Some Late Winter and Spring Relations of the White-tailed Deer to the Ecological Cover Types of the Edwin S. George Reserve, Michigan

by

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Introduction

The white-tailed deer, Odocoileus virginianus borealis Miller, is Michigan's foremost big game species. At present, deer hunting is restricted to the upper part of lower Michigan and the Upper Peninsula. It is expected, however, that sometime in the future the herds in southern Michigan will also be large enough to warrant some means of control other than the present bow and arrow season*. Whether or not this control will be an open hunting season for rifle hunters, selective killing by Conservation Department employees, or some other method, will depend largely upon the habits of the animals. To avoid mistakes such as have been made in the past when managing deer herds, the application of biological research to the problem is a necessity. Profound biological and ecological changes are constantly occurring and to keep abreast of the resultant change in problems continuous research is performed. With this point of view in mind, a deer study was initiated in February, 1947, on the Edwin S. George Reserve. The purpose of the investigation was three fold: (1) to add to the knowledge of the relation existing between deer and ecological cover types of southern Michigan, (2) to procure data which might be of use to game management bodies in future years and (3) to collect data to be used in a long term study of the Reserve fauna. While it is admitted that due to fencing the deer of the Reserve are not in a perfectly natural state, it is thought that the approximation is close enough so as to make the study valuable.

* This fact was learned through personal conversation with Mr. Ilo Bartlett, who is in charge of deer investigations and control for the Michigan Department of Conservation.

History of the Reserve

In 1927 and 1928, Colonel Edwin S. George, a Detroit philanthropist, purchased an area of mixed farm, woodland and lowlands approximately 1300 acres in size. He surrounded the tract with a seven foot deer proof fence and stocked it with two male and four pregnant female deer, forming the nucleus of a herd still maintained on the tract. In 1930, Colonel George gave the land to the University Museums of the University of Michigan, to be used as a natural history study area. Since then, the tract has been left in a natural state with the exception of the periodic removal of deer, in keeping with the policy of conservation of the native flora and fauna. It seems pertinent to mention here that the deer removal policy was initiated in 1933, when a census showed that the original six deer had multiplied to an approximate one hundred and sixty (Hickie 1937). Since 1933, an attempt has been made to keep the winter population down to fifty animals since it is thought that this is the approximate carrying capacity of the Reserve.

The tract provides a study area where continued observation of natural successions may take place, with a minimum of outside disturbance. At present, the Reserve contains nearly all of the major ecologic types characteristic of the region, with the exception of lake, stream and beech-maple woodland types. Fauna of the Reserve includes the exotic ringneck pheasant, deer, fox, oppossum, badger, raccoon, muskrat, squirrels, many species of the smaller mammals, song birds, ducks, grouse, and probably other species indigenous to the region. In short, the policy is to keep the area as natural as possible and yet protect it from harmful influences.

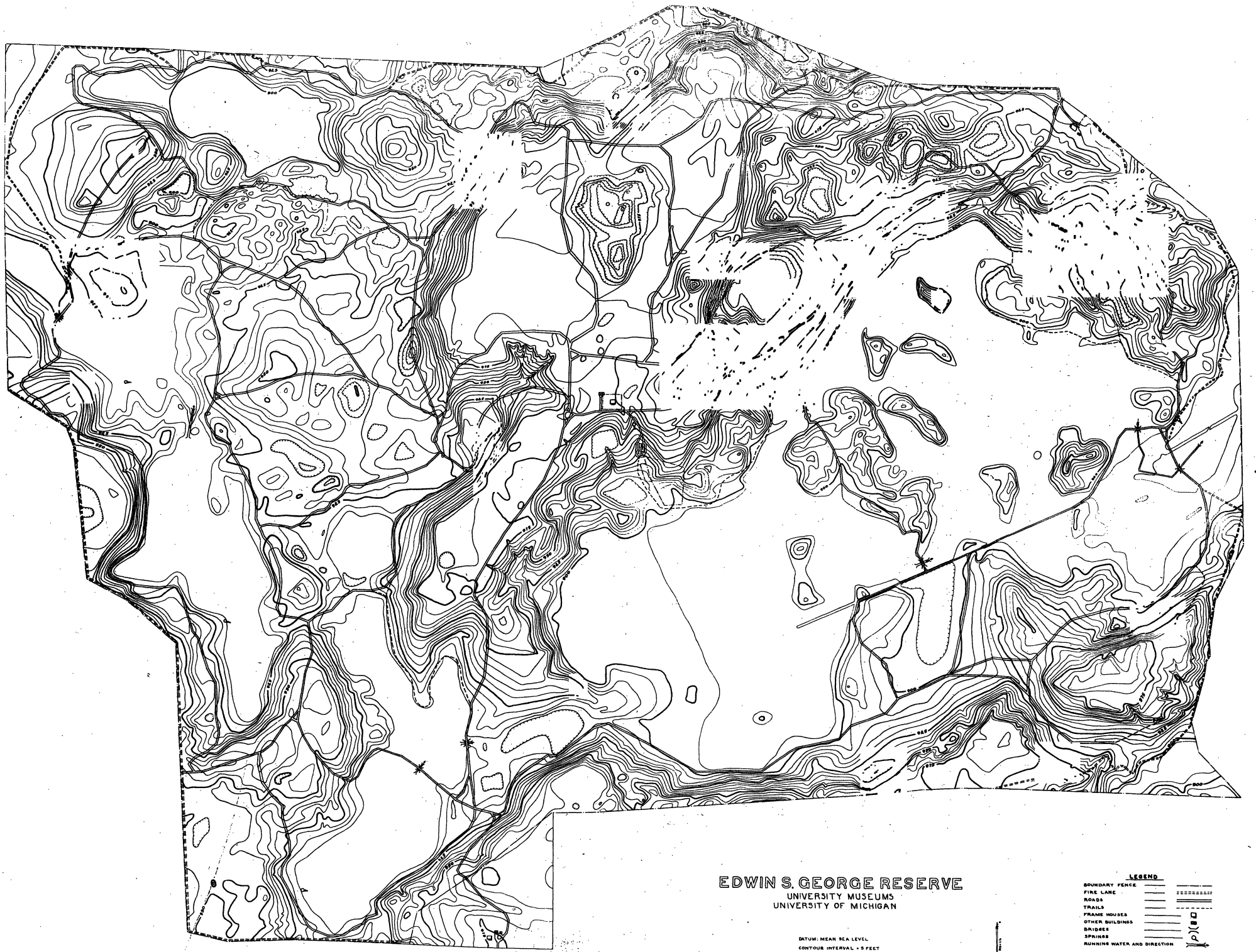
Description of the Area

Location - The Edwin S. George Reserve is situated in the southeastern part of Michigan, approximately four and one-half miles west of Pinckney and about twenty-four miles northwest of Ann Arbor, in the southwestern corner of Livingston county. It lies within range 4 east, township 1 north, and covers section 19 and parts of sections 25, 29, and 30 of Putnam township, and parts of sections 24 and 25 of Unadilla township.

Physiography - The George Reserve lies in a morain of mixed hills, kettles, plains, and basins. The terrain is sharply diversified, giving rise to many and varied slopes and exposures (Map 1). Near the center of the area there is a fairly large, flat, upland plateau; to the northeast of this the land is a mixture of irregular kettles and knobs through which an esker runs; to the east and southeast of the plateau, there is a large basin dotted with upland islands and bordered by mixed plains and steep slopes; to the southwest, west, and northwest of the plateau, the topography consists of uplands and lowlands in rather large blocks. The soils of the Reserve are similarly diversified, including Bellefontaine sandy loam, Plainfield sandy loam, Coloma sandy loam and Miami loam in the uplands, and Greenwood and Rifle peats and Carlisle and Kerston mucks in the lowlands (Cantrall 1943).

Meteorology - The climate of southern Michigan is mild in winter and warm in summer, with a low thermal efficiency and an adequate supply of precipitation the year round. A frost free season of approximately 124 days in length favorably affects plants, as well as animals, of the region.

Since no weather records are kept at the Reserve, temperatures, wind directions and amount of sunshine were recorded by the author. These were then checked at Ann Arbor where other climatological data were obtained.

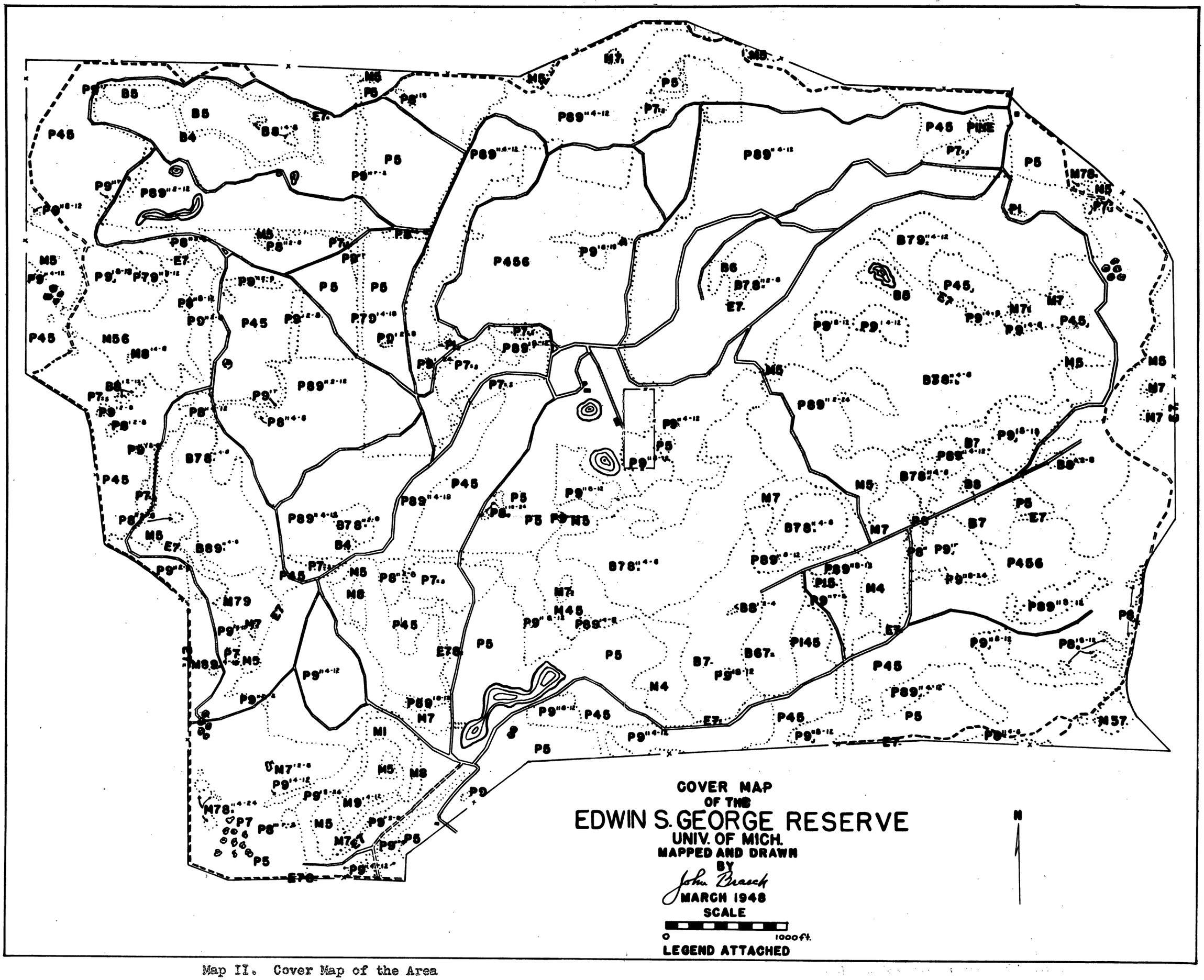


Map I. Contour Map of the Area

During the course of the study, the weather was rather unusual, in that from the middle of January until the second week in March, the ground was covered by a sheet of ice varying in thickness from two to six inches. This feature undoubtedly affected the food habits of the deer, as will be pointed out later. Also, spring saw more than the usual amount of cloudy weather and subsequent rainfall. The influence of this condition upon the deer will also be discussed later.

Vegetation - The flora of the George Reserve is an excellent sample of the region in which it lies. The uplands are covered by ecological cover types ranging from bare ground to oak-hickory woodlands. The lowland successions range from open water to the poison sumac - tamarack type. Graham (1945) has listed the various ecological successions characteristic of such an area. The distribution of the various cover types on the Reserve may be clearly seen by examining Map II. For the most part, the wooded areas are to be found on the slopes and summits of the hills, which were unfit for cultivation. The open grasslands are to be found on the more or less level uplands, while the kettle holes and lowland basins support the marsh, bog, or swamp successions. It will be noted that there is a definite scarcity of ecotones between the various cover types. This feature may be layed to two factors: previous cultivation of the level uplands, and the pressure of the deer herd on the area. The few ecotones that are present occur mainly around the margins of the swamps and marshes.

Aquatic Analysis - Water areas of the Reserve include three dredged ponds, a small bog lake, a dredged marsh margin, four springs and several small temporary ponds found mostly in the woodland depressions. During spring periods of high precipitation, the marshes, swamps, and ponds drain to the east giving rise to small intermittent streams.



Map II. Cover Map of the Area

Cover Map Legend

Upland types - Terrestrial origin

	Porous soils P	Nonporous soils A	Rock outcrops R
1	Bare soil	Bare soil	Bare rock
2			Crutose lichens
3			Foliose lichens Mosses
4	Annuals Mosses seldom	Annuals grasses and perennials starting	Mosses lichens scattered annuals
5	Various grasses scattered perennials	Sod grasses Goldenrod Asters	Scattered perennials Mosses persisting
6	Bluegrass Mixed perennials	Bluegrass Mixed perennials	Grasses Mixed perennials
7	Panicled dogwood Rose Rubus	Dogwoods Rose Rubus Witchhazel	Dogwoods Hazel Rubus
8	Aspen Sassafras Juniper	Aspen Juniper Crataegus Cherry	Crataegus Cherry Aspen
9	Elm Black oaks Hickories	Black and White oaks Hickories	Black oaks Hickories
10	Sugar maple Basswood Beech	Sugar maple Basswood Beech	Sugar maple Basswood

Cover Map Legend

Lowland types - Aquatic origin

	Bogs		Marshes	
	Seepage BS	Stagnant B	Seepage MS	Stagnant M
1	Saturated soil or water	Water	Saturated soil or water	Water
2		Pond weeds Water lilies		Pond weeds Water lilies
3				
4	Sedges Sphagnum seldom	Sedge mat Sphagnum usually Bog plants	Bullrushes Cattails	Bullrushes Cattails
5	Sedges Leatherleaf Scattered perennials	Sphagnum Leatherleaf Sedges Cranberry	Sedges Grasses Cattails	Sedges Grasses Cattails
6	Mixed perennials	Leatherleaf over sedges and sphagnum	Various mixed perennials	Various mixed perennials
7	Highbush cranberry Dogwoods Willows	Dogwoods Huckleberry Chokeberry Spirea	Elderberry Dogwoods Willows	Dogwoods Buttonbush Willow near margin
8	Tamarack Aspen Willows	Tamarack Black spruce	Aspen Willows Black ash Elm	Aspen Dogwoods Black ash Elm
9	Soft maples Swamp white elms Oak	Soft maples Swamp white elms Hickories	Soft maples Elms Hickories	Soft maples Elms Black ash
10	Sugar maple Basswood Beech	Sugar maple Basswood Beech	Sugar maple Basswood Beech	Sugar maple Basswood Beech

Cover Map Legend

Transition types

	Flood plain F	Transition belts E
1	Bare moist soil	Same as corresponding wet or dry land types
2		do.
3		do.
4	Annuals Perennials starting	do.
5	Sod grasses Scattered perennials	do.
6	Various mixed perennials	do.
7	Great variety of shrubs	do.
8	White ash Aspen or other poplar Elm	do.
9	Soft maples Hickories Oaks Elms	do.
10	Sugar maple Basswood Beech	Sugar maple Basswood Beech

Physiographic conditions - Exponential letters

o-Outwash
d-Dunes
k-Kettle hole
l-Calcareous
g-Igneous rock
s-Shale
m-Glacial drift
b-Loess

Disturbance effects - Sub-letters

d-Drained
P-Pastured
e-Eroded
f-Flooded
y-Cutover
x-Burned
a-Wild animal grazing and browsing
b-Blowdown

Timber size and stocking

'	Scattered	Diameter in inches
''	Medium	4-6, 4-12.etc.
'''	Dense	

Shrub Density

— Scattered
= Medium
≡ Dense

Study Methods

Period - The study period extended from the last weekend in January until the first weekend in June, 1947. Between these dates, the author spent two and one-half consecutive days weekly on the area. Facilities were available so that it was possible for him to live on the area thus decreasing the loss of time and other difficulties which might have been encountered had not these accommodations been present.

Mapping - During the early part of the study, an aerial photograph of the Reserve was secured and the major vegetative features were traced from it onto a field map. Using the tracing as a base map, a complete cover map of the area was prepared by pacing and the use of a compass (Map II). Using Graham's (op. cit.) symbols, the ecological cover types were recorded as well as certain topographical features. In this manner a complete map of the important features, which might affect the deer on the Reserve, were recorded.

Observations - In a discussion with faculty members of the University of Michigan School of Forestry and Conservation previous to the study, it was decided that direct observation would be the method best suited to the problem in question. At the same time it was realized that some difficulties would be encountered in trying to observe a species as wary as the white-tailed deer. To minimize the difficulties, observations were conducted by working upwind, where possible, with a pair of 6 x 30 binoculars in the hand. No definite observation stations were established, the observer merely walked back and forth across the Reserve, paying particular attention to various known areas of concentration. As it became evident that the deer

were in a habit of frequenting certain cover types at certain periods, a 20 power Argus Spotting Scope was employed to observe the actions of the animals. In addition to direct observation of the animals, it was thought that other observations such as beds, trails, pellet groups concentrations and browse evidences, would be of value, since these signs are often times valuable in determining the habits of deer (Bennett et. al. 1940).

All of the above records were kept in a field notebook which was carried at all times in the field. After each weekly period of days of observations in the field, the notes were edited and conclusions and opinions of the author set down.

Limitations - It is realized that the study about to be presented has certain definite deficiencies. While direct observation is probably the best method for determining the overall relation between deer and ecological cover types, stomach or fecal analysis would seem to be more desirable for correlating the food habits of deer and ecological cover types. In addition, the study period covered only a part of one year. To determine deer activity under various conditions, a period of several years appears to be a necessity. With these limitations in mind, it must also be realized that the study concerns the deer of the George Reserve only, although close parallels of deer activity on similar areas are quite probable.

Deer Activity as Related to the Cover Types of the George Reserve

Leopold (1931) has declared that each species of animal has certain cover requirements. By fitting his principles to the white-tailed deer, their requirements may be described as bedding, loafing, escape, feeding and fawning cover. These five factors determine the presence or absence of the species and since each factor has its own effect on deer activity,

each must be discussed separately. In the following discussion a description of each requirement will be related to the ecological cover type, or types, which furnish the requirement.

As previously stated, the ice sheet which covered the ground from mid-winter to mid-March appears to have had a definite effect on the activities of the deer herd. Hence, the data about to be presented is divided into two periods: The first period extends from mid-winter to March 8, and will be referred to as the winter period. The second period extends from March 8 to June 10, and will be referred to as the spring period.

Bedding Cover - Bedding cover was taken to mean the cover type occupied by deer during the period of nocturnal resting. Although deer rest in the daytime as well as at night, it was thought that by referring to the diurnal requirements as loafing cover, the problem would be simplified and more easily understood by every one concerned.

The deer of the George Reserve tend to concentrate in swamp areas during the winter period much the same as deer of northern Michigan tend to concentrate in the well known cedar swamps during the same period. Hamerstrom and Blake (1939) found similar concentrations among deer of west-central Wisconsin. With this habit established, it would be expected that this cover type furnishes the needed requirements during the given period.

Due to difficulties of night observation, the data gathered (Fig. 1) are too few to give a conclusive picture, but general observations show that the preferred cover type for bedding was the tamarack-sumac type. Daily, at dusk during the winter period, the animals could be seen going into the swamps, presumably for the night. An inspection of the swamps on various days yielded many beds, although they could not be differentiated as to night beds and day beds. However, since many day beds were positively

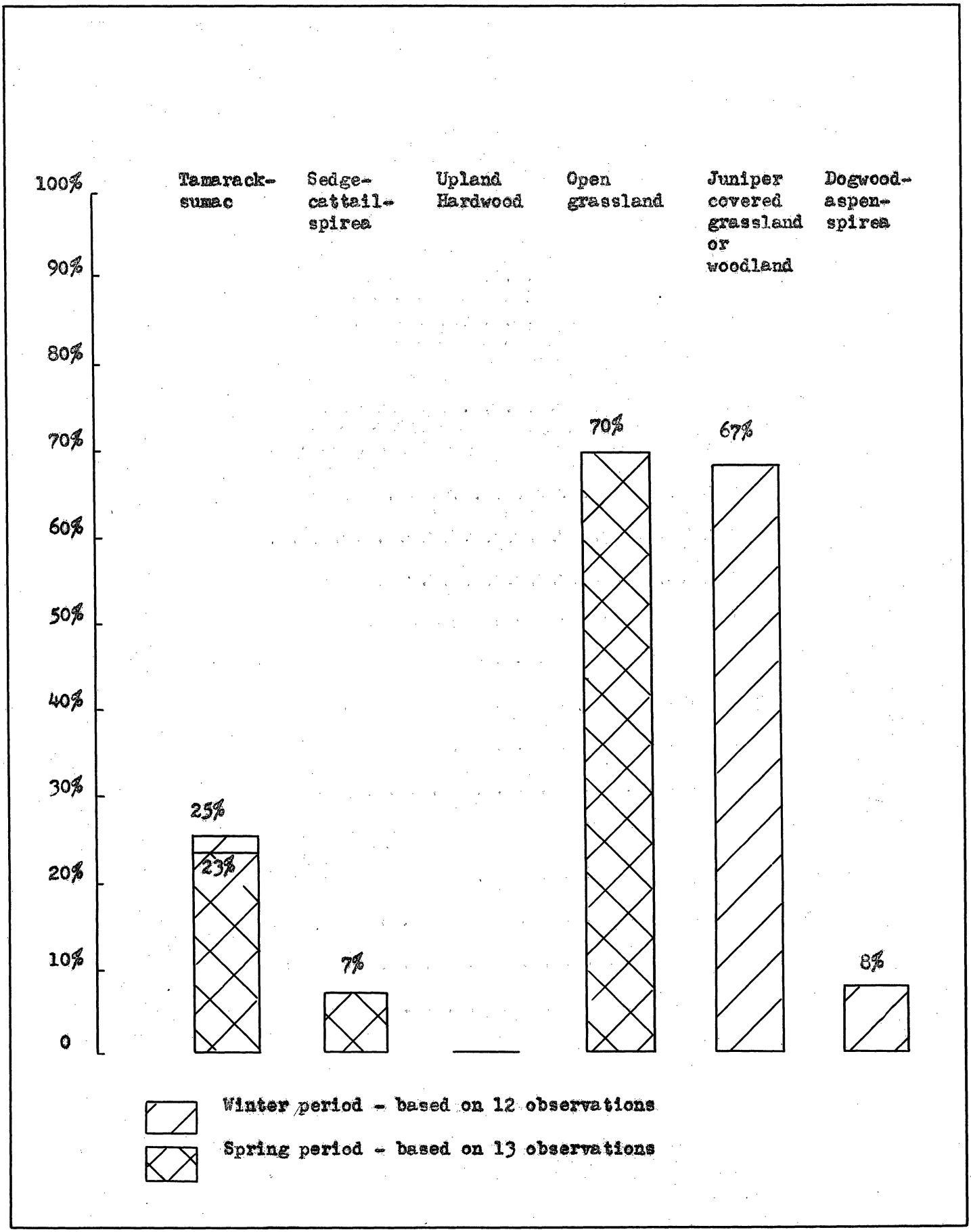


Figure I. Bedding cover preference shown by the George Reserve deer herd.

identified in cover types other than the tamarack-sumac type, it is presumed that the large number of beds found in the tamarack-sumac type was caused by the deer bedding here at night.

An exception to this occurred on the night of February 15, when five night beds were found on the edge of a cattail marsh, in a small grove of trembling aspens. The aspen grove was on the east side of a hill however, where it was protected from the prevailing northwest wind. Whenever other beds were found outside of the tamarack-sumac type, they were always located so as to be protected from the prevailing wind. By taking into account known factors such as wind, temperature, humidity, food and snow, which affect deer activity, it would appear as if wind has the greatest bearing on the choice of bedding cover. Temperature and humidity are approximately the same in the lowlands as in the uplands. Snow and food conditions closely approximate each other also. Wind is much stronger in the open uplands than in the lowlands where topography as well as denser vegetation cut its force. It is not unlikely then, to theorize that wind affects deer just as it does humans and arouses in them a desire for shelter during periods of rest.

As winter ebbs and spring arrives the deer gradually change their bedding cover preference from the lowland swamp to the uplands. During the period of thawing and melting snows, the swamps fill with water and are doubtless uncomfortable habitats. At this time, the animals choose wooded knolls, where the winds bring telltale scents of any intruders. As spring comes to and end, and warmer weather arrives, open grasslands as well as wooded knolls may be used as bedding grounds. As Dixon (1934), who has worked with mule deer, believes, the reason appears to be one of self-preservation, for the slightest attempt to approach deer bedded in short grass leads to a scramble and flight to safety by the animals.

Loafing Cover - As previously defined loafing cover was interpreted

to mean the type of cover chosen for bedding during diurnal periods. In many cases, day and night beds could not be distinguished by observation of the bed alone, so field notes were taken only when the beds could be separated, either by flushing the animial or by a positive identification of the bed through the heat it retained for a short time after being vacated.

An examination of Figure II will indicate that loafing cover during the winter period consisted of two distinct cover types.

During the sunny days of winter, the wooded south and east slopes of hills in close proximity to the tamarack-poison sumac swamps received a great deal of use. This observation is in direct agreement with Cook and Hamilton's (1942) observations on Massachusetts deer. In many cases, these same slopes contained an abundance of juniper, providing browse for the animals. There was one hill in particular in the southeast corner of the Reserve from which deer could always be flushed on sunny days. The cover consisted of a sparce distribution of 10 to 14 inch oak and hickory trees, with a ground cover of common juniper. Here, the deer could feed and bed and still be protected from the prevailing north wind. The exact bedding spots appeared to have been governed by the distribution of sunlight and shade. As Dixon (op.cit.) and Hosley and Zieharth (1935) have also noted, the beds were located so as to be directly hit by the sun's rays. Apparently protection from the wind and direct sunlight are two important factors determining the selection of winter loafing cover. In direct opposition to winter loafing cover on sunny days, the loafing cover on cloudy or stormy days was restricted to the lowland swamp types. During cloudy days, the animals ventured out of the swamp to feed along the upland margins. However, they did not bed down here, but returned to the swamps to bed. On stormy, windy

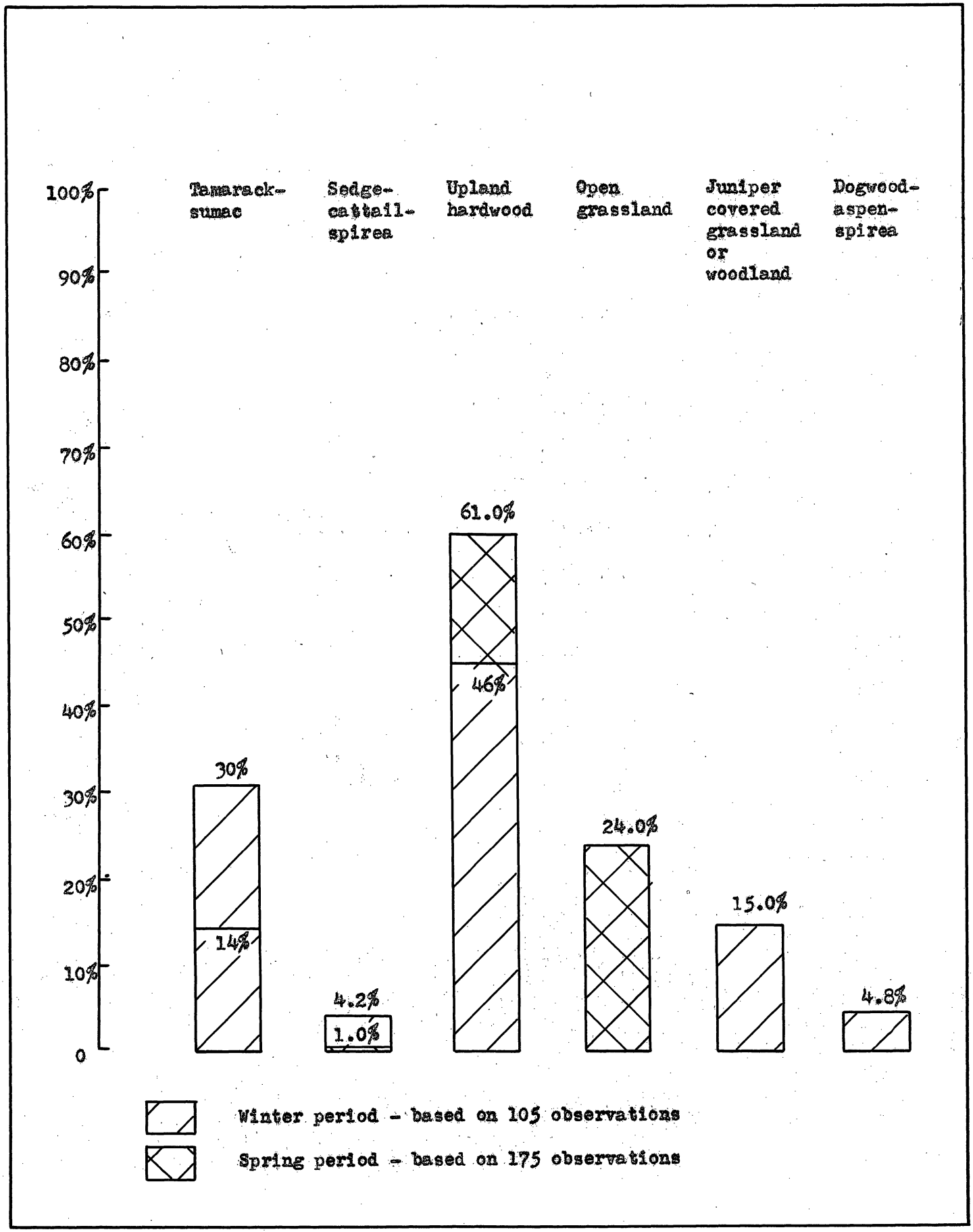


Figure II. Loafing cover preference shown by George Reserve deer herd.

days, the deer tended to form loose bands much the same as Darling (1937) observed in English red deer. These loose bands could always be found in the heaviest tamarack-sumac association, on such days.

As spring replaced winter, the loafing cover preference changed in a similar fashion (Figure II). As the warm days became more abundant, the deer showed a definite preference for the open grass lands, especially the south slopes, or the grassy fields which were protected from the wind by an adjoining woods. A typical example of such preference occurred on March 17. The day was clear in the morning, the temperature was 20 degrees F. and a four to eight mile and hour wind was blowing from the northwest. At 9:55 a. m. ten deer were observed, seven on an open grassy south slope, and three on an open grassy field, protected from the wind by the adjoining woods. From the time the animals were first observed until 10:59 a. m. these ten deer alternately bedded and fed within a short radius of the point of the initial observation. At 10:59, the animals were frightened by an automobile, thus ending the observation.

As the month of June approached and the warm summer days drew near, the loafing cover preference of the deer again showed a definite change, this time to the oak-hickory woods. It should be noted that until the approach of summer, the cover types selected for loafing were selected so as to give a maximum amount of sun. However, with the daily temperatures of May and June being normally warmer than those of the preceding months, the summer loafing cover was apparently selected so as to give shade and consequently more comfortable rest.

Escape Cover - Escape cover may be the most important of the cover needs of an animal, since it may mean the difference between life and death in

many cases. The winter escape cover of the George Reserve deer consisted almost entirely of the tamarack-sumac association (Figure III). An excellent and typical example of this choice occurred on March 23 when a doe, a fawn, and a yearling were flushed three times. All three times, these animals selected swamp cover as the type which they preferred for escape. The selection was especially noticeable on the third flush, when the deer were flushed on the edge of a woods bordered by an open, grassy field approximately one quarter of a mile from the nearest swamp. On flushing, the animals doubled back and went into the swamp, at the point nearest the site of the flush. Here then is a case where three cover types were available and the animals showed a decided choice. It is apparent that heavy swamp associations are chosen for winter escape cover because they offer the best protection from sight.

Spring escape cover varied from winter escape cover the same as spring bedding cover varied from winter bedding cover, in that with the swamps being filled with water, they were more or less uncomfortable for the animals. At the same time, with the hardwood leaves again coming into being, the upland wood type provided seclusion from the eyes of invaders. With these factors in mind, it is apparent why the choice of escape cover shifted from the swamps, to the upland hardwoods in the spring. An excellent example of the above mentioned shift occurred on May 5 when two deer were flushed on a hardwood island surrounded by a large tamarack-sumac swamp. The animals escaped along the edge of the island, and crossed to the nearby uplands by a road which was the only dry connecting link between the two upland types. To reach the road the deer had to run approximately one hundred yards. Had they preferred swamp cover for escape, they could have reached it

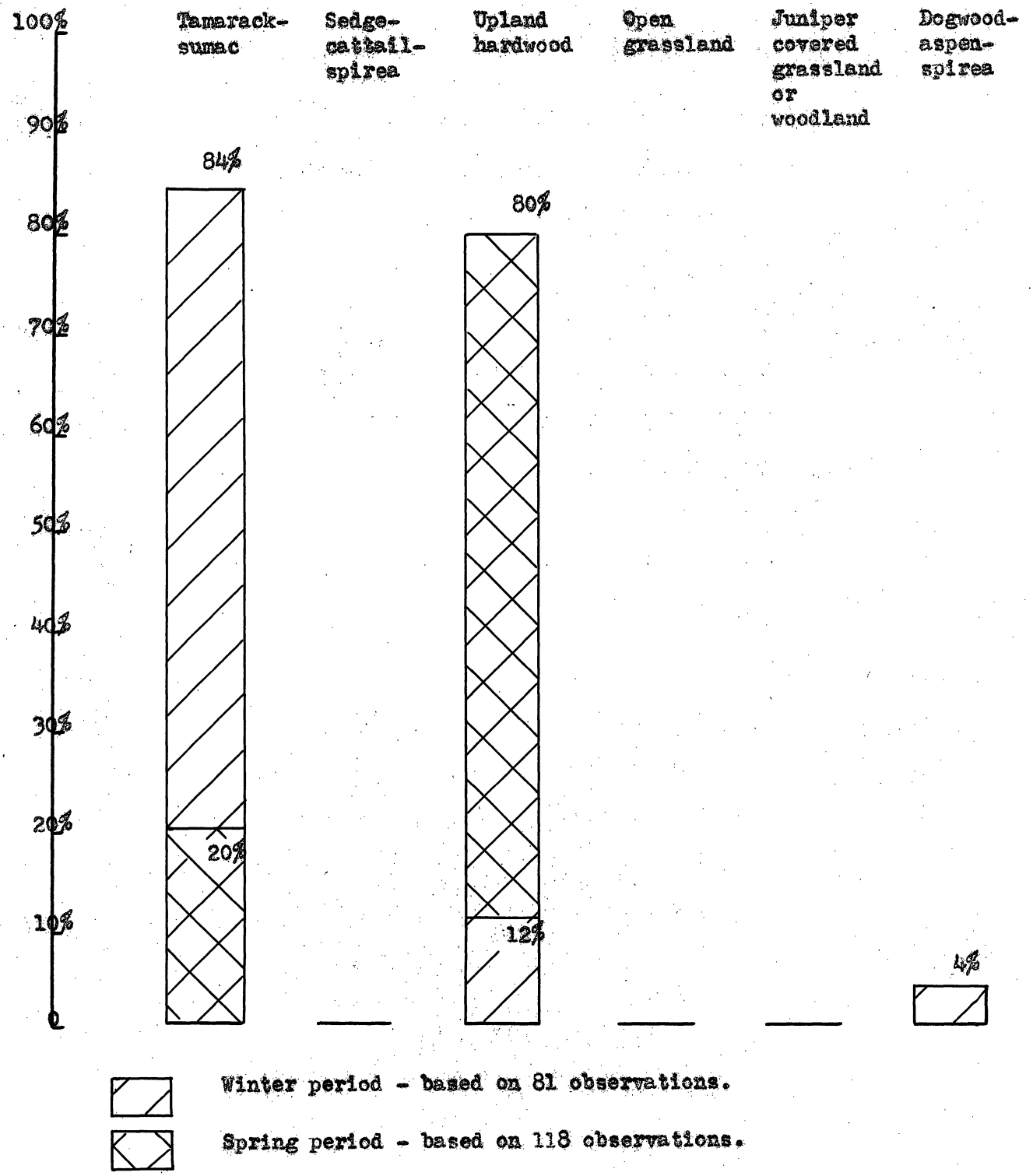


Figure III. Escape cover preference shown by the George Reserve deer herd.

within ten yards of the site of flushing. Numerous other similar examples serve to illustrate the same point.

Feeding Cover - When speaking of the white-tailed deer, probably the greatest controversy centers around the choice of foods. Among the authors who have written on the subject, Atwood (1941), Davenport (1937), Howard (1937), and Shadle and Stullken (1942) are but a very few. However, it is apparent that the choice of food varies greatly. Since the food plants are an integral part of the cover types where deer may be found, it is obvious that the seasonal condition of the plants will govern much of the animals' activities.

During the winter period while the snow was still on the ground, the George Reserve deer were governed chiefly by the distribution of red-osier dogwood and common juniper. While Figure IV seems to indicate a definite preference for the juniper covered grassland or woodland, it is felt that these data should not be taken without regard to the greater ease of observation in this more open type. Observations of the plants themselves showed that the red-osier of the swamps was very heavily fed upon. Since no browse counts were made, this is an extremely important observation, and is the basis for the above statement. As has previous been stated, the lowland swamp was a preferred cover type during the winter period and in this succession could be found an abundance of red-osier. Here then, is another important factor governing the choice of the animals. Common juniper is apparently the upland equivalent of red-osier, for wherever the juniper was found in abundance so were the deer. Thus, in the upland grasslands and woods in the north and northwestern parts of the Reserve direct observation as well as scat and track signs indicated a relative absence of the animals during the winter period. Most of the deer seen were observed in the southern

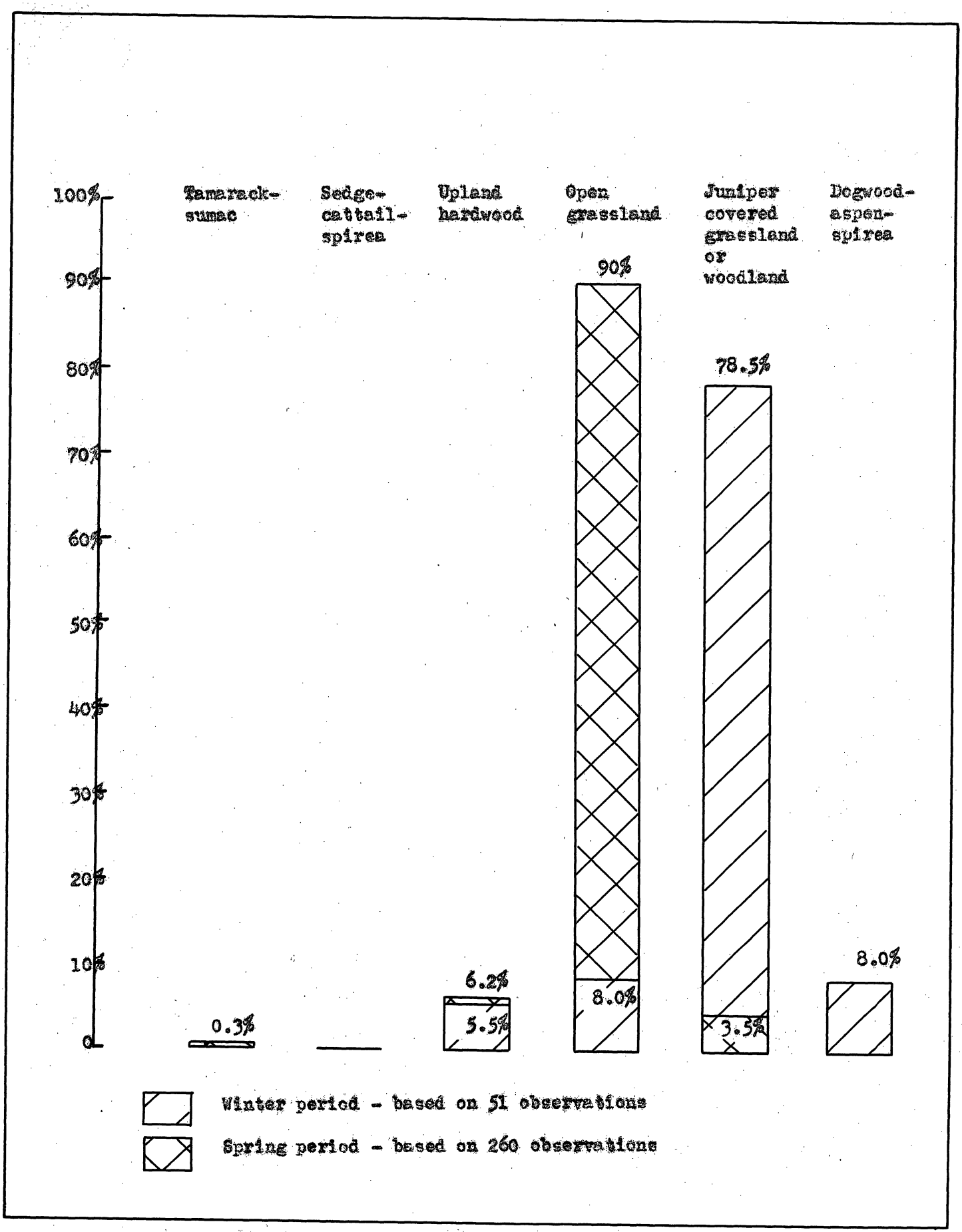


Figure IV. Feeding cover preference shown by the George Reserve deer herd.

and southeastern parts of the Reserve, where juniper and red-osier occurs in abundance. It must be mentioned that feeding cover is governed to some extent by topographic features as has also been noted by Cook and Hamilton (1942). Thus, in the southeastern, hilly part of the Reserve, where juniper is found on the south and east slopes, the deer were also found. Collectively speaking, the ideal upland winter habitat consisted of a south slope, grown up to mature oak-hickory cover with an understory of common juniper.

As the winter period passed and spring came, the snow and ice sheet melted. With the melting of the ice sheet, the food preference of the deer changed sharply from browse to grass. By March 8, the south slopes over most of the Reserve were bare. At this time, the evening feeding period was for the most part spent in grubbing and nibbling the mosses found in and around the grass roots. By March 17, the deer were predominantly grazers, spending only a very small amount of time browsing and from this date until the end of the study, grass formed the main diet of the animals. Again, as in the choice of winter feeding cover, topography played an important part, especially during the months of March and April when the winds were still strong and cold. On March 17, seven deer were observed for one hour, during which time they grazed continuously. The animals were on a grassy, south slope, where they were protected from the northwest wind. At no time did they venture to the open crest of the hill, apparently having found the place most suited to their liking, in that it provided food and warmth as well as protection from the wind. Many other examples of the same choice were observed, conclusively indicating a definite response to topographic features.

Fawning cover - The place where an animal is born is perhaps the most important habitat that the animal may ever occupy. Here, it is presumably protected from enemies and still is provided with all of the necessities of life.

Fawning cover on the George Reserve consisted primarily of middle aged stands of oak-hickory trees with an understory of more tolerant vegetation such as sassafras, hard maple, and blueberry. The fawning period of the Reserve deer herd is probably at its height between the dates of May 20 and June 10. Dr. E. C. O'Roke, who has studied the Reserve deer, as well as Dr. F. N. Hamerstrom, the Resident Naturalist, both agree with these dates. Since only two fawns were found during the study, other data had to be used in order to have enough information from which conclusions could be drawn, concerning this subject. These data include Reserve records of fawns which were found by Dr. Adolf Murie, when he was Resident Naturalist and also verbal information from Dr. O'Roke. All of the fawns found either by others or by the author were found in the upland hardwood cover type. In general, they seemed to be scattered throughout the Reserve wherever a medium stocking of the oak-hickory cover type occurred. There was, however, a definite choice of topography exhibited in that the majority of the fawns found were located on a hill or knoll. This is apparently a safety factor used by the does to prevent surprise appearances of intruders. There was no slope exposure preference shown, however.

Both of the fawns found by the author were found lying down with their backs against down logs, in beds of dry leaves. This appears to be typical of new-born fawns, in that either the doe or the fawn feels safer if its outline is broken by some natural, inanimate object. As a matter of fact, it is extremely hard to see the young animals in such a position.

An interesting incident occurred when the second fawn was found, illustrating the ability of animals to take care of themselves. Upon locating the fawn, the author walked over to it, picked it up and held it until it quieted and then set the animal down in a standing position. The deer was so young or else it was so frightened that its legs buckled under it, and would not support the body. Having no means of marking the animal and wishing to do so, the fawn was securely tied to a down log, while the author ran back to get an ear tag. Upon returning to the original bed of the deer after an absence of approximately fifteen minutes, it was discovered that the fawn had moved or been moved. A thorough search revealed no fawn nor any sign of movement of the animal. How so young a deer could escape after being tied remains a mystery. A feasible explanation seems to be that the doe returned, somehow untied the knot securing her fawn to the log and moved the fawn, but of course no proof is available.

Deer Habitat Change as Effected by Outside Influences

It is known that outside influences such as rain, snow, wind, and sunshine affect deer activity. Darling (op. cit.), Hamerstrom and Blake (op. cit.), Seton (1929), Dixon (op. cit.) and Townsend and Smith (1933) have all noted some experiences concerning the subject.

As previously stated, during winter snow storms, the deer tend to band together and inhabit the swamps almost exclusively. In most cases these bands are composed of several smaller groups, the total number being made up of bucks, does, yearlings, and fawns, apparently without regard to sex or age. Immediately after the storm, the large group breaks up into the original smaller groups, each group going its own way once again. Whether

the same groups always band together cannot be said, but it is believed that they do not.

On rainy, cloudy days the deer were found to be more active than on bright, sunny days. Chapman (1939), who studied white-tailed deer in southeastern Ohio, found the same reaction. In winter, however, the animals were found to be most active on bright, sunny days. The reason appears to be the heat from the sun. In general, on sunny, winter days, the deer may feed throughout the day, resting intermittently. On cloudy days they usually may be found in or near a swamp, usually bedded down. As spring comes and the daily temperatures increase as well as the amount of sunlight, the animals tend to become more selective as to feeding hours. During early spring, morning feeding hours are from about sunrise to about eleven o'clock. Evening feeding hours are from about four o'clock until sundown. During late spring, feeding hours vary again, apparently being chosen so as to avoid the heat of the day. During this period the morning feeding time probably begins sometime before sunrise and ends at about seven o'clock. The evening feeding period begins at about six o'clock and extends well into the night, possibly all night in some cases.

Precipitation, in the form of rain, is another factor which affects deer activity. In general, a light rain will not affect the animals. Usually they may be found feeding in the open, grassy fields during such an occurrence. A heavy, pelting rain, however, usually drives the animals to the upland hardwood cover types, for protection.

Habitat Variations as Caused by Sex and Age Differences

When speaking of the white-tailed deer, it is generally known that both

sexes run together in the fall, during the mating season. However, the sex association at other periods is known by comparatively few. It was a purpose of this study to try and determine this association concerning the George Reserve deer, but after four months of study only a tentative conclusion was reached. Of the many observations made on the animals, all indicate a definite ignoring of sex differentiation during periods other than the mating season. While it is true that certain of the animals could always be found alone, it is also true that the greater percentage of them could be found in mixed groups. Whether the single deer were outcasts, or whether they preferred to live alone is, of course, questionable, but apparently the subject of sex does not enter into the decision. It must be mentioned, however, that all of the observed solitary animals were apparently old animals, past the prime of life. This old age, of course, may have had the effect of making the animals seek seclusion rather than company. There was no cover selection peculiar to these solitary animals; they behaved in similar fashion to the other deer, under like conditions.

Summary

1. The study was made between the months of February and June, 1947, on the Edwin S. George Reserve, which is located in the southern part of Michigan.

2. The area is a typical example of hilly, glacial morainic topography, covered with mixed upland and lowland ecological cover types.

3. The study method used was direct observation of the animals, their scats, tracks, and browsings.

4. The area was cover mapped during the study at the same time that the observations were being made.

5. During winter, bedding cover consisted chiefly of the tamarack-sumac swamp association. Spring bedding cover consisted of the upland hardwood cover type and the open grass association.

6. Winter loafing cover consisted of the tamarack-sumac association on stormy days and the south and east slopes covered with upland hardwoods and common juniper on fair days, while early spring loafing cover consisted of grassy, south and east slopes, and late spring loafing cover consisted of oak-hickory woods.

7. Winter escape cover consisted almost exclusively of the tamarack-sumac association while spring escape cover consisted of oak-hickory woods and the tamarack-sumac swamps.

8. In winter the animals browsed, chiefly on the common juniper, red-osier dogwood and smooth sumac; spring feeding cover consisted almost entirely of open, grassy fields.

9. Fawning cover consisted of a medium stocking of middle aged oak-hickory trees on a knoll or hill.

10. Weather influenced the cover type choice of the deer, bad weather driving the animals to heavy cover, and good weather bringing them out into the more open types.

11. During late winter and spring sex and age are not causes of habitat variation.

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