Bark Beetle-Killed Ponderosa Pine Snag Demography & Initial Changes in Fuel Loads

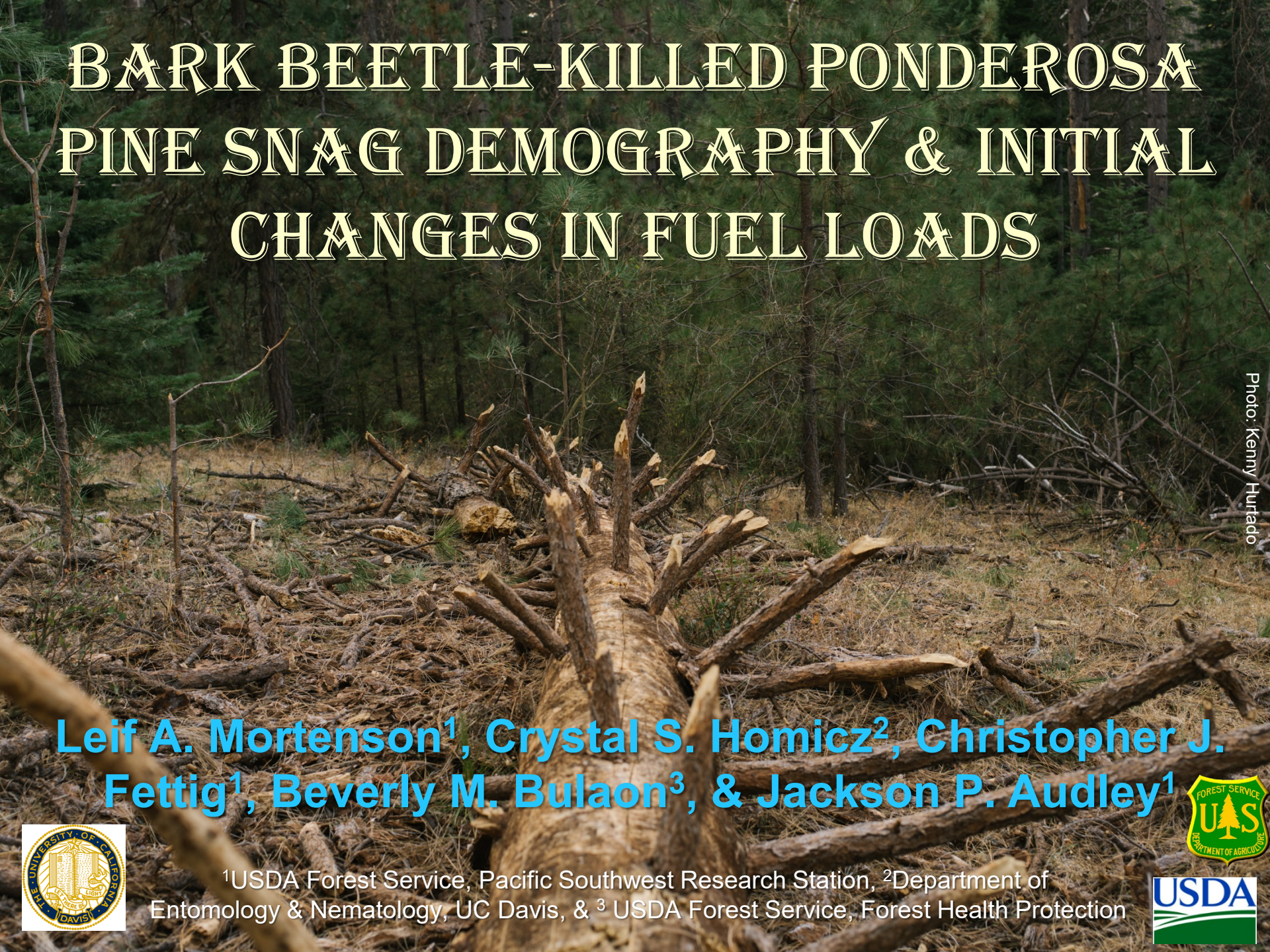


Photo: Kenny Hurtado

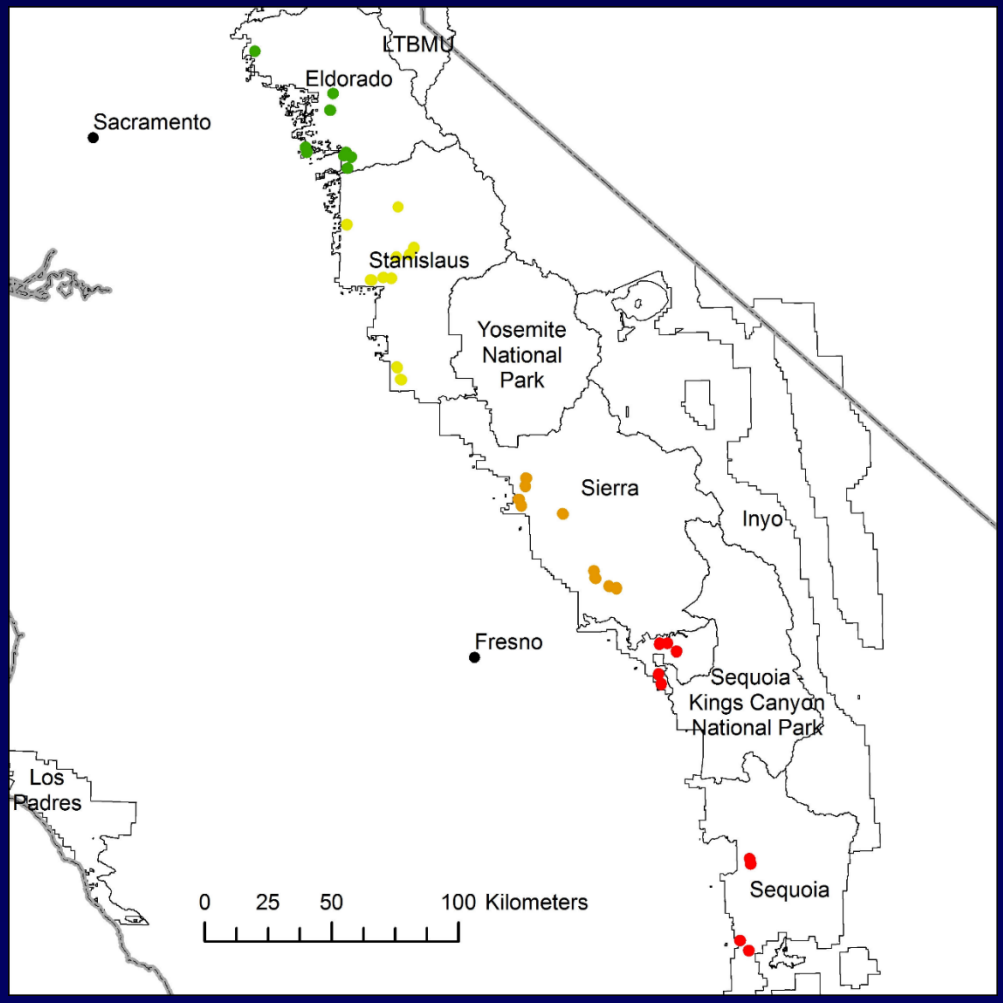
Leif A. Mortenson[1], Crystal S. Homicz[2], Christopher J. Fettig[1], Beverly M. Bulaon[3], & Jackson P. Audley[1]

[1]USDA Forest Service, Pacific Southwest Research Station, [2]Department of Entomology & Nematology, UC Davis, & [3] USDA Forest Service, Forest Health Protection

Overview

- Snag fall rates through winter 2019-20 (2020 field season)
- Changes in fuels from 2017 to 2019
- Share a past (just published) & future lab collaboration utilizing plot network

Network of 180 11.3-m fixed radius plots, stratified by elevation, in forests containing ≥35% ponderosa pine (by basal area) with ≥10% tree mortality in 2014; Sequoia, Sierra, Stanislaus and Eldorado National Forests.



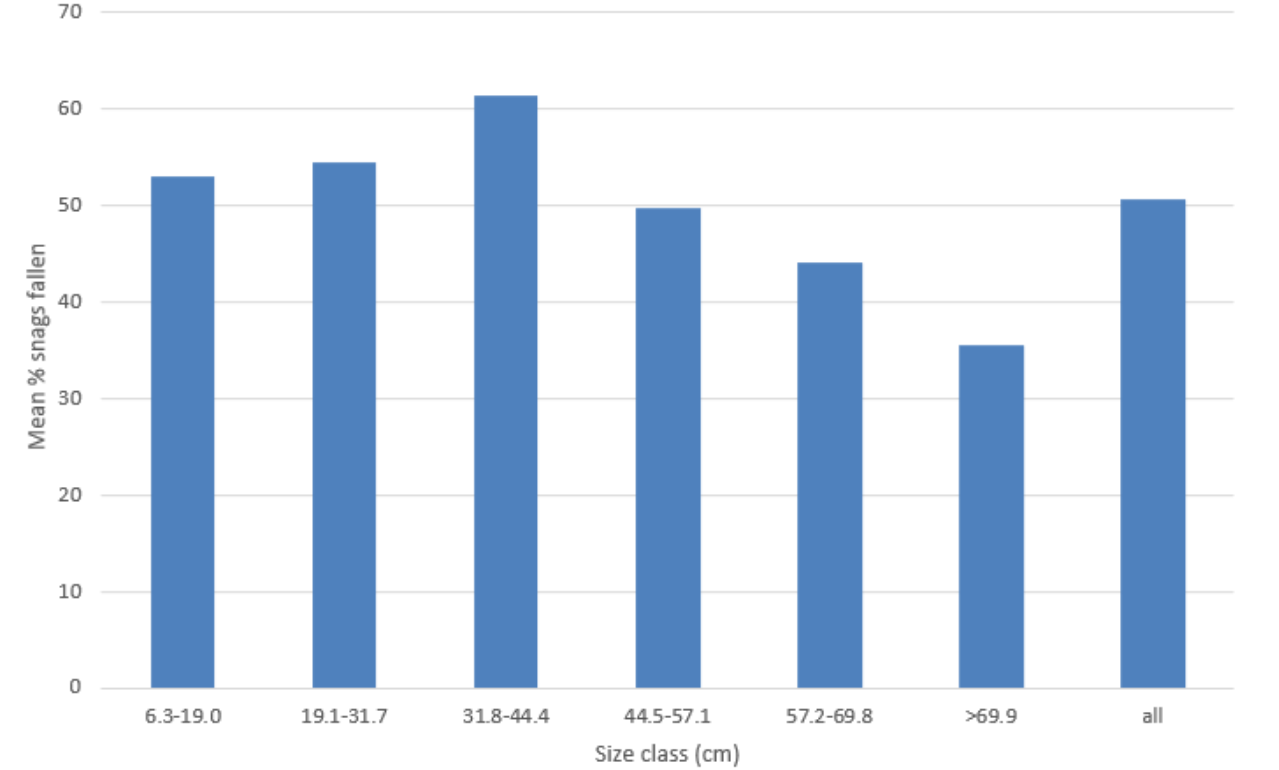
Bark beetle-killed ponderosa snag demography through winter 2019-20

Oh my!!!

clipartpedia.org

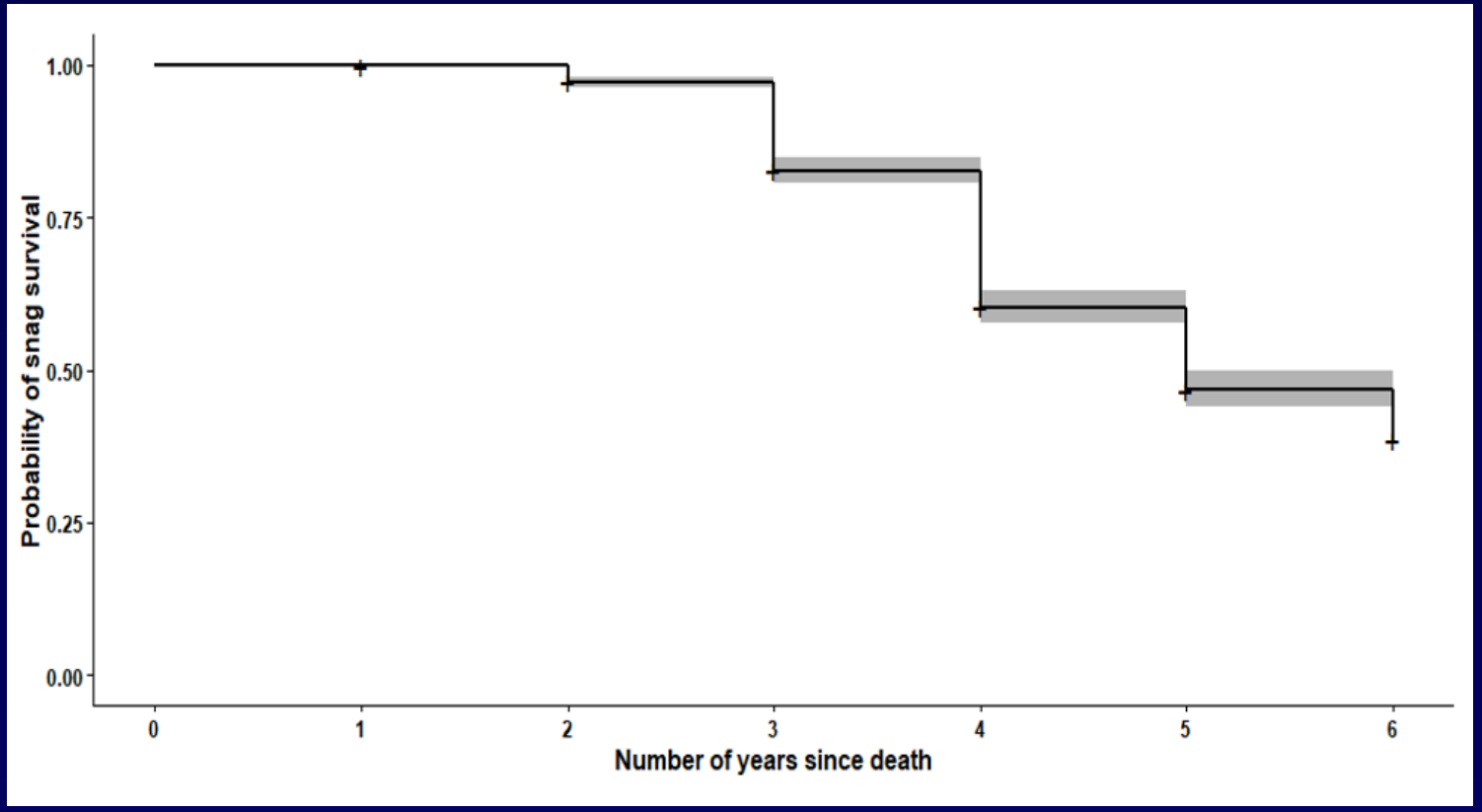
redbubble.com

Mean plot percentage of PIPO snags fallen by diameter size class



- 50.6 ± 1.2% for all tree beetle-killed ponderosa.
- 50.9 for ponderosa all causes of death.

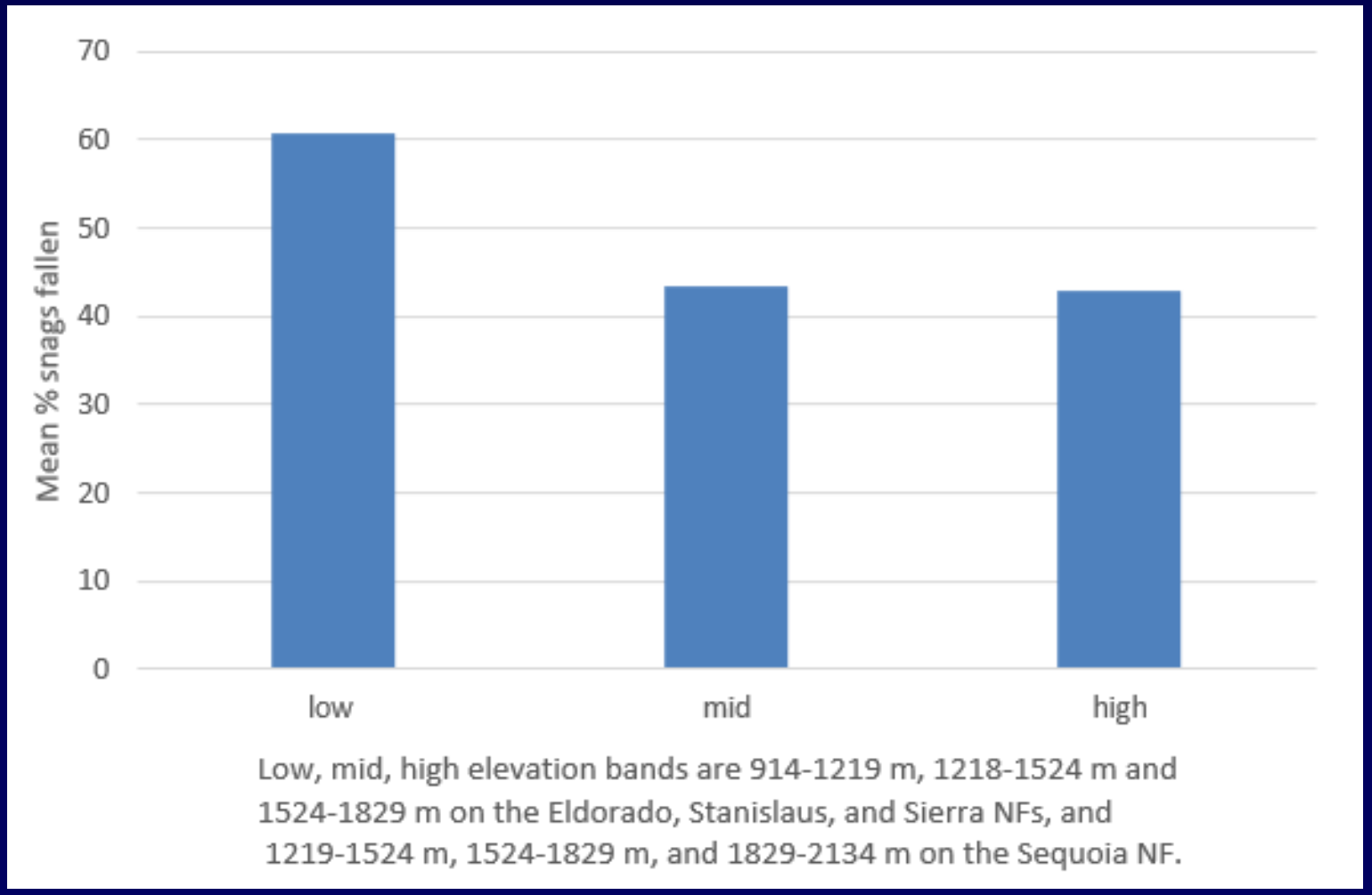
Years since death of fallen snags



Cox's proportional-hazards model describing that snags remain standing based on individual snag and plot level characteristics.

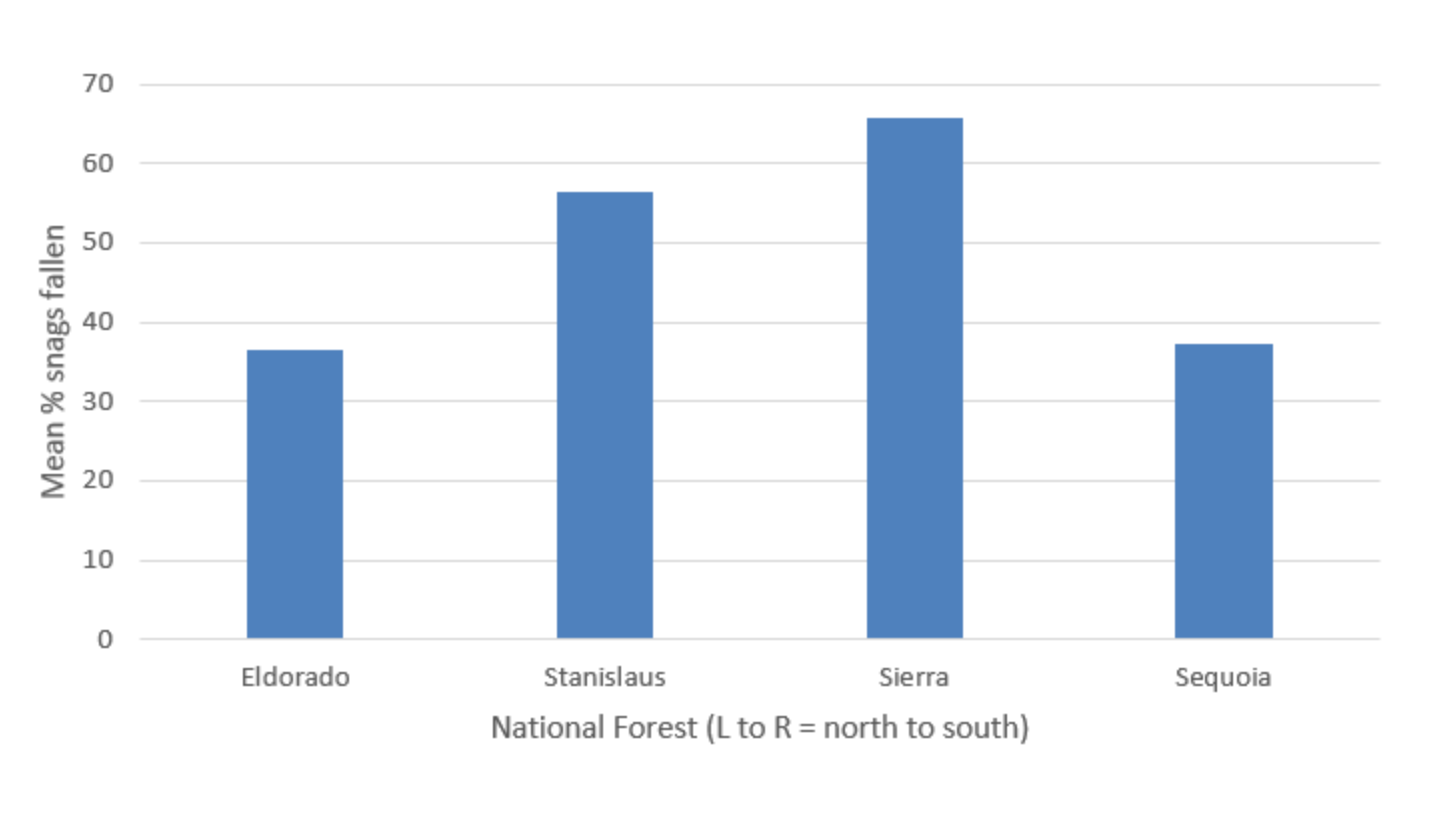
Considerably more rapid than mtn. p. beetle-killed lodgepole pine in the Rockies!

Mean plot percentage of snags fallen by elevation band



Low, mid, high elevation bands are 914-1219 m, 1218-1524 m and 1524-1829 m on the Eldorado, Stanislaus, and Sierra NFs, and 1219-1524 m, 1524-1829 m, and 1829-2134 m on the Sequoia NF.

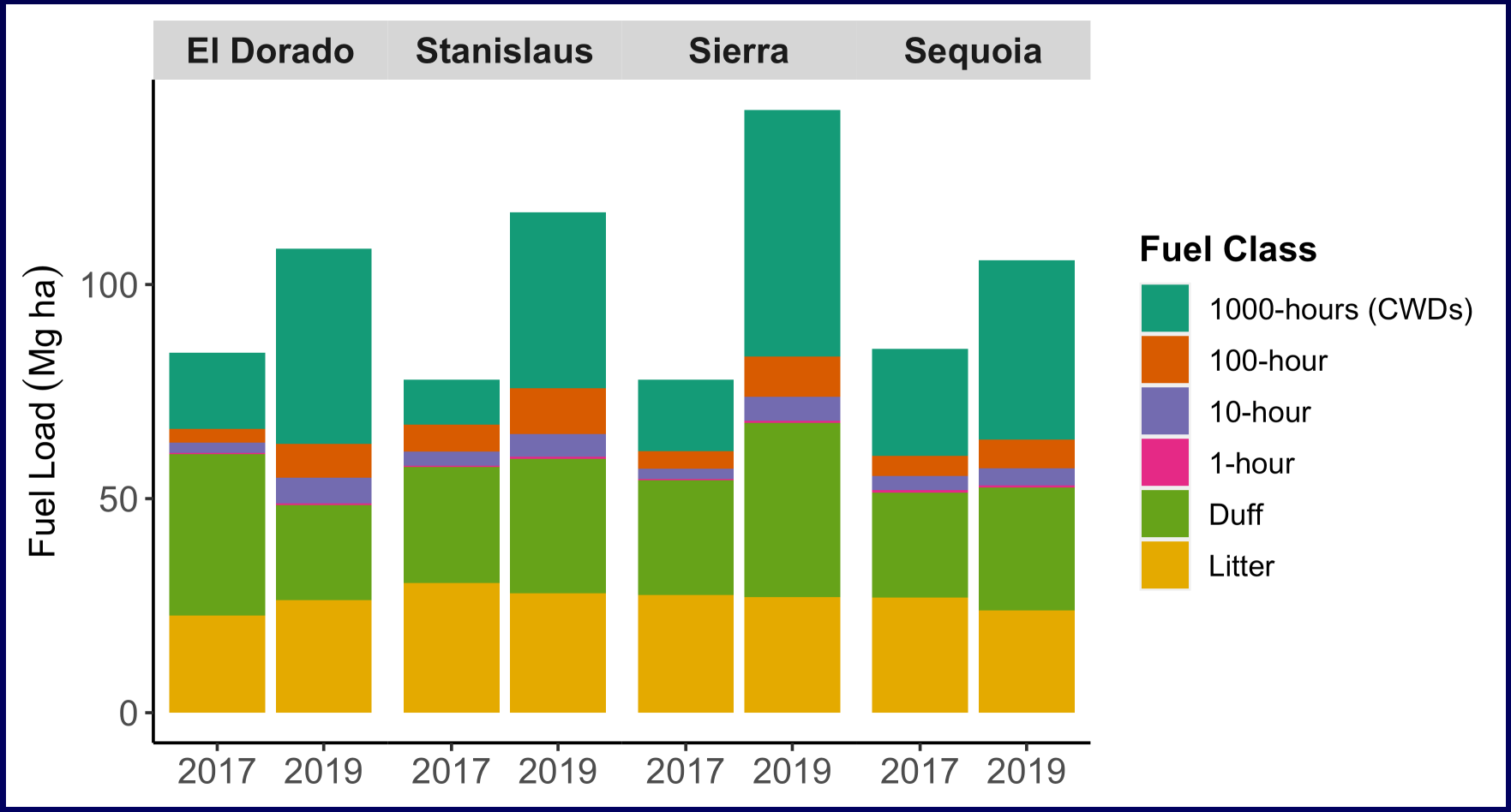
Mean plot percentage of snags fallen by national forest/latitude



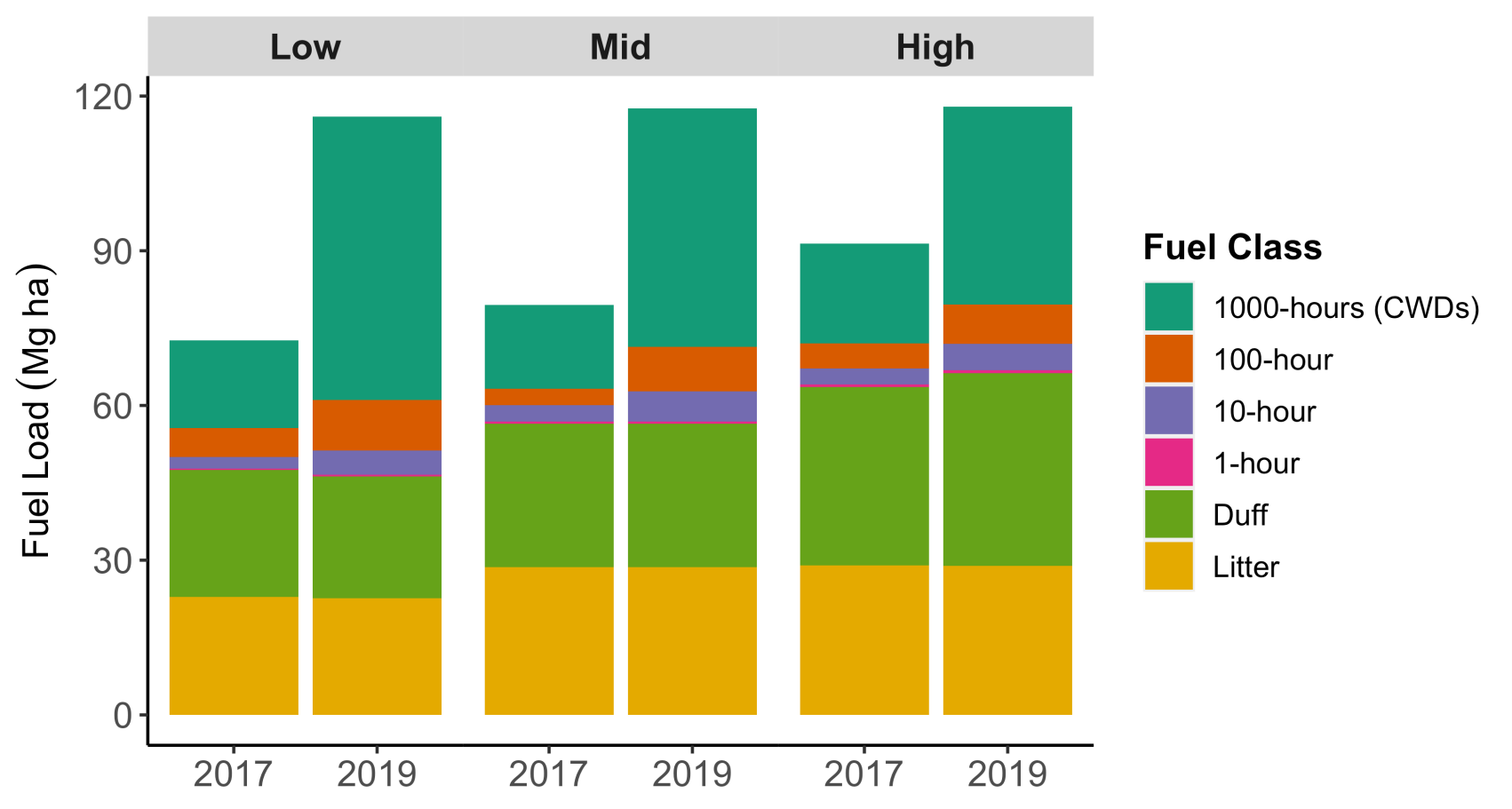
CHANGES IN FUELS 2017-2019

Photo: Kenny Hurtado

2017-2019 FUELS BY NATIONAL FOREST



2017-2019 FUELS BY ELEVATION BAND



Additional Lab Tree Mortality Work

Anders Skjoldjensen

2021 PUBLICATION (NATURE COMMUNICATIONS)

Cross-scale interaction of host tree size and climatic water deficit governs bark beetle-induced tree mortality

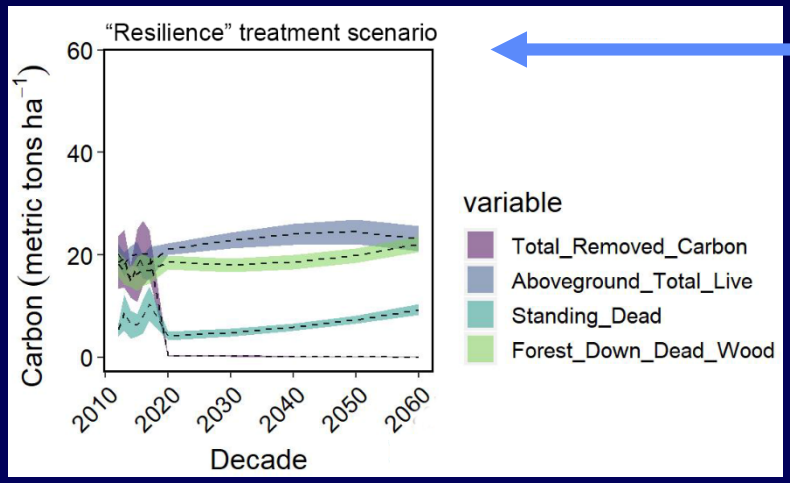
Michael J. Koontz[1,2,3✉], Andrew M. Latimer[1,2], Leif A. Mortenson[4], Christopher J. Fettig[5] & Malcolm P. North[1,2,6]

The recent Californian hot drought (2012–2016) precipitated unprecedented ponderosa pine (*Pinus ponderosa*) mortality, largely attributable to the western pine beetle (*Dendroctonus brevicomis*; WPB). Broad-scale climate conditions can directly shape tree mortality patterns, but mortality rates respond non-linearly to climate when local-scale forest characteristics influence the behavior of tree-killing bark beetles (e.g., WPB). To test for these cross-scale interactions, we conduct aerial drone surveys at 32 sites along a gradient of climatic water deficit (CWD) spanning 350 km of latitude and 1000 m of elevation in WPB-impacted Sierra Nevada forests. We map, measure, and classify over 450,000 trees within 9 km^2, validating measurements with coincident field plots. We find greater size, proportion, and density of ponderosa pine (the WPB host) increase host mortality rates, as does greater CWD. Critically, we find a CWD/host size interaction such that larger trees amplify host mortality rates in hot/dry sites. Management strategies for climate change adaptation should consider how bark beetle disturbances can depend on cross-scale interactions, which challenge our ability to predict and understand patterns of tree mortality.

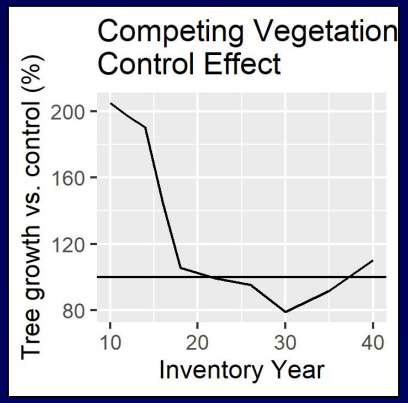
FVS Forest Modeling Project Utilizing Our Plot Network Data

Chris Looney, Research Forester, PSW, christopher.looney@usda.gov

- Quantify long-term impacts of mortality by showing potential forest scenarios if it hadn't occurred.
- Compare options for recovery under climate change (Climate-FVS) and different silvicultural actions.
- Incorporate silvicultural study data from parallel research study.



2022-2023: apply results to improve simulations across network



No salvage or herbicide *Salvage + herbicide*

2021-2022 Integrate results from silvicultural studies

leif.mortenson@usda.gov

FIN