Tracking Tree Mortality and Fire Risk in Giant Sequoia Ecosystems: New Actions to Address New Threats

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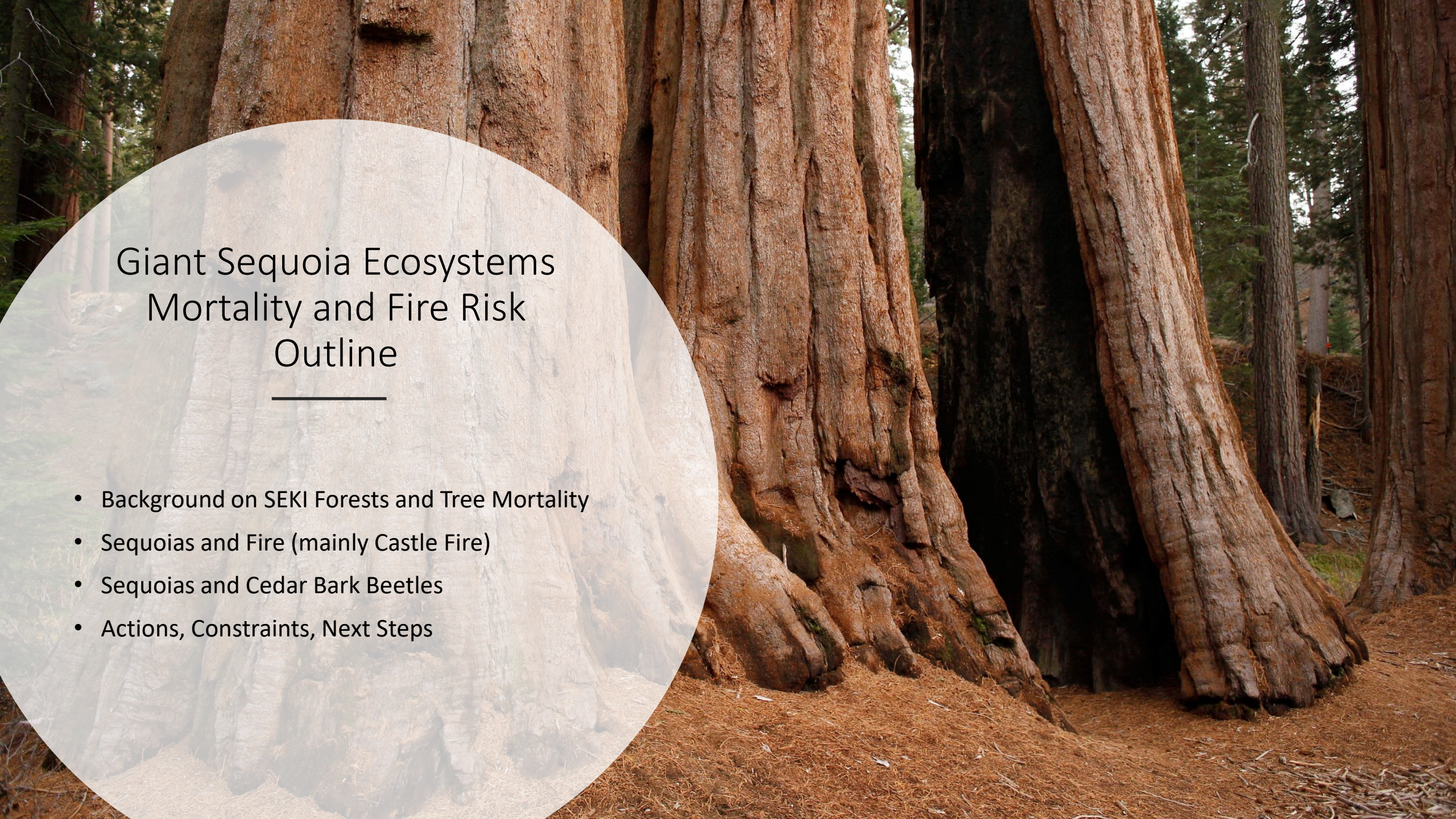
March 2021



Giant Sequoia Ecosystems Mortality and Fire Risk Outline

- Background on SEKI Forests and Tree Mortality
- Sequoias and Fire (mainly Castle Fire)
- Sequoias and Cedar Bark Beetles
- Actions, Constraints, Next Steps

Importance of Forests and Status of SEKI Forests

- Forest Values
  - Carbon storage
  - Water provisioning and storage
  - Wildlife
  - Recreation and tourism – Economic benefits
- PRE-2012-2015 Drought: Status of Sequoia and Kings Canyon National Park Forests
  - Very little logging
  - Started reintroducing fire in the late 1950s
  - Large areas of old growth
  - Despite all that, forests still overly dense

BUT After Drought, Do We Have a Problem?

- Arrived in Southern Sierra in 2015
- Was tree mortality episode a problem ecologically?
  - How many dead trees are there and where are they?
  - What is forest condition post-mortality?
  - Is post-drought reforestation needed?
  - Mortality impacts on fire frequency, fire size, fire severity?

Extent of Mortality In SEKI

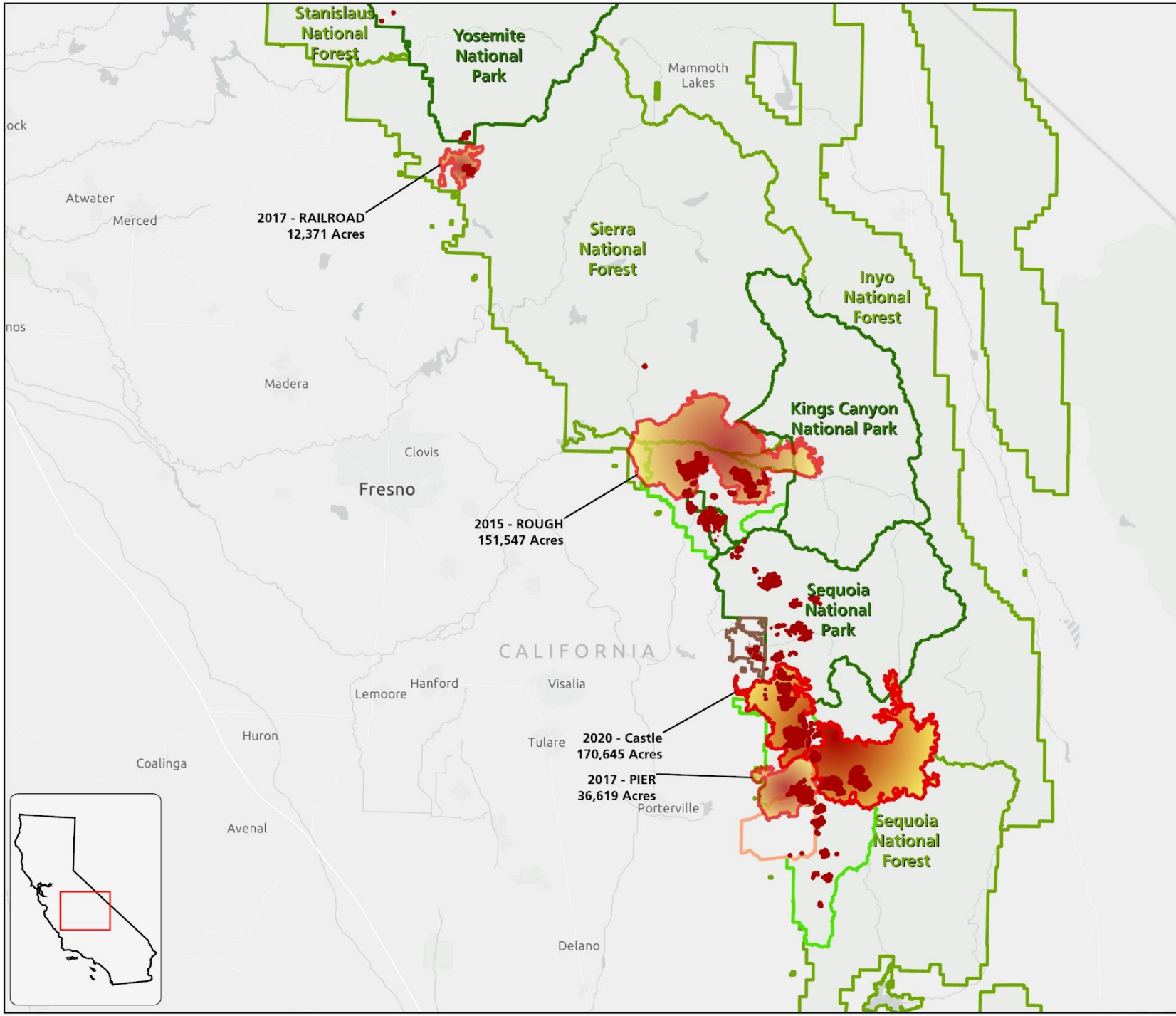
- Aerial detection surveys – estimate from 2017 – 5.8 million
- Remaining Trees
  - USGS Stephenson et al. 2018 J Ecology
    - Around 20% mortality across all species
    - Small, medium and large sizes of almost all species remaining
    - Forest is still forest
  - Only one species of concern at this time – Sugar pine
    - Average of 90% loss of large sugar pines from plots
    - 50% loss of medium sized sugar pines
  - Other five needle pines could become sparse due to interactions of beetles, fire and blister rust (Dudney et al 2020)
- What about impacts to fire and fuels?

DROUGHT MORTALITY NOT EQUIVALENT TO WILDFIRE BUT REFORESTATION POST-DROUGHT IS NOT NEEDED FOR SEKI

MORTALITY, FIRE, AND FUELS

Giant Sequoia Fire History Monarch Mortality

- 1297… ??
- 1987: Pierce (14)
- 2015: Rough (27 NPS 65 USFS)
- 2017: Pier (53 Monarchs)
- 2017: Railroad (33 Monarchs)



2020 Castle Fire

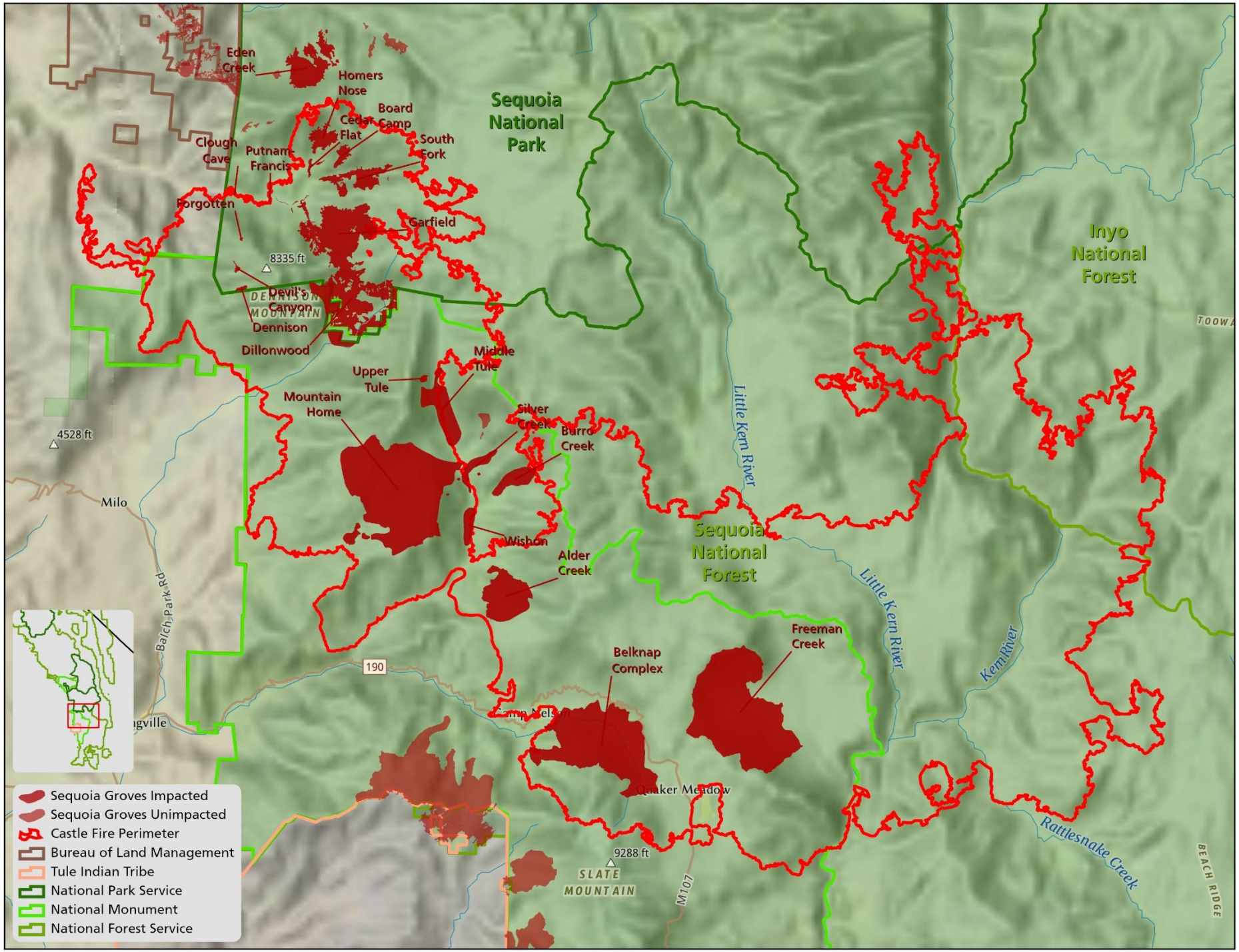
22 sequoia groves burned

- 12 groves on NPS lands (including Eden Creek)
- 10 groves on USFS and private lands

On NPS lands, 13.5% SEGI high severity

On USFS lands, this increased to 40%.

Castle Fire Groves



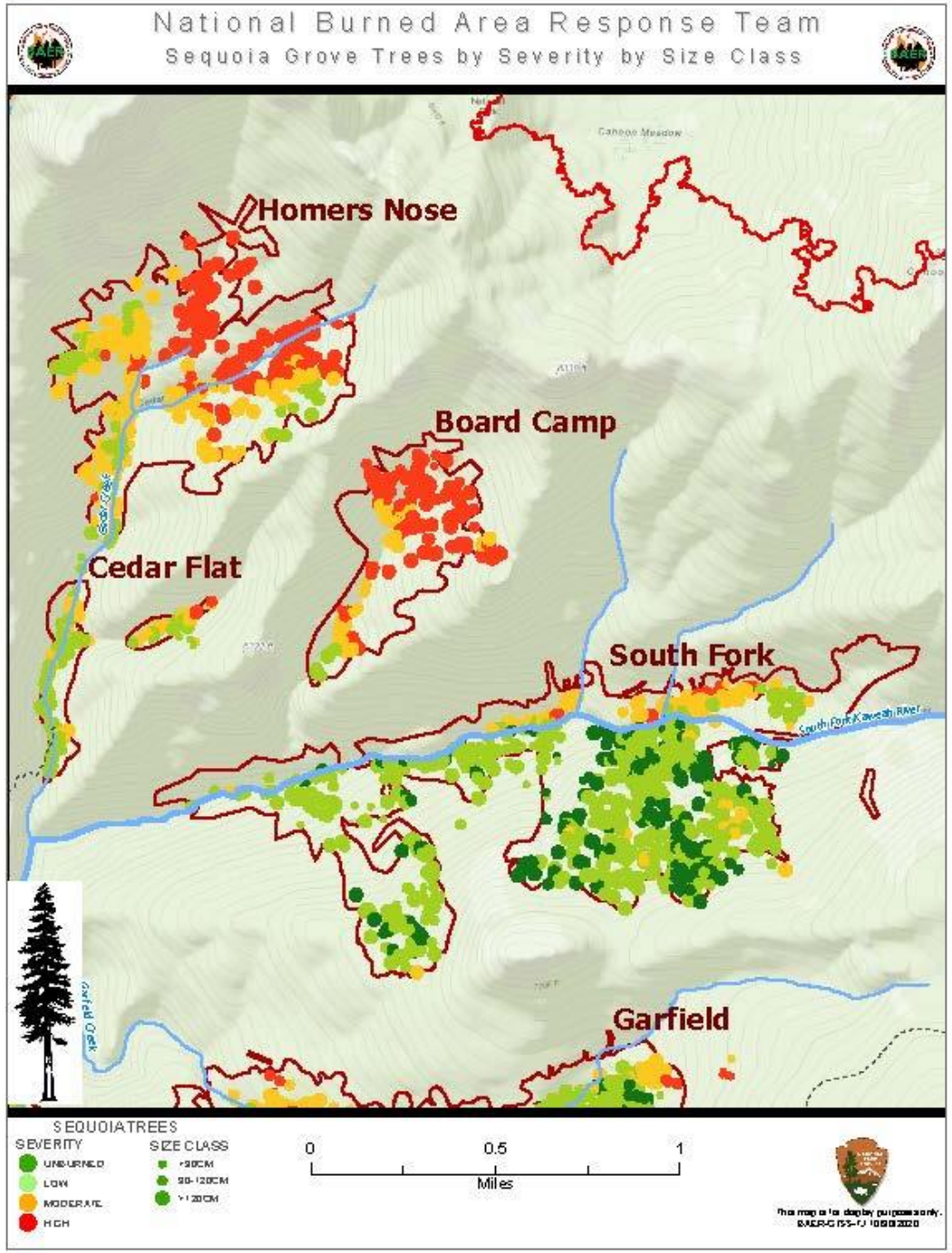
Mortality Rates

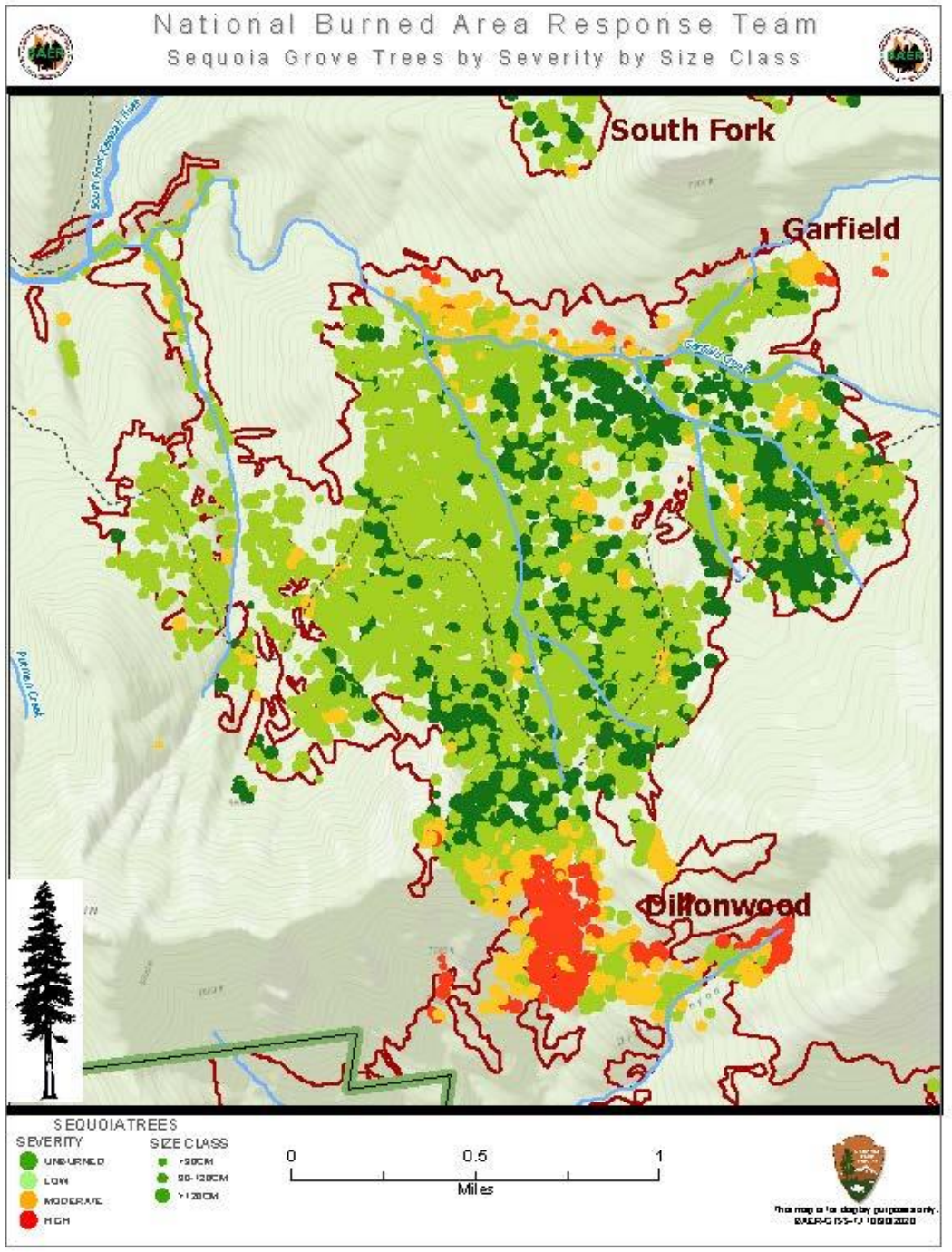
Normal background mortality: 0.1-0.2% per year

As high as 1% after first entry prescribed burn

Pre-2015 wildfire mortality ranges from 0% to 9.5%

Castle Fire Mortality Rates


National Burned Area Response Team
Sequoia Grove Trees by Severity by Size Class
Homers Nose
Board Camp
Cedar Flat
South Fork
Garfield
SEQUOIATREES
SEVERITY
UNBURNED
LOW
MODERATE
HIGH
SIZE CLASS
0
0.5
1
Miles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SEVERITY
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HIGH
SIZE CLASS
0
0.5
1
Miles

Castle Fire Mortality

Estimates and models show:

Of 56,000–90,000 sequoias rangewide, 3-4% were lost in the Castle Fire.

Estimated loss of sequoias over 4’ in diameter:

NPS Lands

340

USFS Lands

Approx. 2100

Primary Concerns

- Recovery of Castle Fire areas without active replanting
- 120 acres high severity large patches*
- Increased erosion potential (measure of potential loss of seed)*
- Potential for forest loss/type conversion
  - 612 acres of high severity large patches
- Impacts to fisher and spotted owl habitats

* Greater than 200 meters from intact forest edge

Sequoias and Beetles

At Sequoia and Kings Canyon:

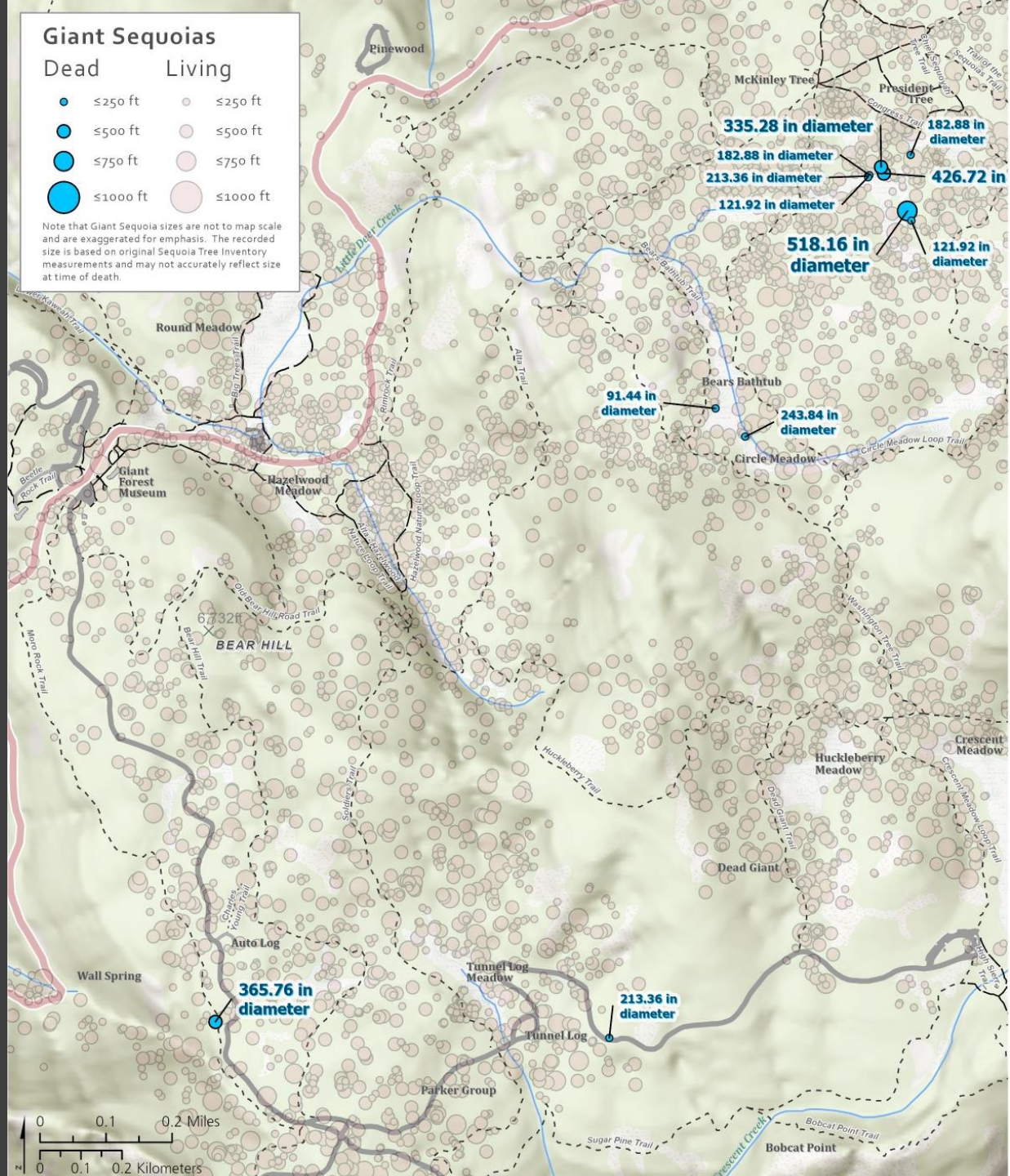
33 known dead monarchs in 3 groves

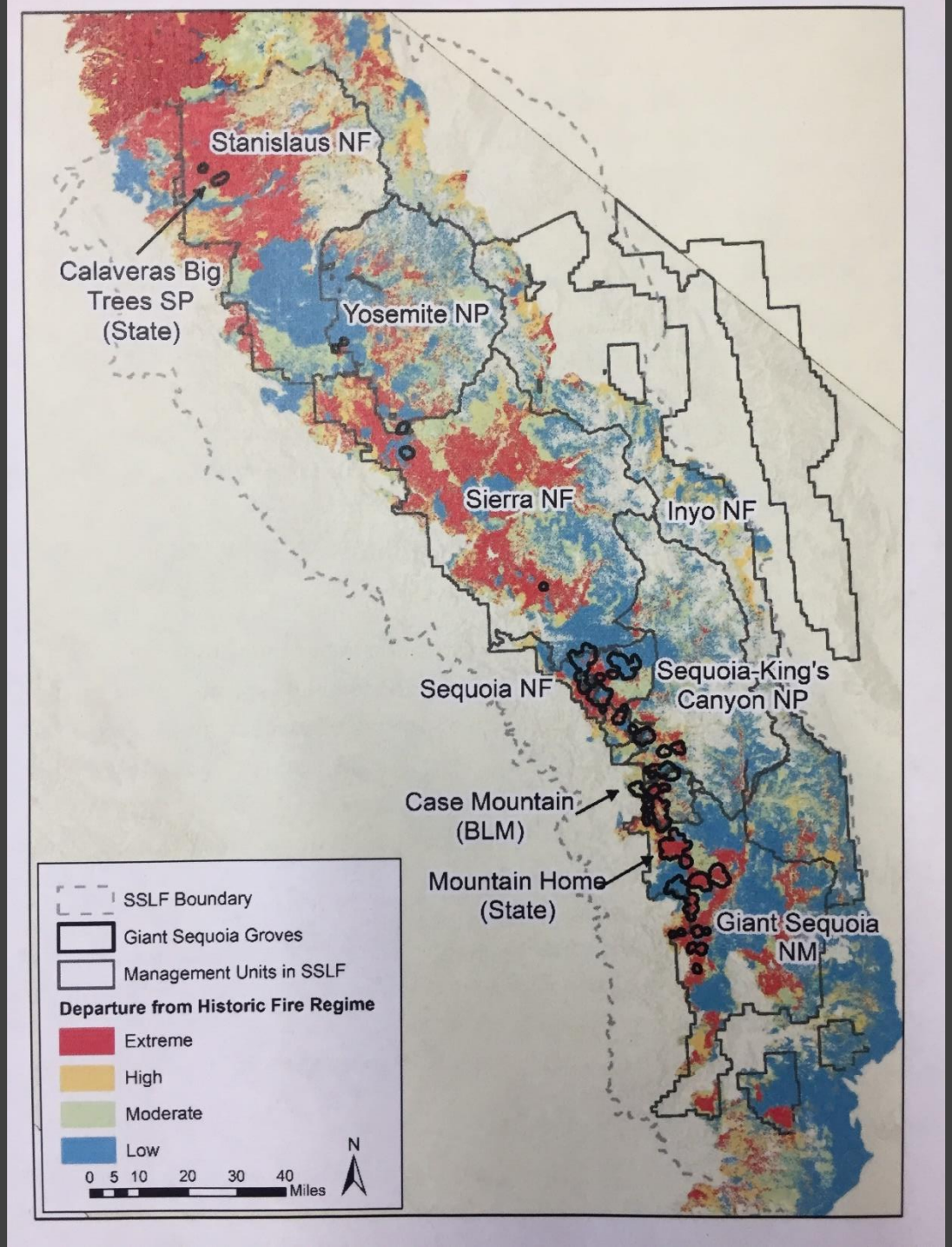
- All in areas with fire in last decade prior to drought
- All with signs of severe fire damage
- Majority in very wet areas
- All with signs of beetle attack

Monarch Sequoia Mortality:

Giant Forest

12 trees




Stanislaus NF
Calaveras Big Trees SP (State)
Yosemite NP
Sierra NF
Inyo NF
Sequoia NF
Sequoia-King's Canyon NP
Case Mountain (BLM)
Mountain Home (State)
Giant Sequoia NM
SSLF Boundary
Giant Sequoia Groves
Management Units in SSLF
Departure from Historic Fire Regime
Extreme
High
Moderate
Low
0 5 10 20 30 40
Miles
N

Summary of Problems

- Potential for catastrophic loss of 2000-year-old trees due to high-severity fire.
- Broadcast burning potentially a great way to protect forests from high severity fire.
- BUT previously unseen fuel loading in forest may impact fire effects during prescribed fires.
- BUT prescribed fire may expose trees to beetle attack.

Actions to Address Fire Threat, Drought, and Beetles

- Prioritize old growth (including groves) for treatment
- INCREASE PACE and SCALE OF TREATMENTS
- Test new approaches to fuel reduction
- Closely monitor even known treatments to detect unanticipated negative effects
- Research beetle problem (vulnerability, reservoirs, treatments)

CONSTRAINTS

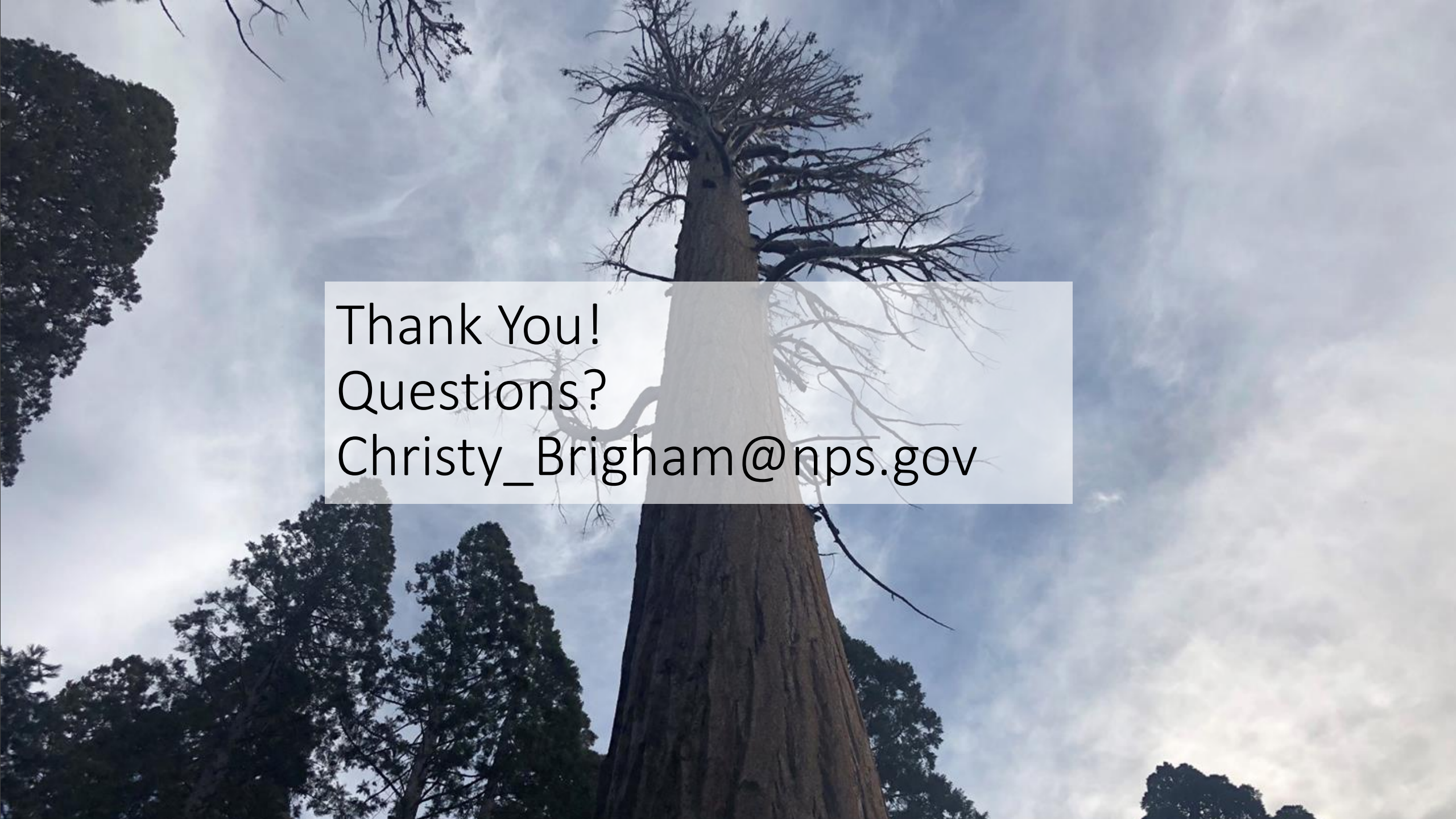
- Knowing where to treat to protect against loss due to high severity wildfire:
  - Threat assessment: better coarse woody debris data
  - Threat assessment: better fire risk models based on new fuels information
  - Threat assessment: more fine-scale accurate dead tree maps
- Knowing where to treat to increase drought resistance:
  - Understanding drought vulnerability
- Funding
- Burn windows
- Fear of unanticipated consequences
- Compliance complexity, cost, timelines (ESA, NEPA, Section 106)
- Staffing

Planned Research and Monitoring Efforts 2021 and 2022 – Understanding the New Fire Environment

- Fire and fuels modeling in Castle Fire footprint (Adrian Das & Carlos Ramirez)
- Intensive fire effects sampling in Castle Fire (Tony Caprio)
- Dead tree map for all of SEKI (stem level) (Adrian Das & Carlos Ramirez)
- Sequoia grove evaluations (coarse woody debris, fuels, mortality, regeneration, stand structure) (Brigham)
- Landscape-scale fuels sampling (FY22) (Adrian Das)
- Integrate with statewide fire and fuels modeling and prioritization efforts
- Broadcast Burning Monitoring and Research:
  - Broadcast burn water source study pre-post fire in Sequoias (Anthony Ambrose)
  - Broadcast burn evaluation of fuel reduction treatments on fire effects to sequoias (Brigham)
  - First entry burn intensive monitoring of fire effects and testing of fuel reduction treatments (Brigham)

Planned Research and Monitoring Efforts 2021 and 2022- Tracking Other Sources of Mortality

- Cedar Bark Beetle genetics (Seth Davis)
- Cedar Bark Beetle attractant testing (Seth Davis)
- Cedar Bark Beetle surveys (Seth Davis)
- On-going Sequoia monarch mortality surveys (Brigham)
- USGS future drought tree mortality vulnerability predictive model (Adrian Das)
- SPLAT treatments of sugar pine in Castle Fire


Thank You!
Questions?
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