

## Forest Thrives In Sludge Application Tests

A six-year, state and federal research-demonstration project to recycle treated municipal wastewater sludge on forest lands has resulted in dramatic growth increase of trees, groundcover and wildlife populations.

The Forest Service's North Central Forest Experiment Station of the U.S. Department of Agriculture did some initial sludge application research on the Manistee National Forest during the late 1970s. Encouraged by the findings of that research, the U.S. Environmental Protection Agency (EPA), Michigan Department of Natural Resources (DNR) and the Departments of Forestry and Fisheries and Wildlife at Michigan State University initiated the \$1.1 million, cooperative six-year project in 1980.

Annual production of wastewater sludge across the country has increased from 4 million tons in 1970 to 7 million tons today as the result of population and industrial growth and laws requiring higher treatment standards at the nation's 15,378 wastewater treatment facilities. Most of the 223,000 dry tons of wastewater sludge generated each year in Michigan by municipal and industrial wastewater treatment facilities is applied on farmland to improve soil fertility and increase crop productivity. The researchers set out to determine the effects of sludge recycling on forest lands in northern Michigan, where less farmland is available.

During the fall of 1981 and spring of 1982, nearly 1 million gallons of liquid wastewater sludge—similar to crude oil in odor and appearance—was trucked from wastewater treatment facilities in Alpena and Rogers City to the Mackinaw State Forest in northern Montmorency County, where it was sprayed evenly over the forest floor. Chemical tests of both sludges showed them to be good sources of nutrients, containing low to moderate levels of trace elements. Approximately 4 dry tons of sludge solids per acre were applied on 12 specially prepared 3.8 acre plots, resulting in substantial loadings of nutrients and trace elements.

Following the sludge applications, significantly increased levels of nitrogen and phosphorus were found in the foliage of dominant trees. The effect was observed within one year of application and persisted for at least three growing seasons. Tree growth in the test areas increased 48 percent for aspen, 58 percent for oak, 38 percent for pine and 58 percent for northern hardwoods. Aspen biomass increases as high as 57 percent led to speculation that sludge application could be economically beneficial to Michigan's forest industry. Researchers estimated that repeated sludge applications—such as once every five years on the same site—could increase timber growth in oak and similar forest types by as much as 15 cubic feet per acre per year.

All nitrate-nitrogen levels in groundwater at a depth of 10 to 28 feet beneath sludge fertilized sites remained well below the 10-milligrams-per-liter EPA water quality standard. Soil water monitored at a depth of 4 feet showed that temporarily elevated nitrate concentrations were too small to alter the quality of local groundwater resources.

Annual production in vegetation growing under aspen increased by 200 percent within one year of sludge application, with similar but smaller increases under oak, pine and northern hardwoods. Protein and phosphorus increases of 20 to 50 percent were measured in wildlife forage plants on sludge fertilized areas, highlighting their importance as sources of nutrients needed to maintain wildlife health and promote population growth. Overall improvement in habitat structure and forage nutritive quality increased populations of small mammals and use of browse by deer and elk.

Bioassays of plant and animal tissues collected from sludge fertilized sites and laboratory food chain studies indicated only minor, non-significant accumulation of toxicants that would not be harmful to forage plants, wildlife or humans. Even results from laboratory studies using

sludge from the highly industrialized Detroit wastewater treatment system yielded only minor accumulations of trace elements similar to those found in free-ranging small mammals in the forest.

Application of sludge on forest lands links the essential environmental need to abate water pollution with attractive land management opportunities to increase timber production and enhance wildlife habitat. Its beneficial use has helped change the emphasis of sludge management programs in Michigan from landfilling a nuisance waste to recycling a valuable byproduct.

A detailed summary of project results, "Sludge Fertilization of State Forest Land in Northern Michigan," will be published this month by the EPA Great Lakes National Program Office. Copies may be obtained from Dr. Dale Brockway, Forest Soil Scientist in charge of the project. Contact him at the DNR Land Application Unit, Box 30028, Lansing, MI 48909, 517-373-8750.

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## Forest Conference Report Available

The Report and Proceedings of the 1987 Great Lakes Governors' Conference, *The Lake States Forests, A Resources Renaissance*, has been released and is available to the public.

The conference was held in Minneapolis last year to broaden the public's understanding of the forests and their potential, to seek consensus on regional forest policies and programs, and to develop an action program for regional cooperation.

Copies of the Report and Proceedings are available by writing to the Lake States Forestry Alliance, 285 Metro Square, St. Paul, MN 55101.