

Huron-Manistee National Forests  
Cadillac-Manistee and Baldwin/White Cloud Ranger Districts  
Wexford, Manistee and Oceana Counties, Michigan

Dr. Donald R. Zak and Dr. Ines Ibanez of the University of Michigan have requested a special use permit to continue research on National Forest System lands. The research is on production and cycling of dissolved organic nitrogen through forest ecosystems.

The research activity would include the following:

- i) continue non-destructive ecological inventories in several forest stands located in the Manistee National forest
- ii) establish seed traps in existing sites to better understand the dispersal of tree propagules as climate changes
- iii) continue experimental atmospheric nitrogen deposition treatments in two previously established sites (Oceana and Wexford), which are part of a long-term ecological research program funded by the National Science Foundation

**Ecological Inventory** – In each research site (listed in table below) they will measure the diameter and height of each tree located in six, previously established research plots (30m x 30m).

In two research sites (Wexford and Oceana), they will annually collect samples of forest floor in three randomly located subplots (30 cm x 30 cm) in each research plot.

Dr. Zak has previously located and maintained four 0.5 m<sup>2</sup> leaf litter traps in each 30m x 30m research plot as well as a series of lysimeters to collect soil water leaching below the root zone (Wexford and Oceana).

From all research sites, they routinely collect soil samples (5-cm diameter and 10-20 cm deep) to quantify soil nutrient pools and microbial processes.

It is a primary purpose to maintain the ecological integrity of these research sites in order to better understand forest dynamics and how they will respond to a changing environment. Inasmuch, our sampling regime is specifically designed to never compromise this important goal.

The research sites are located as follows.

Site Name	Longitude	Latitude	Township/Range	County
MST3	86°10'38.208"	44°15'51.3"	Sec 31, T22N, R15W	Manistee
MST58A	85°53'49.74"	44°18'35.928"	Sec 9, T22N, R13W	Manistee
MST58B	85°53'42.18"	44°18'41.8"	Sec 9, T22N, R13W	Manistee
MST24	85°45'18.54"	44°13'24.12"	Sec 10, T21N, R12W	Wexford
MST7	85°40'24.6"	44°11'31.62"	Sec 29, T21N, R11W	Wexford
MST56	85°42'36.66"	44°16'35.28"	Sec 25, T22N, R12W	Wexford
MST22	85°42'25.32"	44°22'16.74"	Sec 24, T23N, R12W	Wexford
MST41	85°28'54.3"	44°20'49.8"	Sec 35, T23N, R10W	Wexford
Jack Pine	86°00'50.86"	44°14'1.53"	Sec 9, T21N, R14W	Manistee

Wexford	85°50'0.93"	44°22'32.63"	Sec 24, T23N, R13W	Manistee
Oceana	86°8'41.13"	43°40'18.75"	Sec 19, T15N, R15W	Oceana

**Long-term monitoring of tree species recruitment** – in four previously established research sites (indicated below), they will initiate long-term monitoring of tree species recruitment by assessing seed rain and seedling recruitment.

In each stand, they will establish 15 seed traps to collect seed rain. Traps will be 10m apart in three rows (five traps per row) lined up 20 m from each other. Seed traps are built out of 42 cm diameter metal rings with screening attached to them. Traps will be emptied three times a year. Next to each trap they will set up 2m x 1m plots (marking the corners with thin wood posts) to record seedling recruitment data each year. To measure the specific environmental conditions at each site they will install two soil moisture sensors, a temperature data logger and a light sensor at the center of the stand, they will download the data every summer.

The research sites for the Long Term Monitoring are as follows.

Site Name	Longitude	Latitude	Township/Range	County
MST58B	85°53'42.18"	44°18'41.8"	Sec 9, T22N, R13W	Manistee
MST24	85°45'18.54"	44°13'24.12"	Sec 10, T21N, R12W	Wexford
MST56	85°42'36.66"	44°16'35.28"	Sec 25, T22N, R12W	Wexford
Jack Pine	86°00'50.86"	44°14'1.53"	Sec 9, T21N, R14W	Manistee

**Continuation of Simulated Atmospheric Nitrogen Deposition Treatments** – The Oceana and Wexford research sites are part of the Michigan Gradient Project, which was designed to understand the influence of future rates of atmospheric nitrogen on the dynamics of sugar maple-dominated northern hardwood forests in the Upper Great Lakes region.

At the Oceana and Wexford sites they will simulate atmospheric nitrogen deposition by adding 3 grams of nitrogen per meter square in equal increments over the growing season. The treatment is applied as dry pellets of sodium nitrate, which are broadcast over the forest floor of three 30m x 30m plots in the Wexford and Oceana sites.