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Shortleaf Pine/Bluestem Grass Ecosystem Renewal in the Ouachita Mountains

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Presettlement and Current Ecological Conditions

The 8 million-acre (3,237,600 ha) Ouachita mountain physiographic region is located in west central Arkansas and southeastern Oklahoma. The mountains are east to west trending and range in elevation from 500 to 2,700 feet (150-820 in). Travelers in this region prior to European settlement described the landscape as dominated by pine (*Pinus echinata*), pine-hardwood and mixed-oak (*Quercus spp.*) forest communities with fire-dependent and floristically rich grass and forb understories (Du Pratz 1774, Nuttal 1821, Featherstonhaugh 1844). Large grazing herbivores including elk (*Cervus elaphus*), bison (*Bison bison*) and white-tailed deer (*Odocoileus virginianus*) found suitable habitat there (Smith and Neal 1991). Fire return intervals averaged less than 10 years for most sites (Masters et al. 1995). Tree densities averaged 170 trees per acre (420/ha), and the mean diameter was 11.4 inches (29 cm) (Kreiter 1995).

Today the Ouachita mountain landscape is still dominated by forests, but the structure and composition of these forests have changed dramatically. The density of trees has increased to 200 to 250 trees per acre (494-618/ha) and the mean diameter is now 9 inches (23 cm) (Kreiter 1995). Understories are now dominated by woody vegetation and certain once-dominant grasses and forbs are uncommon (Fenwood et al. 1984, Masters 1991, Sparks 1996). Elk and bison have been extirpated. Other species, such as Bachman's sparrow (*Aimophila aestivalis*) and the brown-headed nuthatch (*Sitta pusilla*), have been affected negatively by habitat loss (Jackson 1988) and the red-cockaded woodpecker (RCW) (Picoides borealis) is endangered (Neal and Montague 1991). Average fire return intervals now range from 40 to more than 1,200 years (Masters et al. 1995).

Historical and present-day ecological communities of the 1.7 million-acre (690,000 ha) Ouachita National Forest (ONF) are illustrative of the above descriptions. Present day forests developed largely in response to two factors: commercial exploitation of the original forests and suppression of fires. Large-scale harvest of trees commenced in the 1910s and by 1940 most of the virgin forests had been cut (Smith 1986). With USDA Forest Service (FS) stewardship, the period of forest regeneration that followed was marked by a strict policy of wildfire suppression. That policy has largely remained in effect to the present. The recent use of prescribed fire by managers, averaging 25,000 acres (10,100 ha) annually over the last decade (R. Miller personal communication: 1995), has been insufficient to maintain a woodland (i.e., tree/grass) ecosystem. The result is that such ecosystems have all but disappeared from the Ouachita mountain landscape (Foti and Glenn 1991).

Desired Ecological Condition in the Context of a Contemporary Landscape

National forest lands are now subject to the philosophy of ecosystem management. Ecosystem management has been variously defined, but most definitions have two attributes in common: an overriding goal to protect ecosystem integrity, sometimes called ecosystem health, and an allowance for human uses that do not compromise ecosystem integrity. The following are key elements of a large-scale ecosystem management project on the ONF to restore the shortleaf pine-bluestem grass ecosystem on 155,010 acres (62,730 ha), and in the process provide sufficient habitat for a recovered population of the endangered RCW and a sustainable supply of wood products (FS 1996).

Elements of Ecosystem Management

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Increasing the use of prescribed fire and using tree cutting to simulate natural disturbance patterns. Reduction of basal area is accomplished by commercial thinning. Stand regeneration is accomplished by commercial timber sales using irregular seed tree and irregular shelterwood methods. With either regeneration method, some of the seed trees are retained indefinitely. The size of prescribed burning units encompasses landscapes rather than smaller stand-sized blocks. The average size of prescribed burning units has increased from 200 to 600 acres (81-243 ha), with some units as large as 8,000 acres (3,230 ha) (R. Miller personal communication: 1997). In the past, most prescribed burning occurred during the dormant season from October to March. We now include some burning during the growing season to emulate fire patterns described in Foti and Glenn (1991) and Masters et al. (1995).

Using a modified control strategy for wildfires. Traditional FS policy has been to suppress all wildfires and minimize the area burned regardless of whether the fire was beneficial to resources. We found that a modified control strategy for wildfires, which recognizes that some wildfires are beneficial and should be allowed to burn, helps increase the area affected by fire each year. In those instances where wildfires are burning within prescription, occurring in areas determined to be desirable and not threatening human safety or property, willdfires can be allowed to burn to the nearest man-made or natural barrier. This change is an example of "FIRE 2 1," a new effort initiated by FS leadership to embrace the changing responsibilities in wildland fire management in the 21st century (Apicello 1996). Goals for FIRE 21 include contributing to restoring, maintaining and sustaining ecosystem function for healthier forests and rangelands, and integrating wildland fire management concerns and the role of fire into all agency management programs, where appropriate.

Increasing rotation age. The minimum time between regeneration cutting, or rotation age, has been increased from 70 to 120 years for shortleaf pine forest types. This allows for a greater number of acres of older trees and results in increased mast production from hardwoods retained in these pine stands. The older trees are also required for RCW and other cavity-dependent species. Cavity development is associated with a fungal heart rot (*Phellinus pinii*) infection that usually does not occur in stands less than 70 years of age.

Maintaining mixtures of native pines and hardwoods. An important part of the restoration process is to replace non-native trees when possible and retain mixtures of pines and hardwoods on the landscape both among and within stands. Retention of mast-producing trees has been a significant issue for the ONF

Developing and maintaining forested linkages among mature forest habitats. Minimizing ecotonal differences between contiguous stands and reducing habitat fragmentation is important to many bird species. Each timber harvest proposal is examined for ways to keep forest regeneration localized, which maximizes the size of areas that support mature stands. We have increased the size of regeneration areas from 40 to 80 acres (16-32 ha). Because the total amount of regeneration per year or decade is fixed by the rotation age, achieving it on fewer, larger areas rather than many smaller areas reduces the total edge between dissimilar conditions. This also maximizes the area of contiguous mature habitat.

Recognizing that people are an important part of this ecosystem. Traditional uses of forest, such as timber harvesting, hunting, firewood gathering, bird watching and fishing, continue while we work to restore ecological (historical) conditions. No special limitations are placed on the public while using the area. Project planning incorporates local values through an extensive public involvement program. Information from monitoring the effects of restoration has been gathered through close collaboration with university researchers. Detailed information is used to monitor the effectiveness of our projects and guide the restoration effort.

Assessing Ecological Health

There are three areas by which the ONF can measure success at attaining ecosystem health. Biodiversity, recreation opportunities and timber supplies are used as "yardsticks" because all were significant issues in recent planning efforts.

Biodiversity

Wilson et al. (1995) examined the breeding bird response to this restoration effort. They found that 10 species of ground/shrub-foraging species (yellow-breasted chat [*Icteria virens*], brown-headed cowbird [*Molothrus ater*], Carolina wren [*Thryothorus ludovicianus*), northern cardinal [*Cardinal cardinalis*], wild turkey [*Meleagris gallipavo*], indigo bunting [*Passerina cyanea*], northern bobwhite [*Colinus virginianus*], chipping sparrow [*Spizella passerina*]) and shrub nesting species (American goldfinch [*Caruelis tristis*], prairie warbler [*Dendroica discolor*]) were favored by thinning and prescribed burning, as compared with controls. Two ground-nesting species, the ovenbird (*Seiuris aurocapillus*) and black-and-white warbler (*Mniotilta varia*), declined in the same restoration areas. Small mammals were found to have increased in numbers and species on the same restored sites

(Lochmiller et al. 1993). Sparks (1996) found that prescribed burning produced higher herbaceous species richness and diversity, and forb and legume abundance in the project area.

Recreation Opportunities

Outdoor recreationists, including hunters and bird watching enthusiasts, are attracted to these restored lands. In A Birder's Guide to Arkansas, White (1995) featured the project area as a unique opportunity to view RCW, brown-headed nuthatch and Bachman's sparrow. Discussing the decline of the northern bobwhite, Brennan (1991) provided some evidence that the forest-management techniques used here (reduction of tree basal area, reduction of midstory and prescribed burning every one to three years) resulted in higher bobwhite numbers. Masters et al. (1996) examined whitetailed deer forage production on the project area. They found that restoration efforts increased preferred deer forage sixfold.

Timber Supply

Timber harvesting is an essential part of these restoration efforts. The environmental impact statement for the FS long-term strategy for RCW recovery (USDA 1995) in the Southern Region concluded that this region-wide restoration effort would result in a gradual long-term increase of timber supplies after an initial decline. The ONF implementation of this strategy, because of favorable age class distribution, projected that timber harvest volumes would remain constant in the next two decades, and decline slightly from 29.2 to 27.5 million cubic feet of wood by the fifth decade (Bukenhofer et al. 1994). The decline in long-term sustained yield is largely a function of increasing the rotation age from 70 to 120 years.

Other Considerations

Another measure of ecosystem health is the potential for reintroduction of extirpated species. The elk has been successfully reintroduced to three nearby locales, the Buffalo National River in northern Arkansas, and the Pushmataha and Cookson Hills wildlife management areas in eastern Oklahoma. Earlier attempts at reintroduction failed due to brain worm (*Parelaphostrongylus tenuis*) infestation (Carpenter 1973). Recent studies (Raskevitz 199 1) determined that the intermediate hosts for the brain worm were snails (Gastropidae) that were dependent on moist forest conditions where tree densities were high, including a well-developed mid-story. They found that elk preferred habitat that included open, drier forest conditions unfavorable to the snails, and this preference yielded elk with no clinical signs of brain worm infestation. In the future, we expect that the drier forest conditions provided by shortleaf pine/bluestem grass ecosystem renewal will supply a sufficient quantity of suitable habitat capable of supporting a reintroduction of elk in the ONF.

Summary

The most influential laws relating to and governing FS land management activities include the Multiple Use-Sustained Yield Act, Endangered Species Act, National Forest Management Act, Clean Water Act and, to a lesser extent, the Clean Air Act. For many, these laws present conflicting direction and create an insurmountable operational, regulatory and judicial tangle.

All of these laws predate direction issued by FS Chief Dale Robertson to Regional Foresters in June 1992 in which he admonished them to follow a philosophy of ecosystem management in their stewardship of national forest lands. All of these legal mandates remain in full force. Collectively, these laws can be summarized as requiring that national forests be managed to allow for sustainable human uses, both economic and non-economic, without compromising land health. The role of the ecosystem management policy adopted by the FS is to provide a single, all-inclusive philosophical context for management that integrates the spirit and letter of these laws. It puts sustaining land health first. We think this is appropriate, for over the long term, it will be impossible to sustain human uses without first sustaining the health of the land.

Our project is one example of ecosystem management. It embodies elements of landscape ecology, restoration ecology and endangered species recovery. It seeks to restore an entire ecosystem on portions of today's Ouachita mountain landscape. This is not so much because the landscape was prominent in pre-European settlement times, but rather because it had almost disappeared along with its unique flora and fauna. The project is mindful of Aldo Leopold's (1949) famous dictum that saving all parts and pieces of the ecosystem is the first precaution of intelligent tinkering. At least in this case, we have demonstrated that managing for ecosystem integrity (health) need not result in significant reductions in timber resources for traditional human uses. This, coupled with the increased recreation opportunities enumerated above, is a "win win" situation.

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