Field Instruction in Prescribed Burning Techniques at the University of Minnesota

FRANK D. IRVING

University of Minnesota

SPRING fires have been used on the Cedar Creek Natural History Area in Anoka County, Minnesota, since 1964 to restore and maintain about 500 acres of natural habitat for scientific and educational purposes. In the six spring burning seasons from 1965 to 1970, a total of 108 seniors majoring in forestry or wildlife management have earned academic credits by participating in burns covering 1,245 acres which were conducted on 19 dates.

This paper describes the area which is being managed by fire and outlines the procedure used to adapt this effort for educational purposes.

The Cedar Creek Natural History Area has a total area of about 4,500 acres and is administered by the University of Minnesota and the Minnesota Academy of Science (Marshall, 1968). Under the leadership of Dr. William H. Marshall, Director of Field Biology and professor of wildlife management, a decision was made in 1963 to initiate a program of systematic prescribed burning on a portion of this area to compensate for the influence of effective forest fire protection which had essentially excluded wildfire as

an ecological factor (Marshall, 1964). This selected area, which is now being expanded to 800 acres by the acquisition of privately owned tracts, is on the Anoka sand plain about 30 miles north of Minneapolis. It has sandy upland soils and shallow peat over sand on the poorly drained lowland.

The major upland cover type on the fire managed area is a mixed oak forest similar to the xeric forest of southern Wisconsin (Curtis, 1959). Hill's oak (*Quercus ellipsoidalis*, E. J. Hill) and bur oak (*Q. macrocarpa*, Michx.) contribute approximately 110 and 23 square feet of basal area per acre respectively to the mixed oak stands which cover 60 percent of the unit. Old fields with a thin stand of June grass (*Poa pratensis* L.), little bluestem (*Andropogon scoparius*, Michx.), big bluestem (*A. gerardi*, Vitman) and other grasses and forbs cover 25 percent of the area. The remaining 15 percent is marsh with cattail (*Typha latifolia*), *Carex spp* and associated lowland plants. The history of land use before purchase included grazing, wood cutting, farming and burning. Before settlement, the original vegetation undoubtedly was similar to the oak openings described by Curtis (1959). Complete protection from cutting, grazing, and fire has allowed a heavy understory dominated by hazel (*Corylus americana*, Walt.) and other shade tolerant hardwoods to develop (Fig. 1).

To restore these oak stands to an approximation of the savanna recorded by early travelers (Fig. 2), the Cedar Creek prescribed burning unit has been divided into 14 compartments which vary from 10 to 80 acres in area. Where roads or truck trails were not available for compartment boundaries, a tractor and disk constructed narrow fire breaks. The following treatments are being tested:

1. Annual burn
2. Two burns—one year rest
3. Two burns—two years rest
4. Three burns—three years rest
5. Four burns—two years rest
6. One burn—five to eight years rest
7. Control (no burn)

Surface fuels now vary considerably within compartments reflecting present cover types, past land uses, topography, and recent

FIG. 1. A dense hazel understory in an unburned oak stand.

fire history. After the first burn in each compartment, the surface fuels are generally light (oak leaf litter in the woods and cured grass in the fields).

In the six spring seasons from 1965 to 1970, class size has varied from 4 to 32. The students who registered for problem credit were seniors. All of the forestry majors had had some classroom and field instruction in fire control, and many of them had had limited fire control experience while on summer jobs. The wildlife students were also seniors, but few had received any classroom instruction in fire and few had job experience which exposed them to fire control tools and methods. Since this course was offered on an elective basis, only students with interest and curiosity registered. When asked why they wanted to participate, most indicated that they wanted to learn how to handle fire so they could use it in their future careers as land managers.

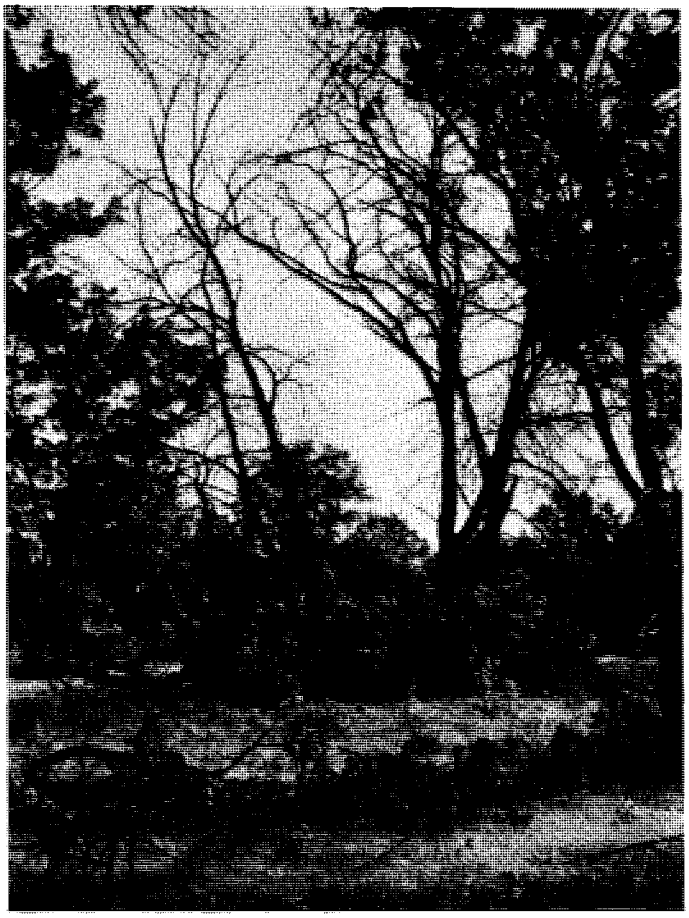

FIG. 2. Fire mortality has reduced the density of burned oak stands.

Experience has evolved the following approach: During the first week of the spring quarter, the class assembles for a briefing session in which the objectives and methods of burning at Cedar Creek are explained. Each class is divided into four crews and crew assignments are made for each compartment to be burned. When a crew is assigned to *fire behavior* they take weather observations, compare observed values to those forecast earlier, and watch changes in rate of spread, fire intensity and smoke characteristics. The *ignition* crew handles the firing, *under the guidance of the instructor.* The *holding* crew, using hand tools, suppresses any spotfires or cross-overs. The *patrol and mop-up* crew watches the cool sectors of the perimeter as firing progresses and puts out special hazards near the line which might produce a spotting problem if the wind increases before they burn out.

The instructor follows the fire weather and fuel conditions until satisfactory conditions for burning develop. Fire danger data from the Carlos Avery district office of the Division of Lands and Forestry, Minnesota Department of Conservation (6 miles southeast of Cedar Creek) are used for this decision. Burns have been conducted in the buildup index (Nelson, 1964) range of 7 to 32. Higher values would be acceptable, but they have not occurred during the seasons when the classes were ready to burn. Fires have been started with wind velocities as high as 20 mph, but the 8-12 mph range is preferred. Early season fires commonly begin with air temperature in the 50° to 65° F range and later fires with 70° to 85° F. Relative humidity at ignition has ranged from 25 to 45 percent, but 30 to 40 percent is preferred. By taking advantage of the variation in fuels and selecting different burning conditions and herbaceous stages it is possible to demonstrate a wide range of fire behavior.

To avoid conflicts with part-time job commitments of students, burns are not scheduled on weekends. Fridays are used only when time is running out near the end of the spring quarter. By using only 4 days per week, the 5 week season is reduced to only 20 possible days for burning; and unfavorable weather generally reduces this to from 3 to 8.

When conditions appear to be satisfactory for a burn, a weather forecast is requested from the Minneapolis office of the Weather Bureau, Environmental Science Services Administration. Crew leaders are informed before noon, and the crews assemble in the field at 4:30 PM to draw equipment and discuss the plan.

Mr. Alvar Peterson, resident manager of the Cedar Creek Natural History Area, prepares the hand tools (fire rakes, shovels, back pack pumps, and swatters) and is present during each burn with a wheel tractor equipped with a pump and pulling a trailer with water barrels and extra hand tools. Mr. Peterson also obtains the necessary burning permit and assumes responsibility for patrol and mop-up after the crews are released.

When the tools have been distributed and the crews briefed, ignition begins with a test fire on the lee side in a corner of what will become the base line (Fig. 3). If the test fire behaves satis-

factorily, the base line is backfired (Fig. 4) and a narrow strip head fire is set. During this phase of the operation, the ignition crew is expected to watch the fire behavior and coordinate its action with the holding crew. The width of successive strip head fires is adjusted to the existing wind and fuel conditions (Fig. 5). Since the usual class size in recent years has provided two or three times the number of people needed to handle a burn safely, students on all crews have a chance to observe and interpret the influence of fuel and weather variables on fire behavior.

The holding crew generally has very little to do *if* the ignition crew is doing its job well. However, some weak spots in the fire breaks, occasional wind shifts, and excessive strip widths with head fires can produce problems. When a spot fire occurs, the nearest member of the holding crew takes direct action and calls for help if needed. The holding crew follows the progress of ignition and reacts to the fire. Whenever possible, the members of the holding crew are encouraged to examine the compartment before the date of the burn to inspect the lines and identify fuel problems (inside and outside of the burn) which might require special attention.

The patrol and mop-up crew watches the base line until it cools down, then takes over the flanks as firing progresses (Fig. 6). Whenever smoke reduces visibility on roads, members of this crew station themselves on the road and warn motorists. They also answer questions about the burn. (This is one important way to reduce negative public reaction to burnings.) The mop-up effort is usually limited to a few spots close to a fire break, such as hollow standing trees or stumps which might provide brands for spot fires. All crews are generally released by 9 PM and are often finished by 7 PM if only one compartment is burned in an evening.

Several features of this instructional effort appear to contribute to its success:

1. A broad objective of burning, a flexible fire prescription, and a relatively long spring fire season makes it possible to schedule three or four burns in spite of schedule conflicts and other restrictions.
2. The burn compartments are large enough to include signifi-

FIG. 3. Each burn starts with a test fire.

FIG. 4. The base line is backfired to produce a wide safety strip.

FIG. 5. Several strip head fires burning simultaneously speed up ignition.

FIG. 6. When the fire cools down, patrols extinguish fires near the line which might throw brands.

cant variation in fuel types but small enough to be burned in about 1 hour.

3. The natural area maintenance objective requires repeat burns and allows the accumulation of experience with individual blocks.
4. The fuel and weather conditions involved are safe enough to allow the use of bad examples as a teaching technique.

This effort is designed to introduce future land managers to the tools and techniques of prescribed burning. It stresses simple concepts and reinforces these through field application and repetition. The brief written reports and evaluations received from the students suggest that they obtain some knowledge of fire use as well as some elementary skills. These evaluations also indicate positive attitudes toward fire use and the associated problems. As with any instructional effort, however, the final measure of success has to be the performance of the students, and time will provide this measure.

LITERATURE CITED

Curtis, J. T. 1959. The vegetation of Wisconsin. Univ. Wis. Press, Madison, 657 pp.

Marshall, W. H. 1964. Cedar Creek Natural History Area, 1963. Minn. Acad. Sci. Proc., Vol. 31, (2):130-134.

Marshall, W. H. 1968. The Cedar Creek Natural History Area: A Progress Report. J. Minn. Acad. Sci., Vol. 35 (1):57-60.

Nelson, R. M. 1964. The national fire danger rating system: Derivation of spread index for eastern and southern states. Southwestern Forest Expt. Sta., U. S. Forest Ser. Res. Paper, SE-13, 44 pp., illus.