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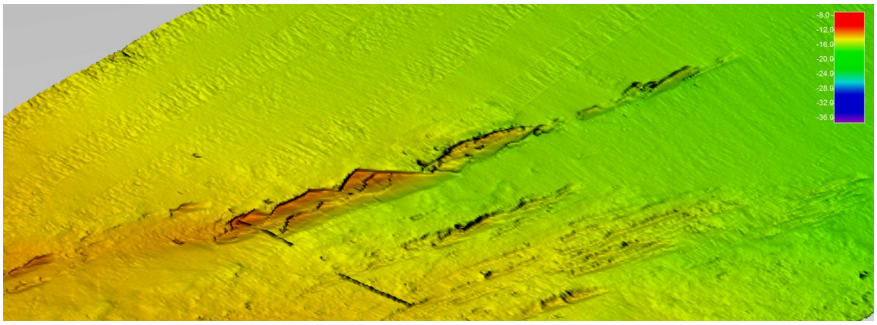
Solving a Mystery From the Deep

By Ted Gostomski, Network Science Writer

How many times do we as field ecologists document something—new growth, the return of an extirpated species, or some strange phenomenon—knowing that we may never know the end result? Quite often. Did the forest regenerate? Did the restored species survive? What was that weird thing we saw or heard? We rarely know the ultimate outcome. So you can imagine the excitement when, in the course of a Great Lakes Restoration Initiative (GLRI) project to map the bottom of Lake Superior and Lake Michigan, mysteries are revealed and then solved!



A mystery yet to be solved. This image from the bottom of Siskiwit Bay (Isle Royale) shows a shelf of rock with an interesting fracture pattern. Water depth increases in the shift from reds and oranges (8–14 meters/26–46 ft) to greens (16–26 meters/52–85 ft).

This bathymetry project, led by Midwest Region fisheries biologist Jay Glase, and accomplished in large part by hydrographic surveyor Lara Hutto, is using LiDAR (light detecting and ranging) and sonar to create maps that show the lake bottom within the jurisdictional boundaries of national parks located along the shores of Lake Superior (Isle Royale, Apostle Islands, and Pictured Rocks) and Lake Michigan (Sleeping Bear Dunes and Indiana Dunes) in new and interesting ways. From these data, we are learning more than just how deep the water is; we can also see the topography, determine bottom composition, and identify both known and undocumented objects including fish spawning reefs, areas of sediment accumulation, and cultural sites such as shipwrecks and old dock cribbing.

Network staff have assisted with this Midwest Region project by acquiring the LiDAR data from the U.S. Army Corps of Engineers; providing boat operators to pilot the custom-made, sonar-equipped research vessel appropriately named the *Echo*; and recently by participating in a dive to follow-up on an interesting anomaly seen on the bottom of Lake Superior in the Apostle Islands.

Last winter, Hutto was processing data collected by the *Echo* in the spring of 2013. She was creating imagery from data collected approximately a quarter-mile offshore from Raspberry Island (in the Apostle Islands) when an oval-shaped depression and three curiously symmetrical mounds appeared on the computer screen. What appeared to be a trench underscored the round items. A screen capture of the image was saved and shown to Apostle Islands cultural resources specialist Dave Cooper and others. No one could say for sure what the *Echo* had found, but many were curious, so on a very windy day in September, a dive team comprised of Cooper, Glase, Midwest Region aquatic ecologist Brenda Moraska Lafrancois, and Network aquatic ecologist David VanderMeulen visited the site. What they found was a very large pile of rocks, some of which they brought to the surface. With a bit of detective work by Network staff and Cooper, the mystery began to unfold.

The rocks, we have learned, are iron ore. Upon learning that, the group wondered if a ship had gone aground there, creating the trench with its hull. In an effort to free itself, had the crew dumped their cargo of iron ore to lighten their load? A few days later, Cooper added a large piece to the puzzle.

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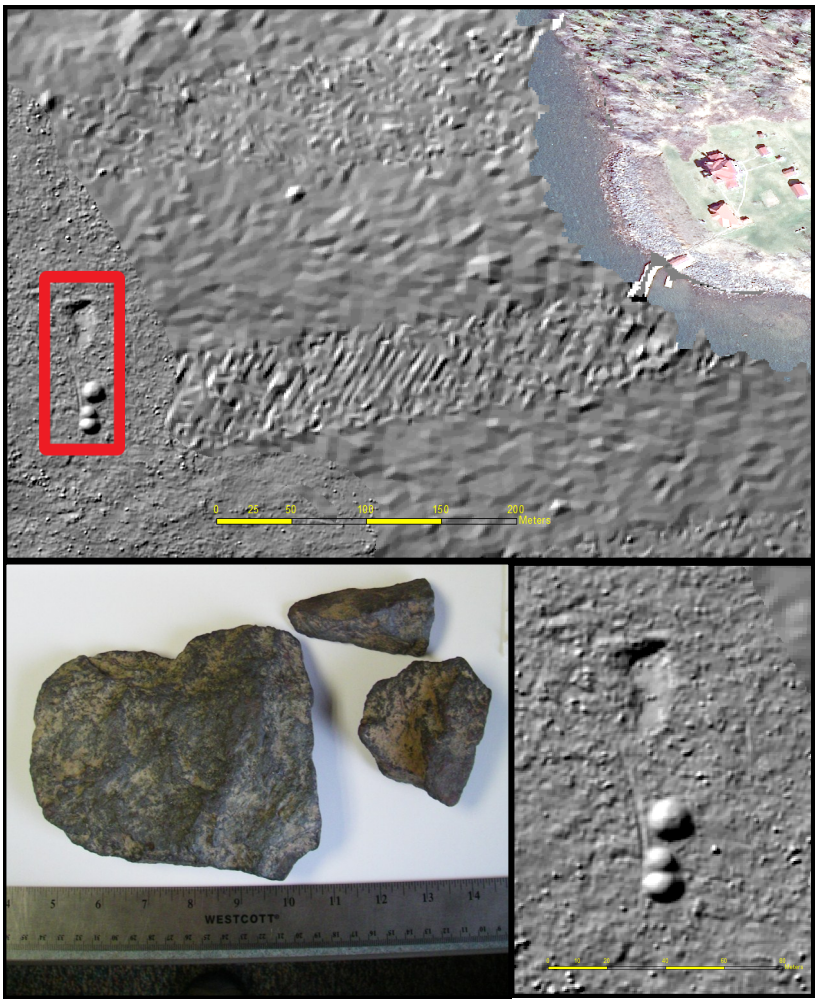
Solving a Mystery From the Deep

(Continued from page 1)

My initial research points to the stranding of the steamer Marion *on June 18, 1898, loaded with iron ore from Two Harbors, Minnesota. She grounded* [off] *Raspberry Island and had to dump part of her cargo in order to be towed off.*

There were other strandings [off] *Raspberry, but right now* Marion *is the only one I know about carrying iron ore.*

The interesting thing to me is this may be the forgotten story of the origins behind the name "Marina Shoal" (still shown on the NOAA charts)—though the vessel was actually named Marion *(the name on the bow may have been partly illegible to the keeper's view).*



The mystery revealed. Clockwise from top: the mystery pit and mounds located just offshore from Raspberry Island Lighthouse; in a close-up view, the linear depression created by the *Marion*'s hull is more clearly visible beside the mounds; the iron ore retrieved from the mounds during a dive by park, Network, and Midwest Region staff.

Cooper pulled out the Raspberry Island light keeper's log for 1898 and found entries in which the keeper recorded the grounding of the *Marion* on 18 June, the arrival of the tug boat *Lyon* on 20 June to free her, then the arrival a month later of officials from the hydrographic office in Duluth who were "trying to locate the cargo that was thrown overboard by the [Steamer] 'Marina' and the place she struck." (Note how the keeper now refers to the ship as the steamer "Marina" instead of "Marion.")

It is sometimes difficult to convince people why mapping the bottom of the lakes can be an important endeavor. Aside from exciting cultural mysteries, we are also using the bathymetry information to aid in solving natural resource problems such as the accumulation of toxic algae offshore from Sleeping Bear Dunes National Lakeshore in Michigan. The mapping project has revealed underwater pits where the algae are accumulating, and as it decays, it is creating a deadly form of botulism that is killing fish-eating birds such as loons, mergansers, and gulls. It is another link in the causal chain behind the large waterbird die-offs on Lake Michigan. What else can we learn? What else might we discover? We probably will not end up with all the answers, as we did with the Raspberry Island mounds, but like our commitment to long-term monitoring, projects like lake mapping are more than just "nice information to have," they are forming and answering questions we would not even know to ask. ●

Great Lakes RESTORATION

Network Contributions to Other Projects

The Great Lakes Network is contributing data and other expertise to a number of projects. A few examples:

Vegetation—Suzanne Sanders and Jessica Kirschbaum are working with Don Waller at the University of Wisconsin to examine differences in vegetation between the presettlement period and the current time. This project will likely examine how vegetation patterns have been altered in respect to the fire tolerance (or intolerance) of species. In preparation for this project, spatial data from the Public Land Surveys were obtained for eight of the nine parks. These data include the tree species names, diameters, and distances from survey grid section corners.

Contaminants—The Network and our partners at the University of Wisconsin–La Crosse have contributed data from PIRO, SACN, and VOYA to a national Dragonfly Mercury Project led by the NPS Air Resources Division. New products from that project are now available, including a full-color, four-page fact sheet that highlights findings from a 2013 study in 22 national parks and one state park. Available at www.nature.nps.gov/air/Studies/air_toxics/dragonfly/docs/DragonflyMercury_2013-DataSummary.pdf. There is also a clearinghouse of educational tools relevant to the Dragonfly Mercury Project at www.nature.nps.gov/air/Studies/air_toxics/dragonfly/educational.cfm. A scientific report on the study is currently under review and will be published in the Natural Resources Technical Series in January.

Water Quality—David VanderMeulen and Rick Damstra are providing inland lake Secchi disc data (a measure of water clarity) collected at ISRO, PIRO, and SLBE to the Michigan Department of Environmental Quality (MI DEQ) and the U.S. Geological Survey's Michigan Water Science Center (MI USGS). MI DEQ and MI USGS are using satellite imagery of the lakes to predict Secchi disc measurements, and comparing their predictions with our observed values. Because Secchi disc values are used to calculate the trophic status of lakes, this modeling effort allows us to estimate the productivity of inland lakes that are not routinely monitored in our Michigan national parks.

Sister Parks—Network staff are working with Chris Stein, Jonathan Moore, and Jean VanTatenhove at SACN and a number of Costa Rican parks staff to advance the goals of a Sister Park relationship between thirteen national parks in the upper Midwest (and including the Great Lakes Network office) and seven parks and protected areas of Costa Rica's Osa Peninsula. We are working with Costa Rican biologists to identify natural resources for long-term monitoring in the Osa Peninsula, and with outreach staff to develop communication and interpretive tools about those resources. A five-person NPS team that included Bill Route and Ted Gostomski from the Network office visited the Osa Peninsula in July to experience first-hand some of the parks and the challenges faced by managers there. ●

Staff Insider

Ted Gostomski, Science Writer/Biologist

Ted has a Master's degree in Conservation Biology from Central Michigan University where he studied common loons nesting on the Lake Superior shoreline of Isle Royale. He joined the Network as a seasonal boat operator in 2007 and was hired as the science writer/biologist in 2008. As the science writer, Ted is responsible for sharing the Network's science findings with Network parks, partners, and others in a variety of formats. As a biologist, he oversees the landbird monitoring program and provides logistical and field support to all the other Network programs, primarily as a boat operator on Lake Superior and on the Mississippi River. Ted also serves as the Network Safety Officer and is an Emergency Medical Technician. ●

NPS photo/Bill Route

2014 Field Season Summary

Amphibians

Amphibian monitoring continued at INDU, SLBE, and PIRO, and was implemented at two additional parks this year: APIS and MISS. (*See Acronym Decoder along the bottom of the next six pages for a key to park and agency names.*) We also worked with staff at GRPO to do some initial site selection for song meter placement next year.

Contract herpetologist Gary Casper visited both APIS and MISS to establish sites, provide training on setting up the song meters, and conduct supplemental salamander searches. Gary is quite proficient at finding salamander evidence; many species appear to be doing quite well on the Apostle Islands. The Mississippi River was in flood stage for a substantial part of this past spring and summer, which resulted in two of the song meters being submerged, and prevented us from deploying all 10 units. This park, being primarily within the riparian corridor, presents some unique challenges—units need to be set out early in the year, and doing so sometimes requires the use of tall ladders to keep the units high and dry.

Gary Casper (right) and Ulf Gafvert discuss placement of an amphibian data logger on Stockton Island (APIS), while Ulf prepares a HOBO temperature logger for deployment into the pond. *NPS photo/Ted Gostomski*

The data (SD cards and HOBO temperature loggers) are starting to come in from the parks. We have yet to determine whether or not the units performed better than last year. The next step is to compile this year's data in order for Gary to complete the analysis and provide us with results.

Bioaccumulative Contaminants—Bald Eagles

We returned to the field this year to collect blood and feather samples from young bald eagles at APIS, MISS, and SACN. We and our partners started by conducting aerial surveys to locate active nests and to assess the growth and health of the eagle population.

The number of active bald eagle territories has steadily increased at all three parks since 2006 (*chart 1*). In particular, we have witnessed a dramatic increase at MISS, where the number has more than doubled since 2007 to 49 active territories in 2014. We counted the number of young produced on a subset of these territories and found that productivity has declined since 2006, though this decline leveled off or slightly increased this year (*chart 2*).

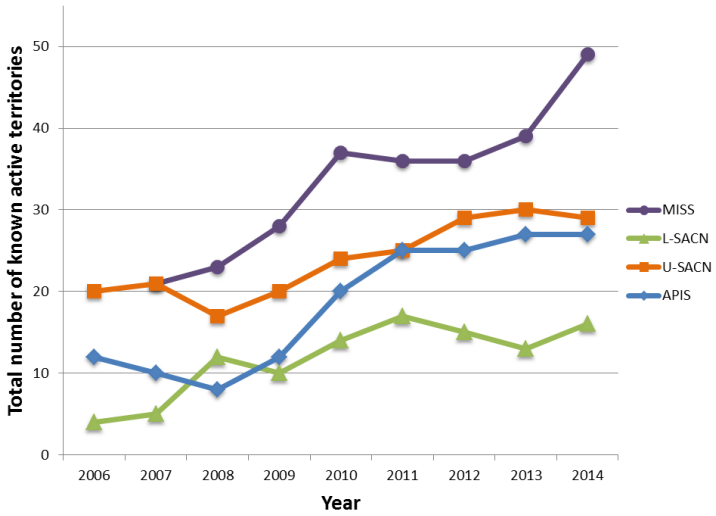


Chart 1. Number of active eagle territories at MISS, SACN (L-SACN=below St Croix Falls, U-SACN=above St Croix Falls), and APIS, 2006–2014.

Both APIS and the upper SACN have produced <1.0 young per occupied territory over the past four-to-five years, and production remains below the healthy population threshold of 1.0 young per occupied territory (*red line in chart 2*). However, we are not overly concerned. These northerly areas have less abundant prey, and there is greater potential for severe weather during the early nesting period (i.e., more nest failure). So we might expect periods of low productivity at these northerly parks.

Acronym Decoder

APIS
Apostle Islands National Lakeshore (Wisconsin)

GLKN
Great Lakes Inventory and Monitoring Network

Together these data suggest that an increasing number of eagle pairs are squeezing into the population at each park, but that finite resources are limiting the population's overall productivity. It is also possible that these populations have higher proportions of newly formed pairs, and that these inexperienced nesters are more prone to failure or low production. We will continue to monitor these populations to see whether the number of nesting pairs plateaus and productivity stabilizes.

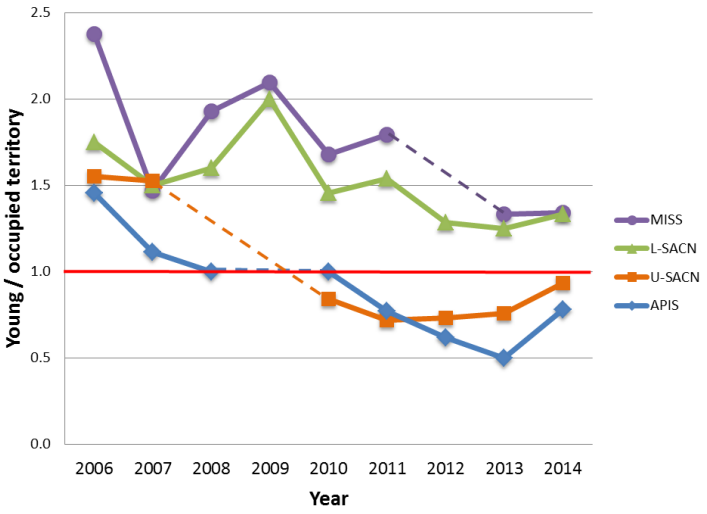


Chart 2. Number of young eagles produced per occupied territory at MISS, SACN (L-SACN=below St Croix Falls, U-SACN=above St Croix Falls), and APIS, 2006–2014. Dotted lines span years when surveys were not conducted. Data are from surveys conducted by the Network and the Wisconsin DNR.

We now have seven years of monitoring data on contaminants in bald eagles. This year we concentrated on publishing two journal articles presenting our results on flame retardants (PBDEs) and water and stain resistant chemicals (PFCs) at APIS, SACN, and MISS. We report three key findings: (**1**) most, but not all, congeners of these chemicals (akin to species within a genus) have declined due to their recent (2002–2004) removal from the market; yet, because they are so persistent, they will continue to be in the environment for many years. (**2**) The patterns within and among the three parks are striking, and we argue that these patterns are partially explained by waste water treatment plants, which collect but do not remove these chemicals. Hence, eagles that nest and feed in close proximity to waste water treatment plants are exposed to higher levels of the chemicals, and other aquatic organisms in the area are similarly exposed. (**3**) The patterns we see are ultimately linked to differences in the types of aquatic systems and the levels of human influence on those systems. For example, bald eagles at MISS and on the lower SACN are exposed to more pollution due to human development and thus, have a higher potential for bioaccumulation. These large, productive rivers support complex, multi-tiered food webs, and each tier has the potential to accumulate and further magnify these chemicals. APIS, on the other hand, while relatively unproductive (lower potential for bioaccumulation), receives chemicals from regional and global air pollution and the cold, deep waters of Lake Superior retain them for a longer period of time. The result is that we see a different mix of congeners in APIS eagles and a generally slower rate of decline in contaminants. Eagles on the upper SACN are the least contaminated with these chemicals. Nonetheless, we show that some congeners are increasing on the upper SACN even while decreasing at other park areas. The reasons for this apparent discrepancy are still unknown.

Landbirds

This was a good year for the landbird program. Apostle Islands re-started their surveys after a three-year hiatus, PIRO successfully transitioned to a new observer and are now on their fourth year of data collection, MISS is restructuring their surveys and taking control of data collection, and the central landbird database was completed and is now up and running. This last one—the database—has been a long-running challenge, in part because of the amount of legacy data (pre-Network protocol) collected by parks; how that information is entered affected the standardization of data fields so that both legacy and current data could be accessible. The database still has limited portability, but we are working to put it on a web-based server so that park staff can enter their data from any government computer.

In other developments, we have contracted former ISRO biological technician Alex Egan to conduct trend analyses for parks with >5 yrs of songbird data (pre– and post-Network protocol). Preliminary analyses will be completed by the end of 2014. A technical report and peer-reviewed manuscript will be prepared in 2015. Other highlights from the season:

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2014 Field Season Summary

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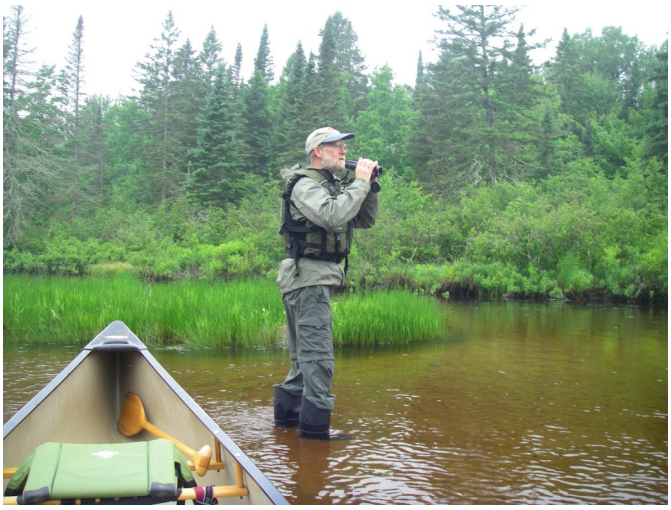
Apostle Islands National Lakeshore

During an enforced hiatus from breeding bird surveys between 2011 and 2013 (due to staffing complications), park staff reevaluated the bird survey protocol in light of climate change and to better meet survey site criteria. Among some of the changes, points were added to wetland areas so that the park can monitor the effects climate change may have on bird species that inhabit sensitive wetlands; some existing points were eliminated or moved to correct long-standing issues with proximity to one another, to Lake Superior or sources of noise interference, or inaccurate habitat representation. Habitat information for survey points was also aligned with the National Vegetation Classification map completed in 2010. Additionally, points were eliminated from some transects that were too long and could not be completed during prescribed survey hours.



Robin Maercklein conducts a songbird survey on the upper Namekagon River (SACN). *NPS photo/Ted Gostomski.*

A total of 693 birds (57 species) were detected in 2014. Overall for the period 1995–2014, there is a decreasing trend in average species richness per point, but a stable trend in average abundance per point. A report is being drafted that details the changes to the survey points and puts the 2014 data into historical context.

Isle Royale National Park

Volunteers David and Sara Fehringer and Alex Egan helped to complete Isle Royale's bird surveys this year. The Fehringers report their "most interesting sighting was a pair of bluebirds at Siskiwit Lake. Unfortunately they were absent for the survey, but we saw them while scouting the night before and then on the way back after the survey." The only bluebird recorded during the songbird surveys (1996–2013) was in 2000 on the Chippewa Harbor–Lake Richie transect.

Pictured Rocks National Lakeshore

Volunteer Scott Hickman passed the binoculars to Skye Haas this year. PIRO biologist Cindy Heyd reports that, "We started later due to the long winter/abnormally cold spring. When we could start, migrants were still moving through, and species were in the wrong habitats."

St. Croix National Scenic Riverway

Retired SACN biologist Robin Maercklein completed the riverway's bird surveys. One thing that stood out for him this year was Prothonotary Warblers. "Previously I had only known them from the lower St. Croix below Osceola, WI, where they are a common species. This year I found them at two new locations, separated by just a half-mile. These new locations were near the mouth of the Sunrise River—one on the Wisconsin side and one downstream on the Minnesota side. Had I looked at the *Wisconsin Breeding Bird Atlas*, I would have seen that breeding of this species was known from a single Atlas block four or five miles farther upstream. Incidentally, a Red-headed Woodpecker was heard from the same location as the Wisconsin Prothonotary Warbler sighting [at the Sunrise River]. That is the first Red-headed Woodpecker on the survey since 1982."

Land Cover/Land Use

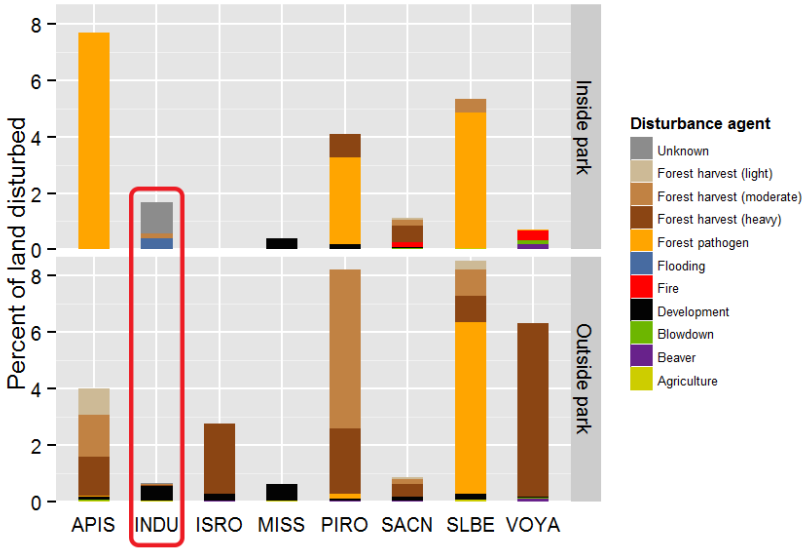
The Network land cover monitoring program is in the fifth year of implementation, and this year's focus was on Indiana Dunes National Lakeshore. We mapped and analyzed land cover disturbances within the park and on adjacent lands, encompassing a total area of 164,220 hectares (6,420 ha in the park, 157,800 ha outside the park).

Our analysis showed that the percentage of land disturbed inside the park was the fourth highest among parks thus far. Activities related to invasive species eradication and wetland restoration (within the "Unknown" category) accounted for just

over 100 ha (247 acres; 1.7% of the total) during the six-year analysis period (2007–2012) (*see graph*).

Outside the park, disturbances were largely due to development activities, totaling 980 ha (0.63%) of land of the focal area over the six-year period. The full technical report will be published early next year.

Also, we are working with the State of Michigan to implement two LiDAR elevation data acquisition projects this coming spring. Thanks to staff at PIRO and SLBE for providing additional funding to help make these projects come together.



Land cover disturbances inside and adjacent to Indiana Dunes (INDU), 2007–2012, compared to seven other Network parks, grouped by disturbance agent.

Vegetation

The vegetation monitoring crew spent the summer at Grand Portage resampling the 20 plots established in 2007 and installing an additional three plots. These plots will help us understand the ongoing dynamics of key species of interest at GRPO including paper birch, black ash, white pine, and balsam fir.

Collectively, we found 30 tree species, 31 species of shrubs, and 148 unique herb taxa. Although we did encounter several non-native species, none of these were problematic invasive species. Throughout the park, we encountered large living aspen amid both standing dead trees and recently downed individuals. Aspen, along with paper birch, is an early successional species that, when it dies, is being replaced in certain niches by balsam fir.

While most of our plots did not contain cedar, one plot contained a fair amount of mature cedar, as well as abundant regenerating individuals under two meters in height. This is significant because intense browsing pressure by high numbers of deer are inhibiting regeneration of cedar throughout the region. As part of our annual reporting, we will attempt to relate park deer densities with impacts to both woody and herbaceous preferred browse species.

These findings will be especially relevant as they provide a solid assessment of forest structure and composition prior to infestation of emerald ash borer (EAB). The closest current documented location of EAB is in Superior, Wisconsin, 146 miles to the southwest.

Water Quality—Large Rivers

Prior to 2014, we conducted water quality monitoring at MISS and SACN every other year, alternating between the parks. Beginning this year, we suspended routine water quality monitoring at MISS due to duplication of effort with other agencies' monitoring efforts. However, in July and August, SACN biological technician Michelle Prosser and MISS park staff collected water samples from Coldwater Spring and four Mississippi River sites that were subsequently tested for pesticides, pharmaceuticals, personal care products, and waste water indicators. This represents a continuation of the contaminants screening work we started at MISS in 2013. A recently published Resource Brief summarizing this work can be found on our website, http://science.nature.nps.gov/im/units/glkn/publications.cfm.

Michelle, with assistance from both SACN and MISS staff, also led the water quality monitoring work at SACN in 2014. Once

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2014 Field Season Summary

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again sampling was pushed back for a week in April due to the lingering winter and attendant ice, snow, and high water conditions. Monitoring was successfully completed for the rest of the 2014 monitoring season.

Since 2013, we have transitioned towards sampling at previously unmonitored mainstem sites in the upper half of SACN. In 2014, we suspended monitoring on three Wisconsin tributaries to Lake St. Croix due to duplication of effort with other agencies. We continue to monitor all six sites that were randomly-selected for monitoring when the protocol was implemented in 2007, along with four other non-random sites in the upper riverway. Continued monitoring at the random sites will allow us to make park-wide inferences on long-term trends in water quality, and monitoring at the non-random sites will provide site-specific information that is of high interest to the park and regional water quality professionals.

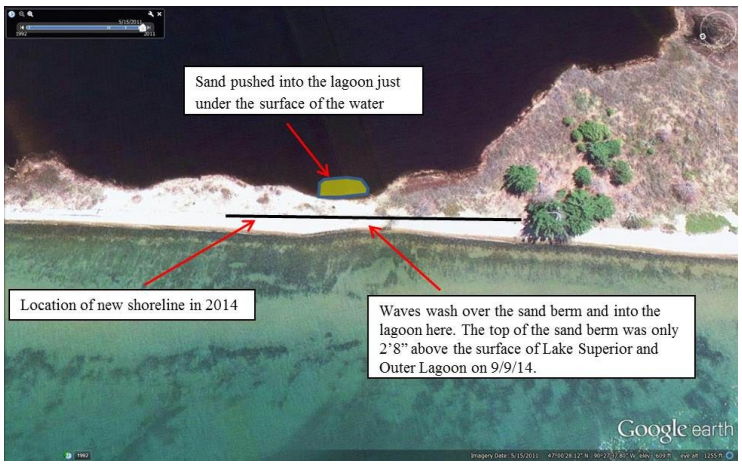
As of September, Rick Damstra, who has been the Network's lake aquatic ecologist since 2009, became the new rivers aquatic ecologist (previously occupied by David VanderMeulen, and vacant since February 2013).

Water Quality—Inland Lakes

We conducted three rounds of sampling on 31 lakes in six parks, plus some additional work on non-index lakes at PIRO. Vertical arrays of temperature loggers collected data year-round from one lake each at ISRO, PIRO, SLBE, and VOYA. Data from these arrays are providing important information on available fish habitat and thermal structure of the lakes as it is related to weather and climate.

Apostle Islands National Lakeshore

Sampling at APIS is now occurring only at the Outer Island lagoon. Outer's lagoon has the greatest separation from Lake Superior and therefore functions the most like an inland lake, unlike the lagoons previously monitored at Stockton and Michigan islands and at Little Sand Bay. However, with water levels in Lake Superior rebounding from near all-time lows and reaching levels not seen in nearly 20 years, wind-driven waves breached a low spot on the sand berm at Outer lagoon, driving Lake Superior water and sand from the beach over the berm and into the lagoon. For the first time since monitoring at Outer Lagoon began in 2007, we have strong evidence that, in 2014, lagoon water levels were controlled by Lake Superior water levels as water infiltrated through the sand berm.



Shifting sands. High wind and waves pushed sand over the berm separating the Outer Island lagoon from Lake Superior, and significantly narrowed the lakeside beach. *Aerial photo from Google Earth (May 2011).*

In June, July, and August, sampling also occurred at seven Lake Superior sites within the Apostle Islands. These samples are being tested for pesticides, pharmaceuticals, personal care products, and waste water indicators as part of a collaborative effort to screen NPS surface waters for a wide variety of contaminants of emerging concern. This work is in collaboration with the U.S. Environmental Protection Agency (EPA), NPS Water Resources Division, and six other NPS I&M Networks. The EPA will test the samples for approximately 270 different chemicals, and with some funding from the Great Lakes Restoration Initiative, we will begin to work this winter with the USGS Minnesota Water Science Center staff to assess the data and report results.

Indiana Dunes National Lakeshore

Josh Dickey conducted all three rounds of sampling at Middle Lagoon this year, with assistance from other park staff. We

will continue to monitor at Middle Lagoon and to provide technical assistance for other aquatic monitoring efforts.

In early November, Josh collected water samples from 18 sites across the park that were tested for pesticides, pharmaceuticals, personal care products, and waste water indicators under the same protocol described for APIS. The sites coincide with areas where fish are monitored, and will provide added context to that work.

Isle Royale National Park

Rick Damstra and water quality technician Erica Janocha completed routine monitoring at all nine index lakes despite bad weather and equipment issues. We appreciate the assistance of park staff Erin Haglund and Lucas Westcott, as well as Mark Romanski, Seth DePasqual, and Erin Lehnert, who provided crucial boat support. Rick and Erica maintained a vertical array of temperature probes on Lake Richie for the fifth full season and serviced temperature and depth loggers on Washington Creek and Benson Creek. Blue-green algae blooms were not observed at Lake Richie in 2014, and toxins produced by algal blooms were not detected in samples collected from the lake in 2012 and 2013.

This was Rick's last full season working on Isle Royale. He is grateful for the five summers spent on the island and thanks the park staff there for their help and friendship.

Pictured Rocks National Lakeshore

Leah Kainulainen, with assistance from some park and Network staff, completed all scheduled routine monitoring at six inland lakes. In June and October, she downloaded data from and serviced the vertical array of temperature probes on Grand Sable Lake. Leah continued collecting bathymetric data from each of the six index lakes and is on track to complete this work in 2015, and she continued pilot-testing the Network's Wadeable Streams protocol on Miner's River by deploying a multiprobe and collecting macroinvertebrates. She and David VanderMeulen collected sediment cores in August for diatom analysis (see *Diatoms* below).

Leah Kainulainen maps the bathymetry of Beaver Lake at PIRO. *NPS photo/David VanderMeulen.*

Sleeping Bear Dunes National Lakeshore

Chris Otto, with the assistance of park staff, completed routine monitoring at the six index lakes. He also maintained a vertical array of temperature probes at Manitou Lake on North Manitou Island, and in September, he and Leah Kainulainen did routine maintenance on the temperature array and collected sediment cores for diatom analysis (see *Diatoms* below).

Voyageurs National Park

Jaime LeDuc completed all sampling at the eight index lakes with assistance from park biological technician Ladd Corrin and other staff and volunteers. In May and October Jaime downloaded data from and serviced the vertical array of temperature probes on Little Trout Lake. Jaime continued to collect water samples from five inland lakes to be assessed for mercury levels. This work is part of an ongoing collaboration between the Network, the park, and USGS to monitor mercury levels in the park's inland lake.

Diatoms

Sediment cores are collected from inland lakes and areas of sediment deposition in river sites every three-to-five years for analysis of diatom species composition. Under most conditions the silica-based cell walls of diatom remains are well-preserved in sediment, and once collected are easily identified to the species level by expert algologists. Diatoms serve as bioindicators of water quality because the assemblage of species present reflects conditions in the lake or river.

2014 Field Season Summary

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This year, after a hiatus from fieldwork in 2013, we collected sediment "short-cores" from four lakes at PIRO and six lakes at SLBE during the last round of water quality monitoring. A short-core collects about 15 to 30 cm (6 to 12 inches), of sediment from the bottom of a lake. From that short-core, we extract the most recently-deposited upper layer of sediment (about 2 cm, which represents approximately the last three-to-five years) and send that sub-sample to our collaborators at the St. Croix Watershed Research Station (SCWRS).

David VanderMeulen with a surface sediment core collected from Beaver Lake (PIRO) in August 2014. *NPS photo/Leah Kainulainen.*

SCWRS staff will analyze the short-core sediments this winter, along with diatoms from sediment "long-cores" (one-to-three meters in length) collected from four inland lakes at VOYA in 2010 as part of a separate study on mercury in sediment. Diatom communities in the long-cores can be cataloged going back 150+ years before present, which allows us to model what water quality conditions were like in these lakes before European settlement. This information also provides context in which we can place current water quality conditions. In 2015, we will again collect short-cores from eight lakes at VOYA, and hope to take samples from additional lakes at the park if funding is available.

Weather and Climate

The Network continued its participation in the Climate Analyzer web portal (www.climateanalyzer.org/glkn/map_html) for park climate data retrieval and visualization. We have added a few new stations for some parks that give more options for current (vs. historical) data retrieval. In the coming year, we will work to integrate climate data tools into park-specific web pages on the Network website.

Network data manager Mark Hart with the Sand Island weather station. *NPS photo/Dave Cooper.*

RAWS (remote-access weather stations) stations at PIRO and SLBE were visited for annual maintenance and sensor-upgrade in the spring. An additional RAWS station was deployed on the north end of Sand Island at APIS. This station should give a fuller picture of climate in the park, as this location is strongly influenced by the open, deep water portion of Lake Superior. Located just east of the historic Sand Island lighthouse, this station received special attention to reduce its visual impact on the visitor experience. A clearing was made in some younger trees that were encroaching on the historic lighthouse grounds, but enough trees were left to provide a visual screen from the lighthouse location. Additionally, almost all parts of the station and support structure were painted a natural color to reduce the station's visibility from boats on the lake. ●

New Reports and Publications

Baker, G. M., N. Duncan, **T. Gostomski**, M. A. Horner, and D. Manski. 2014. The bioblitz: Good science, good outreach, good fun. Park Science 31(1): 39–45.

Brigham, M.E., M.B. Sandheinrich, D.A. Gay, R.P. Maki, D.P. Krabbenhoft, and J.G. Wiener. 2014. Lacustrine responses to decreasing wet mercury deposition rates—Results from a case study in northern Minnesota. Environmental Science and Technology 48(11): 6115–6123.

Haro, R. J. 2014. All along the watchtower: Larval dragonflies are promising biological sentinels for monitoring methylmercury contamination. Park Science 31(1): 70–73.

Route, W. T., R. E. Russell, A. B. Lindstrom, M. J. Strynor, and **R. L. Key**. 2014. Spatial and temporal patterns in concentrations of perfluorinated compounds in bald eagle nestlings in the upper Midwestern United States. Journal of Environmental Science and Technology 48: 6653–6660.

Sanders, S. and **J. Grochowski**. 2014. Alternative metrics for evaluating forest integrity and assessing change at four northern-tier U.S. national parks. American Midland Naturalist 171:185–203.

Sanders, S. and **J. Grochowski**. 2014. Forest vegetation monitoring protocol version 2.0: Great Lakes Inventory and Monitoring Network. Natural Resource Report. NPS/GLKN/NRR—2014/799. National Park Service. Fort Collins, Colorado.

Have you seen our videos?

Find them on our website *http://science.nature.nps.gov/im/units/glkn/*

or the NPS I&M YouTube page *www.youtube.com/user/IMPNPS*

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National Park Service
Great Lakes Inventory and Monitoring Network
2800 Lakeshore Drive East, Suite D
Ashland, Wisconsin 54806
Phone: (715) 682-0631
http://science.nature.nps.gov/im/units/glkn/

Improving park management through greater reliance on scientific knowledge

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Isle Royale National Park
Mississippi National River and Recreation Area
Pictured Rocks National Lakeshore
Sleeping Bear Dunes National Lakeshore
St. Croix National Scenic Riverway
Voyageurs National Park

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Editor
Ted Gostomski

Network Coordinator
Bill Route

Webmaster
Mark Hart

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Dave Cooper
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