New Products for Reducing Southeast Forest Disturbance Risk and Recovery Time

Steven McNulty and Michael Gavazzi
USDA Southeast Climate Hub
Research Triangle Park, NC

1

To Address the issue of disaster impacts on working land sustainability, USDA Secretary of Agriculture Vilsack established a series of climate hubs in 2014 with the following mission:

To develop and deliver science-based, region-specific information and technologies for agricultural and natural resource managers that enable climate-smart decision-making and provide assistance to enable land managers to implement those decisions.

2

2

USDA Climate Hub Regions

USDA Climate Hubs for risk adaptation and mitigation to climate change

3

Southeast Climate Hub Mission

Increase resilience of working lands to climate variability and change through adaptive management



4

Developing Land Manager Tools

SERCH is working with federal, state and private organizations to develop practical tools that land managers can use to increase their resilience to climate variability and change.

Examples include:

- AgroClimate
- SERCH LIGHTS
- Tool Shed
- Instructional webinars, workshops, guides, etc.

5

Three Important Points

Disturbance is part of the natural ecosystem and it always will be.

Many types of disturbance have increased over the past century.

Almost all types disturbance as expected increase moving forward.

7/29/20

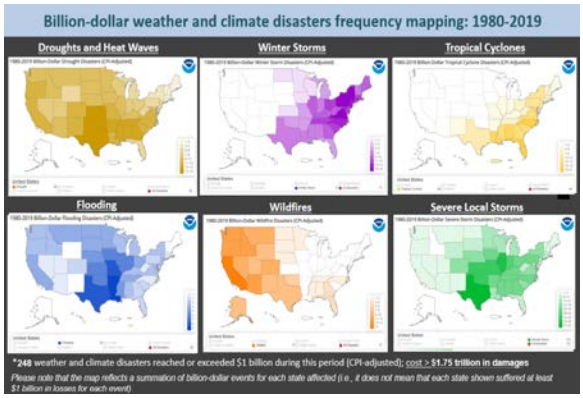
6

Disturbance Patterns

If you are planting or managing stand with a 30+ year rotation, you better consider both short-term disturbances and long-term trends

7/29/20

7



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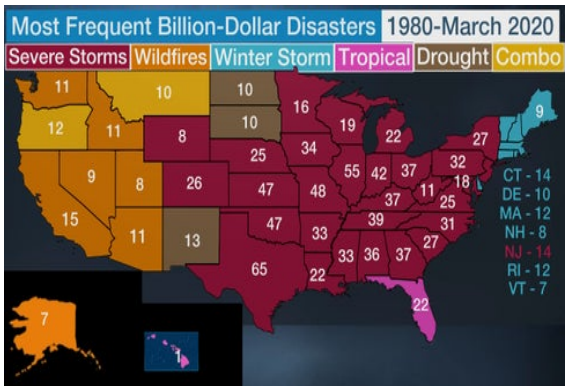


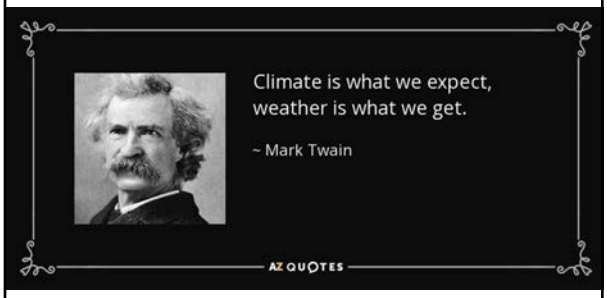
The Weather Channel

9

Drought

10

On more point



7/29/20

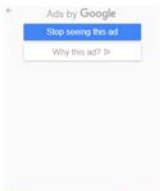
11

Weather

A Brutal Heat Wave Is About to Scorch Many Parts of the Country for Weeks

Areas in the South may hit up to 120 degrees this weekend.

By Karin Miller Jul 10, 2020



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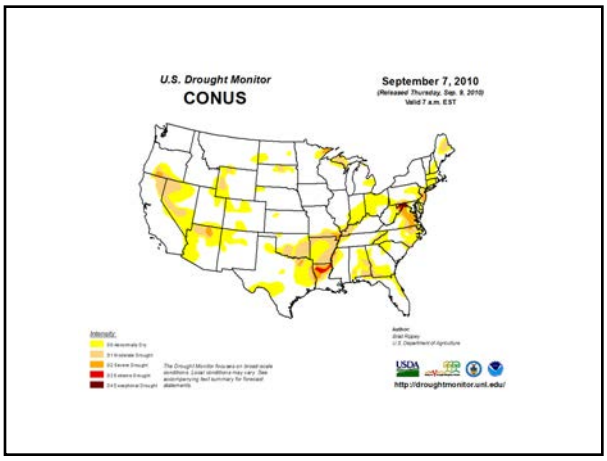
U.S. Drought Monitor
CONUS
September 7, 2010
(Released Thursday, Sep. 9, 2010)
Valid 7 a.m. EST
http://droughtmonitor.unl.edu/

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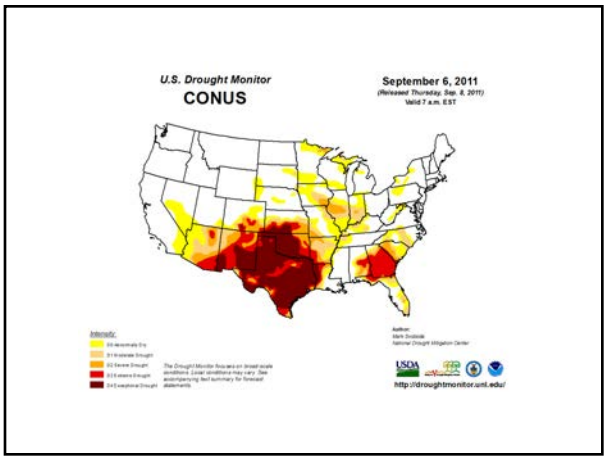
U.S. Drought Monitor
CONUS
September 6, 2011
(Released Thursday, Sep. 8, 2011)
Valid 7 a.m. EST
http://droughtmonitor.unl.edu/

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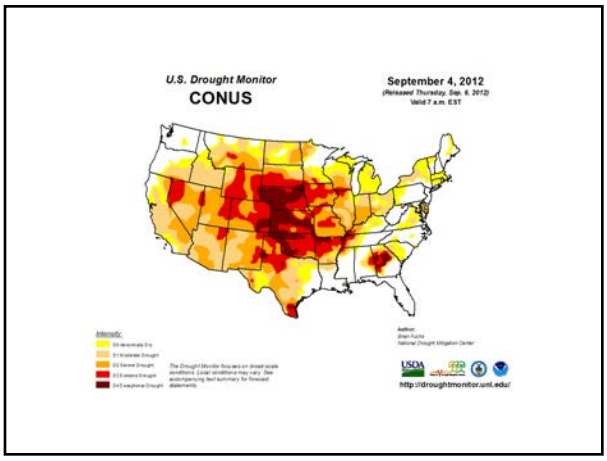
U.S. Drought Monitor
CONUS
September 4, 2012
(Released Thursday, Sep. 6, 2012)
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http://droughtmonitor.unl.edu/

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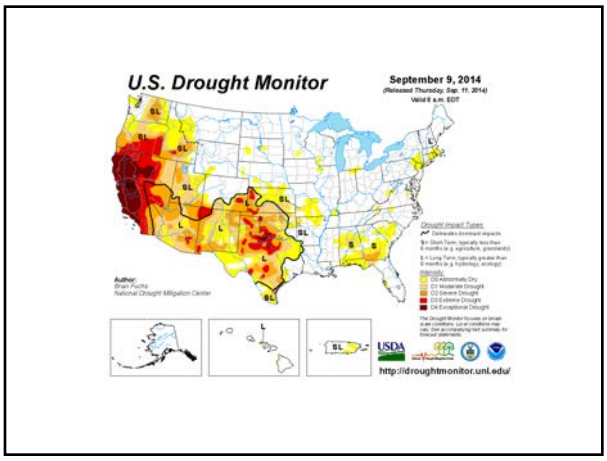
U.S. Drought Monitor
September 9, 2014
(Released Thursday, Sep. 11, 2014)
Valid 8 a.m. EDT
Author:
Brian Fuchs
National Drought Mitigation Center
Drought Impact Types:
Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought
USDA
http://droughtmonitor.unl.edu/

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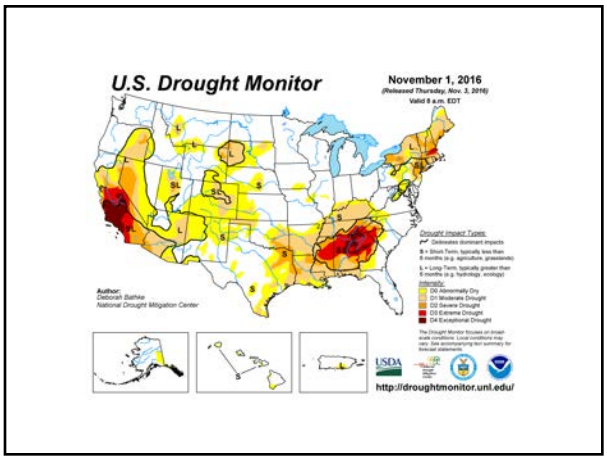
U.S. Drought Monitor
November 1, 2016
(Released Thursday, Nov. 3, 2016)
Valid 8 a.m. EDT
Author:
Deborah Bathke
National Drought Mitigation Center
Drought Impact Types:
Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought
USDA
http://droughtmonitor.unl.edu/

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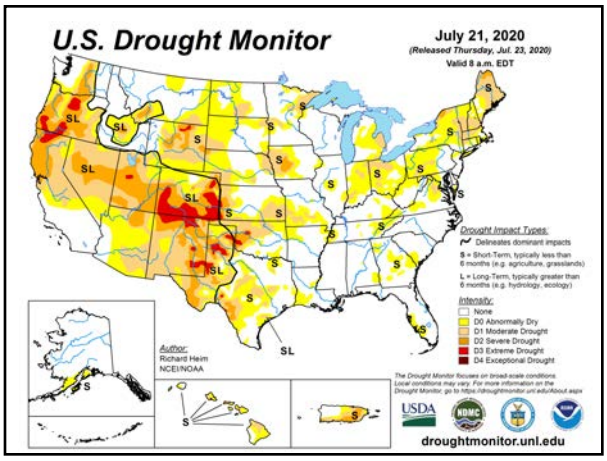
U.S. Drought Monitor
July 21, 2020
(Released Thursday, Jul. 23, 2020)
Valid 8 a.m. EDT
Drought Impact Types:
Delineates dominant impacts
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)
Intensity:
None
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought
Author:
Richard Heim
NCEI/NOAA
USDA
droughtmonitor.unl.edu

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RESEARCH ARTICLE : ENVIRONMENTAL STUDIES

Summer soil drying exacerbated by earlier spring greening of northern vegetation

Xu Lian[1], Shilong Piao[1,2,3,*], Laurent Z. X. Li[4], Yue Li[1], Chris Huntingford[5], Philippe Ciais[6], Alessandro Cescatti[7], Ivan A. ...
+ See all authors and affiliations

Science Advances 03 Jan 2020:
Vol. 6, no. 1, eaax0255
DOI: 10.1126/sciadv.aax0255

Article | Figures & Data | Info & Metrics | eLetters | PDF

Abstract

Earlier vegetation greening under climate change raises evapotranspiration and thus lowers spring soil moisture, yet the extent and magnitude of this water deficit persistence into the following summer remain elusive. We provide observational evidence that increased foliage cover over the Northern Hemisphere, during 1982–2011, triggers an additional soil moisture deficit that is further carried over into summer. Climate model simulations independently support this and attribute the driving process to be larger increases in evapotranspiration than in precipitation. This extra soil drying is projected to amplify the frequency and

Science Advances
Vol 6, No. 1
01 January 2020
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Tree Response to Drought

It depends…

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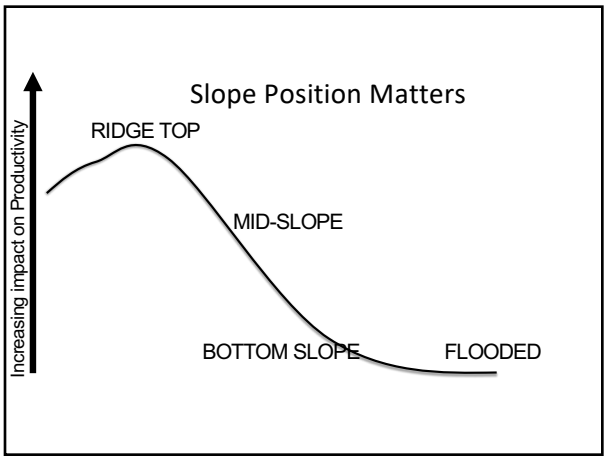
Four Potential outcomes of Drought

1. Reduction in productivity followed by forest recovery
2. Reduction in productivity and no recovery (tree mortality)
3. No significant change in productivity
4. Increased productivity

21



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Reduction in productivity followed by forest recovery

- Wait it out
- Pre-drought thinning
- Pre-drought controlled burn

23

Reduction in productivity and no recovery (tree mortality)

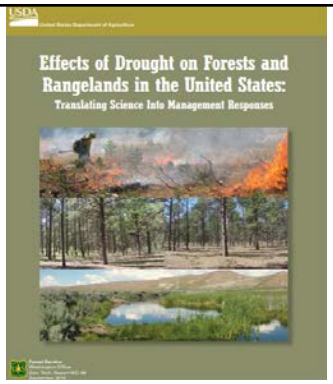
- Wait it out (natural regeneration)
- Pre-drought thinning
- Pre-drought controlled burn
- Selected species shift
- Harvest or not

24

Drought Tolerant Southeast Tree species

Carya illinoensis (pecan)
Catalpa speciosa (catalpa)
Cedrus spp. (cedar)
Celtis spp.(hackberry)
Fraxinus pennsylvanica (green ash)
Fraxinus velutina (velvet ash)
Gleditsia triacanthos (honeylocust)
Gymnocladus dioicus (Kentucky coffeetree)
Juniperus spp.(junipers): J. virginiana in particular.
Magnolia grandiflora (southern magnolia)
Nyssa spp. (gums)
Pinus spp. (pines): P. palustris (longleaf), P. virginiana (scrub).

25



Vose, James M.; Peterson, David L.; Luce, Charles H.; Patel-Weynand, Toral., eds. 2019. Effects of drought on forests and rangelands in the United States: translating science into management responses. Gen. Tech. Rep. WO-98. Washington, DC: U.S. Department of Agriculture Forest Service, Washington Office. 227 p. https://doi.org/10.2737/WO-GTR-98

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McNulty, Steven; Baca, Aurelia; Bowker, Michael; Brantley, Steven; Dreaden, Tyler; Golladay, Steven W.; Holmes, Tom; James, Natasha; Liu, Shan; Lucardi, Rima; Mayfield, Albert; Sun, Ge; Treasure, Emrys; Conner, L. Mike; Smith, Lora L.; Vose, James M. 2019. Managing Effects of Drought in the Southeast United States. In: Vose, James M.; Peterson, David L.; Luce, Charles H.; Patel-Weynand, Toral, eds. Effects of drought on forests and rangelands in the United States: translating science into management responses. Gen. Tech. Rep. WO-98. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office. 191-220. Chapter 9.

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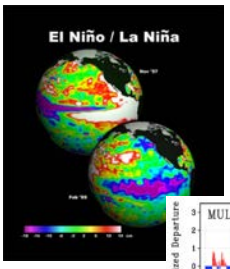
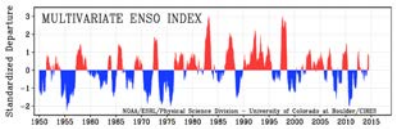
El Niño and La Niña



El Niño is associated with unusually warm water in the eastern Pacific Ocean, usually observed near Christmas (so associated with the coming of "The Child"). La Niña is the opposite phase of El Niño, with unusually cool water in the eastern Pacific Ocean.



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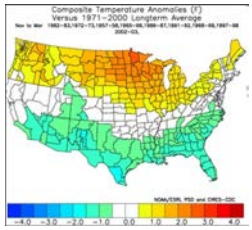
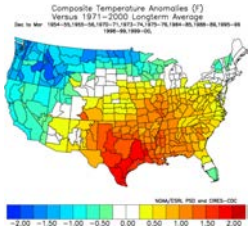
El Niño and La Niña

Temperature



El Niño



La Niña

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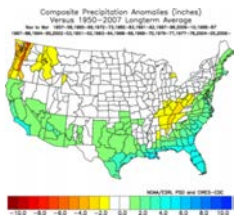
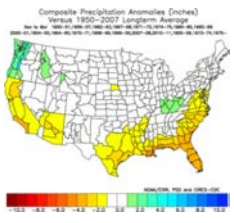
El Niño and La Niña

Precipitation



El Niño



La Niña

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NATURE CLIMATE CHANGE | REVIEW

ENSO and greenhouse warming

Wenju Cai, Agus Santoso, Guojian Wang, Sang-Wook Yeh, Soon-Il An, Kim M. Cobb, Mat Collins, Eric Guilyardi, Fei-Fei Jin, Jong-Seong Kug, Matthieu Lengaigne, Michael J. McPhaden, Ken Takahashi, Axel Timmermann, Gabriel Vecchi, Masahiro Watanabe & Lixin Wu

Affiliations | Contributions | Corresponding author

Nature Climate Change (2015) | doi:10.1038/nclimate2743
Received 30 March 2015 | Accepted 01 July 2015 | Published online 17 August 2015

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Abstract

Abstract • Introduction • Changes in the mean state • ENSO asymmetry and extremes • Projected changes in extreme ENSO events • ENSO teleconnection under greenhouse warming • Summary, uncertainties and future research • References • Acknowledgements • Author information

The El Niño/Southern Oscillation (ENSO) is the dominant climate phenomenon affecting extreme weather conditions worldwide. Its response to greenhouse warming has challenged scientists for decades, despite model agreement on projected changes in mean state. Recent studies have provided new insights into the elusive links between changes in ENSO and in the mean state of the Pacific climate. The projected slow-down in Walker circulation is expected to weaken equatorial Pacific Ocean currents, boosting the occurrences of eastward-propagating warm surface

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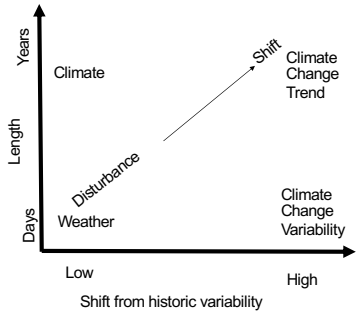
How weather becomes climate change



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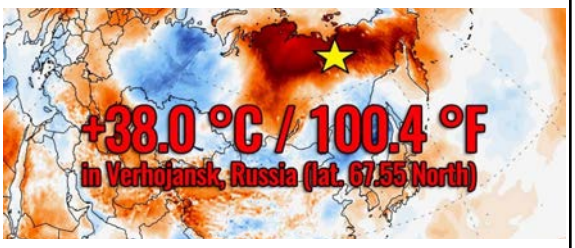
Arctic heat wave "essentially impossible" without human-caused climate change, study finds

BY JEFF BERARDELLI
JULY 15, 2020 / 5:01 PM / CBS NEWS



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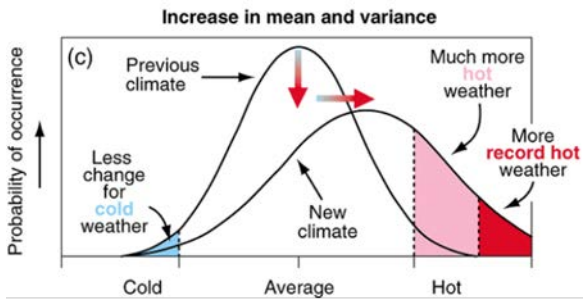
Impact of climate change on extreme events



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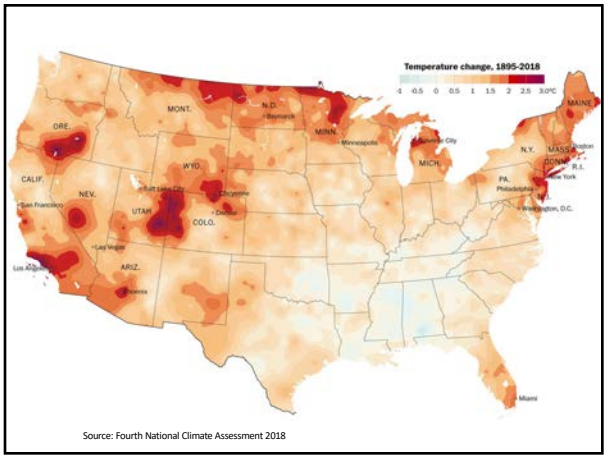

Source: Fourth National Climate Assessment 2018

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TECH TIMES
PERSONAL TECH
BIZ TECH
FUTURE TECH
SCIENCE
LIFE
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TAG NASA , NOAA , Global Warming , Arctic sea ice
Getting Hotter And Hotter: January 2016 Is Hottest Month On Record
By Ted Ranosa, Tech Times | February 20, 7:30 AM
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It seems that there just isn't going to be any let up to the heat people have been facing for the past few months.
NASA and the National Oceanic and Atmospheric Administration have just declared January of this year as the warmest month ever to be recorded. This means the Earth has been plagued with record-breaking heat for the ninth straight month now.
According to the space agency, January 2016 clocked in temperatures that reached 2.03 degrees Fahrenheit above normal levels, which is considered to be the highest margin of any recorded month.
The abnormally high heat has also caused sea ice in the Arctic to reach its lowest point even though January is known to be a month

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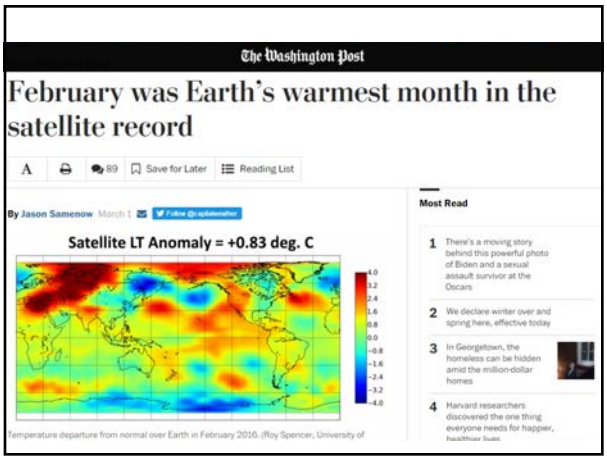
The Washington Post
February was Earth's warmest month in the satellite record
A
89
Save for Later
Reading List
By Jason Samenow March 1
Follow @splatalewther
Satellite LT Anomaly = +0.83 deg. C
4.0
3.2
2.4
1.6
0.8
0.0
−0.8
−1.6
−2.4
−3.2
−4.0
Temperature departure from normal over Earth in February 2016. (Roy Spencer, University of
Most Read
1 There's a moving story behind this powerful photo of Biden and a sexual assault survivor at the Oscars
2 We declare winter over and spring here, effective today
3 In Georgetown, the homeless can be hidden amid the million-dollar homes
4 Harvard researchers discovered the one thing everyone needs for happier,

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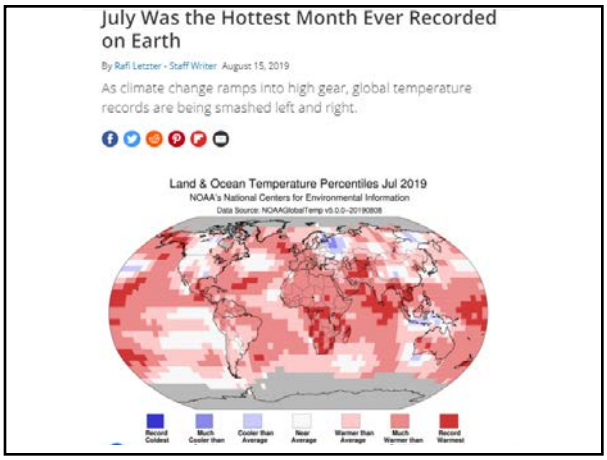
July Was the Hottest Month Ever Recorded on Earth
By Rafi Letzter - Staff Writer August 15, 2019
As climate change ramps into high gear, global temperature records are being smashed left and right.
Land & Ocean Temperature Percentiles Jul 2019
NOAA's National Centers for Environmental Information
Data Source: NOAAGlobalTemp v5.0.0-20190808
Record Coldest
Much Cooler than
Cooler than Average
Near Average
Warmer than Average
Much Warmer than
Record Warmest

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YALE
Climate
Connections
ARTICLES
RADIO PROGRAM
TOPICS
ABOUT
CONTACT US
NEWSLETTER
EYE ON THE STORM
May 2020: Earth's warmest May on record
2020 has a 49% chance of becoming the warmest year on record.

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How to fly safely
Can Vitamin D help?
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Money
Tech
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Opinion
2020 expected to be Earth's warmest year on record, scientists say
Doyle Rice USA TODAY
FAQs
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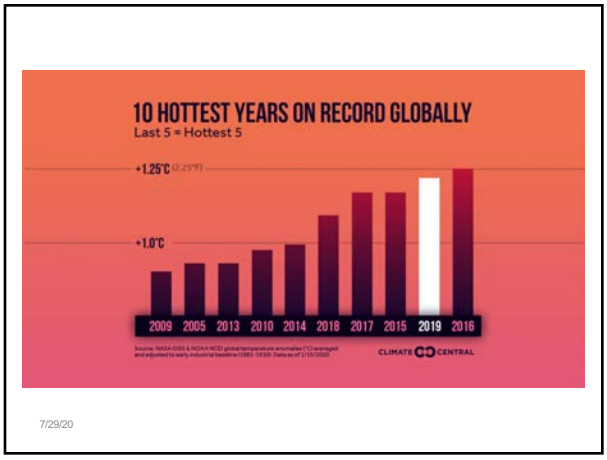
10 HOTTEST YEARS ON RECORD GLOBALLY
Last 5 = Hottest 5
+1.25°C
+1.0°C
2009
2005
2013
2010
2014
2018
2017
2015
2019
2016
CLIMATE CENTRAL
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Wild fires

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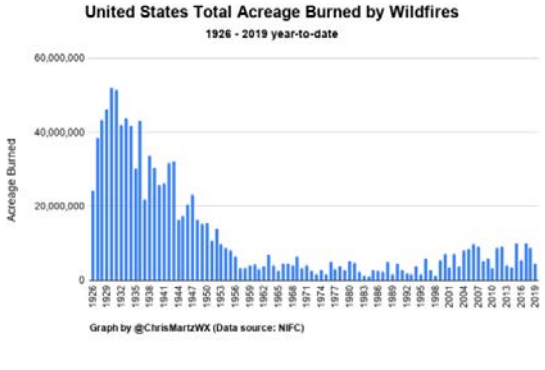

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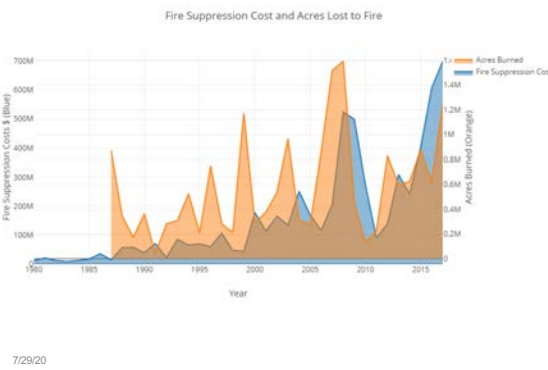

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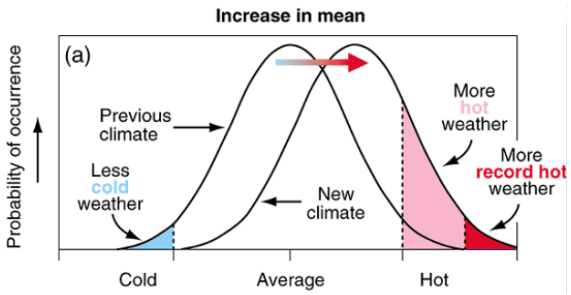

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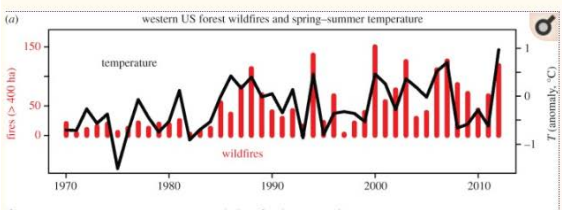

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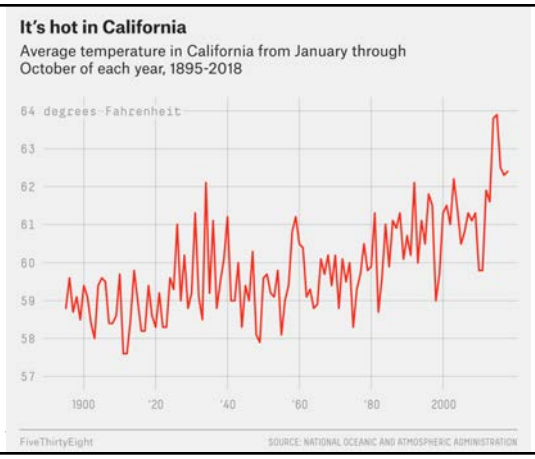

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Forest Insect Outbreaks:
Southern Pine Beetle

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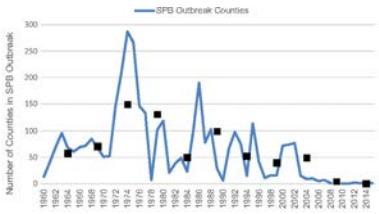

Asaro, C., Nowak, J.T., & Elledge, A. (2017). Why have southern pine beetle outbreaks declined in the southeastern U.S. with the expansion of intensive pine silviculture? A brief review of hypotheses.

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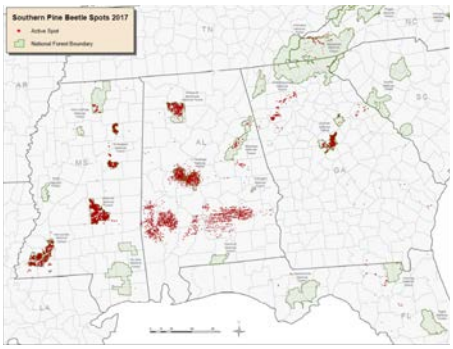

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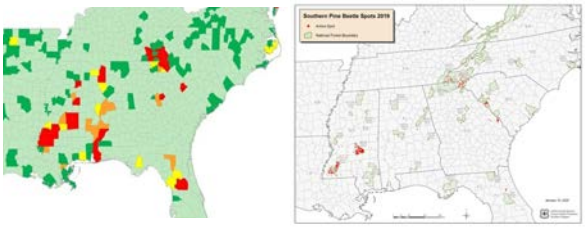
Our ability to predict the future. In this case with beetles

SPBOM1 2019 Predicted

Observed



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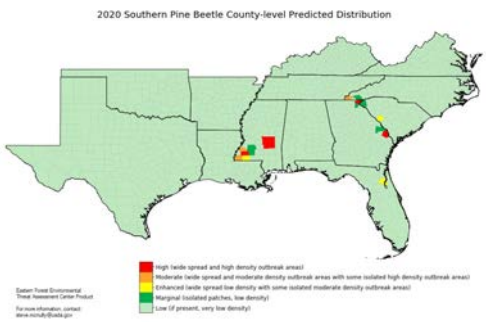

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MITIGATION

1. Seek, Find and Destroy
   - Develop accurate outbreak models to predict areas with the highest risk and focus monitoring in those places
   - When found, quickly cut all infected timber and a buffer around the outbreak
   - Also monitor moderate outbreak areas with some traps, and keep the communication network open to learn about possible unexpected outbreak areas from foresters and landowners.
2. Reduce Risk
   - based on model parameters correlated with SPB outbreak, there are four risk factors
   - Previous years SPB locations (the largest factor): If you saw the beetles in a stand last year
     chances are very good that they will be there this year unless treated.
   - Climate: can not control drought or elevated air temperatures which are the primary factors
   - Growth: Faster growing trees are more at risk during a drought because they can dry out the stem
     more quickly than slower growing trees

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Impacts of Climate Variability

	LOW	MARGINAL	ENHANCED	MODERATE	HIGH
Temperature Increase (2 degrees C)	0.4%	-9.3%	-5.6%	16.7%	0.0%
Precipitation Decrease (20% less)	-1.5%	30.2%	27.8%	0.0%	3.6%
Both Changes	-1.4%	27.9%	22.2%	16.7%	0.0%

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Storms

7/29/20

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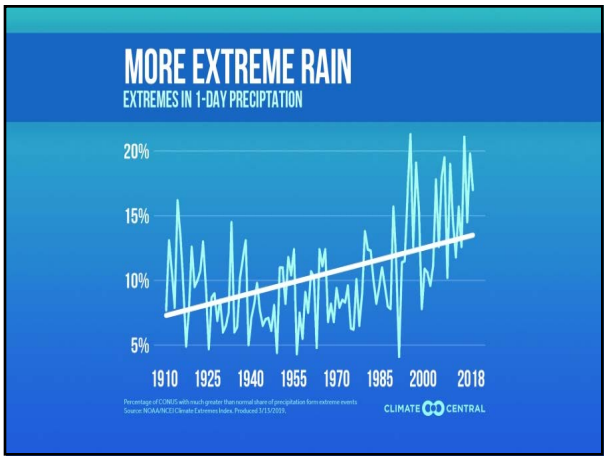

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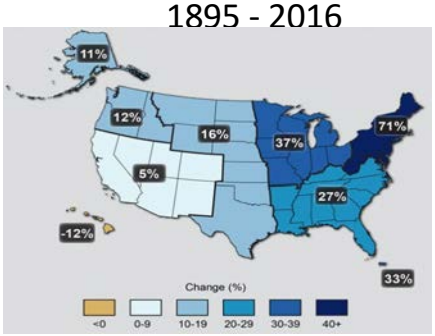
Change in Very Heavy Precipitation 1895 - 2016



Source: Karl et al 2017

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Storm Surge/Damage Potential

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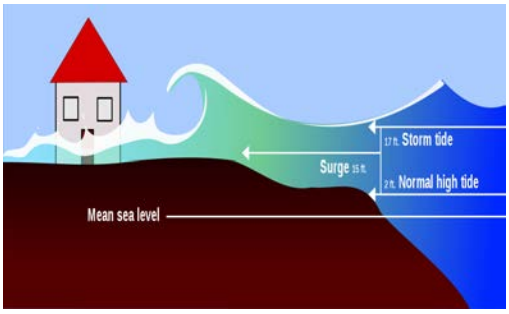

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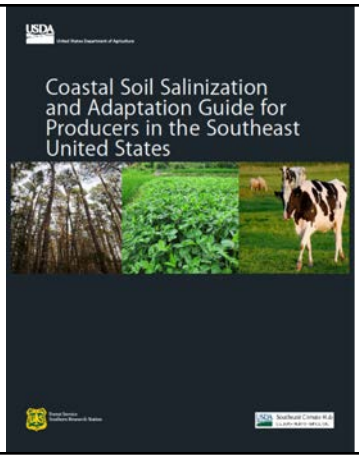

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How will this affect your nursery operation?

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Climate change impacts on nurseries

Warmer temperatures & longer periods without rain
- Increase shading or move outdoor production to greenhouses/controlled environments
- Water stress so will need to irrigate more & more efficient irrigation systems
- Identify drought tolerant species
- *Identify species adapted to a warmer climate*
  - *Different plant hardiness zones*
  - *Require less chilling hours*

Photo: Confederated Tribes of the Umatilla Indian Reservation
Tribal Native Plant Nursery

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Climate change impacts on nurseries

More intense periods of rain / saturated soils
- May need to protect hoop houses
- May need to protect plants
- Enhance drainage

New / Increase in pest and disease pressure
- Modify integrated pest management practices
- Identify resistant species

Sea level rise
- Monitor salinity of irrigation water
- Move operations upland

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Climate change impacts on nurseries

Warmer temperatures & longer periods without rain
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  - *Different plant hardiness zones*
  - *Require less chilling hours*

Photo: Confederated Tribes of the Umatilla Indian Reservation
Tribal Native Plant Nursery

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Seedlot Selection Tool

- Online https://seedlotselectiontool.org/sst/
- GIS (geographic information system) tool
- Designed to *help* forest managers match seedlots with planting sites based on climatic information.
  - To use along with your expertise and ecological knowledge
- Climates of the planting sites can be chosen to represent current climates, or future climates based on selected climate change scenarios.

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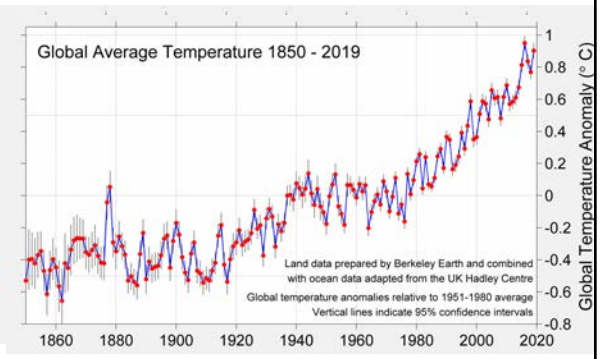

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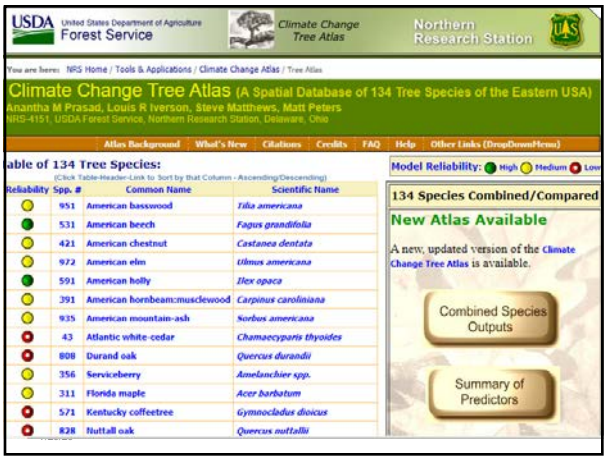

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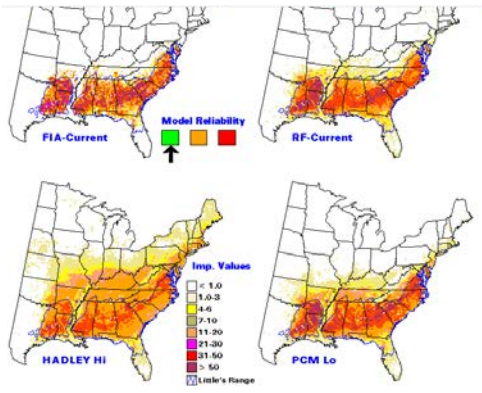

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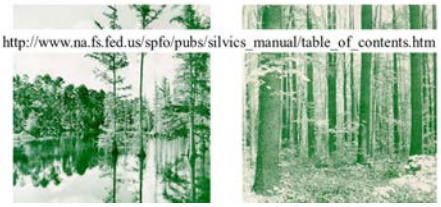
United States Department of Agriculture Forest Service
Agriculture Handbook 654 (1990)

Silvics of North America

Volume 1 – Conifers

Volume 2 - Hardwoods

http://www.na.fs.fed.us/spfo/pubs/silvics_manual/table_of_contents.htm



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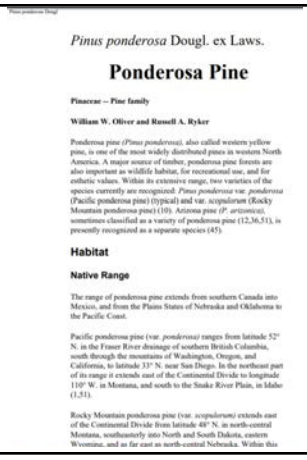

Pinus ponderosa Dougl. ex Laws.

Ponderosa Pine

Pinaceae -- Pine family

William W. Oliver and Russell A. Ryker

Ponderosa pine (*Pinus ponderosa*), also called western yellow pine, is one of the most widely distributed pines in western North America. A major source of timber, ponderosa pine forests are also important as wildlife habitat, for recreational use, and for esthetic values. Within its extensive range, two varieties of the species currently are recognized: *Pinus ponderosa* var. *ponderosa* (Pacific ponderosa pine) (typical) and var. *scopulorum* (Rocky Mountain ponderosa pine) (10). Arizona pine (*P. arizonica*), sometimes classified as a variety of ponderosa pine (12,36,51), is presently recognized as a separate species (45).

Habitat

Native Range

The range of ponderosa pine extends from southern Canada into Mexico, and from the Plains States of Nebraska and Oklahoma to the Pacific Coast.

Pacific ponderosa pine (var. *ponderosa*) ranges from latitude 52° N. in the Fraser River drainage of southern British Columbia, south through the mountains of Washington, Oregon, and California, to latitude 33° N. near San Diego. In the northeast part of its range it extends east of the Continental Divide to longitude 110° W. in Montana, and south to the Snake River Plain, in Idaho (1,51).

Rocky Mountain ponderosa pine (var. *scopulorum*) extends east of the Continental Divide from latitude 48° N. in north-central Montana, southeasterly into North and South Dakota, eastern Wyoming, and as far east as north-central Nebraska. Within this

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V 2 Chapter Format

Introduction
Habitat

- Native range (w/map)
- Climate
- Soils and topography
- Associated forest cover (by area)
  - Tree
  - Understory

Life History

- Reproduction and growth
  - Flowering and fruiting
  - Seed production and dissemination
  - Seedling development
  - Vegetative reproduction

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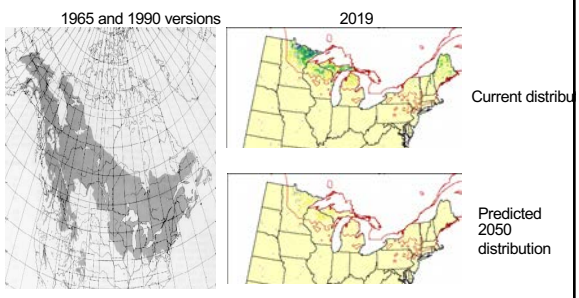
Black Spruce



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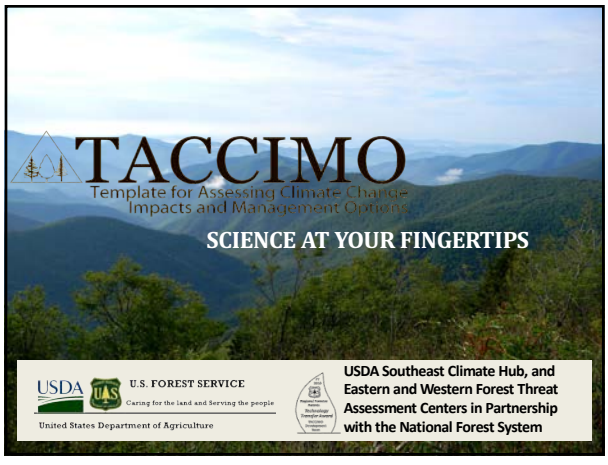

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Introductions and Overview

The Template for Assessing Climate Change Impacts and Management Options (TACCIMO) delivers access to the most current climate change science, including dynamically linked peer-reviewed publication findings describing effects and management options that provide insight into climate influences on natural resources.

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Who is using TACCIMO?

- **NEPA Analysis and Responding to Public Comments**
  - **NEPA coordinators** develop effects analysis and respond to public comments regarding climate change and carbon sequestration.
- **Climate Change Vulnerability Assessments**
  - Has provided the **scientific basis** for a variety of vulnerability assessments.
- **State and Private-Level Forest Management**
  - Regional and state groups have used TACCIMO to craft climate change materials for extensions professionals and private landowners.
- **Everyday Use**
  - **Every day climate change needs** by federal, state, and private natural resource professionals, and provides a **valuable teaching aid for climate change education**.

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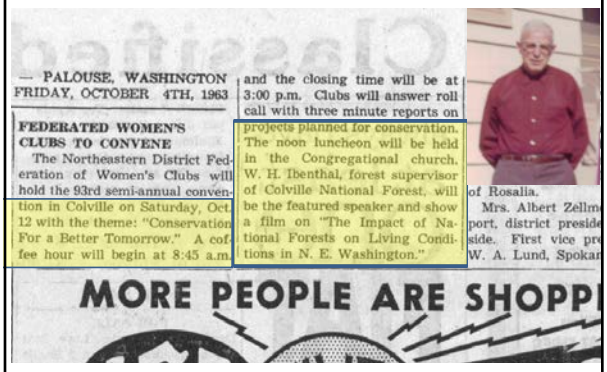
Conservation and ecosystem stress are not new issues



— PALOUSE, WASHINGTON
FRIDAY, OCTOBER 4TH, 1963

FEDERATED WOMEN'S CLUBS TO CONVENE

The Northeastern District Federation of Women's Clubs will hold the 93rd semi-annual convention in Colville on Saturday, Oct. 12 with the theme: "Conservation For a Better Tomorrow." A coffee hour will begin at 8:45 a.m. and the closing time will be at 3:00 p.m. Clubs will answer roll call with three minute reports on projects planned for conservation. The noon luncheon will be held in the Congregational church. W. H. Ibenthal, forest supervisor of Colville National Forest, will be the featured speaker and show a film on "The Impact of National Forests on Living Conditions in N. E. Washington."

of Rosalia.

Mrs. Albert Zellm
port, district preside
side. First vice pr
W. A. Lund, Spokar

MORE PEOPLE ARE SHOPP

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