

averaged 67 pounds per acre, and insect galls, which averaged 22 pounds per acre, were the two most common items found, but their use by the wild turkey during the study period was insignificant. Pecan, spice-bush, and animal matter were found to be available in the litter in only small quantities, but they made up a major portion of the contents of the crops and droppings analyzed. The one exception to this inverse ratio was that of the wild grape which was rated third in quantity in the litter study and was found to be utilized frequently by the turkey. The major green plants which were available during this late winter season were the nettle, *Urtica chamaedryoides*, wild carrot and switch cane. Although green material did appear in the droppings, it was impossible to identify the species involved. The green material found in the turkey crops consisted of switch cane leaves and wild carrot.

It is recognized that the quantity of turkey crops and droppings collected was insufficient to draw conclusions concerning the acceptability of the various food items found in the litter. Plans have been made to continue collections of digestive tracts of wild turkey along with the forest litter samples. The information derived from future collections will be used in an effort to determine the carrying capacity of the wild turkey for similar hardwood forest areas of the Mississippi Delta.

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RESPONSE OF WILDLIFE HABITAT TO THE PRESCRIBED BURNING PROGRAM ON THE NATIONAL FORESTS IN SOUTH CAROLINA

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INTRODUCTION

Prescribed burning is an important management tool on the two National Forests in South Carolina. The Francis Marion National Forest in the coastal plain area has been using prescribed burning in resource management since 1947. Currently 43,000 acres of the total 245,000 acres are burned annually. The Sumter National Forest in the rolling piedmont area has been using prescribed burning since 1960. Currently approximately 1,000 acres of the total 342,000 acres are burned annually.

All use of fire is based on a detailed prescription by a professional forester and is scheduled under precise conditions of weather to obtain specific results by specific techniques.

The bulk of the burning is performed to control undesirable understory species and reduce accumulation of flammable material. Other burns are conducted for planting site preparation, seedbed preparation, range improvement, brown-spot control and wildlife habitat improvement.

There is no set burning interval on the National Forests. Burning

is scheduled as needed to accomplish certain objectives in resource management, only if the use of fire is the most efficient and economical method for that particular site.

The effect of a prescribed burn varies with weather, intensity of burn, fuel availability, techniques used, and soil conditions. Most of the burns indicated immediate responses that tended to improve wildlife habitat.

The following vegetative responses were observed on the Francis Marion National Forest:

Experimental Burns

The Santee Experimental Forest established a series of small plots that were treated by prescribed fire, utilizing different burning intervals. This study has been going on since 1947.

One plot was burned every winter for 20 consecutive years. This annual winter fire plot, in the loblolly pine type with deep sandy soil, each year indicated a good response of partridge pea (*Cassia nictitans*), winged sumac (*Rhus copallina*), beggartick (*Desmodium spp.*), and various other legumes considered desirable as wildlife food.

Based on a detailed soil analysis by the Southeastern Forest Experiment Station, the frequency of fires used had no detrimental effect on soil porosity, organic content, percolation rate, amount of nutrients, or pH. In fact, when compared with an unburned control area, these soil characteristics were improved by annual winter burning.

Another adjacent plot burned annually each summer resulted in a decrease of woody plants and desirable legumes. Grasses dominate the forest floor. From the wildlife standpoint, this burning frequency was of little value for wildlife food.

A control plot in the same area unburned for 20 years showed a dense understory of undesirable species which provided little for wildlife except cover. Fuel accumulated on the plot created an extreme fire hazard.

Operational Burns

Operational burns on National-Forest lands occur every 3 to 5 years on the same area based on prescriptions. Most of the burns are conducted during the dormant season. The use of summer burning is increasing. However, it is utilized primarily during that portion of the rotation just prior to the seed tree or removal cuts to prepare a favorable seedbed.

Winter burning on a 3 to 5 year interval results in an excellent response of legumes. The type of response varies with basal area of the overstory. In shady areas legumes such as partridge pea and beggarticks frequently follow the fire. In open areas woody plants, hardwood sprouts, and grasses often come in after burning.

On ridges dominated by longleaf pine, runner oak (*Quercus pumila*) appears to be able to survive prescribed burning and retain its vigor. The acorn crop is lost for one growing season, but acorns are produced with increased vigor by the fire pruned oak the second growing season after the burn.

The following are observations made on an area burned during the winter of 1967. General fire and weather information:

—Date	1/18/67
—Type of Fire	Backfire
—Rain	3 days since .10 rainfall
—Area	469 acres
—Wind	NE Steady, 5-8 mph
—Temperature	57°F
—Relative Humidity	36%
—Class Day	M3—BUI 16
—Fuel	Titi (<i>Cyrilla racemiflora</i>), galberry (<i>Ilex spp.</i>), pine needles, leaf litter, gasses

This area was examined in July 1967 and had vigorous plants of runner oak, panicum, beggarticks, partridge pea, and other legumes. The runner oak, however, did not bear acorns.

Immediately across the road in the same general type that has not been burned for three years the following observations were made:

- runner oak, vigorous and producing acorns
- rough consisting of needles, leaves and grass-covered forest floor (approximately 3-4 tons per acre)
- fewer beggarticks
- almost no partridge pea
- fewer other legumes
- increase in titi, galberry, and sweet pepperbush (*Clethra alnifolia*).

Similar responses were observed on many other operational burns. After 3 to 5 years the forest floor becomes smothered with litter and duff and only woody plants and strong perennials survive.

In the Francis Marion National Forest coastal plain pine type burns are needed at least every 3 to 5 years to maintain productivity of desirable wildlife foods.

For intensive management of quail, annual winter prescribed burns produce the maximum response of game food preferred by this species.

Prescribed Burning on Piedmont Districts

Desired results can be obtained on the piedmont, as well as on the coastal plain, by the *proper* use of fire on *well-selected* sites.

All prescribed burning on piedmont ranger districts for wildlife management has been within the last 7 years with 60% within the past 3 years.

A restocking program was started in 1954 by the cooperative efforts of the South Carolina Wildlife Resources Department and the U. S. Forest Service. Prior to this, the area was void of deer and wild turkey.

Since the time of stocking, game populations have mushroomed until practically all U. S. Forest Service land is well-stocked. Our work has changed from the establishment of populations to the improvement of wildlife habitat.

The following responses were observed on several operational wildlife habitat prescribed burns:

First-Year Burns (with less than 1 full growing season)

This site was selected for four reasons:

1. Adequate game populations in the area.
2. Much of the area had an overstory of young loblolly pine saw-timber with an average basal area of 95 square feet per acre, plus a dense understory of pine saplings, scattered suppressed forbs and browse species, and accumulation of litter preventing development of annual leguminous plants and other desirable species.
3. With the exception of a few scattered dogwoods (*Cornus florida*), there were no mast-producing hardwoods to be damaged or destroyed by the fire.
4. The use of fire on this site was compatible with the management of other resources.

The burn was made under the following weather conditions:

—Date	1/26/67
—Method	Strip Head
—Wind	SW 5-7 mph, Steady
—Temperature	70°F
—Relative Humidity	40%
—Class Fire Day	3
—Build-up Index	35
—Rain	.5 days since .50 rainfall

This burn provided the desired results—the elimination of heavy litter and stimulation of forbs and browse production.

In mid-June the following observations were made: partridge pea was abundant and well distributed over the entire burn; several species of beggarticks and lespedezas (*Lespedeza spp.*) were also numerous.

The panicums showed predominance among the grasses. Most of the panicums were headed out and were providing an early source of seed for the bird populations.

All browse species responded with vigor several weeks after the burn. The major species in this group were honeysuckle (*Lonicera japonica*), greenbrier (*Smilax spp.*), wild grape (*Vitis spp.*), winged sumac, smooth sumac (*Rhus glabra*), trumpet creeper (*Campsis radicans*), red maple sprouts (*Acer ruba*), as well as other hardwood sprouts.

Most of the sumac on the burn had attained a height of 12 to 24 inches. Honeysuckle, trumpet creeper, and greenbrier came back vigorously where it had been suppressed by litter previous to the burn. Many were in bloom.

Desirable hardwood sprouts such as red maple and sassafras (*Sassafras albidum*) were providing available browse. In most cases prior to burning it was out of reach.

Second-Year Burns (1½ Growing Seasons)

This site was selected for the same reasons as the previous site: Heavy overstory and a dense understory of pine saplings; the ground cover was a heavy litter accumulation with a sparse stand of grasses, forbs, and vines.

The weather conditions were:

—Date	3/3/66
—Method	Backing and Strip Head
—Wind	SW 3 mph, Steady
—Temperature	70°F
—Relative Humidity	24%
—Class Fire Day	3
—Build-up Index	42
—Rain	2 days since .07 rainfall

The desired results were obtained on this site, mainly the elimination of the understory pine saplings and reduction of litter except in small spots of heavy scorch. These small hot spots resulted in heavy needle cast, creating nearly the same situations that existed prior to the burning.

This points out the need of a steady wind with sufficient force to keep the heat dissipated horizontally to prevent heat from ascending vertically and scorching needles.

The response of game food plants remained vigorous during this second growing season. The greatest significance was the increase in the number of plants, both legumes and browse. Poison ivy (*Rhus radicum*) appeared to be spreading on this site.

With the exception of a few clumps of dead brush and new growth vines which provide good coverts for the smaller species of wildlife, the ground cover remains open enough for easy passage and use by young quail and turkey.

Third-Year Burn (2½ Growing Seasons)

On the burns of more than two full growing seasons conditions change somewhat.

The honeysuckle has spread over most of the area with a mixture of trumpet creeper, greenbrier, and other vegetation. This provides excellent browse areas. The seed-producing plants are becoming suppressed by these browse species, and by a build-up of a pine-needle litter. Seed production is greatly decreased.

A maintenance burn is needed after 3 or 4 years if legumes and other forbs are desired for small game.

If browse is needed, these areas can be left and new sites selected for treatment by fire to increase seed production within the home range of the populations utilizing the area.

Little or no soil movement was experienced on these burns. Sites selected for wildlife habitat burns should not have steep slopes, should have a considerable amount of sandy soil mixed with clay and have an overstory that will produce a light fall of leaves and needles to help protect the soil during the winter.

Prior to preparing the burning prescription, each area is examined closely by the District Ranger and State Wildlife Biologist. This is done to: determine the wildlife needs; select a site which will respond to these needs after burning; and, to prescribe the kind of fire needed to accomplish these objectives.

Like other tools, fire has several disadvantages. Experienced personnel are needed. Weather conditions must be right. Scattered desirable species, particularly mast-producing hardwoods, are often lost or reduced to browse in the form of sprouts. One must often make a choice, browse or mast.

On areas such as old home sites, crabapple stands, chinquapin ridges, abandoned orchards, or areas having fire-susceptible species that are a good source of wildlife food, fire should be excluded.

SUMMARY

Prescribed burning on the Francis Marion National Forest in loblolly and longleaf pine stands results in a favorable response of desirable legumes and other forbs preferred by deer, turkey and quail the first few years. As the rough builds up, the woody plants and grasses dominate the forest floor. For maximum wildlife habitat improvement, burning frequency should be three years or less. Careful techniques of burning are necessary to prevent acceleration of needle cast and premature accumulation of the smothering duff and litter.

Prescribed fire can be used successfully in the piedmont areas of the Sumter National Forest. The results are similar to those experienced in the coastal plain. However, the interval between fires can be extended one to two years longer in most cases and still retain favored wildlife food plants even for quail.

Fire should be excluded from areas such as old home sites, which are rich in a variety of wildlife food plants and are susceptible to fire.

All burning on the National Forests in South Carolina to improve wildlife habitat is carried out with the cooperation of the South Carolina Wildlife Resources Department and our District Rangers.

Our end objective is to maintain wildlife populations to provide good hunting for our sportsmen.

CHANGES IN THE MIGRATION AND WINTERING HABITS OF CANADA GEESE IN THE LOWER PORTION OF THE ATLANTIC AND MISSISSIPPI FLYWAYS—WITH SPECIAL REFERENCE TO NATIONAL WILDLIFE REFUGES

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INTRODUCTION

Many interesting and important changes have occurred in recent years in the migration and wintering habits of Canada geese in the lower portion* of the Atlantic and Mississippi Flyways. The purpose of this

* For the purpose of this paper, the lower portion of the Mississippi Flyway includes the States of Arkansas, Kentucky, Tennessee, Alabama, Mississippi, and Louisiana; the lower portion of the Atlantic Flyway includes Maryland, Virginia, North and South Carolina, Georgia, and Florida.