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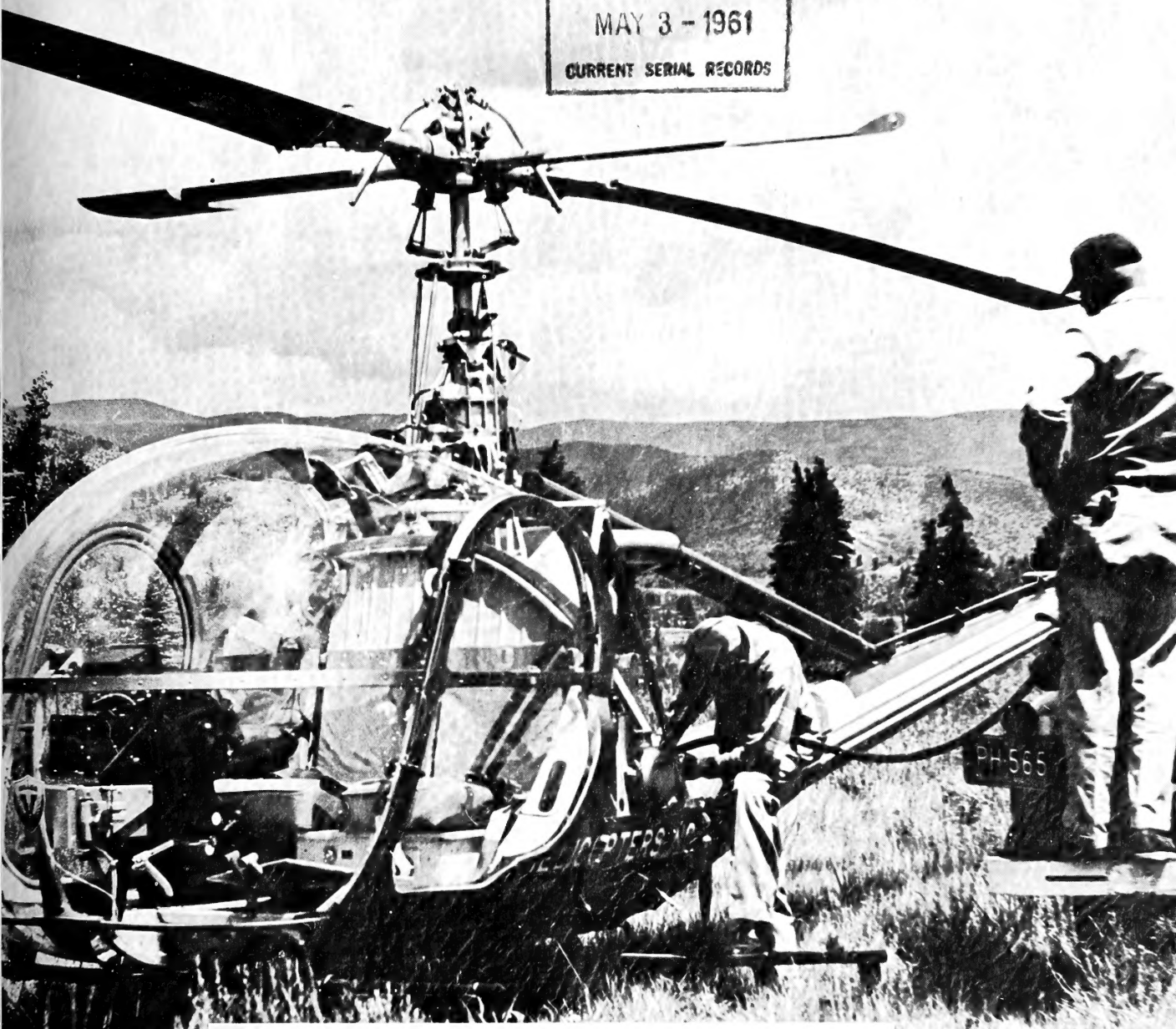
Forest Insect Conditions In Central and Southern Rocky Mountains 1960



ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION
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FOREST SERVICE U. S. DEPARTMENT OF AGRICULTURE

KINDS OF SURVEYS

Detection surveys are the sum of surveillance and an annual systematic aerial survey. Forests covered by a network of roads are reasonably well patrolled for incipient outbreaks. Areas receiving little or no forest travel are covered annually by systematic aerial surveys specifically designed to discover unusual forest damage.

Biological evaluations determine where an infestation is on the infestation-trend curve. It includes an analysis of population density and numbers of the pest insects, abundance and susceptibility of the food supply, and natural enemies and their probable effectiveness. The precision of the evaluation depends upon the soundness of the survey data and what is known about the habits of the insect. Workable techniques have been developed for sampling densities and predicting trends for the Engelmann spruce beetle, Black Hills beetle, and spruce budworm. Empirical methods must be used to evaluate infestations of other insect pests until more is known about their habits.

An operational survey gathers information the forest manager needs for control planning in addition to the biological evaluation. Operational surveys delineate infestation boundaries and determine the area or number of trees infested and the values at stake.

Control or suppression tactics are often a combination of methods to fit the situation. Expressed in the simplest terms, the objective of direct control is to sufficiently curtail the multiplication of the pest population so that natural factors can suppress the following generations. Success of the operations depends upon an accurate biological evaluation and a well designed and precisely executed control plan.

Cover photo. --Servicing the helicopter in a meadow within the forest saves time and costs of the Engelmann spruce beetle detection survey. The more inaccessible spruce stands in Colorado and northern New Mexico were covered by helicopter. It is believed that an annual survey should detect all outbreaks in their early stages.

FOREST INSECT CONDITIONS IN CENTRAL AND SOUTHERN ROCKY MOUNTAINS, 1960

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Rocky Mountain Forest and Range Experiment Station[1]
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FOREST INSECT CONDITIONS IN CENTRAL AND SOUTHERN ROCKY MOUNTAINS, 1960

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Insects can multiply their numbers many times in one generation when environmental conditions are favorable. Similarly, insect populations may decline and eventually collapse when the weather is unfavorable or their biological enemies outmultiply them. For this reason incipient outbreaks must be discovered early, identified, and promptly controlled. Declining infestations must likewise be identified and control withheld if we are to buy the most with the pest-control dollar.

When a pest insect maintains a high population for several consecutive years, the area of infestation enlarges, much timber may be lost, and the cost of suppressing the outbreak increases with each new generation. This happened in the Engelmann spruce beetle outbreak that started from a widespread blowdown of spruce in 1939. Before it was stopped in 1952, it killed 53 billion board feet of spruce and lodgepole pine. From 1953 to 1958, bark beetles, aided by a prolonged drought, killed 1.3 billion board feet of sawtimber in New Mexico and Arizona. Currently, an aggressive outbreak of the spruce budworm covers 1,277,120 acres in southern Colorado and northern New Mexico.

Spruce budworm outbreak most extensive on record

Mortality of Douglas-fir and true fir caused by the spruce budworm (Choristoneura fumiferana (Clem.)) has been moderate to heavy for several years. The advanced reproduction in the understory is receiving the heaviest damage.

The area of infestation increased from 1,052,840 acres in 1959 to 1,277,120 acres in 1960 (table 1). Of more importance than this increase in acreage is the increased amount of area in the heavier defoliation classes. Light defoliation indicates that the defoliation is barely visible from the air; moderate, top one-fourth of the trees are defoliated; heavy, top one-half of the trees are defoliated and top-killing is in progress; and very heavy, top three-fourths of the trees are defoliated and tree-killing is in progress.

The forecast made in 1959 that damage in 1960 would be severe proved to be accurate. This forecast was based upon the abundance of egg masses deposited by the 1959 flight of moths.

Table 1. --Areas and degrees of defoliation by spruce budworm, 1960

Area	Light	Moderate	Heavy	Very heavy	Total
			Acres		
Colorado					
Pike National Forest	93,900	30,190	3,960	350	128,400
Rio Grande National Forest	17,430	18,920	10,520	1,560	48,430
Routt National Forest	2,300	670	80	0	3,050
San Isabel National Forest	54,320	5,940	280	0	60,540
San Juan National Forest	108,510	139,290	10,730	0	258,530
Tierra Amarilla Grant	310	8,090	2,000	0	10,400
Uncompahgre National Forest	6,500	720	230	0	7,450
New Mexico					
Carson National Forest					
Forest Service land	47,040	139,360	14,720	0	201,120
Adjacent private land	60,320	103,040	18,880	2,080	184,320
Santa Fe National Forest					
Forest Service land	156,800	73,920	10,720	2,880	244,320
Adjacent private land	57,120	10,880	0	0	68,000
Navajo Indian Reservation	24,800	33,760	4,000	0	62,560
Total	629,350	564,780	76,120	6,870	1,277,120

Heavy damage is forecast for 1961. --A heavy egg mass deposit by the 1960 flight of moths will produce a larval population in 1961 that will cause severe defoliation in many areas unless natural-control factors intervene. In some areas of southwestern Colorado, the density was less than in 1959. A summary of the egg mass densities is as follows:

Location and number of plots in 1960	Egg masses per 1,000 square inches of foliage	
Colorado	1959	1960
Pike National Forest (6)	88.9	44.1
Rio Grande National Forest (12)	20.1	9.1
San Isabel National Forest (3)	--	10.9
San Juan National Forest (16)	23.5	12.0
Uncompahgre National Forest (1)	--	3.3

Location and number of plots in 1960 (Continued)	Egg masses per 1,000 square inches of foliage (Continued)	
New Mexico	1959	1960
Carson National Forest		
Eastern Division and adjacent lands (11)	49.0	31.4
Western Division and adjacent lands (8)	18.4	35.3
Santa Fe National Forest		
Western Division and adjacent lands (6)	34.6	30.9
Navajo Indian Reservation (4)	--	33.9

Areas with more than 15 egg masses per thousand square inches of foliage will receive severe defoliation unless unpredictable climatic factors intervene. The decline in egg mass densities on the San Juan and Rio Grande National Forests is not sufficient for a collapse of the outbreaks, but it may be an early sign of one. Egg mass sterility and parasitism varied from 2 percent to 34 percent between the plots, or more than double that in 1959. This amount is not expected to significantly influence the trend of the infestation.

Figure 1. --Understory and future crop of white fir and Douglas-fir severely injured by spruce budworm, Carson National Forest.

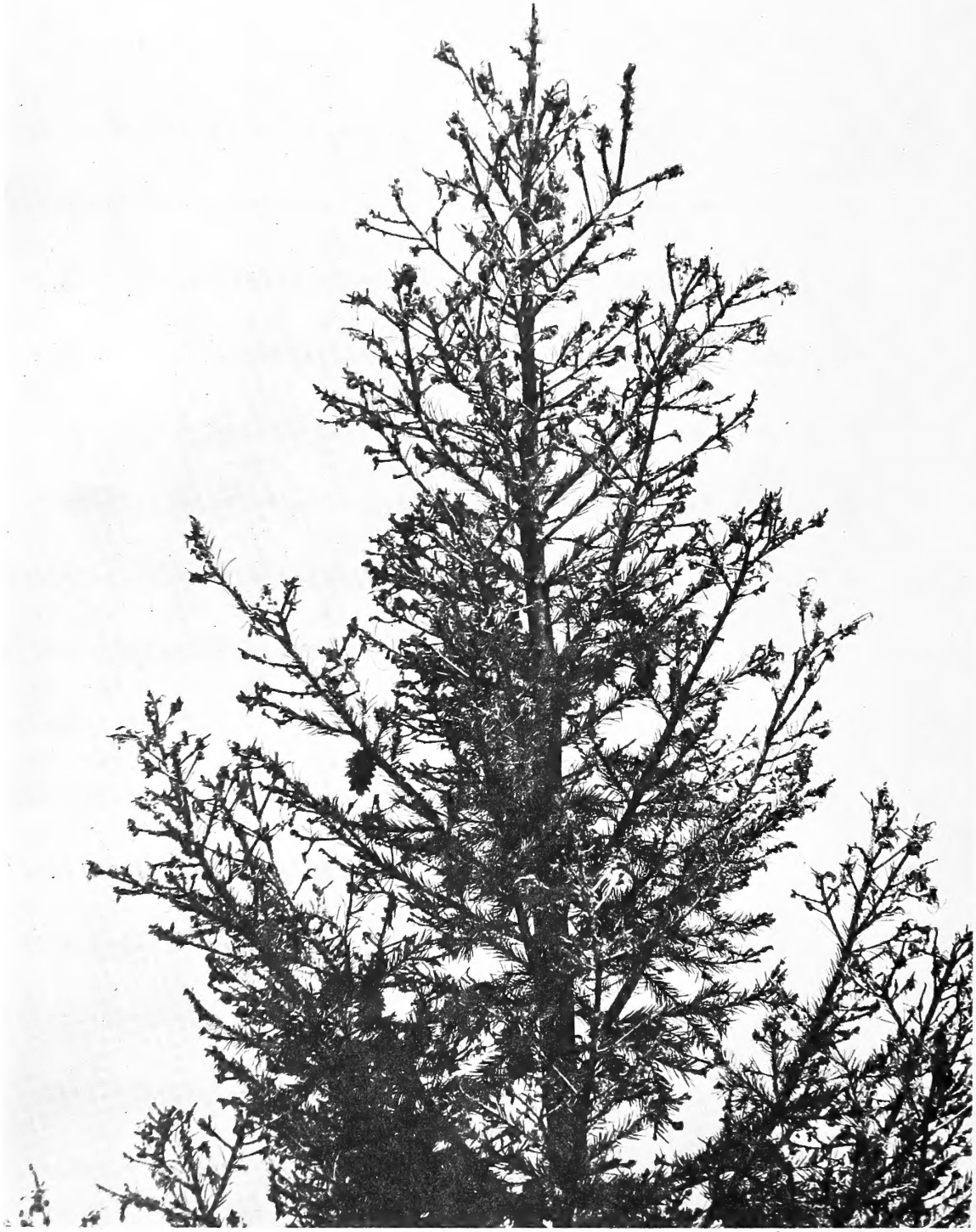

Figure 2. --Young Douglas-fir severely defoliated by spruce budworm, Pike National Forest.

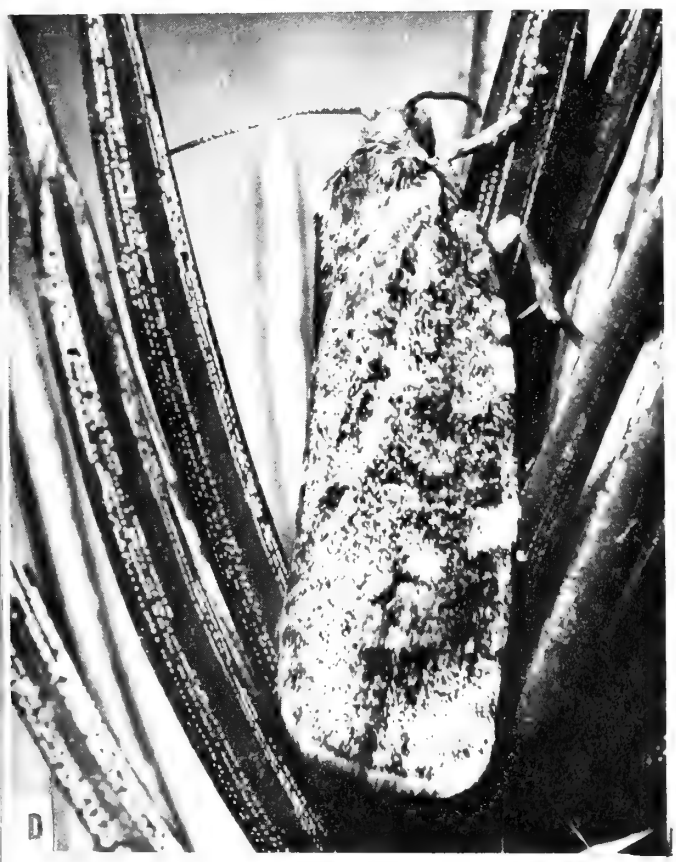

Figure 3. --

A, Newly hatched larvae from spruce budworm egg mass on Douglas-fir needle.

B, Full-grown spruce budworm larva on defoliated Douglas-fir branch.

C, Spruce budworm pupa on branch tip.

D, Spruce budworm moth.

Engelmann spruce beetle epidemics still threaten

The Engelmann spruce beetle (Dendroctonus engelmanni Hopk.) continues to be a serious problem in mature and overmature stands of Engelmann spruce in Colorado and northern New Mexico.

Twenty-seven areas of infestation (more than five infested trees per group) were found in Colorado. Fifteen of these were within or adjacent to timber sales. The remaining twelve infestations were the result of beetle population moving from blowdowns into standing green trees. Two such areas with considerable windthrow were found on the San Juan National Forest. The East-Mosca-Cold Creek infestation has nearly 10,000 infested trees on 7,000 acres. The East Mountain infestation has more than 6,000 infested trees on 3,000 acres.

The outbreak reported last year on the Tierra Amarilla Grant near Chama, New Mexico, increased in severity. Tree-killing is intense on 8,000 acres of Engelmann spruce, with no signs of a letup in 1961. This outbreak originated in logging debris in adjacent areas.

An outbreak with a potential of enveloping extensive areas of spruce was discovered on the Rio Grande Grant and adjacent Carson National Forest in New Mexico. A large beetle population had been building up for several years in logging areas on the Rio Grande Grant. The amount of fresh cull and debris was not adequate to absorb the 1960 beetle flight. Consequently, the beetles infested many standing trees on the Grant lands and the adjacent Carson National Forest. The infestation covers about 10,000 acres, about half of which is on the Carson National Forest. A large number of beetles will emerge in 1961. Woodpecker feeding on the new brood is light to absent. This outbreak has the characteristics and the extensive areas of spruce needed for exploding into a major outbreak.

Figure 4. --Roadless Engelmann spruce forests such as this one on the Arapaho National Forest can be viewed from helicopter at close range to discover incipient outbreak centers of Engelmann spruce beetle and blowdowns that breed outbreaks.

Figure 5. --Cull logs and tops of Engelmann spruce left in logging areas provide ideal conditions for a buildup of epidemic numbers of the Engelmann spruce beetle.

Figure 6. --Engelmann spruce beetle brood in the cull logs is evaluated by removing bark samples 6 by 12 inches and counting the number of new beetles.

Black Hills beetle infestations increase in Colorado and Wyoming, decline in South Dakota

Infestations of the Black Hills beetle (Dendroctonus ponderosa Hopk.) have plagued the ponderosa pine on the Front Range of Colorado for many years. Small epidemic areas appeared again in 1960. The greatest increase was on the Pike and San Isabel National Forests in Colorado and the Bighorn National Forest in Wyoming (table 2). The number of infested trees increased 7.5 times on the Blue Mountain and 1.3 times on the Stoll Mountain areas on the Pike National Forest. Approximately 4,800 trees are infested on 9,000 acres in these two infestations.

Table 2.--Location and acreage of Black Hills beetle infestation by intensity classes as determined from aerial surveys

National Forest and adjacent lands	Intensity of infestation 1/				1960 total	1959 total
	Light	Moderate	Heavy	Very heavy		
	Acres					
Arapaho 2/	300	75	0	0	375	940
Bighorn	2,715	600	1,700	600	5,615	1,010
Pike	15,700	100	20	0	15,870	2,100
Rio Grande	325	0	0	0	325	20
Roosevelt	13,540	1,050	50	0	14,640	21,930
San Isabel	2,000	250	25	55	2,330	120
San Juan	5,700	0	0	0	5,700	35,780
Total	40,280	2,075	1,795	705	44,855	61,900

1/ Light, 0.1 to 0.2 tree per acre and up to 5 trees per group; moderate, 0.3 to 0.4 tree per acre and up to 10 trees per group; heavy, 0.5 to 0.8 tree per acre and up to 20 trees per group; very heavy, 0.94 tree per acre and large groups.

2/ Forest not covered completely in aerial survey.

An evaluation of the density of beetles beneath the bark in July in four infestations produced the following data and predictions:

Location	Living beetles (No. per sq. ft.)	Trend of infestation
Roosevelt National Forest		
Boulder District	43	increasing
Estes Park District	51	increasing
San Isabel National Forest		
San Carlos District	83	increasing
Black Hills National Forest	18	declining

Extensive maintenance control has been necessary on the Black Hills National Forest for more than 10 years to prevent outbreaks. An operational survey of the heaviest infestation areas in September showed a decrease of 7.5 to 1 in the number of infested trees.

Scattered tree-killing continues on 1,000 acres of ponderosa pine on the Carson National Forest in northern New Mexico. In 1960, 200 infested trees were sprayed with a water emulsion of ethylene dibromide. Brood production has been unusually high, 116 beetles per square foot at the time of emergence. Only by annual treatment of a relatively small number of trees has a major outbreak been prevented.

Mountain pine beetle outbreaks continue in lodgepole and limber pine stands on the Shoshone National Forest

Tree-killing by the mountain pine beetle (Dendroctonus monticolae Hopk.) continued at a high rate in limber pine on two areas. Lodgepole pine losses are increasing in the Long Creek and Sheridan Creek drainages and decreasing in several areas. An estimated 12,620 trees were killed on 21,145 acres in 1960.

Beetle populations were high in limber pine and in some lodgepole pine areas. Results of the biological evaluations and trend of the infestations on the Shoshone are as follows:

Species and location	Living beetles (No. per sq. ft.)	Probable trend of infestation	Level of tree mortality
Limber pine:			
Rock Creek	64	Increasing	High
Pete Miller Park	40	Static or increasing	High
Lodgepole pine:			
Marston and Younts Creeks	21	Static	High
Wiggins Fork	12	Static or decreasing	Moderate
Long Creek	63	Increasing	High
Sheridan Creek (A)	9	Decreasing	Low
Sheridan Creek (B)	61	Increasing	High

Douglas-fir beetle damage increases

Infestations of the Douglas-fir beetle (Dendroctonus pseudotsugae Hopk.) increased sharply throughout the Douglas-fir stands in Arizona and

New Mexico. The beetle is epidemic on 225,000 acres. New outbreaks were discovered on the Kaibab and Apache National Forests and the Fort Apache Indian Reservation. Losses on the Santa Fe and Coronado National Forests continued at a high level.

Most of the infestations in Colorado and Wyoming are in the light to moderate categories. Total area of infestation increased from 7,440 acres in 1959 to 10,390 acres in 1960. Fluctuations in infestation trends have been especially evident on the San Juan National Forest, where 14,000 acres were recorded in 1958, only 450 acres in 1959, and 2,320 acres in 1960. Infestations increased on the Pike, Roosevelt, and parts of the Shoshone National Forests and decreased on the San Isabel National Forest.

Brood densities were studied in three infestations to develop information on the relationship between densities per square foot and the trend of infestation. The findings were as follows:

Location	Number of living beetles per square foot		Trend of infestation
	Fall of 1959	Spring of 1960	
Clarks Fork District			
Shoshone National Forest	42	10	declining
Wapiti District			
Shoshone National Forest	42	31	increasing
South Platte District			
Pike National Forest	--	33	increasing

Drought conditions and abundant thinning slash result in engraver beetle outbreak in the Black Hills

The Oregon pine engraver (Ips oregoni (Eichh.)) was the cause of scattered group killing of ponderosa pine in the northern Black Hills in 1960. Large beetle populations developed in an abundance of logging and thinning slash and attacked standing trees. In logged and thinned areas on both Federal and private lands, groups of 5 to 30 trees were killed. Much of the mortality was in vigorous reproduction left after thinning. The epidemic area has been subject to drought in recent years. A similar but more devastating outbreak developed in the Black Hills in 1933 and lasted for 4 years.

Fir engraver damage continues

Two new infestation centers of the fir engraver (Scolytus ventralis Lec.) appeared, one on the Kaibab National Forest and the other on the Carson National Forest. Each covers about 600 acres. The 2-year-old outbreak on the Lincoln National Forest and Mescalero Indian Reservation is still active on 25,000 acres. Large trees with high value are being killed. The outbreak on Sandia Mountains, active for many years, is decreasing, but tree-killing is still severe on 5,000 acres.

Large white fir infested with fir engraver difficult to spot

Spotting trees infested with fir engraver beetles for control and evaluating the brood for prediction of infestation trend has been handicapped by lack of information about the beetle's pattern of infesting the stem. While the effort this year was limited to a stem analysis of five trees (figs. 7 and 8), results are interesting and useful. Only the smallest tree, 12 inches d.b.h., contained brood below 5 feet. The 17-inch tree contained no brood below 10 feet; the 20-23 inch trees contained no brood below 15 feet. Optimum brood production in the stem started at 40 feet and extended as high as 70 feet. This means that infestations in large trees cannot be spotted from the ground until the foliage fades.

Figure 7. --Trees infested with the fir engraver were felled and sampled at heights of 2 feet, 5 feet, and continuing at 5-foot intervals until upper limits of the infestation were reached.

Figure 8. --Two 6 x 6-inch bark samples (1/2 square foot of bark surface) were taken from opposite sides of the bole at each sampling height to obtain brood density and distribution patterns of the fir engraver.

Activity of western balsam bark beetle continues

The loss of subalpine fir to the western balsam bark beetle (Dryocoetes confusus Sw.) continues. About 15,000 acres of subalpine fir in Colorado were infested in 1960 at moderate intensity; epidemic conditions continue on the Rio Grande National Forest.

Extensive killing of true fir occurred on 40,000 acres on the Carson National Forest in northern New Mexico.

Pine bark beetle damage in New Mexico and Arizona is low

Little mortality of ponderosa pine throughout Arizona and New Mexico was caused by the complex of Dendroctonus and Ips beetles. Localized outbreaks were found on the Lincoln National Forest and the San Carlos Indian Reservation. Several infested trees in the Lincoln outbreak felled for a stem analysis showed that the Oregon pine engraver killed the top section of the stems and that Dendroctonus barberi Hopk. and D. convexifrons entered the lower sections.

Arizona five-spined ips -- a serious enemy of second-growth ponderosa pine

An outbreak of the Arizona five-spined ips (Ips lecontei Sw.) continues to kill second-growth ponderosa pine, particularly within areas set aside for summer homes or recreation near Prescott, Arizona. Tree-killing in groups of 10 trees or more (fig. 9) is also common in timber-producing areas. Total area infested is approximately 10,000 acres.

Douglas-fir tussock moth controlled

A new infestation center of the Douglas-fir tussock moth (Hemerocampa pseudotsugata McD.) was discovered on San Mateo Mountain in New Mexico during the aerial detection survey in June. The U.S. Forest Service promptly sprayed this new center of 3,070 acres as well as 4,707 acres of old infestation in the Sandia Mountains, both areas on the Cibola National Forest. Five widely separated outbreaks have been suppressed in Forest Service Region 3 since this insect was first discovered in the Southwest in 1957.

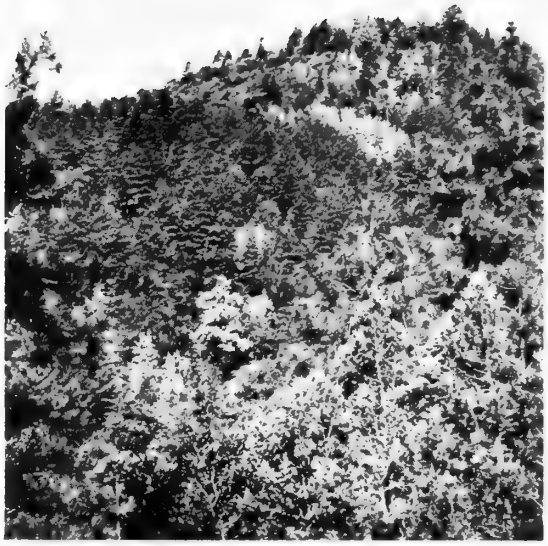

Figure 9. --Tree-killing caused by Arizona five-spined ips on Prescott National Forest, Arizona.

Great Basin tent caterpillar outbreaks continue in some areas

At the time of the collapse of outbreaks in many areas in 1958, new centers and areas of infestations developed. The present infestations cover about 100,000 acres of aspen in northern New Mexico. A native virus of the caterpillar, a most important natural-control agent, is present in most infestation centers. The disease failed to erupt in 1960. The number of caterpillars killed by the virus and other natural agents was negligible.

The downward trend of infestations in southern Colorado started in 1958 when 131,000 acres of aspen were defoliated. Infested area dropped to 44,510 acres in 1959 and to 5,840 acres in 1960. The epidemic lasted for about 10 years. The caterpillar killed aspen on a net area of about 6,000 acres and caused an unknown amount of growth loss.

Pandora moth flight heavy in southern Wyoming

Numerous adults of the pandora moth (Coloradia pandora Blake) emerged in July from the infestation discovered in 1959 on 8,420 acres of lodgepole pine in the Medicine Bow and Routt National Forests. Spent moths were present in great numbers on the forest floor in August. Many moths also flew long distances; they were reported as being attracted to lights in towns more than 100 miles from the outbreak center.

The egg deposit appeared to be light within the infested area. The pandora moth has a 2-year cycle, spending the first year in the second instar larval stage on twigs. Little feeding is done the first year. If the outbreak continues, heavy feeding will take place in 1961. An evaluation of the infestation trend can best be made in the spring of 1961.

Figure 10. --Newly emerged female pandora moth on trunk of lodgepole pine, Medicine Bow National Forest.

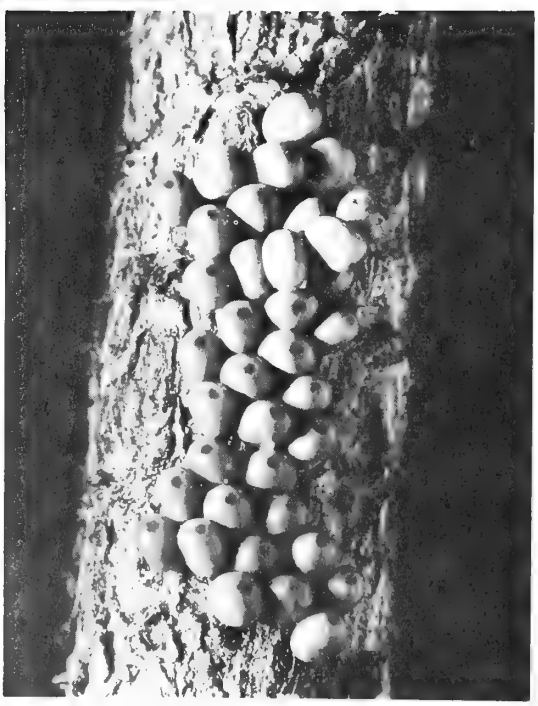

Figure 11. --Pandora moth eggs are deposited in clusters on twigs and needles.

Miscellaneous defoliator infestations

A localized outbreak of a sawfly (Neodiprion sp.) on ponderosa pine continues in the Zuni Mountains in western New Mexico. Since its discovery in 1949, damage has been limited to an area of 1,200 acres.

Localized infestations of two unidentified leaf rollers are causing light damage on 1,500 acres of aspen in northern New Mexico and in northern Arizona.

A needle miner infestation was found in 3,000 acres of pine on the Jemez District, Santa Fe National Forest. The infestation presently is of little or no economic importance.

Forest insect conditions in Southwest national parks and monuments

Insect activity on the national parks and monuments of the Southwest increased slightly in 1960. The most important insects were engraver beetles, the Douglas-fir beetle, and the fall webworm.

An outbreak of Ips confusus (Lec.) developed in an area of cabled pinyon-juniper adjacent to Walnut Canyon National Monument. Beetles that emerged from this slash killed small groups of pinyon in late summer. Infestations of this same bark beetle continued at Grand Canyon and Mesa Verde National Parks. Activity decreased at Canyon de Chelly National Monument and Big Bend National Park.

The Douglas-fir beetle infestation on the north rim of Grand Canyon continued to increase in 1960. Infested groups of trees are widely scattered and inaccessible, making control measures impractical.

Spruce budworm feeding is noticeable on the north rim of Grand Canyon. This is the first activity since the area was aerially sprayed with DDT in 1958 (see figs. 4-9).

The fall webworm (Hyphantria cunea Drury) is increasing at Bandelier, Chaco Canyon, and Aztec Ruins National Monuments.

The walnut caterpillar (Datana sp.) infestations at Carlsbad Caverns National Park were light. Control was continued against the insect on trees along the approach road.