PRELIMINARY REPORT OF RESEARCH CONDUCTED IN THE HURON MOUNTAIN CLUB HEMLOCK - HARDWOOD DEER YARD

SUBMITTED BY JOHN HENDRICKSON

JUNE 20, 1969

INTRODUCTION

The white-tailed deer (Odocoileus virginianus) is an animal of economic and esthetic value. Laws enacted to protect deer and the development of favorable habitat following the large lumbering operations of the late nineteenth and early twentieth centuries have allowed deer populations to rise to a high level. At the present, favorable habitat is rapidly being destroyed, and the habitat created by lumbering is, in many areas, growing into mature forests. These problems are forcing biologists to study limiting factors of deer populations so, through control, deer populations can be maintained at a level high enough to satisfy sportsmen yet low enough not to exceed the limiting factors.

In areas such as Minnesota, Maine, Wisconsin, and northern Michigan the winters are severe and marked by low temperatures and deep snow. The advent of inclement winter weather causes whitetails to seek cover in an area that provides a maximum of physical comfort. This "yarding" is vital to the over-winter survival of whitetails along the northern edge of their range. Verme (1965) states that while conifer swamps are preferred wintering areas of northern Michigan whitetails, they usually avoid sites where shelter is inadequate even though browse may be plentiful.

Although conifer swamps seem to be preferred wintering sites, there are regions which provide adequate protection for reasons other than the dense cover provided by a mature swamp conifer stand. Such an area is a "hemlock-hardwood" yard located in the Huron Mountain Club, northern Marquette County in the Upper Penninsula of Michigan. Shelter in this yard appears to be a result of the moderating effects of Lake Superior.

This type of yard would appear to differ not only in cover composition

from a commercial conifer yard, but also in regard to browse production and utilization, snow conditions, deer movement, and various microclimatic conditions. The objectives of my research are:

DESCRIPTION OF THE STUDY AREA

The Huron Mountains are a range of granite hills rising a maximum 1,518 feet above sea level or 916 feet above the level of Lake Superior (Smith, 1929). The deer yard is in a fringing area one to four miles wide lying between the base of the mountains and Lake Superior.

The study area is located within the Huron Mountain Club located approximately ten miles west of Big Bay in northern Marquette County in the Upper Penninsula of Michigan (Map 1). At the time of maximum concentration the deer yard comprises an area from the base of the Huron Mountains to the shore of Lake Superior, west of Howe Lake to the Little Huron River, and east to Conway Lake (Map 1).

The yard can be subdivided into three different regions according to cover type. The predominant cover is a hemlock-hardwood type. There is a cedar swamp region and also a red pine, jack pine habitat that was used extensively by the deer.

As one can see from the map this is a large yard. In order to save time and for convenience most studies were conducted in an area encompassing Pine Lake, Rush Lake, and Jensen's swamp. The three different cover types are represented in this area.

In the hemlock-hardwood part of the yard, hemlock (Tsuga canadensis) is interspersed with red maple (Acer rubra), sugar maple (Acer saccharum), yellow birch (Betula lutea) and the important browse species striped maple (Acer pensylvanicum). Red pine (Pinus resenosa), jack pine (Pinus banksiana) and some oak (Quercus rubra) comprise another area. The swamp area contains cedar (Thuja occidentalis), tag alder (Ulnus incana) and hemlock. This is by no means a complete description of cover species found within the yard. A study of the cover and understory species has not been

conducted, so I have no quantitative data.

There has not been extensive lumbering in the Huron Mountain Club. Most of the forest lands have had only the White pine removed and this was done early in this century. In certain areas north of Rush and Howe Lakes and around Conway Lake more extensive cutting has been conducted. At the present these areas have the greatest concentration of deer within the yard.

The climate is characterized by great fluctuations between summer and winter temperatures. The average January temperature is approximately 17-18° F. and the average July temperature is approximately 65° F.

The climate of Michigan is greatly influenced by the large bodies of water surrounding the state. Wills (1941) states that narrow bands extending along the shores of Lakes Superior and Michigan have a modified marine climate most of the year. The lakes seldom freeze over entirely, their temperatures remaining above freezing in the coldest weather. The north and northwest winds are considerably tempered in severity as they pass over the warmer waters. In this way the temperature of the cold air may be raised as much as 20° F so that areas immediately along the south shore of Lake Superior do not experience the severe cold that prevails farther inland.

SNOW CONDITIONS

At some significant depth and at a certain degree of fluffiness, snow becomes a mechanical obstacle hindering the movement of animals. This hindering of movement depends not only on the peculiarities of snow cover e.g. its supporting ability, or in other words its resistance to compaction, but also on height, weight, and also morphology of the extremities of certain organisms (Formozov, 1946).

Verme (1968) states that two climatic factors, cold weather and snow pack conditions, cause the greatest physical hardship upon deer during the winter. Deer expend great amounts of energy if they have to struggle through deep soft snow to get food.

Snow depth and "snow compaction" readings were taken at random spots within the deer yard and at various points outside of the yard. Readings were also obtained from the Michigan Department of Natural Resources.

Snow compaction readings were taken with a snow compaction guage described by Verme (1968). The guage consists of a two foot length of copper tubing having an inside diameter of one inch. Molten lead was then poured into the tube to give a total weight of three pounds. A short cord was attached through holes drilled at the top of the tube so it could be plumbed during tests. The tube is marked in gradations of tenths of feet.

To use the snow compaction guage it is lowered until its base just touches the snow and then released. The distance it drops represents the support factor of the snow from a vertical force of about 3 lbs. per square inch. Verme reported that, in use, the distance deer sank and the distance the guage dropped were quite similar.

TEMPERATURE AND WIND CHILL

Deer receive protection from low temperature and wind chill within a deer yard. Under cover of a forest temperatures may be 2° F warmer than in the open. Robinson (1961) observed significant temperature differences between open habitat and dense habitat. Ozoga (1968) found that wind flow in a dense conifer stand was only a small fraction of that blowing through an opening. In this particular yard temperatures are also moderated by the proximity of Lake Superior.

Due to a lack of equipment, no temperature or wind chill readings were taken in the winter of 1968-69. However, I feel a good comparison could be made by comparing temperatures in Marquette and those of the County airport and relating this to temperatures within the yard and at some inland point of higher elevation.

A couple of recording thermographs would be helpful.

DEER MOVEMENT

Three aspects of deer movement are being studied. These are: (1) factors leading to concentration of deer in the yard, (2) movement of deer within the yard, and (3) factors leading to dispersal of the deer. Hopefully a fourth factor can be studied. I am attempting to determine the total range of the deer in an attempt to discover how large an area the deer come from.

Low temperature and/or snowfall seem to be signals for deer to start moving toward their winter yards. Hamerstrom and Blake (1939) felt that an average weekly temperature of 20° F started deer moving toward the yard.

Bartlett (1950) found that deer in Michigan sought shelter when snow depths reached 12 inches. In the Huron Mountain Club deer were in the yard before there was snow on the ground.

To better study the movement of deer within the yard, and in hope of learning where these deer come from, I initiated a collaring program to tag the deer. I obtained deer collars from District Game Biologist Dick Aartila and began collaring in February 1969. The collars are an automatic tagging device designed and described by Louis J. Verme (1962).

The device is basically a snare modified to include a collar which locks securely about the animal's neck. The snare is designed so that when the collar is secured the animal may pull free from the anchor. The collar bears a numbered tag for identification (Fig. 1).

The collars were set along well used runways and hung between two closely spaced trees (Fig. 2). The lowest point of the snare was about 15" above the ground. The anchor wire was filed about halfway through near the tip of the snap. This allowed the deer to pull free after being

snared. After the anchor wire is filed, its free end is inserted through the collar ring to form a noose. The anchor wire was moored by driving a nail into a tree and then wrapping the anchor wire around the nail.

Different colored collars were used in different parts of the yard. 23 green collars were put out around Pine Lake and 25 red collars were put out west of the skeet range.

As another indication of movement within the yard, I correlated single vs. multiple tracks with snow depth. Tracks crossing the Howe Lake road were counted while driving the snowmobile. Only tracks crossing the road were counted since after several trips up and down the road the snow became packed and deer used the snowmobile tracks as a runway. When the number of multiple tracks is greater than the number of single tracks the deer are utilizing packed trails rather than wandering about on their own.

Deer movement also seems to be related to browse utilization. As preferred browse is used up the deer move into areas where starvation browse (red pine, jack pine) abounds. It appears the deer would rather eat this than nothing at all.

I also correlated dispersal of the deer with temperature and snow depth.

Figure 1

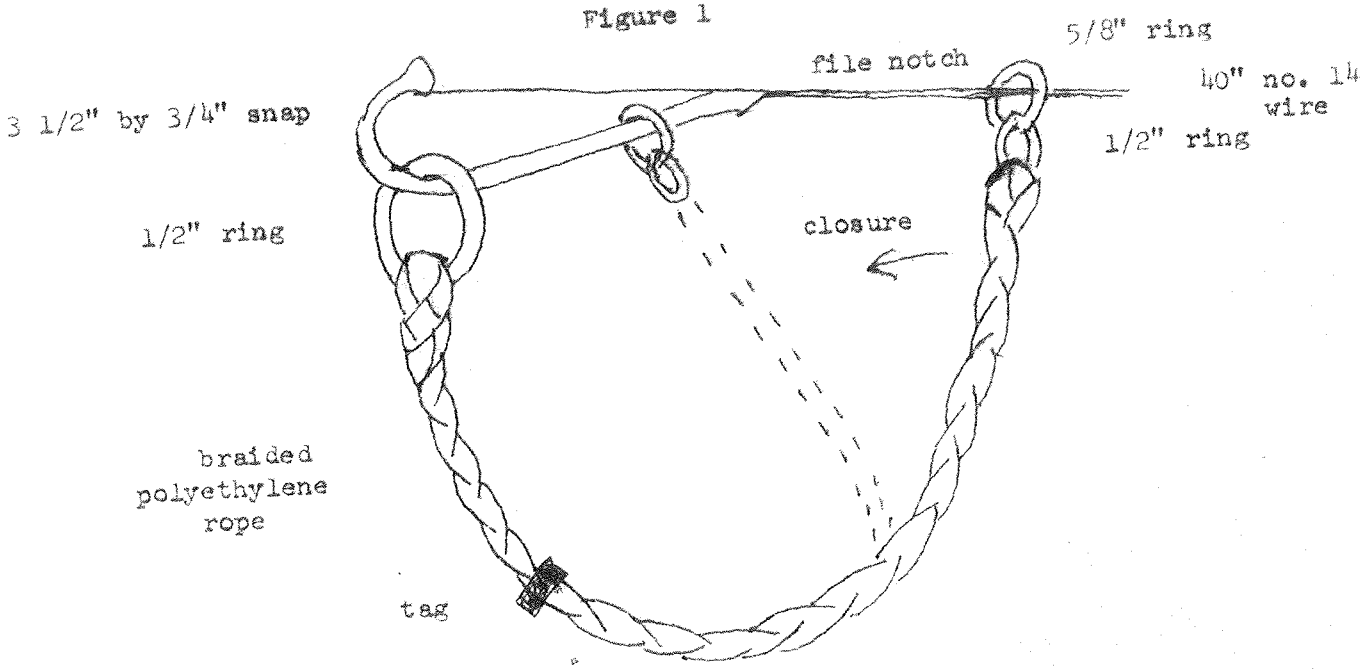
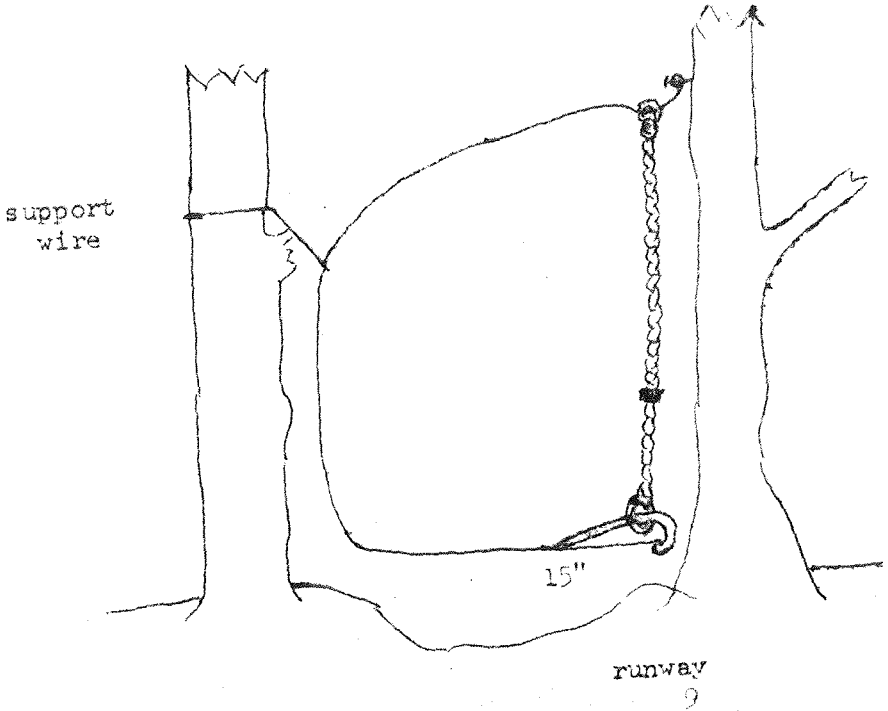


Figure 2



DEER BEDDING

Severinghaus (1963) found that when deer yard they seek areas of heavy cover that provides them maximum physical comfort. Robinson (1960) has shown that penned deer are sensitive to winter weather and bed in niches which provide the most favorable microclimate available.

Deer beds were analyzed by the point quarter method in an attempt to see if bed selections were random or were selected by the deer because of density of cover.

Because of a lack of equipment, no actual microclimate measurements were made.

BROWSE PRODUCTION AND UTILIZATION

Browse utilization was measured by Alton Westover in 1968-1969. All species of browse, utilized and not utilized, were measured in randomly selected plots. The plots were 2' wide x 10' long x 6' high. All browsed twigs were counted and then all unbrowsed twigs were counted, clipped, and weighed. This information enabled him to compute the percentage browse utilized, total browse removed and theoretical total browse (Table I).

Since there has been little lumbering in the Huron Mountain Club the hemlock - hardwood forest appears to be an even-aged stand. The forest floor is open and parklike. The mature forest stand and dense canopy allows little light to reach the forest floor so growth of an understory is impeded. The browse that does occur appears to be clumped and not randomly dispersed. The browse is found in small clearings or along roads.

In December, at the start of the yarding period, browse production was very low - only 10.7 lbs. per acre. By March 80-100% of most palatable browse had been utilized. Because of the low production, high utilization, and high population in the yard many cases of starvation could be expected.

TABLE I
(cont.)

	% Utilized	Total Browse	Total Browse Removed
Striped Maple *Acer pensylvanicum*	83%		
Red Maple *Acer rubra*	88%		
Sugar Maple *Acer saccharum*	89%		
Hemlock *Tsuga canadensis*	present but dead		

DEER MORTALITY

Through the course of the 1968-69 winter, 20 dead deer were reported (Table II). Westover and I found 4, club guards reported 4, Stuart Bennet found 8, Ralph Howell 1, and John Voght 3. Of these deer 12 had starved, 2 drowned, and cause of death was unknown for 6. These finds were not the result of an organized search but were more or less by chance. Also, one deer that was near death was run down on foot, caught and then released. This deer was in an advanced stage of malnutrition. It had lost control of its hind quarters and fell several times during the chase even though the surface on which it was running was firm.

Other instances of deer mortality were reported but details such as age, sex, cause of death, and date of death were not known so these deaths were not recorded.

RECORD OF DEAD DEER FOUND IN 1969
(Map Number One)
TABLE II

1.	2-1-69	**Location:** Jensen's Swamp **Found by:** J. Hendrickson **Cause of death:** starvation	**Sex:** **Age:**	Male Fawn
2.	2-8-69	**Location:** south side Pine Lake **Found by:** A.J. Westover J. Hendrickson **Cause of death:** unknown	**Sex:** **Age:**	Unknown Unknown
3.	2-15-69	**Location:** behind Johnson's residence **Found by:** A.J. Westover J. Hendrickson **Cause of death:** starvation - marrow fat content - less than 5%	**Sex:** **Age:**	Male Fawn
4.	2-12-69	**Location:** Pine Lake boathouses **Found by:** club guards **Cause of death:** drowned	**Sex:** **Age:**	Female Unknown
5.	2-12-69	**Location:** middle of Pine Lake **Found by:** club guards **Cause of death:** malnutrition (starvation - marrow fat content - less than 5%)	**Sex:** **Age:**	Male Fawn
6.	2-12-69	**Location:** mountain stream **Found by:** club guards **Cause of death:** unknown	**Sex:** **Age:**	Unknown Unknown
7.	2-12-69	**Location:** on road, Pine River bridge **Found by:** R. Howell **Cause of death:** starvation - marrow fat content - less than 50%	**Sex:** **Age:**	Male Fawn
8.	4-8-69	**Location:** white gate on Pine Lake **Found by:** J. Hendrickson **Cause of death:** unknown	**Sex:** **Age:**	Unknown Unknown
9.	4-5-69	**Location (approx.):** east of club compound **Found by:** club guard **Cause of death:** unknown	**Sex:** **Age:**	Unknown Unknown
10.	3-30-69	**Location:** club road, old farm **Found by:** A.J. Westover J. Hendrickson **Near Death**	**Sex:** **Age:**	Unknown Fawn

Deer Found by Stuart Bennet

11.	_____	Location: north end Conway Lake Found by: S. Bennet Cause of death: starvation	Sex: Age:	Male Unknown
12.	_____	Location: north end Conway Lake Found by: S. Bennet Cause of death: starvation	Sex: Age:	Male Fawn
13.	_____	Location: north and Conway Lake Found by: S. Bennet Cause of death: starvation	Sex: Age:	Male Fawn
14.	_____	Location: south end Conway Lake Found by: S. Bennet Cause of death: drowned	Sex: Age:	Unknown Unknown
15.	_____	Location: south end Conway Lake Found by: S. Bennet Cause of death: starvation	Sex: Age:	Female Fawn
16.	_____	Location: west side Conway Lake Found by: S. Bennet Cause of death: starvation	Sex: Age:	Male Fawn
17.	_____	Location: west side Conway Lake Found by: S. Bennet Cause of death: starvation	Sex: Age:	Unknown Unknown
18.	_____	Location: west side Conway Lake Found by: S. Bennet Cause of death: starvation	Sex: Age:	Male Fawn
19.	4-15-69	Location: cuttings, west of Conway Lake Found by: J. Voght Cause of death: unknown	Sex: Age:	Female Adult
20.	4-15-69	Location: east end Howe Lake Found by: J. Voght Cause of death: starvation - marrow fat content - less than 5%	Sex: Age:	Male Fawn
21.	3-15-69	Location: Jensen's Swamp Found by: J. Voght Cause of death: unknown	Sex: Age:	Female Adult

RESULTS: SNOW CONDITIONS

The first lasting snowfall in the deer yard in the 1968-69 winter occurred about November 19, 1968. Snow depth increased to a maximum of 2.0 to 2.2 feet by mid-February. The snow cover had completely melted by April 19, 1969.

The United States Weather Bureau at Marquette reported that snowfall for the months of December 1968, and January 1969, were unusually heavy. The total snowfall for the month of December was the heaviest since 1910 and the third heaviest on record. The total snowfall for January was the fourth heaviest in the last forty years.

Snow depth readings taken at Five-Forks near the Salmon-Trout River were obtained from the Department of Natural Resources. This spot is not in the deer yard but is in the fringing area between the Huron Mountains and Lake Superior. By November 20, 1968, there was 8" of snow on the ground. A maximum depth of 31" was reported on January 10, 1969. The snow cover had melted by April 16, 1969 (Table III).

Several snow depths were reported from the Yellow Dog Plains during the winter. This area is at a high elevation about 9 miles south of the deer yard. It is believed deer from this area winter in the club yard. In late March, W. L. Robinson reported 5" of snow on the ground. On March 29, Harold Harju reported 4'6" of snow cover. On April 28, 1969, Robinson reported there was still snow on the Plains. By May 11, 1969, it was reported that all the snow had melted and the first deer track was seen on the Plains.

Snow compaction readings reached a minimum value of 0.6' in late January. This was due to a January thaw which caused a thick crust to form

on the snow. The compaction readings went up to .8' in February as more snow fell on the snow crust. It wasn't until late March that the crust deteriorated and allowed the compaction guage to pass through. The last of March and the first week in April the guage would drop to the ground so compaction readings were equal to the snow depth.

MAXIMUM SNOW DEPTHS FOR NOVEMBER - APRIL 1968-69
TABLE III

November, 1968 - November 20 - 8"

December, 1968 - December 31 - 22"

January, 1969 - January 10 - 31"

February, 1969 - February 13 - 27"

March, 1969 - March 21 - 28"

April, 1969 - April 1 - 20"

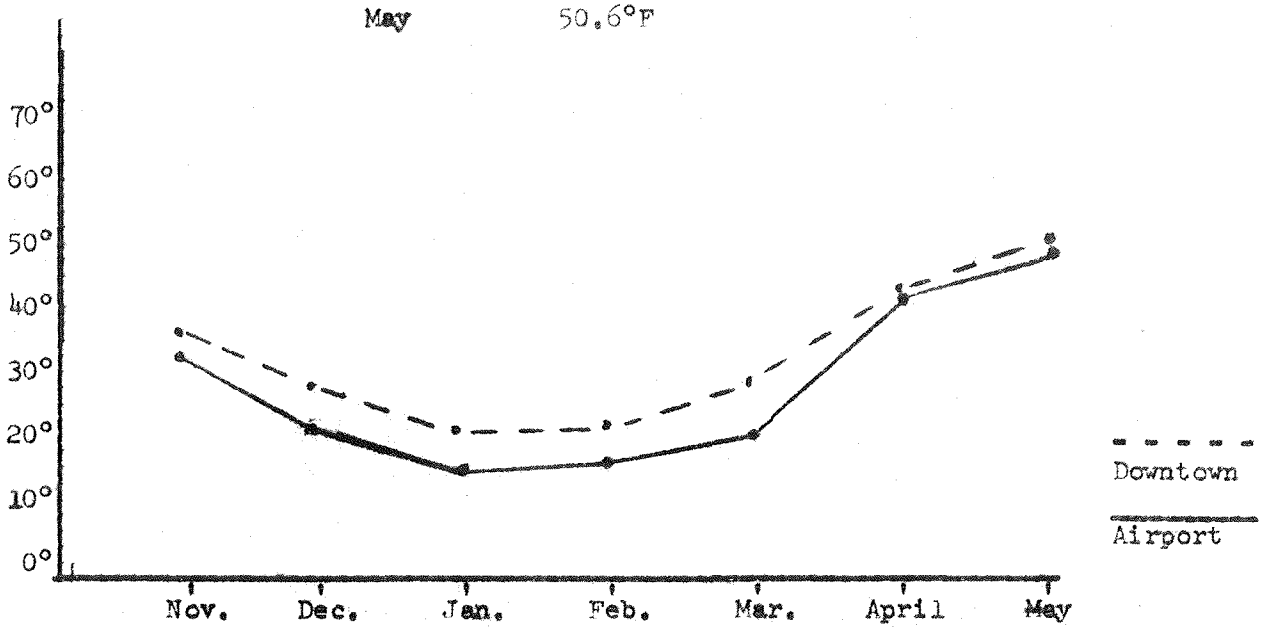
AVERAGE MONTHLY TEMPERATURES
TABLE IV

Downtown Marquette

November	35.0°F
December	24.1°F
January	21.3°F
February	22.6°F
March	25.6°F
April	41.8°F
May	51.9°F

Marquette County Airport

November	30.8°F
December	20.0°F
January	16.9°F
February	17.2°F
March	19.9°F
April	41.7°F
May	50.6°F



RESULTS: DEER MOVEMENT

I first observed deer in the yard on November 19, 1968. This was the first trip to the yard for me and concentration had already occurred. This was about the time of the first major snowfall of the winter so the deer had moved into the yard before there was a snow cover. The average minimum temperature for the week preceding November 19, was 27°F. The average minimum terperature for the next preceding week was also near 27°F. But the last 3 days of October and the first 4 days of November averaged 38°F. At this time deer were dispersed about the yard to a greater extent than would be observed later in the winter.

As snow depth increased and available browse decreased, the deer became concentrated in two main areas of the yard. One area north of Rush Lake extends to the shore of Lake Superior, includes Jensen's swamp and continues around the shores of Pine Lake. The second area is around Conway Lake. Deer could be found most anywhere in the fringing belt between the Huron Mountains and Lake Superior but these two areas had the heaviest concentrations.

By January 31 the snow depth on the fringes of the yard had reached its maximum depth of 31". The deer had concentrated in the hemlock-hardwood area north of Rush Lake and in Jensen's swamp. The number of multiple tracks exceeded the number of single tracks by February 15 (Table V) indicating the deer no longer found it advantageous to leave well worn trails to browse. Westover reported that by February 8, 81% of the striped maple, 100% of the red maple, 62% of the sugar maple, and 100% of the hemlock had been utilized. On January 31 deer were observed browsing spruce in the hemlock-hardwood area. By the end of February the browse line had

reached 6' on the spruce near the skeet range.

During this period the frequency of deer observed in the unfavorable red pine - jack pine area increased. Previous to this several trails had been noted in this habitat but there was no indication of extensive browsing or other activity that would lead one to believe this area was being heavily utilized. Now there was evidence of much browsing on the red pine and jack pine along the road to the skeet range. Spruce, red pine, and jack pine are a starvation diet for deer. It appears that when the preferred browse was utilized the deer preferred to eat the unpalatable species rather than eat nothing at all so some moved to the area where it was available. From early February until the deer left the yard in April deer were observed in the red pine - jack pine area. Snow depth did not differ in this area.

Twenty-four deer were collared in 1969. Fourteen were collared with green collars at various points around Pine Lake. Ten deer were collared with red collars at points north of Rush Lake and west of the skeet range (Table VI). The collars were intended to be used to estimate populations, trace movements of deer within the yard, and learn the total range of the deer.

By following deer trails I surmised there was extensive movement between the different parts of the yard, however I couldn't prove this since I could not recognize individual deer. But if I collared deer in different areas with different colored collars I could then follow their movements. I observed only four collared deer this winter and all those had green collars. They were also all observed in the approximate area where the collars had been set. I think the red collars were set too late in the winter so there was not much time to observe these. Shortly after these

RECORD OF COLLARS TAKEN BY DEER IN 1969
(Map Number Two)

1.	Green	6067	2-20-69 Pine River 500' west of club road
2.	Green	6074	2-18-69 Pine River, top of bluff
3.	Green	6060	2-16-69 north side club road
4.	Green	6069	2-16-69 north side club road
5.	Green	6068	2-18-69 Pine River and Lake junction
6.	Green	6073	2-16-69 bluff west end Pine Lake
7.	Green	6052	2-16-69 bluff west end Pine Lake
8.	Green	6058	2-20-69 north edge Pine Lake
9.	Green	6065	2-20-69 corn pile Pine Lake
10.	Green	4816	4-3-69 south of creek, west of Pine Lake
11.	Green	4817	4-3-69 Jack Pine - Red Pine area
12.	Red	6597	4-3-69 Rush Creek (Big Oak)
13.	Red	6599	4-3-69 south of main road between road and Rush Lake
14.	Red	6585	4-3-69 south of main road between road and Rush Lake
15.	Red	6592	4-3-69 Willow Swamp north of Rush Lake
16.	Green	6053	4-10-69 across creek, west end Pine Lake
17.	Green	4820	4-10-69 white gate

18.	Green	4825	4-10-69 corn pile, Pine Lake
19.	Red	6589	4-10-69 northwest of Skeet Range (above Jensen's Swamp)
20.	Red	6596	4-10-69 200' east of 6589
21.	Red	6576	4-10-69 Jensen's Swamp
22.	Red	6598	4-10-69 Jensen's Swamp
23.	Red	6582	4-10-69 near clumped Striped Maple
24.	Red	6586	4-10-69 Cedars north of Willows north of Rush Lake

REFERENCES CITED

Bartlett, I. H.

1950. Michigan Deer. Game Div., Mich. Dept. Conserv., Lansing. 50 pp.

Formozov, A. N.

1946. Snow cover as an integral factor of the environment and its importance in the ecology of mammals and birds. Occasional publication No. 1, Boreal Institute, University of Edmunton, Alberta.

Hamerstrom, F.N., Jr., and James Blake

1939. Winter movements and winter food of white-tailed deer in central Wisconsin. J. Mammal., 20 (2): 206-215.

Ozoga, John J.

1968. Variations in microclimates in a conifer swamp deeryard in northern Michigan. J. Wildl. Mgmt., 32 (3): 574-584.

Robinson, W.L.

1961. Test of shelter requirements of penned white-tailed deer. J. Wildl. Mgmt., 24 (4): 364-371.

Severinghaus, C. W.

1953. Springtime in New York - another angle. N.Y. State Conservationist, 7(5): 2-4.

Smith, R. A.

1929. Geology of the Huron Mountain District, "The Book of Huron Mountain". pp 68-70.

Verme, Louis J.

1962. An automatic tagging device for deer. J. Wildl. Mgmt., 26 (4): 387-392.

1965. Swamp conifer deeryards in northern Michigan: their ecology and management. J. Forestry, 63(7): 523-529.

1968. An index of winter weather severity for northern deer. J. Wildl. Mgmt., 32 (3): 566-574.

Wills, H. Merrill

1941. Climate of Michigan. Yearbook, U.S. Dept. Agriculture, pp 914-924.