



On the Beach: Underground Secrets of the Lake Superior Shoreline

By Declan Spring

The research team lead by Harry Jol, a professor of geography at the University of Wisconsin-Eau Claire, spends a lot of time on the beach. But for the most part, Jol and his fellow researchers steer clear of the scenic kind sought by tourists, favoring instead the ancient beachlines so



covered with pines, blueberries and other vegetation that you'd be hard pressed to find a spot bare enough to put up an umbrella or lay down a towel. These forays are undertaken to help scientists understand the ages of ancient sandy deposits along the Lake Superior shoreline.

The deposits of sand formed when the lake's water levels were much higher than they are today. Now several hundred feet inland, these sandy ridges mark the spots where thousands of years ago, Lake Superior's waves were lapping onto solid ground. Working with Walter Loope from the U.S. Geological Survey and Walter's son, Henry Loope from the Indiana Geological Survey, Jol is beginning to illuminate the history of changing lake levels and effects of changes in the climate.

The three primary researchers have collectively spent hundreds of hours on the shorelines within the Huron Mountains, going inland even beyond Ives Lake. When out in the field, they carry and use devices called ground penetrating radar

(GPR). The GPR system uses two antennae: the transmitter sends electromagnetic signals or waves into the ground while the receiver collects the returning signals or waves that reflect off "subsurface strata." On their backs, researchers carry packs with computers that record the resulting images of what's underground. The images can be viewed in real time as the work proceeds.

"In determining the stratigraphy, the layering and the geometry of coastal sand deposits along Lake Superior, we're looking closely at various shoreline processes," says Jol. "We are creating a continuous record of the coastline from five or ten thousand years ago up to the time we're living in now."

HOW TO FIND THE ANCIENT BEACH RIDGES

Even without expensive equipment, it's possible to see the rise and fall of old beach lines as you move inland (south) from the current shoreline. A good place to experience the scale of the vast glacial lake that preceded Lake Superior is on the Roller Coaster Road. This is a wide dirt path that runs perpendicular to the western end of the cabins of the Huron Mountain Club. On the Roller Coaster Road, every rise you pass over—and there are many—marks a line where the water level once was. Each small valley is the result of a slope where dry land transitioned into the bed of the lake.

Without geological forces pushing the sand around, the up and down effect of the Roller Coaster Road wouldn't exist and the road would have had to have been called something else.

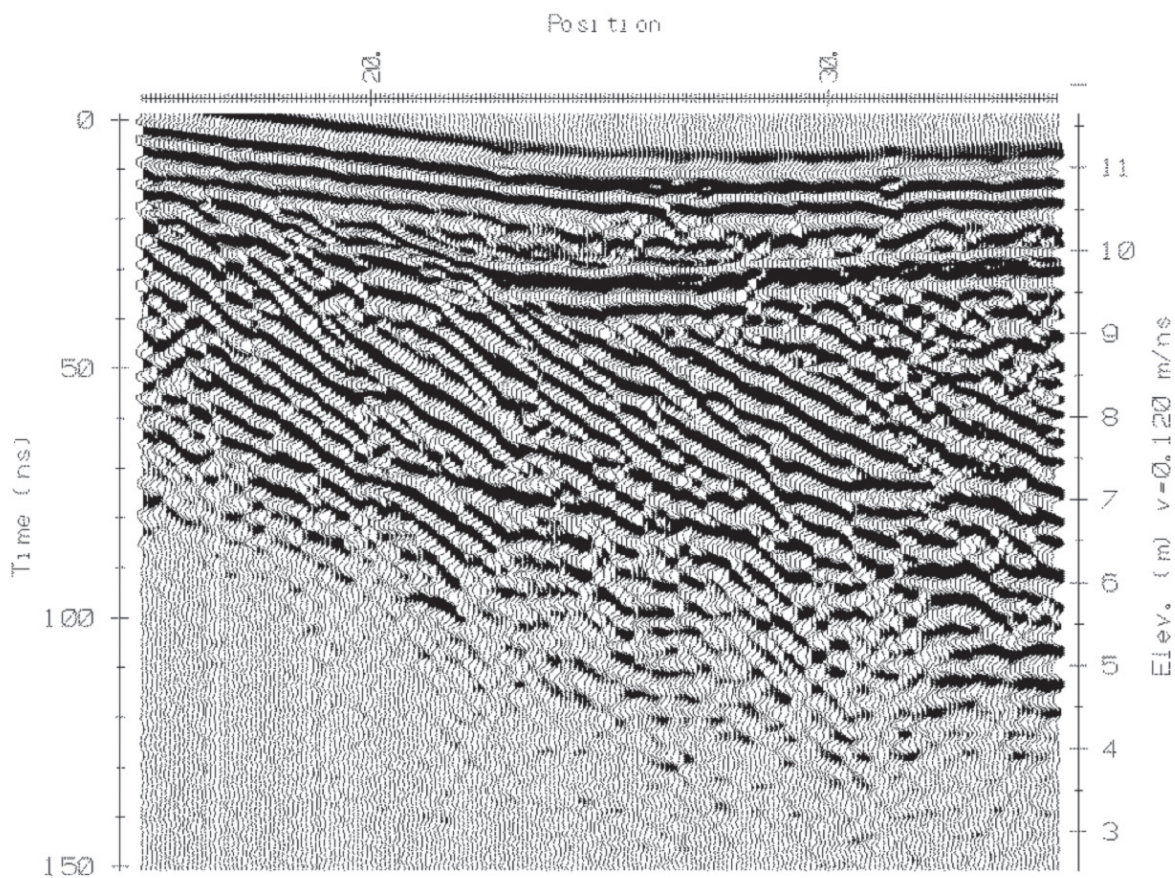


Above: The team of Harry Jol and Walter Loope conduct cutting edge work on climate at the Huron Mountains. The project started because of concerns over rising and falling lake levels. How the water levels fluctuate in the future can be projected more accurately when climate scientists are armed with data from the past.

Below: One of the things that makes this work so painstaking is the accurate recording and processing of the readings. An extremely detailed data set must be collected. Compared to the type of land surveying that's used to make a topographic map, for example, data for that is collected every five meters. In contrast, Jol and his team must collect data every half-meter—ten times the level of detail.

Photos by Harry Jol

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Above: This technique for data collection is non-invasive. It's a relatively new technology providing continuous, high-resolution data that previous geophysical tools were unable to achieve. The images appear in both two dimensions and three dimensions. They look a little like the patterns found in antique rugs.

Below: The research team sometimes utilizes an older method for assessing coastal sand, the kind that was standard before GPR became the norm. Samples are collected with a hand-operated drill called a bucket auger. These samples are submitted to a lab and analyzed; these help supplement the GPR data

Photo by Harry Jol

There are two main natural forces Jol is concerned with: erosion and "progradation," which is the build-up of sediment that allows a coastline to build out. "That's what you want," Jol says.

This project was initiated because of concern about lake level fluctuations and interest in understanding epochal changes along the Lake Superior coast. The research supports a larger project led by the US Geological Survey researching sand dunes all over the Upper Peninsula of Michigan to shed light on climate change that's taking place over time.

"When we understand changing lake levels, we can understand how levels rise and fall in other lakes and oceans. The goal is to have a model that we can compare in locations all over the world," says Jol.

While the land Jol has studied at the Huron Mountains is covered in vegetation, there is evidence that there used to be what are called "aeolian" (wind-blown) sand dunes thousands or so years old. "One can hypothesize," Jol says, "that there must have been a drier climate than that of the current one in order for these dunes to form."

"The Huron Mountains are so pristine, they're perfect for this kind of research," says Jol. "We can do readings and create models for coastal lakshores that would be impossible in more developed areas. The Huron Mountains offer a natural laboratory that has seen little influence by humans since the last glaciation, thus leaving the landscape relatively unchanged and offering a better opportunity for the research of this important natural process."

What's New: Report on 2014 Research Season

By Kerry Woods, Director of Research

ANNUAL MEETING

Forty-seven supporters of the Foundation, both donors and researchers, attended the Foundation's annual meeting at the end of July, where they heard Dr. Donald Waller of the University of Wisconsin-Madison deliver an excellent talk about the effects on Great Lakes forests of browsing by white-tailed deer. Waller is the John T. Curtis Professor of Botany and has done ground-breaking research in areas ranging from invasive species to conservation of rare species to plant genetics to the regulation of biodiversity. He and his students have published more than a dozen papers related to deer and have become authorities on deer browsing issues.

Waller's work has generated much interest because of findings that the dramatic increase in deer populations has reduced tree regeneration and plant diversity in forests of the Great Lakes region. These results confirm the observation voiced by Aldo Leopold seventy-six years ago in his report on the lands and wildlife of the Huron Mountain Club. Waller's group maintains the five-acre "deer enclosure" near Fisher Creek. It's one of a network of such experiments around Wisconsin and Michigan, but the Huron Mountain location is particularly important as it's the only deer study site located in old-growth forest.

MANIERRE AWARD

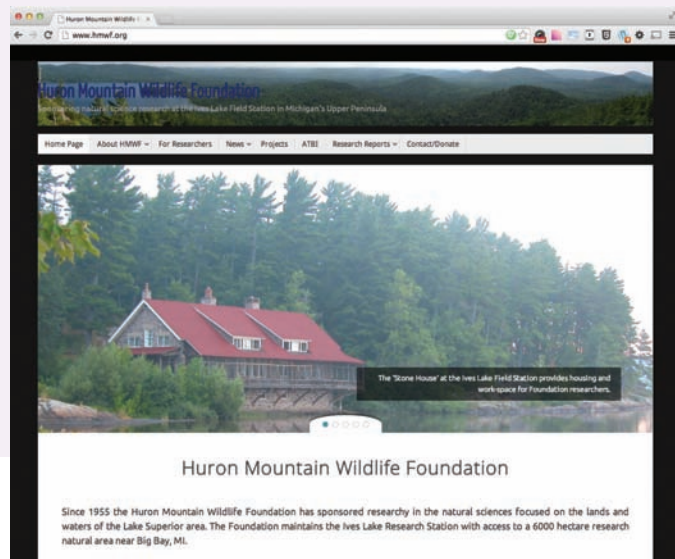
At the annual meeting, the Manierre Award was presented to Dr. Oliver Gailing of Michigan Technological University. Dr. Gailing's research on the genetics of oak populations in the Upper Peninsula has been exceptionally productive, resulting in five published articles thus far. The Manierre Award was established to recognize research papers that result from work conducted under the auspices of the Foundation. Dr. Gailing was chosen in recognition of two recent publications addressing genetic and ecological differences between northern red oak (*Quercus rubra*) and Hill's oak (*Q. ellipsoidalis*). Both papers came out in 2013. Full citations and links for these and past Manierre Award winners can be found on the "news" page at the Foundation's website, www.hmwf.org.

Oliver Gailing, an associate professor in the School of Forest Resources and Environmental Science at Michigan Technological University, won this year's Manierre Award for conducting significant research in the Huron Mountains and publishing results in national journals.

FOUNDATION WEBSITE

A completely redesigned website went live in September 2014. Some parts of the site are still being built, but it is already much more user-friendly. The front page of the site has a "blog" format that has short stories about the Foundation's work. The new site hosts the Foundation's library of research reports and occasional papers as well as links to publications completed by our researchers. It also is where you can find the list of all of the species recorded within the boundaries of

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the Huron Mountain Club. Known as the “All-Taxa Biodiversity Inventory,” the list contains a total of 4,386 species among all the groups. When several significant additions are posted from recent research, the total will certainly surpass 4,500.

ON A PERSONAL NOTE

I just returned from a month-long visit to Slovenia as a Fulbright “Senior Specialist.” The primary objective of the Fulbright project was to work with Slovenian forest scientists at the University of Ljubljana to develop research and educational agendas around old-growth forest reserves in Slovenia. Slovenia is a small country with extensive forests, including more old-growth remnants than one might expect in Europe. I visited several of their

reserves, and they are impressive forests. Still, the very largest of the old-growth remnants there are only a few hundred acres. I was repeatedly struck by how fortunate we are in the United States to have an area like the Huron Mountains where an intact old-growth landscape offers unique research possibilities.

The culmination of the project was a networking workshop on long-term, permanent-plot studies in old-growth forests. Over 20 researchers from nine countries participated. I presented information about permanent-plot studies at the Huron Mountains, and out of that came the possibility of developing joint projects European researchers. Perhaps some Slovenians or other Europeans will turn up at Ives Lake in coming years.

RESEARCH PUBLICATIONS AND PRESENTATIONS

By Kerry Woods, Director of Research

Over the last six months, HMWF-sponsored research has born abundant fruit in the form of papers published in peer-reviewed journals. Such publications are the primary pathway by which the work of the Foundation becomes known to the scientific community, and it's the most visible ratification of the value of our research. It's a pleasure to point to both the steadily increasing productivity of HMWF researchers and the variety and quality of journals in which their work appears. The large group of papers reported here includes a disproportionate number in journals of forestry and forest ecology, but over the last two years, I tally 17 different journals publishing HMWF products in a variety of fields. These range from the pre-eminent journals in ecology to journals of animal behavior, herpetology, invertebrate zoology, forestry, invasion biology, and plant genetics.

Here are nine papers either recently published or accepted for publication and “in the pipeline,” and one recently completed Ph.D. dissertation. As usual, I will place hard copies of these publications in the library at the Stone House at Ives Lake, but most can be provided in digital form on request to authors (some are “open access” at the journal's website, and pdf's can often be found at authors' websites).

Fahey, R.T., Fotis, A.T., and Woods, K.D. 2014. Quantifying canopy complexity and effects on productivity and resilience in late successional hemlock-hardwood forests. *Ecological Applications*. *In press*. <http://dx.doi.org/10.1890/14-1012.1>

Fahey, R.T. and C.G. Lorimer. 2014. Habitat associations and 150 years of compositional change in white pine-hemlock-hardwood forests based on resurvey of public land survey corners. *Journal of the Torrey Botanical Society* 141(4). *In press*.

Gailing, O. and Curtu, A.L. 2014. Interspecific gene flow and maintenance of species integrity in oaks. *Annals of Forest Research* 57: 5-18.

Gora, E. M. and Yanoviak, S.P. 2015. Electrical properties of temperate forest trees: a review and quantitative comparison with vines. *Canadian Journal of Forest Research*. *In press*.

Lind-Riehl, J., Sullivan, A.R. & Gailing, O. 2014. Evidence for selection on a CONSTANS-like gene between two red oak species. *Annals of Botany* 113(6): 967-975. doi:10.1093/aob/mcu019

Muzika, R.M., Guyette, R.P., Stambaugh, M.C., and Marschall, J.M. 2015. Fire, drought and humans in a heterogeneous Lake Superior landscape. *Journal of Sustainable Forestry*. *In press*.

Reynolds, J. W., and Wetzel, M.J. 2014. A checklist by counties of earthworms (*Oligochaeta*: *Acanthodrilidae*, *Lumbricidae*, *Megascolecidae* and *Sparganophilidae*) in Michigan, U.S.A. *Megadrilogica* 17(x). 21 pp. *In press*.

Williams, E.W. and Waller, D.M. 2015. Tracking morphological change and demographic dynamics in ephemeral *Botrychium* s.s. (*Ophioglossaceae*) populations. *Journal of the Torrey Botanical Society*. *In press*.

Willis, J.L. 2014. Substrate Effects on Seedling Dynamics in Managed Northern Hardwood Forests. Ph.D. Thesis. Michigan State University

Woods, K.D. 2014. Multi-decade biomass dynamics in an old-growth hemlock-northern hardwood forest, Michigan, USA. *PeerJ*. 09/2014; 2:e598.

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The Chance to Dive In: Submit a Research Proposal

A stay at the Ives Lake Research Station is productive both indoors and out. Outside, research is conducted within a large ecologically and geologically diverse natural area; indoors, the Stone House and the Red House offer well-designed work spaces for processing specimens, for team meetings, and for compiling and analyzing results.

The Foundation is interested in both hypothesis-driven and descriptive field research and monitoring in all areas of field-based natural science. If you (or perhaps a colleague) specialize in arachnids, in an under-studied group of invertebrates, or in freshwater plankton, we'd particularly like to hear about it. Proposals for the 2015 field season should be submitted by February 1, 2015; this deadline is strict if funding is requested. Check website for details.

Above: When work is done for the day, researchers at Ives Lake sometimes make use of a diving board located outside the Stone House. Photo by Jill Riddell

About the Huron Mountain Wildlife Foundation:

Since 1955, the Huron Mountain Wildlife Foundation has supported original research in a wide variety of scientific fields. The research takes place in the Upper Peninsula of Michigan. More information on the Foundation can be found at: www.hmwf.org

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