An Ecological Approach to Managing Southern National Forests for Red-cockaded Woodpecker Recovery

Dennis L. Krusac, *U.S. Department of Agriculture, Forest Service, 1720 Peachtree Road NW, Suite 816 N, Atlanta, GA 30367*

Joseph M. Dabney, *U.S. Department of Agriculture, Forest Service, 1720 Peachtree Road NW, Suite 816 N, Atlanta, GA 30367*

John J. Petrick, *U.S. Department of Agriculture, Forest Service, 1720 Peachtree Road NW, Suite 816 N, Atlanta, GA 30367*

Abstract: The U.S. Department of Agriculture, Forest Service red-cockaded woodpecker (*Picoides borealis*) recovery strategy is based on conservation biology principles. It implements landscape-scale management by identifying 26 habitat management areas (HMAs) totaling nearly 810,000 hectares. Within these designated HMAs, longer timber harvesting rotations will be established. Management intensity levels (MILs) will be established based on red-cockaded woodpecker (RCW) population size. The smallest populations will receive the most intensive direct RCW management while being most restrictive regarding forest management. The combination of identifying HMAs and implementing longer timber harvesting rotations and appropriate MILs should overcome the effects of past fragmentation and demographic isolation. Prescribed burning regimes will mimic historical fire regimes of southern pine ecosystems.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 48:374–382

Historically, the red-cockaded woodpecker (RCW) ranged throughout the pine forests of the southeastern United States from Missouri, Kentucky, and Maryland, southward to Florida and westward to eastern Texas (Hooper et al. 1980). Losses of foraging and nesting habitat led to the red-cockaded woodpecker being listed as an endangered species in 1970. Suitable RCW habitat has continually decreased since its listing, and now the bird's range has been reduced primarily to public lands (mainly national forests) in the southern United States.

The RCW is a cooperative breeder and helper birds aid the breeding pair in rearing their offspring (Lennartz and Harlow 1979, Lennartz 1983, Walters 1990, Walters et al. 1988, 1992). Individual groups, family units of 1 or more birds, maintain year-round territories around their cavity tree cluster and foraging habitat. Preferred RCW nesting habitat consists of open park-like stands of mature pine with little or no midstory vegetation. The RCW is the only woodpecker which excavates cavities almost exclusively in living pines. There is a preference for older trees and trees infected with redheart fungus (*Phellinus pini*) for cavity excavation (Jackson 1977, Conner and Locke 1982, Hooper et al. 1991*a,* Rudolph and Conner 1991). Redheart fungus usually is not abundant in southern pines until the trees are 80 to 100 years old, but the fungus may infect pines as young as 40 years of age (Wahlenberg 1946, 1960).

National Forest System lands comprise only about 6% of the forested lands in the South, but these lands have been identified with 80% of the RCW recovery objectives. Because national forests are so critical to recovery, intensive, protective forest management, including management of commercial timber harvest, is required to ensure a sustained flow of RCW habitat through time.

To develop an RCW recovery strategy, we analyzed 5 main topics: causes of RCW population declines, past RCW management strategies, natural disturbance processes of southern pine ecosystems, ecosystem function, and existence of other threatened, endangered, or sensitive species occurring in similar habitats. The strategy addresses the effects of management on biological and physical resources as well as economic constraints. This paper will only discuss causes of RCW population declines, effects of past RCW management, and natural disturbance processes and how they were critical in the development of the proposed strategy.

Recovery Strategy Development

Primary Causes of RCW Population Declines

Although RCWs will use many pine forest types, they are most closely associated with the longleaf pine (*Pinus palustris*) forest. Historically, longleaf pine dominated between 24.3 and 32.4 million ha of the coastal plain region (Betts 1954, Croker 1987). Less than 1.6 million ha of the original longleaf pine type remained in 1989 as second growth stands (Landers et al. 1989). Habitat loss, fragmentation, and the associated demographic isolation are a primary cause of RCW population declines (Jackson 1971, Lennartz et al. 1983, Conner and Rudolph 1991). Lack of suitable cavity trees, potential cavity trees, and a high rate of cavity tree mortality are other major causes of RCW population decline (Steirly 1957, Ligon 1970, Jackson 1971, Jackson et al. 1979, Lennartz et al. 1983, Conner et al. 1991, Rudolph and Conner 1991).

Another major cause of RCW population decline is hardwood midstory development. The development of dense hardwood midstory causes cluster abandonment either by adversely changing habitat conditions or increasing cavity competition (Hooper et al. 1980, Hovis and Labisky 1985, Conner and Rudolph 1989, Loeb et al. 1992, Loeb 1993). The lack of hardwood midstory control in foraging habitat can also have impacts. In stands with tall dense midstories, a significant portion of the female's preferred foraging substrate may be unavailable or avoided (R. N. Conner and D.C. Rudolph unpubl. data). Pine midstory development may have similar affects.

Past RCW Management

Prior to 1968, RCW cavity trees were routinely removed from national forests during timber stand improvement activities (C. Vonn Hermann, pers. commun.). In 1968, the U.S. Department of Agriculture, Forest Service (USFS) established a policy to protect cavity trees and a 60-m buffer around them. Passage of the Endangered Species Act in 1973 required the USFS to begin implementing RCW management in an attempt to recover the species. In 1975, the USFS amended its policy to include providing 16 ha of pine >20 years old adjacent to cavity tree clusters and performing midstory control. A RCW recovery plan was issued in 1979 and USFS policy again was amended to conform with the recovery plan. Changes included increasing foraging habitat from 16 ha to a range of 40 to 100 ha, establishment of recruitment stands for population expansion, and recommending timber rotations of 80 years for longleaf pine and 70 years for other yellow pines. In 1985 the RCW recovery plan was again revised, which led to yet another revision of USFS policy (Meier 1995). Even with more intensive and protective management, most national forest RCW populations continued to decline (Costa and Escano 1989). The only population to have a documented increase was on the Francis Marion National Forest (Hoope et al. 1991*b*).

Most of the past RCW management direction included prescribed burning which occurred during the winter months (dormant season), timber rotations of less than 80 years, and extensive use of clearcutting for forest regeneration. Past RCW management direction failed to use a landscape-scale approach to management. Even the most protective management direction could lead to fragmentation and demographic isolation in small, widely dispersed populations (Conner and Rudolph 1991). In dense RCW populations, the effects of forest regeneration are not as significant as in widely dispersed populations (Wood et al. 1985, Conner and Rudolph 1991, Hopper and Lennartz 1995).

Natural Disturbance Processes of Southern Pine Ecosystems

Sprugel (1991) stated "natural" communities do not exist for long periods without large-scale disturbance; rather, several communities compose any "natural" site at any point in time. Large- and small-scale disturbances result in even-aged and uneven-aged regeneration sites. Some recent examples of landscape-scale disturbances include the 1980 explosion and eruption of Mount St. Helen's, the 1988 Greater Yellowstone fires, and the landfall of hurricane Hugo in 1989. Hurricanes have been a major disturbance force in southeastern coastal plain forests (Hooper and McAdie 1995) and have had major impacts on RCW habitat and populations (Engstrom and Evans 1990, Hooper et al. 1990). Eleven of the 15 RCW recovery populations are vulnerable to hurricane damage. Repeated hits from high winds to the same areas could extirpate RCWs from these areas. Currently, at least 2 recovery areas are in the process of restoration from hurricane damage. Silvicultural practices can be used to reduce the damage caused by hurricanes to RCW habitat (Hooper and McAdie 1995).

Of all the natural disturbance forces exerting change on the landscape, only fire can be somewhat controlled. Because of human intervention, the total extent of fire in the southeastern United States has decreased by almost 95% in the past 50 years (Simard and Main 1987). Control of fire and other alterations of natural processes have influenced the structure, function, and composition of most ecosystems in North America (Samson 1992). Recurring fires, a long-standing evolutionary agent of habitat change to which native species are adapted (Christensen 1981), can help maintain stable communities. Because fire control and prescribed burning during the vegetative dormant season has led to the development of dense hardwood midstory in many forests, human interference with natural fire regimes has affected the RCW. To recover the red-cockaded woodpecker, a more natural fire regime will be required.

Key Elements of Red-cockaded Woodpecker Recovery

Based on the analysis of the major areas of concern, 7 keys to RCW recovery were identified. Five of these represent ecological approaches to recovery, the other 2 elements represent intensive management to reverse downward RCW population trends and alleviate problems associated with demographic isolation.

Ecological Elements of Recovery

Habitat Management Area Designation.—Habitat management area (HMA) designation involves the delineation of an area that represents the desired future demographic configuration of an RCW population. It is a strategy for management at a landscape scale. The intent is to manage an area large enough to avoid or overcome the adverse effects of fragmentation and to reduce the risks involved with small populations and stochastic events. The average HMA size is 30,150 ha. In many cases, entire national forests are identified as HMAs. Total land areas involved in HMAs, including suitable and unsuitable RCW habitat, may exceed 1.2 million ha.

Management Intensity Levels.—Four management intensity levels (MILs) were identified based on RCW population size. Small, widely dispersed RCW populations are more susceptible to extirpation (Gilpin and Soule 1986, Goodman 1987). Conner and Rudolph (1991) have shown small RCW populations are more susceptible to habitat changes than larger populations. Based on this, RCW populations with less than 40 potential breeding pairs will receive the most intensive RCW management, while being most restrictive in regard to the production of forest products. Populations with more than 400 potential breeding pairs will be considered recovered, and will receive the least intensive RCW management and will have the fewest restrictions on other resource management activities.

Midstory Control.—The adverse effects of midstory development have been discussed previously. The existing midstory conditions have developed because of changes in the natural fire regime. Historically, the USFS has controlled most wild fires occurring on national forest lands. Prescribed burning for RCW habitat improvement has been completed primarily in the vegetative dormant season, and hence has had little effect on controlling hardwood midstory development. The dense hardwood shrub and midstory vegetation has impacted RCWs.

The proposed RCW recovery strategy emphasizes prescribed burning for midstory control with much of the burning occurring during the growing season and implements a 3- to 5-year burning cycle. This mimics the natural fire regime and should eventually result in improved habitat conditions. Prescribed burning may not be effective initially because of the large size of much existing midstory vegetation. Therefore, initial management may have to include cutting hardwood stems with chainsaws, treating individual stems with herbicides, and using mechanical equipment such as shearing blades and hydro-muchers. After initial treatments to control vegetation, it should be possible to use prescribed burning to maintain the desired habitat conditions.

Longer Timber Rotations.—Past RCW management relied on an 80-year rotation for longleaf pine and a 70-year rotation for other pine species. The proposed RCW recovery strategy would implement a 120-year rotation for longleaf and shortleaf pine (*P. echinata*) and a 100-year rotation for loblolly (*P. taeda*) and slash (*P. elliottii*) pines. An optional 80-year rotation for loblolly and shortleaf pines can be implemented in areas of historically high southern pine beetle (*Dendroctonus frontalis*) infestations. The extended rotations are based on the RCW's preference for older trees and the rate of heartwood and heart rot development. Clark (1992) determined that on an average site it would take 70 years for loblolly pine and 90 years for longleaf pine to develop an adequate core of heartwood for RCW cavity excavation. Past timber rotations would prescribe the harvest of forest stands before they became suitable for RCW cavity excavation. It is essential that the longer rotations be implemented and a balanced age-class distribution achieved. The balanced age-class distribution will allow a sustained flow of RCW habitat through time. This is critical because only a remnant of the original habitat exists today to recover the species.

Full Range of Vegetative Management Options.—Forest management must occur to maintain the open stand conditions the RCW prefer and to ensure a sustained flow of habitat through time. All silvicultural methods must be available to properly manage RCW habitat. Habitat management will range from thinnings and prescribed burning to forest regeneration, to perpetuate RCW habitat. Regeneration methods will range from clearcutting to single tree selection. Clearcutting will be used primarily for ecosystem restoration to restore the naturally occurring pine types, in areas that have undergone forest type conversions. The most commonly used regeneration method will be the irregular shelterwood. With this method, the residual trees are left in perpetuity. The amount of basal area retained on site varies by MIL, with the greatest number of residuals left in the smaller, more vulnerable populations. The purpose of this technique is to ensure a flow of RCW habitat through time, while minimizing the effects of fragmentation and providing for old trees scattered across the landscape.

Intensive Management Elements of Recovery

The intensive management elements of recovery are the construction of artificial cavities and translocation of young RCWs. These strategies will be used to reverse downward RCW population trends and to overcome the effects of past fragmentation that led to demographic isolation.

Artificial Cavities.—Artificial cavities will be used to increase the supply of cavities in active clusters and to stimulate colonization of unoccupied habitat (Copeyon 1990, Copeyon et al. 1991, Walters 1991, Walters et al. 1992). Artificial cavities also have proven affective in stabilizing populations following cavity loss from natural causes (Conner et al. 1994, Watson et al. 1995). Three types of artificial cavities will be used including drilled cavities, drilled cavity start-holes, and cavity inserts.

Translocation of Young RCWs.—Translocation involves the moving of juvenile RCW from one location to another to create a potential breeding pair. In most cases, the appropriate sex juvenile RCW is moved to a single-bird group creating a potential breeding pair. Rudolph et al. (1992) described a second type of translocation which results in the establishment of new RCW groups by releasing a nonrelated juvenile male and female together in unoccupied habitat. Both methods of translocation have been successful, but they must be used in conjunction with artificial cavities and midstory control to be effective.

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