DAMAGE TO LOBLOLLY PINE BY WINTER ROOSTING BLACKBIRDS AND STARLINGS

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ABSTRACT

Roosting blackbirds and starlings (Sturnus vulgaris) *caused extensive damage to a 4-hectare, 14-year-old loblolly pine* (Pinus taeda) *stand near Shannon, Georgia. Over a 4-year period, a one million-bird roosting population killed 96 percent of the pines on a 2-hectare area, which resulted in a loss of $51.80 per hectare. Black and white panchromatic and infrared film exposed from 150 to 250 meters altitude effectively delineated areas of tree stress and mortality. Approximately 1 hectare of the roost site treated with surfactant solution at the rate of 61.2 liters per hectare during a test in 1969 showed no adverse effect on roost vegetation.*

Winter roosts of blackbirds [red-winged blackbird (*Angelaius phoeniceus*), common grackle (*Quiscalus quiscula*), brown-headed cowbird (*Molothrus ater*), and rusty blackbird (*Euphagus carolinus*)] and starlings numbering up to several million birds are common in the Southeastern United States (Meanly and Webb 1965). Damage to roost vegetation by birds is observed commonly, but documentation of the actual effect on habitat is sparse.

The same sites often are utilized by roosting birds for several consecutive winters. One in the Dismal Swamp on the Virginia-North Carolina line was used by 20 to 30 million birds for at least 5 years (Hardy 1961). Another winter roost, in freshwater marsh at Reelfoot Lake, Tennessee, was occupied from 1940 to 1949 and probably for several years before and after that period (Cypert 1949) and (Dunbar 1951).

A roost near Shannon, Georgia, was occupied by birds for at least three consecutive winters in a stand of loblolly pine. During the winters of 1969 and 1970, this roost was utilized by U. S. Fish and Wildlife Service biologists of the Patuxent Wildlife Research Center including the author, for conducting tests to evaluate aerial delivery of surfactants as stessing agents (Hardy et al. 1970) on roosting birds.

This paper reports (1) damage to the Shannon 14-year-old pine stand resulting from successive-winter bird roosting, (2) the use of low-level aerial infrared photography in delineating the extent of affected vegetation, and (3) the lack of effect of surfactant applications to roost habitat.

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STUDY AREA

The Shannon roost site is located in Floyd County, 11 kilometers northeast of Rome in northwest Georgia. Land use of the area is general farming and timber production typical of the southern Applachian ridge and valley region. The major forest type is oak-pine—50 percent is southern pines.

The roost site is located in a 4-hectare, even-aged stand of loblolly pine which was 14 years old in 1973. The understory was limited to areas where the closed canopy was broken and consisted mostly of sweetgum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), Japanese honeysuckle (*Lonicera japonica*), and elderberry (*Sambucus canadensis*).

U. S. Department of Agriculture aerial photographs show that the roost site was under row-crop cultivation in 1955. Aerial photographs taken in 1955, 1960, 1965, and 1972 trace the typical old-field plant succession from bare soil. Once the field was left fallow, natural regeneration resulted in the old-field habitat and then the even-aged loblolly pine stand.

Soils are heavy clay loam with an impervious hardpan underlain with limestone. Drainage of surface water is medium to poor. A low area covering approximately 1 hectare

near the center of the roost site holds surface water for extended periods following heavy rains.

METHODS

Initial ground and aerial surveys were made in February 1969 to delineate and inventory vegetative species of the roost. The roost site was checked again in the late winter of 1970 and 1971. Ground and aerial checks in February 1973 indicated extensive tree mortality, and resulted in a more detailed evaluation of damage sustained.

On-the-ground estimates of damage were made with the assistance of the Regional Forester of the U. S. Fish and Wildlife Service. Aerial photographs taken by the author, U. S. Department of Agriculture photographs, and ground reconnaissance were used to delineate the damaged area. Age of the stand and time of mortality were determined by increment boring of live and dead trees. Basal area, stem frequency, volume per hectare, and tree height were taken from ten randomly selected representative 0.04 hectare plots within the pine stand adjacent to the roost-damaged area.

Oblique (45-60° angle) aerial photographs were taken from a Cessna 337 Sky Master at altitudes of 150 to 250 meters. Four types of film were used in a 35-mm Honeywell Pentax with a f 1.8, 55mm lens. Exposures with Kodak PX Pan 135 black-and-white film, Ektachrome 135 film, black-and-white infrared, and color infrared film were exposed.

Although Kodak Ektachrome Infrared and standard Ektachrome film were used in the damage survey, color photographs were too expensive for this publication. In color infrared, healthy conifers were depicted as reddish to bluish-white to gray. The infrared reflectance of various degrees of vegetative vigor recorded in color IR was a valuable tool in surveying the extent of damage to the pine stand.

Twenty soil samples were taken from 10 randomly selected locations—5 within the roost, and 5 within the pine stand but outside the roost-damage area. Two samples, one at 15-centimeter depth and the other at the surface, were taken at each of the 10 locations. Analyses were provided by the soil laboratory, University of Georgia.

A comparison of tree mortality was made between the surfactant-treated and control areas of the study site. Approximately 1 hectare of the study site had received surfactant solution at the rate of 61.2 liters per hectare during the Patuxent test in February 1969.

RESULTS AND DISCUSSIONS

Bird activity was typical of winter blackbird and starling roosts in the Southeast. Although there is no definite record, the roost site is believed to have been occupied initially in the winter of 1967-68.

Beginning in the late fall of 1968, birds roosted at the site through the winter of 1970-71. The heaviest roosting concentrations occurred on the damage site during the winters of 1968-69, 1969-70, and 1970-71. In February 1970 at the time of peak total roosting population, species composition was estimated to be: red-winged blackbird, 40 percent; common grackle, 20 percent; brown-headed cowbird, 20 percent; starling, 20 percent; and rusty blackbird, trace.

Seasonal roosting activity was typical of Southeastern winter roosts. Limited numbers of residents and early migrants began using the site in early October. By early December, the size had increased to two hundred thousand, and the roosting population peak of about 1 million birds was reached in late January and February. Spring abandonment of the roosting site occurred much more rapidly than the fall buildup. During the middle two weeks of March, the roosting population was reduced by 90 percent due to spring migration. The remaining few thousand birds gradually dispersed by mid-April.

Extensive damage occurred to the 14-year-old stand of loblolly pines in which the roosting birds concentrated. Tree mortality was estimated at 96 percent of the stems within the 2-hectare portion of the stand where the heaviest concentrations of roosting birds occurred. Basal area of a representative 0.04-hectare plot taken near the roost site within the same pine stand was 10.6 square meters in the 10.2 to 25.4 centimeter class. Tree height was about 14.6 meters; volume was estimated at 9.31 cords per hectare. A

Table 1. Soil analysis indicating pH and soluble salts (kilograms per hectare) from ten roost related stations.

		pH	*P*	*K*	*Ca*	*Mg*	NH_4	NO_3
SURFACE	Roost	6.70 0.29	−58.96[a]	33.76± 23.35	−220.62[a]	58.60± 16.94	13.94± 2.17	51.77± 11.63
	Nonroost	6.00± 0.82	−39.24[b]	21.05± 6.52	−202.25[b]	33.69± 21.77	15.17± 5.65	27.29± 19.77
	Significance level of two-tailed Student's t-test	NS[c]		NS		NS	NS	(P 0.009)
SUBSURFACE	Roost	4.64± 0.48	10.70± 7.86	32.37± 5.29	76.94± 21.54	7.68± 1.15	10.03± 0.92	6.40± 2.17
	Nonroost	4.70± 0.19	5.18± 4.57	28.47± 13.86	71.31± 25.57	8.85± 2.49	9.75± 1.22	6.12± 1.61
	Significance level of two-tailed Student's t-test	NS	NS	NS	NS	NS	NS	NS

[a]All sample values above minimum detectable limit.
[b]Some sample values above maximum detectable limit.
[c]Not significant (P 0.009).

closed canopy revealed no thinning or other management practices had been used. The mortality within the 14-year-old pine stand represents an economic loss of $51.80 per hectare, based on an estimated growth rate of 2.5 cords per hectare per year ($7 per cord) and $12.14 per hectare for site preparation and stand re-establishment.

The results of soil samples (Table 1) indicated heavy concentrations of total soluble salts in the surface layer of soil within the roost. For example, five of the six elements included in the test were substantially greater in the roost-soil surface samples. Within the subsurface soil samples, phosphorus was the only element that appeared significantly higher within the roost area. In the case of roost-soil surface samples, phosphorus at 58.56 kgs/ha and calcium at 219.61 kgs/ha represent a "greater than" value since the analysis procedures did not measure at higher concentration. All other values are actual concentrations measured.

Although the total soluble salt content present within the roost at the time of tree mortality is not known, the soil analyses indicate that elemental concentrations probably existed that were responsible for the tree mortality.

Low-level aerial black and white photography, using both standard panchromatic and infrared film, was valuable in delineating vegetative stress and mortality. Infrared film, originally designed for camouflage detection in military operations (Eastman Kodak Company 1968), emphasizes difference in infrared reflectance of healthy, stressed, and dead vegetation that are much less discernible with standard film or the naked eye. Individual live trees within the area of mortality are much less easily distinguished in the standard panchromatic photograph (Fig. 1) than in the infrared photograph (Fig. 2.).

In February 1969, the site was used for evaluating aerial delivery of a surfactant solution on roosting birds as a stressing agent (Hardy et al. 1970). The test area received surfactant solution treatment of 61.2 liters per hectare of a linear alcohol ethoxylate surfactant. Aerial application was made to a one hectare block in the southern portion of the active roost. No visible damage attributable to the surfactant applications could be

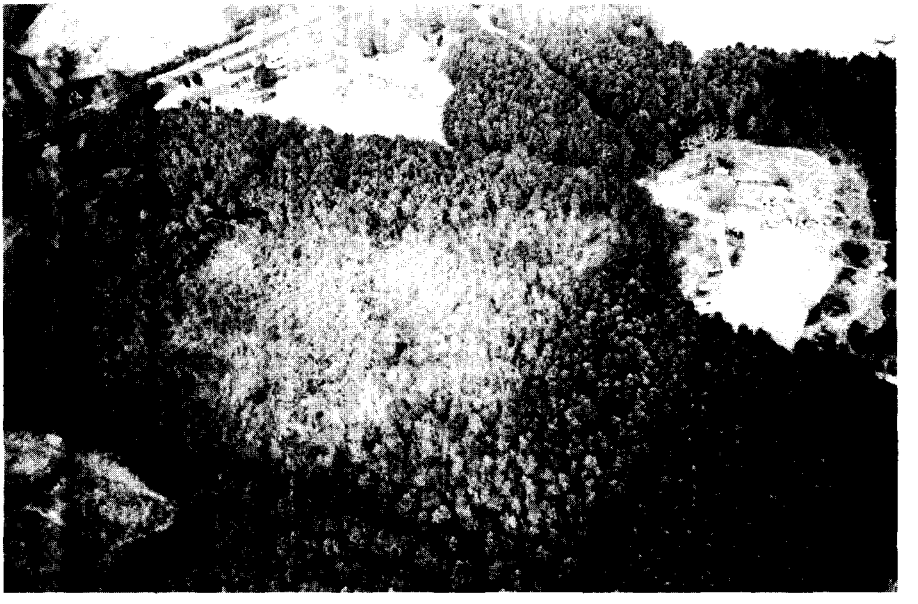

Figure 1. Black and white panchromatic photograph. Lighter tone within the pine stand represents area of heavy tree mortality.

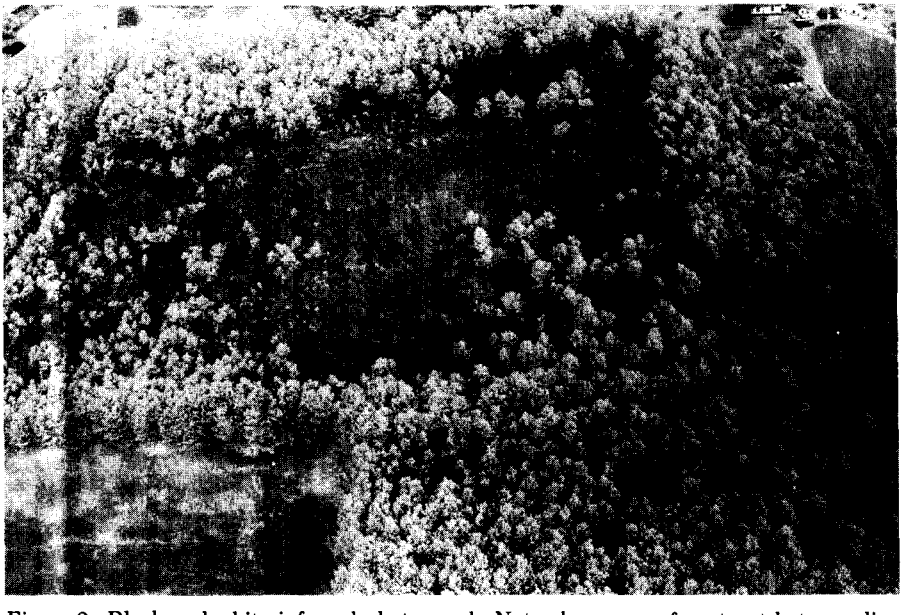

Figure 2. Black and white infrared photograph. Note sharpness of contrast between live (light tone) and dead (dark tone) trees. Individual live trees throughout the affected area are distinguishable.

Figure 3. Ground level view of damaged area at roost site.

detected two weeks after the treatment. Soil tests and timber mortality surveys made in March 1973 revealed no evidence of adverse effect on roost vegetation from the surfactant solution.

On the basis of these observations, a combination of factors associated with successive occupation of the roost appears responsible for the tree mortality. These include an accumulation of soluble salts in the soil and mechanical damage to tree needles and branches. The latter results in vegetative stress by increasing susceptibility to insects and disease, and also reduces crown area necessary to maintain vigorous growth. Although additional analyses will be required to determine the specific factors and their relative contribution to such loss, the damage to this pine stand due to successive blackbird roosting is obvious.

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