

Massachusetts

Weather and Fire Danger- Rapid Wildfire Risk Assessment

Prepared by: Eastern Area – Decision Support Group 11/04/2024



Executive Summary

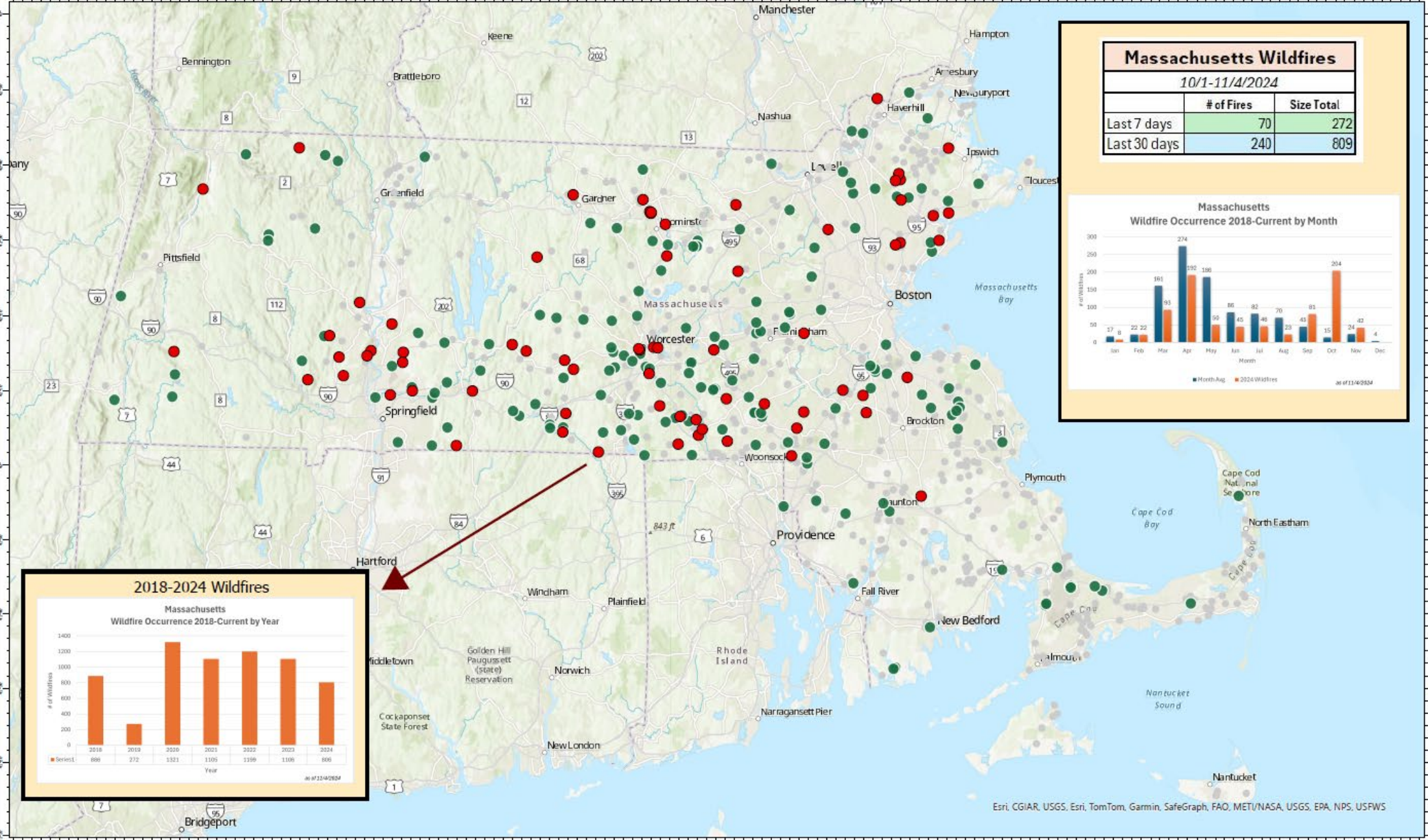
In response to expanding and elevated wildfire risk and an uptick in wildfire occurrence a wildfire risk analysis was conducted to assess the potential and expected fire environment in the State of Massachusetts for the remainder of the fall fire season. The analysis included a look at the current fire environment and extended forecast, fuels compared to normal for the time of year, National Fire Danger Rating System's Fire Danger Indices, and fire occurrence. *For a glossary of terms used in this assessment refer to the final page*

Rapid Assessment Findings and Recommendations

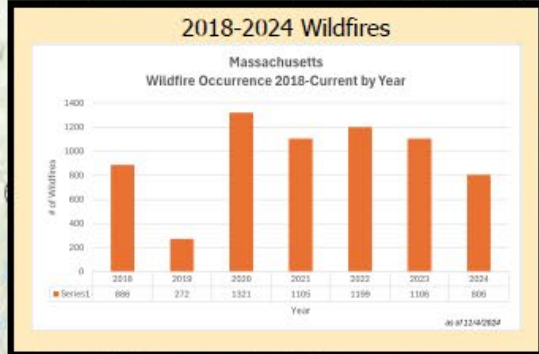
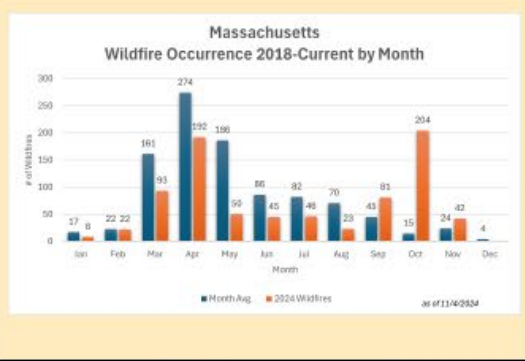
Based on current fuel conditions and forecasted weather conditions, the most likely scenario is an above average level of wildfire activity for the next week. This level of activity will likely cause some slight increase in firefighting resources being mobilized within a state.

- Greatest days of concern over the New England Metro and the eastern Mid-Atlantic States this week are Tuesday afternoon into Wednesday, November 6-6, 2024.
- Temperatures will warm up to above normal levels once again Monday into Wednesday from west to east across the Mid-Atlantic States into southeastern New England with high climbing back into the 70s.
- Gusty S-SW winds at 10-15 mph are forecast over these areas Tuesday afternoon into early Wednesday evening with gusts to around 20 mph.
- Min RH levels in the 40s to low 50s are forecast Tuesday and Wednesday afternoon.
- Mainly dry conditions are still being indicated in the NOAA 7-day total precipitation forecast through next weekend over the eastern Mid-Atlantic States up into the New England Metro. <https://www.wpc.ncep.noaa.gov/qpf/p168i.gif>

- **Fire managers must consider potential extreme fire behavior, which can be expected with the current drought conditions under moderate fire weather conditions. As fire danger indices exceed the 97th percentile, extreme fire behavior and rapid-fire spread characteristics should be expected. Tactics should be altered to provide for firefighter and public safety.**
- **Do not expect any fire to be routine. Be prepared to utilize indirect tactics with extended mop-up. Utilize aerial supervision to help direct crews and keep them informed on fire behavior. Ensure that LCES is in place before engaging on any fire. Remember to STOP, THINK, and TALK before you ACT... and actively look for ways to minimize risk to firefighters in what is forecast to be a period of very high fire danger.**
- **Augmentation of initial attack resources will likely be required throughout the fall. This will result from increased fire behavior, fire spread, and longer mop-up times due to drought stressed fuels and soil.**
- **Additional resources, both ground and aviation, may be needed.**



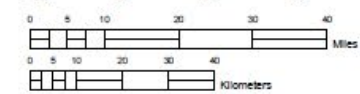
Massachusetts Wildfires		
10/1-11/4/2024		
	# of Fires	Size Total
Last 7 days	70	272
Last 30 days	240	809



2024 Fire Occurrence
 Massachusetts -Statewide
 11/4/2024

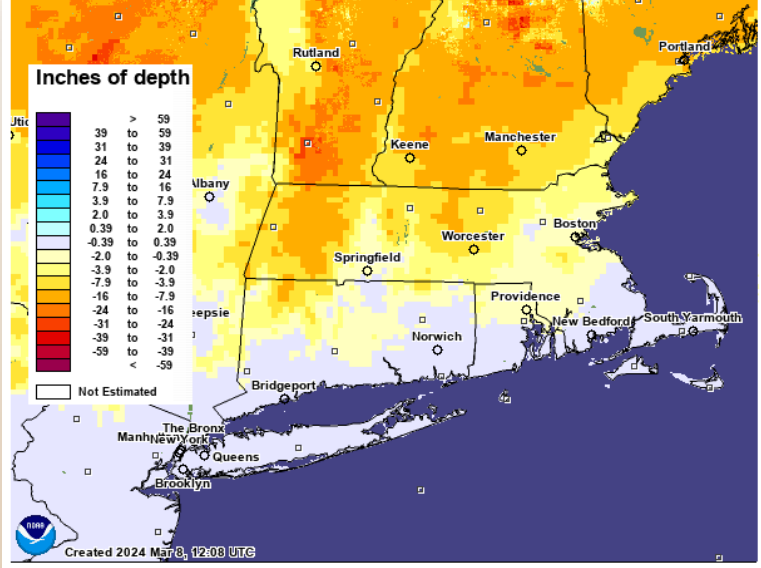
Legend

- Red dot: Incidents_Last 7Days
- Green dot: Incidents_Last 30Days
- Grey dot: Incidents_1/1 to 9/30



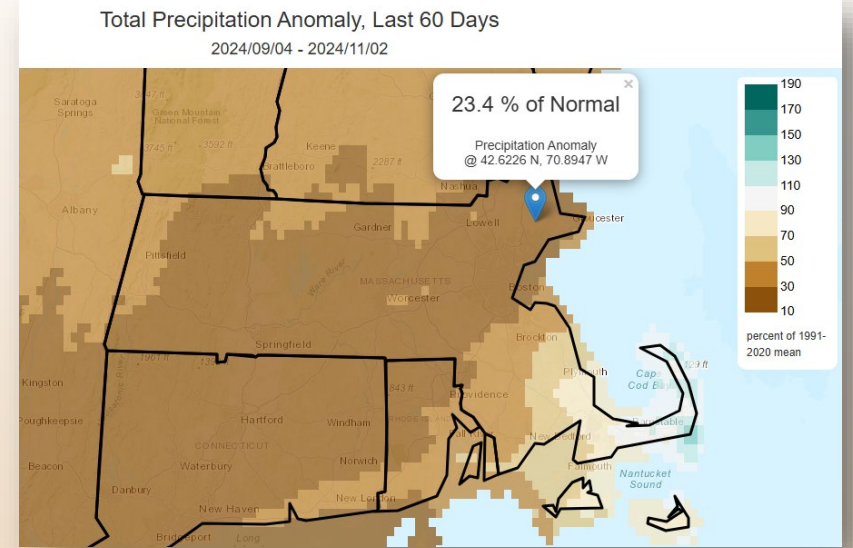
Esri, CGIAR, USGS, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, EPA, NPS, USFWS

Modeled Snow Depth Departure from Normal (Daily) for 2024 March 8, 6:00 UTC



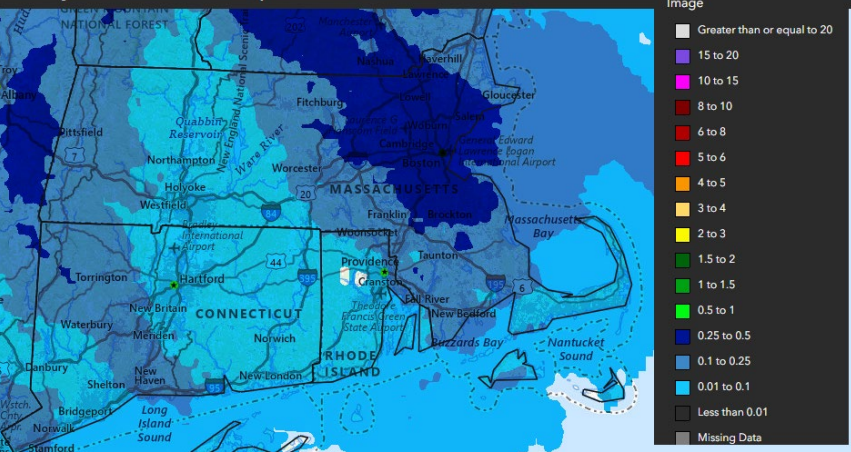
Precipitation Analysis

The winter of 2023/2024 saw far below normal snowpack throughout the state. In early-March, snow depth estimates from NOAA ranged between 2-16 inches below normal. Late spring precipitation helped moderate conditions until late August when a dryer than normal pattern developed and has ensued through early November.

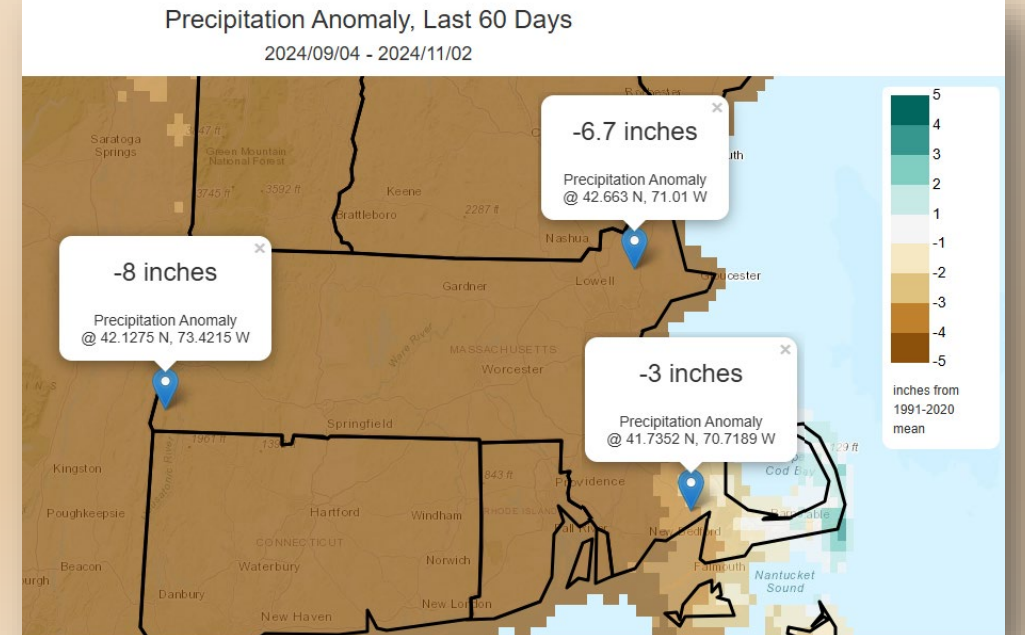


The past 60-days has seen between 22-43 % of normal precipitation over most of Massachusetts.

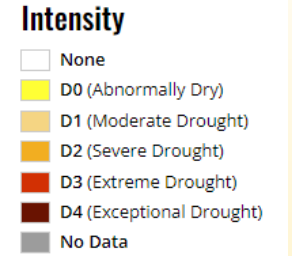
7-Day Observed Precipitation



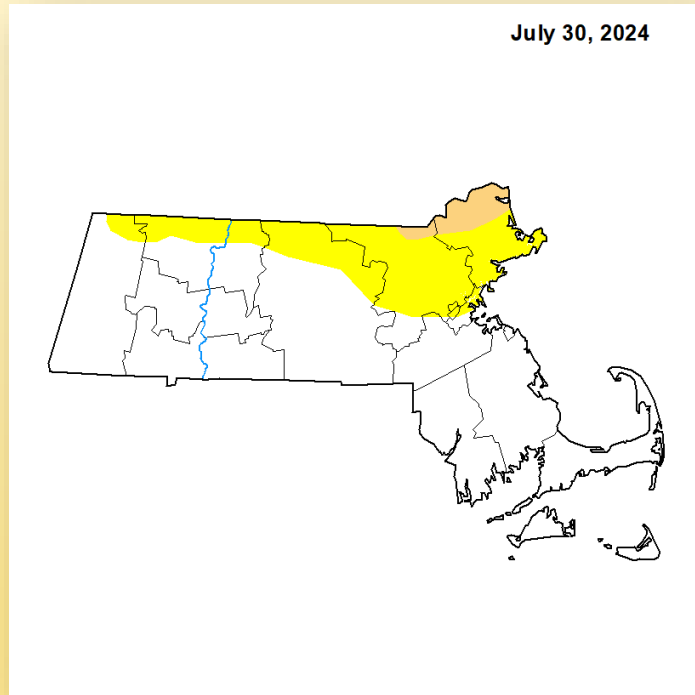
Precipitation observed on October 30 was negligible and ineffective in moderating any wildfire risk in the long-term. Overall, the fire environment has experienced a dry and droughty 60 days and fuels conditions are at critical levels. Deficits over the past 60 days range between near normal over Cape Cod to -8.0 inches in the southwest part of the state.



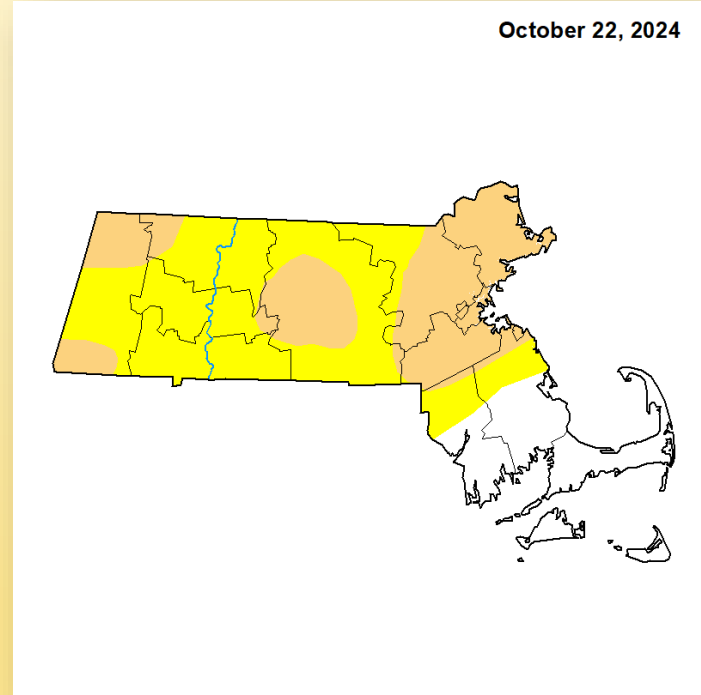
Current Drought Comparison



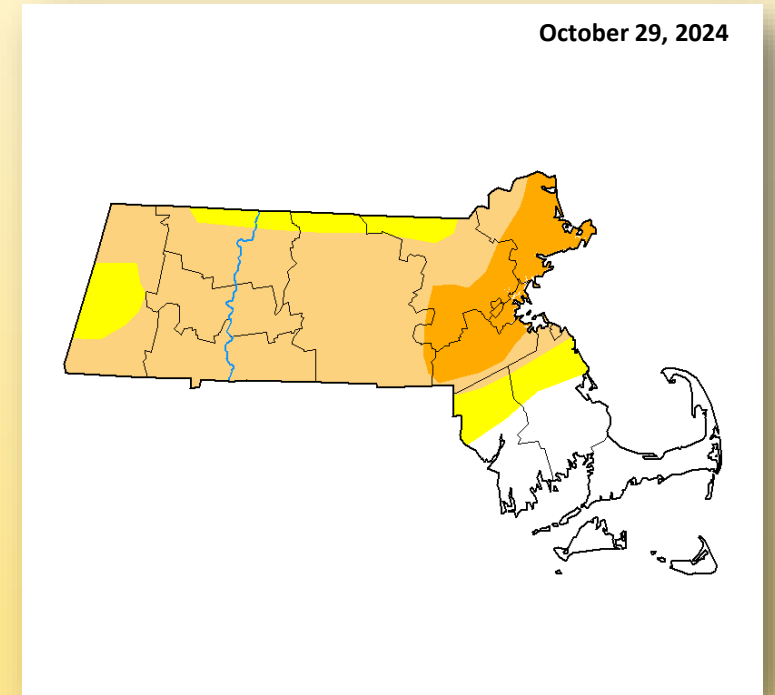
3 months ago



1 week ago

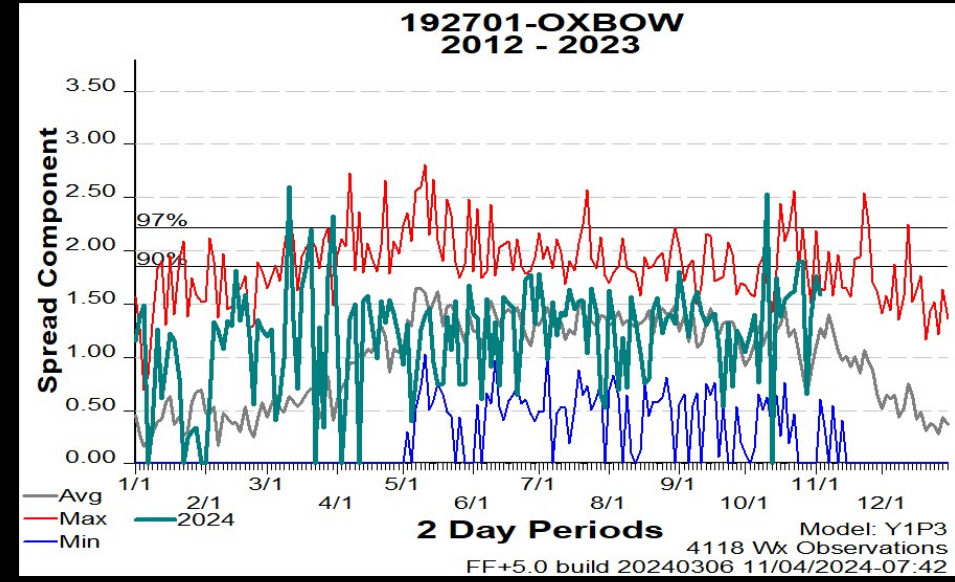
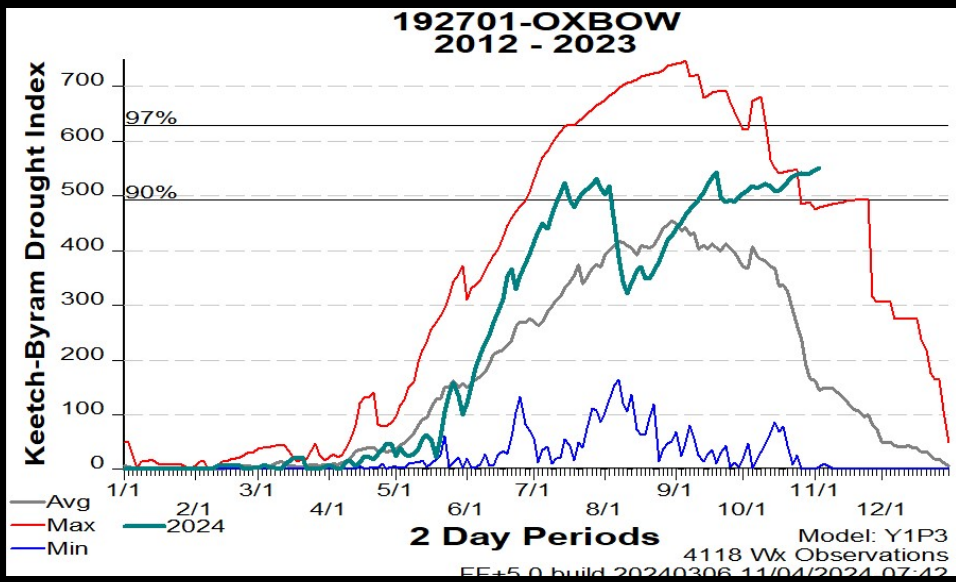
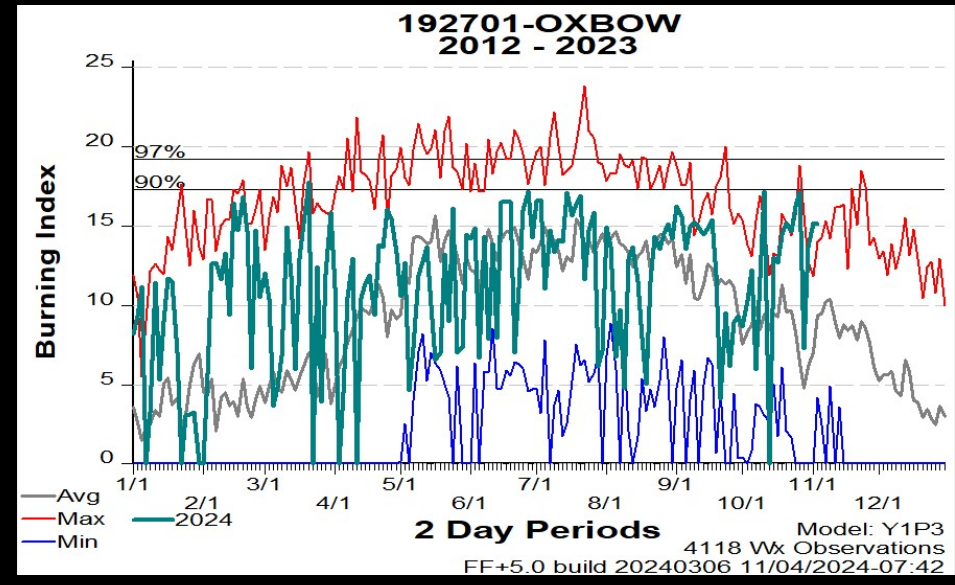
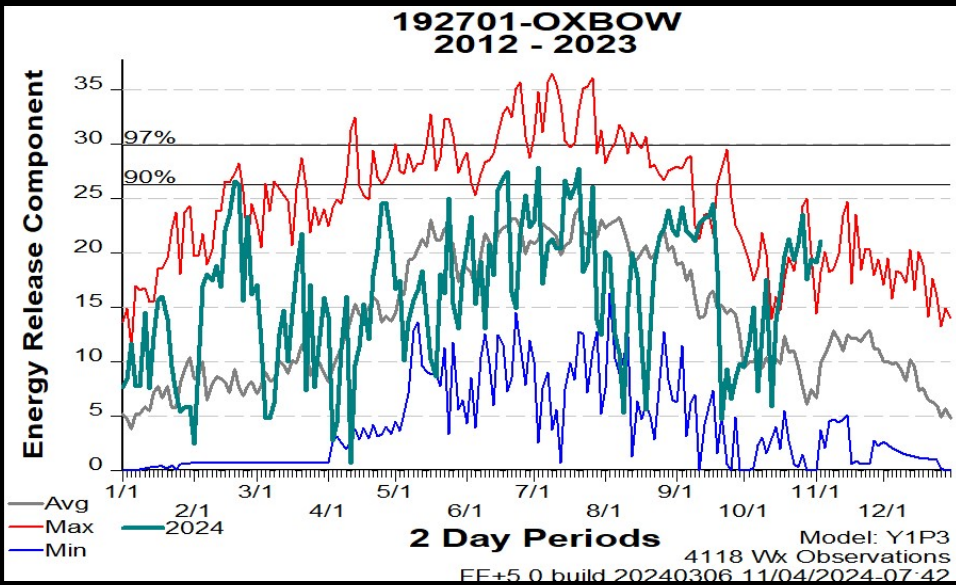


Current



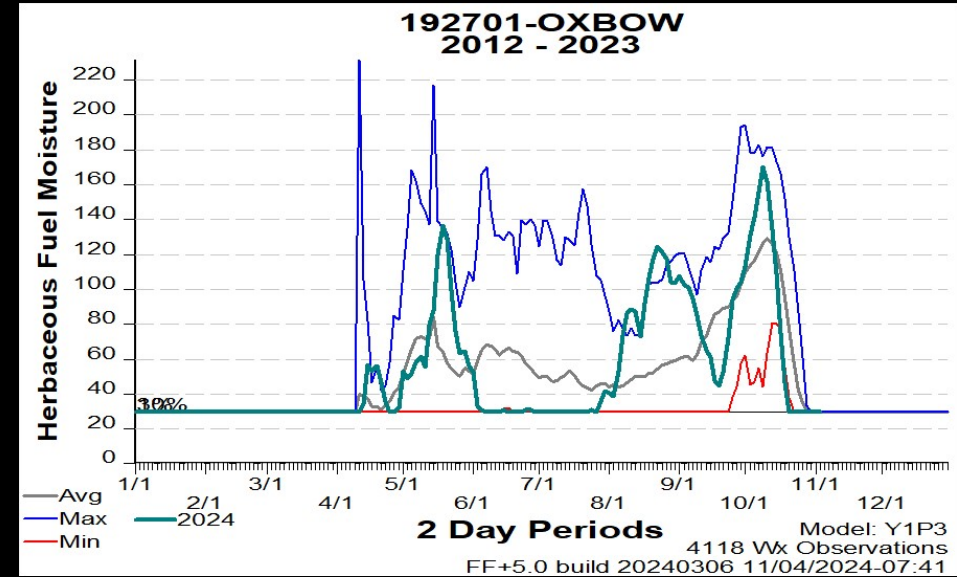
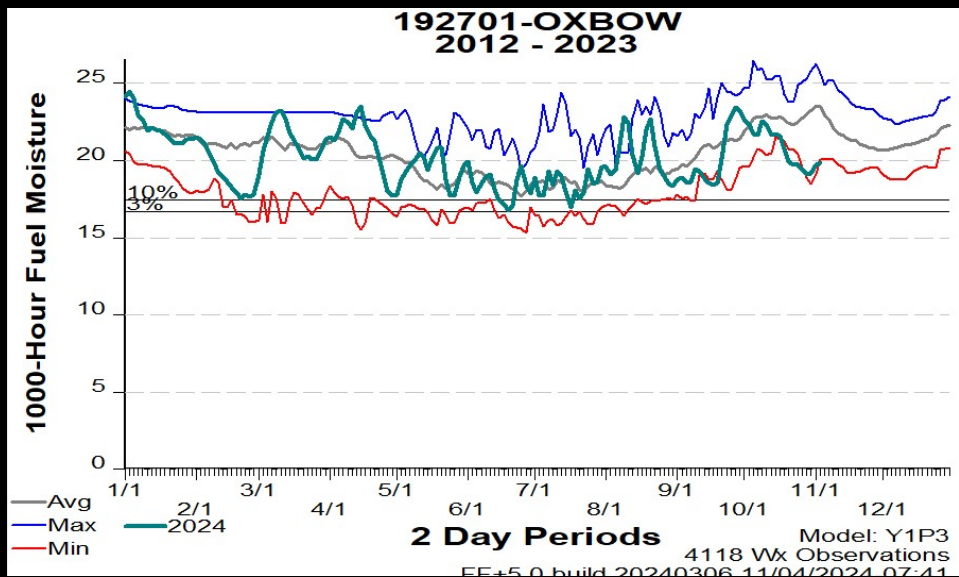
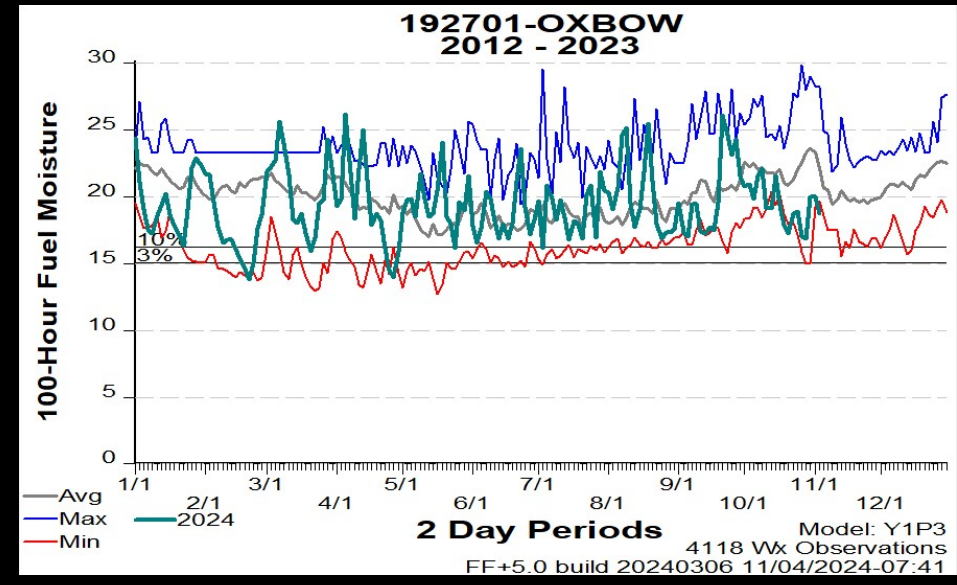
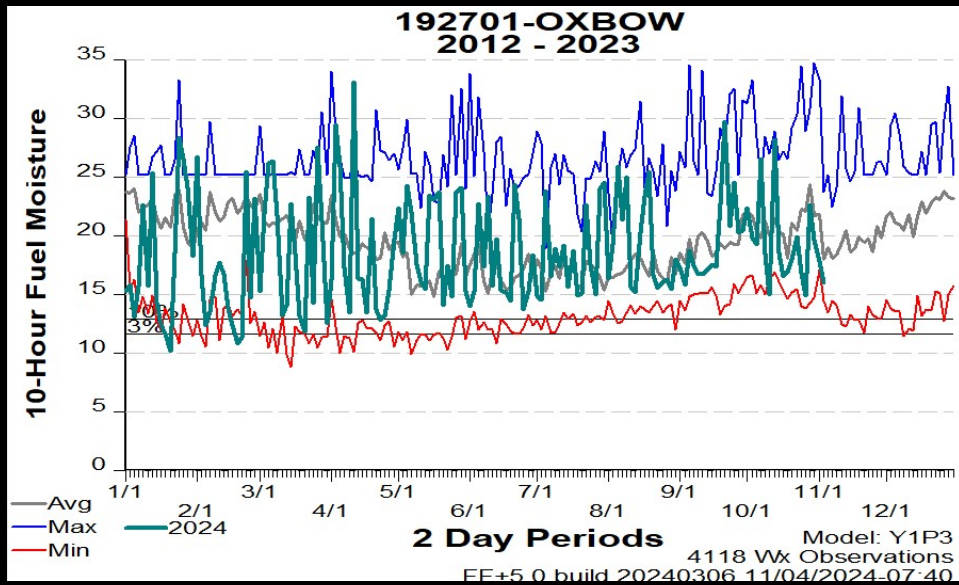
Drought conditions have worsened over the past three months. Abnormally Dry (D0), Moderate (D1), and now Severe (D2) Drought Intensity have developed throughout the majority of Massachusetts. Most of the recent large fires in the eastern side of the state are all being influenced by Moderate to Severe Drought. Elevated fire danger and dry fuel conditions will likely contribute to continued fire growth on any existing or new emerging incidents until substantial weather changes are experienced (i.e. increased Relative Humidity, Precipitation, and Cooler Temperatures).

OXBOW RAWS NFDRS Indices- Climatology Graphs



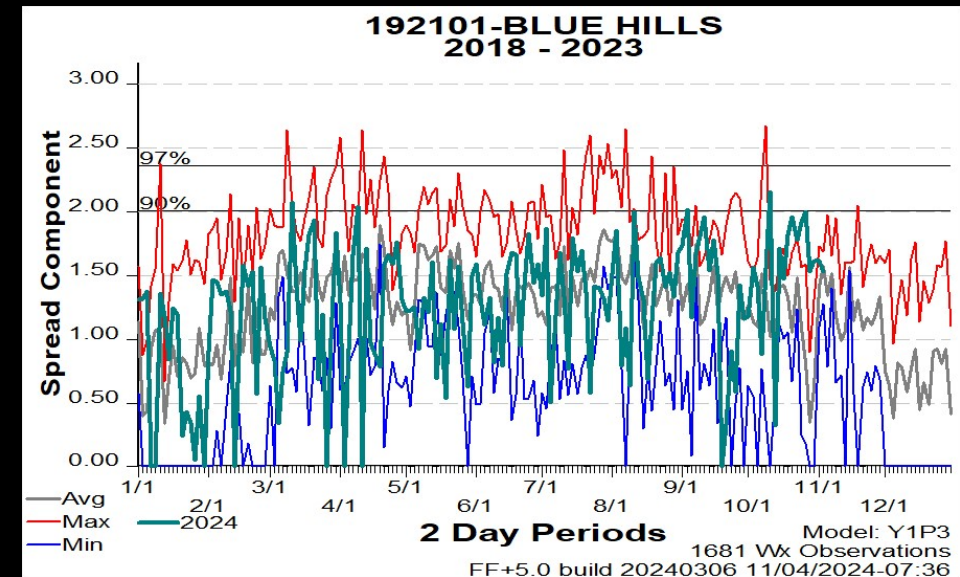
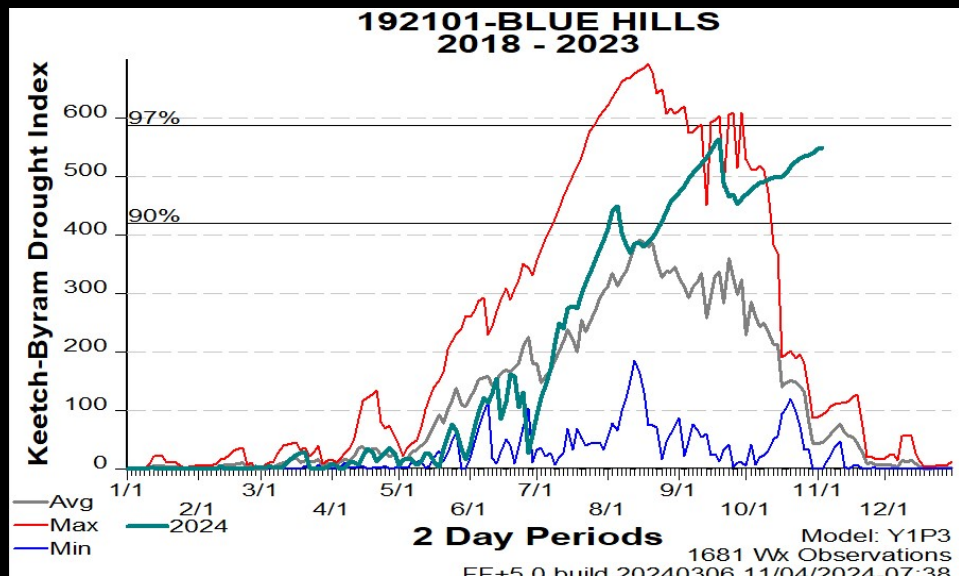
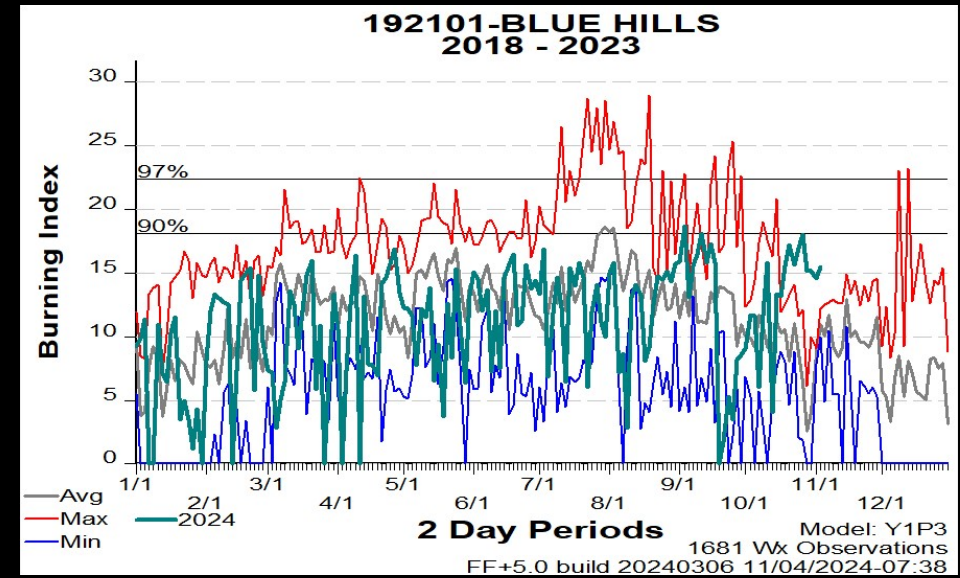
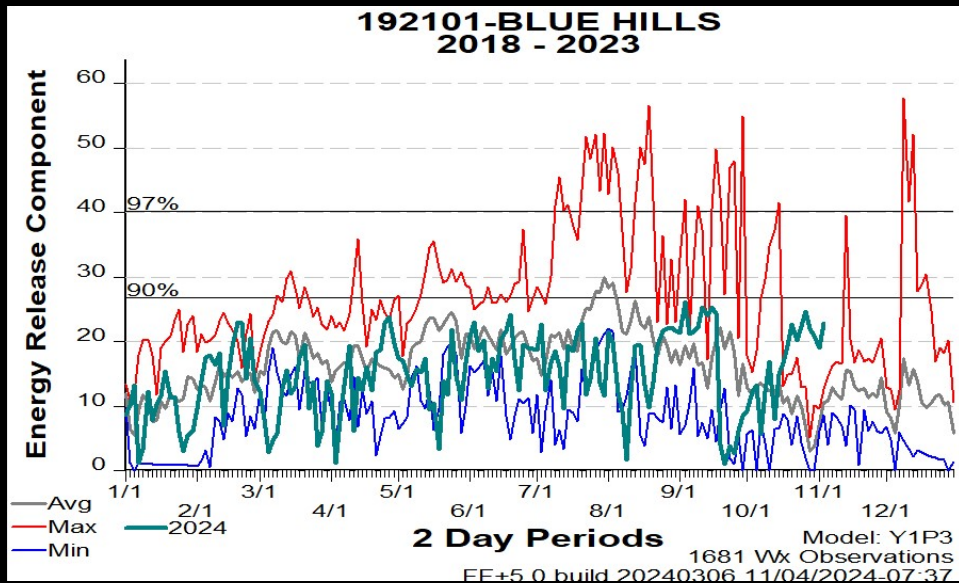
- Recent precipitation shows the short-term effect on some indices (BI, SC) whereas longer term indices had less of a decrease (KBDI, ERC).
- Long term precipitation deficits are allowing some indices to remain above the average and near maximum values for this time of year.
- BI and SC have decreased closer to average for this time of year but could trend higher with limited forecasted precipitation over the area.

OXBOW RAWS NFDRS Indices- Climatology Graphs



- Herbaceous and woody fuel moistures reduced to fully cured ~7-10 days ahead of average for this time of year.
- 100 and 1,000-hour fuel moistures are below average with Oxbow RAWs continuing to trend below historic ranges.
- 10-hour fuels rebounded closer to average following recent precipitation but will likely dry out with limited moisture in the forecast.

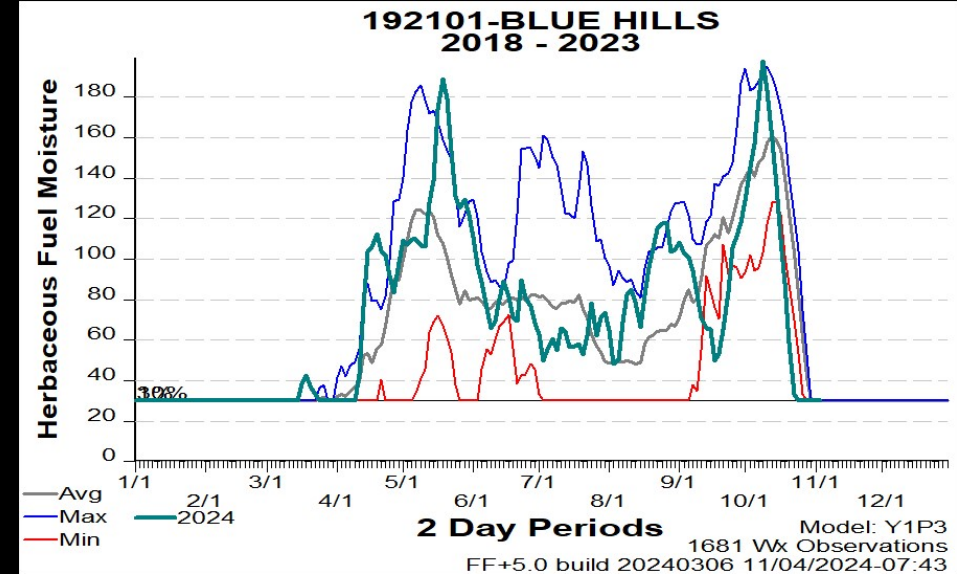
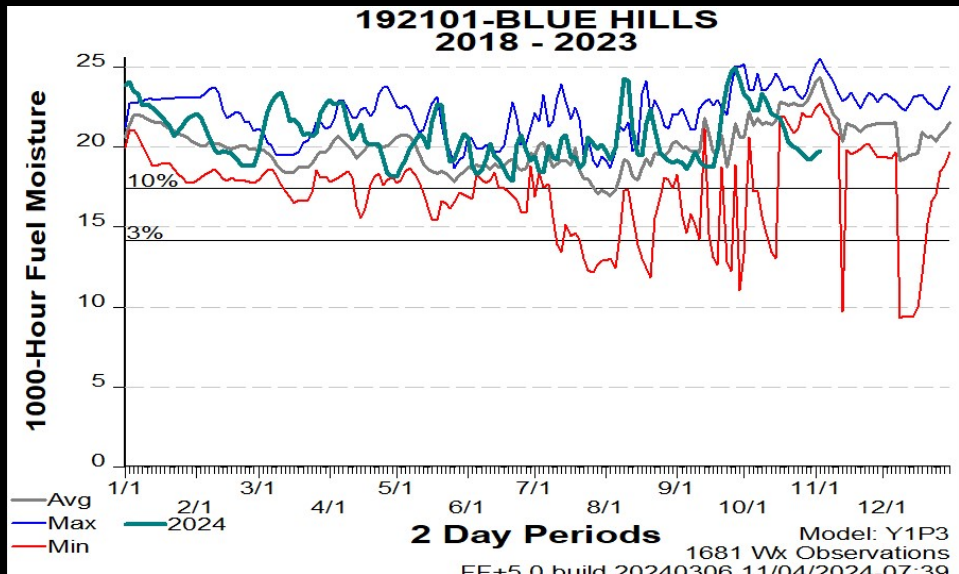
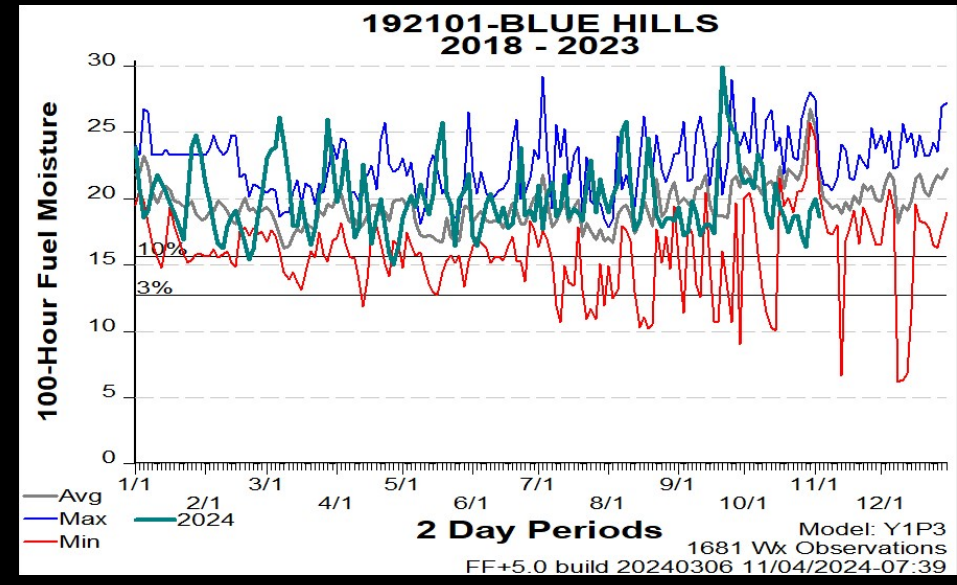
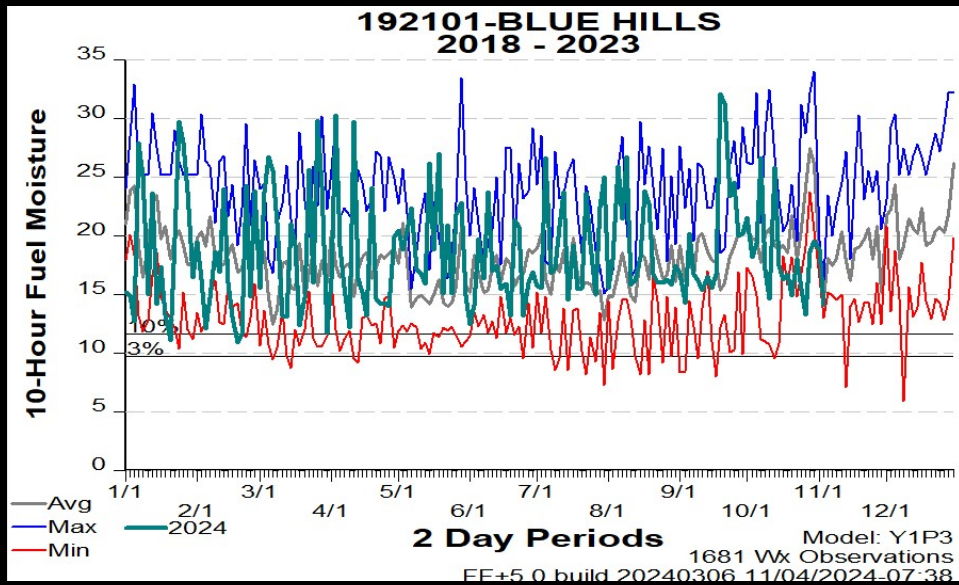
BLUE HILLS RAWS NFDRS Indices- Climatology Graphs



- All indices above are above historical maximum values and percentiles for this time of year.
- The relationship of these indices to precipitation deficits yield increased availability of fuels that are typically not seen this time of year.

*Note that there is only 6 years of historical data for Blue Hills RAWs

BLUE HILLS RAWS NFDRS Indices- Climatology Graphs



-Herbaceous and woody fuel moistures reduced to fully cured ~1 week ahead of average for this time of year.

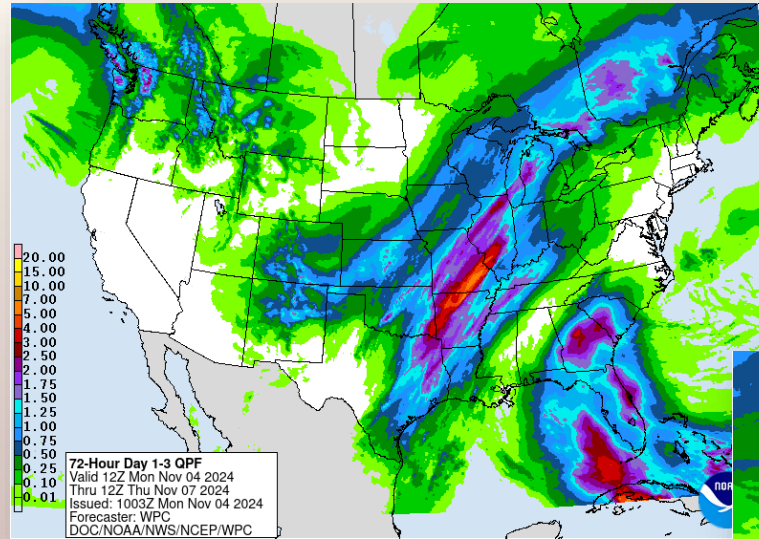
-1,000-hour fuel moisture is below average with Blue Hills RAWS continuing to trend below historic ranges.

*Note that there is only 6 years of historical data for Blue Hills RAWS

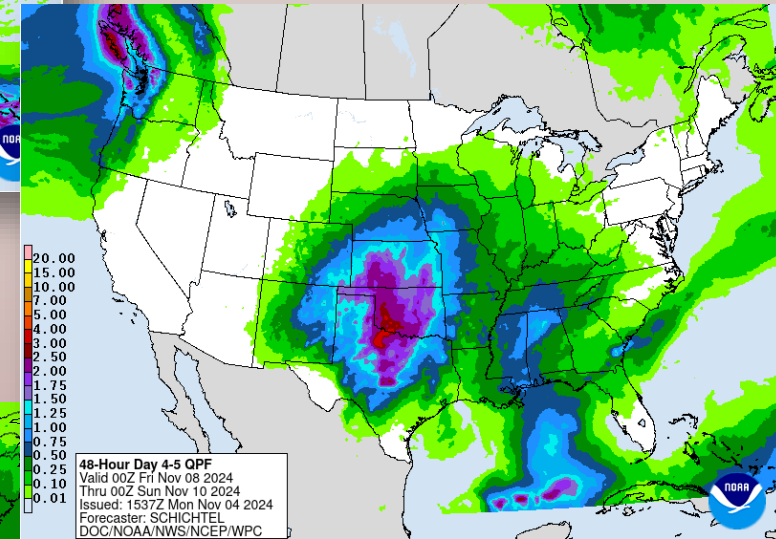
Quantitative Precipitation Forecast

NOAA's Quantitative Precipitation Forecast describes no precipitation over Massachusetts over the next 5-days. Days 6-7 of the QPF do show a system making its way into the New England States and models currently describe 0.01 to 0.25 inches over this 6-7 day period.

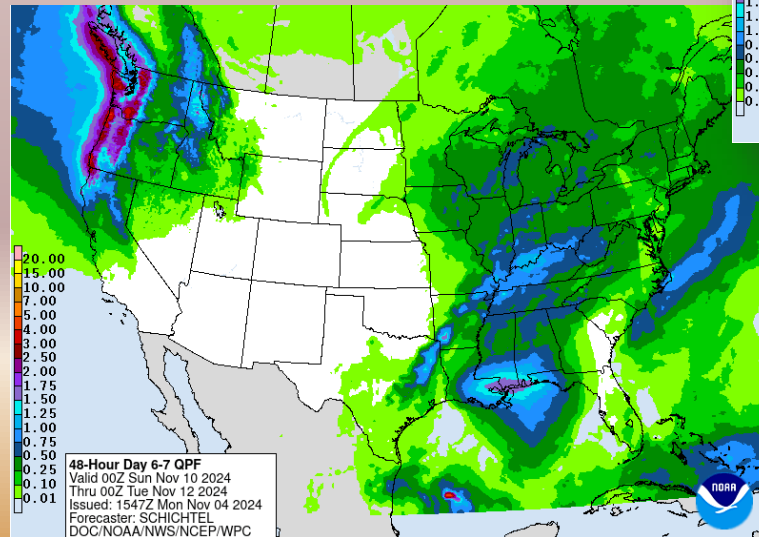
Days 1-3 QPF



Days 4-5 QPF



Days 6-7 QPF



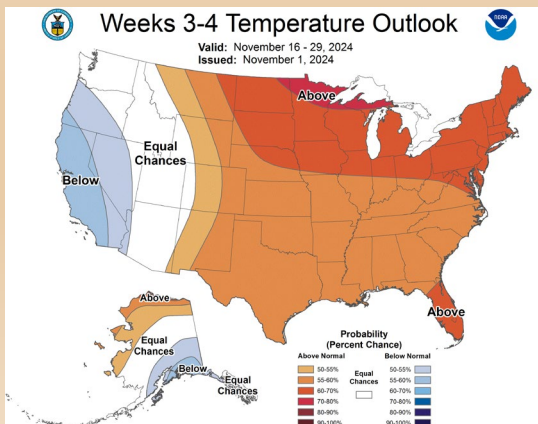
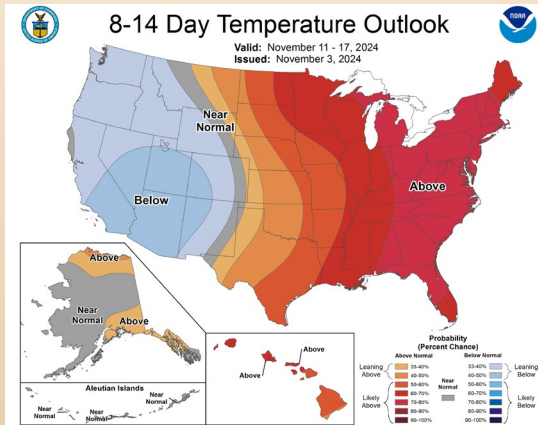
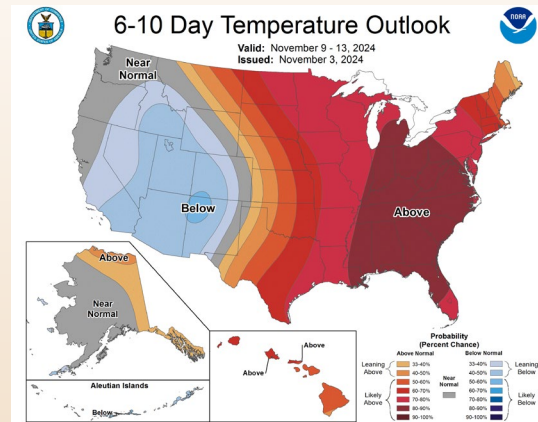
Weather Outlook

6–10-day weather outlook continue showing above normal temperatures while precipitation outlooks now lean towards above normal precipitation over the western third of the state

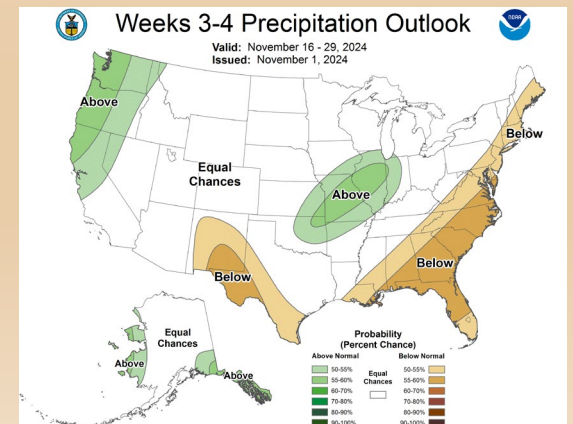
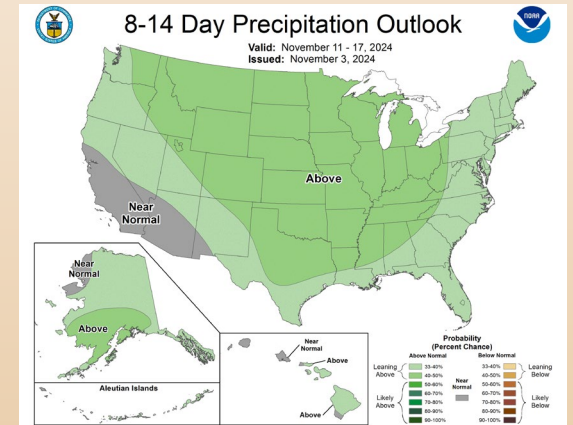
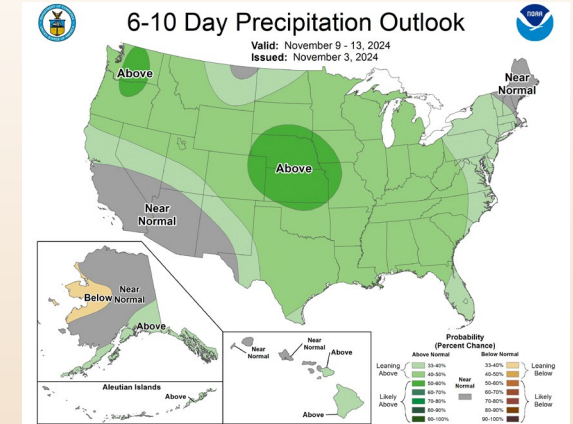
8–14-day weather outlook shows above normal temperatures while while precipitation outlooks now lean towards above normal precipitation

3–4-week weather outlook shows likely above normal temperatures and lean towards below normal precipitation in the longer-term

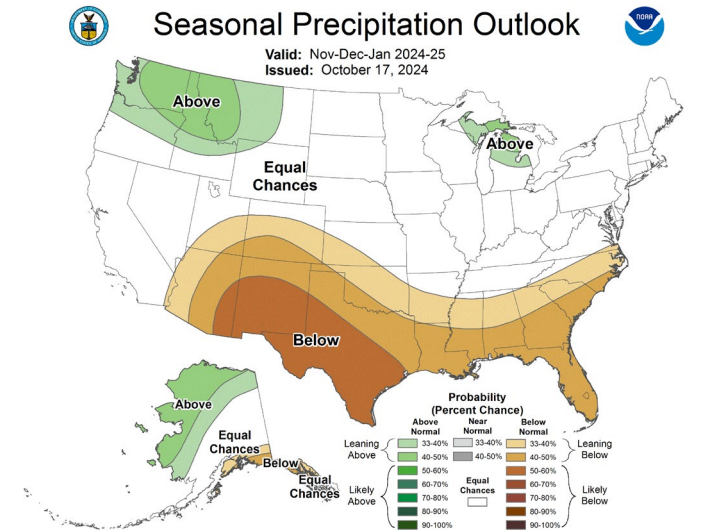
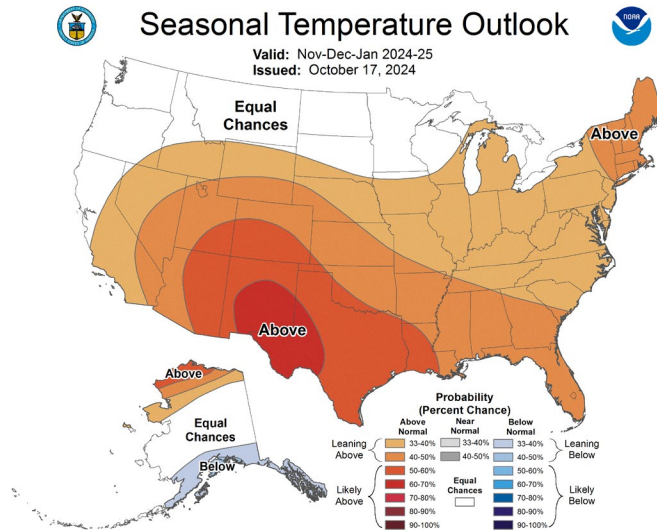
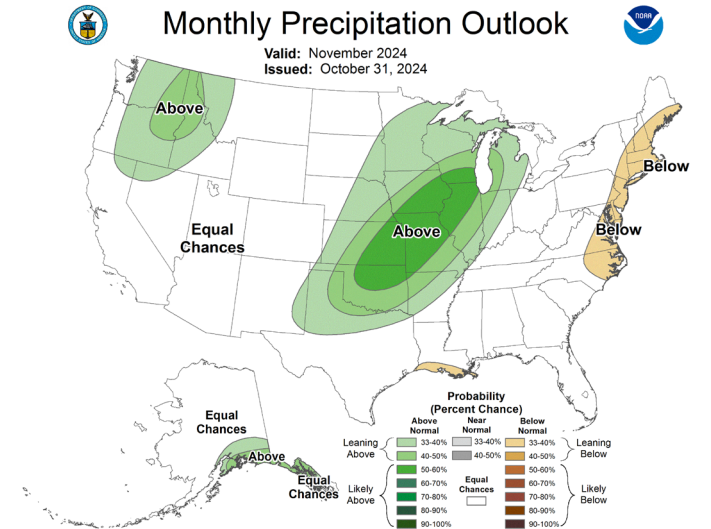
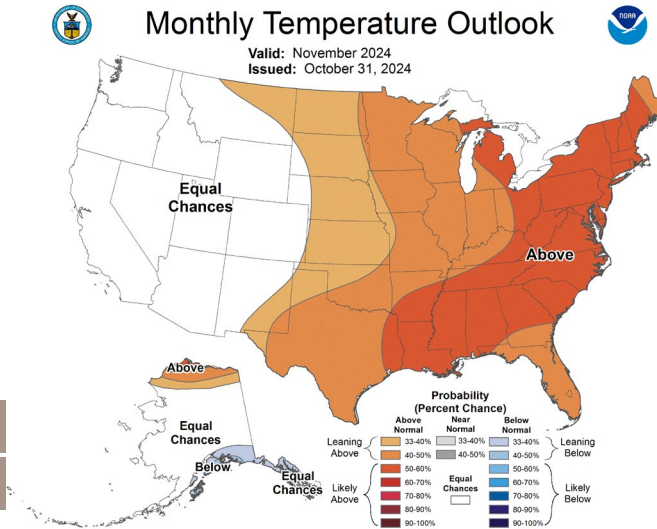
Temperature



Precipitation

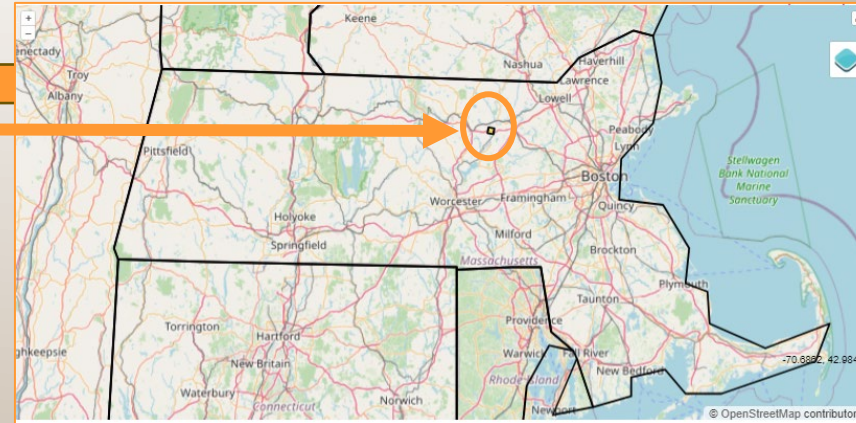


Monthly/Seasonal Outlook



Fire Behavior / Fire Danger / Fire Weather Forecasts

The intent of these forecasts is to offer a general overview of expected fire environment conditions over the next 7-days. The outputs are based on an NWS Point forecast over Devens, MA, and the fire behavior outputs are specific to that point location.



Devens, MA Weekly Summary		Mon Nov 4	Tue Nov 5	Wed Nov 6	Thu Nov 7	Fri Nov 8	Sat Nov 9	Sun Nov 10	Mon Nov 11
Max Temp, °F		53	68	73	62	57	53	54	61
Min Temp, °F		33	44	58	45	39	37	33	45
Max RH, %		93	100	93	97	85	76	92	100
Min RH, %		48	65	57	48	43	43	52	64
Max Dewpoint, °F		42	57	58	52	37	35	43	51
Min Dewpoint, °F		25	43	53	37	34	30	29	44
Max Wind, mph		7	10	12	7	9	7	7	7
Min Wind, mph		1	5	3	2	2	2	2	3
Max Wind Gust, time/dir.		1 PM ↗	1 PM ↗	12 PM ↗	1 PM ↘	1 PM ↗	12 PM ↘	1 PM ↗	1 PM ↗
Max Wind Gust, mph		9	24	25	15	18	16	15	16
Min Wind Gust, mph		3	8	9	7	7	6	6	7
Max Cloud Cover, %		85	83	57	33	26	26	79	84
Min Cloud Cover, %		66	19	31	19	10	19	24	29
Max Prob. of Precip., %		0	3	8	8	13	7	31	32
Max Haines		4	4	4	5	5	5	4	3
Max LAL		1	1	1	1	1	1	1	1
Max Mixing Height, ft		3255	2672	3847	4599	4675	4497	3226	3856
Min Mixing Height, ft		458	542	508	487	494	449	423	426
Max Ventilation Rate, kt-ft		33	48	85	69	79	67	39	54
Min Ventilation Rate, kt-ft		1	5	5	3	2	3	2	3
Max LVORI		6	9						

	4-Nov			5-Nov			6-Nov			7-Nov			8-Nov			9-Nov			10-Nov		
FM	ROS	FL	POI	ROS	FL	POI	ROS	FL	POI	ROS	FL	POI	ROS	FL	POI	ROS	FL	POI	ROS	FL	POI
GR2	12.3	2.6		17.4	2.9		22.3	3.3		12.3	2.6		18.4	3.2		13.3	2.7		12.3	2.6	
SH3	1.8	1.5		2.5	1.8		3.1	1.9		1.8	1.5		2.4	1.8		1.8	1.6		1.8	1.5	
TU3	11.1	4.8	26	16.4	5.7	24	20.5	6.3	25	11.1	4.8	28	15.4	5.6	33	11.5	4.9	32	11.1	4.8	26
TL2	0.4	0.4		0.6	0.5		0.7	0.6		0.4	0.4		0.6	0.5		0.4	0.5		0.4	0.4	
TL6	1.6	1.4		2.3	1.6		2.9	1.8		1.6	1.4		2.3	1.6		1.7	1.4		1.6	1.4	

ROS= Surface Rate of Spread (ch/hr)
FL= Surface Flame Length (feet)
POI= Probability of Ignition
GR2 (102)= Grass, Low load
SH3 (143)= Shrub, Moderate Load
TU3 (163)= Timber Understory, Moderate Load
TL2 (182)= Timber Litter, Low Load
TL6 (186)= Timber Litter, Moderate Load

Fire Danger and Fire Weather Matrix

Eastern Massachusetts

*Solar Radiation and Wind Gust Speed are not forecast through WIMS, values displayed are observations

*Burn Period Index (BPI) = (Temperature ÷ Relative Humidity) x Windspeed

*ERC2 x Wind reflects the compounding influence of dry fuels combined with wind. 10% drier fuels will exhibit a 23% increase in fire behavior with the same windspeed.

Weather Station:	OXBOW (192701)	NFDRS Fuel Model Y, 2018-2023 Historical
NFDRS Station:	OXBOW (192701)	
Workbook created by Brad Pietruszka, please send any bug reports to bradley.pietruszka@usda.gov		

NFDRS & Fire Weather Forecast

		Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon
		10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11
N F D R S	ERC Percentile	98%	98%	95%	95%	94%	98%	98%	98%	93%	88%	90%	95%	97%	98%	98%	93%	88%	85%	93%	94%	93%	
	BI Percentile	98%	95%	99%	92%	88%	99%	95%	88%	92%	88%	82%	100%	88%	92%	95%	92%	92%	88%	98%	98%	95%	
	KBDI Percentile	96%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	98%	98%	98%	98%	98%	98%	98%	98%	
	ERC	31	31	29	29	28	32	32	31	27	25	26	29	30	31	32	27	25	24	27	28	27	
	BI	22	20	24	19	18	25	20	18	19	18	17	29	18	19	20	19	19	18	22	22	20	
	KBDI	481	486	491	497	501	503	504	505	506	507	510	513	518	522	523	523	523	523	523	523	523	
	1 hr	8	9	9	10	12	9	10	12	16	13	11	9	10	10	12	15	15	14	12	12	14	
	10 hr	13	15	17	15	15	13	13	14	18	21	19	13	12	14	12	19	19	18	15	14	15	
	100 hr	15	15	16	17	17	16	15	15	15	17	19	18	16	15	14	15	18	18	18	17	16	
	1000 hr	18	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	
Live Herbaceous	115	104	91	76	60	48	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30		
Live Woody	114	107	98	89	78	71	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60		
w e a t h e r	Max Temp	83	86	80	68	64	64	57	61	60	78	85	80	60	55	55	70	73	74	66	64	59	
	Min RH	26%	28%	26%	37%	28%	26%	21%	32%	63%	44%	35%	18%	37%	28%	31%	53%	59%	45%	35%	32%	37%	
	Min Temp	44	50	49	45	34	48	32	33	36	52	51	56	35	27	27	45	59	47	40	40	35	
	Max RH	85%	90%	94%	80%	91%	67%	86%	78%	92%	95%	94%	62%	78%	90%	78%	100%	93%	100%	85%	82%	92%	
	Max Wind	7	7	11	4	5	11	8	6	8	9	8	14	5	5	6	8	8	6	10	9	8	
	Max Gust	17	14	22	16	10	27	16	16	18	14	15	25	14	12	9							

Fire Danger and Fire Weather Matrix

Eastern Massachusetts

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 *ERC2 x Wind reflects the compounding influence of dry fuels combined with wind.
 10% drier fuels will exhibit a 23% increase in fire behavior with the same windspeed.

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NFDRS Station:	Blue Hills (192101)	

Workbook created by Brad Pietruszka, please send any bug reports to bradley.pietruszka@usda.gov

NFDRS & Fire Weather Forecast

		Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon
		10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11
N F D R S	ERC Percentile	86%	84%	79%	70%	84%	84%	90%	88%	90%	70%	79%	66%	70%	86%	86%	75%	75%	75%	84%	88%	88%	
	BI Percentile	94%	88%	91%	74%	88%	94%	96%	88%	91%	64%	81%	81%	64%	81%	81%	96%	96%	88%	96%	96%	94%	
	KBDI Percentile	94%	94%	95%	95%	95%	95%	95%	95%	95%	95%	95%	96%	96%	96%	96%	96%	96%	96%	96%	96%	96%	
	ERC	23	22	21	19	22	22	25	24	25	19	21	18	19	23	23	20	20	20	22	24	24	
	BI	18	16	17	14	16	18	20	16	17	13	15	15	13	15	15	19	20	16	19	19	18	
	KBDI	507	513	519	523	527	529	531	533	534	535	537	540	544	548	549	549	549	549	549	549	549	
	1 hr	8	11	11	12	10	9	9	12	11	17	11	12	14	11	14	15	14	14	13	12	14	
	10 hr	14	16	17	19	15	16	13	13	15	22	20	21	17	14	15	19	19	19	14	14	15	
	100 hr	18	17	18	19	19	19	18	17	16	16	19	20	20	19	17	17	19	20	19	17	17	
	1000 hr	21	20	20	20	20	20	20	19	19	19	19	20	20	20	19	19	19	19	19	19	19	
Live Herbaceous	123	112	99	85	71	55	37	30	30	30	30	30	30	30	30	30	30	30	30	30	30		
Live Woody	119	112	104	95	85	76	63	60	60	60	60	60	60	60	60	60	60	60	60	60	60		
w e a t h e r	Max Temp	83	86	80	68	64	64	57	61	60	78	85	80	60	55	52	68	74	74	64	59	55	
	Min RH	26%	28%	26%	37%	28%	26%	21%	32%	63%	44%	35%	18%	37%	28%	42%	50%	55%	48%	42%	40%	41%	
	Min Temp	44	50	49	45	34	48	32	33	36	52	51	56	35	27	32	45	59	52	41	40	36	
	Max RH	85%	90%	94%	80%	91%	67%	86%	78%	92%	95%	94%	62%	78%	90%	85%	100%	93%	95%	79%	75%	86%	
	Max Wind	7	7	11	4	5	11	8	6	8	9	8	14	5	5	3	10	11	6	8	7	6	
	Max Gust	17	14	22	16	10	27	16	16	18	14	15	25	14	12	9							

Glossary of Wildland Fire and Weather Terms

National Fire Danger Rating System (NFDRS)

- **NFDRS** is a system that allows fire managers to estimate today's or tomorrow's fire danger for a given area. Managers use *NFDRS* to input data and to receive information used to determine fire danger in their area. *NFDRS* is based on historical weather observations at *Remote Automated Weather Stations (RAWS)*.
- **Energy Release Component (ERC)** is a calculated output of the *NFDRS*. The *ERC* is a number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. *ERC* has memory and as live fuels cure and live fuels dry, the *ERC* will increase.
- **Burning Index (BI)** is a number related to the contribution of fire behavior to the effort of containing a fire. The *BI* (difficulty of control) is derived from a combination of *Spread Component* (how fast it will spread) and *Energy Release Component* (how much energy will be produced).
- **Keetch-Byram Drought Index (KBDI)** assesses the risk of fire by representing the net effect of evapotranspiration and precipitation in producing cumulative moisture deficiency in deep duff and upper soil layers.
 - The *KBDI* attempts to measure the amount of precipitation necessary to return the soil to full field capacity. The index ranges from zero, the point of no moisture deficiency, to 800, the maximum drought that is possible, and represents a moisture regime from 0 to 8 inches of water through the soil layer.
- **Ignition Component (IC)** relates to the probability of a firebrand producing a fire that will require suppression action. It is mainly a function of the 1-hour time lag (fine fuels) fuel moisture content and the temperature of the receptive fine fuels. *IC* has no units. A percentage of probability from 1-100.
- **Spread Component (SC)** is a rating of the forward rate of spread of a head fire. It integrates the effect of wind, slope, and fuel bed and fuel particle properties. The daily variations are caused by the changes in the wind and moisture contents of the live fuels and the dead fuel time lag classes of 1, 10, and 100 hr.
- **Percentile**, in the context of *NFDRS*, is a value on a scale of one hundred that indicates the percent of distribution that fire danger indices rank, as based on historic occurrence. i.e., the 97th percentile for an *NFDRS* index means that only 3% of the historic records held a value higher, while 97% were lower.

Fire Behavior Attributes

- **Rates of Spread (ROS)** is the surface rate of spread in chains per hour. One chain is equal to 66 feet.
- **Flame Length (FL)** is the length of the flame on the surface from base to tip (not vertically).
- **Probability of Ignition (PIO)** is the probability of a fire brand igniting at the surface.

Fire Behavior Fuel Models

- **GR2 (102)** is low load, dry climate grass
- **SH3 (143)** is moderate load, humid climate shrub
- **TL2 (182)** is low load broadleaf litter
- **TL6 (186)** is moderate load broadleaf litter

Live and Dead Fuel Moistures used in both NFDRS and Fire Behavior Calculation

- **1-Hour Fuel (1 HR)** is a dead fuel, sized less than ¼ inch, with a time lag of 1 hour; meaning these fuels typically take 1 hour to cure.
- **10-Hour Fuel (10 HR)** is a dead fuel, sized between ¼ and 1 inch, with a time lag of 10 hours; meaning these fuels typically take 10 hours to cure.
- **100-Hour Fuel (100 HR)** is a dead fuel, sized between 1 and 3 inch, with a time lag of 100 hours; meaning these fuels typically take 100 hours to cure.
- **1000-Hour Fuel (1000 HR)** is a dead fuel, sized over 3 inches, with a time lag of 1000 hours; meaning these fuels typically take 1000 hours to cure.
- **Live Herbaceous and Woody Fuel Moisture** values are important for fire spread models as they offer a dynamic fuel moisture value that should typically parallel those live herbaceous and woody fuel moistures being experienced within vegetation in which wildfires are spreading. The lower the value the dryer.