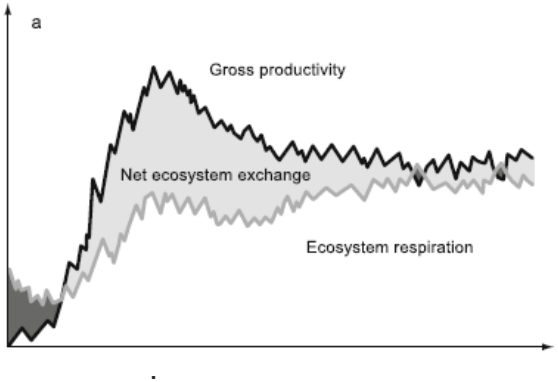
CARBON STATUS OF SIERRA NEVADA FOREST ECOSYSTEMS

John J. Battles

University of California, Berkeley

August 21, 2013



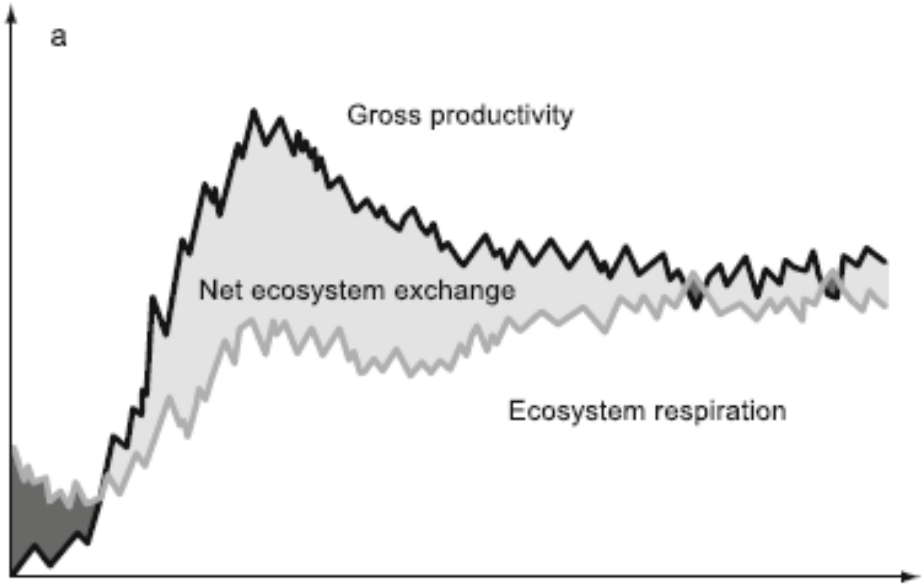
outline

1) theory: carbon balance
2) status: Sierran conifer forests
3) risks: catastrophic and chronic

theory

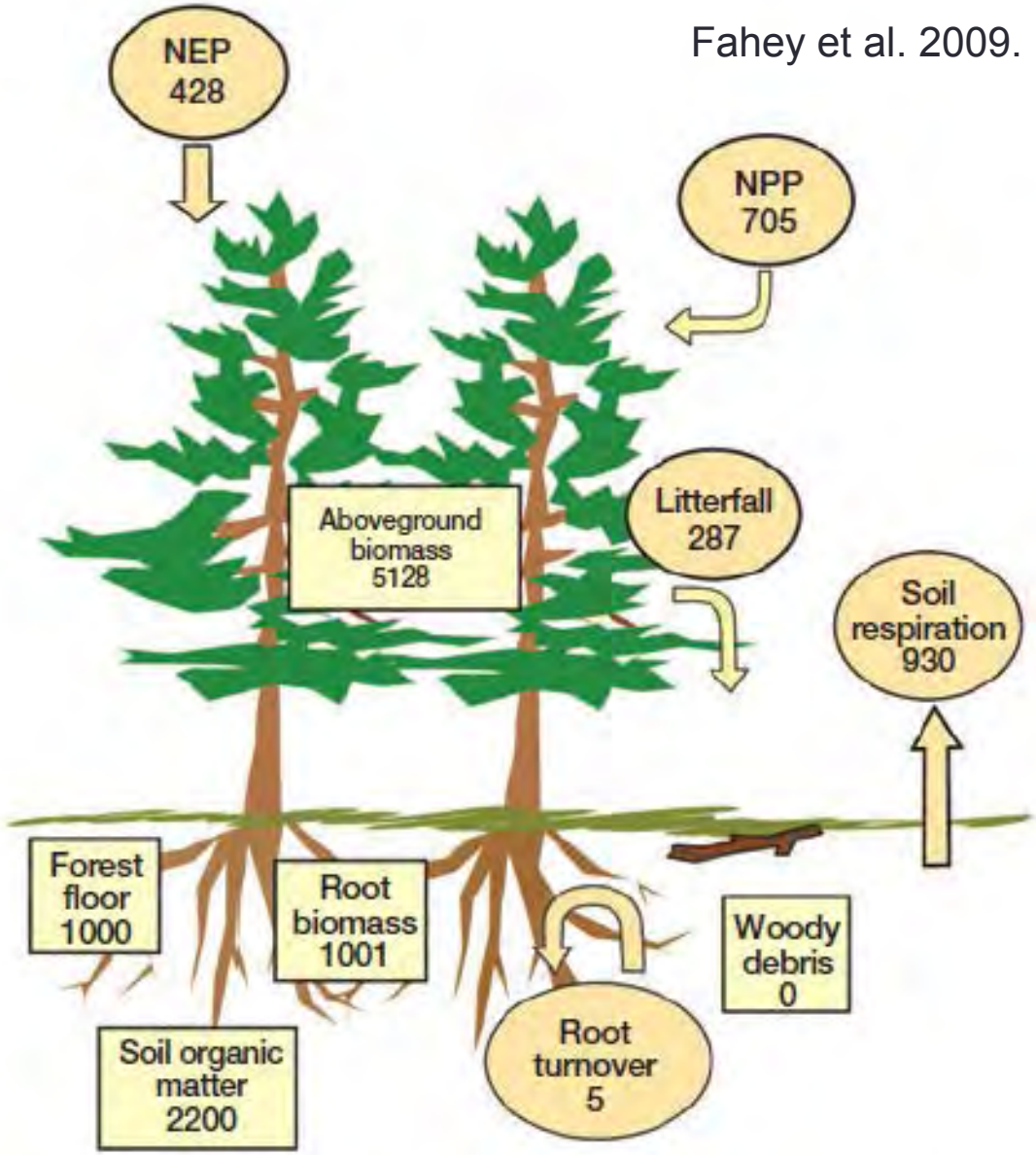
Productivity/Biomass Link

$$\frac{dB}{dt} = NEE = GPP - R_e$$



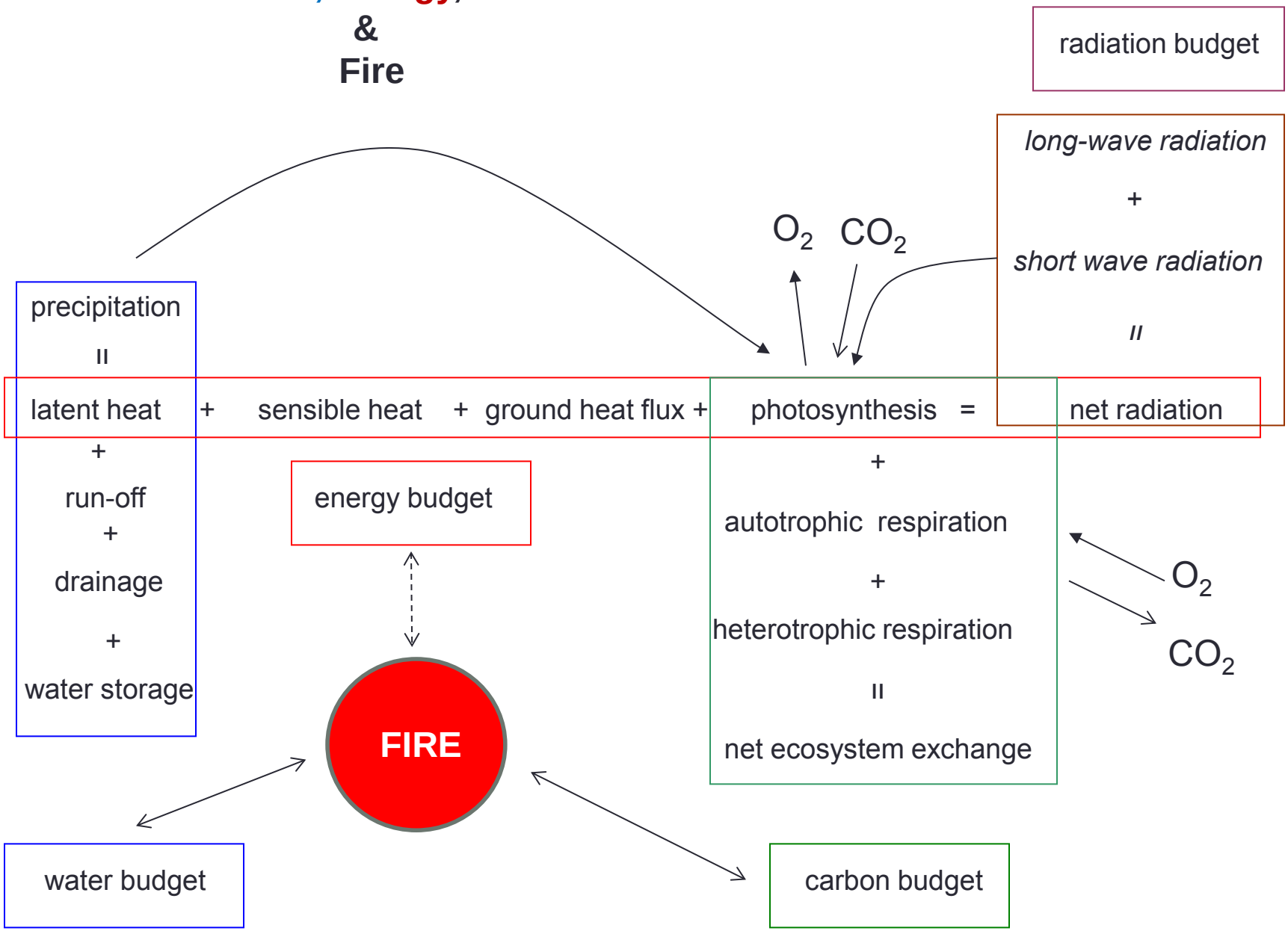
Pools and fluxes

Fahey et al. 2009. Frontiers

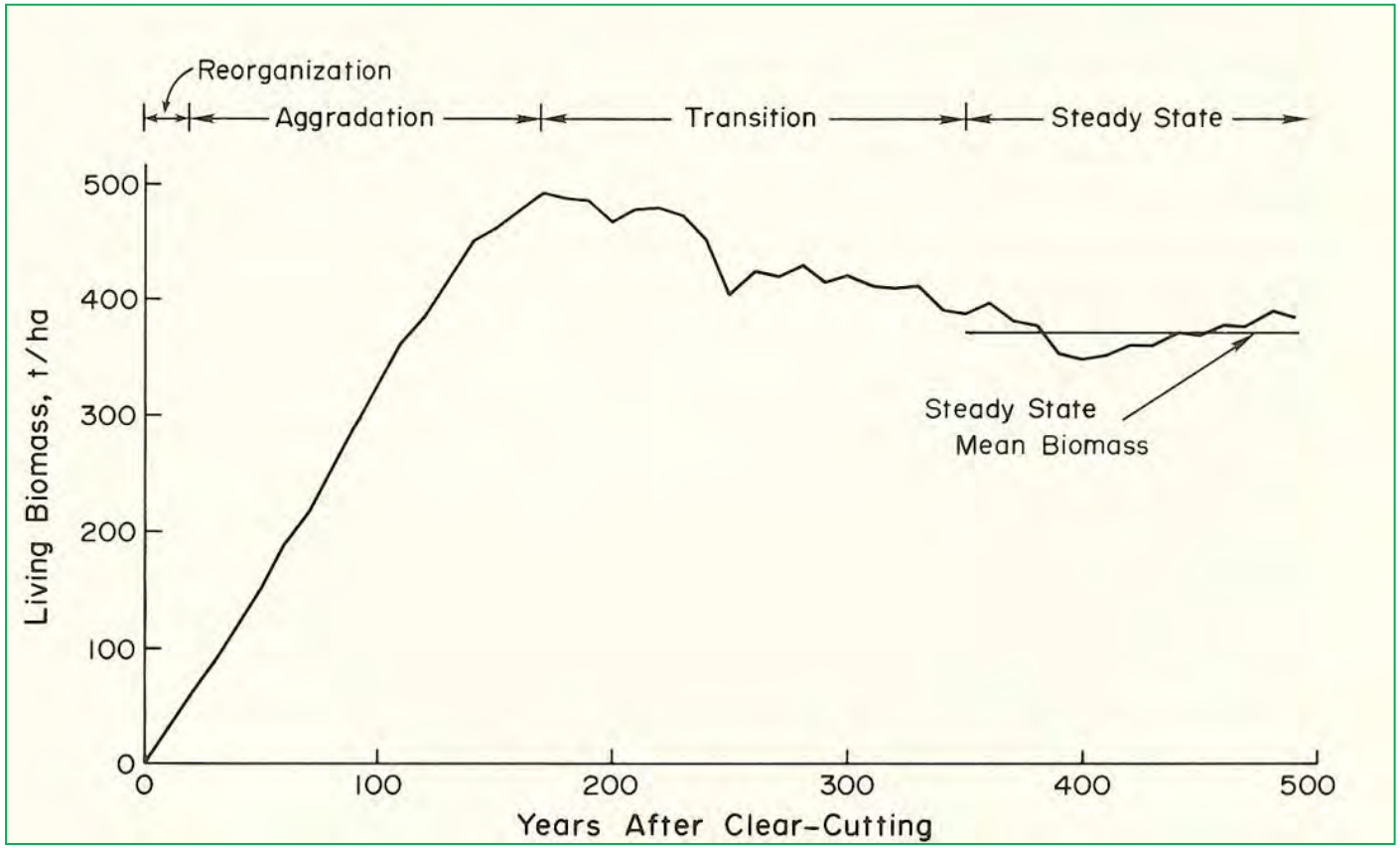


Major carbon pools (boxes, g C m^{-2}) and fluxes (ovals, g C m^{-2} yr^{-1})

A Cheat Sheet of Water, Energy, and Carbon Balance & Fire

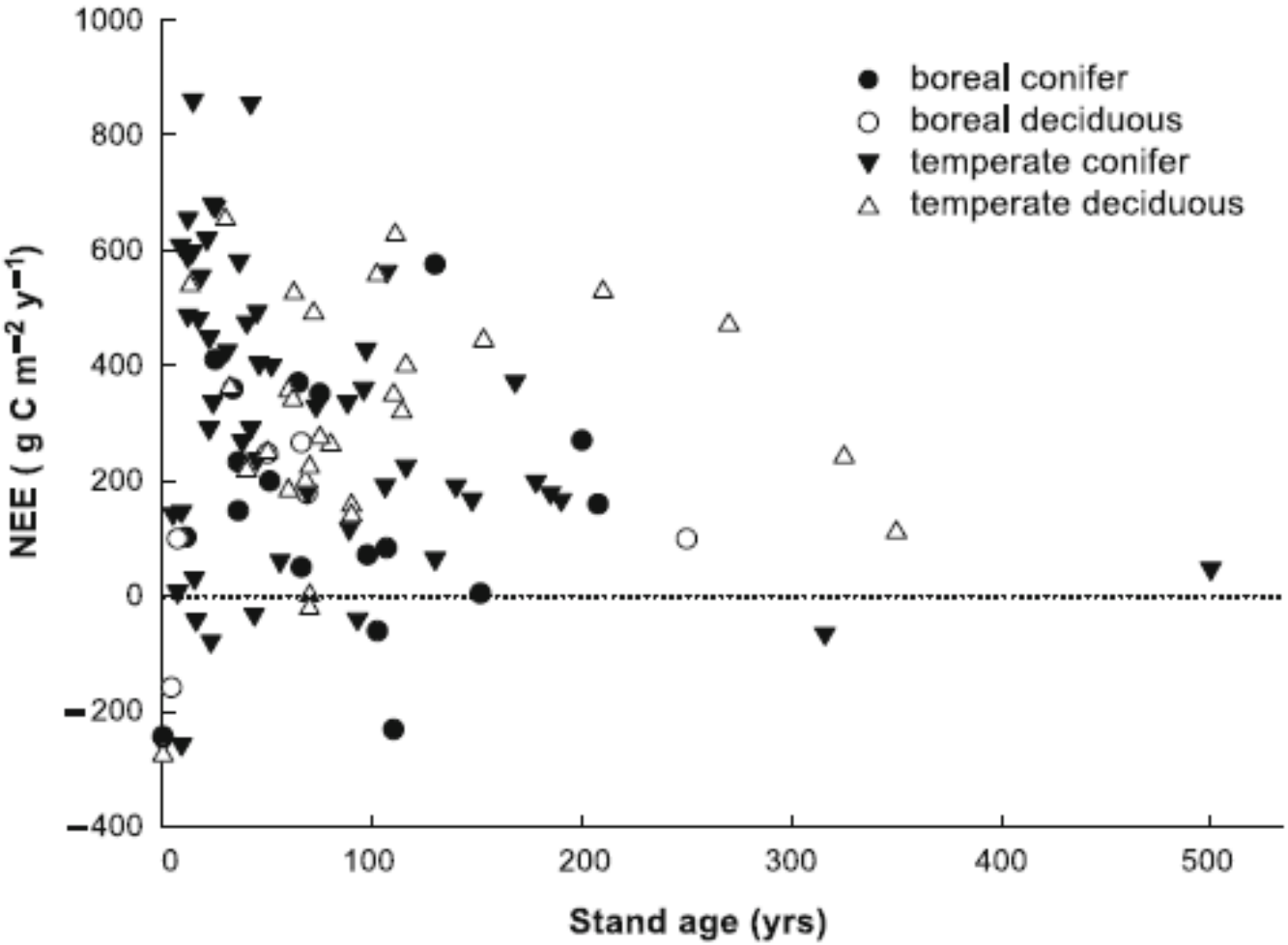


Carbon carrying capacity



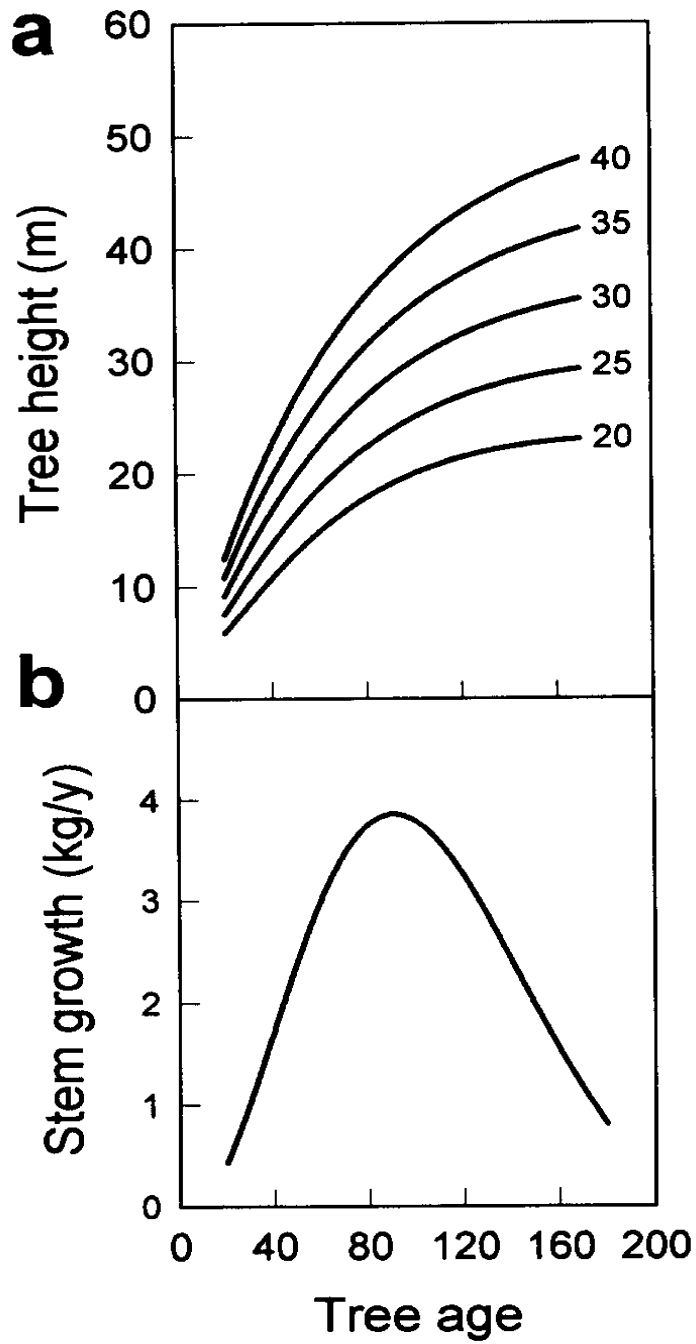
Bormann and Likens 1979. Springer-Verlag
Keith et al. 2009.PNAS

Endless carbon sinks?



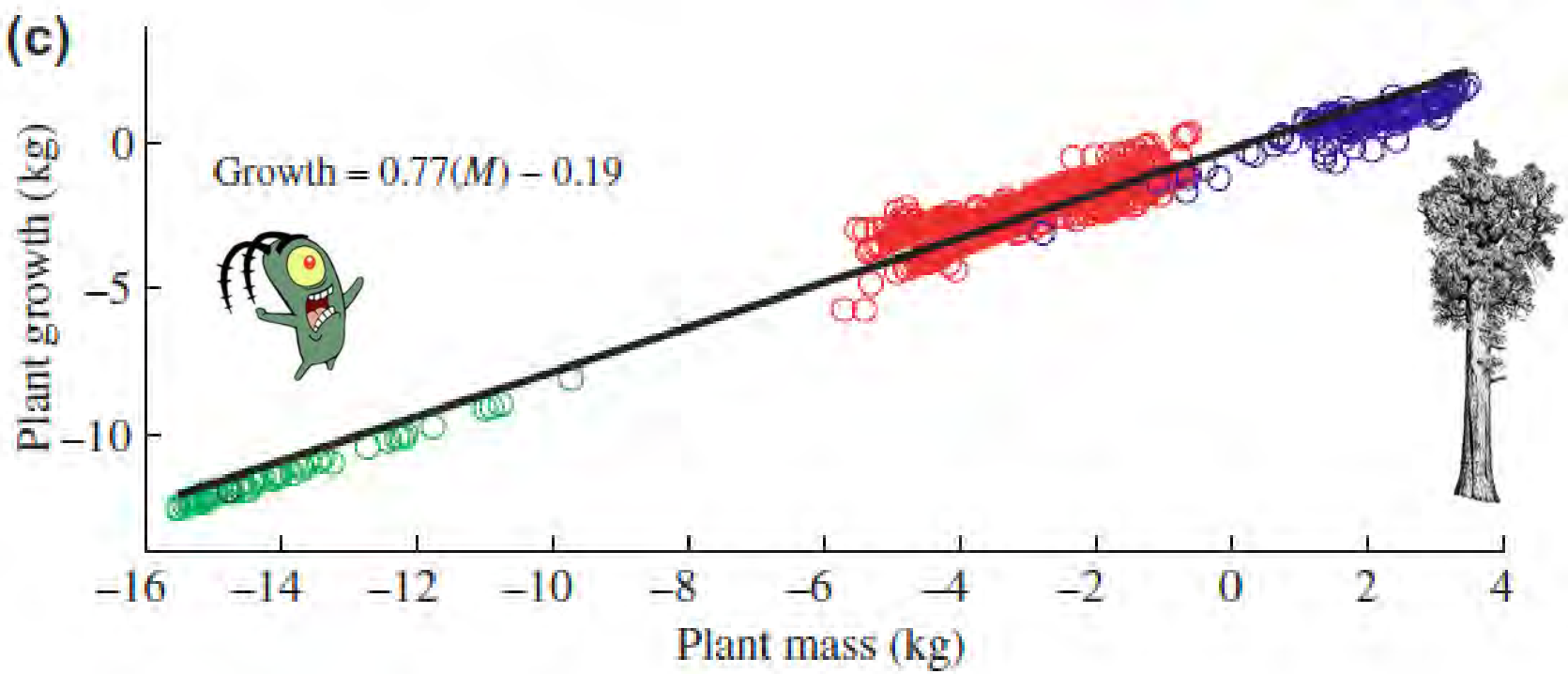
Knohl et al. 2009. Springer-Verlag
Luyssaert et al. 2009. doi:10.3334/ORNLDAAC/949

Age-related decline in growth



Ryan and Yoder. 1997. Bioscience

Metabolic Scaling Theory

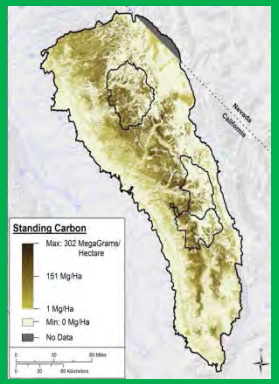


Price et al. 2010. New Phytologist

status

Blodgett Forest ,CA

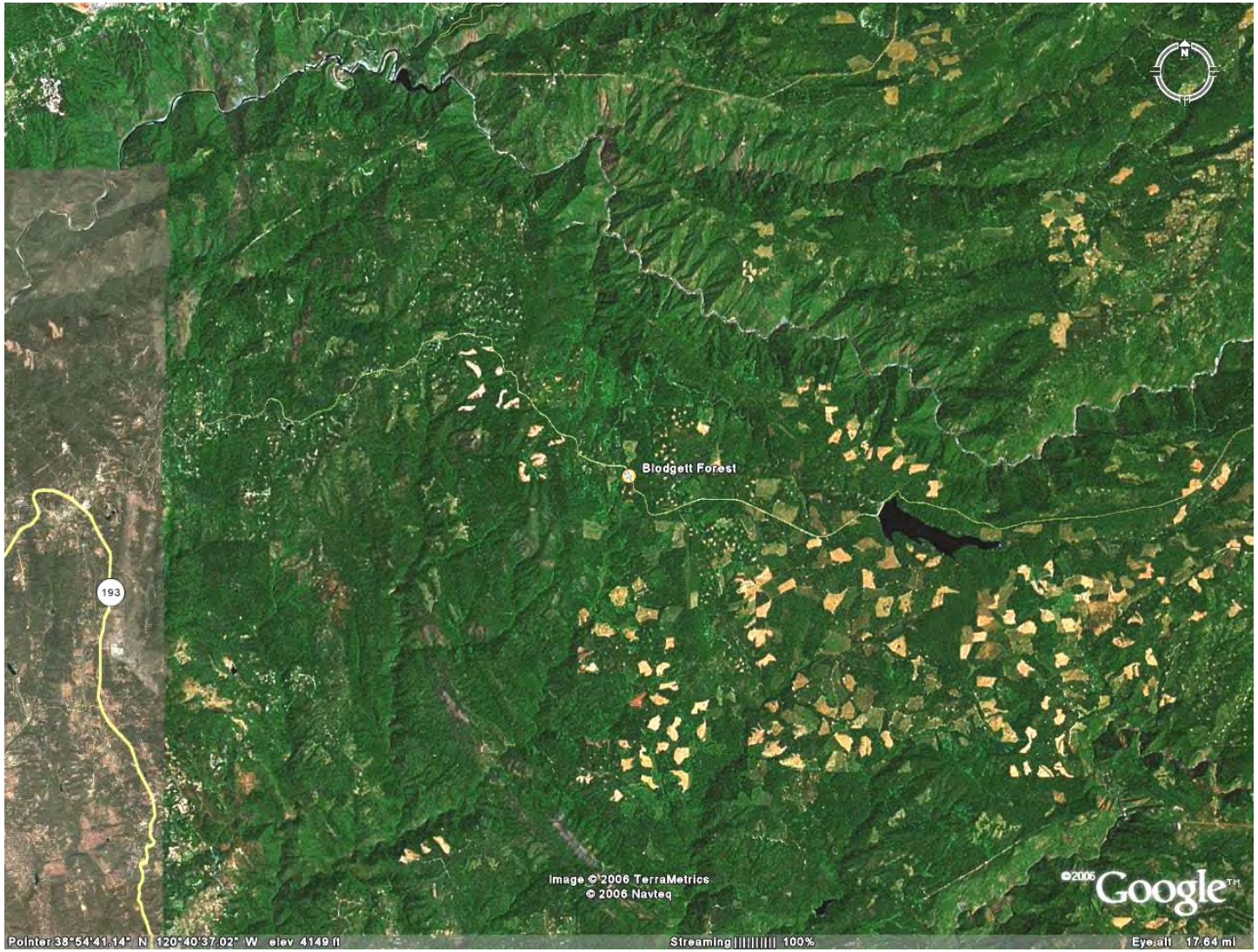
SEKI, YOSE NPS



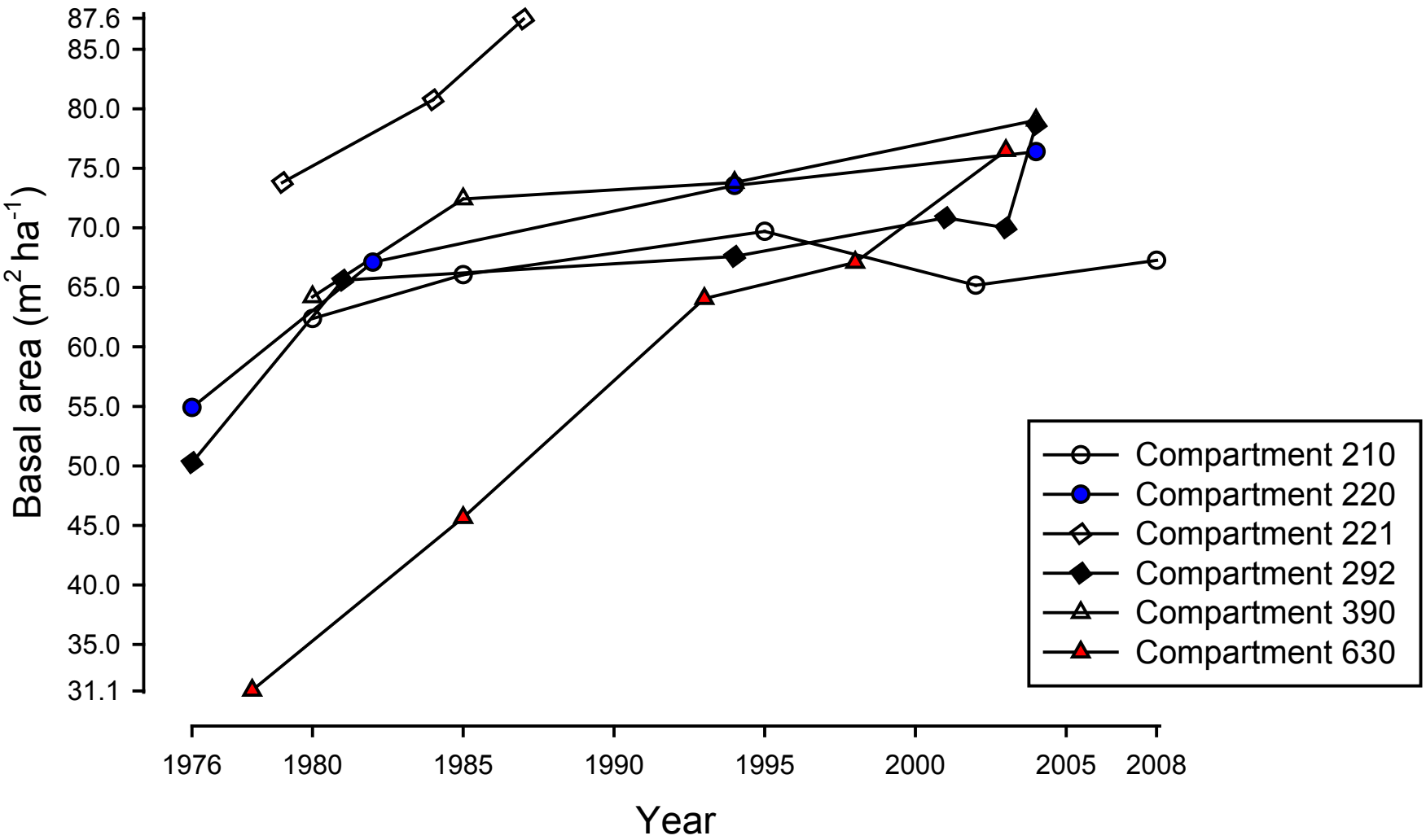
Blodgett Forest Research Station

Robert A. York

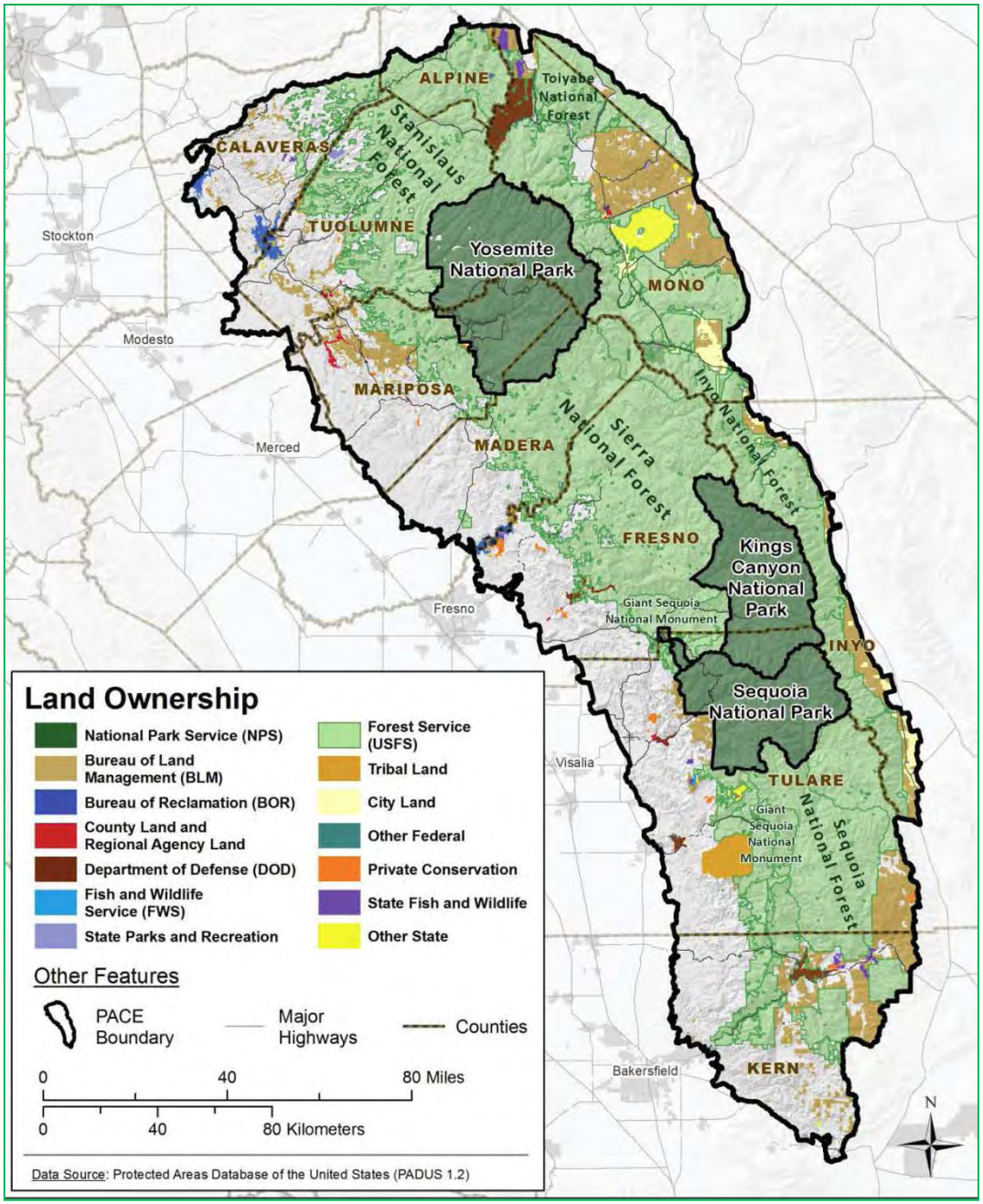
Forest management gradient



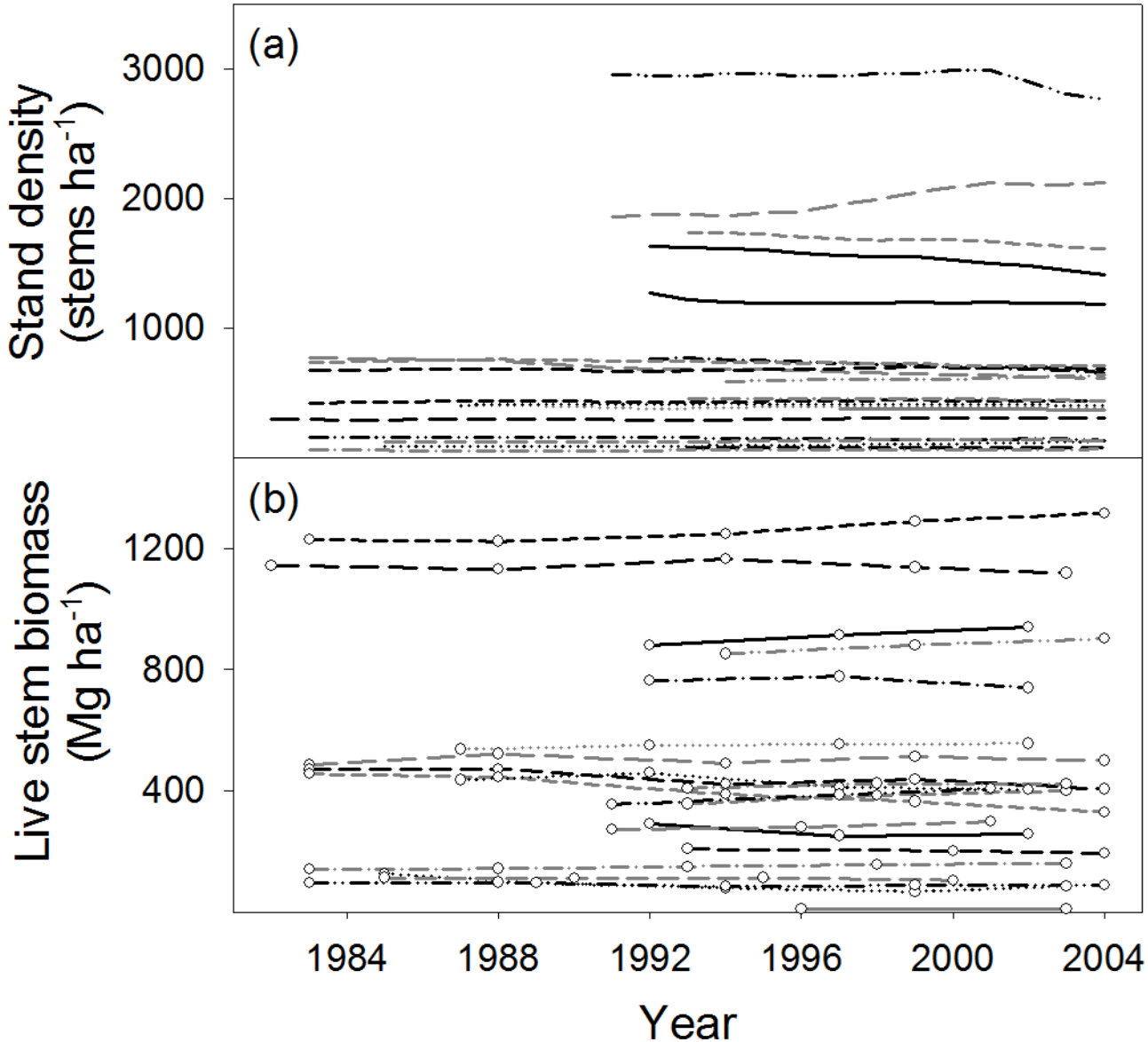
Trends in growth (reserve compartments, BFRS)



Southern Sierra Nevada

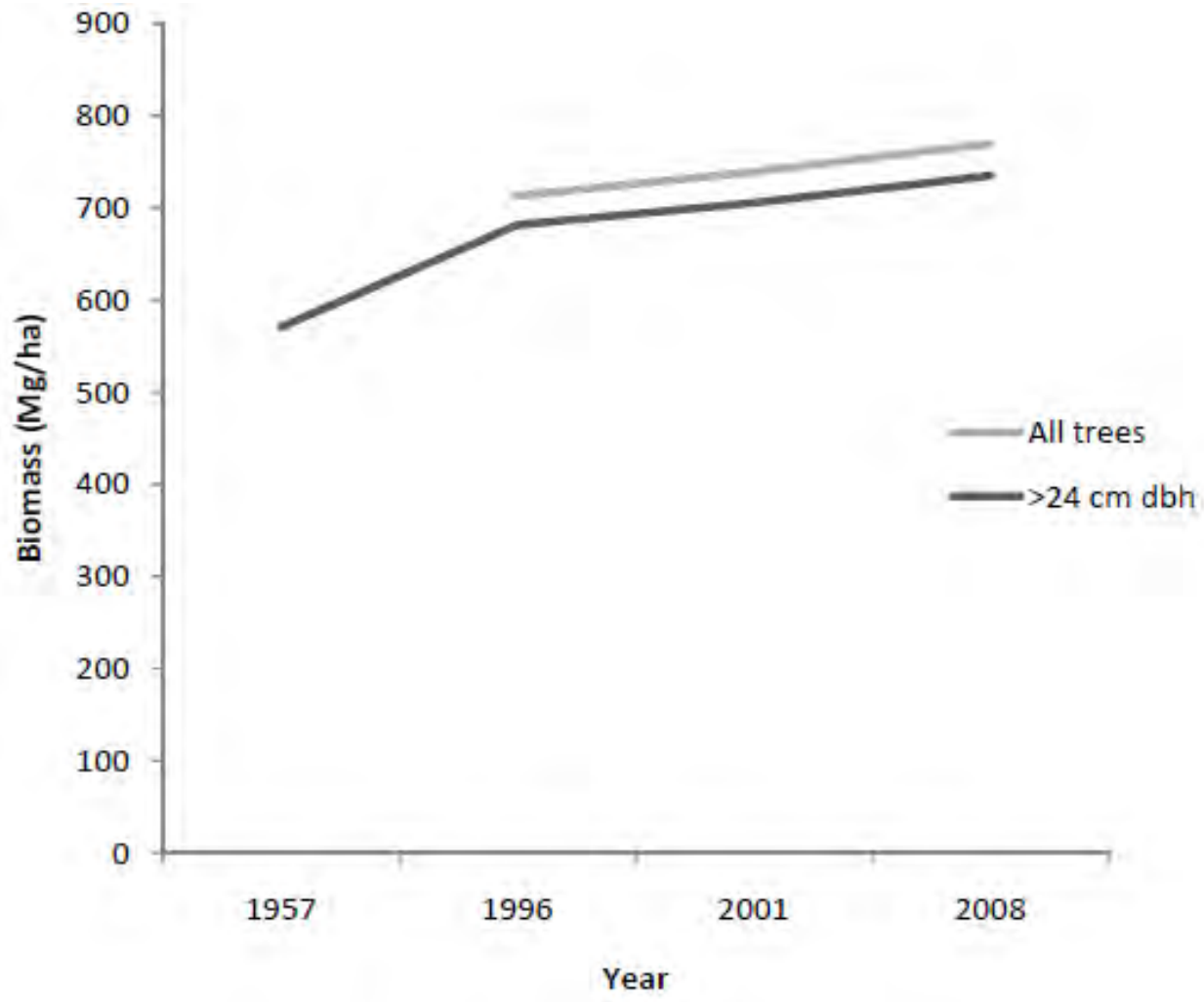


Trends in growth (old-growth in YOSE and SEKI)



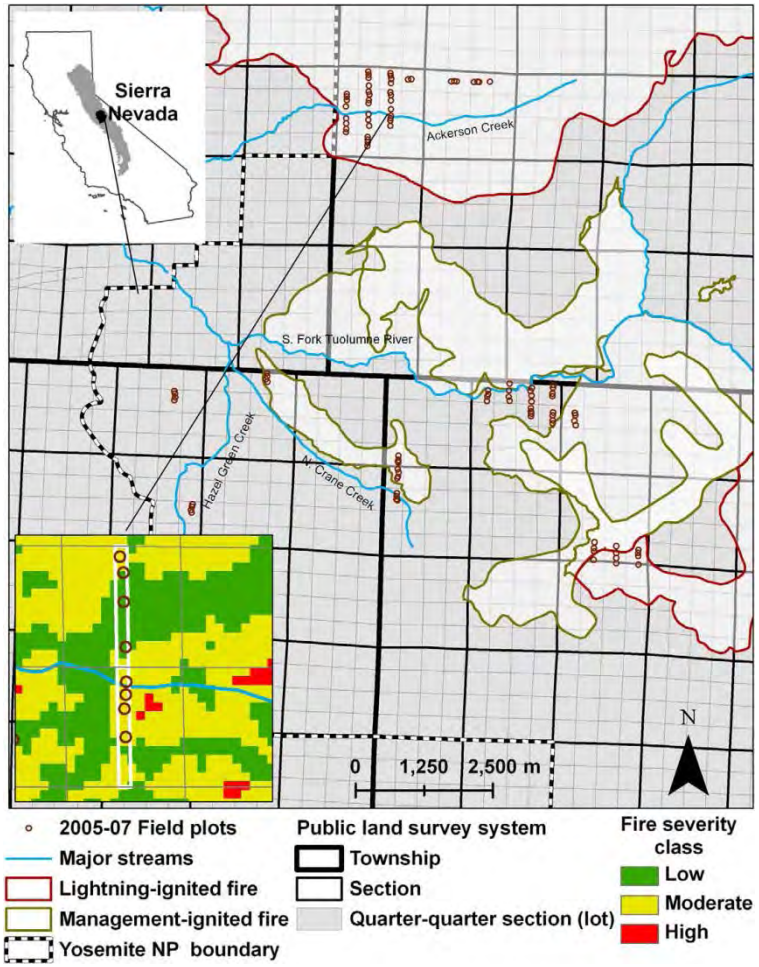
van Mantgem and Stephenson 2007. Ecology Letters (supplement)

Trends in growth (Baker OG Forest, Plumas TNF)

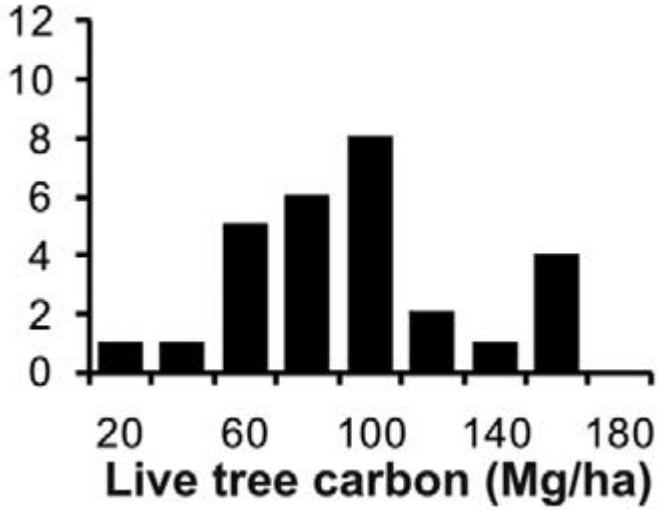


Krivek-Tetley. 2010. Thesis

Reconstructed forest structure



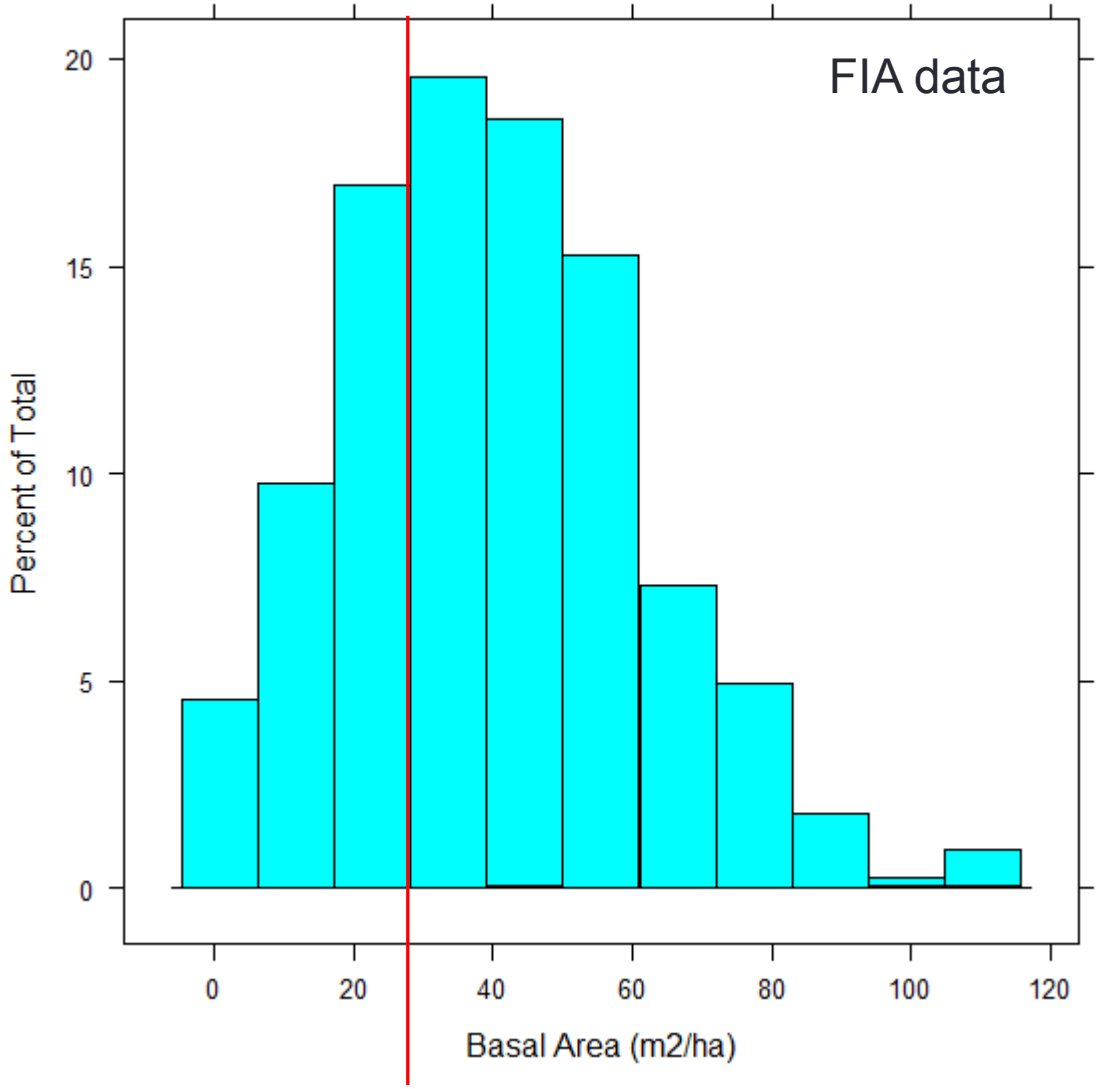
Year	Density (trees ha^{-1})	Basal Area ($m^2 ha^{-1}$)
	mean (sd)	mean (sd)
1899	516 (242)	69.4 (25.9)
2002	159 (117	29.9 (19.6)



Scholl and Taylor. 2010. Ecological Applications
Collins et al. 2011. Ecosphere

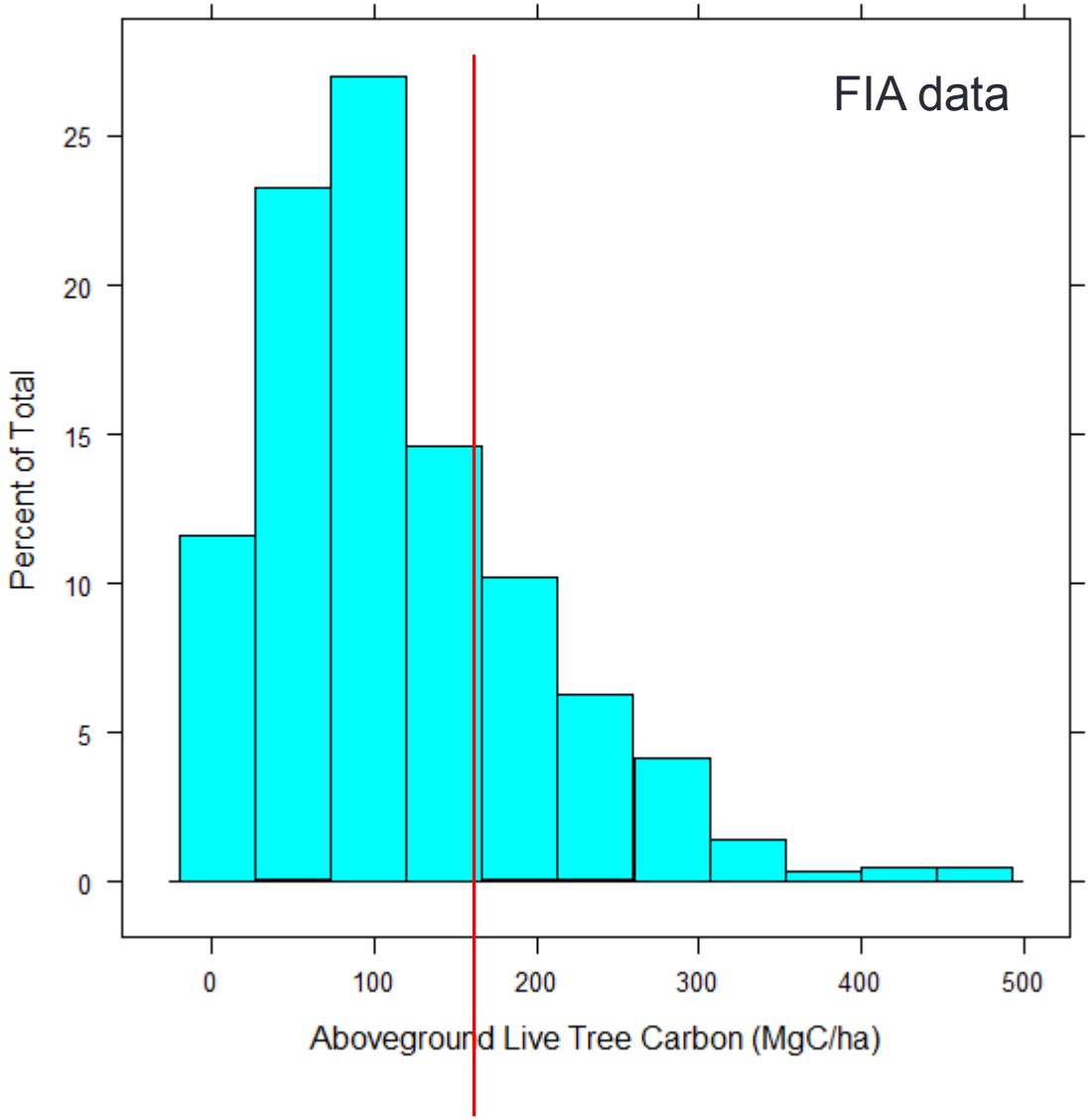
photo credit: A.E. Scholl

Structure of contemporary mixed conifer forest



1898 mean = 29.9 m^2/ha

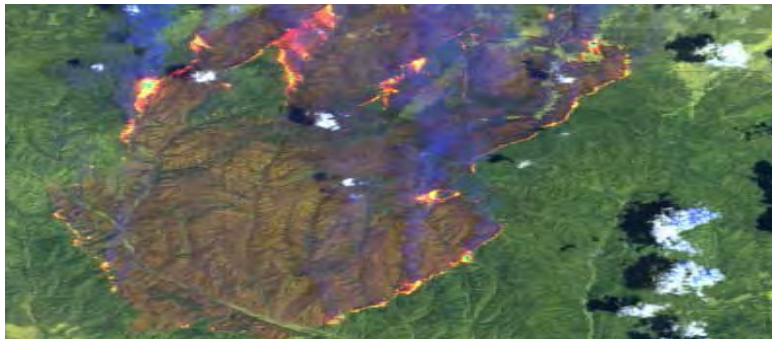
Carbon storage of contemporary mixed conifer forest



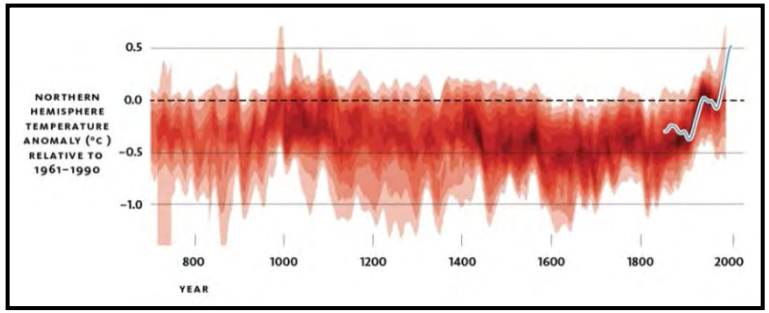
1911 max = 160 MgC/ha

risks

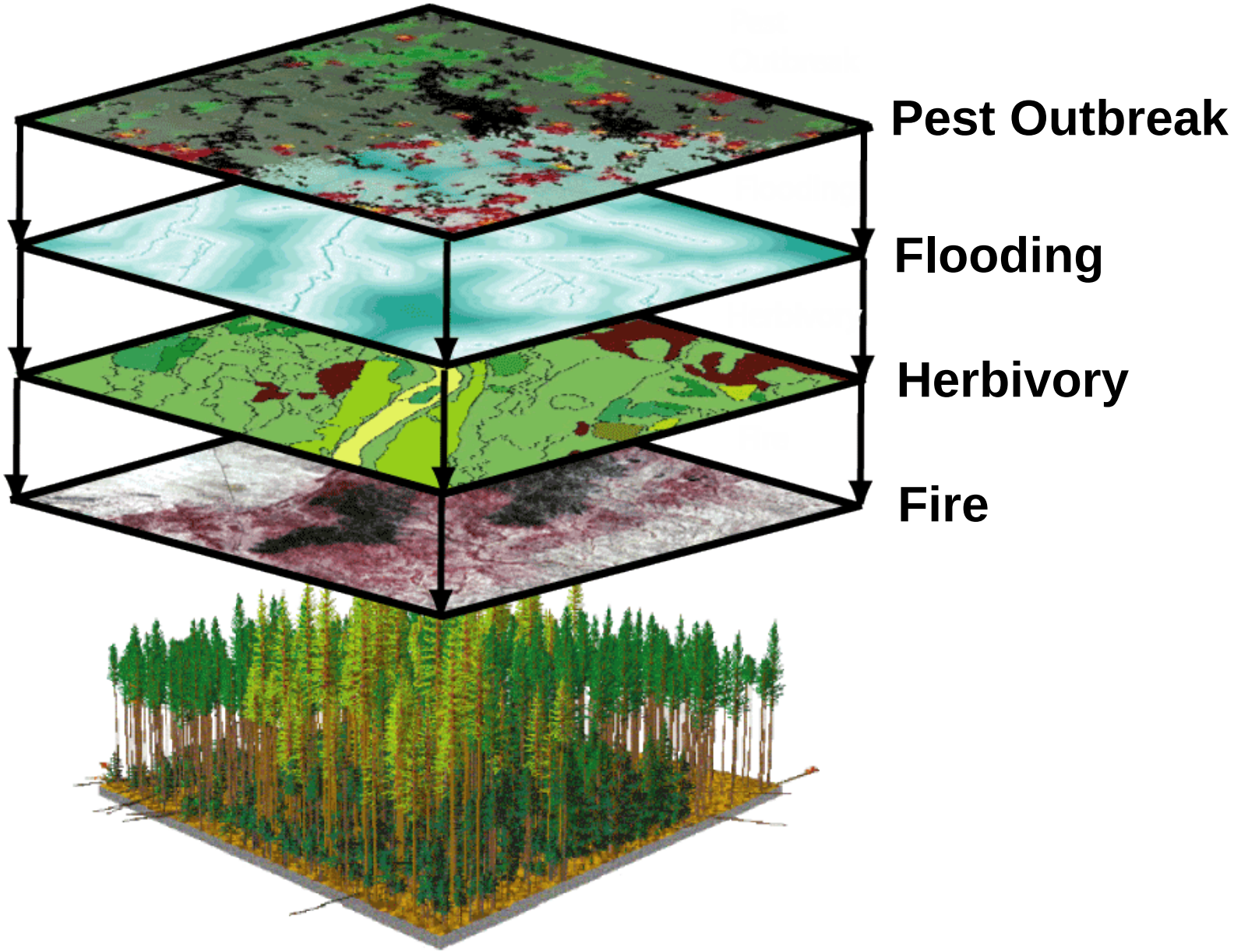
Catastrophic events



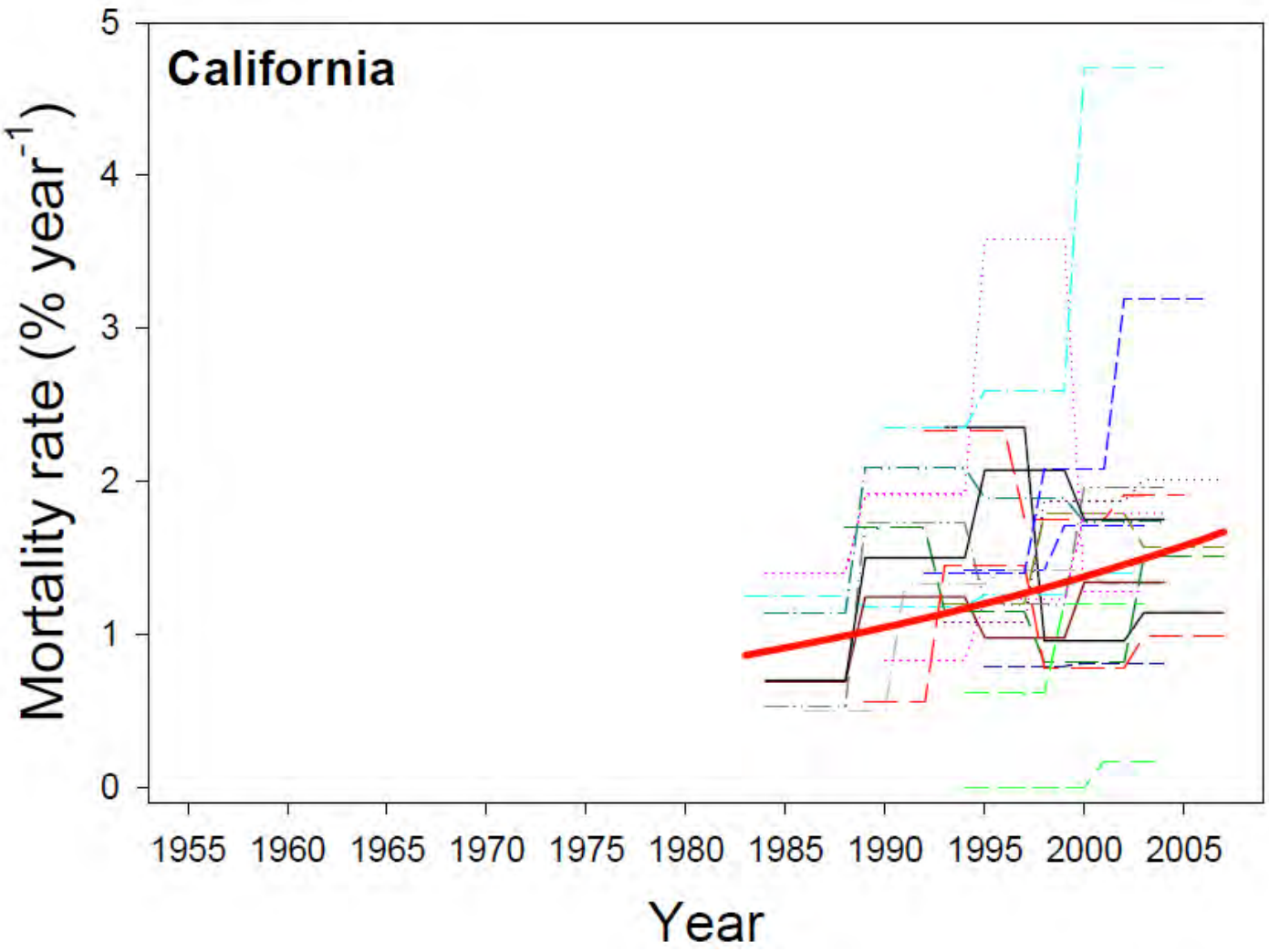
Chronic stressors



Disturbance regime -- integral aspect of dynamics

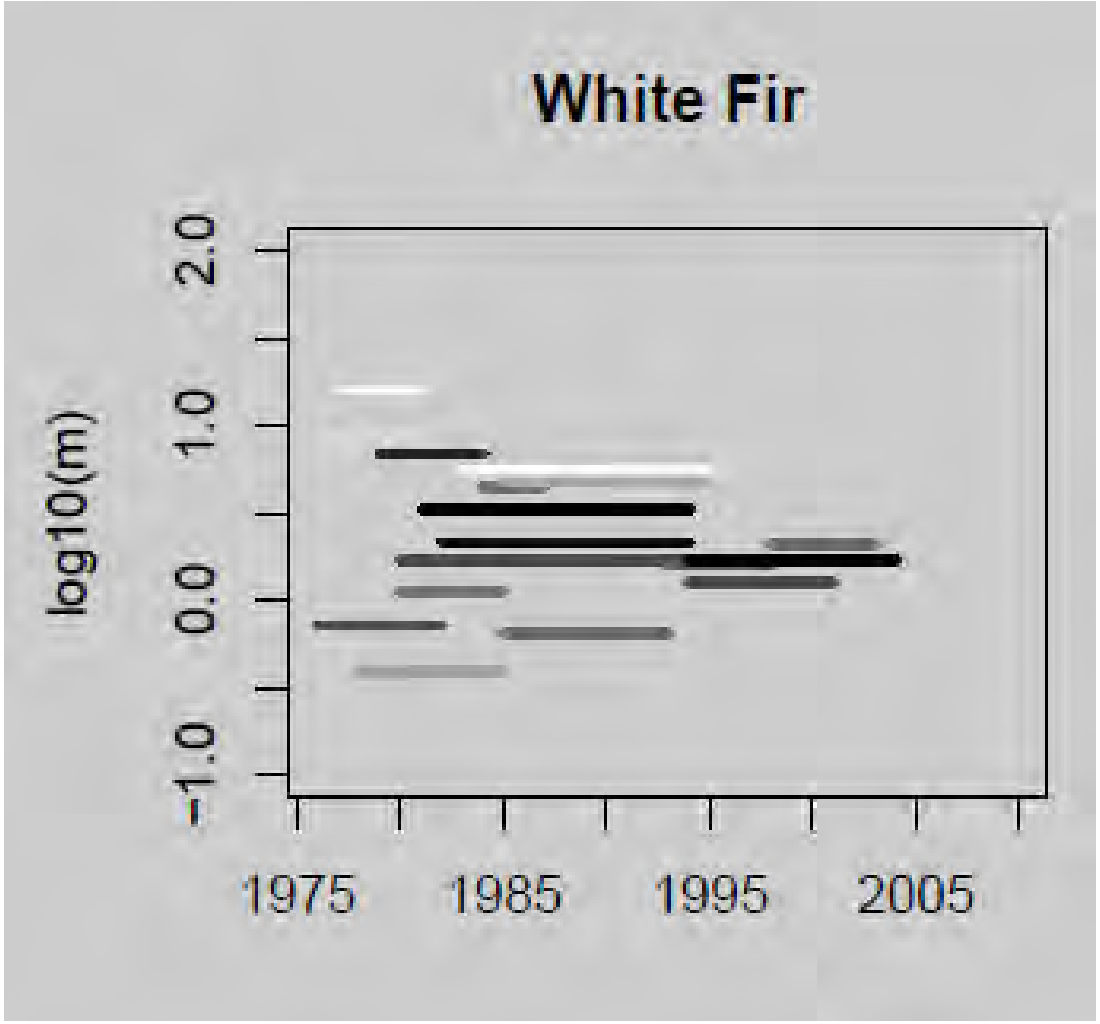


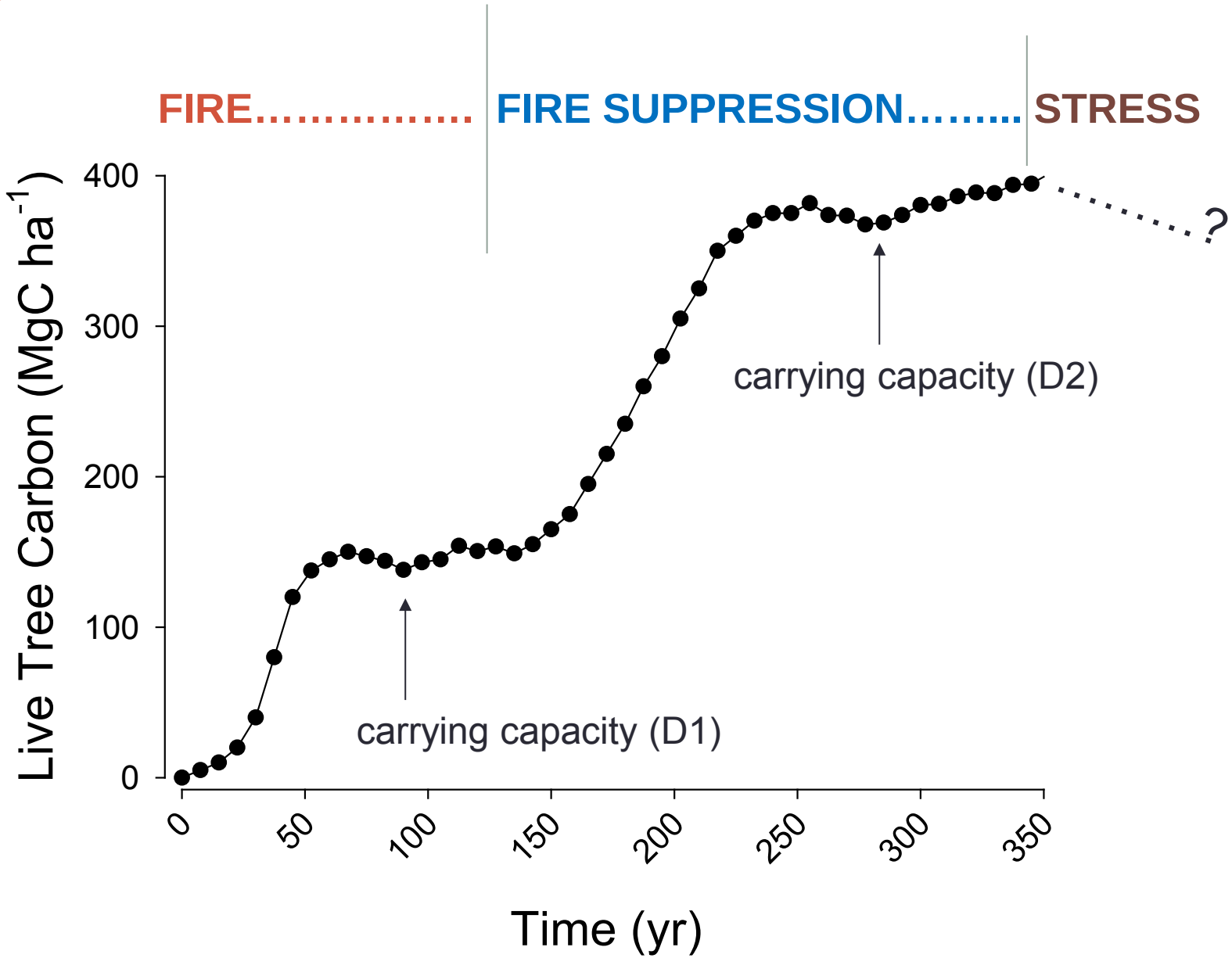
Apparent climate-induced mortality in old-growth forests



van Mantgem et al. 2009. Science (supplement)

Subtle climate effects on mortality at BFRS



Eitzel. 2013. PhD dissertation

Summary: carbon and disturbance