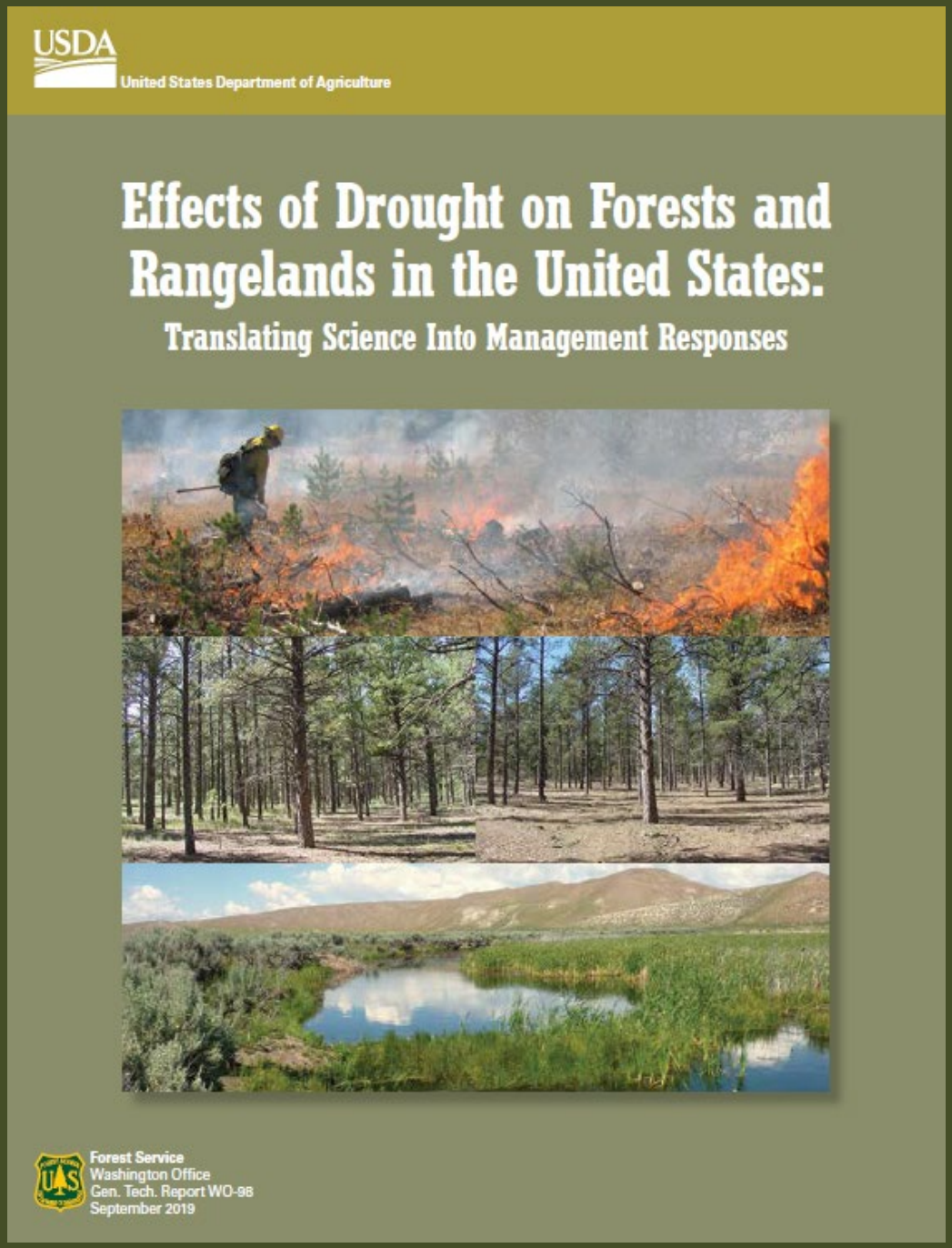

J.M. Vose, D.L. Peterson, C.H. Luce, and T. Patel-Weynand, eds.

67 authors and co-authors from USFS R&D, National Forests, USGS, Universities, Research Centers, and other Federal and State Agencies

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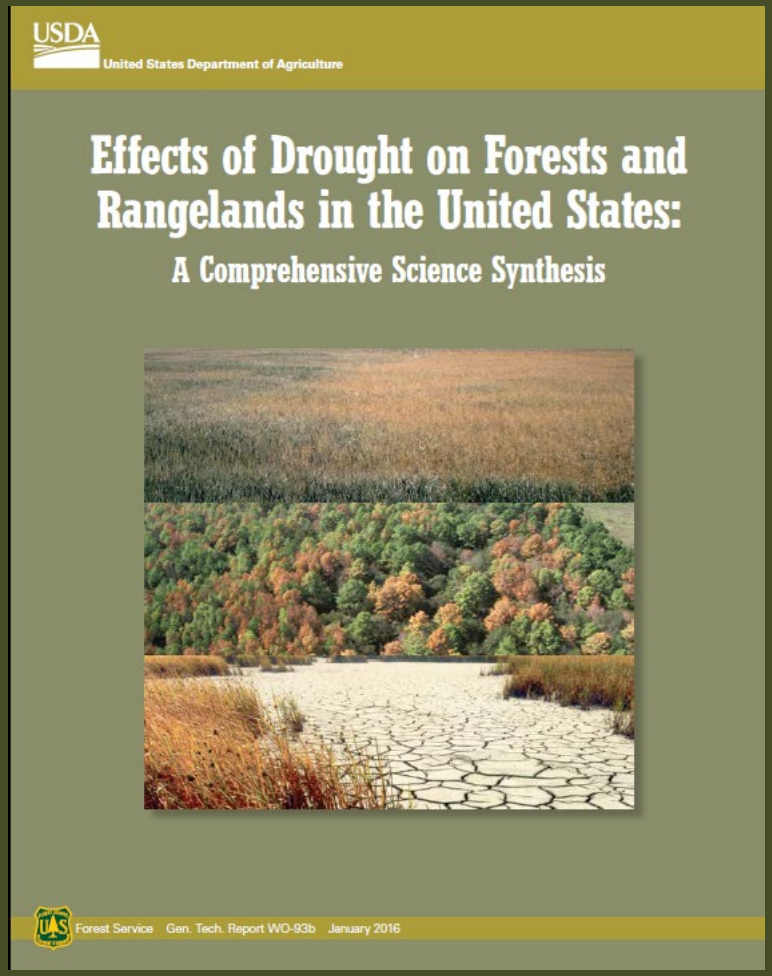
Translating the science



Research and Development

Approach

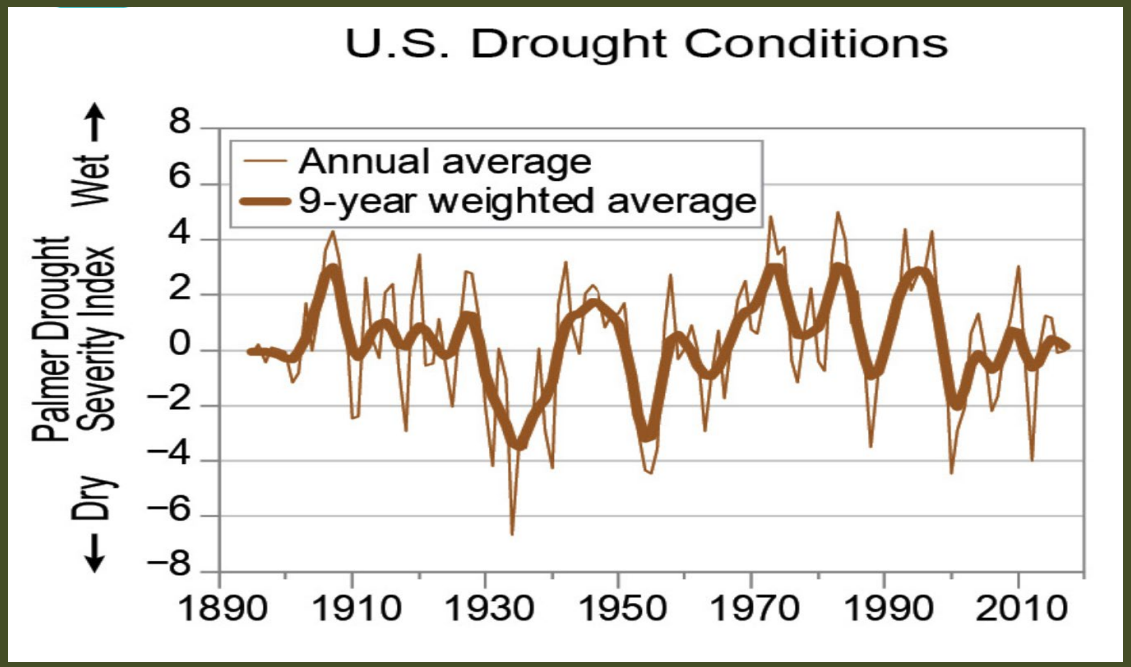
- Build on recent science — update as appropriate
- Involve managers in process
    - co-authors
    - workshops
    - reviewers
    - Hubs & Climate Adaptation Science Centers
- Consistent overall framework & definitions
- Regional

Regional Chapters

- Pacific Northwest & Alaska (Halofsky et al.)
- California (Fettig et al.)
- Hawai‘i & U.S.-Affiliated Pacific Islands (Frazier et al.)
- Interior West (Peterson et al.)
- Great Plains (Hanberry et al.)
- Midwest and Northeast (Asbjornsen & Campbell et al.)
- Southeast (McNulty et al.)

Drought and forests

Drought is a natural component of most ecosystems and is one of many biophysical variables that shape forests and rangelands.



Adapting to drought

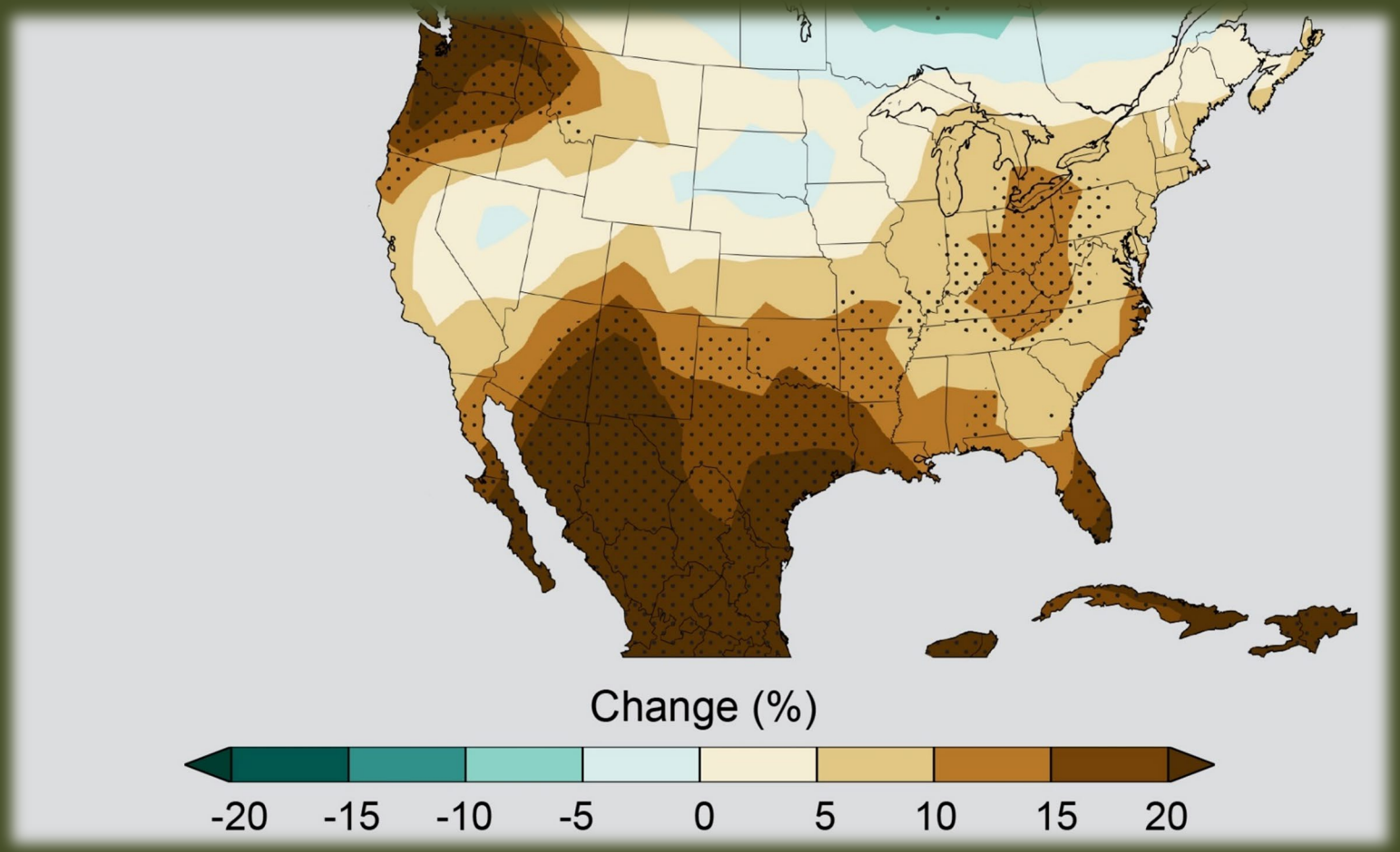
- In areas that frequently experience drought, adaptation often occurs naturally. Areas that have not historically experienced drought may be the most vulnerable to new drought regimes.
- Changing drought regimes may require purposeful management actions to maintain ecosystem structure and function.
- Historical and biophysical context can constrain or enhance management options.

Types of drought

- Meteorological
- Hydrological
- Agricultural
- Socioeconomic

- **Ecological** - *ecological droughts are those that are outside of the conditions that the ecosystem (species, processes, etc.) is adapted to, with observable impacts such as widespread tree mortality, growth reduction, large wildfires, etc.*

Change in Maximum Number of Consecutive Dry Days



GCRP 2014, Our Changing Climate

Glimpses of the future…

Texas

- 300 million trees died during 2010-2011 drought.

California

- The 2012-2016 drought was the most severe in 1,200 years, resulting in 147 million dead trees.

Fire Damage in Gatlinburg, Tennessee

Figure 6.3: In autumn 2016, a prolonged dry period and arson in the southern Appalachian region resulted in 50 major wildfires that burned over 100,000 acres in 8 states, caused 15 deaths, and damaged or destroyed nearly 2,500 structures in Gatlinburg, Tennessee. If drought or prolonged dry periods increase in this region as expected, fire risk will increase in both forests and local communities. Photo credit: Flickr user highlander411 (CC BY 2.0).

How do we manage in the face of current and future drought?

- Minimize impacts by anticipating and preparing for drought.
- Facilitate recovery by increasing resilience and recovery from the next drought.
- Facilitate transitions by creating ecosystem conditions (structure and function) that anticipate future droughts.

Examples for forests in the Southeast

CHAPTER 9

Managing Effects of Drought in the Southeast United States

Steven McNulty, Aurelia Baca, Michael Bowker,
Steven Brantley, Tyler Dreaden, Steven W. Golladay, Tom Holmes,
Natasha James, Shan Liu, Rima Lucardi, Albert Mayfield, Ge Sun, Emrys Treasure,
L. Mike Conner, Lora L. Smith, and James M. Vose

Water resources

Vulnerability

Drought will affect a wide range of factors related to water resources: water supply, transpiration, evaporation, baseflow, and hydroperiod.

Drought management options

- Enhance conservation; reduce groundwater and surface-water use for agriculture and lawns.
- Mulch where appropriate; apply solid waste in plantation forests.
- Reduce off-stream water withdrawal; adjust outflow from reservoirs; reclaim wastewater.
- Maintain riparian buffers and stream shading.

Wildfire risk

Vulnerability

Drought and extended dry periods will increase wildfire risk in southern forests

Drought management options

- Reduce fuel loads
  - prescribed fire
  - reduce stand density
  - mastication
  - herbicide
- Managed wildfire

Prescribed Fire

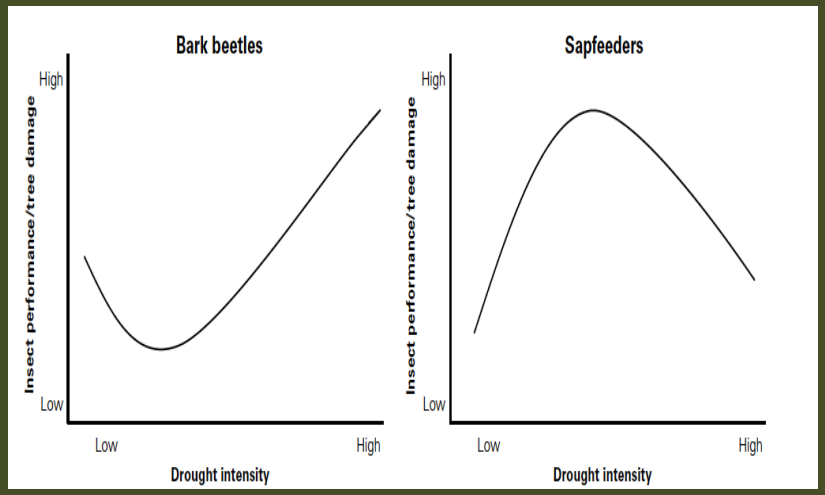
Insect outbreaks

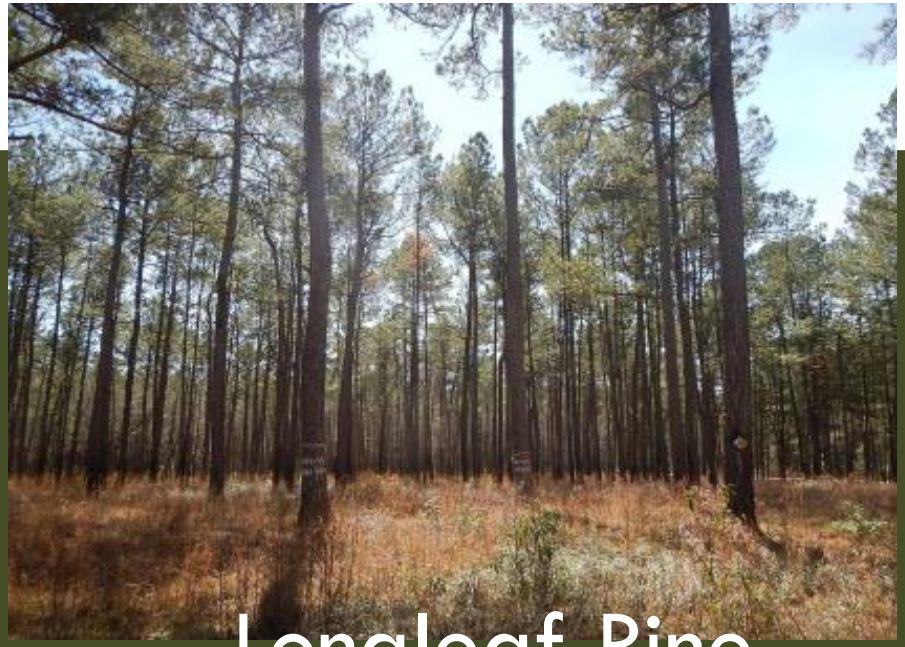
Vulnerability

Drought can reduce tree vigor and increase susceptibility to insect outbreaks such as pine beetles

Drought management options

- Improve and maintain tree vigor - reduce stand density
- Plant and favor resilient species





Longleaf Pine

Managing stands at lower densities is a common theme among forest management options to decrease vulnerability to future drought

Implies a trade-off of lower standing timber volume to reduce wildfire risk, minimize insect damage and mortality, and reduce impacts on streamflow

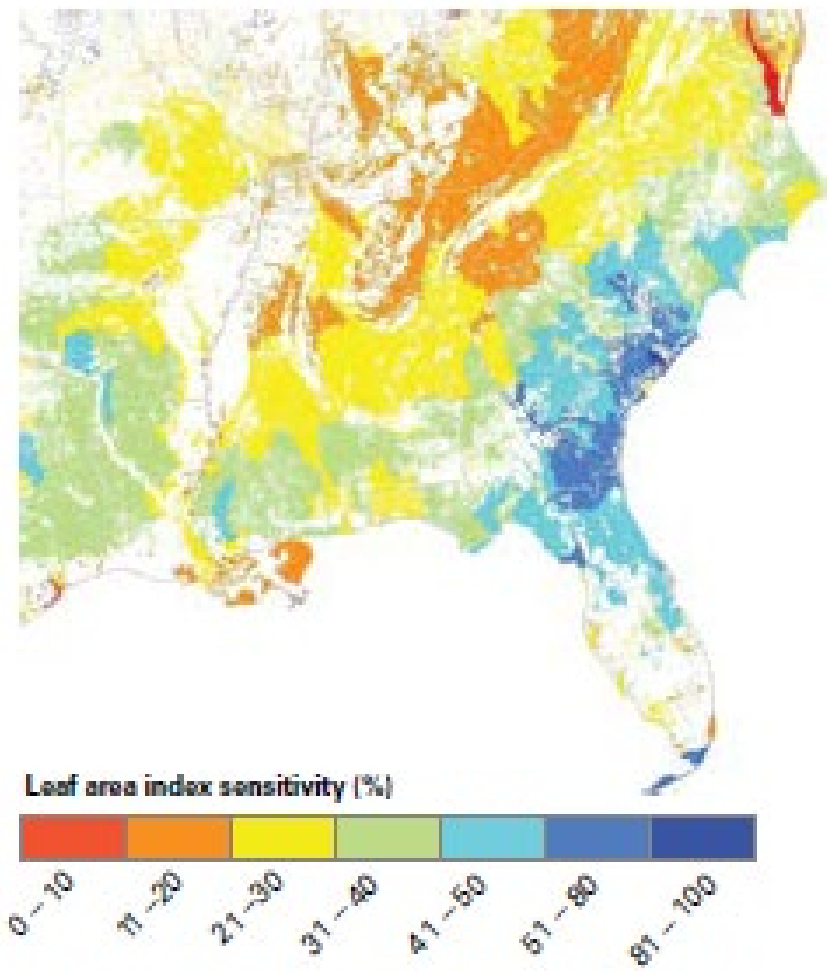
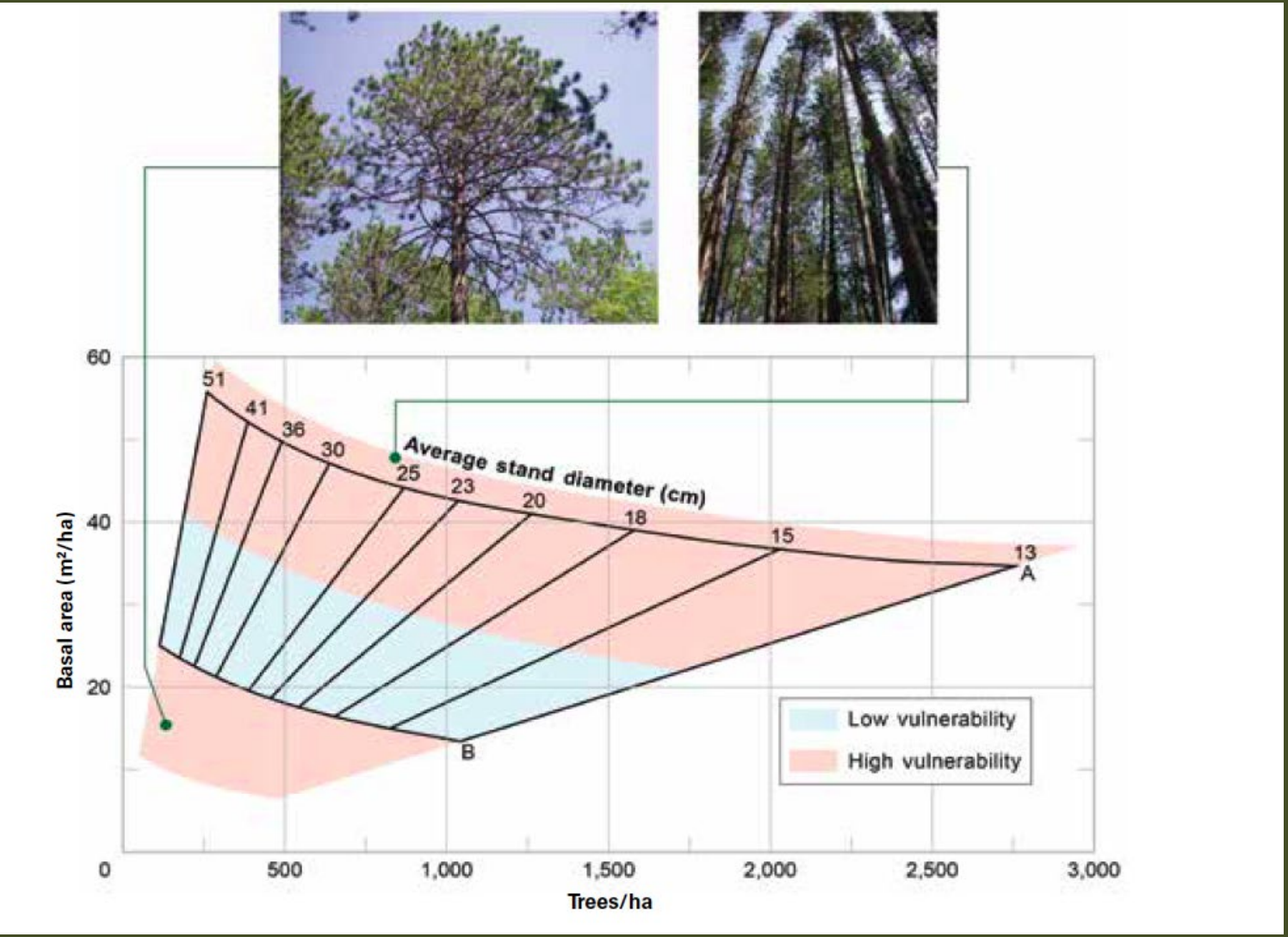


Figure 9.13—Water yield response to 50-percent reduction of leaf area index as simulated by the Water Supply Stress Index model. (Source: Sun et al. 2015a)

Different ways to think about managing size and density



Clark et al. 2016

Conclusions

Drought is likely to continue—and increase—as a **major stressor** in forest and rangeland ecosystems.

We understand most of the impacts, and many management options are available.

Drought-informed resource management will mostly require fine tuning and prioritization of existing practices.

Conclusions

Despite differences in biophysical context among regions, many of the drought management options are similar.

Drought management needs to be institutionalized within and among organizations and implemented across large spatial scales to maximize effectiveness.

Conclusions

This assessment provides a science-based starting point for natural resource managers — we still have much to learn, and surprises are likely.

Long-term monitoring and experiments will play a critical role in learning and adaptive management.

Thank you!

You can find the Drought Management GTR here:

https://doi.org/10.2737/WO-GTR-98