

RUNNING BUFFALO CLOVER MONITORING

in the

Hamilton County Park District

1993

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RUNNING BUFFALO CLOVER MONITORING IN THE HAMILTON COUNTY PARK DISTRICT
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SUMMARY

OBJECTIVES: Monitoring of running buffalo clover was conducted for a fifth year to continue following the growth and reproduction of the clover plants within three marked plots as well as some individual plants. We hoped to learn more about reproduction by seeds and stolons and life histories of individual plants.

METHODS: Plants within the marked plots were mapped three times during the season. The individually marked plants were documented when found. Flowering stems were counted on the Miami Fort and estimates of numbers of plants present were made for all Shawnee Lookout populations. Running buffalo clover seeds were planted in the greenhouse and their germination and growth recorded.

RESULTS: Population sizes have increased on the Miami Fort and at Bobcat Ridge Picnic Area, but a decrease in numbers of plants was found at Cabin View Picnic Area. On the Miami Fort, 263 flowering stems were counted. The clover plants, individually marked as seedlings in September 1991, flowered and grew stolons this year. Seeds planted in the greenhouse, germinated and grew stolons in two months.

RECOMMENDATIONS: Monitoring the marked plots should be continued for another year since this is the only long term field study of this clover in progress. Each year adds to the understanding of this plant and provides a better basis for management.

The recently discovered site at Newberry Wildlife Sanctuary should be counted in May.

Picnic area and trail maintenance should be continued as usual. Herbicide use should be avoided in the vicinity of the running buffalo clover. Continuing the suggested mowing schedule at the Miami Fort will be very important because of competition by other plants.

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INTRODUCTION

Running buffalo clover (Trifolium stoloniferum) is a federally endangered species of which little is known. This is the fifth consecutive year of monitoring the clover in the Hamilton County Park District, and the only long term study of this species in process anywhere. The 1993 work concentrated on the life history of individually marked plants, and the seasonal fluctuation of numbers of plants.

PURPOSE

The purpose of this project was to monitor square meter plots within three selected populations of running buffalo clover in the Hamilton County Park District, in order to learn more about reproduction by seeds and stolons, and life histories of individual plants.

METHODS

1. The plants within the three square meter plots were counted three times during the season (April, May, and August), and mapped on graph paper.
2. Data was collected at each visit, on the five individual clover plants marked in 1991.
3. Estimations of total numbers of plants at Bobcat Ridge and Cabin View picnic areas were made in May. At this time the grass was tall at the Miami Fort hiding the individual plants, however the abundant flowers were relatively easy to see and therefore were counted in lieu of plants. Later in the summer, an estimate was made of the number of plants on the Miami Fort.
4. Both the Trailside and Blue Jacket Trail areas of previous clover populations were searched in vain.
5. Running buffalo clover seeds from the Miami Fort were planted by John Klein in a greenhouse to evaluate fertility, and germination without scarification.

RESULTS

The clover plants on the Miami Fort and at Bobcat Ridge Picnic Area continue to increase in number each year, while the Cabin View population appears to be declining.

A large new colony of clover plants was found on the southwestern corner of the Miami Fort by Sabina Sulgrove. This colony is 200 feet from any other known clover plants, and consists of about 100 plants circling an American elm tree on three sides. This accounts for the increase in number of plants on the Fort.

Counts and estimates of population sizes over the past years are as follows:

	1988	1989	1990	1991	1992	1993
Miami Fort	100-110	103	104	188	427	500
Bobcat Ridge	9	82	109	115	115	125
Cabin View	unknown	unknown	148	246	246	97

Numbers refer to individual plants with established roots. Plants on stolons without established root systems are not counted as separate plants.

Marked Plots: Data from monitoring the square meter plots can best be shown with numbers of plants counted within the marked plot at each monitoring date (Fig. 1). As only three visits were made this year, the points on the graph are marked with * instead of connecting dots. A fourth count was made at Bobcat Ridge during a picnic. Again we see numbers in April similar to those of the previous fall (except for Cabin View), and then a drop off in May. This was a dry summer which could have contributed to the decrease in numbers in August. I had expected, based on the last two years data, to find the number peak in August. Cabin View, which is the driest area, appears to have a diminishing population.

Flowering on the Miami Fort: Flowering was profuse. The picnic areas are mowed weekly and many of the flowers are lost. Therefore it is not possible to count flowering plants accurately except at the Fort. Flowering stems were counted with no attempt to check if they might have been connected by stolons. About half of these flowering stems had two flowers.

Miami Fort flowering and total plant count data is presented together, with some comments on the summer weather:

	1988	1989	1990	1991	1992	1993
Flowering stems	many	6	27	76	111	263
Total plants	100-110	103	104	188	427	500
	very dry	dry			wet cool	hot dry

Ethel Hickey* found that during the very wet summer in Missouri, running buffalo clover flowers did not produce seed.

*a biological technician with the Mark Twain National Forest in Missouri, reintroducing running buffalo clover into Missouri.

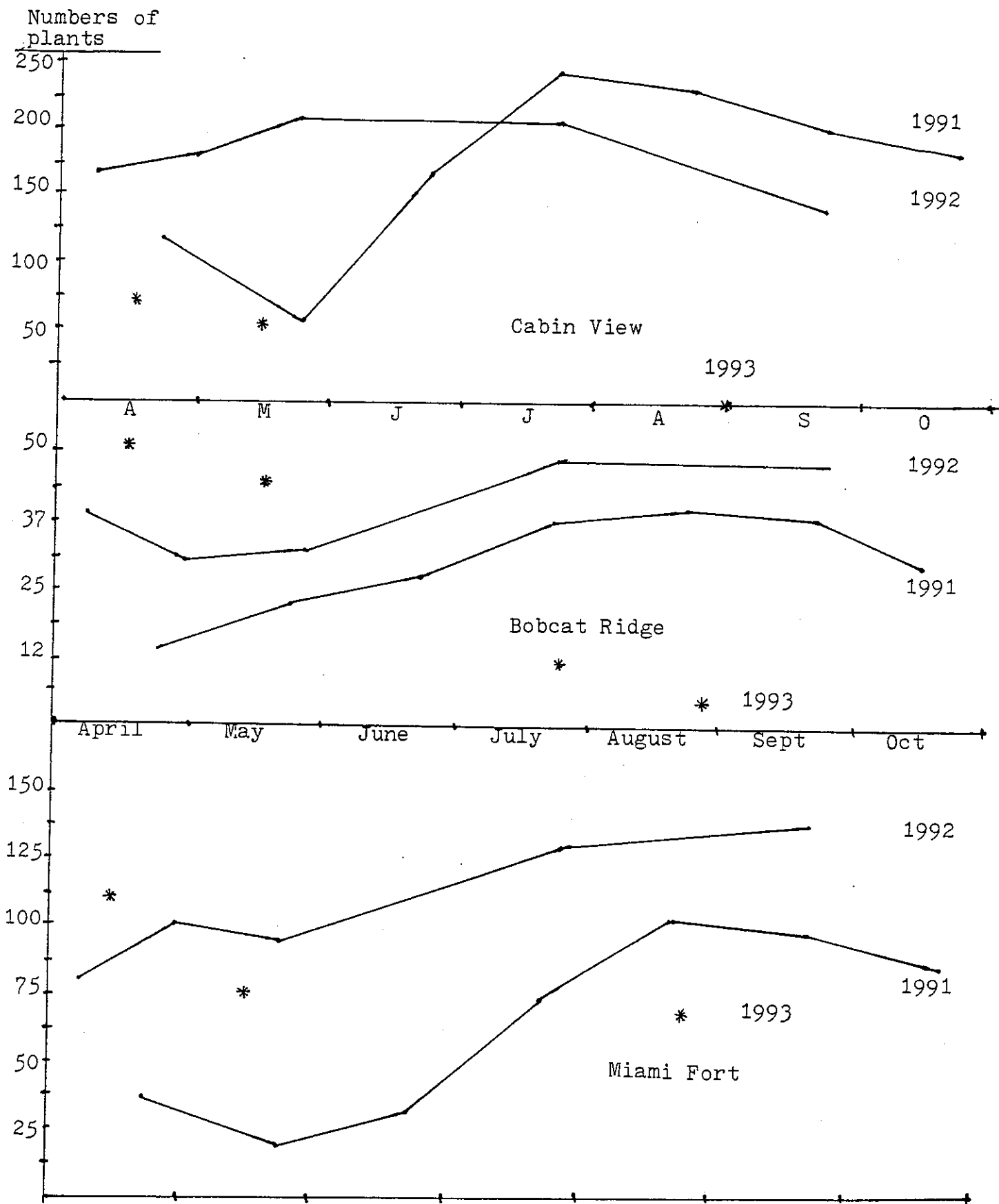


Fig. 1. Numbers of Running Buffalo Clover plants counted in each square meter plot at each monitoring visit.

Individually marked plants: Five tiny seedling were marked with loops of colored wire and have been followed for three seasons:

September 17, 1991	Tiny (1 inch tall) seedlings were marked.
October 17, 1991	All five tiny plants found.
April 3, 1992	Five tiny plants.
April 29, 1992	Two tiny, three medium.
May 22, 1992	One tiny and four with large leaves.
July 22, 1992	Four with large leaves, one not found.
September 23, 1992	All five plants with large leaves.
April 14, 1993	Two plants, each has two tufts*. Two plants are simple, and one not found.
May 20 1993	One plant has two stolons with one flower each. One plant has one flower and one rooted stolon. Three plants not found.
August 30, 1993	No plants found.

* "tufts" = Plants in early spring often are already divided into two or more parts which appear to be flat green tufts diverging from a common root system. These tufts (meristems) consist of stipules, and unexpanded leaves, stolons and stems ready to grow.

TWO YEARS WERE NEEDED FROM GERMINATION TO FLOWERING AND STOLON PRODUCTION,

HOWEVER;

John Klein planted some seeds he had collected from the Fort in 1991 and kept in the freezer over the winter. We wished to know if 1. these seeds would germinate without scarification and 2. if they were fertile? He planted 50 individual fruits (we would expect 100 seeds to be contained if all were fertile).

These were planted in the Prairie Nursery Greenhouse in late March or early April. Twelve plants germinated, and by June 3rd, ten of these had rooted stolons! These greenhouse plants of the same genetic stock, developed in two months to the rooted stolon stage, which took the outdoor plants two years. We now know that at least 12 % of the seeds were fertile and germinated without scarification. We can expect that more plants will germinate by next spring. In July, the clover plants were planted outdoors near a black walnut tree. Their survival and any additional plants which germinate from the original planting will be documented.

DISCUSSION

RUNNING BUFFALO CLOVER: a pioneer on disturbed soil.

What is the difference between two month plants in the greenhouse and two year plants in the field? Competition, moisture, soil and air temperatures are the obvious differences. No fertilizer was used in the greenhouse plantings. This brings us back to the suggested natural habitat of loose disturbed soil along a buffalo trail. The vegetation would be kept low by the frequent grazing and trampling of the animals traveling this trail. However, clover plants in the wild might never grow as fast as those under greenhouse conditions.

On the Miami Fort, the only destruction of vegetation and loosening of the soil is from the mower when it circles the irregular terrain and scrapes the ground clean in places, and to a much lesser extent, grazing of deer and hoof prints in the soil. Do the "scraped circles left by the mower" remind us of the new colony on the Fort which encircles a tree on three sides? Would an experimentally scraped area of the Fort give rise to running buffalo clover plants?

Besides the known habitats of mowed lawns, picnic areas and the Miami Fort, the clover is also found on the edge of trails, logging roads in the woods, and sand bars in streams. The latter three habitats have experienced mechanical actions which might have stirred up seeds already in the soil as well as disturbing the soil, loosening it and destroying much of the existing vegetation. Then, once the clover is established at a site, it continues to multiply by plants on stolons as well as slowly maturing seedlings until whatever limiting factors cause the demise of the population.

WHERE WERE ALL THE CLOVER PLANTS IN AUGUST?

The monitoring of the past two years has shown that the peak in number of plants present in each plot has occurred between late July and September. Therefore the plants were counted in late August this year expecting to hit the peak. This is not what was found (Fig 1).

According to the histories of the five individually marked plants (and other observations by this author), plants which produced stolons and/or flowers this year would be dormant (or dead) by August. Plants found at this time would be the big leafed plants which germinated in 1992, and will produce stolons and/or flowers in 1994. If this theory is true then very few plants germinated in 1992 or very few survived until August 1993. The summer of 1992 was very wet, while the summer of 1993 was dry. Although dryness might be the reason for the absence of many clover plants in August, the summer of 1989 was very dry and the clover did not seem to suffer, however; no comparison counts were made. In August 1989, for example, the clover at Mitchell Memorial Park was big and lush. If, in fact, very few plants germinated in 1992, then, we would expect flowering and stolon producing plants to be infrequent in 1994 within the marked plots. (Other colonies on the Miami Fort had many big leafed plants which should mature to the flower and stolon producing stage in 1994.)

No work has been done in this study to determine how long it takes plants on stolons to flower. Perhaps these plants flower the second year as they have a head start over the seedlings. We also do not know where the plants from stolons are in August. Are they dormant or are they simply detached from the stolons by then and appear the same as the young plants from seeds. Although it is common to see plants in August with remnants of stolons, it seems that the majority of plants seen at this time have no indication of any previous stolon attachment. This area needs more work.

WILL THE FIVE INDIVIDUALLY MARKED PLANTS BE FOUND NEXT YEAR? If they are dormant, perhaps they will be found in late April or May of 1994. It appears that young plants overwinter and older plants experience dormancy (Becus 1992). We would like to know how many years the clover plants live.

FACTS LEARNED FROM THIS YEAR'S STUDY:

1. Plants in the field took two years from germination to stolon production while plants in the greenhouse took two months.
2. At least some of the seeds from the Miami Fort plants are fertile.
3. Running buffalo clover seeds do not require scarification for germination.
4. August is not always the peak in number of clover plants visible.

THEORIES ON REPRODUCTION AND MATURATION OF RUNNING BUFFALO CLOVER PLANTS:

Theory 1. The absence or presence of plants in August is dependent upon germination the preceding year.

Theory 2. Flowering is dependent (at least in part) on germination two years before.

Theory 3. Seeds may remain in the soil for years until the proper conditions for germination occur. Mechanical disturbance, exposing the seeds to freezing and thawing, and removing surrounding vegetation may induce germination.

RECOMMENDATIONS

As some populations increase in size, others decrease. Only one new population has been found in Ohio in the past three years although more people are looking for this plant each year. This species should still be considered rare and proper management policies should be practiced in order to encourage its continued existence.

Picnic area and trail maintenance should be continued as usual. All herbicide use should be avoided in the vicinity of the running buffalo clover. Continuing the suggested mowing schedule at the Miami Fort will be very important because of competition by other plants.

Three counts of the marked plots in 1994 should show if the populations are stable. Also we hope to learn if the five marked plants are still alive and to learn how long lived these plants are.

If a small area of the Miami Fort were scraped of vegetation and monitored, we may learn if seeds are present in the soil seed bank and can be forced to germinate by mechanical soil disturbance. This would be the same idea as burning a prairie to enhance germination of seeds in the soil. Ethel Hickey is planning to use cattle to graze some of the Missouri running buffalo clover to see if the grazing, and disturbance by hooves will encourage flowering.

LITERATURE CITED

Becus, M.S. 1992. Running buffalo clover monitoring in the Hamilton County Park District. Report submitted to the Ohio Div. Nat. Areas and Preserves, Ohio Dept. Nat. Resources, Columbus, Ohio.

ACKNOWLEDGEMENTS

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