Research Learning Center (RLC) Report to Congress – FY 2006

Great Lakes Research and Education Center

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Contents

Page

EXECUTIVE SUMMARY……..……4

GLREC SUMMARY……..…..……....…..5

BUDGET SUMMARY …….……...…....5

SUMMARY OF ACCOMPLISHMENTS…… …….……...… .5

RELEVANCE OF PARK RESEARCH TO THE PUBLIC, EDUCATORS, AND RESEARCHERS……..…….....…….…….….…7

IMPACTS TO ACCOMPLISHMENTS…….....….....….8

COLLABORATION ACROSS THE CHALLENGE… ……....……..11

ACCOMPLISHMENTS

GOVERNMENT PERFORMANCE RESULTS ACT (GPRA) GOALS...….. …….……12

VALUE TO PARTNERS ……...…….....12

PUBLISHED LITERATURE RESULTING FROM GLREC EFFORTS……..14

FUTURE PLANS FOR FY 2007……..16

FIGURE 1: GLREC FIELD RESEARCH STATION…… ……..…….……...……....17

FIGURES 2A, 2B, 2C: RESEARCH INTERNS…….…… ……...18

APPENDIX I: TABLES:

TABLE 1: GREAT LAKES RESEARCH AND EDUCATION CENTER AND NETWORK PARKS…...19

TABLE 2: GLREC FY2006 BUDGET SUMMARY……..20

TABLE 3: GLREC FY2006 HOUSING……..21

TABLE 4: GLREC FY2006 FACILITATED RESEARCH PERMITS……..22

TABLE 5: GLREC FY2006COMMUNICATIONS……..27

TABLE 6: GLREC FY2006 PARTNERSHIPS……..31

TABLE 7: GLREC FY2006 STUDENT RESEARCH FACILITATED OR SUPPORTED THROUGH PERMITS……...…….....32

TABLE 8: GLREC FY2006 STUDENT INTERNSHIP PROGRAM…….....33

APPENDIX 2: INTERNSHIP SUMMARY…….34

EXECUTIVE SUMMARY

The Great Lakes Research and Education Center was established in 2002 as part of the Natural Resource Challenge mandate. Its goals are 1) to facilitate research in 10 Great Lakes National Parks; 2) to provide park science research and education opportunities to the public; and 3) to convey applied natural and cultural resources research to the network parks through education and outreach.

During Fiscal Year 2005-2006 the Great Lakes Research and Education Center made considerable progress in development of research and education programs. Activities included completion of the Field Research Station, provision of laboratory equipment, development of the educational resource center, and increasing partnerships to enhance research and engage the public in park science. Both multi-park and individual park research projects were enhanced directly through GLREC staff support, such as grant writing, funding procurement, and technical support. Research results were communicated to managers and the public through education workshops, citizen science training, local and national publications, and presentations at local and national meetings. The GLREC staff co-authored or provided financial support for eight professional research publications. Staff also produced several newspaper articles, brochures, local publications, and electronic communications to the public on Great Lakes national parks research and management programs.

During the 2005-2006 fiscal year, program implementation proceeded primarily with Research Learning Center base funding. Research projects funded through NPS and USGS grants provided support for multi-park research from which informal education programs were developed. Future planning will include expanding research at the GLREC Field Research Station, developing partnerships for funding support, developing scientific consortia with universities and other government agencies to enhance research opportunities and information sharing, continue citizen science training programs, developing training opportunities for park staff, and expanding data and information transfer among the network parks and other Natural Resource Challenge programs.

GLREC Summary

The Great Lakes Research and Education Center (GLREC) was established in 2002 to facilitate research in 10 national park units in the Great Lakes Region with Natural Resource Challenge (NRC) funding of $225,000 (Appendix 1, Table 1).

Center staff consists of a Research Coordinator and an Education Coordinator.
The Research Coordinator assists researchers in grant writing for internal and external funding sources, reviews technical reports, provides technical support, develops internship programs, manages park research permits, oversees single and multi-park research projects, and manages the housing and the Field Research Station for researchers to use. The Education Coordinator provides research focused educational workshops, provides current natural resource research information to network parks, develops educational materials, manages the educational loan materials, and facilitates several educational and interpretive programs.

The facilities include a renovated 1908 Sears catalog house that serves as a Field Research Station (FRS) for laboratory and office use by visiting researchers. The FRS wet laboratory facilities includes a drying oven, incubator, laminar flow hood, growth chamber, microscopes, pH meters, centrifuge, microassay equipment, other materials used for research and training purposes, and high speed internet access (Fig. 1). Educational materials, such as science kits, are also housed in the FRS and made available to teachers. In addition, dormitory housing is available to visiting researchers.

Budget Summary

Budget information is shown in Appendix 1, Table 2. Approximately $172,474 (77%) of the FY2006 budget was allocated to staff salaries and support. A student internship program for eight parks was developed and supported with $27,800 from the GLREC. Laboratory development, research and education supplies, and provision of high-speed internet in the FRS accounted for the majority of the supplies and equipment costs. On-line science library search capacity through Current Contents Connect was provided to 12 resource managers for a total cost of $3,000. Research support was provided to a Michigan Technological University Ph.D. student ($2,490) and to Pictured Rocks NL ($2,000 for DNA analysis). The GLREC contributed matching funds of $2,700 for conducting an educational mapping workshop. Radio telemetry equipment was purchased to support research at Pictured Rocks National Lakeshore and other NPS units ($1,996). Parks as Classrooms funding was obtained to support Great Lakes Educator Workshops integrating research and education at network parks on Lakes Michigan and Superior ($20,988). No other external partners provided operational funding support in 2005-06.

Summary of Accomplishments

Facilitated Use of Parks for Scientific Research

- *No. nights used in park housing*

Lodging was provided to11 researchers at INDU for a total of 84 nights and for two researchers at SLBE for six nights (Appendix 1, Table 3). The total cost savings to researchers for lodging was $5,864.

- *RPRS Permits at INDU*

The Research Coordinator processed 39 active permits and 8 recently expired permits related to inventorying, monitoring, and research. RPRS permits are described in Appendix 1, Tables 4a and 4b.

- *Multipark projects*

The Research Coordinator continued facilitating a research project on cattail hybridization and pitcher plant population genetics. Plant materials were collected from one additional sampling site (park), respectively, for each project during summer 2006. The information gained from this research will have implications to wetland restoration in the Great Lakes Network (GLKN) parks.

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- *Laboratory facilities used*

The Nature Conservancy (TNC) conducted controlled rearing of Karner Blue Butterfly, a federally endangered species found in INDU, at the GLREC research station during June and July 2006. Brood-chamber rearing is part of a re-introduction program coordinated by TNC in state and federal lands in the Midwest.

High-speed internet access was provided this year for researchers and interns using the FRS Station. University of Illinois Urbana-Champagne researchers (4) used the research station for conducting methyl mercury research during July and August 2006. Biologists from the Midwest Region Inventory and Monitoring Program also used the facility for a long-term water quality monitoring project.

The conference facilities were used to host three research seminars, four research meetings, and the first day of a three-day Willow Identification Workshop sponsored by Purdue University Lafayette for resource managers and researchers in Indiana.

- *Non-NPS funds leveraged for park research and education*

USGS National Wetlands Research Center provided in-kind support of $47,000 to conduct a wetland mapping education/training program called WETMAAP (Wetland Education through Maps and Aerial Photography) at Purdue University North Central. A Purdue University researcher obtained $7,000 from an Indiana Coastal Grant to host the program. Louisiana State University also contributed $5,000 toward implementation of WETMAAP. The GLREC provided technical support and $2,300 to the program, and the Great Lakes Northern Forest CESU provided $2,300. Total amount of non-NPS funding leveraged for this project is $59,000.

Value-added Products and Research Information Provided to Staff and Management

- Research internship program for eight GLKN parks
- License for electronic scientific search capability of Current Contents Connect for GLKN park managers

- Botanical training for resource managers (Willow Identification Workshop)
- 2005 Year in Review (published in 2006) report on invasive cattail species, providing information to managers to assist in decision to remove it from wetlands during restoration; 2006 Year in Review article submitted on pitcher plant population genetics in the Great Lakes region; 2006 Park Science article on Advances in Recreational Water Quality Monitoring in Indiana Dunes National Lakeshore.
- Invasive Species "Train the Trainer" Workshop for managers and educators
- Information shared on invasive species seed transport resulted in one Midwest Region park supplying staff with wire brushes to clean their boots and another making brushes available to interpretive staff and visitors through their bookstore.

Relevance of Park Research to the Public, Educators, and Researchers

Appendix 1, Table 5 presents the communication of scientific information conveyed by the GLREC coordinators. These include:

- Presentations at meetings

  Marburger, J., S. Travis, and S. Windels. 2005. The Role of Hybridization in Cattail Invasions of Freshwater Wetlands of Great Lakes Network Parks, North Central Weed Science Society of America, 12-15 December 2005, Kansas City, MO

  Marburger, Joy E. and Wendy W. Smith. 2006. The Great Lakes Research and Education Center – Linking Research and Outreach in the Great Lakes National Parks. Western Great Lakes Research Conference, 22-23 March, 2006, Ashland, WI

- Workshops

  Great Lakes Educator Workshops linking research at Great Lakes National Parks with educational activities and community outreach projects were conducted at five parks through funding from PMIS Parks as Classrooms. A DVD highlighting featured research is in production.

  One Great Lakes Educator Workshop linking educational activities and recent research was conducted in Northwest Indiana for Boys and Girls Club staff.

  Two multi-day educator workshops focusing on wetlands research and education were conducted in partnership with The Notebaert Nature Museum, the Indiana Dunes Environmental Learning Center, the Coffee Creek Conservancy, and Indiana Dunes National Lakeshore.

  An Avian Educators workshop was held at Indiana Dunes National Lakeshore. The workshop featured an ongoing bird banding project and was held in cooperation with the Indiana Department
  of Natural Resources.

  An Invasive Species "Train the Trainer" workshop for land managers and non-formal education providers was conducted at Indiana Dunes National Lakeshore in cooperation with U.S.G.S., the Save the Dunes Conservation Fund, the Northwest

Indiana Regional Planning Commission, and the Northwest Indiana Invasive Plants Network.

- University presentations

  Marburger, Joy. 2006. Research Opportunities in Great Lakes National Parks. University of Illinois Chicago, 5 September 2006.

- NPS-sponsored Western Great Lakes Research Conference

Both coordinators assisted in development and coordination of the conference (an annual event)

Promoting Resource Stewardship through Partnerships

Appendix 1, Table 6 presents the *major* partners during FY 2006 including:

- NGOs such as Chicago Wilderness, Midwest Invasive Plant Network, Northwest Indiana Invasive Plant Network, Save the Dunes Conservation Fund, the Nature Conservancy
- GLRC-USGS Purple Loosestrife Volunteers (citizen science program)
- Wetlands education workshops sponsored by IDELC, USGS, and Notebaert Nature Museum
- Great Lakes Educator Workshops funded through Parks as Classrooms and co-sponsored by multiple organizations including Alliance for the Great Lakes, Illinois-Indiana Sea Grant, USGS, Northern Michigan University

Impacts to Accomplishments

2006 Changes

In order to consolidate facilities and enhance coordination, the GLREC Coordinators moved offices into shared park buildings (NPS and USGS). The Research Coordinator and the GLREC research intern provided assistance in plant sample collections at SLBE for USGS researchers. The Education Coordinator conducted a series of workshops in the GLKN parks during summer 2006 as a result of a Parks-As-Classrooms grant. The Education Coordinator also represented the RLC, GLREC, and INDU during a three-week visit to a sister park in Poland. Park-based funding paid for this travel.

Vignettes

Vignettes for various topics include the following:

- *Facilitating use of parks for scientific inquiry*

The GLREC facilitated several multi-park projects, including continuing research on cattail hybridization and pitcher plant population dynamics. The Research Coordinator collected cattail morphological data and leaf materials at SLBE during August 2006, to add a fourth park to the data set. The Research Coordinator facilitated housing for continuing the pitcher plant research project at INDU, in addition to three other parks under investigation.

The Research Coordinator managed a total of 47 permits. Tables 4a and 4b provide details on permit research topics and their relevance to INDU information needs. The number of students involved with research projects through the RPRS permits are shown in Appendix 1, Table 7.

Housing was provided to 11 researchers in INDU. Of these 10 were university researchers and one was a resource manager from the Midwest Inventory and Monitoring Program. SLBE also provided housing to two INDU park staff conducting work on a multi-park project for the USGS.

- *Supporting science-informed decision making*

The Research Coordinator provided information on ongoing research and research needs in GLKN parks through several oral and poster presentations at scientific meetings and at universities. Information on GLKN park research needs was conveyed to the Great Lakes Northern Forest CESU coordinator, who is the lead in development of a Midwest Region Science Strategy. The Research Coordinator conveyed the implications of changes in wetland habitats due to invasive cattails through the 2005 (published in 2006) Year in Review. The Education Coordinator provided information on changes and improvements in water quality monitoring and beach health through the 2006 summer edition of Park Science (to be published in FY07). Information on invasive plants was shared with resource managers through publications and GLREC participation in the Northwest Indiana Invasive Plants Network and the Midwest Invasive Plants Network.

Both the research and Education Coordinators assisted in organizing the 2006 Western Great Lakes Research Conference by editing abstracts and producing the program brochure. The conference is sponsored by three components of the Natural Resource Challenge (Great Lakes Northern Forest CESU, GLKN Inventory and Monitoring Program, and the GLREC) and a host CESU institution, usually a university.

- *Communicating relevance and providing access to research knowledge*

This year the GLREC provided electronic scientific literature access to resource managers in the GLKN parks. At this time 12 resource managers have received the license.

GLREC staff provided research reports through a series of e-mails to researchers, educators, resource managers, and interpreters around the Midwest Region. Programs on wetland issues were conducted for upper elementary students, information on invasive species were highlighted on a radio program, and an open house for teachers was held to showcase many science- and education related materials available for loan through the GLREC. The Education Coordinator gave presentations on the GLREC and Research Learning Centers at Kampinos National Park and students at the Sladow School in Poland as part of a park exchange program with INDU during summer 2006.

- *Promoting resource stewardship and research communication through partnerships*

The Research Coordinator reviewed and edited the following USGS National Wetlands Research Center research and resource stewardship documents, requested by the USGS research plant ecologist:

Cengiz TÜRE, Nuket Akanýl BINGO, Beth A. MIDDLETON, Harun BÖCÜK. Phenological and morphormetric characteristics of invasive plant *Lythrum salicaria* L. naturally growing in different phytogeographical regions of Turkey (In review).

Middleton, B.A. 2006. Global citizen, local volunteer. Abstract for George Wright Society Conference, April 2007.

Middleton, B.A. 2006. Impoundment and baldcypress swamp management. National Wetlands Research Center Open File Report.

Middleton, B.A. 2006. Implications of climate change on baldcypress swamp management. National Wetlands Research Center Open File Report.

Middleton, B.A. 2006. Invasive species and climate change. National Wetlands Research Center Open File Report.

Middleton, B.A. 2006. Fire management in fens and wet grasslands grazed by cattle. National Wetlands Research Center Open File Report

- *Grants Facilitated by Research Coordinator*

  Co-wrote POBS grant with USGS (3 year study of cattail), $171,000 (including in-kind support from GLREC) (completed in 2006)

  Co-wrote CCI grant for Jennifer Karberg's research on pitcher plants (Michigan Technological Univ.) $15,000 of total $65,569 (completed in 2006)

  Wrote Coastal Grant for Robin Scribailo, Purdue University, who obtained $7,000 match with USGSs $52,000, GLRECs $2,700, and CESUs $2,300 to execute WETMAAP project (this is an international project); total of $64,000 (2006-07)

  Co-wrote Coastal grant for Young Choi, Purdue University, who developed an oak savanna restoration research project and demonstration site, $38,800 obtained; $68,000 grant (ongoing research)

  Total direct grant support for researchers involving Research Coordinator was $369,570.

- *Review and Editing of Research Proposals*

The Research Coordinator reviewed the following research proposals associated with INDU research permits in 2006:

Development of a Diagnostic Indicators for Assessing "Health" of Black-Oak (*Quercus velutina*) Savannas in the Chicago Region, Dr. Young Choi, Purdue University Calumet

Methylmercury in the Wetlands of the Indiana Dunes National Lakeshore and Grand Calumet Watershed: Tests of Diffusive Gradients in Thin Films as a Means of Monitoring Bioavailable MeHg, Dr. Robert Hudson, University of Illinois Urbana Champagne

Rates of sand movement and Mt. Baldy dune migration at Indiana Dunes National Lakeshore, Dr. Zoran Kilibarda, Indiana University Northwest

Collaboration across the Challenge

The following example(s) relate how the GLREC is improving efficiency and effectiveness in working with other NRC programs.

- Continued collaboration with the Great Lakes Northern Forest CESU, GLKN Inventory and Monitoring Program, and Great Lakes Exotic Plant Management Team in organizing the Western Great Lakes Research Conference and development of a Regional Science Strategy.

- Support for a research project with a CESU university researcher (University of Illinois) facilitated by the GLREC to test the efficacy of a new probe to evaluate methyl mercury in water to supplement the use of organisms for testing bioaccumulation of this contaminant.

- Development of a research internship program in 2006 (Figs. 2 a,b,c) to assist resource managers in eight GLREC network parks in research and monitoring projects (Appendix 1, Table 8). Both resource managers and student interns reported a very positive experience with this program. This program was funded by $25,000 from the GLREC budget.

- Collaborative funding support from the Great Lakes Northern Forest CESU for research and education projects. These include:

  Continued funding support for Ph.D. student (Michigan Technological University) who is conducting demographic and genetic research on pitcher plants in four GLKN parks. Funding was obtained through a CCI grant ($15,000) and GLREC contract ($2,490).

  Funding support for implementing a USGS-Purdue University sponsored training workshop on remote sensing and map interpretation for teachers and managers ($2,000 from the GLREC; $3,000 from the CESU; $5,000 from Louisiana State University, $7,000 from the Indiana Coastal Grants Program via Purdue University; and $47,000 of in-kind contributions from the USGS National Wetland Research Center Mapping Unit.

Government Performance and Results Act (GPRA) Goals

The achieved GPRA goals and the percent time appropriated to the goals include:

Goal Ia1A- Disturbed Lands, 5%
Goal Ia1B- Invasive (non-native) Plants, 10%
Goal Ia1C- Land Health: Wetland Areas, 10%
Goal Ia1E- Land Health: Upland Areas, 5%
Goal IIa1A- Visitor Satisfaction, 20%
Goal IVb1a- Park Partnerships, 50%

There is overlap in some of the goals, such as GLREC development and implementation of public workshops on topics such as plant taxonomy, wetland restoration and protection, and invasive species control (Goals Ia1B, Ia1C, Ia1E, IIa1A, IVb1a).

Value to Partners: Quotes (3 each)

To Research Coordinator:

- Dr. Young D. Choi, Professor, Department of Biological Sciences, Purdue University Calumet, Hammond, IN 46323

Phone 219-989-2325 E-mail ydchoi@calumet.purdue.edu

My project is titled, "Demonstration of oak savanna restoration in Lake Michigan Sand Dunes, Indiana." This project was conducted in a formerly sand mine sites in the West Beach Unit and a formerly industrial site located south of the West Beach Unit within the boundary of the Indiana Dunes National Lakeshore (INDU). GLREC has assisted for identification of the project sites provided technical advice and administrative support for acquiring research permits from the INDU and providing locations for educational demonstration sites.

I am located at Purdue University Calumet and am the principal investigator. Dr. Joy Marburger of the GLREC, and Dr. Noel Pavlovic of USGS are co-investigators of this project. Additionally, two undergraduate students, two graduate students, and one post-doctoral assistant at Purdue University Calumet are involved in this project.

- Mr. Lawrence Handley, Remote Sensing and Mapping Co-Director, USGS National Wetlands Research Center, 700 Cajundome Boulevard, Lafayette, LA 70506

Phone 337-266-8691 Email larry_handley@usgs.gov

For the past three years Joy Marburger has been working to have a WETMAAP site developed at Indiana Dunes National Lakeshore to provide maps, aerial photos, and satellite imagery as resource materials to K-12 formal and informal educators through workshops and the web. Joy has networked with local educators, Purdue University, Indiana Lake Michigan Coastal Grants Program, among others in order to promote the education concept and secure funding for the project. After several proposals Joy's

persistence has assisted in securing the funding through a consortium of entities including the National Park Service, the USGS, Inidana Lake Michigan Coastal Grants Program, Purdue University, the University of Louisiana at Lafayette, and Chadron State College in Nebraska.

- Dr. Robert J.M. Hudson, Associate Professor, Department of Natural Resources and Environmental Sciences, University of Illinois Urbana-Champaign, Urbana, IL 61801
Phone 217-333-7641 Email rjhudson@uiuc.edu; rjmhudson@gmail.com

During the summer of 2006, my research group (3 graduate students plus myself) conducted a field study of methylmercury in wetlands of the Grand Calumet watershed and Indiana Dunes National Lakeshore (INDU). For this project, we used the field research station at INDU as our base of operations. We also conducted sample processing and experimental incubations in the lab. Joy Marburger, the Research Coordinator at INDU, assisted us greatly in planning the logistics for the field effort, in the permitting process, and in learning details of the INDU wetlands that were important for our sampling design. In addition to our field effort last summer, Joy and I have been collaborating on a pilot-scale field study to test a novel method for sampling methylmercury in water from wetland pools that should provide a more accurate and economical means of assessing wildlife exposure to this toxicant. This project has the potential to allow broad-scale studies of MeHg to be conducted by NPS field workers without a great deal of training and at a very modest cost compared to having specially-trained field researchers collect water for MeHg analysis.

To Education Coordinator:

- Stephanie Smith, Education Program Manager, Alliance for the Great Lakes
17 N. State Street, Chicago, IL, 60602
Phone (312)939-0838 ext. 226 E-mail ssmith@greatlakes.org

The Great Lakes Research and Education Center (GLREC) proved an essential partner in working with the Alliance for the Great Lakes this year. Together we crafted workshops for formal and non-formal educators to teach them about the Great Lakes, provide key educational resources and scientific research, demonstrate ways to integrate the information into classroom learning and offer an opportunity to bring stewardship and service learning to their students. Wendy Smith of the GLREC was the guiding force behind the unique and successful workshops that reached nearly 60 educators at 5 National Parks throughout the Great Lakes region. The GLREC's role was of particular importance in bridging the gap between educators and scientists and finding ways to bring research to students in the region. The partnership was of great importance to the Alliance for the Great Lakes, as it enabled us to conduct outreach and forge new relationships in parts of the Great Lakes region we would otherwise have been unable to reach with our Great Lakes in My World curriculum and Adopt-a-Beach program. The Alliance is extremely appreciative of this partnership!

- Robin G. Goettel, Associate Director for Education, Illinois-Indiana Sea Grant College Program, University of Illinois, 368 NSRC, MC-635, 1101 W. Peabody Drive, Urbana, IL 61801 Phone 217 333-9448 E-mail goettel@uiuc.edu

Illinois-Indiana Sea Grant has appreciated working with the GLREC on many levels. Education Coordinator Wendy Smith has been invaluable to our education program. We partnered with Wendy and the GLREC to present the 2006 Great Lakes Institute. This allowed us to share numerous program resources and new research findings on issues such as fish contaminants and aquatic invasive species, and also to offer new opportunities for teacher professional development by sharing information on the COSEE (Center for Ocean Science Excellence in Education) Great Lakes project. Wendy Smith served on our planning committee for our "Fish School" education project and assisted with publicity for this workshop which enabled teachers to learn more about the fish consumption issues related to mercury and PCB contaminants in fish. She also served on our COSEE Advisory board. We are most grateful for the support Wendy and Joy Marburger, GLERC Research Coordinator, have given us in planning the field experience at Wolf Lake where teacher attendees will get a firsthand look at aquatic invaders and will learn more about management, research, and control strategies.

- Mark Gleason, PhD Candidate, Michigan Technological University,
3499 Coit Ave, NE, Grand Rapids, MI 49525
Phone 616-363-0806 E-mail gleason@mtu.edu

My partnership with GLREC has allowed me to improve my work in two different ways. First, by presenting my research to groups in connection to GLREC activities I find I am able to share my area of interest. Too often in the past and even today researchers conduct projects then report their findings to a small group of members of their field of study. I have felt for a long time that those of us that undertake "publicly" funded research have a responsibility to share that research with those that pay for it. GLREC has provided me with an opportunity to do just that. Second, I have been able to include participants of GLREC activities into my research. I am working with underwater robotics to improve natural resources education. GLREC has provided me with a number of audiences to use as part of my efforts to develop programs to improve public education about the least understood and visited of our public areas. Those areas are located underwater and rarely seen by park visitors.

Published Literature Resulting from GLREC Efforts

Cengiz Ture, Nuket Akanýl Bingo, Beth A. Middleton, Harun Bocuk. 2006. Phenological and Morphormetric Characteristics of Invasive Plant *Lythrum salicaria* L. Naturally Growing in Different Phytogeographical Regions of Turkey (submitted to Wetlands).

Choi, Y.D., J. Marburger, and W. Smith. 2006. Demonstration of Oak Savanna Restoration in Lake Michigan Sand Dunes (Indiana). Ecological Restoration 24(1):30.

Glowacki, G., and R. Grundel. 2005. Status of the Eastern Massasauga Rattlesnake at Indiana Dunes National Lakeshore, p. 41. Report to the Great Lakes Inventory Network National Park Service.

Karberg, Jennifer and Joy Marburger. 2006. Determination of Genetic Diversity and Restoration Potential of the Pitcher Plant (*Sarracenia purpurea*) in the Lake Superior and Lake Michigan Watersheds. National Park Service Natural Resources 2006 Year in Review. (submitted to NPS)

Lebrun-Southcott, Zoe. 2006. Piping Plover Recovery Efforts at Sleeping Bear Dunes National Lakeshore. National Park Service Natural Resources 2006 Year in Review. (submitted to NPS).

Marburger, Joy. 2006. Silent Stalkers of the Bog. Singing Sands Almanac, Summer 2006.

Middleton, B.A. 2006. Global citizen, local volunteer. Abstract for George Wright Society Conference, April 2007.

Pavlovic, N. B., R. Grundel, and W. Sluis. 2006. Groundlayer vegetation gradients across oak woodland canopy gaps. Journal of the Torrey Botanical Society 133:225-239.

Smith, W., Nevers, M., and Whitman, R. 2006. Advances in Recreational Water Quality Monitoring in Indiana Dunes National Lakeshore. Park Science, Summer 2006.

Travis, S.E., J.E. Marburger, S.K. Windels, and B.A. Middleton. 2006. The Role of Hybridization in Cattail (*Typha* spp.) Invasions of Freshwater Wetlands in Great Lakes National Parks. The Society of Wetland Scientists 27th International Conference and the Australian Marine Sciences Association 44th Annual Meeting, 9 - 14 July, 2006, Cairns, Australia (abstract and poster).

Travis, S.E., S.K. Windels, and J.E. Marburger. 2006. The Prevalence of Hybridization in Cattail (*Typha* spp.) Invasions of Freshwater Wetlands in Great Lakes National Parks. Western Great Lakes Research Conference 22-23 March, 2006, Ashland, Wisconsin (abstract).

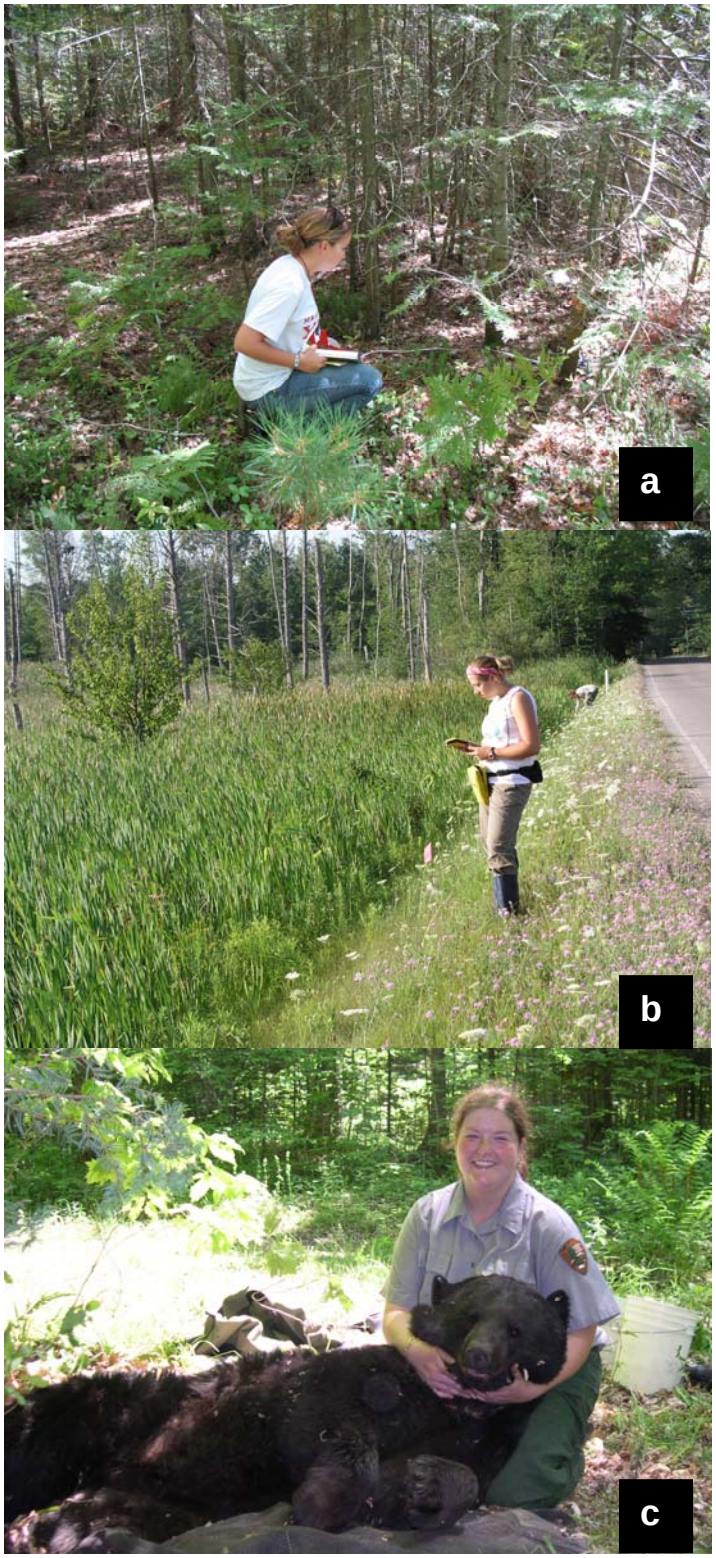
Future Plans for FY 2007

Future priorities for the program include:

- establish a strategic plan and increased communication among the GLREC staff and regional program staff to achieve the RLC mission and goals of the plan
- seek external funding sources and partnerships to continue and expand research and education opportunities
- facilitate rigorous scientific approaches to park science to improve resource management
- enhance closer relationship with university researchers; develop educational/outreach component associated with research objectives

- provide more housing for researchers to conduct research in parks
- develop scientific consortia with universities and other government entities to enhance information sharing among researchers and managers
- continue development of GLREC research facilities to encourage more research in Great Lakes network national parks
- promote high quality citizen science training to the public and university students alike to assist researchers in data collection
- improve data and information technology accessibility among the network parks and Natural Resource Challenge programs
- develop student internship programs with direct involvement of CESU university researchers
- develop avenues to communicate research to wider and more diverse audiences.

Figure 1: GLREC Field Research Station. University of Illinois Ph.D. student conducting methyl mercury research.



Figures 2: GLREC Research Interns: a) Apostle Island National Lakeshore; b) Indiana Dunes National Lakeshore; c) Isle Royale National Park

Appendix I: Tables

Table 1. Great Lakes Research and Education Center and Network Parks

RLC Name	Parks Served	Acronym	Initial/main Funding Source
Great Lakes Research and Education Center- 2002	**Indiana Dunes National Lakeshore, IN (host park)** Other parks in network include: Apostle Islands National Lakeshore (WI) Grand Portage Nat'l. Historic Monument (MN) Indiana Dunes National Lakeshore (IN Isle Royale National Park (MI) Keweenaw National Historic Park (MI) Pictured Rocks National Lakeshore (MI) St. Croix National Scenic Riverway (WI) Sleeping Bear Dunes National Lakeshore (MI) Voyageurs National Park (MN)	 APIS GRPO INDU ISRO KEWE PRNL SACN SLBE VOYA	Natural Resource Challenge ($225,000)

Table 2. GLREC FY2006 Budget Summary

Prepared by Scott Hicks, Assistant Chief of Resource Management and Lisa Van Auken, Administrative Assistant, Indiana Dunes National Lakeshore

SALARIES							
Name	**Title**	**Grade**	**Step**	**RLC Funds used**	**% of RLC funds**	**Other NPS funding**	**Non-NPS Funding**
Joy Marburger	RLC Research Coordinator	11	4	$75,291.49	33%		
Wendy Smith	RLC Education Coordinator	11	4	$83,257.34	37%		
Carlene Grecco	Other (GLREC intern)	3	1	$5,914.37	3%		
Maintenance OT				$1,510.11	1%		
Internship Accts				$8,653.00	4%		
SUBTOTAL SALARIES				**$172,474.31**	**77%**		
TRAVEL				$3,781.00	2%		
EQUIPMENT PURCHASES AND MAINTENANCE				$2,393.00	1%		
SUPPLIES				$12,926.00	6%		
SERVICES				$20,332.00	9%	$2,300.00	$59,000.00
							USGS/Purdue U.
PRINTING				$28.00	0%		
BUILDING REHAB AND MAINTENANCE				$0.00	0%		
OTHER ADMIN COSTS (e.g. GSA vehicle, etc.)				$13,065.69	6%	$490.31	
ASSESSMENTS (Regional and park based)				$0.00	0%		
PARKS AS CLASSROOMS						$20,988	$11,775.00
TOTAL				**$225,000.00**	**100%**	**$23,778.31**	**$70,775.00**

Table 3. GLREC FY2006 Housing

Type of Housing	No. Researchers	$ / Night @ # Nights	Total Cost	Equivalent Private Lodging	$ / Night @ # Nights	Total Private Value	Savings to Researchers
House 1 (GLREC pays)	6	$9.78/night 69 nights	$674.82	Hotel	$75.00/night 69 nights	$5,175.00	$4,500.18
House 2 (Researcher pays)	5	$10.10/night 15 nights	$151.50	Hotel	$75.00/night 15 nights	$1,125.00	$973.50
Sleeping Bear Dunes NL (GLREC funded construction)	2	$10.00/night 6 nights	$60.00	Hotel	$75.00/night 6 nights	$450.00	$390.00
Total			**$886.32**				**$5,863.68**

Other Savings to Researchers

Researchers and their support staff had access to kitchen and laundry facilities at INDU and to kitchen facilities at SLBE. Researchers from University of Illinois Urbana Champagne utilized the FRS laboratory for 11 days during the summer to conduct their research. Besides using the equipment provided by GLREC, they had access to ultra-pure water to conduct their analyses. The GLREC research intern provided staff support to University of Illinois researchers in developing a new analytical method for methyl mercury analysis. The FRS also provided researchers and students with office space and high-speed internet access. The GLREC Research Coordinator conducted oversight of the project permits, housing, lab use, and intern staff involved with the projects. The Research Coordinator assisted three researchers in grant proposal writing (described in text).

Tables 4a and 4b. GLREC FY2006 Facilitated Research Permits

LEVEL OF RLC INVOLVEMENT is ranked as follows:
0=no involvement
1=little or superficial involvement (e.g. communicate with researchers about projects via phone or email or at professional or in-park meetings)
2=moderate involvement (e.g. provide short term housing, participate in scientific meetings/workshops on research topic, facilitate communication of research results to managers or public)
3=significant involvement (e.g. provide long term housing – several weeks to months, provide computer access, actively solicit projects, co-write research proposals, focused effort to communicate research results to managers or the public)
*identifies research that helped to reduce park back-logged needs for resource management information.

Table 4a. FY2005-2006 Active Permits at Indiana Dunes National Lakeshore

	Permit Number- Active	**Title/Description**	**Level of RLC Involvement**
1	INDU-2006-SCI-0012	Isolation of Arbuscular Mycorrhizae Fungi from Indiana Dunes NL	1*
2	INDU-2006-SCI-0018	A Spatio-Temporal Study of Methylmercury Biogeochemistry in Wetlands of the Southern Lake Michigan Watershed	3*
3	INDU-2005-SCI-0006	A Survey of Submerged Aquatic Plants and Associated Invertebrates	1*
4	INDU-2005-SCI-0016	Assessing the Potential Homogenization of the Vegetation of the Western Great Lakes Coastal Dunes	1*
5	INDU-2006-SCI-0022	Avian Influenza Surveillance Program	2*
6	INDU-2006-SCI-0015	*Botrychium matricariifolium* Occurrence in Northwest Indiana	3*

7	INDU-2004-SCI-0002	Collection of Endangered Butternut Germplasm for Improving Disease Survival	1
8	INDU-2006-SCI-0008	Dancing in the Dark? Is There Succession of Arbuscular Mycorrhizal Fungal Communities?	1
9	INDU-2004-SCI-0008	Determine Occurrence and Population Distribution of Rare Plant species in Indiana Dunes National Lakeshore and Collect Voucher Specimens of Species	1*
10	INDU-2006-SCI-0002	Do interacting Microbial Mutualists Alter the Invasibility of Dune Plant	2*
		Communities?	
11	INDU-2006-SCI-0016	Do Symbioses Determine Plant Species Abundances? How Do Endophytic Fungi Control Rarity, Dominance, and Invasiveness of Grasses?	2*
12	INDU-2005-SCI-0004	Ecological Impacts of Remediation at the Grand Calument River	1
		Superfund Site: Assessment of Great Blue Heron Reproductive Success	
13	INDU-2006-SCI-0007	Effects of Persistent Pollutants on Great Blue Heron Reproductive Success	1
14	INDU-2006-SCI-0020	Examination of Population Characteristics of Two State-listed (Indiana)	1*
		Carex Species Within the Pannes of the IDNL West Beach Unit	
15	INDU-2006-SCI-0013	Examining an Invasive Vine (Oriental Bittersweet) and its Native Congener: Morphology, Genetics, Hybridization and Fire Effects	1*
16	INDU-2003-SCI-0012	Experimental Restoration of Oak-savanna in the Indiana Dunes NL	3*
17	INDU-2006-SCI-0010	Exploring Mechanisms Behind Biological Invasions in Wetlands: Do Microbes Mediate	3*

		Plant Invasion Success by Altering Nutrient Dynamics?	
18	INDU-2006-SCI-0005	Field Methods for College Biology Students	1
19	INDU-2005-SCI-0007	Genetic Diversity of *Sarracenia purpurea*: Restoration in Indiana Dunes National	3*
		Lakeshore	
20	INDU-2004-SCI-0005	Gypsy Moth Survey	1
21	INDU-1994-SCI-0003	Impact of Air Pollution on the Fungi of Indiana Dunes National Lakeshore	1*
22	INDU-2005-SCI-0013	Update of Indiana Dunes National Lakeshore Herbarium	1
23	INDU-2003-SCI-0009	Kankakee Sands Efroymson Restoration Project (KSER) I	1
24	INDU-2004-SCI-0010	Kankakee Sands Efroymson Restoration Project (KSER) II	1
25	INDU-2006-SCI-0014	Monitoring Avian Productivity and Survivorship in Miller Woods	1*
26	INDU-2005-SCI-0021	Mycorrhizal Regulation of Ecosystem Response to Chronic Nitrogen Deposition	1*
27	INDU-2005-SCI-0009	Northern Indiana Public Service Company (NIPSCO), Bailly Generating Station,	1
		RCRA Facility Investigation	
28	INDU-2004-SCI-0015	Integrating Long-term Demographic Data and Repeated Genetic Sampling for Viability	1*

		Analysis of Natural and Restored *Cirsium pitcheri* (Pitcher's thistle)	
29	INDU-2004-SCI-0017	Persistence and Dispersal Patterns of *Galerucella* sp. at Long Lake, Indiana Dunes NL	1
30	INDU-2006-SCI-0019	City of Pines and Adjacent Indiana Dunes National Lakeshore Contaminant Site	1
		Remedial Investigation	
31	INDU-2005-SCI-0014	Population genetics of *Sabatia angularis* (Gentianaceae) in the Upper Midwest	2
32	INDU-2006-SCI-0017	Probabilistic Assessment of the Grand Calumet River and Indiana Harbor Canal	1*
		Canal Area of Concern with Emphasis on Development of Delisting Criteria	
33	INDU-2006-SCI-0003	Sediment Movement and Deposition along the South Shore of Lake Michigan	2*
34	INDU-2005-SCI-0008	Shrubs and Woody Vines of Indiana (photographic key)	2*
35	INDU-2005-SCI-0020	Spatial and Temporal Effects of Climate Change on Great Lakes Wetlands	1
36	INDU-2006-SCI-0021	The Role of Soil-borne Pathogens in Forest Dynamics and Disease	1*
37	INDU-2004-SCI-0016	Recovery Plan and Seed Banking of *Cirsium pitcheri* (Pitcher's thistle)	1*
38	INDU-2005-SCI-0017	Long-term comparison of the demography and genetics of natural and restored	1*
		populations of *Cirsium pitcheri*: Can we create and maintain viable plant populations?	
39	INDU-2006-SCI-0011	Long-term Water Quality Monitoring of Inland Lakes of Indiana Dunes NL	2*

Table 4b. FY2004-2005 Recently Expired Permits at Indiana Dunes National Lakeshore

	Permit Number	Title/Description	Level of RLC
	Recent Expired FY 2005		**Involvement**
1	INDU-2004-SCI-0007	Amphibian and Reptile Survey fo the Former Lake County Area #28 (as Identified	1*
		in a 1979 Inventory of Natural Areas in the Indiana Coastal Zone Study Area	
2	INDU-2004-SCI-0009	An Ecological Study of the Hymenoptera of the Great Lakes Region, with an	1*
		Emphasis on Determining Potential Pollinators of Native Vegetation	
3	INDU-2004-SCI-0018	Effects of Fire Frequency on the Understory Species Richness of a Fire	2*
		Suppressed Silt Loam Savanna Complex	
4	INDU-2004-SCI-0019	Effects of Hybridization on Herbivore Resistance Traits and Implications for	1
		Polyploid Speciation in Sunflowers	
5	INDU-2004-SCI-0003	Mesocosm and Field Studies to Determine the Levels of Heavy Metals and	1*
		Nitrogen in Pannes, Their Spatial Distribution Within a Panne, and the Threshold	
		Levels Necessary to Increase Susceptibility of Panne Vegetation to Plant Invaders	
6	INDU-2004-SCI-0006	Monitoring Avian Migrations, Productivity, and Survivorship in Miller Woods	2*
7	INDU-2004-SCI-0013	Occurrence and Transport of Enteric Viruses and Water Quality Indicators	1*
8	INDU-2003-SCI-0017	The Role of Belowground Plant-Microbe Interactions in Plant Invasions	1*

Table 5. GLREC FY2006 Communication

Type of Product or Event	Audience P=public T=Teachers or students M= Mgmt or Staff S=scientists or professionals	Title of Product/Event	Program Objective	Number of Scientists Involved or Contributing	Type of Recipients, Benefactors, or Participants	Number of Recipients, Benefactors, or Participants (% signed as volunteers) Note estimates w/ an *	Length of Event (hours)
Workshop	T	Exploring Wetlands Teacher Workshop	provide general wetlands info, research, and activities	1	Middle and High School Teachers	12	12
Workshop	T	Great Lakes Education Workshop	share current information on Great Lakes Issues	1	Boys and Girls Club Counselors	10	3
Open House	T	GLREC Educational Resources Center Open House	show educators natural resources educational materials that they can borrow	0	Primary and Secondary Teachers, Public	18	1
Workshop	T,M	Avian Educators	provide educators with activities and information on bird banding project and other educational activities	1	Formal and non-formal educators	11	3
Radio Show	P	"Naturally Speaking"	share information on invasive	1	general public	???	0.5

			species work				
School Program	T	Exploring Wetlands	teach about wetland invasives including invasive hybrid cattails	1	primary school students	35	1.5
Workshop	PTM	Invasive Species Train the Trainer Workshop	Provide info and materials for participants to teach the public about invasives and how to combat them	1	non-formal educators and land managers	31	5
Workshop	T,M	Great Lakes Educator Workshop	share research from Pictured Rocks Nat'l Lakeshore and present complimenting educational activities	2	formal and non-formal educators, interpretive staff	13	6
Workshop	T	Great Lakes Educator Workshop	share research from Isle Royale and Keweenaw and present complimenting educational activities	3	formal and Non-formal educators	11	16
Workshop	T	Great Lakes Educator Workshop	share research from Apostle Islands and present complimenting educational	2	formal and non-formal educators	11	7.5

			activities				
Workshop	T,M	Great Lakes Educator Workshop	share research from Sleeping Bear Dunes and present complimenting educational activities	1	formal and non-formal educators, interpretive staff	13	8
Workshop	T, M	Great Lakes Educator Workshop	share research from Indiana Dunes and present complimenting educational activities	2	formal and non-formal educators, interpretive staff	12	31
Science Magazine on-line	M, R, P	Current scientific research related to natural resources	Provide current research information via email	multiple	Network RM, RLC Research Coordinators, researchers	100	N/A
e-mail bulletins	T,M	"Did You Know?" bulletins	share recent research	8	network RM and Interp staffs, Educators, and Partner educators	e-mail is received by about 250 recipients	N/A
Current Contents Connect	M	literature search capacity via website	increase availability of scientific literature to resource managers	N/A	license to 12 resource managers in the GLKN network	12 resource managers	N/A

University Seminar	S, T	Research Opportunities in Great Lakes National Parks	Provide opportunities for research in the GLKN parks	6	researchers, undergraduate, and graduate students	30	1.5
Workshop	T, M	Wetlands in Parks (WIP)	Provide current information and training on wetland issues	1	educators, interpreters, interested public	13	30

Table 6. GLREC FY2006 Partnerships

Partner Name*	Level (national, regional, state, local)	Focus (education, research, restoration of historic structures)
Alliance for the Great Lakes	regional	education
Annis Water Resources Institute	regional	education/research
Center for Ocean Science Excellence in Education	federal	education/research
Chicago Botanic Garden	regional	research
Chicago Wilderness (multi-partnership within)	regional	education/research
Coffee Creek Watershed Conservancy	local	education
Copper Country Intermediate School District	regional	education
Empire, MI, Michigan Town Board	local	educational
Field Museum of Chicago	regional	research
Friends of Indiana Dunes	local	education
Illinois-Indiana Sea Grant College Program	federal	education/research
Indiana Department of Natural Resources	state	education
Indiana Dunes Environmental Learning Center	regional	education
Indiana University NW	regional	education
Midwest Invasive Plants Network	regional	education/research
Moosewood Nature Center	local	education
Northern Michigan University	regional	education/research
Northwest Indiana Invasive Plants Network	local	education
Notebaert Nature Museum	regional	education/research
NW Indiana Teacher Training Hub	regional	education
Pier Wisconsin	regional	education/research
Purdue University, Calumet, Lafayette, North Central	state	education/research
Region 5 Environmental Protection Agency	federal	education
Save the Dunes Conservation Fund	local	education
Shedd Aquarium	regional	education/research
University of Illinois Urbana Champagne	regional	research
USDA Forest Service- North Central Research Station	regional	education
US Environmental Protection Agency Region 5	regional	education/research
US Fish and Wildlife Service	federal	education
USGS Lake Michigan Ecological Research Station	federal	research
USGS National Wetlands Research Center	federal	education/research

* This list does not include other research and education institutions involved with the RPRS permit system.

Table 7. GLREC FY2006 Student Research Facilitated or Supported Through Permits

Degree Being Sought	No. of students	Fields of Research	Research Topics	Types of Products
Post-doctoral Appointment	2	Plant Ecology, Microbial Ecology	Microbial communities in wetlands; relationship to cattail invasions Effects of microbial mutualists in exotic plant invasions of dunes	Research publications Research publications
PhD	1 1 1 1	Microbiology Molecular Plant Genetics Restoration Ecology Biogeochemistry	Soil fungi regulation of ecosystem response to atmospheric nitrogen Genetic diversity of pitcher plants Restoration of oak-savanna at Indiana Dunes NL Methyl mercury processing and bioaccumulation in wetlands in Indiana Dunes NL and the Grand Calumet region	Research publications Research publications, Year in Review article (2006); Workshop presentations; restoration techniques Demonstration site, presentations, publications Research publications, meeting presentations
Post Master's	1	Plant Taxonomy	Population characteristics of two state-listed *Carex* (sedge) species in the pannes of Indiana Dunes NL	Research publications; restoration techniques
Master's	1 1 2	Molecular Ecology Biogeochemistry Biogeochemistry	Microbial soil communities and relationship to sand dune succession Heavy metal and nitrogen deposition effects on plant invasions of pannes in Indiana Dunes NL Mycorrhizal regulation of ecosystem response to chronic nitrogen deposit	Research publications Research publications Research publications
Bachelor's: capstone	1	Geomorphology	Sediment and sand movement and deposition along the southern shore of Lake Michigan	Undergraduate student project; publications
Bachelor's	1 3	Biogeochemistry Biogeochemistry	Development of methyl mercury probes for water sampling in wetlands Mycorrhizal regulation of ecosystem response to chronic nitrogen deposit	Probes for M.S. student to deploy in Indiana Dunes NL wetlands Undergraduate student training

Total number of students working on research projects through RPRS at INDU: 16

Table 8. GLREC FY2006Student Internship Program*

Degree Sought	Park	No. students	Fields of Research	Research Topics	Types of Products
Post Master's	SLBE	1	Biology (Avian ecology)	Piping Plover Recovery Efforts at Sleeping Bear Dunes National Lakeshore	2006 Year in Review article, Presentation at Great Lakes Piping Plover Recovery Group meeting
Master's	PIRO	1	Biology (Mammalogy)	Hair Sampling of Black Bear and White-tailed Deer for DNA Population Characterization	Data and Report
Bachelor's capstone	VOYA	1	Biology (Avian Ecology)	Synthesis of Great Blue Heron Monitoring Data: 1974-2006	Senior B.S. Thesis
Bachelor's	APIS INDU ISRO KEWE SACN	5	Anthropology Chemistry, Biology Biology (Mammalogy) Cultural History Biology	Woody Debris Availability to Campers for Firewood Methyl Mercury Analytical Methods, Endangered Butterfly Mustelid Survey/Marten Tracking via Radio-collar Timeline of Michigan Copper Mining Grassland Butterfly and Bird Population Monitoring	Report and Park Presentation Methyl Mercury Probe, Presentation Data and Report Brochure, Poster Two Reports, Presentation

***GLREC provided full or partial funding for internship program.**

Total number of students receiving training through the GLREC internship: 8

Appendix 2: Internship Summary

Introduction

The National Park Service initiated the Natural Resources Challenge in 1999. The Challenge resulted in the development of Research Learning Centers (RLCs) throughout the country. The RLCs increase the effectiveness and communication of scientific research in national parks by 1) facilitating use of parks for scientific inquiry; 2) supporting science-based decision making; 3) communicating current research information; and 4) promoting resource stewardship through partnerships. RLCs initiate, support, and implement a wide variety of research projects and provide opportunities for university students to work with researchers and park managers. The Great Lakes Research and Education Center (GLREC) initiated a university student internship program in 2005 to provide support for researchers and managers in the Great Lakes Network parks (GLKN). Among the 10 GLNK parks, eight participated in the program.

Internship Funding

The GLREC allocated $$27,800 of FY 2005-2006 budget for development of the internship program at eight parks. INDU administered fund distribution to each park. In February 2006 an announcement was developed for summer student internships according to the research needs of the responses received from eight park managers (Appendix 1). The schedule for the interns' duty time varied by park needs. The announcement was advertised through the Great Lakes Northern Forest Cooperative Ecosystem Study Unit (CESU), RLC and national NPS websites, and the Society of Wetland Scientists. Applicants sent materials including their resume, preferred primary and secondary site (parks), and references to the GLREC Research Coordinator. The Research Coordinator sorted the applicant materials by applicants' preferred parks, and sent applicant materials to each park. The resource management staff at each park then selected the most qualified applicant for their park.

There were a total of 49 applicants from several universities in the Midwest region. The number received and reviewed for each park were:

APIS	NA
INDU	10
ISRO	9
KEWE	1
PIRO	5
SACN	8
SLBE	7
VOYA	9
Total	49

Products

Each park produced a report on the research and monitoring projects that interns were assigned. Products that interns produced included development of research equipment, reports, and oral presentations using Powerpoint™ to park staff and at conferences. Reports and Powerpoint™ presentations will be entered into NPS websites for managers and the public to view. Table 8 summarizes student background, projects, and products obtained through the internship. A survey questionnaire was emailed to both the resource managers and the interns to evaluate the success of the program. Resource managers were very pleased with the interns' qualifications and results that they produced.

Future Planning for GLKN Internships

The Great Lakes Research and Education Center played an important role in promoting student research opportunities in the GLKN parks. This effort benefited resource managers in providing needed field assistance, and provided students with a hands-on research and monitoring experience in the eight GLKN parks.

A RLC research internship program can provide a strategic link for conducting park science and meeting public education needs. The program can provide hands-on training of undergraduate and graduate students for future natural resource manager positions in a real-world situation. Parks are "living laboratories" in which concepts can be tested in the field for improving park management. For example, a student could conduct experimental seed germination and propagation studies of various native plant species in order to develop better restoration techniques. Interns who are paid by the NPS can be trained by scientists and managers to help conduct research projects in the parks. Several of the projects were focused on monitoring activities rather than actual research. Resource managers in the participating parks recommended continuation of the program; however, future efforts should be more focused on actual research projects by teaming the student intern with a university or USGS researcher. The Northern Forest Great Lakes CESU could be a point of contact to promote the research elements of the program.