United States
Department of
Agriculture

Forest Service

**Southern Forest
Experiment Station**

New Orleans,
Louisiana

Research Paper
SO-251

Injection of 2,4-D to Remove Hardwood Midstory Within Red-Cockaded Woodpecker Colony Areas

Richard N. Conner

SUMMARY

Red-cockaded woodpecker *(Picoides borealis)* colonies on the Angelina National Forest were monitored from 1984 to 1986, after hardwoods on the site had been injected with the herbicide 2, 4-D. The herbicide effectively reduced the hardwood midstory; however, possible toxicity to woodpeckers and cavity tree mortality are problems associated with the use of 2,4-D. Because of its lower toxicity to pines, the herbicide hexazinone is suggested as an alternative to 2,4-D. Use of any herbicide is suggested only as a one-time application to eliminate large hardwoods so that prescribed fire can later be used to control hardwoods in woodpecker colonies.

October 1989

Injection of 2,4-D to Remove Hardwood Midstory Within Red-Cockaded Woodpecker Colony Areas

Richard N. Conner

INTRODUCTION

The control of hardwood trees and midstory foliage that grow around the living pines that red-cockaded woodpeckers *(Picoides borealis)* use for cavity trees is considered to be important for the management of this woodpecker species (U.S. Department of the Interior 1985). Hardwood midstory encroachment is a possible cause for colony abandonment (Hopkins and Lynn 1971, Van Balen and Doerr 1978, Locke and others 1983, Hovis and Labisky 1985, Conner and Rudolph 1989). Midstory encroachment is more of a problem for colonies in loblolly *(Pinus taeda)* and shortleaf *(P. echinata)* pine forests on mesic sites, where hardwoods are more abundant, than in longleaf pine *(P. palustris)* stands. Although prescribed fire every 3 years is perhaps the preferred way to prevent a dense hardwood midstory, prescribed fire cannot be used to reduce an established midstory (Brender and Cooper 1968, Langdon 1981).

Alternative methods of hardwood control include mechanical removal with chainsaws or handtools and chemical treatment with herbicides (often synthetic plant auxins such as 2,4-D). Mechanical control of hardwoods has an immediate effect but usually results in extensive coppice sprouting during subsequent growing seasons. Mechanical removal is also more costly than herbicide treatment (Council for Agricultural Science and Technology 1978). Injection with herbicides provides a method to remove hardwood midstory that may reduce sprouting from stumps because of the resulting root kill (Williston and others 1976). The decay and falling of midstory trees treated with herbicides would be slow, providing a gradual alteration of the habitat. This slow removal would have less of a visual impact on red-cockaded woodpeckers and might reduce the risk of colony abandonment due to rapid habitat change.

In this study the 2,4-D treatment of hardwoods was monitored in nine red-cockaded woodpecker colonies. The colony areas were being treated as part of a Southwide USDA National Forest System (NFS) project. Cavity tree status (active vs. inactive) and an estimate of nesting attempts were evaluated before and after treatment. Cavity tree status and nesting results from these nine colonies were compared with similar data from nine untreated colonies.

METHODS

Study Area

The 2,4-D treated hardwoods were in woodpecker colonies on the northeastern portion of the Angelina National Forest (Nacogdoches and San Augustine Counties) in eastern Texas. Red-cockaded woodpecker colonies in this portion of the national forest are found on mesic sites in mature stands composed mainly of loblolly and shortleaf pines. Oaks *(Quercus* spp.*)*, sweetgum *(Liquidambar styraciflua)*, and hickories *(Carya* spp.*)* are the most abundant hardwoods in these stands. Red-cockaded woodpecker colonies serving as experimental controls for the study were located in the southwestern portion of the Angelina National Forest (Angelina and Jasper Counties), where the dominant cover type was longleaf pine. These stands typically had a lower hardwood basal area and more xeric soils than stands in the northeastern portion of the study area. The treatment and control portions of the study area were separated by the Sam Rayburn Reservoir and were about 21 miles apart. It would have been ideal to have untreated control colonies also located in the loblolly-shortleaf pine types; however, all active colonies in this timber type on the Angelina National Forest had been treated with 2,4-D by NFS personnel, and thus none were available to serve as controls.

Procedures

The nine red-cockaded woodpecker colonies in the northeastern portion of the Angelina National Forest and the nine control colonies in the southwestern portion were monitored weekly from March to July in 1984, 1985, and 1986 for the presence and behavior of woodpeckers and activity status (active vs. inactive) of all tagged cavity trees (Jackson 1977, 1978). Cavity trees were judged active if bark at resin wells excavated by

Richard N. Conner is research wildlife biologist, U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station, Nacogdoches, TX 75962.

red-cockadeds was red, indicating recent pecking. If a woodpecker appeared at the nest entrance during the nesting season when the cavity tree was tapped, the woodpecker was considered to be incubating eggs. Nestling red-cockaded woodpeckers were considered present if they were heard begging or if an adult was seen carrying food to the cavity.

During August and September of 1984, hardwoods in the nine treated colonies were injected with a dimethyl amine salt of 2,4-D using hypohatchets. Injected hardwoods ranged from 1 to 12 inches in diameter at breast height (d.b.h.) and 6 to 36 ft in height. Some pines (4–10 inches in d.b.h.) in each colony area were also injected with 2,4-D.

Pretreatment basal areas of all 18 colonies were measured with a basal area prism during July 1984. Posttreatment basal areas were measured during the spring of 1985 after hardwood refoliation. All basal area measurements were made at five randomly determined points within each colony.

RESULTS

Hypohatchet injection with 2,4-D markedly reduced live hardwood basal area in the northeastern portion of the study area. Average hardwood basal area in these nine colonies dropped from 26.8 to 5.7 ft^2/acre. About 90 percent of the injected hardwoods were killed, which is generally considered a normal and acceptable kill. Total basal area dropped from 95.5 to 68.2 ft^2/acre because some pines (26 percent of the total basal area) were also injected. Within 1 month of injection, leaves on almost all hardwoods within the woodpecker colonies had turned brown, indicating the death of the trees. About 2 inches of rain had fallen on the 2,4-D treated area several weeks after treatment, possibly causing a growth surge in the trees and enhancing the effectiveness of the herbicide injection.

Basal areas of pines and hardwoods in the control colonies were 66.9 and 2.6 ft^2/acre, respectively. In the past, prescribed fire had been used to control hardwoods in the southwestern portion of the study area. The most recently prescribed fire in the longleaf pine area had been in 1978.

In the spring of 1984, prior to treatment, both treated and control areas had similar estimated nesting efforts (table 1). In the treated area, 83 percent of all cavity trees were active, and in the nine control colonies, 75 percent of all cavity trees were active.

The number of active cavity trees in both treated and control areas dropped considerably in 1985. However, 1985 estimates of nesting attempts and number of cavity trees with young were similar to those of 1984 in both study areas (table 1). In 1986, the number of active cavity trees in both treated and control areas was similar to what it had been in 1985. The nesting effort in both areas may have dropped slightly in 1986 (table 1).

Table 1.—*Active and inactive cavity trees and nesting-attempt estimates for nine 2,4-D treated and nine control red-cockaded woodpecker colonies*

	Cavity trees		Estimated nesting attempts	Cavity trees with young
	Active	Inactive		
	Number			
1984				
Treated	43 (83)*	9 (17)	7	6
Control	44 (75)	15 (25)	7	7
1985				
Treated	28 (54)	24 (46)	7	6
Control	31 (51)	30 (49)	8	7
1986				
Treated	27 (51)	26 (49)	6	4
Control	30 (49)	31 (51)	6	5

*Numbers in parentheses are percentage of total number of cavity trees present.

The reduced hardwood basal area of the 2,4-D treated colonies was still visually evident in 1986, 2 years after injection. However, there was some coppice sprouting and growth of smaller hardwoods into the midstory during the 1986 breeding season.

Two cavity trees in the 2,4-D treated colonies died after the injection treatment. Some small pines within 15 feet of these two cavity trees had been injected with 2,4-D. The herbicide was apparently transported through root systems (via root grafts), resulting in the cavity tree mortality. The two cavity trees died during the same time period as the injected hardwoods, and showed no evidence of either lightning strike or beetle attack.

DISCUSSION

The injection of 2,4-D into midstory hardwoods was an effective way to control midstory encroachment in red-cockaded woodpecker colonies; the hardwood kill was about 90 percent, and hardwood basal area was reduced substantially. Regrowth of a hardwood understory and some of the hardwood midstory was somewhat evident 2 years after injection. Prescribed fire should be used as soon as possible following herbicide treatment of hardwoods in order to prevent the reestablishment of new hardwood stems. Treatment with herbicides should be considered as a one-time application to bring colony areas to a condition where hardwoods can be managed with prescribed fire.

Unlike mechanical midstory control, injection with 2,4-D was relatively quiet (compared to chain saw operations), required minimal time in the colony areas, and caused a gradual change in the habitat as trees died slowly but remained standing. Mechanical midstory removal causes a sudden change in the appearance of the colony area and may increase the possibility of colony abandonment. The effect of a sudden change in the appearance of an active colony should be further investigated.

Unlike red-cockaded woodpeckers, other species of woodpeckers often forage on dead hardwoods. The increase in foraging habitat due to the increase in the number of dead hardwoods could attract other woodpecker species to the area, resulting in an increase in competition for red-cockaded nest cavities. This also deserves further investigation.

There was a decrease in the number of active cavity trees the year after 2,4-D injection, but the decrease was observed in both the treated and control areas. The cause of this study-wide decrease in active cavity trees probably relates to an overall decline of red-cockadeds on the Angelina National Forest (Conner and Rudolph 1989).

Contamination of arthropod prey with 2,4-D needs further evaluation. Recently, Hoar and others (1986) observed carcinogenic effects of 2,4-D on vertebrates. Tissue samples from northern cardinals *(Cardinalis cardinalis)* foraging in 2,4-D-sprayed areas contained elevated levels of 2,4-D relative to control area cardinals (Kroll and Kulhavy 1985). Although red-cockadeds rarely forage on hardwoods, particularly if the trees are dead (Hooper and Lennartz 1981), arthropods are capable of moving from injected trees to other uninjected hardwoods and pines. A one-time application of herbicide, as opposed to regular use, would minimize the probability of red-cockadeds consuming contaminated arthropods.

When using 2,4-D to reduce pine basal area in colony areas, there are potential dangers. The first and perhaps greatest danger is cavity tree mortality when pines sufficiently close to cavity trees for root contact and grafting are injected. The herbicide can be passed through the root systems of one pine to another pine, and on some occasions pines can be killed by 2,4-D exuded from roots of hardwoods, even when only hardwoods are injected (J. B. Baker, pers. comm.).[1] An alternative and safer herbicide to use for control of hardwoods in close proximity to pines would be hexazinone because pines are much more resistant to hexazinone than to 2,4-D. A one-time use of hexazinone (2 ml of hexazinone injected per incision, with one incision per 2.5 cm of stem diameter, measured at ground level) should be considered as a method to control hardwoods in woodpecker colonies. Hexazinone is also less toxic to wildlife than 2,4-D (Beste 1983).

Another danger that may be incurred when pines near cavity trees are injected with herbicides is the creation of a southern pine beetle (SPB), *Dendroctonus frontalis*, outbreak. Following injection treatments of small diameter pines with 2,4-D in woodpecker colonies on the Bienville National Forest in central MIssissippi, Smith (1981) observed that 22 percent of the cavity trees became infested with SPB. Once started, an SPB outbreak could destroy all the cavity trees in the colony. Use of hexazinone rather than 2,4-D when hardwood control is the objective would reduce this danger because pines are more resistant to hexazinone than they are to 2,4-D.

Overall, the use of herbicides to eliminate midstory hardwoods in red-cockaded woodpecker colonies appears to be a good strategy. Use of 2,4-D is not recommended because of its potential toxicity to woodpeckers and the extreme sensitivity of pines to this herbicide. If financial constraints prohibit mechanical control, hexazinone should be considered as a one-time treatment of hardwoods to return colony areas to conditions where prescribed fire can be used to control hardwood encroachment.

[1]Personal communication from James B. Baker, Southern Forest Experiment Station, Monticello, AR.

LITERATURE CITED

Beste, C. E. 1983. Herbicide handbook. Champaign, Il: Weed Science Society of America. 515 p.

Brender, Ernst V.; Copper, Robert W. 1968. Prescribed burning in Georgia's Piedmont loblolly pine stands. Journal of Forestry. 66: 31–36.

Conner, Richard N.; Rudolph, D. Craig. 1989. Red-cockaded woodpecker colony status and trends on the Angelina, Davy Crockett, and Sabine National Forests. Res. Pap. SO-250. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 15 p.

Council for Agricultural Science and Technology. 1978. The phenoxy herbicides. Council for Agricultural Science and Technology, Report No. 77. Ames, Iowa: Agronomy Department, Iowa State University. 28 p.

Hoar, Sheila K.; Blair, Aaron; Holmes, Frederick F.; Boysen, Cathy D.; Robel, Robert J.; Hoover, Robert; Fraumeni, Joseph F. 1986. Agricultural herbicide use and risk of lymphoma and soft-tissue sarcoma. Journal of the American Medical Association. 256: 1141–1147.

Hooper, Robert G.; Lennartz, Michael R. 1981. Foraging behavior of the red-cockaded woodpecker in South Carolina. Auk. 98: 321–334.

Hopkins, Melvin L.; Lynn, Teddy E., Jr. 1971. Some characteristics of red-cockaded woodpeckers cavity trees and management implications in South Carolina. In: Thompson, Richard L., ed. The ecology and management of the red-cockaded woodpecker; 1971 May 26–27; Folkston, GA. Tallahassee, FL: Bureau Sport Fisheries and Wildlife and Tall Timbers Research Station: 140–169.

Hovis, Julie A.; Labisky, Ronald F. 1985. Vegetative associations of red-cockaded woodpecker colonies in Florida. Wildlife Society Bulletin. 13: 307–314.

Jackson, Jerome A. 1977. Determination of the status of red-cockaded woodpecker colonies. The Journal of Wildlife Management. 41: 448–452.

Jackson, Jerome A. 1978. Pine bark redness as an indicator of red-cockaded woodpecker activity. Wildlife Society Bulletin. 6: 171–172.

Kroll, James C.; Kulhavy, David L. 1985. Ecological assessment of herbicide treatment on a southern forest ecosystem. Final report coop-agreement with USDA Forest Service #19-80-388. Southern Forest Experiment Station. 29 p.

Langdon, O. Gordon. 1981. Some effects of prescribed fire on understory vegetation in loblolly pine stands. In: Wood, Gene W., ed. Prescribed fire and wildlife in southern forests; 1981 April 6–8; Myrtle Beach, SC. Georgetown, SC: Belle W. Baruch Forest Science Institute of Clemson University: 143–153.

Locke, Brian A.; Conner, Richard N.; Kroll, James C. 1983. Factors influencing colony site selection by red-cockaded woodpeckers. In: Wood, Don A., ed. Red-cockaded woodpeckers symposium II proceedings; 1983 January 27–29; Panama City, FL. Tallahassee, FL: State of Florida Game and Fresh Water Fish Commission: 46–50.

Smith, Michael W. 1981. Comments on herbicide injection for habitat maintenance of red-cockaded woodpecker colonies. The Mississippi Kite. 11: 52–53.

U.S. Department of the Interior. 1985. Red-cockaded woodpecker recovery plan. Atlanta, GA: U.S. Fish and Wildlife Service. 88 p.

Van Balen, Jill B.; Doerr, Phillip D. 1978. The relationship of understory vegetation to red-cockaded woodpecker activity. In: Dimmick, Ralph W., ed. Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies; 1978 November 5–8; Hot Springs, VA. Nashville, TN; Wildlife Resources Agency, Ellington Agricultural Center: 82–92.

Williston, H. L.; Balmer, W. E.; Abrahamson, L. P. 1976. Chemical control of vegetation in southern forests. Atlanta, GA: U.S. Department of Agriculture, State and Private Forestry, Southeastern Area, Forest Management Bulletin. 2 p.

Discussion of herbicides in this paper does not necessarily constitute recommendation of their use or imply that uses discussed are registered. If herbicides are handled, applied, or disposed of improperly, they can harm humans, domestic animals, desirable plants, pollinating insects, and fish or other wildlife. Water supplies can be contaminated. Herbicides should be used only when needed and handled with care. Directions on the container label should be followed and precautions heeded.

Conner, R. N. 1989. Injection of 2,4-D to remove hardwood midstory within red-cockaded woodpecker colony areas. Res. Pap. SO-251. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 4 p.

Use of herbicides is a possible one-time treatment to eliminate hardwoods within red-cockaded woodpecker colonies. Possible toxicity to woodpeckers and cavity tree mortality are problems that must be considered before herbicide use.

Keywords: Hardwood control, herbicides, woodpecker management.