Comparison of Fire, Herbicide, and Sod Removal to Control Exotic Vegetation

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Restoration of native vegetation is one of the top management priorities of Indiana Dunes National Lakeshore (IDNL) (Hiebert 1990a). However, dominance of exotic vegetation often hinders the native vegetation restoration in razed residential sites within the IDNL boundary (Hiebert 1990b). Thus, the removal of exotic vegetation is critically important for a successful restoration (Choi and Pavlovic 1993). Although there have been some suggestions for controlling exotic vegetation (Hiebert and Pavlovic 1987), the effectiveness and ecological consequences of such suggestions are still inconclusive (McEachern 1991). The purpose of the project described here was to study the effectiveness of three treatments (prescribed burning, herbicide application, and sod and topsoil removal) in discouraging exotic vegetation and encouraging the growth of native vegetation on razed residential sites located on xeric sand dunes.

In August 1992, 24 8-m by 8-m experimental plots were established in three residential sites. Cover of exotic species (pretreatment data) was estimated using a point contact frame (Barbour et al. 1980) in August 1992. In May 1993 these plots were randomly divided into four groups, six plots for each group. The first six plots, the control group, were not subjected to any treatment. The second, third, and fourth groups were assigned to fire, herbicide, and sod removal treatments, respectively. The fire plots were burned at ground temperatures ranging from 120°C to 315°C. Each herbicide plot was treated with 1.6 L of 24% Roundup — a mixture of 1 part Roundup and 5 parts water. All sod and topsoil were removed, ranging from 10 cm to 80 cm in depth, from each sod removal plot. Post-treatment vegetation data were collected in August 1993 using the method applied for pretreatment data collection.

Prescribed burning has been suggested as a control method for some exotic herbaceous species (Olson 1975, Apfelbaum and Rouffa 1983, Cole 1991). In our study, fire did not discourage the exotic vegetation. Three months after burning, mean ground cover of Kentucky bluegrass (*Poa pratensis* L.) increased from 57% to 73%, and quackgrass (*Agropyron repens* [L.] Beauv.) decreased slightly, from 74% to 60%. These changes were not much different from those recorded in the control plots (bluegrass 59% to 80% and quackgrass 81% to 70%). Unless it is repeated, burning is not likely to be an effective method for controlling such exotic species as bluegrass or quackgrass. Although fire destroys the aboveground vegetation, it also likely stimulates vegetative reproduction from the underground rhizomes of these exotic species.

Herbicide was very effective in reducing the cover of bluegrass from 84% to 1% and quackgrass from 74% to 9%. Similar results have been reported with other exotic species (Bingham et al. 1980, Marquis et al. 1984, Nuzzo 1991). Although herbicide could eliminate most of shallow-rooted grasses and forbs, some roots, rhizomes, seeds, and other propagules of exotic species were probably still viable in the topsoil.

Although there are several reports on the mechanical removal of exotic plants (Fawcett 1980, Kline 1986, Nuzzo 1991), the removal of entire sods and topsoils has not been reported in the literature yet. In our experimental plots, the removal of sods and topsoils reduced the cover of bluegrass from 62% to 3% and quackgrass from 71% to 2%. Although this method

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includes a potential risk of removing seed banks of native species, newly establishing native species could be benefited by (1) growing on the sandy and relatively infertile substrate — a natural characteristic of the Lake Michigan sand dune ecosystems, and (2) avoiding potential competition with existing exotic plants.

Generally, herbicide treatment and sod removal were more effective methods than burning to control exotic vegetation, especially bluegrass and quackgrass, in our experimental plots. However, some new exotic species, including crabgrass (*Digitaria sanguinalis* [L.] Scop.), filled the gaps left by bluegrass and quackgrass in several plots (up to 53% ground cover). These new exotic species, as well as the sprouts from viable roots, rhizomes, seeds, or other propagules, may become a major obstacle in the restoration of native vegetation in the next few years.

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