

Effects of Certain Common Brush Control Techniques and Materials On Game Food and Cover On a Power Line Right-of-way

No. 2

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Effect of Certain Common Brush Control Techniques and Materials On Game Food and Cover on a Power Line Right-of-way No. 2*

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A FIRST REPORT (1) made on this research project included a complete description of the objectives, treatments applied and the experimental design used. For the purpose of this paper, it seems sufficient to say that a series of large-scale spray tests were set up in the spring of 1953 on an electric power line right-of-way which had been cleared in the winter of 1951-52 through a typical oak-hickory type forest in central Pennsylvania. The main objective of the spray tests was to determine the effects of various commercially applied sprays on game food and cover. Six treatments were applied in four replications to control brush on the right-of-way; five were applied in the early summer of 1953 and one (E) in the winter of 1954. The techniques used may be briefly characterized:

A—No spray.

B—Broadcast foliage spray of 2,4-D plus 2,4,5-T butoxy ethanol esters, half and half; at a concentration of 4 pounds combined acid equivalent per 100 gallons of water.

C—Oil-water, semi-basal summer spray of emulsifiable acids of 2,4-D plus 2,4,5-T, half and half; 3 gallons of spray material to make a concentration of 6 pounds of combined acid equivalent per 100 gallons spray in an oil-water carrier consisting of 10 gallons of No. 2 fuel oil in 87 gallons water.

D—General summer basal spray of emulsifiable acids of 2,4-D plus 2,4,5-T, half and half; at a concentration of 12 pounds of combined acid equivalent per 100 gallons of spray, No. 2 fuel oil being used as a carrier.

E—Selective winter basal spray of 2,4,5-T butoxy ethanol esters at a concentration of 12 pounds of acid equivalent per 100 gallons of spray, No. 2 fuel oil being used as a carrier.

F—Broadcast foliage spray of Ammate at a concentration of $\frac{1}{4}$ pound per gallon of water; 4 ounces of duPont sticker-spreader were added per 100 gallons of spray.

EFFECT OF SPRAYS ON WOODY BRUSH

After clearance of the forest cover on the right-of-way during the winter of 1951-52, a woody shrub layer developed consisting primarily of clumps of tree sprouts. One growing season following clearing, and prior to spraying in 1953, this layer had attained a height ranging from 3 to 6 feet and covered 20 to 34 per cent of the ground surface. The species com-

Table 1. — Top kill in September 1954 of original stems sprayed in June 1953 (E sprayed in January 1954).

Species	A Unsprayed	B Foliage	Treatments		E Winter Basal	F Ammate
			C Oil-water	D Summer Basal		
		per cent	per cent	per cent	per cent	per cent
White oak	—	92	98	99	97	100
Red oak	—	92	99	96	94	99
Black oak	—	86	100	100	96	100
Chestnut oak	—	90	99	97	99	99
Bear oak	—	89	94	98	96	100
Red maple	—	98	99	99	99	99
Sassafras	—	100	100	99	99	100
American chestnut	—	100	100	100	100	100
Juneberry	—	80	100	100	—	92
Aspen	—	100	100	100	100	100
Black cherry	—	100	100	100	100	100
Fire cherry	—	100	—	100	100	100
Black gum	—	100	100	100	—	100
Hawthorn	—	100	100	—	—	—
Hickory	—	100	—	100	100	100
Large-leaved holly	—	—	—	100	—	100
No. stems basis for weighted average	Before spray	17592	18520	20784	25814	22184
	After spray	1032	176	224	439	64
Weighted average all species		94.1	99.0	98.9	98.3	99.7

position of this woody shrub layer can be seen in table 1; see Appendix for scientific names. All sprays were applied in June 1953, except Treatment E (Selective winter basal) which was applied in January 1954.

In September 1954, two growing seasons after spraying, the shrub layer on all sprayed areas was practically nonexistent, except for a very few scattered sprout clumps which had been missed or not thoroughly sprayed. Top kill given in table 1 refers to death of plants above the ground line and is based on total stems on four replications. The relative top kill for all species caused by the various sprays was tested by analysis of variance, and highly significant differences were found between the effects of Treatment B and all other treatments. There were no significant differences between other treatments. The cover of the shrub layer in 1954 on all sprayed areas was less than 1 per cent, as compared to the unsprayed areas of Treatment A on which it increased from 29 to 54 per cent over the same period.

The summer and winter basal sprays, Treatments D and E, and the oil-water, semi-basal, Treatment C, were most successful in preventing resprouting. It may be noted from table 2 that the greatest number of new sprouts of all species combined were found on Treatment F (Ammate), which had 27 per cent resprouting, followed by Treatment B (Foliage) with 21 per cent resprouting. Although sprouting was more prolific on Treatment F (Ammate), these sprouts, in general, were smaller than the sprouts on any other treatment and many will die during the coming winter.

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Table 2. — Resurge of sprouts from sprayed stems two growing seasons after spray (except treatment E which had one growing season after spray).

Species	Treatments										
	A	B		C		D		E		F	
	Unsprayed	Foliage		Oil-water		Summer Basal		Winter Basal		Ammate	
	No. per acre	No. per acre	Per cent	No. per acre	Per cent	No. per acre	Per cent	No. per acre	Per cent	No. per acre	Per cent
White oak	1,248	192	16	104	7	32	1	133	3	24	2
Red oak	1,320	264	15	144	8	88	7	160	5	624	21
Black oak	368	128	17					66	6	200	52
Chestnut oak	2,064	1,192	27	280	5	208	6	40	1	3,200	58
Bear oak	968	1,608	63	376	23	680	25	266	9	368	48
Red maple	1,432	136	7	304	11	40	2	213	6	904	40
Sassafras	888	80	2	328	9	400	6	425	7	456	6
Chestnut	48	24	6	0		0		0		8	2
Juneberry	72	24	60	0		0				96	30
Aspen		0		0		0		0		0	
Black cherry		0		0		0		0		0	
Fire cherry		0				0		0		0	
Black gum	8	0		0		0				0	
Hawthorn		0		0							
Hickory	8	0				0		0		0	
Dogwood	16					0				0	
Holly						0				0	
All species	8,440	3,648	21	1,536	8	1,448	7	1,303	5	5,880	27

EFFECT OF SPRAYS ON GENERAL PLANT COVER

The right-of-way vegetation before spraying had been divided into two layers for analysis. A shrub layer was recognized which had developed to become 3 to 6 feet in height, composed primarily of woody brush produced by tree sprouts and seedlings and tall shrubs. Between and beneath this layer was a ground layer which was dominated by a BRACKEN-SEDGE-HERB-BLUEBERRY cover.

Effect of Sprays on the Shrub Layer

As described in the preceding section, all of the spray treatments caused a nearly complete top kill of woody brush over 3 feet in height. New sprouts which arose after spraying, also unsprayed seedlings with very few exceptions, remained below 3 feet at the end of the growing season of 1954.

The woody shrub layer therefore can be said to have been eliminated from all spray areas. The degree of permanence of this elimination undoubtedly will vary with the effectiveness of each treatment, not only in killing back the brush but also in suppressing resprouting.

The shrub layer of the unsprayed areas continued to develop normally into a thicket of tree sprouts and tall shrubs up to 8 feet in height and covered 54 per cent of the total ground area. Its species composition remained the same as in 1953, with the oaks (White, Red, Black, Chestnut and Bear) dominant. In certain replications sassafras was very abundant, while Red maple was common throughout.

Effect of Sprays on the Ground Layer

After the shrub layer, woody vegetation over 3 feet in height, had been eliminated from sprayed areas, only a low plant cover remained on the right-of-way, herein referred to as the ground layer. With the exception of a few tall herbs which developed in late summer, such as fireweed and tall grasses, this layer was under 3 feet in height. Woody plants in

the ground layer at this time consisted of (1) new sprouts from sprayed trees and shrubs, and (2) small seedlings, seedling sprouts and suckers.

Although numerous, these low woody stems are of minor cover value in the ground layer at present and are of interest mainly in respect to their possible development into tall brush in future years. However, it is probable that their importance in such treatments as summer basal (D), where a tight ground cover has been maintained, could be overrated. Many small seedlings, for example, will not reach a height where they will require artificial control, as they will be suppressed by other vegetation and destroyed by animals.

Table 3. — Abundance, cover and type of grouping (sociability) of dominant species of plants in the ground layer two growing seasons after spraying on the electric power line right-of-way (one season for E).

Species	A	B	C	D	E	F
	Unsprayed	Foliage	Oil-water	Summer Basal	Winter Basal	Ammate
Bracken	AS*	AS	AS	AS	AS	AS
Sedge	3.2-4	1.1	1.1-3	3.3-4	2.1-4	+1
Loosestrife	2.3	2.3	1.3	1.3	1.2-3	1.2-3
Changeable	1.1	1.1	+1	1.1	1.1	+1
panic grass	1.2-3	1.2-3	1.2	+2-3	+2-3	1.1-4
Large-leaved	1.1-2	1.3-4	1.2	1.2-3	1.2-3	1.2
panic grass	+1	1.1	2.1-3	1.2	1.1	5.5
Fireweed						
Low late	2.2-3	+1	+1-3	1.2-3	1.1-3	+1-2
blueberry						
Low early	1.1-2	+1	+1	+1	1.1-2	+1
blueberry	1.1	+1	+1	1.1	1.1	+1
Teaberry	1.1-2	+1	+1	+1	+1	+1
Witch-hazel	+1	+1	1.1	+1	+1	1.1
Blackberry	+1	+1	+1	+1	+1	1.1
Sweetfern	+1	+1	+1	+1	+1	1.1

*A — Abundance and cover expressed in symbols:

- +—Sparse, cover very small
 - 1—Plentiful, but of small cover value
 - 2—Covering 1/20 to 1/4 of the area
 - 3—Covering 1/4 to 1/2 of the area
 - 4—Covering 1/2 to 3/4 of the area
 - 5—Covering more than 3/4 of the area
- S — Grouping (sociability) expressed in symbols: For example, 2.3 indicates that a plant covers 1/20 to 1/4 of the ground area and occurs in small patches.
- 1—Growing singly
 - 2—Grouped or tufted
 - 3—Small patches (less than 1 milacre)
 - 4—Extensive patches or carpets
 - 5—Pure population



Fig. 1. — Natural forest cover present before right-of-way clearance. Sparse Shrub and Ground Layers.

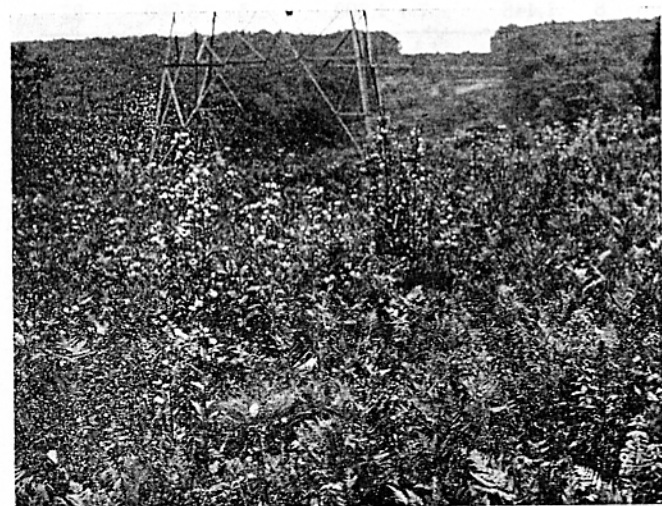


Fig. 3. — Summer basal spray area, 2 years after spraying. A tight Ground Layer of BRACKEN-SEDGE-HERB-BLUEBERRY-Grass has remained to become a dense, low cover.

Major changes in the dominant species of the ground layer from the uncut woodland through two growing seasons after spraying are summarized in table 3. Uncut woodland, before the original right-of-way clearance, had a sparse ground layer dominated by a BRACKEN-SEDGE-HERB-BLUEBERRY cover which covered 64 per cent of the ground surface. After the right-of-way was cleared in the winter of 1951-52, the plants of the forest floor spread to cover 79 per cent of the ground surface at the end of the first growing season. The species composition of the ground layer on the new right-of-way remained essentially the same as in the forest. The only prominent new invader in this first season was fireweed, which appeared in abundance in spots where brush had been burned and mineral soil exposed. A few sweetfern and blackberry seedlings also appeared in those bare spots probably through seed deposited by birds and other animals.



Fig. 2. — Unsprayed right-of-way, 3 years after clearance. Heavy Shrub Layer composed mostly of tree sprouts up to 8 feet in height on average sites.

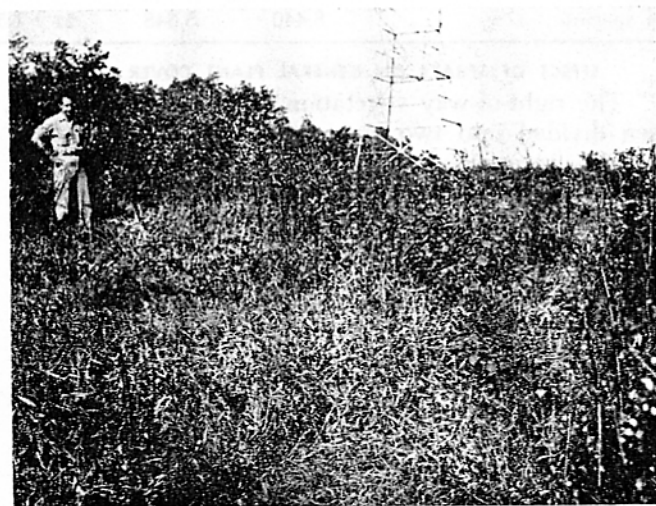


Fig. 4. — Winter basal spray area, 1 year after spraying. A Ground Layer of BRACKEN-SEDGE-HERB-BLUEBERRY-Grass has remained to form a dense, low cover.

As a result of spray treatments applied in June 1953, marked changes began to appear in the ground layer. By September 1954, two growing seasons after treatment, the cover and species composition of the ground layers on various treatment areas were different enough to make distinction possible between them as described in the following sections.

Treatment A — unsprayed

The total cover increased from 79 per cent to 96 per cent with no marked change in the original dominant plant cover which remained BRACKEN-SEDGE-HERBS-BLUEBERRY. There was some increase in bracken, panic grasses and grass as a minor component of the dominant cover.

Treatment B — broadcast foliage spray

The ground layer was almost completely browned after spraying owing to a 100 per cent top kill on most herbs such as wild sarsaparilla and loosestrife, a 90 to 100 per cent kill on bracken, and an 80 to 90

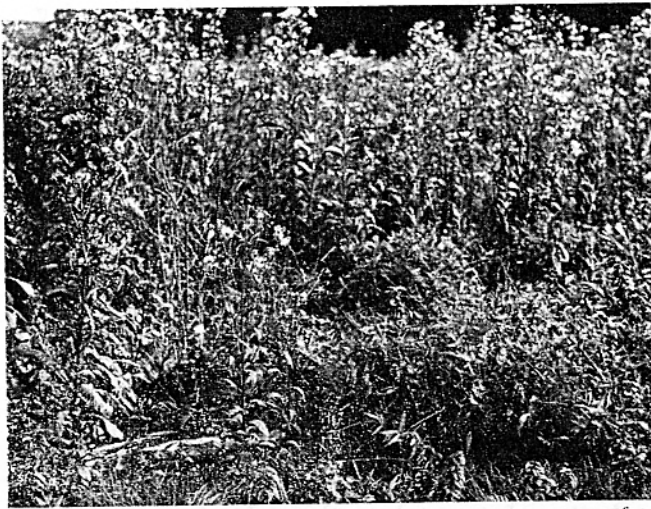


Fig. 5. — Oil-water semi-basal spray area, 2 years after spraying. A Ground Layer of FIREWEED-Bracken-Grass-Sedge has developed owing to extensive killing of original ground cover.

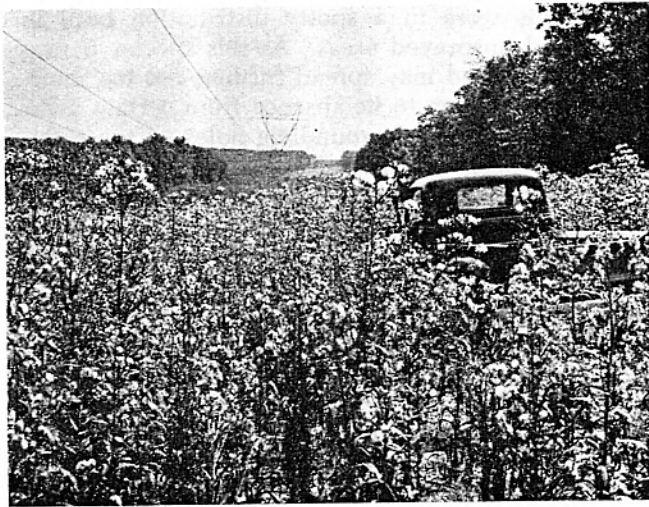


Fig. 7. — Ammate foliage spray area, 2 years after spraying. A FIREWEED-Sedge-Grass ground cover has developed owing to extensive kill of original ground cover plants.

per cent kill on sedge. Most striking was a light top kill of only 10 per cent on the panic grasses in nearly all plots. A 90 to 100 per cent top kill was recorded on low shrubs such as blueberry, witchhazel and teaberry.

Two growing seasons after spraying, the cover of the areas had returned to 79 per cent but the species composition was markedly altered and a SEDGE-GRASS-Herb plant cover dominated the area. This grassy type of right-of-way has been developed by sedge and grasses whose roots were not killed by the 2,4-D + 2,4,5-T spray. Species which can spread both vegetatively by rhizomes and by seeds, such as the panic grasses and upland bent, typically spread from sparse single plants or small groups to large patches and probably will be more important in the future.

Bracken had been reduced to where it was of small cover value and grew singly rather than in groups or patches. Low shrubs, such as blueberry,



Fig. 6. — Broadcast foliage spray area of 2,4-D + 2,4,5-T, 2 years after spraying. A SEDGE-GRASS-Herb cover has developed after virtual elimination of Bracken and Blueberries.

had disappeared or were very sparse.

Although fireweed had become abundant, it was scattered thinly and in general remained of small cover value. Loosestrife, another herb, was abundant but of small cover value and prominent only in early summer.

Treatment C — oil-water, semi-basal spray

This treatment caused a top kill and browning of most of the ground layer owing to the incidental spread of the high pressure spray that was used to wet the lower two thirds of the stems and foliage of woody brush. The browning extended over most of the area. At the end of the second growing season after spraying the ground layer had built up to cover an average of 79 per cent of the ground area. This was caused in a large part by the increase in fireweed which covered from 1/20 to 1/4 of the area to change the dominant cover to FIREWEED-Bracken-Grass-Sedge. Although a right-of-way cover dominated by a herbaceous annual had been created, it is probable that fireweed soon will be replaced by perennial plants.

Treatment D — summer basal spray

As this spray was applied directly to the woody brush, it only affected the ground layer immediately around the stems sprayed. The net effect on ground cover, therefore, was negligible and the cover value of the ground layer after two growing seasons was 95 per cent, or about the same as in unsprayed areas. One of the outstanding characteristics of this technique has been maintenance of a tight ground cover.

The dominant plants of the ground layer remained practically stable two seasons after spraying. A BRACKEN-SEDGE-HERB-BLUEBERRY cover still dominated, with grasses increasing to become a minor component. Bracken showed a tendency to spread into the other plant covers, such as patches of sedge and low blueberry, and maintained its dominance. Sedge and blueberry on the other hand decreased.

It is of interest to observe that at this time the typical woodland herbs have become crowded and suppressed, or have disappeared. Such species as wild sarsaparilla, false Solomon's-seal, Indian cucumber-root, and lady's slipper, which flourish under the canopy of the forest, lost out in competition on the open right-of-way. Of all the herbs of the woodland, only loosestrife has increased and held its own, so that along with fireweed it is one of the prominent aspect plants of the ground layer on the right-of-way.

Treatment E — winter basal spray

This basal type of spray produced results similar to those by the summer basal described in the previous section. The ground cover was killed only in the areas immediately surrounding sprayed stems. Plant changes were slight during the first season with some increase in panic grasses and fireweed in sprayed spots but no increase in low shrub cover. A BRACKEN-SEDGE-HERB-BLUEBERRY-Grass cover dominated the sprayed areas. A large number of tree seedlings and low sprouts were present owing to difficulties in finding them in the course of winter spraying.

Treatment F — broadcast foliage spray with Ammate

This spray produced nearly complete browning of the ground layer for the first growing season and winter after application. A 90 to 100 per cent top kill was recorded on bracken and an 80 to 100 per cent kill on sedge. The herbs and panic grasses were completely killed back. Of the shrubs, only mountain-laurel showed signs of resistance to the spray, while blueberry suffered 90 to 100 per cent top kill.

Two growing seasons after spraying, a new ground cover had developed to occupy 71 per cent of the ground area. This was largely owing to invasion of fireweed, an annual herb that commonly invades burned and disturbed areas of the region. Most of the woodland herbs had disappeared, and even loosestrife had become very sparse. Bracken and blueberry were very sparse having been completely killed in most spots by the spray.

Fireweed up to 6 feet tall dominated the treatment areas, and, in moist spots, formed a complete cover. Beneath this tall herb cover were scattered seedlings and sprouts of species present on the right-of-way before spraying, such as sedge and panic grasses. Small blackberry and sweetfern seedlings also were numerous beneath the fireweed; other formerly prominent shrubs, such as blueberry, were lacking or only found in occasional unsprayed spots. Although it is probable that perennial plants will succeed fireweed in the next few years, the present dominant cover is FIREWEED-Sedge-Grass.

WILDLIFE USAGE OF THE SPRAYED AREAS

Although it is too soon after spraying to determine the ultimate or long time effect of the various brush control techniques on wildlife usage of the areas, certain immediate effects can be described which are of practical interest.

During the first growing season after spraying, June to October, 1953, deer browsed heavily on sassafras sprouts on the right-of-way and but lightly on the other woody plants. The amounts and kinds of woody browse available were greatly reduced by the sprays. However, new shoots of bracken were eaten in moderate amounts along with the abundant herb, loosestrife. Panic grasses also were utilized to a moderate degree.

Direct observations of game species during the first summer after spraying showed that deer were using not only the unsprayed but also the sprayed areas. Rabbit and turkey signs were found both in unsprayed and in sprayed areas.

The intensive observations made by a wildlife technician (8) from October through December of 1953, both in the day and at night, showed a general distribution of game along the right-of-way, table 4. Summarizing the observations, it may be said that deer were seen in at least one replication of each treatment during the fall and early winter after spraying. Rabbits were in a spotty distribution both in sprayed and unsprayed areas. As this species is in a build-up stage and may spread further, not too much weight can be given to its absence from certain areas as yet. The number of groundhog holes on the right-of-way has been increasing in the past two years. Grouse were observed in the woodland edges in at least one replication of all treatments and in the right-of-way proper of all except Treatments B and D. Gray squirrels were found in the edges of both unsprayed and sprayed areas and extended their activities to the center of the right-of-way in a number of cases. Turkeys and turkey signs were seen only in the sprayed areas of the first replication where a flock of 14 birds was observed and a hunter made a kill in a flock of 4 during the hunting season. The only dead or otherwise abnormal animal noted was the one dead rabbit found in June of 1953 in Treatment A before any treatments had been given.

A special technique of observation was used in March and May 1954, when pellet counts were made on the 120 original line transects, (20 in each treatment) which were expanded to strips 3 feet in width for this purpose. Pellets were removed from the transects after each count. Summarized in table 5, the pellet counts indicate that deer were active on all treatments up to March, Treatments B (broadcast

Table 4. — Number of times common wildlife species were observed after spraying on test areas from October through December 1953.

Wildlife Observed	A	B	C	D	E	F	Total
	Unsprayed	Foliage	Oil-water	Summer Basal	Unsprayed	Ammate	
Deer	8	11	30	12	8	9	78
Rabbit	1	4	1	3	1	0	10
Grouse	5	7	3	1	6	2	24
Turkey	0	16	1	1	0	1	19
Squirrel	0	1	3	3	6	6	19
Fox	0	0	1	0	0	0	1
Opossum	0	0	1	0	0	0	1

Table 5. — Average number of pellets per treatment area on 3-by-100-foot strip transects on the electric power line; 20 strips taken in each treatment.

Treatment	March, 1954			May, 1954		
	Deer	Rabbit	Grouse	Deer	Rabbit	Grouse
A—unsprayed	349	101	2	290	84	0
B—broadcast foliage, D+T	112	95	0	195	35	0
C—oil-water, semi-basal, D+T	216	3	0	100	1	0
D—summer basal	391	132	0	191	31	0
E—unsprayed	532	102	0	295	47	0
F—Ammate	165	2	1	139	4	12

foliage), F (Ammate) and C (oil-water) being the least used. Those three treatments also had produced the lowest quantities of woody browse from 1 to 5½ feet in height. Rabbit pellets were found in all areas, but were sparse on Treatments C and F. Grouse pellets were sparse or absent throughout, although birds had been seen in all treated areas.

Pellet counts taken on the same transects on May 1954, table 5, indicated that deer were still using the right-of-way with heaviest usage occurring on the unsprayed areas. Rabbit pellets were found in all areas with the fewest in Treatments C and F. Grouse pellets were found only in the Ammate area.

There is no doubt from the pellet counts that deer, rabbit, and grouse were using the right-of-way after spraying in all treatment areas. There was some evidence that heaviest usage was in the unsprayed areas, which could be expected as more woody browse was present in those areas as winter food and the shrub layer offered good cover. However, the count of pellets in the sprayed areas indicated that they are still being used by game. Data taken in the next two years should indicate how usage tends to level off in relation to the more permanent effects of the treatments.

Table 6. — Recorded (2,3,4,5,6,7) and observed seasonal utilization by common game species of common plants which occurred on the power line right-of-way.

	DEER				GROUSE				TURKEY				RABBIT ^o			
	Sp	Su	F	W†	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W
Herbs and Grasses																
Bracken	L	L	—	—	—	—	H	—	—	—	—	—	—	—	—	—
Sedge	H	L	L	H	—	—	L	L	L	H	L	H	—	—	—	—
Loosestrife	L	L	—	—	—	—	—	—	—	—	—	—	—	L	—	—
Panic grass	L	L	L	L	—	—	L	—	—	L	H	L	—	—	—	—
Fireweed	L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Miscellaneous grasses	—	—	L	L	—	—	L	L	H	H	H	H	—	—	—	L
Strawberry	—	—	—	—	H	H	H	L	—	—	—	—	—	H	L	—
Sheep sorrel	—	—	—	L	H	L	H	L	—	—	L	—	H	H	—	—
Ladies tobacco	H	L	L	H	—	—	L	—	—	—	—	—	—	H	—	—
Shrubs																
Blueberry	H	L	L	H	—	H	H	H	—	H	—	L	L	L	L	H
Teaberry	L	L	L	L	—	—	H	—	—	L	L	L	—	—	—	—
Witch-hazel	L	L	L	H	—	—	H	—	—	—	H	L	—	—	—	L
Blackberry	L	L	L	L	L	H	H	L	—	—	L	L	H	H	H	H
Sweetfern	L	—	L	H	—	—	—	—	—	—	—	—	—	—	—	L
Huckleberry	—	—	—	L	—	L	L	L	L	H	H	H	—	—	—	L
Border Trees																
Bear oak	L	L	L	L	—	—	H	—	H	H	H	H	—	L	—	H
Quercus spp. (fruit)	H	H	H	H	—	—	H	—	H	H	H	H	—	L	—	H

^o Reputed by some authorities to eat nearly every kind of green grass, succulent herb or flowering plant, also cones and shoots of most woody plants.

† Seasons: spring, summer, fall and winter.

An evaluation of the various spray areas for game may be obtained from a comparison of the common plants in table 3 with the reported usage of such species in table 6.

SUMMARY

A replicated series consisting of five spray treatments and one control were applied to woody brush by commercial techniques on a power line right-of-way in central Pennsylvania in June 1953 and January 1954. Data were taken two growing seasons after the first applications (one season for winter basal).

The shrub layer over 3 feet in height had been eliminated by all the sprays through a 94 to 99 per cent complete top kill on all species of woody brush combined. Brush on unsprayed control areas (Treatment A) had grown to 8 feet in height with a 54 per cent cover value, and a BRACKEN-SEDGE-HERB-BLUEBERRY-Grass ground layer under 3 feet in height had developed between the tall brush.

Treatment B (broadcast foliage) after a 94.1 per cent top kill had considerable resprouting (21 per cent) with very few seedlings appearing in the ground layer which was dominated by a SEDGE-GRASS-Herb cover after virtual elimination of bracken and blueberry. This spray gave the best control of sassafras.

Treatment C (oil-water, semi-basal) was the most effective spray of the series. After a 99 per cent top kill, only 8 per cent resprouting occurred and a small number of seedlings were missed. Owing to extensive killing of ground cover by the spray, the dominant cover was changed to FIREWEED-Bracken-Grass-Sedge.

Treatment D (summer basal) produced a 98.9 per cent top kill and was superior in suppression of resprouting (7 per cent resprouting). A tight cover

of low plants was maintained and the dominant cover remained unchanged as BRACKEN-SEDGE-HERB-BLUEBERRY-Grass. Numerous seedlings and small suckers of sassafras were present among the ground cover after spraying.

Treatment E (winter basal) had but one season after application for sprout development. However, it looks promising where sassafras was not abundant in view of a 98.3 per cent top kill and a low resprouting of 5 per cent. One of its major weaknesses was the large number of seedlings (twice as many as in summer basal) that were left after spraying. Its effect on the ground cover was similar to summer basal (D).

Treatment F (Ammate) gave the highest top kill of 99.7 per cent; but had produced the most sprouts two growing seasons after spraying (27 per cent). After an extensive kill of the ground cover, a ground layer of FIREWEED-Sedge-Grass developed. A relatively small number of seedlings and low single sprouts appeared after spraying.

Wildlife usage of the sprayed areas after treatment has indicated that the right-of-way is still attractive to game species and that small game, in particular may be expected to increase as the plant cover develops.

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- (2) Bramble, W. C. and M. K. Goddard. 1953. Seasonal browsing of woody plants by white-tailed deer in the ridge and valley section of central Pennsylvania. *Jour. For.* 51 (11): 815-819.
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- (4) Dalke, P. D. and P. R. Sime. 1941. Food habits of the eastern and New England cottontails. *Jour. of Wildlife Mgt.*, 5 (2): 216-228.
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- (7) Kuhn, Tracy M. 1941. November foods of the ruffed grouse in Pennsylvania. *Pa. Game News* XII (2): 10-11.
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APPENDIX

List of Common and Scientific Names of Plants
Referred to in the Report

From Gray's Manual of Botany, 8th Edition, 1950

Aspen	<i>Populus grandidentata</i>
	<i>Populus tremuloides</i>
Blackberry	<i>Rubus allegheniensis</i>
Blueberries	<i>Vaccinium angustifolium</i>
	<i>Vaccinium vacillans</i>
Bracken	<i>Pteridium aquilinum</i>
Cherry, Black	<i>Prunus serotina</i>
Fire	<i>Prunus pensylvanica</i>
Chestnut	<i>Castanea dentata</i>
Dogwood, Flowering	<i>Cornus florida</i>
False Solomon's-seal	<i>Smilacina racemosa</i>
Fireweed	<i>Erechtites hieracifolia</i>
Gum, Black	<i>Nyssa sylvatica</i>
Hawthorn	<i>Crataegus</i> spp.
Hickory	<i>Carya</i> spp.
Holly, Large-leaved	<i>Ilex montana</i>
Huckleberry	<i>Gaylussacia baccata</i>
Indian Cucumber-root	<i>Medeola virginiana</i>
Juneberry	<i>Amelanchier arborea</i>
Lady's Slipper	<i>Cypripedium acaule</i>
Loosestrife	<i>Lysimachia quadrifolia</i>
Maple, Red	<i>Acer rubrum</i>
Mountain-Laurel	<i>Kalmia latifolia</i>
Oak, Bear	<i>Quercus ilicifolia</i>
Black	<i>Quercus velutina</i>
Chestnut	<i>Quercus prinus</i>
Red	<i>Quercus rubra</i>
White	<i>Quercus alba</i>
Panic grasses	<i>Panicum latifolium</i>
	<i>Panicum commutatum</i>
Sassafras	<i>Sassafras albidum</i>
Sedge	<i>Carex pensylvanica</i>
Sweetfern	<i>Comptonia peregrina</i>
Teaberry	<i>Gaultheria procumbens</i>
Upland Bent	<i>Agrostis perennans</i>
Wild Sarsaparilla	<i>Aralia nudicaulis</i>
Witch-Hazel	<i>Hamamelis virginiana</i>