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AMANDA MCCOY • The State News

Field Technician Kate Bonnema injects water samples taken from the plots of land that are part of the Kellogg Biological Station Long Term Ecological Research into bottles for testing. The research site, funded by the National Science Foundation, studies the long term affects of agriculture on ecology.

By AARON JOHNSON
The State News

Hickory Corners - On a March morning, a small, green all-terrain vehicle moved over a field that usually is home to crops.

Remnants of last year’s wheat are still visible, but the only green perceivable lay between dead shoots.

The vehicle’s driver stopped at a square cooler dug into the ground and with a soft pop, Yuliya Golod pulled the top off a flask hidden in the box.

For the previous 24 hours the flask had been hooked up to a lysimeter - a device that pulls up water from about a meter under the plot and moves it for storage in the flask.

She placed the flask in a cardboard box along with flasks from other plots on the site.

“Very little’s coming out,” she said.

Later in the day, Golod and her fellow field technicians would filter the water inside the flask and determine the concentration of nitrate, ammonia and other compounds - the first such analysis of the year.

She’ll collect flasks again in April. The flasks will then be collected once every two weeks through December.

The data will give researchers information into what has been moving through the soil and what ultimately will be feeding the corn crops that will grow there this summer.

Last year at this time, Golod was sitting in a classroom, but after graduating from MSU in December she began work at the Kellogg Biological Station Long-Term Ecological Research Site.

The site, run by MSU, consists of many fields planted with various crops and subject to different treatments.

Workers at the site have made the same analyses Golod made on the water for 14 seasons in an attempt to develop data from the soil, crops and air around the fields to provide insight into what makes farmlands work.

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Researchers can then use the data for comparisons to the same data at other sites or data taken from the site up to 14 years before to determine what effect different farming practices have on the environment.

The roots

The Kellogg Biological Station is one of 24 sites across the nation funded by a National Science Foundation grant to examine ecological processes over time.

The program started in 1980 with six sites representing different biomes or biological systems.

The North Temperate Lakes Site near Madison, Wis., for instance, specializes in lakes, using 11 lakes to examine how a lake's properties, such as algal composition, acidity and nutrients, change over time.

"We characterize the water quality, the aspects of lakes, by doing those routine measurements - but we also look at the land around the lakes," Wisconsin site director Tim Kratz said.

But despite each site's particular questions, the science foundation's annual $700,000 grant provides researchers the necessary funding that allows data to be collected during a time when a normal research project wouldn't be allotted.

"There's a lot of things that happen in nature that happen longer than the normal three-year grant," said Henry Gholz, director of the long-term ecological research at the science foundation.

Sites are required to reapply for the ecological research grant every six years - double the normal grant cycle - and are evaluated by the science foundation in the middle of each grant cycle.

The evaluators examine the sites' work in five core areas - net primary production, biogeochemical cycling, disturbances, biodiversity and carbon and organic matter.

Down on the farm

Beyond the science foundation's requirements, each site is free to pursue its own interests, which for MSU means farming.

The Kellogg site, entering its 15th season this summer, is the only site to focus on agriculture.

"We pretty much represent the northwestern, central Midwest," project manager Andrew Corbin said.

The site cyclically grows three primary crops - corn, soybeans and wheat. Researchers grow poplar and alfalfa on other sections of land. Interspersed among the sections of crops, researchers allow other fields to grow wild, which they burn every other year.

"With those we're asking what would happen if you stopped farming, and how does that affect the soil profile and soil nutrient cycle?" Corbin said.

Each crop is then separated into several different treatments - conventional farming plots and no-till plots, which are fields that aren't plowed before each planting. Another treatment reduces chemical inputs and a winter cover crop of clover and a fourth treatment receives no chemical inputs.

The variety in treatments mimics the rangepractices used by farmers, which allow researchers to collect and compare data on each type of practice to determine the differences of each practice on the land.

Each treatment is replicated throughout the site in plots one hectare - which is about 2.5 acres - in size, a large size compared to most studies, Corbin said.

“In most studies, you’ll see an entire study in a hectare,” he said. “You won’t see research plots this size anywhere.”

In each plot, Corbin and his crew take the samples necessary to keep within compliance with the science foundation grant’s core goals.

Such samples include taking water from underneath the field, taking soil samples, sampling the plants themselves and gas samples from around the plants.

Corbin has a crew of three field technicians and one permanent lab technician, but the crew is always a year behind on the data because of the large amount of sampling required.

“Just keeping track of all the samples is a job in itself,” he said.

Taking shape

After all the hours needed to keep up with the work, researchers have a collection of data that they can compare from previous years’ samples.

“That’s the beauty of long-term sampling,” Corbin said. “You can go back 10 years and look at what it was like then.”

All of the data is made available to the public for future studies, but Corbin said other scientists will likely benefit most in their private studies.

Each hectare plot has small microplots set aside for individual research, many of which are conducted by MSU professors and graduate students.

“There’s all kinds of papers that come out of this,” Corbin said. “That’s the idea, to get as much information out as possible.”

One such paper, researched by MSU crop and soil science Professor G. Philip Robertson, examined the effect of different farming practices on global warming.

The study, which was published in 2000, took advantage of the site’s agricultural practices and past data.

Robertson, who is on sabbatical in China, looked at each treatment’s contribution of greenhouse gases.

“It surprised us to find out that even our low- and no-input systems, there was still a fair amount of greenhouse gas emission from them,” said plant biology Professor Katherine Gross who works with Robertson.

But the data, collected during 10 years, did show that the fields allowed to grow wild not only had reduced gases, but could essentially take gases such as carbon dioxide, methane and nitrous oxide out of the atmosphere.

“So that sort of spun off some interesting ideas about ‘What if you set aside some land and actually measured carbon?’” Gross said.

The fruits of labor

While the initial six long-term ecological research sites focused on purely ecological experiments, the agricultural focus of the Kellogg Biological Station is part of a growing trend in the network to focus more on human impact and practical issues.

Two of the newest sites, located in Phoenix and Baltimore, focus on urban areas as ecological systems.

Additionally, the science foundation has pushed other sites to incorporate social issues in their studies.

The Kellogg Biological Station site was evaluated by the science foundation last summer. After the evaluation, the science foundation told investigators to work on two areas - one of which involved the application of the data to farms.

“That’s a new thing for us, so we knew we had to work on that,” Gross said.

The site itself doesn’t directly deal with farmers, but deals with MSU Extension agents who talk with farmers and often take them on tours of the site.

Some of the research does extend directly to agricultural affairs such as the global warming study, which recommends the growth of trees around crops to soak up carbon or to persuade farmers to just allow their fields to grow wild.

“Could farmers in Iowa get paid to pull their land out of agriculture?” Gross said.

But Gross said the real application often involves examining practices already used by farmers.

For instance, cover crops are widely used in the winter, but their actual impact is not known, Gross said.

“They often don’t know why the system works the way it does, it just does,” Gross said.

“And that’s not bad, but it’s like, scientifically, you wonder why.”

But ultimately, Gross said, the goal is to change farmers’ outlooks and not just recommend specific management practices.

“The focus is on trying to understand a corn field and a poplar plantation the same way you might want to say, ‘How does the Arctic tundra work or make the coastal marsh have the kind of composition and diversity it has?’” she said.

Instead of just telling farmers not to use as many pesticides, Gross said it may be more beneficial to offer an alternative.

“Our group has as its hypothesis trying to understand these systems as ecological systems so you can manage the biology as opposed to the chemistry,” she said.

Aaron Johnson can be reached at john1187@msu.edu.
