Fire: A Destructive Force Becomes a Useful Tool

FIRE, FORESTS, and preservation seldom go together. But during the 1960s and '70s, University of Minnesota researchers learned to use fire to preserve and restore natural habitats and encourage the growth of certain tree species.

This seemingly contradictory use of fire was first known to Indians who lived in Minnesota prior to white settlement. They observed that the development of some plant species was favored in areas that were periodically burned.

But with the beginning of white settlement, the role of fire changed. It was used to clear woods and prairie to create farmland. At the turn of the century, during a period of rapid agricultural expansion, a number of historic fires caused by the clearing of land resulted in much loss of life and property.

Because of these incidents, a system of fire management was established to control wildfires and the use of fire in clearing land. This, combined with the clearing of woods and prairie for cropland and the extensive logging of forested areas in Minnesota, resulted in a drastic reduction of natural habitats such as the oak savanna and tree species such as the Norway pine. There was a failure to understand the role fire had played in the past.

Then, about 30 years ago, researchers in Minnesota and around the country started to demonstrate that fire could be useful in wildlife management, preparing forestry sites for planting, and controlling plant diseases. They began to convince the public that fire used in the right place at the right time with adequate control could be a useful tool.

Currently, Experiment Station researchers are continuing to study how fire can be reintroduced into natural habitats and its effect on vegetation. The researchers include Frank Irving and Henry Hansen of the Department of Forest Resources on the St. Paul campus; and Clifford Ahlgren, director of research for the Wilderness Research Foundation in Duluth.

Fire Helps Preserve Remnant of Oak Savanna

Part of Frank Irving's research involves preserving an example of Minnesota's oak savanna habitat. Most of his work takes place in the Cedar Creek Natural History Area in Anoka County, an area that contains a number of natural habitats that were present before white settlement.

"When the first settlers moved into Minnesota," Irving says, "a portion of the land was oak savanna, which is a mixture of grass, grassy openings, plus individual bur oak trees and clusters of these trees. The savanna is the transitional stage between prairie and forest.

"The savanna was the product of frequent fire," explains Irving. "Fires were ignited by lightning or Indians in the spring. These annual fires produced a selective mortality among trees and grasses."

Fires killed thin-barked trees while thick-barked trees, such as the bur oaks with their greater heat resistance, survived. Perennial grasses that grew from their roots every year were also favored. Fire maintained the oak savanna, which eventually develops into a dense oak forest if it is not burned.

However, as settlers converted large tracts of prairie and forest into farmland and the annual spring fires were controlled, the oak savanna habitat became endangered.

"What we are trying to do is to reintroduce fire into this environment so we can come up with a habitat that approaches the conditions which existed before settlement," says Irving.

To accomplish this, Irving has prescribed a series of burns on tracts in the Cedar Creek area to maintain areas of existing oak savanna. He says that preserving a habitat with fire is a slow process because of the time required for the vegetation to come into a dynamic equilibrium with the fire. "When you're dealing with bur oak trees with a life span of 200 years, you just can't hurry them along," he points out.

More immediate results have come from developing the techniques of when and how to use fire in selected areas. "Most burns are conducted in April and May under carefully chosen weather conditions," Irving says. "By avoiding hot, dry, windy days, and burning in the late afternoon, control is relatively simple. Prepared firebreaks and existing road systems provide secure boundaries."

Irving has developed a system of noting the drying weather conditions following the spring snow melt and using spot
weather forecasts to select the days on which to burn.

He believes the information generated from the Cedar Creek study will be useful to other researchers. "There are a number of natural systems within the state which are being restored and maintained. We have already provided information to people in some of these operations from our experiences with fire behavior, the effects of fire, and weather conditions, so they don't have to start from ground zero," he says.

Irving points out that the research isn't costly and serves an important purpose: "I think we have some obligation to future generations to provide them with the opportunity to see a rich variety of habitats including the savanna in Minnesota."

Preparing a State Forest for Future Generations

Paralleling Irving's interest in the use of fire in habitat preservation is the research of Henry Hansen. He is attempting to maintain and restore areas of Norway pine forest in Itasca State Park in northwestern Minnesota.

The park, created by the state legislature in 1891, covers 32,000 acres. Today, some 7,000 acres of the park consists of old-growth Norway pine, which may be one of the largest stands of these trees left in the state. And according to Hansen, the habitat is endangered.

"Extensive logging of the Norway pine occurred before the park was established and a number of fires which spread from nearby farmland destroyed young pine trees. The result is that a large portion of the park is covered by second-growth aspen trees," Hansen explains. "The older Norway pine are now over 200 years old and attrition to wind and insects is increasing along with the danger of a forest fire. Few young pine trees are being established."

A restoration project has been prompted by the legislative mandate that created the park, which states that the original forest should be preserved, and by several studies which showed that park visitors greatly enjoyed viewing the pine stands. The project includes local park and forestry personnel, University researchers, and personnel from the Department of Natural Resources.

"In the natural process, fires would burn periodically in this area," Hansen explains. "Sometime during the life span of the Norway pine, a fire would have controlled the growth of brush and coincided with a year of good seed production. With the right weather conditions, a new growth of young pines would be produced. But with the logging and the need for fire control in the state, this process was interrupted."

Project members are trying to telescope the process of establishing young pine trees down to a few years. A tract of 5,000 acres in the park was set
aside for restoration over a 15-year period.

"The first part of the restoration involves clear cutting and logging of aspen from parts of this area," says Hansen. "Fire is now used to control the growth of brush and new aspen trees which formerly were sprayed with herbicides. After clearing the land, a new stand of Norway pine is planted.

"We are learning what combination of logging, burning, seeding, and planting is necessary to restore Norway pine to the forest. The methodology developed should begin to restore some of the vegetation in the park to its original condition and may serve as a model for other natural areas in the state."

Hansen and his colleagues have been successful in converting smaller tracts of aspen stands to pine. But along with success have come a number of setbacks. A severe drought in 1976 wiped out a particularly promising growth of young pine. Deer and the continual growth of brush have also been major obstacles in establishing plantings.

"Without some kind of continuing habitat management, there is a possibility that we will lose this particular pine forest," observes Hansen. "The stage is set for some major catastrophe to happen to these old pine trees and the day when they are gone may not be too far off."

**Human Intervention May Prevent Re-establishment of Pine Forests**

Hansen’s concern for the regeneration of the Norway or red pine is shared by Clifford Ahlgren. In research conducted in the Boundary Waters Canoe Area and Quetico Provincial Park, Ahlgren found that the red pine may no longer be able to reproduce naturally because of man’s intervention.

"Due to extensive logging of the trees during the early 1900s along with uncontrolled fires," Ahlgren says, "the huge seed supply needed to maintain the red pine forest is no longer available. Red pines have gradually been reduced because of modern conditions which have negatively influenced its seed source and seedbed plus the competition from other trees following a fire.

"In wilderness or natural areas, the ideal management is seemingly to let nature take its course," he says. "If the reproductive capacity of species were not influenced by the impact of civilization, nature could be effective."

Ahlgren points out that permitting wildfires to burn or using prescribed burns on standing timber can aid in perpetuating the aspen-spruce-fir complex or restoring jack pine and black spruce stands, but not red pine.

"Such species as the red pine cannot be restored by natural means to the position they represented in the forests of the past. If their perpetuation is desired, knowledge of their reproductive requirements must be applied to current conditions," Ahlgren says. "When managing forests, the choices are to establish forests resembling the primeval stand through man’s effort or permit the development of forests by natural means in which other species predominate."

In the 1980s, the researchers will further examine the use of fire in managing natural habitats. Their work will benefit Minnesotans of the future. For as Frank Irving emphasizes, "What we’re talking about is preserving small samples of unique and historic habitats because life would be poorer without them."

—Greg Doerning
Above: Beardtongue or large-flowered penstemon, an indicator of prairie vegetation, blooms on the oak savanna after a series of prescribed spring burns designed to thin understory species such as hazel, pincherry, chokecherry, and juneberry.

Opposite page: In the Cedar Creek Natural History area, a strip fire is started with a gasoline-oil mixture.

Above: Fire moves up the bark of paper birch in a controlled burn in Itasca State Park. Logging and repeated burning help eliminate second-growth stands of birch and aspen and prepare the area for the successful establishment of young red pine.

Left: These red or Norway pine in Itasca State Park are 150-200 years old. As they mature, more and more will fall prey to wind, insects, and diseases. To ensure that future generations of Minnesotans will be able to enjoy such pine forests, scientists are learning how fire can aid in establishing replacement stands of young pine.