

## *Fire Danger Rating Operations Plan 2013*

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### *Organization*

The Northwest Coordination Center (NWCC) is divided into two functions, Emergency Operations and Predictive Services.

The Emergency Operations serves as the focal point for providing logistical support to ongoing and anticipated wildland fire activity for all federal and cooperating state agencies in Oregon and Washington.

Predictive Services was created in 1997 as an enhancement of the Intelligence Coordinator position. Emphasis has centered on the development of scientifically based innovative solutions in a collaborative, team-oriented environment involving intelligence staffers, fire weather meteorologists, fire behavior analysts, and weather and climate research scientists. The goal of Predictive Services is to help promote more proactive resource decision making.

### *Introduction*

With regards to daily fire operations, the primary responsibility of Predictive Services at NWCC is to provide sound guidance to regional and national resource managers concerning current and projected “**Significant Fire**” potential throughout the Northwest Region. The goal of this guidance is to help facilitate efficient and effective resource decisions that make best use of available resources.

Predictive Services provides various levels of guidance on several different time scales including “*seasonal*” outlooks “*monthly*” outlooks and “*daily*” outlooks for the next 7 to 10 days. This Operating Plan will outline NWCC’s operational “**7-Day Significant Fire Potential Model**” material (heretofore referred to as “model”) including other supportive guidance material as well as the weather monitoring infrastructure designed to support it.

This “model” is run each morning and, normally, results will be posted to our web site by about 0900 PDT usually commencing around May 1 and continuing through the entirety of the “fire season”. The primary purpose of the “model” is to predict the probability for a “**Significant Fire Event**” for each of the next 7 days. By “significant fire event”, we mean the following.

<p>“<b>Significant Fire Event</b>” – A fire of such size or complexity that will likely require mobilization of additional resources from outside the area in which the fire situation originates.</p>
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## **Weather and Fuels Monitoring Infrastructure**

In order to facilitate the assessment of fire potential with some degree of spatial resolution we have broken the region up into a subset of smaller forecast areas. In addition, we have established a manageable sub-network of “key” weather and NFDRS reporting sites. These RAWs will be used for monitoring both weather and fuel conditions needed in the determination of fire potential.

The forecast areas were determined by using a statistical “cluster” algorithm to group existing RAWs into relatively homogeneous sub-groups. The goal of this type of analysis is to establish forecast areas where all RAWs react similarly to daily weather regimes. All RAWs were correlated with one another based on daily minimum relative humidity. Highly correlated RAWs were grouped together forming distinct areas. On an average, RAWs within any particular area tend to correlate better with one another than they do with RAWs in adjoining areas. This analysis resulted in 12 distinct “Predictive Service Areas” or **PSAs**. A map of our PSAs is included as Appendix 1.

The Pacific Northwest possesses a relatively dense network of over 200 fire danger RAWs with as many as 30 located in some of our PSAs. Many of the RAWs give redundant information, at least for regional scale fire danger rating. We decided to pare the network down to a more manageable number. Again, RAWs within each PSA were correlated with one another and redundant RAWs discarded. This resulted in a sub-network of 73 unique “key” RAWs across the region. These 73 RAWs represent the core RAWs to be used in our “Significant Fire Potential” Model. A listing of the Key RAWs in each PSA is contained within Appendix 2.

### **Quality Control**

NFDRS output is a major factor in determination of fire potential. Poor quality weather observations will guarantee the failure of NFDRS, as well as other programs that rely on accurate weather data. This could lead to costly management decisions at the local, regional and national level and ultimately could affect firefighter safety. Therefore, a program of quality control of RAWs observations is a critical management responsibility. Data should be monitored at all levels. A portion of the responsibility for quality control of RAWs data resides here at NWCC. We collect and archive a full 24 hours of weather data from nearly all RAWs in the region daily. Informal monitoring of the data quality is undertaken. Discovered problems will be communicated to individual RAWs owners. In addition, a year-end report will be generated and distributed to the field summarizing the timeliness of daily entry of weather into NFDRS by the various field sites responsible for input of weather into WIMS.

### **Fire Potential Model**

Ten day projections of fire activity are made daily at NWCC. Forecasted elements include *daily number of ignitions*, *daily probability of a new significant fire*, *expected number of new significant fires* and the *expected duration of any new significant fires*. Projections will be made for each PSA.

For purposes of our “model”, we have chosen to measure “significant fire” in terms of its size. The rationale for this is that the occurrence of large fires represents a scenario where outside resources will be needed, costs escalate and regional and national resource managers get involved.

We have adopted the following determination for a “**Large Fire**”.

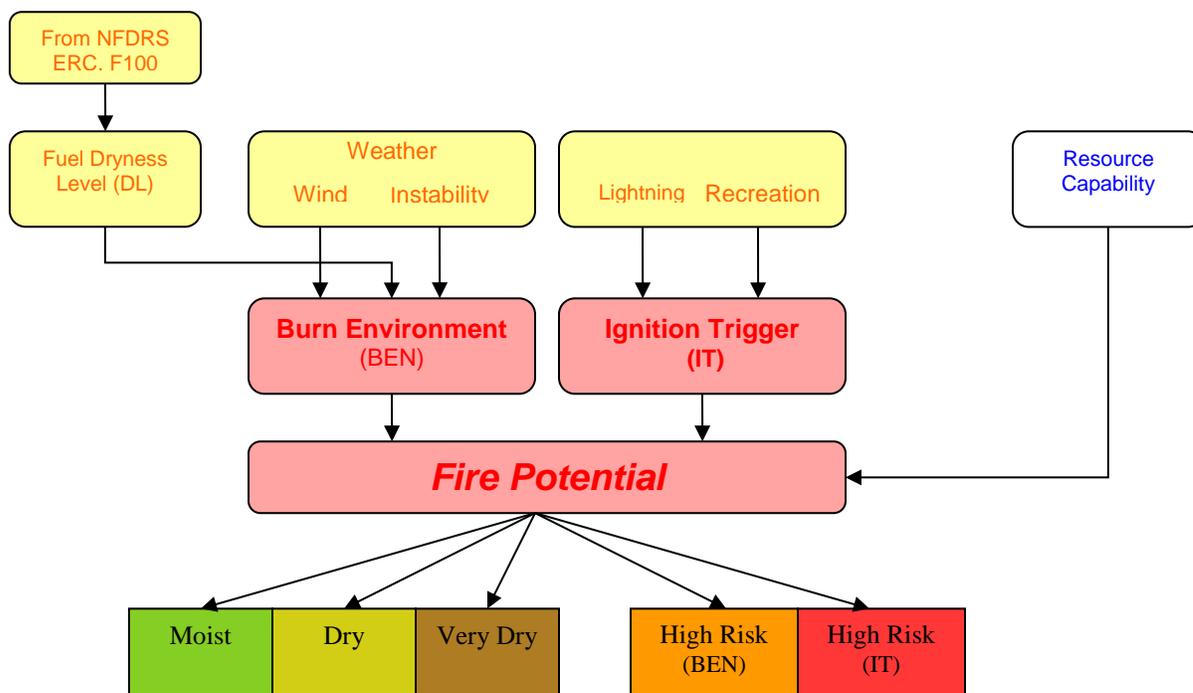
“**Large Fire**” – A fire meeting or exceeding the size of the 95<sup>th</sup> percentile of historic “daily largest fires” for all June/September fire days. This value will be rounded as follows:

When the “95<sup>th</sup> percentile fire” is,

1. >10,000 acres – round to nearest 1000 acres
2. 1000-10,000 acres – round to nearest 500 acres
3. 100-1000 acres – round to nearest 100 acres
4. <100 acres – round to 100 acres

This criterion results in a “large fire” size unique to each PSA, ranging from as small as 100 acres to as large as 10000 acres. [Appendix 2](#) specifies the size of a large fire for each PSA. “*Large Fire*” sizes will be updated periodically.

### Fire Potential Model NWCC



Our forecast for the daily probability of a large fire is the product of the assessments of the **Burn Environment (BEN)** and the presence or absence of an **Ignition Trigger (IT)**. **Resource Capability** is not formally a part of our Fire Potential model but will be subjectively factored into our forecast if thought to be significant. Our model must be thought of as a dynamic process and will improve over time as we continue to update it with new data and new research. Objective forecasts of fuel moisture, weather and ignition trigger events are made each morning at NWCC. These components are combined in our model to forecast the “*Fire Activity*” for each individual PSA for each of the next 10 days.

Fuel Dryness (Dryness Level) Changes have been made for the 2013 fire season

Fuel dryness is just one of several important components determining overall fire potential. Predicated on our research we have chosen either the NFDRS Energy Release Component for fuel model G (ERC) or the 100-hr fuel moisture (F100) as the basis for our Fuel Dryness Level (DL). Whichever of these components best delineates between 3 unique levels of large fire potential for a particular PSA is used for determination of the DL for that PSA. The values for both observed and forecasted ERCs or F100s represent the average of the “Key RAWs” for that PSA. The 3 levels for the DL are:

1. Green (DL1): Moist fuels... Very low (*\*conditional*) probability of a large fire
  2. Yellow (DL2): Dry fuels... Average (*\*conditional*) probability of large fires.
  3. Brown (DL3): Very dry fuels... Above average (*\*conditional*) probability for a large fire.
- \* Conditional upon getting ignitions

Following is the methodology for determining the DL.

1. First the “normal probability” for a large fire on any given *fire day* is determined for each PSA and is typically around 2-5 percent depending on the PSA (a rare event)
2. Once the “normal probability” has been determined for a particular PSA, the threshold ERC or F100 is set so that, when attained, the probability for a large fire is double the average. This DL is designated as brown (DL3).
3. Similarly, the threshold for the ERC or F100 where the probability of a large fire is half or less of average is designated as green (DL1).
4. Yellow (DL2) represents values of ERC or F100 falling between the thresholds for the brown and green DLs.

For each PSA, The fuel moisture parameter used for its DL determination along with their thresholds is included in **Appendix 2**. Associated large fire probabilities are also included.

Each morning we collect the observed NFDRS ERC and F100 for the previous afternoon from WIMS. This data is used to initialize our model. We then run raw grid point data from weather models through regression equations to generate temperature and relative humidity forecasts for each of our “key” RAWs for each of the next 10 days. These forecasts along with the observed ERC and F100 data are then fed through another algorithm which forecasts the daily average F100 and ERC-G for each PSA for each of the next 10 days. These ERC-G and F100 forecast values then determine our daily DL forecast for each of the next 10 days for each PSA. The 10-day forecasts of temperature, relative humidity, ERC-G, F100 and DL are posted daily on the NWCC Predictive Services web page.

The fuel moisture is only the first step in assessing the overall risk of a “large fire”. By itself, fuel moistures will typically give no greater than a 5% to 15% chance for a large fire. However, when fuel moistures are assessed in conjunction with other *Burn Environment (BEN)* parameters such as wind and instability and/or *Ignition Triggers* such as lightning amount these probabilities can be elevated to well above the 20% threshold that we use for issuing a “high risk” alert.

## Burn Environment

The burn environment, in our model, is determined from forecasted values of ERC or F100, wind, and atmospheric instability. These predictors relate to large fire occurrence by defining the underlying environmental fuel and weather conditions that will either aid or inhibit significant fire spread on any given day. We have algorithms that forecast the daily level of fuel moisture, wind and instability for each PSA.

Historic probabilities of large fires for combinations of fuel moisture, wind and instability have been determined. If our algorithms produce a significantly elevated probability of a large fire for a particular day and PSA, we may issue a “High Risk” alert for a large fire due to a critical *Burn Environment*. It will be designated with an ORANGE colored block on our 7-Day Significant Fire Potential Product.

## Ignition Triggers

Forecasted values of ERC or F100 are combined with an assessment of an **Ignition Trigger** potential to derive the probability of a large fire due to mass ignitions. Throughout most of the Northwest Region, the **number of daily ignitions** correlates better with the occurrence of large fires than any other single factor. Our analyses show that for particular levels of fuel dryness, as the number of ignitions increases so does the probability that a large fire will occur.

Unlike the burn environment which merely promotes or inhibits fire growth, an Ignition Trigger actually starts fires. If an ignition trigger event starts enough fires in the right places, available resources can be overwhelmed often resulting in a large fire. Occasionally, an ignition trigger event may be so overwhelming that many large fires result.

Ignition trigger events can be related to human activity or be natural (lightning). In the Northwest, high recreation events such as the 4<sup>th</sup> of July and the Labor Day weekend often lead to numerous ignitions and occasionally a large fire. But, by far the most critical Ignition Trigger event in the Northwest is **LIGHTNING!** Lightning not only can result in an overwhelming number of ignitions but ignitions are more likely to be in remote locations and in rugged terrain. The forecasting of significant lightning events is a major focus of the fire forecasters at Predictive Services, NWCC.

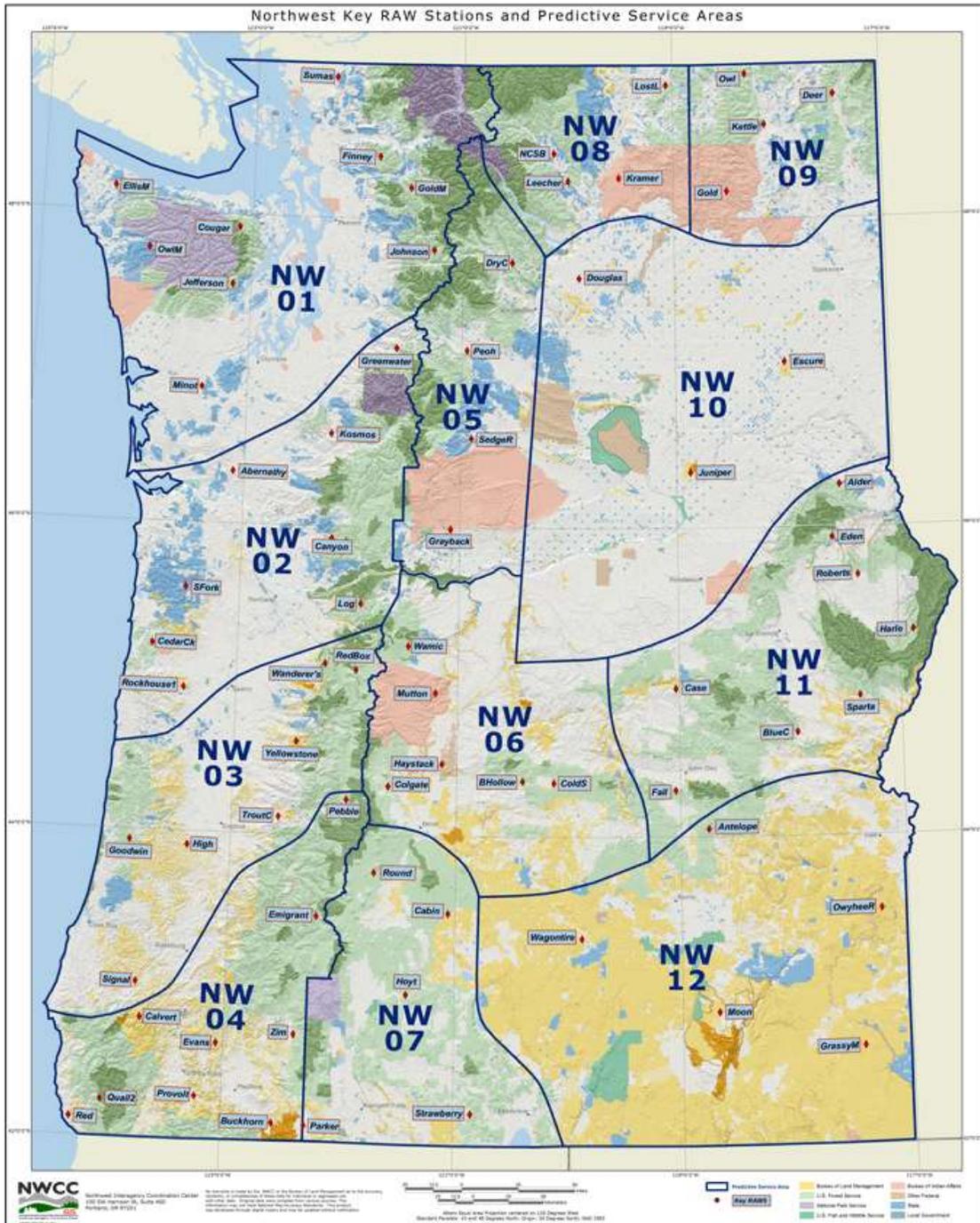
We have developed objective algorithms for forecasting the probability of lightning, lightning amount, number of ignitions and the probability of a large fire due to lightning. Input to the equations includes raw grid point data from weather models, as well as our ERC/F100 forecasts discussed earlier. These equations are run each morning giving us objective guidance as to the number of lightning ignitions and the potential for a large fire in any particular PSA on any one of the next 10 days. If our forecasts result in a large fire probability exceeding 20% for a particular day and PSA, we may issue a “High Risk” alert. It will be designated with a RED colored block on our 7-Day Significant Fire Potential Product. It is up to the discretion of the forecaster whether or not to follow this guidance

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# Appendix 1

## Map of NWCC's PSAs & Key RAWs



## **Appendix 2**

### Individual Details for Each PSA

The following pages shows the threshold values of ERC or F100 used to define the dryness levels for each PSA. Also various pertinent “Large Fire” potential statistics and information is documented.

## PSA NW01 (W1)

This area represents northern portions of western Washington and includes the Olympic Peninsula and west slopes of the north Washington Cascades. PSA fuel moistures are determined by the average of the Key RAWS in the zone.

Key RAWS: Sumas Mountain, Finney Creek, Gold Mountain, Johnson Ridge, Ellis Mountain, Cougar, Owl Mountain, Jefferson, Minot Peak

Each RAWS receives equal weighting for NFDRS Index calculations.

Determination of DL: ERC for Fuel Model G

“Large Fire Day” = A day with an occurrence of at least one 100+ acre fire

### ERC threshold values used for DL determination

Based on June-September data (2000-2011)

DL	ERC Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	≤ 26	75%	25%	.6%
Yellow (dry)	27 - 36	19%	33%	2%
Brown (very dry)	≥ 37	6%	42%	6%

\* Conditional Probability: Assumes at least 1 ignition

### Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “**High Risk**” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

#### Specifics for PSA NW01

- Burn Environment... The probability of a large fire on any day independent of a lightning episode (i.e. due solely to the burn environment) is less than 1%. Wind and instability show virtually no relationship to the occurrence of large fires. Even when burning conditions are at a 95<sup>th</sup> percentile level there is only a 3.7% chance of a large fire. Therefore we are not apt to issue a High Risk for a new large fire due to burning conditions alone. However, we will occasionally issue a High Risk when there is a large fire in progress and burning conditions reach a 95<sup>th</sup> percentile level determined solely by an ERC value of 40 or higher, especially if there is a thermal trough pattern in western Washington
- Lightning... Between 2000 and 2012 there were 5 large fires that occurred during lightning episodes. That translated to about 1 “large lightning fire event” every 2 years with a 2% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” about once per year and can be expected to correctly forecast about 55% of all large fires while forecasting false alarms about 73% of the time.

## PSA NW02 (W2)

This area represents southwest Washington and northwest Oregon. Average PSA fuel moistures are determined by the average of the Key RAWs in the zone.

Key RAWs: Greenwater, Kosmos, Canyon Creek, Log Creek, Abernathy, South Fork, Cedar Creek, Rockhouse 2

Each RAWs receives equal weighting for NFDRS Index calculations.

Used to determine DL: ERC for fuel model G

“Large Fire Day” = A day with an occurrence of at least one 100+ acre fire

### “ERC threshold values used for DL determination

Based on June-September data (2000-2011)

DL	ERC Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	≤ 19	51%	0%	0%
Yellow (dry)	20 – 43	42%	62%	2%
Brown (very dry)	≥ 44	8%	38%	5%

\* Conditional Probability: Assumes at least 1 ignition

### Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “**High Risk**” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

#### Specifics for PSA NW02

- Burn Environment...A critical burn environment shows a relatively good relationship to large fire occurrence in NW02, unlike most PSAs. Between 2000 and 2012, 9 large fires occurred independent of a lightning episode. Of these, 4 (44%) occurred under 98<sup>th</sup> percentile burning conditions as determined by ERC and instability (wind shows no relationship to large fire occurrence). A 98<sup>th</sup> percentile burn environment represents our threshold for issuing a High Risk. At this level we can be expected to issue about 1 High Risk per year while correctly forecasting about 45% of large non-lightning related large fires. About 3 out of 4 issuances will likely be false alarms. We may also issue a High Risk if a large fire is in progress and we expect a 95<sup>th</sup> percentile burn environment, especially if a thermal trough is present.
- Lightning...Between 2000 and 2012 there were 9 large fire days that occurred during lightning episodes. That translated to less than 1 “large lightning fire event” per year with a 4.5% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” about once every year or 2 and can be expected to correctly forecast about 31% of all large lightning fires while forecasting false alarms 65% of the time.

### PSA NW03 (W3)

This area represents central portions of western Oregon. Average PSA fuel moistures are determined by the average of the Key RAWS in the zone.

Key RAWS: Wanderer’s Peak, Red Box Bench, Yellowstone, Trout Creek, Stayton, High Point, Goodwin Peak, Signal Tree

Each RAWS receives equal weighting for NFDRS Index calculations.

Used to determine DL: ERC for fuel model: G

“Large Fire Day” = A day with an occurrence of at least one 100+ acre fire

#### “ERC threshold values used for DL determination

Based on June-September data (2000-2011)

DL	ERC Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	≤ 28	47%	0%	0%
Yellow (dry)	29 – 49	48%	72%	2%
Brown (very dry)	≥ 50	5%	28%	7%

\* Conditional Probability: Assumes at least 1 ignition

### Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “**High Risk**” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

### Specifics for PSA NW03

- Burn Environment... The probability of a large fire on any day independent of a lightning episode (i.e. due solely to the burn environment) is less than 1%. Wind and instability show virtually no relationship to the occurrence of large fires. Even when burning conditions are at a 95<sup>th</sup> percentile level there is only about a 5% chance of a large fire. Therefore we are not apt to issue a High Risk for a new large fire due to burning conditions alone. However, we will occasionally issue a High Risk when there is a large fire in progress and the ERC reaches 53 or higher, especially if there is a thermal trough pattern in western Oregon.
- Lightning... Between 2000 and 2012 there were 8 large fires that occurred during lightning episodes. That translated to about 1 “large lightning fire event” every 2 years with a 4.1% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” about once every 2 or 3 years and can be expected to correctly forecast about 49% of all large lightning fires while forecasting false alarms a low 28% of the time.

## PSA NW04 (W4)

This area represents southwest Oregon. Average PSA fuel moistures are determined by the average of the Key RAWS in the zone.

Key RAWS: Pebble, Emigrant, Zim, Buckhorn Springs, Evans Creek, Provolt, Calvert Peak, Quail Prairie, Red Mound

Each RAWS receives equal weighting for NFDRS Index calculations.

Used to determine the DL: 100-HR FM

“Large Fire Day” = A day with an occurrence of at least one 100+ acre fire

### “F100 threshold values used for DL determination

Based on June-September data (2000-2011)

DL	F100 Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	≥ 12	57%	11%	1%
Yellow (dry)	10 – 11	38%	64%	6%
Brown (very dry)	≤ 9	5%	24%	15%

\* Conditional Probability: Assumes at least 1 ignition

### Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “**High Risk**” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

#### Specifics for PSA NW04

- Burn Environment... The probability of a large fire on any day independent of a lightning episode (i.e. due solely to the burn environment) is around 2%. Wind and instability show virtually no relationship to the occurrence of large fires so the burn environment is solely determined by the ERC. ERC is also poor at delineating between large fire days and “small” fire days. Therefore, we will only rarely issue a High Risk for a new large fire due to burning conditions alone. Our ERC threshold for issuance of a High Risk is 71 or higher which represents about a 99<sup>th</sup> percentile value. At this level the probability of a large fire is about 15% (i.e. 85% false alarms). Using this criterion, we can be expected to correctly forecast only about 8% of large human caused fires. At forecaster discretion we may also occasionally issue a High Risk if a large fire is in progress and the ERC reaches 65 or higher, especially with a thermal trough.
- Lightning... Between 2000 and 2012 there were a whopping 49 large fires that occurred during lightning episodes. That translated to nearly 2 “large lightning fire events” per year and a 10.7% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” about 2 or 3 times per year and can be expected to correctly forecast about 69% of all large lightning fires with a false alarm frequency of 57%.

## PSA NW05 (C1)

This area represents the east slopes of the Washington Cascades and lower valleys. Average PSA fuel moistures are determined by the average of the Key RAWS in the zone.

Key RAWS: Dry Creek, Peoh Point, Sedge Ridge, Grayback

Each RAWS receives equal weighting for NFDRS Index calculations.

Used to determine DL: 100-HR FM

“Large Fire Day” = A day with an occurrence of at least one 700+ acre fire

### “F100 threshold values used for DL determination

Based on June-September data (2000-2011)

DL	F100 Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	≥ 12	28%	5%	1%
Yellow (dry)	8 – 11	50%	51%	4%
Brown (very dry)	≤ 7	22%	44%	8%

\* Conditional Probability: Assumes at least 1 ignition

### Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “**High Risk**” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

#### Specifics for PSA NW05

- Burn Environment...Between 2000 and 2012 there were 27 large fires in C2 that occurred independent of lightning episodes. But there is less than a 3% chance of getting a large fire on any particular day due to burning conditions alone. The burn environment in C1 as determined by the 100-hr FM and wind is very poor at distinguishing between large fire days and “small” fire days. About two-thirds of non-lightning large fires occur under rather benign burn conditions. Even at a 95<sup>th</sup> percentile burn condition there is only about a 7% chance for a large fire. Our model uses a 99<sup>th</sup> percentile burn environment as the threshold for issuing a High Risk for a non-lightning related large fire. With that criterion we can be expected to issue 1 High Risk per year and correctly forecast about 7% of all non-lightning related large fires. Even with that stringent criterion we can expect that 75% of our forecasts will be false alarms.
- Lightning...Between 2000 and 2012 there were 28 large fires that occurred during lightning episodes. That translated to between 1 and 2 “large lightning fire events” per year with a 7.2% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” close to twice per year and can be expected to correctly forecast about 59% of all large lightning fires while forecasting false alarms 65% of the time.

## PSA NW06 (C2)

This area represents north central Oregon including the east slopes of the north Oregon Cascades. . PSA fuel moistures are determined by the average of the Key RAWS in the zone.

Key RAWS: Wamic Mill, Mutton Mountain, Colgate, Haystack, Board Hollow, Cold Springs

Each RAWS receives equal weighting for NFDRS Index calculations.

Used to determine DL: 100-HR FM and ERC

“Large Fire Day” = A day with an occurrence of at least one 1200+ acre fire

### “F100/ERC threshold values used for DL determination

Based on June-September data (2000-2011)

DL	ERC Threshold	F100 Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	< 53	-			
	≥ 53	> 11	22%	2%	2%
Yellow (dry)	≥ 53	8 – 11	51%	39%	5%
Brown (very dry)	≥ 53	≤ 7	27%	59%	11%

\* Conditional Probability: Assumes at least 1 ignition

### Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “**High Risk**” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

### Specifics for PSA NW06

- Burn Environment...In NW06 there is less than a 2% chance that a large fire will occur on a day independent of a lightning episode. Between 2000 and 2012 only about one-third of the 14 non-lightning related large fires occurred under burning conditions that could be considered as elevated while the rest occurred under normal or even very benign conditions. Even when burn conditions are critical there is only about a 10% chance that a large fire will occur. Our model uses a 99<sup>th</sup> percentile burn environment level as a threshold for forecasting a High Risk. With this criterion we can expect to correctly forecast about 15% of all non-lightning related large fires. With this extreme condition we can also expect that 8 out of 10 of these forecasts will be false alarms. With forecaster discretion we may issue a High Risk when our model suggests an elevated burn environment (95<sup>th</sup> percentile level) when there is an “existing” large fire that we think may be affected.
- Lightning...Between 2000 and 2012 there were a whopping 86 large fires that occurred during lightning episodes. That translated to about 3.5 “large lightning fire events” per year with a 13.2% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” about 5 or 6 times per year and can be expected to correctly forecast almost 79% of all large lightning fires while only forecasting false alarms around 54% of the time.

## PSA NW07 (C3)

This area represents south central Oregon. . PSA fuel moistures are determined by the average of the Key RAWS in the zone.

Key RAWS: Round Mountain, Cabin Lake, Hoyt, Parker Mountain, Strawberry

Each RAWS receives equal weighting for NFDRS Index calculations.

Used to determine DL: 100-HR FM

“Large Fire Day” = A day with an occurrence of at least one 100+ acre fire

### “F100 threshold values used for DL determination

Based on June-September data (2000-2011)

DL	F100 Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	$\geq 12$	25%	0%	0%
Yellow (dry)	8 – 11	51%	38%	2%
Brown (very dry)	$\leq 7$	24%	62%	6%

\* Conditional Probability: Assumes at least 1 ignition

## Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “**High Risk**” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

#### Specifics for PSA NW07

- Burn Environment...Between 2000 and 2012 there were 11 large fires that occurred independent of lightning episodes. That represents only about a 1% chance on any particular non-lightning day. Furthermore, these fires have occurred across the entire spectrum of burn conditions. Only 2 of these fires have occurred when burning levels were at 90<sup>th</sup> percentile or higher while over half have occurred under normal or even very benign conditions. Our model determines burning conditions solely by the 100-hr FM as wind and instability show little or no relationship with large fire occurrence. Due to the low probabilities for human-caused large fires we will rarely, if ever, issue a High Risk due solely to the burn environment. However, if there is a large fire in progress and the forecasted 100-hr FM is expected to be at or below 5 we may be inclined to issue a High Risk.
- Lightning...Between 2000 and 2012 there were 28 large fires that occurred during lightning episodes. That translated to 1 or 2 “large lightning fire events” per year with a 6% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” about 4 to 5 times per year and can be expected to correctly forecast about 75% of all large lightning fires while forecasting false alarms 76% of the time.

## PSA NW08 (E1)

This area represents north central Washington (Okanogan country). . PSA fuel moistures are determined by the average of the Key RAWS in the zone.

Key RAWS: Leecher Mtn, NCSB, Kramer, Lost Lake

Each RAWS receives equal weighting for NFDRS Index calculations.

Used for determination of DL: 100-HR FM

“Large Fire Day” = A day with an occurrence of at least one 2200+ acre fire

“F100 threshold values used for DL determination

Based on June-September data (2000-2011)

DL	F100 Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	$\geq 10$	48%	6%	1%
Yellow (dry)	8 – 9	31%	28%	3%
Brown (very dry)	$\leq 7$	20%	67%	11%

\* Conditional Probability: Assumes at least 1 ignition

### Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “**High Risk**” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

#### Specifics for PSA NW08

- Burn Environment...The burn environment alone cannot distinguish between large fire days and “small” fire days in any meaningful way. Between 2000 and 2012 there were only 10 large fires that occurred independent of lightning episodes. That represents about a 1% chance of a large fire on any such day. Furthermore, more than half of those fires occurred on days when the burn environment was either normal or very benign. Only 2 large fires have occurred when burning conditions were at or above a 90<sup>th</sup> percentile level. Even at 90<sup>th</sup> percentile level burning conditions the chance of a large fire is only about 3%. With such a low probability, we will rarely, if ever, issue a “High Risk” alert due to burn conditions alone. However, in the case where there is an existing large fire in progress and we expect at least a 97<sup>th</sup> percentile burn environment, we may at times issue a High Risk. For NW08, the burn environment is determined by the 100-hr FM and low level instability that often accompanies a thermal trough.
- Lightning...Between 2000 and 2012 there were 30 large fires that occurred during lightning episodes. That translated to 2 “large lightning fire events” per year and a 7.5% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” about 4 times per year and can be expected to correctly forecast about 64% of all large lightning fires with a false alarm frequency of about 69%.

## PSA NW09 (E2)

This area represents the northeast Washington Mountains (Colville country). . PSA fuel moistures are determined by the average of the Key RAWs in the zone.

Key RAWs: Owl Mountain, Deer Mountain, Kettle Falls, Gold Mountain

Each RAWs receives equal weighting for NFDRS Index calculations.

Used to determine DL: 100-HR FM

“Large Fire Day” = A day with an occurrence of at least one 100+ acre fire

### “F100 threshold values used for DL determination

Based on June-September data (2000-2011)

DL	F100 Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	$\geq 11$	40%	7%	1%
Yellow (dry)	7 – 10	46%	55%	3%
Brown (very dry)	$\leq 6$	14%	38%	7%

\* Conditional Probability: Assumes at least 1 ignition

## Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “High Risk” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

#### Specifics for PSA NW09

- Burn Environment...Between 2000 and 2012 there were 16 large fires that occurred independent of lightning episodes. That represents about a 2% chance of a large fire on any such day. About half of those fires occurred on days when burn conditions were elevated (i.e.  $\geq 85^{\text{th}}$  percentile condition) while the other half occurred under normal to even very benign conditions. Even with  $85^{\text{th}}$  percentile burning conditions there is only about an 8% chance of a large fire. Our model criterion for forecasting a High Risk for human-caused large fires is when the burn environment is above a  $99^{\text{th}}$  percentile level. With that criterion we will only rarely issue a high risk for a non-lightning related large fire. We can expect to correctly forecast about 13% of such fires but with a very low rate of false alarms...33%. We may at time also issue a High Risk if a large fire is in progress and the burn environment reaches  $95^{\text{th}}$  percentile levels. Our model determines the burn environment from the ERC and wind.
- Lightning...Between 2000 and 2012 there were 21 large fires that occurred during lightning episodes. That translated to 1 or 2 “large lightning fire events” per year with a 3.5% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” about 1 to 2 times per year and can be expected to correctly forecast about 46% of all large lightning fires with a false alarm frequency of about 66%.

### PSA NW10 (E3)

This area represents the Columbia Basin of eastern Washington extending into north central Oregon. . PSA fuel moistures are determined by the average of the Key RAWS in the zone.

Key RAWS: Douglas, Escure, Juniper Dunes

Each RAWS receives equal weighting for NFDRS Index calculations.

Used to determine DL: 100-HR FM

“Large Fire Day” = A day with an occurrence of at least one 700+ acre fire

“F100 threshold values used for DL determination

Based on June-September data (2000-2011)

DL	F100 Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	$\geq 12$	12%	0%	0%
Yellow (dry)	6 – 11	82%	77%	4%
Brown (very dry)	$\leq 5$	6%	23%	12%

\* Conditional Probability: Assumes at least 1 ignition

### Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “High Risk” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

#### Specifics for PSA NW10

- Burn Environment... Between 2000 and 2012 there were 17 large fires that occurred independent of lightning episodes. That represents less than a 3% chance of a large fire on any such day. Only 3 of those fires occurred on days when burn conditions were high (i.e.  $\geq 90^{\text{th}}$  percentile conditions) while all others occurred under fairly benign conditions. Furthermore, even at  $90^{\text{th}}$  percentile burning conditions there is only about a 5% chance of a large fire. For that reason we will rarely, if ever, issue a High Risk for a new large fire due to burning conditions alone. We may at times issue a High Risk if a large fire is in progress and the burn environment is expected to reach  $95^{\text{th}}$  percentile levels. Our model uses the 100-hr FM, wind and low level instability in determining the burn environment
- Lightning...Between 2000 and 2012 there were 30 large fires that occurred during lightning episodes. That translated to just under 2 “large lightning fire events” per year and a 5.8% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” about 3 times per year and can be expected to correctly forecast about 56% of all large lightning fires with a false alarm frequency of about 69%.

## PSA NW11 (E4)

This area represents the mountains of northeast Oregon, essentially the Wallowas and eastern portions of the Blue Mountains. . PSA fuel moistures are determined by the average of the Key RAWS in the zone.

Key RAWS: Alder, Roberts Butte, Harle Butte, Eden, Sparta Butte, Blue Canyon, Case, Fall Mountain

Each RAWS receives equal weighting for NFDRS Index calculations.

Used for determination of DL: ERC for fuel moisture G

“Large Fire Day” = A day with an occurrence of at least one 1200+ acre fire

### “ERC threshold values used for DL determination

Based on June-September data (2000-2011)

DL	ERC Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	≤ 62	54%	3%	< .5%
Yellow (dry)	63 – 74	26%	33%	5%
Brown (very dry)	≥ 75	20%	64%	12%

\* Conditional Probability: Assumes at least 1 ignition

## Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “**High Risk**” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the

weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

#### Specifics for PSA NW11

- Burn Environment... Between 2000 and 2012 there were only 7 large fires that occurred independent of lightning episodes. That represents a 1% chance of a large fire on any such day. Two of those fires occurred with an ERC value of 88 or higher. At that level, the probability of a large fire is about 17% and we use that as our threshold for issuing a High Risk for a human-caused large fire. We can expect to issue only about 1 High Risk per year using that criterion. We may also occasionally issue a High Risk for cases when an existing large fire is in progress and we expect an ERC of 85 or higher (95<sup>th</sup> percentile). Wind and instability shows no significant relationship to large fire occurrence.
- Lightning... Between 2000 and 2012 there were 47 large fires that occurred during lightning episodes. That translated to between 2 and 3 “large lightning fire events” per year and a 5.7% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” about 4 times per year and can be expected to correctly forecast about 79% of all large lightning fires with a false alarm frequency of about 59%.

Forecasting large fires in NW11 relies primarily on correct forecasts of lightning amount. There is a strong relationship between large fires and lightning amount in conjunction with fuel moisture.

## PSA NW12 (E5)

This area represents the high desert regions of southeast Oregon. . PSA fuel moistures are determined by the average of the Key RAWS in the zone.

Key RAWS: Antelope, Owyhee Ridge, Grassy Mountain, Moon Hill, Wagontire

Each RAWS receives equal weighting for NFDRS Index calculations.

Used to determine DL: 100-HR FM

“Large Fire Day” = A day with an occurrence of at least one 10,000+ acre fire

“F100 threshold values used for DL determination

Based on June-September data (2000-2011)

DL	F100 Threshold	% of all fire season days	% of all large fire days	Conditional Probability of a large fire
Green (moist)	$\geq 8$	33%	0%	0%
Yellow (dry)	6 – 7	30%	10%	2%
Brown (very dry)	$\leq 5$	33%	90%	8%

\* Conditional Probability: Assumes at least 1 ignition

## Brief Overview of NWCC Fire Activity Forecast Model

Our assumption is that large fires result as a consequence of a critical burn environment (i.e. dry fuels, wind, instability) and/or mass ignitions that overwhelm IA capability (usually lightning). A day is considered a “**High Risk**” for a large fire when, with forecaster discretion, the “calibrated” large fire probability from our Fire Activity Forecast model approaches 20% or higher. This criterion may be lowered for human caused large fires since historically there is rarely any burn condition severe enough to result in as high as a 20% chance for a human-caused large fire. Due to the rarity of large fire events (about 1 to 2% of summer days) it is nearly impossible to forecast correctly the occurrence of large fires without an accompanying large percentage of false alarms.

A High Risk may also be issued for the potential for significant growth on an existing large fire due to an elevated burning environment. This is a more subjective call but our large fire probabilities are used as guidance.

We define a “lightning episode” as a lightning day plus the 2 following days. If a large fire is discovered within a “lightning episode” period, it is classified as a lightning related large fire regardless of its true cause. On the other hand a large fire discovered outside a “lightning episode” period is classified as a non-lightning related fire, even if it was lightning caused. The assumption is that its growth was more attributable to the weather/fuel conditions on the discovery date than to IA resource depletion from the previous lightning episode.

“High Risk” alerts will be indicated on the 7-Day Significant Fire Potential Chart as either ORANGE if the high risk is due to a critical Burn Environment or as RED if the high risk is due to a significant Ignition Trigger.

High Risk Events might include **dry fuels** in combination with:

- **Significant Lightning** (Ignition Trigger)
- **Wind** (Burn Environment)
- **Unstable atmosphere** (Burn Environment)
- **High Recreation** (Ignition trigger)

Forecasts of lightning amount, ERC, F100, wind speed and low level instability are made each morning at NWCC. These forecasts define the level of criticality of both the burn environment as well as the lightning episode and therefore form the basis for our forecasts of fire activity (i.e. number of ignitions, large fire probability and number of large fires).

#### Specifics for PSA NW12

- Burn Environment... Between 2000 and 2012 there were no large fires that occurred independent of lightning episodes. Therefore, we have no objective basis for forecasting a large fire due solely to burn environment considerations. However, with forecaster discretion, high risks may rarely be issued when an existing large fire is in progress and we expect much elevated burning conditions as determined by ERC and wind.
- Lightning...Between 2000 and 2012 there were 33 large fires that occurred during lightning episodes. That translated to about 2 “large lightning fire events” per year and a 4.3% chance of a large fire per event. As currently calibrated, our Fire Activity Forecast Model will normally forecast a large fire probability high enough for a “High Risk” between 4 and 5 times per year and can be expected to correctly forecast about 58% of all large lightning fires with a false alarm frequency of about 75%.

Forecasting large fires in NW12 relies primarily on correct forecasts of lightning amount.