# J9.12 THE 2003 NATIONAL SEASONAL ASSESSMENT WORKSHOP: A PROACTIVE APPROACH TO PRESEASON FIRE DANGER ASSESSMENT

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## 1. INTRODUCTION

Each year, more than $1 billion is spent on wildfire suppression in the US. In spite of this spending and much effort going into fuel treatments, millions of acres are burned each year by wildland fires. In order to meet this considerable challenge, a proactive approach to wildland fire management is necessary. Change from reactive to proactive fire management requires decision-support products, forecast tools, and structured technology transfer processes informed by science-based knowledge.

According to the National Fire Plan (NFP) Research & Development 2002 Business Summary (USDA Forest Service, 2003), "a strong science foundation is key to managing the wildfire hazard and supporting management decisions in the most cost-effective and environmentally sensitive way. Supported by scientific knowledge, decisionmakers are better equipped to more reliably forecast or prevent damaging fires and to understand the consequences of the decisions for society and for forest and rangeland health." The NFP 2002 Business Summary and an executive summary from the recent Joint Fire Science Program March-April 2003 workshops on the collective needs of fire managers and applied fire researchers conclude that effective technology transfer was an essential need for bridging the worlds of fire managers and researchers.

Climate impacts on regional wildland fire incidence, size and intensity are a growing concern to both the public and federal fire and land management agencies. Over a decade's worth of research has demonstrated strong relationships between wildland fire, persistent climate patterns, such as El Niño-Southern Oscillation, and fuel moisture (Simard et al., 1985; Swetnam and Betancourt, 1990; Brenner, 1991; Jones et al., 1999; Hess et al., 2001). There is strong evidence that some of the general characteristics of the fire season can be forecast several months in advance, especially where fuel load buildups are high and climate patterns have been shown to contribute to wildfire regimes. This is readily seen from statistical relationships between antecedent moisture and summer fire activity. These relationships are driven chiefly through the build up of fuels and fuel moisture due to antecedent seasonal climate anomalies raising or lowering the potential for wildfire activity (Westerling et al. 2003; 2002). Moreover, climate forecasts and drought monitoring have improved rapidly based on advances in understanding the long-term circulation of the ocean-atmosphere system. As climate forecasts have improved and become more available, the need to develop forecasts that "matter" to specific sectors and interests (Stern and Easterling, 1999) has taken on greater importance. Federal agency fire managers stand to benefit from advances in climate forecasts, particularly when forecasts are tailored to their needs, effectively translated and communicated, properly interpreted, and synthesized in a systematic fashion.

In this paper we describe the development and implementation of a multi-agency partnership and technology transfer process designed to improve information available to fire management decision makers, and improve the prospects for proactive management decisions. We describe the products of the process, and we evaluate the process — a week-long workshop that brought together fuels specialists, fire managers, fire meteorologists, fire behavior analysts, and climatologists — in terms of its success in building capacity within organizations and improving the dialogue and trust between management and researchers, fire specialists and climatologists. We also provide recommendations from the workshop participants, and a brief summary of key improvements to be applied to future workshops.

## 2. SYNERGISTIC THINKING AND PARTNERSHIPS

### 2.1 *Background and Impetus for the Workshop*

The workshop spawned in response to events, such as the very active La Niña-driven fire year of 2000, and as a result of fortuitous interactions between bridge-building individuals at several organizations with the mandate to improve the use of climate information in resource management.

The National Fire Plan established Predictive Service units at the National Interagency

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Coordination Center (NICC) and eleven Geographic Area Coordination Centers (GACCs). Predictive Services' mission is to integrate climate, weather, situation, resource status and fuels information into products that will enhance the ability of wildland fire managers to make proactive short-and long-range decisions for strategy development and resource allocation. NICC utilizes Predictive Services to help coordinate timely and cost-effective movement of firefighting resources between the GACCs.

The Climate Assessment for the Southwest (CLIMAS), a NOAA-funded Regional Integrated Sciences and Assessments project, was developed to improve the understanding of the vulnerability of the Southwest region to climate variations and changes. CLIMAS strives to improve the flow of climate information to interested stakeholder groups, including fire managers, in the Southwest. CLIMAS fire-climate workshops (Morehouse, 2000; Garfin and Morehouse, 2001) have set a standard for bringing together fire managers, academic researchers, and operational climatologists for dialogue and action to improve fire management and research. These workshops helped to foster interactions between bridge-building individuals at the institutions involved in developing the workshop process described herein.

The program for Climate, Ecosystem and Fire Applications (CEFA) of the Desert Research Institute (Reno, NV) has been a key collaborator in helping the climate forecast community to better address fire management stakeholder needs. CEFA serves as a liason between the decisionmaker (user) and the scientific research community by assisting in technology and information transfer and eliciting user feedback. Moreover, CEFA undertakes state-of-the-art applied research to improve the understanding of relationships between climate, weather, fire, natural resources, fire risk, impacts and hazards.

Synergistic thinking with regard to climate and proactive fire management, and a spirit of collaboration between individuals at these institutions set into motion the creation of a structured process, called the National Seasonal Assessment Workshop (NSAW), to produce preseason fire danger outlooks for the 2003 fire season.

### 2.2 *Workshop Goals, Objectives and Process Design*

The overarching objective of the workshop process was to improve information available to fire management decision makers for allocation of firefighting resources at local, regional, and national scales. The NSAW, which took place during the week of February 25-28, 2003, was explicitly designed with the goal of bringing together operational climate forecasters and fire specialists to utilize climate history, long-range climate forecasts and up-to-date fuels assessments in preseason fire outlook reports. The NSAW and the process leading to the development of the NSAW was designed (a) to foster communication and cooperation, e.g., between climate forecasters and GACC specialists, workshop organizers and participants; (b) to enhance collaboration and innovation, e.g., between climate forecasters; and (c) to develop a sustained partnership between organizations in order to ensure continued technology transfer, collaboration, innovation, and productive work output. Additional goals addressed further needs for improved communication and cooperation between the GACCs, in order to: (a) improve national fire danger outlook "edge-matching" in adjacent regions, through sharing information about regional fuels and climate/weather patterns, and (b) enhance the capacity of the GACCs to share methods, techniques and information useful for producing their own seasonal outlooks.

A little more than one year prior to the workshop, individuals from the aforementioned institutions began to develop an initial concept for the workshop. The fundamentals of workshop process concept development and multi-institution collaborative project management included a commitment to sustained interaction between partnering institutions, equality in partnership, and clear partnership responsibilities. NICC guided the concept development process, took the lead on communication with project advisors and participants, and took responsibility for the fuels assessment activity; CLIMAS developed the formal concept proposal, presented the concept to participants, and took responsibility for workshops logistics; and CEFA took responsibility for the consensus climate forecast activity and for ensuring that forecast information was communicated in a clear and effective manner by climatologists to fire specialists.

Over a period of months, the workshop concept was designed and refined in great detail. While the aforementioned is not remarkable or unusual in the course of a technology transfer initiative, it was done in a manner that emulated some of the goals of the workshop, i.e., to maximize participation, input, a sense of ownership of and investment in the process, and information flow. The concept was reviewed by an advisory committee, including potential workshop participants, and then presented to the potential workshop participants at a business meeting approximately four months prior to the NSAW. A result of interactions during the aforementioned concept development period was the development of a tentative workshop process, structure, and protocols. Thus, prior to the workshop, and with input from workshop participants, a preliminary set of standards, procedures and protocols for producing multi-timescale fire danger outlooks was developed. The protocols were established in a manner that facilitates the easy update of seasonal outlooks as needed. At the NSAW, these standards were finalized and put to immediate use by each geographic area as they created region-specific, comprehensive, seasonal fire danger outlooks, incorporating information about climate and fuels conditions.

The NSAW was structured to provide opportunities for the climate forecasters to interact personally with fire management professionals. This allowed forecasters to improve their understanding of the needs of the fire management community and, ultimately, to improve the format and content of climate and weather forecast products in order to address management needs.

## 3. WORKSHOP STRUCTURE AND FLOW

The NSAW agenda was structured to minimize the time participants spent passively listening to research presentations and to maximize the time spent (a) working on outlook reports, (b) consulting with climatologists and other geographic area personnel, (c) reporting progress, getting clarification, and providing feedback to the meeting organizers and other geographic area personnel. The physical meeting space was selected to provide an environment conducive to dialogue and discussion.

The first full day of the meeting provided participants with important background talks and information, including national climate forecasts and regional fuels assessments. During the first day of the NSAW, participants also

- gave final feedback on the aforementioned protocols and report format
- clarified the goals and process of composing the outlooks
- agreed on a basic layout style, outline and format, document length, mechanism for updates and forecast coordination between adjacent geographic areas.

Climate forecasters prepared the national consensus climate forecast for spring and summer 2003. Forecasters compared the results of various forecast models and examined historical probabilities of above and below-average temperature and precipitation based on analogue configurations of the ocean-atmosphere system. Based on their intimate knowledge of the strengths and weaknesses of the models and historical data, they determined the regions of maximum agreement. The forecasters clarified forecast probabilities for problematic regions and assigned no forecast confidence to regions where conflicts between forecast tools could not be resolved.

During the second day of the NSAW, the consensus climate forecast was reported and participants were given the opportunity to question climate forecasters regarding the regional details of the forecast. Participants then spent the next two days of the workshop in breakout work sessions divided up by geographic area. Individual breakout rooms were located along a common hallway at the conference venue. This allowed geographic areas the privacy necessary to concentrate on work and at the same time the logistical convenience necessary to facilitate communication between the geographic areas. All geographic area workgroups reconvened once each day in order to discuss progress, problems, and the content and distribution of a workshop synthesis volume.

One of the outstanding highlights of the workshop was the degree of coordination, communication, and cooperation within and between geographic area workgroups. The workshop provided an opportunity for fuels, fire behavior, and fire weather specialists, often dispersed throughout large multi-state geographic areas, to meet face-to-face in order to discuss on the ground and forecast conditions throughout the broader geographic area. The two California geographic areas collaborated on a single assessment representing both northern and southern parts of the state; similarly, the eastern and western Great Basin geographic areas worked together to prepare an integrated outlook. Geographic area fire weather program managers were especially heartened to receive firsthand fuels information from the far reaches of their geographic areas. The workshop served to lay the groundwork for sharing information on fuels assessments among the geographic areas.

The geographic areas worked together to build on each other's strengths and share expertise. The workshop participants expressed satisfaction with and enthusiasm for bringing together all 11 geographic areas for one national preseason outlook meeting. The flow of information between geographic areas was particularly impressive with regard to forecasts and assessment methodologies. Participants noted that collective knowledge and expertise from each of the 11 geographic areas, along with a healthy sense of friendly competition, resulted in enhancements to geographic area reports that would not be possible in isolation. Moreover, they shared information regarding how their regions have been affected by vast areas of forest mortality due to drought stress and insect infestation — information which was of particular interest to climate forecasters.

Climate forecasters expressed an appreciation for the consensus forecast process, which allowed them to compare notes and weigh the strengths and weaknesses of individual forecasts. However, the resulting forecast was probably conservative due to the nature of the consensus process; at the same time, confidence in the geographic extent of forecast probability anomalies was probably strengthened by the process. An important outcome is that climate forecasters were sensitized to the forecast and data needs of particular geographic areas, such as Alaska (the geographic area with the greatest number of wildland acres burned in 2002).

## 4. WORKSHOP PRODUCTS

The tangible products of the NSAW included the following:

- 2003 consensus climate forecasts for wildland fire management
- Geographic area wildland fire outlook reports
- NICC preseason national wildland fire outlook
- Standardized protocols for producing long-range fire danger outlooks
- Frameworks for future multiagency cooperation

### *4.1 Consensus Climate Forecast*

Under the guidance of CEFA, climate forecasters merged climate predictions into a consensus forecast for the 2003 fire season. This new climate decision-support tool, along with regional fire and fuels assessments prepared in advance of the workshop, provided the foundation for the seasonal fire danger outlooks.

Seasonal forecasts of two-category probabilistic temperature and precipitation anomalies were produced for the contiguous United States and Alaska as significant input into the geographic area wildland fire seasonal outlooks. Forecast consensus was reached by combining several monthly and seasonal forecasts produced at the International Research Institute for Climate Prediction, the Scripps Institution of Oceanography Experimental Climate Prediction Center, the NOAA/NCEP/NWS Climate Prediction Center, and the NOAA/CIRES Climate Diagnostics Center. The primary purpose of the consensus forecast was three-fold, as follows:

- to produce seasonal climate forecasts for use in developing a national seasonal wildfire outlook
- to determine whether or not additional probabilistic information could be provided for areas where individual forecasts showed little confidence
- to directly integrate climate forecast information into specific geographic area decision-making.

The forecast periods were March-May (MAM) and June-August (JJA) 2003. A combination of dynamical and statistical models from the respective organizations, and forecaster judgment were incorporated in producing the forecasts. A newly developed statistical model and analysis of precipitation forecasts in the southwest U.S., as well as historical climate information based on averages of ENSO-related precipitation and temperature for MAM and JJA during rapidly declining El Niño phases, were consulted. These objective forecasts were then combined with forecaster judgment including model forecast skill, temperature versus precipitation correlations, and current opinions regarding the state of ENSO.

The forecasts were produced via a round-table forum during the workshop. The discussions were characterized by collegiality between participants, and enhanced communication between forecasters. Forecast discussion lead to determining regions of warm/cool and dry/wet, and assigning a consensus probability. Since the forecasts were comprised of only two categories, the probabilities simply represent the chance of above or below average conditions.

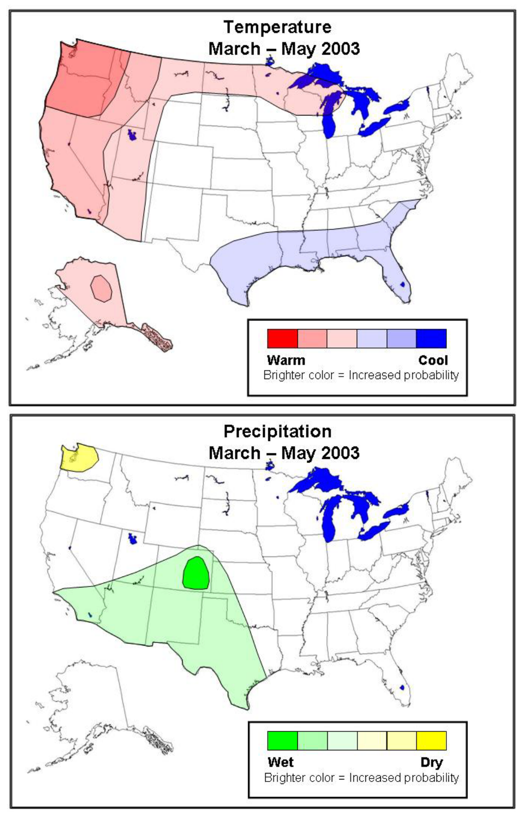


**Figure 1. March-May 2003 Consensus Climate Forecast for Fire Management.**

Figure 1 shows the 2003 seasonal U.S. consensus forecasts for MAM temperature and MAM precipitation, respectively. The primary highlights of these maps are increased likelihoods of above normal temperature for large portions of the West during MAM and JJA (not shown), and above normal precipitation for the Southwest during MAM. The seasonal outlook of wildfire potential, which was developed in part from these figures, is available at the NICC web site: http://www.nifc.gov/news/intell_predserv_forms/season_outlook.html.

This is only the second effort to produce a consensus forecast by combining forecasts from different organizations (see Brown et al. 2002). Thus, estimates of quantitative skill cannot be offered at this time. The skill has been established for most of the inputs, and it is likely that the consensus forecast skill would be equal to or slightly larger than individual forecasts, depending on the region and the number of inputs that were in agreement.

### *4.2. National and Geographic Area Wildland Fire Outlooks.*

The preseason fire danger outlooks were produced by the coordinated efforts of GACC fire meteorologists, fuels analysts, fire behavior analysts, and other regional fire specialists. Outlooks followed an agreed-upon format and set of protocols for content; participants also consulted a comprehensive list of climate and fire history products and forecast tools. Fire danger predictions were expressed in terms of best-case/most likely/worst-case scenarios.

Each geographic area wildland fire outlook covered the following content:

- executive summary (including a specific forecast statement and a statement about forecast confidence)
- caveats regarding the use of the report
- current climate and fuel conditions (including comparison with historical records)
- climate and weather outlooks
- fire occurrence and resource outlooks (including estimated number of fires and expected resource needs)
- future scenarios and probabilities (including Fire Family Plus analyses, sub-regions of concern, season ending event probabilities)
- management implications and concerns
- summary and recommendations

The complete pre-season fire danger outlooks for each of the 11 geographic areas, as well as a national wildland fire outlook can be found on the NICC Predictive Services website (http://www.nifc.gov/news/nicc.html). For several of the geographic areas (e.g., Alaska, California, Great Basin, Rocky Mountain), the NSAW reports were considered as preliminary assessments of potential fire danger. These regions are subject to significant variability in late winter/early spring precipitation; hence, conditions could change substantially prior to the onset of the fire season. Seasonal fire danger outlooks were designed to updated as needed prior to and during the fire season for each of the geographic areas. The aforementioned website can be checked for updates.

## 5. RECOMMENDATIONS

In addition to daily sessions devoted to providing feedback and course adjustment during the workshop, participants were given ample time during a working lunch on the final day of the workshop to convey constructive criticism of the workshop process. Critiques were designed to address what worked and how to maintain or improve it, and what did not work and how to improve or change it.

Workshop participants expressed satisfaction with the breakout group organization. Some geographic areas, such as Southern California, mentioned that future seasonal assessment workshops would be enhanced by greater participation of state fire management agencies.

A key success was the design of breakout session and report writing activities. Participants supported and were enthusiastic about cooperative work in a "work retreat-style" atmosphere, away from offices, routines, and interruptions. Participants found the following:

- individual breakout rooms facilitated concentrated work within groups
- close proximity between breakout rooms aided interaction between groups
- taking time out from individual work sessions in order to gather in large group feedback sessions during the course of the breakout report writing activity was productive and informative
- communication with and/or feedback from other geographic areas enhanced the quality and completeness of their reports.

Workshop participants were enthusiastic about producing a joint technical note on the analytical techniques used to produce preseason outlooks. All participants valued innovation and the sharing of techniques. When questioned about what they would like to see in a post-fire season assessment and evaluation meeting, participants mentioned the need for talks on climate diagnostics (i.e., analyses of past climate behavior). Climate forecast evaluation and review was also a subject of keen interest to workshop participants. Particular topics of interest included the following:

- The North American summer monsoon, the Four Corners high and how these relate to thunderstorm activity
- More information and diagnostics regarding lightning occurrence and, if possible, a lightning forecast
- A climate outlook for the upcoming winter season

Participants expressed frustration with the structure of climate forecast activity and climate forecaster participation in the workshop. Participants recommended that climate forecasters arrive one day prior to the workshop in order to produce the consensus forecast and give any necessary individual presentations. They remarked that geographic area personnel interested in individual climate forecast presentations could arrange to arrive early in order to attend these presentations. This would also increase their opportunities to question climate forecasters regarding the consensus climate forecast.

Participants desired more background from the climatologists with regard to the factors considered in producing individual long-range climate outlooks. Although considerable effort would be required to provide such background, this would provide an excellent opportunity for forecasters and workshop organizers to provide training on climate forecast methodology and evaluation. All of the aforementioned would allow geographic area fire specialists more time to interact directly with climate forecasters during collective question-and-answer and individual breakout sessions on the first day of the workshop.

Finally, participants recommended that workshop organizers, as well as participants, need to better prepare workshop materials in advance of the meeting. Better preparation includes:

- providing comprehensive checklists of data and analyses needed by geographic areas
- priority access to NICC online databases
- the creation of rough draft outlooks by the geographic areas prior to future workshops.

## 6. CONCLUSIONS AND FUTURE DIRECTIONS

The NSAW marked a turning point in the progression from dialogue and exchange of ideas between climatologists and fire management personnel to an operational process for producing pre-season fire danger outlooks. Workshop participants and climate forecasters worked together in a focused and productive manner. The carefully structured workshop process successfully created an atmosphere of collegiality, openness, enthusiasm and an impressive degree of cooperation between workshop participants. Moreover, through pre-workshop communication and feedback, participants rapidly adopted outlook protocols and the method of presenting outlooks.

In retrospect, workshop success hinges on maximizing opportunities for participant interaction. In post-workshop evaluations, workshop participants placed exceedingly high value on interaction, and the sharing of data and forecast expertise. Face-to-face contact between individuals helped to build bridges on several levels:

- between forecasters and fire specialists
- between fire specialists and fire managers
- between workshop organizers and participants

Direct interactions between the various organizers and workshop participants, a cornerstone of successful technology transfer (USDA Forest Service, 2003), fostered trust and increased commitment to the workshop process. Moreover, sustained, iterative interaction between workshop organizers increased commitment to the project, and improved multi-institutional coordination.

In terms of human resources, several lessons were learned. Workshop organizers will need to ensure the participation of all parties necessary for producing the outlooks, including non-GACC partners in geographic areas where state fire management personnel play key roles in overall fire management and planning. Workshop organizers need to work harder to secure the participation of multiple participants from each geographic area. We found that in the cases where the GACC participant did not have an established rapport with his/her non-GACC collaborator, high levels of synthesis were not realized. Workshop organizers also realized the importance of employing the services of a professional technical writer, as was done in the highly successful 2003 Joint Fire Science Program regional workshops, in order to facilitate the rapid turnaround of workshop reports.

In addition, workshop organizers need to put further effort into securing a higher level of commitment and more resources from climate forecast entities; a greater level of time and commitment by the climate forecasters is key to improving fire and climate outlooks, increasing understanding of the methods and analyses produced by climate forecasters, and engendering greater trust and understanding between the climate research and fire operations communities.

A key indicator of the success of the workshop was the enthusiastic support of workshop participants for future workshops, and collaboration on a technical note. Workshop participants expressed strong support for training on forecast and climate assessment techniques, and the construction, interpretation, and use of the national climate forecasts. The aforementioned training, which has the potential to improve forecast skill and build capacity within the GACCs, has been incorporated into the NICC Predictive Services calendar; a medium-range forecast training has been scheduled for winter 2003, and the three institutions responsible for organizing the NSAW are in the process of developing a long-range climate forecast training, in conjunction with NOAA's Climate Services Division.

In conclusion, carefully structured workshop organization and a collegial environment generated an unexpected level of enthusiasm and cooperation between participants, as well as learning and sharing of expertise. The workshop process provided a model and mechanism for moving the entire Predictive Services organization forward to meet its goals of integrating climate, weather, situation, resource status and fuels information into products that will enhance the ability of wildland fire managers to make proactive short-and long-range decisions for strategy development and resource allocation, and to improve efficiency and firefighter safety. NSAW organizers are now planning a 2004 NSAW, for the western U.S. and Alaska, as well as a separate eastern U.S. workshop.

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