

SUMMARY OF WORKSHOP FINDINGS

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SIGNIFICANT FINDINGS

Below is the list of significant findings drawn from the breakout session reports and plenary presentations. It is important to note that these findings, as well as the workshop report, were available for review and comment to all interested participants through a secured website. The significant findings are:

1. Education concerning climate change issues is lacking and is badly needed. All the breakout groups recognized the need for clearly-written educational materials appropriate for a broad audience, ranging from classroom materials to media materials for the general public. Time and again comments were heard regarding the need for understandable (“...speak to me in my language, not yours...”) and relevant information that is readily accessible and meaningful to everyone. In addition, this information needs to be targeted to specific sector interests such as insurance, utilities, the ski industry, forestry, etc. As part of any educational program, a critical review of the current evidence must be included.
2. A regional integrated assessment is needed to provide sound climate change scenarios by which informed policy decisions can be made. This assessment must objectively address the uncertainty in climate change predictions by integrating scientific, economic, technological, and societal parameters. The lack of an integrated climate scenario assessment for New England was identified as a critical missing piece, the results of which would be of great value to the broad stakeholder audience. Resources must be provided to fill this current gap in our ability to understand both the issues and the impacts of climate change at the local level.
3. Regional and relevant examples of climate change impacts are needed. Stakeholders clearly identified a need for regional examples in terms that they can understand (i.e., what will the potential impact of increased diseases have on my health insurance premiums, what will my timber yields look like under a certain model scenario, etc.).
4. Generally, stakeholder perceptions are that global warming and climate change are important concerns, and the consequences of both have the potential for substantial impacts on many of the sectors represented at the workshop. Although, a minority were skeptical of the human influence to climate change and questioned the role of climate change on impacts in the Northeast.
5. The levels of uncertainty associated with climate change are high, but we need to act now by addressing policy, research and public awareness on the issues of climate change. Many in the audience were surprised by the level of uncertainty associated with many regional climate change issues. Significant knowledge gaps exist in many areas, and must be filled using focused studies integrating climate change science and regional sectors’ issues and concerns (insurance, utilities and energy, forestry, fisheries and agriculture, human health, local governments and resource management, recreation and tourism, etc.).
6. The consequences of climate change will likely exacerbate current environmental stresses on all sectors.
7. The overall participant reaction was to ask for appropriate “next steps” and for guidance on what they can do to limit climate change and its impacts on the New England and upstate New York region.
8. Easy access to scientific and regional data on climate change is not available and needs to be developed. A centralized, authoritative source of data concerning regional climate change impacts, sea-level rise, and regional high risk areas does not currently exist, and needs to be developed. Critical evaluation of the data and evidence for recent change in climate should be provided as part of any database.
9. The potential role of the El Niño - Southern Oscillation (ENSO) phenomenon as a factor influencing the weather of New England and

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upstate New York was recognized and seen as of great importance, particularly as a phenomenon that may allow us to predict seasonal patterns (drought, snow fall, average temperatures) in advance. This was seen by all participants as highly significant. The relationship between El Niño effects and climate patterns in the Northeast is unclear and requires more research. One participant, an owner of a major ski area, expressed the opinion that learning more about the ENSO would have a major impact on the ski and related hospitality industries. He asked, "Where can I get more information on El Niño?"

10. Although the workshop did not dwell on the aspects of climate change considered "bad news," the overall impact on New England is likely to be negative or at least result in unwanted change to "quality of life" issues important to New Englanders. It must be noted, however, that some sectors may possibly benefit from these impacts. In either case, we need to prepare for the coming changes. More relevant information must be made available and presented in a format that stakeholders understand and will find useful for their sectoral interests.
11. Policy and funding issues need to be addressed at the local, state, and federal levels to show stakeholders that the governing bodies of this country view climate change as an important issue—one which all members of society need to pool resources and work together in order to solve.
12. Incentive programs to reduce emissions and/or preserve and enhance existing CO₂ sinks must be developed. Programs like these currently do not exist at the regional level; these programs could provide an impetus to reduce CO₂ emissions by investment in renewable and efficient energy technologies.

WHAT WE LEARNED

The New England Regional Climate Change Impacts Workshop was very successful, especially in the areas of stakeholder participation, media coverage and opening a dialogue between the technical (scientists, researchers, etc.) and the average person (local government officials, business owners, students, public school teachers, the "person-on-the-street," etc.).

Several important lessons were learned regarding how to organize and present a workshop that will attract non-technical participants, along with mem-



James Platts, Senior Engineer from Northeast Utilities, presents the view of potential impacts of climate change from the utilities industry perspective.

bers of the research community, local, state and federal agencies. These include:

1. **Personal Contacts**—Our original mailing list was provided by the EPA. Additional names were added following personal contacts within each sectoral group. The resulting list was screened to ensure a representative number of non-technical stakeholders were invited. Each letter of invitation was individually addressed and personally signed by the director of the host institute. About 400 letters were sent out as part of a packet that included the tentative agenda and a statement of the workshop goals; 122 participants attended. Approximately half of the invitees were non-technical/non-agency stakeholders representing business/industry, energy/utilities, human health, tourism/recreation, natural resources/agriculture, education/information transfer, local government, resource management and NGOs. Access to and information about the workshop was available in a specially developed website: <http://www.necci.sr.unh.edu>.
2. **Engaging The Stakeholders**—The first day of the workshop focused on stakeholder perspectives, instead of the science of climate change. The initial six presentations of the first plenary session were all made by stakeholders representing the sectors cited above in #1. Most attendees felt excited about participating in the workshop, and found the interaction between stakeholders and researchers, scientists, and agency personnel to be "stimulating," and "a great opportunity to speak with the experts."
3. **Speaking "Plain English"**—The White Paper for the workshop was intentionally written so as to be understood by the average person, rather



Samuel Adams, President of the Loon Mountain Recreation Corporation, Dr. Theodore Loder, UNH, and Lynne Carter, Visiting Scientist, URI, discuss educational needs highlighted during the first day's discussions.

than as a collection of scholarly articles produced by scientists. All plenary session speakers were asked to design graphics aimed at the average person, not a scientific audience, and to speak in "plain English." The science presenters were thanked at the end of the workshop by a stakeholder participant for "...speaking to us in our language, not yours."

4. Detailed Instructions—Providing detailed instructions to session chairs, rapporteurs, and presenters regarding expectations, audience, anticipated products, and required duties helped to create a collaborative, supportive environment.

5. The Four Questions—The four questions raised by Jerry Melillo at the national organizing workshop held at the Aspen Global Change Institute, were presented to all participants as defining the workshop approach/format. These provided an excellent focus for discussions in the sectoral breakout sessions.
6. Food/Facilities—The excellent food and facilities provided by the New England Center were a major contributing factor to the success of the workshop. This was mentioned often in participant evaluations as contributing to "a professional atmosphere" conducive to discussion and active involvement. Telephone, fax, and laptop plug-in stations, and computer printers were available on-site. Refreshments were provided throughout the day so participants could take a quick break when needed and return easily to the workshop.
7. Media Coverage—The use of a media coordinator, a Media Breakfast (held on the first day, with a group of the invited presenters available to answer questions and a distributed press kit), easy access to telephones and ready access to workshop presenters and keynote speakers, facilitated the highly successful media coverage of the workshop. Reporters were seen as part of the effort to educate the public about climate change, and their participation was welcomed in all aspects of the workshop. The media coordinator facilitated access to presenters and the keynote speakers, provided technical assistance when asked, and was available as a resource to the media. Several of the reporters for the major outlets (AP, New York Times, Boston Globe, NPR) all cited feeling welcome, well-informed, and part of a well organized, well-facilitated activity.



During the media breakfast local, regional, and national members of the press query scientists and representatives from federal agencies about climate change issues.

STAKEHOLDER MESSAGE

If there was a single message to come from the workshop, it was that there exists a need for a strong educational program to be developed on regional climate change issues and impacts, aimed at the classroom and the boardroom, the media and the non-scientific residents of the region. The scientific and research community needs to do better at informing the American public or engaging them in a discussion of the climate change issues that will affect their lives—and those of their children—in the future. The public wants to know and are hungry for information—it's just not easily accessible.

We were asked to address stakeholders in their own forums in order to “get the word out” to the broader stakeholder groups (i.e., presentations at trade shows, special workshops to include more stakeholder representation, etc.).

The general perception of many participants was that the political will and conviction to act in face of the current scientific understanding about climate change does not exist. This must be countered if we hope to implement necessary mitigation and coping measures strategized during the workshop.

SOME SURPRISES

One of the most significant scientific surprises to come from the workshop was the strong correlation seen in the various data indicative of warming in Alaska (a shift in mean air temperature, the melting of permafrost, the loss of salmon habitats, sea ice recession, tree core data, etc.) attributed to a “regime shift” that began in the mid-1970s. Similar patterns of change are being seen in the growth parameters of New England forest species (based on increment core samples) and significant thaw / freeze events leading to forest decline, with the occurrence of a “turned-on” El Niño covering the same time period. These concurrent events suggest a hemispheric teleconnection that is only now being recognized and documented.

A second surprise was seen as several stakeholders became aware of the value of learning more about the El Niño and its potential economic impact on the New England ski industry, energy and utilities planning, and resource management planning. Prior to the workshop, few participants were aware of such knowledge or its high value in planning ahead for their day-to-day operations.



Dr. Glenn Juday, University of Alaska, describes Alaskan climate experience.

CROSS-CUTTING THEMES FROM THE BREAKOUT SESSIONS

Over the course of the two-day workshop, several common themes emerged from two or more of the sectoral breakout discussions which captured many of the major concerns or perceptions of the stakeholders. These cross-cutting themes represent significant regional issues which need future research and effort in order to clarify for stakeholders the extent to which they represent either real threats- or real solutions regarding climate change impacts.

1. Education and Public Awareness—Clear and understandable information on climate change issues and impacts was noted by all sectors as a significant missing component. This information is badly needed for both the classroom and the boardroom. Misinformation abounds regarding climate change, both intentional and unintentional, and all participants expressed the importance of correcting this situation. Additionally, it is important to clearly state the misgivings about the current data and understanding of climate change science.
2. Air Quality—Changes in chemical climate (increasing levels of air pollution) have had a significant impact on the New England / upstate New York region. Poor air quality impacts human health, and subsequently, the insurance industry, ecosystem health, and subsequently the timber and tourist industry, as well as agricultural productivity. Recent changes in EPA-mandated ambient air quality standards will lead to financial and technical challenges to the energy and utilities sector.

3. **Quality Of Life**—Changes in both the chemical climate (#2 above) and physical climate (warming trends, changes in precipitation patterns, altered seasons) will lead to significant impacts on the New England quality of life. Warmer winters, hotter summers, altered forest composition, and reduced air quality were examples frequently raised by participants as changes considered unwanted and to be avoided.
4. **El Niño**—If there was one topic that attracted the most interest among participants, it was El Niño, and the need to know more about it. It will be essential that future efforts be directed toward improving our understanding of the connections between this natural weather phenomenon, potential interactions between anthropogenic forcing factors and El Niño, and the impacts that El Niño has on the New England region.
5. **The Need To Know The Truth**—All participants expressed the need to know and understand the “reality” of climate change—not the scare tactics (disease, droughts, floods, etc.) or the misinformation (global warming isn’t real, or that it will be a good thing) related to “the debate among scientists.”
6. **The Need For Practical “Action Items”**—Participants seemed to accept climate change as a reality, and wanted to know what steps they could take now to help correct the situation.
7. **The Need To Know More About The Models**—Participants wanted more information about the models (General Circulation Models) used to predict future climate change scenarios, their relative strengths and weaknesses, and potential sources of errors.
8. **A Regional Integrated Assessment**—An integrated assessment should incorporate scientific, economic, technological and societal components to provide model scenarios of climate change impacts. Such models must be developed in order to assist regional efforts to implement coping and/or mitigation strategies. Regional focus will be essential, since impacts on people’s livelihood and quality of life will get the attention of the people of the Northeast.

KNOWLEDGE GAPS AND RESEARCH NEEDS

During the course of the workshop, participants identified specific knowledge gaps and research

needs considered either to be lacking at present, or not in a form which is readily usable to the non-specialist. It was noted that while some of the desired information may be found in the research literature, a focused effort is needed which translates the research findings into a form that may be easily understood by interested stakeholders. These are as follows:

1. A clear relationship between human activities and climate change must be established. Although the science behind climate change is credible and compelling, the weak link is the cause and effect relationship between human activities, rising CO₂ levels and the warming trend over the past 100 years. Subtle variations in CO₂ level curves can be connected to changes in human activities (such as the oil embargo in 1973) and a compelling case could be made (but hasn’t). A similar comparison should be made between volcanic eruptions and CO levels, since a common “explanation” for the increasing CO₂ levels is volcanic activity. Such studies must be conducted and the results presented in clear and convincing manner that can be understood by a non-technical audience.
2. A “danger level” for CO₂ must be identified as well as appropriate target levels for both reducing and eliminating the threat of global warming. Further research of ice cores and seafloor sediments should be supported so that global impacts (temperature, rainfall, sea level, etc.) can be predicted for specific CO₂ levels, with an acceptable degree of accuracy. In this manner, the average person will have an idea of what to expect if the CO₂ level reaches a specified level (e.g., 400 ppm, 700 ppm, etc.).
3. The ability to separate noise (the natural background or variability in the system) from the signal (human contributions) in CO₂ data must be developed. To do this, a detailed assessment of both background CO₂ sources (respiration, others) and natural variations (volcanic eruptions, others) must be conducted so that the relative contributions of both human activities and natural sources can be calculated. Are there ways to identify the sources of each type of CO₂? If not, could such a capability be developed? In addition, other sources of global temperature rise (variation in solar activity, changes in surface reflectivity, etc.) need to be identified and quantified, so that these potential sources can be put in perspective to greenhouse gas emissions.
4. The risks and benefits of waiting for certainty in the relationship between human activity and

climate change must be identified. What are the predicted impacts of doing “business as usual” until the year 2050, 2100, etc.? What will the costs of such a “business as usual” approach be, vs. the costs of taking action now? Are there additional benefits (win/win scenarios) to taking action? Answering these questions will require the development of more accurate models (climate, integrated assessment and economic).

5. Appropriate policy responses to limit emissions must be identified and presented as realistic options to the people of the United States. Honest and accurate options must be developed that address conservation approaches, the new technology options, renewable energy sources and natural CO₂ sequestration methods. Most participants indicated a willingness to “take action” if mandated to do so by policy changes.
6. A range of response options must be developed for possible implementation, from new enhanced technologies to selective use of fossil fuels. As stated above, many of the participants indicated a willingness to “take action” if mandated to do so. People are looking for direction and need to know what their options are.
7. A research program focused on enhanced, low-impact technologies that actually reduce emissions must be developed. For example, the fuel cells that produce water as a by-product and the electric/internal combustion hybrids, actually use gasoline as a hydrogen source (producing CO₂ in the process). Alternative energy sources have yet to be proven as reliable and practical. A focused research program is needed to identify and prioritize, both in terms of estimated costs and emissions reduction, the most effective and appropriate approach(es) to be used.
8. Improved models (climate, integrated assessment, economic) and predictions must be developed. While many of the current models work well at the global scale, few regional models have been developed, in part due to regionally-specific input parameters. Since regionally-specific models were identified by participants as needed, a focused effort on the development and testing of such models must be made. Ronald Prinn’s MIT integrated assessment model was recognized by the participants as being very valuable if available for regional applications.
9. The cause and effect relationships between specific remedial actions and CO₂ level reduc-

tions must be identified and quantified. If an 80 mpg automobile were available, and 50% of the American public drove one, what impact would it have on CO₂ emissions? If the price of gas were \$5.00 per gallon, what impact would it have on CO₂ emissions? If everyone in the U.S. planted 10 trees, what impact would it have on CO₂ emissions? Would it matter if they were fast-growing or slow-growing species? What would be the most effective remedial actions to take?

10. An understanding of the interaction of multiple stressors on natural systems is lacking but essential for determining the impacts of climate change on natural and managed systems. Most of the research on how climate change might affect forests and crops is single-factor work: how higher temperatures affect plant growth, pest survival and spread, or plant vigor. Not enough science has been conducted looking at how plants, and other organisms, respond to exposure from multiple stresses such as higher than normal temperatures, increased CO₂, changes in precipitation patterns, shifts in concentration of ozone and other air and ground pollutants, etc. Not only is our understanding focused on single factors, it is dominated by studies on single species rather than on communities. And, often studies are done under laboratory conditions rather than in a natural setting. More systems-based research on natural ecosystems is needed to better understand the plasticity of these systems to climate change.
11. Effective educational programs must be developed and presented to the public. To be effective, such programs must be age-appropriate (primary, middle and high school levels, as well as adult), written in “plain English,” available for both formal educators (classroom teachers) and informal educators (Cooperative Extension Specialists, Boy/Girl Scout leaders, etc.) and readily available to all. Special attention must be paid to assisting the media in its role of effectively educating the public regarding climate change issues.

WIN-WIN SITUATIONS TO ENABLE CHANGE

Participants were asked by Jerry Melillo to identify win-win situations appropriate for the New England region and its inhabitants. Such situations were defined as scenarios in which both the stakeholders/sectors and the environment/climate benefited from changes in “business as usual.”

1. Promotion of CO₂ sinks (forests) that are commercially viable (sustainable forestry practices) as well as a way of removing CO₂ emissions from the atmosphere.
 2. High-efficiency, combined-cycle gas turbines will not only reduce the CO₂ produced but eliminate many air pollutants.
 3. Investment into cleaner technologies that alleviate the problem of CO₂ production also reduce business and industries liabilities, strengthen a good neighbor image, and create a strong regional manufacturing presence.
 4. Implementation of energy efficiency programs have the potential to decrease the cost of doing business and make regional industry more competitive (Germany and Japan use half the energy per dollar of gross domestic product as the United States).
 5. Improving scientific and environmental literacy among the general public can be accomplished by supporting research professionals for their direct involvement in outreach activities. By broadening the role of scientists and public officials to include communication, we are likely to engage the public in the debate on the seriousness of global environmental issues.
 6. Documentation of human health issues by medical and public health professionals for the purposes of studying the impacts on health by climate change can motivate commitment and action to mitigation strategies by government, industry and individuals. This can then have feedbacks to preventative health care and diagnosis. Demonstrating a direct link between climate change and human health will bring climate issues to the forefront of the public's attention.
 7. Improvement of techniques for preserving and improving soil quality in managed and natural ecosystems and farmlands will benefit industry and landowners by helping to sustain productivity and enhance the carbon sequestration by such soils. Incentive programs which encourage landowners to sequester carbon in their soils should be developed, which will benefit the landowner and help to reduce the carbon dioxide levels in the atmosphere.
- ties which will be needed in order to fully and accurately address the regional assessment of climate change and its impacts. Based on the participant reactions, climate change/variability is certainly an issue which engages stakeholder interest. The outcomes of the breakout sessions should be looked at as an energetic start and a brainstorming event, which does not represent the true constituency of the stakeholder groups nor do the findings of the breakout sessions necessarily represent true and factual information. We must be careful not to infer agreement or consensus among stakeholders on climate change issues and concerns based on the limited sample size. In addition to reaching a larger stakeholder constituency, a coordinated public education program at all levels, from the classroom to the boardroom, needs to be implemented.
2. More in-depth background research must be conducted, both to understand the regional impacts as they relate to individual stakeholder groups and to precisely define the human impact on climate change. Regional workshops should be held for each of the stakeholder groups in order to 1) reach a broader constituency for input and feedback regarding concerns, issues, and coping strategies and 2) to allow for enhancement of public awareness through concrete and understandable examples. These activities should occur over a 2-3 year period in which people from each stakeholder group are included in the research, regional workshops, and writing activities leading to a detailed regional assessment by and for their sectoral group.
 3. The final recommendation is that we need to begin work with stakeholders and the general public on action items. What can the average person do to make a difference? How can ski operators minimize their effects on climate change and what can they do to help educate their users on climate-related issues? How does a utility worker begin to influence the company's CEO of the potential benefits for using newer, cleaner technology? We need to begin to focus on positive items and actions which individuals, companies, and governments can do to help reduce human-induced climate change in order to avoid the apathy and despair surrounding the issues.

RECOMMENDATIONS

Three broad recommendations, based on the outcomes of the workshop are:

1. From the coordinators' perspective, this event was an excellent first step in a series of activi-