on the kinds of vegetation most in jeopardy in the state. This bias notwithstanding, the system can probably be used for a variety of purposes.

Vegetal-environmental units of varying degrees of specificity may be recognized on the landscape. The natural vegetation over much of Arkansas, for instance, is "forest." But a particular stand in Newton County might be described as a "beech-umbrella magnolia-yellow mandarin community type." A total of four levels of specificity were identified and incorporated in the classification system. This hierarchical system progresses from physiognomic and cover classes, at the most general levels, to both cover and community types.

Physiognomic classes are defined in terms of predominant life forms and general appearance. Classes found in Arkansas include Forest, Savanna, and Herbaceous Vegetation (Table 1). Cover classes are based on dominant genera in the tallest layer of vegetation and a certain range of site conditions. As shown in Table 1, 17 such units are presently in use. Cover types are generally named according to species which recur under similar environmental conditions and which make up 20% or more of the total canopy of a given stand. This category has proven particularly useful for the Inventory Program and will be discussed in detail.

While dominance is a primary criterion for identifying and naming cover types, overemphasis of this factor easily results in a meaningless proliferation of "types" due to accidents of dispersal or disturbance than to intrinsic site conditions. Therefore, a certain amount of variability among stands within a cover type was considered acceptable even if nominate species was rather poorly represented. Emphasis was on species assemblages tending to recur in similar environments, not on species differences considered in isolation from the environment.

In some cases, dominance was abandoned almost entirely as a basis for discriminating cover types from one another; for example, where the physical environment all but overshadowed the biological, as in rock outcrop communities (e.g., the "sandstone outcrop cover type"). This rule also applied when important regional differences in species composition did not necessarily involve dominants, as in the example of "Osage Prairie."

Of the 46 cover types listed in Table 1, at least 15 represent parts of the potential natural vegetation of the Ozark Mountain and Ouachita Mountain Natural Divisions (natural divisions follow Foti, 1974). Five occur, or potentially occur, on Crowley's Ridge; at least 19 are to be expected in the Mississippi Alluvial Plain; and 25-30 belong in the West Gulf Coastal Plain. Each of these communities is defined in cover type "abstracts" on file in the offices of the Arkansas Natural Heritage Commission.

Protection Status.

Published information regarding vegetation of natural area quality

Table 1. Outline of vegetation classification system developed for the Arkansas Natural Heritage Inventory Program.

<table>
<thead>
<tr>
<th>Forest Vegetation</th>
<th>Quercus Xerophyte Cover Class</th>
<th>Q. stellata-Q. marilandica</th>
<th>post oak-blackjack oak</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quercus-Carya Cover Class</td>
<td>Q. alba</td>
<td>white oak</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q. alba-Q. falcata-Carya spp.</td>
<td>white oak-southern red oak-hickory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q. alba-Q. rubra-Carya spp.</td>
<td>white oak-northern red oak-hickory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q. rubra-Liquidambar styraciflua-Carya spp.</td>
<td>northern red oak-water gum-hickory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q. velutina-Carya texana</td>
<td>black oak-black hickory</td>
<td></td>
</tr>
<tr>
<td>Quercus spp.-Acer saccharum</td>
<td>F. grandifolia</td>
<td>mixed oak-sugar maple</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F. grandifolia var. pagodifolia-Q. michauxii-Carya spp.</td>
<td>cherrybark oak-swamp chestnut oak-hickory</td>
<td></td>
</tr>
<tr>
<td>Quercus-Pinus Cover Class</td>
<td>Quercus spp.-P. taeda</td>
<td>mixed oak-lobolly pine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q. alba-P. echinata</td>
<td>white oak-shortleaf pine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q. stellata-P. echinata</td>
<td>post oak-shortleaf pine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P. echinata</td>
<td>shortleaf pine</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P. echinata-P. taeda</td>
<td>shortleaf pine-lobolly pine</td>
<td></td>
</tr>
<tr>
<td>Fagus-Mixed Hardwoods Cover Class</td>
<td>F. grandifolia-Litodendron tulipifera</td>
<td>beach-yellow poplar-oak-hickory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F. grandifolia Quercus spp.-Magnolia tripetala</td>
<td>beech-mixed oak-umbrella magnolia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F. grandifolia-Terrace Hardwoods</td>
<td>beech-terrace hardwoods</td>
<td></td>
</tr>
<tr>
<td>Nyssa-Taxodium Cover Class</td>
<td>T. distichum</td>
<td>baldcypress</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T. distichum-N. aquatica</td>
<td>baldcypress-water tupelo</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N. aquatica</td>
<td>water tupelo</td>
<td></td>
</tr>
<tr>
<td>Quercus-Hydropetrous Cover Class</td>
<td>Q. lyrata-Carya aquatica</td>
<td>overcup oak-water hickory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q. nigra-L. philos-Liquidambar styraciflua</td>
<td>Nuttal's oak-water gum-sweetgum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q. phillos-Ulmus crassifolia</td>
<td>willow oak-cedar elm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q. nigra-Liquidambar styraciflua</td>
<td>water oak-sweetgum</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mixed Hydrophytic Oaks</td>
<td>mixed hydrophytic oaks</td>
<td></td>
</tr>
<tr>
<td>Populus-Salicetea-Pinetetea-Acer Cover Class</td>
<td>Populus deltoides</td>
<td>cottonwood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N. nigra-Pinus occidentalis</td>
<td>river birch-sycamore</td>
<td></td>
</tr>
<tr>
<td></td>
<td>S. nigra</td>
<td>black willow</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. saccharum</td>
<td>silver maple</td>
<td></td>
</tr>
</tbody>
</table>

**GLADE/OUTCROP VEGETATION**

- Xerophytic Hardwoods-Juniperus Cover Class
- Quercus durandii-Juniperus spp.
- Q. arkansana-Q. incana-Q. stellata var. margarita
- Juniperus ashei
- Juniperus virginiana
- Mixed xerophytic hardwoods
- Rock Outcrop Cover Class
- Sandstone Outcrop
- Limestone/Dolomite Outcrop
- Igneous Rock Outcrop

**HERBACEOUS VEGETATION**

- Andropogon Sorghastrum - Panicum Cover Class
- Cherokee Prairie
- Grand Prairie
- Osage Prairie
- Schizachyrium-Triplasis Cover Class
- Blackland Prairie
- Anemonevirginiana Cover Class
- A. virginiana
- Emergent Wetland Cover Class
- Typha latifolia
- Mixed sedge-rush
- Decodon verticillatus
- Swamp isostele

**SAVANNA VEGETATION**

- Pinus-Quercus-Grainoidi Perrenalis Cover Class
- A. occidentalis-Q. stellata-Grainoidi
- shortleaf pine-post oak-grass

*cover types listed within each cover class; community types have been omitted
found in Arkansas is scanty (Shepard and Bogess, undated; Waggoner, 1975; Federal Committee on Ecological Reserves, 1977; Zachry et al., 1979) and rarely provides sufficient information to permit classification at the cover type level. Agency reports and site surveys completed before 1979 are of similar value. Hence, most of the findings presented here are field surveys by the author.

Of the more than 34 million acres in Arkansas, about 34,000 acres, or 0.1% of the state, have been permanently set aside to preserve natural features and qualities. In some cases, these include little-disturbed plant communities. The latter, however, occupy no more than 10% of the total "protected area." Most of the 34,000 acres fall within three statutory wilderness areas; the remainder, within the state's 23 natural areas.

High quality examples of ten cover types, one of which occurs twice, are represented for these areas (Table 2). Six of the nine areas, which include seven of the ten cover types, are within the Arkansas System of Natural Areas; the other three areas, each with one cover type, are part of the National Wilderness Preservation System. Although most of the vegetation remnants in these areas are quite small (15-200 acres each), those remnants in wilderness areas eventually may develop into very extensive "old-growth" stands.

Somewhat surprisingly, more permanently protected examples of cover types occur in the Mississippi Alluvial Plain than in any other natural division. On Crowley's Ridge and in the West Gulf Coastal Plain, for instance, no mature stands of natural vegetation are protected by law. One high quality example of a cover type is protected in the Ouachita Mountains, and five such examples are protected in the Ozark Mountains.

Several other pieces of public land have also been withdrawn from resource extraction and development activities, though not necessarily on a permanent basis. These administrative withdrawals usually are made in recognition of outstanding natural, scenic, or geological features. Included are research natural areas, special interest areas, wilderness study areas, and national natural landmarks. Only the first two, however, will be discussed here.

Arkansas has five research natural areas (RNAs), four of which support outstanding examples of little-disturbed plant communities (Table 3). A candidate research natural area on Crowley's Ridge also contains a high quality forest remnant. Two of the cover types found on RNAs are not represented by high quality stands in either wilderness areas or state natural areas, according to available information. While the remaining types listed in Table 3 are so-represented in these areas, RNAs in the state range from 100 to 973 acres and are managed solely for the purpose of non-destructive research. Three of the five RNAs occur in the Ouachita Mountain Natural Division.

No RNAs have been established in the Ozarks, but the Ozark-St. Francis National Forest has recognized 12 areas, ranging from 220 to 7000 acres—for scenic, botanical, and geological features of special interest. These special management units are administratively excluded from most timber management activities, and certain kinds of recreational activities are discouraged as well. Five of these areas, four of which are in the Ozarks, include remnants of mature forest vegetation in excellent condition (Table 4). All but one of the cover types represented, however, are also found in state natural areas or wilderness areas.

In the Ouachita National Forest, the three "scenic areas" not associated with a research natural area total about 920 acres. No significant remnants of mature vegetation have been located on these lands.

In all, nearly 51,000 acres of public lands in Arkansas have wilderness area, state natural area, research natural area, or special interest area status (Table 5). A total of 13 cover types, several represented at least twice, have been located on these lands. Six cover types are protected on more than one site, but seven are found on only one site each and often occupy only a very small area. No cover types are protected on more than four sites, and those occurring on three or four such sites generally exhibit sufficient intra-type variability to justify some seemingly "redundant" protection. Understories of beech forests in the Ozarks, for instance, differ markedly from the ones in the Ouachitas.

Many other high quality examples of natural vegetation, including ones occurring in certain state parks, state wildlife management areas, Forest Service recreation areas, and roadless and undeveloped area evaluation II (RARE II) areas, currently lack any form of long-term protection. Many of the most significant remnants of natural vegetation in the state also occur on private land, but, to date, very...
few individuals or corporations have set aside remnant natural vegetation on these lands. One important exception is the old-growth loblolly pine-shortleaf pine stand within Levi-Wilcox Demonstration Forest in Ashley County, which has apparently been permanently removed from commercial timber management. Other highly significant natural areas which may be managed to sustain their pristine qualities by the present landowner(s) cannot be regarded as permanently protected.

**DISCUSSION**

Relatively few of the cover types found in Arkansas are represented by high quality examples in existing wilderness, natural, and special interest areas. In the Ozarks, only mesic oak-hickory and mixed mesophytic types are well-represented, while dry xeric vegetation has been all but ignored. The Mississippi Alluvial Plain has some fine stands of bald cypress, native prairie, and bottomland hardwood on protected areas, but several bottomland and non-forested wetland types are completely unprotected. The Ouachita Mountains have three protected areas in which high quality communities occur, but the same cover type predominates on each. In the West Gulf Coastal Plain, no mature, little-disturbed plant communities of any kind have been protected and, unfortunately, very few examples of such communities remain. The same could be said for Crowley's Ridge except for the presence there of a single, semi-protected remnant plant community.

Of the 33 unprotected cover types, good examples of all but seven were located during the 1979 and 1980 field seasons. Reflecting the extreme vulnerability of high quality stands, two of the most significant areas—each of which supports two or more cover types—are heavily cut-over during this period. Opportunities to protect outstanding examples of vegetation cover types certainly remain. Accomplishing this goal, however, will require a concerted effort to establish additional research natural areas and wilderness areas, to acquire conservation easements on certain privately-owned lands, and to inform landowners of the irreplaceable nature of the little-disturbed plant communities which remain.

**ACKNOWLEDGMENTS**

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Valuable input regarding the classification system was provided by Steve Buttrick, Bob Irving, and Bill Shepherd. Unpublished site reports, original field data, and leads to high quality areas were graciously offered by Tom Clark, E. E. Dale, Jr., and Jerry Roberts. Bill Shepherd and Ken Smith reviewed the manuscript. Special thanks are due Richard Davis and Gayle Garrison, who accompanied the author in the field on numerous occasions.

**LITERATURE CITED**


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Table 5. Arkansas public lands on which natural vegetation is legally or administratively protected from commercial use or development.

<table>
<thead>
<tr>
<th>Type of Areas</th>
<th>Acres</th>
<th>Fraction of State Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilderness Areas</td>
<td>27,575</td>
<td>.008</td>
</tr>
<tr>
<td>State Natural Areas</td>
<td>4,023</td>
<td>.0014</td>
</tr>
<tr>
<td>Research Natural Areas</td>
<td>2,143</td>
<td>.001</td>
</tr>
<tr>
<td>Special Interest Areas</td>
<td>16,796</td>
<td>.0015</td>
</tr>
<tr>
<td>Totals</td>
<td>35,446</td>
<td>.0014</td>
</tr>
</tbody>
</table>

TURNER, L. M. 1937. Some soil characteristics influencing the distribution of forest types and rate of growth of trees in Arkansas. J. For. 35:5-11.


