

# El Niño Update & Implications for Forestry

October 2015



**El Niño** is the warm phase of an ocean-atmosphere circulation pattern in the equatorial Pacific Ocean, known as the El Niño-Southern Oscillation (ENSO), which is responsible for a large fraction of the year-to-year variability in global climate. In previous CSLN bulletins we have highlighted the role of ENSO in shaping [short-term variability](#) in global temperature.

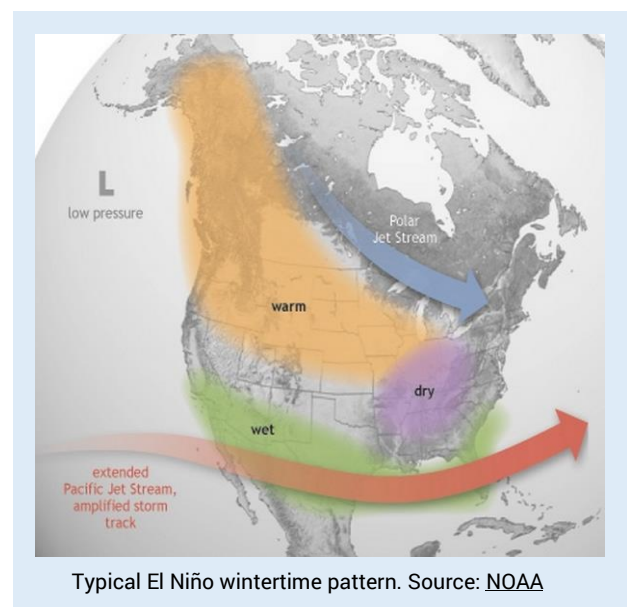
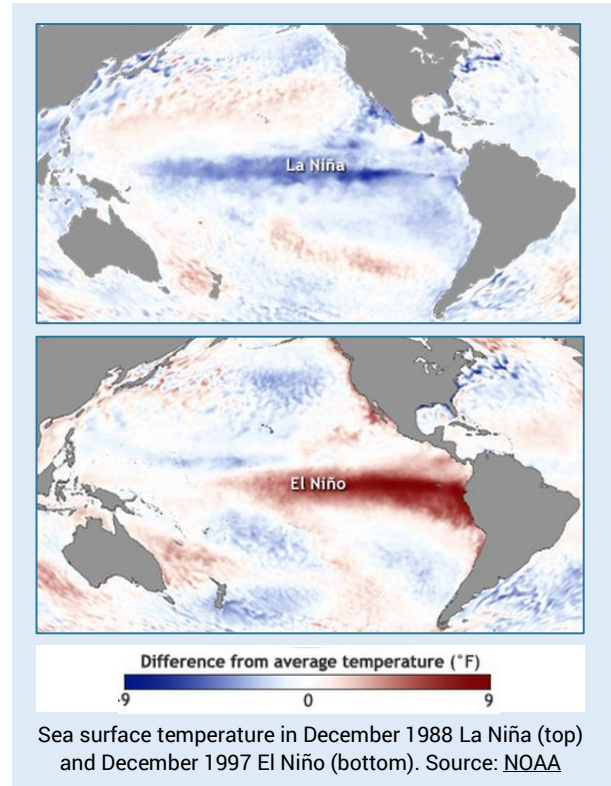
**How it works:** The trade winds typically blow east to west around the equator, pushing warm surface ocean water so it piles up in the western Pacific near Indonesia. When these winds strengthen, it causes upwelling of deep, cold ocean water near the west coast of South America and we see *below-average* surface ocean temperatures in this region, also known as a La Niña. When these winds weaken (every two to seven years), the warm water “sloshes back” toward South America leading to the *above-average* surface ocean temperatures of an El Niño event (see figure, right).

**Why it matters:** These changes alter global atmospheric circulation patterns and consequently have a big influence on temperature and precipitation throughout the world. In particular, ENSO has implications for:

- **Global Temperature** – During an El Niño, enough extra heat is transferred from the ocean to the atmosphere that average global temperatures can rise for a period of time, which is why there is a good chance that this year will beat 2014 as the warmest year on record if there is an El Niño.
- **Regional Weather** – The domino effect caused by the warmer ocean surface during an El Niño leads to a shift in the jet stream that has implications for weather patterns in the United States, with the effects here predominantly felt in the fall and winter months.

The weather in some regions, like the Gulf Coast or southern California, is more directly influenced by El Niño conditions than other regions, such as New England, where we are more likely to experience a change in regional weather if it is a particularly strong El Niño event. Predictions about specific impacts are highly uncertain, but it is *generally* associated with:

- Cooler and wetter-than-average conditions along the Gulf Coast (Texas to Florida)\*
- Above-average temperatures and below-average snowfall in New England
- Warmer temperatures and less snowfall in the upper Midwest to Great Lakes areas
- Drier-than-normal conditions across the Great Lakes to the Ohio River Valley
- More severe weather in the southern U.S.
- More eastern Pacific hurricanes and fewer Atlantic hurricanes
- Wetter weather in southern California



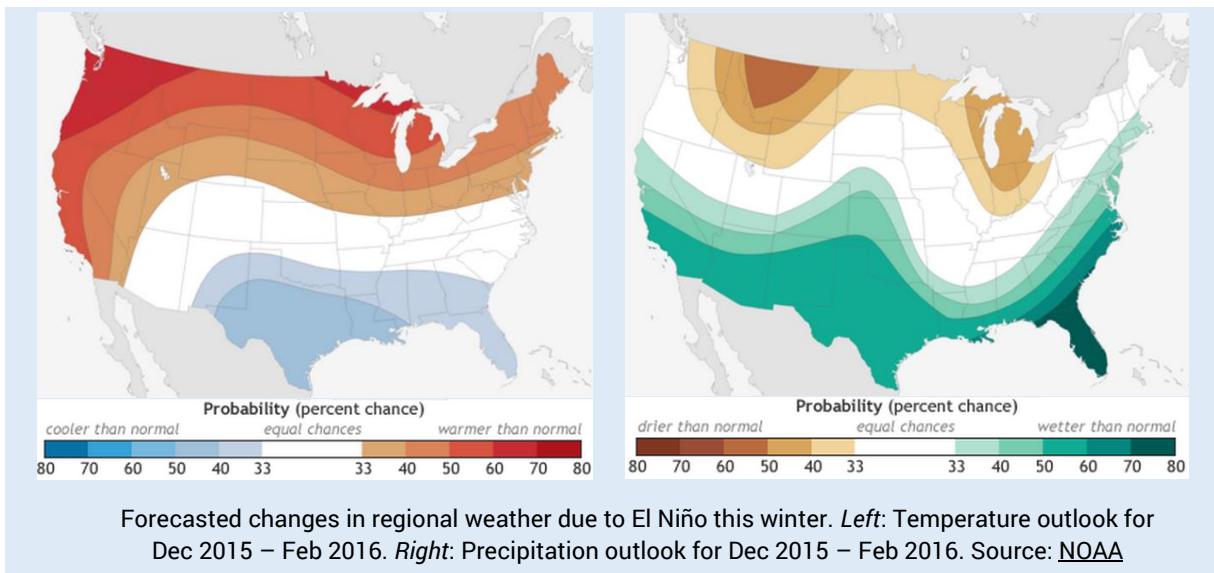
\* This is the most reliable and frequently observed El Niño signal.

- **Forest Productivity & Fire Frequency** – Weather changes associated with ENSO affect plant productivity and these changes cascade up through the food web shaping entire ecosystems. For example, El Niño years can flip the Amazon region from being a carbon sink to a carbon source, wetter periods during La Niña episodes have been linked to more successful seedling establishment in some Australian tree species, and ENSO-induced droughts contribute to increased wildfires in some places.

Fire regimes in the western continental U.S. and western boreal forests of North America are particularly sensitive to ENSO-driven climatic change, especially the interaction of ENSO with another climate phenomenon known as the Pacific Decadal Oscillation (PDO). Taken together, these climate patterns explain a notable portion of the fire history in these regions.

ENSO/PDO activity drives fire behavior by influencing fuel moisture. Wildfire frequency, severity, and total area burned are affected by seasonal precipitation, temperature, and atmospheric conditions (specifically the frequency of blocking high pressure systems and extreme fire weather), but the impacts of ENSO are variable and regionally-specific. For example, El Niño typically brings wetter winter-spring conditions to the Southeastern and Southwestern U.S. and the area burned is reduced. In contrast, El Niño events tend to bring warmer and drier winter-spring conditions to the Pacific Northwest and the result is increased wildfire activity during those seasons, but it also typically leads to more precipitation in the summer, coinciding with fewer large fires in the warmer months.

**ENSO Status Update:** “There is an approximately 95% chance that El Niño will continue through Northern Hemisphere winter 2015-16, gradually weakening through spring 2016” ([NOAA CPC](#)). These estimates are based on several indices generated from monitoring air pressure changes, sea surface temperatures, outgoing longwave radiation, and wind in the equatorial Pacific. Each of these variables capture a component of the ocean and atmospheric dynamics that are part of the ENSO phenomenon.



### How might climate change influence future ENSO events?

There are a number of ingredients that combine to produce ENSO (atmospheric circulation, ocean convection, cloud cover, etc.) and climate change will affect all or most of these, so it is reasonable to expect that ENSO may change in the future. While some recent research suggests there is a chance for an increase in extreme El Niños, at this time it is difficult to say what the net effect will be on the strength and frequency of El Niño events. One thing that is certain is that climate change may enhance some of the impacts from ENSO events, e.g. warmer average temperatures may turn an El Niño-induced dry period into severe drought, or the biasing of precipitation toward heavy downpours in a warmer atmosphere may exacerbate flash flooding risk in areas where El Niño brings increased precipitation.

*Note:* For El Niño updates and excellent explanations of emerging and on-going research on the topic of ENSO, check out the [NOAA ENSO blog](#)