



ecosystem
Science
Center

Annual Report – Ecosystem Science Center

July 1, 2004 – June 30, 2005



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Introduction to ESC – A Message from the Director

The Ecosystem Science Center has just completed its first full year, and this report details our accomplishments. With the support of Michigan Tech University's administration, we banded together to promote ecosystem science, with a special emphasis on promoting the involvement of graduate and undergraduate students in the research process. We are off to a great start!

Our research activity and expenditures rank us as one of the top centers and institutes on campus. More importantly, we were able to initiate what I hope will become long-standing activities: a graduate student research forum, as well as research and travel grants for graduate and undergraduate students. Many of our graduate students also traveled to professional meetings such as the annual meeting of the Ecological Society of America. We also supported the Distinguished Ecologist Lecture Series, the North American Air Pollution Workshop, and the North American Forest Biology Workshop. We hosted a National Science Foundation Research Experience for Undergraduates Site – *Ecosystems in Transition*, which brought 10 bright undergraduate students to campus from all around the country for a summer research experience. All of these activities enriched our professional lives, and furthered our research and educational goals.

We are spreading the message – well deserved – that Michigan Tech is a great place to learn about ecosystems – a national university of choice, when it comes to the Ecosystem Science Center and its faculty, staff, and affiliated students. We hope you enjoy this report, and if you have any questions, please don't hesitate to contact me.



Sincerely,

Kurt S. Pregitzer

Dr. Kurt S. Pregitzer

Director, Ecosystem Science Center

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ESC Members & Focus Area



Kate Bradley, Research Scientist – Post-Doctoral Scholar

Research Interests

Ecosystem ecology: Studying aboveground interactions between plants & insects; Belowground links between plants, soil microorganisms, & nitrogen availability; Responses of soil microorganisms - particularly arbuscular mycorrhizal fungi - to global changes, including increased N, CO₂ & O₃; How changes in soil microbial community function and/or composition may affect future dynamics of plant communities; How altered lignin biosynthesis in aspen trees affects composition and functioning of soil microbial communities; Consequences of microbial responses on soil carbon storage.



Andrew Burton, Research Associate Professor

Research Interests:

Forest responses to global change factors
Belowground processes
Carbon and nutrient cycling
Physiological ecology of tree roots
Undergraduate involvement in research



Jennifer Eikenberry, Assistant Research Scientist

Research Interests:

Operate and maintain the analytical equipment for sample analysis in the labs, including the Isotope Ratio Mass Spectrometer (IRMS), Gas Chromatograph (GC), High Pressure Liquid Chromatograph (HPLC), Total Organic Carbon analyzer (TOC analyzer), Elemental Analyzer (EA), and Total Nitrogen analyzer.



David Flaspohler, Associate Professor

Research Interests:

Avian Ecology: evolution of nest site selection and breeding strategies, effects of nest predators and parasites on breeding strategies.

Conservation Biology: forest fragmentation, maintaining viable populations in managed forest landscapes, amphibian habitat associations and monitoring, application of conservation biology to management.

Community and Population Ecology: interactions of temperate and tropical forest birds, habitat selection, predator-prey interactions.



Alex Friend, Project Leader – USDA Forest Service

Research Interests:

Ecosystem science, with a specialization in tree physiological ecology, and a focus on root physiology, nutrient acquisition, and carbon allocation as they are affected by soil N, atmospheric CO₂, tropospheric O₃, organismal interactions, and other environmental variables. Phenomena of ongoing exploration in these realms are physiological plasticity, compensatory processes, cost-benefit analogies using plant carbon, homeostasis & sensitivity to environmental variation, and scaling & hierarchical variation in processes. Common applications of this are: forest ecosystem management, global change biology, and phytoremediation.



Robert Froese, Assistant Professor - Biometrics

Research Interests:

Quantitative problems in forestry and ecosystem science. Of particular interest is the application of models to real world problems, specifically how the distance between basic sciences and natural resources management may be bridged by building more sophisticated models that remain accessible by managers. Such models must use commonly available inputs or inputs that are easily imputed, but must also be demonstrably tied to underlying biophysical theory. Forest vegetation simulation modeling. Site quality estimation using methods based on tree physiology. Applied statistical tools to support quantitative resource analysis and modeling. Measurement error statistical models.



Christian Giardina, Research Ecologist – USDA Forest Service

Research Interests:

Biotic and abiotic controls on belowground carbon allocation and cycling in forests.
Global change impacts on plant function.
Plant biochemical controls on plant-soil interactions.



Shekhar Joshi, Associate Professor – Plant Molecular Genetics

Research Interests:

Impact of long-term stand management on genetic diversity in Northern Hardwoods. Genomics, Biotechnology, and Bioinformatics of cellulose and lignin biosynthesis in trees.
Tree Species identification using DNA barcodes.



Dave Karnosky, Professor – Forest Genetics and Biotechnology

Research Interests:

Genetic aspects of air pollution and climate change.
Influences of CO₂ and O₃ on gene expression and gene regulation.
Forest genetics/biotechnology of yield.
Larch breeding and control of flowering in larch.
Micropropagation and genetic engineering of fast-growing trees such as *Larix*, *Pinus* and *Populus*.



John King, Assistant Professor – Ecosystem Science

Research Interests:

Using an ecophysiology approach to examine how forest productivity is influenced by resource availability as influenced by environment and global change.
Specific interests include: how atmospheric chemistry affects ephemeral plant tissue chemistry, decomposition, and carbon and nutrient cycling in forest soils; how the changing atmosphere will affect the forest hydrologic cycle; and carbon allocation and storage in forest ecosystems.
Tropical forest ecology, conservation, and sustainable development.



Erik Lilleskov, Research Ecologist – USDA Forest Service

Research Interests:

Application of a mixture of molecular genetic, physiological, stable isotopic, ecosystem analytic and statistical tools to investigate the relationship between ecosystem attributes and microbial community structure and function. The focus to date has been on mycorrhizal fungi, the dominant microbial functional group in many forest ecosystems. Recent work has focused on the mechanisms that structure mycorrhizal communities at the stand level--examining the spatial structure of ectomycorrhizal fungal communities and, through experimental lab and field studies, determining the effect of small-scale alteration of nutrient availability on mycorrhizal community dynamics.



Wendy Loya, Research Scientist – Post-Doctoral Scholar

Research Interests:

Research interests span the disciplines of biogeochemistry, climate change science, ecosystem ecology, soil science, microbial ecology and natural resource management. Research is aimed at understanding how changes in the environment affect ecosystems, particularly the cycles of carbon (C) and nitrogen (N), which play an integral role in the structure and function of natural systems. The majority of work has primarily involved experimentation to understand how increases in levels of CO₂ and O₃ in the atmosphere, increases in N deposition, and warmer temperatures will alter ecosystem level C and N fluxes between the atmosphere, plants, and soils in both northern forests and the arctic tundra.



Linda Nagel, Assistant Professor

Research Interests:

Silviculture and forest vegetation dynamics.
Ecophysiology of forest stand structures.
Management of invasive species.



Rolf Peterson, Professor

Research Interests:

Ecology and population dynamics of mammals, carnivore ecology, predator-prey relationships, wolf-prey dynamics and other ecological studies at Isle Royal National Park.



Kurt Pregitzer, Professor; Director

Research Interests:

Ecosystem science designed to understand how ecosystems function: investigating ecosystem processes at a variety of spatial and temporal scales, plant-microbe interactions in the rhizosphere, as well as the landscape, consequences of management activities and altered atmospheric chemistry. Current investigations focus on global change issues, including carbon cycling, atmosphere-plant-soil-water interactions, and understanding the consequences of nitrogen deposition.



Andrew Storer, Assistant Professor

Research Interests:

Forest insect ecology.
Insect/fungus/plant interactions in forest ecosystems.
Impacts of exotic species on forest ecosystems.
Interactions among fire, insects and disease on forest ecosystems.
Urban forest health.



John Vucetich, Assistant Research Professor

Research Interests:

Demographic and genetic aspects of population biology, conservation of endangered and recovering species, ecological modeling, trophic interactions, and wildlife biology.



Chris Webster, Assistant Professor

Research Interests:

Animal interactions, plant community ecology, ecology of invasive species, forest stand dynamics, ecological restoration, and silviculture.



Jessica Bibbee, Associate Director

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Trish Burton, Administrative Staff

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FY04

ESC Financial Synopsis

	ESC	Centers/Institutes at MTU (15 total)
Number of Awards:	24	237
Award Amount:	\$3,060,687	\$15,841,583
Number of Projects:	30	255
FY04 Expenditures:	\$2,577,161	\$15,841,583

Additional information can be found at The [Office of the Vice President of Research, MTU](#).



ESC Active Awards

Name PI, Co-PI(s)	Sponsor Name	Project Title	Awarded Amount	Start Date	End Date
Pregitzer, K.	US Dept of Agriculture	Carbon and Nitrogen Cycling in Aspen Forests	\$79,000	7/1/2001	6/30/2006
Karnosky, D. C.J. Tsai	US Dept of Energy	An Integrated Functional Genomics Consortium to Increase Carbon Sequestration in Poplars: Optimizing Aboveground Carbon Gain	\$599,836	4/1/2004	3/31/2006
Pregitzer, K.	US Dept of Agriculture	Using Stable Isotopes to Determine the Rate and Fate of Canopy CO ₂ Flux in the Aspen FACE Experiment	\$65,000	7/1/2002	9/30/2005
Peterson, R.	US Dept of Interior	Occurrence and Relative Abundance of Bats in Pictured Rocks National Lakeshore, Apostle Island National Lakeshore, and Grand Portage National Monument	\$4,037	9/30/2002	3/30/2005
Peterson, R., J. Vucetich	US Dept of Interior	Wolf/Moose Population Monitoring, Isle Royale National Park, 2005-2010	\$53,599	1/1/2005	9/30/2010
Vucetich, J., R. Peterson	US Dept of Interior	Non-Intrusive Assessment of Genetic Deterioration in the Isolated Wolf Population in Isle Royale National Park	\$20,535	9/12/2003	9/30/2004
Pregitzer, K., A. Burton	National Science Foundation	Nitrogen Saturation: Mechanisms and Consequences of Altered Ecosystem Metabolism	\$810,000	9/1/2003	8/31/2006
Pregitzer, K.	US Dept of Agriculture	Effect of Increased Atmospheric CO ₂ and O ₃ on Mycorrhizal Fungal Communities	\$16,440	5/28/2003	5/15/2008



ESC Active Awards – *continued*

Name PI, Co-PI(s)	Sponsor Name	Project Title	Awarded Amount	Start Date	End Date
Pregitzer, K.	US Dept of Agriculture	Woody Plants, Carbon Allocation & Fine Roots	\$20,004	7/2/2003	6/18/2008
King, J.	US Dept of Agriculture	Fluxes, Decay Rates, and Mean Residence Times of Carbon and Nutrients in Leaf Litter of Northern Forests Under Elevated CO ₂ and Tropospheric O ₃	\$15,200	7/1/2003	12/1/2006
Pregitzer, K.	US Dept of Agriculture	Measuring Belowground Processes	\$30,000	8/11/2003	6/30/2006
Storer, A.	US Dept of Agriculture	Monitoring and Evaluating Health of Ash Trees in Michigan's Rural Forests	\$317,265	8/1/2003	9/30/2006
Burton, A., K. Pregitzer	National Science Foundation	REU Site for Ecosystems in Transition: The Role of Research in Assessing Ecosystem Responses to a Changing Environment	\$155,463	3/1/2004	2/28/2006
King, J.	US Dept of Agriculture	Forest Ecophysiological Responses will Influence Regional Water Supplies due to Altered Atmospheric Conditions in the Near Future	\$450,000	8/1/2004	7/31/2007
Pregitzer, K., C. Giardina, W. Loya	North Carolina State University	Effects of Down-and Up-Regulated Lignin Biosynthesis of Populus on Soil Carbon Transformation and Storage	\$315,647	3/1/2004	2/28/2006
Storer, A., L. Nagel	US Dept of Agriculture	Interactions Among Prescribed Fire, Mechanical Treatments, Insect Pests and Pathogens in Red Pine	\$60,256	4/1/2004	12/31/2008



ESC Active Awards – continued

Name PI, Co-PI(s)	Sponsor Name	Project Title	Awarded Amount	Start Date	End Date
Storer, A., E. Lilleskov, D. Richter	Huron Mountain Wildlife Foundation	Effect of Invasive Earthworms on Soil Carbon and Biodiversity of Northern Hardwood and Hemlock Forest Ecosystems	\$5,059	4/1/2004	12/31/2005
Storer, A.	US Dept of Agriculture	Michigan Statewide Trap-Tree Emerald Ash Borer Detection Survey 2004	\$287,571	1/1/2004	6/30/2005
Froese, R.	Ontario Ministry of Natural Resources	An Evaluation of Increment Modeling Approaches used in Forest Vegetation Simulator Variants & Recommendations for Application in the Great Lakes Region	\$52,895	3/15/2005	3/30/2008
Storer, A.	US Dept of Agriculture	Michigan and Northern Wisconsin Emerald Ash Borer Detection Survey 2005	\$359,205	3/1/2005	6/30/2006
Pregitzer, K.	US Dept of Agriculture	Soil Carbon Cycling and Storage in Response to Elevated Tropospheric CO ₂ and O ₃ at the Aspen FACE Experiment	\$39,000	7/1/2005	6/30/2010
Storer, A., L. Nagel	US Dept of Agriculture	Modeling Phloem Removal from Ash Stands to Reduce the Density of Emerald Ash Borer While Maximizing Genetic Diversity of Ash	\$109,208	3/1/2005	4/30/2007
Pregitzer, K., A. Burton, D. Karnosky, J. King	State of Michigan	REF-IE: Enhancing Research Infrastructure in the Aspen FACE Experiment	\$40,000	5/15/2005	6/30/2006
Pregitzer, K.	US Dept of Agriculture	Stable Isotope Analysis to Elucidate the Physiological Basis of Silvicultural Treatment Response in Great Lakes Pine Ecosystems	\$35,000	8/2/2005	9/30/2009



ESC Active Awards – continued

Name PI, Co-PI(s)	Sponsor Name	Project Title	Awarded Amount	Start Date	End Date
Webster, C.	Keweenaw Community Forest Company	Mesic Conifer Restoration Monitoring	\$2,457	6/1/2005	5/31/2006
Pregitzer, K.	University of Michigan	Ecosystem Response to Elevated Tropospheric CO ₂ and O ₃ is Regulated by Plant - Microbe Interactions in Soil.	\$269,358	1/15/1994	8/14/2005
Karnosky, D., J. Isebrands, K. Pregitzer	US Dept of Energy	Genetic Differences and Resulting Life Histories Interact with Atmospheric CO ₂ and O ₃ to Control the Rate and Fate of Photosynthate Accumulation and the Cycling of C and N in Northern Forests	\$998,090	4/1/2004	3/31/2005
Karnosky, D., K. Pregitzer	US Dept of Energy	Impacts of Elevated CO ₂ and O ₃ , Alone and in Combination, on the Structure and Functioning of a Northern Forest Ecosystem: Operating the Aspen FACE User Facility	\$2,174,120	4/1/2005	3/31/2006
Peterson, R., J. Vucetich	National Science Foundation	Long-Term Trophic Interactions of Wolves and Moose on Isle Royale	\$194,014	8/1/2004	7/31/2010
Peterson, R.	National Science Foundation	LTREB: Multi-Level Trophic Dynamics of Wolves, Moose, and Vegetation	\$6,000	8/15/1999	7/31/2004
Cumulative Awarded Amount for Active Projects (30 Projects, 85 Years combined):			\$7,584,260		



ESC Member Publications

Bub, B.R., **D. J. Flaspohler**, and C. J. F. Huckins. 2004. Riparian and upland breeding-bird assemblages along headwater streams in Michigan's Upper Peninsula. *Journal of Wildlife Management* 68:383-392.

Burton, A.J., K.S. Pregitzer, J.N. Crawford, G.P. Zogg, and D.R. Zak. 2004. Simulated chronic NO₃-deposition reduces soil respiration in northern hardwood forests. *Global Change Biology* 10(7):1080-1091.

DeForest, J.L., D.R. Zak, **K.S. Pregitzer**, and **A.J. Burton**. 2004. Atmospheric nitrate deposition and the microbial degradation of cellobiose and vanillin in a northern hardwood forest. *Soil Biology and Biochemistry* 36: 965-971.

Giardina C, Coleman M, Binkley D, Hancock J, King J, Lilleskov E, Loya W, Pregitzer K, Ryan M, Trettin C. 2005. The effects of global change on belowground carbon allocation in forests. In D. Binkley and O. Menyailo (eds), *Tree Species Effects on Soils: Implications for Global Change*. NATO Science Series. Kluwer Academic Press (Invited).

Giardina, C., M. Coleman, J. Hancock, **J. King**, **E. Lilleskov**, **W. Loya**, **K. Pregitzer**, and M. Ryan. 2005. The effects of global change on belowground carbon allocation in forests. Chapter 7 pp.119-154. In D. Binkley and O. Menyailo (eds), *The impacts of global climate change on plant soil interactions*. NATO Science Series.

Gupta, P., S. Duplessis, H. White, **D.F. Karnosky**, F. Martin, and G.K. Podila. 2005. Gene expression patterns of trembling aspen trees following long-term exposure to interacting elevated CO₂ and tropospheric O₃. *New Phytologist* 167:129-142.

Heitzman, E., **K.S. Pregitzer**, and R.O. Miller. 2004. A comparison of pre-European settlement and present-day forests in Delta County, Michigan. *The Michigan Botanist* 43(1): 25-37.

Jenkins, M.A., **C.R. Webster**, G.R. Parker, and M.A. Spetich. 2004. Coarse woody debris in managed central hardwood forests of Indiana, USA. *Forest Science* 50:781-792.

Joshi, C.P., S. Bhandari, P. Rangan, U.C. Kalluri, X. Liang, T. Fujino, and A. Samuga. 2004. Genomics of cellulose biosynthesis in poplars. *New Phytologist* 164:53-61.

Kalluri, U.C. and **C.P. Joshi**. 2004. Differential expression of two cellulose synthase genes associated with primary wall and secondary wall development in aspen trees. *Planta* 220:47-55.

Karberg, N.J., **K.S. Pregitzer**, **J.S. King**, **A.L. Friend**, and J.R. Wood. 2004. Soil carbon dioxide partial pressure and dissolved inorganic carbonate chemistry under elevated carbon dioxide and ozone. *Oecologia* 142:296-306.

Karnosky, D.F. and S. Long. 2004. Air pollution effects on forest and agricultural systems under a changing environment. (Abstract p. 7) *Int. Symposium on Food Production and Environmental Conservation in the FACE of Global Environmental Deterioration*. FPEC 2004.

Karnosky, D.F., and R.C. Thakur. 2004. Genetic aspects of air pollution and climate change. pp. 223-229. In: J. Burley, J. Evans, and J. Youngquist (Eds.), Genetics and Genetic Resources, Encyclopedia of Forest Sciences. Academic Press. London.

Karnosky, D.F. 2005. Ozone effects on forest ecosystems under a changing global environment. *Journal of Agricultural Meteorology* 60(5):353-358.

Karnosky, D.F., **K.S. Pregitzer**, D.R. Zak, M.E. Kubiske, G.R. Hendrey, D. Weinstein, M. Nosal, and K.E. Percy. 2005. Scaling ozone responses of forest trees to the ecosystem level in a changing climate. *Plant, Cell and Environment* 28:965-981.

King, J.S., P.J. Hanson, E. Bernhardt, P. DeAngelis, R.J. Norby, and **K.S. Pregitzer**. 2004. A multi-year synthesis of soil respiration responses to elevated atmospheric CO₂ from four forest FACE experiments. *Global Change Biology* 10:1027-1042.

Lilleskov, E.A. 2005. How do composition, structure and function of mycorrhizal fungal communities respond to nitrogen deposition and ozone exposure? pp. 769-801. In J. Dighton, P. Oudemans, J. White (eds.). *The Fungal Community: Its Organization and Role in the Ecosystem*. 3rd Edition. CRC Press, New York, USA.

Loranger, G.I., **K.S. Pregitzer**, and **J.S. King**. 2004. Elevated CO₂ and O₃ concentration differentially affect selected groups of the fauna in temperate forest soils. *Soil Biology and Biochemistry* 36:1521-1524.

Lotts, K.C., TA Waite, and **J.A. Vucetich**. 2004. Reliability of absolute and relative predictions of population persistence based on time series. *Conservation Biology* 18(5):1224-1232.

Loya, W.M. and P. Gogan. 2004. News and Views: Carbon conundrum on the tundra. *Nature*, 431 (406-408).

Mankovska, B., K. Percy, and **D. F. Karnosky**. 2005. Impacts of greenhouse gases on epicuticular waxes of *Populus tremuloides* Michx.: Results from an open-air exposure and a natural O₃ gradient. *Environmental Pollution* 137:580-586.

O'Hara, K.L. and **L.M. Nagel**. 2004. A Multiaged stocking model for Black Hills ponderosa pine. *Western Journal of Applied Forestry* 19:242-244.

Potvin, M.J., **R.O. Peterson**, and **J.A. Vucetich**. 2004. Wolf Homesite Attendance Patterns. *Can. J. Zool* 82:1512-1518.

Pregitzer, K.S. and Euskirchen, E.S. 2004. (Review) Carbon cycling and storage in world forests: Biome patterns related to forest age. *Global Change Biology* 10:2052-2077.

Pregitzer, K.S. and **J.S. King**. 2005. Effects of soil temperature on nutrient uptake. pp. 277- 310. In H. BassiriRad, ed. *Nutrient acquisition by plants, an ecological perspective*. Ecological Studies, Vol. 181. Springer-Verlag, Berlin Heidelberg.

Pregitzer, K.S., D.R. Zak, **A.J. Burton**, J.A. Ashby, and N.W. MacDonald. 2004. Chronic nitrate additions dramatically increase the export of carbon and nitrogen from northern hardwood ecosystems. *Biogeochemistry* 68:179-197.

Ranjan, P., Y. Kao, H. Jiang, **C.P. Joshi**, S.A. Harding, and C.J. Tsai. 2004. Suppression subtraction hybridization-mediated transcriptome Analysis from multiple tissues of aspen (*Populus tremuloides*) trees altered in phenylpropanoid metabolism. *Planta* 219:694-704

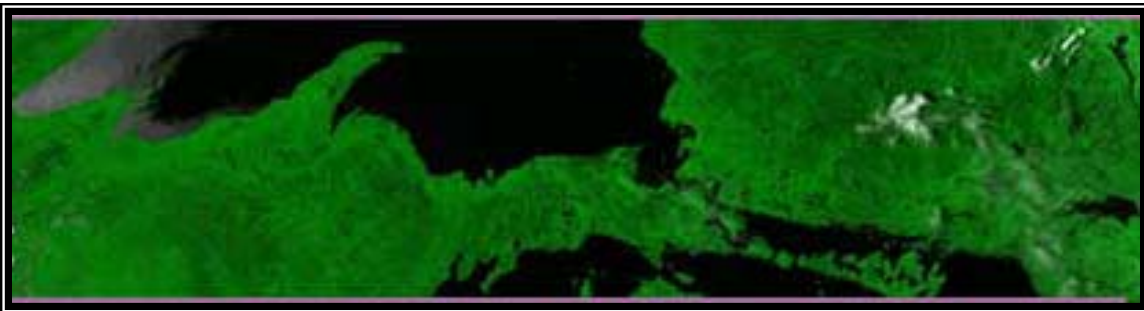
Robinson, A.P. and **R.E. Froese**. 2004. Model validation using equivalence tests. *Ecological Modeling*, 176, 349-358.

Samuga, A. and **C.P. Joshi**. 2004. Expression patterns of two primary cell wall-related cellulose synthase cDNAs, PtrCesA6, and PtrCesA7 from aspen. *Gene* 334:73-82.

Schwartz, J.W. **L.M. Nagel**, and **C.R. Webster**. 2005. Effects of uneven-aged management on diameter distribution and species composition of northern hardwoods in Upper Michigan, U.S.A. *Forest Ecology and Management* 211:356-370.

Treseder, K.K., M.F. Allen, R.W. Ruess, **K.S. Pregitzer**, and R.L. Hendrick. 2005. Lifespans of fungal rhizomorphs under nitrogen fertilization in a pinyon-juniper woodland. *Plant and Soil* 270:249-255

VanDusen, P., C.J.F. Huckins, and **D.J. Flaspohler**. 2005. Associations among selection logging history, brook trout, macroinvertebrates and habitat in Northern Michigan headwater streams. *Transactions of the American Fisheries Society* 134:762-774.



Vucetich, J.A. and **R.O. Peterson**. 2004. The influence of prey consumption and demographic stochasticity on population growth rate of Isle Royale wolves (*Canis lupus*). *Oikos* 107:309-320.

Vucetich, J.A. and **R.O. Peterson**. 2004. The influence of top-down, bottom-up, and abiotic factors on the moose (*Alces alces*) population of Isle Royale. *Proceeding Royal Soc Lond, B* 271:183-189.

Vucetich, J.A. and **R.O. Peterson**. 2004. Long-term population and predation dynamics of wolves on Isle Royale. pp. 281-292 in *Biology and Conservation of Wild Canids*, edited by D. Macdonald & C. Sillero-Zubiri, Oxford University Press.

Vucetich, J.A. and **R.O. Peterson**, and T.A. Waite. 2004. Raven scavenging favours group foraging in wolves. *Animal Behaviour* 67:1117-1126.

Wan, S., R.J. Norby, **K.S. Pregitzer**, J. Ledford, and E.G. O'Neill. 2004. CO₂ enrichment and warming of the atmosphere enhance both productivity and mortality of maple tree fine roots. *New Phytologist* 162:437-446.

Webster, C.R., M.A. Jenkins, and J.H. Rock. 2005. Long-term response of spring flora to chronic herbivory and deer exclusion in Great Smoky Mountains National Park, USA. *Biological Conservation* 125: 297-307.

Webster, C.R., M.A. Jenkins, and J.H. Rock. 2005. Twenty years of forest change in the woodlots of Cades Cove, Great Smoky Mountains National Park. *Journal of the Torrey Botanical Society* 132: 280-292.

Webster, C.R., and C.G. Lorimer. 2005. Minimum opening sizes for canopy recruitment of midtolerant tree species: a retrospective approach. *Ecological Applications* 15: 1245-1262.

Webster, C.R., K. Nelson, and S.R. Wangen. 2005. Stand dynamics of an insular population of an invasive tree, *Acer platanoides*. *Forest Ecology and Management* 208: 85-99.

Zak, D.R., **K.S. Pregitzer**, W.E. Holmes, **A.J. Burton**, G.P. Zogg. 2004. Anthropogenic N deposition and the fate of 15NO₃⁻ in a northern hardwood ecosystem. *Biogeochemistry* 69(2):143-157.



North America Forest Biology Workshop – July 12-15, 2004

John King organized the 18th North American Forest Biology Workshop, hosted by School of Forest Resources and Environmental Science, Michigan Technological University, July 10-15, 2004. The event was sponsored in part by the Tree Physiology and Genetics Working Groups, SAF.

Invited Speakers

An Overview of the Forested Ecosystems of the Northern Lake States

Dr. Dennis Albert, Michigan Natural Features Inventory, Ecology Program Leader

Gradients of Management Intensity in the Context of Natural Disturbance

Wayne Bell, Ontario Ministry of Natural Resources, Ontario Forestry Research Institute

Forest Management Opportunities for Increasing Carbon Sequestration

Dr. Richard Birdsey, Northeast Research Station, USDA Forest Service

The Case for Contextual Forest Management in the 21st Century

Dr. Thomas Crow, USDA Forest Service, WFWAR

Natural Disturbance Regimes in Great Lakes Forests

Dr. Lee Frelich, Department of Forest Resources, University of Minnesota

Integrated Assessment of Two Decades of Land Cover, Forest, and Socio-Economic Change in the Midwest

Dr. Eric Gustafson, North Central Research Station

A Century of Watershed Lessons and Emerging Information Needs

Dr. George Ice, NCASI

Copper Mining Industry Use of Forest and Aquatic Resources of the Keweenaw

Dr. Larry Lankton, Department of Social Sciences, Michigan Technological University

Fine Hardwood Tree Improvement - An Approach to Individual Tree Selection

Dr. Charles H. Michler, Hardwood Tree Improvement and Regeneration Center, USDA Forest Service, North Central Research Station, Purdue University

N Deposition and Forest Function

Dr. Knute Nadelhoffer, University of Michigan Biological Station, University of Michigan

Forest Productivity in a CO₂ Enriched Atmosphere

Dr. Richard Norby, Environmental Sciences Division, Oak Ridge National Laboratory



*Silvicultural Approaches for the Matrix:
Balancing Ecological and Production Goals at Multiple Scales*
Dr. Brian Palik, North Central Research Station

Ozone and Forest Productivity: State of Science and Risk
Dr. Kevin Percy , Natural Resources Canada, Canadian Forest Service-Atlantic Forestry Centre

Exploiting the Pre-European Settlement Forest: Michigan's Enduring Ecological Legacy
Dr. Kurt Pregitzer, School of Forest Resources and Environmental Science,
Michigan Technological University

Tree Improvement in the Lake States - Current Status - Future Opportunities
Dr. Donald Riemenschneider, North Central Research Station

CO2 Recycling in Trees
Dr. Robert Teskey, Warnell School of Forest Resources , University of Georgia

Functional Genomics and Forest Tree Improvement: A Case Study on Resource Allocation
Dr. Chung-Jui Tsai, School of Forest Resources and Environmental Science,
Michigan Technological University



Distinguished Ecologist Lecture Series – Fall, 2004

Michigan Technological University, the USDA Forest Service - North Central Research Station, the Ecosystem Science Center, and the Graduate School supported the Distinguished Ecologist Lecture Series with the following objectives:

- to provide students, faculty and researchers at MTU and NCRS with opportunities to hear prominent ecologists discuss their research,
- to provide graduate students with a unique seminar experience, and
- to provide leading ecologists with an opportunity to learn more about research being conducted at MTU and the NCRS.

Each fall semester, the Distinguished Ecologist Lecture Series will host internationally recognized ecologists. Each visit by an ecologist will include: delivering the Distinguished Lecture, leading a graduate seminar on a topic of the ecologist's choice, meeting with students and faculty, touring MTU and NCRS research facilities, and attending social events. Below is a list of the Distinguished Ecologist who visited the MTU campus in Fall of 2004:



1. **Dr. James Tiedje**, Michigan State University – taught “Genomic Insights into Environmental Microbiology”, September 9, 2004.

Interests: the ecology, physiology, and biochemistry of microbial processes important in nature and of value to industry; ecology, physiology and biochemistry denitrification; the fate and impact of genetically engineered microbes, so that their success or risk in nature can be better predicted.



2. **Dr. Sam McNaughton**, Syracuse University – taught “Thirty-one years of Continuous Research on the Serengeti Grazing System”, September 23, 2004.

Interests: Ecosystem and plant ecology; grassland ecosystems; ecology of large mammalian herbivores; conservation biology; research since 1974 in Serengeti National Park.



3. **Dr. Mike Ryan**, USDA Forest Service, Rocky Mountain Research Station – taught “Carbon Allocation in Forest Ecosystems”, September 30, 2004

Interests: understanding what controls ecosystem metabolism-the exchange of carbon and water between forests and the atmosphere; understanding how changes in climate, land use, and disturbance will affect forest productivity and the role of forests in the global carbon cycle.



4. **Dr. Joy Zedler**, University of Wisconsin, Madison – taught “Wetland Degradation and Restoration: Challenges in the Great Lakes Region”, October 28, 2004.

Interests: Restoration ecology; wetland ecology; reestablishment of rare plants; interactions of native and exotic species; adaptive management.



Sponsored Graduate Student Research & Travel Grants Summary 2004-05

GRADUATE STUDENT TRAVEL GRANTS

Applicant	Advisor	Meeting	Status	Granted
1. Cinzia Fissore	Christian Giardina	American Geophysical Union Fall Meeting	Poster Accepted	\$500
2. Brian Beachy	Andrew Storer	Ecological Society of America Annual Meeting	Poster to be submitted	\$500
3. Lingli Liu	John King	37 th Air Pollution Workshop	Talk accepted	\$500
4. Justin Rosemier	Andrew Storer	54 th Annual North Central Forest Pest Workshop	Talk submitted	\$500
5. Jessica Hancock	Christian Giardina	ESA Annual Meeting	Poster submitted	\$500
6. Jessica Metzger	Andrew Storer	Entomological Society of America Annual Meeting	Poster to be submitted	\$500
7. Matthew Powers	Linda Nagel	ESA Annual Meeting	Talk submitted	\$500
8. Alan Talhelm	Kurt Pregitzer	ESA Annual Meeting	Attended	\$500
Total				\$3,500

GRADUATE RESEARCH GRANTS

Applicant	Advisor	Study	Items	Granted
1. Joseph Bump	Rolf Peterson	Predators, prey carcasses and nutrient subsidies	Supplies, services, travel	\$750
2. Justin Rosemier	Andrew Storer	Impacts of beech bark disease on native small mammal communities	Travel	\$750
3. Cinzia Fissore	Christian Giardina	Abiotic controls on soil carbon decomposition and formation...	Supplies, services, personnel	\$750
4. Emmanuel Opuni-Frimpong	David Karnosky	Conservation and restoration of mahogany in plantation forest	Travel	\$750
5. Brian Beachy	Andrew Storer	Impacts of an exotic disease complex on forest biodiversity	Travel	\$750
6. Laura Kruger	Rolf Peterson	Identifying sources populations of little brown bats ...	Supplies and services	\$750
7. Peter Hurly	David Flaspohler	Forest herb recovery and the legacy of the white-tailed deer over browse on...	Supplies and personnel	\$750
8. Michelle Manarolla	David Flaspohler	Influence of Lake Superior shoreline housing development on breeding...	Supplies and travel	\$750
9. Jessica Hancock	Christian Giardina	Effects of altered lignin biosynthesis on Aspen	Travel	\$750
10. Alan Talhelm	Kurt Pregitzer	Carbon Storage in Northern Hardwoods forest under N deposition	Travel and sample processing	\$750
11. Linda van Diepen	Kurt Pregitzer	A study of nitrogen cycling within <i>Acer saccharum</i> dominated forest using a ...	Sample processing	\$750
Total				\$8,250



1st Annual ESC/BRC Graduate Research Forum – February 25, 2005

ESC co-sponsored the first graduate research forum in the School of Forest Resources and Environmental Science, alongside the Biotech Research Center. Altogether, a total of 36 masters and PhD graduate students submitted abstracts along with their posters.

The Graduate Research Forum provided an opportunity for students to share their ideas and results with each other and faculty. Posters covered a wide variety of research topics in the areas of Carbon and Nutrient Cycling and Storage, Biotechnology and Molecular Genetics, Population and Community Ecology, Wildlife, Insects and Diseases, among others.

ESC and BRC each gave a four awards, based on who submitted the best poster. Criteria included, but were not limited to, scientific validity, overall appearance, information flow, etc.

ESC presented the following awards:

Grand Prize (\$500) – Lingli Liu
Merit Award (\$100) – Sarah Brodeur
Merit Award (\$100) – Justin Rosemier
Merit Award (\$100) – Michele Manarolla

The Graduate Research Forum will continue to be held on an annual basis.



Research Experiences for Undergraduates

The ten-week Research Experiences for Undergraduates (REU) program is sponsored by a grant from the National Science Foundation (NSF) through the Ecosystem Science Center. Ten undergraduate students from California, New York, Massachusetts, Illinois, Wisconsin, Michigan, and the UP spent the summer of 2005 at MTU's School of Forest Resources and Environmental.

The REU students worked with faculty mentors to study ecosystem responses to man's activities, and performed research related to current environmental issues in forest ecosystems. During their stay, the REU students learned how to design experiments and communicate results, developed and conducted an independent research project, and presented their research findings at a symposium sponsored by MTU. They also explored career possibilities in ecology and environmental science, and attended the Ecological Society of America's annual meeting in Montreal in August.

Students selected for the 2005 REU program included:

- Kathryn Amerell (UW Stevens Point),
- Reid Andress (MTU),
- Chris Doogan (Southern Illinois Univ),
- Justin Hanisch (MTU),
- Nicholas Jensen (UW Stevens Point),
- Hazen Kazaks (UC Berkeley),
- Tara Novak (Carroll College, WI),
- Frances O'Donnell (Harvard),
- Claudia Pingatore (UC Berkeley), and
- Katie Temple (RPI).

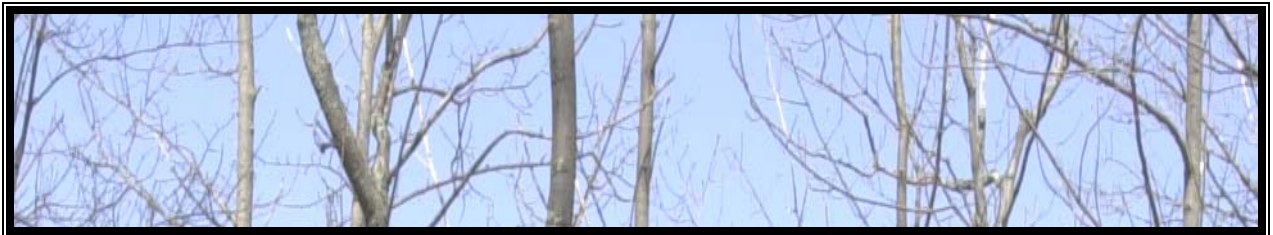
ESC members who served as faculty mentors during the 2005 program included Andrew Burton (also REU Director), Kurt Pregitzer, Chris Webster, Linda Nagel, Andrew Storer, John Vucetich, and Erik Lillskov and Christian Giardina from the US Forest Service North Central Station.



Research conducted by the REU students covered a wide range of range of topics:

- the spread of invasive plant species along trails,
- restoring the yellow birch component of northern forests,
- life-history of native coaster brook trout populations,
- the C storage potential of coarse woody-debris in forests removed from management, and
- and genetic and environmental regulation of leaf phenolics.

During the summer of 2004, ten of the thirteen students participating in the program were supported by NSF funds through the Ecosystem Science Center. Two of these participants, Rita Koch from UW Stevens Point, and Janet Frederick from MTU, will be entering graduate school at MTU this fall, with ESC member Andrew Storer as their advisor. Additional information on the [REU program](#) is available on the web. Abstracts of the [student research](#) performed in 2004 are also available.



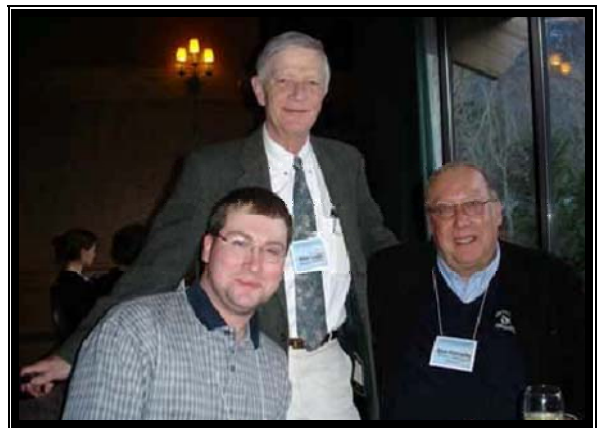
Air Pollution Workshop – April 25-28, 2005

Refer to the [June 2005 Aspen FACE Newsletter](#), for more coverage:

Dave Karnosky, Aspen FACE Director, acted as Program Co-chair for the 37th Air Pollution Workshop this Spring in Banff, Alberta, Canada.

The session which Dave chaired focused on interacting stresses, as a result of Aspen FACE research. He also presented information regarding his research at the Ozone Gradient Study and Gene Expression Research. In addition to presenting his research, Dave acted as the Workshop's AV and computer specialist.

Other ESC affiliates also attending the Workshop and presenting Aspen FACE research were John King, and Lingli Liu, MTU graduate student.





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