Future forest health concerns for Nevada

Janice Alexander
University of California Cooperative Extension, Novato, CA
jalexander@ucanr.edu

UC CE

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

Pacific Southwest Research Station

Outline

What is shaping change in Nevada forests?

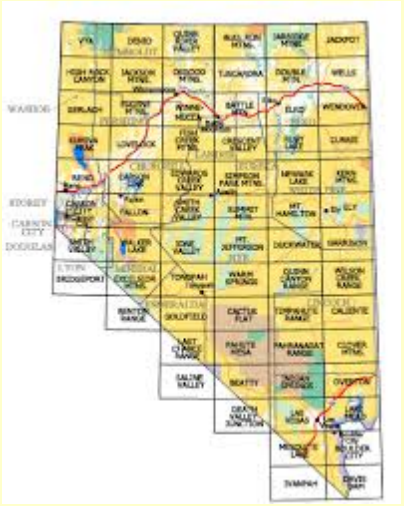
What will Nevada forests contain in 2114?

Current and future concerns???

- Climate Change
- Drought
- Fire
- Lack of resources to care for land; politics

Photo: International Car Forest, rotorama.com

Nevada Bioregions



Sierra Nevada
Intermountain Desert
Mojave Desert

Photos: Nevada mojave (flickr.com); Intermountain region (fs.fed.us)

Threats

Drought. Water diversion.

Fire.

Development. Urban encroachment. Drug manufacturing.

Recreation over-use. Off-road vehicles. Tourism. Recreational shooting areas.

Grazing.

Oil and gas drilling. Mining.

Poor vegetation management.

Air pollution.

Lack of care for species valued by tribes.

Photos: Los Padres Forest Watch, Popular Mechanics

Threatened and Endangered Species

40+ federally-listed threatened & endangered species

Southwestern willow flycatcher
Yuma clapper rail
Numerous fishes (pupfish, chub, trout, springfish, etc.)
Gray wolf
Sierra Nevada bighorn sheep
Numerous plants (milk-vetch, buckwheat, etc.)
Desert tortoise

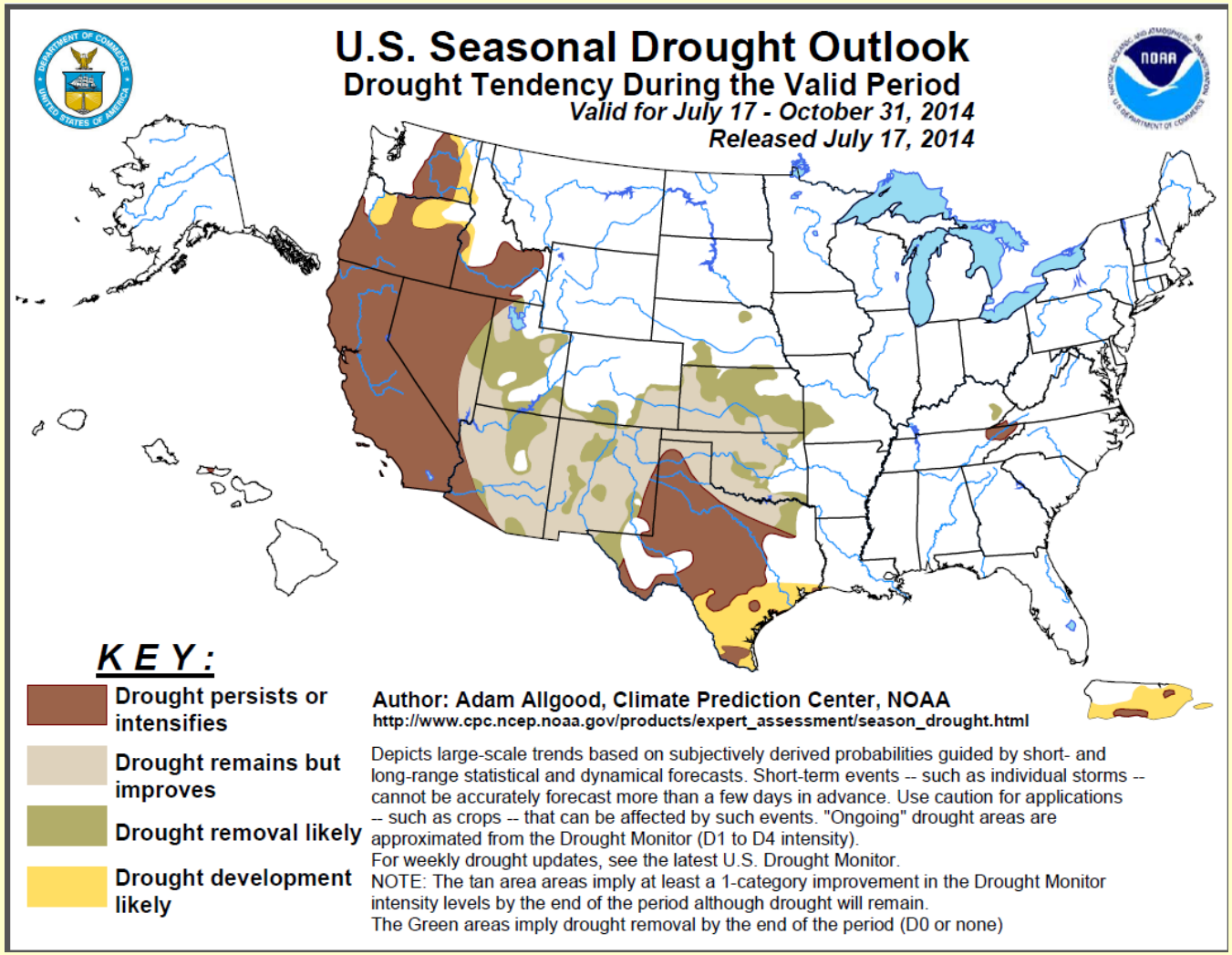
Photos: Southwestern willow flycatcher (nrcs.usda.gov); gray wolf (fws.gov); steamboat buckwheat (dcnr.nv.gov); Devil's hole pupfish (nas.er.usgs.gov)

Climate & Climate Change

2014 is warmest year in 120 years of recordkeeping.

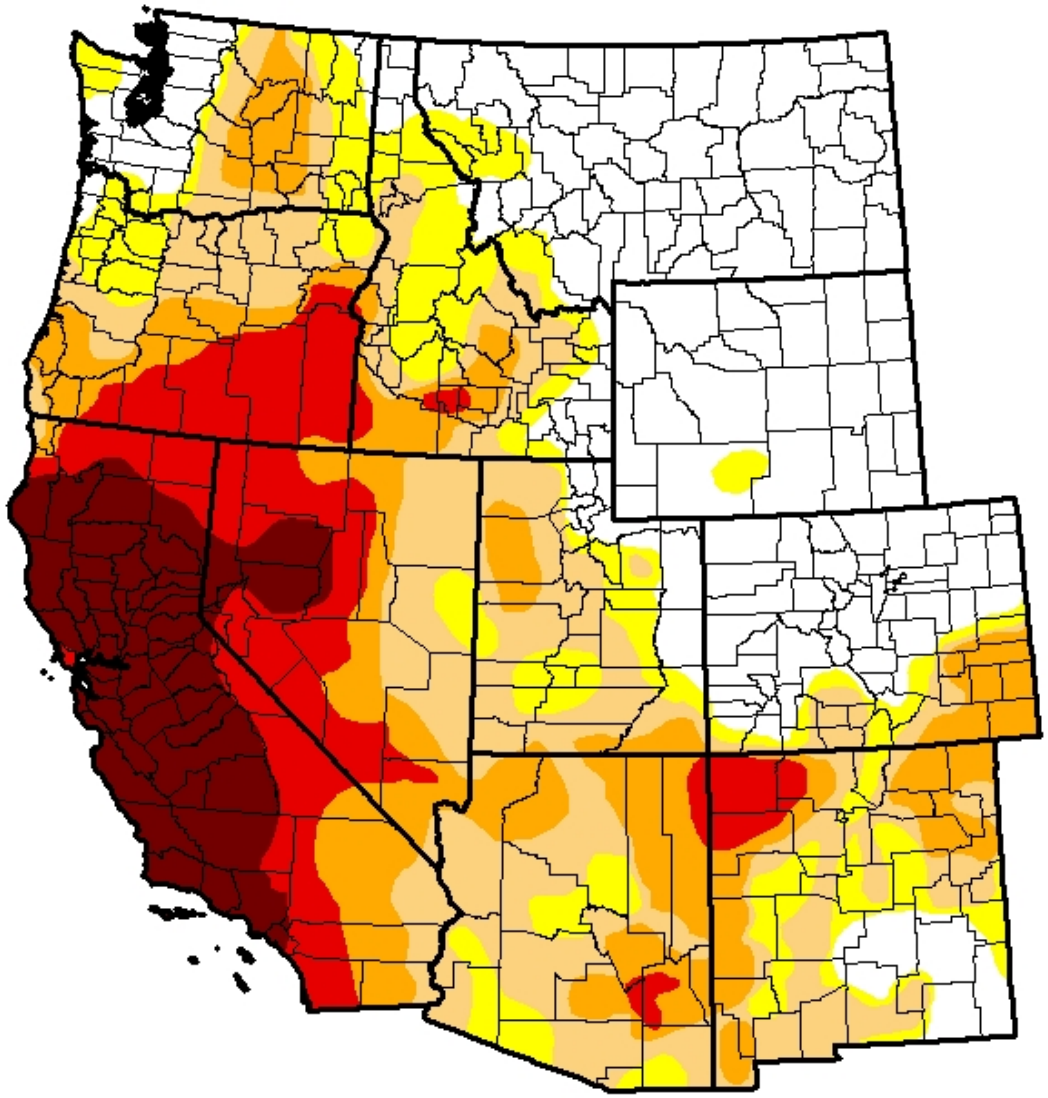
By 2100, average temperatures in Nevada are predicted to increase 3-4°F (spring/fall) and 5-6°F (summer/winter).

Changes in precipitation, including 16 fewer days in the snow season since 1950, mean limited water supplies.



Climate Central.org ; cier.umd.edu

U.S. Drought Monitor
West



October 14, 2014

(Released Thursday, Oct. 16, 2014)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	31.95	68.05	55.56	35.07	19.75	8.90
Last Week *10/7/2014*	31.51	68.49	55.52	35.65	19.95	8.90
3 Months Ago *7/15/2014*	31.51	68.49	60.35	46.65	23.56	6.02
Start of Calendar Year *12/31/2013*	22.20	77.80	51.44	31.11	7.75	0.63
Start of Water Year *9/30/2014*	31.48	68.52	55.57	35.65	19.95	8.90
One Year Ago *10/15/2013*	27.53	72.47	56.15	32.44	5.34	0.63

Intensity:

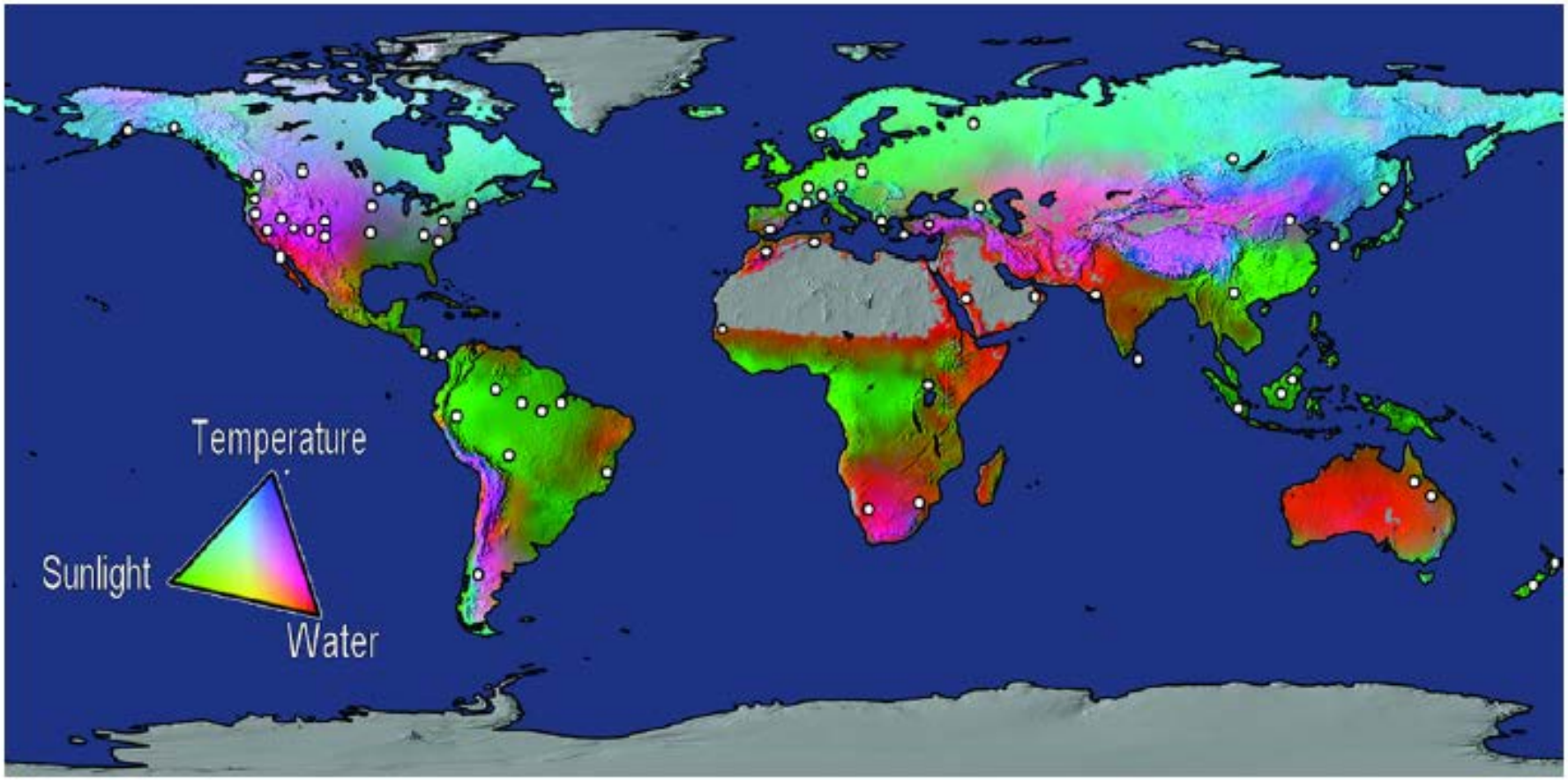
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Mark Svoboda
National Drought Mitigation Center

http://droughtmonitor.unl.edu/

Locations of increased forest mortality due to drought & high temperatures



C. D. Allen et al. 2010. A global overview of drought and heat-induced tree mortality reveals emerging climate change risks for forests. For. Ecol. Manage. 259: 660–684.

How will forests respond to climate change?

Warming will:

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

Photo: conifers.org

Chumua, D.J., P.D. Anderson, G.T. Howe, C.A. Harrington, J.E. Halofsky, D.L. Peterson, D.C. Shaw, and B. St. Clair. 2011. Forest Responses to climate change in the northwestern United States: Ecophysiological foundations for adaptive management. Forest Ecology and Management. 261: 1121-1142

Which areas & which trees will die?

Soil depth and quality is key

LETTER

doi:10.1038/nature11688

Global convergence in the vulnerability of forests to drought

Brendan Choat[1]*, Steven Jansen[2]*, Tim J. Brodribb[3], Hervé Cochard[4,5], Sylvain Delzon[6], Radika Bhaskar[7], Sandra J. Bucci[8], Taylor S. Feild[9], Sean M. Gleason[10], Uwe G. Hacke[11], Anna L. Jacobsen[12], Frederic Lens[13], Hafiz Maherali[14], Jordi Martínez-Vilalta[15,16], Stefan Mayr[17], Maurizio Mencuccini[18,19], Patrick J. Mitchell[20], Andrea Nardini[21], Jarmila Pittermann[22], R. Brandon Pratt[12], John S. Sperry[23], Mark Westoby[10], Ian J. Wright[10] & Amy E. Zanne[24,25]

ARTICLES
PUBLISHED ONLINE: 30 SEPTEMBER 2012 | DOI: 10.1038/NCLIMATE1693
nature climate change

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

A. Park Williams[1]*, Craig D. Allen[2], Alison K. Macalady[3,4], Daniel Griffin[3,4], Connie A. Woodhouse[3,4], David M. Meko[4], Thomas W. Swetnam[4], Sara A. Rauscher[5], Richard [illegible], Henri D. Grissino-Mayer[7], Jeffrey S. Dean[4], Edward R. Cook[6], Chand[illegible], Michael Cai[8] and Nate G. McDowell[1]

Review
Cell PRESS

The interdependence of mechanisms underlying climate-driven vegetation mortality

Nate G. McDowell[1], David J. Beerling[2], David D. Breshears[3], Rosie A. Fisher[4], Kenneth F. Raffa[5] and Mark Stitt[6]

[1] Los Alamos National Laboratory, Los Alamos, NM, USA
[2] Department of Animal and Plant Sciences, University of Sheffield, Sheffield, UK
[3] School of Natural Resources and the Environment, and Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, AZ, USA
[4] National Center for Atmospheric Research, Boulder, CO, USA
[5] Department of Entomology, University of Wisconsin, Madison WI, USA
[6] Max Planck Institute for Molecular Plant Physiology, Potsdam, Germany

Carbon: Beetles cause forest to go from sink to source.

nature
International weekly journal of science

Letter

Nature **452**, 987-990 (24 April 2008) | doi:10.1038/nature06777; Received 9 December 2007; Accepted 29 January 2008

Mountain pine beetle and forest carbon feedback to climate change

W. A. Kurz[1], C. C. Dymond[1], G. Stinson[1], G. J. Rampley[1], E. T. Neilson[1], A. L. Carroll[1], T. Ebata[2] & L. Safranyik[1]

1. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia, V8Z 1M5, Canada
2. British Columbia Ministry of Forests and Range, Victoria, British Columbia, V8W 9C2, Canada

Kurz, W. A., C. C. Dymond, G. Stenson, G. J. Rampley, A. L. Carroll, T. Ebata, and L. Safranyik. 2008. Mountain pine beetle and forest carbon feedback to climate change. Nature 452:987–990.

Carbon and forest fungi - understanding is pretty basic

Global Change Biology

Global Change Biology (2011), doi: 10.1111/j.1365-2486.2011.02543.x

REVIEW

Effects of biotic disturbances on forest carbon cycling in the United States and Canada

JEFFREY A. HICKE*, CRAIG D. ALLEN†, ANKUR R. DESAI‡, MICHAEL C. DIETZE§, RONALD J. HALL¶, EDWARD H. (TED) HOGG¶, DANIEL M. KASHIAN**, DAVID MOORE††, KENNETH F. RAFFA‡, RONA N. STURROCK‡‡ and JAMES VOGELMANN§§

*University of Idaho, Moscow, ID 83844, USA, †U.S. Geological Survey, Los Alamos, NM 87544, USA, ‡University of Wisconsin, Madison, 53706, WI 53706, USA, §University of Illinois at Urbana-Champaign, Urbana, IL 61801, USA, ¶Natural Resources Canada, Canadian Forest Service, Edmonton, T6H 3S5, AB T6H 3S5, Canada, **Wayne State University, Detroit, MI 48202, USA, ††University of Arizona, Tucson, AZ 85721, USA, ‡‡Natural Resources Canada, Canadian Forest Service, Victoria, BC V8Z 1M5, Canada, §§U.S. Geological Survey, Sioux Falls, SD 57198, USA

Hicke, J. A., Allen, C. D., Desai, A. R., Dietze, M. C., Hall, R. J., Hogg, E. H., Kashian, D. M., Moore, D., Raffa, K. F., Sturrock, R. N. and Vogelmann, J. 2012. Effects of biotic disturbances on forest carbon cycling in the United States and Canada. Global Change Biology, 18: 7–34.

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?

Gordon E. Grant, Christina L. Tague, and Craig D. Allen 2013. Watering the forest for the trees: an emerging priority for managing water in forest landscapes. *Frontiers in Ecology and the Environment* 11: 314–321

Photo credit: TNC

Acknowledgements

Western Region Tribal IPM Work Group

University of California Cooperative Extension

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Photo: Electric tree, Burning Man (flickr.com)