Aerial Survey of Napa and Lake Counties
May 2, 2022

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Conifer Mortality Trends in Napa 2021-2022

- Spring 2021: Limited and patchy mortality in ponderosa pine and Douglas-fir
  - Based on driving surveys
  - Lake Co.: Mortality in Middletown, Boggs, to Kelseyville: More extensive and included significant fading in knobcone pine

Conifer Mortality Trends in Napa 2021-2022

- Top-down kill in ponderosa pine and Douglas-fir
- Caused by a complex of beetles
  - Western pine beetle
    - Ponderosa pine
  - Engraver beetles, more than one genus and species
    - Ponderosa pine, Douglas-fir, knobcone pine
  - Flatheaded boring beetle
    - Douglas-fir
- Even aged knobcone pine stands weak
  - Fire mediated regeneration, stands very old and senescent (reaching end of lifespan)

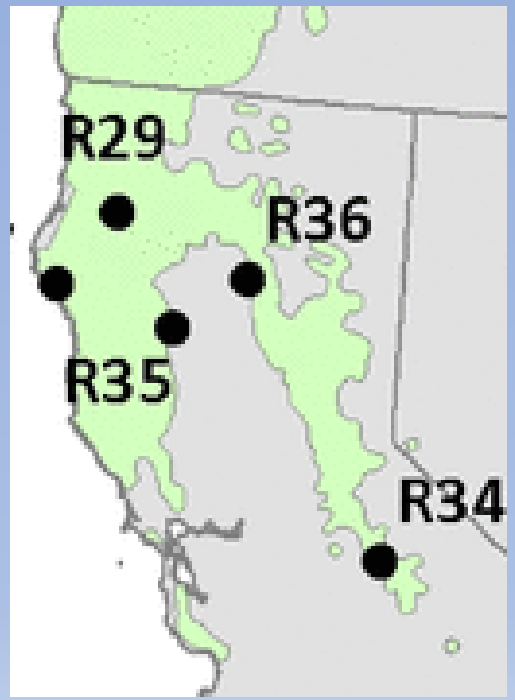
Engraver damage under Bark of Douglas-fir

Conifer Mortality Trends in Napa 2021-2022

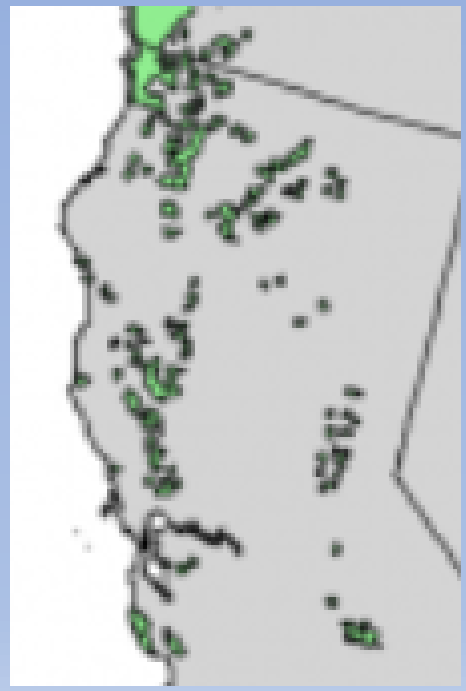
Conifer Distribution Napa = Southern Finger/Edge of Distribution on Coast North of SF Bay

Ponderosa Pine

Douglas-Fir



Knobcone Pine



Conifer Mortality Trends in Napa 2021-2022

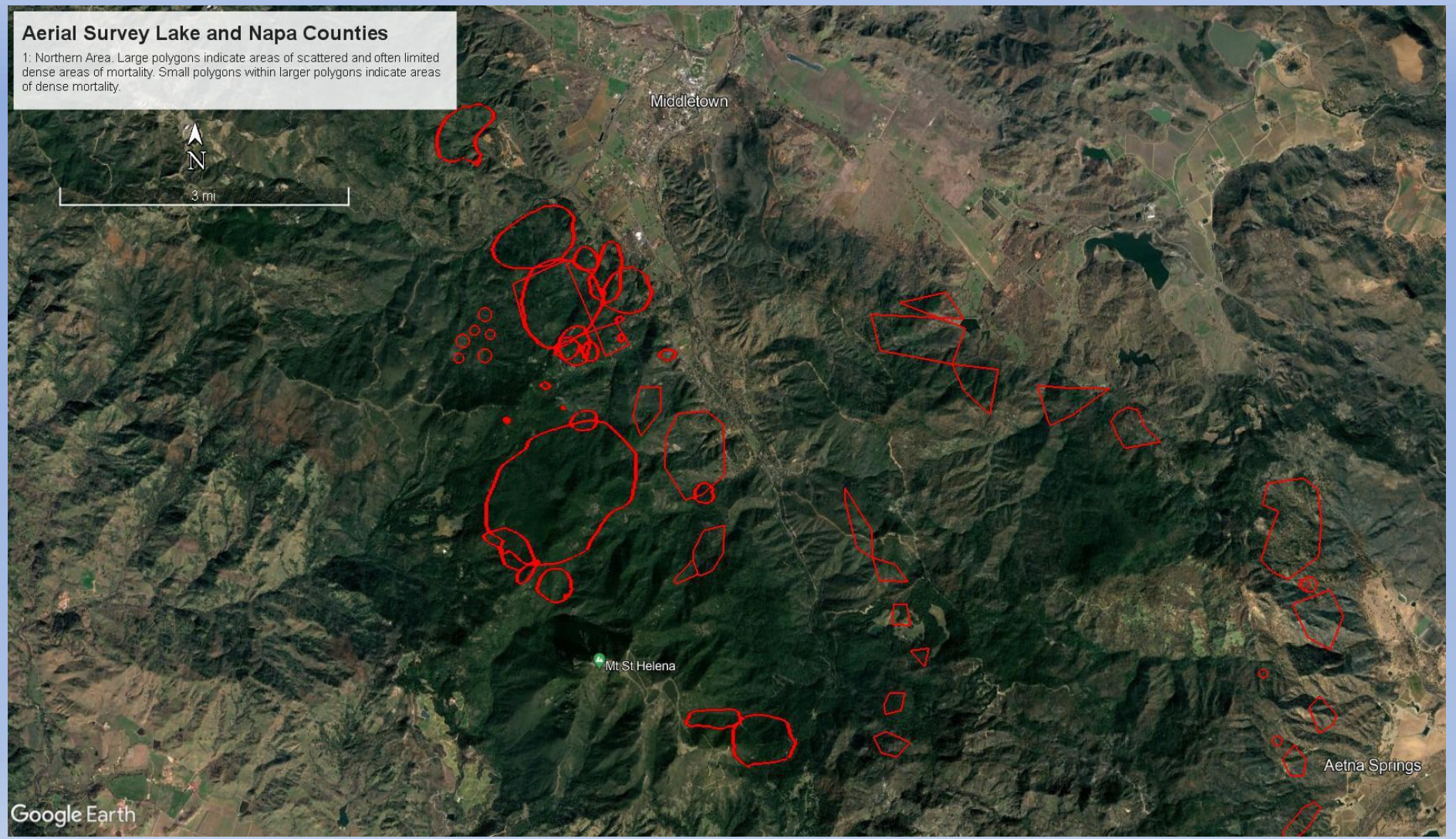
- Summer and early fall 2021 very dry and hot
  - Sap is primary defense for conifer trees
  - As insects chew into healthy tree they are killed by exuding sap
- Heat stress in combination with drought caused very high stress in the trees
  - Many trees with little to no sap
- Reduces the trees resistance to insects and disease
  - Beetle attack and reproduction rates very high during summer and fall 2021
- High levels of attack in fall 2021

Conifer Mortality Trends in Napa 2021-2022

- Warm weather in fall 2021 and warm and dry weather in winter and spring 2022
  - Beetles continued to develop and damage trees throughout fall-spring
- Areas of mortality rapidly expanded starting in November and continued through the present
- Beetle activity usually slows down during the winter, but activity was very high in fall-winter-spring 2021-2022
- If drought and heat persist pine distribution is likely to contract toward the north and west

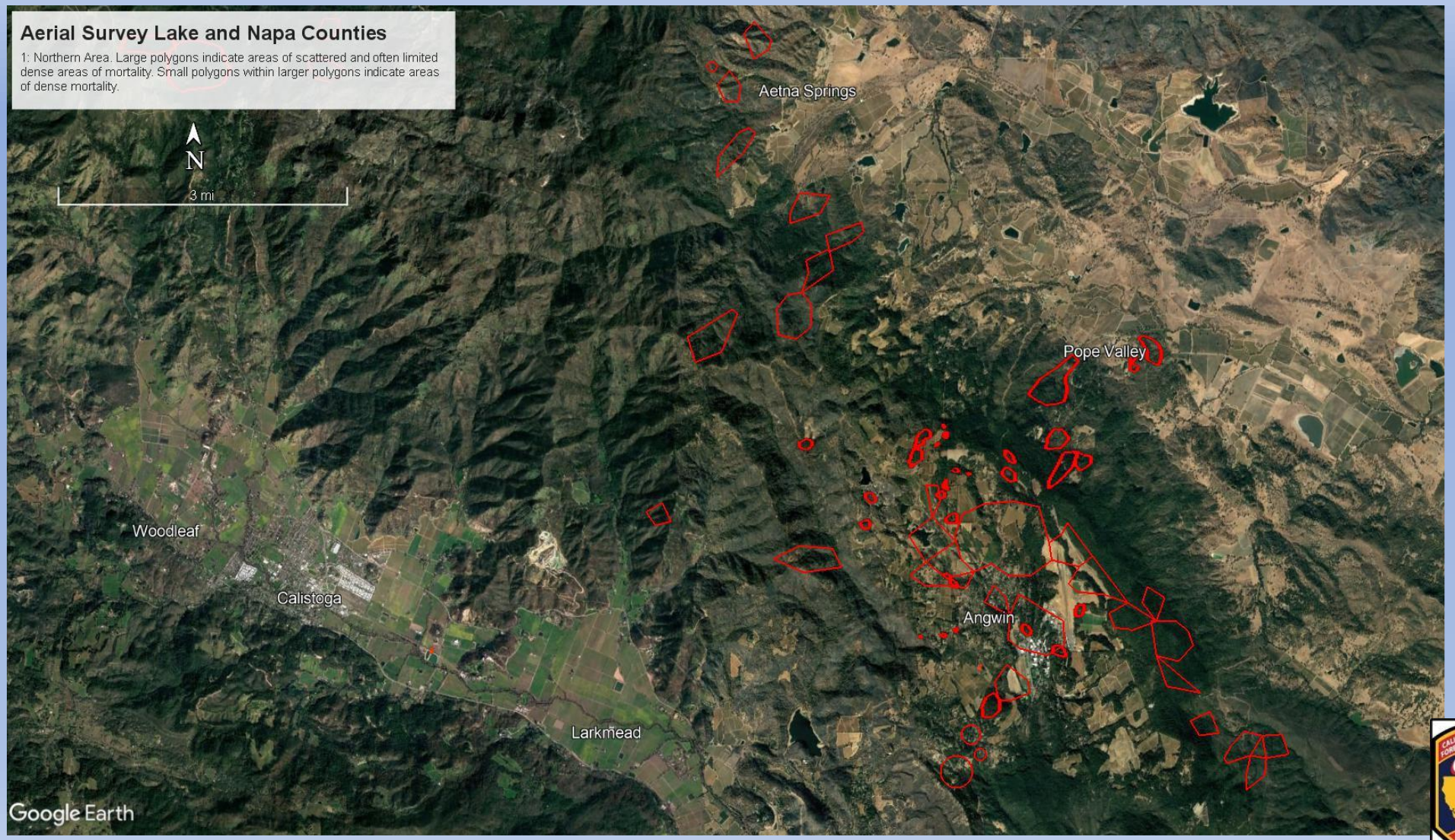
Flight Path May 02, 2022

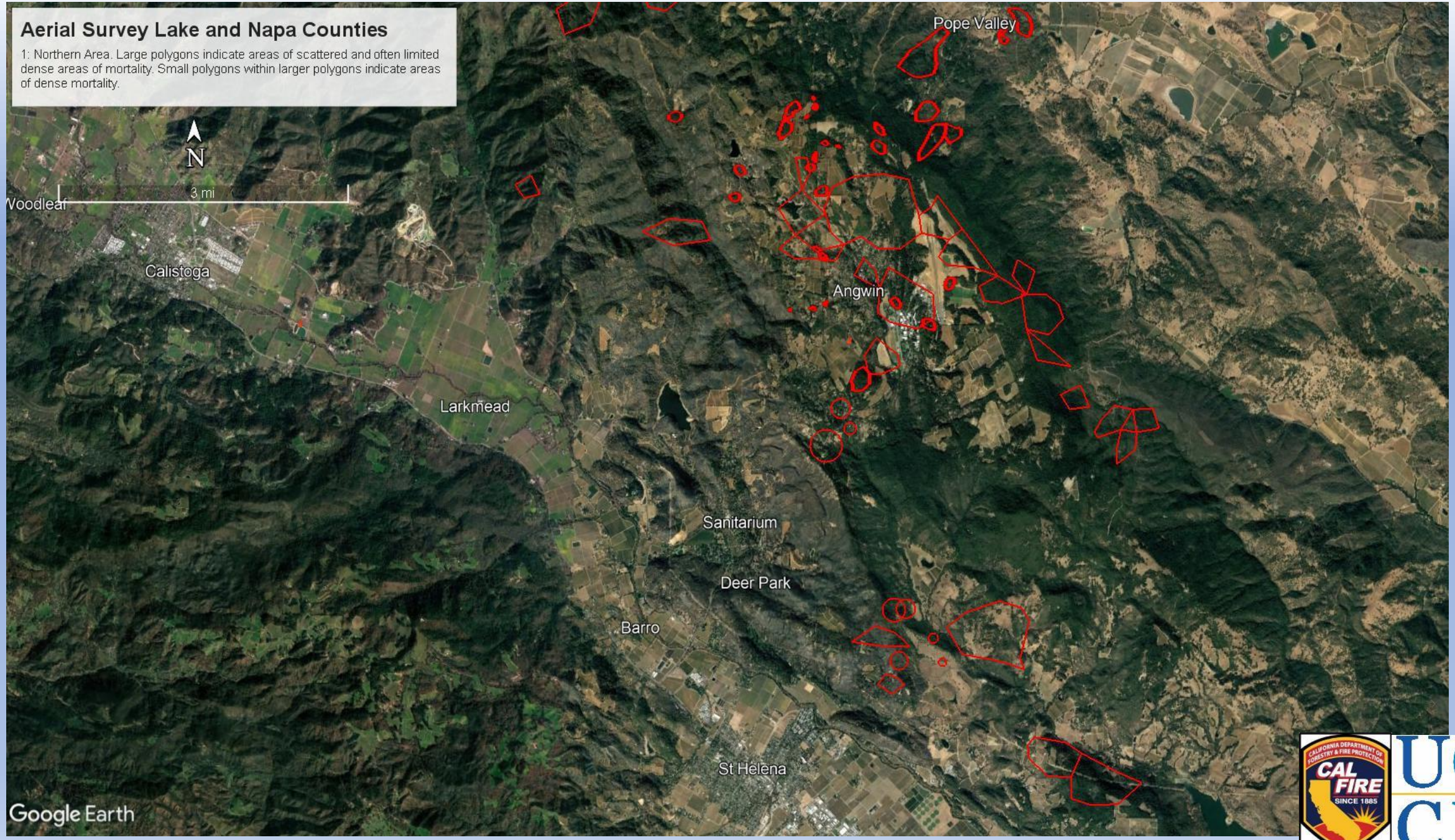
Mortality more extensive from Mt. St. Helens north



Extensive mortality north of Aetna Springs

Angwin is a center of mortality, many soils very shallow, 1-2 feet deep




Aerial Survey Lake and Napa Counties
1: Northern Area. Large polygons indicate areas of scattered and often limited dense areas of mortality. Small polygons within larger polygons indicate areas of dense mortality.
N
3 mi
Woodleaf
Calistoga
Larkmead
Pope Valley
Angwin
Sanitarium
Deer Park
Barro
St Helena
Google Earth

Pervasive Douglas-fir mortality near Angwin airport. Douglas-fir mortality is more difficult to identify on the landscape than pine mortality because the trees often lose their needles incrementally and many trees turn gradually gray rather than going through a red stage. Some ponderosa pine mortality is also present in this photo.

Note body of water, in next slide

Ponderosa pine and Douglas-fir mortality on a slope northeast of Angwin. Forest transitions to the east to oak dominated hardwood forest as Howell Mt. Rd. descends to Pope Valley.

Pope Valley

Ponderosa pine and Douglas-fir mortality near Middletown. Note that this mortality is associated with the presence of oaks. Oaks are indicative of dry areas, and many may transition to hardwood stands if drought continues