FACING THE FUTURE

The FACTS II (Aspen FACE) Newsletter

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David F. Karnosky 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 70 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 Emission) 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 trees 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. All major decisions at the Aspen FACE facility are made by the Steering Committee which includes Dave Karnosky, Kurt Pregitzer (MTU), Neil Nelson (U.S. Forest Service), Kevin Percy (Canadian Forest Service), and George Hendrey (Queens College). Dr. Mark Kubiske is an ex-officio member of the Steering Committee and he coordinates science at the site.

Karnosky Receives Scientific Achievement Award

Dr. David F. Karnosky, Professor of Forest Genetics & Biotechnology, Michigan Technological University and Director, Aspen FACE, received a Scientific Achievement Award from the International Union of Forestry Research Organizations (IUFRO) on August 8, 2005 at IUFRO's XXII World Congress in Brisbane, Australia. Dr. Karnosky was honored for his long-term research on genetic aspects of air pollution and climate change. Dr. Karnosky has written over 200 scientific publications including two books entitled "The Impact of Carbon Dioxide and Other Greenhouse Gases on Forest Ecosystems" (CABI Press 2001) and "Air Pollution, Global Change and Forests in the New Millennium" (Elsevier Press 2003). The award was one of 10 awarded by IUFRO at the World Congress which is held every 5 years. Dave's family including his wife Sherry and sons Daver and Jason were on hand to see Dr. Karnosky receive the award at IUFRO's opening ceremony. The World Congress was attended by some 2,000 delegates.

Monarch Butterfly Flourishes at Aspen FACE

The monarch butterfly, which needs milkweed as its primary habitat, was seen again in very large numbers at Aspen FACE. Milkweed, which is one of the primary food sources for monarch butterfly larvae, is very common at Aspen FACE and again had a large seed crop in 2005. The link of the monarch butterfly and milkweed is also closely linked to the natural toxins of milkweed making the butterfly poisonous to most predators. Milkweed is also a valuable bioindicator of O_3. We commonly see visible O_3 symptoms on milkweed in the O_3 rings but not outside the rings.

Finnish Scientists Visit Aspen FACE

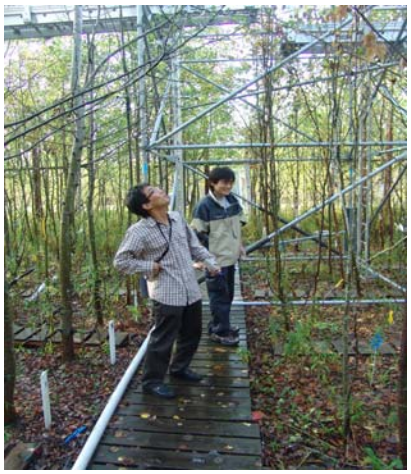
A team of Finnish scientists, headed by Dr. Elina Vapaavuori (METLA) and Dr. Elina Oksanen (University of Joensuu), along with Dr. Sari Kontunen-Soppela (METLA), visited Aspen FACE on August 14-20, 2005. The team is working collaboratively with Dr. David Karnosky (MTU) and with visiting scientist Dr. Johanna Riikonen (University of Kuopio, Finland), who spent the summer at Aspen FACE. The team is examining genomic issues of birch responses to elevated CO_2.

Canadian Forest Service Director General Visit

Dr. John Richards, Director General, Atlantic Forestry Centre, Canadian Forest Service, visited Aspen FACE on September 13-14, 2005. Dr. Richards (2nd from left) is shown with Dr. Kevin Percy, CFS [left], Dr. Dave Karnosky, MTU (2nd from right), and Dr. Neil Nelson, USFS. Following a tour of the site, the team met to discuss collaborative research efforts.

Japanese FACE Scientists Visit Aspen FACE

Dr. Dongsu Choi and graduate fellow Norikazu Eguchi, Hokkaido University, visited Aspen FACE on October 5, 2005. They were representing their own forest FACE experiment in Hokkaido where they are examining the effects of elevated CO_2 on some nine tree species including aspen, birch and maple closely related to those species at Aspen FACE.



PopFACE Scientist Visits Aspen FACE

Dr. Carlo Calfapietra, Department of Forest Environment and Resources, University of Tuscia, Viterbo, Italy recently visited Aspen FACE. Dr. Calfapietra is collaborating with Dr. Dave Karnosky (MTU) and Dr. Tom Sharkey, (University of Wisconsin) on a collaborative project to examine VOC emissions at Aspen FACE. Dr. Calfapietra will be a visiting scientist in Dr. Sharkey's lab for the next year and is being funded by the Italian government.

Well Dug for New Laboratory

A 140 foot well was dug by Webster Well Drilling late this fall at Aspen FACE to accommodate the new laboratory which will be built at Aspen FACE early in 2006.

University of Illinois Graduate Student Models Aspen FACE Productivity

University of Illinois graduate student Victoria Wittig, an Oak Ridge Associated University GREF fellow, visited Aspen FACE on September 20, 2005 to discuss data sets she needs to model the gross primary productivity (GPP) of the Aspen FACE experiment. Wittig, a student with Steve Long, met with her GREF mentor Dave Karnosky, Michigan Tech, and Anu Sober, Tartu University, Estonia.

USFS Hosts Legislative Tour of Aspen FACE

Drs. Neil Nelson and Mark Kubiske, and Communication Services Group Leader Deb Dietzman, USFS, hosted the Chequamegon-Nicolet National Forest Legislative Tour, which led off with a visit to the FACE site on August 10, 2005. The participants included both district and Washington, DC staff from Senators Kohl and Feingold and Representatives Green and Obey. Forest Service participants include staff of the Chequamegon-Nicolet National Forest and the North Central Research Station. Both the Congressional and the National Forest participants expressed great interest in the FACE stop. The event was organized by the Chequamegon-Nicolet National Forest to familiarize the Wisconsin Congressional delegation with Forest Service issues in the State.

NBC26 of Green Bay Interviews Aspen FACE Scientists

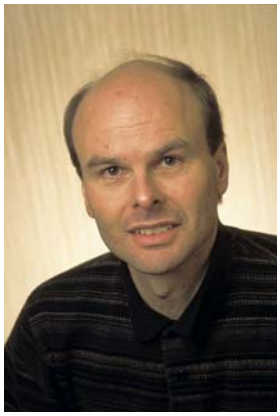
Owen Jensen, a television reporter for NBC26 of Green Bay, Wisconsin visited Aspen FACE on October 5, 2005 to interview Aspen FACE scientists Drs. Vanessa Quinn, USFS, and Dave Karnosky, Michigan Tech. The story is scheduled to run in late November or early December.

Aspen FACE Scientists Take Part in UNEC Workshop on Critical Levels of Ozone

Aspen FACE scientists Drs. Dave Karnosky, Michigan Tech, and Kevin Percy, Canadian Forest Service, were invited speakers at the UNECE Convention on Long-range Transboundary Air Pollution (http://www.unece.org/env/lrtap) sponsored workshop "Critical levels of ozone: further applying and developing the flux-based concept" held November 15-19, 2005 in Obergurgl, Tyrol, Austria. Dr. Karnosky chaired Session 2 entitled "Keynote Presentations on Forest Trees" and presented a paper entitled "Ozone effects on growth and productivity of *Populus tremuloides* Michx.: A comparison of results from OTC, FACE, and ozone gradient studies with a common set of genetic materials," with coauthor Kevin Percy. Dr. Percy presented a paper entitled "The North American ozone air quality standard: efficacy and performance with two northern hardwood forest trees species." Dr. Percy's paper was coauthored by Aspen FACE investigators Drs. Karnosky and Heilman, Aspen FACE site engineer Jaak Sober, and others: another paper from the work submitted elsewhere is co-

authored by Dr. Alan Legge, Biosphere Solutions (see photo). The meeting, attended by some 100 international scientists, was held to examine the flux-based concept of an ozone critical level for Europe. The United States (1947) and Canada (1973) are two of 55 UNECE member countries. Both countries ratified the Convention on LRTAP in 1979.

People at Aspen FACE



Warren E. Heilman, USFS, Lansing, Michigan
Editors: Warren, what is your position title?
Warren: I am the Project Leader and a Research Meteorologist for the Atmosphere-Ecosystem Interaction Research Work Unit at the USDA Forest Service – North Central Research Station lab in East Lansing, MI

Editors: What is your background?
Warren: I graduated from South Dakota State University in 1979 with a B.S. degree in physics, and then attended graduate school at Iowa State University, receiving my M.S. and Ph.D. degrees in meteorology in 1984 and 1988, respectively. My graduate studies focused on modeling atmospheric boundary-layer conditions over complex terrain to gain a better understanding of how terrain irregularities and surface vegetation impact atmospheric turbulence in the boundary-layer. After graduate school, I worked with Computer Sciences Corporation in Research Triangle Park, NC as an EPA contractor to develop improved air-quality modeling tools for the Agency. In 1990, I was hired as a Research Meteorologist with the North Central Research Station to head up the Station's fire-weather and forest-atmosphere interaction research program.

Editors: How did you get hooked up with Aspen FACE?
Warren: In 1997, the USDA Forest Service – Northern Global Change Research Program, which is providing partial funding for the Aspen FACE project, asked me to design a meteorological monitoring network at the study site that could provide core meteorological data for the overall Aspen FACE project. With help from Ron Teclaw at the Forest Service lab in Rhinelander, we designed and installed this network with appropriate data archiving, quality control, and data delivery protocols so that anyone requiring core meteorological data for their studies at the FACE site can access the data about a month after it is collected. Beyond the meteorological data support we are providing, I am conducting my own research on how changes in vegetation brought on by elevated carbon dioxide and ozone concentrations can impact the atmospheric environment within vegetation layers.

Editors: We have seen you guys are installing lots of new micrometeorological equipment at the site. What are you guys up to?
Warren: The new micrometeorological equipment being installed right now is meant to fill in the gaps that currently exist in the monitoring network. With the new equipment, meteorological and soil conditions will be monitored in all the FACE treatment plots, providing valuable replication data.

Editors: What is your take on elevated ozone being a problem for the growth in the Lake States?
Warren: Model simulations and observations indicate that ozone pollution is not just an urban problem. Hourly surface ozone concentrations above 60 ppb during the April – September period are fairly common over many areas of the Great Lakes region. Concentrations at that level can adversely affect certain ozone sensitive tree species. Where and when these high concentrations occur depend to a large degree on the meteorological conditions that are present. Simulations of ozone generation and transport in the region clearly show that ozone and ozone precursor chemicals can be transported to locations far downwind of precursor chemical emission sites. Over an entire ozone season, the repeated exposure of vegetation to elevated surface ozone concentrations brought on by these transport episodes may have an adverse impact on some ozone sensitive tree species.

Editors: Have you seen any surprises in the micrometeorology research at Aspen FACE? Or, are things pretty much as you expected?
Warren: What has been most surprising from the micrometeorological research so far is the impact that elevated carbon dioxide concentrations alone and in combination with elevated ozone concentrations are having on the atmospheric environments within the treatment plots. While elevated carbon dioxide concentrations in the atmosphere can have a warming effect on the global atmosphere, the response of forest vegetation to greenhouse gases may lead to a more stable near-surface atmosphere with fewer days dominated by unstable free convection conditions. Elevated carbon dioxide concentrations in the presence of elevated ozone concentrations may not result in the same stability enhancements within forest-vegetation environments. These stability characteristics affect the way heat, moisture, and chemicals move through forest vegetation layers.

Editors: What is your take on Aspen FACE?
Warren: The Aspen FACE project has offered a unique opportunity for scientists from many different disciplines to conduct much needed basic and applied research on the impacts of climate change and elevated greenhouse gas concentrations on forest ecosystem processes.

*Editor*s: What other projects are you working on?
Warren: My other projects include research on small-scale fire-atmosphere interactions, vegetation impacts on forest micrometeorology, climate indicators of risk to forest health, and landscape-change impacts on ozone pollution in the Midwest. I'm

also heading up the Eastern Area Modeling Consortium, established by the U.S. National Fire Plan, to improve fire-weather and smoke transport predictions for the north central and northeastern U.S.
Editors Note: Warren will receive a plaque from the Aspen FACE project at this year's annual meeting thanking him for his tremendous and unselfish contributions to the Aspen FACE project for the long-term effort he has made in the micrometeorological monitoring at the site.

Vanessa Quinn, USFS, Rhinelander, Wisconsin
Editors: Vanessa, what is your position title?
Vanessa: I am a post-doctoral research associate with the Forest Service.

Editors: What are your career goals?
Vanessa: I am interested in working in biological sciences as an educator and a researcher.

Editors: Where are your from and where did you study?
Vanessa: I grew up in Wausau, WI (about an hour south of Rhinelander). I did my undergraduate degree at the University of Wisconsin-Madison. My master's degree is from Northern Michigan University and my PhD is from Indiana State University

Editors: How did you end up working on Aspen FACE?
Vanessa: I am interested in the evolutionary responses of populations to environmental stressors. I began a project 3-years ago in which I was examining the black willow scale and its response to elevated CO_2 and O_3.

Editors: You have worked on scale occurrence at Aspen FACE on organizing the yearly height and diameter growth data and updating the ring maps. Are these your main Aspen FACE tasks?
Vanessa: In addition to these tasks I have been managing and maintaining the harvest data sets and organizing tours of the
FACE site for school, industry, and private groups.

Editors: Have you seen any surprises in the growth data?
Vanessa: Every year there are many new surprises in the data set that are only evident when one is in the rings measuring the tree. I've been intrigued by the effects of insect populations on the trees and how species of insects can affect trees differently depending on the treatment.

Editors: What is your take on this Aspen FACE experiment?
Vanessa: The opportunity to be part of such an important project has been wonderful. This project gives us a window into the future health and composition of our forest ecosystems. Because we are studying the future I've been intrigued with the responses of school kids to this work. Most of the kids that speak up during tours want to know what they can do to help the environment and "help the trees get better". I'm not sure if pre-teens can think about their lives 50 years from now, but they seem to be able to understand that changing their behavior can make a difference.

Editors' Note: Vanessa is taking a new job with University of Wisconsin Campus, Barron County, in mid-January, 2006. Thanks Vanessa, for your many contributions to Aspen FACE! We hope you bring your students back to the site.

Aspen FACE New Publications

Chapman, J.A., J.S. King, K.S. Pregitzer, and D.R. Zak. 2005. Effects of elevated CO_2 and tropospheric O_3 on tree fine root decomposition. Tree Physiology 25:1501-1510.

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 O_3 compromises net primary production in young stands of trembling aspen, paper birch and sugar maple in response to elevated atmospheric CO_2. New Phytologist 168:623-636.

Liu, L., J.S. King, and C.P. Giardina. 2005. Effects of elevated atmospheric CO_2 and tropospheric O_3 on leaf litter production and chemistry in trembling aspen and paper birch ecosystems. Tree Physiology 15:1511-1522.

Mondor, E.B., M.N. Tremblay, C.S. Awmack, and R.L. Lindroth. 2005. Altered genotypic and phenotypic frequencies of aphid populations under enriched CO_2 and O_3 atmospheres. Global Change Biology 11:1-7.

Mattson, W.J., R. Julkunen-Tiitto, and D.A. Herms. 2005. CO_2 enrichment and carbon partitioning to phenolics: do plant responses accord better with the protein competition model or the growth differentiation model?" Oikos 111:337-347.

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-Mugnossa, R. Oren, W.H. Schlesinger. 2005. Forest response to elevated CO_2 is conserved across a broad range of productivity. Proc. Nat. Acad. Sci. (In Press).