

A STUDY OF GRAZING ON
CERTAIN NORTHERN MICHIGAN
CUT-OVER LANDS

Thesis for the Degree of M. S.
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Dee Lee Weaver

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A STUDY OF GRAZING ON CERTAIN NORTHERN MICHIGAN
CUT-OVER LANDS

by
Dee Lee Weaver

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THESIS

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INTRODUCTION

Michigan lumbering activities reached peak production about 1890. Large areas denuded of forest cover have been the result. With the timber gone, many lumbering operators ventured into the business of grazing sheep and/or cattle on these cut-over lands. This has been especially true on the lands north of T16N in Michigan. A few of these grazing ventures have survived. Many more have gone the way of the tall timber. But still more important is the large number of small scale farmer-grazers now operating in northern Michigan. There are also a few large-scale operators grazing livestock on many sections of cut-over land.

According to the 1935 census, 23.5% of the farm area of Michigan was in wild pasture and in the 27 counties of the Lower Peninsula of Michigan north of T16N, 38.2% of the area in farms was in wild pasture. These figures alone indicate that the wildlands play a part in the agriculture of the State.

The use of cut-over lands for pasture is not confined to these lands under private ownership. Both the State Department of Conservation and the United States Forest Service issue grazing use permits on certain publicly owned lands under their jurisdiction in Michigan. There also appears to be quite extensive "trespass grazing" on unfenced public and privately owned lands. Consequently there is much more extensive use of cut-over lands for grazing than the census figures indicate.

The problem objective was to determine the livestock carrying capacities for the major types of wildland pasture (cut-over lands used for pasture). There are other objectives upon which this objective is

dependent. These objectives are, namely: (1) to obtain histories of past wildland grazing ventures; (2) to determine the principal types of native wildland forage; (3) to learn the current practices of herd and range management; (4) to obtain the gains or productions made by livestock on specific tracts and under particular types of use or management; (5) to determine the possibilities of improving wildland pasture or of supplementing it with plowland pasture; (6) to determine the effect of grazing on the condition and botanical composition of the range; (7) to determine the effect of wildland grazing on wildlife populations; (8) to determine the future utility of wildland areas for grazing; (9) to determine the relation or influence of wildland grazing to forest use; and (10) to determine the relation or influence of wildland grazing on recreation.

A preliminary survey was made. The Michigan Department of Conservation and the U. S. Forest Service indicated a desire to obtain histories of past grazing histories. During the process of obtaining these grazing histories in northern Michigan, the 22 pasture areas were selected for study. To acquaint the reader with some of the background in Michigan grazing ventures, the grazing histories are first presented.

Because of the invaluable aid given the author, a dedication of gratitude is given to Professor L. R. Schoenmann, Dr. C. E. Millar, Dr. C. M. Harrison and Professor V. A. Freeman of Michigan State College, and to Mr. Charles E. Millar of the Michigan Department of Conservation. The thesis would not have been possible but for the aid and cooperation given by the Michigan Agricultural Extension Division, Michigan Agricultural Experiment Station, Michigan Department of Conservation, United States Forest Service and the farmers and ranchers of northern Michigan.

The problem was designated in 1940 as a Bankhead-Jones project in the Michigan Agricultural Experiment Station. Under the provisions of this project, a cooperative agreement was made with the State Conservation Department to cover their interest and support of the work. An advisory committee to the project was appointed by Director V. R. Gardner of the Experiment Station. This committee, consisting of Professor L. R. Schoenmann of the Conservation Institute, Professor V. A. Freeman of the Animal Husbandry Department, and Dr. C. M. Harrison of the Farm Crops Department, Michigan State College, has guided the work on which this thesis has been based.

GRAZING HISTORIES

The following discussion concerns 9 brief histories of past grazing ventures.

No. 1. Brueggeman Area:

This area is located in northeastern Gladwin County. In 1939, he bought 50 ewes with the aid of a loan from a local bank. These ewes he placed on a 60-acre tract that was quite densely covered with 20 to 25 feet high aspen, white birch and willow. Much of the land was wet. Because there were extremely few openings in the stand and the area was wet, very little suitable feed was available to the sheep.

During the winter of 1939-1940, the sheep had no shelter and little hay was fed to them. By the spring of 1940, 7 ewes remained alive out of the original 50. Mr. Brueggeman had the note for the sheep, but nothing left to pay off the note.

This is an example, rather extreme but true, of what can happen where an attempt is made to graze livestock in a dense forest stand. The stand was dense enough to allow very little ground feed. The trees were large enough to place browse out of reach from the sheep. The area was wet, thus encouraging sheep parasites. The sheep had no winter shelter. They had very little winter feed. Any one of these factors could have been sufficient to cause failure in the grazing venture.

No. 2. Rainey Lake Ranch:

The late John Krauth, owner of the area, described the ranch as follows: "The Rainey Lake Ranch, comprising approximately 13,000 acres, is located on the south side of Presque Isle County bordering the county of Montmorency for a distance of five and one half miles. On the west it fronts Presque Isle and Montmorency State Forest Preserve, for a

distance of five miles. It is flanked on the south for a distance of five miles by the Rainy River Marsh tract."

Mr. Krauth purchased the cut-over land in 1898 from a lumberman. In the fall of 1901, he purchased a carload of western ewes in Chicago. Mr. Krauth had no hay stored and depended upon hay to be hauled into the ranch. The snow became too deep to get a sled or wagon into the ranch. Also, the ewes were bred on the western range, and dropped most of the lambs in January. The consequence was that most of the lambs died, and many of the ewes died of starvation.

However, he did manage to retain ownership to the ranch. By 1918 he had 200 acres of land cleared and was raising sufficient hay for winter feed. At this time the ranch was sold on contract to two men. These men tried dairy farming; the partnership broke over financial difficulties shortly after. Mr. Krauth then had the ranch on his hands again.

In about 1925, he again sold the ranch on contract to six investors from Detroit. These men invested heavily in buildings (\$12,000 for one barn) and attempted to run beef cattle. When the 1929 depression hit, the barn burned, and Mr. Krauth got the ranch back again. The ranch has been abandoned since 1930.

At present, the ranch, which is owned by Mr. Krauth's aged widow, contains five lakes. Two-hundred acres on Emmet sandy loam soil are cleared. The southwestern part of the ranch is mostly jack pine and aspen cover on Roselawn sand, Rubicon sand and Emmet loamy sandy soils. There is quite a high percent of swamp scattered throughout the area consisting of Carbondale muck and Spaulding peat. There are also scattered spots of Griffin sandy loam and Emmet loamy sand.

Most of the area has come back to dense aspen and white birch on the upland soils. The mucks and peats have a dense cover of aspen,

spruce and cedar. The southwestern part of the ranch was burned over in 1937. This was the jack pine-aspen area. In general, it might be said that the only place where desirable forage may be found for livestock on the area is the area of 200 acres that was cleared.

No. 3. Underhill Ranch:

Located in northeastern Crawford County, there are approximately 3,000 acres in the tract. Except for less than 60 acres of river bottom land (Lupton muck), the entire area is, and was, open jack pine plains on Grayling sand.

The ranch, promoted by Dr. Underhill, was started in about 1900. The venture was financed by New York investors. A large barn, 2 silos, several buildings and two houses were constructed. Approximately 300 acres were cultivated for corn and hay. This crop area was fenced. They had about 500 head of Hereford and Short Horn steers. They hired three cowboys to herd the cattle. These cattle were herded throughout the township and into Otsego County.

The cattle were shipped in by rail from Chicago in the spring and then shipped out as feeders in the fall. Only a few head of cattle were fed over winter.

The hay and corn crops failed. The beef cattle failed to make expenses. Dr. Underhill left for Oregon in 1920. Except for the areas along the river, the land became tax delinquent and returned to State ownership. The railroad into the nearby town of Lovells has long since abandoned.

In this same general area, there were other people who attempted to range beef cattle, but all have gone. The one remaining industry of these particular jack pine plains is that of servicing the summer tourists and the sportsmen.

No. 4. Watershed Ranch:

This ranch also was located in Crawford County but was in the western part of the county. The pasture consisted of six sections of cut-over land on which a none too thrifty stand of red pine and jack pine had once stood. The ranch had 300 ewes. They bought hay and some grain for winter feed. However, the death rate of lambs was very high. Expenses overran income, and the land returned to State ownership via the tax delinquency route.

No. 5. N. W. Ogemaw County:

This entire area, because of its general land type of jack pine and aspen on Grayling and Roselawn sands in predominance, is treated as one venture. The principle area, Foster township, was settled first in 1874 and reached its peak population about 1880. Having first been denuded of timber, the next step in the area was the attempt at farming. Those men who were grazing cattle and sheep on the large free range outlasted the farmers. Most of these farmers had vacated by 1890. Large running fires were an annual spring event to keep down the brush and to, as they thought, "help the grass." By 1900, most of the cattlemen and sheepmen were gone. By 1920, nearly all the grazing operators had left. The last man to graze on a large scale left in 1925. He generally bought two carloads of steers in the spring and sold the lot in the fall for feeders. However, even the whole township, of free pasture at the time, was not sufficient to warrant staying in the business.

This last man, however, did not stop operations devoid of money. He quit when he still had some money left although he lost money during the last three years of his cattle business, he had been losing money. The writer was unable to learn the reasons for this loss in profit.

No. 6. White Ranch:

Located in southeastern Charlevoix County and northeastern Antrim County, the area consisted of four sections of land. The original forest stand, cut over in 1903, was hard maple, beech, elm and basswood. The soils were Emmet sandy loam, Emmet loamy sand, Ogemaw sandy loam, and some Carbondale muck.

Immediately after the area was cut-over, timothy and red clover seed was broadcast. Some smooth brome grass was sown in also. After this seeding, 150 head of Shorthorn grade cattle were turned out to graze. The next year 300 head were placed on the area. These cattle were used for beef for the White Lumber Company camps.

This venture continued until about 1914. Meanwhile the hardwood second growth had come in, and the areas of timothy and clover were crowded out. The area was abandoned when the White Lumber Company set up a paper pulp plant on the West Coast.

No. 7. Richardson Ranch:

Located in southeastern Cheboygan County at the site of the present headquarters of the Pigeon River State Forest, the ranch was owned by two lumbermen, F. L. Richardson and Thomas McDade. It was originally set up on somewhat the same idea as the White Ranch. Three sections were fenced after the area was cut over. In this enclosure they ran beef cattle and used the beef for their lumber camps. Many of the cattle were shipped to their farm in Ohio for winter feeding.

A large barn was built that contained 100 steel stanchions for the cattle. The large white pine stumps were pulled in a field near the barn and timothy and clover hay grown on the area.

As the lumbering was dying out in the early 1920's, old woods workers were placed on the ranch to care for the cattle. The "old timers" in this vicinity tell many stories about how the old "lumber-jacks" killed or sold cattle belonging to the lumber company.

In 1927, the railroad into the ranch was taken out. That was the last year cattle were run on the area. In 1928, the ranch was sold to the State of Michigan. The tract and its headquarters then became a part of the Pigeon River State Forest.

No. 8. Paige Farm:

Located centrally in northern Clare County, the farm consisted of 1120 acres. The soils are predominantly Roselawn sandy loam and some Ogemaw sandy loam on which the cultivated crops and hay were grown. Large white pine and red pine stumps still remain on the areas used for pasture.

Mr. Paige bought the ranch in 1902 from a lumberman, Mr. Blodgett. He built a large two story, 16 room house, a tenant house, a 98 foot by 100 foot barn and several other buildings. He planted 25 acres to apple trees. An estimated 200 acres was used for cultivated crops and timothy and red clover hay. The farm was run by a manager, and generally carried 150 to 160 head of beef cattle. The cattle were bought in February and March and fed on hay and ensilage until they were turned onto the pasture in April or May. The cattle were then sold, a carload at a time, until all were sold by November.

Leslie D. Robertson bought the farm in 1917 and sold it to Harry J. Collins in 1922. Operations ceased in the fall of 1928, and has since been used only occasionally by renters. In 1938, Mr. Yake obtained the farm by a mortgage from Mr. Collins.

At present, the large house is in need of repair and the farm buildings are sagging. Much of the land is now held in separate blocks of ownership, apparently for oil speculation.

No. 9 Serradella Farm:

Located in Iosco County seven miles north of the city of Oscoda, the ranch consisted of approximately 4,000 acres bought in 1904 by Mr. Carl E. Schmidt, a Detroit manufacturer. The soil was a deep sand, formerly supporting jack pine and aspen. The purchase price was one dollar per acre.

Of all the stories the writer has heard pertaining to farming or livestock ventures in Michigan, this venture was by far the most spectacular. Mr. Schmidt deliberately selected an area that Professor Roth, of the University of Michigan, Professor Kedzie, of the Michigan Agricultural College, and others told him was incapable of growing anything usable. At the time of the purchase, there were nine deserted cabins of farmers who had attempted to make a living on the area, and apparently had failed.

The first operation was to clear 320 acres of the land of stumps to facilitate cultivation. On this he planned to raise winter feed for livestock and some cash crops. He paid one dollar per stump for each stump pulled. On one 40-acre field, he paid \$3,850 for the stumps pulled. The first field was cleared of stumps, plowed, and planted to the best potatoes and corn available.

The first harvest yielded six bushels of potatoes to the acre where ten bushels had been planted. The corn grew 14 to 18 inches high. This was in 1906. By 1920, these same soils were yielding 200 bushels of potatoes per acre and the corn was over 6 feet tall. However, no estimate can be made of the thousands of dollars Mr. Schmidt spent on

fertilizers shipped in and the tons of barnyard manure purchased from nearby farms.

He imported plants from all over the world. He named the farm after a European legume, Serradella. He imported machinery for working the farm. Plowing was done by attaching a plow to a cable run between two steam tractors. He employed men from Germany and Denmark whom he thought might be able to increase production.

The livestock he tried through the years included Galloway cattle, Holstein cattle, sheep, hogs (1000 at one time,) chickens, Morgan horses and Percheron horses.

Mr. Schmidt died in the early 1920's. At his death, the financial backing for the farm ceased. Some of the land was purchased by a few farmers, but they since have given up. The land apparently was not durable. The buildings have been dismantled. Most of the area is now in public ownership.

The histories on the past grazing ventures were obtained by conversations with old residents, in some cases with the former operators, from old pamphlets and newspapers, and from county court records. The details in some instances may not be entirely accurate due to the inconsistencies in the memories of the old residents, or their colorful elaboration of incidents and details. However, in most cases the stories from different individuals were essentially the same.

The purpose in obtaining the histories was to attempt to discover the reasons behind the decline of each grazing venture. It was hoped that these reasons would point out the land types unsuited to grazing and the management practices that appeared to be impractical.

Following are those conditions and/or management practices which appeared to be responsible for the discontinuance of grazing ventures:

1. Where cattle or sheep are carried the year around, winter feed must be raised on the area. The expenses incurred in buying and bringing in feed for livestock are prohibitive.

2. Where Grayling sand is the only soil type on the area, it cannot support a domestic livestock population. However, Grayling sand areas that are open to moderately covered with woody vegetation are successfully used in conjunction with better soil types.

3. Any area that supports a dense stand of trees, regardless of the quality of the soil, cannot be economically grazed.

4. Cattle or sheep should not travel more than one mile to obtain drinking water. The areas close to water become overgrazed, and those more than one mile distant from water remain very lightly grazed to unused.

5. The practice of using a cowboy to herd cattle or a herder for sheep has only rarely succeeded in Michigan. None of these herding practices have succeeded for any length of time on open range.

6. Capitalizing beyond the need of necessary equipment and buildings has been a large factor in the decline of many grazing ventures. The Rainey Lake Ranch, the Richardson Ranch, the Paige Farms, and the Serradella Farms are typical examples.

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PROBLEM STUDY AREAS

In June of 1940, 37 areas were selected in the northern part of lower Michigan which were being used wholly or in part for the grazing of livestock. The attempt was to select those pastured areas which are representative of the different types of grazing ventures now in progress. By the fall of 1941, 22 study areas remained. The other areas were dropped for reasons of lack of cooperation from the operators or because these ventures were not suited to the nature of the study. Table 1 indicates the locations of the remaining 22 areas which are here discussed.

The Problem Study Areas were first mapped according to the Mapping Procedure outlined. The acres contained in each of the units were then determined by planimetering. These units will then be grouped to form the Pasture Classes to be found in each of the areas, and the Animal Unit Capacity of each Pasture Class computed.

The livestock carried on each area will be correlated with the calculated Animal Unit Capacity. Those conditions indicating the apparent success of each venture and an approximation of the wild game populations will also be presented.

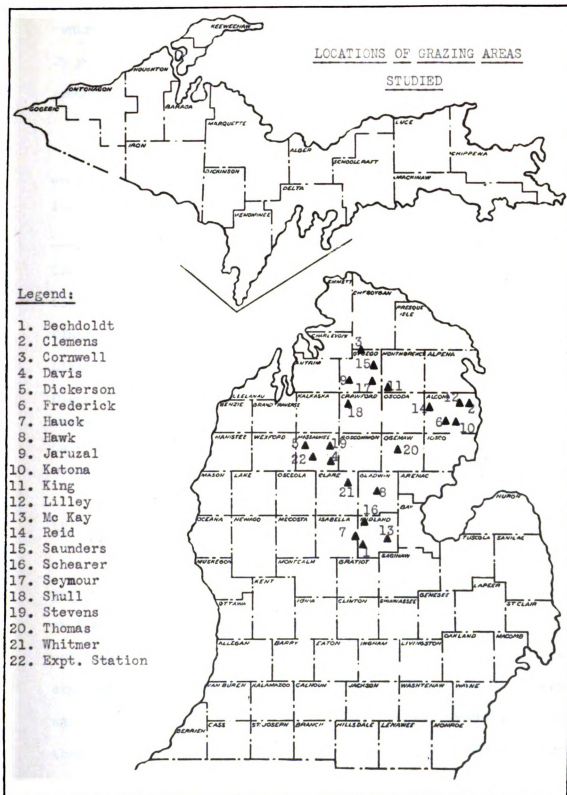
Note: It may be desirable to read the Mapping Procedure (pp. to) to facilitate interpretation of the legends on the following maps. The sections on the Determination of Animal Units (pp. to) and Wildland Pasture Types (pp. to) will aid the reader to interpret presentation of data on each of the study areas.



Legend:

- 1. Beech
- 2. Cereals
- 3. Corn
- 4. Daisies
- 5. Flowers
- 6. Fruits
- 7. Grass
- 8. Hay
- 9. Leaves
- 10. Maples
- 11. Pines
- 12. Rye
- 13. Sycamores
- 14. Tansies
- 15. Vines
- 16. Wheat
- 17. Yucca
- 18. Zinnias
- 19. Apples
- 20. Bananas
- 21. Carrots
- 22. Cabbages
- 23. Cauliflowers
- 24. Cucumbers
- 25. Eggplants
- 26. Garlic
- 27. Lettuce
- 28. Onions
- 29. Peas
- 30. Potatoes
- 31. Spinach
- 32. Tomatoes
- 33. Turnips
- 34. Watermelons
- 35. Zucchini

Table 1.



Bechdoldt Area No. 1.

This area consisted of one hundred and sixty acres located in central western Midland County where the operator has been located for 20 years. There are 158 acres used for pasture, no hay or crops are produced. Two acres are occupied by the yard and buildings.

Calculation of Carrying Capacity

Forage value areas by acres	Carrying capacity per class by animal units
Class II	2.2
Class III	3.0
Class IV	2.8
Class V	4.9
Class VI	0.0
Calculated Carrying Capacity	12.9 Animal Units

Livestock carried consisted of 50 ewes and 40 lambs, a total of 12.5 Animal Units.

On the face of the data presented, the area should be able to carry 12.9 animal units. Yet with 12.5 animal units on the area, lambs at 5 months of age averaged only 50 pounds each. The lambs were not only light in weight but were also thin. Poor management is the chief explanation. During the hot, dry months of July and August, grazing was confined to the droughty Rubicon sand areas, severely overgrazing these areas. The sheep were not turned onto the Newton sand area (wet in spring and fall, moist in summer) until the rains had started in the fall. By the time the sheep were turned onto the Newton sand area, the



Fig. 1. A dense stand of second growth hardwoods furnishes little or no feed for livestock.

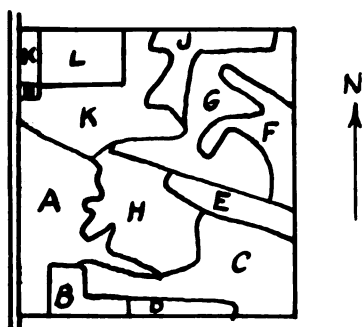


Fig. 2. Dense lowland sedges furnish no edible forage for livestock.

BECHDOLDT AREA NO. 1 MIDLAND COUNTY

SCALE: 3 IN. = 1 MILE
160 ACRES

LEGEND



A	86	
	F-P-Mu/Ss	
	P-P-1-3	
	Kg-Bg-Wc-Gz-Sg	
	60	
	III	
	G ₂	

B	86	
	F-P-Mu/Ss	
	0	
	Al-Rc-Kg-Rt-Sg	
	73	
	II	
	G ₃	

C	86	
	F-P-Mu/Ss	
	P-Wb-4"-1	
	Lr-Gz-Kg	
	10	
	V	
	G ₁	

D	86	
	F-P-Mu/Ss	
	0	
	Qg-Rt-Kg-Sg	
	70	
	II	
	G ₁	

E	86	
	F-P-Mu/Ss	
	P-Sp-Cz-Wb-4"-2	
	Lr	
	0	
	VI	
	G ₀	

F	46	
	F-F-Ss	
	P-Wb-1-2	
	Kg-Pg-Bk-Cf	
	30	
	IV	
	G ₂	

G	46	
	F-F-Ss	
	P-Wb-4"-2	
	Bk-Kg-Pg-Wg	
	10	
	V	
	G ₁	

H	86	
	F-P-Mu/Ss	
	P-Wb-Sm-Em-4"-2	
	Bg-Sg-Rg-Kg-Ct	
	10	
	V	
	G ₁	

J	46	
	F-F-Ss	
	0	
	Sg-Pg-Bk-Kg	
	15	
	V	
	G ₂	

K	46	
	F-F-Ss	
	0	
	Kg-Pg-Ms-Bk-Cf-Mu	
	30	
	IV	
	G ₄	

L	46	
	F-F-Ss	
	0	
	Mu-Cg-Kg-Qg-Cf	
	V	
	G ₄	

grasses had grown tall and coarse, and the area had become too wet for good sheep pasture. However, this Newton sand area would have been ideal for summer pasture, because it would be moist enough to permit growth of forage throughout the dry months. The dry Rubicon sand then should have been used in the spring and fall. The sheep would have grazed this way if they had free use of the entire 158 acres, but the fence between the dry land and the moist land portions of the tract was not opened until the forage on the dry pasture had been very heavily depleted.

Clemens Area No. 2.

This unit consists of 600 acres in central eastern Alcona County, 360 acres being owned and 240 acres rented, and has been located here for about 8 years.

Mr. Clemens is a farmer using little wild pasture, but depending primarily upon the income from alfalfa and vetch seed production.

Of the 600 acres operated by this farmer, only 80 acres were studied. This was a cleared field of Selkirk loam, fertilized at the rate of 300 pounds of 0-20-0 fertilizer to the acre. This resulted in a pasture consisting of Dutch white clover and Kentucky bluegrass of 100% density. On this area were placed 36 Hereford cows and their 33 calves, 11 two-year old Hereford heifers, and one Hereford bull. This totaled 64.5 animal units carried on the 80 acres for 6 months. In December of 1940, calves averaging between 8 and 9 months of age averaged 526 pounds each.

In 1941, the white clover-bluegrass area was severely affected by drought. For 6 weeks in July and August, the cattle were placed on an 80-acre alfalfa field. In November, 1941, the 7 to 8 month-old calves averaged 428 pounds each.



Fig. 3. Bluejoint grass, Calamagrostis canadensis, on wet lands furnishes much needed forage to cattle in the dry months of July and August.



Fig. 4. Droughty sandy soils produce limited forage for livestock. Only a small portion of the ground is occupied by edible grasses.

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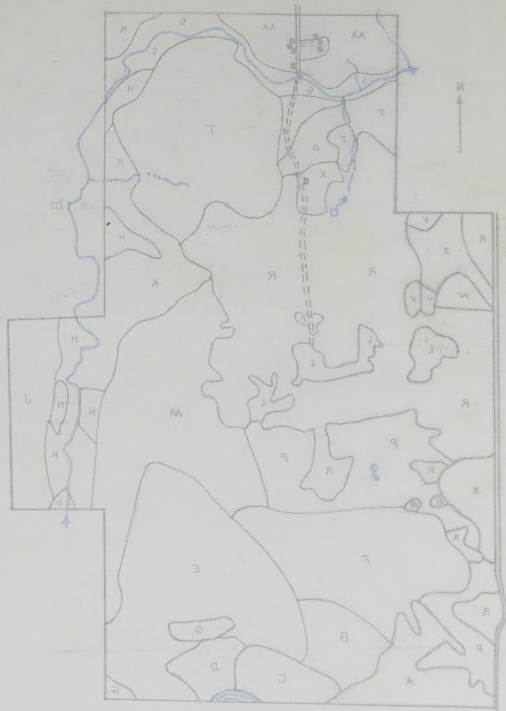
CORNWELL RANCH NO. 3
CHEBOYGAN & OTSEGO COUNTIES
SCALE: 2 in. = 1 Mile
4480 Acres



LEGEND

29 U-G-Ls Hm-Em-Bw-4th-2 Lr 0	29 R-F-Ls-16 P-Ok-Sm-4th-3 Bx-Sr-Kg-Cg-Pg 10	26-58 U-G-Ls-2G Em-Hm-Bw-Bu-2-3 Kg-Tm-Dn-Bk 60
29 U-G-Ls P-Wb-4th-2 Kg-Cg-Br-Bk 20	29 U-G-Ls Em-Hm-P-2-3 Kg-Cg-Mw 50	29 U-G-Ls-2G Bw-1-3 Cg-Kg-Bw-Mw-Cg 50
29 U-G-Ls P-Sm-1-2 Kg-Cg 50	29 U-G-Ls-2GB Hm-Em-1-2 Kg-Mw-Bk-Gn 60	26 U-G-Ls-2G Em-Sm-1-3 Kg-Bw-Mw-Cg 65
29 U-F-Ss 0 Pg-Kg-Cg 20	29 U-G-Ls-2G Em-Hm-Pc-1-2 Kg-Cg-Bk-Mw-Gn 45	26 U-G-Ls-2G Hm-Em-Bw-Pg-80th-2 Cg-Kg-Mw-Hw 45
29 U-F-Ss Pc-2-1 Br-Kg-Cg 10	70 F-I-Sb O(Wp-4th+Stumps) Kg-Dn-Mw 75	26 U-G-Ls-2G 0 Kg-Dn-Qg 65
29 U-G-Ls-16 Sm-Pc-P-2-2 Kg-Cg-Mw 50	29 U-G-Ls-2G Hm-Em-Bk-4th-2 Lr 0	29 U-G-Ls-16 Hm-Em-Pc-2-2 Kg-Bk-Mw-Hw 60
70 F-I-Mp Sp-Cr-4th-2 0	29 U-G-Ls-2G Hm-Em-Pc-1-2 Kg-Cg-Bk-Mw 60	29 U-G-Ls-2GB Em-Hm-Bw-Bk-4th-2 Kg-Cg 25
20 F-I-Mp P-Sp-Cr-4th-3 0	30-80 F-I-Mp Em-Sp-1-3 Kg-Dn-Gn-Sg 70	26-29 U-G-Ls-3GC 0 Kg-Qg-Al-Dn 70

CORNWELL RANCH NO. 3
CHEBOYGAN & OTSEGO COUNTIES
SCALE: 2 in. = 1 mile
4480 Acres



IV	1-6-12 1-6-12 1-6-12	5
B	U-6-12 P-6-12 K-6-12	5
C	1-6-12 P-6-12 K-6-12	5
D	U-6-12 P-6-12 K-6-12	5
E	1-6-12 P-6-12 K-6-12	5
F	1-6-12 P-6-12 K-6-12	5
G	1-6-12 P-6-12 K-6-12	5
H	1-6-12 P-6-12 K-6-12	5

IV	1-6-12 1-6-12 1-6-12	5
B	U-6-12 P-6-12 K-6-12	5
C	1-6-12 P-6-12 K-6-12	5
D	U-6-12 P-6-12 K-6-12	5
E	1-6-12 P-6-12 K-6-12	5
F	1-6-12 P-6-12 K-6-12	5
G	1-6-12 P-6-12 K-6-12	5
H	1-6-12 P-6-12 K-6-12	5

IV	1-6-12 1-6-12 1-6-12	5
B	U-6-12 P-6-12 K-6-12	5
C	1-6-12 P-6-12 K-6-12	5
D	U-6-12 P-6-12 K-6-12	5
E	1-6-12 P-6-12 K-6-12	5
F	1-6-12 P-6-12 K-6-12	5
G	1-6-12 P-6-12 K-6-12	5
H	1-6-12 P-6-12 K-6-12	5

Cornwell Ranch, Area No. 3.

This consisted of 4480 acres located in southern Cheboygan and northern Otsego counties.

This tract was fenced in 1915 and leased for 5 years to the president of the New York Central Railroad. He ran 5,000 sheep on the area but scab and management troubles induced him to quit the venture. The present owner has run cattle on the area since 1920. For the last 7 years, he has had an average of 243 steers with an average of 582 pounds beginning weight and an average gain of 180.5 pounds during the May to October grazing season. He carries no cattle through the winter but buys from many markets in May and sells them as feeders in October.

The soils are predominantly Emmet sandy loam and Emmet loamy sand (Ref. 1).

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity Per Class by Animal Unit
Class II	296	65.8
Class III	1537	219.6
Class IV	617	51.4
Class V	717	39.8
Class VI	1304	0

Calculated Carrying Capacity : 376.6 A. U.

As the map (Area No. 3) indicates, most of the area was lightly to moderately grazed. From all indications, the area is capable of carrying more animals than have been kept. In 1941, it carried 340 steers averaging 700 pounds midsummer weight, 67 ewes, 2 bucks and 69 lambs, a total of 323 animal units.

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Forage V

Class I

Class II

Class III

Class IV

Class V

Class V

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Watering spots are well distributed throughout the entire area. They consist of numerous springs and the Sturgeon River. Deer and elk are well represented throughout the area. Only a few partridge and rabbits were noted.

Davis Area, No. 4.

This area consists of 1080 acres located in southeastern Wisconsin County. Eight hundred and twenty acres are owned and 260 acres are rented. The present owner has been on this area since 1905.

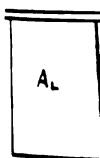
Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Unit
Class I	12	6.0
Class II	358	71.6
Class III	73	9.2
Class IV	35	3.9
Class V	170	1.9
Class VI	109	0.0

Calculated Carrying Capacity : 93.6 A. U.

Livestock carried on pasture consisted of 40 milk cows producing, on the average, 600 pounds of milk per day, 10 heifers, 100 old ewes, 50 yearling ewes, 80 lambs and 10 young horses, which gives a total of 93.0 Animal Units on pasture. The fact that the cows were fed silage, hay and grain at the barn would discount the actual load carried by the pasture. As indicated (map No. 4.), the pastured areas were lightly to moderately grazed.

DAVIS A
MISSAU
SCALE: 3
1080 AC



A	F
	LW
	Sg

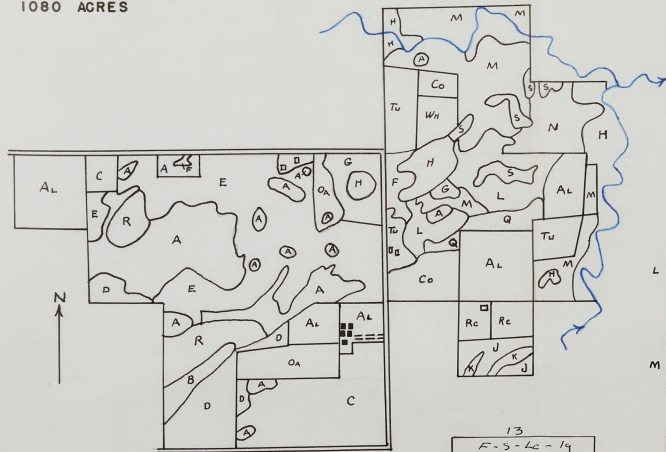
B	F
	p
	LR

C	F
	p
	Kg

DAVIS AREA NO. 4
MISSAUKEE COUNTY

SCALE: 3 IN. = 1 MILE

1080 ACRES



LEGEND

40	
F-P-Mc	X G ₁
Lw-4"-1	
Sg-Bg-CT	
10	

40	
F-P-Mc	VI G ₀
P-4"-1	
LR	
5	

81	
F-S-Cc-1g	II G ₃
P-Wb-Sm-2-2	
Kg-Tm-Wc-Rc	
75	

81	
F-S-Cc-1g	III G ₂
P-Wb-4"-2	
Kg-Tm-Bg-Wc	
60	

81	
F-S-Cc-1g	II G ₃
P-Sm-Wb-2-2	
Kg-Tm-Wc-Qg	
80	

40	
F-P-Mc	I G ₂
O	
Rc-Ag-Sg	
80	

13	
F-S-Lc-1g	G
P-Sm-Wb-Hm-4"-2	
Kg-Sg-Wg-Tm	

13	
F-I-Lc	VI G ₀
Em-Sm-Bw-4"-3	
LA-Sg	
0	

15	
F-G-Ls	V G ₁
P-Wb-4"-2	
Sg-LA-Bk-Bg-Wg	
20	

15	
F-G-Ls	IV G ₁
P-Wb-2-2	
Kg-Cg-Bk-Bg-Sg	
30	

85	
F-P-Lc	II G ₀
O	
CT-Sg	
0	

13	
F-G-Lc	II G ₃
O	
Kg-Tm-Qg-Wc	
70	

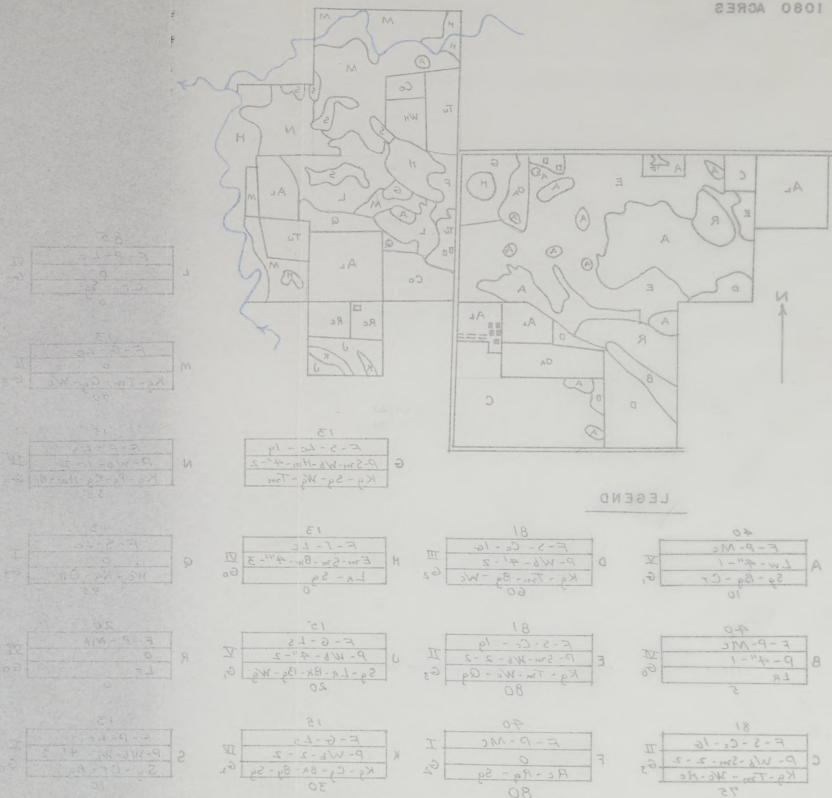
15	
F-F-Ls	IV G ₃
P-Wb-1-2	
Kg-Pg-Cg-Hw-Bk	
35	

13	
F-S-Lc	I G ₃
O	
Wc-Kg-Dh	
95	

20	
F-P-Mp	VI G ₀
O	
LF	
0	

13	
F-P-Lc	V G ₀
P-Wb-Wb-4"-2	
Sg-CT-Bg	
10	

DAVIS AREA NO. 4
MISSAUKEE COUNTY
SCALE: 3 IN. = 1 MILE
1080 ACRES



The operator usually plans on having 40 acres in crops each year. These include corn for silage, turnips and oats. He has 120 acres in legume (alfalfa) hay.

Occasionally, deer are seen on the area. Fox squirrels are numerous along the river bottom; partridge and rabbits are scarce. There have been no predators for several years.

Dickerson Area No. 5.

Located in northwestern Missaukee County, this area consists of 340 acres. The owner has 256 acres in pasture land and 84 acres in crops. The crops consist of corn, wheat, buckwheat, oats, alfalfa, potatoes and some land lying fallow. The soils are predominantly Blue Lake loamy sand with some Kalkaska sandy loam that is under cultivation.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class IV	94	7.8
Class V	53	3.0
Class VI	109	0.0

Calculated Capacity : 10.8 Animal Units

On this area were carried 11 milk cows, 4 dairy heifers and one bull, a total of 14.5 Animal Units. The cattle were very thin, and milk production dropped severely in July and August. As indicated on the map of Area No. 5, the pasture was severely overgrazed. The forage was almost entirely Canada bluegrass.

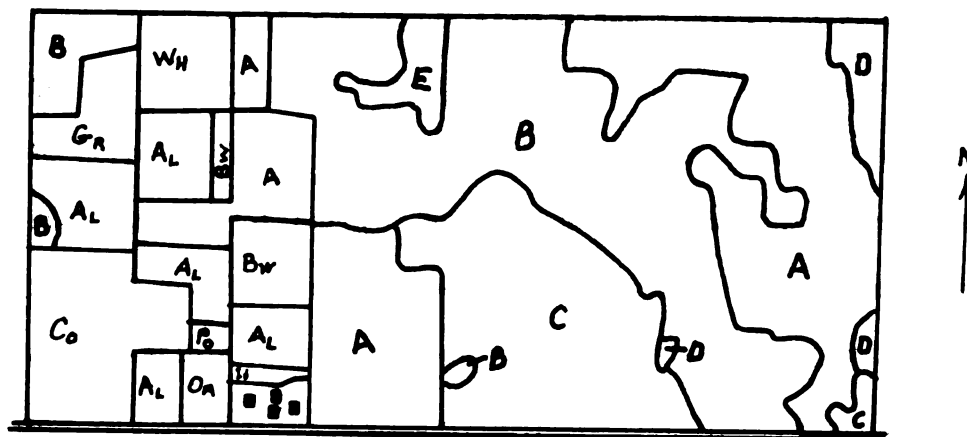


Fig. 5. Orange hawkweed, Hieracium aurantiacum, that is heavily grazed. This weed is commonly found on areas depleted of plant nutrients by past exhaustive cultivation.

D
M
S
3



DICKERSON AREA NO. 5
 MISSAUKEE COUNTY
 SCALE: 4 IN. = 1 MILE
 340 ACRES



LEGEND

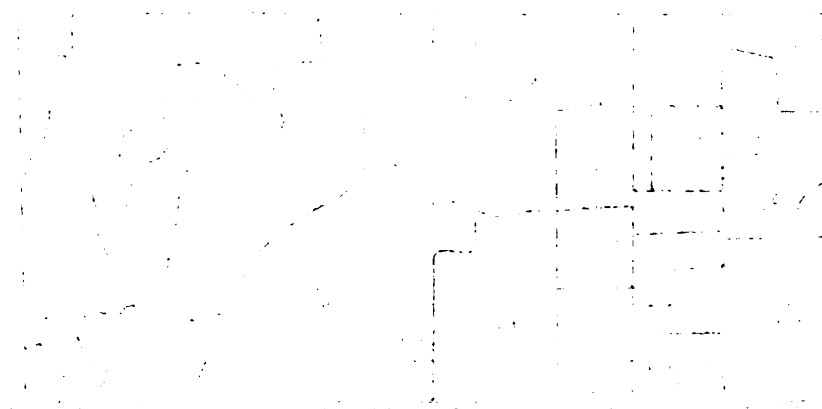
A	58	
	R-G-Ls-3Gc	
	O	
	Cg	
	55	
	IV	G ₄

B	41	
	R-G-Ls-3Gc	
	Hm-Ok-Pc-4"-2	
	La-Wg-Cg	
	5	
	VI	G ₂

D	58	
	U-G-Ls-2Gc	
	P-4"-2	
	La-Kg-Cg-Wg	
	15	
	V	G ₂

C	41	
	R-G-Ls-3Gc	
	Hm-Ok-Pc-3"(20%)22	
	Cg-Pg-Sg	
	20	
	V	G ₁

E	41	
	U-G-Ls-3Gc	
	O	
	Cg	
	5	
	VI	G ₄



10/10/10

10/10/10

10/10/10

10/10/10

10/10/10

The operator of this area did not appear prosperous. The farm buildings were in need of repair and his equipment was old and in need of repair.

Frederick Area, No. 6.

This unit comprises 1430 acres located in central southern Alcona County. The operator has been located here since 1920. He has 50 acres in lakes and 165 acres in alfalfa and crops. The crops consist chiefly of corn, soybeans, oats and alfalfa seed. The soil is chiefly Roselawn sandy loam with some spots of Nester loam. Water is well distributed throughout the area; two lakes, a creek, and two wells.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class I	34	11.3
Class III	459	65.6
Class IV	342	31.1
Class V	55	3.1
Class VI	375	0.0

Calculated Capacity : 111.1 Animal Units

Livestock carried consist of 103 ewes, 100 lambs, 53 Angus cows, 11 Angus heifers, 6 Angus steers, 1 Angus bull and 40 Angus calves, a total of 106.7 Animal Units carried.

The forage consists chiefly of Kentucky bluegrass. There are also 34 acres of sweet clover pasture. Around the lakes, there is blue-joint grass pasture. Game is plentiful throughout the area. Deer, partridge and pheasants were commonly noted.

FRE
ALC
SCA
148



A

B

FREDERICK AREA NO. 6
ALCONA COUNTY
SCALE: 3 IN. = 1 MILE
1480 ACRES



LEGEND

F	28	U-S-Cc	III
		Hm-Bw-P-4"-3	
		Kg-Wc-Dh-Gr	
	35		

G	23-35	U-F-Ls	IV
		Uw-4"-1	
		Sf-Bk-Kg-Cg	
	20		

H	60	F-P-Mc	VI
		O	
		Lf	
	0		

J	35	U-G-Ls	VI
		Rp-Ok-4"-3	
		La	
	0		

K	28	U-M-Cc	IV
		Hm-Bw-P-4'-1	
		Kg-Wc-Ac	
	30		

L	60	F-P-Mc	V
		O	
		Sg-Ct-Bg	
	15		

M	70	F-P-Mc	VI
		Sp-Cr-Tm-4"-2	
		O	
	0		

A	35	U-G-Ls	VI
		P-Wb-Ok-4"-3	
		La-Ss	
	0		

C	35	U-G-Ls	IV
		P-Wb-4"-2	
		Kg-Bk-Cg-Sg-Wg	
	30		

N	35	U-G-Ls	III
		O	
		Kg-Qg-Sf-Cg	
	50		

B	35-46	U-G-Ls	III
		P-Wb-Ok-1-3	
		Kg-Sf-Bk-Cg-Pg	
	60		

E	35	U-G-Ls	VI
		P-Uw-4"-1	
		La	
	0		

P	23	F-G-Ls	VI
		O	
		Bk-Sf	
	0		

1 2 3 4 5

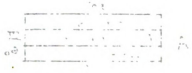


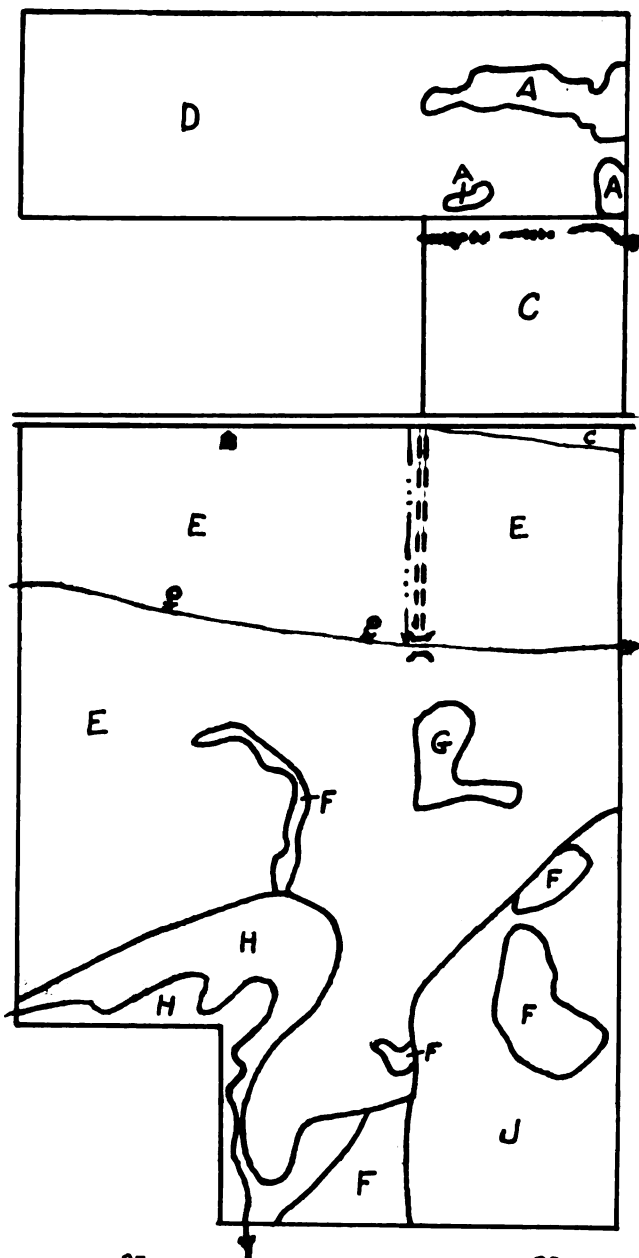


Fig. 6. Scattered trees permit the growth of a fairly good grass cover. The trees also provide shade for cattle in hot weather.



Fig. 7. Ranching operations are successful on areas well covered with edible grasses.

HAUCK AREA NO. 7
MIDLAND & ISABELLA COUNTIES
SCALE: 4 IN. = 1 MILE
600 ACRES



LEGEND

F	15		
	F-F-Ls		
	OK-4'-1		
	Lc		
	0		
		VI	G ₀

G	85		
	F-S-Ls		
	Hm-P-4'-2		
	Kg		
	30		
		IV	G ₂

H	73		
	F-I-Lc		
	Em-Hm-OK-4'-3		
	Kg		
	20		
		IV	G ₂

A	85		
	F-S-Lc		
	P-Em-4'-3		
	Kg-Dn		
	80		
		II	G ₁

D	85		
	F-S-Lc		
	O		
	Kg-Tm-Rt		
	80		
		II	G ₂

C	85		
	F-S-Lc		
	O		
	Tm-Kg-Rt		
	80		
		II	G ₂

E	85		
	F-S-Ls		
	O		
	Kg-Tm-Rt-Cg		
	80		
		II	G ₂

J	15		
	F-F-Ls		
	OK-2-1		
	Kg-Cg-Gr-Hw		
	30		
		IV	G ₁

Country	1950	1960	1970	1980	1990	2000	2010	2020	2030	2040	2050
Japan	7	8	10	12	14	16	18	20	22	24	26
Germany	10	11	12	13	14	15	16	17	18	19	20
France	11	12	13	14	15	16	17	18	19	20	21
Italy	12	13	14	15	16	17	18	19	20	21	22
Spain	13	14	15	16	17	18	19	20	21	22	23
Sweden	14	15	16	17	18	19	20	21	22	23	24
United Kingdom	15	16	17	18	19	20	21	22	23	24	25
United States	16	17	18	19	20	21	22	23	24	25	26
Canada	17	18	19	20	21	22	23	24	25	26	27
South Korea	18	19	20	21	22	23	24	25	26	27	28
China	19	20	21	22	23	24	25	26	27	28	29
India	20	21	22	23	24	25	26	27	28	29	30
Brazil	21	22	23	24	25	26	27	28	29	30	31
Argentina	22	23	24	25	26	27	28	29	30	31	32
South Africa	23	24	25	26	27	28	29	30	31	32	33
Uganda	24	25	26	27	28	29	30	31	32	33	34
Kenya	25	26	27	28	29	30	31	32	33	34	35
Malawi	26	27	28	29	30	31	32	33	34	35	36
Zambia	27	28	29	30	31	32	33	34	35	36	37
Botswana	28	29	30	31	32	33	34	35	36	37	38
Nigeria	29	30	31	32	33	34	35	36	37	38	39
Senegal	30	31	32	33	34	35	36	37	38	39	40
Ghana	31	32	33	34	35	36	37	38	39	40	41
Sierra Leone	32	33	34	35	36	37	38	39	40	41	42
Liberia	33	34	35	36	37	38	39	40	41	42	43
Ivory Coast	34	35	36	37	38	39	40	41	42	43	44
Upper Volta	35	36	37	38	39	40	41	42	43	44	45
Chad	36	37	38	39	40	41	42	43	44	45	46
Niger	37	38	39	40	41	42	43	44	45	46	47
Mali	38	39	40	41	42	43	44	45	46	47	48
Guinea	39	40	41	42	43	44	45	46	47	48	49
Sierra Leone	40	41	42	43	44	45	46	47	48	49	50
Liberia	41	42	43	44	45	46	47	48	49	50	51
Ivory Coast	42	43	44	45	46	47	48	49	50	51	52
Upper Volta	43	44	45	46	47	48	49	50	51	52	53
Chad	44	45	46	47	48	49	50	51	52	53	54
Niger	45	46	47	48	49	50	51	52	53	54	55
Mali	46	47	48	49	50						

100-100000

The buildings were adequate and in good repair. Modern machinery and equipment were used. This venture in livestock apparently was successful. The cattle and sheep were in good condition at all seasons of the year. The calves at $8\frac{1}{2}$ months of age averaged 400 pounds, lambs weighing 85 to 95 pounds were marketed at 7 to 8 months of age. Cattle and sheep are wintered on alfalfa hay.

Hauck Area No. 7

This consists of 600 acres located centrally on the line between Isabella and Midland Counties. The entire 600 acres is used for pasture. The cattle are bought in Texas and Colorado in the spring, pastured in the summer and placed in the feed lot in winter on the owner's farm in Isabella County. They are sold as fat cattle in the late winter. He has operated here since 1930.

The major portion of the area is cleared. The soils are principally Munuscong sandy loam, Ogemaw sandy loam and Griffin loam, (Ref. 2). Water is supplied by three flowing wells and the Salt River at the south end of the areas. The forage is predominantly Kentucky bluegrass.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class II	479	95.8
Class IV	96	9.6
Class VI	25	0.0

Calculated Capacity : 104.4 Animal Units

Livestock carried consisted of 100 head of 600 pound steers and 30 head of 500-pound steers, a total of 101 animal units carried. The cattle were all grade Hereford steers. The 600-pound steers gained an average of 1.37 pounds per day on pasture while the 500-pound steers made an average gain of 1.2 pounds per day.

The only game noted on the area was numerous rabbits.

Hawk Area No. 8.

The eighth area studied consists of 240 acres located in central Gladwin County. It is divided into one 80-acre and one 160-acre pasture which are rented to local farmers. The 80-acre pasture is principally Saugatuck sand.

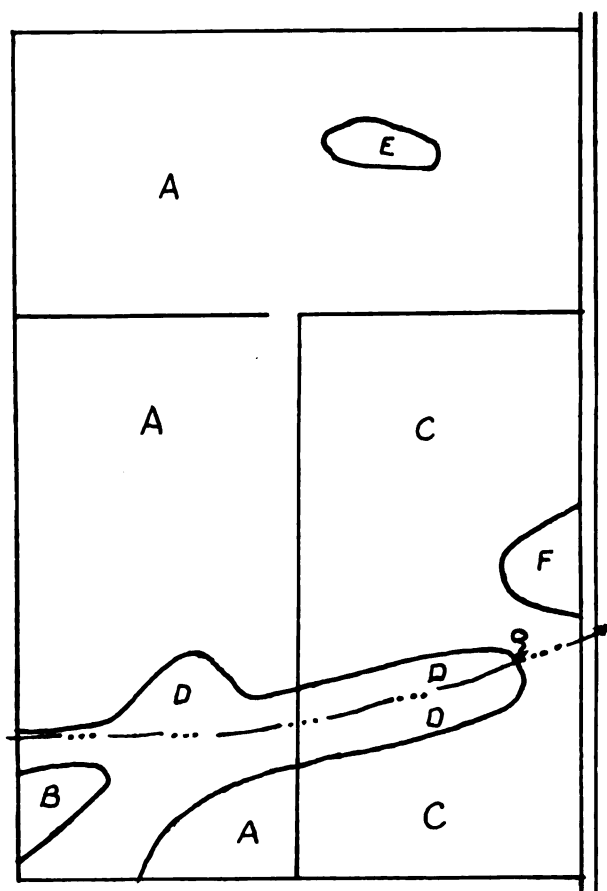
80-Acre Pasture
Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class III	70	7.8
Class IV	10	.7
Calculated Carrying Capacity : 8.5 Animal Units		

Livestock carried consisted of 27 ewes, 27 lambs, and 7 head of 600-pound heifers, a total of 12.4 Animal Units carried. The pasture was severely overgrazed, the cattle were thin, and the lambs gained slowly. The lambs weighed 75 pounds at $7\frac{1}{2}$ months of age.

The 160-acre pasture was mainly Saugatuck sandy soil, Newton sand.

HAWK AREA NO. 8
GLADWIN COUNTY
SCALE: 12 IN. = 1 MILE
240 ACRES



LEGEND

C	36		
	F-P-Ss		
	O		
	Kg-Pg-Bg-Sg		
	35		
			III G ₄

D	86		
	F-P-Ms		
	P-4"-1		
	Bg-Sg		
	15		
			V G ₂

A	36		
	F-P-Ss		
	O		
	Kg-Bg-Sg		
	60		
			II G ₃

B	36		
	F-P-Ss		
	O		
	Pg-Kg-Sg		
	20		
			V G ₂

E	86		
	F-P-Ms		
	Cr-Sp-4"-2		
	O		
	O		
			VI G ₀

F	86		
	F-P-Ms		
	O		
	Sg-Bg		
	15		
			V G ₁

160-Acre Pasture
Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Unit
Class II	141	28.2
Class V	17	1.0
Class VI	2	0

Calculated Capacity : 29.2 Animal Units

The livestock carried consisted of 75 ewes, 65 lambs, and 13 600-pound dairy heifers, a total of 28.7 animal units carried. The heifers of the same type as on the 80-acres pasture were in better condition. The lambs at 7 months of age averaged 80 pounds. The pasture was more moderately grazed.

No game of any kind was noted on either of the pastures.

Jaruzal Area No. 9.

The 520 acres comprising this ranch are located in central Otsego County. There are 320 acres of wildland pasture and 200 acres in the farm. The pasture has about 250 acres of Rubicon sand and 70 acres of Kalkaska sandy loam. The farm, 200 acres, is Kalkaska sandy loam. About 20 % of the pasture has a moderate stand of aspen and white birch. The remainder is open stump pasture. The forage is predominantly Kentucky bluegrass with poverty oatgrass and sand sedges.

In 1941, the crops consisted of 20 acres of potatoes, 120 acres of alfalfa and mixed hay, $23\frac{1}{2}$ acres of oats, 8 acres of corn, 4 acres of wheat and 7 acres of sweet clover.

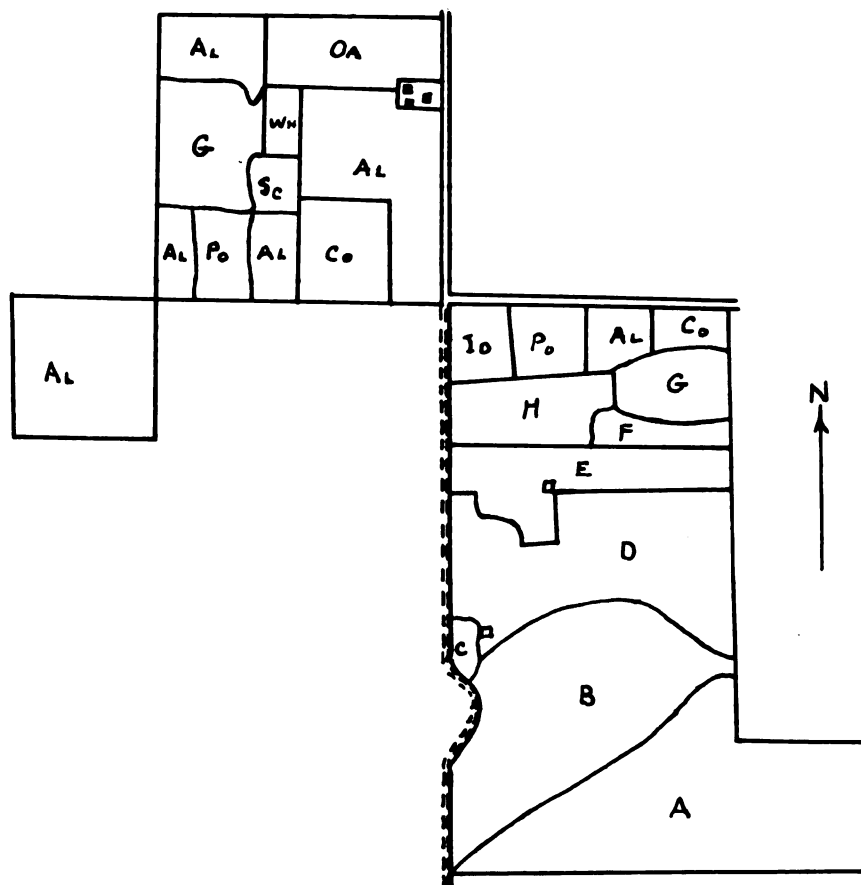


Fig. 8. Good grade cattle are produced on good wildland pasture.



Fig. 9. Deferred grazing allows extra growth of pasture plants in the early spring.

JARUZAL AREA NO.9
OTSEGO COUNTY
SCALE: 3 IN. = 1 MILE



LEGEND

46	
F-F-Ss	IV
P-Sm-4'-2	G ₂
Kg-Cg-Bk-Pg	
20	

46	
F-F-Ss	IV
P-Sm-2-2	G ₂
Kg-Cg-Pg-Sf	
30	

76	
F-F-Ss-1g	IV
0	G ₃
Kg-Qg-Cg	
25	

72	
U-F-Ss	IV
0	G ₃
Qg-Cg-Kg	
25	

72	
F-F-Ls	VI
Hm-Bs-Bh-Hm-Bh-4'''	G ₁
Lr-Ws	
0	

76	
U-F-Ss-1g	V
P-Sm-4'-2	G ₂
Bk-Kg-Cg-Wg	
10	

72	
F-F-Ls	V
Sm-Sm-Hm-3''(60%)	G ₀
Kg-Lr	
20	

72	
F-F-Ls	IV
0	G ₀
Cf-Mw-Qg	
20	



Figure 1

The diagram illustrates the basic components and layout of the system, including the main body, inlet, and outlet ports, and the associated piping.

The system is designed to handle the flow of fluid from the inlet through the main body to the outlet, with the piping ensuring proper connection and flow direction.

The diagram also shows the relative positions of the various components, allowing for a clear understanding of the overall configuration and the intended function of the assembly.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class IV	230	19.2
Class V	78	5.2
Class VI	39	0.0

Calculated Capacity : 24.4 Animal Units

Livestock carried on the area consisted of 29 dairy cows and 15 dairy heifers, a total of 44.3 animal units carried. The heifers remained on the pasture at all times during the season. The dairy cows were on pasture only during the day. The cows were fed grain and hay at the barn and kept in overnight. Portions of the pasture were heavily overgrazed.

Partridge were scarce on the pasture. Deer tracks were occasionally seen. Butterfat production of the 29 cows in May was 541 pounds; June, 542 pounds; July, 537 pounds; August, 473 pounds; September, 553 pounds; October 1-15, 236 pounds.

The operators' buildings were adequate and in good repair.

Katona Area No. 10.

The 584 acres are located in southern Alcona County. Of this, 544 acres are owned and 40 acres are rented; 90 acres are cleared of trees. The operator started here in 1925 with no land cleared. The soils are Nester loam, Roselawn sandy loam, and Roselawn sand. Forest cover is principally maple, aspen and oak.



Fig. 10. Good water resources are good assets for livestock production on wildland pastures.



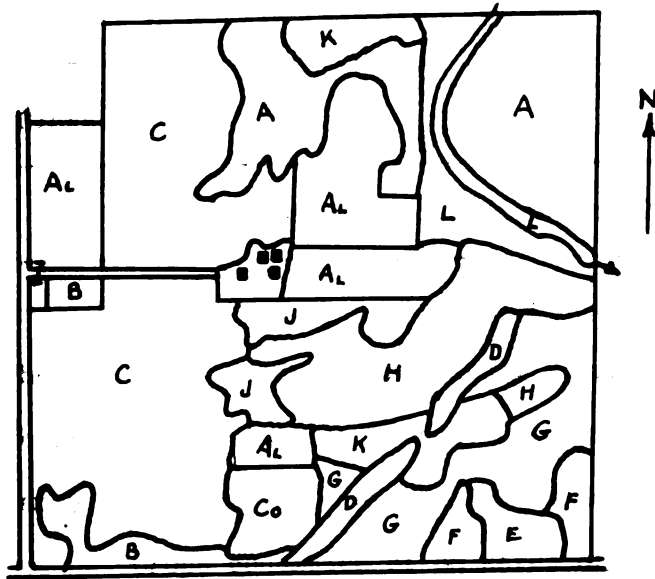
Fig. 11. The cut-over wildland areas of Michigan have many clumps of trees to offer shade to cows and their calves.

KATONA AREA NO. 10

ALCONA COUNTY

SCALE: 3 IN. = 1 MILE

584 ACRES



LEGEND

	60 <table><tr><td>F-P-Mc</td></tr><tr><td>D Sp-Cr-P-4'''-3</td></tr><tr><td>0</td></tr><tr><td>0</td></tr></table> VI G₀	F-P-Mc	D Sp-Cr-P-4'''-3	0	0	35 <table><tr><td>R-G-Lc</td></tr><tr><td>H P.Wb-Hm-4"-2</td></tr><tr><td>Bk-Kg-Cg-Wg</td></tr><tr><td>15</td></tr></table> V G₁	R-G-Lc	H P.Wb-Hm-4"-2	Bk-Kg-Cg-Wg	15							
F-P-Mc																	
D Sp-Cr-P-4'''-3																	
0																	
0																	
R-G-Lc																	
H P.Wb-Hm-4"-2																	
Bk-Kg-Cg-Wg																	
15																	
A	28 <table><tr><td>R-G-Cc</td></tr><tr><td>P-Sm-4'-3</td></tr><tr><td>Kg-Wc-Cg</td></tr><tr><td>70</td></tr></table> II G₂	R-G-Cc	P-Sm-4'-3	Kg-Wc-Cg	70	E	16 <table><tr><td>U-F-Ss</td></tr><tr><td>0</td></tr><tr><td>Kg-Cg-Pg-Ss</td></tr><tr><td>30</td></tr></table> IV G₁	U-F-Ss	0	Kg-Cg-Pg-Ss	30	J	24 <table><tr><td>R-G-Lc</td></tr><tr><td>P.Wb-2-2</td></tr><tr><td>Kg-Cg</td></tr><tr><td>80</td></tr></table> II G₂	R-G-Lc	P.Wb-2-2	Kg-Cg	80
R-G-Cc																	
P-Sm-4'-3																	
Kg-Wc-Cg																	
70																	
U-F-Ss																	
0																	
Kg-Cg-Pg-Ss																	
30																	
R-G-Lc																	
P.Wb-2-2																	
Kg-Cg																	
80																	
B	28 <table><tr><td>U-G-Lc</td></tr><tr><td>O(Wp-4'''-4 stump)</td></tr><tr><td>Sz-Kg-Bk</td></tr><tr><td>20</td></tr></table> IV G₁	U-G-Lc	O(Wp-4'''-4 stump)	Sz-Kg-Bk	20	F	16 <table><tr><td>U-F-Ss</td></tr><tr><td>OK-4'''-2</td></tr><tr><td>Pg-Ss-Cg-Kg</td></tr><tr><td>10</td></tr></table> V G₀	U-F-Ss	OK-4'''-2	Pg-Ss-Cg-Kg	10	K	24 <table><tr><td>R-G-Lc</td></tr><tr><td>0</td></tr><tr><td>Kg-Cg-Dn</td></tr><tr><td>80</td></tr></table> II G₂	R-G-Lc	0	Kg-Cg-Dn	80
U-G-Lc																	
O(Wp-4'''-4 stump)																	
Sz-Kg-Bk																	
20																	
U-F-Ss																	
OK-4'''-2																	
Pg-Ss-Cg-Kg																	
10																	
R-G-Lc																	
0																	
Kg-Cg-Dn																	
80																	
C	28 <table><tr><td>U-G-Lc</td></tr><tr><td>P.Wb-Hm-4"-2</td></tr><tr><td>Kg-Cg-Bk-Wg</td></tr><tr><td>25</td></tr></table> IV G₁	U-G-Lc	P.Wb-Hm-4"-2	Kg-Cg-Bk-Wg	25	G	35 <table><tr><td>U-G-Ls</td></tr><tr><td>P-Wb-Sm-4'''-2</td></tr><tr><td>Lr</td></tr><tr><td>0</td></tr></table> VI G₀	U-G-Ls	P-Wb-Sm-4'''-2	Lr	0	L	76 <table><tr><td>F-I-Sb</td></tr><tr><td>0</td></tr><tr><td>Sg-Ct</td></tr><tr><td>15</td></tr></table> V G₁	F-I-Sb	0	Sg-Ct	15
U-G-Lc																	
P.Wb-Hm-4"-2																	
Kg-Cg-Bk-Wg																	
25																	
U-G-Ls																	
P-Wb-Sm-4'''-2																	
Lr																	
0																	
F-I-Sb																	
0																	
Sg-Ct																	
15																	

1. The first part of the document is a letter from the author to the editor, dated 10/10/1964. The letter is addressed to the editor of the "Journal of the American Medical Association" and is signed by the author.

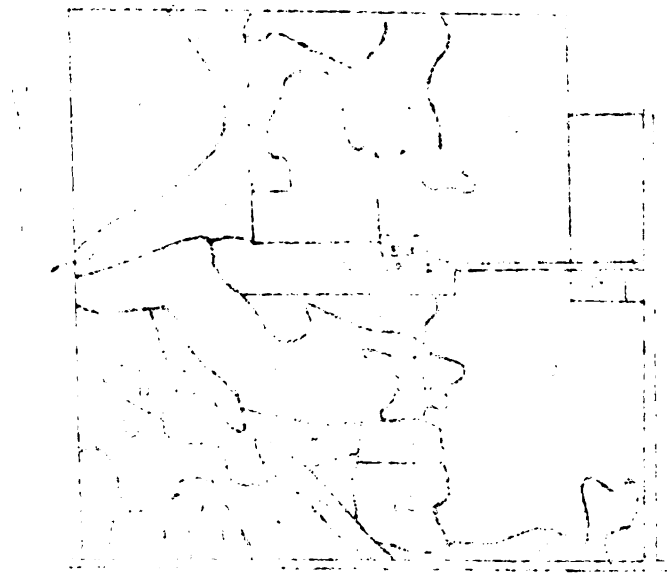


Figure 1

The first part of the document is a letter from the author to the editor, dated 10/10/1964. The letter is addressed to the editor of the "Journal of the American Medical Association" and is signed by the author.

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The fourth part of the document is a letter from the author to the editor, dated 10/10/1964. The letter is addressed to the editor of the "Journal of the American Medical Association" and is signed by the author.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class II	139	27.4
Class IV	120	10.0
Class V	100	5.0
Class VI	61	0.0

Calculated Capacity : 42.4 Animal Units

The livestock consisted of 93 ewes, 108 lambs, 5 beef cows, 5 head of 700-pound heifers, and 5 calves, a total of 35.5 animal units carried. At 7 months of age, the lambs averaged 85 pounds. The calves at 9 months of age averaged 420 pounds.

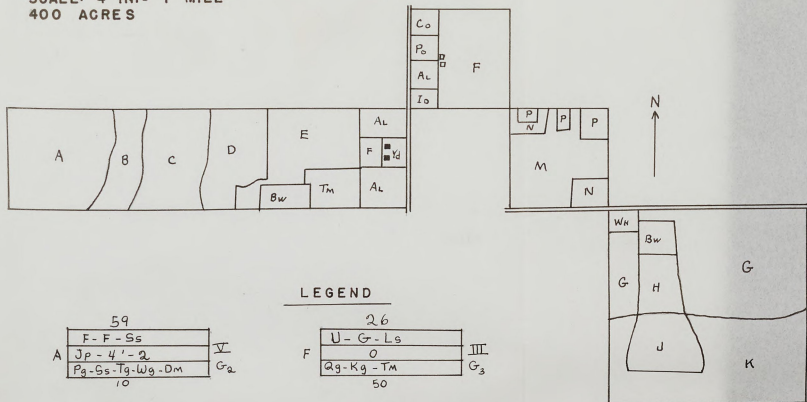
Crops consisted of 88 acres of alfalfa hay and 16 acres of corn. Deer were numerous on the area, and there was a heavy partridge population.

The operator's income was supplemented by carpentry work. The farm buildings were adequate and in good repair. The house was new and modern. He used Power machinery, and two horses for farm work.

King Area No. 11.

This 400 acres is located in southwestern Montmorency County. He is using 200 acres of wild pasture. There are approximately 80 acres of Grayling coarse sand, 150 acres of Roselawn sandy loam and 170 acres of Emmet sandy loam, (Ref. 8). In the pastured area, 25% is covered by jack pine and oak, 25% is covered by aspen and 50% is open. The operator has been here for 19 years.

KING AREA NO. 11
MONTMORENCY COUNTY
SCALE: 4 IN. = 1 MILE
400 ACRES



LEGEND

A	59	
	F-F-Ss	
	JP-4'-2	V
	Pg-Ss-Tg-Wg-Dm	G ₂

B	59	
	F-F-Ss	
	OK-Jp-P-4'-2	V
	Pg-Kg-Cg-Wg-Dm	G ₂

C	59	
	F-F-Ss	
	OK-Sw-4'-2	V
	Kg-Cg-Pg-Sf	G ₂

D	35	
	U-F-Ss	
	P-4'-2	V
	Kg-Cg-Pg-Sf	G ₂

E	35	
	U-F-Ss	
	OK-Pg-4'-2 Stumps	III
	Kg-Sf-Bk	G ₃

F	26	
	U-G-Ls	
	O	III
	Ag-Kg-Tn	G ₃

G	26	
	U-G-Ls	
	RSM-DK-Wb-Rp-4'-2	VI
	LR-Kg-Sg	G ₀

H	26	
	U-G-Ls	
	O	III
	Ac-Bw-Ag-Kg	G ₀

J	35	
	U-F-Ss	
	O	IV
	Ac-Cg-Ss-Pg-BR	G ₀

K	35	
	U-F-Ss	
	OK-P-Wb-Jp-Bc-4'-2	V
	Pg-Ss-BK-Kg	G ₀

M	26	
	U-G-Ls	
	O	II
	AL-Kg-Ag	G ₃

N	26	
	U-G-Ls	
	O(Hm-P-4'-2 Stumps)	III
	Kg-DN	G ₃

P	26	
	U-G-Ls	
	Hm-4'-2	VI
	LR	G ₀

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class II	27	5.4
Class III	47	6.7
Class IV	45	3.8
Class V	163	9.1
Class VI	73	0.0

Calculated Capacity : 25.0 Animal Units

The livestock consisted of 17 head of 700-pound heifers, 74 ewes and 58 lambs, a total of 33.0 animal units carried. The dairy heifers remained in fair condition, the lambs at 4 months averaged 50 pounds. However, the pasture was overgrazed, and the lambs were usually sold by the middle of July at the 50-pound weight. This was done to relieve the pressure on the pasture.

Crops consisted of alfalfa and timothy hay, buckwheat, corn, potatoes and wheat. Considerable deer damage was done to crops. Partridge also were numerous.

The farm buildings were in good repair, but the house was rather small. The operator used modern power equipment. His income was occasionally supplemented by carpenter work and lodging and board for deer hunters.

Lilley Area No. 12.

This area consists of 29 acres located in central eastern Alcona County. It is part of a 320-acre farm. The 29-acre area is cleared



Fig. 12. An abandoned field on a slowly drained sandy loam soil that now makes a class II pasture.

Selkirk loam and Houghton muck. The forage was a Class I stand of Dutch white clover and Kentucky bluegrass. The area had been used for sheep pasture for 10 years. The area in 1940 was heavily grazed.

In 1940, the area carried 80 ewes, 74 lambs and 39 wether lambs, a total of 27.5 animal units. The lambs averaged 80 pounds at $5\frac{1}{2}$ months of age.

In 1941, the 29 acres carried 71 ewes, and 61 lambs, a total of 17.2 animal units carried. The lambs at $5\frac{1}{2}$ months of age averaged 75 pounds. The pasture appeared to be lightly to moderately grazed. Portions of the pasture were grazed close, while other spots carried grass of considerable height.

McKay Area No. 13A, 13B

These two parcels, a total of 840 acres are located in central Midland County. It was divided into two nearby parcels, 400 acres in 13A and 440 acres in 13B. The principal soils are Newton sand, Rubicon sand, Munuscong loamy sand, Munuscong sandy loam and Ogemaw sandy loam.

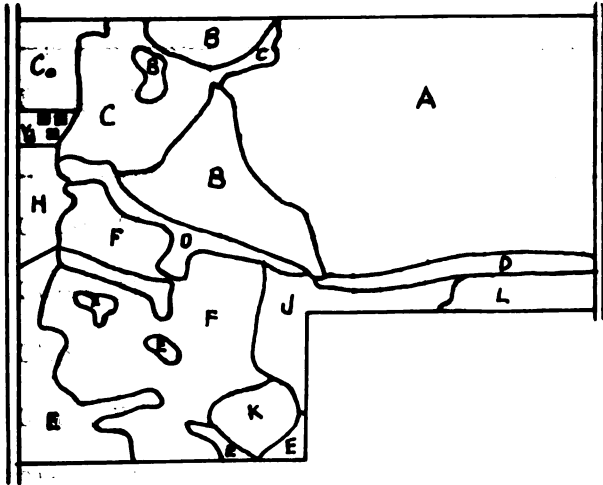
Calculation of Carrying Capacity in 13A

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class II	17	3.4
Class III	48	6.9
Class IV	92	7.6
Class V	219	12.2
Class VI	9	0.0

Calculated Capacity: 30.1 Animal Units

MC KAY AREA NO.13A MIDLAND COUNTY

SCALE: 3 IN. = 1 MILE
400 ACRES



LEGEND

A	86-36-45		
	F-P-Ss		
	RWb-Sm-4"-3	V	
	Bk-Bg-Kg-Pg-Sg-Wg	G ₁	
	10		

F	36-86		
	F-P-Ss		
	RWb-Em-Al-4"-2	V	
	Bg-Sg-Kg-Wg	G ₁	
	15		

B	15-55		
	F-S-Ls		
	Sm-Em-PWb-4"-3	IV	
	Kg-Bk-Bg-Sg-Wg	G ₁	
	20		

H	55		
	F-G-Ls		
	0	III	
	Kg-Cg-Qg-Rg	G ₃	
	65		

C	55		
	F-F-Ss		
	PWb-1-2	IV	
	Kg-Pg-Cg-Bk-Bz	G ₃	
	30		

J	84-15		
	F-P-Lc		
	0	II	
	Kg-Dn-Wc	G ₃	
	75		

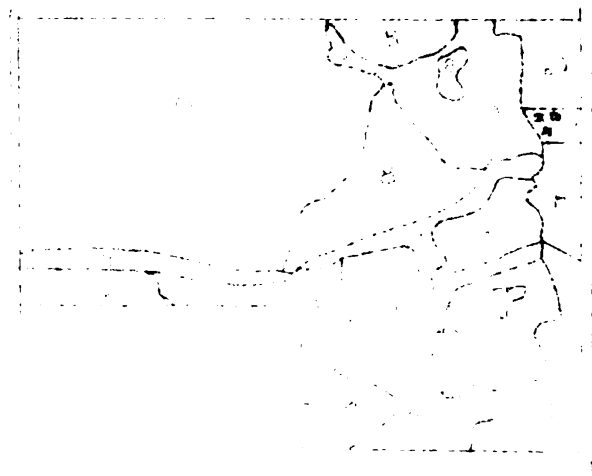
D	6		
	F-F-Ss		
	Bz	IV	
	Cg-Pg-Kg-Hw	G ₃	
	30		

K	5		
	F-P-Ss		
	PEm-Wb-Sm-4"-3	VI	
	Lz-Sg	G ₀	
	0		

E	36		
	F-P-Ss		
	PWb-Bz-1-2	III	
	Kg-Cg-Bg-Bk-Ms	G ₀	
	50		

L	5		
	F-S-Ls		
	0	III	
	Rg-Cg-Kg-Qg	G ₃	
	60		

1. The first part of the report
 2. The second part of the report
 3. The third part of the report
 4. The fourth part of the report



Map of the study area

The first part of the report
 describes the study area and the
 objectives of the study.

The second part of the report
 describes the methodology used in the
 study.

The third part of the report
 describes the results of the study.

The fourth part of the report
 describes the conclusions of the study.

The fifth part of the report
 describes the limitations of the study.

The sixth part of the report
 describes the future work.

The seventh part of the report
 describes the acknowledgments.

The eighth part of the report
 describes the references.

The ninth part of the report
 describes the appendices.

The tenth part of the report
 describes the index.

Livestock carried on 13A consisted of 18 Shorthorn cows with 18 calves, a total of 25.2 animal units. The area throughout was moderately grazed. Cows and calves remained in good condition. Yearling calves from this area averaged 605 pounds.

Calculations of Carrying Capacity in 13B

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class II	20	4.0
Class III	43	7.2
Class IV	94	8.5
Class V	109	6.8
Class VI	32	0.0

Calculated Capacity : 26.5 Animal Unit

Livestock carried on Area 13B consisted of 30 dry Shorthorn cows, 1 Shorthorn bull, ten 600-pound heifers, a total of 36.0 animal units carried. During a portion of the dry months, the cattle were grazed on second cutting alfalfa to relieve the load from the pasture. Cattle remained in good condition throughout the grazing season.

Cultivated areas were occupied by 90 acres of alfalfa and mixed hay, 31 acres of corn and 15 acres of potatoes. The work was done entirely by hired help, 3 men. The owner is a Midland realtor.

Reid Area No. 14.

This area consists of 720 acres located in central Alcona County. The soil is predominantly Emmet sandy loam with some areas of Saugatuck sand and Carbondale muck. Twenty percent of the area is densely covered

MC KAY AREA NO. 13B

MIDLAND COUNTY

SCALE: 3 IN. = 1 MILE

440 ACRES



LEGEND

75	
U-F-Ss	III
Sm-Em-P-2-2	G ₂
Kg-Hw-Bz-Sb	
60	

86	
F-P-Ms	VI
P-Em-4"-2	G ₂
LR-Sg	
0	

36	
F-P-Ss	VI
Wp-P-Sm-4"-2	G ₀
LR	
0	

99	
F-F-Ss	V
P-Sm-Wp-2-2	G ₂
Pg-Bk-Hw-Kg-Bz	
20	

36	
F-P-Ss	VI
P-Em-Sm-AL-4"-2	G ₀
LR-Rf-Ss-Sg	
0	

36	
F-P-Ss	VI
Pwb-Hn-4"-2	G ₁
Bk-Bz-Lr-Sg-Pg-Wg	
10	

6	
U-F-Ss	IV
F-Wb-1-2	G ₃
Kg-Cg-Ss-Gz-Mg	
30	

10	
F-S-Ss	VI
Pwb-Em-4"-2	G ₀
LR-Sg-Ss	
0	

6	
U-F-Ss	VI
P-Wb-4"-2	G ₀
LR	
0	

6	
U-F-Ss	IV
Pwb-OK-Su-Bz-1-2	G ₃
Kg-Cg-Pg-Gz-Bz	
30	

86	
F-P-Ms	IV
Pwb-Em-1-2	G ₂
Sg-Kg-Bz-Wg	
20	

18-15	
U-G-Ls	III
Pwb-Em-1-2	G ₃
Kg-Cg-Qz-Tm	
40	

18	
U-G-Ls	V
Pwb-Sm-OK-4"-3	G ₁
Bk-Kg-LR-Wg	
15	

15	
F-G-Lc	II
0	G ₃
Kg-Gz-DN	
10	

36	
F-S-Ss	III
Sm-Wb-4"-2	G ₃
Kg-Cg-DN-Sg	
50	

55	
F-P-Ss	IV
Em-An-CR-Wb-4"-3	G ₃
Kg-LR	
25	

5-84-18	
F-S-Lc	V
Pwb-Em-OK-4"-3	G ₂
LR-Kg-Rg-Bz	
10	

84-18	
F-S-Lc	II
Em-OK-Wb-2-2	G ₃
Kg-Rg-Gz-DN	
70	

440 ACRES
SCALE: 3 IN. = 1 MILE
MIDLAND COUNTY
MC KAY AREA NO. 13B

by principally aspen and white birch; 56% is moderately covered; 13% is improved pasture; 7% is alfalfa hay; and 4% is in buildings and lake.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class II	93	18.6
Class IV	176	13.9
Class V	224	11.2
Class VI	142	0.0

Calculated Capacity : 33.7 Animal Units

Livestock carried on the area consisted of 40 ewes, 40 lambs, 15 yearling ewes, 12 Hereford cows, 2 head of 600-pound Hereford heifers, and 10 Hereford calves, making a total of 30.4 animal units. The livestock at all times was in good condition. The lambs at 4½ months of age averaged 78 pounds. The 9-month calves averaged about 400 pounds.

The operator had a portable sawmill which he used for cutting lumber from clearing operations. The lumber paid for his clearing of the land. Alsike clover and sand vetch seed were broadcast over each area after clearing. The land was then used for sheep pasture for 4 years after which it was plowed and seeded to alfalfa after the stumps were pulled or blasted out.

Numerous Deer and partridge were noted on the area.

Saunders Area No. 15.

This unit consists of 1080 acres located in central Otsego County. The operator owns 920 acres and rents 160 acres for pasture.

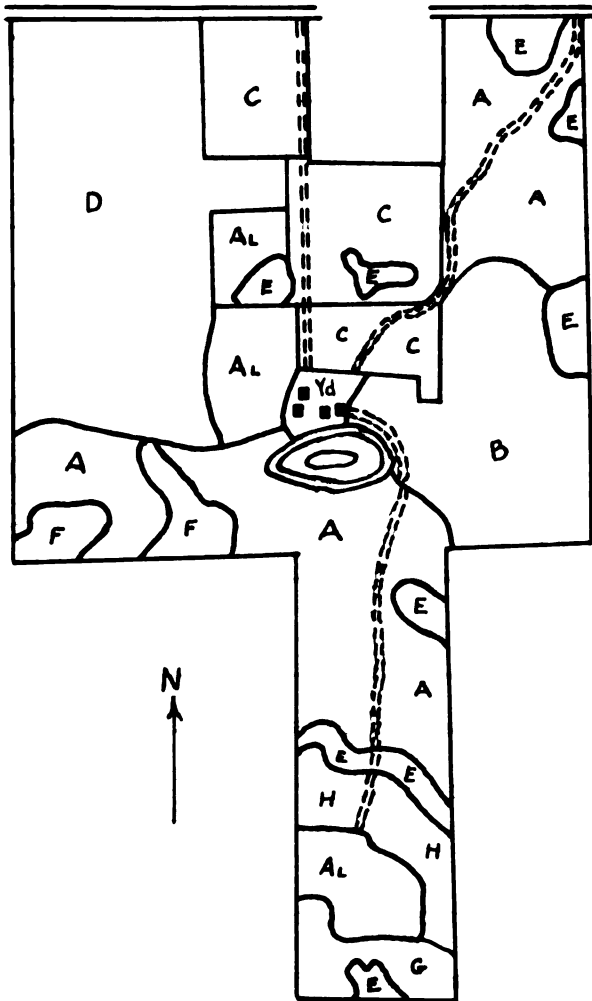


Fig. 13. Thin cattle and denuded soil are the results of overgrazing on sandy soils.



Fig. 14. Overgrazing does cause depletion of grasses, leaving the exposed soil subject to wind and water erosion.

REID AREA NO. 14
ALCONA COUNTY
SCALE: 3 IN. = 1 MILE
720 ACRES



LEGEND

A	26-36	
	R-G-Ls	V
	P.Wb-Hm-OK-4"-3	G ₁
	Bk-Lr-Sg-Kg-Wg	10

C	26	
	R-G-Lc	II
	Hdwd Stumps	G ₃
	Kg-Ac-Wc-Sv-Bk	70

G	35	
	F-S-Lc	VI
	P.E-Wb-4"-2	G ₀
	LR	0

B	26	
	R-G-Ls	VI
	P.Wb-Hm-OK-4"-3	G ₀
	LR-Sg-Wg	0

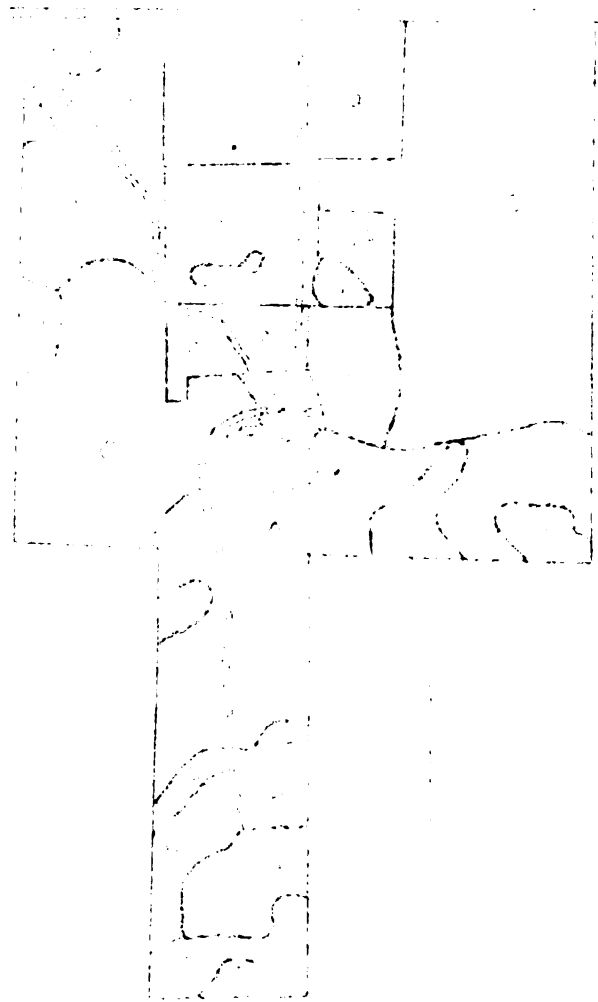
D	26	
	R-G-Lc	IV
	Hm-P.Wb-Bc-4"-2	G ₂
	Kg-Cg-Ba-Bk-Wg	40

H	26-35	
	R-G-Ls	V
	P.E-M-Sm-4"-3	G ₁
	BK-LR-Kg-Wg	15

E	70	
	F-P-Mc	VI
	CR-Sp-P-4"-2	G ₀
	0	0

F	70	
	F-P-Mc	V
	0	G ₀
	Sg-Cf-Bg	15

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Approximately 500 acres of the area are covered by a spruce-cedar swamp, 400 acres are occupied by a medium stocking of aspen-white birch, 130 acres consist of abandoned farm land and 30 acres are in alfalfa for hay. The soils are predominantly Rifle peat and Emmet loamy sand.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class II	35	7.0
Class III	225	32.1
Class IV	91	7.7
Class V	42	2.3
Class VI	647	0.0

Calculated Capacity : 49.1 Animal Units

Livestock carried consisted of 49 Hereford cows, 40 calves, and 11 head of 600-pound steers and heifers, a total of 72.9 animal units carried.

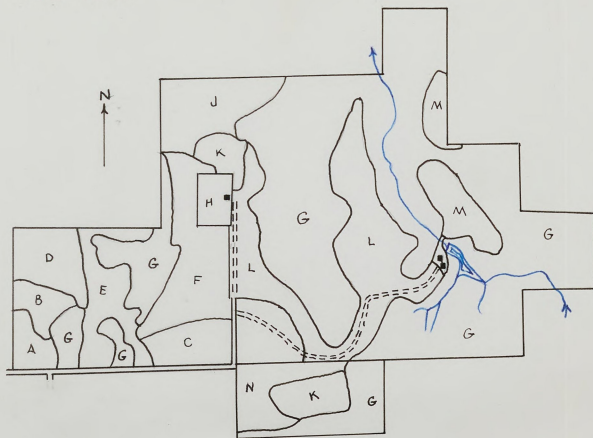
The area had been in use for only 5 years, with a much smaller number of cattle. It was heavily overgrazed. The cows were in a thin condition, the young stock at 16 months of age weighed only 640 pounds and were lacking in condition. Eight calves born in the spring of 1941 died shortly after birth. No signs of game were noted on the area at any time. This area was in need of a sharp reduction in the number of livestock.

The owner, a Gaylord dentist, stated that he was losing money on the venture and that he intended to quit the enterprise.



Fig. 15. The gasoline pump and concrete water tank economically furnish good water where lakes, streams or springs are not plentiful.

SAUNDERS AREA NO. 15
OTSEGO COUNTY
SCALE: 3 IN. = 1 MILE
1080 ACRES



LEGEND

46

U-F-Ss
P.Wb-4"-2
Kg-Bk-Sg-Lr

25

A

IV

G₃

46

U-F-Ss
O
Kg-Qg-Tm-Cg

60

D

III

G₃

70

F-P-Mc
Sp-Cr-Tm-Lw-4"-2
Bm

0

G

VI

G₁

26

R-F-Ss
O
Kg-Qg-Cg-Mw

70

K

II

G₃

46

U-F-Ss
P.Wb-4"-2
Kg-Cg-Bk

50

B

III

G₃

70

F-P-Mc
Cr-Sp-Burned
Ct-Sg

0

E

VI

G₁

26

R-F-Ss
O
Qg-Tm-Kg

60

H

III

G₃

26

R-F-Ss
Sm-P.Wb-4"-2
Kg-Cg-Mw-Ac

40

L

III

G₃

26

U-F-Ss
P.Bc-Bw-Su-4"-2
Kg-Cg-Sg-Bk

30

C

IV

G₃

25

R-F-Sr
P.Wb-Sm-4"-2
Bk-Lr-Ss

5

F

VI

G₁

39

U-F-Ls
P.Wb-4"-2
Kg-Cg-Sg

30

J

IV

G₃

58

U-F-Ls
P.Wb-Sm-4"-2
Kg-Tm

20

M

V

G₃

26

R-F-Ss
Em-2-2
Kg-Bg

50

N

III

G₃

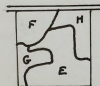
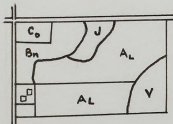
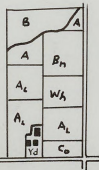
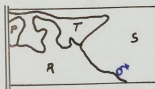
1080 ACRES
SCALE: 3 IN. = 1 MILE
OTSEGO COUNTY
SAUNDERS AREA NO. 12



LEGEND

A U-F-22 Kd-BK-22-1-2 30	D U-F-22 Kd-BK-22-1-2 30	E U-F-22 Kd-BK-22-1-2 30	F U-F-22 Kd-BK-22-1-2 30	K U-F-22 Kd-BK-22-1-2 30
B U-F-22 Kd-BK-22-1-2 30	E U-F-22 Kd-BK-22-1-2 30	H U-F-22 Kd-BK-22-1-2 30	W U-F-22 Kd-BK-22-1-2 30	
C U-F-22 Kd-BK-22-1-2 30	F U-F-22 Kd-BK-22-1-2 30	I U-F-22 Kd-BK-22-1-2 30	N U-F-22 Kd-BK-22-1-2 30	

SCHEARER AREA NO. 16
MIDLAND COUNTY
SCALE: 3 IN. = 1 MILE
380 ACRES



LEGEND

14	
F-G-Ls	
O	
Kg-Mu-Ct-Mw	
70	

A II
G₃

14	
F-G-Lc	
Hm-Bh-Em-Ah-4"-4	
Lr-Sg	
0	

B VI
G₃

13	
F-G-Lc	
Hm-Bh-Bw-Em-4"-4	
Lr	
0	

C VI
G₀

13	
F-G-Lc	
0	
Kg-Qg-Rt-Mw	
70	

D II
G₂

12	
F-P-Ss	
Pwb-Sm-4"-2	
Kg-Bk-Sg	
25	

E IV
G₂

11-36	
F-P-Ss	
0	
Sc-Qg-Rt-Kg	
45	

F III
G₃

14	
F-S-Ls	
P-Sm-1-2	
Kg-Kg-Mu-Hw-CF	
45	

G III
G₂

36-86	
F-P-Ms	
Lw-AL-4"-1	
Sg-Bg	
20	

H IV
G₁

13	
F-S-Lc	
Em-Sm-2-3	
Kg-Gr-Wc	
40	

J III
G₂

99	
F-F-Ss	
P-1-2	
Kg-Pg-Rg-Hw	
30	

K IV
G₃

86	
F-P-Ms	
AL-4"-1	
Bg-Rt-Sg	
35	

L III
G₃

36-86	
F-P-Ms	
0	
Ct-Sg-Bg	
10	

M V
G₂

15	
F-P-Ls	
Lw-1-1	
Kg-Rt-Wc-Ct	
45	

N III
G₃

85	
F-P-Ss	
P-3" (40%) - 1	
Sg-Ct	
0	

P VI
G₁

11	
F-S-Ss	
Psm-Tm-1-3	
Kg-Hw-Cg-Wc-Bk-CF	
35	

R III
G₃

14	
F-F-Ls	
Pwb-Sm-4"-3	
Bk-Pg-Sg-Lr	
5	

S VI
G₀

14	
F-P-Ls	
P-Lw-Sm-AL-4"-3	
Sg	
0	

T VI
G₀

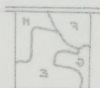
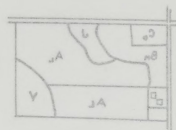
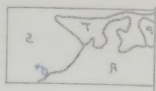
13	
F-P-Lc	
0	
Sg	
10	

V V
G₀

LEGEND

VI F-G-1c 0 30 10	V F-G-1c 0 30 10	IV F-G-1c F-G-1a 0 30 10	III F-G-1c F-G-1a 0 30 10	II F-G-1c F-G-1a 0 30 10	I F-G-1c F-G-1a 0 30 10	VI F-G-1c F-G-1a 0 30 10	V F-G-1c F-G-1a 0 30 10	VI F-G-1c F-G-1a 0 30 10	V F-G-1c F-G-1a 0 30 10	IV F-G-1c F-G-1a 0 30 10	III F-G-1c F-G-1a 0 30 10	II F-G-1c F-G-1a 0 30 10	I F-G-1c F-G-1a 0 30 10	VI F-G-1c F-G-1a 0 30 10	V F-G-1c F-G-1a 0 30 10
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380 ACRES
SCALE: 3 IN. = 1 MILE
MIDLAND COUNTY
SHEARER AREA NO. 16



Schearer Area, No. 16.

This area consists of 380 acres located in northwestern Midland County, of which 280 acres are owned and 100 acres are rented. Wild pasture available consists of one 80-acre tract, two 40-acre pieces, part of a 100-acre area and part of a 40-acre tract. The operator has been located here for 43 years. The soil consist chiefly of wet sands (Saugatuck, Colwood, Newton).

The cultivated areas were occupied by 93 acres of alfalfa and mixed hay, 30 acres of white beans, 18 acres of corn and 9 acres of wheat.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class II	20	5.0
Class III	77	12.8
Class IV	32	3.2
Class V	17	1.0
Class VI	73	0.0

Calculated Capacity : 21.0 Animal Units

Livestock carried consisted of 100 ewes, 100 lambs, 9 head of 400-pound Hereford steers, a total of 30.4 Animal Units carried. The areas were heavily grazed, but when the pastures became short, the sheep were turned into alfalfa fields to relieve the pressure on the pastures. The stock was in good condition throughout the season. The lambs averaged 65 pounds at 3 months of age.

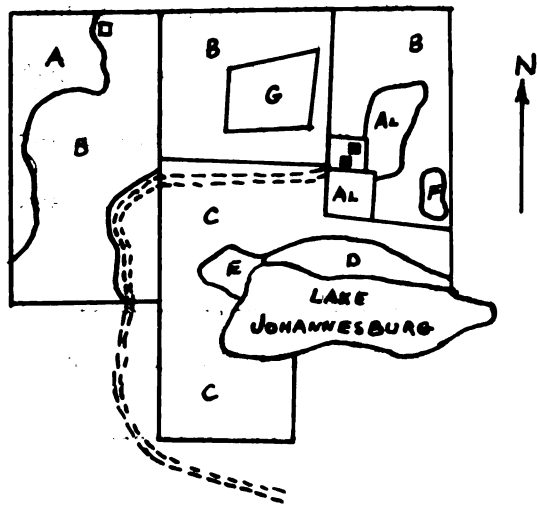
The buildings were in good repair and the operator lived comfortably.

SEYMOUR AREA NO. 17

OTSEGO COUNTY

SCALE: 3 IN. = 1 MILE

260 ACRES



LEGEND

28	
R-G-Ss/Ls	2G
Hm-Em-4"-2	VI
LR	G ₀
0	

26-28		
B	R-G-Ss/Ls - 2G	II G ₃
	Hm-Em - 2 - 2	
	Kg-DN-Tm - Ac	
80		

26-42		
C	U-G-Ss/Ls - 2G	III G ₃
	Hm-Em-2'''-50%-2	
	Kg-DN-Ac-Tm-Rc	
60		

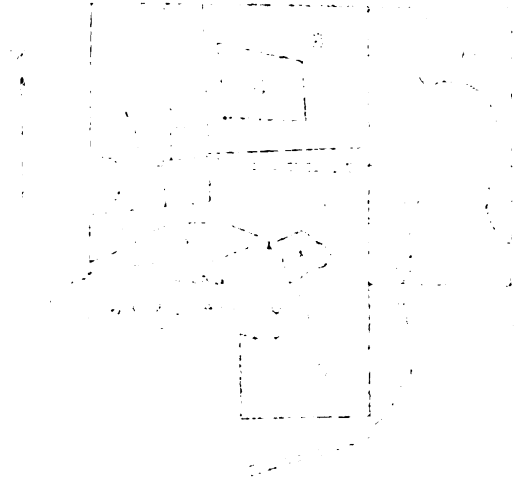
42		
D	R-G-Ss/Ls-2Gb	VI G ₀
	P-Wb-4"-2	
	LR-Wg	
0		

	42	
E	R-G-Ss/Ls-2Gb	VI G ₀
	Hm-Bs-4'''-2	
	LR	
	0	

26		
F	U - G - Ls	I G ₃
	0	
	Bm	
90		

28		
G	F - G - Lc	I G ₃
	0	
	Sc - Al - Kg	
80		

THE
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ATTORNEY GENERAL
STATE OF NEW YORK
ALBANY



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Seymour Area No. 17

The area consists of 260 acres located in central eastern Otsego County. Of this 246 acres are pasture, 12 acres are in alfalfa and 1 acre is occupied by the yards and buildings. The operators have been located here for 10 years. The soils are predominantly Emmet sandy loam, Nester loam and Blue Lake sandy loam. Approximately 20% of the area is densely covered by second growth hard maple and elm, 50% has scattered maple and elm, 15% is open grassland, and 10% is in alfalfa and brome grass.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class I	12	6.0
Class II	129	25.8
Class III	75	10.7
Class VI	30	0.0

Calculated Capacity : 42.5 Animal Units

Livestock carried consisted of 30 head of 500-pound Hereford and Angus steers and heifers, 20 Angus cows, 16 calves, a total of 47 animal units. The area was heavily grazed in some units, and would not have carried the cattle if it had not been for the alfalfa and brome grass improved pasture. The operators were establishing 20 acres more of alfalfa and brome brass pasture.

The calves, when the study started, weighed 400 pounds and made an average gain of 201 pounds in $3\frac{1}{2}$ months on pasture. Cattle at all times were in good condition.

Partridge were noted occasionally on the area. The operators, two retired men of the U. S. Navy, had a supplemental income in the form of pensions.

Shull Area No. 18

This unit of 3663 acres is located in northwestern Crawford County. The land had not been grazed for several years prior to being fenced in April, 1941. The soils are Kalkaska loamy sand in the valleys, Blue Lake loamy sand on the slopes and Kalkaska sandy loam on the uplands. (Ref. 6) About 20% of the area is moderately stocked with pin-cherry, hard maple and elm and 80% has scattered pin-cherry and elm.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class III	1505	215
Class IV	1703	155
Class V	311	18
Class VI	144	0

Calculated Capacity : 388 Animal Units

Livestock carried consisted of 1891 ewes and their lambs making a total of 473 animal units. The livestock were on the area from April 15 to August 10 or approximately $\frac{2}{3}$ of the normal grazing season. There was also an accumulation of feed from previous years. Consequently, the area appeared to be lightly grazed. The lambs at $3\frac{1}{2}$ months of age averaged 51 pounds at the time they were taken from pasture.



Fig. 16. Young aspen Populus sp., furnish a portion of the feed for cattle on wildland pasture. Red maple, Acer rubrum, is also browsed.



Fig. 17. The area to the right of the fence has gone ungrazed. That to the left has been moderately grazed for 21 years.

SHULL AREA NO. 18
CRAWFORD COUNTY
SCALE: 2 IN. = 1 MILE
3663 ACRES



LEGEND

A	58	
	U-G-Ls-2gcb	III
	R-Em-Bw-P-1-1	G ₁
	Kg-Cg-Bk-Bk-Mw	

B	41	
	S-F-Ls-2gb	IV
	R-Cc-Em-Hm-Bw-P-1-1	G ₁
	Kg-Bk-Bk-Cg	

C	41	
	S-G-Ls-2gb	V
	R-Hm-Bw-Em-4-1	G ₀
	Bk-Kg-Bk	

D	20	
	F-I-MP	V
	O	G ₁
	Sg	

E	20	
	F-I-MP	VI
	Sp-Cr-Tm-P-4-1-2	G ₀
	O	

F	55	
	U-G-Ls-2gb	III
	Em-R-Hm-Bw-3-25-2	G ₁
	Kg-Tm-Cg	

H	46	
	F-F-Ss	IV
	R-Cc-P-1-1	G ₁
	Kg-Cg-Tg-Bk-Dm	

J	55	
	F-G-Ls-2gb	VI
	Hm-Em-Bh-4-1-1-2	G ₀
	Lr-Ss	

K	55	
	F-G-Ls-2gb	III
	Pc-Sm-Bk-1-1	G ₀
	Qg-Tm-Mw	

SHULL AREA
CRAWFORD COUNTY
SCALE: 2 IN. = 1 MILE
3663 ACRES

The operator, a stockman from near Clare, Michigan, was well pleased with the results on the pasture. The chief difficulty encountered was the obtaining of a competent sheepherder to care for the sheep.

Stevens Area No. 19

This area consists of 920 acres located in central northern Missaukee County. The operator has been located here for 38 years. The soils are mostly lowland wet loams, principally Selkirk loam. There are also some higher dryer soils, principally Ogemaw sandy loam and Rubicon sand. The forest cover is varied.

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Unit
Class II	96	19.2
Class III	99	11.0
Class IV	395	30.4
Class V	139	7.7
Class VI	88	0.0

Calculated Capacity : 68.3 Animal Units

The livestock carried consisted of 18 dairy cows, 10 beef grade heifers, 5 yearling grade beef steers, 30 beef grade calves, one Hereford bull, 80 ewes and 70 lambs, a total of 53.8 animal units carried. The pasture in general was lightly to moderately grazed. The dairy cows, 18 in number, for the last 3 years averaged 177 pounds of butterfat per cow per year. In 1939, for the six months on pasture, the cows averaged

STEVENS AREA NO. 19

MISSAUKEE COUNTY

SCALE: 3 IN. = 1 MILE

920 ACRES



LEGEND

55	
F-G-Ls	VI
Hm-Ah-Bh-4'''-3	G ₀
Lg-Cm-Sg-Rf	
0	

13	
F-P-Lc	V
0	G ₀
Sg-Bg-Ct	
15	

13	
F-S-Cc	II
0	G ₃
Kg-Wc-Qg-Rc	
80	

13	
F-S-Cc	II
0	G ₃
Wc-Kg-Sg	
80	

46	
F-F-Ls	IV
Wp-1-4	G ₁
Kg-Cg-Bk-Pg	
40	

15	
F-P-Ls-1G	VI
P-Wb-Tm-Sp-4'''-1	G ₀
Sg	
0	

36	
F-S-Ls	IV
P-Wb-Lw-4'-1	G ₁
Kg-Bk-Sg-Wg	
20	

40	
F-F-Mc	VI
Sp-Tm-P-4'''-2	G ₀
Sg-Ct	
0	

15	
F-F-Ls-1G	III
0(Wp-4'''-4 stumps)	G ₃
Kg-Cg-Dx-Wc-Mu	
40	

15	
F-F-Ls-1G	IV
P-Wb-4'-2	G ₂
Kg-Cg-Bk-Pg	
25	

15	
F-F-Ls-1G	IV
0	G ₄
Kg-Cg-Cf	
30	

13	
F-P-Lc	IV
0	G ₁
Sg-Bg	
20	

13	
F-P-Cc	IV
P-Wb-4'''-2	G ₂
Kg-Sg-Bg-Wg	
25	

20	
F-P-Mp	VI
Sp-Cg-Tm-4'''-2	G ₀
Sg	
0	

13	
F-P-Cc	V
Lw-P-Tm-4'''-1	G ₀
Sg-Bg-Ct	
10	

13	
F-P-Cc	III
Lw-P-4'-1	G ₃
Kg-Sg-Wc	
35	

13	
F-S-Cc	II
0	G ₂
Kg-Tm-Qg-Sg	
80	

15	
F-G-Ls	VI
P-Wb-4'''-2	G ₀
Lc-Bk-Rf	
0	



Fig. 18 An area containing dense clumps of hardwoods intermingled open grazed areas.



Fig. 19. Weeds, grasses and brushpiles denote an area recently cleared of a dense stand of hardwoods. This is the first step in pasture development.

95 pounds of butterfat per cow. The lambs at 6 months of age averaged $86\frac{1}{2}$ pounds.

In 1941, the gross farm income amounted to \$3,799.33. This may be itemized as follows: Wool, \$288.53; Cottage rental to hunters, \$217.81; Sale of lambs, \$424.00; A.A.A. payments, \$129.70; Total butterfat, \$1358 (3,522 pounds); beef cattle, \$741; hogs, \$381.85; misc., \$258.44.

Deer frequented the area occasionally. No other game was noted.

Thomas Area, No. 20.

This unit of 1280 acres is located in northwestern Ogemaw County. The operator has been located here for 24 years. Approximately 50% of the area is covered by oak and some aspen, too dense to offer any forage; the other 50% has either scattered oak and aspen or is cleared for cultivation. The soils are predominantly Roselawn sandy loam (Ref.7).

Calculation of Carrying Capacity

Forage Value Areas by Acres	Carrying Capacity per Class by Animal Units
-----------------------------	--

Class II	61	12.2
Class III	307	43.9
Class IV	80	6.7
Class V	18	1.0
Class VI	616	0.0

Calculation of Carrying Capacity :53.8 Animal Units

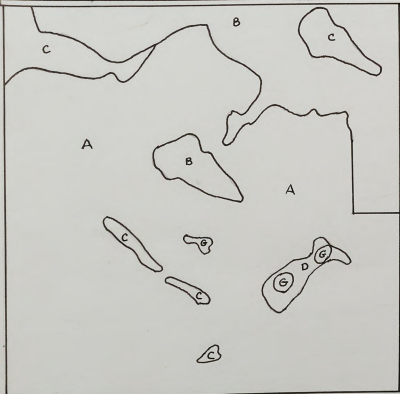
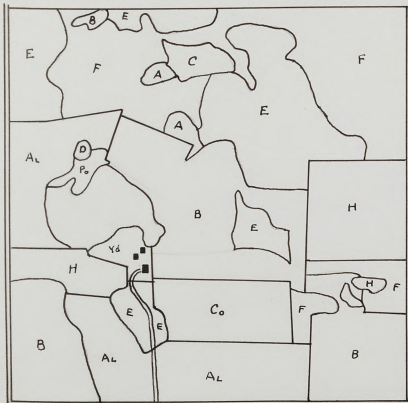
Livestock carried consisted of 30 Hereford cows, 30 Hereford calves, 1 Hereford bull, 10 head of 600-pound Hereford heifers, 5 head of 600-pound Hereford steers, 80 ewes and 70 lambs, a total of 63.5

THOMAS AREA NO. 20

OGEMAW COUNTY

SCALE: 4 IN. = 1 MILE

1280 ACRES



LEGEND

A	16	
	R-F-Ss	2G
	OK-Sm-P-Wp-RP-4"-2	VI
	Ss-LR-Ms-BK-Fg	G ₀
	5	

B	35	
	U-G-Ls	2G
	OK-1-2	III
	Kg-Cg-SF-Tm	G ₂
	50	

C	35	
	U-G-Ls	2G
	OK-P-Wb-Sm-4'-2	IV
	Kg-SF-BK-Ss	G ₁
	30	

D	16	
	F-P-Ms	
	P-Sm-Wp-4"-2	V
	Kg-Ss-LR	G ₂
	10	

E	35	
	U-G-Ls	2G
	OK-Sm-P-4"-2	VI
	LR-Wg-Js	G ₀
	0	

F	35	
	U-G-Ls	2G
	OK-P-Sm-4'-2	IV
	Kg-SF-BK	G ₁
	20	

G	20	
	F-P-MP	VI
	0	G ₀
	LF	
	0	

H	35	
	U-G-Ls	2G
	0	II
	Ss	G ₃
	70	

THOMAS AREA NO. 20
OGEMAW COUNTY
SCALE: 4 IN. = 1 MILE
1580 ACRES

LEGEND

10	20
20	30
30	40
40	50
50	60
60	70
70	80
80	90
90	100

10	20
20	30
30	40
40	50
50	60
60	70
70	80
80	90
90	100

10	20
20	30
30	40
40	50
50	60
60	70
70	80
80	90
90	100

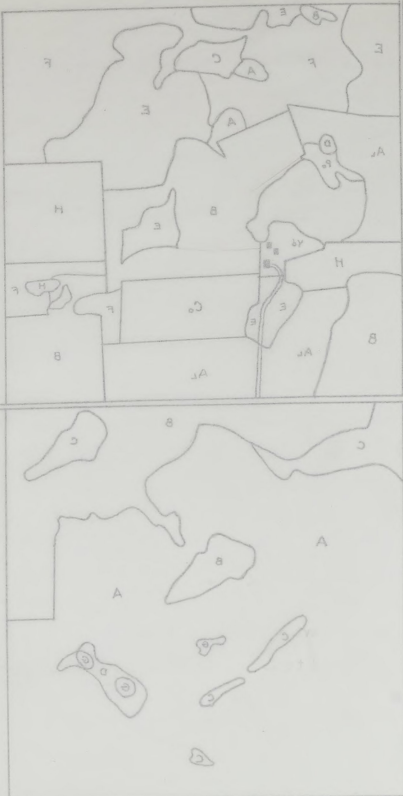
10	20
20	30
30	40
40	50
50	60
60	70
70	80
80	90
90	100

10	20
20	30
30	40
40	50
50	60
60	70
70	80
80	90
90	100

10	20
20	30
30	40
40	50
50	60
60	70
70	80
80	90
90	100

10	20
20	30
30	40
40	50
50	60
60	70
70	80
80	90
90	100

10	20
20	30
30	40
40	50
50	60
60	70
70	80
80	90
90	100



animal units carried. Calves at 9 months averaged 420 pounds. Lambs at 6 months averaged 84 pounds.

The sheep remained on the area to graze throughout the season, but the cattle grazed only about $2/3$ to $3/4$ of the season. The rest of the season the cattle were grazing free on surrounding areas. In 1941, 104 acres of the area was seeded to alfalfa and brome grass for pasture. The operators believed the home area would then be sufficient to graze the cattle for the entire pasture season. Sweet clover had been used for pasture for the sheep.

The cultivated areas were used for 27 acres of rape for hog pasture, 34 acres of corn and 43 acres of alfalfa hay.

The farm buildings (see Fig. 4) were adequate and in good repair. The farm was very well equipped with machinery. The venture appeared to be entirely successful.

Deer were very numerous on the area. Thirty to forty deer were commonly seen on a 26 acre alfalfa field in the evening. No other game was noted.

Whitmer Area No. 21

This unit consists of 640 acres located in northeastern Clare County. The operator has been located here for 20 years. The area was logged in 1890 and burned over in 1918. Approximately 37% of the area is now so heavily covered by aspen, soft maple and white birch as to offer no feed to livestock; 16% is moderately covered with aspen, soft maple and white birch; 37% is fairly open; and 10% is in cultivation and buildings.

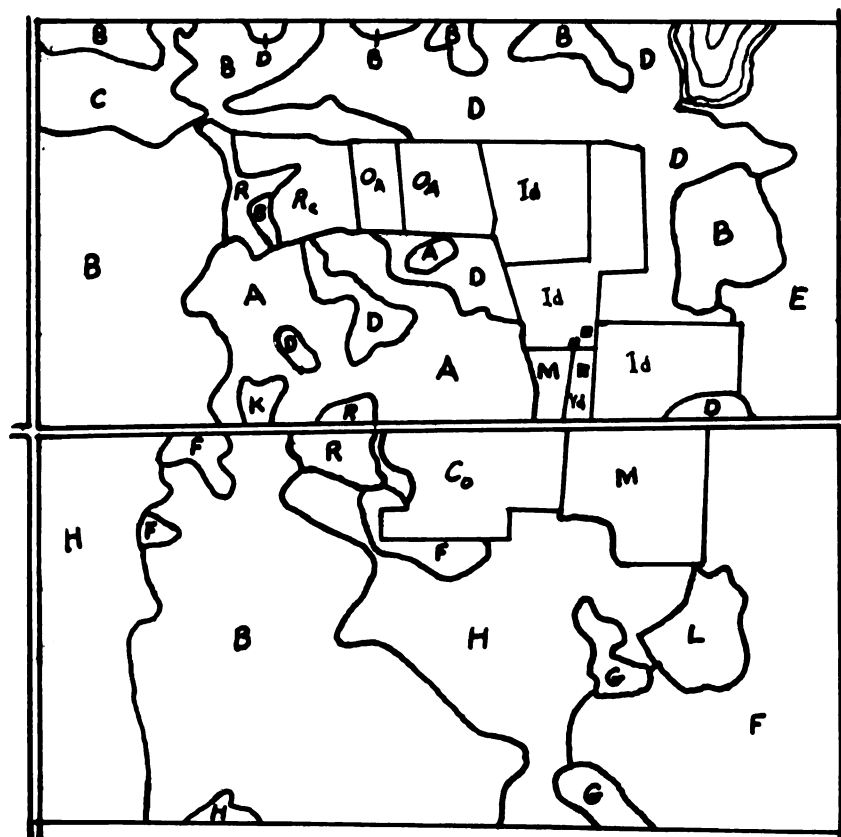


Fig. 20. Wandering cattle lightly graze this area now covered by a heavy grass sod.



Fig. 21. Many good quality sheep are produced on such wildland pastures as this.

WHITMER AREA NO. 21
CLARE COUNTY
SCALE: 4 IN. = 1 MILE
640 ACRES



G	36	F-P-Ss	VI
		P-4'''-2	
		Bk-Lr-Bg	
	5		

H	15	U-G-Ls	IV
		Sm-P-Wb-wh-4'-3	
		Kg-Tn-Sf-Bk-Wg	
	25		

K	13	F-S-Lc	II
		Em-I-3	
		Kg-Gr-Tn	
	80		

LEGEND

A	15	U-F-Ls	VI
		Sm-P-Wb-Bs-4'''-3	
		Lr-Bk-Ss-Bk-Ms	
	0		

D	16	U-F-Ss	IV
		P-Sm-OK-2-2	
		Cg-Kg-Pg-Bk	
	30		

L	20	F-P-Mp	VI
		Sp-4''-2	
		Lf-Bm	
	0		

B	16	U-F-Ss	VI
		P-Wb-Sm-4'''-2	
		Lr-Bk-Sg-Wg	
	0		

E	16	U-F-Ss	IV
		P-Wb-Sm-4'-2	
		Kg-Cg-Pg-Sf	
	30		

M	15	U-F-Ls-3 Gc	III
		Q(Rp-Wp-4''-4stumps)	
		Kg-Cg-Sf-CF	
	55		

C	15	U-F-Ls	IV
		Sm-OK-2-3	
		Pg-Sg-Cg-Kg	
	25		

F	15	F-F-Ls	III
		Sm-OK-P-2-3	
		Kg-Sf-Pg-Cg	
	45		

R	40	F-P-Mc	VI
		AL-SP-4'''-1	
		Sg	
	0		

Calculation of Carrying Capacity

Forage Value Areas by Acres		Carrying Capacity per Class by Animal Units
Class II	1	.2
Class III	93	13.3
Class IV	212	17.7
Class VI	250	0.0

Calculated Capacity : 31.2 Animal Units

Livestock carried consisted of 10 dairy cows, 6 head of 700-pound dairy heifers, 71 ewes, 58 lambs and one dairy bull, a total of 29.5 Animal Units carried. The cattle were in fair condition. The lambs at 5½ months of age averaged 83 pounds. The area appeared to be grazed at capacity carrying ability.

The locality had a heavy deer population and many deer were seen on the area. However, no deer were noted at any time in the same pasture with the sheep.

The operator had a supplementary income as a mechanic for the County Highway Department.

Lake City Experiment Station Area No. 22.

The area consists of 156 acres located near Lake City. The problem area was selected in June, 1941 with the purpose of obtaining grazing records over a period of years. The other study areas, numbers 1-21, offered no definite promise that a prolonged study could be carried on.

At the Lake City Experiment Station, a 60-acre field was selected. This had not been used since 1930 and had grown up to numerous species



of woody vegetation. The trees and shrubs chiefly aspen, red maple and hazelnut, were about one inch in diameter on the average (see Map No.22). The soils were predominantly Ottawa loamy sand, Nester silt loam and Arenac sandy loam, with small spots of Newton sand. The field was bounded on the north by the Mosquito Creek. This area was designated the "Wild Pasture."

In the fall of 1941, 7 study plats were set out on the area, each marked out by 4 iron pipes driven in the ground. Ocular estimates by plant species and photographs were made of each plat. The plats were set out in the 7 different conditions or types of pasture that existed in the 60-acre pasture area. The plans are to have each plat area observed and reported on each year and more detailed comparisons made at the end of 5 years.

On June 4, 1941, 12 Hereford cows and their 10 calves were weighed and placed on the 60-acre Wild Pasture. Similarly, 12 cows and their 10 calves were placed on a 56 acre field of alfalfa-Kentucky bluegrass-white clover pasture. This second pasture, designated as the "Control Pasture" with its cattle was used as a check on the "Wild Pasture." Every 3 weeks, weights were taken of each group of cattle during the pasture season.

During the dry months of July and August, the cows on the Wild pasture dropped in weight, but the calves continued to gain in weight. The cows in the "Control Pasture" lost very little in weight, and the calves continued to gain. One cow in the "Control Pasture" died in August, causes unknown.

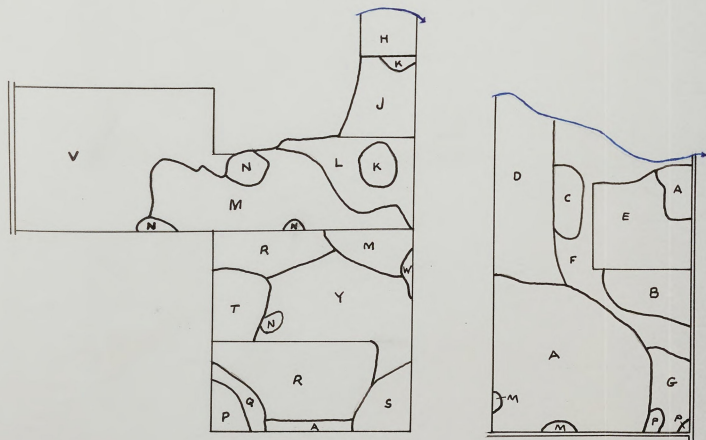
On October 29, 1941, the cattle were removed from both pastures, and their weights were taken. Following is a table of weights taken June 4 when the cattle were placed on pasture and October 29 when they were taken from the pasture.

EXP'T STATION AREA NO.22

MISSAUKEE COUNTY

SCALE: 4 IN. = 1 MILE

156 ACRES



LEGEND

A	8 F-F-Ss 2G Sm-P-wh-2-1 Kg-Cg-Hw-Bk 55 III G₃	C	13 F-P-Cc RSm-Lwb-4"-1 Sg-Bg 10 V G₃	E	28 F-G-Lc 0 Hw-Cg-Kg-Mu 15 Y G₄	G	15 F-G-Ls RSm-Lw-2-1 Kg-Sg-Hw-Bg 40 III G₃	N	27-84 F-P-Lc Em-1-3 Bg-Sg 20 IV G₂	W	84 F-P-Lc P-AL-4"-1 Sg-Bg 10 V G₀
B	28 F-G-Lc Sm-P-wh-Lw-4"-2 Kg-Bk-Sg-Wg 25 IV G₃	D	12 F-F-Lc Sm-P-wh-Lw-2-1 Kg-Cg-Hw-Bk-SF 40 III G₃	F	28 F-G-Lc Sm-P-wh-2-1 Kg-Hw-Cg 60 II G₃	H	12 U-G-Lc 0 Kg-AL-2g 80 II G₂	P	20-10-86 F-P-Mu AL-4"-1 Sg-Bg 10 V G₀	Y	28 F-G-Lc Sp-2-1 Kg-Cg-Tm-Hw 50 III G₀

15

F-G-Ls	
0	
Kg-Cg-Hw	
50	

III

28

U-S-Lc	
D(Hm-RWb-4"-2 Stump)	
Kg-Hw-Wc-Cf	
75	

II

28-27

F-G-Ls	
0	
Kg-Tm-Rt-Rc	
70	

III

28

F-P-Lc	
P-Em-Lwb-2-2	
Sg-Bg	
25	

IV

13

F-P-Ls	
AL-Lw-4"-1	
Sg-Bg	
15	

V

28

F-G-Lc	
Sm-P-wh-OK-4"-2	
Kg-Bg-Sg	
20	

IV

28

F-G-Lc	
Sp-4"-1	
Kg-Cg-Hw-Tm	
40	

III

28-86

F-G-Lc	
0	
Kg-Hw-Wc	
75	

II

12-27-86

F-G-Lc	
0	
Kg-DN-AF-Hw-Wc	
80	

II



Fig. 22. Loamy sandy soils lightly grazed produce good summer feed for livestock.



Fig. 23. Wildland pasture, hay and silage built these buildings and keep them in repair.

Weights of Cattle at Beginning and End of Pasture Season

Control Pasture Group			Wild Pasture Group			
Date	Weight of 12 cows	Weight of calves	Total weight	Weight of 12 cows	Weight of calves	Total weight
June 4	11,096	974	12,070	10,921	1,058	11,979
Oct.29	11,092*	3,673	14,765*	11,576	3,644	15,220

* 11 cows; an 880 pound cow died in August.

From the table above, it can be seen that there was no significant difference in the gains made by the cattle on the two pastures. Throughout the season, the cattle were all in good condition.

Upon inspection of the two pastures, there was a small reserve of feed left on the Control Pasture. On the Wild Pasture, the forage was very closely grazed and nearly all woody vegetation was severely browsed. Apparently, the reserve in forage that had built up during the previous 11 years was depleted.

The writer's opinion is that during another season, the number of cattle must be reduced on the Wild Pasture. In the grazing seasons to come, the weights on the cattle will indicate to what extent the livestock load should be reduced. Probably, the livestock on this Wild Pasture should be reduced to 6 cows and their calves.

Wild Pasture
Calculations of Carrying Capacity

Forage Value Areas by Acres	Carrying Capacity per Class by Animal Units
Class II	9.4
Class III	36.2
Class V	14.4

Calculated Capacity : 8.7 Animal Units

Animal Units Carried : 16.8 (12 cows + calves.)

There is a possibility that the pasture will improve under use. If this does occur, then the pasture will be able to support from year to year more than the anticipated 6 cows and their calves. However, this is very doubtful under the extremely heavy grazing to which the pasture was subjected during the 1941 grazing season.



Fig. 24. The plat frame used in establishing the pasture study at the Lake City Experiment Station



Fig. 25. This covered salt rack was used by cattle. Deer also frequented the salt rack.

Table #7

ANIMAL UNITS CARRIED AS COMPARED TO CALCULATED CAPACITIES		
AREA	A.U.CARRIED	CALCULATED A.U.CAPACITY
Bechdoldt	12.5	12.9
Clemens	64.5	60.0
Cornwell	323.0	369.9
Davis	83.0	93.6
Dickerson	14.5	12.1
Frederick	106.7	111.1
Haucks	101.0	104.4
Hawk	28.7 12.3	28.2 8.5
Jaruzal	44.3	24.4
Katona	35.5	42.4
King	33.0	25.0
Lilley	18.7	20.0
McKay a	25.2	30.1
McKay b	36.0	28.2
Reid	30.4	33.7
Saunders	72.9	49.1
Schearer	30.4	21.0
Seymour	45.2	48.0
Shull	475.2	426.3
Stevens	58.8	68.3
Thomas	63.5	53.8
Whitmer	29.5	29.6
Expt. Sta.	16.8	8.7
Totals	1761.6	1709.3

MAPPING PROCEDURE

The problem revolves to a great extent around the forage that livestock obtain on cut-over lands in Michigan. The production of plants in an area depends upon the light obtainable from the sun, the moisture and fertility available from the soil, and the competition of the associated flora and fauna. Plants naturally reflect their environment, but any one factor in that environment may be the limiting factor in the production of feed or forage for livestock consumption. For example, every condition for the growth of Kentucky bluegrass may be ideal, except the lack of sufficient light due to a dense forest stand. Or the limitations may be due to lack of moisture, or too much moisture, or infertile soil, or overgrazing, or in the competition of other plants. Therefore, to obtain a complete picture of conditions on an area, a method of mapping had to be developed that would show the plant associations and conditions on each individual soil type. The object was to devise a method that would depict the soil conditions, plant associations, and use of each area on a single map. This would keep all the information together, in one usable form.

Standardized methods of showing base features was used, i.e., boundaries, buildings, streams, lakes, dams, roads as used by the Land-Economic Survey and U.S.D.A. Soil Survey.

LAND FEATURES

The character of the land was mapped in unit areas on the basis of topography, kind of soil, amount of surface stone, field crops, tree growth, and ground cover. Each unit area must be a fenced or naturally bounded area which will be shown on the map by a black line boundary and designated by a capital letter. As each different unit area is

identified and outlined on the map by its black line, its character will be described by a fraction-style symbol which will be placed in the space below the map. The following legend gives the symbols to be used in making up this descriptive fraction.

Legend of Map Symbols

Topography

- F - Flat or level - 0 to $2\frac{1}{2}\%$ slope
- U - Undulating or smooth wavy - $2\frac{1}{2}$ to $7\frac{1}{2}\%$ slope
- G - Gently rolling or gently sloping - 5 to 15% slope
- S - Strongly rolling or moderately steep sloping - 10 to 30% slope
- H - Steep, hilly, or very rough - mainly over 30% slope

Kind of soil

- Ss - Sand with sandy or sand-gravel subsoil
- Ls - Light or sandy loam with sandy clay subsoil
- Lc - Heavy or good loam with more clayey subsoil
- Cc - Clay loam or clay with heavy clay subsoil
- Ms - Shallow muck on sand
- Mc - Shallow muck on clay
- Mm - Shallow muck on marl
- Mr - Shallow muck on rock
- Mp - Deep muck or peat
- Sb - Stream bottom soil
- Ba - Barren; lake beach, mud flats, sand-blows, pits, quarries, mine dump, etc.

Natural drainage

- F - Fast and free as on the dry jack pine plains or oak hills
- G - Good or adequate as on the rolling hardwood uplands
- S - Slow or inadequate as on the flat clay lands and low wet sand flats

P - Poor as on the swamps, marshes, bogs

I - Intermittently flooded at times as in streams bottoms which are subject to occasional overflow

Surface Stoniness

0 - No stones

1 - Small amount of stones

2 - Moderate amount

3 - Large amount

In using the symbols, the number indicating degree of stoniness is followed by a small letter to designate the nature of the stones as: g for gravel, c for cobbles, b for boulders, s for broken slab rocks, r for rock ledges, and k for rock knobs.

Example: 2gb means moderate amount of gravel and boulders.

3s means large amount of broken slab rock.

1r means small amount of ledge rock or shelving rock outcrops.

2gc means moderate amount of gravel and cobbles.

Tree Growth

Ok - Oak

Hk - Hemlock

Wb - White birch

Iw - Ironwood

Sm - Soft maples

Bc - Black cherry

Hm - Hard maple

Em - Elm

Pc - Pin cherry

Bw - Basswood

Ah - Ash

Cc - Choke cherry

Bh - Beech

Bg - Balm of gilead

Wp - White pine

Yb - Yellow birch

P - Aspen (Popple)

Rp - Red pine

Jp - Jack

Lw - Lowland willow

Bm - Balsam

Al - Alder

Cr - Cedar

Jb - June berry

Sp - Spruce

Su - Sumac

Tm - Tamarack

Wc - Wild crab apple

Hn - Hazelnut

Wp - Wild plum

Wh - Witch hazel

Ma - Mountain ash

Uw - Upland willow

Mh - Michigan holly

Type combinations

When any of the above species occur singly or in pure stands, only one symbol will be used. But where two or more species are found growing together, as many symbols as may be needed to typify the character of the stand will be used.

Example: Jp - pure stand of jack pine.

Jp-Ok-P - combination stand of jack pine, oak, and aspen which is principally jack pine with some oak and still less aspen.

Two story stands

If the overstory constitutes the major part of the stand, then the symbols for its species should be listed first in the order of their prominence with the symbols for the understory following in the order of their prominence. If, however, the understory constitutes the major part of the stand then list the symbols for the understory species first in the order of their prominence with the symbols for the overstory following in the order of their prominence.

To indicate which species constitutes the overstory and which the understory, the symbols for the species in the overstory are underlined.

Example: P-Bg-Cr-Sp means an overstory of aspen and balm of gilead with more aspen than balm of gilead; and an understory of cedar and spruce in which there is more cedar than spruce.

Density

In all tree stands, pure or combination, the density of the stand will be indicated as:

- 1 - denotes open (no trees or only a few individual trees for livestock shade).
- 2 - denotes scattered trees (individual trees and/or small groups of trees which are so scattered that they shade less than 15% of the area).

- 3 - clumps of trees (usually second growth in isolated clumps or patches which may cover any amount up to 75% of the area. When the clump condition is designated it will be necessary to follow the 3(with a figure in parenthesis) to show how much of the area is occupied by the clump growth.

Example: 3(30) about 30 per cent
 3(50) about half
 3(75) about three fourths

4 - denotes uniform stand.

In the density groups 3 and 4 (clumps and uniform stands) the relative density of the tree growth will further symbolize for open shade, semi-open shade, and closed shade.

Example: 3' for open shade clumps
 3'' for semi-open shade clumps
 3''' for closed shade clumps
 4' for open shade uniform stand
 4'' for semi-open shade uniform stand
 4''' for closed shade uniform stand

Size or age

1 - reproduction less than one inch and a half in diameter or less than 20 feet high.

2 - young second growth less than 3 inches in diameter or less than 40 feet high.

3 - advanced second growth less than 9 inches in diameter or less than 55 feet high.

4 - mature second growth over 9 inches in diameter that exceed 55 feet in height and including all lightly culled or virgin stands of comparable height.

The symbols for density and size or age class will follow the type symbol and be separated from the type symbol and each other by a simple dash.

Examples:

- Jp -3(50)'''-1 for jack pine closed shade clumps of reproduction
- Jp-4'''-2 for jack pine semi-open shade uniform stand young second growth
- Jp-2-3 for jack pine scattered stand advanced second growth
- Jp-1-4 for jack pine open stand nature growth
- P-Bm-Sp-Cr-4'''-1 For a closed shade uniform stand consisting of an overstory of aspen with understory of balsam, spruce and cedar in which the aspen overstory does not exceed 20 feet in height (this is not very common).
- P-Bm-Sp-Cr-4'''-2 Same as above except that overstory of aspen is between 20 and 40 feet high (more common).
- P-Bm-Sp-Cr-4'''-3 Same as above except that the overstory of aspen is between 40 and 55 feet high (most common).
- P-Bm-Sp-Cr-4'''-4 Same as above except that the overstory of aspen is over 55 feet in height (rather unusual but may occur).

Farmstead, Fields, and Ground Cover

Id - Idle	Ps - Peas
Fs - Farm yard, garden and barn lots	Bd - Burdock
Or - Orchards	Oa - Oats
By - Berries	Mu - Mullein
Cn - Corn	Wh - Wheat
Po - Potatoes	Mw - Milkweed
Bn - Beans (white or red)	Ry - Rye
Sb - Soybeans	Md - Medic
Sp - Spelts	Hw - Orange Hawkweed
Qg - Quack grass	Bg - Broom sedge
Tm - Timothy	Cf - Crowfoot
Rt - Redtop grass	Wg - Wheat grass
Bm - Brome grass	Pg - Poverty oatgrass

Al - Alfalfa	Dy - Daisy
Sc - Sweet clover	Sb - Strawberry
Rc - Red clover	Br - Briars (blackberry, raspberry, dewberry)
Ac - Alsike clover	Ct - Cat-tails
Cg - Canada bluegrass	Sg - Sedges
Kg - Kentucky bluegrass	Bg - Bluejoint grass
Wc - White Clover	Bm - Bog mosses (Sphagnum, etc.)
Sv - Sand vetch	Lf - Leatherleaf
Rw - Ragweed	Cf - Cinquefoil
Bw - Buckwheat	Eb - Blueberries
Be - Butter and eggs	Bk - Bracken fern
Ss - Sand sedge	Sf - Sweet fern
Gr - Goldenrod	Wn - Wintergreen
Dn - Dandelion	Ce - Common everlasting
Ts - Thistles	Rf - Royal fern
Dm - Dry moss and lichens	Wf - Woods fern
By - Bear berry	Co - Clintonia
So - Solomon seal	Bs - Bedstraws
Cm - Club mosses	Lr - Leaf litter

The symbols for the farmstead, field and ground cover conditions will be arranged on one line of the fractional symbol in the order with which the separate species are using the land and light on the area, with the most prominent species first and the successively less prominent species following in order. Ordinarily it will be satisfactory to list at least three ground cover species but in many instances it will be desirable to list up to five or six species when that number or more are significantly represented in the association. The larger number will be significant when some desirable or undesirable forage species is

present in minor quantity so that rating its occurrence may indicate the possibility of management to encourage or eliminate that particular species.

Example: Kg-Ac-Wc means Kentucky bluegrass, alsike clover, and white clover in a combination that consists mainly of Kentucky bluegrass with some alsike and less white clover.

Md-Hw-Cg-Kg-Qg means medic, hawkweed, Canada bluegrass, Kentucky bluegrass, and quack grass in a combination in which the medic uses more of the land and light than any other single species with the others following in the order shown.

GENERAL

Soils

In those cases where the investigator was able to do so, the descriptive fraction is headed with the number which is commonly used in soil mapping for the soil type. It is necessary, therefore, to attach a legend of the soil types and their respective numbers so that these soil type numbers at the head of the fraction can be unmistakably identified.

Legend of Soil Types and Corresponding Numbers

<u>Series No.</u>	<u>Soil Type</u>	<u>Series No.</u>	<u>Soil Type</u>
5	Antrim sandy loam	18	Ottawa fine sandy loam
6	Eastport sand	20	Rifle peat
8	Ottawa loamy sand	21	Maumee loam
10	Greenwood peat	23	Barker loam
11	Arenac loamy sand	24	Onaway loam
12	Arenac sandy loam	26	Emmet sandy loam
13	Selkirk silt loam	27	Iosco sandy loam
14	Colwood silt loam	28	Nester loam
15	Ogemaw sandy loam	29	Emmet loamy sand
16	Roselawn sand	30	Lupton muck

<u>Series No.</u>	<u>Soil Type</u>	<u>Series No.</u>	<u>Soil Type</u>
35	Roselawn sandy loam	60	Spaulding peat
36	Saugatuck sand	70	Carbondale muck
40	Houghton muck	72	Echo sand
41	Blue Lake loamy sand	73	Griffin clay loam
42	Blue Lake sandy loam	76	Griffin sandy loam
45	Mancelona sandy loam	80	Kerston muck
46	Rubicon sand	81	Bergland clay
55	Kalkaska sandy loam	84	Bergland loam
56	Grayling sand	85	Munuscong sandy loam
58	Kalkaska loamy sand	86	Newton sand
59	Grayling coarse sand	99	Weare sand

Feed value

After the investigator made up the description fraction symbol for the soil, farmstead, fields, trees, and ground cover, then the "Feed Value" of the area was indicated by placing a summary figure below the fraction to indicate the relative density and volume of palatable forage on the area. This figure was selected from a scale of 100. Example: 90 was used to indicate a very productive tract on which practically the entire growth consisted of palatable forage species in an almost complete ground cover. Then 30 meant a tract on which the amount of palatable forage was only a third as good as in the first instance by reason of (1) the presence of undesirable and/or unusable species in the ground cover and/or overstory which are using the land and light to the exclusion of desirable and usable forage species; or (2) the fact that the site condition (soil, fertility, moisture, stoniness, etc.)

was such that the amount and feed value of the forage would rate about $1/3$ as good as in the first instance.

Grazing Index

When the descriptive fractional symbol had been completed as indicated in the preceding instructions, then in the field office or while on the ground (preferably the latter) the investigator rated each mapped area as to its utility for grazing on a scale of six classes. This rating was designated by placing a Roman numeral at the right of the fractional symbol. In this rating scale, "I" was the best grade with the highest grazing utility while "VI" was the poorest grade covering those areas with no grazing utility.

This type of rating is necessary so that for a tract like a "forty" or several "forties" or a half section or several sections, the individual mapped areas on the whole tract can be conveniently added up on the basis of their respective acreages and six point ratings into a final "carrying capacity, management and administrative class."

Grazing Use

When the investigator mapped each individual unit, he noted whether or not it was being grazed and the degree of such use. His observations were recorded by placing a "G" at the right of the fractional symbol with a sub-figure for either light, moderate, heavy, or overgrazing.

Example: G0 denotes no grazing.

G₁ denotes lightly grazed.

G₂ denotes moderately grazed

G₃ denotes heavily grazed.

G₄ denotes overgrazed.

Wildlife

When the investigator mapped each individual unit area, he made a record of any wildlife or wildlife signs encountered. This was done by placing an "X" on the map at the location where the wildlife or its signs were noted. The first X will be sub-numbered as X_1 , the next X_2 , the next X_3 and so on. Then on the margin of the map list the X_1 , X_2 locations in order with a brief comment.

Example: X_1 Beaver cuttings

X_2 Deer tracts

In the field notes for the tract these instances are more fully described under the appropriate tract designation as "Feed Tract" X_2 Deer Tracks (followed by a paragraph of explanation).

Special attention was given to the animals of the game species, fur-bearers, fish and predators of these species. Any other species of wildlife were included if significant.

In the field notes as complete a report as possible was made of the extent to which the individual mapped areas are being used by wildlife for food and shelter and the influence which this use is having on the site growth, if any.

THE FRACTIONAL SYMBOL

An interpretation of a possible complete fractional symbol is given below:

$$A \quad \frac{\left(\frac{36}{F-Ss-S-O} \right)}{\left(\frac{P-Wb-Fm-Sp-Al-4'-3}{B-Wn-Ss-Kg-Cg} \right)} \quad \begin{matrix} V \\ G_2 \end{matrix}$$

A — designates the mapped area on which this type is located.

36 — designates Saugatuck sand.

F-Ss-S-O — denotes a nearly flat area of sandy soil with a sandy subsoil

which is kept moist by the high water table. The area is free from gravel and stone.

P-Wb-Bm-Sp-Al4''-3 - designates a two-story stand in which aspen and white birch constitute the overstory with balsam, spruce and alder in the understory. The stand as a whole is uniform and closed shading in density with the overstory reaching a height of 40 and 55 feet.

B-Wn-Ss-Kg-Cb - designates a ground cover in which bracken fern uses the most land and light with wintergreen, sand sedge, Kentucky bluegrass and Canada bluegrass in the order named.

10 - indicates that the area is very low in feed value of palatable forage on the scale of "0 to 100."

V - shows that the area rates next to the poorest possible grazing conditions on the scale of "I to VI" in which "I" is the highest or best possible grazing condition and "VI" has no grazing value.

G₂ - indicates that the area is moderately grazed.

In addition to making maps of the areas studied, a record was kept on each area relative to the number of livestock carried, kind of livestock and the production and the condition of the livestock.

Production of beef cattle was obtained by procuring the weights of the cattle at the time of going on to pasture. These weights were then subtracted from the weights when leaving the pasture. This difference gave the pounds gained on pasture.

Production of sheep was computed by obtaining the age and weights of lambs as they came off from pasture. For dairy cattle, milk production or butter fat production was obtained by months for each area.

The livestock production on each area was necessary information because it acted as a measurement of the production of an area. This was especially true when combined with the degree to which each area was grazed and/or browsed.

Determination of animal units:

Another factor which had to be considered in determining the carrying capacity of livestock on any area, was the definition of what constituted an "Animal Unit." Each type of livestock requires different amounts of feed. There also appeared to be differences in feed requirements within each type of livestock. For example, a nursing ewe does not require the same amount of feed as an 800-pound beef steer or a 1000-pound dairy cow giving 10 quarts of milk per day. The problem was to construct a scale of values in which one herd of dairy cattle could be compared with another herd of dairy cattle or flock of sheep or herd of beef cattle. For example, if a certain area adequately carries a herd of 20 beef steers averaging 600 pounds each, how many ewes with lambs could we expect the same area to adequately carry?

At present, the most dependable information as to feed requirements of any animal, is that of daily total digestable nutrients required by an animal (Ref.3). By arbitrarily selecting an 800-pound beef steer or heifer as equalling one animal unit, the values in animal units for other types and weights of livestock were determined. This was done by interpolation using the total digestable units requirements as a basis. See Table #2.

Table 2

DETERMINATION OF ANIMAL UNITS		
Animal Type	Requirements in T.D.N. per day	Animal units
Dry ewe	1.7 - 2.0	.20
Nursing ewe	2.5 - 2.8	.25
200# steer or heifer	4.0 - 4.2	.40
300# steer or heifer	5.5 - 5.9	.50
400# steer or heifer	6.6 - 7.2	.60
500# steer or heifer	7.7 - 8.5	.70
600# steer or heifer	8.7 - 9.6	.80
700# steer or heifer	9.7 - 10.7	.90
800# steer or heifer	10.7 - 11.8	1.00
900# steer or heifer	11.7 - 12.9	1.05
1000# steer or heifer	12.6 - 13.9	1.10
*700# Dairy cow	5.81	.50
*800# Dairy cow	6.53	.55
*900# Dairy cow	7.23	.60
*1000# Dairy cow	7.93	.65
*1100# Dairy cow	8.61	.70
*1200# Dairy cow	9.29	.75
*900# Beef cow	9.7	.80
**1000# Beef cow	10.5	.90
**1100 Beef cow	11.3	.95
**1200 Beef cow	12.0	1.00

* Add .05 A.U. for each quart or 2 lbs. of milk produced per day on the average for entire grazing season.

** Add .5 A.U. to each cow nursing calf.

Table 2 (cont.)

DETERMINATION OF ANIMAL UNITS		
Animal type	Requirements in T.D.N. per day	Animal units
<u>IDLE HORSES</u>		
1000#	7.0 - 9.0	.7
1100#	7.5 - 9.7	.8
1200#	8.0 - 10.3	.85
1300#	8.5 - 10.9	.9
1400#	8.9 - 11.5	.95
1500#	9.4 - 12.1	1.0
1600#	9.9 - 12.7	1.05
1700#	10.3 - 13.3	1.1
1800#	10.8 - 13.8	1.15

WILD LAND PASTURE TYPES

The data from the past two years work, indicate that there are four principle factors which determine the carrying capacity of an area. These principle factors are: 1. The density of the edible forage occupying the ground; 2. the species of plants occupying the ground; 3. the nature of the soil; and 4, the availability of browse. However, there is an inter-relationship between these factors. For example, the density and species of ground forage is determined to a great extent by the nature of the soil.

These four factors that were used to determine the carrying capacity of an area are the end results of multiple factors influencing the area. Those factors apparently having the most influence upon forage density appeared to be: (a) nature of the soil; (b) amount of forest overstory; (c) past practices on the area; (d) species occupying the area. Those factors apparently having the most influence upon species of plants occupying the ground cover appeared to be: (a) nature of the soil; (b) past use of the area; (c) forest overstory. Those factors apparently having the most effect upon the nature of the soil appeared to be: (a) Physical and chemical properties of the soil; (b) drainage; (c) past practices on the soil. Those factors which apparently determined the availability of browse appeared to be: (a) nature of the soil; (b) size of woody vegetation; (c) density of woody vegetation; (d) species of woody vegetation; (e) past use of the area.

Table 6 is the summarization of the pasture classes into a carrying capacity scale. Graphs were made using the data from the maps supplemented with the production data. Those factors which determined the carrying capacity of an area are designated in Table 6.

Table 5

Carrying Capacity - Ratings by Classes

Class	Range of Acres per Animal Units
I	1-3
II	4-5
III	6-9
IV	10-14
V	15-20
VI	Over 20

The above values indicate the number of acres of the corresponding pasture class necessary to support one animal unit for a 6-month pasture season.

The values for Table 5 were determined by trial and error method from the information gained on the pasture study areas that had been grazed over a period of years. Many sets of values were tried on all of the study areas and correlated with the data. The values in Table 5 seemed to fit all conditions of the areas studied. See Table 7 for this summarization. Future application of these values on additional areas may indicate that some changes are needed.

Table 6

PASTURE CLASSIFICATION

SOIL CLASS	*Feed Density % By Pasture Class					
	I	# II	# III	# IV	# V	VI
Swamp & Marsh (Swamp-Conifer)		60-80	40-60	20-40	10-20	0-10
Swamp Border & River Bottom (Swamp-Conifer)		60-80	35-60	20-35	10-20	0-10
Moist Sands (Pine-Swamp Conifer)		60-80	35-60	20-35	10-20	0-10
Moist Loam (Hardwood)		60-80	35-60	20-35	10-20	0-5
Dry Loam (Hardwood-Pine)		70+	40-70	20-40	10-20	0-10
Dry Loamy Sand (Pine-Hardwood)		Alf. or sweet clover	45+	25-45	10-25	0-10
Dry Sand (Pine)		Sweet clover	50+	25-50	10-20	0-10

*Density based on Kentucky bluegrass, bluejoint grass, timothy, redtop grass, smooth brome grass, orchard grass.

#Advance one class (III to II, or II to I) where white clover, alfalfa, sweet clover, alsike clover, or Reed Canary grass is dominant forage, drop to next poorer class where Canada bluegrass is dominant.

Table 8*SOIL TYPES WHICH CONSTITUTE GENERALIZED SOIL CLASSES

Generalized Soil Classes	Specific Soil Types	Organized Forest Cover
Swamp and marsh	10,20,30,40,50,60,70,80	Swamp-conifer
Swamp Border & River Bottom	21,73,76,81,84,85,86	
Moist sands	6,11,15,18,36	Pine-swamp conifer
Moist Loam	5,12,13,14,23,24-27-28	Hardwood
Dry Loam	26,35,42,45,55	Hardwood-Pine
Dry Loamy sand	8,29,41,58,72	Pine-Hardwood
Dry Sand	16,46,56,59,99	Pine

* The above table designates the soil types that are included in the generalized soil classes used in Table 6, (Ref.3).

In order to make use of Table 6 to determine the carrying capacity of an area, a definite procedure should be followed.

1. Map the area by the method previously outlined.
2. Refer to Table 6 to determine which class each area should be classified.
3. Determine the number of acres occupied by each of the 6 Pasture Classes.
4. Divide acreage of each Pasture Class by the factor in Table 5 of the corresponding Pasture Class.

For example, if there are 70 acres in Pasture Class III' divide by 7. This equals 10. The number 10 indicates that the 70 acres of Pasture Class III will carry 10 animal units for 5 to 6 months on pasture. Do this for each Pasture Class, add together to get the Total Animal Units the pasture will carry.

5. For beef cattle the number of cattle, type of cattle (steers, heifers, cows, calves) and weights must be determined.

For dairy cattle, the number, weights, and production must be determined. For sheep, the number of ewes and the number of lambs must be determined. With these data, refer to Table 4 to determine the number of animal units to be pastured. The number of animal units to be carried should equal, or be less than, the total number of animal units an area is capable of carrying.

A word of warning should be noted here. Table 5 and Table 6 are based upon only two summers' data. Therefore, these two tables cannot be entirely accurate for several reasons. A difference in the season's temperature and precipitation from that which occurred in 1940 or 1941 could change the values in Table 5. Further application of the values in Table 6 may indicate a change is needed in the limits of each Pasture

Class.

It is recommended that future application should be made of the method outlined, be supplemented with detailed records and a study be made of the records. This should be done to determine what changes should be made in Tables 5 and 6.

Example of the method to determine the carrying capacity of a particular wildland pasture:

Total acreage: 60 acres.

Soil type: Emmet sandy loam (Soil No. 26).

Livestock to be carried: 30 ewes with 30 lambs.

Under Soil Class in Table 6, it is a dry loam.

In mapping the area, it is found there are (1) 10 acres of a good stand of alfalfa-brome grass pasture. This would fall in pasture Class I. There are (2) 10 acres of open Kentucky bluegrass and quack grass of 75% density. This would fall in Class II. There are (3) 10 acres of Kentucky bluegrass under a scattered stand of hard maple; grass density is 45%. There are (4) 10 acres of Kentucky bluegrass under an even but open stand of hard maple; grass density is 35%. There is (5) 10 acres of Kentucky bluegrass under a moderate stand of hardmaple; grass density is 15%. There are (6) 10 acres of a dense stand of hard maple; grass density is 0%.

Refer to Table 6 to determine in which class each of these 6 areas is to be classed. The first 10 acres falls in Class I, the second in Class II, the third in Class III, the fourth in Class IV, the fifth in Class V and the sixth in Class VI.

To discover the Animal Units each of these six Classes will carry, refer to Table 5.

Class	Acres	Determination of Animal Units		
Class I	10	10/3	:	3.3
Class II	10	10/5	:	2.0
Class III	10	10/9	:	1.1
Class IV	10	10/13	:	0.8
Class V	10	10/18	:	0.5
Class VI	10	10/00	:	0.0
The area is capable of carrying				7.7 Animal Units

In determining the number to divide into the 10 acres of each pasture class, the grass density figure indicated whether each Class was average, low, or high. For example, in Class III, the grass density was 45%. In Table 6, for dry loam, 45% is in the lower limits of Class III. Therefore, it would take a larger acreage to support livestock than if the feed density were 60 or 65%. The higher number for Class III in Table 5 was used to divide into 10. That meant that 10 acres of Pasture Class III would carry 1.1 Animal Units. All the areas combined will carry 7.7 Animal Units.

The next step; how many Animal Units do 30 ewes nursing their 30 lambs constitute? In Table 4, it will be noted that one nursing ewe equals .25 Animal Units. $30 \times .25 = 7.5$ Animal Units to be carried.

The 60-acre field has the capacity to carry 7.7 Animal Units. The thirty ewes with lambs equal 7.5 Animal Units. Therefore, the pasture will safely and adequately carry the sheep for the full 5 or 6 months grazing season under ordinary or normal weather conditions.

SUMMARY

A study has been made to determine the carrying capacities for domestic livestock on wildland pastures of certain northern Michigan cut-over lands. This study has been of an extensive nature.

Twenty-two areas were selected for study and cooperation arranged with the grazing operators.

These areas were mapped in detail according to the Wild Land Pasture Mapping Procedure developed in the course of the study. Records were obtained relating to the livestock production made on each area. Also on each area, the physical features and vegetation conditions were then correlated with the livestock production to determine the livestock carrying capacity.

The principal factors involved in this correlation have been discussed. Some observations regarding the apparent relation of grazing upon wild game species were reported.

Conclusions reached as a result of the study are:

1. The livestock carrying capacity of a wildland pasture in northern Michigan is principally dependent upon the nature of the soil and the density of the species of edible forage upon the area. The Animal Units carried on the pastures studied indicated that there was a correlation between soils-forage conditions-and the carrying capacity.
2. Areas supporting dense stands of tree growth are not successfully pastured, because browse is out of reach and there is practically no ground forage available.
3. An area whose soils are composed only of deep dry sands such as the "jack pine plains and hills" cannot support a livestock population successfully over a period of years. The Underhill Ranch,

Serradella Farms and the early ventures in northwestern Ogemaw County are good examples. Apparently the inability to raise sufficient winter feed and the deficiency of palatable summer forage on these soils, are the principal limiting factors.

4. The availability and distribution of good drinking water is as important to wildland grazing as the forage. Livestock tend to graze those areas which they visit the most frequently. Consequently, water does play an important part in the distribution of grazing and utilization of forage.

5. Apparently cattle do not offer serious competition to wildlife where the areas are moderately grazed. Deer, partridge, and pheasants were numerous on the Frederick Area. Deer and partridge were also well represented on the Katona and Cornwell areas.

6. The income from livestock on wildland pastures is a major source of sustenance to the majority of ventures studied. The use of wildland pastures appeared to be an integral and necessary part in the agriculture of northern Michigan.

7. In general, the small operators do not depend solely upon the income from livestock on wildland pastures. For example, the operator of the King Area did some carpenter work and serviced deer hunters. The operator of the Jaruzal Area raised potatoes for a cash crop.

8. It is not economical to purchase feed for winter consumption by livestock. The purchase of feed nearly proved disastrous in the early history of the Rainy Lake Ranch and was a large factor in the failure of the Watershed Ranch. The purchase of feed often consumes that margin of profit made on the livestock while grazing in the summer.

9. Improved pastures consisting of alfalfa, alfalfa-brome grass, fertilized white clover or sweet clover on soils suited to the production of each particular forage, are desirable and often necessary for the maintenance of livestock. This is especially true in the drought months of July and August.

10. Good livestock management is a pre-requisite to successful wildland grazing operations. These practices, which too often are neglected, may well include amount and quality of winter feed, a lambing date in accordance with the climate, adequate housing, use of coarse salt rather than block salt, and parasite control.

11. A method has been developed whereby northern Michigan cut-over lands can be classified according to their utility for wildland grazing. It is possible for anyone familiar with Michigan vegetation and farm animals to determine the livestock carrying capacity of any particular wildland pasture. Its value is especially significant to the public interests. The Michigan Department of Conservation now has $4\frac{1}{2}$ million acres of cut-over lands under its supervision. These lands are under a policy of multiple use. It is now possible to include the grazing of domestic livestock where this use will not conflict with forest or recreational interest.

PLANT CHECK LIST

Alder	<i>Alnus incana</i>
Alfalfa	<i>Medicago sativa</i>
Ash	<i>Fraxinus</i> sp.
Aspen	<i>Populus</i> sp.
Balm-of-Gilead	<i>Populus candicans</i>
Barley	<i>Hordeum sativum</i>
Basswood	<i>Tilia glabra</i>
Bearberry	<i>Arctostaphylos nevadensis</i>
Bedstraw	<i>Galium</i> sp.
Beech	<i>Fagus grandifolia</i>
Birch, white	<i>Betula papyrifera</i>
Blackberry	<i>Rubus allegheniensis</i>
Bluegrass, Canada	<i>Poa compressa</i>
Bluegrass, Kentucky	<i>Poa pratensis</i>
Bluestem	<i>Andropogon</i> sp.
Bracken Fern	<i>Pteridium latinsculium</i>
Buckwheat	<i>Fagopyrum esculentum</i>
Bullrush	<i>Scirpus sylvaticus</i>
Cedar, White	<i>Chamaecyparis thyoides</i>
Cherry, Black	<i>Prunus nigra</i>
Cherry, Choke	<i>Prunus virginiana</i>
Cherry, Pin	<i>Prunus pennsylvanica</i>
Cinquefoil	<i>Potentilla</i> sp.
Clover, Red	<i>Trifolium pratense</i>
Clover, Sweet	<i>Melilotus</i> sp.

Clover, White	<i>Trifolium ripens</i>
Club Moss	<i>Lycopodium</i> sp.
Corn	<i>Zea Mays</i>
Daisy	<i>Chrysanthemum</i> sp.
Dandelion	<i>Taraxicum officinalis</i>
Elm	<i>Ulmus</i> sp.
Everlasting, Common	<i>Guaphalium obtusifolium</i>
Fern, Sweet	<i>Myrica asplenifolia</i>
Goldenrod	<i>Solidago</i> sp.
Grass, Bluejoint	<i>Calamagrostis canadensis</i>
Grass, Brome	<i>Bromus inermis</i>
Grass, Orchard	<i>Dactylis glomerata</i>
Grass, Poverty Oat	<i>Danthonia s. icata</i>
Grass, Quack	<i>Agropyron repens</i>
Grass, Redtop	<i>Agrostis alba</i>
Grass, Reed; Canary	<i>Phalaris arundinaceal</i>
Grass, Timothy	<i>Phleum pratense</i>
Hawkweed, Orange	<i>Hieracium aurantiacum</i>
Hazelnut	<i>Corylus americana</i>
Labrador Tea	<i>Ledum groenlandicum</i>
Leatherleaf	<i>Chamaedaphne calyculata</i>
Maple, Black	<i>Acer nigrum</i>
Maple, Red	<i>Acer rubrum</i>
Maple Silver	<i>Acer saccharinum</i>
Maple, Sugar	<i>Acer saccharum</i>
Medick, Black	<i>Medicago lupulina</i>
Milkweek	<i>Asclipias syriaca</i>

Oak	<i>Quercus</i> sp.
Oats	<i>Avena sativa</i>
Pine, Jack	<i>Pinus Banksiana</i>
Pine, Red	<i>Pinus resinosa</i>
Pine, White	<i>Pinus strobus</i>
Potato	<i>Solanum tuberosum</i>
Raspberry, Black	<i>Rubus occidentalis</i>
Raspberry, Red	<i>Rubus idaeus</i>
Rosemary, Bog	<i>Andromeda glaucophylla</i>
Rush	<i>Juncus</i> sp.
Rye	<i>Secale cereale</i>
Sedge	<i>Carex</i> sp.
Solomon's-Seal	<i>Polygonatum pubescens</i>
Soybean	<i>Glycine Max</i>
Spruce	<i>Picea</i> sp.
Sumac, Staghorn	<i>Rhus typhina</i>
Tamarack	<i>Larix laricina</i>
Thistle, Canada	<i>Cirsium arvense</i>
Thistle, Russian	<i>Salsola pestifer</i>
Turnip	<i>Brassica Rapa</i>
Vetch, Hairy	<i>Vicia villosa</i>
Wheat	<i>Triticum aestivum</i>
Willow	<i>Salix</i> sp
Wintergreen	<i>Pyrola</i> sp.

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