

Fermilab Joins a Network of DOE National Environmental Research Parks

by Kevin A. Brown

"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect." - Aldo Leopold

At home within and around Fermilab's accelerator is the biota (flora and fauna) of prairie, oak-savanna, forest, and wetland communities once common throughout the Midwest. Because many of these ecological communities - in some cases entire ecosystems - have all but disappeared in this region of the country, ecologists and environmental scientists cannot thoroughly study them to predict the outcomes of human stresses on those habitats that do remain. Fortunately, Fermilab, recently designated by the U.S. Department of Energy (DOE) as part of a network of National Environmental Research Parks, offers researchers exceptional opportunities to study protected habitats on-site. With these opportunities, natural scientists and other interested persons can address some of the ecological questions that could benefit both the environment and mankind.

According to John Paulk (*Res.Div./Adv. Compt.*), Research Park Coordinator at Fermilab, an Environmental Research Park is "a protected public land where qualified researchers can conduct various types of ecological research." The Department of Energy's Office of Health and Environmental Research established a network of Environmental Research Parks, or ParkNets, at various sites across the country in response to the National Environmental Policy Act (NEPA) of 1969. NEPA defined the nation's goals of restoring, protecting, and enhancing environmental quality. The Parks uphold the policy's goals by supporting an assortment of ecological research projects and protecting priceless habitats within a given Park's boundaries.

The Road to Research Park Designation at Fermilab

Although Robert Betz, Professor of Biology, Northeastern Illinois University; Ray Schulenberg, former Curator of the Morton Arboretum; and Rudy Dörner (*Bus. Sect./Emer. Ser.*) did not realize it, the road to Research Park designation began in 1973 with their efforts to restore tall-grass prairie inside the Main Ring. The prairie restoration project currently includes approximately

700 acres of prairie, in various stages of restoration, inside and outside the Main Ring. It has a long history of internal and external support. Internally, Fermilab Director Emeritus Robert R. Wilson supported the project at its inception, and that support has been carried forward by the Lab's current Director, Leon M. Lederman. Fermilab's Roads and Grounds Department has also contributed time and effort to the project. Externally, professional consultant Betz has applied scientific and practical expertise to nurture the project, and countless seed-harvesting volunteers have advanced the restoration effort. In May 1974, a Prairie Committee, comprised of Fermilab employees and Betz, was in place to establish goals for the project and monitor its development. Finley Markley (*Tech. Suppt./Eng.*) currently chairs the Prairie Committee.

The Research Park idea originated from discussions at a Prairie Committee meeting several years ago. The Committee then worked closely with Leon Lederman to investigate the advantages and disadvantages of Research Park designation. Argonne National Laboratory (ANL) fueled additional interest in Research Park designation at Fermilab when, in 1984, ANL Director Alan Schriesheim requested that a group of Argonne terrestrial ecologists be permitted to conduct ecological research in the prairie restoration project. This accelerated the chain of events that culminated in the proposal that Fermilab become a DOE Research Park.

This proposal was endorsed, signed, and submitted by Lederman in September 1985. Official approval came in a letter to Lederman dated April 5, 1989, from Andrew E. Mravca, Area Manager, Batavia Area Office, Department of Energy. That letter was in response to a memo to Hilary J. Rauch, Manager, DOE Chicago Operations Office, from Robert O. Hunter, Jr., Director of the Department of Energy's Office of Energy Research, authorizing the designation. Essentially, the Prairie Committee's unequivocally successful prairie restoration project, which demonstrated the ecological value of the Fermilab site, justified Research Park designation at Fermilab.

The National Environmental Research Park Network

Fermilab is the DOE's sixth National Environmental Research Park. Each Park in the national network has ecosystems unique to a geographical region (Fig. 1, page 20). "In the past," said Walt Conley, Director, National Environmental Research Program, "the National Environmental Research Park network was viewed as a patchwork quilt that didn't constitute a program, and people didn't see where the Research Park program was going. The emphasis now is to pull the Parks together to represent a spectrum of ecological areas."

The overall goals of the Park program are to (1) develop methods to quantitatively and continuously assess and monitor the environmental impact of human

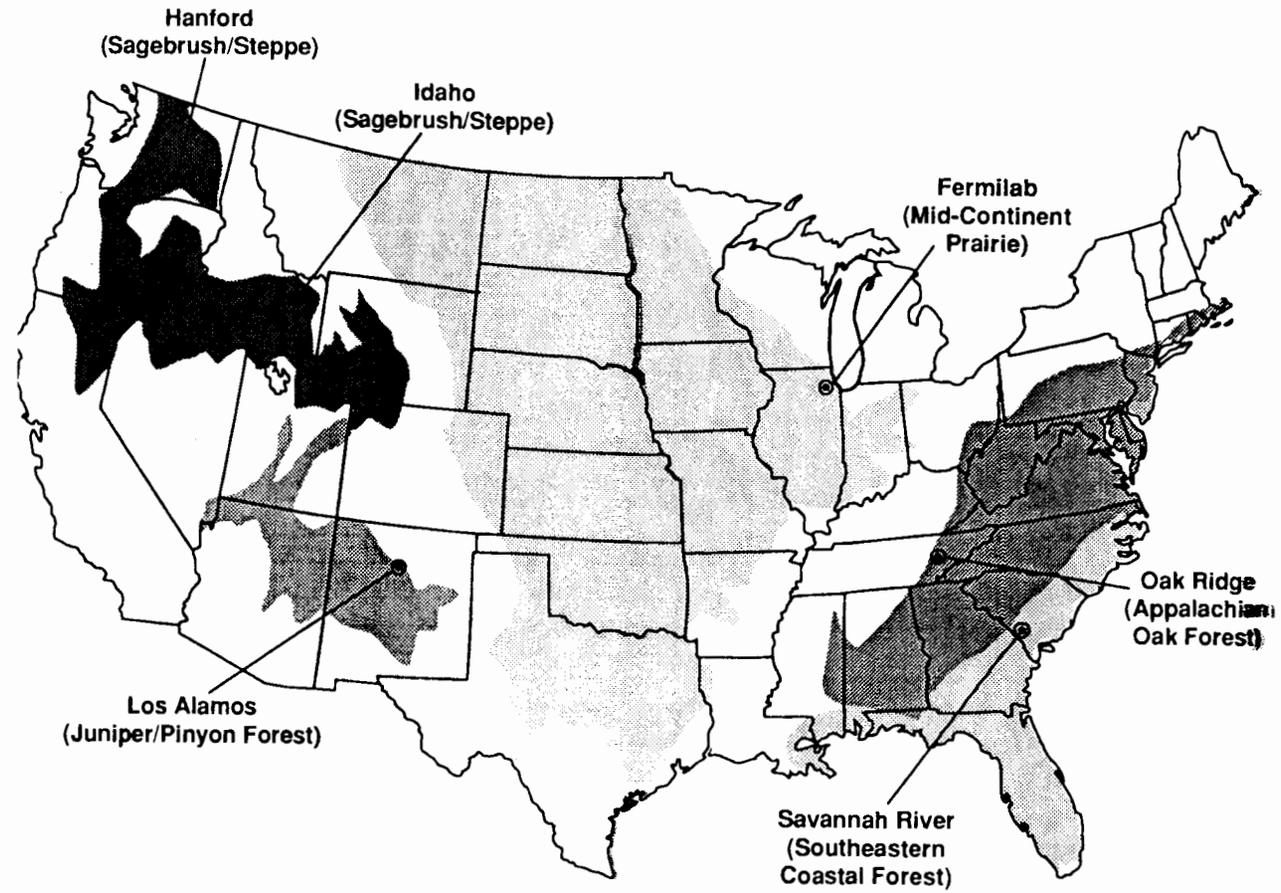


Fig. 1 Sites of the DOE National Environmental Research Parks and associated ecological regions.

activities; (2) develop methods to establish or predict the environmental response to proposed and ongoing activities; and (3) demonstrate the impact of various activities on the environment and evaluate methods to minimize adverse impacts.

There are two Parks in the east. The first, Savannah River National Environmental Research Park at the Savannah River Plant in South Carolina, encompasses 192,000 acres of hardwood forests, swamp forests, and wetlands. It was designated in 1972. The second, Oak Ridge National Environmental Research Park on the Oak Ridge Reservation in Tennessee, encompasses 13,590 acres of oak-hickory and hardwood forests, old fields, grasslands, loblolly pine plantations, eastern red-cedar barrens, streams, and rivers. It was designated in 1980.

Two of the three Parks in the west were established in 1975: the 570,000-acre Idaho National Environmental Research Park at the Idaho National Engineering Laboratory in southeastern Idaho, and the 570-square-mile Hanford National Environmental Research Park near Richland, Washington. The Idaho Research Park supports the biota characteristic of an arid sagebrush ecosystem as well as aquatic systems; the Hanford Research Park encompasses a Shrub-steppe biome (a complex biotic community characterized by the distinctive life-forms of important climax species covering a large geographic area). Unique to the Hanford Park is a 120-square-mile Arid Lands Ecology Reserve for long-term, extensive ecological study. The third Park, Los Alamos National Environmental Research Park at Los Alamos National Laboratory, New Mexico, was established in 1977. It encompasses 27,000 acres of Pinyon-juniper woodlands and grasslands.

Fermilab's Research Park exemplifies distinctive and threatened grassland and oak-savanna ecosystems in the Midwest. Said Paulk, "Adding Fermilab to this network fills a void in a vital and probably most vulnerable part of the country by providing a site for monitoring important environmental trends in these ecosystems." Fermilab is fortunate to have many other kinds of natural and human communities, including agricultural fields, woodlands, fence rows, wetlands, and the Fermilab Village. These habitats are suitable for a wide range of research opportunities, especially in agroecosystem and landscape ecology. Furthermore, 26 archaeological camp and village sites have been identified on-site: **one of these sites, inside the Main Ring, could be eligible for the National Register of Historic Places.**

The Research Park designation for Fermilab applies to the entire 6800-acre site, but certain areas will be off-limits due to accelerator operations or other activities. Even with these limitations, researchers have access to approximately

3700 acres encompassing a variety of ecological systems.

Environmental Research at Fermilab

Several specific areas of research have been proposed for the Fermilab Park. One area of research is to characterize the developing prairie and other systems on-site. Researchers would collect information to build a data base on site meteorological conditions, hydrology, soil properties, vegetation communities, animal populations, and aquatic biota. Another area of research is to establish long-term studies to follow successional changes in the developing prairie and other areas, such as old fields and woodlands. Of special interest to ecosystem ecologists would be combined long-term and short-term studies of these habitats to understand the mechanisms of community developments and changes. Moreover, the prairie restoration project is illustrative of accelerating vegetational succession (where a climax plant community has evolved within decades from human enrichment rather than over millennia from natural forces); studies of this process at Fermilab would also contribute to an understanding of succession.

Although Fermilab lacked official Park designation during the past three years, natural scientists have conducted a number of formal and informal ecological studies on-site. Current research projects include bird surveys by Vicki Byre, an ornithologist from the Chicago Academy of Sciences; insect surveys by Ron Panzer, an entomologist from Northeastern Illinois University; reptile and amphibian surveys by Kenneth S. Mierzwa of the Chicago Herpetological Society; and soil studies by Julie Jastrow from ANL. Researchers typically receive funding from their sponsoring organizations or other resources - the National Science Foundation, for example.

Unique to the Fermilab Park is a six-member Environmental Advisory Committee organized by Lederman. This committee reviews research proposals in a selection process that parallels that of the high-energy physics research program. Committee members, who are specialists in botany, biology, and zoology from across the country, include Paul G. Risser, University of New Mexico; Roger C. Anderson, Illinois State University; Timothy R. Seastedt, Kansas State University; John A. Wiens, Colorado State University; Samuel J. McNaughton, Syracuse University; and Betz. Prospective projects are evaluated in terms of scientific merit, availability of a suitable research site, compatibility with other activities, and potential contribution to the objectives of the Research Park program. The committee then makes its recommendations to Fermilab's Director.

The Benefits of Research Park Designation

Research Park designation will benefit Fermilab, the Park network, natural scientists, and the public in a number of ways. First, Research Park designation demonstrates Fermilab's dedication to protecting vanishing habitats, which will attract support from a broader public who may have been unaware of Fermilab's concern for the environment. Second, Fermilab, as a Research Park, advances the DOE's ambition to establish a continental gradient of Research Parks representing a broad spectrum of ecosystems in the United States. Third, natural scientists will benefit by being a part of the national network of parks. Fermilab's Research Park will attract attention from other researchers, especially those interested in the processes of ecological systems. Commented Byre, "The network will improve the effectiveness of large-scale research because it will help scientists create larger, more comprehensive data bases."

To illustrate, scientists at the Hanford Park in southeastern Washington state are studying Great Blue Heron eggs. The purpose of their research is to monitor the heron eggs nationwide for toxic chemicals. To aid their research, the scientists on the project are corresponding with other Parks home to Great Blue Herons, including Fermilab. The comprehensive, nationwide results of such research could further protect these and other species of birds from hazardous chemicals. "Professional and amateur ornithologists are very aware of the value of the Fermilab site," said Byre.

Fourth, approximately 50,000 people visit Fermilab each year; moreover, Fermilab's site is more open and accessible to the public than most other Parks in the network. This affords Fermilab an excellent opportunity to share with the public the importance of environmental issues in our society. Scientists' research projects could be used to illustrate the efforts to address those issues. Remarked Betz, "Fermilab could significantly contribute to a growing effort in the Chicago area to restore vanishing prairie-savanna communities." Fermilab's Prairie Committee is establishing a restored prairie outside the Main Ring for the general public. **This prairie will have an interpretive trail, accessible to the handicapped, so that people can see, smell, and feel what a prairie is** - probably for the first time. Research Park status will support this and other Lab efforts to heighten public awareness of ecosystem restoration, protection, and preservation.

The Future of the Environmental Research Park Network

Under Conley's direction, the Park network has ambitious but attainable intra- and interpark goals for the future, ranging from gathering baseline data to characterize the natural history of an area - Byre's bird surveys, for example - to developing ecological models that accurately predict the global outcomes of hu-

man pressures on the environment. "I think the possibilities are endless," Conley said.

Fermilab has tremendous potential to help attain program goals. At the intrapark level, Fermilab's Environmental Advisory and Prairie committees have already won Conley's praise for their effectiveness and vision in administering research projects and restoring prairie. To illustrate, the Prairie Committee's updated 10-year plan recommends that specific tracts of restored prairie outside the Main Ring be set aside for manipulative research, including studies of the responses of prairie communities, in various stages of development, to mechanical disturbance, fire, changes in water-table elevation, introduction of toxic materials, selective removal of system components through the use of pesticides, and artificial changes in available nutrients or moisture. This research will expand the ParkNet data base to include information about prairie responses to perturbations.

In addition to manipulative research, Fermilab will begin to enrich older prairie plots inside the Main Ring with plants characteristic of pre-settlement prairie. Plans also call for the reintroduction, where appropriate, of threatened and endangered plants and animals. Examples under consideration for reintroduction include the Spotted Turtle (*Clemmys guttata*), the Barn Owl (*Tyto alba*), the Greater Prairie Chicken (*Tympanuchus cupido*), the Buffalo Clover (*Trifolium reflexum*), the Showy Lady's Slipper (*Cypripedium reginae*), and the Spotted Coral-Root Orchid (*Corallorhiza maculata*). Prior to Research Park designation, the Prairie Committee set a precedent for enrichment and reintroduction efforts by supporting studies that began to characterize the ecological communities on site.

One objective at the interpark level is to conduct workshops at Research Parks and universities for cross-site synthesis. Between July 1989 and November 1989, five topical workshops are scheduled that focus on transects, meteorology, standards, or data-structures; a broad spectrum of topics that Conley refers to as boiler plate; and succession. These workshops, organized by Conley through the Office of Health and Environmental Research, will enable scientists to discuss their research and address world-wide environmental problems, including global warming, acid rain, and endangered species. Conley felt that Fermilab could make an especially significant contribution to the succession workshop because the Lab's prairie restoration project is a chronology of developing plots. This chronosequence reveals the evolution of prairie soils, plants, and soil/plant interactions.

NERPs have demonstrated their value through an inestimable number of published and unpublished papers, species lists, and ongoing and proposed projects.

Fermilab and the other Parks collectively possess impressive resources, many of which remain untapped because of weak links that have afflicted the network in the past. Mindful of that, the DOE is strengthening the Park network and preparing each Park to play a more significant role in ecological research. Said Conley, "All the DOE labs have extraordinary opportunities for ecological research. They also have world-class technology and incredible expertise available; we want to hook them together and extract this expertise. ParkNet is going to grow."

