SAPSUCKER

Damage Varies with Tree Species and Seasons

by Francis M. Rushmore

U.S.D.A. FOREST SERVICE RESEARCH PAPER NE-136
1969

NORTHEASTERN FOREST EXPERIMENT STATION, UPPER DARBY, PA.
FOREST SERVICE U.S. DEPARTMENT OF AGRICULTURE
RICHARD D. LANE, DIRECTOR

The Author

FRANCIS M. RUSHMORE, research forester, was graduated from the Forestry School of Pennsylvania State College in 1939. His Army duty from 1941 to 1967 included nearly 5 years active duty and advancement from Private to Lt. Colonel. He joined the Northeastern Forest Experiment Station in 1946 and worked in forest economics in several states, including a year at Cooperstown, New York. His silviculture research includes work in Maryland from 1947 to 1950, in New York from 1950 to 1961, and in Maine since 1962. His major interests have included silvicides and recreation research, research cooperation, and work with conservation organizations. Since 1962 he has specialized in the study of wild animal damage and its relationship to forest trees.

Figure 1.—This 9-inch paper birch was killed by sapsuckers during the second year of feeding.

SAPSUCKER

Damage Varies with Tree Species and Seasons

■

A Growing Concern About the Sapsucker

AS USE of our forests intensifies, we foresters are paying more and more attention to the agents that damage trees. Much attention has been paid to fire, insects, and diseases. Now we are becoming more concerned about the damage done by animals and birds.

One bird that draws our attention is the yellow-bellied sapsucker. This sapsucker (*Sphyrapicus varius varius* L.) is a member of the American woodpecker family. It attacks trees to feed on the sap and bark tissues (fig. 1). Its attacks can kill the tree or seriously degrade the wood.

To learn more about this bird, the damage it does, its habitat, and its ecology, the Northeastern Forest Experiment Station has made a 5-year series of observational studies of this sapsucker and its behavior and feeding habits in our New England forests.

IMPORTANCE

Ornithologists—whose concern has been mainly with the bird itself—reported more than 100 years ago that the sapsucker attacks orchards, shade trees, and forest trees. A few studies, beginning about 60 years ago, have directed attention to the damage done to forest trees.

Our best information dates back to 1911, when McAtee (*4*) described different kinds of sapsucker damage and summarized what was then known about the sapsucker in the United States. Much of his information was based on studies south of the bird's nesting range. He estimated that sapsuckers damaged at least 10 percent of the trees within their range, and in some areas more than 90 percent of the trees. He reported damage to the wood of 174 tree species.

We can only guess how widespread sapsucker damage is today. But we are beginning to acquire up-to-date information. For example, in 1968 the U.S. Forest Service included evaluations of sapsucker damage among the data to be collected in its forest survey of Maine—the first state-wide survey of sapsucker damage.

Sapsuckers not only injure the tree; they also damage the wood. One common kind of damage attributed to sapsucker attack is known as bird peck. Another is the discoloration associated with sapsucker wounds. The literature cited refers to other kinds of damage.

RANGE

Of the four subspecies of yellow-bellied sapsucker, only one—*Sphyrapicus varius varius* L.—occurs in eastern North America (*2*).

This sapsucker is a migratory bird. It spends the summers on its northern nesting range in the United States and Canada. This range extends from the East Coast nearly to the West Coast, generally between 40 and 50°N. latitude in the East and 52 to 63°N. in the Pacific Northwest. The range also extends southward along the Appalachian Mountains to about 35°N. (*2*).

This sapsucker's winter range is generally south of 40°N. and as far south as the West Indies and Central America.

Because of this wide migratory range, the sapsucker may attack trees throughout most of North America. At some time of the year this sapsucker or the three western subspecies can be found in all the timber-producing regions of North America.

In New England, sapsuckers can be found on their nesting range from about mid-April till late September or early October. Throughout that period their major foods are tree sap and bark, and insects.

Study Methods

Our study was designed to find when and how sapsuckers damage trees in this region, and whether they prefer some tree species to others.

Observations for this study were made during five summers, 1964 to 1968. Most of the work was done on our 4,000-acre Penobscot Experimental Forest near Orono, Maine. Some observations were made in other parts of eastern Maine, in northern Pennsylvania, in the Adirondack Mountains of New York, and in New Brunswick and Nova Scotia, Canada.

Ninety-two percent of the observations that were made within sapsucker territories and along a 5-mile sapsucker survey route were made by the observer traveling on foot. Travel on this route totaled 137 miles. The other 8 percent of the observations were made after approaching known feeding trees in an automobile.

Most observations were made at a distance of less than 100 feet. Binoculars were used (7 x 50 or 8.5 x 44).

A bird was considered to be feeding only if its drilling on the tree was intensive enough to produce substantial amounts of sap or bark. Casual pecking around old sapsucker holes was not counted as feeding.

Identifying the sapsucker territory is extremely important in the study of this bird and the damage it does. Sapsuckers establish strong nesting and feeding territories in woodlands during the spring, and stay there until fall. In the spring only

one pair will occupy a territory. Later in the summer and fall a family of about six birds (including offspring) will occupy the same territory. They do not move haphazardly about the forest. This permitted intensive study of the birds.

Twenty-seven sapsucker territories were delineated on the Penobscot Experimental Forest. These provided 96 percent of the observations (table 1).

Table 1.– Number of tree-days[1] sapsuckers were observed feeding, April 1964 through October 1968

Species	Apr	May	Jun	Jul	Aug	Sep	Oct	Total
Eastern hemlock	32	45	2	3	14	20	–	116
Red spruce	15	21	1	3	2	3	2	47
Black spruce	2	–	–	–	1	–	–	3
White spruce	–	–	–	–	1	–	–	1
Balsam fir	–	–	6	2	1	2	1	12
Eastern white pine	–	–	–	–	2	2	1	5
Northern white-cedar	1	–	–	1	2	2	–	6
Tamarack	–	–	–	–	2	–	–	2
Quaking aspen	13	4	2	–	1	7	–	27
Bigtooth aspen	2	1	–	–	–	–	–	3
Red maple	6	51	22	22	25	45	6	177
Sugar maple	–	2	2	3	3	–	–	10
Striped maple	1	–	–	–	–	–	–	1
Silver maple	–	–	–	–	2	–	–	2
Paper birch	3	23	28	70	75	133	34	366
Gray birch	–	5	6	14	10	9	–	44
Yellow birch	–	1	–	3	4	–	–	8
Northern red oak	–	4	1	3	1	5	4	18
American beech	–	1	–	–	–	3	1	5
Serviceberry	–	1	–	–	2	2	7	12
American elm	–	1	1	1	–	1	3	7
Elm (exotic)	–	–	–	–	2	–	–	2
Speckled alder	–	–	–	6	–	–	–	6
Red berried elder[2]	–	–	–	2	–	–	–	2
White ash	–	–	–	1	2	3	1	7
Black ash	–	–	–	1	–	1	–	2
Eastern hophornbeam	–	–	–	–	–	–	2	2
Apple	–	1	–	–	–	4	1	6
Total	75	161	71	135	152	242	63	899

[1] One tree-day: feeding was counted only once per day, regardless of number of times observed or the number of birds feeding on the tree.

[2] Fruit eaten.

The other 4 percent of the observations were obtained in 49 additional territories: 2 percent were made on other parts of the Experimental Forest; 1 percent were made elsewhere in eastern Maine; 1 percent were made in northern Pennsylvania, the Adirondack Mountains of New York, and in New Brunswick and Nova Scotia, Canada.

Sapsuckers used 47 percent of the Experimental Forest. This was determined by a 12-percent survey of the 4,000 acres in 1966. The 27 territories averaged 7.6 acres. These same territories were occupied for at least three summers (1966-68), and probably for many years before that.

The 27 territories were found by using a new sapsucker calling and surveying technique (*F. M. Rushmore, publication pending*). It was from 5 to 11 times more efficient than birding techniques commonly used (*7*).

An important element of this technique is the distinctive drumming used by sapsuckers. It can be used to identify sapsuckers without seeing them. Most drumming occurs in spring. No other woodpecker in this region drums the same way. And as far as I know, no other woodpecker in any region does it the same way, except other sapsuckers (*2*). The first part of the sapsucker's drumming is a fairly rapid beat (it is generally similar to the complete drumming of other kinds of woodpeckers). Only the sapsucker has the special ending of several more slow, measured taps. A whole sequence might go about like this: . . . . . — — — — —

On a calm day this can be heard at least 600 feet.

When sapsuckers were observed feeding, these data were recorded: tree species and d.b.h. of trees; area location; bird age and sex; date and time; and other related data. To be included in this report a sapsucker must have been seen actually drilling or feeding on a tree. The only exceptions (1 percent of the 899 observations) were when birds were not present, but daily inspection of trees definitely identified new sapsucker holes.

To obtain the 899 observations (table 1), 535 trees were counted no more than once per day, regardless of the number of times birds were observed feeding. Feeding was observed on

205 days, on 26 tree species and 2 shrub species. Sapsuckers were under observation 650 hours. An estimated 714 sapsuckers occupied the areas when observations were made.

From 1964 to 1968, in consecutive order, the earliest spring observations of sapsuckers on the Experimental Forest were made on 17, 30, 20, 25, and 19 April; the last fall observations were made on 30 September, 7 October, 29 September, 13 October, and 5 October. These dates do not necessarily mean first arrival or last departure.

Results

The sapsuckers showed seasonal preferences among the species they were seen feeding on (table 1). In early spring they fed on hemlock, spruce, and aspen for several weeks. Then they used red maple heavily in May and at least until mid-June. By late May the three birch species had assumed increasing importance, which continued throughout the summer. In dry years, apparent moisture stress in birch and other hardwoods drove the sapsuckers back to the hemlocks. Some other tree species provided important food in the fall.

FEEDING HABITS

The sapsuckers had feeding habits that made repeated observations easy. The same birds made frequent trips to the same tree daily. These visits continued for periods lasting several days to several months. Sapsuckers drilled only on live trees to get sap and bark. It was easier to identify sap feeding than bark feeding.

Sap.—Feeding on sap was recorded when these clues were apparent:

- A bird's visit to a number of existing fresh holes, and sap-collection activities not accompanied by drilling.
- Definite rapid siphoning of sap from holes—where sap had filled the holes and its removal could be clearly seen.
- Wet sap on the tip of a bill.

- Insertion of the bill tip at the bottom of sap holes and moving it from one side to the other, to wipe up, or to siphon, small quantities of sap.

When sap occurred in very small quantities, I could not always tell definitely whether the bird was feeding on sap, phloem, or other tissues.

My observations gave substantial evidence of sap feeding on 14 of 19 species observed in 1964. And by 1968 sap feeding had been observed on 23 of the 28 species listed in table 1: the exceptions were white spruce, tamarack, beech, hophornbeam, and elder. Sap feeding probably occurred on all species except elder, but there were too few observations to establish this definitely.

It has been reported that sapsuckers get intoxicated by feeding on fermented sap or fruit. I did not see any evidence of intoxication. Sapsuckers normally avoided fermented sap and fed only on fresh sap. Among the 532 birds I saw feeding on sap, only on two occasions did I see birds take fermented sap. One juvenile bird tasted it and went immediately to fresh sap. Another time, a pair of adults fed their fledglings on solidified fermented paper birch sap. The evidence suggests that this probably was necessary because red squirrels *(Tamiasciurus hudsonicus loquax* Bangs), feeding only on fresh sap, denied the birds access to their own sap holes.

Woody tissues.—Feeding on live bark tissues was common. I often saw small bits of it being eaten. I assumed that it was phloem, but specimens were not taken from the birds for identification. I do not know of any report that cites precise identification of the bark tissues sapsuckers eat.

A different kind of feeding occurred near the cambium, on what I assumed to be new callus tissues. It occurs around the perimeter of the sap pits. Specimens were not taken for examination. This kind of feeding is common and distinctive. The very rapid taps with the bill are noticeably faster than those used for other bark feeding or drilling.

None of the holes I saw extended noticeably into the xylem. A few of the soft outer cells might be eaten.

Drying of the xylem and bark at the holes is a serious matter. Once dead, the xylem does not join again on that plane, even if new wood eventually covers it. Some effects of that have been described (*3, 4, 9*).

Insects.—Insects were a major food of sapsuckers. My 1,301 recorded observations of insect feeding do not represent the total observed. Sapsuckers were experts at catching insects in mid-air. But they accepted other opportunities in virtually any location. Insects made up the bulk of the nestlings' food. Adult birds generally added sap to a bill full of insects just before flying to the nest. To a lesser extent, insects were fed without the sap.

TREE MORTALITY

Many of the birds' favorite hardwood trees probably will be killed by repeated drilling within future years—assuming that the sapsucker population remains fairly constant. Here is the tree mortality that sapsuckers had already produced among all damaged trees found within ten nesting territories in 1964:

Species	*Trees damaged (number)*	*Mortality*[1] *(percent)*
Red maple	190	40
Paper birch	102	51
Gray birch	39	67
Hemlock	73	1
Red spruce	31	3
Total	435	–

[1] *Trees dead or nearly dead.*

Intensive feeding can kill a small tree in a single season, but generally two or more years of drilling are needed to kill trees 8 inches d.b.h. or larger.

DAMAGE IN LIVING TREES

Sapsucker damage was found on 51 species. Feeding was actually observed on 28 species (table 1). The other species, on which only damage was observed, were:

Wild apple	Boxelder
Crab apple	American mountain-ash
American basswood	Black oak
White birch (2 horticultural species)	White oak
Buckthorn	Scotch pine
Black cherry	Red pine
Chokecherry	Balsam poplar
Pin cherry	Lombardy poplar
Hawthorn	Staghorn sumac
American hornbeam	Willow (3 species)

The conifers and the less-favored hardwoods may continue to receive some damage annually, but most of them probably will live. This is based upon the assumption that drastic changes will not occur in either the stand compostion or the sapsucker population.

The quality of the wood in these living trees will depend upon the frequency and severity of the damage. Ring shake and other quality-reducing internal defects in trees remaining alive after being damaged by sapsuckers have been described elsewhere (*3, 4, 8, 9*). Bird peck defect caused by sapsuckers has been discussed in numerous publications. Many of our living trees will contain the same kinds of defects.

Other damaged trees may heal and escape further damage for an unpredictable number of years—provided they are not used by subsequent sapsucker populations. Damaged wood fibers will remain within the trees and reduce the wood quality. Some trees may escape further damage for many years, and then may be revisited by sapsuckers and may be killed in one summer by intensive feeding.

Conifers

Hemlock.—Eastern hemlock (*Tsuga canadensis* (L.) Carr) was the conifer that sapsuckers fed on most in this area (table 1). Repeated annual sapsucker attacks on hemlocks are common in this region. Both local and migrant birds are responsible.

This feeding on hemlocks was seasonal: it was not continuous throughout the growing season. Most feeding on hemlock occurred upon arrival of the birds about mid-April and continued into May. This period overlaps with early concurrent

feeding on red spruce and later heavy feeding on paper birch and red maple in May.

Droughts apparently affected the feeding pattern. Sapsuckers fed heavily on hemlocks in spring 1964, switched to hardwoods, and then resumed feeding on hemlocks to a lesser extent later in the summer—after the sap in hardwood species diminished. Essentially the same sequence occurred in 1968, when severe moisture stress apparently occurred in paper birch and red maple about the last week of August, and the birds had to feed on hemlocks. Within 2 weeks, and after rains, sapsuckers had abandoned the hemlocks and returned to the paper birches.

When droughts did not occur, sapsuckers seldom fed on hemlocks in summer. With adequate rainfall in July 1966, and an abnormal abundance in the summer of 1967, sapsuckers used hemlocks very little in those summers. Juvenile birds did a little casual drilling late in those summers, but the adults retained possession of their favorite paper birches.

Red spruce.—Sapsucker work on red spruce (*Picea rubens* Sarg.) occurred mostly during late April and early May, about the same time as on hemlock (table 1). The only drilling observed on red spruce after 11 May, 1964 was done by two juvenile birds, one on 16 July and one on 14 August. A similar pattern occurred in the other years.

Other conifers.—The sapsuckers showed little interest in black spruce (*Picea mariana* (Mill.) B.S.P.), balsam fir (*Abies balsamea* (L.) Mill.), northern white-cedar (*Thuja occidentalis* L.), and eastern white pine (*Pinus strobus* L.) within the stands under observation (table 1). Most of the summer drilling on these conifers seemed to be casual exploration by juvenile birds.

Hardwoods

Birches.—The birches were the favorite trees of sapsuckers. Paper birches (*Betula papyrifera* Marsh.), most abundant in the stands, were used heavily. Few yellow birches (*B. alleghaniensis* Britton) were available, but most of those found had been killed or damaged by sapsuckers. Gray birch (*B. populifolia* Marsh.) was used more than the data indicate. Damage found on gray birches was not always useable because birds were absent. In

several areas gray birches seemed to be preferred over nearby paper birches.

Data were inadequate for comparing relative preferences for the three birches.

Paper birch.—Among all the trees available, paper birch appeared to be the favorite species. It normally was fed upon from April to October (table 1). Paper birches that earlier in summer had served as major sources of food for adults and nestlings were closely guarded later by adult birds, from late July until the migration began in late September or early October.

Paper birch remained the favorite species of sapsuckers even in August and September 1964 and 1968 when drought conditions appeared to diminish sap flow drastically, compared with earlier in the summer. Moisture stress in the birches as appeared to force sapsuckers to work on hemlocks in both years. They returned to birch later. Adult birds continued to guard their favorite band of holes and appeared to feed more heavily upon the birch bark. Bark was removed between vertical rows of holes, thus enlarging them into abnormally wide and long strips (0.5 inch to about 1.25 inch wide, and up to several inches long) (fig. 1).

Although most holes were drilled on birch trunks, holes also were made on branches. Drilling on branches happened mostly in spring. The birds also commonly drilled substantial numbers of holes on birch branches in late summer, when their preferred holes on the trunk no longer produced sap. Improved sap production after heavy rains brought birds back to the trunk, except on trees rapidly dying from sapsucker damage.

Red maple.—Red maples (*Acer rubrum* var. *rubrum* L.) were used heavily by sapsuckers in spring of all 5 years (table 1). But in summer use varied widely and appeared to depend upon the amount of rain. After 25 June, 1964, use had noticeably lessened, about half the time consisting of casual drilling around old holes by juvenile birds. During the exceptionally dry summers of 1964 and 1968, red maples were used for casual drilling by both juveniles and adults while they awaited a turn at the sap holes on a favorite birch. But such feeding was of

short duration and few fresh holes appeared on red maples during July and later. The last sap feeding on red maple in 1964 was observed on 8 June. It appeared that feeding on bark tissues, rather than sap, occurred from July on.

The abnormally wet summer of 1967 produced a marked difference in sapsucker use of red maples, as compared with the drought summer of 1964. In 1967 some red maples produced sap throughout the summer and were used into October. Even when that happened paper birches were more favored (table 1).

In relatively dry summers some red maples on the edge of marshy ground were used more and longer than nearby red maples on higher, drier ground. However, in general, these sapsuckers began leaving hemlocks and spruces and turning gradually to intensive feeding on red maples in early May, and this continued until about mid-June. By then the birds had become more interested in the three birch species. There was no sharp demarcation in use of different tree species; it was a gradual process, with considerable overlapping.

Sugar maple.--Only a few sugar maples (*Acer saccharum* Marsh.) occurred in the territories studied. On 18 June, 1964 strong flows of sap occurred at sapsucker holes on a 7-inch d.b.h. sugar maple and on a nearby 11-inch paper birch on our Maine forest. These trees served as major sources of sap for a pair of sapsuckers feeding nestlings. The same sapsucker activities occurred on 30 June, 1966 on a 12-inch sugar maple in northwestern Elk County, Pennsylvania.

Aspens.—Neither of the aspen species appeared to be favorite trees for sapsucker feeding except in late April, when sapsuckers commonly fed on sap from the branches of quaking aspen (*Populus tremuloides* Michx.) and bigtooth aspen (*P. grandidentata* Michx.) (table 1). The holes were made within 3 to 5 feet of the branch tips.

Aspens here normally are not used as much by sapsuckers as birch or maple. Sapsuckers fed lightly on the boles of the largest aspens. I found small quaking aspens damaged on clearcut strips. The smallest quaking aspen I have found with sapsucker holes was 1-3/4 inches d.b.h. It appeared that aspen here was used more when other preferred species were not available.

However, aspens are favorite sapsucker nesting trees in this area. Of the 29 nests found in 1964, 25 were in aspens.

Red oak.—Sapsuckers fed on northern red oak (*Quercus rubra* L.) more than is indicated by table 1. Other evidence of heavy feeding was found when the birds were not present. Few oaks occur in the stands where these observations were made.

When moisture stress increased in paper birch, resident sapsuckers frequently fed on red oaks available within their territory. This occurred with increasing frequency in September. It was continued by migrants into October.

Sapsuckers killed one or two northern red oak limbs about 5 inches diameter on several trees on the Penobscot Experimental Forest. But that is not common here because the birds prefer paper birch, and the supply is ample. Local birds and migrants do not feed on many of the oaks here long enough to form the large bands of holes necessary to kill the stems.

I do not know for sure that oaks become favorite trees as the birds proceed south. But the limited evidence available suggests that northern red oak and other oaks may be major species for sapsucker feeding during their fall migration. Other kinds of oaks observed in Massachusetts and Connecticut appear to have been damaged by fall migrants.

In any region where oaks are a favorite species, and sapsuckers stay long enough to make many holes in individual trees, greater damage probably would result than occurs here. Oaks are damaged on the migratory and wintering ranges south of here (*4*).

Ash.—Neither white ash (*Fraxinus americana* L.) nor black ash (*F. nigra* Marsh.) were fed on very much by sapsuckers in this area (table 1). Only juvenile birds were seen drilling white ash in 1964. An adult that I disturbed near its nest drilled one hole in a black ash; this appeared to be a diversionary action, rather than feeding. Intensive feeding does occur on a few ash here in early fall, but it is rare—compared with feeding on most other hardwoods.

Another common practice is light tapping and wiping that appears more to involve bill cleaning than feeding. Loafing and preening occur at the same places. I have seen this repeatedly on

individual ash and northern white-cedar. It also occurred on the edges of dead bark on other species. This should not be misinterpreted as feeding.

Other hardwoods.—Serviceberry (*Amelanchier laevis* Wieg.) was used mostly in the fall (table 1). The birds paid it little attention until birch sap became scarce.

In the fall of 1967 and 1968, the same 8-inch d.b.h. serviceberry was used heavily by local birds and by migrants as late as 13 October, 1967. In early October 1967 profuse quantities of sap flowed, diminishing rapidly as the foliage colored. Sap flow in 1968 was noticeably less, perhaps because of the summer drought.

Is serviceberry a favorite species of fall migrants? It may be if it consistently produces sap later than other hardwoods along the migration route, as it has here. The literature does not provide an answer.

Striped maple (*Acer pensylvanicum* L.) generally is a small tree in this region. I observed feeding on it only once, in April. A few other damaged trees were found when birds were not present. It appeared to be low on the preference list when other and larger hardwoods were available.

Other hardwood species sapsuckers fed upon only occasionally, and generally lightly, were American basswood (*Tilia americana* L.), balsam poplar (*Populus balsamifera* var. *balsamifera*), American beech (*Fagus grandifolia* Ehrh.), and eastern hophornbeam (*Ostrya virginiana* (Mill.) K. Koch). Most of that feeding occurred here in late September and early October (table 1). Local and migrating birds were involved.

American elm (*Ulmus americana* L.) was fed upon lightly in Maine. It does not appear to be a preferred species if birch and maple are available and producing sap. If not, heavy feeding may occur on elm for short periods, especially late in summer. It also has served as a convenience species near some nests in May and June, generally when red maples were not available.

Elm (*Ulmus* spp.) and silver maple (*Acer saccharinum* L.) were damaged heavily by sapsuckers 18 August, 1965 and earlier, near Kentville, Nova Scotia. Severe damage had occurred on 10 elms and 6 maples, ranging from 3 inches to 14 inches

d.b.h. All were shade trees planted around a large motel. The manager's deep concern about the damage was well justified.

Many berries of red-berried elder (*Sambucus pubens* Michx.) were fed to young sapsuckers by their mother on 6 July, 1964. No evidence of sap or bark feeding on this shrub species was seen.

Speckled alders (*Alnus rugosa* (DuRoi) Spreng.) with heavy sap flow held the interest of an entire family of sapsuckers on 13 July, 1964. Other stems of this species were found earlier and later where sapsuckers had fed heavily, but the birds were not seen feeding. Some alders were killed. Most of the feeding appeared to occur about mid-summer. Alder has been an important food species at some locations in Maine where trees higher on the preference list were not available.

In Maine, most of the feeding on apple (*Malus* spp.) trees apparently occurred after late summer. Local birds used it when birch sap was not available in sufficient quantities. The limited evidence I have for Maine indicated very heavy feeding on apple trees by fall migrants, and limited use by local birds at other seasons.

The damage would be much more severe on apple trees if the sap holes were as large as those made during summer feeding on other hardwoods. Small gimlet-type holes normally are found here. Some larger sap holes were made by local juvenile birds in August 1968.

If sapsuckers visit an area, one of the easiest places to see the damage is in an old apple orchard, or near wooded margins in producing orchards.

Tree Sizes Damaged

Most of the trees damaged had an average d.b.h. of 4 to 8 inches. However, the range of diameters observed varied from a minimum of 2 inches to a maximum of 16 inches.

Discussion

SOME MANAGEMENT IMPLICATIONS

In other regions.—Sapsuckers cannot be dismissed lightly because the tree species damaged here do not exist, or are of minor importance, in other regions. One thing appears quite certain: If sapsuckers spend much time in an area, they probably are feeding on live, woody vegetation of some kind.

The feeding patterns observed here might be similar elsewhere in the northern nesting range—wherever the tree species are similar and nesting occurs. Elsewhere, differences probably occur in the tree species used and the feeding dates—especially in the wintering ranges.

Should damaged trees be cut?—We do not know how sapsuckers would react if their favorite feeding trees were removed for stand improvement. In this region, when sapsuckers kill their own favorite feeding trees, they simply move to other trees and continue their feeding. I have seen that repeatedly. In those areas where timber cutting has removed sapsucker-damaged trees, the birds began drilling undamaged trees. In other areas, heavy cutting has forced the birds to concentrate in adjacent woodlands, where abnormally severe sapsucker damage then occurred.

Cutting sapsucker-damaged trees to improve timber stands might be more likely to discourage migrant birds if they had another source of food within reasonable distance. But nesting sapsuckers would still need feeding trees. I believe local sapsuckers would simply turn to the available trees left in the stand—and these might be the best trees left after timber stand improvement.

Healthy trees also damaged.—Prior wounds on a tree are not necessary to attract sapsuckers. If sapsuckers occupy a nesting territory in this region, they will readily start new wounds on undamaged healthy trees. Among the 535 trees used for this study, only 5 had sapsucker drilling above earlier wounds made by an agent other than sapsuckers: 3 were above cankers or conks, 1 was above a partial porcupine girdle, and 1 was above a

dead area that probably resulted from sapsucker drilling about 6 years earlier.

However, old sapsucker wounds on trees are highly attractive to sapsuckers. These wounds provide the basis for much future intensive sapsucker feeding in this region, and I believe the same should apply in any region. These trees may—or may not—be used first. It is common, in stands where there are many trees to choose from, for sapsuckers to begin feeding on undamaged trees, even though old feeding wounds occur on other trees nearby. For example, among a different group of 557 sapsucker-damaged trees I found in 1964, 49 percent had only damage that had been done prior to 1964, 25 percent had old and 1964 damage, and 26 percent had only 1964 damage. There were 116 conifers and 441 hardwoods.

Sapsuckers kill trees.—Can sapsuckers kill trees? That question has been asked often. They are known to kill at least 32 species of trees, shrubs and vines (*4*). For over 50 years persons reporting sapsucker damage have said that sapsuckers can kill trees of some species (*1, 4, 5, 6*). Occasionally it has been hinted that some other virulent organism also may be involved, but evidence has not been presented to support it.

In the course of this study I watched 22 trees gradually die during a period in which they sustained severe sapsucker damage: 16 were paper birch, 1 was gray birch, 1 yellow birch, and 4 red maple. The same birds and trees were observed repeatedly from the time damage began until the trees died. No other kind of animal damage appeared on these trees. When the band of holes became large enough, and occurred below all branches, the entire tree died. If one or more branches—of any size—occurred below the holes, they remained alive, but the tree above the holes was killed. The latter condition is common; it occurred on 112 hardwoods of the 557 sapsucker-damaged trees I found in 1964.

Hemlock a key species.—Hemlocks may be an important link in the life history of sapsuckers. It is an important early spring food in Maine for local and migrating birds. The evidence indicates that the same applies in the Adirondack Mountains of New York, and on the Allegheny National Forest in northern

Pennsylvania. Feeding occurs on eastern hemlock in Vermont and West Virginia, and on Carolina hemlock in South Carolina and Georgia (*4*).

A western race of sapsucker damages western hemlock (*2, 4, 11*).

I believe that future observations will reveal similar use of hemlock over a much larger area. If you wish to make a quick check for evidence of sapsuckers, look at the hemlocks. If nesting does not occur in a region, migrants probably made the holes.

Apple a key species.—Sapsucker damage can be found in many apple orchards. But the impact of that damage on fruit trees has not been studied intensively in the Northeast (*4*). Current evidence suggests that trees of the apple family may form an important link in the life history of sapsuckers. These trees provide an abundant, easily located source of food during fall migration—and may thus sustain the birds on their movement to their wintering grounds among southern forests.

Migrants add to damage.—Migrating sapsuckers add to the damage caused by local nesting birds. Both spring and fall migrants normally used the same trees damaged earlier the same year, or in preceding years. Migrants pass through our local sapsucker territories in several waves. Individual migrants stay and feed for several hours to a week or longer. Later migrants may use the same trees.

I believe this habit also might prevail farther south, between the summer and winter ranges. But there only waves of migrants would be involved, not nesting or wintering birds..

Conclusion

The species of trees used by sapsuckers in the forests of northern New England have been determined, together with some information about frequency of use. Other research is providing a means for surveying sapsucker populations and identifying sapsucker family territories. These studies increase our knowledge of the habitat requirements and ecology of the

bird and should lead to development of feasible methods for surveying and predicting sapsucker impact on timber management and other forest uses.

Literature Cited

(1) Adams, Charles C.
1923. NOTES ON THE RELATION OF BIRDS TO ADIRONDACK FOREST VEGETATION. Roosevelt Wild Life Bull. 1:487-519.

(2) Howell, Thomas R.
1952. NATURAL HISTORY AND DIFFERENTIATION IN THE YELLOW-BELLIED SAPSUCKER. Condor 54: 237-282.

(3) Jorgensen, Richard N., and Sophie L. Lecznar.
1964. ANATOMY OF HEMLOCK RING SHAKE ASSOCIATED WITH SAPSUCKER INJURY. U. S. Forest Serv. Res. Paper NE-21, 9 pp. N.E. Forest Exp. Sta., Upper Darby, Pa.

(4) McAtee, W. L.
1911. WOODPECKERS IN RELATION TO TREES AND WOOD PRODUCTS. U. S. Dep. Agr. Biol. Survey Bull. 39, 99 pp.

(5) McAtee, W. L.
1962. THE RELATION OF BIRDS TO WOODLOTS IN NEW YORK STATE. Roosevelt Wild Life Bull. 4:7-152.

(6) Northeastern Forest Experiment Station.
1965. REPORT 1964. U. S. Forest Serv. N.E. Forest Exp. Sta., 77 pp.

(7) Northeastern Forest Experiment Station.
1967. REPORT 1966. U. S. Forest Serv. N.E. Forest Exp. Sta., 98 pp.

(8) Ohman, John H., and K. J. Kessler, Jr.
1964. BLACK BARK AS AN INDICATOR OF BIRD PECK DEFECT IN SUGAR MAPLE. U. S. Forest Serv. Res. Paper LS-14, 8 pp. Lake States Forest Exp. Sta., St. Paul, Minn.

(9) Shigo, Alex L.
1963. RING SHAKE ASSOCIATED WITH SAPSUCKER INJURY. U. S. Forest Serv. Res. Paper NE-8, 10 pp. N.E. Forest Exp. Sta., Upper Darby, Pa.

(10) Todd, W. E. Clyde.
1940. BIRDS OF WESTERN PENNSYLVANIA. Univ. Pittsburgh Press, 710 pp.

(11) Ziller, Wolf G., and David Stirling.
1961. SAPSUCKER DAMAGE IN COASTAL BRITISH COLUMBIA. Forestry Chron. 37: 331-335.

■

THE FOREST SERVICE of the U. S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.