



## FACING THE FUTURE

The FACTS II (Aspen FACE) Newsletter  
Volume 2, No. 1, June 2003

David F. Karnosky and Janet M. Pikkarainen, Editors



Adam Wiese (left) leads a training session for scaffold climbing.

### Scaffold Training Session

Bill Danfield (USFS) and Adam Wiese (USFS) lead an Aspen FACE site scaffold climbing training session on June 3, 2003. Sixteen people including senior investigators, graduate students, undergraduate students and technical support people took part in the training which included a hands-on climb using the harness and buddy system. *Reminder, no one is authorized to climb the scaffolds in each Aspen FACE ring without receiving training.*

### Kurt Pregitzer Returns

Kurt Pregitzer (Aspen FACE Steering Committee) returned to MTU after a six-month sabbatical at Colorado State University. During his sabbatical, sponsored by DOE's Office of Science (BER) through NIGEC's Scholars in

Residence Program, Kurt was synthesizing data on carbon cycling and storage in the world's forests. Kurt and his wife Maria also tested a few Colorado ski slopes.



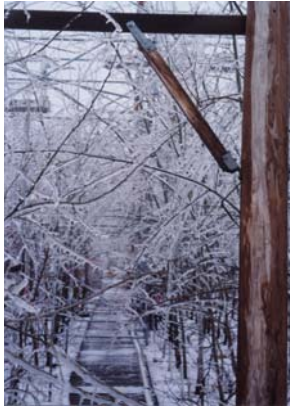
### Web Site Changes

We moved the Aspen FACE web site to Michigan Tech this year. The new address is <http://aspenface.mtu.edu>. The move was facilitated by Dave Karnosky (left) and Janet Pikkarainen (right). We are continuing to make additions to the site. Please pass along your suggestions for improvements to Janet ([jmpikkar@mtu.edu](mailto:jmpikkar@mtu.edu)) or Dave ([dbkarnos@mtu.edu](mailto:dbkarnos@mtu.edu)). Many thanks to



George Host (NRR) for setting up and maintaining our original web site for the past six years.





### Ice Storm Blankets Aspen FACE Site

One of the worst ice storms on record in the Rhinelander, Wisconsin area occurred over two days (April 16 and 17, 2003). The two-day storm resulted in layers of ice 1-2 cm in thickness coating branches, buds and stems. Fortunately, our site came through very well with only minor damage from a few snapped stems and branches.



### 2003 Student Operators

Sravanth Reddy (left) (MTU senior in electrical engineering) returns for his second season as a student operator. We welcome Sravanth back. By the way, Sravanth handles the JLG boom lift very well in changing vertical vent pipe slots, etc. Our second student operator this year is Rahul Bandaru. Rahul is a graduate student in MTU's Department of Electrical Engineering and he has an extensive electronics background.

### Passive Ozone Monitors

Drs. Kevin Percy (Aspen FACE Steering Committee) and Roger Cox, Canadian Forest Service, have supplied us with passive O<sub>3</sub> monitors (see photo on the right) that Jaak Sober (see photo) and Kevin's student, Robert Partridge (see photo) have placed throughout the O<sub>3</sub>, CO<sub>2</sub>+O<sub>3</sub>, and control rings at 2 and 4 m in height along transects through each sector of the rings. Preliminary observations with the passive samplers (in late summer 2001) showed an excellent mixing of O<sub>3</sub> throughout the canopy.



Aspen FACE site operator Jaak Sober (above) and Canadian Forest Service graduate student Robert Partridge (right)



Dave Ellsworth

### New Grants and Other Support

**Dr. David Ellsworth** (University of Michigan) received \$135,782 from DOE's Office of Science (BER) through NIGEC for his project entitled "Canopy conductance and CO<sub>2</sub> uptake in response to trace gases CO<sub>2</sub> and ozone in aspen and aspen-birch forests." Mark Kubiske (USFS) and Evan McDonald (USFS) are co-investigators on the project which will begin this summer.

**Dr. Eric Kruger** (University of Wisconsin) received \$113,045 from the WFE Environmental Research Program for a project entitled "Projecting impacts of greenhouse gases on carbon sequestration by Wisconsin's forests." Edward Jepsen (Wisconsin DNR), Mark Kubiske (USFS), and David Karnosky (MTU) are co-investigators.



Eric Kruger

**Dr. Steve Long's** Ph.D. student Victoria Wittig (University of Illinois) was awarded a DOE-sponsored Global Change Education Program fellowship to improve model parameters for two ecosystem models: PNET and GTEC,

with Aspen FACE data. Wilfred Mac Post (ORNL) and Dave Karnosky (MTU) are mentors for Victoria's project. The fellowship was awarded by Oak Ridge Institute for Science and Education.

**Dr. Kevin Percy** has been awarded a new project entitled "Evaluation of Canada-Wide Standard for Ozone Efficacy in Protecting Canada's Forests." T. Dann (Environment Canada), M. Nosal (STATSCON, Calgary), Mark Kubiske (USFS), and D.F. Karnosky (MTU) are co-investigators. The project compares various O<sub>3</sub> standards and O<sub>3</sub> predictors as predictors of aspen growth at the Aspen FACE project. O<sub>3</sub> flux is being estimated based on O<sub>3</sub> concentrations, stomatal conductance values, and soil moisture levels (provided by Kurt Pregitzer's (MTU) group).

### **Respirator Reminder**

Just a reminder that respirators are required at all times when entering O<sub>3</sub> or CO<sub>2</sub>+O<sub>3</sub> rings during O<sub>3</sub> fumigation. To get respirators from Wendy Jones, Safety Coordinator at the Aspen FACE site, an OSHA Respirator Survey must be on file with the U.S.F.S. This survey must be approved by an appropriate health facility (St. Mary's Hospital in Rhinelander, WI has been handling these requests for about \$40 per survey). It is best if people outside of the Rhinelander area visit their own health agencies, as a follow-up physical may be required.



### **Ozone Monitor Calibration**

Jim Trochta (left), Wisconsin DNR, Air Quality Division, continues to operate an O<sub>3</sub> monitor at the Aspen FACE site as part of the Wisconsin DNR's state ozone monitoring program. Jim stops by for biweekly calibrations with his secondary ozone standard. Our Aspen FACE O<sub>3</sub> monitors are calibrated seasonally against this secondary standard. Thanks, Jim and the Wisconsin DNR, for your long-term (over 10 years) assistance of our project.

### **Belowground Team**

Post doctorate fellow Wendy Loya (right) is leading Kurt Pregitzer's (MTU) belowground team this summer. In addition to collecting biweekly minirhizotron data, Wendy supervises the 4-person undergraduate (all MTU) contingency at the site.

Wendy has just been awarded a System for Analysis Research and Training (START) award to attend the International Young Scientists' Global Change Conference in Trieste, Italy in November of this year. Congratulations Wendy!



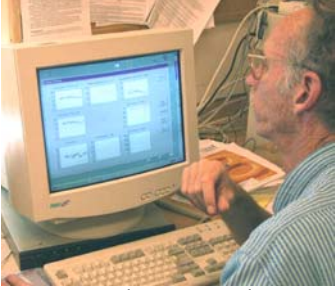
### **Insect Interaction Study**

Paula Marquardt (USFS) and Mark Kubiske (USFS) are examining the effects of the aspen blotch miner (photo) on gas exchange in aspen. You are likely to see their bags (photo) in various positions in the canopy at the Aspen FACE site. In 2001, the aspen blotch miner peaked at our site, with numerous blotches per leaf throughout the canopy. How this loss of photosynthetically active leaf surface to insects affects the leaf's ability to capture carbon under the various treatments is an interesting research question.



## Aspen FACE Operations (Nagy's Corner)

*John Nagy (Brookhaven National Lab) offers the following information on Aspen FACE operations. Incidentally, John spent a week at our site in late April this year incorporating the latest BNL technology into our operation system.*



At the Aspen FACE Project, operation mode for CO<sub>2</sub> fumigation is Solar like most other BNL-associated FACE experiments. Thus fumigation is turned off at night. Turning CO<sub>2</sub> fumigation on and off is automatic and generally occurs when no operator is on the site. The value of the sun altitude parameter, +6 degrees, is higher than most other sites. At the latitude of Rhinelander, fumigation is enabled about 50 minutes of time after sun rise on June 21 and 40 minutes on September 21. These are the extremes. In late September, the sun altitude parameter is changed to +12 degrees after bud set and when diurnal curves show photosynthetic activity is reduced to a shorter portion of each day.

For reasons of human and plant safety, enabling ozone fumigation is not automatic and ozone treatment only occurs when operators are on site. In the morning after evaluating current conditions and the weather forecast, the operators decide whether there will be any ozone treatment that day and what the target concentrations will be. If treatment is a go, the operators power up the ozone generators and make other preparations and checks. Then control program computer operation mode for the ozone rings is changed from Off to Clock mode with a turn-off time of 19:00 hours. The control program takes over from that point but conditions are monitored continually by operators who may abort the run. The opposite sequence is followed in the evening.

## New Publications

Rick Lindroth's group reports the following:

Lindroth, R.L., S.A. Wood, and B.J. Kopper. 2002. Response of quaking aspen genotypes to enriched CO<sub>2</sub>: foliar chemistry and tussock moth performance. *Agricultural and Forest Entomology* 4:315-323.

Kopper, B.J. and R.L. Lindroth 2003. Responses of trembling aspen (*Populus tremuloides*) phytochemistry and aspen blotch leafminer (*Phyllonorycter tremuloidiella*) performance to elevated levels of atmospheric CO<sub>2</sub> and O<sub>3</sub>. *Agricultural and Forest Entomology* 5:17-26.

Kopper, B.J. and R.L. Lindroth. 2003. Effects of elevated carbon dioxide and ozone on the phytochemistry of aspen and performance of an herbivore. *Oecologia* 134:95-103.

Awmack, C.S., R. Harrington, and R.L. Lindroth. 2003. Individual performance does not predict aphid population responses to elevated atmospheric CO<sub>2</sub> or O<sub>3</sub>. *Global Change Biology* (in press).

Holton, M.K., R.L. Lindroth, and E.V. Nordheim. 2003. Foliar quality influences tree-herbivore-parasitoid interactions: effects of elevated CO<sub>2</sub>, O<sub>3</sub>, and genotype. *Oecologia* (in press).

Great work!

Dave Karnosky (MTU) reports the following papers:

Karnosky, D.F. 2003. Impacts of elevated CO<sub>2</sub> on forest trees and forest ecosystems: Knowledge gaps. *Environment International* 29:161-169.

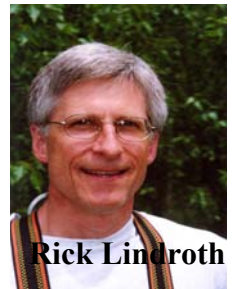
Karnosky, D.F., D.R. Zak, K.S. Pregitzer, C.S. Awmack, J.G. Bockheim, R.E. Dickson, G.R. Hendrey, G.E. Host, J.S. King, B.J. Kopper, E.L. Kruger, M.E. Kubiske, R.L. Lindroth, W.J. Mattson, E.P. McDonald, A. Noormets, E. Oksanen, W.F.J. Parsons, K.E. Percy, G.K. Podila, D.E. Riemenschneider, P. Sharma, R. Thakur, A. Sober, J. Sober, W.S. Jones, S. Anttonen, E. Vapaavuori, B. Mankovska, W.E. Heilman, and J.G. Isebrands. 2003. Low levels of tropospheric O<sub>3</sub> moderate responses of temperate hardwood forests to elevated CO<sub>2</sub>: A synthesis of results from the Aspen FACE project. *Functional Ecology* 17:289-304.

Thanks to all who contributed on this one!

## Other Recent Papers:

McDonald, E. P., E.L. Kruger, D.E. Riemenschneider and J.G. Isebrands. 2002. Competitive status influences tree-growth responses to elevated CO<sub>2</sub> and O<sub>3</sub> in aggrading aspen stands. *Functional Ecology* 16 (6): 792-801.

Larson, J.L., D.R. Zak, and R.L. Sinsabaugh. 2002. Microbial activity beneath temperate trees growing under elevated CO<sub>2</sub> and O<sub>3</sub>. *Soil Science Society of America Journal* 66:1848-1856.



Rick Lindroth

## “People at the FACE site” – Evan McDonald



Position: Research Scientist, USFS

Degrees: B.S. (SUNY-Genesco); Ph.D. (Duke)

*Editors:* How did you end up at the FACE site and how many years have you been here?

**Evan:** My PhD advisor, Boyd Strain, was one of the pioneers in the area of research on elevated CO<sub>2</sub> effects on plants, and instrumental in developing the FACE experiment at Duke. Ironically, I was not directly involved with the many elevated CO<sub>2</sub> studies going on at Duke, as my research examined physiological responses to variation in light availability. But coming out of Boyd Strain's lab, I could not avoid CO<sub>2</sub> studies for long. In 1994 I went to Madison as a postdoctoral scientist to study elevated CO<sub>2</sub> effects on tree-insect interactions with Richard Lindroth at the University of Wisconsin. I then had the opportunity to continue post-doctoral work with Eric Kruger, also at UW-

Madison, just as the first full growing season of the Aspen-FACE experiment in Rhinelander was beginning. In May of 1998 I headed North to work at the FACE project, and I have stayed with it and lived in Rhinelander ever since.

*Editors:* Evan, I know you are involved in a tremendous amount of studies over the years, as I have watched you at the FACE site. Could you briefly describe some of these and tell us perhaps what your favorite project has been.

**Evan:** I am working on many above-ground studies at Aspen-FACE, with the research questions developing along with the stands as they grow. One of my central interests is how changes in one resource affect plant utilization of other resources. In this experiment, both CO<sub>2</sub> and ozone strongly affect plant carbon status, the former acting as a fertilizer and the latter as a stress agent. How these gases individually and in combination alter the tree's use of light, nitrogen, and water is an interesting problem. I am interested in how responses at that scale translate into whole-tree and ultimately stand-level processes. The availabilities of light, nutrients and water are often limiting for tree growth, with trees competing for these resources. So competition becomes an important factor to consider, the effects of which cannot be captured at the leaf-level alone. The competition effects interact with clonal differences and the atmospheric treatments, making for a complicated story in keeping with the ecological complexity we would expect given the many sources of variation in the experiment and nature itself. Another effort I have led is building up a program to monitor sap flux in the Aspen-FACE stands. Over the years this entailed a lot of headaches, but we worked out a lot of those problems and this year succeeded in setting up measuring equipment in all 12 rings to simultaneously follow whole-tree transpiration in the aspen stands. This is especially satisfying because seeing the sap flow data coming in is the equivalent of taking the tree's pulse around the clock.

*Editors:* Where is your work heading these days?

**Evan:** I have become intrigued with the possibility that one of the important leaf-level responses, which is stomatal closure in response to elevated concentrations of CO<sub>2</sub> or ozone, appears to strongly affect whole-tree transpiration and may ultimately affect the tree's acquisition of nitrogen. Our hypothesis is that decreased uptake of water consequently decreases the rate mobile forms of nitrogen (such as nitrate) are delivered to the roots. This is a challenging problem to deal with in a field setting, but we are looking for evidence and correlations to test the idea. I am continuing with the process of compiling and relating all of the separate data sets needed to quantify the stand-level resource use efficiencies. We have several years worth of results now and some patterns may be emerging with respect to stand age? Maybe we will find some surprises.



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*Editors:* Evan has also contributed tremendously to the Aspen FACE project, behind the scenes, with ring map development, harvest logistics, and growth measurement logistics, among many other chores he has managed.