PRODUCTION AND DEER UTILIZATION OF WOODY BROWSE ON THE JEFFERSON NATIONAL FOREST, VIRGINIA

Introduction

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Wildlife management on National Forest land is accomplished through the joint efforts of the State fish and game departments and the Forest Service. The States are responsible for protection and utilization of the animals and the Forest Service for management of the habitat. Both agencies have a common objective of providing as much quality recreation for hunters, fishermen and other wildlife-oriented groups as the animal-habitat resources can provide at a sustained annual level.

In order to sustain the productivity of understory habitat for white-tailed deer, the Forest Service found it necessary to determine:

(1) The kind and amount of woody browse contributing to the annual food supply of deer.

(2) The environmental influences responsible for producing an adequate supply of acceptable browse in forested areas.

(3) The effects of ecological succession and management practices on the long-term trends in understory conditions for deer, by remeasuring the same plots using the same methods.

These are the three goals of deer range surveys in the Eastern Region of the Forest Service. Initial measurements have been completed on six of the seven National Forests in the Region. This paper deals primarily with the first objective—kind and amount of woody browse the deer are actually eating in relation to what is available—and the results presented here apply to only one National Forest in southwest Virginia.

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Jefferson National Forest

This Forest was established in 1937 under the Weeks Law, and to date about 550,000 acres are in Government ownership. Elevation ranges from 600 feet near Bedford, Virginia to 5,729 feet on Mt. Rogers, the highest point in Virginia. Most of the land lays on lower slopes, upper slopes, and ridge tops in the heart of the Appalachian Mountains which run generally in a northeast-southwest direction. Practically the entire Forest is covered with second growth hardwood and pine. The principal timber types are Oak, Oak-Hickory, Oak-Pine, Cove-Hardwood, and Pine, with scattered areas of Northern Hardwood.

What is now the Jefferson National Forest was devoid of deer at the turn of the century. Fire protection, timber harvest, enactment of game laws, and the cooperative efforts of the Virginia Commission of Game and Inland Fisheries and the U. S. Forest Service set the stage to re-establish deer. A deer stocking program was initiated in 1929 and continued to the early forties. The first deer season was in 1946. Deer populations are presently estimated to range from one deer per 20 acres in some sections to one deer per 200 acres in other sections. The Forest is currently supporting a kill of about 3,000 deer annually.

Survey Procedures

Field work was done during the summers of 1961 and 1962 and consisted of establishing 187 paired plots permanently marked to permit remeasurement. None have been remeasured yet. The plots were laid out systematically over the entire National Forest on the basis of one paired plot per 3,000 acres. Data on browse production and utilization were based on the twig count-twig weight method developed by E. L. Shafer of the Northeastern Forest Experiment Station (1). Further description of the method will not be given here as it can be read in detail in the Journal of Wildlife Management.

Plots consisted of two belt transects two chains apart, and each transect was 50 feet long and 26 inches wide. Twig counts were made in a one-foot to five-foot zone above the ground. Twigs with less than one inch annual growth were not counted. Each twig within the zone was tallied as browsed or unbrowsed, and as seedling or sprout origin. Twig weights by species were established as an independent operation and applied to the twig count data to give results in terms of browse weight actually consumed by deer in relation to the total available.

Browse Production

Forty-six individual species and eighteen species groups of woody plants occurred on one or more of the 187 plots (Tables 1 and 2). Ten species comprised 74 per cent of the total number of twigs produced. Eight of these were non-commercial from the standpoint of timber production. The Vaccinium group ranked first in total number of twigs available, followed closely by Mt. Laurel and then huckleberry. Single species of oak were too sparse to treat individually, but taken collectively they ranked fourth in total number of twigs.

(1) Journal of Wildlife Management, Vol. 27, No. 3, July, 1963.

Ranking species by weight of browse produced (Chart 1)—Mt. Laurel was first, followed by the oak group, greenbrier, and azalea in that order. The Vaccinium group and huckleberry together comprised 26 per cent of the total twigs, yet they made up only 8 per cent of the total by weight. On the other hand, greenbrier made up only 3 per cent of the total twigs but contributed 8 per cent of the total weight. The average for the entire forest was 56,000 twigs per acre, producing 37 pounds of browse (oven dry) available to deer.

Browse Use

Browsing occurred on 54 per cent of the plots. On the forest as a whole, browsing was considered light as only 2.3 per cent of the available twigs were browsed. From this it may be inferred that any individual species which is browsed in excess of this percentage may be considered as being preferred by deer because they are selecting it at a greater rate than would be evident from randomized feeding. Twenty-one species were in this category (Table 1, Col. 3).

Greenbrier would probably rank first in importance if a selection was made on the basis of the 1961-1962 observations. This species contributed 49 per cent by weight of all browse used while making up only 20 per cent of the total by twig count (Chart 2). In supplying this volume, slightly over 16 per cent of the greenbrier twigs were eaten. It also had widespread distribution, occurring on 49 per cent of the plots. Greenbrier (49%) and azalea (11%) together made up 60 per cent of the total weight consumed while accounting for only 26.8 percent of the total twigs consumed. Blueberry and deerberry ranked third and contributed 6 per cent of the volume by weight and 26 per

cent of the total twigs browsed. American chestnut sprouts also made up 6 per cent of the volume by weight while representing 5 per cent of the twigs browsed.

The oaks as a group did not make a substantial contribution to the diet of deer. Oak twigs were fairly abundant (10% of the total) and well distributed over the forest, yet they made up only 2 per cent of all twigs browsed. Taking all oak species as a group only 0.5 per cent of them were browsed. Mt. Laurel and huckleberry, although abundant (25 per cent of the twigs available), were browsed at a rate below the forestwide average.

Use vs. Production

Deer habitat management requires that the food supply be maintained in proper balance with the number of deer occupying the particular range. This makes it necessary to know and understand which plants are most sought after. Deer obviously browse on a variety of plants in any given locality during the course of a year. The fact that more than half of the species of woody plants growing on the Jefferson National Forest were browsed is to be expected. The degree of browsing between species varies significantly to indicate that some species are eaten more readily than others when a choice exists.

Of the species which made up 5 per cent or more of the total twigs browsed, it can be assumed that *greenbrier, sourwood, azalea, dogwood, blueberry,* and *chestnut* are presently the choice species on the Jefferson National Forest (Table 1, Cols. 2 and 3). Rubus, New Jersey tea, Crataegus, white ash, honey locust, and common elderberry are also preferred by deer but they do not occur in sufficient abundance to be considered important in the total diet.

Frequency of occurrence of the preferred species was greatest in the oak type and next greatest in the Oak-Hickory type. Oak-Pine, Cove-Hardwood, Pine, and Northern Hardwood followed in that order (Table 3).

Some Management Inferences

The Jefferson National Forest has no well defined "key areas" such as represented by winter deer yards in the Northern States. This means that range conditions must be assessed through study of indicator species over wide areas rather than adequacy of browse in small areas. The present survey indicates that the six preferred woody plants (greenbrier, sourwood, azalea, dogwood, chestnut, and blueberry) are best suited as indicators of incipient over-populations. All these species are fairly abundant and well distributed throughout the National Forest.

Whitetailed deer, besides browsing on a large number of different woody plants are known to consume a large variety of other foods such as fleshy fruits, acorns, leaves, grasses, and other herbaceous plants, and fungi. These are taken in varying proportions depending upon vailability. No attempt is made in this paper to assess the overall importance of woody browse in the total diet of deer on the Jefferson National Forest, but it is apparent that woody browse probably accounts for a much smaller proportion than was previously suspected. For this reason, carrying capacity related solely to browse production will not be attempted from information gathered during the surveys herein reported.

Some woody species are definitely sought after and other species of questionable value are eaten when readily available. This gives added significance to plant abundance and frequency in range surveys, particularly with species of low palatability when their overall contribution is substantial.

The quantity and quality of food for deer can be improved on the Jefferson National Forest by converting some of the understory from Mt. Laurel and huckleberry to species more acceptable to deer. This can be accomplished through direct wildlife habitat improvement projects or by coordination with timber management operations. Likewise, timber management operations that may adversely affect the choice species should be modified so that conditions for these species will be enhanced.

Timber management operations aimed at stand regeneration should recognize that six choice deer-food plants are non-commercial species for timber production and these should be encouraged to flourish in order to reduce browsing pressure on desirable tree seedlings.

The role of greenbrier as browse for deer as well as food and cover for other wildlife species suggests the desirability of propagating this plant to assure an adequate stocking.

In passing, it should be pointed out that the six choice browse plants are also important food producers for other species of wildlife. The needs of these other species deserve equal consideration in the determination of proper range use by deer.

Adequacy of sample based on twig production was determined by using the formula $\frac{\quad}{SE}^2 = t^2 c^2$

where SE = sampling error
t = factor for probability (2 for probability of 95%)
C = coeffecient of variation (.85)
N = number of plots (187)

The data on 187 plots falls within ± 12½% of the mean using this formula.

Summary

Determination of the production and deer use of woody plants on the Jefferson National Forest has been made by analysis of 187 paired plots. Data on these plots collected during the summer months of 1961 and 1962 show the following:

1. Browse consumption can be expressed either as number of twigs browsed or weight of twigs browsed. There is a significant difference between the two expressions because of the wide variation in twig weights among different species.
2. Forty-six species and 18 species groups occurred on one or more of the 187 field plots. Thirty-four species or species groups showed evidence of browsing, six of which can be considered preferred or choice species.
3. Greenbrier and azalea together made up 60 per cent of the total weight consumed, yet they represented only 26.8 per cent of the total twigs browsed.
4. Non-commercial species comprised 89 per cent of the total twigs that were utilized.
5. Frequency of occurrence of the preferred species was the greatest in the oak type.

JEFFERSON NATIONAL FOREST
DEER BROWSE SURVEY
TABLE 1
BROWSE SPECIES ON 187 PLOTS

Species	Per Cent of All Twigs Produced	Per Cent of All Twigs Browsed	Per Cent of Individual Species Browsed	Per Cent Frequency Occurred
	Col. 1	Col. 2	Col. 3	Col. 4
Blueberry-Deerberry	16.3	25.9	3.7	55.6
Greenbrier	3.0	20.2	16.3	49.2
Azalea	4.4	6.6	3.5	29.4
Flowering Dogwood	4.1	6.5	3.7	34.2
American Chestnut	4.9	6.1	2.7	50.3
Sourwood	2.4	5.8	6.1	26.2
Black Gum	3.9	4.1	2.5	52.4
Huckleberry	10.5	6.3	1.5	21.4
Red Maple	2.2	1.8	2.0	47.6
Hawthorn	0.2	1.0	12.1	3.7
Grape	0.4	0.8	4.6	16.6
Hickory spp.	0.6	0.6	2.4	25.7
White Ash	0.1	0.5	8.1	4.3
Alder	0.7	0.4	1.4	3.2
Black Birch	0.3	0.4	2.9	4.3
Honey Locust	*	0.4	83.3	1.1
Witch Hazel	1.7	0.4	0.6	26.2
Tulip Tree	0.2	0.4	6.0	5.3
Elderberry	*	0.4	31.2	1.1
New Jersey Tea	*	0.3	17.3	1.6
Rose spp.	0.2	0.3	3.3	1.1
Juneberry	0.4	0.2	1.0	10.7
Sriped Maple	0.6	0.2	0.9	5.3
Ironwood	0.9	0.2	0.6	13.9
Black Locust	0.4	0.2	1.3	15.5
Oak ssp.	9.7	2.2	0.5	82.9
Mountain Laurel	15.0	1.8	0.3	47.1
Sub-total	74.2	85.5		
Raspberry-Blackberry	0.8	2.8	8.0	5.3
Sassafras	2.3	2.6	2.7	65.8
Viburnum spp.	0.9	0.2	0.6	11.8
River Birch	*	0.1	5.0	1.6
Chinquapin	0.4	0.1	0.5	5.3
Sumac spp.	*	0.1	6.2	1.1
Rhododendron	3.8	0.1	*	19.3
All Species	91.3	100%	2.3	

* Less than 0.1%

JEFFERSON NATIONAL FOREST

DEER BROWSE SURVEY

TABLE 2

UNBROWSED SPECIES ON 187 PLOTS

Species	Per Cent of Total Twigs Produced	Per Cent Frequency Occurred
Sugar Maple	0.4	4.3
Mountain Maple	*	1.6
Sweet Buckeye	*	1.1
Yellow Birch	*	1.6
Coast Pepperbush	*	0.5
Red Bud	0.6	3.2
American Hazelnut	0.1	1.6
Beaked Hazelnut	*	0.5
Burning Bush	*	0.5
Beech	0.8	3.2
Hydrangea	0.2	1.6
Holly spp.	0.1	1.1
Butternut	*	0.5
Spice Bush	0.5	3.2
Lespedeza spp.	*	0.5
Cucumber Magnolia	*	3.2
Virginia Creeper	*	2.1
Shortleaf Pine	0.1	0.5
Pitch Pine	0.2	4.8
White Pine	0.8	7.5
Virginia Pine	0.3	4.8
Cherry spp.	0.2	3.2
Purple Chokeberry	1.8	7.0
Oilnut	0.7	6.4
Poison Ivy	0.1	1.6
Gooseberry	0.1	1.1
Mountain Ash	*	0.5
Snowberry	*	1.1
Basswood	0.2	1.6
Hemlock	1.1	5.9
	8.3	

* Less than 0.1%

JEFFERSON NATIONAL FOREST

DEER BROWSE SURVEY

TABLE 3

DISTRIBUTION OF PREFERRED BROWSE PLANTS BY FOREST TYPE BASED ON OCCURRENCE WITHIN PLOTS

Species	(Per Cent)) Oak (70 plots)	Oak-Hickory (39 plots)	Oak-Pine (38 plots)	Cove-Hardwood (29 plots)	Pine (8 plots)	Northern Hardwood (3 plots)	All Types (187 plots)
Blueberry	22.5	8.6	19.1	3.7	2.7	-	55.6
Greenbrier	15.5	13.9	10.2	6.9	2.7	-	49.2
Azalea	20.9	3.7	2.1	2.7	-	-	29.4
Dogwood	8.0	10.8	6.9	8.0	0.5	-	34.2
Chestnut	22.0	13.4	8.0	4.8	1.6	0.5	50.3
Sourwood	11.6	5.7	4.2	3.7	1.0	-	26.2
Relative Ranking by Types	1	2	3	4	5	6	

TABLE 4

PLANTS LISTED IN THIS PAPER

	Common	Scientific Name
1.	**Striped Maple**	Acer pennsylvanicum
2.	Red Maple	Acer rubrum
3.	Sugar Maple	Acer saccharum
4.	Mountain Maple	Acer spicatum
5.	Sweet Buckeye	Aesculus octandra
6.	Alder	Alnus spp.
7.	Juneberry	Amelanchier canadensis
8.	Black Birch	Betula lenta
9.	Yellow Birch	Betula lutea
10.	River Birch	Betula nigra
11.	Hickory	Carya spp.
12.	American Chestnut	Castanea dentata
13.	Chinquapin	Castanea pumila
14.	New Jersey Tea	Ceanothus americanus
15.	Red Bud	Cercis canadensis
16.	Coast Pepperbush	Clethra alnifolia
17.	Flowering Dogwood	Cornus florida
18.	American Hazelnut	Corylus americana
19.	Beaked Hazelnut	Corylus cornuta
20.	Hawthorn	Crataegus spp.
21.	Burning Bush	Euonymus atropurpureus
22.	Beech	Fagus grandifolia
23.	White Ash	Fraxinus americana
24.	Huckleberry	Gaylussacia spp.
25.	Honey Locust	Gleditsia triacanthos
26.	Witch Hazel	Hamamelis virginiana
27.	Hydrangea	Hydrangea spp.
28.	Holly	Ilex spp.
29.	Butternut	Juglans cinera
30.	Mountain Laurel	Kalmia latifolia

31.	Lespedeza	Lespedeza spp.
32.	Spice Bush	Lindera benzoin
33.	Tulip Tree	Lirodendron tulipifera
34.	Cucumber Magnolia	Magnolia acuminata
35.	Black Gum	Nyssa sylvatica
36.	Ironwood	Ostrya virginiana
37.	Sourwood	Oxydendrum arboreum
38.	Virginia Creeper	Parthenocissus quinquefolia
39.	Shortleaf Pine	Pinus echinata
40.	Pitch Pine	Pinus rigida
41.	White Pine	Pinus strobus
42.	Virginia Pine	Pinus virginiana
43.	Cherry	Prunus spp.
44.	Oilnut	Pyrularia pubera
45.	Purple Chokeberry	Pyrus floribunda
46.	Oak	Quercus spp.
47.	Rhododendron	Rhododendron maximum
48.	Azalea	Rhododendron spp.
49.	Poison Ivy	Rhus radicans
50.	Sumac	Rhus spp.
51.	Gooseberry	Ribes spp.
52.	Black Locust	Robina pseudo-acacia
53.	Rose	Rosa spp.
54.	Raspberry-Blackberry	Rubus spp.
55.	Elderberry	Sambucus canadensis
56.	Sassafras	Sassafras albidum
57.	Greenbrier	Smilax spp.
58.	Mountain Ash	Sorbus americana
59.	Snowberry	Styrax abassia
60.	Basswood	Tilia americana
61.	Hemlock	Tsuga canadensis
62.	Blueberry-Deerberry	Vaccinium spp.
63.	Viburnum	Viburnum spp.
64.	Grape	Vitis spp.

Chart I.
Woody Plants Available To Deer (Production)

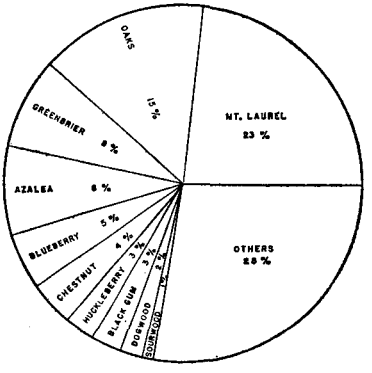

Figure a

Percent of total by
Twig Weight

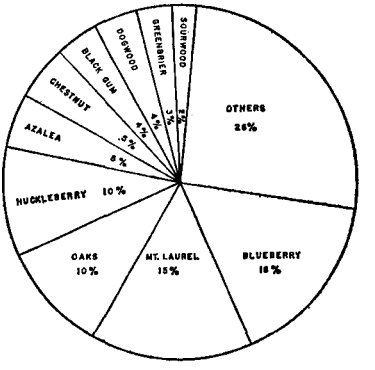

Figure b

Percent of total by
Twig Count

Chart II.
Woody Plants Browsed By Deer (Use)

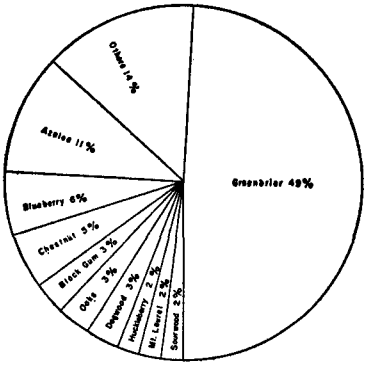

Figure a.

Percent of Total
by Twig Weight

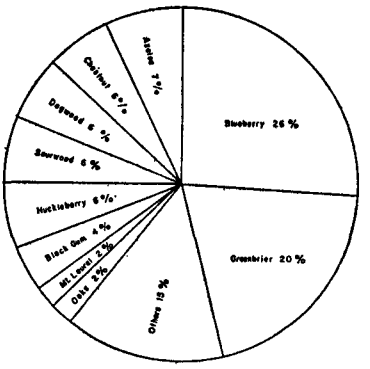

Figure b.

Percent of Total
by Twig Count

AN ELECTRICALLY ACTUATED RELEASE MECHANISM FOR DROP-NETS

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Abstract

An electrically actuated release mechanism for drop-nets has been designed and tested in Oklahoma. During a three-year testing period 1015 Rio Grande Turkeys have been trapped with drop-nets utilizing this improved release mechanism. Anvantages of the improved release mechanism over the mechanical release types are: (1) The net can be dropped by the operator from an extended distance and from any direction; (2) The mechanism is not adversely affected by rain,

ice, or snow; (3) The mechanism does not require daily adjustment; (4) The mechanism will support the extreme weight and stress of a seventy by seventy foot net.

INTRODUCTION

Drop-nets have been used successfully by the various Conservation Agencies for a number of years. An adequate description of the design and operation of these nets and release mechanisms has been published by several researchers (Jacobs, 1957), (Glazner, Gottem, Jackson 1964) and (Ellis 1961). Therefore a comprehensive description of the general technique will not be included here. The drop-net technique has evolved as the most efficient method of capturing several species of game birds, particularly the Rio Grande Turkey.

Although the efficiency rating of the mechanically actuated drop-net was good, one segment of the mechanism still contributed to a host of problems and malfunctions. The mechanical "trigger" or release mechanism was complicated, difficult to erect and operate, inoperable during freezing rain, sometimes released only part of the net, sometimes accidentally released during periods of high winds, was sensitive and required daily adjustment. The need for improvement of the release mechanism was self-evident. A literature search in April, 1961 did not reveal any "trigger" design that was substantially more efficient or dependable than the one then in common use.

Summary and Conclusions

A concerted effort was made during the summer of 1961 to design, fabricate and test various experimental types of release mechanisms. All experimental models would be tested against the following specifications: (1) Must be simple to operate, (2) Must be capable of functioning after being exposed to freezing rain, (3) Must be capable of suspending and releasing a minimum of three hundred pounds, (4) Must be stable to eratic pulls such as would be produced by a seventy foot net during a forty mile per hour wind, (5) Must be capable of dropping a net instantaneously at all points of suspension, (6) Must be stable and not require daily adjustment and (7) Must permit the operator to drop the net from any direction and with a distance tolerance of zero distance to two hundred yards.

Several models of release mechanisms were designed, built and tested, utilizing an electric solenoid. These models worked well except that the available solenoids were not capable of releasing more than one hundred pounds, even when an extensive system of levers and cams were added to the system. The only source of electrical current available at a trap-site would probably be limited to a twelve volt automotive circuit. It was determined after initial testing with available twelve volt solenoids that this release mechanism was not workable.

Mechanical systems utilizing manual control were designed and tested. All of the systems tested did not show substantial merit over the systems in present use and were abandoned.

A third system was designed, built and tested. This mechanism was fired electrically and utilized expanding gases from a black powder electrical squib to actuate the system. This system met all seven of the specification requirements during laboratory testing and was therefore ready for field testing during the 1961-62 turkey trapping period. Trapping normally proves to be best during December, January and February. The newly designed release shackle was field tested during three successive trapping seasons.

The net was dropped thirty-one times during the three trapping periods. Two malfunctions occurred during this period and both were caused by a broken wire in the firing circuit between the power source and the net. A total of 1015 turkeys were trapped for transplanting purposes during the course of the study.

DROP-NET SUSPENSION
AND
WIRING DIAGRAM

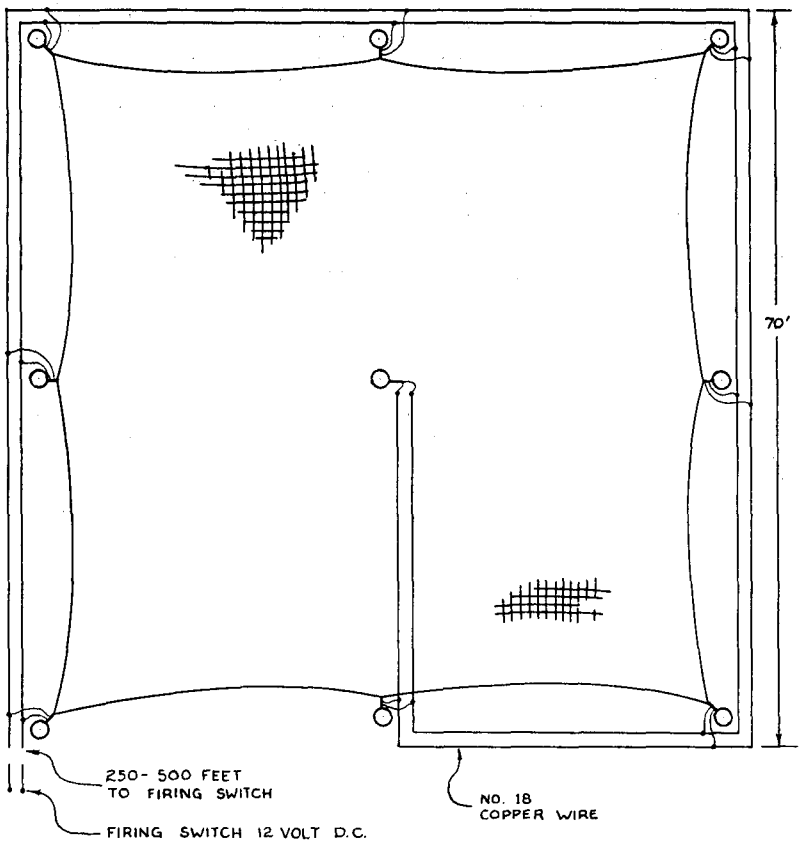

FIG. 1

When utilizing this system, the net is suspended six feet above the ground by eight perimeter posts. The center of the net is suspended ten feet above the ground by one center post. A release shackle connects the net to each of the nine posts. (Figure 1). Each shackle is wired parallel to a twelve volt direct current electrical circuit (Figure 1. Suspension and wiring diagram.).

The trapper utilizes a pickup truck or other vehicle for a blind and an electrical power source during trapping activities. The blind, or vehicle is usually located from 250 to 500 feet from the net.

DROP-NET SUSPENSION AND RELEASE ASSEMBLY

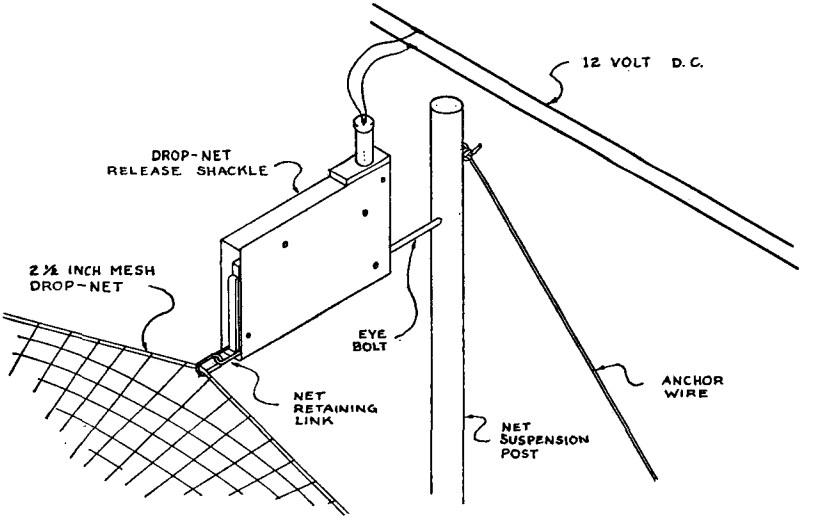

FIG. 2

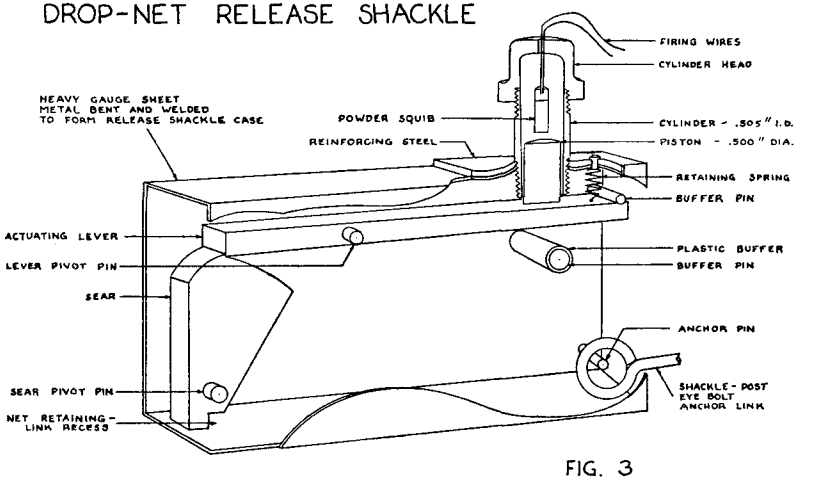

FIG. 3

When a desirable group of birds comes under the net, the trapper closes the twelve volt circuit; therefore, firing the *powder squibs* (Figures 2 & 3). The expanding gases force the piston downward, thus pivoting the *actuating lever* which disengages the *sear*. The disengaged

sear pivots from the force of the net-pull permitting the *net retaining-link* to disengage from the *net retaining-link recess*. The net is then free to fall by force of gravity. In most instances during this study, rubber boosters were attached to the net perimeter at each shackle connection and then stretched to the base of the suspension post and attached there to an eye-bolt. These boosters snap the net downward much faster than would the force of gravity by itself. The rubber then holds the net close to the ground after the "drop", permitting fewer birds to escape around the perimeter than would normally escape if no boosters had been used.

Advantages of the electrically-fired release shackle over the mechanically actuated mechanisms used prior to this development are:

1. Eliminates daily adjustment prior to expected "drop".
2. Ease of firing will permit utilization of larger and heavier nets.
3. Ice and snow will not malfunction the shackle when it is protected by a plastic wrapper.
4. Permits the trapper to drop the net from any direction and over obstacles or steep terrain.

Since this mechanism has proven itself to be superior to the mechanical system, it is therefore recommended for general field use. The mechanism is simple to fabricate at a cost of approximately eight dollars per unit, or seventy-two dollars per set of nine.

Acknowledgements

Appreciation is extended to Mr. Charles O. Gilliam for his help during the fabrication and testing phase of this work and to Mr. Paul Mace for providing the line-drawings in this paper.

Recommendations for Further Study

This system appears to be adaptable to actuation by radio signals. It seems logical that a dry cell battery could be located at the net-site to furnish power for the radio receiver and firing of the black powder squibs. This system would enable the trapper to actuate the system from a much greater distance than is now possible. It would give the trapper much more freedom of movement and he would not be compelled to remain in one stationary place of concealment prior to dropping the net.

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