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BIRD AND MAMMAL PROBLEMS IN SOUTHEASTERN PINE FORESTS

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ABSTRACT: Birds and rodents eat pine seeds needed for regeneration, and the larger mammals destroy established seedlings by browsing or trampling. Some of the problems they cause have been solved or solutions are near; some still defy solution.

INTRODUCTION

Management of the vast pine forests of the southeastern United States is rapidly being intensified because of an ever-increasing demand for forest products and an expanding knowledge of silvicultural techniques. For example, fertilization is becoming widespread, and genetically improved seed (valued at up to $1,000 per pound) is available. As such cultural practices are intensified and the costs are increased, there is a concurrent increase in the importance of birds and mammals that are detrimental to timber production.

Some type of cultural treatment is required before attempting to regenerate any forest area. Preparing the site is normally the first step. Almost any site preparation, be it a simple prescribed fire or an intensive mechanical clearing, will yield excellent seed-producing annuals for bird food. First-rate deer forage is available within a few months. Fresh grasses and tender branch tips are prime food for free-roaming domestic livestock. Populations of small rodents reach a peak about one year after harvesting. All these animals--and more--are drawn to site-prepared areas in large numbers. They vary in size from the shorttail shrew (*Blarina brevicauda*) that weighs about 9 grams to the Brahma bull (*Bos indicus*) weighing up to 900 kilograms.

The rapid influx of animals onto an area where the forester is trying to establish a new stand of trees brings many and varied problems. This paper describes the more important ones caused by these creatures, which are classed in two categories--seed eaters and seedling predators.

SEED EATERS

Many residents of southeastern forests will consume pine seeds wherever they are exposed; but the major seed eaters, the ones with which foresters are most concerned, are birds and small rodents.

Birds

The species of seed-eating birds found in our pine forests are too numerous to list. However, all except three notable species belong to the order *Passeriformes* and are commonly called passerines. The three exceptions, which are also three major upland game birds, are mourning doves (*Zenaidura macroura*), bobwhite quail (*Colinus virginianus*), and wild turkey (*Meleagris gallopavo*).

Birds are most numerous and most troublesome in the fall months. Pine seeds begin to fall in late October, reaching a peak in late November and early December. Longleaf pine (*Pinus palustris*) is normally direct-seeded about the same time, since it is a fall germinator. These are also the approximate dates when large flocks of migratory birds begin to arrive. When the resident population is inflated with the migrants, a great many birds are on hand to seek out and eat seeds. Royal 1 and Ferguson (1962) counted 20 species of ground-feeding birds on an east Texas study plot; most were migrants, and all were seed eaters. Under these circumstances, only heavy seed crops will produce enough pine seeds to supply the predator population with food and still leave enough seed for stand regeneration.

Thus, it was learned early in developing the longleaf direct-seeding technique that a bird repellent was essential. During that search for an effective repellent, the first actual measure of bird depredations was obtained. Mann and Derr (1955) broadcast 12,500 untreated longleaf seeds per acre on an open area, and 90 percent were destroyed in 11 days. Several other studies that compared various candidate repellents with untreated seeds reported similar seed losses.

The concerted effort to find a bird repellent soon produced the desired results. Morkit, anthraquinone, quinizarine, and thiram all provided excellent protection from bird depredations 1/ (Mann et al., 1956). They were in powdered form, however, and created dusts during treating and sowing operations that were noxious to the handlers. Then thiram was manufactured in a liquid suspension known as Arasan 42-S[2/] that eliminated the bothersome dusts (Derr, 1964). A hungry bird may eat an Arasan-treated seed or two before rejecting others, but many birds pick up the first seed only to drop it undamaged (Mann, 1968). Liquid Arasan is still used in the South as an effective bird repellent.

Rodents

The rodents that pose a major threat to southern pine seed include five small species — Eastern harvest mouse (Reithrodontomys humulis), white-footed mouse (Peromyscus leucopus), cotton mouse (P. gossypi nus), golden mouse (Ochrotomys nuttalli), and hispid cotton rat (Sigmodon hispidus)--plus the gray squirrel (Sciurus carolinensis) and the fox squirrel (S. niger).

Small rodents, excluding squirrels, cause most seed losses in late winter when the population is on the increase. They are ground dwellers, making their nests and runways beneath pine straw and leaves, and in the grass. Although some daylight feeding is done, most foraging is at night on top of the surface litter. According to Howard et al. (1968), mice can locate seeds in total darkness and can even discriminate between conifer seed and other seed by means of a highly developed sense of smell. Winter populations in Louisiana average four to six mice per acre (Hatchel1, 1964), and they will consume up to a pound or more of seed between seedfall and germination. Therefore, seeds require protection from these small rodents before direct seeding can be practical.

To provide that protection, the U.S. Fish and Wildlife Service (1956) had recommended the addition of endrin to powdered bird repellents. Not only did endrin give good protection from rodents, it also repelled many insects that feed on pine seed. Then, when liquid Arasan and endrin were combined in 1959, a repellent was formulated, registered, and labeled that is still in use today. The two in combination seem to have a synergistic effect on small rodents and provide much greater protection than endrin alone. In the laboratory, most mice will sample a few treated seeds, ingest a sublethal dose, become sick, and will often starve to death before taking more treated seeds. When a choice of other food is available, they show no apparent ill effects from the few treated seed they do eat.

However, endrin is a highly toxic insecticide, is persistent in the environment, and is therefore unpopular in the public eye. Since 1969, a substantial part of my research effort has been to find a suitable replacement for endrin. To date, the only promising candidate is Mestranol, an antifertility agent produced by Snytex Laboratories. Crouch and Radwan (1971) found that it reduced consumption of Douglas-fir seed as well as endrin did. In seven laboratory tests and in a field test completed last year, I found Mestranol to be less effective than endrin, but it does provide an acceptable level of protection to southern pine seeds. Laboratory tests and field evaluations are continuing at this time to gain a longer experience record before any recommendations are made.

All these repellents are totally ineffective against squirrels, and squirrels can consume many more seeds than the small rodents. I have found that some individuals will eat up to 500 untreated longleaf seeds per day. Thus, a single animal is capable of consuming more than a pound of seed during the 25-day germinating period. Croker (1968) reported high losses of repellent-treated longleaf seeds in repeated attempts to direct-seed long, narrow mountaintop clearcuts on the National Forests of Alabama. He concluded that direct seeding is likely to fail where squirrel populations are high.

Contrary to popular belief, pine seeds treated with the recommended dosage of 0.5 percent endrin will not kill southern tree squirrels. In 5 years I killed seven of 300 caged squirrels with endrin, but each of those seven had eaten more than 70 longleaf seeds coated with 5.0 percent or more endrin. Many of the others ate more than 400 seeds in

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[1/] This paper reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State or Federal agencies before they can be recommended.

[2/] Mention of trade names is solely to identify materials used and does not imply endorsement by the U.S. Department of Agriculture.

4 days that were coated with 1.0-percent endrin, and none showed any ill effects.

Not only do squirrels consume large quantities of seeds on the ground, they also seriously deplete a potential seed crop by destroying green cones on the tree. Although no published data could be found on the magnitude of pine cone damage, the ground under large cone-bearing trees is often covered with green cone scales in late summer.

The only known protection against squirrels is heavy hunting before cone maturity and seed fall. Hunting out of season, of course, requires a special permit from State wildlife officials.

Besides the five species of small rodents and two species of squirrels discussed above, many other animals eat pine seeds, but they are regarded as minor predators.

SEEDLING PREDATORS

The term "seedling predator" includes both animals that feed on small seedlings and those that eat no part of the plant but destroy it by trampling. Domestic livestock head the list of seedling predators. When allowed to roam the open range, domestic livestock are far more destructive to young seedlings than are the wildlife species.

Hogs (Sus scrofa)

Probably the single most important vertebrate enemy of young longleaf pine is the free-ranging woods hog, or "piney woods rooter." Hogs do their damage by uprooting young trees to eat the thick, succulent bark and cambium around the roots and root collar. The starchy material is quite nutritious and is a prized part of the woods hog's diet. Most damage occurs in late winter and early spring when other foods are scarce. Also, high water in the spring often forces hogs from their preferred bottomland habitat onto higher ground where pines are planted.

Hogs have been observed destroying young trees at the rate of six per minute per animal, and sustained damage of 400 seedlings per day has been recorded (Hopkins, 1948). One old sow is known to have destroyed 6,612 grass-stage seedlings in one month. Hogs also damage larger trees by digging out and completely girdling lateral roots, thus creating susceptibility to disease, insect attack, and windthrow.

Longleaf is most susceptible to hog damage during the grass stage, and the fact that it may stay in this stage of no height growth for 3 to 10 years aggravates the problem. Although hogs prefer longleaf, they will also destroy slash pine (P_. elliottii) and, to a lesser extent, loblolly pine (P. taeda). A central Louisiana landowner had learned from experience not to plant longleaf; so he switched species and planted 12,000 acres of slash and 500 acres of loblolly pine. Heavy damage was inflicted on the slash, and 74 percent of the established loblolly seedlings were killed (Peevy and Mann, 1952).

Some areas have passed local laws which make loose hogs illegal on pine sites. But all too often such laws are not enforced. A real need in pine producing areas is strong state legislation with teeth in it. But for now, expensive hog-proof fences are the only means of excluding piney woods rooters.

Cattle (Bos taurus and B. indicus)

Range cattle damage or destroy pine seedlings by trampling or browsing. Heaviest damage occurs during the early years when seedlings are generally less than 6 feet tall. The young trees are trampled by cattle moving onto the area to graze and browse the fresh new greenery that always follows site preparation. Trampling damage is particularly high where large herds congregate near water holes and supplemental feeding sites. Browsing on pine seedlings occurs mainly in late winter and early spring when preferred species have been killed by winter cold or overbrowsing. During these times cattle will nip out the terminal shoot, browse needles and lateral branches, and even bite the seedling off near the groundline. Some mortality results, but major damage is deformity and growth reduction.

Research at Alexandria, Louisiana, has shown that cattle and pine trees can be grown together if the herds are regulated and managed, and a program of rotational, prescribed burning is followed. After 10 years of study in central Louisiana, Pearson et al. (1971) found that if forage utilization is limited to less than 40 percent of production, cattle

damage to pines is usually negligible. Although this light to moderate level of grazing had no adverse effect on survival or growth of pines to age 5 years, survival was significantly reduced when grazing utilized more than half the available forage. Cattle repellents have effectively deterred browsing in some instances, but the trampling problem persists. Thus, where grazing intensity cannot be controlled through herd manipulation, a system of temporary fences around regeneration areas may be necessary.

Sheep and Goats (Ovis aries and Capra hircus)

Both of these animals are very destructive to young pine trees. They completely consume seedlings up to 2 years old, then concentrate on succulent white terminal buds and twigs of older plants. In a Mississippi study where 1,200 acres were stocked with nearly two million longleaf pine seedlings (1,486 per acre), sheep damaged 78 percent of the trees between 11 and 20 inches in height (Maki and Mann, 1951). Mortality was relatively light, but loss in growth was about 25 percent, and all seedlings were deformed from the constant grazing. Damage decreased as seedlings became taller and ceased at about 4 feed in height. Goats, on the other hand, have been observed to ride saplings down to eat the tender terminals until stems become too large to bend. Seedling mortality is also higher from goat damage than from sheep damage.

Repellents are ineffective against these animals, and where they are allowed to roam on the open range, fencing is the only solution.

White-tailed Deer (Odocoileus virginianus)

Deer damage to pine regeneration is not as serious as many foresters believe. In fact, Ripley and McClure (1963) show pine as a starvation food; they list 56 species of browse plants common to Georgia forests that deer prefer over pine. However, when these preferred foods are scarce and deer populations are high, damage to young pine can be quite serious. The situation can become acute where pine monoculture is being practiced and no consideration is given wildlife habitat when cutting and regeneration decisions are made.

Research has shown that, with a little careful planning, the South's timber crops and deer herds can be grown in harmony. Block clearcutting followed by site preparation and regeneration for even-aged forestry is an excellent management practice in southern pineries. Many wildlife biologists agree that this is also a highly successful deer management technique, provided the blocks are kept small. However, deer herds are like stands of trees--overstocking is detrimental to either one. They both must be managed if the two are to be grown together. If excess deer are not harvested through hunting, they soon deplete preferred and staple browse and must rely on starvation foods which include pine. Decimation of the herd follows through malnutrition, disease, and reduced reproduction. Likewise, if the forest is not opened up through harvest cutting, the closed canopy will shade out and practically eliminate deer food plants.

Kitchens (1962) summed up the timber-deer problem like this: "good timber management and good game management are synonomous; the problem has been to get the two in tune." This cooperation has been partially accomplished through the efforts of foresters and wildlifers to learn each others' language and to understand each others' problems.

Cottontai1 Rabbit (Sylvilagus floridanus)

The cottontail is an unpredictable but ever-present threat to southern pine regeneration. It is unpredictable because of the extreme fluctuations in population levels. Damage is usually confined to the winter months when natural foods are scarce or absent. Since southern and southeastern winters are relatively mild, much of the rabbit's natural food remains green, and his winter food supply is usually sufficient. Damage under these conditions is minor. When winters are severe, however, and young succulent pine seedlings are the only greenery available, damage can be quite serious.

Older seedlings such as planted nursery stock or year-old natural and direct-seeded plants are usually clipped 3 or h inches above the ground. The top may be eaten, or it may be left lying beside the stump. The clipped stubble will usually sprout, however; so the damage is not fatal even though a year's growth may be lost. Burns (1961) reported that clipping of planted loblolly seedlings in Mississippi sometimes reached 90 percent.

In contrast, cotyledon-stage seedlings, or those that have just germinated after direct seeding or natural seedfall, are clipped at the groundline, and the entire seedling is consumed. This damage is always fatal. I have counted up to 6,000 fall-germinated longleaf seedlings per acre clipped by rabbits (Campbell, 1371).

Clipping of planted nursery seedlings can sometimes be prevented by dipping the tops in a repellent before planting (Burns, 1961). Mann and Derr (1954) tried population reduction; they removed 110 rabbits from a 275-acre plantation, and clipping continued unchecked. The only known method to reduce cotyledon clipping of fal1-germinated longleaf is to direct-seed in the spring rather than in the recommended fall months (Campbell, 1970). Rabbit population on a regeneration area can be kept to a minimum by complete site preparation. Few rabbits will venture into an area where there is absolutely no cover, and those that do are vulnerable to predators.

Plains Pocket Gopher (Geomys bursarius)

This subterranean predator has a small range within the southern pine region, but he is well known in western Arkansas and Louisiana and in eastern Texas and Oklahoma. Pocket gophers destroy pines by eating the roots from below or by grasping the roots of small seedlings and pulling entire plants downward into their burrows. Feeding may occur throughout the first 2 to 6 years of tree growth. Published information on damage levels is scarce, but local foresters estimate that up to 50 percent of longleaf stands have been destroyed. Fortunately, gophers are selective in habitat preference. They will burrow only in light soils and may occupy only 20 or 30 acres of a large plantation.

The accepted control method is to place grain or sweet potato slices treated with strychnine in the burrow. Such treatment poses little or no danger to other animals or birds because the bait is below ground and generally accessible only to gophers.

Other pocket gophers exist in the southeastern United States, but personal communications indicate they are a minor problem.

Voles (Microtus ochrogaster, M. pinetorum, and M. pennsylvanicus)

Voles are found in much of the southeastern United States, but like pocket gophers, they seem to be a localized problem. The only region reporting heavy damage is the Cumberland Plateau, where population levels peak in December and often exceed 100 animals per acre. According to Dimmick and Dietrick (1970), several thousand acres of Virginia pine (P. virginiana) were damaged or destroyed by prairie and pine voles. One large company reported a $400,000 loss. The meadow vole destroyed nearly half a million young pines in one Tennessee County. Dr. Dimmick reported in a personal communication that Virginia pine is the preferred species. Where Virginia and loblolly pines were planted side by side, Virginia pine was heavily damaged, but only an occasional loblolly was attacked.

Voles make partial or complete girdles of roots or stems. They prefer a heavy grass rough; so trees are usually 2 to 3 years old before the habitat is suitable for populations high enough to cause heavy damage. By the time trees are 7 years old, the bark apparently becomes thick enough to discourage voles from girdling.

Voles can be detected by looking for active runways, droppings, and nests in the grass rough. There are no known repellents to prevent vole damage, but populations are easily controlled by broadcast-sowing 10 pounds of oat groats per acre that have been treated with 0.15 pound of zinc phosphide.

Cotton Rat (Sigmodon hispidus)

Cotton rats feed on pine seedlings as well as seed. Although grass-stage longleaf is the most susceptible species, all southern pines are vulnerable. The seedling is partially or completely girdled near the root collar. Soil may or may not be scratched away from the root collar in the form of a small depression. The damage is inconspicuous and may not be discovered until a few seedlings begin to die. Cotton rat girdling is usually localized in small patches; so most damage goes unreported. One of the few documented cases described ^00 acres of direct-seeded longleaf, where about 10 percent of the resulting seedlings were injured or killed (Meanley and Blair, 1957). The damage was spotty: on some areas of 10 to 15 acres, almost half the seedlings were attacked; other parts of the stand escaped almost completely.

The cotton rat is found only in a heavy grass rough; therefore, elimination of that grass by fire before planting or seeding eliminates the problem--at least temporarily. Should another rough build up before the young trees can withstand a prescribed burn, strychnine-treated grain can be placed in the tunnels, which are quite obvious in the dense grass.

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