Future forest health concerns for Southern California

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Photos: Downtown Pasadena.com; Californiachapparal.org
Outline
What is shaping change in Southern CA forests?
What will Southern CA forests contain in 2114?
Current and future concerns???

- Climate Change
- Drought
- Fire
- Laurel wilt
- Insects from Mexico?
- Lack of resources to care for land; politics
Southern CA Bioregion

Photos: Californiachaparral.org
Threats

Drought

Fire

Water Diversion

Development. Urban encroachment.

Recreation over use.  Off-road vehicles.

Tourism. Recreational shooting areas.

Drug manufacturing.

Grazing

Oil and gas drilling. Mining

Poor vegetation management

Air pollution

Lack of care for species valued by tribes
Threatened and Endangered Species

- 76 federally listed threatened & endangered species in the 4 Southern CA National Forests.

- 405 at-risk species

San Joaquin kit fox, Smith’s blue butterfly, California spotted owl, bald eagle, California red-legged frog, arroyo toad, California jewelflower, California gnatcatcher, California condor, ash-gray Indian paintbrush, bird-footed checkerbloom, steelhead trout, Santa Ana sucker and many more
Southern CA – 2014 Aerial Survey

Cleveland NF: Drought effects on CA black oak

Angeles NF: Coulter pine plantations with Ips

San Bernardino NF: Jeffrey pine killed by CA fivespined Ips. These trees are located in Idyllwild.

Angeles NF: Coulter pine killed by CA fivespined Ips

Photos: USFS Forest Health Protection
Laurel Wilt – Threat to California Bay Laurel

Redbay ambrosia beetle, 
*Xyleborus glabratus*

*Raffaelea lauricola – a fungus*
1. Red Palm Weevil, *Rhynchophorus ferrugineus*
2. South American Palm Weevil, *Rhynchophorus palmarum*

Mexican pine beetle, *Dendroctonus mexicanus*

Laguna Beach (Orange Co.) 2010

San Ysidro (San Diego Co.) 2011

Credit: UC Riverside; Center for Invasive species Research
Climate & Climate Change

- 2014 is warmest year in 120 years of recordkeeping.
- CA’s average temperature has been 4.6°F above average. That smashes the previous record by 1.4°F.

Los Angeles currently sees 23 days above 90°F. Increases to 41 days by 2050.

Climate Central.org
Sea Level Rise

- 6 inches within 20 years, and 3 feet or more by the end of the century
- Loss of approximately 23% of freshwater marshes (by 2100)
- A slight gain of salt marshes because freshwater marshes and swamplands convert to salt marshes when inundated.

- Beaches?

Credit: San Diego Coast Keeper, Newport – D. Ramey-Logan
Fire! Drought stress! Lack of water!
Southern CA Ecosystems – Fire and Climate Change

- Fire is an essential ecosystem process in many southwestern forests.
- Fire prone forests are likely to become more flammable with climate change.
- Restoring fire may facilitate climate change adaptation.

In 1980 the largest wildfire was about 50,000 acres over 3 weeks of burning. Now we’re seeing 40,000, 50,000, 60,000 acres burned in a day. – Tom Swetnam, Univ. Of Arizona

<table>
<thead>
<tr>
<th>FIRE NAME/CAUSE</th>
<th>DATE</th>
<th>COUNTY</th>
<th>ACRES</th>
<th>STRUCTURES</th>
<th>DEATHS</th>
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</thead>
<tbody>
<tr>
<td>1 CEDAR (HUMAN RELATED)</td>
<td>October 2003</td>
<td>SAN DIEGO</td>
<td>273,246</td>
<td>2,820</td>
<td>14</td>
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<tr>
<td>2 RUSH (LIGHTNING)</td>
<td>August 2012</td>
<td>LASSEN</td>
<td>271,911 CA / 16,664 NV</td>
<td>0</td>
<td>0</td>
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<tr>
<td>3 REI (HUMAN RELATED)</td>
<td>August 2013</td>
<td>TUOLUMNE</td>
<td>257,314</td>
<td>112</td>
<td>0</td>
</tr>
<tr>
<td>4 ZACA (HUMAN RELATED)</td>
<td>July 2007</td>
<td>SANTA BARBARA</td>
<td>240,207</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5 MATILIA (UNDETERMINED)</td>
<td>September 1932</td>
<td>VENTURA</td>
<td>220,000</td>
<td>0</td>
<td>0</td>
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<tr>
<td>6 WITCH (POWERLINES)</td>
<td>October 2007</td>
<td>SAN DIEGO</td>
<td>197,990</td>
<td>1,650</td>
<td>2</td>
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<tr>
<td>7 KLAMATH THEATER COMPLEX (LIGHTNING)</td>
<td>June 2008</td>
<td>SISKIYOU</td>
<td>192,038</td>
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<td>8 MARBLE CONE (LIGHTNING)</td>
<td>July 1977</td>
<td>MONTEREY</td>
<td>177,866</td>
<td>0</td>
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<td>9 LAGUNA (POWERLINES)</td>
<td>September 1970</td>
<td>SAN DIEGO</td>
<td>175,425</td>
<td>382</td>
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<tr>
<td>10 BASIN COMPLEX (LIGHTNING)</td>
<td>June 2008</td>
<td>MONTEREY</td>
<td>162,818</td>
<td>58</td>
<td>0</td>
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<tr>
<td>11 DAY FIRE (HUMAN RELATED)</td>
<td>September 2006</td>
<td>VENTURA</td>
<td>162,702</td>
<td>11</td>
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<tr>
<td>12 STATION FIRE (HUMAN RELATED)</td>
<td>August 2009</td>
<td>LOS ANGELES</td>
<td>160,557</td>
<td>209</td>
<td>2</td>
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<tr>
<td>13 McNALLY (HUMAN RELATED)</td>
<td>July 2002</td>
<td>TULARE</td>
<td>150,696</td>
<td>17</td>
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<td>14 STANISLAUS COMPLEX (LIGHTNING)</td>
<td>August 1987</td>
<td>TUOLUMNE</td>
<td>145,980</td>
<td>28</td>
<td>1</td>
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<tr>
<td>15 BIG BAR COMPLEX (LIGHTNING)</td>
<td>August 1999</td>
<td>TRINITY</td>
<td>140,948</td>
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<td>0</td>
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<tr>
<td>16 CAMPBELL COMPLEX (POWERLINES)</td>
<td>August 1990</td>
<td>TEHAMA</td>
<td>125,892</td>
<td>27</td>
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<tr>
<td>17 WHEELER (ARSON)</td>
<td>July 1985</td>
<td>VENTURA</td>
<td>118,000</td>
<td>26</td>
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<tr>
<td>18 SIMI (UNDER INVESTIGATION)</td>
<td>October 2003</td>
<td>VENTURA</td>
<td>108,204</td>
<td>300</td>
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<td>19 HWY. 58 (VEHICLE)</td>
<td>August 1996</td>
<td>SAN LUIS OJIBO</td>
<td>106,668</td>
<td>13</td>
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<tr>
<td>20 IRON ALPS COMPLEX (LIGHTNING)</td>
<td>June 2008</td>
<td>TRINITY</td>
<td>105,865</td>
<td>2</td>
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</tbody>
</table>

There is no doubt that there were fires with significant acreage loss in years prior to 1932, but those records are less reliable, and this list is meant to give an overview of the large acreage-loss fires in more recent times. (Also note that this list does not include fire jurisdiction. These are the top 20 within the state, regardless of whether they were state, federal, or local responsibility.)
Locations of increased forest mortality due to drought & high temperatures

Which areas & which trees will die?

Global convergence in the vulnerability of forests to drought

Temperature as a potent driver of regional forest drought stress and tree mortality

The interdependence of mechanisms underlying climate-driven vegetation mortality
Carbon. Beetles cause forest to go from sink to source.

Manage water for forest health!

Mulch
Thinning and species selection
Soil conservation
Irrigation

Water for fish? Water for farms? Water for city people?
Or – water for the forest?

Acknowledgements

USDA Forest Service,
Pacific Southwest Research Station
Thousand Cankers Disease and the Walnut Twig Beetle in California

Walnut twig beetle, *Pityophthorus juglandis*

& *Geosmithia morbida*

Credit: UC IPM Online
Increasing stand density

Altered species composition

Fire suppression

Root disease,
Dwarf mistletoe,
Beetles

D. Conklin, USFS
How will forests respond to climate change?

Warming will
- decrease snowpack,
- cause earlier snowmelt,
- increase summer evapotranspiration,
- increase the frequency and severity of droughts,
- increase risk of frost injury
- change germination time
- change time of bud set and bud break

Shot Hole Borer (*Euwallacea sp.*) and Fusarium Dieback (*Fusarium sp.*)

- Los Angeles and Orange Counties

- Hosts: Coast live oak, box elder, avocado, big leaf maple, California sycamore and more
What will drive forest change?
Gold spotted oak borer, *Agrilus auroguttatus*

Coast live oak in San Diego Co. and CA black oak in Riverside Co.
Range of coast live oak

Range of CA black oak

Range of gold spotted oak borer?