Post-fire Forest Restoration Considerations

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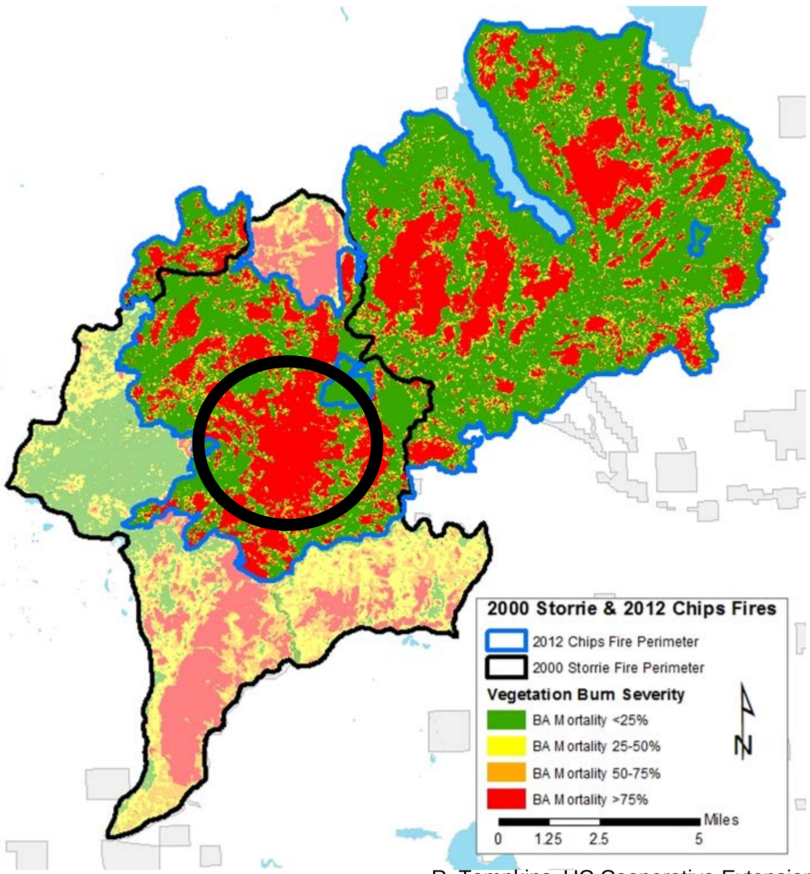
Plan for these landscapes to burn again

Lessons from the 2000 Storrie and 2012 Chips Fires



R. Tompkins, UC Cooperative Extension

Photo Credits: David Kinateder, Plumas NF

Coppoletta et al. 2016. Post-fire vegetation and fuel development influences fire severity patterns in reburns. Ecological Applications 26(3). Pp. 686-699.

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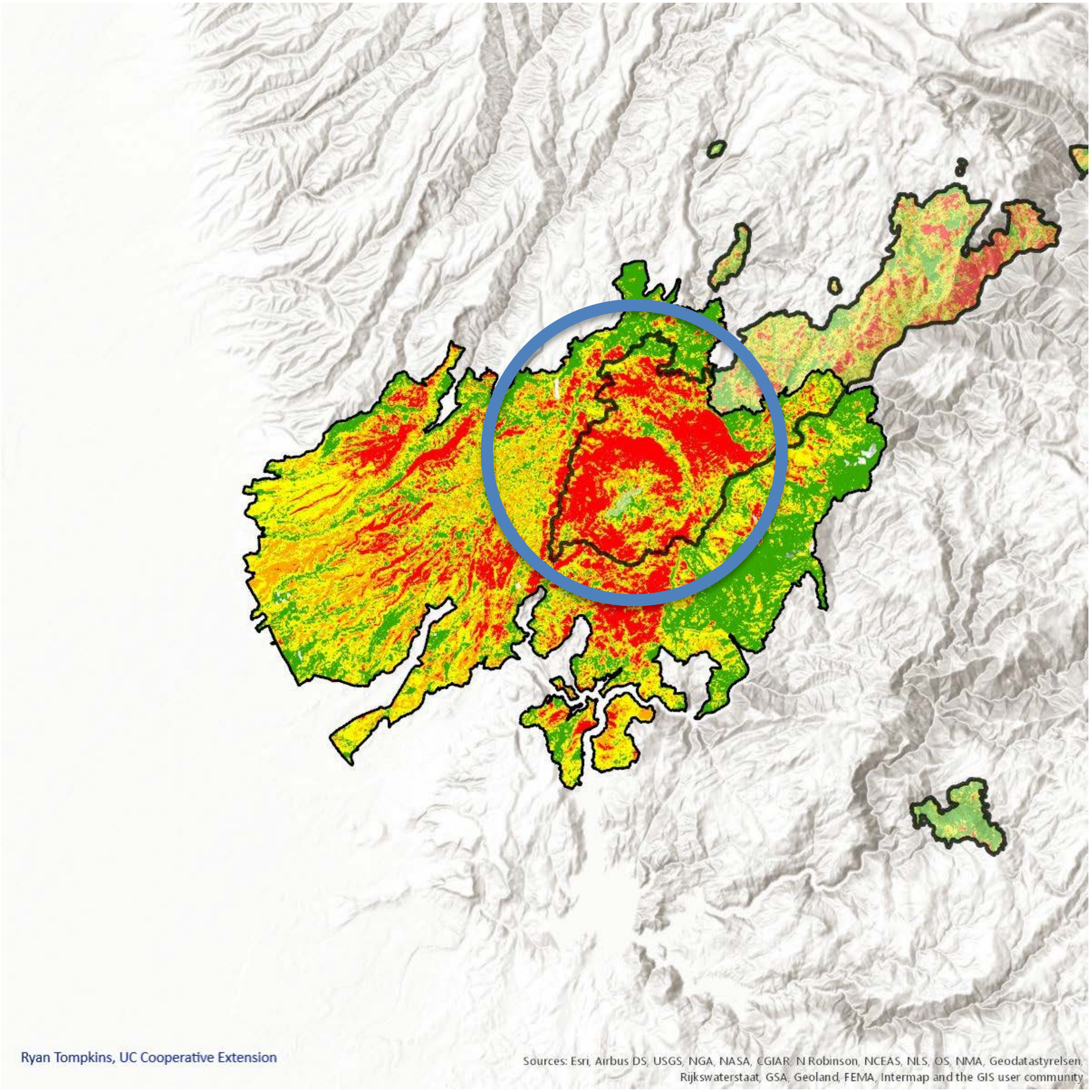
Similar trends in the 2008 BTU Complex and the 2018 Camp Fire



Consider seed sources & resilience of natural regeneration

2011 – Post 2000 Storrie Fire

Photo credits: D. Kinateder, USFS

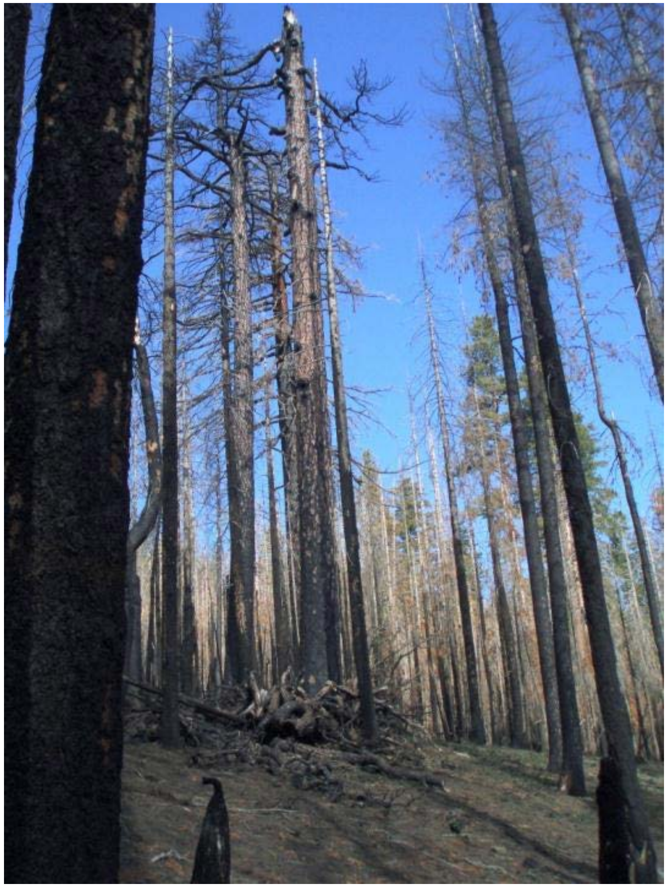
Collins and Roller. 2013. Early forest dynamics in stand replacing fire patches in the northern Sierra Nevada, California, USA. Landscape Ecol 28: 1801–13

Young et al. 2018. Post-fire forest regeneration shows limited climate tracking and potential for drought-induced type conversion. Ecology. https://doi.org/10.1002/ecy.2571

Post-fire landscapes are dynamic

What grows up eventually comes down

Photo credits: Plumas NF staff



Angwin et al. 2012. Hazard Tree Guidelines for Forest Service Facilities and Roads in the Pacific Southwest Region. US Forest Service, Region 5, Forest Health Protection. Report #RO-12-01, April 2012

Smith and Cluck. 2011. Marking guidelines for Fire-Injured Trees in California. US Forest Service, Region 5, Forest Health Protection. Report #RO-11-01, May 2011.

McCreary and Nader. 2011. Burned Oaks: Which ones will survive? University of California Agriculture and Natural Resources Publication 8445. January 2011.

Consider development of fuel profiles over time

Observations from the 2007 Antelope Complex Fire

Coppoletta et al. 2016. Post-fire vegetation and fuel development influences fire severity patterns in reburns. Ecological Applications 26(3). Pp. 686-699.

Restoration actions can either disrupt or perpetuate post-disturbance homogeneity

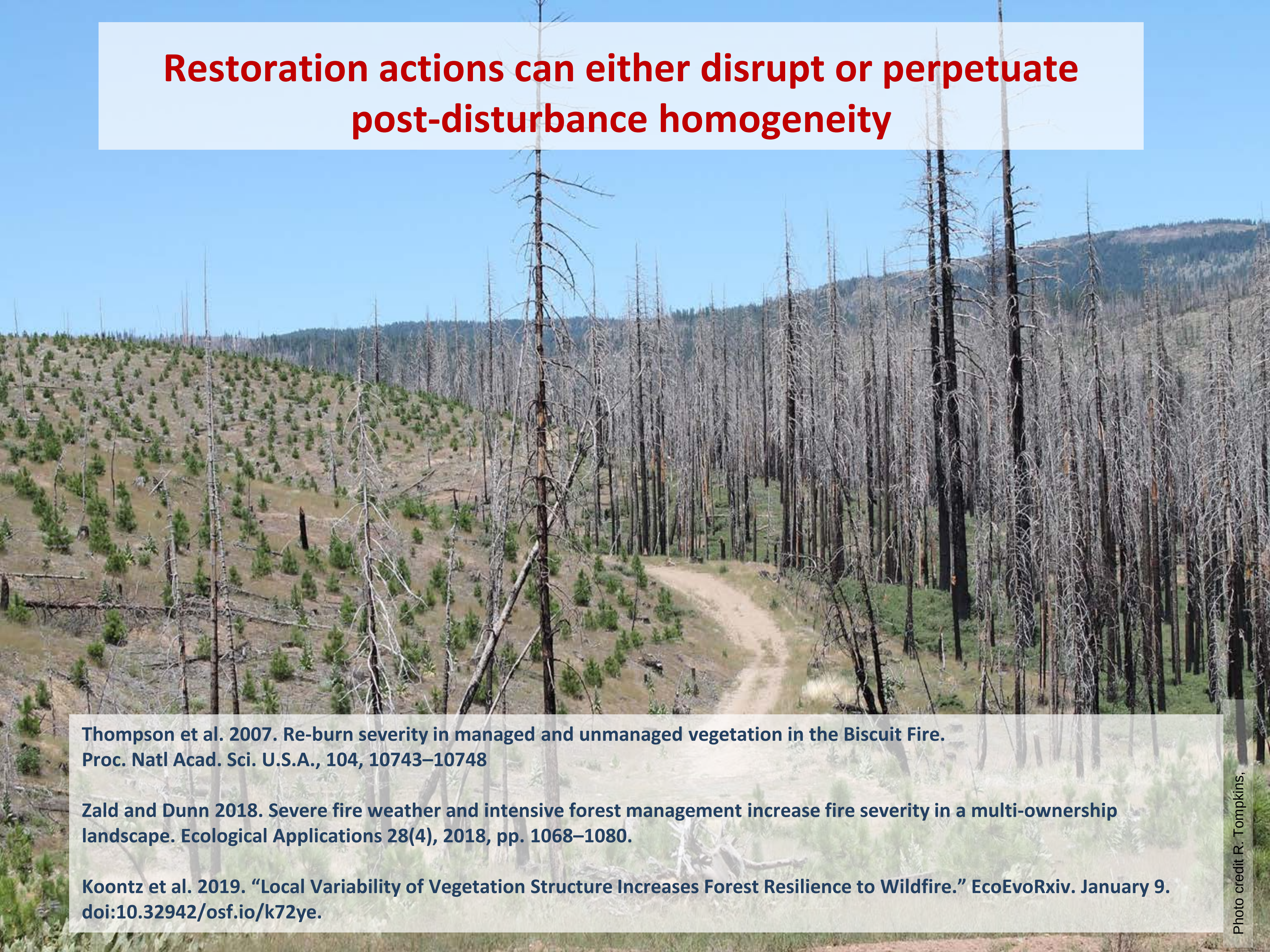


Photo credit R. Tompkins,

Thompson et al. 2007. Re-burn severity in managed and unmanaged vegetation in the Biscuit Fire. Proc. Natl Acad. Sci. U.S.A., 104, 10743–10748

Zald and Dunn 2018. Severe fire weather and intensive forest management increase fire severity in a multi-ownership landscape. Ecological Applications 28(4), 2018, pp. 1068–1080.

Koontz et al. 2019. “Local Variability of Vegetation Structure Increases Forest Resilience to Wildfire.” EcoEvoRxiv. January 9. doi:10.32942/osf.io/k72ye.

Opportunity to diversify reforestation tactics:
Manipulating planting density and arrangements

Arrangement influence on pattern

Additional Factors to Diversify:

- Density (planted trees/acre)
- Species
- Seed Lots & Elevations
- Seed Zones

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How can we promote heterogeneity following large, severe disturbances?

From Stephens, Millar, and Collins. 2010 in *Environmental Research Letters*

*"Planting seedlings of multiple species in clusters (2–3 seedlings over an 5 m × 5 m area) at wide and variable spacing (7–15 m) would produce **higher spatial heterogeneity** versus the standard grid pattern, and require less maintenance (e.g., pre-commercial thinning) as the forest stands develop (Tompkins 2007)."*

Boulder Fire 2007: 6 months after the fire

Photo R. Tompkins,

2016: 10 years after the fire

North et al. 2019. Tamm Review: Reforestation for resilience in dry western U.S. forests. Forest Ecology and Management 432 (2019) 209-224.

An example from the 2012 Chips Fire

Consider competition and development of live fuel profiles

Photo R. Tompkins,

Long-term need for maintenance of reforestation investment

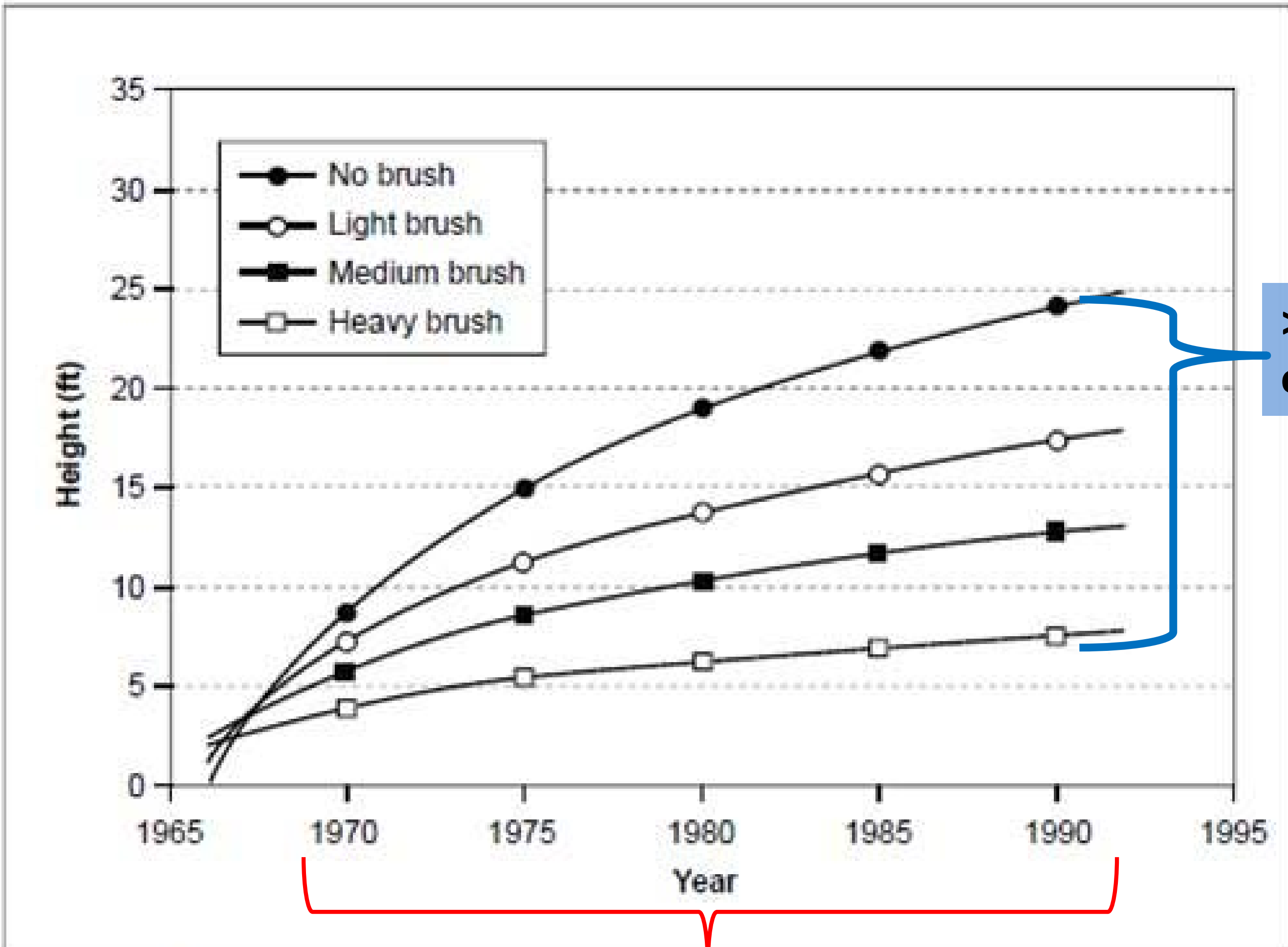


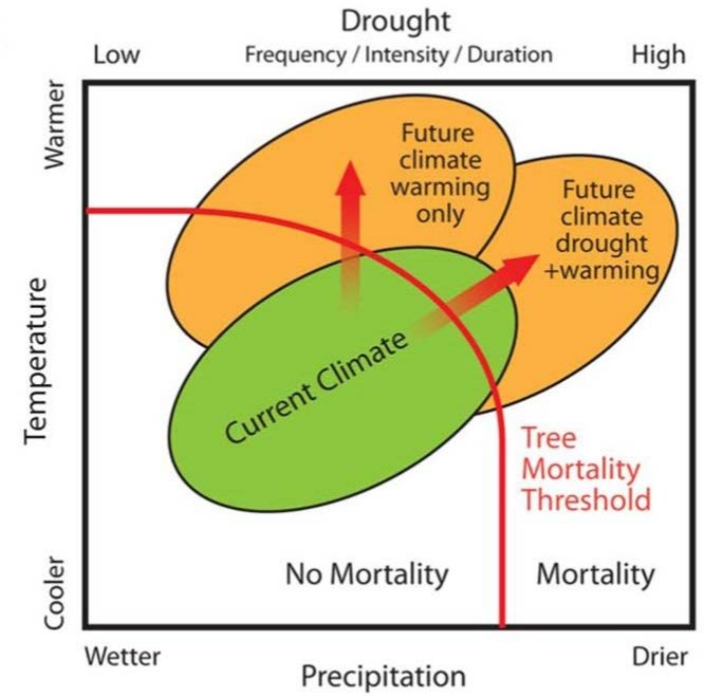
Figure 9—Relationship of pondero
brushfields, 1966–1992.

> 15 ft height difference over 25 yrs

What's the probability the site may re-burn in 25 years?

From McDonald and Fiddler 2010

What scientists predict the present → future holds:



From Allen et al 2015

- "Quantitative Evidence for **Increasing Forest Fire Severity** in the Sierra Nevada"
  Miller et al 2009
- "Temperate forest health in an **era of emerging megadisturbance**"
  Millar and Stephenson 2015
- "**Widespread Increase of Tree Mortality Rates** in the Western United States"
  van Mantgem et al 2009
- "Long-term climate and competition explain **forest mortality patterns under extreme drought"**
  Young et al 2017
- "Darcy's law predicts **widespread forest mortality** under climate warming"
  McDowell and Allen 2015
- "**Megafires: an emerging threat** to old-forest species"
  Jones et al 2016

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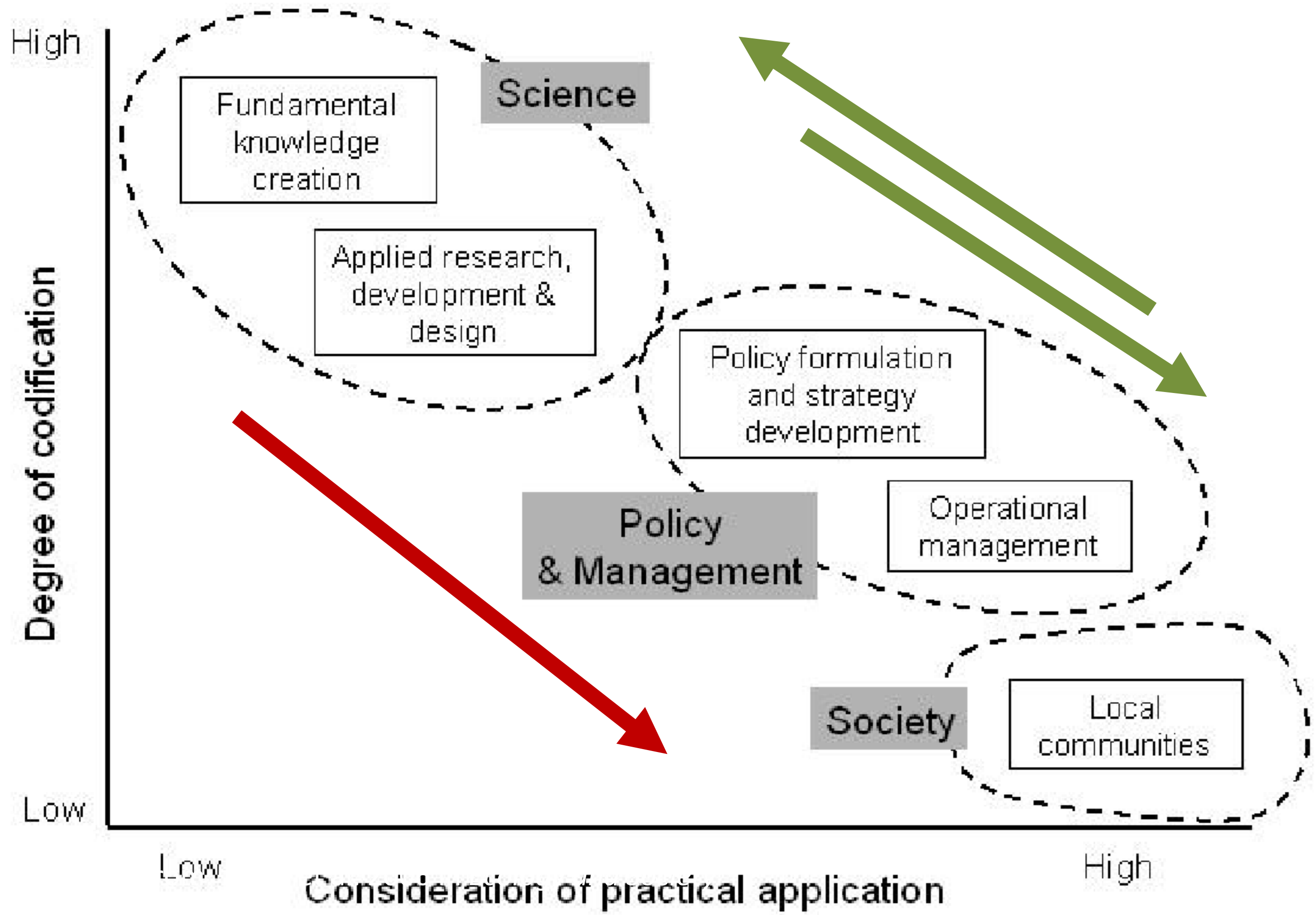
Capacity to Connect Research, Application, and Communities



From Roux et al 2006,

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What are climate smart species?

What are climate smart species?

?

How to maintain?

- Targeted herbivory
- Prescribed fire

Post-fire Landscape Portfolio:

The legacy we leave the next generation of resource managers should be diverse and manage interests, values, risks, and returns

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