A Land Use and Vegetation Analysis of the Moon Lot Based on Aerial Photographs 1935 - 1993

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Introduction

My first experience with the Moon Lot (ML) in Hopkins Memorial Forest was in the early morning on a bitter February day. Passing through the stone wall that marks the north-eastern boundary, my eyes first fell upon the huge sugar maple that guards the entrance. I was irresistibly drawn to the old relic and climbed up a broken limb that had fallen to form a ramp, and came to rest comfortably in the nook of another branch. Even then I think that I was beginning to wonder what the old tree had seen pass beneath its boughs. I sat in that world for well over an hour before I had to continue along in my first exploration of the ML.

With Environmental Studies 102, I returned over and over again to that 57.3 acre plot of land nestled in the heart of what is now all college owned experimental forest. I became only more attached to it with every trip, and began to wish to know more about its history. Very simply, I wanted to understand why it looked the way that it did when ES 102 first intruded upon its soils. The class constructed topographic and vegetation maps, and looked at various pieces of soil and water chemistry, but was only offered enticing bits of information about its past land use. This is a topic that holds great interest to me, namely looking at how events in the past shape the present, so I thought that it would be a worthwhile subject to attempt as an individual project. Since several aerial photographs and/or slides of the area were available, starting in 1935, this seemed like a useful medium through which to work.

Consequently, I have constructed a paper that will attempt to link land use to reforestation and the structure of the forest as it stands today. My predictions are that there is a direct correlation - that the present vegetation in the ML corresponds strongly to its past land use.

Methods

I had at my disposal seven slides showing the Moon Lot from the air, and a few photos. I wanted to get specific numbers of the percentage of reforestation from year to

year. Therefore, I needed to get the slides into a single, comprehensive format which I could use to discern trends and compare data. The best way seemed to be to feed the images into a computer and create digital maps.

In order to do this, then, I had to enlarge the slides so that I could digitize them into the computer. This was accomplished relatively easily with a slide projector. I projected the slides onto more or less eight and a half by eleven pieces of paper and traced around the prominent areas that I saw, especially clearings. I was also usually able to recognize the path of the stream, the sugar maple, the stone wall on the north-eastern border, and the house.

I took these tracings to the biology building where the digitizer was set up. Once the bugs in the program were worked out, it was fairly easy to digitize the maps. I set up a scale based in feet and fit the dimensions of the ML as well as I could. I was able to print the tables of data that I wanted and to produce some decent looking maps. I translated these maps into the Geographic Information System program pMAP and was able to obtain printouts of the maps as well.

Simultaneously, I looked extensively at several research papers on the ML written by Williams students in the past. Since I was not going to be able to conduct a complete vegetation survey of my own, I familiarized myself with the Marr/Stahl data from 1985. I also reviewed the information that the ES 102 class had gathered and looked more carefully at the past sixty years' land use history of the ML. Finally, I was able to pull it all together and begin interpreting the data.

Results

It became obvious that a very direct correlation between the vegetation and the land use history of the ML exists, but I will get more into that later. First, I will explain the maps and the corresponding data.

Each map (maps are on pages 15 through 38)looks a little bit different than the next, and this can be somewhat misleading. In order to enter the maps into pMAP at

the same scale, they had to be digitized with the same ground control points (GCP's). GCP's are described as points that appear on all of the maps. They are used by the computer to ensure that the maps come out the same size. However, it is best to have at least three GCP's a fair distant apart for the computer to correctly make the necessary conversions, and it was difficult to find three such GCP's on all of the maps. Therefore, some of them look slightly skewed or out of shape, but the numbers calculated should be accurate.

It is important to note at this time that a large margin of error exists in all of these conversions from slides to print-outs. I could have missed something on one of the slides or done a poor job of digitizing, and consequently one of the numbers could be off by a decent amount. The fact that the GCP's were also sometimes hard to place made it that much more difficult. Furthermore, many of the slides were of poor quality, especially the 1940 (which is what I attribute the ridiculously low value of acre coverage to) and 1972 slides.

you are right, the 1940 photo qual is not good.

Continuing on, each map, starting at the beginning in 1935, has a scale of eighteen feet per cell. The maps are set up in a straightforward manner with every different object (clearing, stonewall, stream, etc.) receiving a different symbol, which I then further color coded. The colors and the symbols remain the same throughout. Underneath all of the maps is a box that lists the symbols, colors, values, labels, # cells, and % map. The first three are the important ones to notice. Value indicates a certain tag, which corresponds (as do the color and symbol) to a certain object, i.e. tag (value) 5 is equal to clearings.

After each map are two pages of data that relate to that map. If you keep in mind that value means the same thing as class, they should be fairly intelligible. The first data table in each group, called Statistics for File:, lists each class in order and then the total and average lengths, perimeters, and areas (in acres) for each class. Obviously, a line has no area, and a polygonal shape has no linear length. The No. column lists the number of each class that was digitized, i.e. a six in the row next to class five would

indicate that six clearings were digitized. Cumulative totals are not helpful and can be ignored.

The second page of data lists the order in which areas and/or lines were digitized, beginning with the first and running sequentially. Class again refers to value, which refers to a certain symbol and color, which refers to a certain thing. The length of each line, or the perimeter of each polygon, is listed in the length column, and the area, if it were a polygon, is listed in the area column. In the column marked label, I have included what each class stands for, i.e. if there were a five I will have marked clearing. I indicated what class meant what only once per data sheet. Towards the end of some of these data sheets the numbers sometimes get a little bit confused; this generally indicates that I had to do some editing of the original map. All of my cutting and pasting was recorded, so it can often look like quite a mess.

Here is an additional listing of each class for quick reference:

1. house
2. trails
3. roads
4. individual trees/orchard
5. clearing
6. plowed field
7. north branch Birch Brook
8. stonewall
9. sugar maple
10. background
11. plow lines
12. dark shrub
13. unsure
14. light shrub

Remember that I was not able to see each of these things on all of the maps and that this is why they do not all appear; in fact, a couple of them are only on a single map. Trails and roads could easily have been mixed up, and "13. unsure" indicates lines that may have been stonewalls, trails, roads, or none of the above. I included the majestic sugar maple when I saw it more as a tribute than out of any real need. "14. light shrub" and "12. dark shrub" indicate areas that have begun to reforest and are either in a younger

or older stage of succession. "Individual trees/orchard" were included either in the old orchard areas around the house or as scattered trees invading the once open landscape.

It is obvious that the forest has been regenerating itself, this can be seen in the field as easily as it can on these maps. However, I thought it would be helpful to demonstrate this trend in a more apparent format, so I created the data table and graph. The data table includes merely the year and the number of completely unforested acres of land in acres. The graph shows a close to linear pattern of regrowth, indicating that the forest is recovering the open ground at a slow but steady rate.

Interpretation

Before I look into my data, it is important to understand two things that are integral to this report: the past century of land use history in the ML and regional vegetation succession. Therefore, I am going to briefly outline both of them so that they can be pulled into the discussion.

The ML had been used as farmland since the late 1700's, and came into Moon hands, after which it was named, in 1855. It stayed in the family until 1924, when Lowell Primmer bought the land from Alfred Moon for $1000. Lowell Primmer was a railroad engineer, so did not need the land to survive as had Moon. For several years, he only farmed the land on his days off and over the weekends. Due to a strange family situation he was kicked out of his house and moved onto the property in 1945, where he stayed until 1956. Under Moon, the land had been almost entirely cleared, except for a small wood lot. However, by 1935, the date of the first aerial photograph, only slightly more than two-thirds of the land was still clear. This reflects Lowell's use of the farm as a "profitable hobby" and also his lack of time to fully farm the land. By 1950, Lowell was only using about 20 acres near the house for berries and apples, and everything else was left to reforestation. The 1952 photo does not show much forest encroachment, in fact several plow lines can still be seen, but this is too early a photo to see much. Lowell was a quiet, well-off introvert and he farmed the land innocuously; probably most of

the town in the aftershock of industry and the great depression had forgotten that the farm even existed.

In 1951 Lowell was persuaded to give the land to his son, Walter, who in 1956 chained the land off and denied his father access to it. The land became an asset under Walter, no longer an area to be farmed but a piece of land gaining value. Consequently, reforestation was allowed to run completely free on the property after 1956. The 1960 photo begins to show the forest gaining headway on the clearings, though Lowell's orchards are still very obvious. It can be seen that Lowell was an intermediate link between more ways than just physically between Alfred Moon, who depended on the land for his livelihood and Walter, who merely wanted the land for his own capitol gain.

In 1970, Prentice Bloedell, a rancher/farmer Previously lived in Williamstown from the west, bought the farm for $18,500. He wanted to have an isolated farm, and he tried to persuade Williams College, who at that time owned all of the surrounding land, to sell him some more property. At this point, as demonstrated in the 1970 photo, much of the land had been reforested. Consequently, Bloedell really needed more land in order to make anything of his farm. However, in a twist of irony, the college would not budge on its position, and Bloedell ended up selling his land to the college months after its purchase. This sale in 1971 completed the Hopkins Memorial Forest, and the land joined the rest of the college land as an educational and recreational resource.

The 1993 land use map (pg. 14) compiled by ES 102 shows the obvious remnants of many past uses: clearings, stonewalls and piles, cut trees, roads, Norway Spruce and apple trees are among them.

Making an abrupt switch to vegetation patterns, Hopkins Forest, and therefore the ML, falls in a transition zone between a northern hardwoods-hemlock region and a central mixed hardwoods region. This means that the ML, in a state of climax (if a forest can ever actually reach climax), defined as the time when the forest is in "dynamic steady state equilibrium," would consist primarily of hemlock, beech, sugar

maple, black birch with some yellow and paper birch, white ash, basswood, and white pine. It is generally agreed that the rates and routes of evolution vary tremendously, and are affected by topography and nearby seeding trees, but even more so by land use. The forest will eventually approach a northern mixed hardwoods climax, given time and no further human interference.

The ML is undergoing secondary succession, a natural process following the abandonment of cleared land. Stated basically, the forest is encroaching and reseeding the fields from all sides. There are two kinds of succession in the ML: old field and cut area. Old field succession would follow this general trend: field-shrubs-pioneer tree species (fast growing, intolerant)-transition species-climax species (slow growing, tolerant). Tolerance is the ability of a tree to develop and grow in its own shade, and in competition with other trees. Specific to this area, then, the cycle might look something like this: white pine, gray birch, alder, cherry, aspen, paper birch, and black birch to red maple, red oak, white ash, yellow birch, beech, and sugar maple and finally to beech, sugar maple, hemlock, yellow birch, basswood and white pine. In cut area regrowth, reforestation tends to start somewhere in the middle of the cycle. For example, if an area were lightly cut, tolerant species would probably have the advantage over other species.

So, in a general sense, how do land use and reforestation interact? Simply, the intensity of reforestation depends on the past land use. If a woodlot was selectively cut for timber, the gaps would be invaded by yellow birch and striped maple, and then continue on up the successional path. However, if an area was pasture land and had been compacted under the hooves of animals, then probably hardtack and shrubs would first appear and then feed into a succession stage of red maple, red oak, and white pine. More intense still, though, are plowed fields, which begin with aspen and gray birch leading to paper birch and then to red maple.

Two observations are readily apparent and important. Firstly, the ML is in varying stages of secondary succession. However, it does not really appear close to

climax anywhere. Secondly, it has been demonstrated by the maps, the graph, and by history that over the past sixty years the ML has slowly been allowed to reforest. Given these two notes, and the information discussed above, it seems that vegetation succession and land use must be directly related in the ML.

In fact, as I had predicted, the correlation is a very easy one to make and to describe. The ML does represent stages of succession, and these stages can be seen to match with certain areas of land use pretty exactly. My data shows the march of new forests across the once cleared areas, and the vegetation maps of Marr/Stahl and the ES 102 class demonstrate where certain areas match up. Furthermore, the 1993 and 1985 maps compare fairly closely, certainly because eight years is a very short time in the terms of trees.

I will, then, take some time to describe some of the correlations. In the main field of Alfred Moon to the south-west of the house and across the stream, strips of aspen and red oak yield to a large gray and paper birch stand formed in the obvious shape of the old field. That field is still readily apparent in the ML; I remember a friend pointing it out as "this strange area of only one kind of tree." Gray birch represents an early point of succession, which corresponds to the regeneration youth of the spot. White pine domination on the south-central plateau could represent a certain kind of soil or delta (from glacial lake Bascom), but it might also represent vegetation closer to climax in an area that had been a wood lot. Selective cutting would have promoted such succession trends. Around the old house site, there are still some clearings. This was the area that had been the last to be set free, and an area in which the soil would have been especially compact due to years of being treaded upon by human and animal feet. The old fields in this area yield to aspen rather than gray birch, perhaps because of slope aspect or grade, but aspen is also an indicator of early reforestation. On the 1985 map, red oak, red maple, and sugar maple predominate in several smaller areas away from the last abandoned fields. On the more recent 1993 map, they have gained a slight bit more ground. As somewhat tolerant transition species it is logical that they would

be found in these areas acting as they are. Other strips of older vegetation represent areas where there were once roads or stonewalls, i.e. north of the main field (though I could not see it on any of the aerial photos).

Because of these trends, I think that it would be a relatively easy task in the ML, for example (if one so desired), to trace time backward and make a vegetation map of 1935. Since the vegetation seems to follow a fairly normal track of succession, replacing the red maple and red oak with gray birch and aspen should be fairly accurate. Current gray birch and aspen stands could be denoted as shrub or clear land. This move could be easily checked with the photograph from 1935. Such a map could then be used to work further backwards in time, and ascertain greater land use and vegetation changes.

In conclusion, it appears as though the ML in general follows a secondary succession pattern based directly upon past land use for at least the past sixty years. Most variations in the data could probably be explained away as due to either topography, slope aspect, or soil type.

Conclusion

While I do not think that it would have significantly altered my data, it is of primary importance that I reiterate the margin for error in nearly all that I have done. In transforming the slides into computerized maps there were innumerable things that could have gone wrong. The 1993 vegetation map is also suspect to several misidentifications of species. Overall, the possibility of error in the collection of data for this report is astonishing. ?

Thinking about my report over the past couple of days, and of course now that it is too late, I have come up with several ideas on how it could be improved. Firstly, I completely ignored the actual photos available and concentrated completely on the slides. This was, to bluntly deride myself, stupid. With the photos, I could have spent time using the stereoscope, which would have helped a great deal in determining exactly what those areas were that I termed as dark and light shrub. The stereoscope

could also have helped in a more comprehensive attempt to trace a vegetation map backwards. To the same end, I would have liked to see if (Bill Fox's gray tone) program could have helped. I could have created maps with the gray tones, and then made educated guesses, with the help of the stereoscope, as to what species belonged where. I think that this would work better than the rather offhand method I mention in the report (though I also think that said method would work pretty well).

NIH - IMAGE

Doing another complete survey of the ML, while time consuming, would have helped as well, as the ES 102 data is perhaps not the best. It would have been interesting to work in the forest survey plots, but perhaps more so to go to some of the areas of the ML that have not been well explored (south-west corner). This report could have been more complete with discussions of topography, soils, and perhaps even slope aspect, though the more variables that you throw in the harder it becomes to generalize.

Some other details could have helped as well, for instance: talks with the natives, better quality photos, and research into how the ML fits into regional history, rather than just as a separate entity.

Finally, I would like to add a few personal notes of my own. Unfortunately, and I realized it only too late, this project did not seem to have much purpose. I basically set out to prove that land use is linked to vegetation succession, a statement that needs little corroboration. Also, all of my computer work went into getting numbers for the percentage of reforestation, numbers that really were not that necessary when the trend was so obvious. So, while I am satisfied that I learned something and did get something out of it, I am a little disappointed with the outcome of this project.

do you in this?

I think it is time to return to my perch in the sugar maple...

might you have been able to model rates of succession (ft^2/yr) for different vegetation types, slopes, aspects, etc. if you had enough time — B

Sources

Student Papers:

1. A Comprehensive Study of the Moon Lot: Soils, Vegetation, and Land Use. Independent Study, Fall 1985. Elizabeth Marr and William Stahl.

2. A Farm in Hopkins Memorial Forest. Newlin Hastings. Art 201, 1973. 23 p.

3. A Land Ownership History of the Fifth Division, Hopkins Forest, 1765-1912: With Notes Toward a Land Use and Social History of the Same. Deborah Gregg. Summer 1980. 81 p.

4. The Moon Lot Vegetational Analysis as Related to Land Use History. Richard Geier. Bio 303, 1973. c. 40 p.

5. Successional Patterns in Hopkins Memorial Forest. Alan White. Bio 308, May 1973.

Readings for Class:

1. Art, Henry W. and Olivo, Richard F. *Alfred Moon's Farm*. Natural History Magazine; Vol. 134, No 9, Nov. 1975.

2. A Vegetation History of Williamstown 1752-1977. K.A. Satterson. Bio Honors Thesis, 1977.

3. Westveld, M., et al. *Natural Forest Vegetation Zones of New England*. Journal of Forestry; Vol. 54, No 5, May 1956.

Other:

Prof. Henry Art helped very much with supplies, figuring out computer problems, and general advice.

The ES 102, 1993 class (under the direction of Profs. Thoman, DeSimone, Art) provided a great deal of background information as well as the topographic, land use, and vegetation maps for 1993.

Aerial photographs from 1935, 1940, 1942, 1952, 1960, 1970, 1972, 1985.

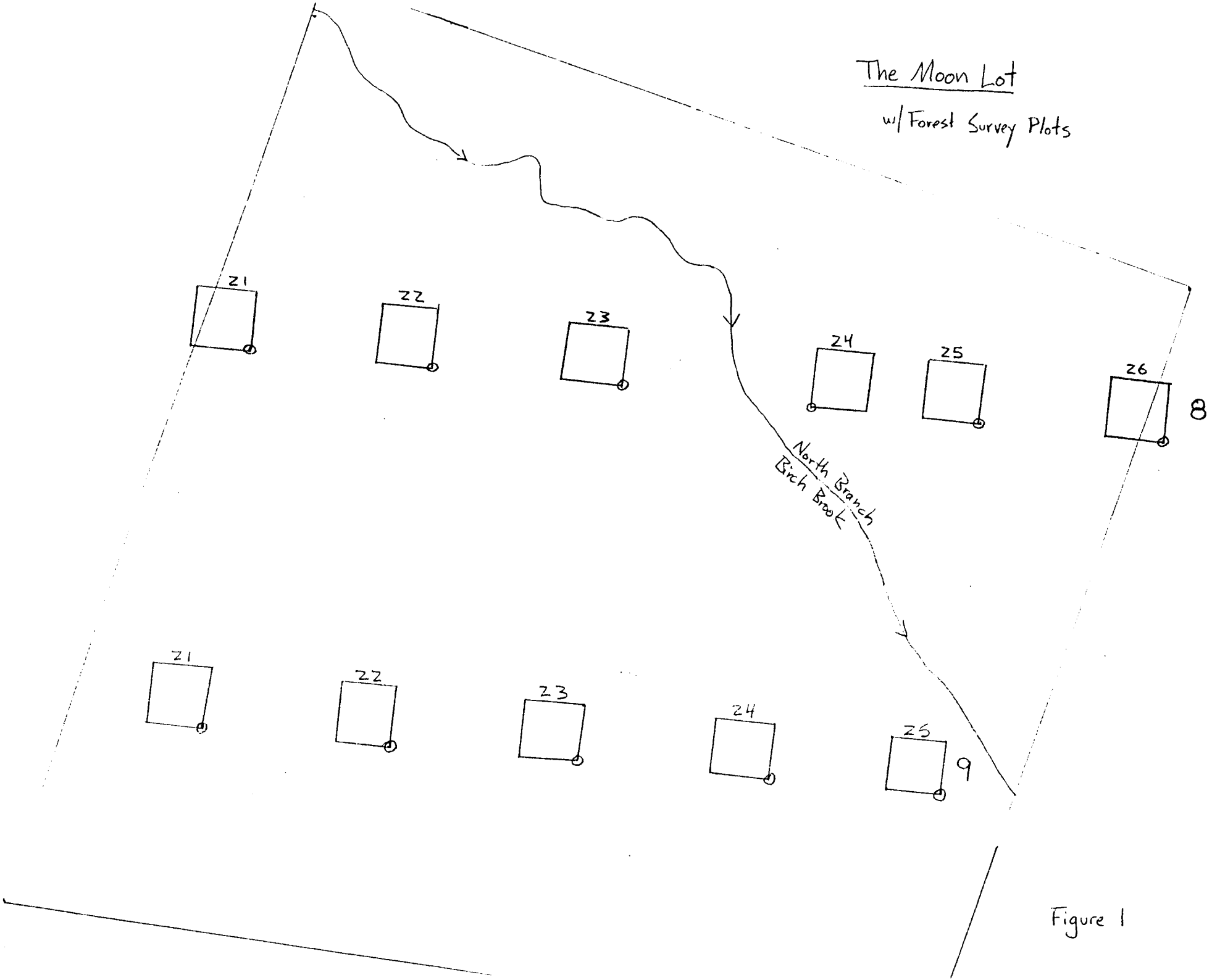
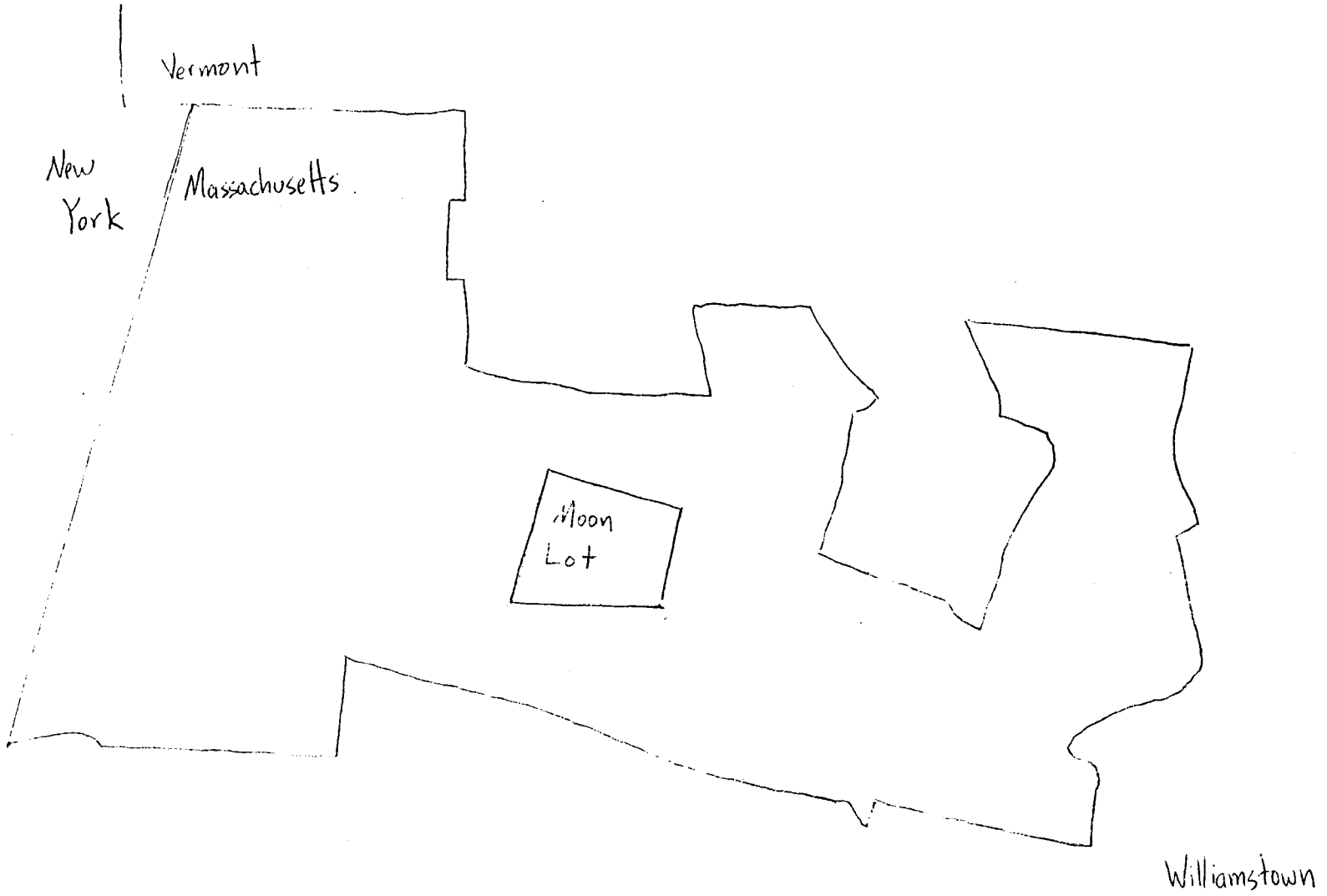

The Moon Lot
w/ Forest Survey Plots
Z1
Z2
Z3
Z4
Z5
Z6
8
North Branch
Birch Brook
Z1
Z2
Z3
Z4
Z5
9

Figure 1



The Moon Lot
in Hopkins Memorial Forest

Figure 2

ES102 Moon Lot - Human Impacts
Spring 1993

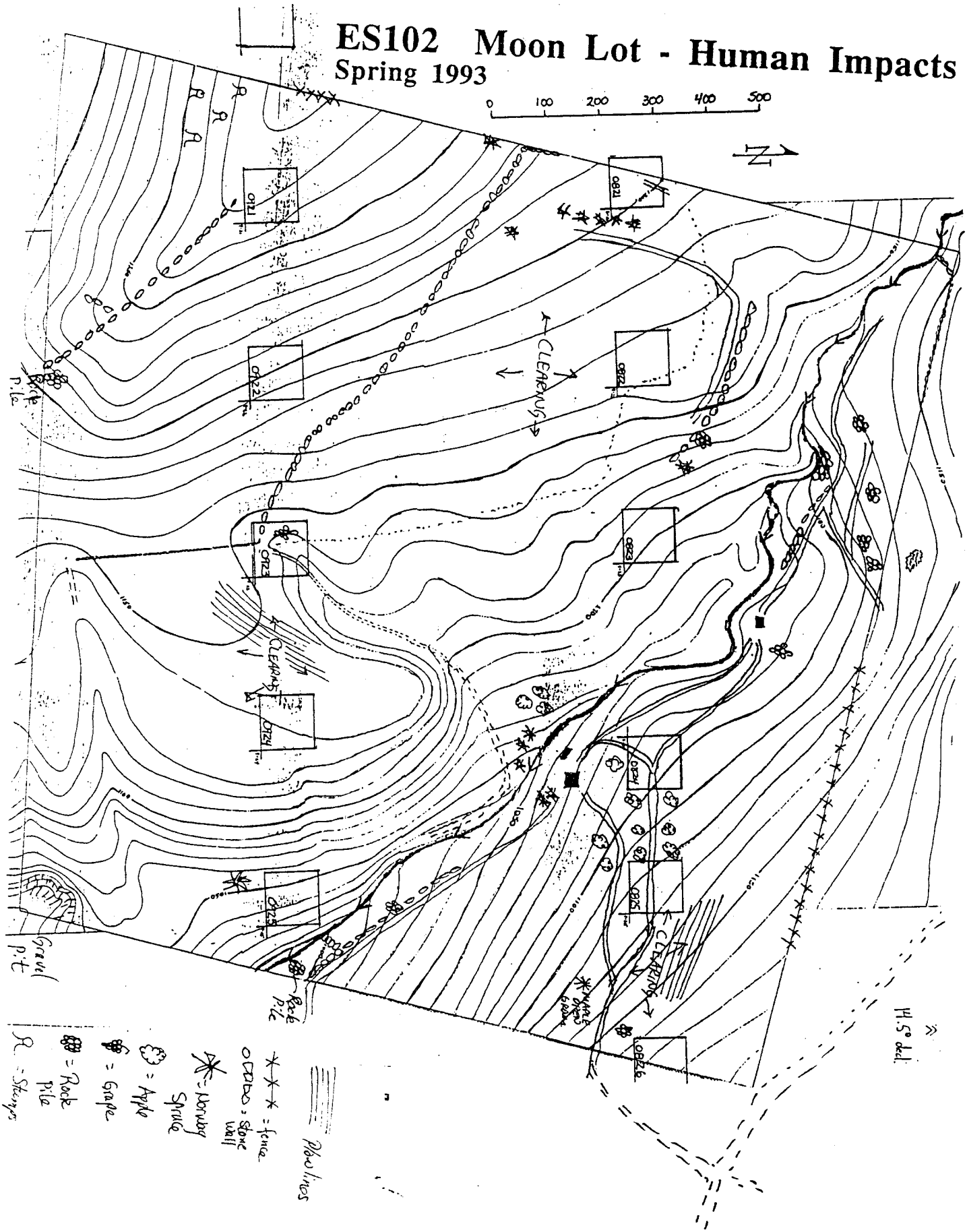
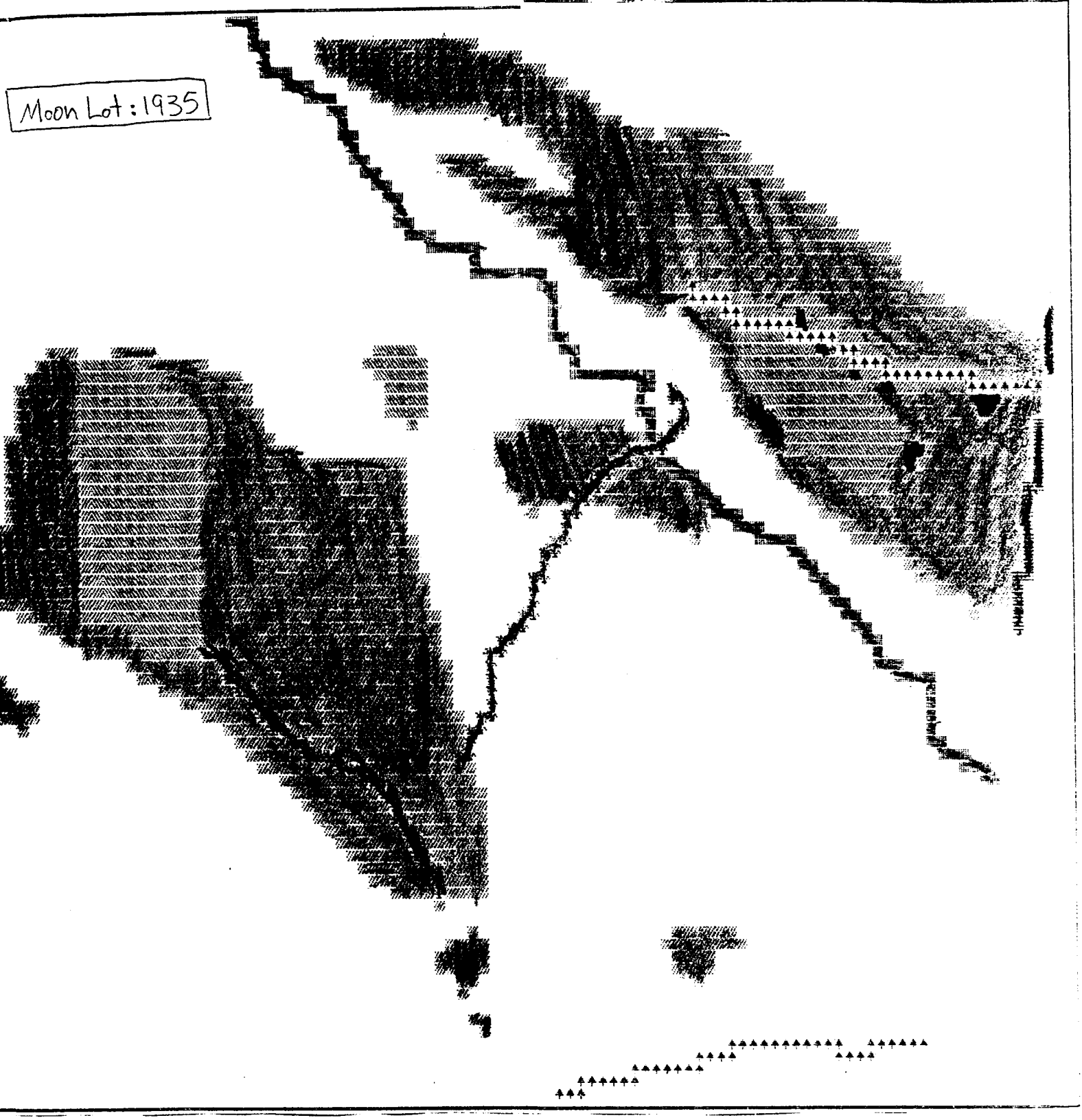


Figure 3



ML1935
Scale: 10.0 feet Per Cell

Symbol	Value	Label	# Cells
	0		5963

Total No. of Cells = 5963

Map 1

STATISTICS FOR FILE : ML1935.VEC

Class	LENGTHS (Ft) Total	LENGTHS (Ft) Average	PERIMETERS (Ft) Total	PERIMETERS (Ft) Average	AREAS (Ac) Total	AREAS (Ac) Average	No.
1	0.00	0.00	239.62	119.81	0.04	0.02	2
2	1229.80	614.90	0.00	0.00	0.00	0.00	2
3	1232.41	616.20	0.00	0.00	0.00	0.00	2
4	0.00	0.00	526.12	87.69	0.03	0.01	6
5	0.00	0.00	9377.10	1172.14	17.15	2.14	8
6	0.00	0.00	2359.82	786.61	1.93	0.64	3
7	1988.03	1988.03	0.00	0.00	0.00	0.00	1
8	399.82	199.91	0.00	0.00	0.00	0.00	2
9	0.00	0.00	132.00	132.00	0.03	0.03	1

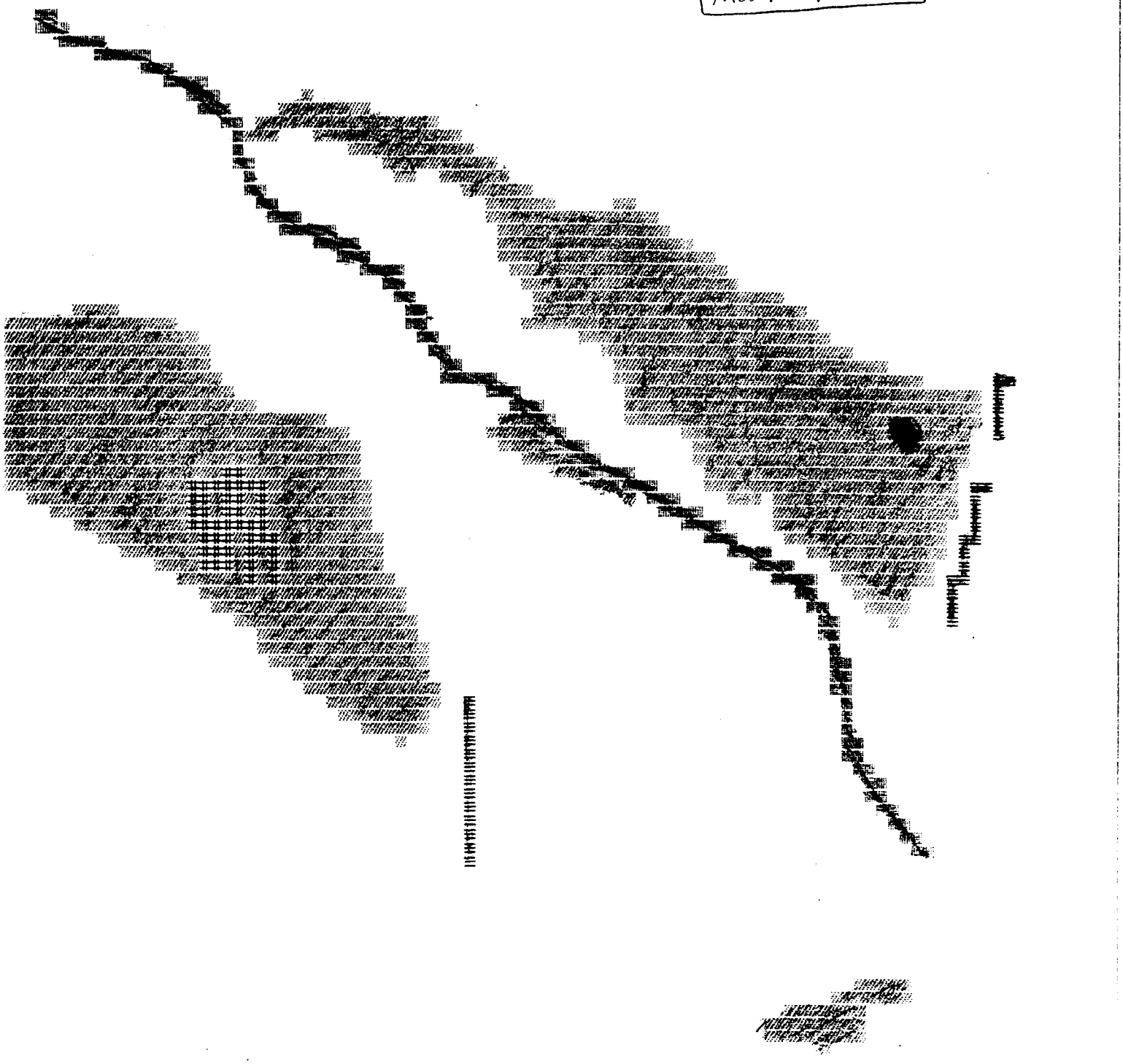
Cumulative total length = 4850.061 Ft
Cumulative total perimeter = 12634.655 Ft
Cumulative total area = 19.173 Ac

Data 1a

LIST OF FEATURES

No.	CLASS	LENGTH	AREA	LABEL
1	5	2885.814	8.121	clearing
2	5	276.918	0.098	
3	5	259.366	0.081	
4	5	103.230	0.014	
5	5	403.584	0.142	
6	5	965.715	0.821	
7	5	3760.523	7.338	
8	6	451.951	0.160	plowed field
9	6	726.880	0.530	
10	1	161.790	0.029	house
11	1	77.831	0.007	
12	4	62.852	0.005	individual trees/orchards
13	4	80.911	0.002	
14	4	68.725	0.001	
15	4	99.438	0.009	
16	4	157.412	0.009	
17	4	56.787	0.004	
18	9	131.999	0.029	sugar maple
19	7	1988.030		stream
20	2	533.846		trails
21	3	617.802		roads
22	8	121.799		stonewalls
23	8	278.019		
24	3	614.606		
25	2	695.959		
26	6	1180.984	1.238	
27	5	721.945	0.535	

Data 1b



ML1940
Scale: 18.0 feet Per Cell

Symbol	Value	Label	# Cells	% Map
	0		7088	[illegible]
	5		1330	[illegible]
	7		1[illegible]	[illegible]
	8		[illegible]	[illegible]
	9		[illegible]	[illegible]
	11		44	[illegible]
		Total No. of Cells =	8600	

Map 2

STATISTICS FOR FILE : ML1940.VEC

Class	LENGTHS (Ft) Total	LENGTHS (Ft) Average	PERIMETERS (Ft) Total	PERIMETERS (Ft) Average	AREAS (Ac) Total	AREAS (Ac) Average	No.
4	161.54	26.92	0.00	0.00	0.00	0.00	6
5	0.00	0.00	6561.81	1640.45	9.77	2.44	4
7	5670.68	2835.34	0.00	0.00	0.00	0.00	2
8	478.77	159.59	0.00	0.00	0.00	0.00	3
9	0.00	0.00	135.54	135.54	0.02	0.02	1
11	698.36	174.59	0.00	0.00	0.00	0.00	4

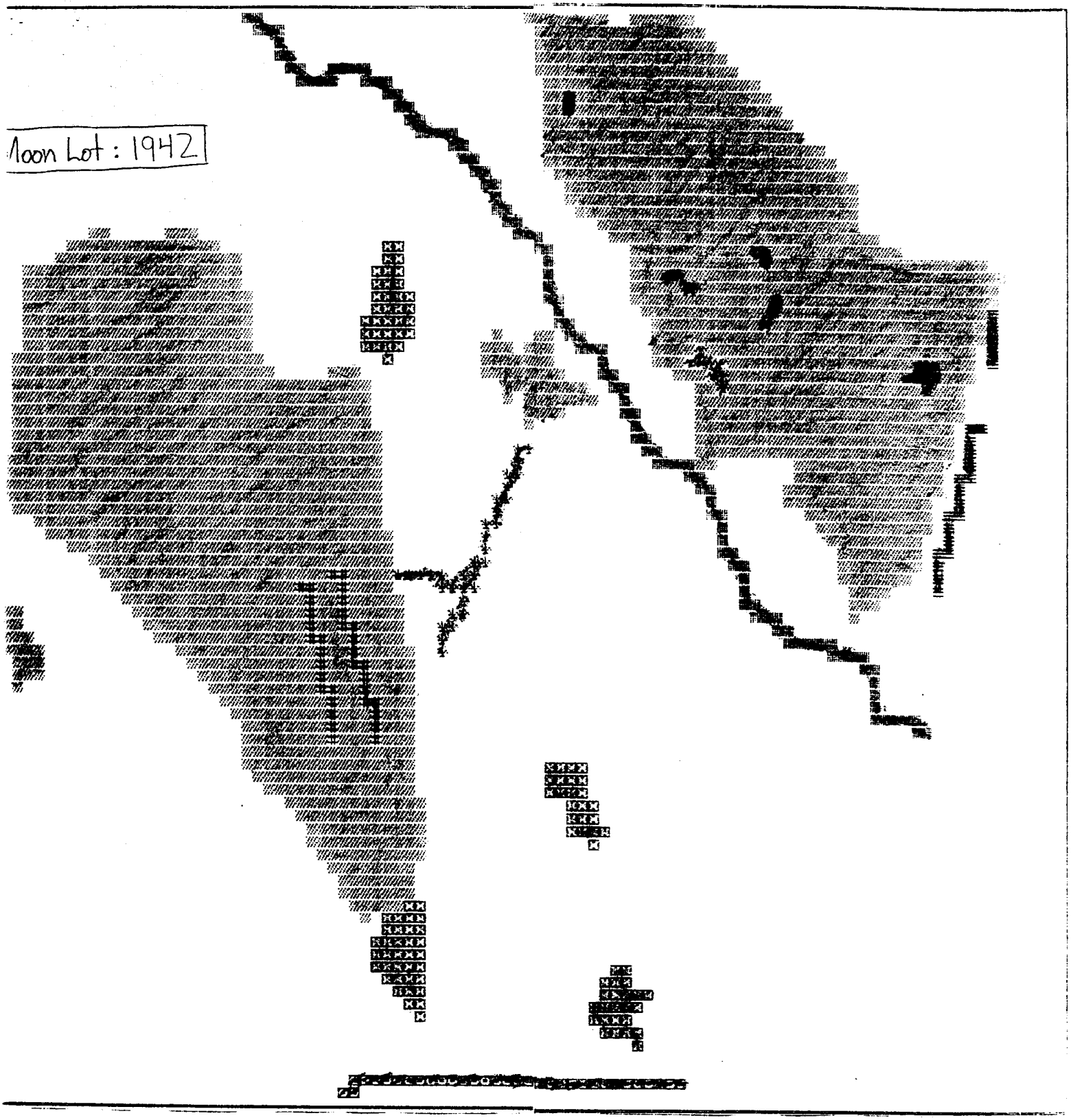
Cumulative total length = 7009.349 Ft
Cumulative total perimeter = 6697.352 Ft
Cumulative total area = 9.798 Ac

Data 2a

LIST OF FEATURES

No.	CLASS	LENGTH	AREA	LABEL
1	5	576.571	0.258	clearing
2	8	83.591		stonewalls
3	8	186.829		
4	8	208.349		
5	5	567.416	0.135	
6	5	2085.815	4.630	
7	7	1890.226		stream
8	11	117.170		plowlines
9	11	140.604		
10	11	131.304		
11	11	309.282		
12	5	3332.008	4.750	
13	9	135.542	0.025	sugar maple
14	4	12.904		individual trees/orchards
15	4	25.056		
16	4	62.638		
17	4	POINT		
18	4	28.687		
19	4	32.258		
20	7	3780.452		

Data 2b



ML1942
Scale: 18.0 feet Per Cell

Symbol	Value	Label	# Cells	% Tot
	0		6015	
	1		2585	
Total No. of Cells =			8600	

Map 3

STATISTICS FOR FILE : ML1942.VEC

Class	LENGTHS (Ft) Total	LENGTHS (Ft) Average	PERIMETERS (Ft) Total	PERIMETERS (Ft) Average	AREAS (Ac) Total	AREAS (Ac) Average	No.
1	0.00	0.00	176.07	176.07	0.04	0.04	1
2	461.67	230.83	0.00	0.00	0.00	0.00	2
4	0.00	0.00	613.22	87.60	0.05	0.01	7
5	0.00	0.00	7418.91	1483.78	16.76	3.35	5
7	1963.37	1963.37	0.00	0.00	0.00	0.00	1
8	397.54	198.77	0.00	0.00	0.00	0.00	2
9	0.00	0.00	168.56	168.56	0.04	0.04	1
11	482.60	241.30	0.00	0.00	0.00	0.00	2
12	0.00	0.00	1686.01	421.50	0.64	0.16	4
13	554.34	554.34	0.00	0.00	0.00	0.00	1

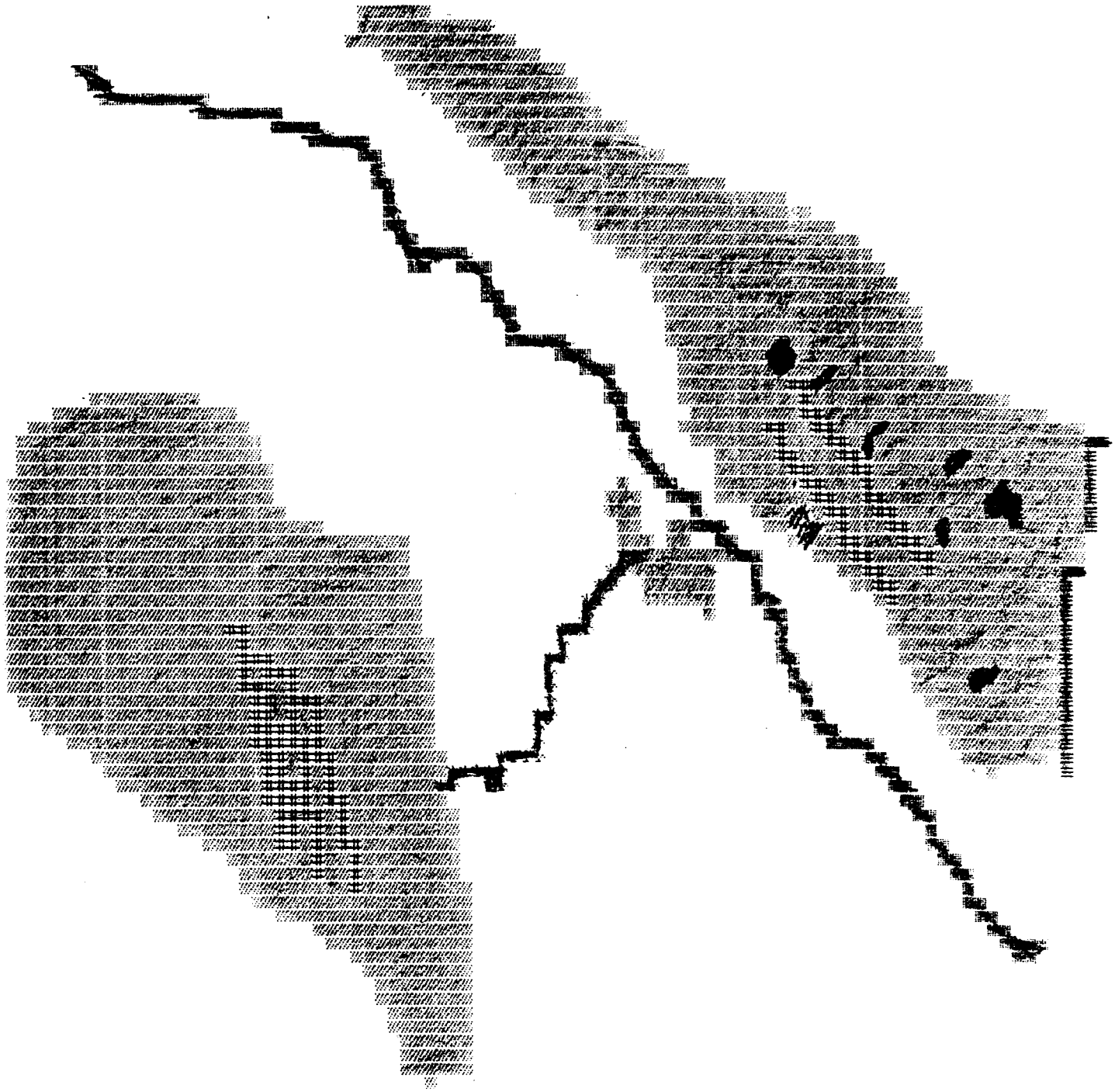
Cumulative total length = 3859.521 Ft
Cumulative total perimeter = 10062.780 Ft
Cumulative total area = 17.528 Ac

LIST OF FEATURES

No.	CLASS	LENGTH	AREA	LABEL
1	12	456.233	0.214	dark shrub
2	5	412.640	0.136	clearing
3	5	441.739	0.217	
4	5	250.792	0.072	
5	12	422.605	0.120	
6	12	404.116	0.138	
7	4	96.854	0.005	individual trees/orchards
8	2	330.172		trails
9	2	131.498		
~~10~~	8	138.592		stonewalls
11	8	258.947		
12	5	2770.723	8.312	
13	7	1963.367		stream
14	5	3543.019	8.027	
15	12	403.058	0.165	
16	13	554.343		unknown line
17	11	247.443		plowlines
18	11	235.159		
19	9	168.561	0.038	sugar maple
20	1	176.072	0.038	house
21	4	68.204	0.004	
22	4	94.342	0.009	
23	4	104.092	0.011	
24	4	82.389	0.008	
25	4	96.593	0.008	
26	4	70.749	0.006	

Data 3b

Moon Lot: 1952



ML1952
Scale: 18.0 feet Per Cell

Symbol	Value	Label	# Cells	% Map
	0		6800	[illegible]
	1		[illegible]	[illegible]
	2		[illegible]	[illegible]
	3		[illegible]	[illegible]
	4		[illegible]	[illegible]
	5		[illegible]	[illegible]
	6		[illegible]	[illegible]
	7		[illegible]	[illegible]
	8		[illegible]	[illegible]
	9		[illegible]	[illegible]
	11		[illegible]	[illegible]

Total No. of Cells = [illegible]

Map 4

STATISTICS FOR FILE : ML1952.VEC

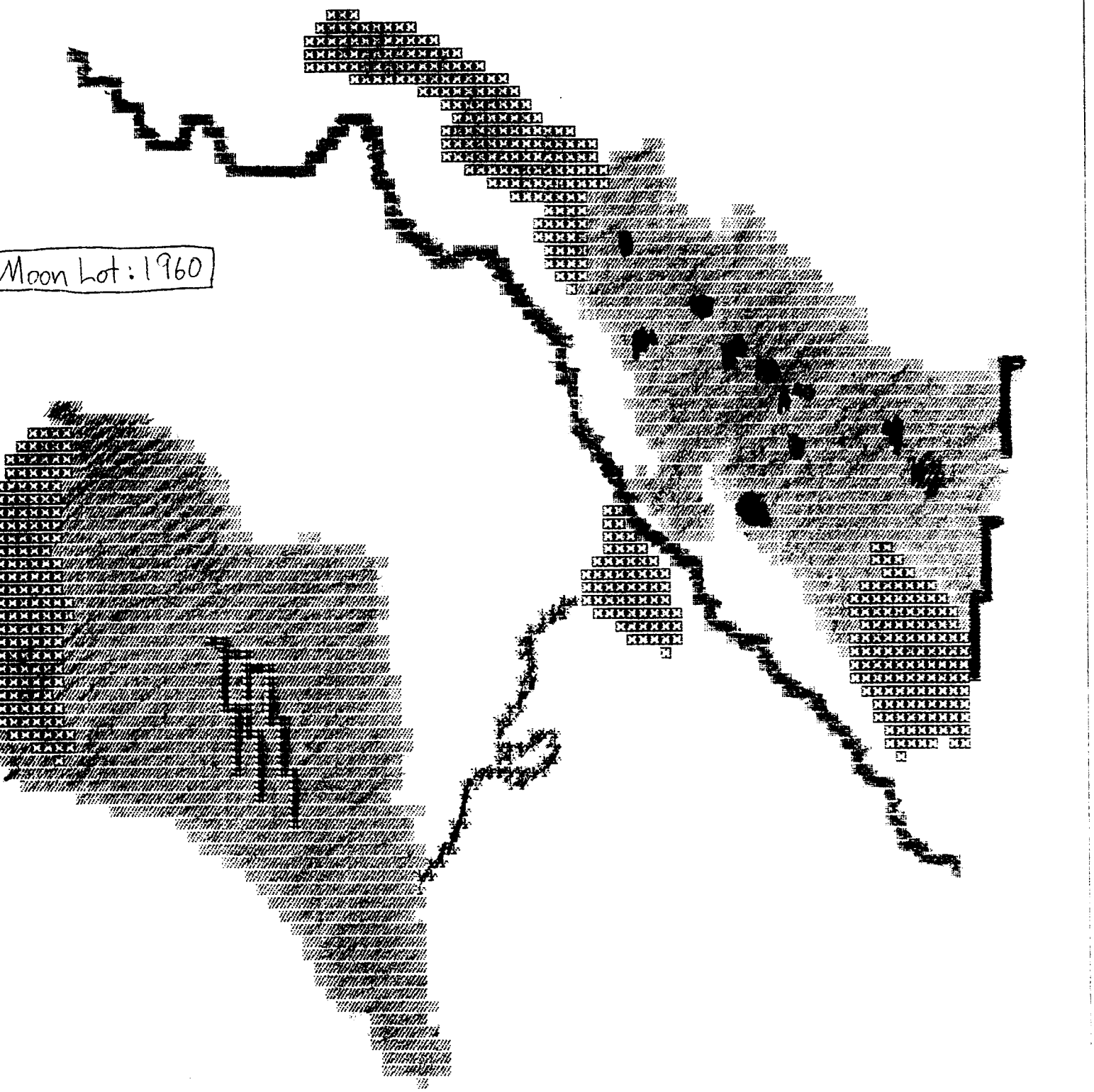
Class	LENGTHS (Ft) Total	LENGTHS (Ft) Average	PERIMETERS (Ft) Total	PERIMETERS (Ft) Average	AREAS (Ac) Total	AREAS (Ac) Average	No.
1	0.00	0.00	136.80	136.80	0.02	0.02	1
2	449.28	449.28	0.00	0.00	0.00	0.00	1
4	0.00	0.00	677.83	96.83	0.09	0.01	7
5	0.00	0.00	6680.13	2226.71	14.85	4.95	3
7	1961.82	1961.82	0.00	0.00	0.00	0.00	1
8	365.23	182.61	0.00	0.00	0.00	0.00	2
9	0.00	0.00	158.39	158.39	0.04	0.04	2
11	1592.43	265.41	0.00	0.00	0.00	0.00	6

Cumulative total length = 4368.765 Ft
Cumulative total perimeter = 7653.150 Ft
Cumulative total area = 15.004 Ac

Data 4a

LIST OF FEATURES

No.	CLASS	LENGTH	AREA	LABEL
1	5	2583.599	7.609	clearing
2	5	3306.290	6.988	
3	5	790.237	0.251	
4	9	158.393	0.042	sugar maple
5	9	POINT		
6	1	136.799	0.025	house
7	4	104.172	0.014	individual trees/orchards
8	4	127.443	0.023	
9	4	94.104	0.008	
10	4	89.811	0.012	
11	4	103.876	0.017	
12	4	87.256	0.012	
13	4	71.169	0.003	
14	11	230.367		plowlines
15	11	256.694		
16	11	252.259		
17	11	310.088		
18	11	274.339		
19	2	449.284		trails
20	8	108.650		stonewalls
21	8	256.579		
22	7	1961.818		stream
23	11	268.687		



ML1960
Scale: 18.0 feet Per Cell

Symbol	Value	Label	# Cells	% Map
	0		6038	[illegible]
	1		[illegible]	[illegible]
	2		[illegible]	[illegible]
	3		[illegible]	[illegible]
	4		[illegible]	[illegible]
	5		[illegible]	[illegible]
	6		[illegible]	[illegible]
	7		[illegible]	[illegible]
	8		[illegible]	[illegible]
	9		[illegible]	[illegible]
	10		[illegible]	[illegible]
	11		[illegible]	[illegible]
	12		[illegible]	[illegible]

Total No. of Cells =

Map 5

STATISTICS FOR FILE : ML1960.VEC

Class	LENGTHS (Ft) Total	LENGTHS (Ft) Average	PERIMETERS (Ft) Total	PERIMETERS (Ft) Average	AREAS (Ac) Total	AREAS (Ac) Average	No.
1	0.00	0.00	168.10	168.10	0.01	0.01	1
2	693.50	693.50	0.00	0.00	0.00	0.00	1
4	0.00	0.00	783.86	97.98	0.11	0.01	8
5	0.00	0.00	6469.24	3234.62	12.91	6.46	2
7	2118.01	2118.01	0.00	0.00	0.00	0.00	1
8	344.28	172.14	0.00	0.00	0.00	0.00	2
9	0.00	0.00	212.21	212.21	0.04	0.04	1
11	628.62	209.54	0.00	0.00	0.00	0.00	3
12	0.00	0.00	4127.31	1031.83	3.57	0.89	4

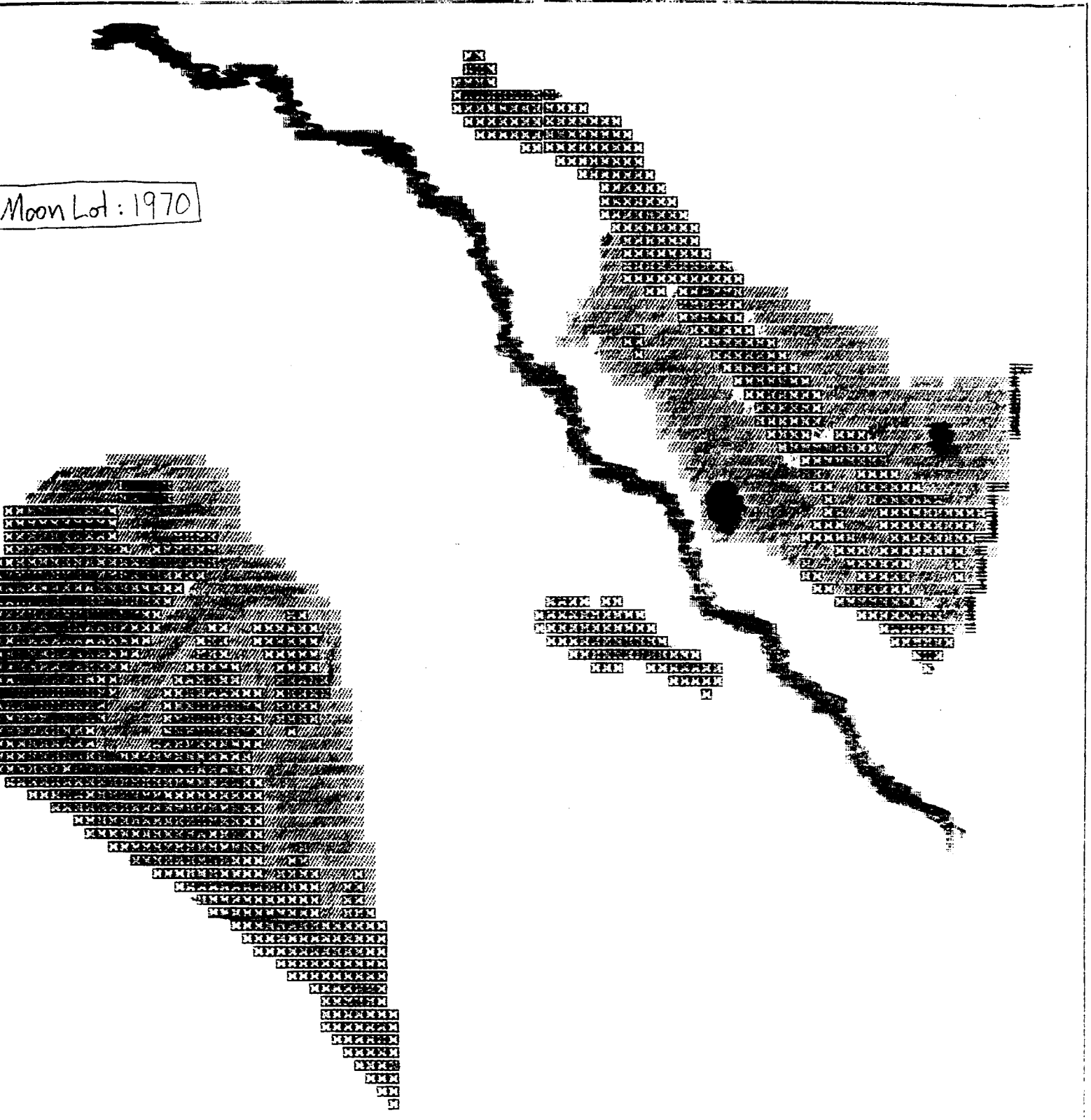
Cumulative total length = 3784.416 Ft
Cumulative total perimeter = 11760.724 Ft
Cumulative total area = 16.645 Ac

Data 5a

LIST OF FEATURES

No.	CLASS	LENGTH	AREA	LABEL
1	5	3377.865	7.215	clearing
2	5	3091.378	5.695	
3	12	1170.547	1.041	dark shrub
4	12	644.649	0.384	
5	12	1435.375	1.264	
6	12	876.743	0.877	
7	9	212.207	0.042	sugar maple
8	1	168.098	0.014	house
9	4	106.615	0.018	individual trees/orchards
10	4	115.912	0.016	
11	4	91.442	0.010	
12	4	90.931	0.011	
13	4	96.221	0.015	
14	4	92.826	0.013	
15	4	87.802	0.012	
16	4	102.113	0.017	
17	11	185.324		plowlines
18	11	209.717		
19	11	233.580		
20	8	129.001		stonewalls
21	8	215.284		
22	2	693.503		trails
23	7	2118.008		stream

Data 5b



ML1970
Scale: 18.0 feet Per Cell

Symbol	Value	Label	# Cells	% Pop
	0		6315	[illegible]
	1		9	[illegible]
	2		759	[illegible]
	3		154	[illegible]
	4		24	[illegible]
	5			
	6			
	7			
	8			
	12		1156	[illegible]
		Total No. of Cells =	3600	

Map 6

STATISTICS FOR FILE : ML1970.VEC

Class	LENGTHS (Ft) Total	LENGTHS (Ft) Average	PERIMETERS (Ft) Total	PERIMETERS (Ft) Average	AREAS (Ac) Total	AREAS (Ac) Average	No.
1	0.00	0.00	169.80	169.80	0.04	0.04	1
5	0.00	0.00	6803.39	1133.90	5.85	0.98	6
7	2041.75	680.58	0.00	0.00	0.00	0.00	3
8	559.56	186.52	0.00	0.00	0.00	0.00	3
9	112.94	112.94	0.00	0.00	0.00	0.00	1
12	0.00	0.00	7807.29	1301.22	7.99	1.33	6

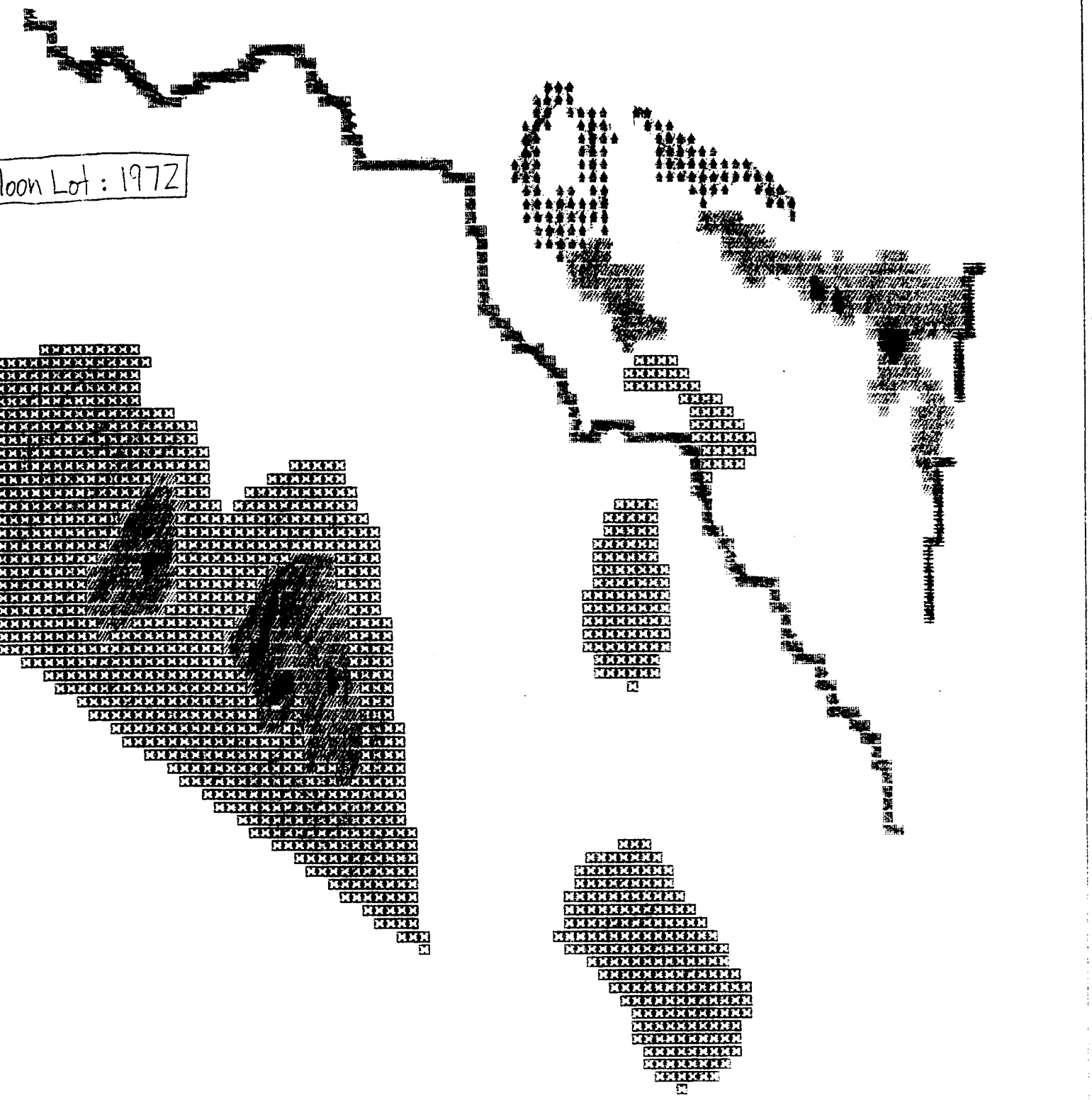
Cumulative total length = 2714.246 Ft
Cumulative total perimeter = 14780.481 Ft
Cumulative total area = 13.881 Ac

Data 6a

LIST OF FEATURES

No.	CLASS	LENGTH	AREA	LABEL
1	5	2783.068	2.829	clearing
2	5	1479.179	1.393	
3	5	1744.671	1.373	
4	12	3400.544	4.465	dark shrub
5	12	232.245	0.079	
6	12	451.247	0.245	
7	12	2884.911	2.761	
8	12	719.214	0.418	
9	5	339.004	0.097	
10	5	195.199	0.052	
11	5	262.269	0.109	
12	1	169.797	0.039	house
13	12	119.134	0.020	
14	8	255.801		stonewalls
15	8	91.787		
16	8	211.975		
17	7	2041.745		stream
18	7	POINT		
19	7	POINT		
20	9	112.938		sugar maple

Data 6h



ML1972
Scale: 10.0 feet Per Cell

Symbol	Value	Label	# Cells	% Map
			6710	

Total No. of Cells =

Map 7

STATISTICS FOR FILE : ML1972.VEC

Class	LENGTHS (Ft) Total	Average	PERIMETERS (Ft) Total	Average	AREAS (Ac) Total	Average	No.
4	0.00	0.00	644.24	71.58	0.07	0.01	9
5	0.00	0.00	4054.18	1013.55	2.45	0.61	4
7	2202.26	2202.26	0.00	0.00	0.00	0.00	1
8	409.87	204.94	0.00	0.00	0.00	0.00	2
9	10.09	10.09	165.92	165.92	0.05	0.05	2
12	0.00	0.00	4950.02	1237.51	9.68	2.42	4
14	0.00	0.00	1872.09	936.04	0.64	0.32	2

Cumulative total length = 2622.217 Ft
Cumulative total perimeter = 11686.452 Ft
Cumulative total area = 12.893 Ac

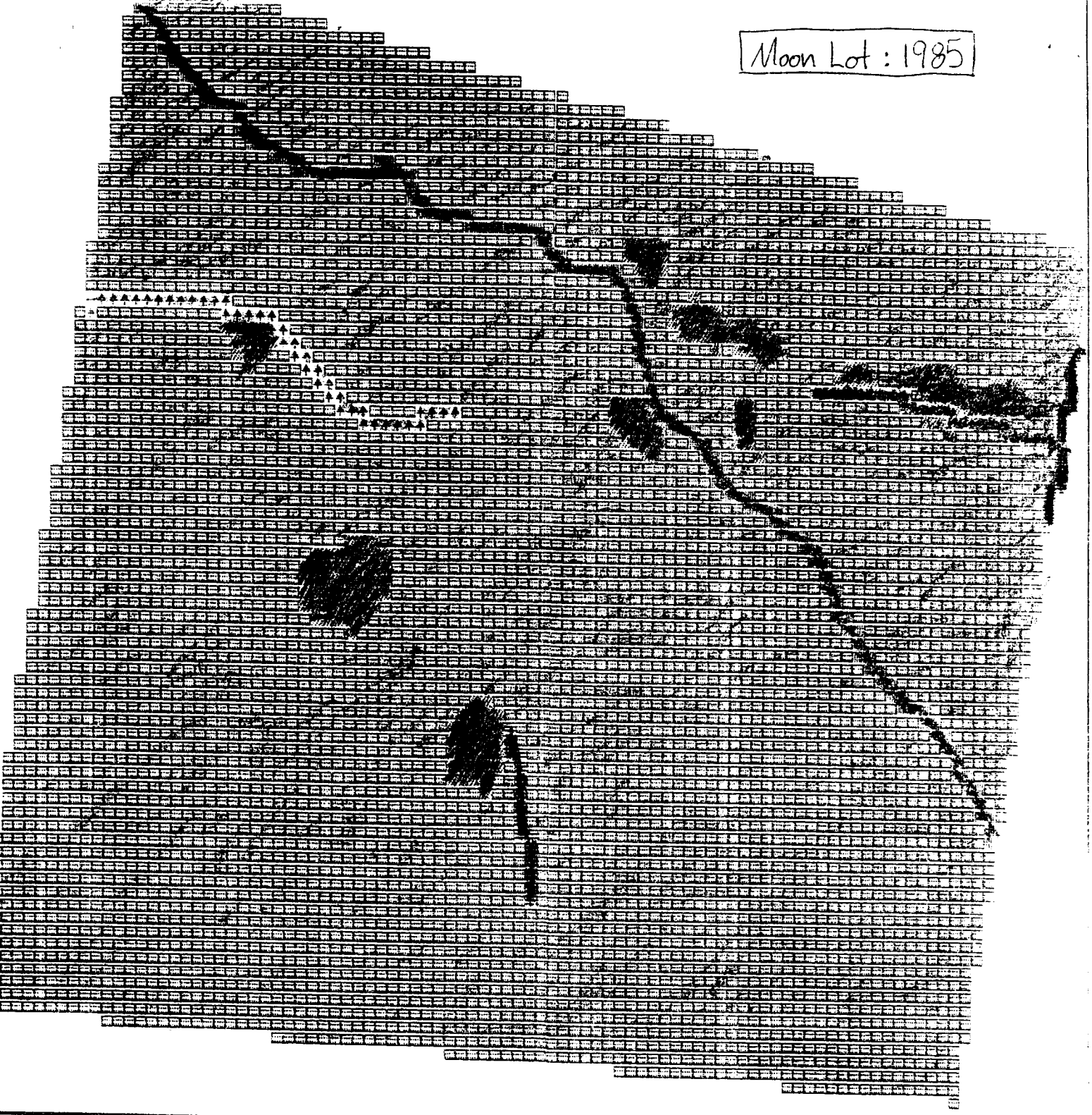
Data 7a

LIST OF FEATURES

No.	CLASS	LENGTH	AREA	LABEL
1	12	2698.098	7.451	dark shrub
2	12	661.560	0.603	
3	12	979.006	1.336	
4	12	611.361	0.295	
5	5	581.835	0.412	clearing
6	5	1101.570	0.828	
7	5	1816.678	0.960	
8	5	554.101	0.249	
9	14	1097.689	0.380	light shrub
10	14	774.397	0.262	
11	9	165.915	0.047	sugar maple
12	9	10.088		
13	4	77.862	0.010	individual trees/orchard
14	4	70.430	0.008	
15	4	68.757	0.007	
16	4	76.856	0.009	
17	4	76.375	0.007	
18	4	46.319	0.003	
19	4	108.169	0.016	
20	4	70.852	0.007	
21	4	48.622	0.004	
22	7	2202.256		stream
23	8	184.043		stonewalls
24	8	225.829		

Data 7b

Moon Lot : 1985



ML1985
Scale: 10.0 feet Per Cell

Symbol	Value	Label	# Cells	% Mas
	1	Contours	2192	
			36	
			442	
			1	
			1	
			1

STATISTICS FOR FILE : ML1985.VEC

Class	LENGTHS (Ft) Total	LENGTHS (Ft) Average	PERIMETERS (Ft) Total	PERIMETERS (Ft) Average	AREAS (Ac) Total	AREAS (Ac) Average	No.
2	424.62	424.62	0.00	0.00	0.00	0.00	1
3	639.51	639.51	0.00	0.00	0.00	0.00	1
5	0.00	0.00	2990.77	332.31	1.31	0.15	9
7	1946.16	1946.16	0.00	0.00	0.00	0.00	1
8	430.00	143.33	0.00	0.00	0.00	0.00	3
10	0.00	0.00	5755.92	5755.92	47.01	47.01	1

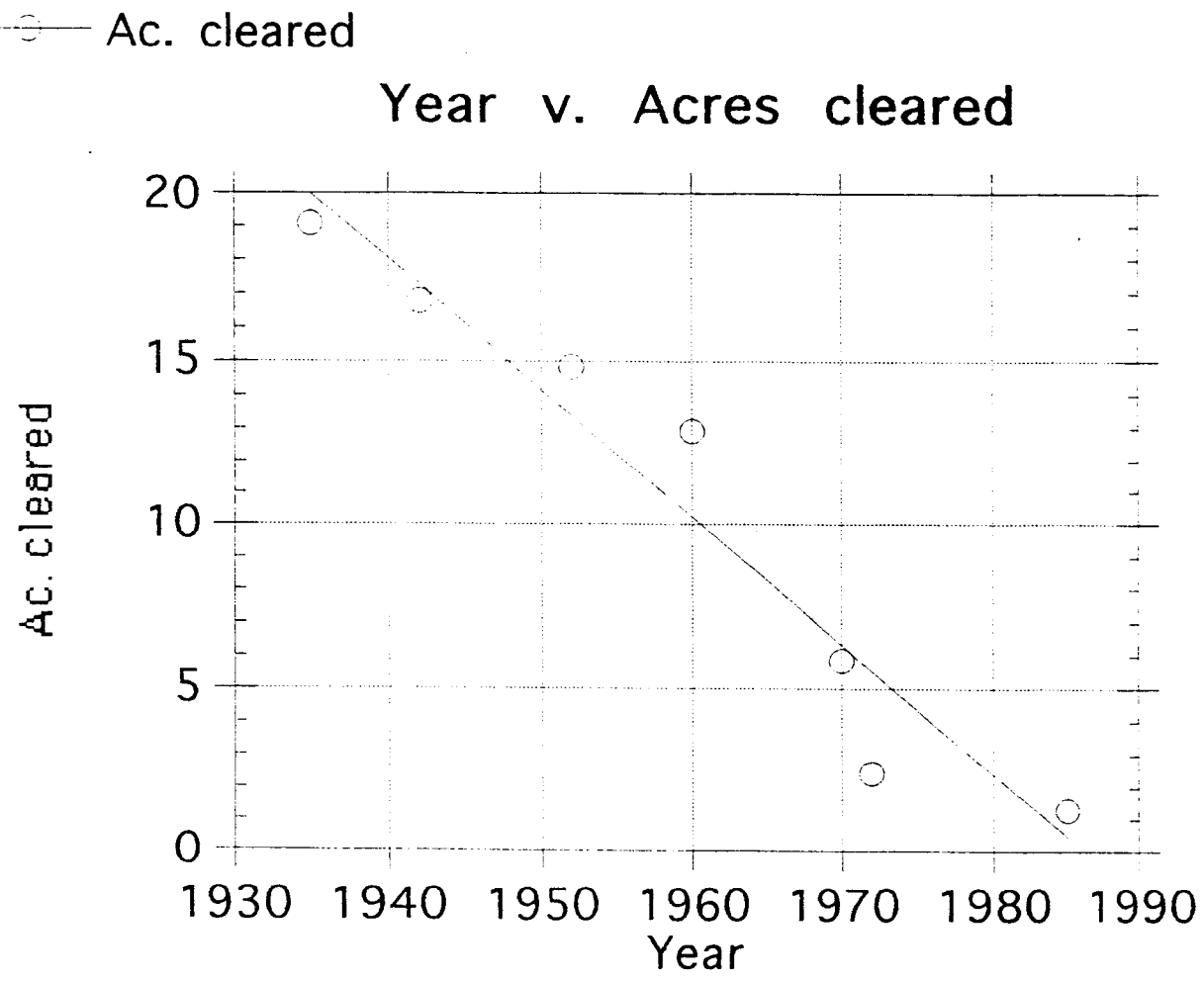
Cumulative total length = 3440.302 Ft
Cumulative total perimeter = 8746.683 Ft
Cumulative total area = 48.313 Ac

Data 8a

LIST OF FEATURES

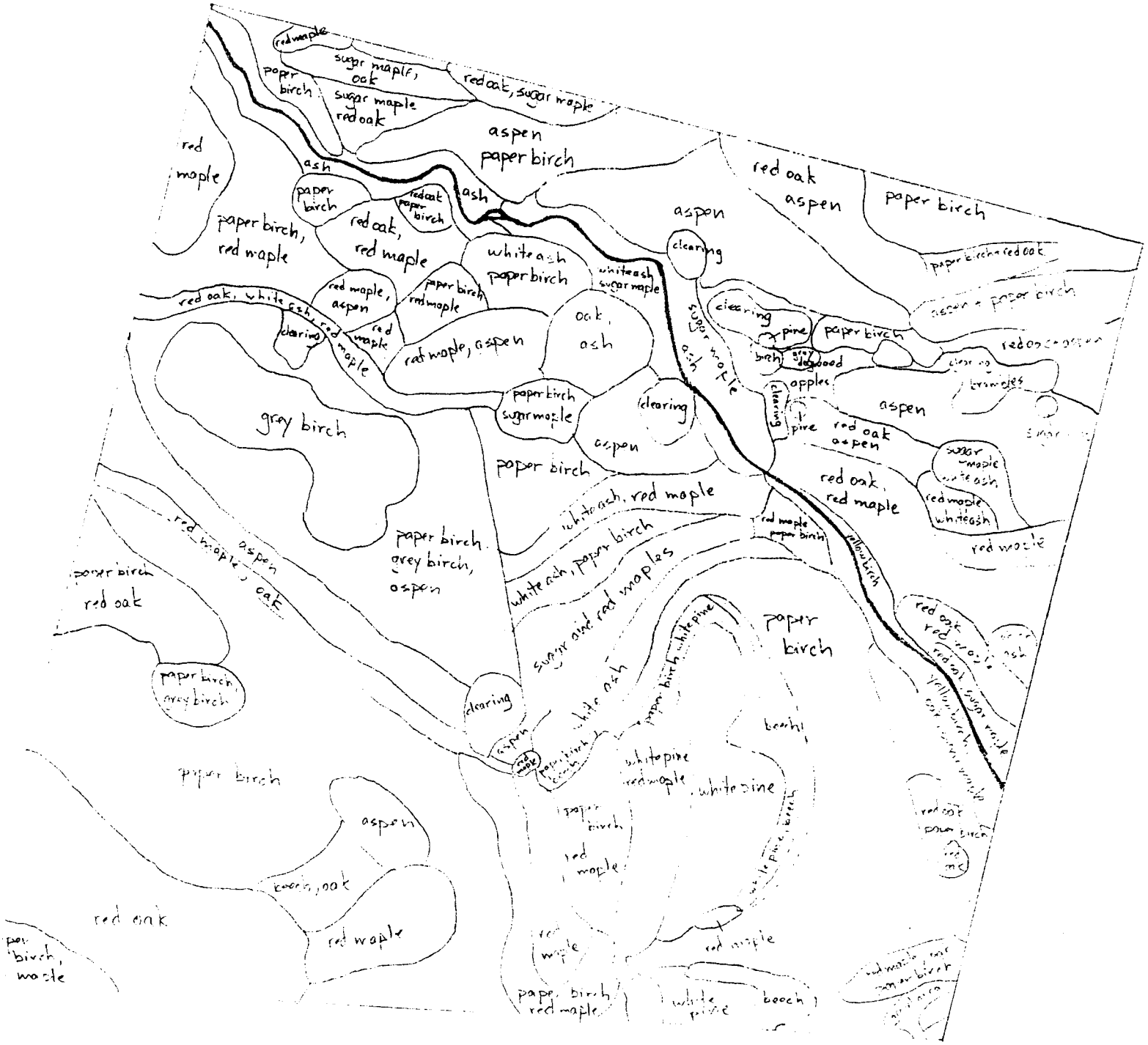
No.	CLASS	LENGTH	AREA	LABEL
1	10	5755.917	47.006	background
2	5	549.022	0.228	clearing
3	5	177.346	0.036	
4	5	468.989	0.195	
5	5	205.766	0.072	
6	5	220.685	0.057	
7	5	280.790	0.139	
8	5	291.770	0.091	
9	5	348.877	0.185	
10	7	1946.161		stream
11	3	639.513		road
12	2	424.624		trail
13	8	109.050		stonewall
14	8	83.433		
15	8	237.521		
16	5	447.520	0.303	

	Year	Ac. cleared
1	1935	19.08
2	1940	9.77
3	1942	16.76
4	1952	14.85
5	1960	12.91
6	1970	5.85
7	1972	2.45
8	1985	1.31



Graph 1

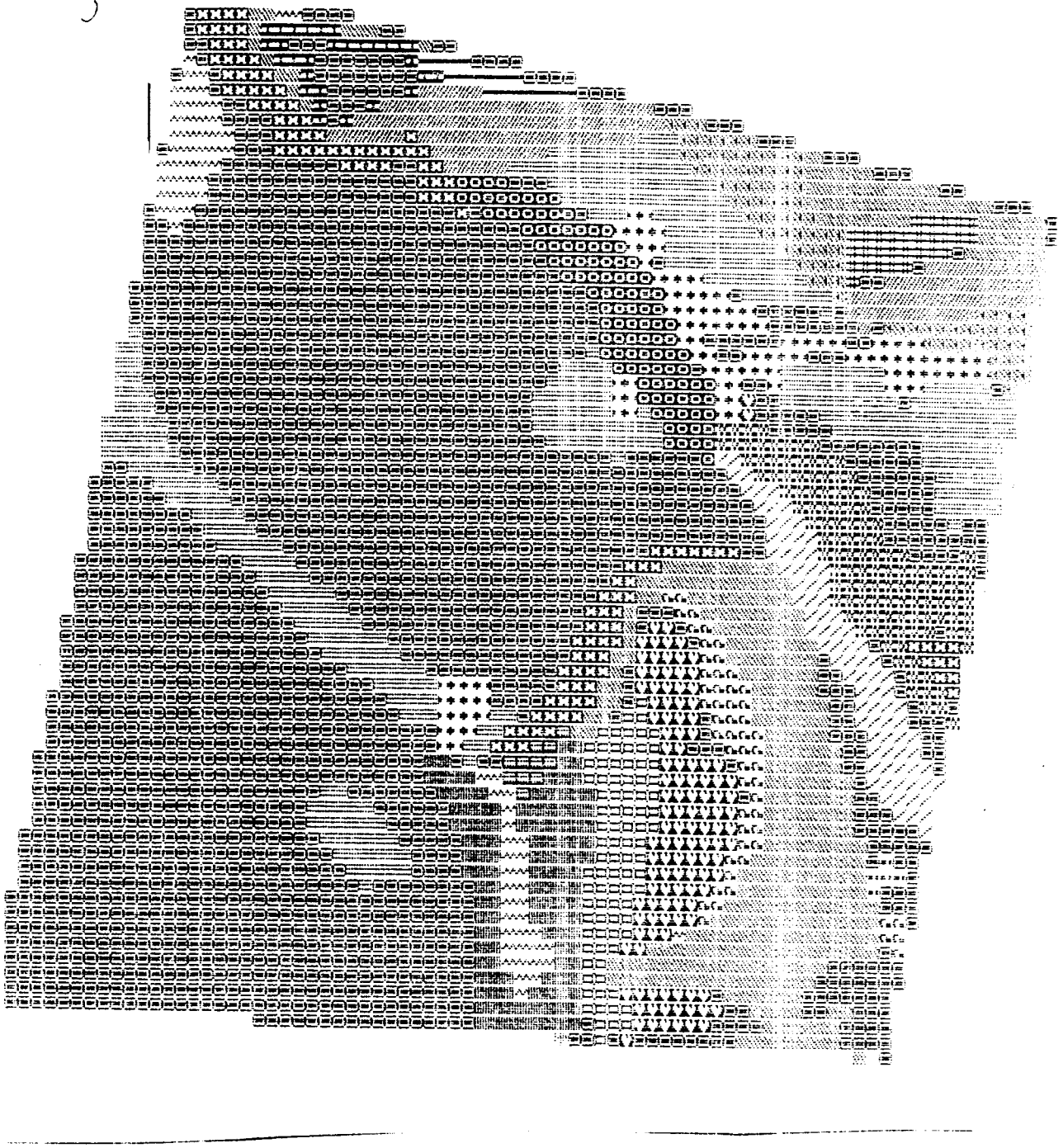
Vegetation Map of the Moon Lot - 1985



Map 9

Marr/Stahl

Vegetation Map of the Moon Lot - 1993



VEGGIE-TYPE
Scale: 18.0 feet Per Cell

Symbol	Value	Label	# Cells	% Area
	0		4334	[illegible]
	1	Red maple	[illegible]	[illegible]
	4	Aspen	[illegible]	[illegible]
	5	Aspen + paper birch	[illegible]	[illegible]
	6	Paper birch	[illegible]	[illegible]
	7	Paper birch + red maple	[illegible]	[illegible]
	10	Paper birch + beech	[illegible]	[illegible]
	11	Paper birch + red oak	[illegible]	[illegible]
	12	White ash	[illegible]	[illegible]
	13	White ash + sugar maple	[illegible]	[illegible]
	14	Beech	[illegible]	[illegible]
	15	Red oak	[illegible]	[illegible]
	16	Red oak + aspen	[illegible]	[illegible]
	21	Yellow birch + sugar map	[illegible]	[illegible]
	23	White pine	[illegible]	[illegible]
	24	White pine + red maple	[illegible]	[illegible]
	25	Boundary	[illegible]	[illegible]
	26	Clearings - treeless	[illegible]	[illegible]
	27	Sugar maple + red oak	[illegible]	[illegible]
	28	Red oak + sugar maple	[illegible]	[illegible]
	29	Red oak + red maple	[illegible]	[illegible]
		Total No. of Cells =	[illegible]	