COLLEGE OF AGRICULTURE & LIFE SCIENCES
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El Niño 2015-2016 : Will It Affect the Wildland Fire Season in Arizona?

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Unexpected below-average precipitation over the past six months has allowed grasses, leaves, twigs, and shrubs to dry out. These desiccated fine fuels have heightened wildland fire danger in the state, despite relatively favorable temperature, humidity, and wind in recent weeks. Widespread critical conditions for wildland fire are anticipated in June.

El Niño events increase the odds for above-average precipitation in Arizona during winter and spring, as the storm track shifts southward and potentially brings more storms to the region[1,2]. However, precipitation totals since last November for much of the state are below normal despite the 2015-2016 El Niño event having been one of strongest on record (Figure 1).

Due in part to this recent lack of rain and snow, abnormally dry and moderate drought conditions now cover the state[4] and coincide with the annual peak in wildland fire. How have past El Niño events affected the potential for wildland fire in Arizona during this time of the year? Has any such influence changed with the unexpected dry conditions over the past six months? In this final Extension Climate Fact Sheet about the 2015-2016 El Niño event, we start to answer these questions and note how current conditions are shaping the wildland fire season this year across the state.

What is the wildland fire season in Arizona? A lack of precipitation, warm temperatures, low humidity, and wind raise the potential for wildland fire by drying fine fuels – grasses, leaves, twigs, and shrubs – and making them easier to ignite and burn[5]. Such hot and dry conditions are common across Arizona in April, May, and June and lead to the annual peak in wildland fire danger throughout the state. Coarse fuels in the forms of branches, logs, and stumps take much longer to dry out. Their moisture levels are related mostly to precipitation totals during the months preceding the peak wildland fire season.

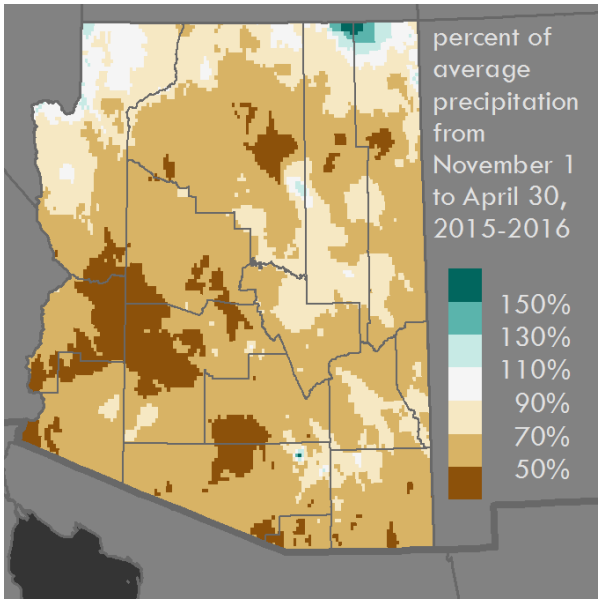

Figure 1. Compared to the average amount of rain and snow between November 1 and April 30, total precipitation during these months of the 2015-2016 El Niño event was below normal for much of Arizona[3]. November-April average precipitation is based on 1981-2010 totals.

Do El Niño events influence the wildland fire season in Arizona? As winter and spring precipitation totals are more likely to be above average during El Niño events[2], wildland fire potential typically is reduced

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from April through June of that same year[6,7,8]. This largely is due to less frequent hot and dry conditions and less drying of fine fuels during the wildland fire season.

Are daily weather conditions important to wildland fire danger? Against the hot and dry climatic backdrop across Arizona from April through June, daily weather conditions – temperature, humidity, and wind – influence wildland fire danger and can be particularly unfavorable when low humidity and high wind co-occur. This combination can promote the rapid spread of fires, especially in fine fuels. Several federal, state, and local land management agencies monitor wildland fire danger in this context through the Remote Automatic Weather Stations (RAWS) network[9]. Data from the RAWS network also serve as input to models that predict behavior of active fires.

Currently, there are 15 active RAWS units in Arizona with data records that start before 1990 (Figure 2, Table 1)[10]. These stations lie mostly in the northwestern, west-central, and southeastern parts of the state. Numerous active and inactive RAWS units with shorter data records also exist throughout Arizona.

Did the unexpectedly dry 2015-2016 El Niño event worsen fire weather this past April? One way to characterize how weather conditions increase or decrease wildland fire danger is through the use of fire weather indices that combine measures of temperature, humidity, and wind. A monthly average of the highest daily fire danger values based on one such index – the Fosberg Fire Weather Index (FFWI)[11] – shows, for example, that fire weather conditions in April of this year at the five RAWS units in northwestern Arizona were not the worst relative to those in past strong

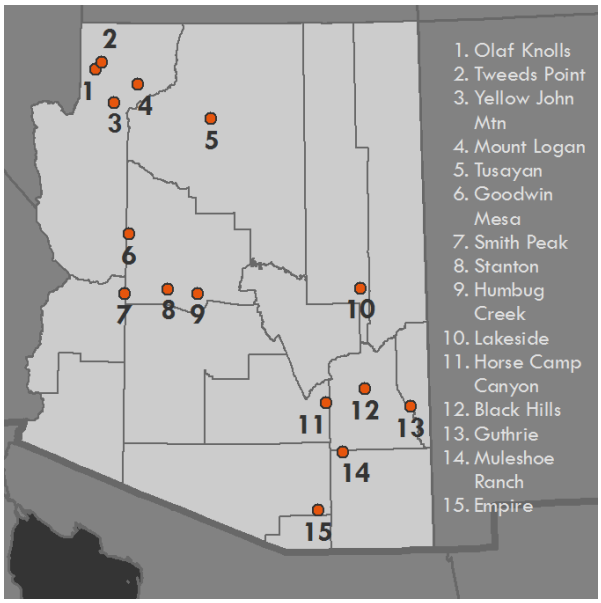

Figure 2. The 15 active RAWS units in Arizona with data records starting before 1990 are clustered in the northwestern, west-central, and southeastern parts of the state[10]. Station names are listed on the right.

station	county	start year	elevation (feet)
1.Olaf Knolls	Mohave	1985	2,900
2. Tweeds Point	Mohave	1985	5,200
3. Yellow John Mtn	Mohave	1988	6,160
4. Mount Logan	Mohave	1985	7,605
5. Tusayan	Coconino	1986	6,700
6. Goodwin Mesa	Yavapai	1985	4,200
7. Smith Peak	La Paz	1989	2,500
8. Stanton	Yavapai	1985	3,600
9. Humbug Creek	Yavapai	1986	5,250
10. Lakeside	Navajo	1986	7,000
11. Horse Camp Canyon	Pinal	1987	4,040
12. Black Hills	Graham	1989	3,300
13. Guthrie	Greenlee	1986	3,600
14. Muleshoe Ranch	Cochise	1988	4,560
15. Empire	Pima	1989	4,650

Table 1. The 15 active RAWS units in Arizona with data records starting before 1990 span an elevational range from 2,500 to just over 7,600 feet above sea level[10]. Start years for individual stations include data within the April-June period.

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El Niño events occuring in 1991-1992, 1997-1998, and 2009-2010 (Figure 3)[12]. Moreover, average fire weather conditions this past April were similar to or better than the average of such conditions during April of past years with either no strong or no El Niño event occurring at four of these five stations (Figure 3 and Table 2). Only the Mount Logan RAWS unit recorded an average FFWI value during April 2016 above the average April FFWI value for non-strong and non-El Niño event years.

In contrast to fire weather conditions in the northwestern part of the state, average conditions during April 2016 at the four RAWS units in west-central Arizona were similar to or worse than the worst conditions during past strong El Niño events (Figure 4). However, average FFWI values in April 2016 were near or below the non-strong and non-El Niño event average values at the Goodwin Mesa, Smith Peak, Stanton, and Humbug Creek stations (Table 2 and Figure 4).

For the six RAWS units in the southeastern part of the state, average fire weather conditions this past April were similar to the worst conditions recorded during past strong El Niño events (Figure 4). Unlike most of the RAWS units in northwestern and west-central Arizona, average FFWI values for April 2016 were below the non-strong and non-El Niño event averages at the Horse Camp Canyon, Black Hills, Guthrie, Muleshoe Ranch, and Empire stations (Table 2 and Figure 4). The average FFWI value for April 2016 was near the non-strong and non-El Niño event averages at the Lakeside station, the northernmost RAWS unit in this group (Figure 2).

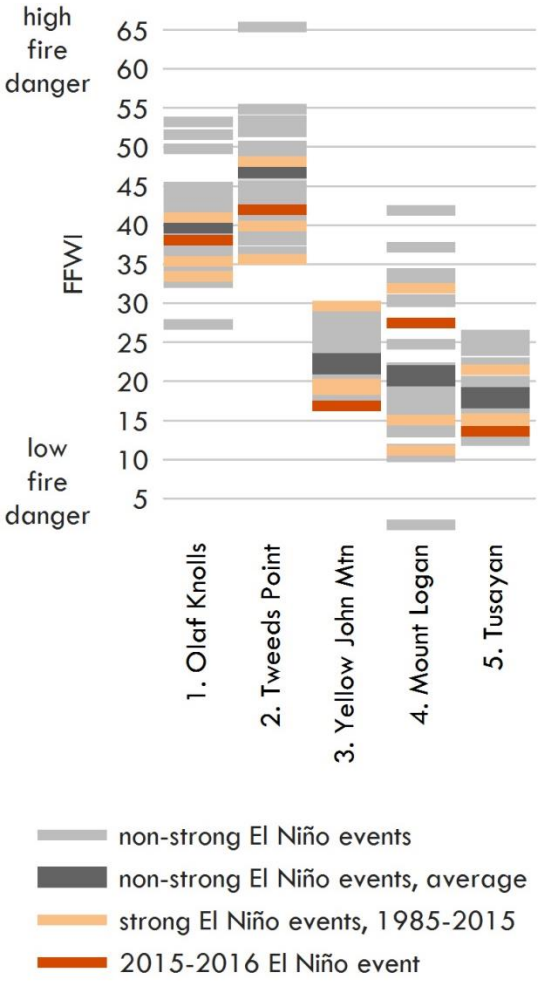

Figure 3. The average of the highest daily fire danger values calculated with the Fosberg Fire Weather Index (FFWI)[11] during April 2016 are not the worst when compared to past strong El Niño events in 1991-1992, 1997-1998, and 2009-2010 [12] at five RAWS units in northwestern Arizona (Figure 2, Table 1).

What level of fire danger might we expect for the remainder of the wildland fire season this year? As wildland fire danger based on recent weather conditions has been relatively low or moderate at almost all RAWS unit locations (Table 2 and Figure 4), the desiccation of fine fuels may be of greater concern. Grasses, leaves, twigs, and shrubs that grew in response to average and above-average precipitation from June through

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station	average April FFWI non-El Niño events	all El Niño events*	strong El Niño events*	2015-2016 El Niño event
1.Olaf Knolls	40.5	38.6	36.6	38.1
2. Tweeds Point	48.2	43.5	41.2	42.0
3. Yellow John Mtn	22.7	21.4	22.8	16.9
4. Mount Logan	22.5	15.9	19.4	27.5
5. Tusayan	18.4	16.4	17.2	13.6
6. Goodwin Mesa	38.8	33.5	31.0	37.7
7. Smith Peak	30.6	27.6	25.6	29.7
8. Stanton	43.9	39.6	36.3	42.1
9. Humbug Creek	50.6	44.0	38.2	46.7
10. Lakeside	28.3	23.5	26.0	27.3
11. Horse Camp Canyon	48.2	42.9	40.7	43.1
12. Black Hills	36.5	32.8	31.4	32.9
13. Guthrie	54.6	46.7	41.9	44.7
14. Muleshoe Ranch	34.4	31.4	29.2	30.2
15. Empire	39.5	35.4	31.8	36.7

*averages do not include the April FFWI value from the 2015-2016 El Niño event

Table 2. Average April values of the highest daily fire danger values calculated with the Fosberg Fire Weather Index (FFWI)[11] at the 15 active RAWS units in Arizona with data records starting before 1990 (Figure 2, Table 1) reflect the general expectation for lower wildland fire danger during El Niño events[12]. Only the Mount Logan station recorded an average FFWI value during April 2016 above the averages for non-, all, and strong El Niño events. Higher (lower) FFWI values correspond to higher (lower) fire danger.

October of 2015 [13,14] appear to be drying out (Figure 5) due to below-average precipitation across much of Arizona over the past six months (Figure 1). Recent near- to above-average precipitation across northern Arizona may temper current wildland fire danger, but conditions could worsen quickly in the coming weeks depending on temperature and wind. Outlooks show above-normal potential for significant wildland fire across southern, central, and northwestern Arizona for the rest of this fire season largely due to dry fine fuels[16].

What could be some of the related relevant impacts in Arizona? The widespread critical conditions for wildland fire that are expected in the coming weeks[16] are important to rural and wildland-urban transition areas in several ways. For instance, high fire danger may restrict recreational and tourist activities that contribute to local economies. Landowners may need to postpone burning debris piles. Contractors using equipment that produces sparks may have to reschedule activities. Also, fire management professionals may need to make decisions regarding the allocation of resources to address the potential for wildland fires while considering the protection of life and property as well as the goals of ecosystem management.

How can I get more information? Several online resources that may be helpful this wildland fire season are available. The Arizona Interagency Wildfire Prevention website provides a broad collection of information regarding wildland fire

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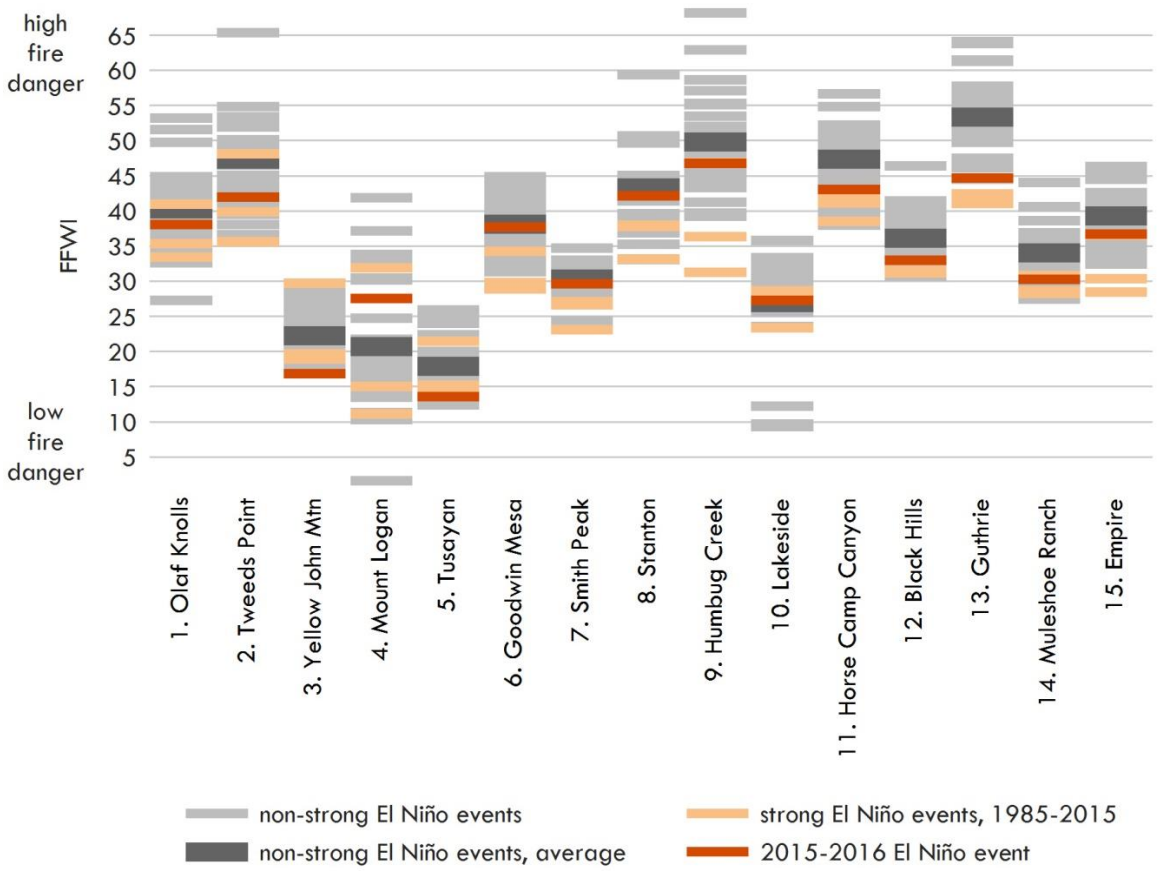

Figure 4. How recent fire weather conditions differ from those of past strong El Niño events depends on the part of the state in which an individual RAWS unit is located. Based on a monthly average of the highest daily values of the Fosberg Fire Weather Index (FFWI)[11], April 2016 conditions were not the worst for stations in northwestern Arizona, similar to or worse than the worst in west-central Arizona, and similar to the worst in southeastern Arizona.

prevention, current fire restrictions, and active fires for the entire state. FireRestrictions.us is a website showing near-real-time fire restriction and closure information for state, tribal, and federal lands in Arizona through a map interface. The InciWeb Incident Information System reports active wildland fire information including land management units and acreage. DroughtView is a web map application that displays near-real-time observations of satellite-measured surface greenness, which is an indication of fine fuel moisture levels.

In addition to this final Extension Climate Fact Sheet about the 2015-2016 El Niño event, climate specialists and scientists of Cooperative Extension are working with the Climate Assessment for the Southwest (CLIMAS) to produce a detailed summary of the event. Please contact us for further information, data, and analysis that could be applied to stakeholder needs in your county.

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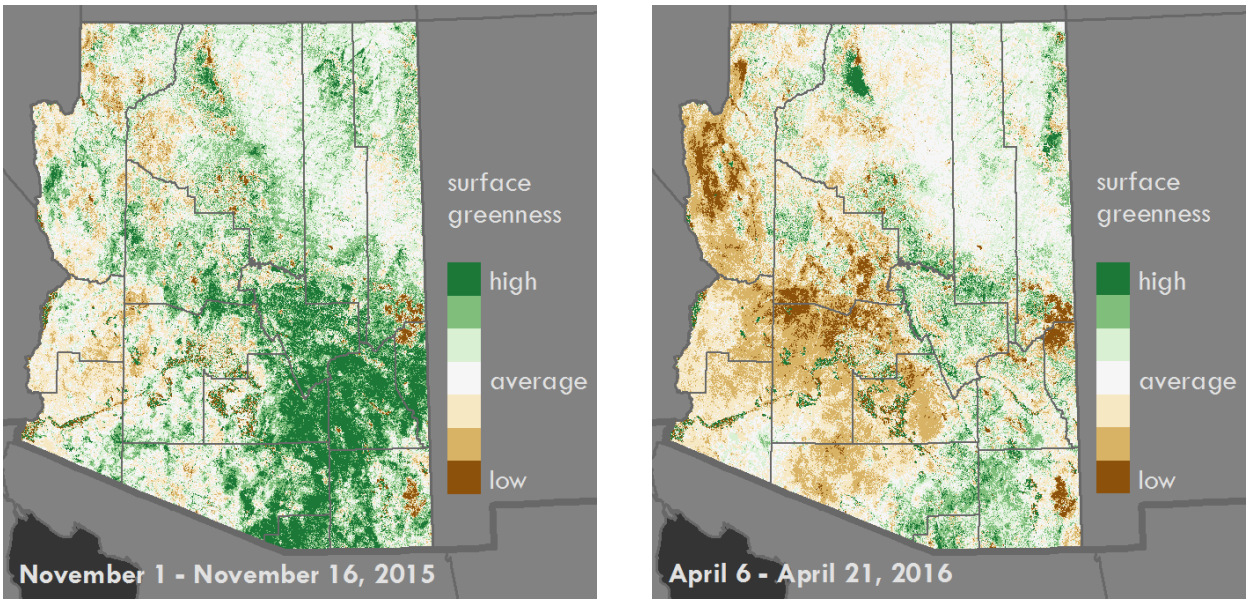

Figure 5. Satellite-measured surface greenness declined between November and April, suggesting that the lack of rain and snow in recent months has curtailed plant growth and reduced plant moisture levels, particularly in the northwestern and southwestern parts of the state[15]. Desiccated vegetation can worsen wildland fire conditions during the April-June fire season.

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