

RUNNING BUFFALO CLOVER MONITORING, INVENTORING AND SURVEYING 1994
(Trifolium stoloniferum)

Final Report for the Ohio Division of Natural Areas & Preserves
Ohio Department of Natural Resources
March 21, 1995

Marjorie S. Becus
9628 Union Cemetery Road
Loveland, Ohio 45140

RUNNING BUFFALO CLOVER MONITORING, INVENTORING, AND SURVEYING - 1994

Summary

OBJECTIVES: Three objectives were included with the singular goal of learning more about this rare plant. The first was to monitor the three permanently marked plots at Shawnee Lookout Park for the fourth year in an ongoing study of population dynamics. The second involved inventoring certain populations to determine if they are increasing or decreasing in size, and the third was to survey the Little Miami River corridor from Loveland to Milford for new populations.

METHODS: The monitoring was accomplished using a square meter frame to delineate the plots marked in 1991. Clover plants growing within this area were counted in April, May and August.

Inventoring: All Hamilton County Park District clover populations, Promont and the Cincinnati Nature Center sites were inventoried.

Surveying: Fourteen nineteenth century houses and five cemeteries originating from that era were visited and their grounds searched for clover. Ten parks were searched.

RESULTS: Monitoring of the square meter plots showed severe decline in numbers of plants in the Bobcat Ridge and Cabin View plots with the Miami Fort plot showing a slight decline.

Inventoring: The Miami Fort and Promont populations increased in size. Newberry, Miami Whitewater and the Cincinnati Nature Center populations remained about the same. Bobcat Ridge and Cabin View populations showed drastic reductions in numbers, and no plants were found at Mitchell Memorial Forest.

Surveying: One small population on the lawn of an 1820s stone house was found by Ann Rehtin during this survey work. Despite various other seemingly choice spots, no other populations were found.

DISCUSSION: Some edaphic factors are examined for possible correlation with the occurrence of running buffalo clover populations. These include:

- A. Soil pH of selected populations, which shows no correlation.
- B. Hamilton County soil types which support the growth of the clover. Most of the known populations in the county are found on only two different soil types: Eden and Parke.
- C. Soil Associations of Hamilton County by percentage of coverage, show that all known clover populations in the county occur on one fourth of the total county soils.
- D. The range of running buffalo clover in the U.S. is mapped with exposed Ordovician limestone to show the similarities in locations.

RECOMMENDATIONS:

1. All known populations of running buffalo clover should be inventoried every third year to ascertain the status of each population.
2. Part of the site of the Mitchell Memorial Park clover population should undergo some soil disturbance to see if this will stimulate germination and growth of clover.
3. The Hamilton County Park District should continue the suggested mowing schedule at the Miami Fort in order to optimize flowering and maturing of the clover seeds.

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INTRODUCTION

Running Buffalo Clover (Trifolium stoloniferum) is a federally endangered species of which little is known. Ohio is one of only five states where this plant is currently found. This is the sixth year of monitoring running buffalo clover in the Hamilton County Park District, and the longest on-going study in process anywhere. The 1994 work included the continued monitoring of marked plots, as well as inventoring other populations in southwestern Ohio, and searching for additional populations along the Little Miami River between Loveland and Milford.

OBJECTIVES

This study included three objectives with the singular goal of learning more about this rare plant. The first objective was to monitor the three permanently marked plots at Shawnee Lookout Park for the fourth year in an ongoing study of population dynamics. The second involved inventoring certain populations to determine if they are increasing or decreasing in size, and the third was to survey the Little Miami River corridor from Loveland to Milford (location of two historical clover sites and one current site) for new populations.

METHODS

1. Monitoring: This was accomplished using a square meter frame to delineate the plots marked in 1991. Clover plants growing within this area were counted. These plots were monitored in April, May and August. Attempts were made to relocate the individually marked plants within these plots.
2. Inventoring: All Hamilton County Park District clover populations, Promont and the Cincinnati Nature Center sites were visited and inventoried. Miami Whitewater Forest was visited in April and again in September with three plants, believed to be the same, found each time. Those inventoried in May included: Newberry Wildlife Sanctuary, Shawnee Lookout Park picnic areas, Promont, and the Cincinnati Nature Center. Congress Green Cemetery was visited in May, but not inventoried. The clover on the Miami Fort was inventoried in August due to mowing of the fort in May. Mitchell Memorial Park was visited in September for the purpose of monitoring, but no clover was found.
3. Surveying: From Loveland to Milford, along the Little Miami River corridor, 14 nineteenth century houses and 5 cemeteries originating from that era were visited and their grounds searched for clover plants. Also 10 parks were searched as well as several other areas which appeared to have suitable habitats for running buffalo clover

When searching for clover a general perusal of the particular area is done with more concentrated hunting in the most likely habitats. These habitats include: In the woods the clover seems to occur in areas where the vegetation is shorter and more sparse. On lawns the same occurs. Where there are small bare spots between grass plants and usually violets and especially Glechoma hederacea, is where the clover grows. However at

the Miami Fort, it persists in tall, thick grass. In late summer or fall, the locations of the clover are the wettest spots. Pilea pumila is often present with the clover.

RESULTS AND DISCUSSION

MONITORING: The permanently marked square meter plots were monitored for the fourth year in a row. Results were disappointing. The counts for all three plots were the lowest encountered in the four years, with no plants occurring at any monitoring visit in the Cabin View plot. This plot had contained 228 rooted crowns within the square meter in August 1991 and the monitored plot was only a section of the colony. The Cabin View plot was originally selected to cover the edge of a dense colony. In 1994, occasional clover plants were found just outside the square meter plots of both Cabin View and Bobcat Ridge. The Bobcat Ridge plot count varied from one to three clover plants. This plot was originally selected to contain a small colony in its entirety. Although the Miami Fort plot count was also low, the actual colony of which the marked plot is a part, has spread further and an estimated total for the colony was 150 plants.

Counts in the Square Meter Plots

	<u>August 1993</u>	<u>April 1994</u>	<u>May 1994</u>	<u>August 1994</u>
Bobcat Ridge	6	2	3	1
Cabin View	0	0	0	0
Miami Fort	62	47	40*	54

* This count may not be accurate due to recent mowing.

The 1994 data is in line with the August 1993 plot counts. Although the colony at the Miami Fort of which this permanent plot is a part, has spread and now covers more area, which can only be explained by new plants either from stolons or seeds, the colony count is lower than the 1992 estimate of 200 plants. Looking at the colony count over the preceding years shows the same pattern as the plot counts. It appears that the plot counts are fairly representative of the colony counts and therefore the sampling method appears to be appropriate.

Miami Fort plot counts compared to colony counts (Walnut with cherry, Site 1, Miami Fort)

	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>
Sq. meter plot (May counts)	ND	ND	22	97	74	40
Colony counts	38	44	53	200	ND	150

ND = no data

On a brighter note, the number of individual running buffalo clover plants on the entire Miami Fort has increased from an estimated 100-110 plants at the time of the discovery in 1988 to an estimated 636 in 1994.

The permanently marked plots were chosen in February 1991. Only areas where running buffalo clover plants could be found and identified at that time of year were used. It is the belief of this author that only first year (therefore young) plants overwinter above ground. The plants are apparently short lived as other observations have indicated. Therefore only if the clover were reproducing by stolons and/or seeds at a rate similar to that of the decline by old age would these plots continue to contain clover plants.

INVENTORING: It is important to count or estimate the number of plants in the various populations every few years to know if the populations are prospering or on the decline. In the case of decline, there may be management practices which could be implemented in hopes of enhancing the chances of survival of the clover.

Hamilton County Park District Clover Sites-1994

<u>Location</u>	<u># plants</u>	<u># flowers (in May)*</u>	<u>Date inventoried</u>
Miami Fort	636	24	August
Bobcat Ridge	47	2	May
Cabin View	12	2	May
New Shawnee Lookout population	5	ND	
Mitchell Memorial Forest	0	ND	September
Miami Whitewater Forest	3	ND	April & Sept.
Newberry Wildlife Sanctuary	172	12	May
TOTAL	875		

Other Populations:

Cincinnati Nature Center	6	0	May
Congress Green Cemetery	ND	3	May
Gatch	24	ND	June
Promont	66	7	May

* Flowering was late probably due to a cool wet spring. Flowers were counted on May 17th or 18th for most populations. The clover was short and many flowers were still in bud. Perhaps counting a week later would have revealed more flowers. Fully developed flower heads are easily visible, but flower buds may be partially concealed and inconspicuous. The flowering stalks apparently experience rapid growth during the time the flower buds are expanding. Nevertheless, it appears that flowering was sparse in all of the Hamilton County Parks. Jennifer Windus reported more abundant flowering at the Niehaus site, and on May 15th, many flowers were observed at the Dinsmore site in Kentucky about seven miles south of Shawnee Lookout Park.

No clover plants could be found at Mitchell Memorial Forest in 1994. This clover site was visited during the summer by Brian Goldick, and by this author late in the season (September 26). No killing frost had occurred and clover at other locations was still large and easy to find. No clover could be found at the Mitchell Memorial site although this was one of our most vigorous populations in 1992 with 235 plants. There was no obvious reason for its demise. The area will be searched next May in hopes of finding some clover plants. This demonstrates the need to inventory all populations every few years.

SURVEYING: With historical collections of running buffalo clover from both Loveland and Miamiville, and a current population in Milford, the Little Miami River corridor seemed to be a prime location for clover. Early into the survey work, Ann Rehtin (Cincinnati Nature Center) who was assisting me, found a colony of clover on the lawn of a circa 1820 stone house still belonging to the original Gatch family. Ann also, at a later visit to the Gatch residence, found several more clover plants on another part of the lawn. After this exciting beginning to the survey work, various locations which seemed to have perfect habitats, were searched, but no other clover populations were found.

Unrelated to this survey, John Klein found four running buffalo clover plants in Shawnee Lookout Park at a different location from any other known plants.

A LOOK AT SOME EDAPHIC FACTORS AND HOW THEY MAY RELATE TO KNOWN POPULATIONS OF RUNNING BUFFALO CLOVER

In an attempt to better understand the specific habitat requirements of this clover so we can better manage for its continued survival, and to help choose appropriate areas for survey work, the following section of this paper is a preliminary attempt to organize some of the the information we have in such a way to demonstrate which edaphic factors appear to have some corrolation with the known populations of running buffalo clover.

A. SOIL pH: During 1994, soil samples were collected from various Ohio, Kentucky and West Virginia clover sites in order to test soil pHs. It was thought that soil pH might be a limiting factor for clover growth.

The results of this work, as summarized in the following table, showed very similar neutral soil pHs for Ohio and Kentucky, but acid soils at the clover sites in West Virginia. Most likely the soil pHs determined represent the geological area where they were taken rather than demonstrating habitat requirements for the clover. We know now that running buffalo clover will grow in soils from pH 5.68 to 7.76 and may not be limited to this range.

Soil pH of Samples from Clover Sites

<u>LOCATION</u>	<u>RANGE in pH</u>	<u># of SAMPLES</u>	<u>AVERAGE pH</u>	<u>MEAN</u>
Southwest Ohio	6.48-7.76	10	7.13	7.12
Kentucky	6.75-7.73	7	7.11	7.24
West Virginia	5.68-6.01	4	5.81	5.84
SW Ohio (non-clover sites) for comparison	6.30-7.55	6	6.89	6.93

The soil samples were collected within the first inch of soil. All vegetation was first scrapped away and then a small sample of soil was collected. For each sample, two or three scoops of soil from different locations among that particular clover population were collected into the same bag. The soil samples were allowed to air dry. Dry soil (approximately three grams) was suspended in 10 ml de-ionized water in a test tube. These samples were shaken vigorously, allowed to sit for ten minutes or more, reshaken and then tested with a laboratory Orion pH meter. No other soil analysis was performed, however the unused portions of the samples were saved in the event further testing should be desired.

B. SOIL TYPES SUPPORTING THE GROWTH OF RUNNING BUFFALO CLOVER IN HAMILTON COUNTY, OHIO (includes all known populations in the county.)

Only Hamilton County soils are being considered because if we include Clermont and Warren counties, various different soil types would be involved. Soil types are fairly local so it is only to be expected that when you travel from one county to another you would encounter different soil types. All soil data except pHs are from Lerch et al. (1982).

Hamilton County Soils which Support Populations of Running Buffalo Clover

<u>DISTURBANCE</u>	<u>CLOVER SITE</u>	<u>SOIL pH if tested</u>	<u>SOIL TYPE*</u>
Deer trail	Mitchell Memorial	7.27	Eden
Fort/mowed	Miami Fort	6.48	Parke
Picnic/mowed	Bobcat Ridge	7.18	Parke
Picnic/mowed	Cabin View	7.52	Parke
Edge of trail	Blue Jacket	----	Parke
Edge of trail	Trailside	----	Parke (?)
Edge of trail	Miami Whitewater	----	Bonnell or Cincinnati
Logging road	Newberry site 1	6.96	Eden
Logging road	Newberry site 2	----	Eden
Cemetery/mowing	Congress Green	----	Parke
Logging road	Warder Perkins	6.77	Parke
Logging road	Niehaus	7.12	Parke

Eden soils are found on dissected hillsides and are derived from limestone bedrock. Parke soils are found on dissected terraces and are formed in loess and underlying old loamy deposits of either alluvial or lacustrine origin.

C. SOIL ASSOCIATIONS OF HAMILTON COUNTY BY PERCENTAGE OF COVERAGE

If we look at the distribution of Hamilton County soil associations by percentages we will see that less than 27% of Hamilton County soils support the growth of known populations of running buffalo clover

Soil associations were used instead of soil types for the chart below because of the availability of percentages. Although not as precise, this will demonstrate the apparent affinity of the clover to certain soils.

(The Promont population, which is in Clermont County, is also on Eden soil.)

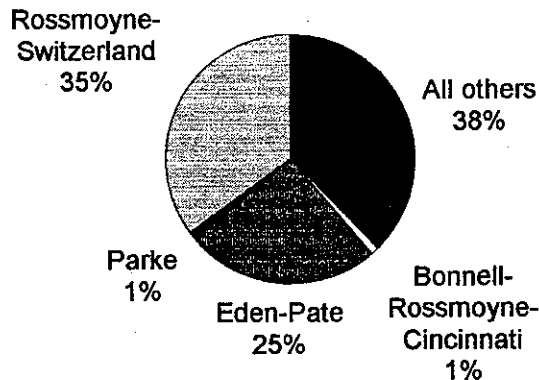
Percentages of Hamilton County Soil Associations which Support Populations of Running Buffalo Clover

<u>SOIL ASSOCIATIONS</u>	<u>PERCENTAGE</u>	<u>CLOVER POPULATIONS</u>
Rossmoyne-Switzerland:	35%	none
Parke:	1%	all Shawnee Lookout clover sites Congress Green Warder Perkins Niehaus
Eden-Pate:	25%	Mitchell Newberry
Bonnell-Rossmoyne-Cincinnati:	1%	Miami Whitewater
All Others:	38%	none

All of these soil associations are found throughout the county, except for Parke which only occurs in the southwest corner of the county along the Ohio River.

The following chart shows the percentages of these soil associations in Hamilton County. The two larger slices of the pie contain no known clover populations while the three smaller slices contain all the known populations. Eden-Pate is roughly 20% Eden and 5% Pate to make this 25% of the county soils.

Soil Associations of Hamilton County, Ohio



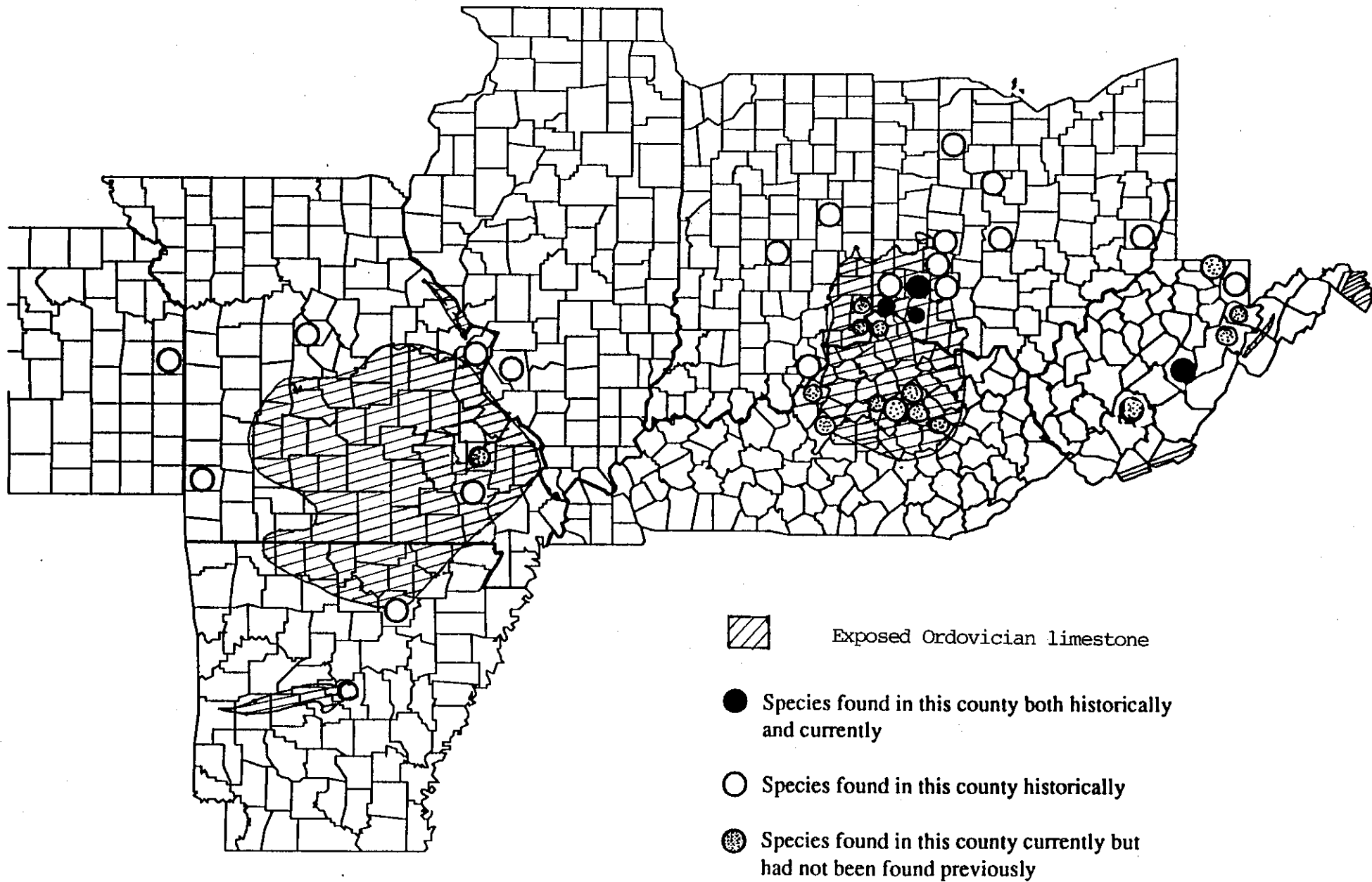
D. A LOOK AT THE LARGER PICTURE, THE RANGE OF RUNNING BUFFALO CLOVER POPULATIONS BOTH HISTORICAL AND PRESENT.

When the distribution of running buffalo clover populations in the United States is mapped and compared to exposed Ordovician limestone (see page 9 for map), there appears to be a correlation. Many of the current populations are in the vicinity of the Cincinnati arch (these include the Ohio, Indiana and northern Kentucky populations), the Ozark dome (Missouri population) and the inner and outer blue grass regions of Kentucky (all central Kentucky populations). All of these features are Ordovician limestone. West Virginia populations are found along the Appalachian Ridge which has strips of Ordovician limestone. However, most West Virginia populations occur on Greenbrier limestone (Harmon, 1994). Greenbrier limestone is of Upper Mississippian origin and therefore more recent than Ordovician limestone (Keroher, 1966). West Virginia geology is diverse, and more study is needed to determine if the distribution of running buffalo clover in that state might correlate to the Ordovician limestone, or is any soil derived from limestone a potential habitat for this clover?

In 1800 there were 30 million buffalo in the United States (Nat'l Geog. 1994). If we assume that the running buffalo clover grew along the buffalo trails, it would have been eaten, trampled and manured by these animals. As this plant responds positively to disturbance, the buffalo trails may have been super highways of running buffalo clover reaching from West Virginia to Missouri. As the plant seems to be short-lived, various populations would develop at certain locations, flourish for a few years, re-seed and persist or disappear. Meanwhile other populations would develop. The buffalo would keep down the surrounding vegetation, disturb the soil, mechanically distress the seeds, and add nutrients. Probably many populations would appear transiently on soils and in conditions which were not ideal for their survival. These populations would have been short-lived but would serve to move this species further and further until more agreeable locations were encountered. Now that the clover is not migrating freely along buffalo trails, the populations known today are probably those enjoying optimal conditions.

Nevertheless, known populations are disappearing and new ones are found. (1994 finds include Gatch and John Klein's population in Ohio, Madison Co. MO, and Hidden Valley IN.) The two most successful clover populations in Ohio are the Miami Fort and Niehaus populations. The Miami Fort population appears to flourish because of the infrequent mowing which does control much of the vegetation without interfering with the clover. Also the scraping of the mower on the uneven terrain appears to be a factor in encouraging new growth of clover at new locations. The Niehaus population continues to increase in size for unknown reasons.

This map was taken from Bartgis, The National Atlas of the U.S., and various other sources.



KEY LEARNINGS:

1. Running buffalo clover will grow on a wide range of soil pHs.
2. Soil type appears to play some role.
3. Areas of exposed Ordovician limestone appear to correlate with many current running buffalo clover populations.
4. Very vigorous populations may disappear for no obvious reason.

RECOMMENDATIONS

1. The mowing schedule at the Miami Fort should be continued indefinitely. This schedule calls for mowing around April 18th and again the first week of May. Then mowing should be curtailed until July when the clover seeds would be mature. Mowing is then done once or twice in the late summer and fall.
2. The area of the clover population at Mitchell Memorial Park should be visited in May to see if any clover plants can be found. If not, or if very few are found, a test portion of the area should be mapped and the soil disturbed, probably by chopping with a hoe. This area should be revisited annually to look for clover.
3. All known populations should be visited every third year to assess the apparent health of the population. In some cases, management needs may be apparent.

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