2004 Fire Season Assessment for the Northwest Geographic Area

(*Final Version*)

Photo – 2003 Davis Lake Fire (Sean Reed – Deschutes NF)

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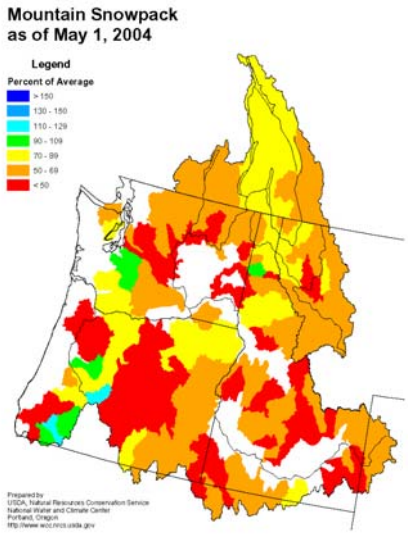
Executive Summary

The following report is the 2004 Northwest Fire Season Severity Assessment based upon seasonal precipitation patterns, snowpack data, drought, snowmelt dates, fire danger indices, fuel moisture information and long-range weather forecasts for the summer and fall. The potential severity of the fire season is determined using statistical techniques that correlate weather, fuel moisture, and fire danger information with historical fire and resource demand records.

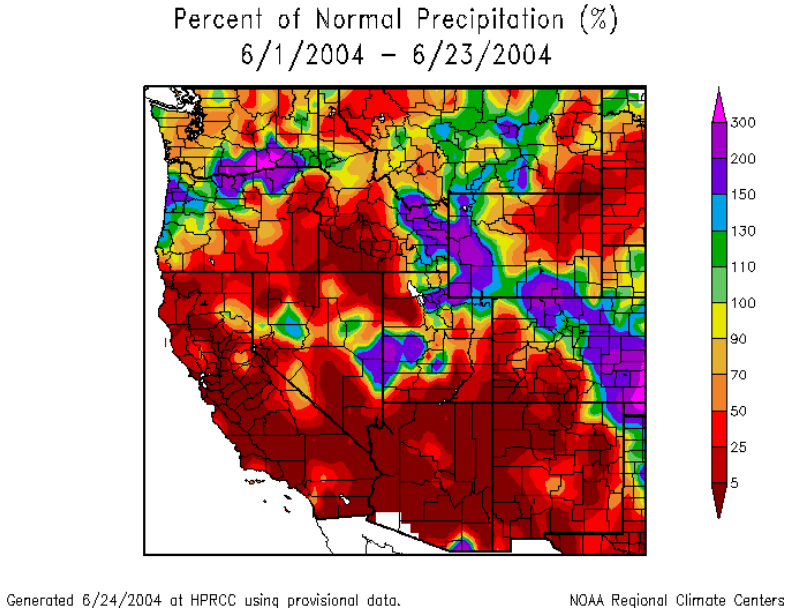
Washington and Oregon experienced cool, wet weather through much of the winter. The latter part of December and the first part of January were particularity cold and wet. Heavy snow and freezing rain fell in Puget Sound and the Willamette Valley, areas west of the Cascades that normally do not see much snow. However, February and March turned warmer and drier than usual. Thus, the winter of 2003-2004 can best be described as highly variable in the Pacific Northwest due to large swings in weather patterns.

Although portions of southern and eastern Oregon reported above-normal November through March precipitation, most of the Northwest received near-average amounts. The driest locations extended across northern and eastern Washington into northeastern Oregon, where winter moisture was only 75-85% of normal.



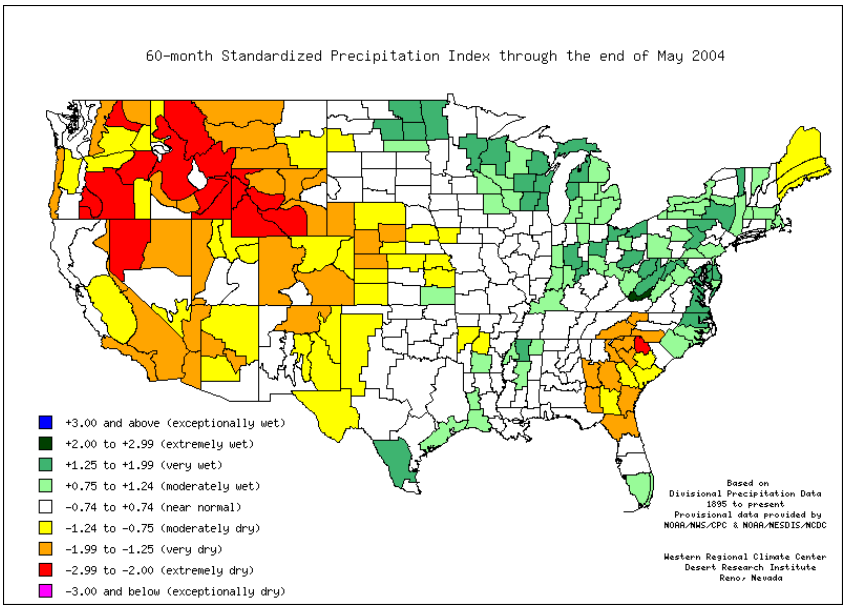
Mountain snowpacks were also above normal throughout much of the winter (except in north central Washington), only to plunge dramatically in March and April. Normally, mountain snowpacks peak around April 1 and gradually melt through the middle of June. However, the snowpack peaked the first part of March, three weeks to a month earlier than usual. As a result, the April 1 Washington and Oregon snowpacks were only 88% of normal. A number of river basins in eastern Washington and northeastern Oregon were as low as 70% of normal.

Warm, dry April weather further depleted the snowpack to 55-65% of average by May 1, with some basins in eastern Oregon well below 50%. The unusual 20-30% April snowmelt was similar to 1994, 1992 and 1987, all of which experienced active summer fire seasons. May turned wet in most areas. As a result, spring rainfall was near seasonal despite the dry April.

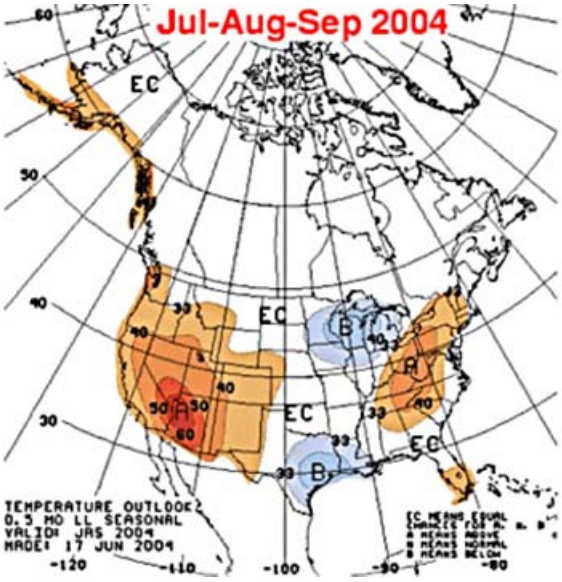


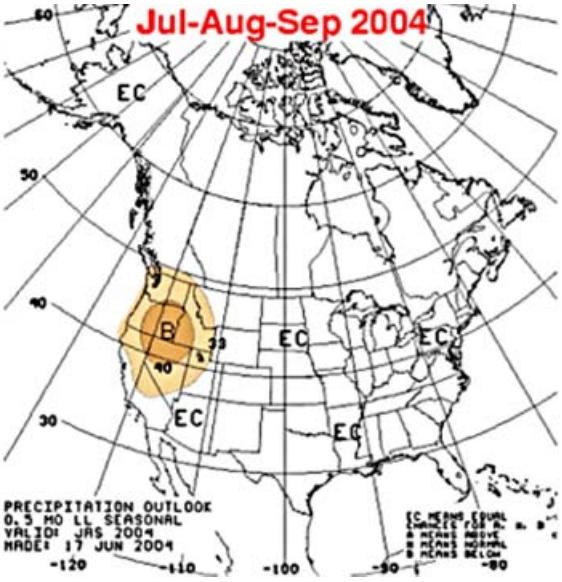
June was generally warm and dry. However, a storm dumped heavy amounts of rain along the Columbia River from southeastern Washington into western Oregon early in the month. The first hot, dry spell of the summer occurred the latter half of the month, drying fuels and raising fire danger.

Drought is also a good predictor of active fire seasons because it lowers the moisture content of both the live and dead fuels, making them more flammable. Long-term drought can also adversely affect forest health by stressing trees and increasing disease and insect infestation. Rainfall deficit, over the past five years, has most of eastern Oregon and eastern Washington classified as “very dry to extremely dry” by the Standardized Precipitation Index.



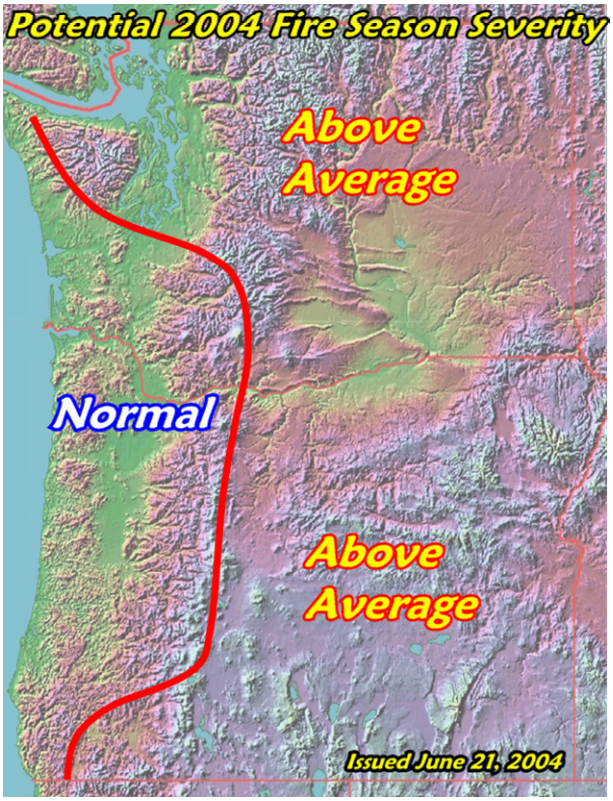
Last year’s El Nino conditions (unusually warm water in the central Pacific Ocean) ended and Neutral conditions (near normal sea surface temperature) are forecast to persist through the summer. Long-range weather forecasts are based in part upon continuation of Neutral conditions in the central Pacific. The forecast for July through September is for warmer-and drier-than-usual weather throughout Washington and Oregon. This is in agreement with a recent trend toward warmer and drier summers in the Pacific Northwest that began in the mid-1980s. The five-year drought is expected to continue in eastern Oregon and eastern Washington, with drought conditions expanding into western Washington and northwestern Oregon.





Fire Season Assessment: Weather trends and fuel moisture indicators correlate very well with past fire seasons in the Northwest and are the basis for this year's fire season severity assessment. The 2004 outlook calls for an **ABOVE AVERAGE fire season in eastern and northwestern Washington and in eastern and southwestern Oregon** (see map) due to these factors:

- Continued long-term drought (5 years) in eastern Oregon and eastern Washington
- A drier-than-normal winter in eastern Washington and in extreme north-eastern Oregon
- Below-normal April 1 snowpack
- A warmer and drier-than-normal March and April
- A rapid and earlier-than-usual snowmelt
- A drier than normal June in most areas
- Multiple rangeland grass crops in eastern Oregon and eastern Washington
- Near-to above-average fire danger indices (late June)
- Long-range forecasts and historical records that favor a drier-than-normal summer
- Two to three episodes of dry lightning that normally occur during the summer



Management implications for an ABOVE-AVERAGE fire season:

- An elevated risk of long-duration timber fires in eastern Washington and eastern Oregon, **especially from Wenatchee/Okanogan southward along the east slopes of the Cascades into the Klamath Falls/Lakeview area**
- An increased threat of extreme fire behavior conditions (i.e. crown fires, long-range spotting, plume dominated fires)
- More and larger range fires than in 2003
- An increased threat to public and firefighter safety during critical fire weather and extreme fire behavior conditions
- A higher-than-normal demand for resources of all types (crews, engines, helicopters)
- An active fire season in multiple areas of the western United States, resulting in stiff competition for resources

With any fire season assessment, the occurrence of dry lightning is always the wild card. The amount and location of dry lightning (or the lack thereof) can rapidly change the character of the fire season. The 2004 fire season assessment is based upon a normal amount (2-3 significant episodes) of summer lightning.

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Introduction and Objectives

The following report is the 2004 Northwest Fire Season Severity assessment based upon seasonal precipitation patterns, snowpack data, drought, snowmelt dates, fire danger indices, fuel moisture information and long-range weather forecasts for the summer and fall. The potential severity of the fire season is determined using statistical techniques that correlate weather, fuel moisture, and fire danger information with historical fire activity and resource demand records. This is the final seasonal assessment for 2004. It will be followed by 10-Day Fire and Weather Assessments (issued Tuesday and Friday) through the remainder of the fire season.

B. Current Conditions

Southern Oscillation:
Winter 2003-2004 experienced a return of Neutral conditions (neither La Nina nor El Nino) in the tropical Pacific Ocean (Figure 1). El Nino and La Nina are phases of a naturally-occurring climatic cycle in the tropical Pacific Ocean known as the Southern Oscillation, which occurs at intervals of two to seven years. El Nino occurs when sea surface temperatures (SST) are warmer than normal. La Nina is characterized by cooler than usual temperature. Neutral conditions exist when sea surface temperatures are near average. El Nino and La Nina affect global weather patterns, especially during winter in the Northern Hemisphere. El Nino tends to produce milder and drier-than-usual winters in the Pacific Northwest, and La Nina results in wetter and cooler winters. However, Neutral conditions appear to have little effect upon weather in the Pacific Northwest. Climatologists expect a continuation of Neutral conditions during the coming fire season.

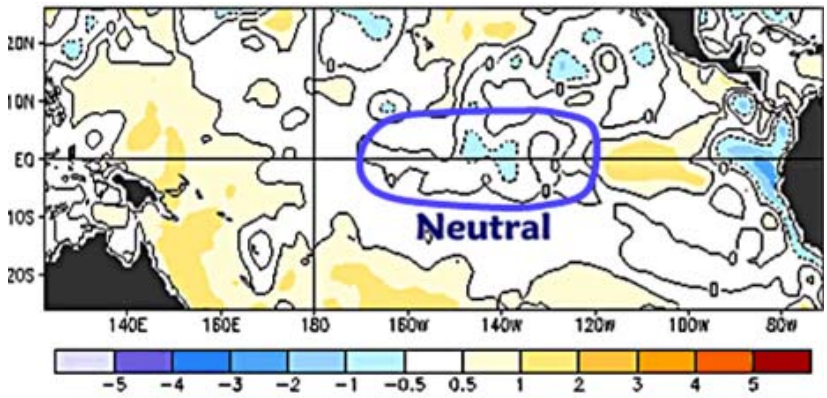
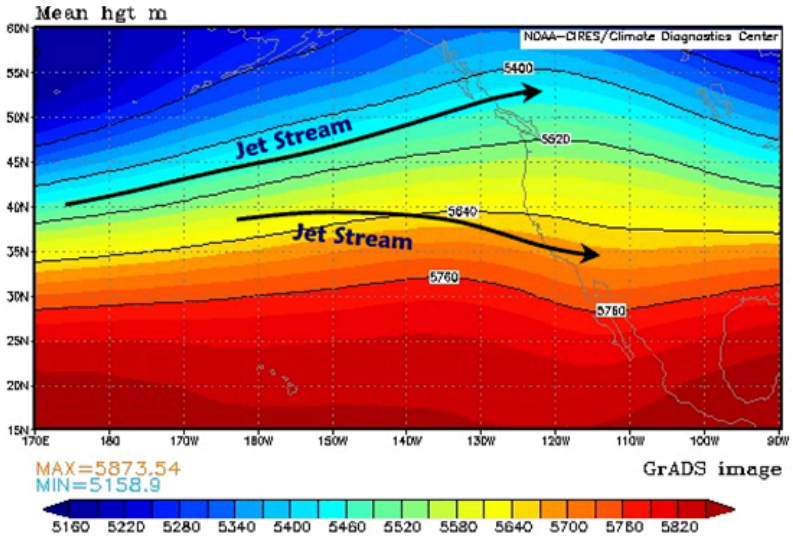


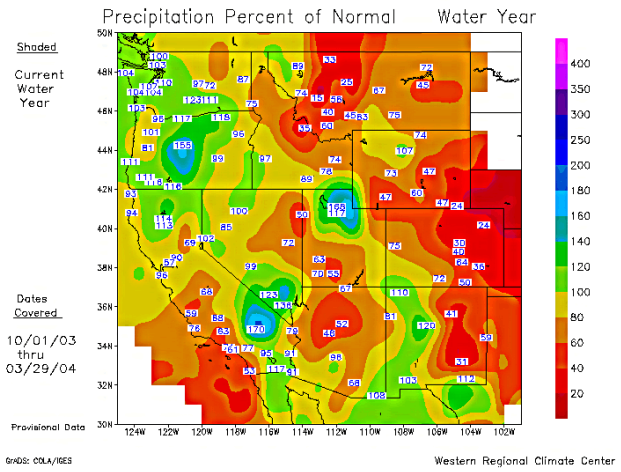
Fig 1 Sea surface temperature (SST) anomalies March 17, 2004

Fig 2 Average 500mb Flow / Jet Stream
Winter 2003 - 2004



Winter Weather:
Washington and Oregon experienced cool, wet weather through much of the winter as the jet stream pushed a series of storms into southwestern Canada and the Pacific Northwest (Figure 2).

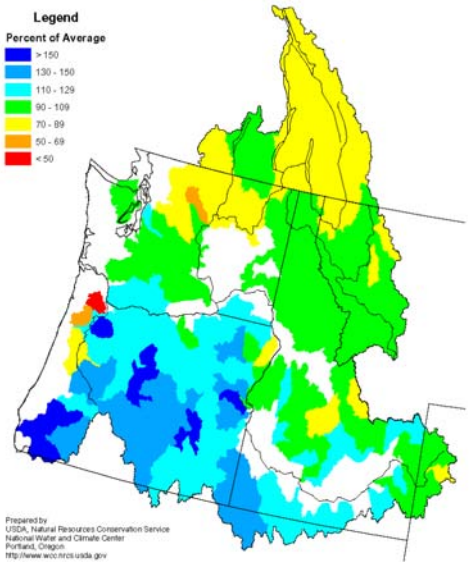
Fig 3



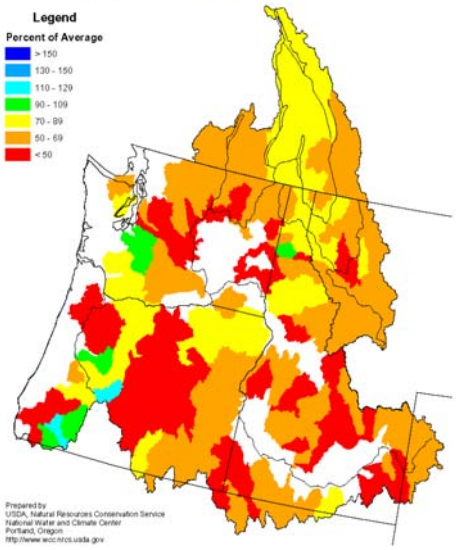
The latter part of December and the first part of January were particularity cold and wet, with heavy snow and freezing rain in the Puget Sound and Willamette Valley areas, locations west of the Cascades that normally do not get much snow. However, February and March turned warmer and drier than usual. This marked change in weather resulted when the jet stream split, forcing storms primarily into California. Thus, the Pacific Northwest winter of 2003-2004 can best be described as highly variable due to large swings in the jet stream. Although portions of southern and eastern Oregon reported above-normal precipitation in November through March, most of the Northwest received near-average amounts. The driest locations extended across northern and eastern Washington into northeastern Oregon (Figure 3), where winter moisture was only 75-85% of normal.

Snowpack: Mountain snowpacks were above normal throughout much of the winter, except in north central Washington. Oregon's March 1 snowpack (Figure 4) was 125% of normal, well above what it had been the previous winter. Washington's snowpack wasn't quite as good, at 95% of average. However, the Wenatchee/Okanogan area in north-central Washington was worse than 2003, with only 75% of average. Mountain snowpacks normally continue to accumulate during March, peak around April 1, and then gradually melt through the middle of June. This year, however, the snowpack peaked around the middle of March, two to three weeks earlier than usual. As a result, the April 1 snowpack dropped to just 88% of normal in both Wash-ington and Oregon. Warm, dry April weather further depleted the snowpack to 50-65% of average by May 1 (Figure 5), with some basins in eastern Oregon well below 50%. Although, the overall snowpack was better than last year, it was still below the long-term average and insufficient to fully moisten large dead fuels.

Mountain Snowpack as of March 1, 2004 **Fig. 4**



Mountain Snowpack as of May 1, 2004 **Fig. 5**

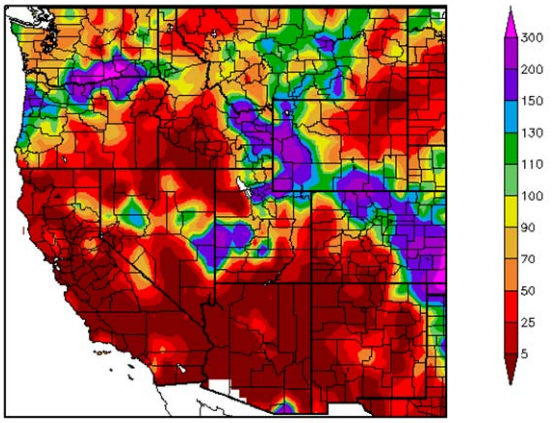


Snowmelt Date: Snowmelt date (derived from SNOTEL stations) correlates very well with fire season severity, especially in timber fuels. An earlier than usual snowmelt typically precedes an above-average fire season in the

Northwest, while a late snowmelt date has proven to be a good indicator of mild fire seasons. This year's Washington snowmelt date is 2-3 weeks earlier than usual and Oregon's is about 1 week early. Washington's snowmelt date is similar to 2001 and 1994, both of which experienced severe fire seasons.

June Rainfall: June rainfall, when combined with winter snowpack, correlates well with active fire seasons. With this year's below-normal snowpack, June would have to be much wetter than usual to mitigate the threat of an above-average fire season. Most of Washington and Oregon experienced a drier-than-usual June (Figure 6) except for an area along the Columbia River from southeastern Washington into western Oregon.

Fig. 6 Percent of Normal Precipitation (%)
6/1/2004 – 6/23/2004



Generated 6/24/2004 at HPRCC using provisional data. NOAA Regional Climate Centers

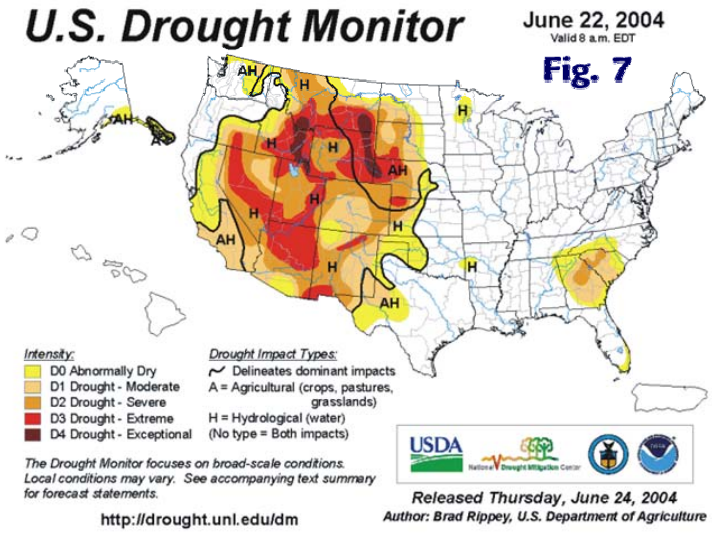
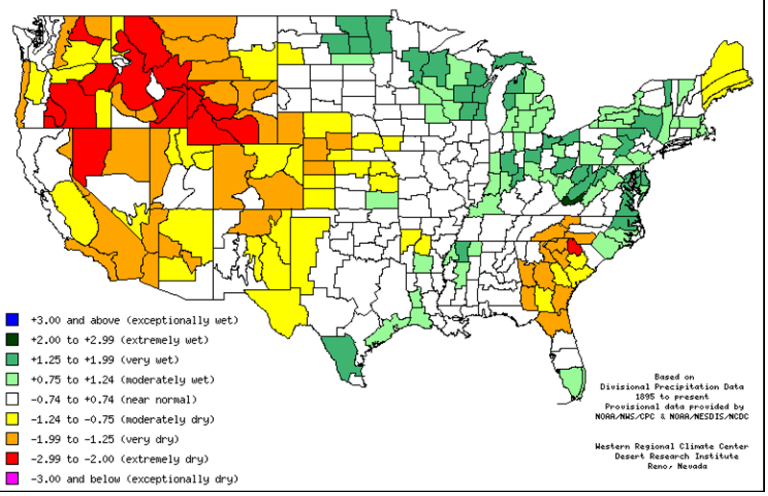


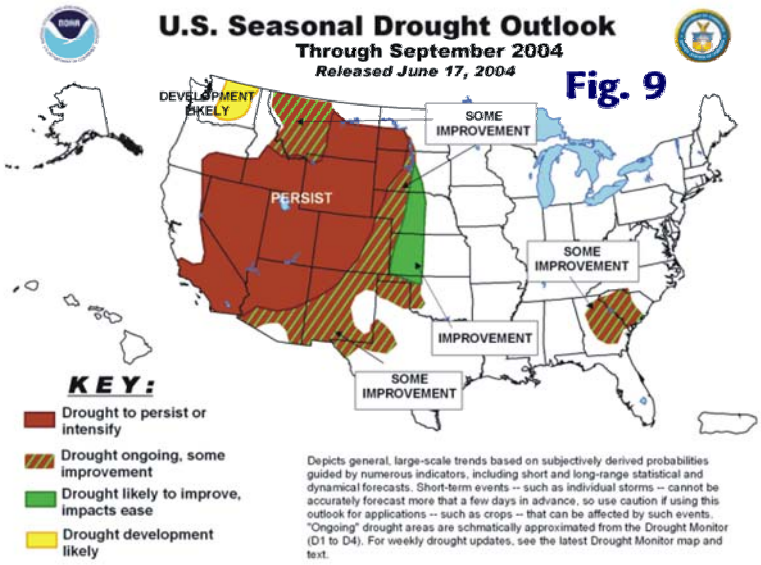
Fig. 7

Drought: Drought is also a good predictor of active fire seasons because it lowers the moisture content of both live and dead fuels, making them more flammable. The June 22 U.S. Drought Monitor (Figure 7) shows moderate drought conditions in Washington and moderate to severe in portions of eastern Oregon.

The Standardized Precipitation Index (SPI) is a good measurement of drought. Unlike other drought indices (i.e. Palmer Drought Index), the SPI has the capability to classify drought over multiple years. The 60-month SPI (Figure 8) shows most of eastern Oregon and eastern Washington as "very dry to extremely dry" over the past five years. Long-term drought can adversely affect forest health by stressing trees and increasing disease and insect infestation.

Fig. 8 60-month Standardized Precipitation Index through the end of May 2004





The U.S. Seasonal Drought Outlook through September 2004 (Fig. 9) calls for "Developing Drought" in central and eastern Washington and "Persistent Drought" in south-eastern Oregon. This is due to the July through September forecast for below-normal rainfall and above-normal temperatures in Washington and Oregon.

Vegetation Condition: Fuel conditions in many areas of the Pacific Northwest are becoming increasingly hazardous. Due to fire suppression and past management practices, forests are becoming denser and dead fuels are accumulating. This condition results in larger and more severe wildfires, especially within ecosystems in which frequent fire has been excluded, ultimately threatening forest and rangeland health.

Of the 47 million acres of federal land in the Pacific Northwest, approximately, 22.6 million acres, or 47 percent, are considered to be in the historically short-interval fire regime groups. The majority of these lands are located on the east side of the Cascade Mountains.

Of these short-interval fire regime acres, 73 percent, or 16 million acres, currently pose a condition at greater risk of severe fires (Condition Class 2 and 3) than would have existed historically (Figure 10). Condition classes are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components, such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire exclusion, timber harvesting, grazing, introduction and establishment of exotic plant species, insects or disease (introduced or native), and other past management activities.

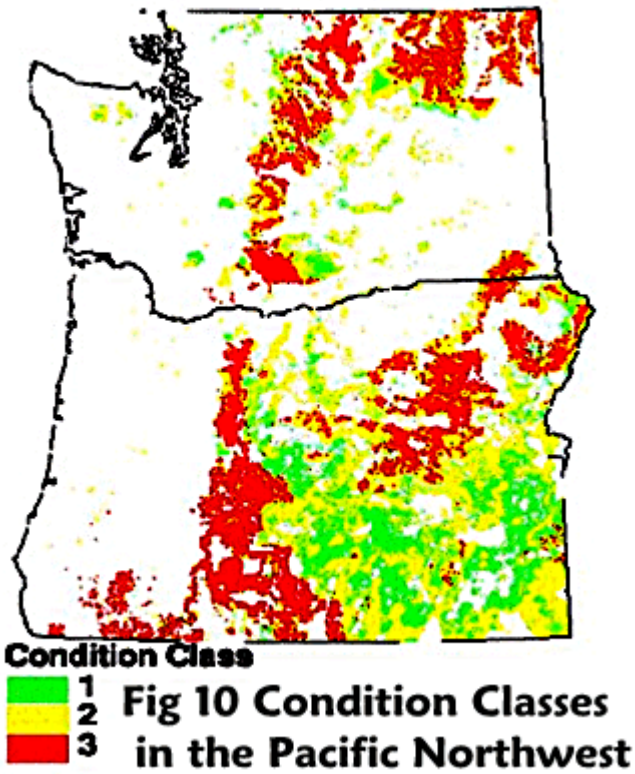
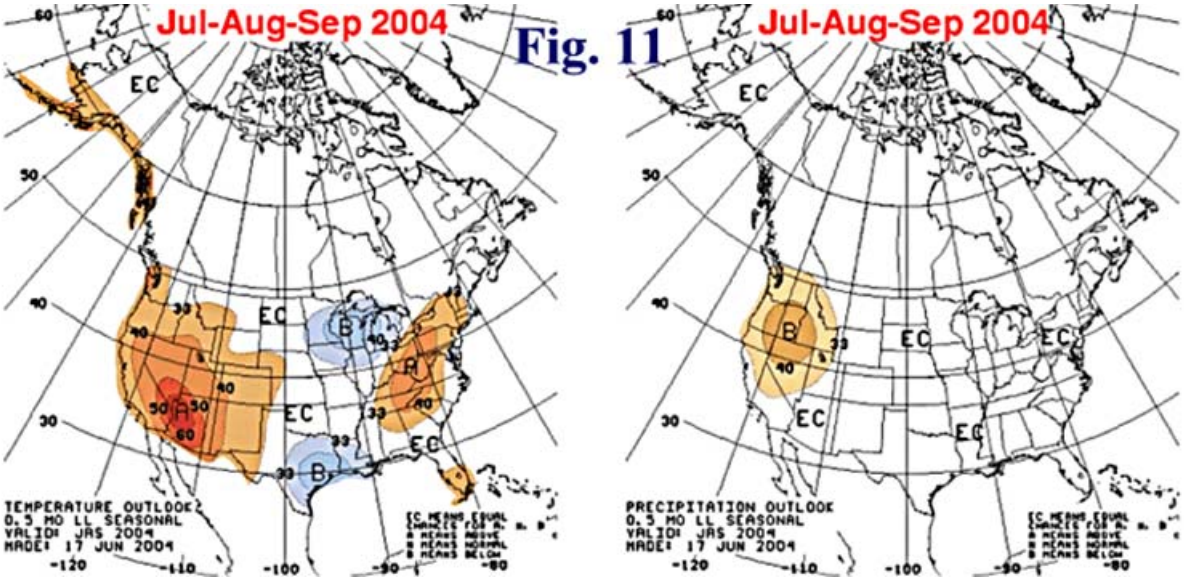


Fig 10 Condition Classes in the Pacific Northwest

C. Climate and Weather Outlook

Last year's El Nino conditions (unusually warm water in the central Pacific Ocean) faded and Neutral conditions prevailed this winter and are forecast to persist through this summer. Long-range weather forecasts are based in part upon continuation of near-normal sea surface temperatures in the central

Pacific. The forecast for July through September (Figure 11) is for a warmer and drier-than-usual summer in Washington and Oregon. This is in agreement with a recent trend toward warmer and drier summers in the Pacific Northwest that began in the mid-1980s. Though lightning outlooks for the summer are not available, the Northwest historically receives two-to-three episodes of problem lightning every summer, with the first event around July 18.



D. Fire Occurrence and Resource Outlooks

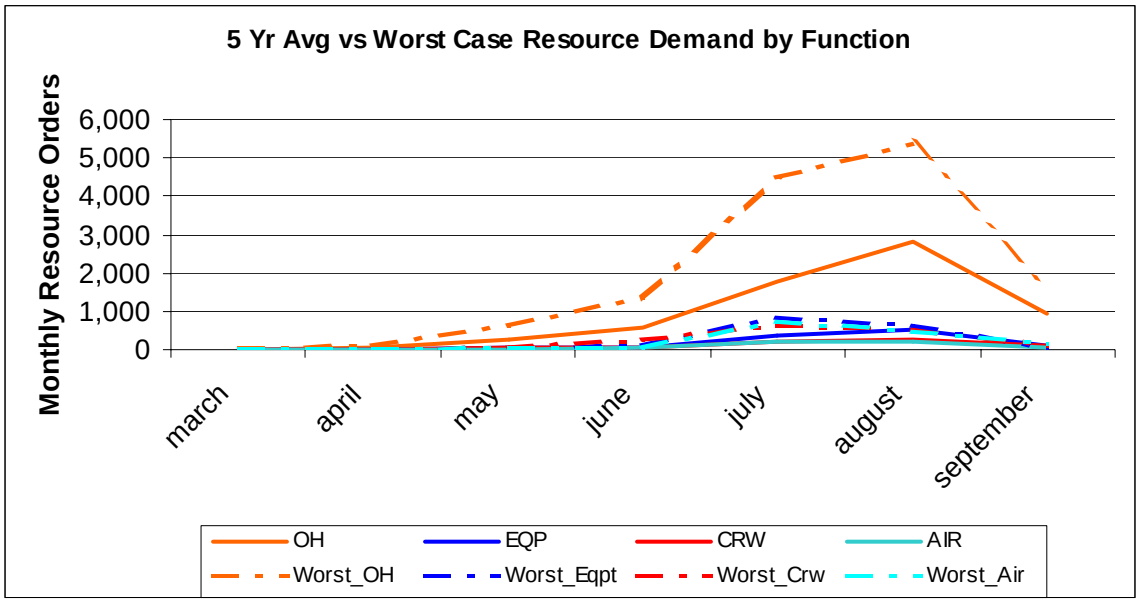
The best predictor of large (97th percentile) fires in the Northwest is … fires. In other words, our fire problem is the result of mass ignitions from lightning episodes.

Analysis has indicated the probabilities of a lightning episode, denoted in the table below as P(episode), is defined as 50 fires per day for 3 days. The probability of multiple episodes in any month, recorded as P(multiEpi) is also shown. Finally, examining all lightning episode dates, the table shows the date around which lightning events have clustered over a 17-year period.

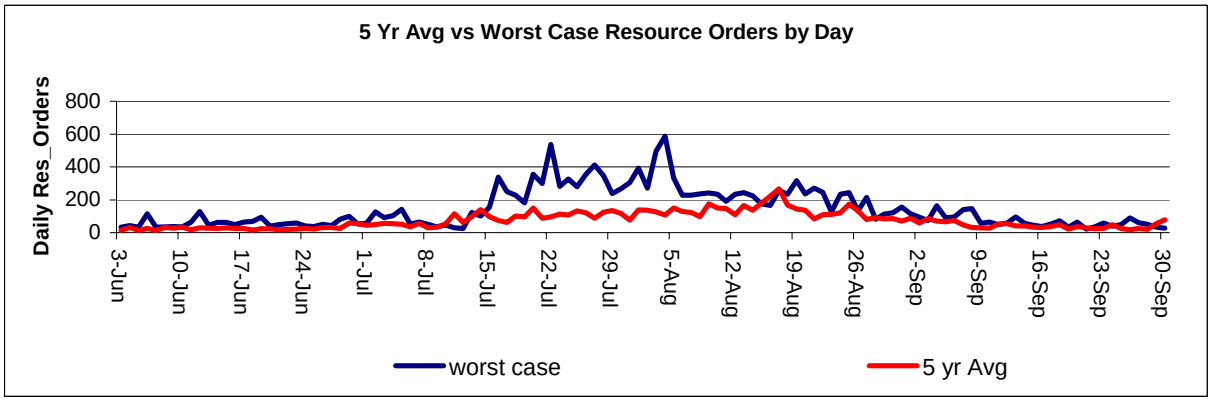
	May	June	July	August	Sept	Oct
P(episode)	0%	12%	71%	71%	35%	0%
P(multiEpi)	0%	6%	18%	35%	0%	0%
CenterDate		6/21	7/24	8/6	9/5	

The table below shows the average number of resource orders received by the Northwest Coordination Center over a five-year period. The year 2002 is used to illustrate the worst-case scenario.

	AVG Orders	WORST Orders	AVG OH	WORST OH	AVG EQP	WORST EQP	AVG CRW1	WORST CRW1	AVG CRW2	WORST CRW2	AVG HEL1	WORST HEL1	AVG HEL2	WORST HEL2
March	30	58	23	44	2	10	0	0	0	0	0	1	0	0
April	72	175	58	117	9	11	1	0	0	0	1	0	0	0
May	354	878	266	610	31	72	11	6	19	45	1	2	1	4
June	751	1,946	590	1,355	45	123	16	20	56	220	2	1	4	6
July	2,606	6,271	1,748	4,475	341	836	73	127	152	467	18	48	21	56
August	4,065	8,262	2,837	5,381	519	651	175	171	163	273	28	44	21	26
September	1,231	2,557	934	1,612	81	70	47	43	43	36	8	11	7	10



Resource demand by day coincides with calculated fire severity (a function of minimum relative humidity), lightning episodes and team deployments. The third week in July and the middle of August are most likely to show the highest severity index ratings, lightning episodes, multiple ignitions, large fire development, team deployments and, therefore, the greatest resource demand.



E. Fire Season Assessment

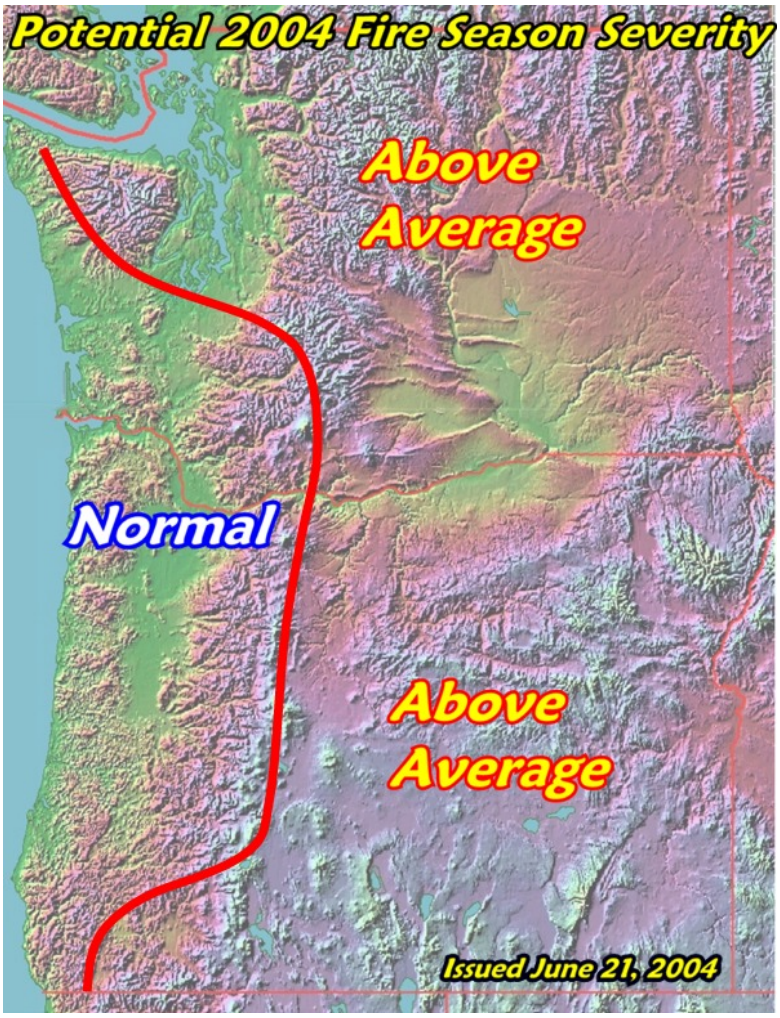
The following weather factors correlate well with fire season severity in the Northwest Geographic Area: winter precipitation, mountain snowpack, drought, snowmelt date, June rainfall, and the amount of summer dry lightning. These factors, together with fuel moisture and fire danger trends, were the basis for this year's fire season severity assessment. The 2004 outlook calls for an **ABOVE-AVERAGE fire season in eastern and northwestern Washington and in eastern and southwestern Oregon** (see map).

The annual number of federal and state acres burned (1970-2003) is used to classify the severity of the fire season as either: Above-Average, Average, or Below-Average. Statistically, Washington and Oregon can expect about 4,000 fires and 150,000 acres burned during an average fire season. Approximately 340,000 acres were burned on state and federal land in 2003 and this year's projection is between 350,000

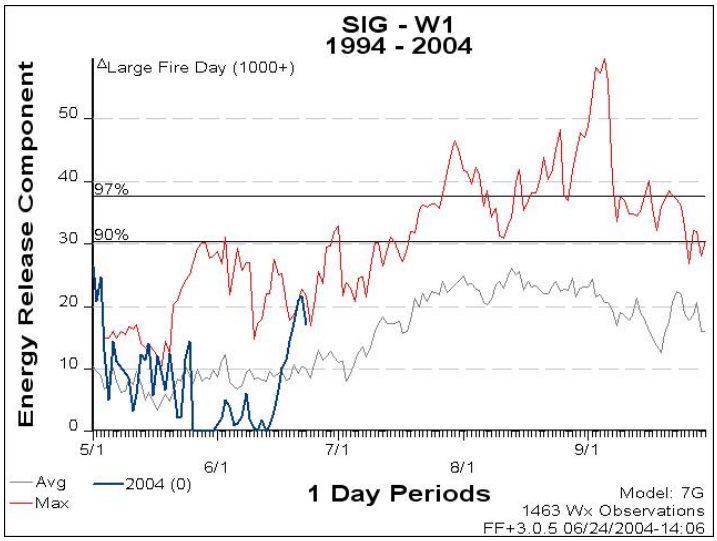
and 400,000 acres burned. A significant increase in the number of range fire acres is likely this year in Oregon compared to 2003.

The forecast **ABOVE-AVERAGE** 2004 fire season for much of Washington and Oregon is due to these factors:

- Continued long-term drought (5 years) in eastern Oregon and eastern Washington
- A drier-than-normal winter in eastern Washington and in extreme northeastern Oregon
- Below-normal April 1 snowpack
- A warmer and drier-than-normal March and April
- A rapid and earlier-than-usual snowmelt
- A drier-than-normal June in most areas
- Multiple rangeland grass crops in eastern Oregon and eastern Washington
- Near-to above-average fire danger indices (late June)
- Long-range forecasts and historical records that favor a drier-than-normal summer
- Two to three episodes of dry lightning that normally occur during the summer

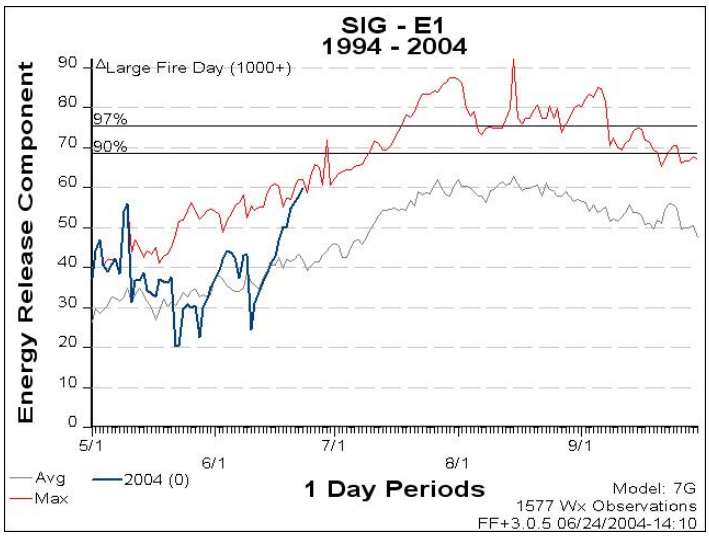


The following section will detail the potential fire season severity by area within Washington and Oregon.



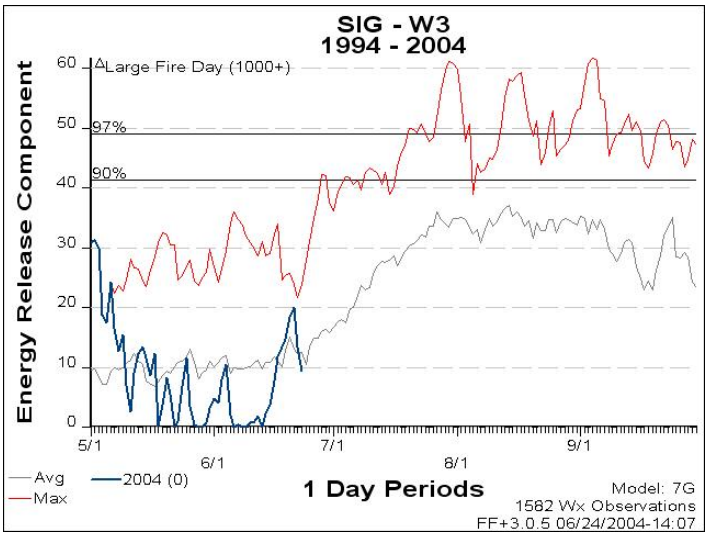
Western Washington Winter snowpack ranged from 82% of normal on the Baker/Skagit River Basin to 104% on the Lewis/Cowlitz Basin. Warm, dry weather in April rapidly melted the snowpack, especially north of Mt. Rainier, which experienced snowmelt dates 2-3 weeks earlier than usual. May rainfall was near-to slightly-above normal. However, dry weather returned in June, especially the last half of the month. The Energy Release

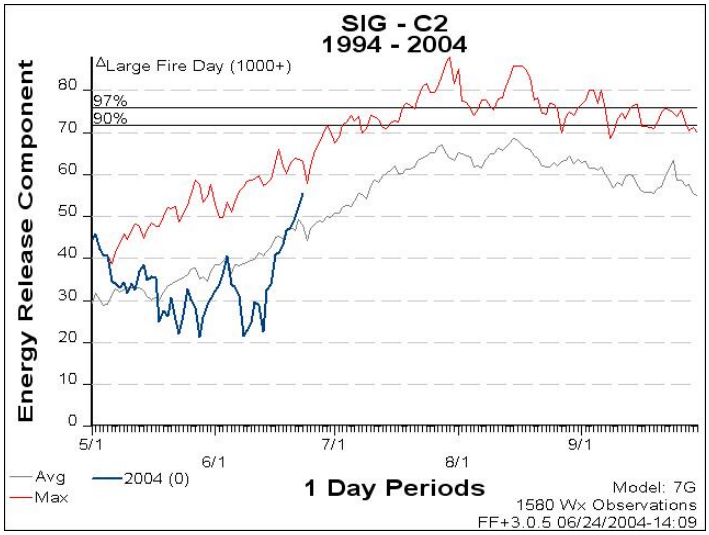
Component (ERC) is currently near the 10-year maximum for late June. The 1,000 HR FM is between 20 and 30%. The long-range outlook slightly favors a drier-than-normal summer. Current and forecast information indicates that northwestern Washington is at an above-average risk of large fires. The greatest risk will be in August and September during "East Wind" events.



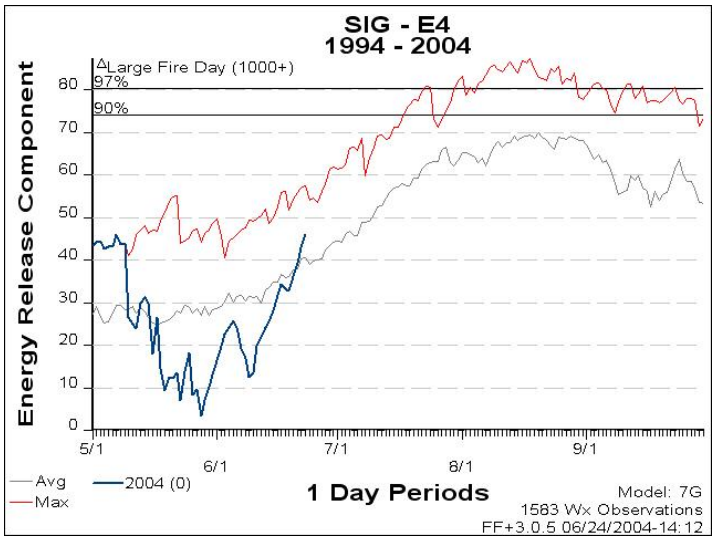
Eastern Washington Winter snowpack ranged from 72% of normal on the Chelan/Wenatchee/Methow River Basins to 97% on the Lower Yakima Basin. Warm, dry weather in April rapidly melted the snow with most basins below 50% by May 1. Snowmelt dates were 3-4 weeks earlier than usual in the Okanogan/Wenatchee area, similar to 1992, 1994 and 2001. May was wet, especially in the Spokane area. June was drier than usual with hot, dry weather the latter part of the month. Multiple grass crops were reported in the Columbia Basin, resulting in good fuel continuity. Much of this grass has not completely cured yet, but will by the second of July. The Energy Release Component (ERC) is well above normal for late June and near the all-time maximum for the date (see graph). The 1,000 HR FM is between 9 and 11% on the Okanogan/Wenatchee, which is more typical of mid-summer rather than June values. The northeastern corner has more seasonal values at 13 and 20%. The east slopes of the Cascades northward to the Okanogan Valley have been drier than usual for last five years. The long-range outlook is for a drier-than-normal summer. Eastern Washington has an above-average risk of large fires with **severe conditions possible on the Okanogan/Wenatchee NF**. The greatest threat will be between July 15 and September 15.

Western Oregon (except Southwest) Winter snowpack was 99-109% of normal on the Willamette and Lower Columbia River Basins. Valley rainfall was slightly below normal. However, a major snow and ice storm occurred in early January in the Portland/Salem area. Warm, dry weather rapidly depleted the snowpack in April, and it was only 65-75% of average by May 1. May was generally wet and cool, resulting in snowmelt dates that were about a week earlier than usual. Cool, wet weather continued the first part of June, with heavy rainfall amounts the second week. Warm, dry weather returned the last half of the month. The Energy Release Component (ERC) has been below normal most of June (see graph) but is now near average. The 1,000 HR FM is between 20 and 30%. The long-range outlook favors a drier-than-normal summer. Based upon current and forecast information, Western Oregon has an average risk of large fires with the greatest threat during "East Wind" events in late August and September.

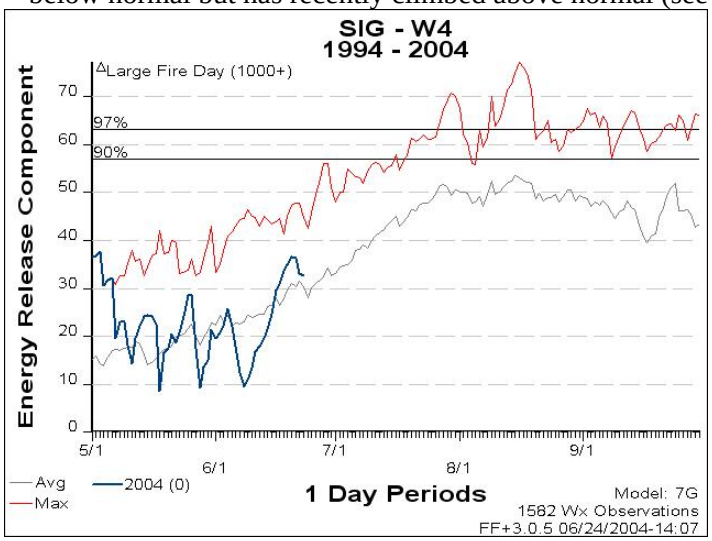




Central Oregon Winter snowpack was 75-100% of normal in Central Oregon. The John Day River Basin recorded its 5th consecutive year of below-normal snowpack. April was warm and dry resulting in rapid snowmelt. The Deschutes River Bain was 78% of normal by May 1, and John Day only 12% of average. May and the first part of June turned wet and cool. As a result, snowmelt slowed at the higher elevations and snowmelt dates were only less than a week early. The latter half of June tuned warm and dry. The SPI drought index indicates "extremely dry" conditions over the past five years. The 1,000 HR FM is between 10 and 15%, which is near normal for late June. The Energy Release Component (ERC) is above normal for late June and is near the maximum for the date (see graph). The long-range outlook is for a warmer and drier-than-usual summer. Central Oregon, which includes the Ochoco and Deschutes NFs, the Prineville BLM and the Warm Springs Agency, has the potential for an above average fire season. The greatest threat will occur between July 15 and September 15

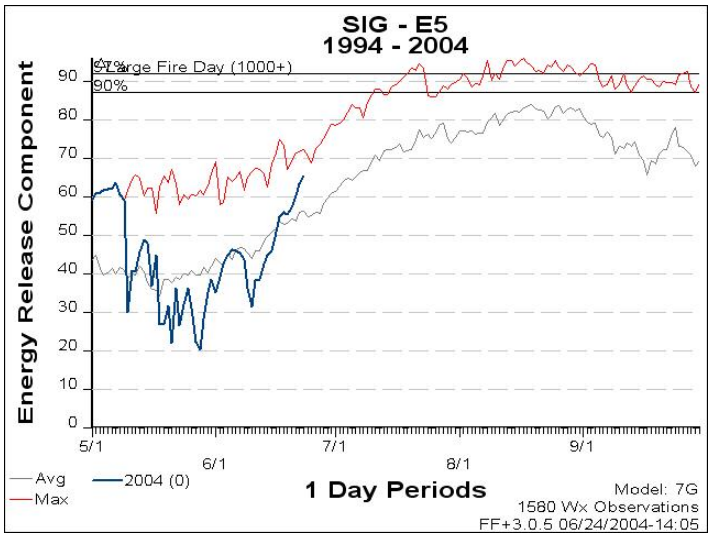


Northeast Oregon Winter snowpack was better than 2003, but still only 70-90% of normal. Warm, dry weather during April rapidly melted the snowpack, and by May 1, it was only 25-50% of average. May and early June turned wet and cool. This delayed snowmelt at the higher elevations, and overall, snowmelt dates were about normal. Warm, dry weather returned the latter part of June. The SPI drought index indicates "extremely dry" conditions over the past five years. The 1,000 HR FM is between 9 and 18%. The Energy Release Component (ERC) has been below normal but has recently climbed above normal (see graph). The long-range outlook is for a warmer and drier-than-usual summer. Northeast Oregon has the potential for an above-average fire season. The greatest threat will be between late July and September 15.



Southwest Oregon Southwest Oregon received near-to above-average winter rainfall for the second year in a row. The Rogue/Umpqua River Basin snowpack was 108% of normal, nearly twice that of 2003. Warm, dry April weather depleted the snowpack to 88% of normal by May 1. Snowmelt dates were less than a week earlier than usual. May and early June were wet and

cool, especially north of the Umpqua Divide. However, the Rogue and Applegate Valleys remained drier than usual. Medford recorded only .18 of an inch of rain in June. The Energy Release Component (ERC) has been below normal most of June, but has recently climbed slightly above normal (see graph). The 1,000 HR FM is between 13 and 18% south of the Umpqua Divide and above 20% north of the Divide. The long-range outlook is for a hot, dry summer. The Rogue, Applegate and Illinois Valleys in Southwest Oregon have an above-average risk for large fires this summer extending into early October.



Southeast Oregon Mountain snowpack was 65-85% of normal this year. However, low elevation precipitation was near the average. Warm, dry weather during April resulted in rapid snowmelt, and the May 1 snowpack was 30-50% of average. May turned cool and wet. However, dry weather returned in June. Multiple grass crops were reported resulting in good fuel continuity. The grass is just now starting to cure. The Energy Release Component (ERC) has been below normal most of June (see graph), but has recently climbed above the norm. Live fuel moisture on the Vale BLM District (measured through the Great Basin Live Fuel Moisture program), was measured at 150% in mid June, which is near normal. The long-range outlook is for a hot, dry summer. Southeast Oregon has an above average risk for large fires this summer with the greatest threat between July 15 and September 15.

F. Management Implications and Concerns

Repercussions of the extended drought and predicted summer dryness will have a profound impact on the severity of the 2004 fire season in eastern and southwestern Oregon, and eastern and northwestern Washington. The below-normal winter snowpack and early snowmelt did not provide enough moisture to mitigate this threat. Long-term drying over the past five years allows large dead fuels to contribute to intense burning, plume development and long-range spotting. It also stresses live fuels, increasing the potential for combustion. Drought-stressed live fuels are more vulnerable to insects and disease, ultimately adding to the dead fuel load. Atmospheric dryness, low soil moisture and low relative humidity also have a negative impact on NFDRS indices, the Energy Release Component (ERC), and 100-hour dead fuel moisture, all of which are associated with the potential for large fire development in the Northwest Geographic Area. Management implications for the scenario illustrated above include:

- A very active fire season in eastern Washington and eastern Oregon, and above normal activity in western Washington and southwestern Oregon
- An elevated risk of long-duration timber fires in eastern Washington and eastern Oregon, **especially from Wenatchee/Okanogan southward along the east slopes of the Cascades into the Klamath Falls/Lakeview area**
- An increased threat of extreme fire behavior conditions (i.e. crown fires, long-range spotting, plume dominated fires)
- More and larger range fires than in 2003
- An increased threat to public and firefighter safety during critical fire weather and extreme fire behavior conditions

- A higher than normal demand for resources of all types
- An active fire season in multiple areas of the western United States, resulting in stiff competition for resources

The wild card is always lightning occurrence. Early snow melt, poor soil moisture, low stream flow, poor ground water and pond recharge, a dry airmass and dry fuels indicate a potentially active fire season. However, they do not necessarily guarantee it. With the number of human-caused fires in the Northwest at a static level (due to an aggressive and successful prevention program), it would not be impossible for the Northwest to experience a near-normal fire season in the absence of dry lightning episodes. In addition, short-term (10 day) severity forecasts for well-defined sub-geographic areas (Predictive Service Areas) become increasingly important. Effective severity forecasts predicting atmospheric conditions, most likely to result in lightning (breakdown of the upper level ridge) allow resources to be pre-positioned in areas of greatest potential. Previous experiences in the Northwest bear witness to the effectiveness of these forecasts in pre-positioning resources.

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