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Red-Cockaded Woodpeckers and Silvicultural Practice: is Uneven-Aged? Silviculture Preferable to Even-Aged

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Red-cockaded woodpeckers and silvicultural practice: is uneven-aged silviculture preferable to even-aged?

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The endangered red-cockaded woodpecker (***Picoides borealis***) has become a high-profile management issue in the southeastern United States. Suitable habitat consists of mature to old pine, or mixed pine-hardwood forest, with minimal hardwood mid story vegetation. Loss of habitat, detrimental silvicultural practices, and changes in the fire regime have resulted in small fragmented populations, most of which have been declining precipitously in recent decades (Costa and Escano 1989, Conner and Rudolph 1989). The current population of 10–12 thousand birds occurs across much of the original range from Virginia and Florida west to Oklahoma and Texas (James 1995). However, populations are restricted to isolated tracts of suitable habitat, primarily on public lands. Consequently, the debate over the future of this once abundant species, characteristic of fire climax pine forests, has focused primarily on management strategies for the species by the U. S. Forest Service (USFS), the agency responsible for the majority of the public forest lands in the region.

The biological attributes of red-cockaded woodpeckers (Walters et al. 1988), their endangered status, their potential for economic impact, and their use as a surrogate for arguments in favor of old growth forests, have combined to make them one of the most intensively researched avian species. The results of this effort have been substantial. Most individuals familiar with the species agree that we now have the techniques and expertise to halt and reverse the declines of recent decades (Escano 1995, Hess and Costa 1995). Recent efforts on National Forests in Texas and elsewhere, have demonstrated that even small populations can be recovered (Conner et al. 1995, Gaines et al 1995, Richardson and Stockie 1995).

Management successes have resulted from the construction of artificial nest and roost cavities, removal of encroaching hardwood midstory vegetation, and translocation of birds. It is important to realize that these successes depend on intensive management of the species and do not directly address the total ecosystem. Proper management of the total ecosystem would allow red-cockaded woodpeckers to maintain viable populations without intensive management on a large scale.

Recovery and management of the red-cockaded woodpecker presents major challenges for managers. In order to be economically feasible management must be based on ecosystem management. It is also clear that successful management is compatible with some level of timber harvest.

In recent years the USFS, timber producers, environmental groups, local governments, and the federal courts have been intimately involved in a debate on silvicultural methods suitable for woodpecker management. The strategies for management of the ecosystem precipitate the major differences between the parties involved. To date, the issue has not been resolved, but substantial progress has been achieved. The following synopsis applies to USFS lands only, although as the manager of most of the existing populations, the future of the species rests primarily with this agency. In Texas, timber harvests on National Forests have been scaled back since the 1988 court case in which the USFS was found in violation of Sections 7 and 9 of the Endangered Species Act. Throughout the remaining range of the species the USFS has modified silvicultural practices with Interim Guidelines to avoid detrimental impacts until a strategy for management of the ecosystem, which is con-

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sistent with recovery of the red-cockaded woodpecker, is devised. To achieve this goal the USFS has prepared and finalized a red-cockaded woodpecker Environmental Impact Statement (U.S. For. Serv. 1995). This document presents a strategy to manage red-cockaded woodpeckers based on ecosystem management within the USFS.

Silvicultural practices are the major point of disagreement among the interested parties and are also the factors that will have the most serious ecological consequences. The management options generally discussed range from the use of even-aged regeneration methods (cleat-cutting, seed-tree or shelterwood methods) to uneven-aged methods (group selection or single-tree selection). Any of these methods when properly implemented, are compatible with recovery of the red-cockaded woodpecker. However, implementation of the various practices differ greatly in their consequences for the overall ecosystem. In the remainder of this comment we would like to contrast 2 regeneration methods that have received considerable support in this debate, irregular shelterwood and single-tree selection.

Four observations concerning red-cockaded woodpecker management and ecosystem management must initially be made. First, the species of pine involved makes a difference. Longleaf pine, due primarily to its much greater resistance to I-ire when young, does not present some of the management difficulties that other species do. Longleaf pine is also less amenable to single-tree selection than loblolly and shortleaf pines, consequently small group selection would be more appropriate (Boyer 1993). In any event, the discussion that follows applies primarily to pine species other than longleaf pine. Second, red-cockaded woodpeckers require older pines as cavity sites (Rudolph and Conner 1991). Tree age requirements vary with species and site, but generally healthy woodpecker populations require trees of ≥80 to 120 years old. Even with trees of this age it is not certain that the birds will be able to maintain adequate numbers of cavities in all instances., Third, red-cockaded woodpeckers tend to avoid habitats with excessive hardwood midstory vegetation (Conner and Rudolph 1989, Loeb et al 1992), both for cavity placement and foraging. Historically, midstory vegetation was controlled by frequent ground tires resulting in a fire climax ecosystem. Finally, sound ecosystem management requires the return of fire as a driving force in the southern pine ecosystem (Platt et al. 1988). Without the return of fire, managers will be faced with an escalating list of rare and endangered plant and animal species dependent on the continued role of fire. Keeping the requirements of the red-cockaded woodpecker in mind, and the nature of the ecosystem on which they depend, we contrast the possible consequences of an irregular shelterwood system and a single-tree selection system in loblolly and shot-deaf pine.

Irregular shelterwood is a silvicultural method that involves harvesting a proportion of the trees at rotation age and leaving a substantial number of residual trees scattered across the stand (Smith 1986, Conner and Rudolph 1989, Conner et al. 1991). In irregular shelterwood, as opposed to "regular" shelterwood, these residuals are left throughout the succeeding rotation, or even in perpetuity. Shelterwood harvesting is generally considered an even-aged method, or a two stage clearcut, if the residuals are removed after adequate regeneration is established.

Single-tree selection varies considerably in practice (Farrar 1981, Guldin and Baker 1988, Williston 1978). As generally discussed with regard to red-cockaded woodpecker management, the following scenario seems close to what would ultimately be implemented under the 1995 Environmental Impact Statement (U.S. For. Serv. 1995). A set rotation age is not utilized. Potential age is controlled by setting a maximum diameter limit. In the case of red-cockaded woodpecker management, this diameter would be set to provide adequate numbers of potential cavity trees. Periodic harvests would be implemented in which all trees in excess of the diameter limit plus a range of sizes down to the smallest with economic value would be removed. A constant, q, in a mathematical formula determines the relative abundances of trees in the various size classes. Harvesting must be heavy enough to open the stand sufficiently to allow regeneration of the desired -species, in this instance pines, to become established.

With proper selection of rotation age for irregular shelterwood, or diameter limit and q for single-tree selection, adequate numbers of potential cavity trees will result. Both methods also rely on natural regeneration with no, or minimal site preparation. However, the methods diverge substantially in other important ways,

An important consideration is ease of implementation. Irregular shelter-wood is easily implemented; residual trees are selected to be retained and all other trees are cut. Single-tree selection requires more care. Minor variations in selection of the trees to be harvested (especially the largest trees) can have profound impacts on forest structure and red-cockaded woodpeckers for decades. Timing of management is critical. Ability to implement is a major concern for those involved with red-cockaded woodpecker management, and will presumably apply to other species as well. To effectively implement technically difficult single-tree selection with a declining workforce and budget constraints is not a trivial consideration.

Under the 2 silvicultural methods, individual stands differ drastically in the frequency of entry for harvesting. Let us assume a rotation age of 100 years or the diameter equivalent. Under irregular shelterwood there is a major harvest entry at rotation age. This would generally be followed by 1 or 2 thinnings and perhaps partial removal of some residuals, a total of 3 to 4 harvesting entries/100 years. With single-tree selection in loblolly and shortleaf pines harvesting entries every 5- 10 years are generally discussed, a possible total of 10-20 entries/100 years. The contrast between the 2 methods in terms of site disturbance, soil erosion, and permanence of the road network to support harvesting is substantial.

Fire is a driving force in southern pine ecosystems (Platt et al 1988). The species of pines present possess different adaptations with differing degrees of resistance to fire. Longleaf pine (*Pinus palustris*) is highly resistant except for very young seedlings; loblolly (*P. taeda*) and shortleaf (*P. echinata*) pines are much less resistant except as adults. Primarily due to this difference the consequences of irregular shelterwood vs single-tree selection are very different depending on the pine species. The following discussion does *not* apply to longleaf pine due to its resistance to fire-induced mortality. Under irregular shelterwood methods, there is only 1 regeneration pulse/rotation, 100 years in our scenario. Fire with all of its many ecological benefits for red-cockaded woodpeckers, and other species, need only be excluded for a period of several years to allow the regeneration adequate time to reach a size resistant to fire. With single-tree selection, regeneration is potentially established following each harvesting entry, every 5-10 years in our example. This greatly restricts the ability of the managers to use fire as a management tool (Cain 1993). One alternative is to tolerate hardwood encroachment with serious consequences for the ecosystem, and the red-cockaded woodpecker. A second alternative, often used, is use of herbicides to control hardwood encroachment (Reynolds et al. 1984). Neither of these alternatives provides the numerous benefits of fire, and herbicide use has ecological consequences of its own in relation to overall plant diversity.

The final, and perhaps most significant contrast in the effects of the 2 harvesting methods concerns the general issue of old growth forest habitat. We are assuming that old trees and old growth forest characteristics are desirable. If "rotation age" under single-tree selection is determined by the established diameter limit, and the diameter limit is set to approximate the size reached by trees in 100 years, the oldest trees in any stand would be approximately 100 years of age. The stand would consist of trees of many sizes and ages up to approximately 100 years and the established diameter limit. Trees approaching the diameter limit and 100 years of age would be relatively rare. Trees approaching the maximum potential age and size for the various pine species would not exist.

Under the irregular shelterwood method the outcome is considerably different. With a 100-year rotation age, the residual trees (or a proportion of the residual trees) will be left throughout the following 100-year rotation. At the time of the second irregular shelterwood harvest, the surviving residual pines will be 200 years old. There is no silvicultuml reason that the survivors could not be designated as residual trees for the next rotation, any deficit being made up with 100-year-old trees. Consequently, at equilibrium and mid-rotation, the stand would consist of 2 age classes, 50 and 150 years of age, plus any survivors of previous rotations. Due to differences in genetics and environment, growth rates would vary. The result would be a forest with all size classes represented and limited age classes spread over a very wide range. The old-age characteristics of the forest would be greatly enhanced compared to the single-tree selection method, due to the potential of some trees on all sites to reach their biologically maximum size and age. Depending on species, trees 2150 cm and 2200 years of age would be possible.

We have purposely restricted our discussion of single-tree selection to a rather narrow range of parameters to provide maximum contrast between even-age and uneven-aged systems. It is possible to set the various parameters (q, entry frequency, diameter limit) such that the result more closely resembles that under the irregular shelterwood system. It is even possible to stipulate that some individual trees be left in perpetuity to provide trees of maximum age and size. However, each added cycle of regeneration, even if only 2-4/rotation significantly reduces the ability to use fire effectively. To approximate the benefits realized under an irregular shelterwood system, single-tree selection requires substantial modification from what is generally discussed. Ultimately, the results closely approach a single regeneration harvest, i.e., an irregular shelterwood system.

In view of the considerations discussed above we encourage those involved in the debate over management of red-cockaded woodpeckers and southern pine ecosystems to seriously consider the benefits of irregular shelterwood methods. Irregular shelterwood should not be dismissed simply because it is an "even-aged method" without considering the many positive attributes. It is also critically important to consider the details

of the irregular shelterwood method, or any method, since they determine the ultimate structure of the forest and the availability of old pines. In the case of irregular shelterwood the number and spacing of residuals determines the outcome. Attention needs to be focused on these details, or any silvicultural system will fail to meet the goals of sound ecosystem management.

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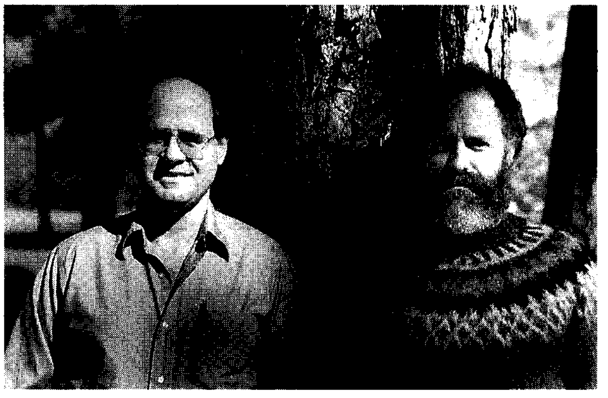

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