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Prairie Restoration Within A Nuclear Accelerator Ring

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In 1840, the official Illinois land surveyor called the northern two-thirds of Illinois first-rate prairie land; rich and open (Ecology at Fermilab). Illinois became know as the Prairie State because it was covered with rich prairies, marshes and savannas (Betz, p.179). The Illinois prairie landscape began to change as settlers moved in and began to cultivate the land (Sullivan, p.42). Much of the pre-settlement prairies were lost and only small remnants exist in railroad right-of-ways and cemeteries (Sullivan, p.43) Though the prairie of Illinois can never be replaced, one organization is trying to restore a section of land to resemble a pre-settlement prairie. The organization is Fermilab National Accelerator Laboratory, more commonly know as Fermilab. Under the direction of Robert Betz and the Ecological Land Management Committee, Fermilab is starting to succeed in reproducing a section of the historic Illinois prairie.

Fermilab

Fermilab is a high energy physics research center located in Batavia, Illinois. The research center is operated by a consortium of universities for the U.S. Department of Energy. The principle experiment instrument at Fermilab is a high energy accelerator. The immense accelerator that is used to shatter protons is four miles in circumference, donut shaped and is half buried in the ground. By shattering the protons, The researchers at Fermilab hope to discover the particles that protons are made of and what properties hold them together (Sullivan, p.41).

How did the restoration project get started?

The restoration project at Fermilab was started by Robert Betz, a biology professor at Northeastern Illinois University in Chicago. Betz became interested in prairies during a field trip to a Santa Fe prairie during the summer of 1959 (Sullivan, p. 44). He began to search all over the Chicago area for remnant prairies. Later, he began to conduct experiments within those remnant prairies to learn more about the working systems within a prairie (Sullivan, p.44).

In the summer of 1971, a friend and fellow biologist told Betz of a new physics laboratory that the federal government was building in Batavia. The lab would own 6,800 acres of land and almost all of it would be vacant. Betz soon approached Fermilabs director Robert Wilson with his proposal for a prairie restoration project for the vacant land. Wilson was interested, but Betz was lacking a respected organizational backer that the government required for such projects. The Nature Conservancy of Illinois allowed Betz to use its name and Betz was given permission from Fermilab to go ahead with the restoration project (Sullivan, p.45).

Within the four mile ring

The land that is within the Fermilab accelerator ring was continuously cultivated for more then a century and was retired from cultivation in 1970 (Betz, p.179-180). The area within the accelerator ring is broken up into tracts based on currant land use. Some examples of the tracts include areas used for agriculture, recreation, residential and ELM. The ELM areas are the tracts in which the restoration is occurring (Ecology at Fermilab). Within the accelerator ring there is a total of 455 acres that have been planted as well as a continuos moat of cooling ponds that act as an excellent fire break (Sullivan, p.42). The area within the ring also contains an oak grove, a small pre-settlement prairie and a substantial marsh (Sullivan, p.45).

Who oversees the Tracts?

Robert Betz and the Ecological Land Management Committee oversee and make recommendations to facilitate the restoration of available tracts. The number one responsibility of the committee is to create a roadmap for the restoration through the Long Range Management Plan. The plans seek to increase native biodiversity and to build upon the many different habitats present. The plans now focus primarily on plant communities and in the future with incorporate various wildlife considerations (Ecology at Fermilab).

As it is described at Fermilabs website, the plans for each tract may be developed in at least two levels of detail. The "first level" plan for each tract includes the location of the tract within the site, the access restrictions and characterized habitat. Second level plans or long range management plan, recommends any management practices that follow the long range objective. Some examples that were found at the Fermilab website of long range management plans would be: to manage to improve the success of nesting grassland birds, or develop and expand the prairie portions. Also included in the long range management plans are management techniques that would improve the less developed features of the habitats within each tract. Long range management plans are only given to those sites that are available for restoration.

The tracts chosen for restoration are based on their availability and their proximity to other restored areas. Betz and the Long Range Management Committee feel that it is more important to restore the larger tracts at Fermilab because they are more valuable to wildlife then small and fragmented tracts. However, they do not have a list that prioritizes the restoration of the various tracts. The annual cost to maintain and restore the tracts as well as the labor that is needed for the project is estimated to be between $40,000 and $60,000 (email, Mike Becker May 28, 1998).

Seed Collection and Preparation

During the summer of 1974, nearly one hundred volunteers from the community and Fermilab collected 400 pounds of prairie plant seed from over 70 locations within a 50 mile radius of Fermilab (Sullivan, p.45). Some of the sites were undisturbed cemeteries and railroad rights-of-way that still contained native prairie plants (Wiley, p.36). When the plant species become large

enough, hand and mechanical harvesting of seeds is conducted on site. The first on site seed collection at Fermilab occurred in 1983.

There are three reasons why volunteers collect seeds from other locations, one, to increase the genetic diversity of the seed mix, two, augument those species that have low populations and three, to introduce new species into the prairie (Betz, p. 181). The seeds used to accomplish the above goals can come from the trading of seeds with local schools and forest preserves (Ecology at Fermilab). Grasses such as big bluestem *(Andropogon gerardii),* indian grass (*Sorghastrum nutans)* and switch grass (*Panicum virgatum)* have the seeds harvested with a front end combine and later the seeds are planted in new plots (Sullivan, p.46).

Once the seeds have been collected by any of the above methods, the seeds are cleaned thoroughly using various sized screens (Betz, p.180). The cleaned seeds are then given a cold treatment in which the seeds are mixed with vermiculite, moistened and placed in plastic bags. The bags are then stored for four-month period at five degrees Celsius. After the four months the seeds are then put on a wooden floor and dried (Betz, p.180). The seeds are then ready to be planted.

Planting the seeds

In the summer of 1974, the grounds and maintenance crew plowed and disked 9.6 acres of land within the accelerator ring (Sullivan, p.45). In June of 1975, the land was disked two more times and was then ready to be planted. The planting in the first few years was done by using a piece of industrial equipment called the Nisbet drill. There were problems with the Nisbet drill that were noticed early on. It tended to clog as well planting the seeds in uniform rows, which can still be seen today. Thus the Nisbet drill was replaced by a state highway salt spreader truck that was modified for seed spreading (Sullivan, p. 45-46). A few years later the salt spreader truck was replaced by an all-terrain seed spreader that uses balloon tires that better distributes the weight of the truck and thus reducing soil compaction (Betz, p. 180).

The first planting in 1975 contained 70 plant species and was soon replaced by a mix of 23 species. The new mix contained 3 grass species and 23 forbs species which Betz calls the prairie matrix. The prairie matrix contains species that survive the longest on degraded soils and compete the best against weeds (Sullivan, p. 45-46). Once the matrix is established, the plant diversity is increased by adding two or three species of grasses and forbs to the tract on a yearly basis (Wiley, p.36).

During the second spring another 10 acres was planted within the ring and by the third spring plot one was ready to be burned (Sullivan, p.45-46). Tracts are now burned in the late spring of their fourth year after planting (Betz, p.181). The burning of the tracts often rejuvenates the systems within the prairie through the elimination of unwanted brush and weeds. Thus reducing competition between prairie plants and invasive weeds (Ecology at Fermilab). The use of herbicides to reduce invasive species is discouraged at Fermilab. Another method of reducing

competition between invasive species and prairie species is the continual over seeding of native ground level species within each tract (Email, Mike Becker May 28, 1998).

Now and in the Future

All the plots, regardless of age, show an increase in the number of plant species and plant populations (Betz, p. 183). A continual road block to the introduction of some of the more rare plant species is a lack of knowledge about the mycorrihizal requirements that are needed for the survival of the plant. A few examples would be Mead' milkweed, Prairie Gentian and Prairie Lily (Betz, p. 184). As well increasing the plant diversity within the prairie, there is a need to increase the animal diversity. In some instances this has occurred naturally for some prairie animals such as bobolinks, Eastern meadowlarks, coyotes, as well as many more (Sullivan, p.47).

There have even been some surprises that Fermilab can not explain. For example, the baptisia dusky wing, a butterfly whose caterpillars feed on the wild and false indigoes within the prairie (Sullivan, p.47). How the butterflies got there seems to be a mystery, but it is a terrific addition to the restoration and it has given hope to those who are working hard to restore the prairie.

Evaluation

Robert Betz and the Ecological Land Management Committee use the presence of different plant species to track the progress of the restoration project. Annual surveys are conducted to determine the increase in plant diversity within each tract. The goal of the Ecological Land Management Committee is to have 150 or more different species per tract that would most resemble a virgin prairie. Some of the older tracts at Fermilab have about 80 different species while some of the newer tracts have about 25 different species (Email, Mike Becker April 21, 1998). It is apparent that Fermilab has a long way to go.

With the limited funds, Fermilab does not track the increase in animal diversity. Though this would provide an essential report on the progress that has been made since 1975. Counting and cataloging vertebrates every three to four years would provide the information necessary to determine if the prairies plant species are attracting the animals that would naturally inhabit a prairie setting.

Another evaluation of progress would be the presence and counting of insect species. Though this can be very difficult and costly, it can provide information that is essential in prairie restoration. The presence of some insects can be increased if there is an increase in plant diversity. Cross referencing between the insect and plant species would help to determine what plants are supporting what insects.

A quote by Robert Betz that appeared an article by Jerry Sullivan from the July , 1988 Audubon magazine best sums up what the prairie restoration at Fermilab is all about. "Time is on your

side. But we live only a little while, and prairies live for millennia. We think, eventually, the prairie will take over and that this will be indistinguishable from a natural prairie. We won't see it in all its glory, but at least we will have prepared the way for somebody else to see it."

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