FACING THE FUTURE

The FACTS II (Aspen FACE) Newsletter

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Andrew J. Burton and Janet M. Pikkarainen, Editors

Aspen FACE is a highly successful project for global change research. Over 100 scientists and students contributing to the project have written over 170 scientific papers and Aspen FACE remains at the cutting edge of forestry and ecological research. Principally supported by the U.S. Department of Energy's Office of Biological and Environmental Research, the Aspen FACE (Free Air CO_2 Enrichment) project is located on USFS property 10 miles west of Rhinelander, Wisconsin. Since 1998, the project has been examining the impacts of elevated atmospheric carbon dioxide (CO_2) and tropospheric ozone (O_3) on the structure and functioning of a northern forest ecosystem dominated by trembling aspen, North America's most widely distributed tree species. The Aspen FACE project became part of DOE's distributed facility in 2003. The Aspen FACE facility is run by Michigan Technological University with MTU's Dave Karnosky as Director until his death on October 24, 2008. Andrew J. Burton (MTU) succeeds as MTU Lead Investigator of the Aspen FACE Project. All major decisions at the Aspen FACE facility are made by the Steering Committee which includes Andy Burton (MTU), Kurt Pregitzer (Univ. Nevada-Reno), Neil Nelson (U.S. Forest Service-retired), Kevin Percy (K.E. Percy Air Quality Effects Consulting Ltd.), and Alistair Rogers (Brookhaven National Laboratory). Dr. Mark Kubiske (USFS) is an ex-officio member of the Steering Committee and coordinates science at the site. ***Note****: Previous issues of the newsletter are available at the Aspen FACE web site http://aspenface.mtu.edu*

2009 Summer Harvest Plans – see page 4

David Karnosky, Aspen FACE Director, Passes Away

Dr. David Karnosky, one of Michigan Tech's premier scientists and mentors, died Friday, October 24, at his home in Chassell at the age of 59. He was a professor of forest genetics and biotechnology in the School of Forest Resources and Environmental Science and had recently accepted an appointment as the Robbins Chair in Sustainable Management of the Environment. In addition, he was the director of the University's Ecosystem Science Center and directed the Aspen FACE (Free-Air Carbon dioxide Experiment) site near his hometown of Rhinelander, Wisconsin.

"He was an exceptional scientist and teacher," said Peg Gale, dean of forest resources and environmental science. "And he was so giving to his students and the people who worked for him; if he saw that you were committed, he would give you the shirt off his back."

"He was one of the most productive scientists I've ever met," said President Glenn Mroz, a member of the SFRES faculty and former dean of the School. "He was way ahead of his time and had an enormous impact in the area of air pollution and forest genetics."

Karnosky came to Michigan Tech in 1983 after eight years as a forest geneticist with the Carey Arboretum of the New York Botanical Garden, in Millbrook, N.Y. His work there served as the foundation for one of his many accomplishments, cloning an elm donated to the city of New York, as legend has it, by the King of Prussia in the late 19th century. Though the elm perished in 1993, Karnosky had propagated the original tree and eventually provided over 1,000 seedlings of the Central Park Splendor elm now growing in parks throughout New York. In addition, he traveled to China, home of the original elm, in 2002 to present 150 seedlings for scientific study.

Since coming to the University, he and his colleagues were the first to genetically engineer a conifer species, *Larix decidua* (also known as larch, or tamarack). He was instrumental in establishing the Aspen FACE site in Rhinelander, where plots are exposed to elevated levels of carbon dioxide and ozone, mimicking atmospheric conditions of future forests. He and other researchers made groundbreaking discoveries there relating to tree growth, physiology, pest interactions and carbon sequestration.

At Michigan Tech, he received the 1993 Research Award and then in 2006 received the International Union of Forestry Research Organization's Scientific Achievement Award.

Karnosky's interests were international, and he traveled throughout Europe, Asia and Africa as part of his efforts to improve tree productivity. Most recently, he returned from a trip to Ghana and showed a 90-minute slide show as part of a belated birthday party in his honor.

"It was a lot of trees, trees, trees," said Janet Pikkarainen, his administrative aide of 13 years. "He loved his work. He was enthusiastic all the time." Pikkarainen remembers her first big project, typing the inaugural proposal for Aspen FACE in 1995. "He was always coming up with new ideas—I was amazed at what he would think of. He was very dedicated to his research, but even though he was so involved, he was considerate, compassionate and giving, such a gentle person."

An avid golfer, he had not hit the links frequently in the last few years. But as a high school student in Rhinelander, he caddied at the local golf course and earned a coveted Evans Scholar award to the University of Wisconsin–Madison, which funded his undergraduate education. After earning a BS in Forestry in 1971, Karnosky went on to earn MS and PhD degrees in Forest Genetics, also from UW-Madison.

"While Dave's work and that of his many collaborators have led to significant accomplishments in forest science, he also inspired others to excel in their scientific endeavors," said Gale. "He mentored over 24 graduate students and also advised many faculty at Tech and at other universities on new ideas and the potential of various sponsors for their research and for international collaborations. His scientific genius will be carried on through the strong connections he has made and the innovative science he created," she said. "We will miss his inspiration and quiet ways."

Karnosky is survived by his wife, Sherry; two sons, David, a student at Michigan Tech, and Jason, at the University of Wisconsin–Madison; brothers William and Brian (Mary), both of Rhinelander; and one grandchild, Cameron.

Karnosky Memorial Fund: A memorial fund has been set up in Dave's name to create an arboretum at the School of Forest Resources and Environmental Science. You may send a donation or contact Chris Hohnholt [Michigan Technological University, School of Forest Resources and Environmental Science, 1400 Townsend Drive, Houghton, Michigan 49931], email: cahohnho@mtu.edu or 906-487-2417 for more information.

Andrew J. Burton Succeeds as MTU Lead Investigator of Aspen FACE Project

Dr. Burton succeeds the late Dave Karnosky as the Lead Investigator of the Aspen FACE project. Andy has a wealth of experience in managing large programs of research.

His research interests are forest responses to global change factors, belowground processes, carbon and nutrient cycling, physiological ecology of tree roots, and undergraduate student involvement in research. His research integrates soil science, hydrology, plant physiology and ecology in order to determine how ecosystems are affected by and adjust to environmental stresses and human manipulations. "By understanding how forests are likely to change, we will be able to adjust our activities now to create a future in which forests can continue to provide the goods and services to which we have become accustomed." said Andy.

Andy Burton, Associate Professor in the School of Forest Resources and Environmental Science, joined MTU in 1994 as a Research Scientist. He graduated from Michigan State University with a BS degree in Forestry in 1983 and an MS in 1986. In 1997, he graduated from MTU with a PhD in Forest Science (Forest Ecology).

If you have any questions about the Aspen FACE experiment, please feel free to contact Andy (ajburton@mtu.edu).

"Facing the Future" Meeting Held in Rhinelander

Aspen FACE hosted a very successful meeting of three Free-Air experiments investigating the impacts of ozone on trees and crops. The meeting was co-chaired by the late David Karnosky (Aspen FACE), Don Ort (SoyFACE) and Rainer Matyssek (SFB 607, Munich, Germany). Twenty different organizations with 93 people from eight countries met at the Holiday Inn in Rhinelander on April 2-4, 2008, representing a delegation from the Technical University of Munich, Germany, along with scientists from Finland, Slovakia, Estonia, England, Italy, Canada and the U.S. "Facing the Future", a joint meeting of the Aspen FACE project, the University of Illinois based SoyFACE project, and the SFV 607 project based at the Technical University of Munich in Germany had a chance to compare results of three similar projects involving carbon dioxide and ozone levels or another way of putting it, global warming and its implications. Thirty-seven talks and 36 posters were presented and an awards banquet was held honoring those who made special contributions to the decade of climate change research conducted at the Aspen FACE site. A field trip to the FACE site concluded the three-day meeting which was a highlight for many of the foreign participants.

A Special Issue of ***Environmental Pollution*** is being prepared for publication in 2009. Some 20 manuscripts on above- and below-ground effects of ozone on aspen, birch, soybean, Norway spruce and European beech have been submitted for peer review. The Special Issue "Facing the Future: Joint Aspen FACE, SoyFace and SFB Meeting" will be dedicated to our late Director, friend and colleague, David F. Karnosky.

Purdue University Forestry Students Tour Aspen FACE

Eric Gustafson provided a lecture on landscape ecology research to the 2008 Purdue University Forestry Summer Camp students during their visit to the Rhinelander lab on May 28. NRS-13 PL Neil Nelson provided a tour of the Aspen FACE site at Harshaw Research Farm. Purdue's forestry summer camp is in nearby Iron River, MI.

Global Change Teachers Tour Aspen FACE

Twenty middle and high school teachers from the Midwest toured the site as part of a week-long Global Change Teachers' Institute in July. Over the past four years, 73 middle and high school teachers have visited Aspen FACE as part of the Institute, extending knowledge of the FACE research into many classrooms in the Lake States as well as locations in California, New York, Maryland, Missouri, Ohio, Illinois, Connecticut, and Mexico. One recent participant, Jenn Carlson, highlighted her visit to Aspen FACE in a paper entitled "Thinking Like an Ecologist", published in the National Science Teachers Association Journal *The Science Teacher* (see our Aspen FACE web site publications).

Neil Nelson Retires from USDA Forest Service

As of January 2, 2009, Dr. Neil Nelson retired from the USDA Forest Service in Rhinelander. Neil joined the Forest Service on May 2, 2004 as a Scientist and Project Leader for RWU 4152 in Rhinelander, Wisconsin. He had more than 30 years of research expertise in plant physiology.

Throughout his career, Neil has been successful in securing research grants and has published more than 50 papers. Neil is a member of the Aspen FACE Steering Committee and spearheaded development of data policy for the Aspen FACE project. Among many accomplishments, he managed the NEPA Environmental Assessment for the Aspen FACE project expansion in 2005 and all research at the Rhinelander Forestry Sciences Laboratory merged into one unit, *Institute for Applied Ecosystem Studies*, in 2007. Neil was named the first Director of the Institute, which includes about 24 staff and managed writing a 5-year strategic research plan for the Institute. Neil, best wishes for a happy and healthy retirement!

Summer 2009 Harvest

The summer of 2009 will be an exciting time in Rhinelander. We will initiate our planned harvest of the FACE experiment following a protocol developed collaboratively between Michigan Tech, the USFS (Rhinelander), the University of Michigan, and the University of Nevada, Reno. The above- and below-ground portions of the experiment will be harvested by block once the entire canopy has developed (all the determinate shoots have elongated). First, the trees will be cut at ground line and taken back to the field lab for analysis. Then, an excavator and commercial soil sieve will be used to recover most of the roots. This exercise will be a real adventure and the results should eventually be very interesting! Details of the harvest protocols and a schematic are available on our website http://aspenface.mtu.edu home page under "What's New" [January 2009].

If anyone has a need to collect data during the harvest or would like samples from the harvest, please complete the registration form for research requests on our web site http://aspenface.mtu.edu/reg.htm. These requests will be handled just like all the previous requests to conduct research on the site. They will be reviewed by the Executive Committee and approved unless there is some conflict with the official harvest protocol.

Having a brief description of the sample types needed and their purpose as soon as possible will facilitate a timely, coordinated harvest. A sample archive will be created, but its purpose is to fulfill requests for future needs that were unknown at the time of the harvest. Meeting current needs during the harvest will help ensure that the archive lasts well into the future. The Executive Committee will begin reviewing requests during a February 18, 2009 meeting. Early requests will be much easier to accommodate.

Sample that will be generated by the harvest include:

- leaves by annual height growth increment (HGI)
- stem cross sections every 1 m and at midpoints of HGI
- branches by order, composited across HGIs
- buds from all 1st order branches within each HGI
- coarse (> 1 mm) and fine (≤ 1 mm) roots by 10 cm depth increment, to 1 m depth.
- root free mineral soil by 10 cm depth increment, to 1 m depth

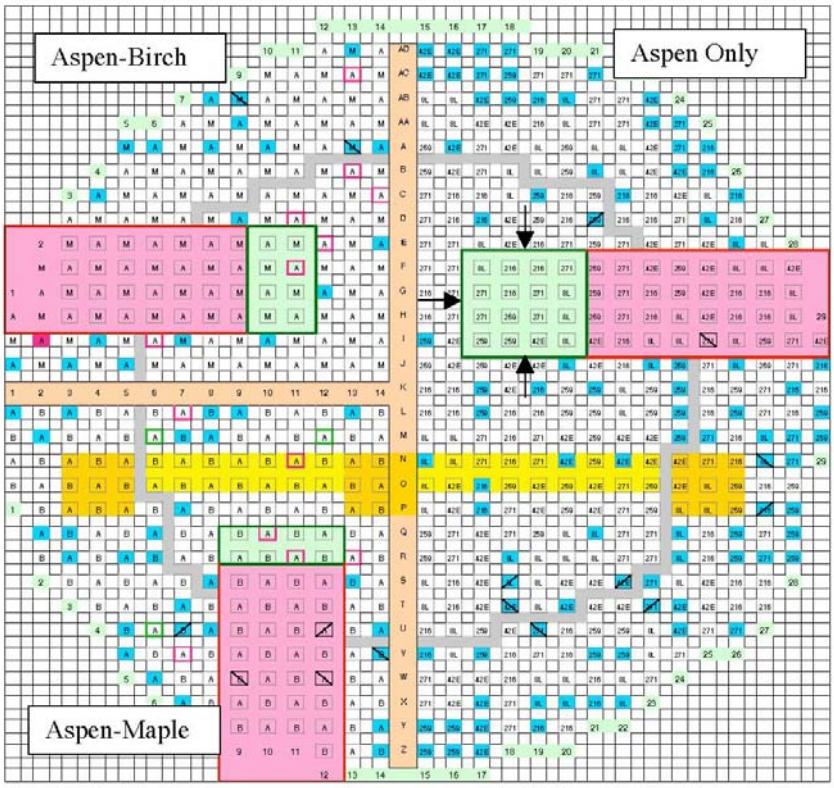

Figure 1. Schematic of a treatment ring at Aspen FACE showing exact locations of tree species (left half, A = aspen clone 216, M = maple, B = birch) and aspen clones (right half). Each tree is identified by its location in a grid of letters (rows) and numbers (columns) and by a unique ID number. Also shown are 3 ring sections divided by wooden walk-ways (tan), location of canopy access scaffolds (yellow & orange), delineation of the treatment "core" area where treatment gas concentrations are most stable (gray), and missing or dead trees (blue). Example locations of cleared access paths are shown as pink rectangles and delineated 4x4 m and 4x2 m harvest plots as green rectangles for the final harvest in 2009. The arrows show the locations of horizontal cores for sampling fine roots to be extracted from the exposed face of the 4x4 pit. Cross-hatched trees were removed in 2000 & 2002.

New Aspen FACE Publications

Bradley, K.L. and K.S. Pregitzer. 2007. Ecosystem assembly and terrestrial carbon balance under elevated CO_2. Trends in Ecology and Evolution 22:538-547.

Calfapietra, C., G. Scarascia Mugnozza, D.F. Karnosky, F. Loretto, and T.D. Sharkey. 2008. Isoprene emission rates under elevated CO_2 and O_3 in two field-grown aspen clones differing in their sensitivity to O_3. New Phytologist 179:55-61.

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Finzi, A.C., R.J. Norby, C. Calfapietra, A. Gallet-Budyneka, B. Gielend, W.E. Holmes, M.R. Hoosbeek, C.M. Iversen, R.B. Jackson, M.E. Kubiske, J. Ledford, M. Liberloo, R. Oren, A. Polle, S. Pritchard, D.R. Zak, and R. Ceulemans. 2007. Increases in nitrogen uptake rather than nitrogen-use efficiency support high rates of temperate forest productivity under elevated CO_2. Proceedings of the National Academy of Sciences 104:14014-14019.

Hillstrom, M.L. and R.L. Lindroth. 2008. Elevated atmospheric carbon dioxide and ozone alter forest insect abundance and community composition. Insect Conservation and Diversity 1:233-241.

Johnson, R.M. and K.S. Pregitzer. 2007. Concentration of sugars, phenolic acids, and amino acids in forest soils exposed to elevated atmospheric CO_2 and O_3. Soil Biology & Biochemistry 39(12):3159-3166.

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Parsons, W.F.J., J.G. Bockheim, and R.L. Lindroth. 2008. Independent, interactive, and species-specific responses of leaf litter decomposition to elevated CO_2 and O_3 in a northern hardwood forest. Ecosystems 11:505-519.

Percy, K.E. and D.F. Karnosky. 2007. Air quality in natural areas: interface between the public, science and regulation. Environ. Pollut. 149:256-267.

Pregitzer, K.S. 2008. Tree root architecture – form and function. New Phytologist 180:562-564.

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Uddling, J., R.M. Teclaw, M.E. Kubiske, K.S. Pregitzer, and D.S. Ellsworth. 2008. Sap flux in pure aspen and mixed aspen-birch forests exposed to elevated concentrations of carbon dioxide and ozone. Tree Physiology 28:1231-1243.

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