National Seasonal Assessment Workshop

Western States & Alaska

Final Report
March 28–April 1, 2005
Boulder, CO

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and Gregg Garfin

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- Tim Brown, Program for Climate, Ecosystem and Fire Applications, Desert Research Institute and California Applications Program RISA
- Gregg Garfin, Climate Assessment for the Southwest, University of Arizona
- Heath Hockenberry, National Interagency Coordination Center
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- Bradley Udall, Western Water Assessment
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Foreword

Although it is presently cloudy in southern Arizona, and the Northern Rockies have received substantial precipitation during the past 14 days, fire season will soon be upon the western United States. As chronicled in this proceedings, the 2005 National Seasonal Assessment Workshop: Western States and Alaska marked another giant step forward in multi-agency collaboration to improve information available to fire management and firefighter safety through the production of pre-season fire potential outlooks. This year, workshop participants distinguished a complex pattern of fire potential anomalies based on interactions between climate conditions, fuel types, long-range predictions of climate and fire activity, and the persistence of disturbance factors, such as drought- and insect-induced forest mortality. Moreover, there was discernible improvement in the facility of the participants to produce timely and comprehensive reports, as well as increased sophistication in the discourse between fire and climate specialists.

The 2005 process was enhanced by the addition of a climate training workshop, facilitated by Tim Brown. The training included presentations by some of the country's leading climate forecasters and diagnosticians. Presentations were accompanied by sophisticated questions from the participants, as well as frank and lively discussion about climate forecast opportunities and limitations. The addition of the training to the workshop schedule resulted in perhaps the most comprehensive and specific set of recommendations on how to improve the National Seasonal Assessment Workshops and the provision of climate and fire information for fire management.

A factor contributing to the success of this year's workshop was the change of location to the National Oceanic and Atmospheric Administration's (NOAA) David Skaggs Research Center in Boulder, Colorado. The participation of NOAA-Cooperative Institute for Research in Environmental Sciences (CIRES) Climate Diagnostics Center (CDC) scientists brought a new dimension to the workshop. These scientists added clarity to the forecast discussion, and by freely contributing their time, they provided state-of-the-art knowledge and analyses to workshop participants. The agenda in Appendix B of this proceedings contains the names of the NOAA scientists who devoted considerable effort to provide the trainings.

As always, some special appreciations are in order. I would like to thank the participants of the workshop for their earnest attitudes and devotion to producing thoughtful 2005 outlooks in record time. Many thanks to our "regular" forecast discussion crew, John Roads (Scripps Institution of Oceanography-Experimental Climate Prediction Center), Tony Westerling (Scripps Institution of Oceanography-Climate Research Division), Jim Lenihan (USDA-Forest Service), and Klaus Wolter (CDC), for taking time from their schedules to participate. Special thanks to Kelly Redmond (Western Regional Climate Center-Desert Research Institute) for his expertise and insights.

Extra special thanks to Randy Dole, Director of the CDC for generously offering us space in the Skaggs building to hold the workshop, and for offering the time and effort of CDC employees to help make the workshop a success. CDC scientists Andrea Ray, Robert Webb, and Brad Udall (Western Water Assessment) provided invaluable assistance and superb insights to improve next year's workshop.

Producing the workshop products requires graphical and editorial expertise, as well as exceptional organization and coordination. Special thanks to Kristen Nelson, Shoshana Mayden, and Melanie Lenart for developing our most efficient process yet.

Finally, I would like to thank my co-organizers, Tim Brown, Heath Hockenberry, Rick Ochoa, and Melanie Lenart for their time, devotion, and collegiality.

Gregg Garfin
April 24, 2005

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Executive Summary

Western States and Alaska Fire Season 2005

Portions of the West face a potentially severe fire season this spring and summer, based on an assessment of more than 50 climatologists, meteorologists, fuel specialists, and fire managers from throughout the West. During the third annual National Seasonal Assessment Workshop: Western States and Alaska, the group produced a map highlighting areas of fire potential for the 2005 season as of April 1 (Figure 1, page 19). Fire potential is the likelihood of fire occurrence based on factors including fuel conditions, weather/climate, and firefighting resources.

Participants from geographic areas across the western United States (Figure 2, page 19) used the seasonal climate forecasts issued by the National Oceanic and Atmospheric Administration Climate Prediction Center (Figure 3, page 20) for their own seasonal assessments of fire potential, along with a climate scenario developed by workshop climatologists based on previous years in which weak El Niño conditions persisted through summer (Figure 4, page 21). The four-day workshop was preceded by a climate training session to provide background on the values and limitations of longer-term climate forecasts.

Issues of Concern

Drought in the north has dried forests while abundant moisture in the south puts rangelands at risk for fire (Figures 5 and 6, page 22 and 23). Participants from the various areas identified an enhanced potential for timber fires as the main concern for the area north of the southern borders of Oregon, Idaho, and Wyoming. This northwest corridor of states has experienced long-term drought and an extremely dry winter characterized by record low snowpack in many basins (Figure 7, page 23).

Meanwhile, areas to the south have experienced unusually high autumn and winter precipitation, increasing live fuels. A heavy and continuous growth of fine fuels (grasses) led to concerns for an increased potential for large rangeland fires once these fuels dry (Figure 8, page 23).

Tree mortality throughout the western United States and southern Alaska poses a threat for enhanced fire potential, especially where interspersed with increased fine fuels. Southern California and Eastern Great Basin representatives also shared concerns that initial response to fires could be slowed in some areas because roads have been covered by landslides or washed out by floods.

Geographic Area Reports

Alaska: The Alaska fire season for 2005 is expected to be normal with the exception of the western Kenai Peninsula, where low snowpack amid large areas of bug-killed spruce create increased fire potential. A predicted warmer-than-average spring is likely to mean an earlier start to the fire season.

Pacific Northwest: An above-average fire season is expected for Washington and Oregon based on ongoing drought, low snowpack, and the likelihood that El Niño type conditions will continue steering storms away from the area. In the most likely scenario, snow will melt during May, and logs and other large fuels will reach critical dryness in late June or early July. Large timber fires are possible, even at high elevations. In the worst-cast scenario, forests west of the Cascades could continue to burn well into October.

Northern Rockies: The combination of long-term drought and low snowpack will lead to an above-average fire potential, especially in northern Idaho and western Montana—particularly from July through September. Spring rains are expected to limit fire potential early in the season, but boost fine fuels that contribute to grassland fires by early summer.

Rocky Mountains: Above-average fire potential is predicted for drought-stricken northern Wyoming and South Dakota's Black Hills. Bug kill has reached epidemic proportions in some areas, including the Black Hills and Wyoming's Shoshone National Forest. Below-average fire potential is expected for portions of southern Colorado that have received substantial winter and spring precipitation.

Great Basin: Extremely low precipitation amid ongoing drought in the north will likely lead to a timber fire

problem in Idaho. Meanwhile, near-record high precipitation in southern Nevada and southwestern Utah has contributed to abundant grass growth, which will enhance rangeland fire potential once grasses cure.

Southwest: Fire potential will likely be below normal in most high-elevation forests, and above normal in lower elevation areas due to near-record high precipitation during autumn and winter. Although above-average precipitation is expected to continue through April, May, and June, dryness will cure grasses and intensify fire potential.

California: Above-normal fire potential is expected for the southern California desert and grassland areas, and in the northeastern corner of California, based on current and forecast weather and fuel conditions. Elsewhere, near-normal fire potential is expected. Fire season is expected to begin a few weeks earlier than normal in the southern California desert areas and a little later than normal in the higher elevations.

The Value of the Workshop

Geographic Area Coordination Center (GACC) representatives indicated that this workshop is a useful opportunity to work together to consider how the influence of fuels and climate during the coming fire season might affect fire potential. The fire season assessments provide for more proactive fire management and will result in improved efficiency and firefighter safety.

Each GACC will issue updates that will be post-edthroughout the 2005 fire season on the National Predictive Services Group website (see References). The 2005 National Seasonal Assessment Workshop: Western States and Alaska was organized by the Program for Climate, Ecosystem, and Fire Applications (CEFA), California Applications Program (CAP), the National Predictive Services Group, and the University of Arizona's Climate Assessment for the Southwest (CLIMAS). The workshop was hosted by the Western Water Assessment and NOAA-CIRES Climate Diagnostics Center.

Participating Agencies

Alaska Interagency Coordination Center
Arizona State Land Department
Bureau of Land Management
CAP/Scripps Institution of Oceanography
California Department of Forestry and Fire Protection
CEFA/Desert Research Institute
CLIMAS/University of Arizona
Dixie National Forest
Eastern Great Basin Coordination Center
ECPC/Scripps Institution of Oceanography
Lassen National Forest
Los Padres National Forest
National Interagency Fire Center
NOAA-CIRES Climate Diagnostics Center
Northern California Coordination Center
Northern Rockies Coordination Center
Northwest Interagency Coordination Center
San Jacinto Ranger District
South Dakota School of Mines and Technology
Southern Area Coordination Center
Southern California Coordination Center
Southwest Coordination Center
United States Northern Command
Pacific Northwest Research Station/USDA Forest Service
U.S. Geological Survey/EROS Data Center
Western Great Basin Coordination Center
Western Regional Climate Center
Western Water Assessment

1. Introduction

About 50 fire managers, fuel specialists, climatologists, and fire meteorologists from throughout the western United States met in late March at the National Oceanic and Atmospheric Administration (NOAA) facility in Boulder, Colorado, to forecast fire potential for the 2005 season during their third annual National Seasonal Assessment Workshop: Western States and Alaska.

The main product of the workshop was a map forecasting fire potential for the western United States (Figure 1, page 19). The map highlights the potential for an above-average spring and summer fire season in northwestern timberlands and southwestern rangelands. Meanwhile, participants predicted below-average fire potential for some mountainous areas of the Southwest during those seasons because of high precipitation levels there, including above-average snowpack.

The gathered experts consider a variety of factors when making their fire potential forecasts. This year, participants distinguished a complex pattern of fire potential anomalies, based on interactions between climate conditions, fuel types, long-range predictions for climate and fire, and the persistence of disturbance factors, such as drought- and insect-induced forest mortality.

Section 2 includes a summary of their conclusions, along with a description of existing climate conditions and forecasts. In addition to producing the forecast map of western seasonal fire potential, members of Geographic Area Coordination Centers (GACCs) (Figure 2, page 19) worked together to produce reports of fire potential forecasts by individual area or with one neighboring GACC. Full reports are accessible on-line through the website of the National Predictive Services Group (see References), which oversees the Predictive Services units present in each GACC.

A description of the workshop process and information on the workshop evolution and benefits are given in Section 3. Each annual workshop includes a feedback session designed to help organizers and participants continue to improve the annual workshops. The recommendations are summarized in Section 3.

The fire potential forecasting process occurs over about two and a half days, which includes the production of the western forecast and the writing and reporting of the individual GACC summaries. The 2005 process was enhanced by the addition of a climate training workshop, as had been recommended by workshop participants in 2004. Moreover, there was discernible improvement in the facility of the participants to produce timely and comprehensive reports, as well as increased sophistication in the discourse between fire and climate specialists. These improvements were evident in:

- Better participant and organizers' preparation for the meeting resulted in a more rapid turnaround time for producing GACC pre-season outlooks.

- Discussion of climate topics and potential climate-fire interactions was lively, in-depth, and more specific than in past years.

- Several of the GACCs offered unsolicited, but much-needed verifications of their 2004 outlooks.

- Concerns about forecasting and management needs in the face of climate change and increasing temperatures was, for the first time, part of the discourse.

Participation by colleagues from the NOAA-CIRES Climate Diagnostics Center, the Western Water Assessment, and the Western Regional Climate Center, improved the flow of information. These colleagues added fresh perspectives on the climate science presented during NSAW. In addition, their input improved the dialogue between climatologists and fire management personnel. Climatologists came away from the meeting with a vastly improved sense of the kinds of issues involved in pre-season fire potential forecasting, as well as enthusiasm and optimism with regard to developing new decision-support research and tools, or adapting existing data analyses to meet the needs of the fire management community.

2. Workshop Results

Climate Conditions and Forecasts

A forecast of fire potential for the West (Figure 1, page 19) was the primary product produced on April 1 by the group of fire and weather/climate specialists gathered in Boulder, Colorado for the third annual National Seasonal Assessment Workshop: Western States and Alaska. After hearing forecasts of climate for spring and summer and exchanging information on climate impacts and fuels conditions, the group delineated the areas of the West likely to face above-average or below-average fire potential. Fire potential is the likelihood of fire occurrence based on factors including fuel conditions, weather/climate, and firefighting resources.

The results of the workshop indicated that there is potential for severe forest fires throughout the drought-stricken northwestern quadrant of the country and for extensive rangeland fires in the unusually lush grasslands in the nation's southwestern quadrant. The concern among workshop participants was supported by the seasonal climate forecasts provided by the National Weather Service's Climate Prediction Center (CPC) and an alternate El Niño scenario forecast based on analogous years.

Long range forecasts and analog years indicated an increased likelihood of above-average temperatures in spring and summer in the Pacific Northwest, although the Northern Rockies could experience below-average temperatures during those seasons. Meanwhile, there's an increased likelihood that precipitation will fall below average in parts of the Pacific Northwest in the spring and summer and in parts of Idaho and Montana during the summer (Figure 4, page 21). If spring follows a pattern comparable to previous weak El Niño years, much of the West could experience above-average April precipitation, although this area would be expected to contract by mid-spring except for a swath just north of the Texas panhandle (Figure 4, page 21).

Klaus Wolter from the Climate Diagnostics Center (CDC) and Tim Brown, director of the Climate, Ecosystem and Fire Applications program, developed a series of three-month scenarios based on the following analog years: 1951, 1953, 1957, 1958, 1965, 1969, 1972, 1979, 1982, 1990, 1991, and 2002. They produced qualitative probability anomalies maps (Figure 4, page 21) for the group based on the composite precipitation and temperature anomalies for those years, with some blending of results from the CPC forecast maps shown in Figure 3. Anomalies are departures from normal values, either above or below average. Wolter and Brown also used the dataset tool to produce maps of the composite anomalies for 500-millibar heights for each three-month period. Fire meteorologists at the workshop indicated they often use the anomalies for height of 500-millibar pressure in the atmosphere to evaluate weather patterns conducive to fire.

Much of the northwestern United States remains under long-term drought. Winter precipitation patterns (Figure 5, page 22) have deepened the drought's hold (Figure 6, page 23), with many mountains in the region setting new record lows for snowpack. Oregon's Mt. Hood, for instance, had collected only 12 inches of its usual 52 inches of snow by mid-March. The shortage of snow on many mountains in Washington, Oregon, Montana, and other states (Figure 7, page 23) means this region will dry up much sooner than usual as the weather warms. Typically, snowpack provides insurance against a lack of spring precipitation, with snowmelt metered out over the course of several months as temperatures increase in the higher elevations. The low snowpack across most of the region gives a strong reason for concern for a long, active fire season in the Northwest.

Meanwhile, the Southwest has been experiencing some relief from the long-standing western drought. Record and near-record precipitation in some locales has contributed to a greening of the Southwest (Figure 8, page 23), with some desert vegetation in Arizona and Nevada growing waist-high and continuous. May and June are typically among the driest months for the southwestern United States, so even monthly values that are 150 percent of average may tally less than an inch in many places during late spring. Because of this, many fuels specialists expect the lush grasslands now thriving in the Southwest to dry out by early summer and act as fine fuels with the ability to transport fire across long distances.

Along with the likelihood of sparse precipitation during May and June in much of the western United States, fire managers can expect an ongoing trend toward warmer temperatures to continue. Climatology comparisons typically involve a recent 30-year period (1971–2000). Meanwhile, an ongoing trend toward warmer temperatures has been detected for much of the West typically since about the mid-1970s. This temperature trend has been shown to be a skillful predictor of future seasonal temperatures. Martin Hoerling, a CDC climatologist who often contributes to the CPC forecast discussion, noted that the warming trend is stronger during winter than summer, which many researchers have linked to the simultaneous trend of earlier snowmelt in the West despite an overall trend toward increasing precipitation rates.

Meteorologists at the workshop took the climate information about current conditions, forecasts, and scenarios into consideration when producing the summaries reported below by geographic area (listed here from north to south, roughly). Specialists in fuels, fire behavior, and resource use also contributed important information about where and when specific conditions might be expected to create severe fire potential or, in some cases, reduce the fire potential for the coming season.

Fire managers often use the Energy Release Component (ERC) and 1000-hour fuel values to estimate fire danger on a particular day, or to forecast fire potential for the coming season based on their projections of how these values will evolve in time. The ERC is an indicator of how much potential energy (in BTUs) is available to be released per unit area in the flaming front, based on moisture content values of various fuel classes, including 1000-hour fuels. The percentage of water content in woody fuels that are 3 to 8 inches in diameter is used to estimate 1000-hour fuel moisture, with lower values indicating drier large fuels.

Summaries by Geographic Areas

Updates to the summaries provided for the following geographic areas will be posted on the National Predictive Services Group (NPSG) website (http://www.nifc.gov/news/pred_services/Main_page.htm) as they are available.

Alaska

According to the most-likely scenario, the Alaska fire season for 2005 is expected to be normal, except for the western Kenai Peninsula, where large areas of bug-killed spruce have caused a fuels problem.

The CPC forecast calls for an elevated chance of warmer-than-average temperatures this spring and also a chance for higher-than-average precipitation. By the later summer months, equal chances of above-average, normal, or below-average precipitation are forecast. The snowpack for most of Alaska for the winter preceding the 2005 season is average to above-average and with higher levels of snow water equivalent (snowpack) than in the past three years in many areas. Deficits in snowpack occur in southern coastal areas, Southeast Alaska, and at lower elevations on the Kenai Peninsula.

Insect infestation on the Kenai Peninsula has caused widespread mortality among spruce on more than 1.5 million acres. A similar situation exists in the Copper River Valley. These hazardous fuel areas are only waiting for the right weather and ignition opportunities to cause large fire problems.

Given the above-average conditions and climate forecasts, the only area of significant concern is the western Kenai Peninsula. The lower-than-average snowpack at lower elevations and the potential for warmer-than-average temperatures combine to elevate fire potential over peninsular areas with beetle-killed spruce.

Following the trends of the past several years, some areas, mainly in southern Alaska, may have earlier-than-average snow-free dates. The warm winter contributed to the below-average snowpack in southern coastal areas, including the panhandle, where early and late winter precipitation fell as rain rather than snow.

Though above-average temperatures are forecast through June for most of Alaska, there is not enough confidence to call for significantly above-normal fire potential. A forecast of a warmer-than-average spring is likely to bring an earlier-than-normal start to the fire season, while an earlier-than-normal green-up due to warmer temperatures should mean a shorter period between snow-free conditions and green-up. The Alaskan fire season is typically bimodal, with one peak between snow-free conditions and green-up, and another peak occurring after vegetation cures.

The confidence level of this assessment is moderate. Subtle changes in locations of high and low pressure features and systems can make a big difference in whether conditions develop that are conducive to significant fire spread and an active fire season. The

lightning season in Alaska does not normally begin until late May, and the prognosis for lightning occurrence accompanied by dry weather is not clear at this time. An update will be posted on the NPSG website (see References) at the end of May.

Alaska contributors: Sharon Alden, Susan Christensen, and Frank Cole.

Pacific Northwest

Fire potential is likely to be above-average and perhaps even severe in Washington and Oregon, based on existing drought conditions. Three possible scenarios (most likely, best-case, and worst-case) for the 2005 fire season were developed based upon current climate conditions combined with forecast and likely alternatives for spring and summer climate.

Because of existing drought, even the best-case scenario could include extensive fires. Except for southern Oregon, which received heavy December snowfall, snowpack throughout Washington and most of Oregon started late and at a slower pace than usual. Dry, mild weather in January and February plunged the snowpack percentages to nearly-record-low or record-low values by March 1 (Figure 7, page 23), rivaling the previous low drought years of 1977 and 2001. The Oregon March 1 snowpack was 46 percent of average, while Washington snowpack averaged only 30 percent of average. Every snowpack reporting station in Washington reported record low values.

In the most likely scenario, near-average temperature and precipitation will occur April–June, while July and August will be typically hot and dry. The record-low mountain snowpack will melt a month earlier than usual. The only snow remaining in May will be in the higher elevations. Large dead (1000-hour) fuels will be unusually low, reaching critical values in late June or early July. Spring moisture will result in increased rangeland grass growth. Severe drought conditions will extend across most of Oregon and Washington. This scenario has a moderate to high probability of occurrence.

Management implications for the most-likely scenario include:

- A very active to severe fire season in Oregon and Washington, both east and west of the Cascades.
- A longer-than-usual fire season starting early and extending later into the fall.
- An increased threat of extreme fire behavior, including crown fires, long-range spotting, and plume-dominated fires.
- An elevated risk of long-duration high-elevation timber fires, with the increased complication of limited access and extreme terrain.

Resource implications of an above-average fire season would include:

- The need for firefighting resources for a longer period of time, with longer mop-up (post-fire response) required in heavy fuels.
- Higher-than-normal demand for resources of all types, with demand in the Pacific Northwest facing competition for potential demand in the northern Great Basin and Northern Rocky Mountains.
- Increase in the fatigue factor for all suppression resources, with implications for firefighter safety.

In the worst-case scenario, Washington and Oregon would likely have a severe fire season, similar to 1994 and 2001. This scenario has a moderate probability of occurrence. The precipitation record for 1970–2004 indicates that after a dry winter, there is a 67 percent chance that the spring will be dry, but only a 30 percent chance that both spring and summer will be dry. However, during severe drought, above-average fire seasons in timber can occur even during wetter-than-usual summers. In this scenario, mountain snowpack would melt about four to six weeks earlier than usual, with little or no snow remaining by mid-May even at the higher elevations. The threat of large timber fires would extend from late June through September, and likely into October west of the Cascades. Resource demands would be heavy.

In the best-case scenario, the threat of an above-average fire potential would diminish significantly if April through June is much wetter than usual. Precipitation would have to exceed 150 percent of average for these three months to mitigate the effects of drought and significantly diminish the threat of an above-average fire season. Precipitation patterns based on instrumental

records for 1970–2004 indicate there is less than a 15 percent chance that April–June would be wet enough to significantly diminish the threat of a severe fire season. Even in the best-case scenario, the threat of large, higher elevation timber fires is likely to exist from late July through early September.

The outlook for April through June slightly favors warmer-than-average conditions throughout the geographic area and equal chances of above-average, average, or below-average precipitation. The outlook for July through September favors a warm, dry summer across the Pacific Northwest. Although lightning outlooks for the summer are not available, the Northwest historically receives two or three episodes of problem lightning every summer, with the first event around the middle of July.

This forecast is based upon seasonal precipitation patterns, drought, current snowpack data, and long-range weather forecasts as of April 1 for the remainder of the spring and summer. Confidence in the analysis is moderate because the preliminary assessment does not include additional factors known to affect fire season severity, including snowmelt date, June precipitation, live and dead fuel moisture, and the amount of summer dry lightning. This preliminary assessment will be updated in late May and a final version will be accessible via the NPSG website (see References) in late June when additional weather, fuel moisture, and fire danger information become available.

Pacific Northwest contributors: Paul Werth and Mike Fitzpatrick

Northern Rockies

Managers should expect an active July through August fire season, with above-normal fire potential mainly in the mountains of western Montana and northern Idaho. Montana and Idaho are in the seventh year of an ongoing drought. North Dakota is also in drought, but to a lesser extent. Although analog years indicate an increased likelihood of above-average moisture and below-average temperatures for North Dakota and most of Montana for the spring, conditions are expected to return to normal (dry and warm) from July through September, increasing fire potential at that time (Figure 4, page 21). Three detailed scenarios were developed for the 2005 fire season.

The most-likely scenario is that spring rains will provide minimal fire potential early in the fire season but will result in the growth of fine fuels that would increase the chances of burning grasslands by early summer. All fuels would be expected to begin drying in mid-July and continuing to dry through August, leading to the potential for an active forest fire season with large fires, especially in northern Idaho and western Montana.

If fall moisture conditions are normal, the season tends to wind down by mid-September. Once grasses are dried by curing naturally or by freezing this fall, the fire potential would increase for the grasslands of eastern Montana as well as North Dakota due to fall and early winter strong wind events. This scenario might be roughly analogous to the latter half of the 2003 season, where very active fire conditions burned large portions of the Northern Rockies. Resources would be taxed under this scenario and the worst-case scenario.

In a worst-case scenario with spring precipitation falling below average, the opportunity for a large fire season would increase. In this scenario, the fire season would start earlier than the usual early July start, and could extend well into the fall. The odds of a normal or above-normal fire season are about equal but would tend to favor the above-normal fire season based on the ongoing drought and considerable fuel loading due to bug kill and natural treefall. This would produce odds of a 40 percent chance for a normal fire season and 50 percent chance for an above-normal fire season. In either situation, large fuels such as logs are likely to be consumed due to low fuel-moisture content.

In the best-case scenario, above-average moisture in spring and summer could result in a short fire season with minimal acreage burned. However, the likelihood of this is small (perhaps 10 percent).

Updates will be issued in June and August, or as necessary, and will be accessible via the NPSG website (see References).

Northern Rockies contributors: Bruce Thoricht, Ron Hvizdak, Colleen Finneman, and Julie Polutnik

Rocky Mountains

The most-likely scenario in northern Wyoming and the Black Hills is that fire potential is expected to be above-normal based on projections of 1000-hour fuel moisture and the related ERC under the following climate scenarios:

- Colorado: Average temperatures and average precipitation duration in April and May, and

above-average temperatures and near-average precipitation duration for June–September.

- Wyoming and the Black Hills (extending into South Dakota): Average temperatures and average precipitation duration in April–June, and above-average temperatures and below-average precipitation duration in July–September.

Despite a few periods of above-normal potential over the remainder of the Rocky Mountain Area, ERC and 1000-hour fuel moisture projections support an overall pattern of average fire potential. Below-average potential is likely in portions of the southern Colorado Mountains because of heavy snowpack and recent precipitation patterns.

Past and expected precipitation this spring promises green-up across much of the area, thus reducing the risk of widespread early season fire potential and activity, such as that experienced in 2002 and March of 2004. However, with extreme to exceptional drought conditions in northern Wyoming and the Black Hills, that area may become more vulnerable for above-normal fire potential by mid to late summer.

Currently, above-average potential for large fires exists over northern Wyoming and the Black Hills for the 2005 fire season. Below-average potential for large fires exists over portions of southern Colorado. Average potential for large fire exists across the remainder of the area. Some large fire activity is to be expected during an average fire season.

Drought conditions have significantly improved over Colorado, Kansas, Nebraska, eastern South Dakota and southern Wyoming over the past year, but have worsened in northern Wyoming and the Black Hills, with "extreme" to "exceptional" drought conditions noted in that area (Figure 6, page 23).

Overall, there are a couple of parallels between current fire conditions over northern Wyoming and the Black Hills, and those conditions (early season high fire potential and activity) experienced in early 2000 and 2002. These include: below-average snowpack and extreme to exceptional drought conditions. However, some factors do not line up with conditions experienced in 2000 and 2002, such as wet and cool trends in March 2005, wet conditions are predicted during the remainder of the 2005 spring season, and current near-average ERC values.

Predictors (such as snowpack) for the 2005 North American Monsoon season are leaning toward a later onset and possibly weaker monsoon season over the Southwest, including southern Colorado. This scenario could result in a longer pre-monsoon window and increased fire potential at lower elevations (generally below 7,500 feet) far from melting snowpack. If El Niño conditions return to neutral by summer as the CPC predicts is likely, another cool and wet summer similar to 2004 is unlikely.

This report should be seen as a preliminary look at the fire potential for the coming season. Mid-to-late spring precipitation will have a large impact on the summer fire potential. It is anticipated that an update to this report will be completed in May 2005 and will be available via the NPSG website (see References).

Rocky Mountains contributors: Tim Mathewson, Russ Mann, Kelly Homestad, and Marco Perea

Great Basin

Extremes of precipitation in fall 2004 and winter 2004/2005 across the Great Basin have created a two-pronged fire potential problem. Near-record rain and snow in the south will contribute to a grass fire problem while extremely low precipitation in the drought-stricken north will lead to a timber fire problem.

The 2005 fire potential is predicted to be above normal across most of the forested lands in southwest Idaho and north of the Snake River Plain, the northern districts of the Bridger-Teton National Forest, and the grass and shrublands below 6,500 feet in southwestern Utah and in the northwestern corner of Arizona (the Arizona Strip).

The main factors contributing to our conclusions are:

- Fall and winter precipitation partially ameliorated the long-term drought.
- One of the wettest winters on record caused extensive fine fuels growth in the southern Great Basin.
- Drought-stressed timber suffered from increased bug kill and disease.

Unless the area experiences an unexpectedly cool and wet spring and summer, the fire season has largely been determined by antecedent conditions. The most likely

climate scenario consists of an average spring followed by a warmer-than-average summer with dry conditions in Idaho and wet conditions in the eastern Basin.

In the most likely scenario, high fire potential is forecast to extend throughout Nevada's Mojave Desert, where exceptional fine fuels growth has occurred in grasslands below 6,500 feet. Most of the northern two-thirds of Nevada would have normal fire potential. Significant snowpack at high elevations and high soil moistures above 6,500 feet will keep dead large fuels from being a problem until late summer, and then only if the typical monsoonal rains do not occur. Even live large fuels would be less of a factor in high elevation fires, since high soil moistures would also keep live foliar moisture high.

For the Eastern Great Basin, conditions in southern Utah are in large part the same as in southern Nevada. Fine fuels will exhibit loadings and continuity at elevations below 6,500 feet to carry fire in the southwest corner of Utah and across the Arizona Strip. Farther north, the timberlands of central and southwest Idaho and western Wyoming continue to suffer from long-term precipitation deficits that have increased mortality from drought stress, disease, and bug infestation problems. Large fuels that likely did not recover from last fall's dry conditions also will contribute to the fire problems. Spring and summer weather will have minor impacts on fire potential this season, both because extremes in weather are not expected, and because fuels conditions are already well established at this point. Therefore, we have high confidence in this forecast.

This outlook is our best estimate of expected conditions for the upcoming fire season. Because it is somewhat early to predict many of the variables, we expect to update this outlook again in late May or early June following green-up when a final assessment of fuel loads and continuity can be made. These updates will be accessible via the NPSG website (see References). In addition, fire danger indices will have had a chance to calibrate by the beginning of summer.

Great Basin contributors: Ed Delgado, Cyndi Sidles, Deb Bowen, Chuck Buescher, Dave Hogan, Fred Svetz, Kathy Wiegard, and Rich Woolley

Southwest

Fire season potential across the Southwest area is expected to be below normal in higher elevation areas with predominantly timber fuel types, but above normal in many lower elevation areas with predominantly grass and brush fuels. This is due to the significant excess of precipitation since the fall of 2004, a current abundance of mountain snowpack and lower elevation herbaceous fuels, and a forecast for a relatively moist April followed by more average seasonal conditions and the possibility of a weak or delayed monsoon onset in July. This could result in a May through July fire season, as compared to the typical March through July season.

The following highlights are based on the forecasted most likely scenario. Overall confidence in this forecast is slightly above average, mainly because of the lack of a climate prediction scenario that could significantly change the current fuel conditions. Climate outlooks call for a possible extension of weak to moderate El Niño conditions through the spring. This supports the forecast for a moist April, and could also lead to a weakened or delayed monsoon onset in July.

Key factors for this season are:

- Abundant mountain snowpack, lush herbaceous fuels growth, and a forecast for an increased likelihood of above-average precipitation in April will likely delay widespread significant fire activity until May.

- The majority of fire activity this year is expected in grass and brush fuels across the southern and far western portions of the region, and where these fuel types overlap areas of tree mortality caused by drought and bark beetle infestation. Fine herbaceous fuel loadings in these areas are the greatest since the mid 1990s, and these fuels should cure between mid-April and mid-May depending on location.

- Firefighting resources must be prepared for fires to move more rapidly than usual in lighter fuel types, with general fire behavior characteristics that are extremely sensitive to variable weather conditions.

- Lower elevation grass and brush fire activity should peak from late April through May across southeastern New Mexico and southwestern Texas, but extend from May into July across southern and western Arizona and southwestern New Mexico.

- Little if any significant fire activity is expected in the timber fuel types, especially above 8,000 feet in the central and northern portions of the area.

- Critical (90th percentile or higher) Area average ERC values are expected to occur from early to mid-June through early to mid-July (3–4 weeks), which is not unusual given the normal variability of fire season conditions in the region. Large fire occurrence is statistically most likely during this time period.

- Overall resource needs in terms of national resources (Type I crews, air tankers, Incident Management Teams, etc.) to support projected fire activity are forecast to be below average, though additional initial attack and extended attack resources will be required for the grass and brush fuel regimes across the southern half of the region.

Southwest contributors: Chuck Maxwell, Rich Naden, and Jay Ellington

California

The current and forecast weather and fuel conditions are projected to lead to above-normal fire potential over the southern California desert areas and in the extreme northern and northeastern corner of California. Elsewhere, near-normal fire potential should exist. In the most likely scenario, fire season is expected to begin a few weeks earlier than normal in the southern California desert areas and a little later than normal in the higher elevations. The Southern California fire season normally runs from about early May through December, while the Northern California fire season typically extends from early June through October.

This assessment is based on past developments, current conditions, trends, and predictions for April through September. A fairly typical spring weather pattern is expected over California. Temperatures in spring are expected to be near average statewide. Spring precipitation overall is expected to be near average in the south and just below average in the north. For the summer period, the area can expect a continuation of near-average temperatures in the coastal areas, while interior portions of the state will likely experience temperatures that are near to slightly higher than average. Precipitation for this period is anticipated to be at or below average, but it should be noted that average precipitation during the summer for much of the state is insignificant. The confidence factor in these climate/weather forecasts is about average.

Although above-average to extremely above-average precipitation occurred in most areas of California during autumn and winter, there remain large areas of brush and timber mortality throughout many portions of the state, especially in southern California oak and tanoak woodlands in the Central Coast area.

Given that this report was generated prior to the significant weather months of April and May, it provides a baseline of information that can be utilized as a preliminary outlook and to improve preparedness for wildland fire management agencies. An updated version of this outlook will be prepared by the end of June and accessible via the NPSG website (see References).

California contributors: Doug Forrest, Ron Hamilton, Carol Hensen, Larry Hood, Mike LeCoco, Beth Little, Bruce Risher, Tom Rolinski, and John Snook

3. Workshop Background and Process

Background

The 2005 National Seasonal Assessment Workshop (NSAW): Western States and Alaska was the third annual workshop organized specifically to produce seasonal fire potential forecasts in the western United States. The 2003 workshop was the first official gathering in which fire and weather specialists from throughout the country gathered to compare observations, share relevant research, and formally consider how the coming seasons' climate might affect the pending fire season.

The fire management community has long known that weather has a big influence on the severity and length of the fire season. Fire units typically include meteorologists who contribute expertise on factors affecting the short and midrange outlooks, from a few days to a week or so. When making their assessments, fire weather experts regularly monitor relative humidity, long-term fuels moisture, wind conditions, and a variety of other factors in their areas.

During the 1990s, forecasts improved for weather patterns that lasted longer than a couple of weeks (climate patterns). Climate forecasts became more reliable as climatologists documented the connections between short-term atmospheric activity over the continental United States and longer-term ocean conditions, especially sea surface temperatures in the tropical Pacific. These long distance influences are known as teleconnections.

Teleconnections Between Climate and Fire
El Niño and La Niña are significant teleconnections that help to explain some of the variation between precipitation and temperature patterns from year to year. And because the ocean temperature patterns tend to last much longer than atmospheric patterns, these teleconnections lend some seasonal persistence to climate processes, particularly for winter and somewhat for spring. This teleconnection is often referred to as El Niño/Southern Oscillation (ENSO) with the latter alluding to the measurable atmospheric changes that come as part of the El Niño phenomenon.

In addition, research by the University of Arizona's Thomas Swetnam and Julio Betancourt contributed insight developed from tree-ring and instrumental records into how regional fire regimes related to ENSO fluctuations. During El Niño years, the southwestern United States tends to be wetter, typically at the expense of the northwestern United States. Meanwhile, temperatures during El Niño years tend to be warmer across the northern half to two-thirds of the West, particularly from December through June. The situation roughly reverses in La Niña years. Swetnam and Betancourt (1990, 1998) found fire severity often was linked to the fluctuation between the two conditions, which tend to occur every three to seven years. For instance, the researchers found southwestern fire regimes tend to be more severe when a wet winter (typically during an El Niño year) is followed by one or more dry years (often related to La Niña).

This emerging ability to foresee the fire potential of a coming season with input from climatic conditions for coming seasons set the stage for the introduction of NSAW and fire potential map production. Although the annual workshop that yields the fire potential maps began in 2003, the development of the interaction goes back to February of 2000, when the previous years' ENSO conditions had many in the fire and climate community concerned—and rightly so, it turned out—about the coming season.

The 2000 workshop, called "The Implications of La Niña and El Niño on Fire Management," was sponsored by three groups affiliated with the University of Arizona: Institute for the Study of Planet Earth, Laboratory of Tree-Ring Research, and Climate Assessment for the Southwest (CLIMAS). It was the first gathering in one place of representatives from fire management, climate science, and fire research from all over the United States.

A Dramatic Beginning
The initial concern for an above-average fire season in 2000 was all too correct. By the end of the year, 7.4 million acres had burned across the country. On the peak day of that season, August 29, more than 28,000 firefighters were working to contain 1.6 million acres burning in 84 large fires in 16 states, according to a report given at the follow-up 2001 workshop by Tim Brown, director of the Desert Research Institute's program for Climate, Ecosystem, and Fire Applications (CEFA).

The 2001 meeting was followed by a 2002 "Fire in the West" workshop. Although primarily designed for information exchange, the 2002 workshop took a step closer to the evolving NSAW format by including an experimental fire potential forecast for the Southwestern Area, which includes Arizona, New Mexico, and Western Texas. At about this time, a division of the National Interagency Coordination Center, the National Predictive Services Group (NPSG), which had participated in several previous workshops, initiated a dialogue with CLIMAS and CEFA that set into motion the creation of the annual predictive workshops. The three groups specifically sought to join expertise to expand the prototype climate-based pre-season fire danger outlooks created by the Southwest Area into the nation's other Geographic Area Coordination Centers (GACCs).

The workshop fit well into CLIMAS's mission, which includes improving the ability of southwestern natural resource managers and other stakeholders to respond sufficiently and appropriately to climatic events and climate changes. CEFA's mission includes providing climate and weather information directly to fire managers, assessing fire risk impacts and hazards, and assisting in the exchange of information and products between fire managers and scientists. NPSG was created partly in response to the severity of the 2000 fire season, with its goal being to improve efficiency in the use of firefighting resources and ensuring the safety of firefighters. So the involvement of NPSG Chair Tom Wordell, NPSG Vice Chairman and Bureau of Land Management (BLM) Fire Weather Program Manager Rick Ochoa, and Assistant BLM Fire Weather Program Manager Heath Hockenberry introduced an element of resource planning as well as fire weather expertise that was carried into the annual workshops.

The result of the NPSG-CEFA-CLIMAS collaboration was the participation of representatives from all 11 GACCs in the 2003 NSAW, and the production of a national map of fire potential for March through August.

Based on the advice of participants, the national workshop was quickly divided into two regional workshops: NSAW: Western States and Alaska, meeting in March, and NSAW: Eastern and Southern States, meeting in January. This separation is based mainly on the fact that western and eastern fire seasons occur at different times, although interregional north-south divides also exists. The 2005 workshop continued the tradition of focused interagency cooperation. The workshop was co-hosted by the National Oceanic Atmospheric Administration (NOAA)-Cooperative Institute for Research in Environmental Sciences (CIRES) Climate Diagnostics Center (CDC) and the Western Water Assessment (WWA). The California Applications Program (CAP) also contributed to the workshop. WWA, CAP, and CLIMAS all operate under NOAA's Regional Integrated Sciences and Assessments program, designed to improve the link between climate sciences and society. CLIMAS retains strong ties to the Institute for the Study of Planet Earth, where the program resides, and the Laboratory of Tree-Ring Research.

Value of Workshop and Products

The rapid evolution of the workshop helps illustrate its importance to the fire management community. Participants at the 2005 workshop also identified a number of ways in which the workshop itself and the products it yields serve them in their efforts to fight fires as efficiently as possible. Some of the main benefits cited by participants in the 2005 workshop are detailed below.

Exchange of Information
One of the main benefits is the opportunity to meet with other GACCs to share views and concerns, especially regarding fuels in vegetation types that cross area boundaries. Although the National Interagency Coordination Center releases monthly updates of the wildland fire output based on input from various GACCs, contributors rarely have the opportunity to brainstorm as a group. Area representatives agreed with a participant's comment that the climate training session preceding the 2005 workshop provided information they would be unable to get anywhere else. The training session was arranged in response to a recommendation during the 2004 workshop. Also, the group appreciated this year's participation of several renowned climatologists, including Kelly Redmond of the Western Regional Climate Center and Martin Hoerling and Klaus Wolter of the Climate Diagnostic Center (CDC).

Consider Future Demand on Resources
Many participants said they considered the workshop a useful way to start preparing for the fire season, including the exchange of information on the potential sharing of resources. Fire season forecasts continue to be useful tools to fire managers in positioning resources. Also, the forecasts are used to schedule training and pinpoint time windows for the use of certain large equipment such as aircraft.

Make Better Funding Decisions
The products produced in the workshop process can help some groups make their case for additional financial support to combat fires. For instance, GACCs can submit to the National Interagency Fire Center "severity requests" for additional short-term funding based on the expectation for above-average fire activity. The NSAW process helps to identify areas in which activity is likely to be above-average.

Facilitate Outreach and Education
For some GACCs, including the Northwest Area, the report prepared for the workshop serves as the basis for numerous spring briefings to groups ranging from fire managers to the media to the public. Fire managers also use the workshop products in their own efforts to educate lawmakers or the public about at-risk areas. The National Predictive Services Group and individual GACCs use the products to brief the media.

Improve Climate and Fire Dialogue
Some participants also appreciated the opportunity to interact in a structured manner with climate experts. The ensuing dialogue can be used to identify climate products that could be produced or refined to better suit seasonal fire forecast needs, as well as to better understand the processes that go into developing climate products. The workshop organizers and hosts regularly interact with the climate community, providing feedback from stakeholders. Further, each workshop features climate experts, some of whom have expressed an interest in adapting products based on user input. This year's workshop was preceded by an optional climate training session that featured prominent climatologists, some of whom were affiliated with the CDC, a co-host of the workshop. Climatologists at this training session and workshop indicated they appreciated the opportunity to interact in a structured manner with fire experts. They gain valuable insight into critical factors for fire management decision making, which allows them to develop research projects and decision-support tools and to improve the flow of climate information to the fire management community.

Recommendations

The closing hours of each year's workshop include some time devoted to gaining feedback from participants on how to make the next workshop even better. Given the nature of the workshop, many of these recommendations relate to climate products. In addition, some of them involved consideration of resources. The group also set the time and place for the 2006 National Seasonal Assessment Workshop: Western States and Alaska.

2006 Workshop
Participants expressed their appreciation for the information and support offered by NOAA's many experts during the 2005 workshop held at NOAA's David Skaggs Research Center, in Boulder, Colorado. After some discussion, the group recommended holding the 2006 western workshop during the first week of April in the same location. Scientists with the CDC and the WWA, both headquartered in the building, agreed to co-host the workshop as they did in 2005. This will allow for the use of the most current monthly forecasts from several groups, including the Scripps Experimental Climate Prediction Center, provided by John Roads.

CPC Seasonal Forecasts
Participants found great value in discussing long-range forecasts with climatologists from the CDC, CPC, and the Desert Research Institute. The group's meteorologists in particular indicated they wanted to know the reasoning behind these forecasts. The western group suggested that future workshops should also include representatives or teleconferencing with the CPC.

Topographic Distinctions
Members of the group indicated they would appreciate having a Geographic Information Systems (GIS) expert on hand to help out with mapping. At the close of the 2005 workshop, Robert S. Webb of the WWA and CDC reported that he has arranged for the 2006 workshop to include participation of a fire researcher who works in an affiliated laboratory. The involvement of this researcher will allow participants to produce maps to discern high-elevation forests and other topographic variations from low elevation grassland or desert areas; elevation-dependent vegetation type has a strong influence on fire season timing and severity.

Lightning Probability
More information on lightning frequency, such as correlations between lightning events and specific weather or climate patterns, would represent a big step forward for much of the West, the Northern California GACC pointed out. In the West, lightning starts typically account for more than 80 percent of fire starts, although some of the largest fires of recent years were ignited by humans. This contrasts with the eastern half of the United States, where most fires (about 90 percent) typically are started by humans. Tim Brown of the Desert Research Institute has access to lightning data that

could be used to develop projects for fire management needs, he indicated. Climatologist Kelly Redmond cautioned that lightning might be one of those things that will remain unpredictable because of its very nature, but noted that researchers "in this building" are working on it. Still, the pace of innovations and knowledge production makes it difficult for society to predict what will be possible a decade from now, Rick Ochoa of National Predictive Services Group suggested. Anomalies in the 500-millibar heights appear to drive lightning as well as weather patterns, a workshop participant speculated.

500-Millibar Heights

As in previous years, the Alaska group requested forecasts of 500-millibar (mb) levels (the height at which atmospheric pressure is half of sea surface pressure). Alaska fire potential has a strong relationship to the atmosphere's 500-mb heights, a participant from Alaska explained. Redmond indicated that forecasters routinely use 500-mb heights to make their forecasts, so it would not be difficult for them to provide these values for at least some of their preliminary forecasts if they were informed of their usefulness. For this year's workshop, Tim Brown and Klaus Wolter provided 500-mb height anomalies during different three-month seasons for a dozen potentially analogous El Niño years using the NCEP-NCAR Reanalysis data set (see References). A participant from Alaska expressed appreciation for the opportunity to examine these, and also planned to explore various options using the website. The tool helps users consider past atmospheric patterns identified by the user as potential analog years.

More Information on Alaska

Alaskan fire managers would like more products and information applicable to their area, including Standard Precipitation Index (SPI) values, which illustrate existing precipitation deficits or surpluses at a variety of scales. Producing SPI values would require extensive data quality control, including estimating any missing values, Redmond explained. Alaska's sparse population and long winters with deep snow cover make data collection especially challenging. Robert S. Webb of the CDC/WWA has also arranged to have an Arctic climate expert on hand for the 2006 workshop to share knowledge with the Alaskan group. Not all of the products workshop participants typically use for their forecasts include Alaska, making the challenge greater for this area. Alaska-based fire specialists said they appreciated the "wind rose" tool on the Desert Research Institute website that allows them to plot prevailing wind directions based on other data (see References).

Downscaling Climate Data

Klaus Wolter of the CDC recommended downscaling climate information to get better resolution. Climate divisions are divided into 102 "megadivisions" nationwide, which leaves the West covered at a fairly coarse scale, especially considering the variability that comes with the mountainous territory. To get a better resolution of climate data, he recommended going straight to the data, which CPC posts on its website (see References). The diagnostics center will be releasing a prototype of downscaled analyses.

Information Clearinghouse

Some of the specialists requested a website clearinghouse for "one-stop shopping" that would contain updated products relevant to future fire potential updates with some identification of the most useful products. A participant pointed out, there are so many links to climate forecasts and products, even the climate experts can't get to them all when working on updates. In response to a request earlier in the process to provide a site for one-stop shopping, CEFA developed a website that serves as a clearinghouse for fire-related climate products, as well as fire forecasts and fuels/vegetation status (see References). In addition, in response to a recommendation during the 2004 workshop, CLIMAS Program Manager Gregg Garfin prepared a compact disk containing a variety of products that might be useful to the 2005 fire potential forecast process.

Vegetation Data

Vegetation status products, using remotely-sensed NDVI data, are available from a variety of sources, including the Wildland Fire Assessment System website (see References). However, remotely-sensed data presented in these products often cannot be taken at face value; much like the use of climate data and forecasts, these products require interpretation by experts. Therefore, some workshop participants suggested that future NSAWs include the participation and perspectives of remote sensing data experts.

Summary

During the 2005 workshop, participants reaffirmed the value of these workshops, and the utility of pre-season outlooks. In fact, most participants mentioned increased demand for pre-season outlooks by fire management officers and others in their geographic areas. The following are among the challenges facing the NSAW process and the community of scientists and operational entities that serve decision-makers at the fire-climate nexus:

- Improving the way the physical and statistical factors used to specify seasonal temperature and precipitation probability anomalies are conveyed to fire management forecasters and decision-makers.

- Enhancing GIS capabilities, to allow forecasters to specify topography-and-ecosystem dependent differences in fire potential.

- Receiving better guidance on the use and interpretation of remotely-sensed vegetation status data.

- Adding the ability to predict resource needs and fire suppression costs.

- Improving the flow, quality, and quantity of fuels status information to the GACCs.

- Expanding their basic knowledge about climate-lightning relationships.

- Improving the time horizon and accuracy of climate predictions.

- Improving the distribution and use of information developed from the seasonal assessment workshops.

Although these challenges loom large, the enthusiasm and dedication of workshop participants and cooperating agencies bodes well for improved pre-season outlooks. The development of new and enhanced products for fire management decision-making in future years also looks promising.

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- NSAW Proceedings: http://www.ispe.arizona.edu/climas/conferences/NSAW/index.html
- Fire and Climate Workshops: http://www.ispe.arizona.edu/climas/conferences/fire2002

CPC—Data sets for downscaling purposes

- Temperature: http://www.cpc.ncep.noaa.gov/pacdir/NFORdir/HUGEdir2/cd102t.dat
- Precipitation: http://www.cpc.ncep.noaa.gov/pacdir/NFORdir HUGEdir2/cd102t.dap

DRI—Remote Access Weather Station:
http://www.raws.dri.edu/index.html

USDA Forest Service—Wildland Fire Assessment System:
http://www.fs.fed.us/land/wfas/

NCEP-NCAR Reanalysis:
http://www.cdc.noaa.gov/cgi-bin/Composites/printpage.pl

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Figure Websites

Figure 3: Climate Prediction Center forecasts
http://www.cpc.ncep.noaa.gov/products/predictions/long_range/two_class.html

Figure 4: Climate Diagnostic Center U.S. climate division dataset maps
http://www.cdc.noaa.gov/USclimate/USclimdivs.html

Figure 5: High Plains Regional Climate Center precipitation and temperature maps
http://www.hprcc.unl.edu/products/current.html

Figure 6a: U.S. Drought Monitor
http://www.drought.unl.edu/dm/monitor.html

Figure 6b: Standardized Precipitation Index
http://www.wrcc.dri.edu/spi/spi.html

Figure 7: National Resource Conservation Service snowpack map
http://www.wcc.nrcs.usda.gov/snow/

Figure 8: Wildland Fire Assessment System greenness map
http://www.fs.fed.us/land/wfas/wfas11.html

5. Figures

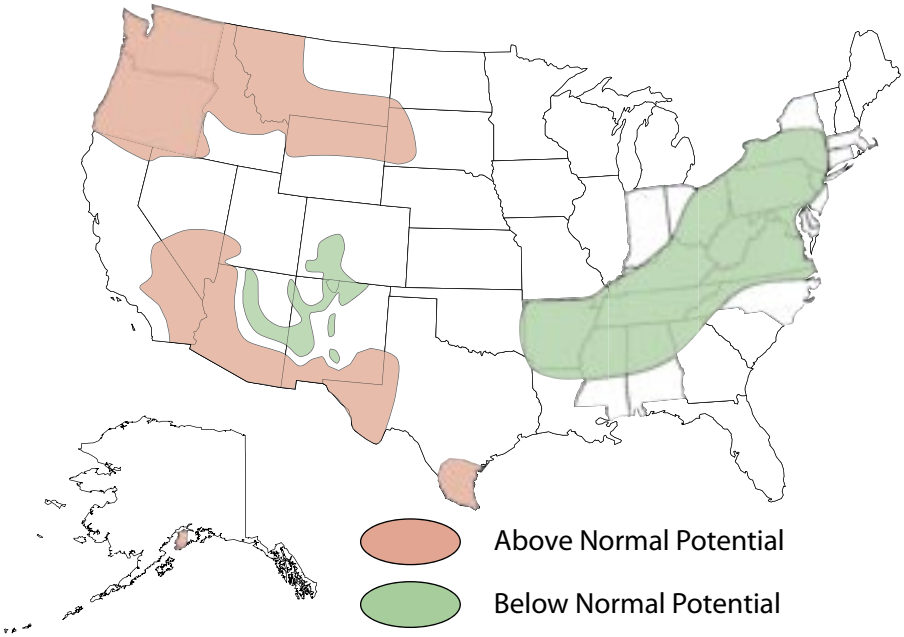


Figure 1. The western portion of the map showing the outlook for national significant fire potential was produced during the workshop ending on April 1. It highlights areas that managers from a variety of geographic areas in the West consider to have either above-average or below-average fire potential during the coming season.

Figure 2. The western half of the United States is divided into nine Geographic Area Coordination Centers (GACCs), delineated in the map above. In the 2005 workshop, the California GACCs produced a combined report, as did the Great Basin GACCs.

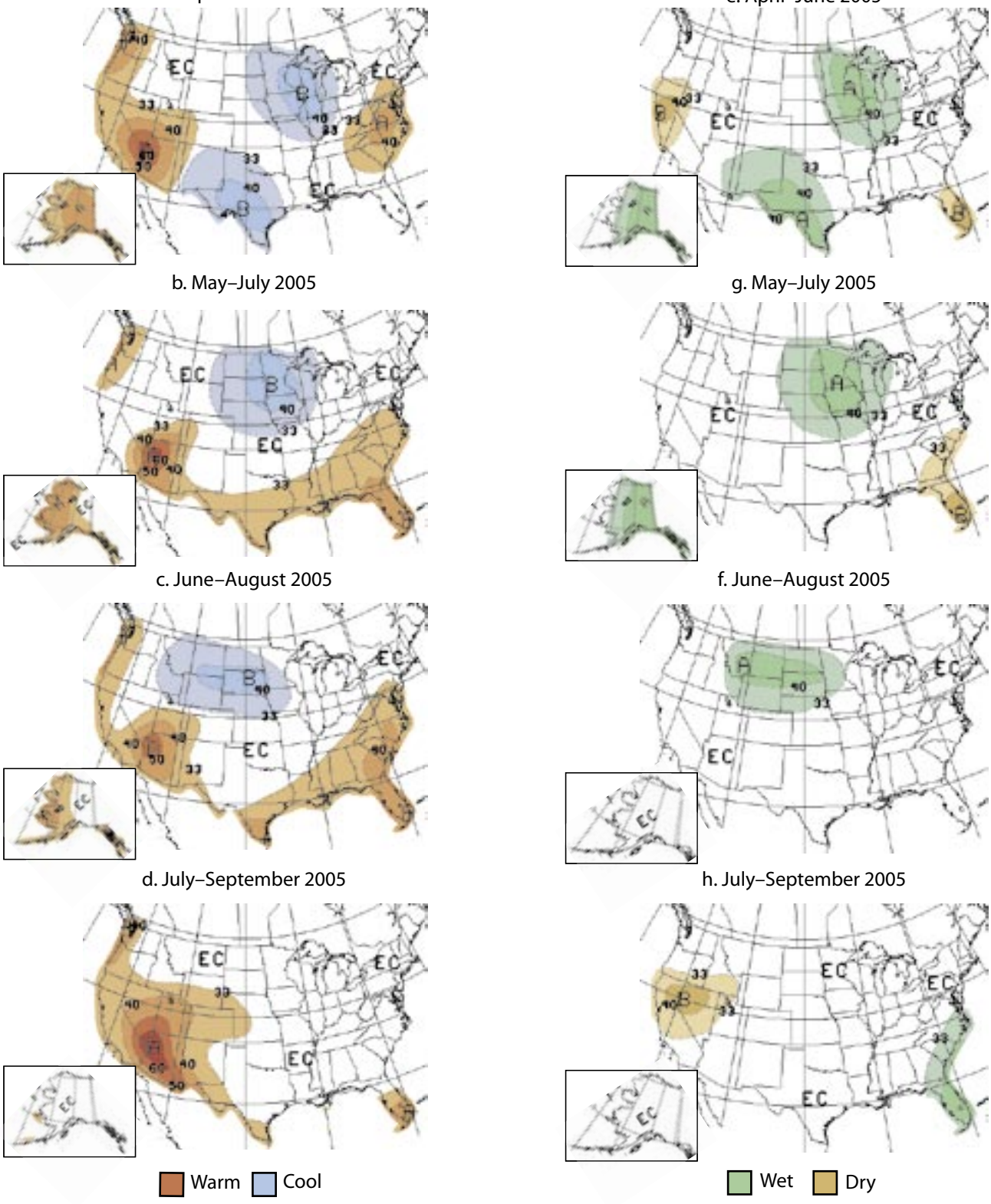
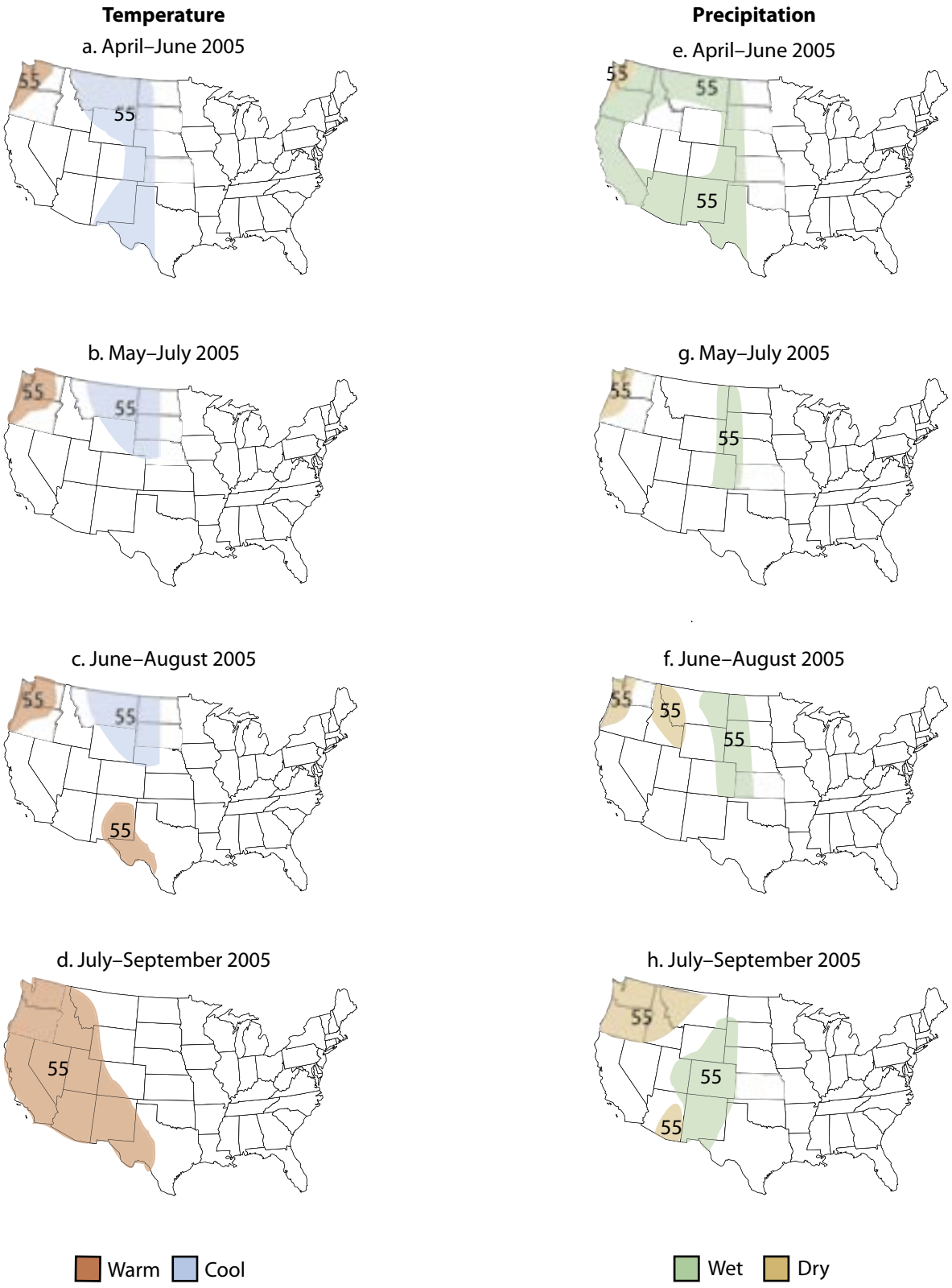


Figure 3a–h. The NOAA Climate Prediction Center (CPC) temperature and precipitation outlooks were used as input to the fire potential outlook during the workshop. They are experimental 2-category forecasts, using the average from 1971–2000 as the basis for comparison. The numbers on the maps indicate the probability of an occurrence, while the letters A and B stand for above average and below average respectively.



EC= Equal chances. No forecasted anomalies.

Figure 4a–h. Seasonal temperature and precipitation scenarios that blend the forecasts in Figure 3 with conditions that occurred during analog years with weak to moderate El Niño conditions initiating in spring and continuing through summer. Only the western states were considered in the scenarios. The maps were produced in an impromptu manner upon request of workshop participants using an online dataset mapping tool (see page 5 for details).

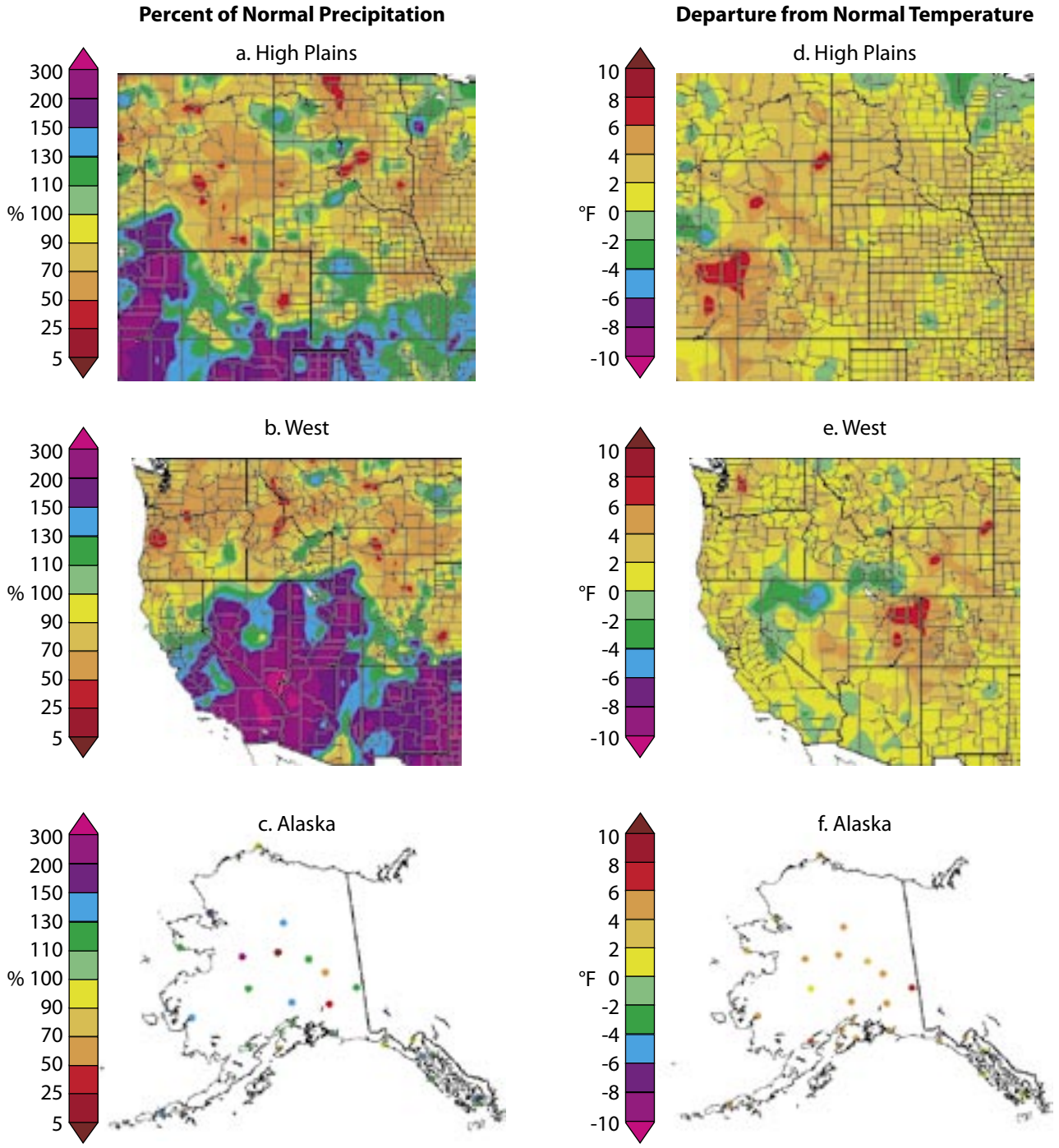
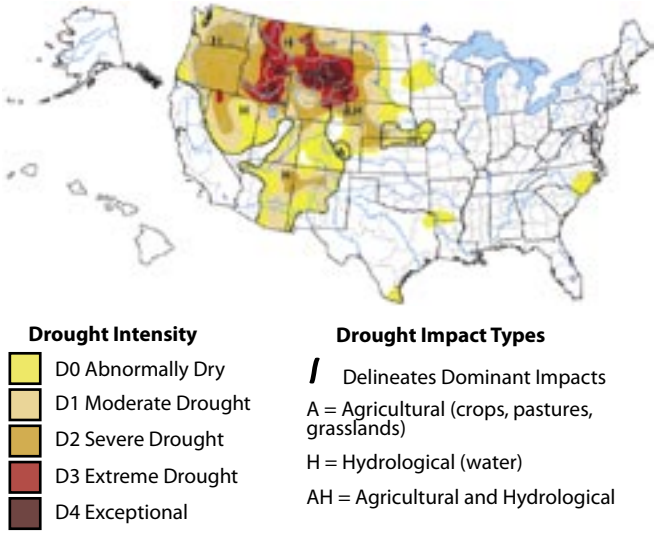


Figure 5a–f. Recent precipitation and temperature conditions according to the High Plains Regional Climate Center (HPRCC). Precipitation since the water year began on October 1 has favored the nation's southwest quadrant, generally at the expense of its northwest quadrant (a and b) according to the HPRCC. Alaskan weather stations have registered mixed outcomes (c). Temperature since January 1 (d, e, and f) generally has been above-average, except in northern Nevada and nearby areas where unusually high snow levels have contributed to cooler-than-average temperatures.

a. U.S. Drought Monitor released March 31, 2005



b. Twelve Month Standardized Precipitation Index

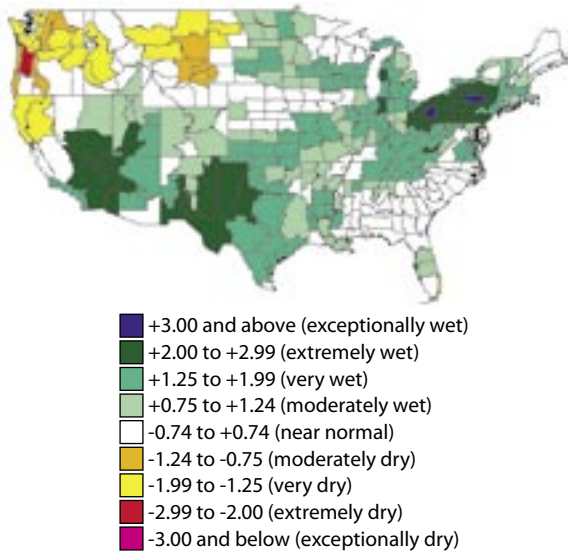


Figure 6a–b. National drought conditions. Drought eased in much of the nation's southwest quadrant, although longer-term hydrologic drought continued in some areas. Meanwhile, drought intensified in the northwestern quadrant and was considered exceptional in some areas (a). Values for the Standard Precipitation Index highlight areas with measured precipitation deficits and surpluses for the 12 months through February 2005 (b).

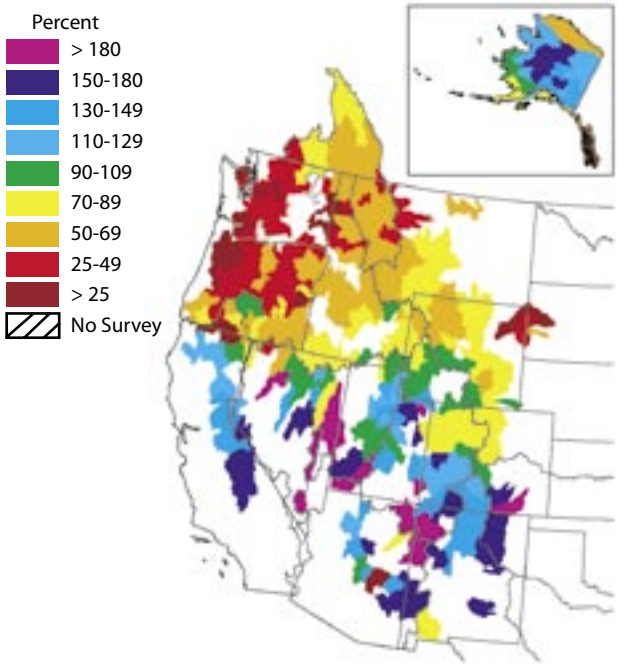


Figure 7. Estimates for mountain snowpack based on SNOTEL station data collections (National Resource Conservation Service) as of April 1, 2005 illustrate the divide between north and south in the West. Existing values are strongly correlated with factors that relate to fire potential, such as soil moisture. Workshop participants used the March 1 map and data updated through late March.

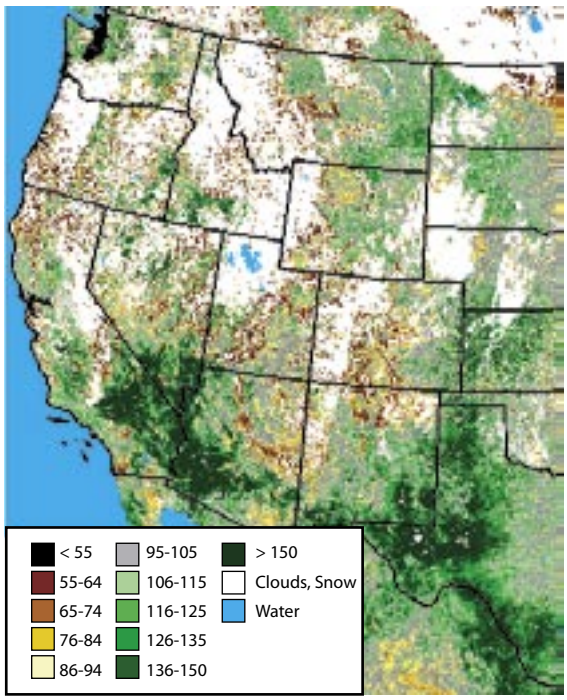


Figure 8. Values (percent of average) for departure from average greenness for the time period of March 23–29, 2005. Values are based on satellite measurements of Normalized Difference Vegetation Index reveal the unusually lush conditions in much of the Southwest according to the Wildland Fire Assessment System. Some of the below-average values in that area highlight areas of past fire occurrence.

Appendices

Appendix A: Seasonal Wildland Fire Assessment Report Outline and Protocols

A. Executive Summary

1. A specific forecast statement (i.e., "the bottom line") should be explicitly included in the executive summary and final summary and recommendations.

2. A statement of the expected range of possibilities (scenarios) for the season.

3. Include a statement about your confidence in the forecast. Mention why you do or do not have confidence, based on your assessment of the various tools used in your forecast.

B. Introduction and Objectives

1. Include guidelines for use of the report and a disclaimer.

C. Current Conditions (including comparison with historical records)

1. Snow (SNOTEL data, SWE, others)

2. Precipitation anomalies (recent week, month, water year)

3. Temperature anomalies (recent week, month)

4. ENSO & other climate indices impact on weather and atmospheric circulation

5. Weather and atmospheric circulation

6. NFDRS, Fire Danger, ERC, and other fire potential indicators

7. Drought indices and maps (PDSI, SPI, KBDI, soil moisture, groundwater, etc.)

8. Vegetation status (NDVI, Greenness imagery)

9. Fuel moisture (live, dead and foliar if known)

10. Fire occurrence data (number, size, duration if known for current year)

11. Fire behavior observations and/or Farsite run comparisons (if appropriate)

D. Climate and Weather Outlooks

1. Long-range climate outlooks (NOAA-CPC, IRI, Scripps, others)

2. Projected atmospheric circulation

3. ENSO and other relevant index forecasts

4. Drought forecasts (including NCDC drought amelioration)

5. Soil moisture forecasts

6. Fire weather indices

E. Fire Occurrence and Resource Outlooks

1. Estimates on number of fires (based on historic lightning episode information, acres burned, duration, Scripps/Westerling model, others)

2. Estimates of expected resource needs

F. Future Scenarios and Probabilities

1. Fire Family Plus

2. Priority sub-regions within Geographic Area

3. Fuel-type considerations

4. Climate considerations

5. Season Ending Event Probabilities

G. Management Implications and Concerns

H. Summary and Recommendations

Seasonal Wildland Fire Assessment Format

- **Text:** Text should be in short, easy to understand, concise statements that refer to and elucidate the accompanying graphics. Remarks need to be "to the point." A specific forecast statement (i.e., "the

bottom line") should be explicitly included in the executive summary and final summary and recommendations.

- **Length:** 10-15 pages (total including graphics). Text will be approximately 3-5 pages.

- **Graphics:** Include all graphics necessary to bolster your forecast, but not so many that the user will be confused or turned off. Additional materials can be folded into an appendix.

NOTE: We suggest that various sources of information be synthesized as much as possible. We advise that you distill the most important information down to just a few sentences that get at the bottom line. Each source does not need to be given exhaustive treatment. It is important to underscore cases where several tools provide either similar or conflicting perspectives. Reinforcement of similar perspectives provides confidence and conflicting perspectives highlight a lack of certainty in the long-term time frame.

Appendix B: Agenda

Monday, March 28, 2005 – Climate Training Workshop (organized by Tim Brown)

Afternoon

15:00–16:00 ENSO – *Martin Hoerling, NOAA-CDC*
16:00–17:00 Teleconnection Indices – *Matt Newman, NOAA-CDC*

Tuesday, March 29, 2005 – Climate Training Workshop (organized by Tim Brown)

Morning

8:30–9:30 Medium Range Forecasts – *Jeff Whitaker, NOAA-CDC*
9:45–10:45 Drought – *Kelly Redmond, Western Regional Climate Center*
11:00–12:00 Downscaling – *Klaus Wolter, NOAA-CDC*

Afternoon

13:15–14:15 Climate Change – *Martin Hoerling, NOAA-CDC*
14:30–15:30 Climate Forecast Tools – *Martin Hoerling, NOAA-CDC*
15:45–17:15 Climate and Fire Forecasts and Discussion with validation of last year's consensus forecast and questions and comments (*moderated by Tim Brown*). *Klaus Wolter, NOAA-CDC; Martin Hoerling, NOAA-CDC; Kelly Redmond, WRCC; John Roads, Scripps ECPC; Tony Westerling, CAP RISA; Jim Lenihan, USDA-FS.*

Wednesday, March 30, 2005 – NSAW: Western States and Alaska

Morning

08:00–08:20 Introduction, logistics, and opening remarks – *Gregg Garfin, CLIMAS*; *Rick Ochoa, NICC*
08:20–08:45 Review of climate forecast (*moderated by Tim Brown*)
08:45–12:00 Weather & fuels assessments/outlooks (*moderated by Rick Ochoa*)
Each GACC to discuss season, weather, and fire considerations specific to them and have invited fuels specialists to discuss current situation, emerging issues, and tools they use to gauge fire/fuels severity – 15 minutes for each GACC.

Afternoon

13:15–13:30 Discussion of assessment procedures and protocols (*Moderated by Gregg Garfin and Rick Ochoa*)
15:00–17:00 Breakout Sessions

Thursday, March 31, 2005 – NSAW: Western States and Alaska

All day Breakout work sessions. Continue outlook. Finalize the report in the afternoon and prepare a presentation for Friday morning.

Friday, April 1, 2005 – NSAW: Western States and Alaska

Morning

08:00–10:30 Reports and presentations – Final presentations by the GACC's on the 2004 season. Each GACC will get 10 minutes. Feedback session to help improve the assessment process for 2005.
10:30–11:00 Closeout/feedback on proceedings.

Appendix C: Participant List

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