



## **FACING THE FUTURE**

### The FACTS II (Aspen FACE) Newsletter

Volume 1, No. 1, April 2002

David F. Karnosky and Janet M. Pikkarainen, Editors

This first “FACING THE FUTURE” newsletter is in response to suggestions that we improve communication among our team’s scientists, post doctorate fellows, technicians, graduate/undergraduate students, and support staff. Future issues will be published once or twice per year, or more frequently if warranted. It will serve as a vehicle for increased communication. As such, we welcome your contributions. Please send Dave Karnosky (karnosky@mtu.edu) ideas for future topics or a few paragraphs that you would like to share with the team. Comments are also welcome on the newsletter format.



#### **Jud Isebrands Retires**

After over 30 years with the USFS, Principal Tree Physiologist, Dr. Judson G. Isebrands, has announced his retirement. A long-time enthusiast for climate change research, Jud was instrumental in bringing the Aspen FACE project to the USFS land at the Harshaw Farm. Jud has been a member of the Aspen FACE Steering Committee since the initiation of the project. He and his Rhinelander team have taken lead roles in site clearing for the project, tree propagation for the project, and for measurements of growth, as well as study of N dynamics and pest occurrence and control.

We’ll miss Jud’s infectious enthusiasm for science but we wish him and his lovely wife Sharon all the best.

#### **FACTS II (Aspen FACE) Renewal**

The FACTS II (Aspen FACE) project has been renewed by DOE’s Office of Biological and Environmental Research, BER, for three years beginning April 1, 2002. The announcement of the award was made at MTU where Drs. David Karnosky and Kurt Pregitzer were visited by U.S. Senator Carl Levin, D-Michigan. According to Senator Levin, “This project is vital to decreasing the uncertainty with regard to greenhouse impacts on future forests.”

It should be noted that the support covers primarily operating costs and it does not completely cover our operating costs. Thus, it is critically



L-R: Senator Levin, Kurt Pregitzer, and Dave Karnosky during Levin’s visit to MTU Forestry on February 21, 2002

important that operating contributions continue from other sources. These contributions were built into the composite budget presented to DOE.

Equipment support in the renewal will allow for upgrading the site's O<sub>3</sub> generator, which is currently undersized for the volume of forest canopy being treated. Several O<sub>3</sub> monitors will eventually be replaced also, as many of these date back to the days of the Forest Response Program of 17 years ago and they are starting to become unreliable.

A special thanks is due our writing team including Don Zak, Kurt Pregitzer, Rick Lindroth, Kevin Percy, Mark Kubiske, George Hendrey, Jud Isebrands, and Dave Karnosky. A short summary of the proposal can be found at the DOE PER web site (<http://www.er.doe.gov/production/ober/GC/per.html>).

### Forest Pest Update

The Forest tent caterpillar (right bottom) saga continues at the Aspen FACE site. Bill Mattson's crew removed over 2000 egg masses from core trees last autumn. This team will also remove egg masses (right top) from the buffer-zone trees as soon as snow melt is over.



Bill says the viability tests his team have run show that egg hatch will likely be very large again this spring, especially in light of the large numbers of egg masses in surrounding aspen forests near and throughout the site.



Our forest pest study team will continue to monitor the dynamics of the forest tent caterpillar outbreak this year. It has been suggested that we mow around those rings where the pests are most likely to invade and that we lay down pesticide spray strips over the mowed fields.



Should the need arise, Bill says he is prepared to rally people to a control campaign focused on soap and water as was done in 2001.

Thanks much to Bill Mattson (left) and his team for their efforts on the serious pest problem!

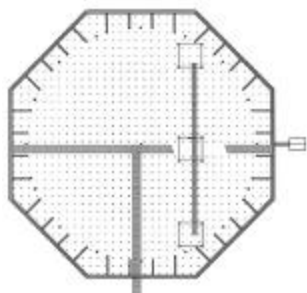
### Canopy Access Update

A self-propelled lift (a larger version of that we have previously used at the site-left) has been purchased by the USFS capital project's program (headed by North Central Station Engineer John Jakel). This lift will be used primarily by site operators to change vertical vent pipe slot configurations and to work on the vertical vent pipes. However, limited availability is possible for sampling crowns. We'll have to test the operation of this vehicle at the site before we can say more about its possible uses. Road weight restrictions resulted in the vehicle being dropped off at the Forest Science Lab in Rhineland.



Jaak Sober, FACE site chief operator (right), is looking into the logistics of renting a tree-spade for moving hybrid poplars near the vertical vent pipes to allow for space for the lift to operate around the outside of each ring.

John Jakel has sent out a proposal requesting bids for a set of three towers and a cross-walk for each ring (left) to allow access to a portion of



the canopy of the aspen and aspen-birch sections of each ring and would allow for the cross-walk heights to be increased yearly as needed.

We are also exploring the possibility of putting inert walkway materials down every other row of each ring to allow for access but while minimizing soil compaction. A sample of the plastic material used at the SoyFACE site is being sent to Dave Karnosky.

### **Planned Harvests—2002**

A second biomass harvest is planned for August 2002. The plan is to harvest one tree of each clone from the aspen side; one maple and one aspen from the aspen-maple quadrant, and one aspen and one birch from the aspen-birch quadrant for each ring. We will again partition the trees into fine roots, coarse roots, stems, and leaves. In addition, we'll conduct a total aboveground biomass harvest for understory vegetation. This harvest will be coordinated with Rick Lindroth and Caroline Awmack's diversity study. Besides providing useful information on site productivity, this harvest will also allow us to have the site clear for the walkway deployment.

These harvests will be a massive undertaking and at our last PI meeting (December 2001), it was suggested that to the extent possible, people should keep August open for their crews to help on this project. Anyone seeking samples from the harvest trees or understory plants should contact Dave Karnosky.

### **Mark Kubiske Joins the Aspen FACE Steering Committee**

Mark Kubiske (below), Acting Project Leader for Project NC-4152, Physiological Processes, of the North Central Research Station, has joined the Aspen FACE Steering Committee. Mark was a post doctoral fellow at MTU during the early days of our FACE project and he helped in much of the early study design and development.



### **Safety**

Wendy Jones (right) continues to be our site's safety officer. We are developing a safety sheet for the site that will allow everyone visiting the site to acknowledge hazards at the site and to say they have read our safety protocol. Mandatory sign-in at the site will continue this year to allow site operators to know who is at the site each day. "Please drive safely at the site and come in out of the thunderstorms!" says Wendy.



### **Protocol Issues**

All new studies and any destructive harvesting at the Aspen FACE site are subject to approval of the Aspen FACE Steering Committee, which includes David F. Karnosky (MTU), Kurt S. Pregitzer (MTU/USFS), Mark E. Kubiske (USFS), Kevin E. Percy (Canadian Forest Service), and George R. Hendrey (Brookhaven National Lab).

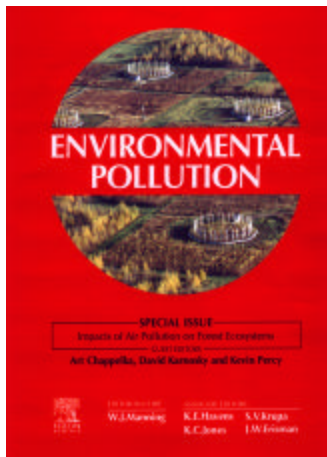
### **O<sub>3</sub> Criteria Document**

Dave Karnosky has been named to a panel of U.S. scientists which is rewriting the U.S. Environmental Protection Agency O<sub>3</sub> Criteria Document. Dave was also involved in writing the last (1996) O<sub>3</sub> Criteria Document. This document serves as the scientific base for setting the Federal O<sub>3</sub> Standard. Dave's contribution to the document focuses on the genetic aspects of ozone effects on plant populations and on genetic variability of responses of crops and trees to ozone.



## New Publications

The Aspen FACE project was recently highlighted in a special issue of *Environmental Pollution* (2001, Volume 115) edited by Art Chappelka and Aspen FACE scientists Dave Karnosky and Kevin Percy. We had the first ever cover photo for the journal.



Some key papers for this issue:

R.E. Dickson, M.D. Coleman, P. Pechter, D. Karnosky—Growth and crown architecture of two aspen genotypes exposed to interacting ozone and carbon dioxide. pp. 319-334.

J.G. Isebrands, E.P. McDonald, E. Kruger, G. Hendrey, K. Percy, K. Pregitzer, J. Sober, D.F. Karnosky—Growth responses of *Populus tremuloides* clones to interacting elevated carbon dioxide and tropospheric ozone. pp. 359-371.

R.L. Lindroth, B.J. Kopper, W.F.J. Parson, J.G. Bockheim, D.F. Karnosky, G.R. Hendrey, K.S. Pregitzer, J.G. Isebrands, J. Sober—Consequences of elevated carbon dioxide and ozone for foliar chemical composition and dynamics in trembling aspen (*Populus tremuloides*) and paper birch (*Betula papyrifera*). pp. 395-404.

M.J. Martin, G.E. Host, K.E. Lenz, J.G. Isebrands—Simulating the growth response of aspen to elevated ozone: a mechanistic approach to scaling a leaf-level model of ozone effects on photosynthesis to a complex canopy architecture. pp. 425-436.

E. Oksanen, J. Sober, D.F. Karnosky—Impacts of elevated CO<sub>2</sub> and/or O<sub>3</sub> on leaf ultrastructure of aspen (*Populus tremuloides*) and birch (*Betula papyrifera*) in the Aspen FACE experiment. pp. 437-446.

W.A. Wustman, E. Oksanen, D.F. Karnosky, A. Noormets, J.G. Isebrands, K.S. Pregitzer, G.R. Hendrey, J. Sober, G.K. Podila—Effects of elevated CO<sub>2</sub> and O<sub>3</sub> on aspen clones varying in O<sub>3</sub> sensitivity: can CO<sub>2</sub> ameliorate the harmful effects of O<sub>3</sub>? pp. 473-481.

David Karnosky, together with Reinhart Ceulemans (Belgium), Giuseppe Scarascia-Mugnozza (Italy), and John Innes (Canada), has recently published a book entitled “The Impact of Carbon Dioxide and Other Greenhouse Gases on Forest Ecosystems”. The book is available from CABI Press (ISBN: 0-85199-551-9). Early reviews of the book have been favorable. The *Bulletin of British Ecological Society* stated “ecologists should find this an excellent source book, written by a truly international panel of contributors.”

Key papers from our group in this:

G.K. Podila, A.R. Paolacci, and M. Badiani—The impacts of greenhouse gases on antioxidants and foliar defence compounds. pp. 57-126.

M.E. Kubiske and D.L. Godbold—Influence of CO<sub>2</sub> on the growth and function of roots and root systems. pp. 147-192.

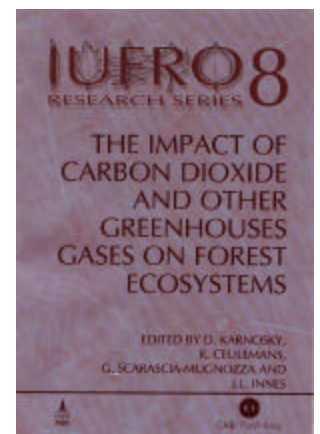
D.E. Karnosky, E. Oksanen, R.E. Dickson, and J.G. Isebrands—Impacts of interacting greenhouse gases on forest ecosystems. pp. 253-268.

D.F. Karnosky, B. Gielen, R. Ceulemans, W.H. Schlesinger, R.J. Norby, E. Oksanen, R. Matyssek, and G.R. Hendrey—FACE systems for studying the impacts of greenhouse gases on forest ecosystems. pp. 297-324.

D.F. Karnosky, G.E. Scarascia-Mugnozza, R. Ceulemans, and J. Innes—Knowledge gaps in the study of the impacts of elevated atmospheric CO<sub>2</sub> and other greenhouse gases on forest ecosystems. pp. 325-340.

## Other Recent Publications

King, J.S., K.S. Pregitzer, D.R. Zak, J. Sober, J.G. Isebrands, R.E. Dickson, G.R. Hendrey, and D.F. Karnosky. 2001. Fine root biomass and fluxes of soil carbon in young stands of paper birch and trembling aspen



as affected by elevated atmospheric CO<sub>2</sub> and tropospheric O<sub>3</sub>. *Oecologia*, 128:237-250.

King, J.S., K.S. Pregitzer, and D.R. Zak. 2001. Correlation of the chemistry of foliage and litter in sugar maple (*Acer saccharum* Marsh.), as affected by elevated CO<sub>2</sub> and varying N availability, and its decomposition. *Oikos* 94:403-416.

Noormets, A., A. Sober, E.J. Pell, R.E. Dickson, G.K. Podila, J. Sober, J.G. Isebrands, and D.F. Karnosky. 2001. Stomatal and non-stomatal limitation to photosynthesis in two trembling aspen (*Populus tremuloides* Michx.) clones exposed to elevated CO<sub>2</sub> and/or O<sub>3</sub>. *Plant, Cell and Environ.* 24:327-336.

Noormets, A., E.P. McDonald, E.L. Kruger, A. Sober, J.G. Isebrands, R.E. Dickson, and D.F. Karnosky. 2001. The effect of elevated carbon dioxide and ozone on leaf- and branch-level photosynthesis and potential plant-level carbon gain in aspen. *Trees* 15:262-270.

Takeuchi, Y., M.E. Kubiske, J.G. Isebrands, K.S. Pregitzer, G. Hendrey, and D.F. Karnosky. 2001. Photosynthesis, light and nitrogen relationships in a young deciduous forest canopy under open-air CO<sub>2</sub> enrichment. *Plant, Cell and Environ.* 24:1257-1268.

### **New Support**

Rick Lindroth and Caroline Awmack recently received a 3-year \$300,000 grant from the NSF Ecology Program. The project will examine how CO<sub>2</sub> and O<sub>3</sub> alter the dynamics of complex trophic interactions.

Mike Miller and Julie Jastrow (Argonne National Laboratory) have recently received an award entitled "Interactive effects of elevated carbon dioxide and ozone on the mycorrhizal symbiosis" from the DOE PER, Office of Biological and Environmental Research (BER) program. Mike and Julie will be examining mycorrhizal fungi at both the Aspen FACE site and the SoyFACE project.

Don Zak and Kurt Pregitzer have recently received an award entitled "Ecosystem response to elevated carbon dioxide and ozone is regulated by plant-microbe interactions in soil" from the DOE PER, Office of Biological and Environmental Research (BER) program. Don and Kurt lead our belowground team and we are happy to have DOE continuing support of this effort.

John King, Don Zak, and Kurt Pregitzer received a 3-year \$265,000 award from the USDA-NRI entitled "Fine root chemistry as affected by elevated CO<sub>2</sub> and tropospheric O<sub>3</sub>: Consequences for carbon cycling and storage".

Dave Karnosky, Gopi Podila, Kevin Percy, and Brenda Callan received a 2-year \$120,000 award from the USDA-NRI entitled "Predisposition of aspen to *Melampsora* rust by O<sub>3</sub>: Mechanisms of Action". This project finally brings a true pathologist (Brenda Callan) to our project.

Congratulations to our science team for their recent successes in the competitive grants arena!

### **"People at the FACE site" – Pooja Sharma**



Position: Ph.D. student (third year) in Forest Molecular Biology and Biotechnology, Michigan Technological University

Hometown: Palampur, Himachal Pradesh, India

Editors: Pooja, How did you end up here?

Pooja: "I found MTU's home page on the net and was fascinated with the work being done with air pollution and trees in Dave Karnosky's lab. In India, the pollution is so thick that you cannot see the sky in many areas."

Pooja's work focuses on understanding what impacts CO<sub>2</sub> and O<sub>3</sub> are having on physiological processes of trembling aspen and sugar maple. In addition, she is examining gene expression patterns using membrane arrays in hopes of linking patterns of gene expression to physiological processes. Pooja's Ph.D. committee includes Aspen FACE scientists Gopi Podila, Mark Kubiske, Anu Sober, and Dave Karnosky.