

Managing Headwaters in the High Country



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Outline

- The forest-water supply connection
- Impacts of drought
- How could forest management help?



Forests and water

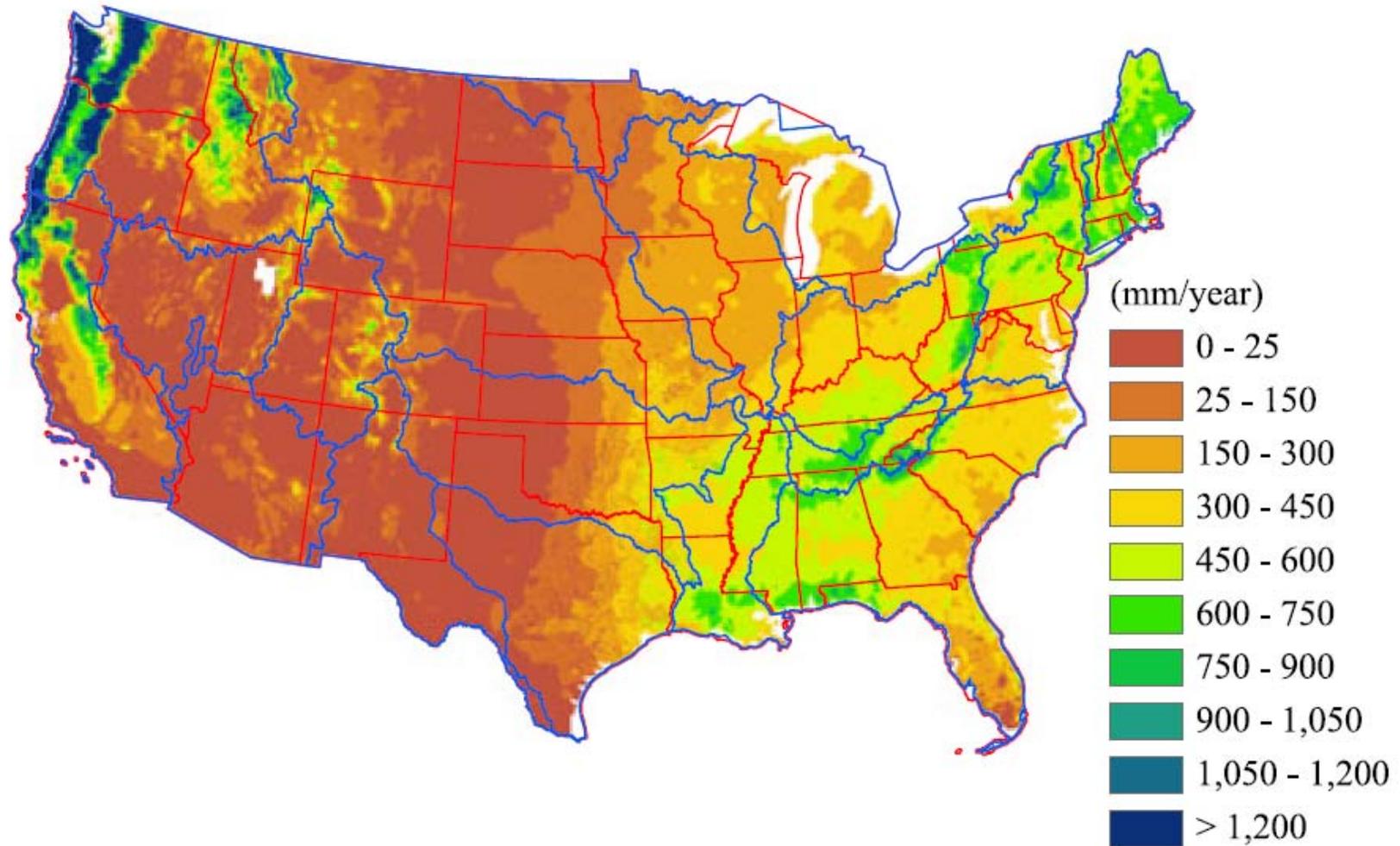
- The cleanest and most regulated supplies of water come from forested landscapes
- Forests can be managed in ways that do not negatively impact water quality



Chattahoochee River, GA



Distribution of water supply in the US



Brown et al., 2008



Forest Ownership in the Conterminous United States

Mark D. Nelson, Greg C. Lilias, and Brett J. Butler
 U.S. Forest Service, Northern Research Station, Forest Inventory and Analysis



Map Description
 This map displays a spatially classified map of forest land across the conterminous United States (CONUS) in 2007. All forestland (as defined by the U.S. Forest Service and the U.S. Department of Agriculture) is shown, and the percentage of corporate ownership of private forest land.

Most of the forestland in the conterminous United States is owned by the U.S. Forest Service, as reported in the National Forest Inventory and Analysis (NFIA) in 2007. The majority of forestland is publicly owned, with the majority of which is owned and managed by the U.S. Forest Service and the U.S. Department of Agriculture. In the East, more than 50% of forestland is privately owned.

Corporate forestland is primarily owned by an individual, family, or trust, or by a corporation, partnership, or other legal entity (SOLE) or a real estate investment trust (REIT). Concentrations of corporate forestland are seen in the West and portions of the South, South Central, Lake States, and the New England region. The data values represent corporate forestland ownership from the National Forest Inventory and Analysis (NFIA) plot data as well as information derived from corporate ownership data.

Table 1 provides a summary of the forestland data by state. Maps produced by the Forest Inventory and Analysis (FIA) are the primary data source for the data displayed in this report. If you have any questions or comments, please contact the FIA data user support team at fia@fs.fed.us.

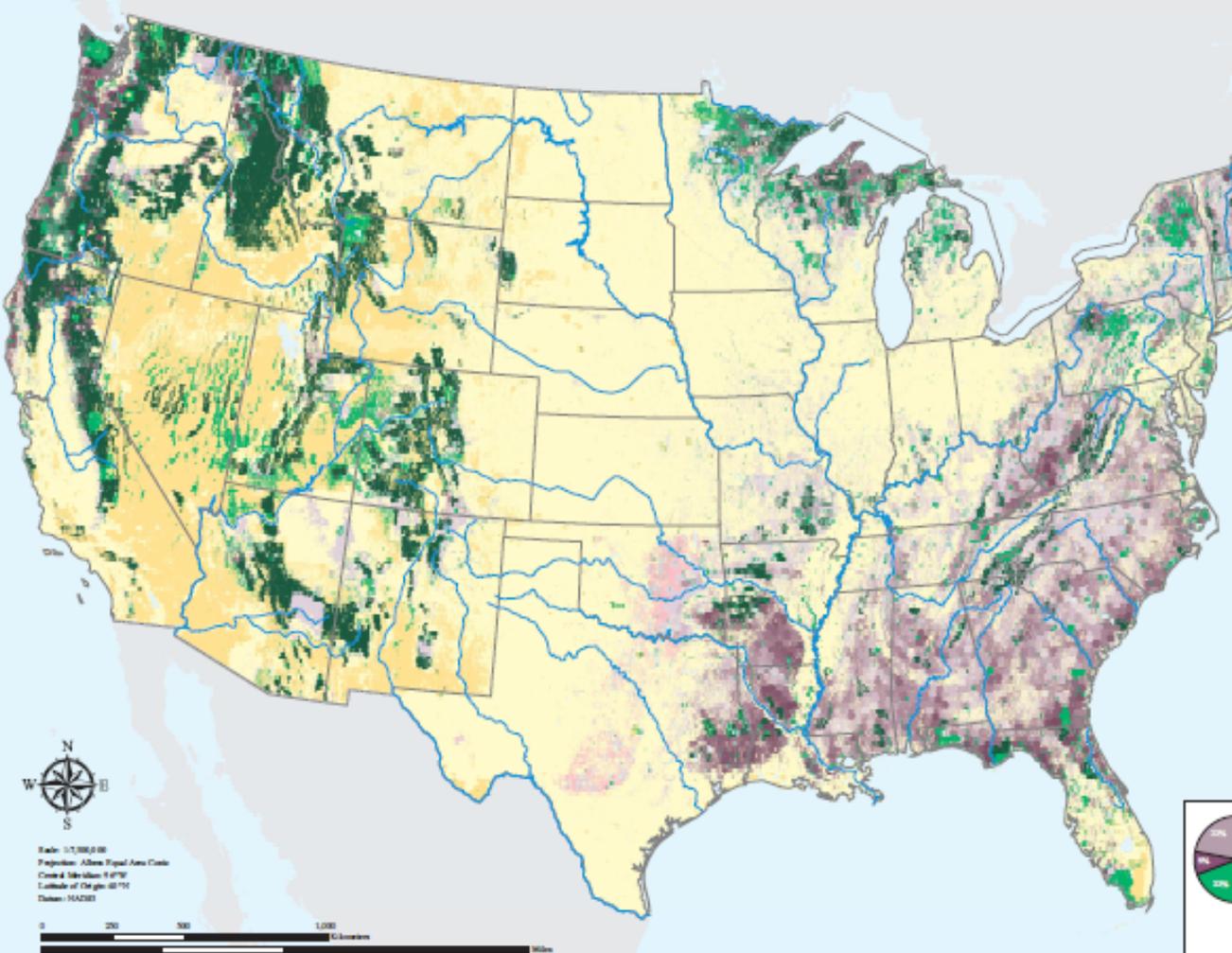
Map Symbols
 National Forest System (NFS) Forest Land (Yellow)
 State Forest Land (Green)
 Private Forest Land (Purple)
 Private Forest Land with Corporate Ownership (Dark Purple)

Data Sources
 The data were derived from the National Forest Inventory and Analysis (NFIA) data for the conterminous United States (CONUS) in 2007. The data were derived from the National Forest Inventory and Analysis (NFIA) data for the conterminous United States (CONUS) in 2007. The data were derived from the National Forest Inventory and Analysis (NFIA) data for the conterminous United States (CONUS) in 2007.

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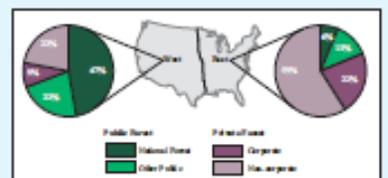
References
 Nelson, M.D., Lilias, G.C., Butler, B.J., and Smith, D.L. 2010. Forest ownership in the conterminous United States. Forest Science 56(4): 641-650.
 U.S. Forest Service. 2007. National Forest Inventory and Analysis (NFIA) Data. U.S. Forest Service, Northern Research Station, Forest Inventory and Analysis (FIA). Available at <http://fia.fs.fed.us/>.

Scale 1:5,000,000
Projection Albers Equal Area Conic
Center 41°N, 100°W
Latitude of Origin 40°N
Distance 10,000,000



Public

Private

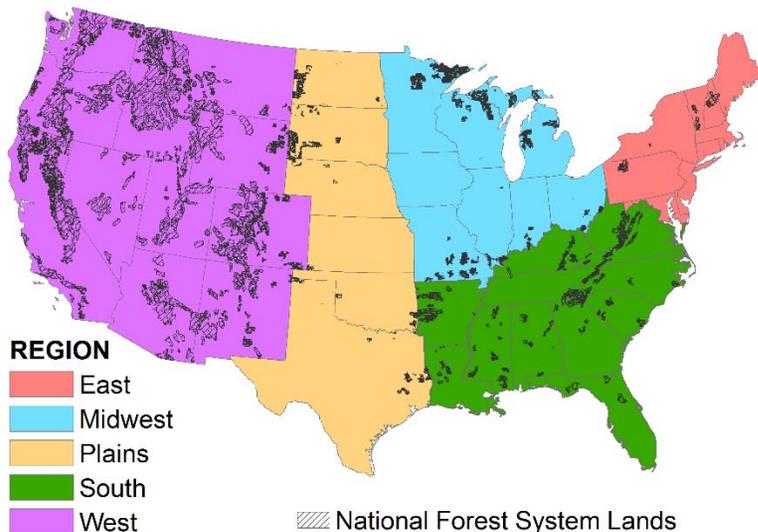
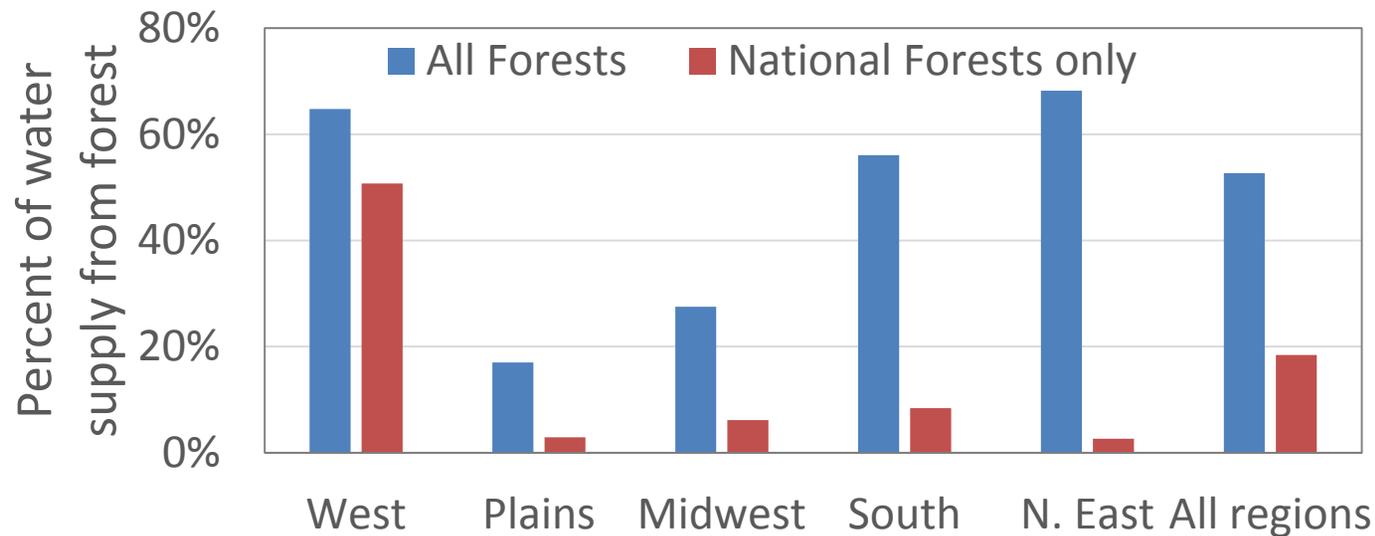


Nelson et al., 2010

Forests comprise 29% of land area; National Forest lands 11%



Importance of forests for water supply



Forests comprise 29% of land area, but provide 53% of water supply

Brown et al., 2008





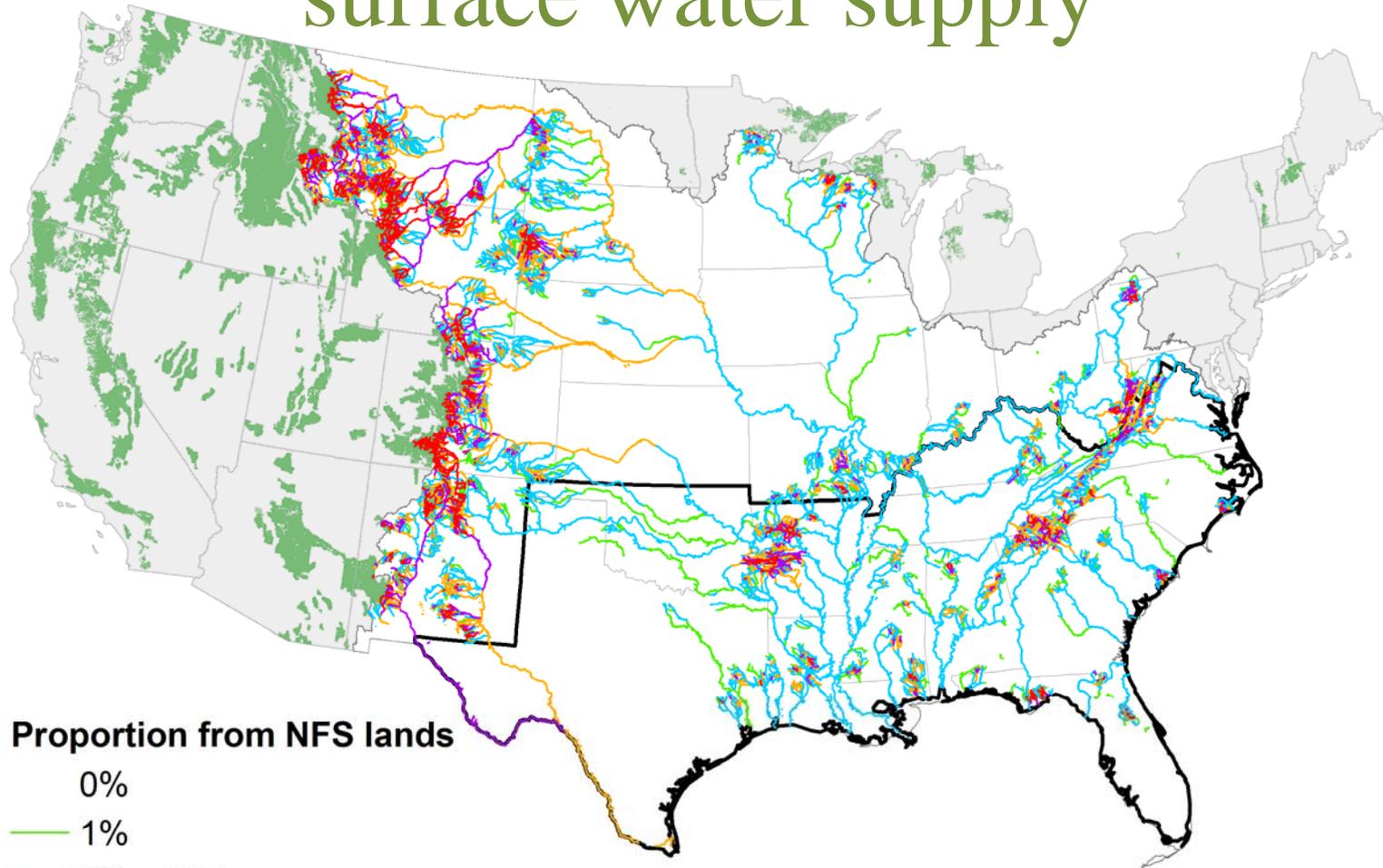
United States Department of Agriculture

Quantifying the Role of National Forest System Lands in Providing Surface Drinking Water Supply for the Southern United States

Peter Caldwell, Corinne Muldoon, Chelcy Ford Miniati, Erika Cohen, Suzanne Krieger,
Ge Sun, Steven McNulty, and Paul V. Bolstad



National Forest contribution to surface water supply



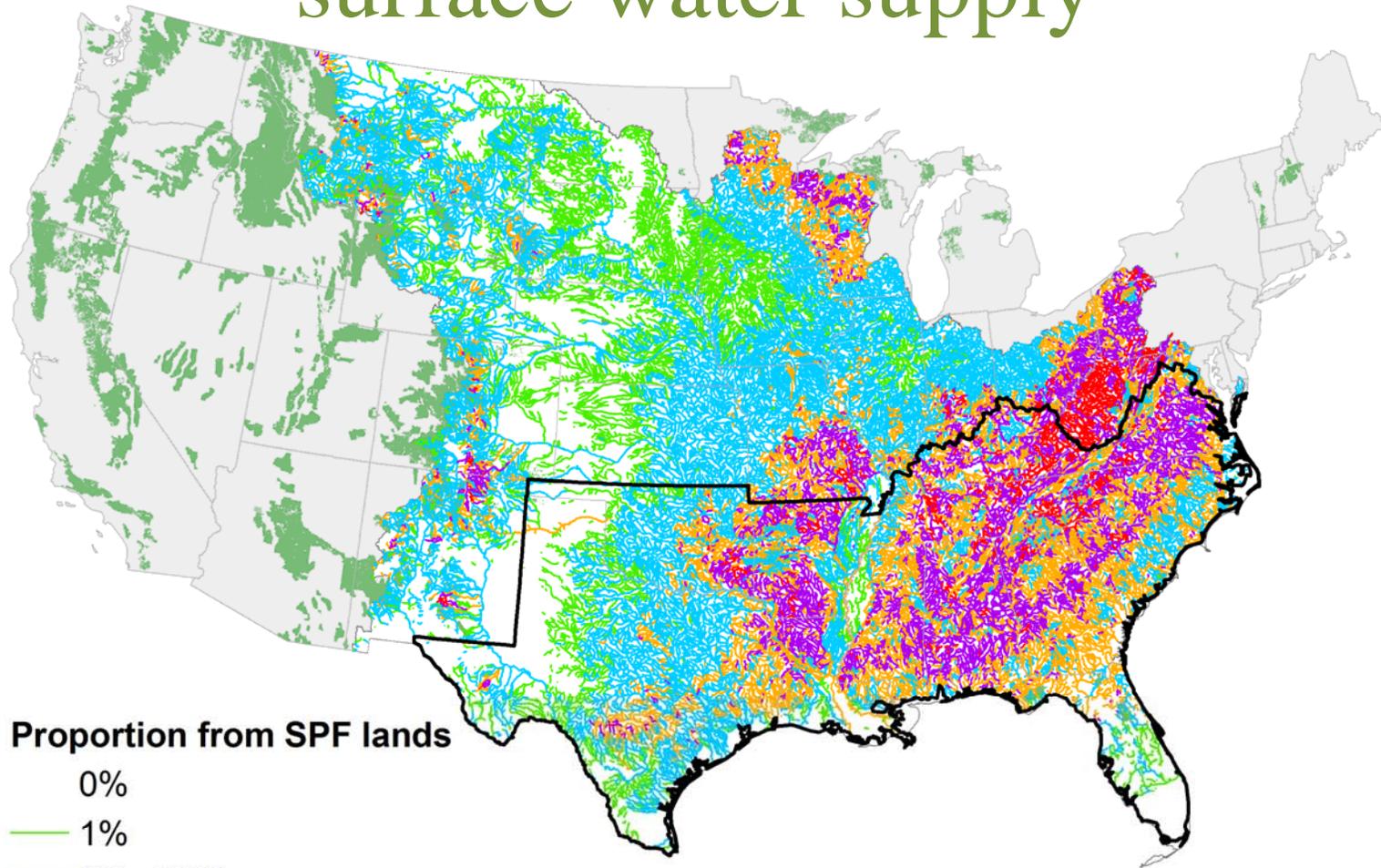
Proportion from NFS lands

- 0%
- 1%
- 2% - 25%
- 26% - 50%
- 51% - 75%
- 76% - 100%

- Southern States of USFS Region 8
- National Forest System Lands
- Study Area



State and Private Forest contribution to surface water supply



Proportion from SPF lands

0%

1%

2% - 25%

26% - 50%

51% - 75%

76% - 100%

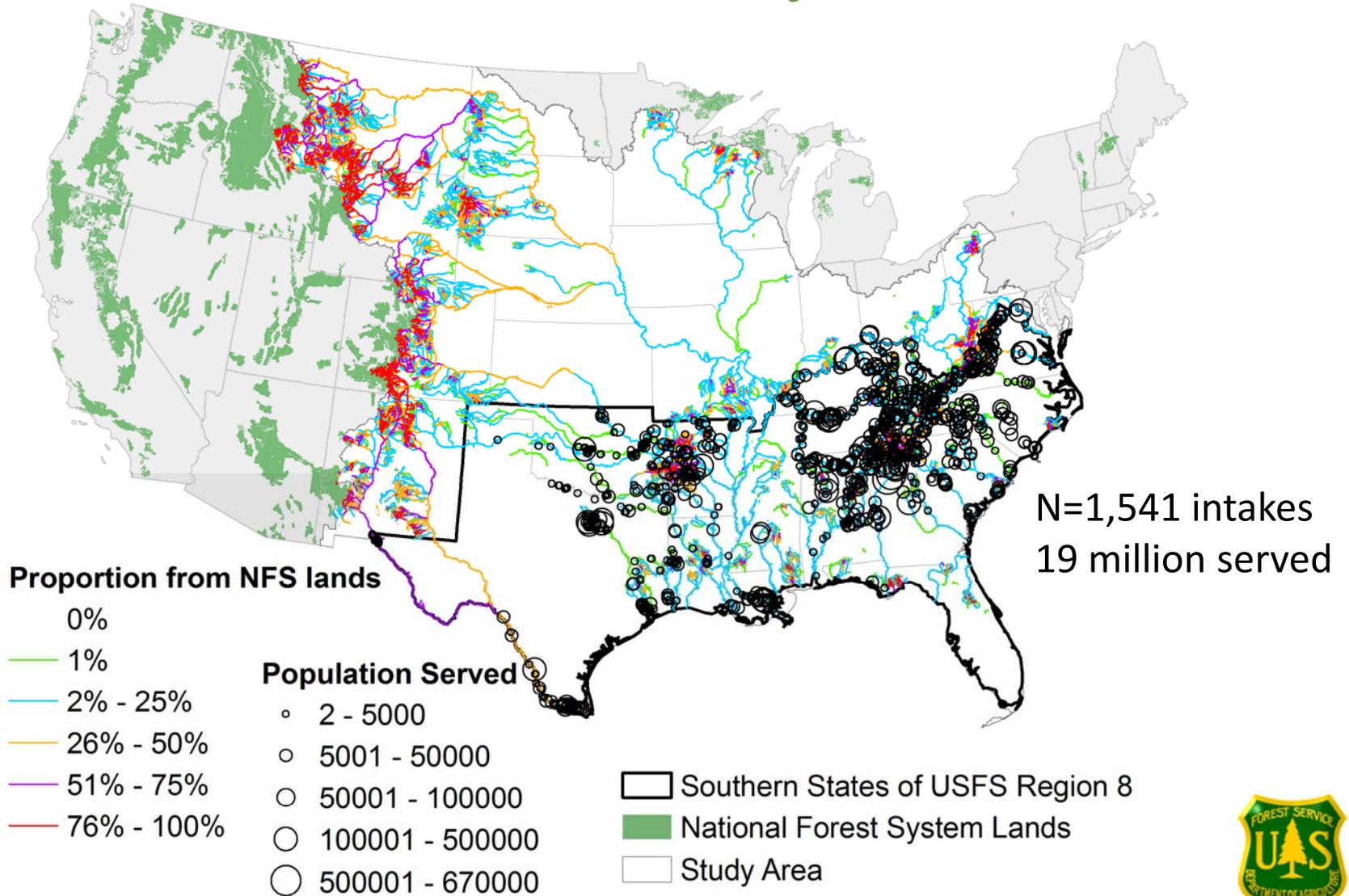
□ Southern States of USFS Region 8

■ National Forest System Lands

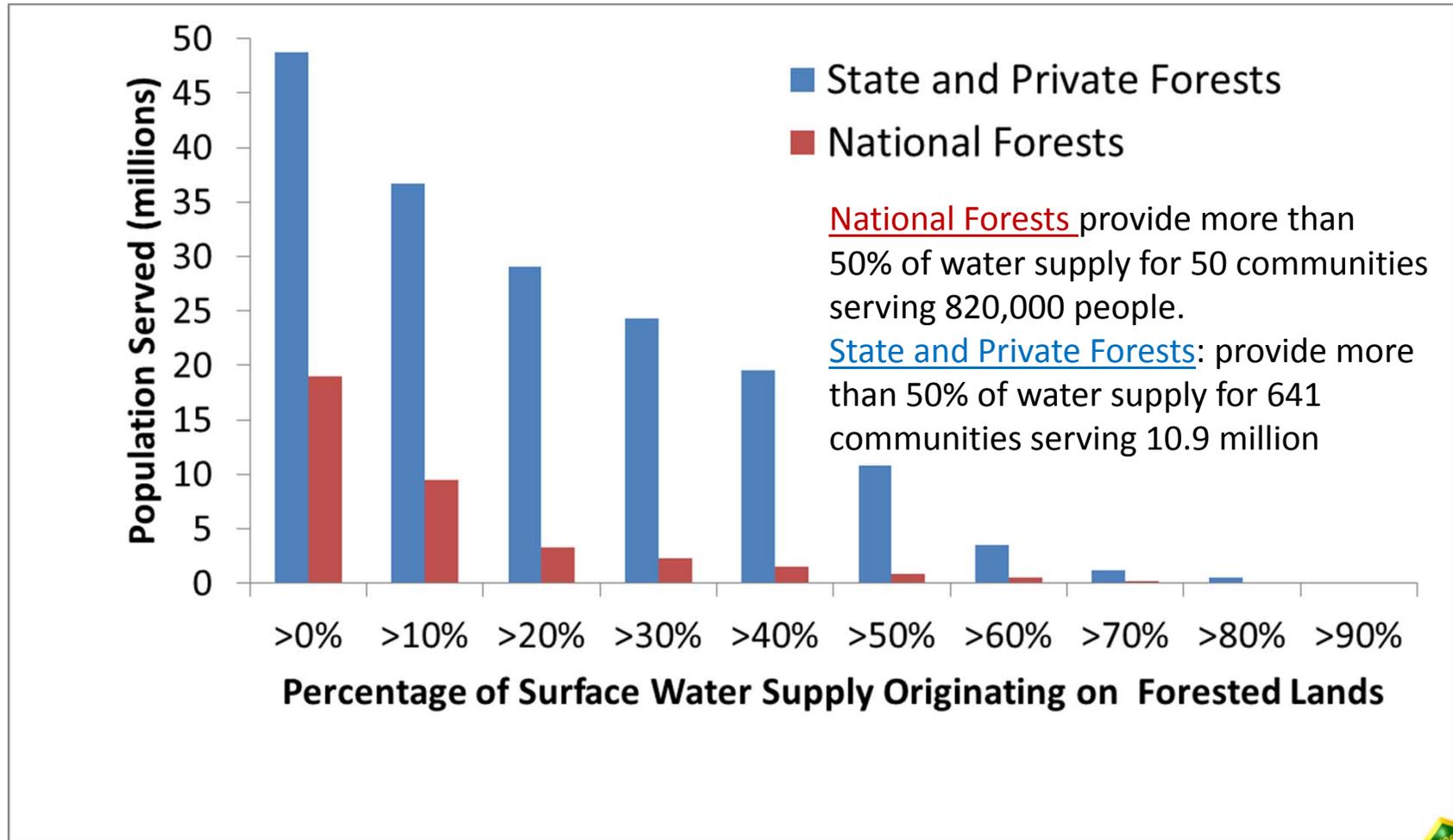
□ Study Area



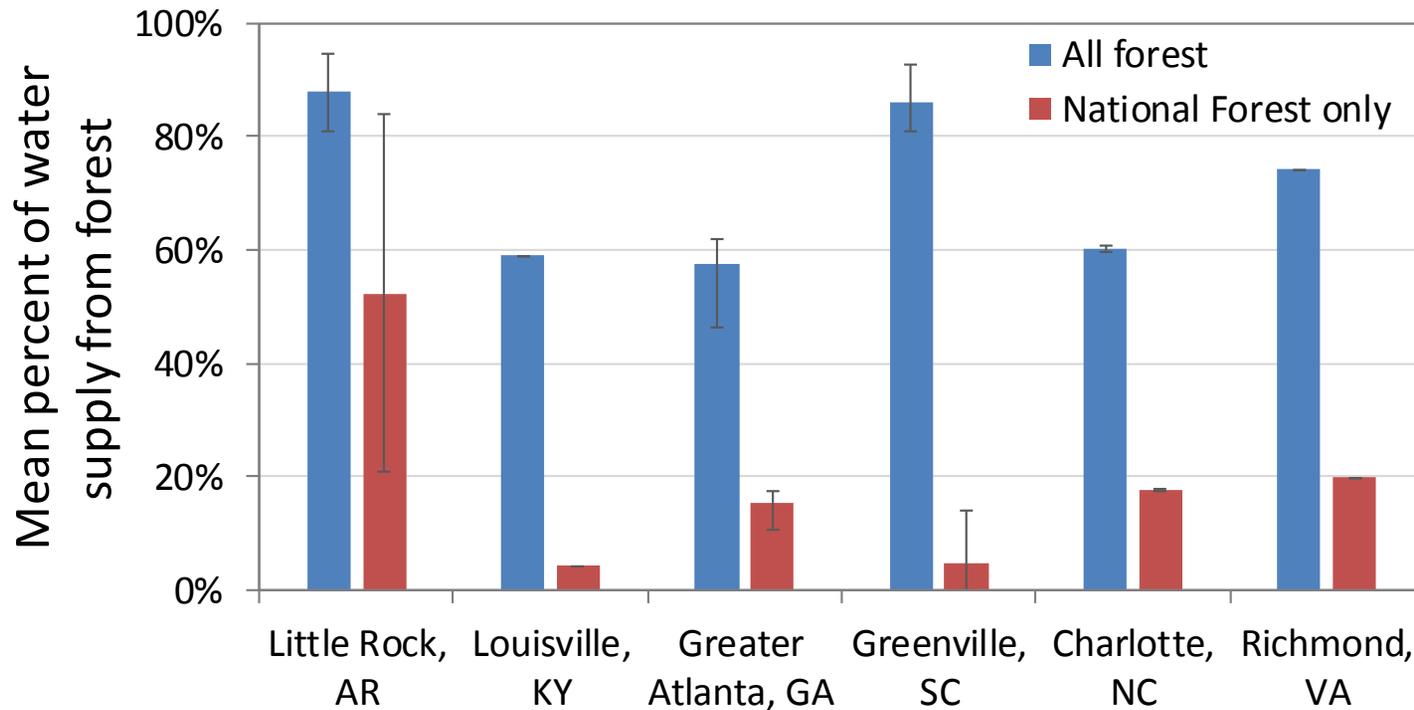
Drinking water intakes receiving water from National Forest System Lands



Millions in the South depend on water originating on forested lands



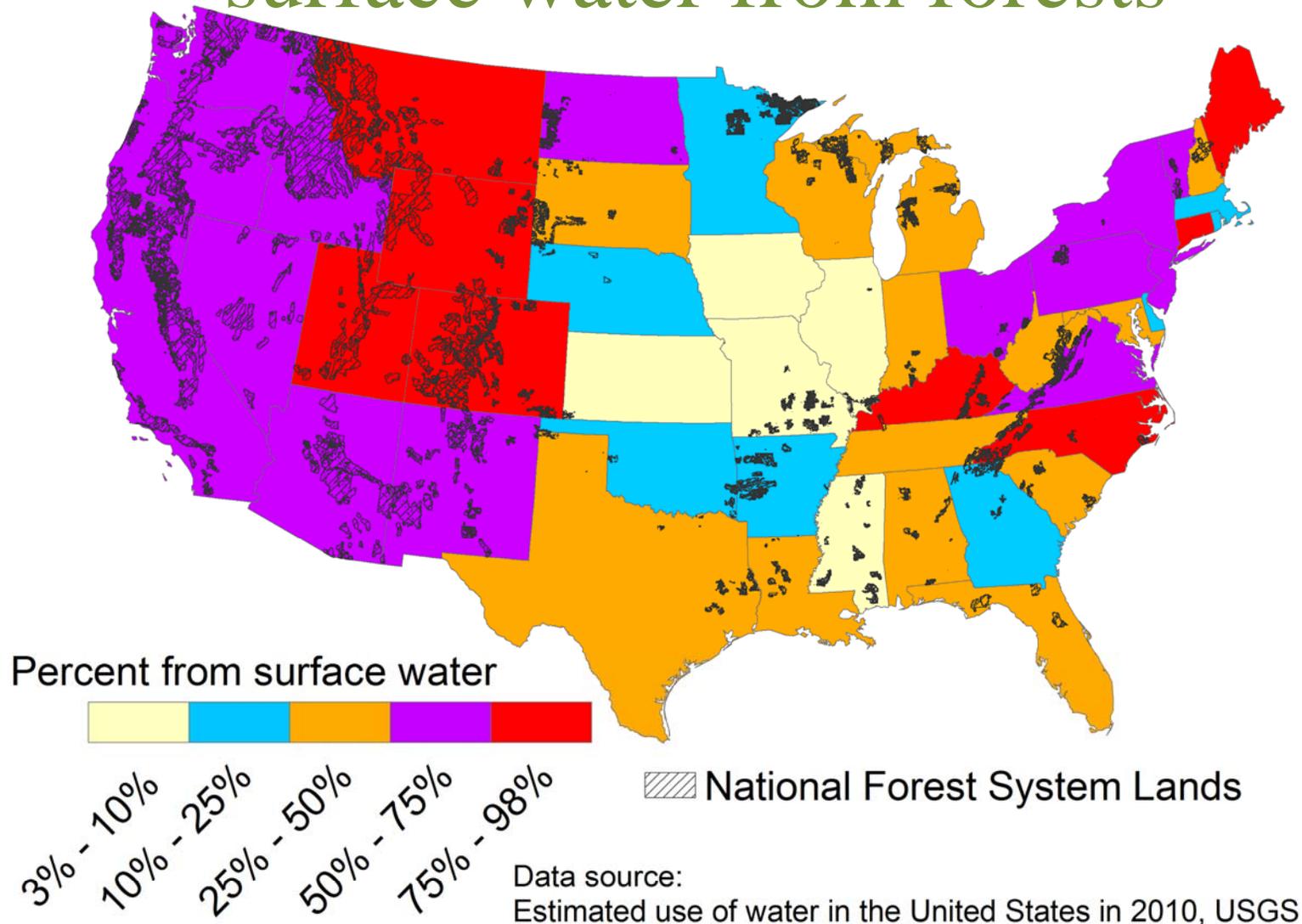
Some example communities



Population served (millions)	0.8	2.2	0.4	0.2	0.2	0.7
Number of intakes	2	5	3	2	1	2



Irrigated agriculture depends on surface water from forests





United States Department of Agriculture

Effects of Drought on Forests and Rangelands in the United States: A Comprehensive Science Synthesis



Forest Service Gen. Tech. Report WO-93b January 2016

Vose et al., 2016



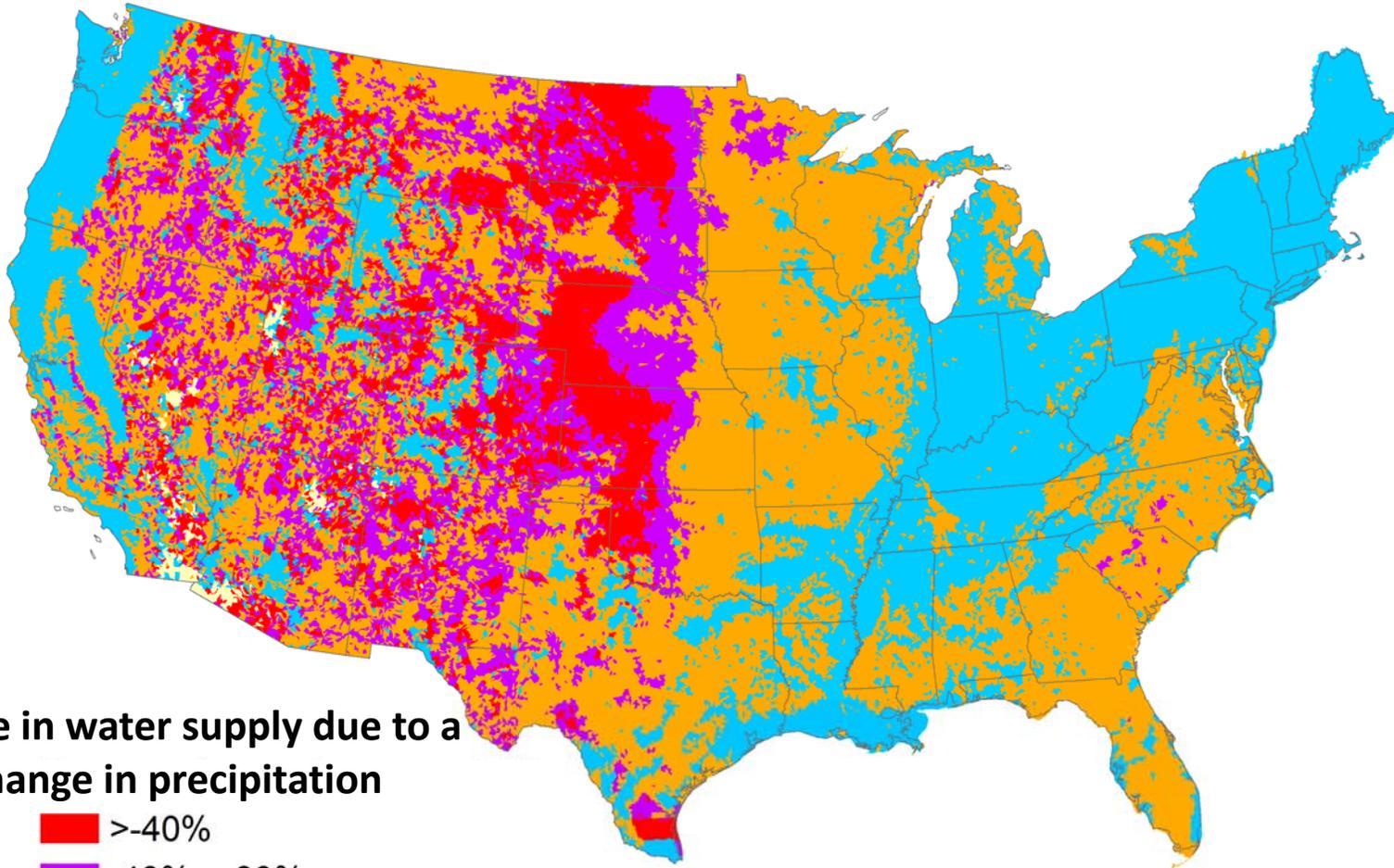
Drought impacts on forests and related ecosystem services

- Impacts on forests
 - Mortality
 - Altered nutrient, carbon, and water cycling
 - Increased susceptibility to invasion of non-native species, insect outbreaks and wildfire
- Impacts on ecosystem services
 - Water supply production
 - Water quality
 - Productivity

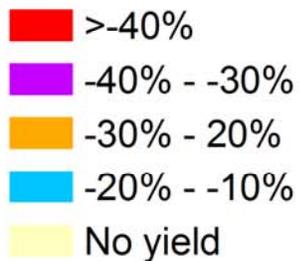
Vose et al., 2016



Sensitivity of water supply to drought



**Change in water supply due to a
10% change in precipitation**

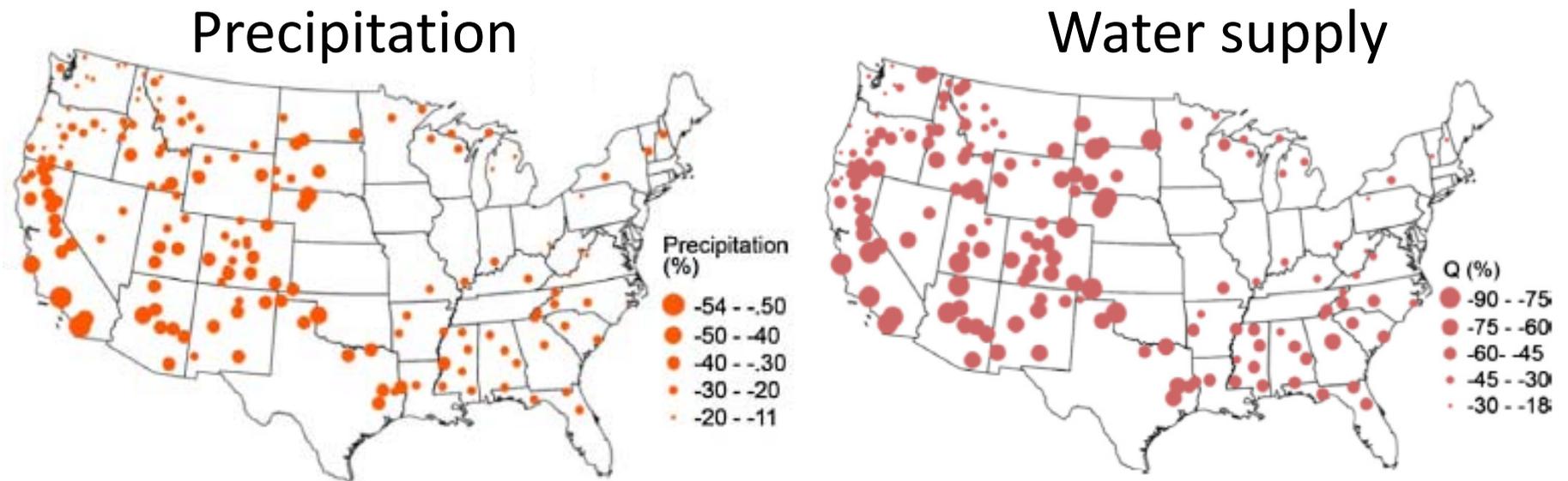


Modified from *Sun et al., 2015*



Drought impacts on water supply from National Forests

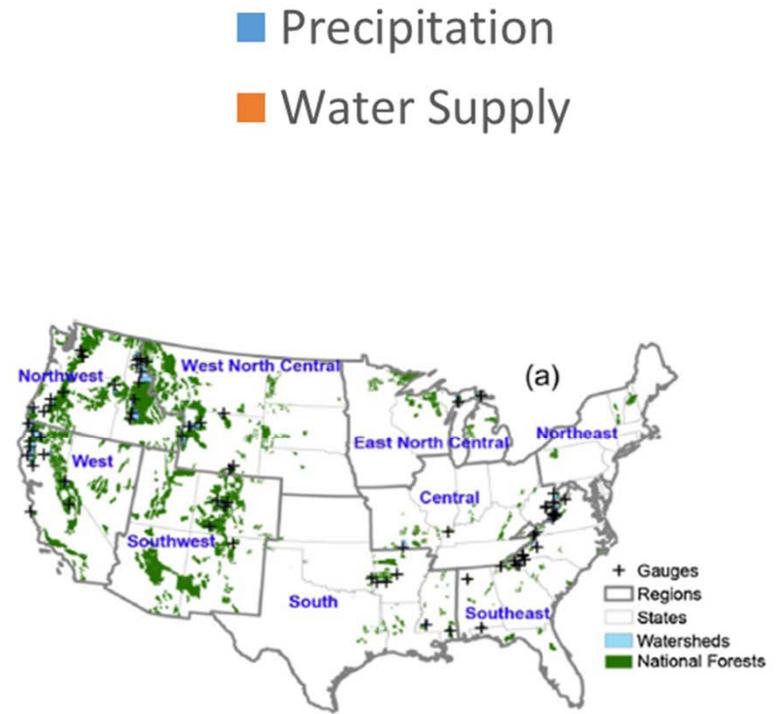
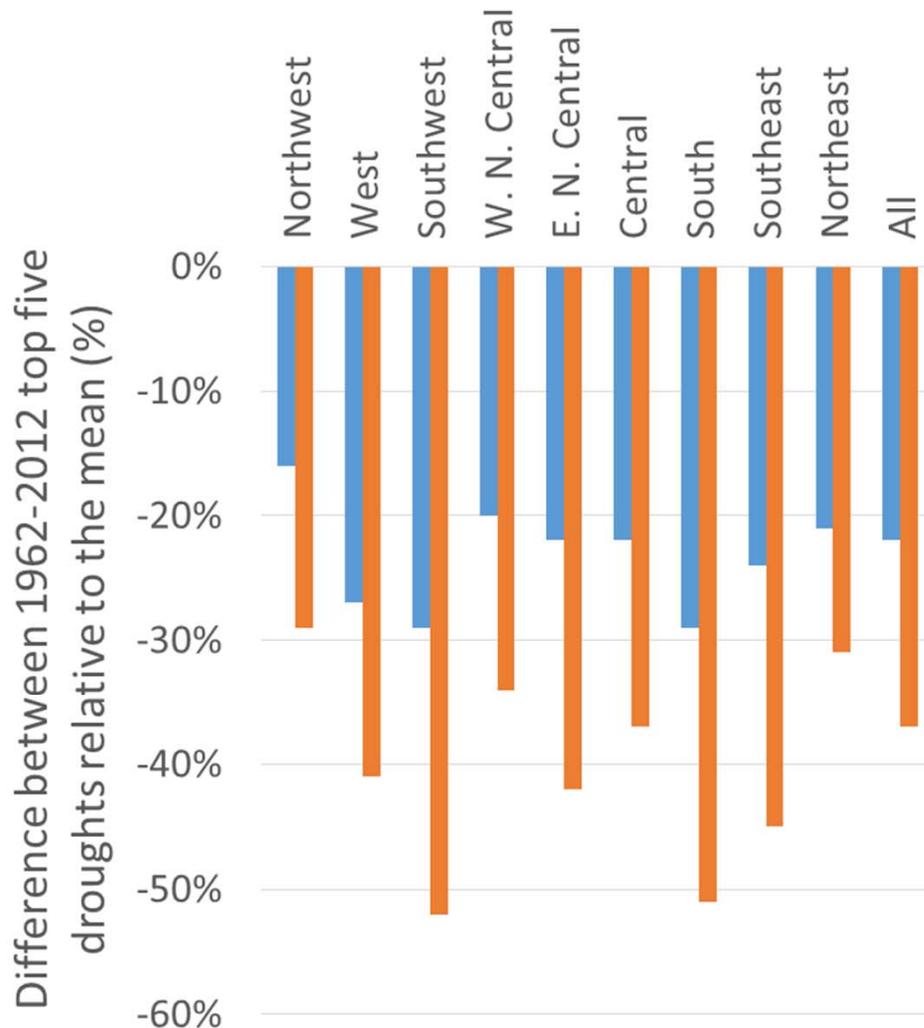
Difference during “top-five”
drought years of 1962-2012 relative to mean



Sun et al., 2015



Drought impacts on water supply from National Forests



Sun et al., 2015



Droughts over time

- Trends in drought frequency and intensity are difficult to detect or project
 - lack of direct observations
 - methodological uncertainties
 - geographical inconsistencies in the trends.
- Low confidence there was a global-scale trend in drought since the mid-20th century
- Droughts will continue to occur, and are projected to become more prolonged and severe in some regions



How could forest management help?

- Reduce vulnerability
 - Thinning/fuel management to reduce water use and reduce risk of wildfire
 - Increase species and age-class diversity within stands to reduce insect attack intensity
- Facilitate transition to a new condition
 - Change forest composition to drought tolerant species that use less water

Vose et al., 2016



Summary

- Forested lands are important for water supply; droughts can have a major impact
- Drought trends difficult to detect, but droughts will continue to occur and we will need to adapt
- Active forest management could help mitigate drought impacts

