



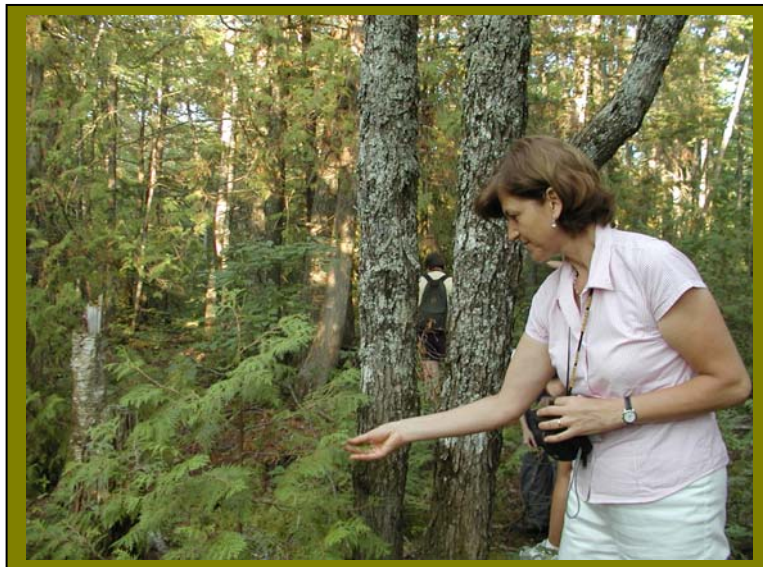
2005-2006

Annual Report



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***This document summarizes the activities of the ESC for the Fiscal Year
2006 (July 1, 2005-June 30, 2006)***

Introduction to ESC – A Message from the Director

The Ecosystem Science Center has completed its third year, and this report details our continuing 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.

For the third year in a row, our research activity and expenditures rank us as one of the top centers and institutes on campus. More importantly, we have continued our graduate student research forum, as well as research and travel grants for graduate and undergraduate students. We awarded our first undergraduate research award this year. Many of our graduate students traveled to professional meetings such as the annual meeting of the Ecological Society of America. We also supported the Distinguished Ecologist Lecture Series, hosted a second year of 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, and our members hosted a very successful Global Change Teacher's Institute, which attracted middle and high school teachers from around the country and Mexico. All of these activities enriched our professional lives, furthered our research and extended our findings to teachers and students interested in ecosystem studies.

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.



Kurt S. Pregitzer
Professor & Director

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ESC Members & Focus Area



Kate Bradley, Research Scientist – Post-Doctoral Scholar

Research Interests:

Belowground links between plants, soil microorganisms, & nitrogen availability
Responses of soil microorganisms to global change
Microbial ecology



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:

Isotope Ratio Mass Spectrometry (RIMS). Gas Chromatography(GC), High Pressure Liquid Chromatography (HPLC), Total Organic Carbon analysis (TOC analyzer), Elemental Analysis.

David Flaspohler, Associate Professor

Research Interests:

Avian ecology
Conservation biology
Community and population ecology



Alex Friend, Project Leader – USDA Forest Service

Research Interests:

Tree physiological ecology
Nutrient acquisition, and allocation affected by climate change
Scaling & hierarchical variation in processes





Robert Froese, Assistant Professor - Biometrics

Research Interests:

Forest vegetation simulation modeling
Site quality estimation based on tree physiology
Applied statistics for resource analysis and modeling
Measurement error statistical models

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 & Biotechnology

Research Interests:

Genetic aspects of air pollution and climate change
Influences of CO₂ and O₃ on gene expression and 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*

Erik Lilleskov, Research Ecologist – USDA Forest Service

Research Interests:

Relationship between ecosystem attributes and microbial community structure and function
Mechanisms that structure mycorrhizal communities at the stand level
Spatial structure of ectomycorrhizal fungal communities
Nutrient availability alterations of mycorrhizal communities



Linda Nagel, Associate 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 of ESC

Research Interests:

Ecosystem processes at a variety of spatial and temporal scales
Plant-microbe interactions in the rhizosphere
Global change issues, including: carbon cycling, atmosphere-plant-soil-water interactions, and consequences of nitrogen deposition



Andrew Storer, Associate 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



John Vucetich, Assistant Professor

Research Interests:

Demographic and genetic aspects of population biology
Conservation of endangered and recovering species
Ecological modeling
Trophic interactions
Wildlife biology



Chris Webster, Assistant Professor

Research Interests:

Plant community ecology
Ecology of invasive species
Forest stand dynamics, and silviculture
Ecological restoration



ESC Staff

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For more information, visit our website at: <http://ecosystem.mtu.edu/>



FY06

ESC Financial Synopsis

	ESC	Centers/Institutes at MTU (17 total)
Number of Awards:	33	261
Award Amount:	\$5,549,377	\$30,295,605
Number of Projects:	36	297
FY06 Expenditures:	\$3,298,246	\$19,336,594

Members of the ESC submitted 44 proposals in FY06, of which 33 were funded for a funding rate of 75%. See the following table summarizing all active grants during FY06.



ESC Active Awards FY06

Name PI, Co-PI(s)	Sponsor Name	Project Title	Awarded Amount	Start Date	End Date
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	03/01/04	2/28/2006
Froese, R	Detroit Edison	Feasibility Study: Managing Carbon in Michigan's Upper Peninsula	\$27,910	12/01/05	09/30/06
Froese, R	USDA Forest Service	Extending Structural Based Prediction and Regional Soil Parent Material Maps to the Prognosis Mortality Model	\$7,000	10/1/2005	9/30/2006
Froese, R., Hyslop, M.	Michigan State University Land Policy Program	The Role of Corporate Timberland Ownership Change in Land Use, Conservation, & Local Prosperity in Michigan's Upper Peninsula	\$50,000	03/01/06	09/30/07
Jurgensen, M.	USDA	Retention and Recruitment of Coarse Woody Debris in High and Low Gradient Streams in Managed and Old Growth Forests	\$10,000	7/2/2003	12/31/06
Jurgensen, M.	USDA	Interactions of Soil Phosphorus, Fumigation, Soil Bulk Density, and Ectomycorrhizal Colonization on Jack Pine Seedling Growth at the James W. Tourney Nursery in Watersmeet, Michigan	\$40,000	8/29/2005	5/15/2008
Jurgensen, M.	U.S, Forest Service	Develop Forest Plan Soil Quality Monitoring Protocols and Validate Region 1	\$141,190	06/16/06	12/31/08
Karnosky, D., J. Isebrands, K. Pregitzer	US Dept of Energy	Genetic Differences and Resulting Life Histories Interact with Atmospheric CO2 and O3 to Control the Rate and Fate of Photosynthate Accumulation and the Cycling of C and N in Northern Forests	\$998,090	04/01/04	03/31/05
			\$90,072	04/01/04	03/31/05
			\$21,741	11/06/04	06/30/05
			\$2,174,121	04/01/05	03/31/06
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	04/01/04	03/31/06
			\$316,393	04/01/06	03/31/07



ESC Active Awards FY06– *continued*

Name PI, Co-PI(s)	Sponsor Name	Project Title	Awarded Amount	Start Date	End Date
Nagel, L.	USDA McIntire-Stennis	Diameter Distributions of Northern Hardwoods Across Spatial Scales	\$7000	10/01/05	09/30/06
Nagel, L.	USDA Forest Service	A proposal to Conduct the Lake States Silviculture Short Course of the USDA PASS	\$37,564	3/23/06	8/31/06
Nagel, L.	US Dept of Agriculture	Assessment of Control Methods for Glossy Buckthorn	\$5,000	2/6/2006	1/1/2007
Peterson, R., J. Vucetich	Michigan Dept of Natural Resources	Ecology of the gray wolf in Michigan	\$26,000	10/1/2002	9/30/2006
Peterson, R., J. Vucetich	National Science Foundation	Long-Term Trophic Interactions of Wolves and Moose on Isle Royale	\$90,000	06/27/05	07/31/11
			\$89,999	02/25/06	07/31/11
Peterson, R., J. Vucetich	US Dept of Interior	Wolf/Moose Population Monitoring, Isle Royale National Park, 2005-2010	\$26,600	01/01/05	09/30/10
			\$36,600	02/07/06	12/31/10
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	01/15/94	12/31/06
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	\$35,000	08/02/05	09/30/09
			\$30,000	08/02/05	09/30/09
Pregitzer, K.	US Dept of Agriculture	Woody Plants, Carbon Allocation & Fine Roots	\$20,004	07/02/03	06/18/08
			\$10,000	07/02/03	06/18/08
Pregitzer, K.	US Dept of Agriculture	Measuring Belowground Processes	\$30,000	08/11/03	06/30/06
Pregitzer, K., A. Burton	National Science Foundation	Nitrogen Saturation: Mechanisms and Consequences of Altered Ecosystem Metabolism	\$210,000	09/01/03	08/31/06
			\$6,000	09/01/03	08/31/06



ESC Active Awards FY06– *continued*

Name PI, Co-PI(s)	Sponsor Name	Project Title	Awarded Amount	Start Date	End Date
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	\$166,330	03/01/04	03/31/07
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	07/01/05	06/30/10
Pregitzer, K., A. Burton, D. Karnosky, J. King	State of Michigan	REF-IE: Enhancing Research Infrastructure in the Aspen FACE Experiment	\$40,000	05/15/05	06/30/06
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	08/02/05	09/30/09
Pregitzer, K.	US DOE	Midwestern Regional Center of the National Institute for Climatic Change Research	\$399,999	12/01/05	11/30/07
			\$1,191,667	12/01/05	11/30/07
Storer, A.	US Dept of Agriculture	Monitoring and Evaluating Health of Ash Trees in Michigan's Rural Forests	\$122,500	08/01/03	09/30/06
			\$129,765	08/01/03	09/30/06
Storer, A., L. Nagel	US Dept of Agriculture	Interactions Among Prescribed Fire, Mechanical Treatments, Insect Pests and Pathogens in Red Pine	\$30,106	04/01/04	12/31/2008
			\$28,999	04/03/06	12/31/2008
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	04/01/04	12/31/05
			\$4,380	04/01/06	03/31/07
Storer, A.	US Dept of Agriculture	Michigan and Northern Wisconsin Emerald Ash Borer Detection Survey 2005	\$359,205	03/01/05	06/30/06
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	03/01/05	04/30/07
Storer, A.	US Dept of Agriculture	2006 Michigan and Northern Wisconsin Emerald Ash Borer Detection Survey	\$367,568	03/01/06	06/30/07



ESC Active Awards FY06– *continued*

Name PI, Co-PI(s)	Sponsor Name	Project Title	Awarded Amount	Start Date	End Date
Storer, A.	US Dept of Agriculture	Evaluation of Public Awareness of Issues Relating to Movement of Firewood and the Exotic Emerald Ash Borer	\$34,952	04/01/06	06/30/07
Storer, A.	US Dept of Agriculture - APHIS	Multistate Comparison of Emerald Ash Borer Trapping and Survey Tools	\$131,617	04/01/06	03/31/08
Storer, A.	WI DNR	Detection Survey for Emerald Ash Borer on State Land in Wisconsin	\$20,000	04/24/06	06/30/06
Storer, A.	US Dept of Agriculture	Identification of wood and bark infesting beetle species caught in Sirex woodwasp detection traps in Michigan	\$6000	06/01/06	05/31/07
Tsai, C.J.	National Science Foundation	A Functional Genomics Approach to Investigate Regulation of Phenolic Glycoside Metabolism in Populus	\$490,154	11/15/04	12/31/06
Vucetich, J. Peterson, R.	National Science Foundation	LTREB: Multi-Level Trophic Dynamics of Wolves, Moose, and Vegetation	\$90,000	08/15/99	07/31/11
Webster, C.	Keweenaw Community Forest Company	Mesic Conifer Restoration Monitoring	\$2,457	06/01/05	05/31/06
Webster, C.	Research Planning, Inc.	Modeling Biomass Recovery Following an Oil Fire at Obed Wild & Scenic River	\$5,046	08/08/05	12/31/05
Webster, C.	US Dept of Agriculture	Restoration of Underrepresented Trees and Shrubs in the Western Upper Peninsula of Michigan	\$7,000	10/01/05	09/30/06



ESC Member Publications from 2005-2006

Please see our website:

<http://ecosystem.mtu.edu/>

For a full list of ESC supported publications

Chung, H., D.R. Zak, and **E.A. Lilleskov**. 2006. Fungal community composition and metabolism under elevated CO₂ and O₃. *Oecologia* 147:143-154.

Cseke, L.J., S. Cseke, N. Ravinder, L.C. Taylor, A. Shankar, B. Sen, R. Thakur, **D.F. Karnosky**, G.K. Podila. SEP-class genes in *Populus tremuloides* and their likely role in reproductive survival of poplar trees. *Gene* 358:1-16.

DeForest, J.L., D.R. Zak, **K.S. Pregitzer**, and **A.J. Burton**. 2005. Atmospheric nitrate deposition and enhanced dissolved organic carbon leaching: Test of a potential mechanism. *Soil Science Society of America Journal* 69:1233-1237.

Flaspohler, D.J., and C. Meine. 2006. Planning for Wilderness: Aldo Leopold's Report on Huron Mountain Club. *Journal of Forestry* 104:32-42.

Giardina, C.P., M.D. Coleman, D. Binkley, J.E. Hancock, J.S. King, **E.A. Lilleskov**, W.M. Loya, **K.S. Pregitzer**, M.G. Ryan, and C.C. Trettin, 2005. The response of belowground carbon allocation in forests to global change. *In*: Binkley, D. and O. Menyailo (eds). *Tree species effects on soils: implications for global change*. NATO Science Series, Kluwer Academic Publishers, Dordrecht.

Gordon, T.R., S.C. Kirkpatrick, B.J. Aegerter, D.L. Wood and **A.J. Storer**. 2006. Susceptibility of Douglas fir (*Pseudotsuga menziesii*) to pitch canker, caused by *Gibberella circinata* (anamorph = *Fusarium circinatum*). *Plant Pathology* 55 (2): 231-237.

Griggs, J.A., J.H. Rock, **C.R. Webster**, and M.A. Jenkins. 2006. Vegetative legacy of a protected deer herd in Cades Cove, Great Smoky Mountains National Park. *Natural Areas Journal* 26: 126-136.

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.

Jost, C., G. Devulder, **J.A. Vucetich**, **R.O. Peterson**, R. Arditi. 2005. The wolves of Isle Royale display scale-invariant satiation and density dependent predation on moose. *Journal of Animal Ecology* 74 (5): 809-816.

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

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.

Karnosky, D.F. and **K.S. Pregitzer**. 2006. Impacts of elevated CO₂ and O₃ on northern temperate forest ecosystems: Results from the Aspen FACE experiment. *In*: Nösberger, J., S.P. Long, R.J. Norby, M. Stitt, G.R. Hendrey, H. Blum, Eds. "Managed Ecosystems and CO₂: Case Studies, Processes and Perspectives", Springer-Verlag, Ecological Studies 187: 213-229.

Karnosky, D.F., J.M. Skelly, K.E. Percy, and A.H. Chappelka. 2006. Perspectives regarding 50 years of research on effects of tropospheric ozone air pollution on U.S. Forests. *Environmental Pollution* (In Press)

King, J.S., M.E. Kubiske, **K.S. Pregitzer**, G.R. Hendrey, E.P. McDonald, **C.P. Giardina**, V.S. Quinn, and **D.F. Karnosky**. 2005. Tropospheric O₃ compromises net primary production in young stands of trembling aspen, paper birch and sugar maple in response to elevated atmospheric CO₂. *New Phytologist* 168:623-636.

King, J.S., C.P. Giardina, **K.S. Pregitzer**, and **A.L. Friend**. 2006. Biomass partitioning in red pine (*Pinus resinosa* Ait.) along a chronosequence in the Upper Peninsula of Michigan. *Canadian Journal of Forest Research* (In Press).

Kubiske, M.E., V.S. Quinn, W.E. Heilman, E.P. McDonald, P.E. Marquardt, R.M. Teclaw, **A.L. Friend**, and **D.F. Karnosky**. 2006. Climatic variation mediates elevated CO₂ and O₃ effects on forest growth. *Global Change Biology* 12:1054-1068.

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*. CRC Press, New York, USA.

Lilleskov, E.A., and Bruns T.D. 2006 Spore dispersal of a resupinate ectomycorrhizal fungus, *Tomentella sublilacina*, via soil food webs. *Mycologia* (In Press).

Marshall, J.M., and **A.J. Storer**. 2006. Influence of *Centaurea biebersteinii* patch size on *Urophora quadrifasciata* (Dipt. Tephritidae) in Michigan. *USA Journal of Applied Entomology* 130 (2): 91-95.

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.

Moyano, F.E., O.K. Atkin, M. Bahn, D. Bruhn, **A.J. Burton**, A. Heinemeyer, W. Kutsch, and G. Wieser. 2006. Respiration from roots and the associated microorganisms. Chap. 6 *In* W. Kutsch, A. Heinemeier and M. Bahn (eds). *Soil Carbon Flux Measurements: An Integrated Methodology*. Cambridge University Press.

Muntifering, R.B., A.H. Chappelka, J.C. Lin, **D.F. Karnosky**, and G.L. Somers. 2006. Chemical composition and digestibility of *Trifolium* exposed to elevated ozone and carbon dioxide in a free-air (FACE) fumigation system. *Functional Ecology* 20:269-275.

Neuendorff, J.K., **L.M. Nagel**, **C.R. Webster**, and M. Janowiak. 2006. Stand structure and composition in a northern hardwood forest after 40 years of single-tree selection. *Northern Journal of Applied Forestry* (In Press).

Norby, R.J., E.H. DeLucia, B. Gielen, C. Calfapietra, **C.P. Giardina**, J.S. King, J. Ledford, H.R. McCarthy, D.J.P. Moore, R. Ceulemans, P. DeAngelis, A.C. Finzi, **D.F. Karnosky**, M.E. Kubiske, M. Lukac, **K.S. Pregitzer**, G.E. Scarascia-Mugnozza, R. Oren, and W.H. Schlesinger. 2005. Forest response to elevated CO₂ is conserved across a broad range of productivity. *Proceedings of the National Academy of Science* 102:18052-18056.

Potvin, M.J., D. Beyer, T.D. Drummer, **R.O. Peterson**, **J.A. Vucetich**, and J. Hammill. 2006. Monitoring and habitat analysis for wolves in Upper Michigan. *Journal of Wildlife Management* 69(4):1660-1669.

Pregitzer, K.S., D.R. Zak, W.M. Loya, J.S. King and **A.J. Burton**. 2006. The contribution of root systems to biogeochemical cycles in a changing world. Chapter 6 in Z. Cardon and J. Whitbeck (eds). *The Rhizosphere - An Ecological Perspective*, Elsevier. (In Press).

Rosemier, J., **D.J. Flaspohler**, and **A.J. Storer**. 2006 (expected). Island-specific ecological release of small mammals in Lake Michigan and potential consequences for ground-nesting birds. *George Wright Forum*. (In Press).

Snively, M. and **D.J. Flaspohler**. 2006. A Comparative Study of Cadmium and Copper in Ruffed Grouse (*Bonasa umbellus*) in regions with and without historic mining. In press: *Ecotoxicology and Environmental Safety* 65:165-170.

Theberge J.A., M.T. Theberge, **J.A. Vucetich**, and P.C. Paquet. 2006. Pitfalls of Applying Adaptive Management to a Wolf Population in Algonquin Provincial Park, Ontario. *Journal of Environmental Management* 37(4):451-60.

Vucetich, J.A., D.W. Smith, and D.R. Stahler. 2005. Influence of harvest, climate, and wolf predation on Yellowstone elk, 1961-2004. *Oikos* 111:259-270.

Vucetich, J.A., M.P. Nelson, and M.K. Phillips. 2006. The normative dimension and legal meaning of 'endangered' and 'recovery' within the United States' Endangered Species Act. *Conservation Biology*. (In Press).

Wangen, S.R., and **C.R. Webster**. 2006. Potential for multiple lag phases during biotic invasions: reconstructing an invasion of the exotic tree *Acer platanoides*. *Journal of Applied Ecology* 43: 258-268.

Wangen, S.R., **C.R. Webster**, and J.A. Griggs. 2006. Spatial characteristics of the invasion of *Acer platanoides* on a temperate forested island. *Biological Invasions*. (In Press)

Webster, C.R., M.A. Jenkins, and S. Joes. 2006. Woody invaders and the challenges they pose to forest ecosystems in the eastern United States. *Journal of Forestry*. (In Press)

Webster, C.R., and M.A. Jenkins. 2005. Coarse woody debris dynamics in the southern Appalachians as affected by topographic position and anthropogenic disturbance history. *Forest Ecology and Management* 217: 319-330.

Wilmers, C.C., E.S. Post, **R.O. Peterson**, and **J.A. Vucetich**. 2006. Disease mediated switch from top-down to bottom-up control exacerbates climatic effects on moose population dynamics. *Ecology Letters* 9: 383-389.

Zak, D.R., W.E. Holmes, M.J. Tomlinson, **K.S. Pregitzer**, and **A.J. Burton**. 2006. Microbial cycling of C and N in northern hardwood forests receiving chronic atmospheric NO₃- deposition. *Ecosystems* 9:242-253.

ESC Activities:



Distinguished Ecologist Lecture Series – Fall 2005

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.
- 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 hosts internationally recognized ecologists. Each visit by an ecologist includes: 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 2005. The instructors for this year were David Flaspohler and Christian Giardina.



September 22, 2005
Dr. Sarah Hobbie
University of Minnesota

“The influence of tree species on biogeochemistry: interactions among litter chemistry, earthworms and microbes.”



October 6, 2005
Dr. Carolyn Bledsoe
University of California - Davis

“Frontiers in mycorrhizal research: functional diversity: functional diversity of ectomycorrhizas in oak woodlands.”



October 27, 2005
Dr. Rick Lindroth
University of Wisconsin-Madison

“What can chemistry tell us about ecology? Insights onto the evolutionary and ecological ‘success’ of a principal North American tree species.”



Sponsored Graduate Student Research & Travel Grants Summary 2005-06

GRADUATE STUDENT TRAVEL GRANTS

Applicant	Advisor	Meeting	Status	Granted
1. Carrie Andrew	Lilleskov	ESA Annual Meeting, Memphis, TN	gave talk	\$500
2. Brian Beachy	Storer	North American Forest Insect Workshop in Asheville NC	poster won 1st	\$500
3. Sarah Brodeur-Campbell	Storer	Entomological Society of America Meeting.	attended	\$500
4. Joseph Bump	Peterson	ESA Annual Meeting	presented talk	\$500
5. Tara Eberhart	Storer	North American Forest Insect Workshop in Asheville NC	pres.talk & poster	\$500
6. Janet Frederick	Storer	North American Forest Insect Workshop in Asheville NC	presented poster	\$500
7. Jessica Hancock	Giardina/Pregitzer	ESA Annual Meeting, Memphis, TN	attended	\$500
8. Bret Huntzinger	Peterson	Midwest Wolf Stewardship Meeting	attended	\$297
9. Maria Janowick	Nagel	Society of Amer. Foresters Nat. Convention, Pittsburgh, PA	attended	\$500
10. Jennifer Karberg	Gale	Research in Ecuador	fieldwork	\$500
11. Rita Koch	Storer	North American Forest Insect Workshop in Asheville NC	presented poster	\$500
12. Jessica Metzger	Storer	North American Forest Insect Workshop in Asheville NC	poster won 1st	\$500
13. Bharat Pokharel	Froese	Western Mensurationists Meeting, Fortuna, CA	gave talk	\$500
14. Alan Talhelm	Pregitzer	ESA Annual Meeting, Memphis, TN	gave talk	\$500
15. Linda van Diepen	Lilleskov/Pregitzer	ESA Annual Meeting	presented poster	\$500
			Total	\$7,297



UNDERGRADUATE RESEARCH GRANTS

Applicant	Advisor	Study	Items	Granted
1. Sam Gardner	Peterson	Does mortality type influence ungulate carcass-derived soil nutrients?	Transport of carcasses from kill sites	\$500



05-06 GRADUATE RESEARCH GRANTS

Applicant	Advisor	Study	Items	Granted
1. Carrie Andrew	Lilleskov	Ectomycorrhizal biomass & respiration under elevated CO ₂ & ozone	soil DNA kits, travel	\$733
2. Joseph Bump	Peterson	1) Perforating ecological filters: 2) Predators, prey, carcasses, nutrient subsidies and ecosystem heterogeneity	1) soil & leaf analysis 2) soil analysis and travel to Yellowstone	\$1500
3. Brian Beachy	Storer	Impacts of an exotic disease complex on forest biodiversity	travel, assistant, voucher I.D.'s	\$750
4. Tara Eberhart	Storer	Tree Ring Analysis to Determine Relative Growth Rates of Ash Trees w/ & w/out Emerald Ash Borer at...	travel to park, assistant for tree ring analysis	\$750
5. Janet Frederick	Storer	Living with Emerald Ash Borer: How can the Movement of Infested Firewood be Stopped?	field assistant, travel to state parks	\$750
6. Cinzia Fissore	Giardina/Pregitzer	Abiotic controls on soil C decomposition and formation along a paired pine...	X-ray diffraction analysis, assistant	\$750
7. Janet Frederick	Storer	Living with the Emerald Ash Borer: How can the movement of infested wood be stopped?	travel to sites, field assistant	\$750
8. Jessica Hancock	Giardina/Pregitzer	The effects of altered lignin biosynthesis on <i>Populus</i>	tissue analysis, assistant	\$750
9. Bret Huntzinger	Peterson	Self-attaching radio collars for wolves	radio collar supplies, travel	\$750
10. Peter Hurly	Flaspohler	Plant defense strategies and ungulate browse on Great Lakes Islands	travel to field site, field assistant	\$750
11. Maria Janowaik	Nagel	Spatial patterning and structural diversity in northern hardwood forests	field equipment, travel	\$750
12. Robin Johnson	Pregitzer	The effects of elevated CO ₂ and O ₃ in amino acid, phenolics, and total sugars...	tray segment for HPLC autosampler	\$750
13. Jennifer Karberg	Gale	Exploring the hydro-ecological conditions of high elevation wetlands in..	travel for field work, field assistant	\$750
14. Rita Koch	Storer	Muskrat Lakes Fire/ Surrogate Study	field assistant	\$750
15. Emmanuel Opuni-Frimpong	Karnosky	Conservation and restoration of genetic diversity of the African mahogany in degraded and conserved forests...	propagation supplies, travel	\$750
16. Jessica Metzger	Storer	Refining trapping methods for emerald ash borer in MI	field supplies, travel to sites	\$750
17. Bharat Pokharel	Froese	Quantifying ecosystem productivity: a comparative analysis of two approaches...	field equipment, travel	\$750
18. Mathew Powers	Pregitzer	Physiological dynamics following ecosystem management treatments	sample analysis, assistant	\$750
19. Alan Talhelm	Pregitzer	1)Effects of N deposition on soil C pools in northern hardwood forests 2)Retrospective C Isotope Analysis of Leaf Litter ...	1) sample analysis, assistant 2) stable isotope analysis	\$1500
20. Linda van Diepen	Lilleskov/Pregitzer	Phosphorus status of plants and soil within an <i>Acer saccharum</i> dominated forest undergone long term increased ...	plant & soil analysis for macronutrients	\$750
Total				\$17,733



2nd Annual ESC/BRC

Graduate Research Forum – February 24, 2006

The ESC co-sponsored the second graduate research forum in the School of Forest Resources and Environmental Science, alongside the Biotech Research Center. Altogether, a total of 41 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 Biotechnology and Molecular Genetics, Carbon and Nutrient Cycling and Storage, Insects and Diseases, Population and Community Ecology, and Wildlife Biology, among others.

Eric Lilleskov and David Flaspohler initiated a poster workshop this year to help students improve the quality of their posters. Twenty-five students participated in the workshop. Our judges saw a marked improvement suggesting the workshop should be continued. Judges this year included David Flaspohler, Linda Nagel, Rod Chimner and Robert Froese.



ESC and BRC each made four awards, based on the following criteria: scientific validity, overall appearance, and information flow.

ESC presented the following awards:

Grand Prize (\$500) – Bharat Pokharel
Merit Award (\$100) –Janet Bandeff
Merit Award (\$100) –Jennifer Karberg
Merit Award (\$100) –Jill Witt

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



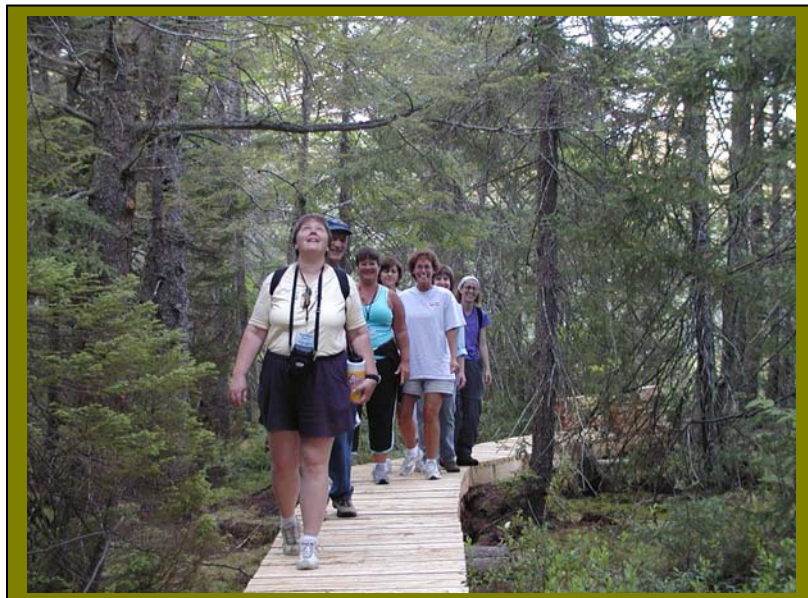
Global Change Teacher Institute

The Institute offered an intensive, interactive five-day program to prepare teachers to engage their middle and high school students in the real-world study of the effects of global change on ecosystems, including the impacts of climatic change, elevated carbon dioxide and ozone levels, nitrogen saturation, acid rain, and exotic species invasions. Educators obtained new knowledge and skills through lecture, hands-on data collection, field trips, and lab experiences. The Institute was taught by internationally-recognized faculty researchers from the Michigan Technological University (MTU) School of Forest Resources and Environmental Sciences, along with guest scientists from the University of Michigan and the USDA Forest Service's Forestry Sciences Laboratory.

Teachers measured the potential impacts of global climate change, elevated ozone and CO₂ levels, acid rain/nitrogen deposition, and the invasion of exotic species on forest health and productivity, ecosystem carbon and nutrient cycling, species composition, and genetic diversity. Participants visited the Aspen FACE (Free-Air Carbon Dioxide Enrichment) Experiment research site (<http://aspenface.mtu.edu/>) at the Harshaw Experimental Forest near Rhinelander, Wisconsin where the effects of elevated CO₂ and ozone on forest productivity are clearly observed. The Institute provided teachers with standards-based professional development and time to plan, discuss, and reflect on their teaching. Participants received a course notebook, handouts, a CD with ready-to-use Powerpoint presentations from the course, and other curriculum-support materials.

Instructors:

Ecosystem Science Center members who were instructors for this institute included: Dr. Kurt Pregitzer, Dr. Andrew Burton, Dr. Kate Bradley and Dr. Erik Lilleskov (USDA Forest Service North Central Research Station). They were joined by: Dr. William (Bill) Holmes, School of Natural Resources and Environment, University of Michigan, and Dr. Janet Vail, Annis Water Resources Institute, Grand Valley State University.





USFS PASS class – Spring 2006

The Lake States Silviculture Module of the Program of Advanced Studies in Silviculture (PASS) Forest Service Certification program was held on the Michigan Tech campus May 15-26, 2006. Linda Nagel was the director of the program. The 12 students in the program came from Minnesota, Wisconsin and Michigan, and were from the US Forest Service, Minnesota Department of Natural Resources, and the Bureau of Indian Affairs.

Specific content covered in the Lake States Silviculture Short Course included:

- » forest diseases and pathogens, with special emphasis on management strategies for prevention and control
- » non-native invasive plants
- » silvics and ecology of forest species of the Lake States, including considerations of shade tolerance, regeneration requirements, and growth characteristics
- » silvicultural systems and practices including identification of objectives, economic considerations, intermediate treatments, regeneration methods for specific forest types, site preparation, and impacts on multiple forest values
- » stand development processes and the influence of site and environmental factors
- » fire ecology and use as a management tool;
- » relationships between wildlife and vegetation in both managed and unmanaged forests;
- » forest soils, geology, and landforms in relation to forest management and productivity
- » hydrology
- » fisheries relationships
- » site quality and productivity
- » markets and utilization
- » pesticide use
- » prescription writing

Topics were covered at a variety of spatial scales (site, stand, forest, landscape, etc.), and examples were shown in the field when possible. Discussion of the impact of forest management on components of the environment was encouraged throughout the session. The session was taught at the graduate level with each topic beginning with a basic review to ensure all students understood fundamental concepts that provided the basis for the level of instruction for this session.

The following instructors participated in the 2006 PASS course. ESC member instructors included: Andrew Burton, Martin Jurgensen, Linda Nagel, Andrew Storer and Chris Webster.

Other participating instructors were: Greg Corace from the Seney National Wildlife Refuge, Casey Huckins from Biology, and Mike Hyslop, Blair Orr, James Schmierer and Amy Schrank (from SFRES).



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 Science.

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.

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 Lilleskov 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. A few examples were:

- 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