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Thill, Ronald Ii.

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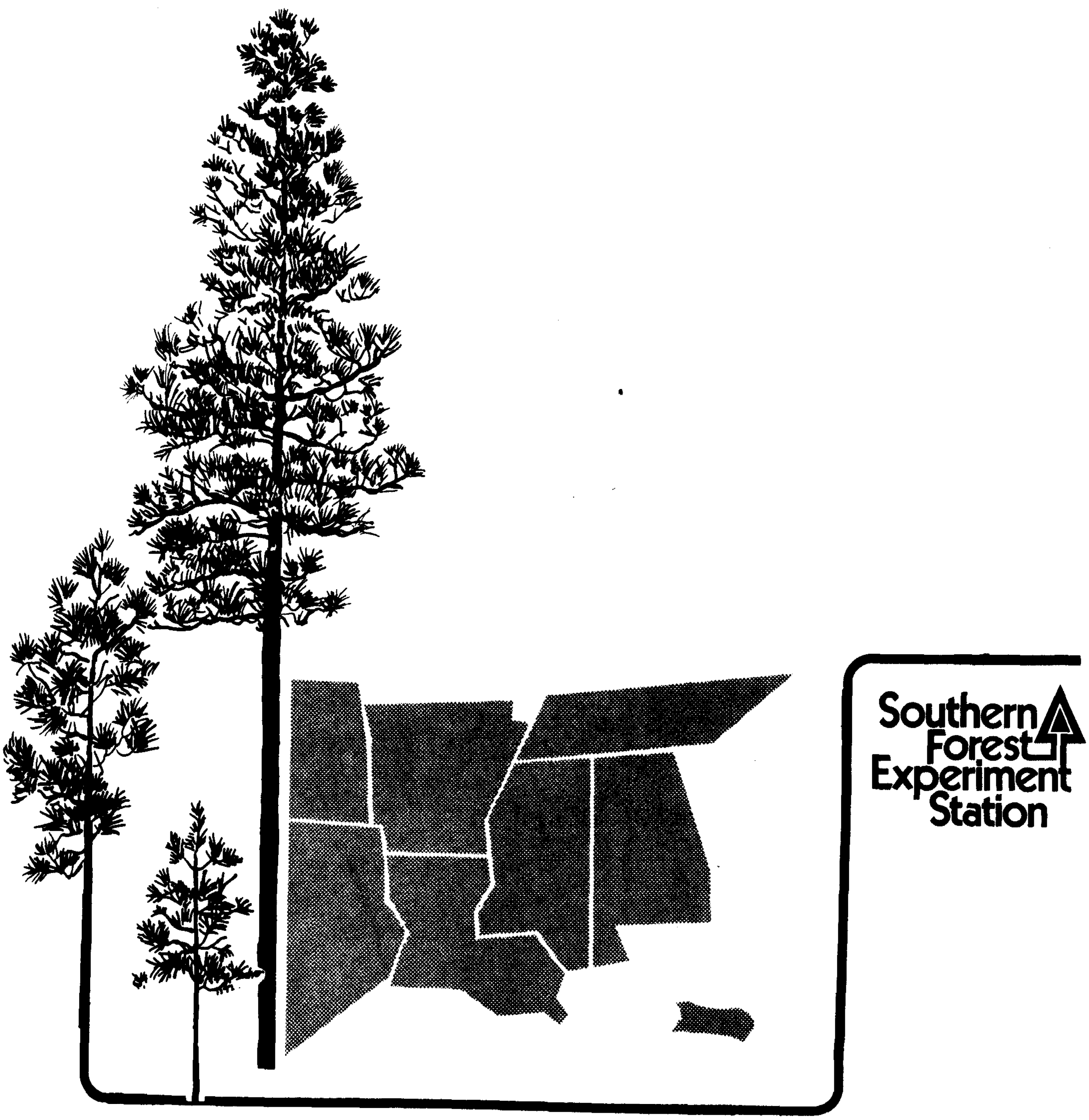

MANAGING SOUTHERN PINE PLANTATIONS FOR WILDLIFE

Ronald E. Thill

Supervisory Research Wildlife Biologist
U. S. Forest Service
Southern Forest Experiment Station
Wildlife Habitat and Silviculture Laboratory[1]
Nacogdoches, Texas

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SUMMARY

This paper reviews available information on how intensive management of pine plantations affects wildlife in the southeastern United States. Practices discussed and evaluated in this paper include harvesting, site preparation, planting, thinning, burning, and fertilizing. Management of special habitat features (e.g., standing dead trees and down woody material) is also discussed.

When size, shape, and spatial distribution of clearcuts are considered, and frequent thinning and burning are practiced after pine canopy closure, intensively managed plantations furnish suitable habitat for many early-succession wildlife species--including key game species such as deer, quail, and rabbits. However, intensive even-aged pine silviculture is detrimental to those species requiring hardwoods, snags and cavity trees, and large down woody material. Habitat requirements of these species can best be met through retention and management of riparian zones or patches of upland hardwoods interspersed within plantations.

Keywords: Harvesting, thinnning, even-aged silviculture, habitat, wildlife

INTRODUCTION

Pine silvicultural practices in the South vary widely within and among ownership classes. Private non-industrial forest landowners, who control about 73% of the South's commercial forests, generally employ minimum forest

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[1] In cooperation with School of Forestry, Stephen F. Austin State University, Nacogdoches, Texas 75962

management and typically rely on natural regeneration following some type of selective timber harvesting. On National Forests of the South, which comprise almost 6% of the South's commercial forest acreage, even-aged management (on about a 65-year rotation) employing clearcutting, site preparation, and planting has dominated pine silvicultural practices for about the last 25 years. Industrial forest lands comprise almost 25% (about 17 million hectares) of the South's commercial forests, and about 31% of this acreage (5.4 million hectares) is in plantations (USDA Forest Service 1988). It is on these lands where pine silviculture is practiced most intensively. Management typically involves clearcutting, intensive site preparation, planting of genetically improved pine seedlings, and short (25- to 35-year) rotations for fiber production. Subsequent treatments may include herbicide and fertilizer applications, prescribed burninq, and one or more thinning operations. All of these practices influence wildlife abundance and diversity.

Most industrial forest acreage is now or soon will be leased for hunting access rights. Growing revenues derived from hunting leases, together with improved public relations benefits garnered from integrated timber and wildlife management programs, has increased forest industry interest in wildlife management (Halls 1975). Many of the larger companies now employ professional wildlife biologists. Except for threatened and endangered species, corporate concerns for nongame species are generally incidental and secondary compared to game species (Melchiors 1983). Principal game species on industry lands include white-tailed deer (Odocoileus virginianus), bobwhite quail (Colinus virginianus), and eastern wild turkey (Meleagris gallopavo).

This paper summarizes information on how intensive management affects wildlife in southern pine plantations. It offers approaches for maximizing habitat quality at minimum expense to classical planation management procedures. Although management for both game and nongame wildlife are addressed, the literature on game species is far more extensive. Emphasis here is on general principles rather than specific management prescriptions for individual species. Major factors to be discussed include harvesting, site preparation, intermediate stand treatments, riparian zone management, and snags and down wood retention.

HARVESTING

Even-aged management begins with the complete (clearcutting) or partial removal (seed tree and shelterwood cuts) of an existinq stand. Factors at this stage of management that most influence wildlife include (a) method of regeneration (b) logging impacts, (c) size, shape, and juxtaposition of cutting units, and (d) rotation length.

Clearcutting alters habitat more dramatically than does any other regeneration method, but relatively little research has been conducted comparing wildlife habitat under clearcutting, seed tree, or shelterwood systems. Seed trees provide perching sites for birds of prey and flycatchers and foraging habitat for woodpeckers and bark gleaning birds. Consequently, seed tree and shelterwood cuts will provide greater nongame diversity prior to removal of seed trees (Smith 1988). Because they alter microclimate less than does clearcutting, seed tree and shelterwood cuts would be less detrimental to microclimate-sensitive species such as terrestrial salamanders (Ramotnik and Scott 1988).

Logging with heavy equipment under wet conditions can result in soil compaction, erosion, and reduced site productivity. Soil compaction can be detrimental to fossorial small mammals and herpetofauna (Ramotnik and Scott 1988). However, soil depressions created under wet logging conditions could improve habitat for amphibians by creating temporary pools of benefit to larval toads, frogs, and salamanders that require water for maturation.

Wildlife biologists have long stressed the need for increasing both within- and between-stand diversity. Within-stand diversity can be increased by retaining large down woody material, snags (standing dead trees), and seed trees, or burning different portions of a stand at different seasons and/or at different frequencies. Longer intervals between burns within pole stands permit the development of one or more additional vegetation strata, which increases bird diversity and abundance (Noble et al. 1980).

Foresters have generally concentrated on increasing between-stand diversity by scheduling and arranging cutting units to create a mosaic of small, different-aged, irregularly shaped stands. These practices create favorable conditions for many early-succession species like deer, quail, and rabbits. For most game species, cuts should be as small as silviculturally and economically practical. Elongate and irregularly shaped cuts provide greater "edge" and habitat diversity than do square or rectangular cuts (McGinnes 1969). The most effective edge conditions occur where age differences between adjacent stands are maximized. For this reason, new clearcuts should be placed next to mid-rotational stands (Harris 1984). Large clearcuts are aesthetically unpleasing to many people and are of limited value to most game species.

Rotation lengths vary with site quality, management objectives, and pine species. Shorter rotations favor early-succession wildlife because more acreage is in younger stands. However, with shorter rotations, there is insufficient time for hardwoods to produce hard mast (nuts and acorns) on which many game and nongame wildlife depend. Shorter rotations also mean fewer snags and den trees and less down woody material.

As more emphasis is placed on nongame species and conservation of threatened or endangered species, traditional guidelines relative to stand size and shape will have to be altered (Smith 1988). For example, birds that require large contiguous forest stands (i.e., "interior", "area-sensitive" species) are adversely affected by forest fragmentation-- often as a result of increased nest parasitism by brown-headed cowbirds (Molothrus ater) (Brittingham and Temple 1983). Likewise, square cutting units are less detrimental to interior species than elongate cuts, because the amount of edge habitat is reduced (Smith 1988).

SITE PREPARATION

Because different types and intensities of site preparation produce different plant responses, foresters may find it practical to tailor treatments to benefit selected wildlife species. For example, soft mast (fruits and berries) is a major component in the diets of many game and nongame species, and should be promoted in clearcuts because short rotations preclude hard mast production. However, soft mast availability is reduced as site preparation intensity is increased (Johnson and Landers 1978, Stransky and Roese 1984). Therefore, foresters'can benefit wildlife by using the least intensive site preparation practical to meet silvicultural needs.

Soft mast supplies will be low for the first two years following site preparation, will peak within about 4 to 5 years (Johnson and Landers 1978), and may begin to decline as early as 6 years after site preparation as canopy closure commences (Campo and Hurst 1981). Lesser amounts of soft mast will be produced by shade-tolerant species after canopy closures, but production will increase following subsequent thinning operations.

Logging debris and roots are often raked into windrows and burned to increase planting space and to facilitate planting. However, retention of windrows can enhance within-stand diversity by providing additional habitat for rabbits, small mammals, and other nongame species (Maser et al. 1979). Burned or partially burned windrows often produce dense stands of fruit-producing shrubs relished by many wildlife species (Campo and Hurst 1981). However, burning of windrows reduces escape cover and is generally thought to reduce windrow value to species dependent on down woody material (Maser et al. 1979). Thus, at least a portion of the windrows should be left unburned; little planting space would be lost if pine were planted close to and on either side of the windrows. Conserving windrows may not be practical where excessive pine seedling damage from rodents is likely, but a few strategically placed snags or residual trees may increase raptor predations sufficiently to reduce seedling damage to an acceptable level.

PLANTING

Planting considerations that influence wildlife include spacing and the species (or genotype) selected for planting. Faster-growing loblolly (*Pinus taeda*) and slash pines (*P. elliottii*) have generally been favored in recent years over shortleaf (*P. echinata*) and longleaf pine (*P. palustrus*). Planting faster-growing species or improved genetic strains means quicker canopy closure and faster reductions in understory forage. Faster-growing trees may harbor fewer arthropods for bark gleaning birds (Dickson 1982). However, with faster growing trees, rotations can be shortened, and more habitat can be made available for early-succession wildlife species. Wider pine spacing benefits wildlife through increased, forage production that persists longer because of delayed canopy closure.

INTERMEDIATE STAND TREATMENTS

After canopy closure, dense pine plantations furnish little for wildlife other than escape or thermal cover. To improve wildlife habitat, intermediate treatments like thinning and burning should be employed as early and often as economically feasible. Other treatments, such as fertilizer and herbicide applications, also influence habitat conditions in both positive and negative ways.

Frequent thinning enhances understory forage production (Blair 1960), forage quality (Halls and Epps 1969), and soft mast production (Halls and Alcaniz 1968). However, on certain sites, excessive thinning without burning may result in a dense hardwood midstory that reduces understory forage through shading and competition (Blair and Enghardt 1976). Thinning also facilitates other understory treatments such as plantings of key forage species (Halls 1973).

Prescribed burning, one of the most valuable tools of southern resource managers, is used for site preparation, fire hazard reduction, hardwood control, control of brown-spot needle disease (Scirrhia acicola) in longleaf pine, and for improving livestock forage conditions. Furthermore, burning at the right season and frequency is generally considered beneficial to game species (Landers 1987), amphibians and reptiles (Means and Campbell 1981), and early-succession small mammals and their predators (Landers 1987).

Because structurally complex communities support greater nongame bird diversity and abundance, fire can drastically alter avian communities. Birds and mammals that are dependent on hardwood communities are adversely affected by fires that destroy hardwoods and eliminate snags (Conner 1981). Burning can also result in long-term reductions in soft mast production on some sites (Lay 1956). In general, burning should be employed on upland sites in a dispersed'pattern on a rotational basis.

Greatest pine responses to fertilization have occurred when phosphorus is applied at planting time on Coastal Plain sites and when nitrogen is applied to pole-size stands on both Coastal Plain and Piedmont sites (Wells and Crutchfield 1974). Few studies have evaluated effects of pine fertilization on wildlife. On nutrient-deficient soils, fertilization should increase understory production and improve forage quality, but some legumes may be adversely affected (Buckner and Landers 1980, Campo and Hurst 1981). Benefits may also be offset by accelerated canopy closure and shorter rotations.

Herbicides play an integral part in plantation establishment and management. Available data suggest that herbicide effects on habitat are generally short-term and that acute toxicity problems are generally unlikely (McComb and Hurst 1987); however, long-term consequences of repeated applications on floral and faunal diversity are unknown. Growing public sentiment against the use of pesticides in general will likely affect future availability of forest herbicides. Public support could be increased if foresters conducted or supported more research on environmental effects of herbicides, encouraged the development and use of more selective herbicides (e.g., those less damaging to key soft mast producers), and minimized the amount of area treated by using spot or banded applications.

RIPARIAN ZONES

To minimize non-point source pollution and to enhance wildlife habitat, the U.S.D.A. Forest Service and several large industrial forest companies now/retain forest stands along intermittent and permanent streams when adjacent stands are converted to pine plantations. These remnant stands (variously referred to as riparian zones, filter strips, stringers, streamers, or streamside management zones) vary widely in width and habitat quality. Where soils, topography, and weather permit, the larger pines and more valuable hardwoods are often harvested from these zones, thereby diminishing their value for wildlife. As management intensifies in the adjacent plantations, riparian zones will become critical sources of hard mast, snags, den trees, and large down woody material.

The value of riparian zones to most wildlife remains largely undefined, but research is now underway to assess how riparian zones of different widths influence abundance and diversity of an array of game and nongame species (Dickson and Huntley 1987, Dickson and Williamson 1988). Riparian zones obviously add habitat diversity and substantial edge, and may serve as travel corridors and permit genetic interchange between otherwise isolated animal populations. Travel corridors that connect forest fragments may also enhance avian diversity (MacClintock et al. 1977) and facilitate repopulation of disturbed sites (Smith 1988).

Optimum widths for riparian zones will vary for each species. For example, gray (Sciurus carolinensis) and fox (S. niger) squirrels in east Texas were abundant in riparian zones wider than 50 m but were virtually absent from zones less than 40 m wide (Dickson and Williamson 1988).

Although riparian zones occupy considerable acreage, little forest management has been practiced in them to date. Recent increase in demand for hardwoods has heightened interest in growing quality hardwoods in riparian zones. If integrated with wildlife needs, hardwood management could benefit wildlife while increasing revenues over that obtained from timber alone (McKee 1987). For example, selection for and management of preferred mast producers and deadening of nonpreferred hardwoods could benefit many game and nongame species through increased availability of mast, snags, and down woody material.

SNAGS AND DOWN WOOD

Snags are an important habitat component, providing roosting, nesting, perching, and foraging sites for many wildlife species. Primary cavity nesting birds (those that can excavate their own cavities) and secondary cavity nesters (those that use natural or otherwise created cavities) comprise a large component of the forest avifauna and play a significant role in regulating endemic insect populations. Tree cavities are also important to many mammals such as squirrels (Sciurus spp. and Tamiasciurus spp.), wood rats (Neotoma spp.), raccoons (Procyon lotor), and opossum (Didelphis virginiana). Thus, forestry practices that reduce decaying older trees and snags adversely affect many wildlife species and may indirectly affect forest insect populations.

Whereas snags smaller than 25 cm in diameter may be used for foraging, many cavity-nesting birds prefer snags larger than 38 cm (Evans and Conner 1979, Neitro et al. 1985). Snags can be created by deadening large hardwoods by herbicide injection or girdling (Conner et al. 1983). Suitable cavity trees can also be created by inoculation of trees with appropriate fungi (Conner and Locke 1983). But retaining adequate densities of large enough hardwood trees'within pine plantations may not be practical under increasingly shorter rotations. Snag retention within clearcuts will increase bird diversity and abundance (Dickson et al. 1983), but may increase nest parasitism by cowbirds (Smith 1988). When seed tree or shelterwood cuts are made, a portion of the seed trees could be retained and managed for snags. Alternatively, snag and cavity requirements could be met within riparian zones or patches of upland hardwoods.

Dead and down woody material (stumps, roots, bark, limbs, and logs) serve many important biological functions including soil protection and nutrient cycling. These materials, especially the larger components, also create habitat structure and diversity that is of great importance to many terrestrial and aquatic wildlife species (Maser et al. 1979, Seehorn 1987). These materials are abundant in natural unmanaged stands but will decrease in abundance as management intensifies and rotations are shortened. Where large down woody material is present, prescribed burning can be used to meet silvicultural and other objectives without a major loss in large down woody materials if fuel moisture content, weather, and burning techniques are carefully considered (Maser et al. 1979).

CONCLUSIONS

Our knowledge of forest-wildlife interactions is far from complete, but enough is known to benefit many wildlife species through modification of current forestry practices. As forest management intensifies, it will be increasingly difficult to accomodate the needs of many wildlife species. Those species that benefit from early successional stages will fare well with even limited forestry concessions. Managing for those species dependent on hardwoods, cavity trees, snags, and large down woody material will require greater concessions.

To a large extent, relative to their counterparts in the western United States, forest industries of the South have been little affected by environmental pressures. As populations, education, and wealth increase across the South, this situation will change. To avoid future environmental confrontations, foresters should heed Ellis's (1987) suggestion that the best approach is "to demonstrate a strong concern for the environment, to seek effective ties with other natural resource professionals and environmental organizations, and to marshal good information on the influences of timber management on wildlife, fish, and other resources." Companies that embrace this philosophy and effectively manage and market their nontimber resources stand to gain financially and from improved public relations.

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