# Sudden Oak Death and Oak Mortality in California

**An Assessment of Sudden Oak Death and Oak Mortality, 2000-2005**

**State and Private Forestry—Forest Health Protection** **August 2006**

# Questions:

- What is the current distribution of SOD in California?
  - By county?
  - By owner?
  - By risk of spread?
  - By elevation?
- Where has oak mortality been mapped in California?
- Based on where SOD has been confirmed, where we have mapped oak mortality, and the risk of spread of SOD in the state, where do we expect to see SOD in the future?

Confirmed SOD

Mapped Oak Mortality

Risk of Spread

SOD Management Priorities

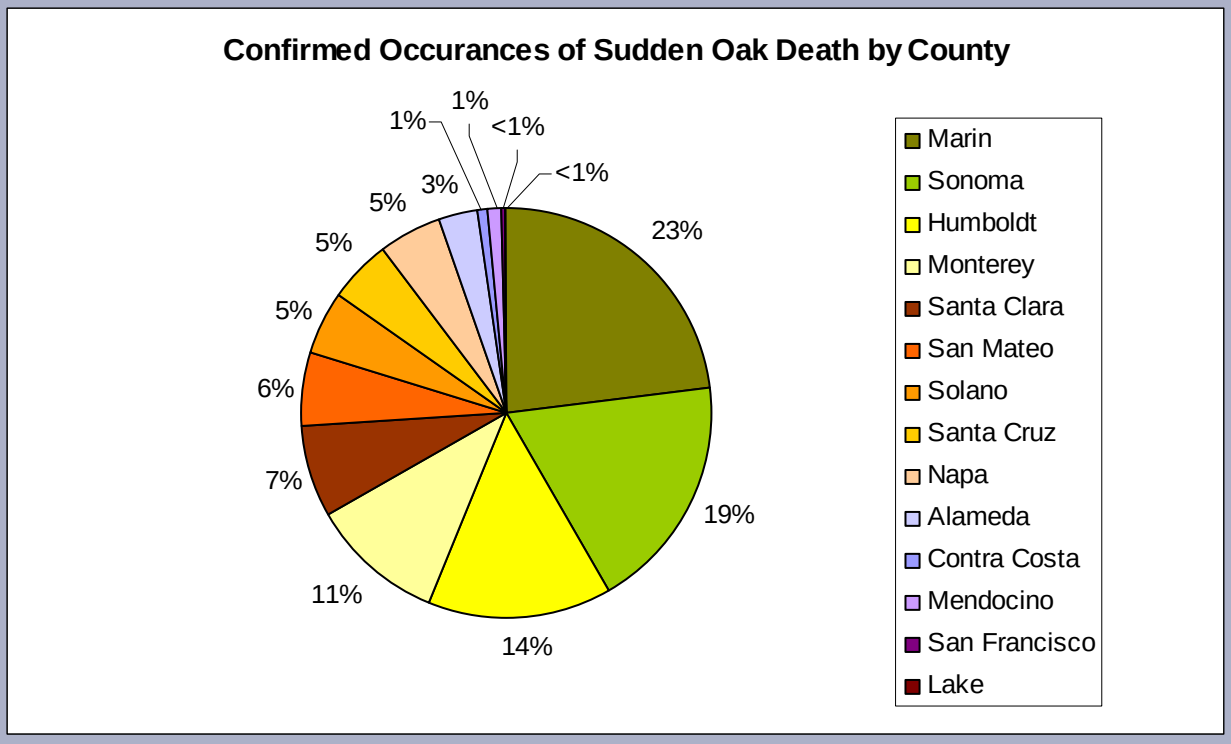
# California Counties with Confirmed *P. ramorum**

* Including Curry County, Oregon

# Locations of Confirmed isolation of *P. ramorum*

# *P. ramorum* confirmations by County 2000-2005

- Since 2000, there have been 897 cases of confirmed isolation of P. ramorum in 14 coastal counties in California.
- Over 50% of these are found in Marin, Sonoma and Humboldt counties.
- 97% occur in coastal influence zones below 2000 feet.

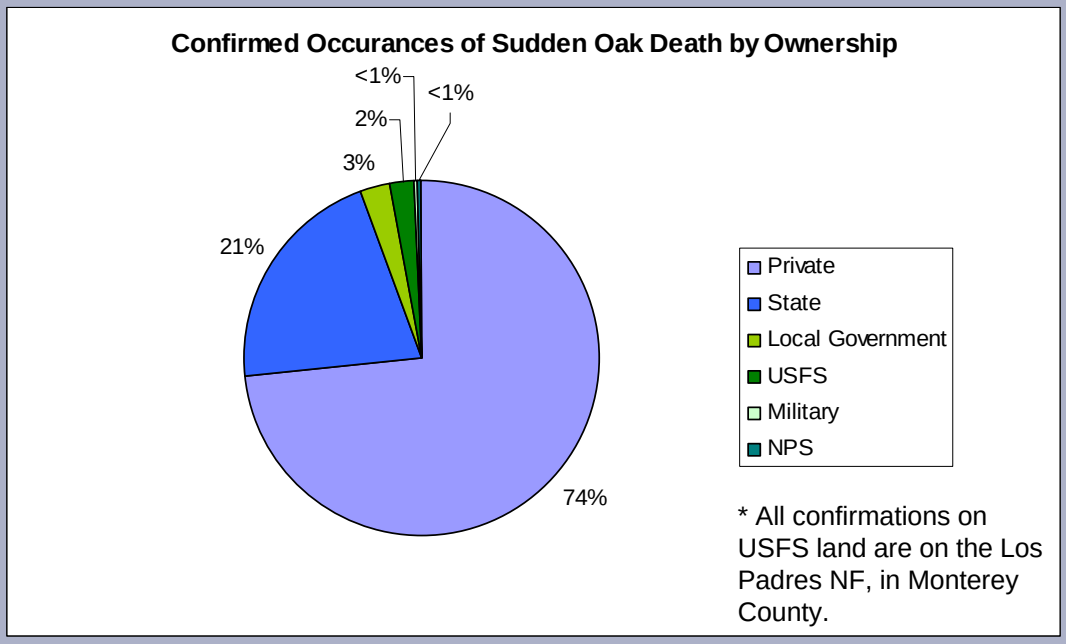


# *P. ramorum* confirmations by County 2000-2005

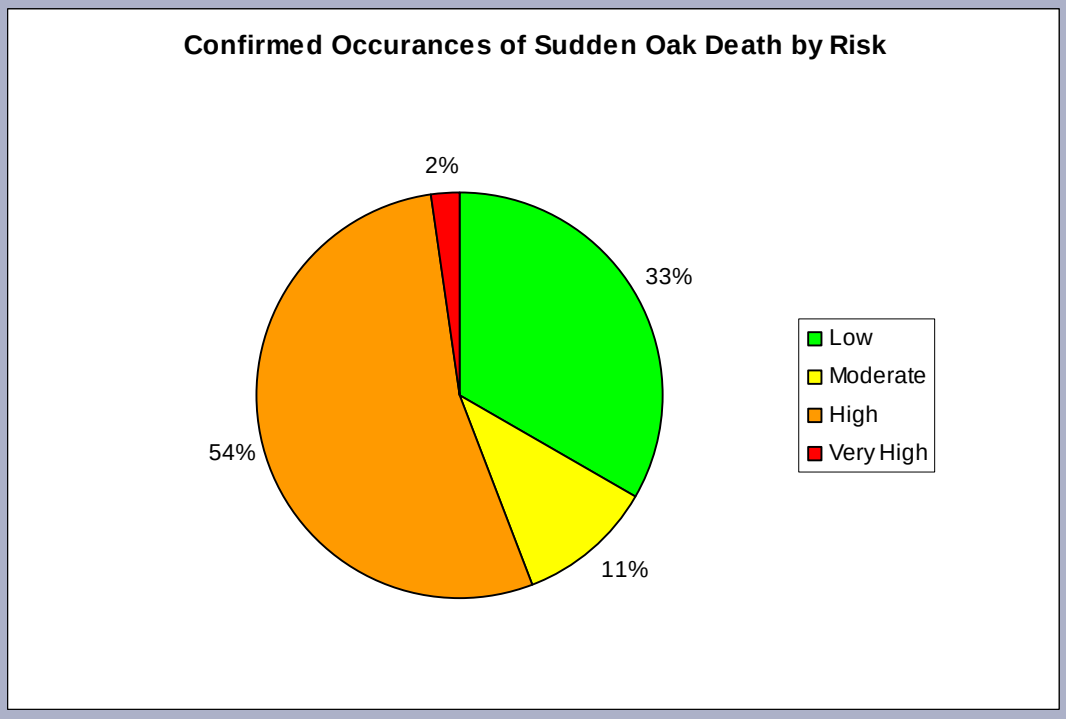
| | Year | | | | | |
|---|---|---|---|---|---|---|
| **County** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** |
| ALAMEDA | 0 | 4 | 1 | 0 | 6 | 16 |
| CONTRA COSTA | 0 | 3 | 2 | 2 | 2 | 0 |
| HUMBOLDT | 0 | 0 | 7 | 5 | 3 | 115 |
| LAKE | 0 | 0 | 0 | 0 | 1 | 0 |
| MARIN | 25 | 52 | 3 | 8 | 11 | 107 |
| MENDOCINO | 0 | 6 | 3 | 0 | 0 | 0 |
| MONTEREY | 3 | 1 | 9 | 81 | 1 | 0 |
| NAPA | 6 | 9 | 10 | 9 | 2 | 8 |
| SAN FRANCISCO | 0 | 0 | 0 | 0 | 2 | 0 |
| SAN MATEO | 0 | 6 | 4 | 14 | 5 | 23 |
| SANTA CLARA | 0 | 9 | 7 | 9 | 2 | 37 |
| SANTA CRUZ | 6 | 6 | 15 | 5 | 4 | 9 |
| SOLANO | 0 | 4 | 2 | 1 | 0 | 39 |
| SONOMA | 32 | 31 | 32 | 40 | 2 | 30 |
| TOTAL | **72** | **131** | **95** | **174** | **41** | **384** |

# *P. ramorum* confirmations by owner 2000-2005

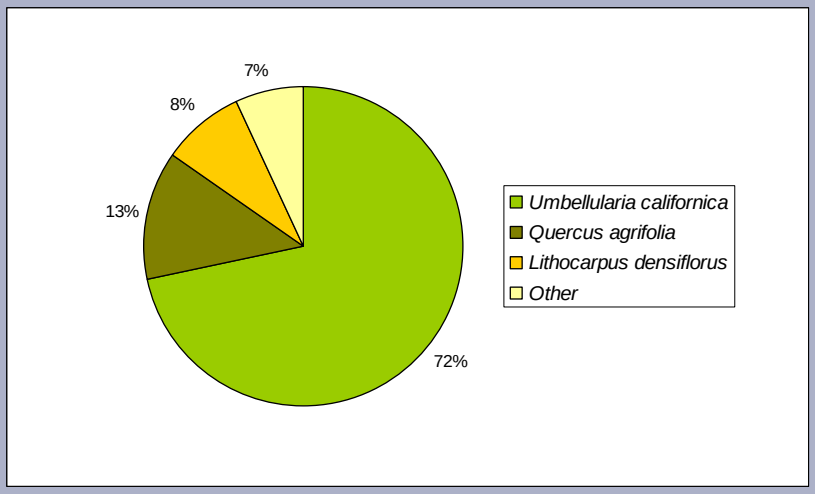
•Most confirmations of *P. ramorum* occur on private and state land




Distribution of *P. ramorum* from 2000-2005 by risk categories (Meentemeyer et al. 2004).



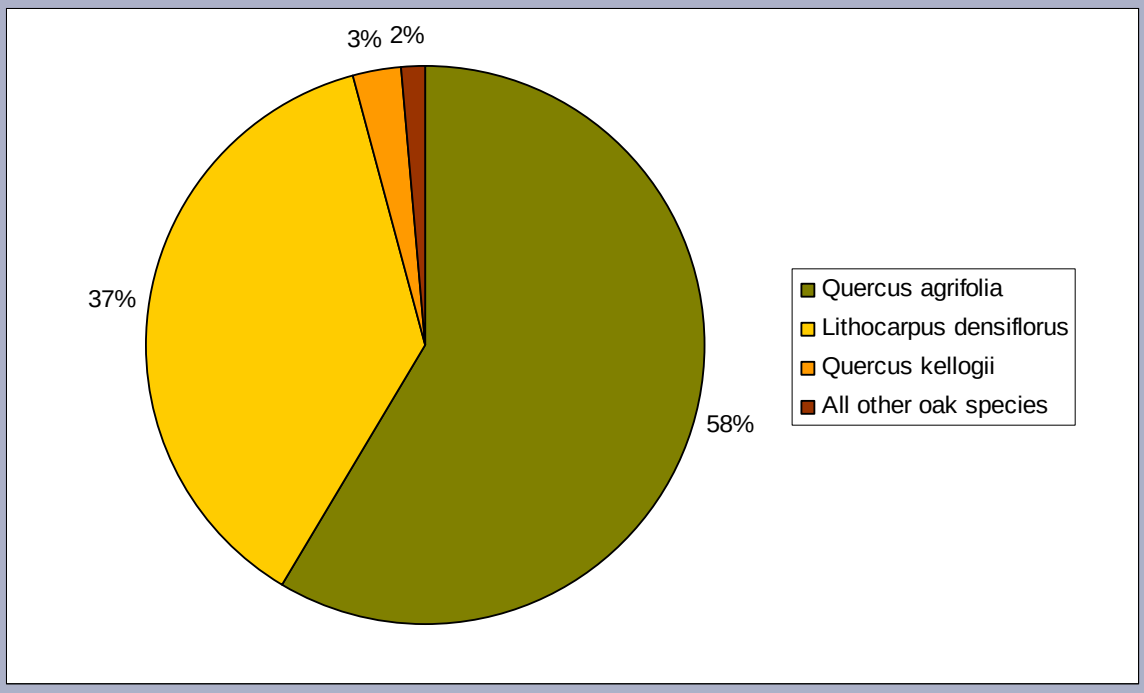
# *P. ramorum* confirmations by host 2000-2005*




| Host | Number | Percent |
|---|---|---|
| *Umbellularia californica* | 644 | 72 |
| *Quercus agrifolia* | 116 | 13 |
| *Lithocarpus densiflorus* | 74 | 8 |
| *Vaccinium ovatum* | 12 | 1 |
| *Sequoia sempervirens* | 6 | <1 |
| *Quercus kellogii* | 5 | <1 |
| *Rhododendron macrophyllum* | 5 | <1 |
| *Acer macrophyllum* | 3 | <1 |
| *Arbutus menziesii* | 3 | <1 |
| *Heteromeles arbutifolia* | 3 | <1 |
| *Pseudotuga menziesii* | 2 | <1 |
| *Adiantum jordanii* | 1 | <1 |
| *Aesculus californica* | 1 | <1 |
| *Corylus cornuta* | 1 | <1 |
| *Lonicera sp.* | 1 | <1 |
| *Osmorhiza chiliensis* | 1 | <1 |
| *Quercus chrysolepis* | 1 | <1 |
| *Quercus parvula* | 1 | <1 |
| *Quercus sp.* | 1 | <1 |
| *Rosa gymnocarpa* | 1 | <1 |
| *Taxus brevifolia* | 1 | <1 |
| Acer circinatum | 1 | <1 |
| unknown | 13 | 1 |

* Most of these are foliar hosts that contract *P. ramorum* but are not killed.

# *P. ramorum* confirmations by host 2000-2005 : host species killed by *P. ramorum*

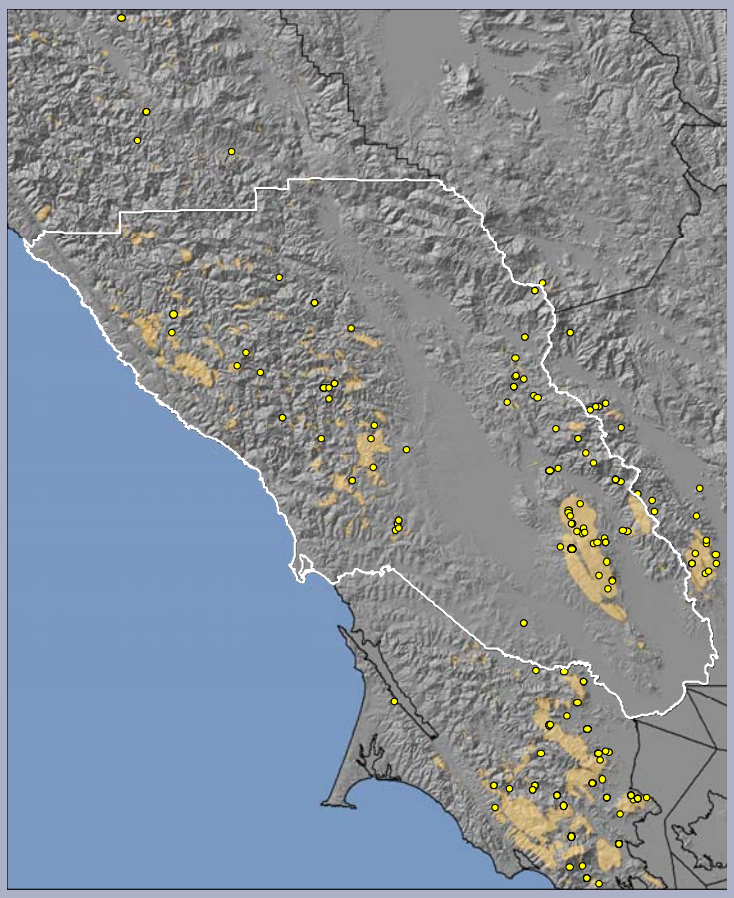



| Host | Number | Percent |
|---|---|---|
| *Quercus agrifolia* | 116 | 59 |
| *Lithocarpus densiflorus* | 74 | 37 |
| *Quercus kellogii* | 5 | 3 |
| All other oak species | 3 | 2 |

# How do confirmed locations of *P. ramorum* compare with mapped oak mortality*?

- 57% of confirmed isolation of P. ramorum fall within ¼ mile (400m) of a mapped oak mortality polygon.
- 73% fall within ½ mile (800m) of a mapped oak mortality polygon
- 80% are within 1 km (0.62 miles)
- 95% are within 2.5 km (1.6 miles)
- Mean distance to mapped oak mortality polygon: 790m (0.49 miles)

*Based on data through 12/2005.

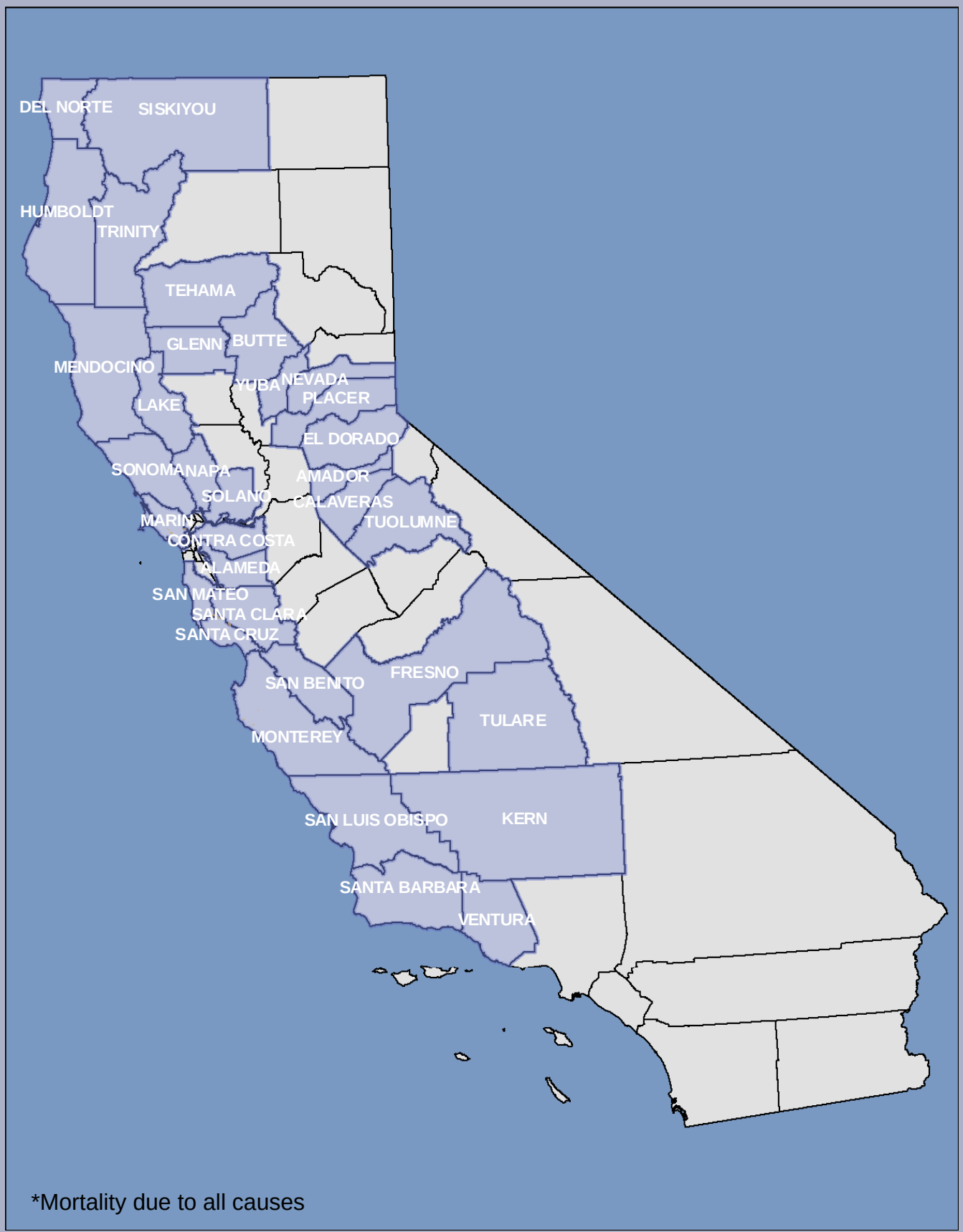


*Mortality due to all causes

# California Mapped Oak Mortality* 2001-2005

*Mortality due to all causes

# California Counties with Mapped Oak Mortality* 2001-2005

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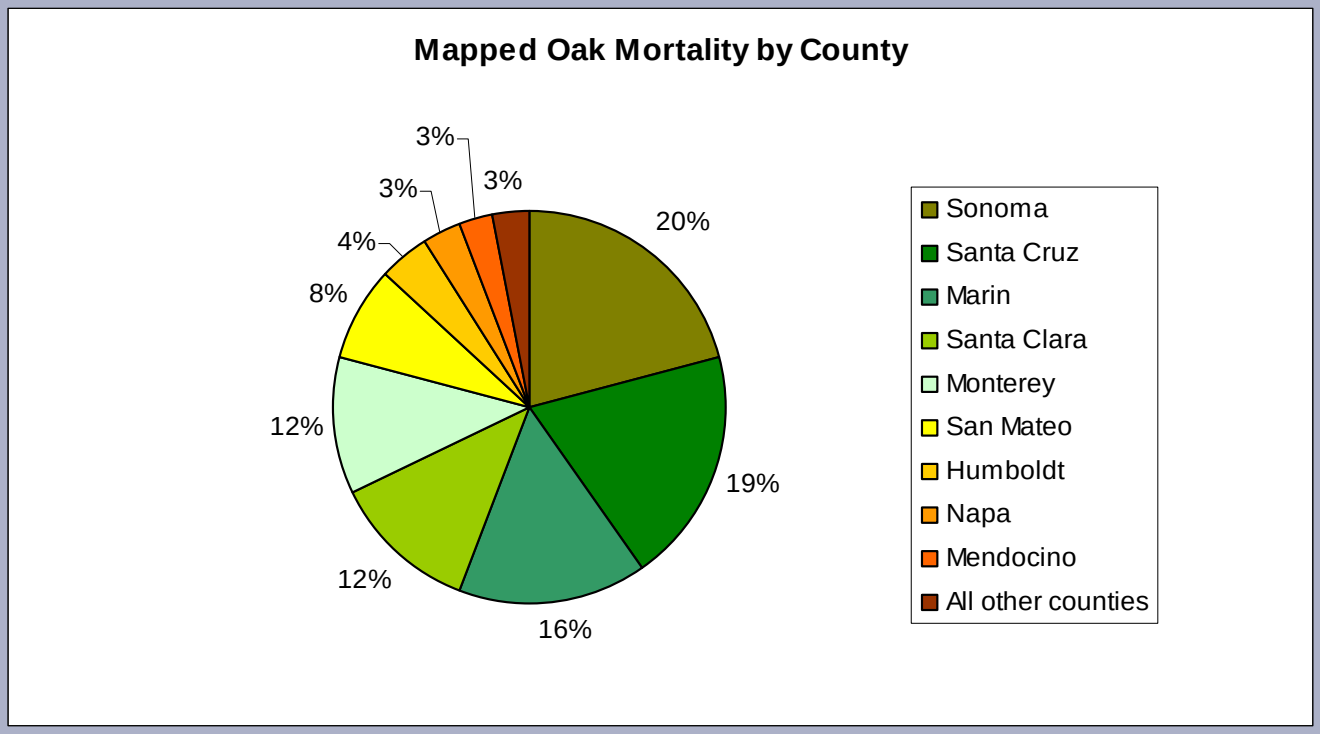
# Mapped Oak Mortality* by County 2001-2005

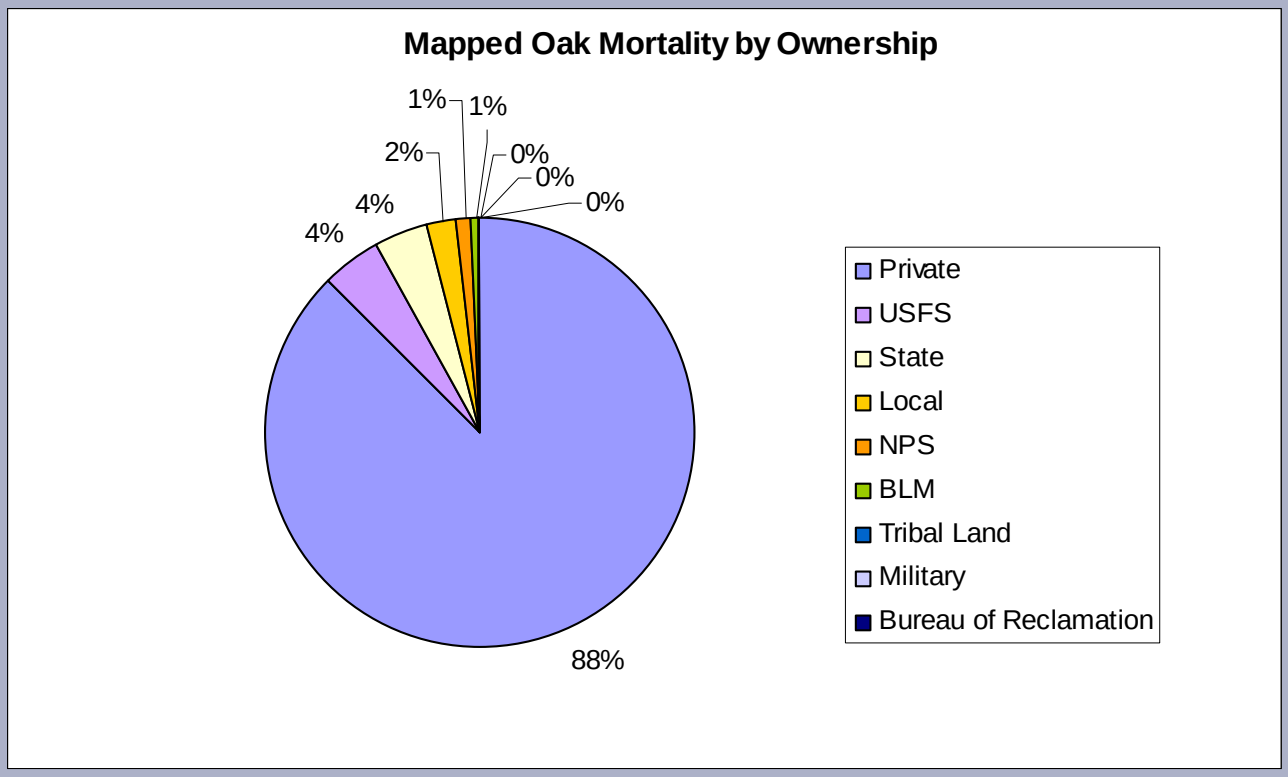
- 97% of Mapped Oak Mortality Occurs in 9 counties




*Mortality due to all causes

| County | Acres | Percent |
|---|---|---|
| Sonoma | 47661 | 20 |
| Santa Cruz | 44897 | 19 |
| Marin | 36112 | 16 |
| Santa Clara | 26947 | 12 |
| Monterey | 26596 | 12 |
| San Mateo | 17633 | 8 |
| Humboldt | 9737 | 4 |
| Napa | 6741 | 3 |
| Mendocino | 6634 | 3 |
| All Other Counties | 8033 | 3 |
| TOTAL | 230990 | 100 |

# Mapped Oak Mortality* by Ownership 2001-2005



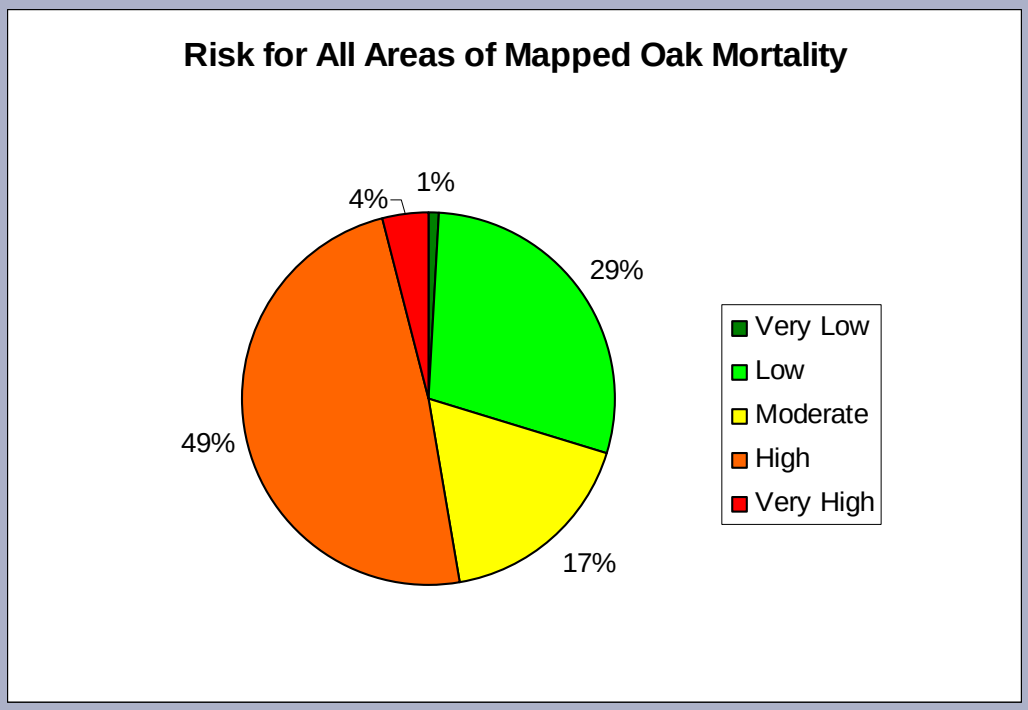

| Owner | Acres | Percent |
|---|---|---|
| Private | 202,291 | 88 |
| USFS | 10,062 | 4 |
| State | 9,625 | 4 |
| Local | 4,976 | 2 |
| NPS | 2,654 | 1 |
| BLM | 1,236 | <1 |
| Tribal Land | 84 | <1 |
| Military | 59 | <1 |
| Bureau of Reclamation | 3 | <1 |
| Total | 230,990 | 100 |

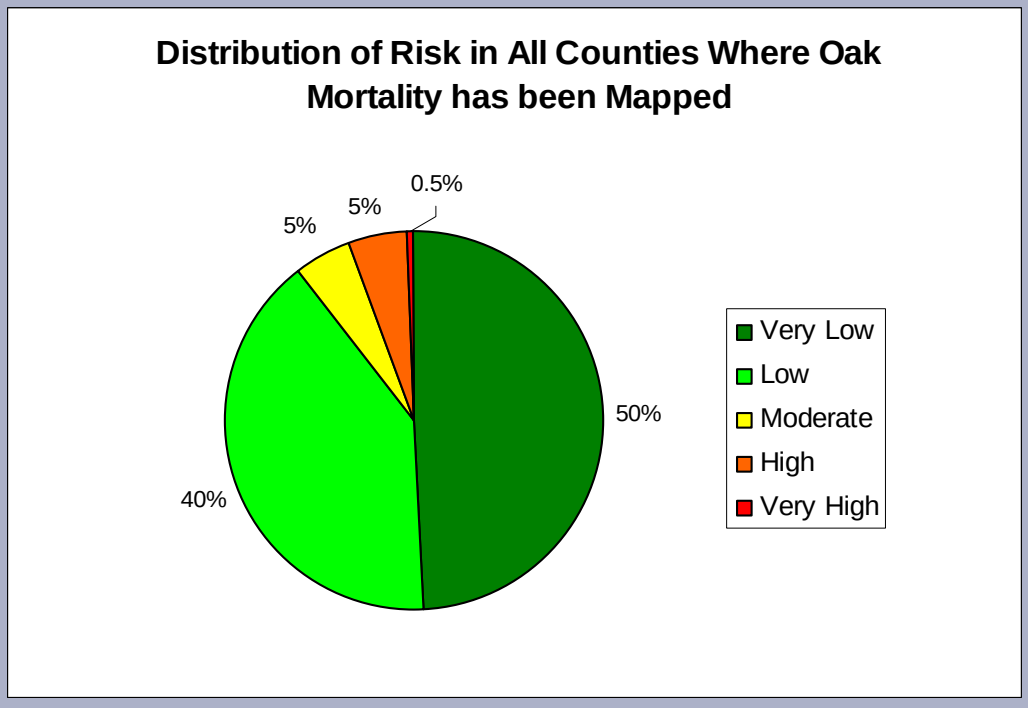
| National Forest | Acres | Percent |
|---|---|---|
| Los Padres NF | 8,649 | 86 |
| Six Rivers NF | 558 | 6 |
| Sequoia NF | 387 | 4 |
| Klamath NF | 198 | 2 |
| Plumas NF | 167 | 2 |
| Mendocino NF | 51 | 1 |
| Eldorado NF | 19 | <1 |
| Lassen NF | 13 | <1 |
| Sierra NF | 13 | <1 |
| Stanislaus NF | 4 | <1 |
| Tahoe NF | 2 | <1 |
| Total | 10,062 | 100 |

*Mortality due to all causes

# Mapped Oak Mortality* by Risk of Spread 2001-2005

- Most oak mortality has been mapped in high, moderate and low risk areas
- Within the counties where oak mortality has been mapped, most land area is in very low and low risk areas

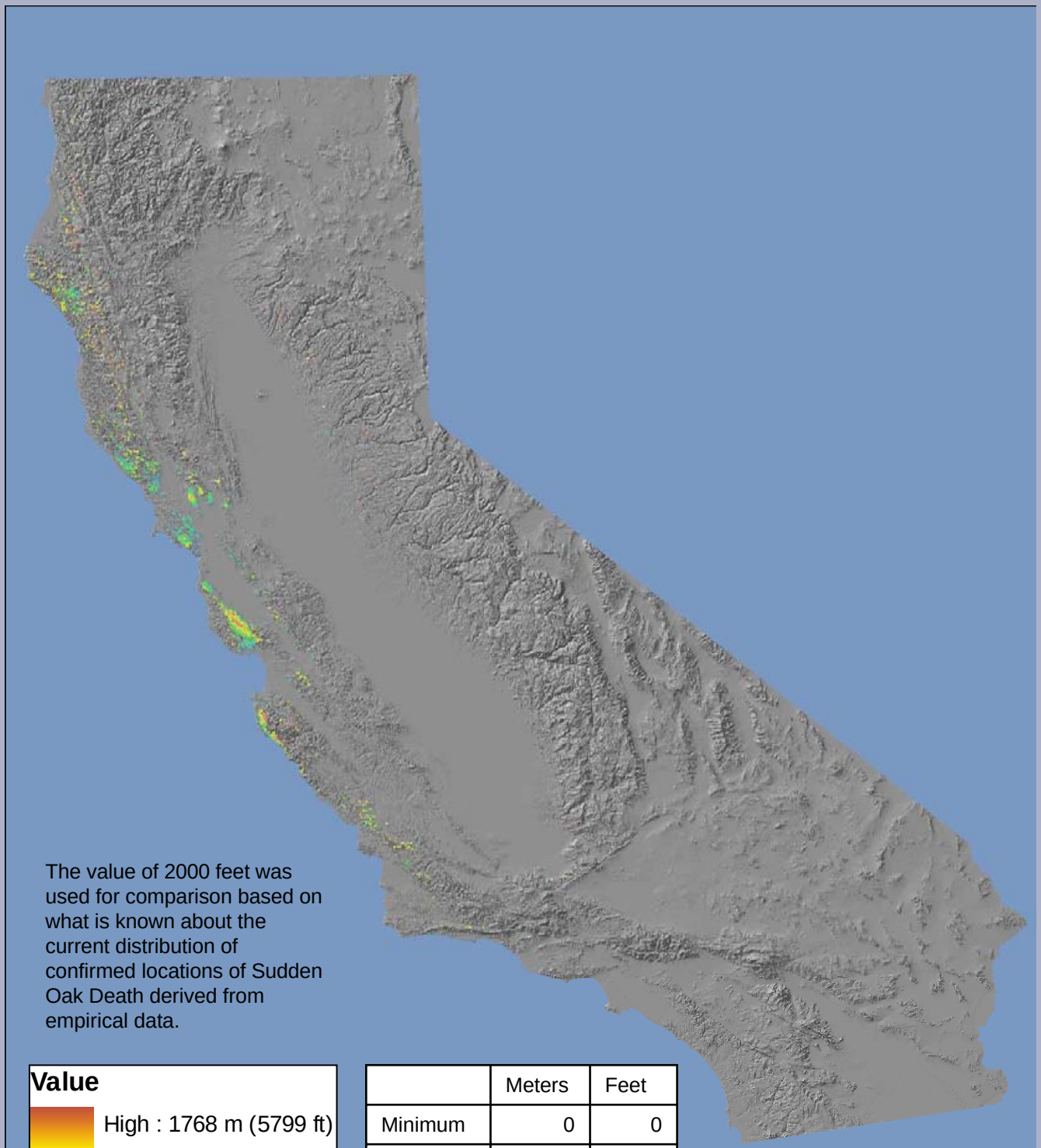



*Mortality due to all causes

# Mapped Oak Mortality* Elevation Distribution

- 87% of Mapped Oak Mortality occurs at elevations < 2000 ft.*



The value of 2000 feet was used for comparison based on what is known about the current distribution of confirmed locations of Sudden Oak Death derived from empirical data.

**Value**

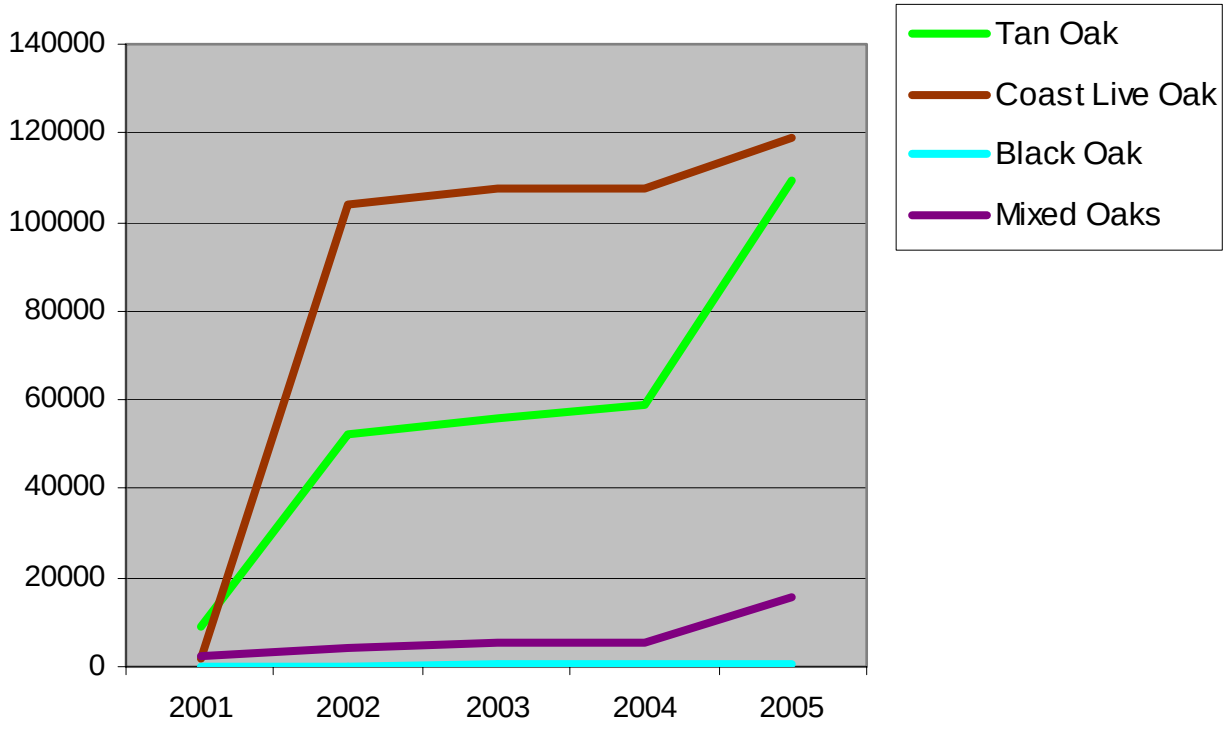
High : 1768 m (5799 ft)

Low : 0 (m)

| | Meters | Feet |
|---|---|---|
| Minimum | 0 | 0 |
| Maximum | 1768 | 5799 |
| Mean | 870 | 2854 |

*Mortality due to all causes

# Oak Mortality* by Host 2001-2005




*Mortality due to all causes

# Where do we expect SOD in the future?

- Risk of Spread in areas not yet mapped as Oak Mortality*, under 2000 feet

| Risk | Acres | Percent |
|---|---|---|
| High | 1,850,405 | 91 |
| Very High | 184,821 | 9 |
| Total | 2,035,226 | 100 |

Risk of Spread

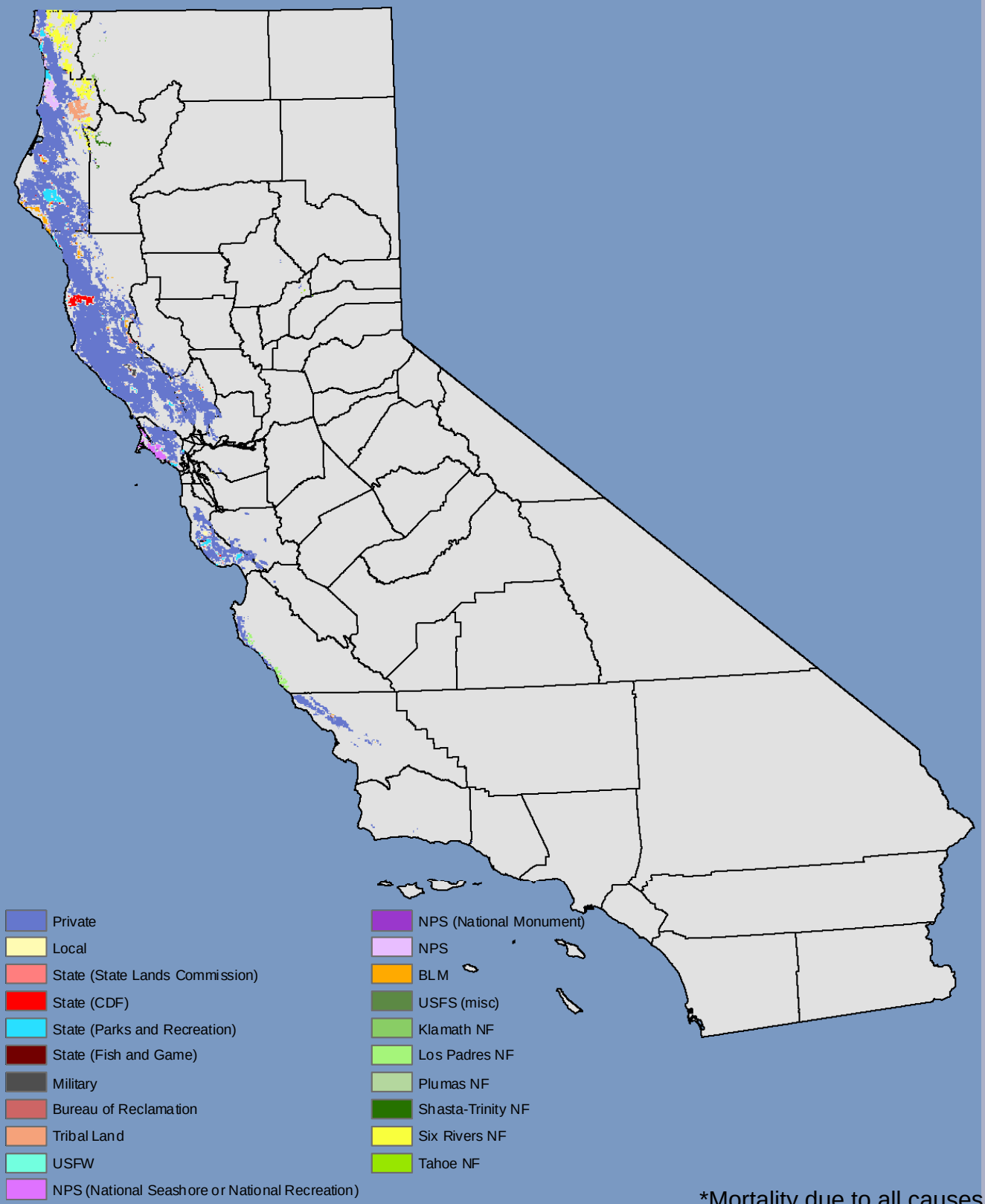
High

Very High

*Mortality due to all causes

# Where do we expect SOD in the future?

Ownership in high and very high risk areas not yet mapped as Oak Mortality*, under 2000 feet




*Mortality due to all causes

**Area classified as very high risk for SOD, where Oak mortality* has not been mapped, below 2000 feet, by county.**

| County | Acres | Percent | Risk |
|---|---|---|---|
| Humboldt | 40,109 | 22 | Very High |
| Santa Cruz | 37,586 | 20 | Very High |
| Del Norte | 35,508 | 19 | Very High |
| Sonoma | 26,197 | 14 | Very High |
| Mendocino | 25,448 | 14 | Very High |
| San Mateo | 19,967 | 11 | Very High |
| Monterey | 7 | 0 | Very High |
| Total | 184,821 | 100 | |

*Mortality due to all causes

**Area classified as high risk for SOD, where Oak mortality* has not been mapped, below 2000 feet, by county.**

| County | Acres | Percent | Risk |
|---|---|---|---|
| Humboldt | 623,647 | 34 | High |
| Mendocino | 519,052 | 28 | High |
| Sonoma | 267,097 | 14 | High |
| Del Norte | 116,094 | 6 | High |
| Napa | 87,873 | 5 | High |
| Marin | 60,421 | 3 | High |
| Santa Cruz | 60,034 | 3 | High |
| San Mateo | 36,097 | 2 | High |
| San Luis Obispo | 22,834 | 1 | High |
| Santa Clara | 19,621 | 1 | High |
| Monterey | 17,989 | 1 | High |
| Lake | 6,643 | <1 | High |
| Trinity | 3,729 | <1 | High |
| Alameda | 3,061 | <1 | High |
| Solano | 2,278 | <1 | High |
| Contra Costa | 1,856 | <1 | High |
| Siskiyou | 1,382 | <1 | High |
| San Benito | 415 | <1 | High |
| Santa Barbara | 225 | <1 | High |
| Yuba | 34 | <1 | High |
| Nevada | 13 | <1 | High |
| Butte | 1 | <1 | High |
| Total | 1,850,394 | 100 | |

*Mortality due to all causes

## Ownerships with most area at risk for Sudden Oak Death in the Future:

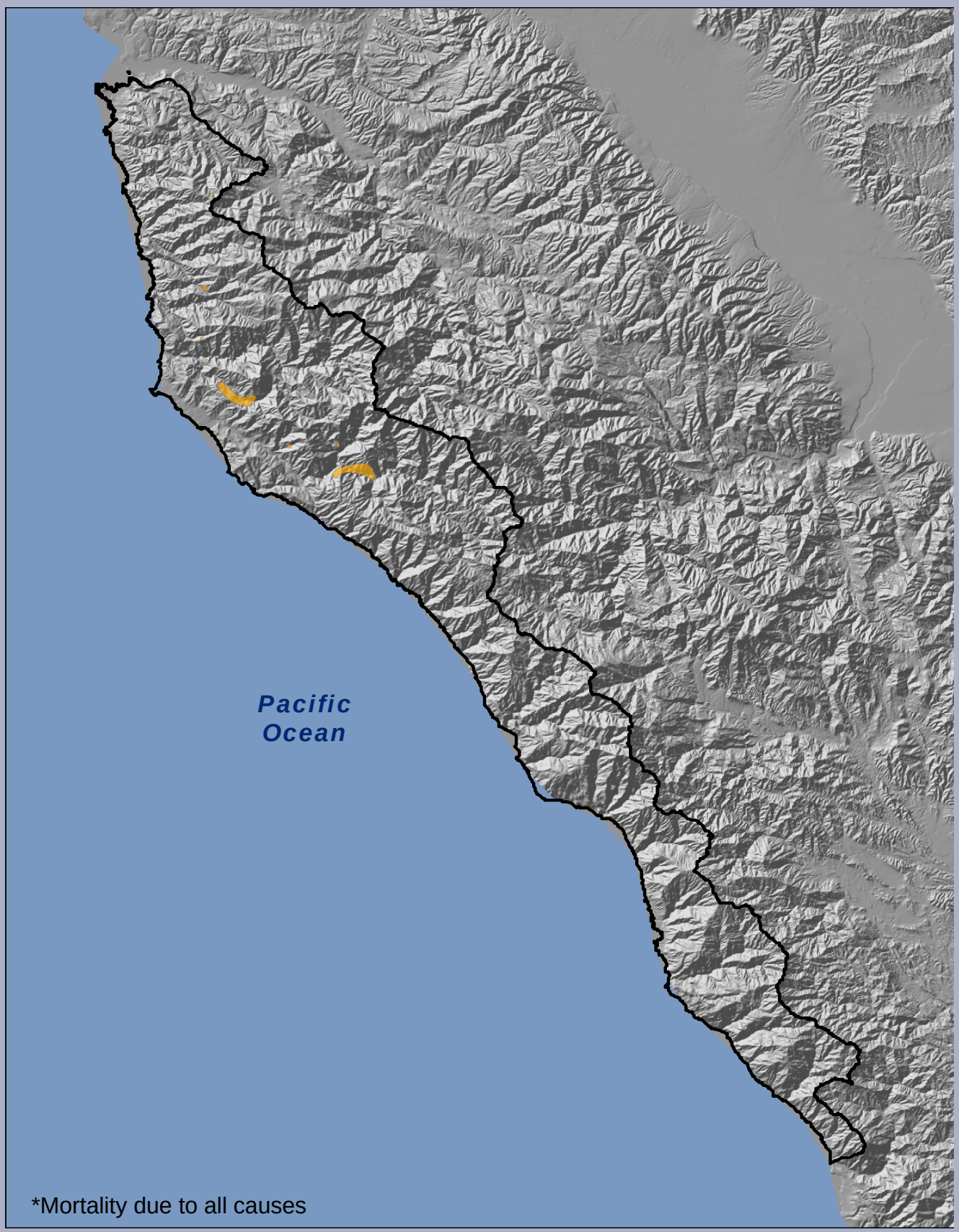
- Private Land
- State Land—Parks and Recreation
- Six Rivers National Forest
- Bureau of Land Management
- National Park Service

**Area classified as high and very high risk for SOD, where Oak mortality* has not been mapped, below 2000 feet, by owner.**

| Owner | Acres | Percent |
|---|---|---|
| Private | 1,703,883 | 84 |
| State (Parks and Recreation) | 102,361 | 5 |
| Six Rivers NF | 78,202 | 4 |
| BLM | 40,444 | 2 |
| NPS | 36,043 | 2 |
| Tribal Land | 19,281 | 1 |
| Local | 13,170 | 1 |
| State (CDF) | 13,086 | 1 |
| NPS (National Seashore or National Recreation) | 10,840 | 1 |
| Los Padres NF | 7,913 | <1 |
| Military | 4,172 | <1 |
| State (State Lands Commission) | 3,239 | <1 |
| Klamath NF | 1,168 | <1 |
| Shasta-Trinity NF | 538 | <1 |
| NPS (national monument) | 487 | <1 |
| State (Fish and Game) | 221 | <1 |
| USFS (misc) | 42 | <1 |
| Tahoe NF | 27 | <1 |
| Unknown | 13 | <1 |
| Bureau of Reclamation | 3 | <1 |
| USFW | 1 | <1 |
| Plumas NF | 0 | <1 |
| Total | 2,035,134 | 100 |

*Mortality due to all causes

# Big Sur Ecoregion Oak Mortality* 2001

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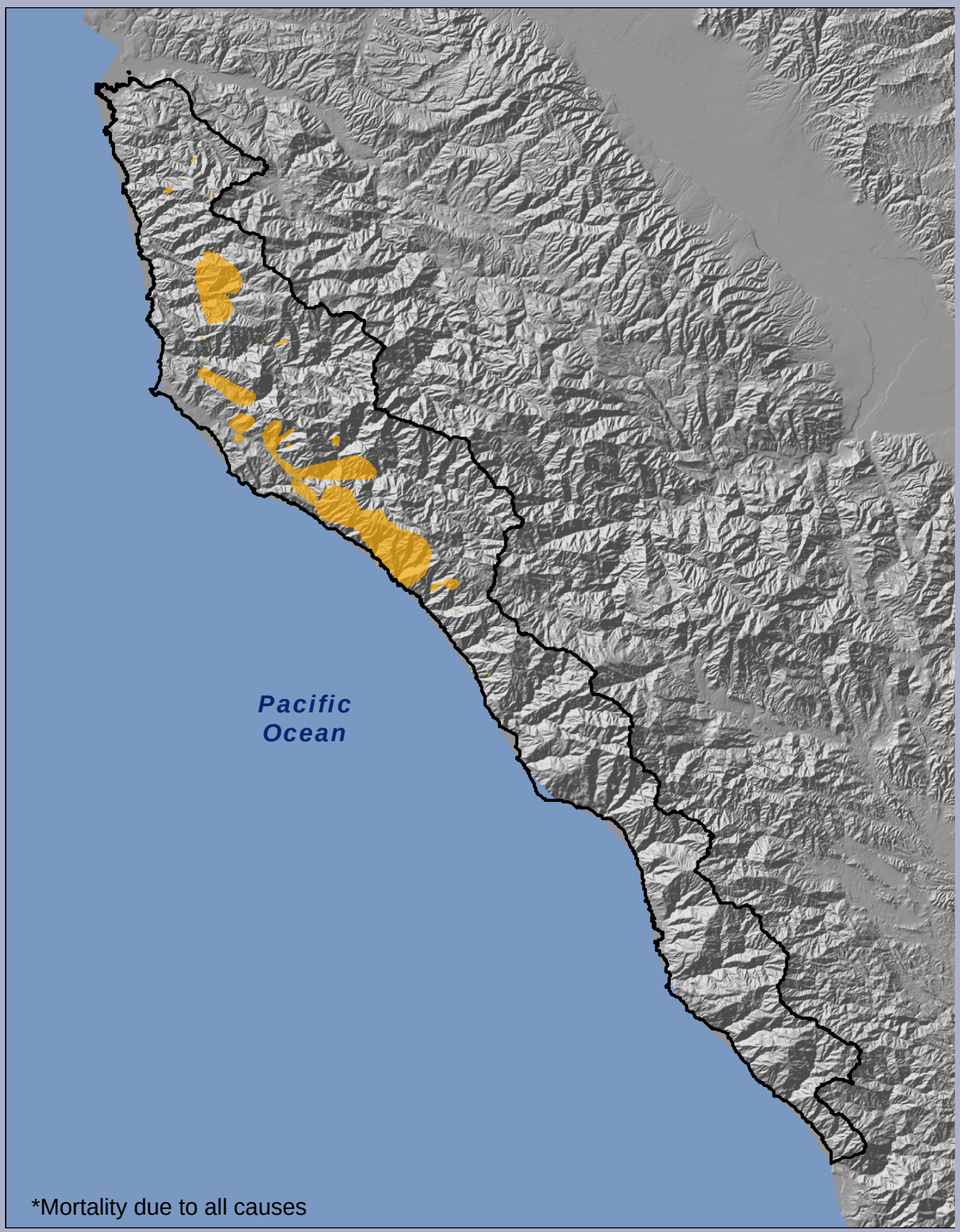
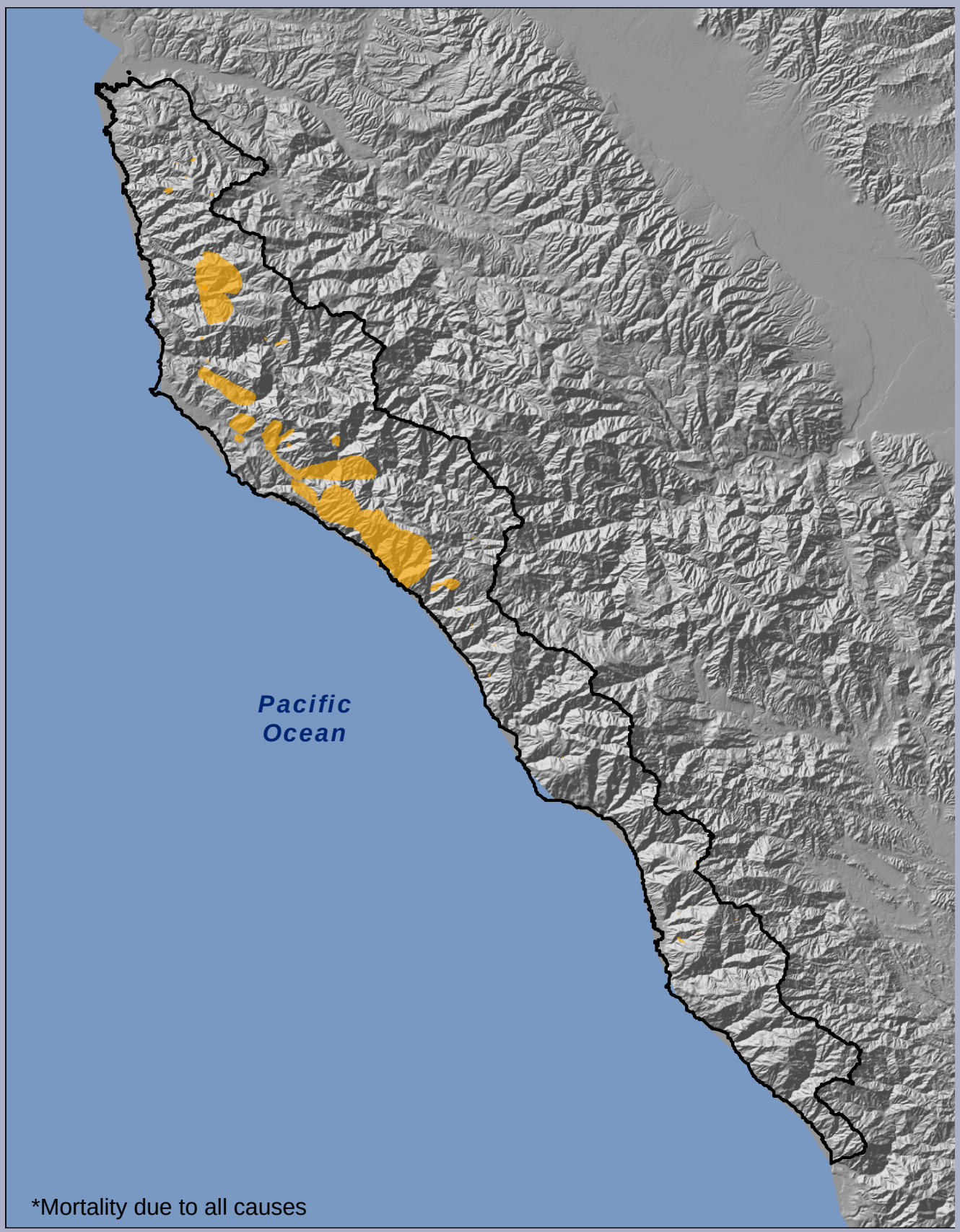
# Big Sur Ecoregion Oak Mortality* 2002



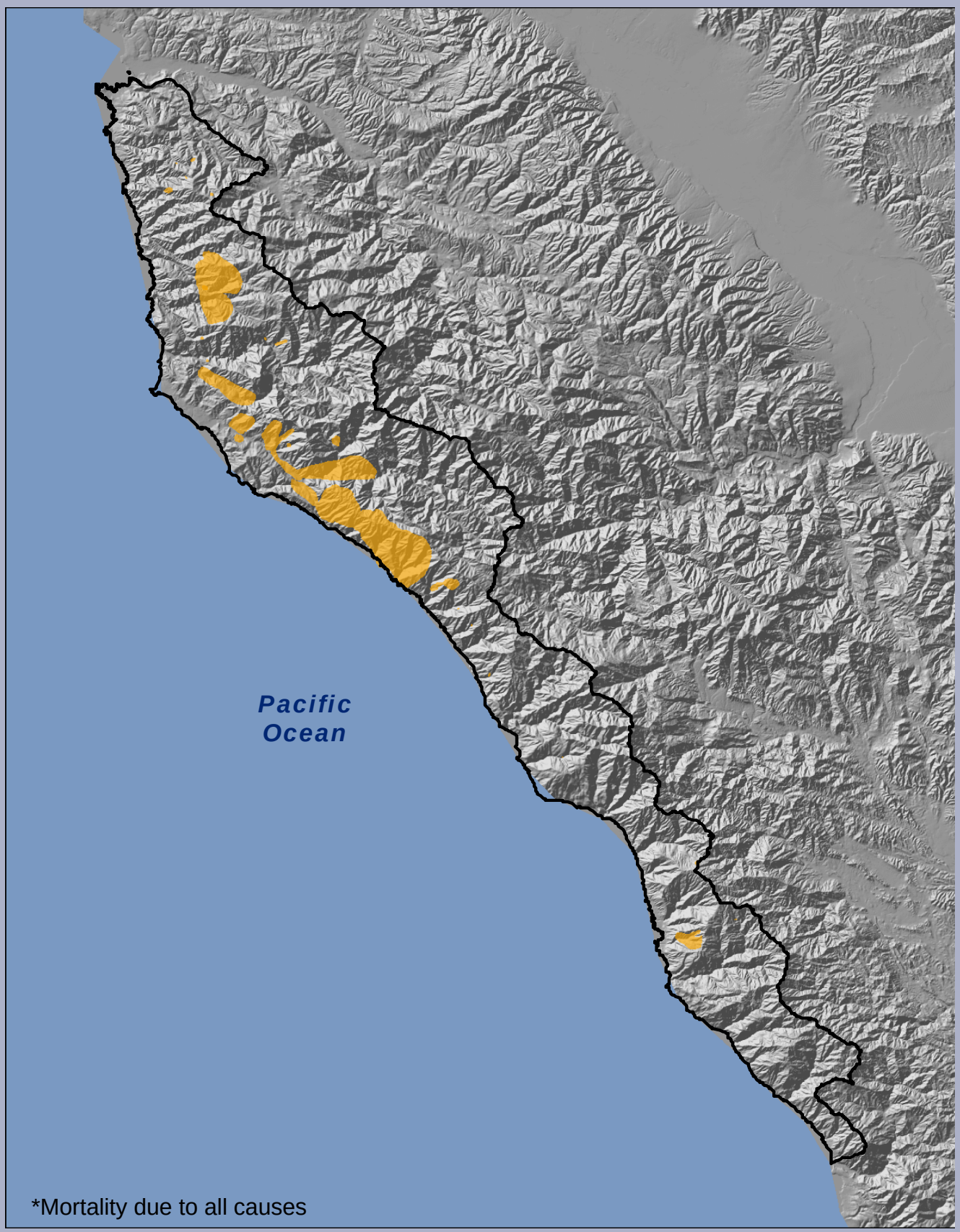

*Mortality due to all causes

# Big Sur Ecoregion Oak Mortality* 2003




*Mortality due to all causes

# Big Sur Ecoregion Oak Mortality* 2004

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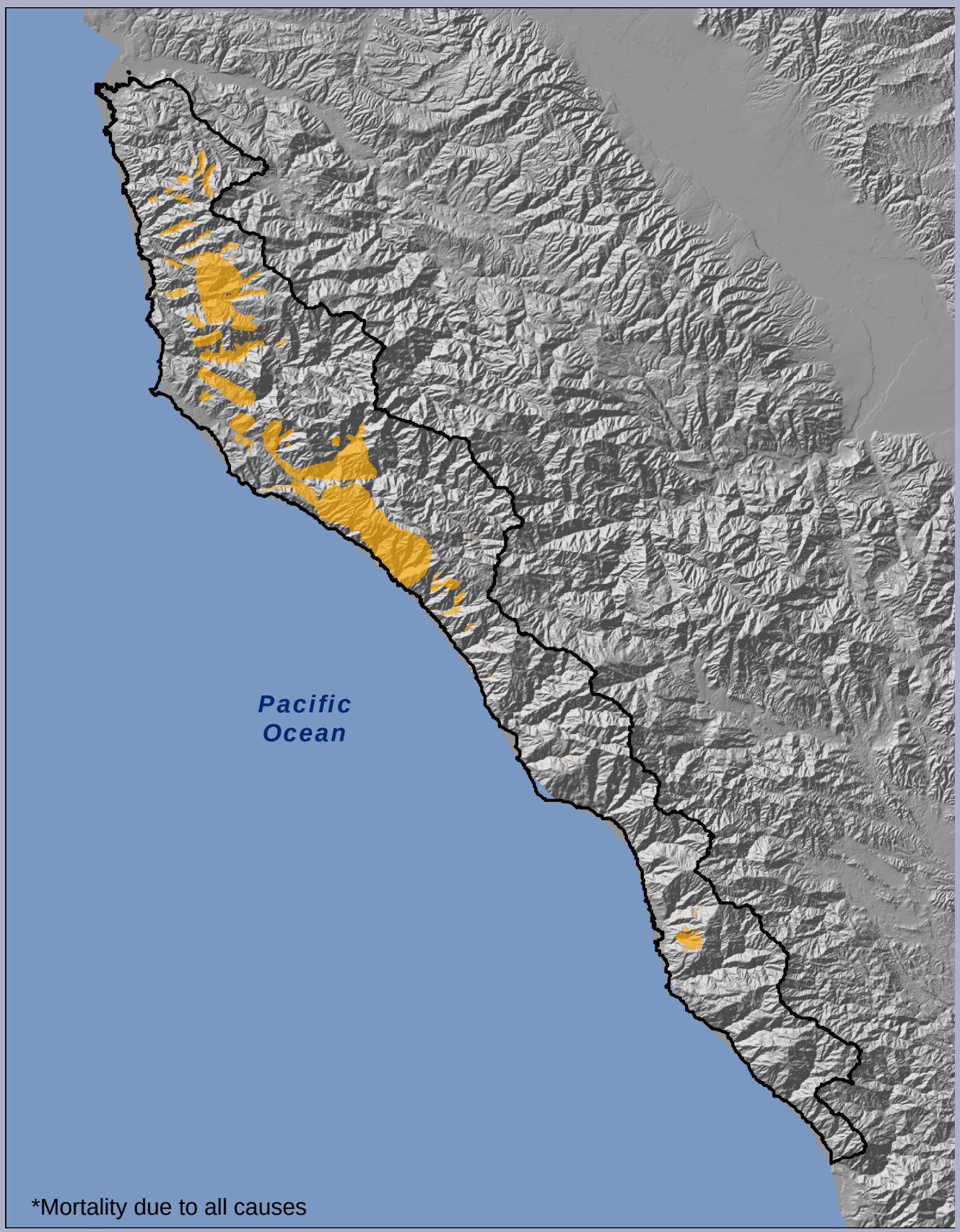
# Big Sur Ecoregion Oak Mortality* 2005

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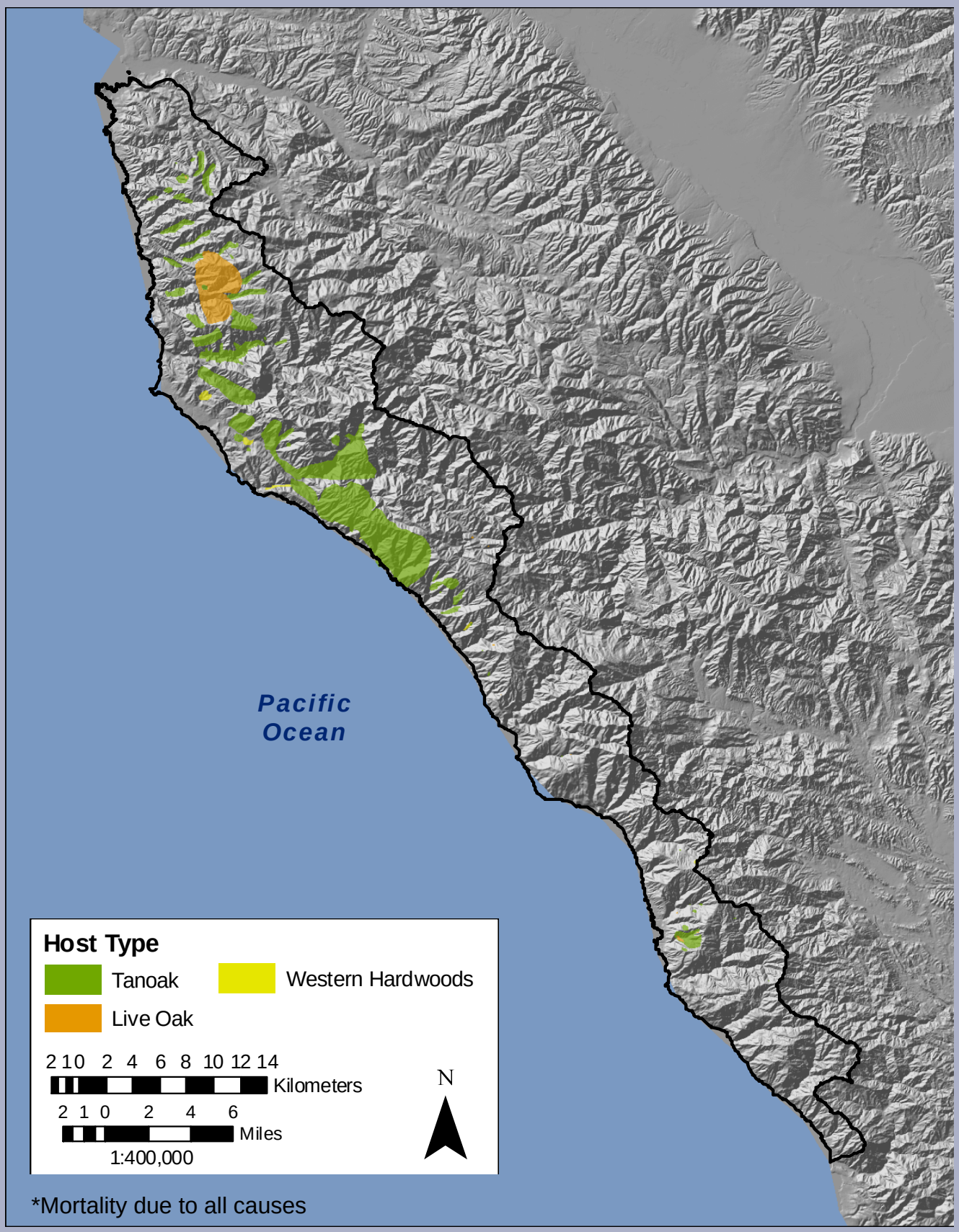
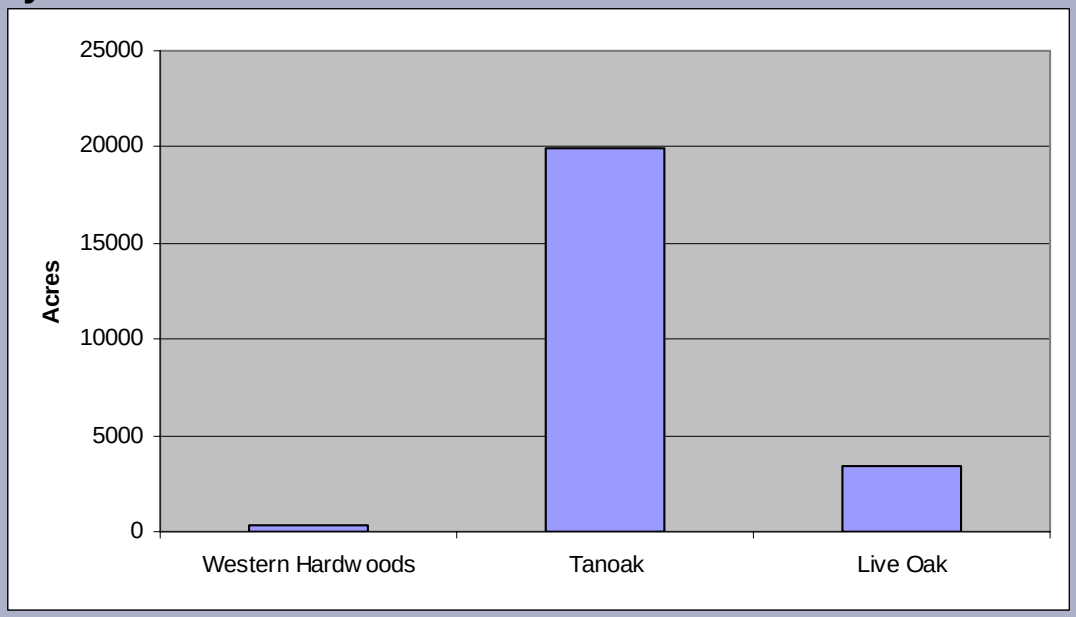
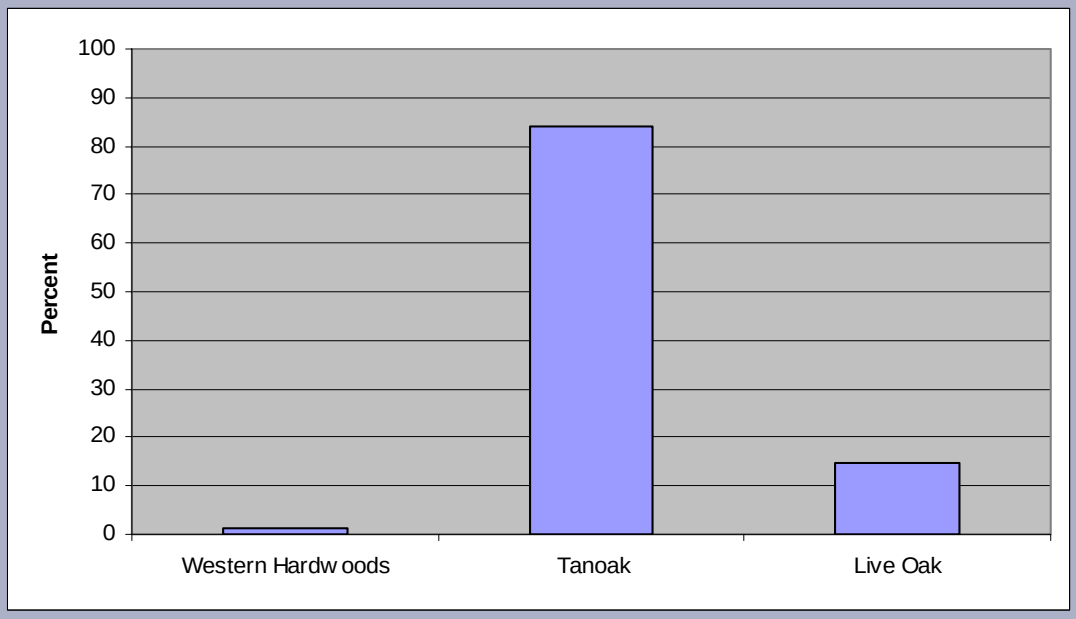
# Big Sur Ecoregion Oak Mortality* by Host




*Mortality due to all causes

# Cumulative Acres of Mortality* in Big Sur Ecoregion due to all causes by Host 2001-2005

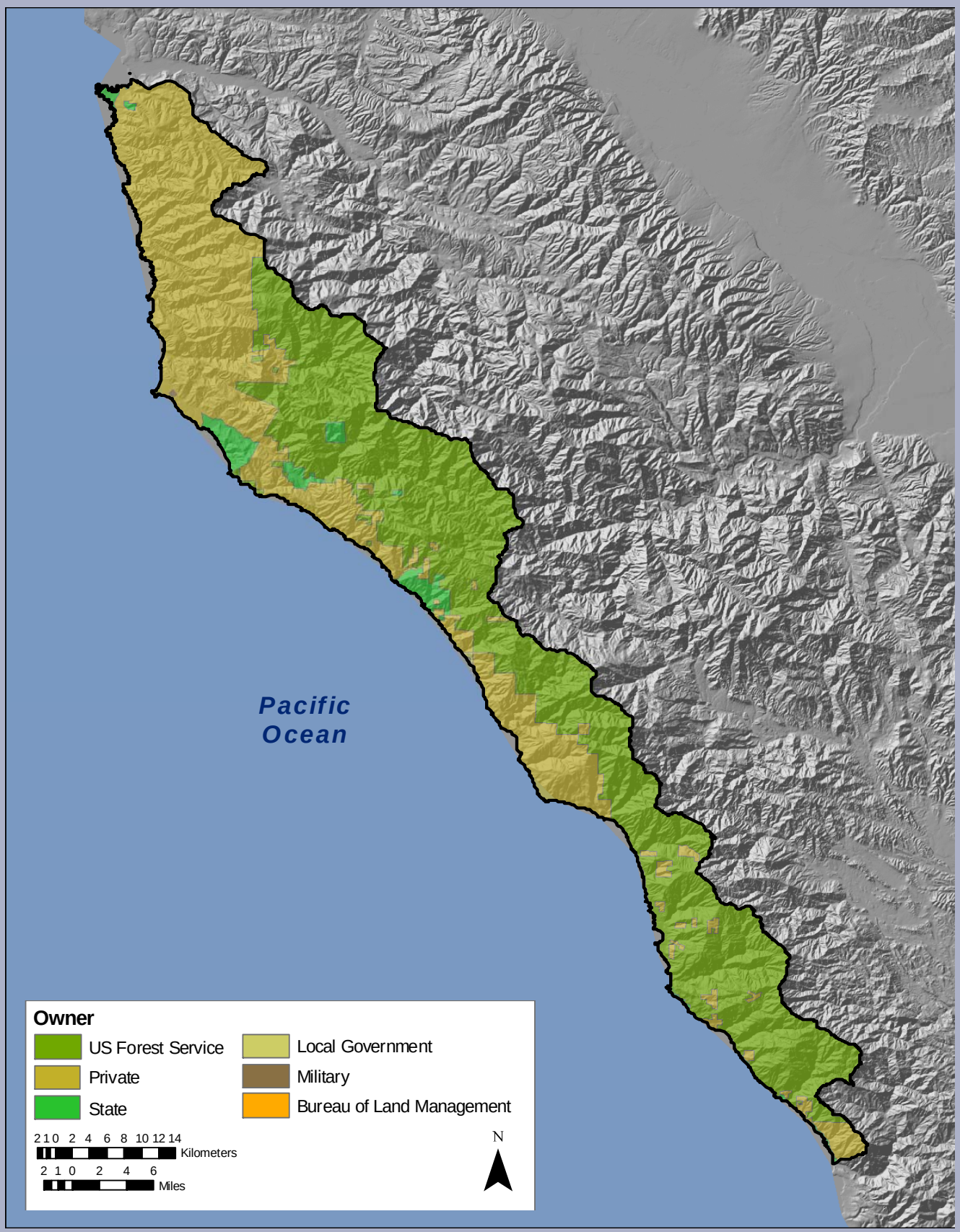



| Host Type | Acres | Percent |
|---|---|---|
| Western Hardwoods | 348 | 1 |
| Tanoak | 19907 | 84 |
| Live Oak | 3438 | 15 |
| Total | 23693 | 100 |

*Mortality due to all causes

# Big Sur Ecoregion Ownership



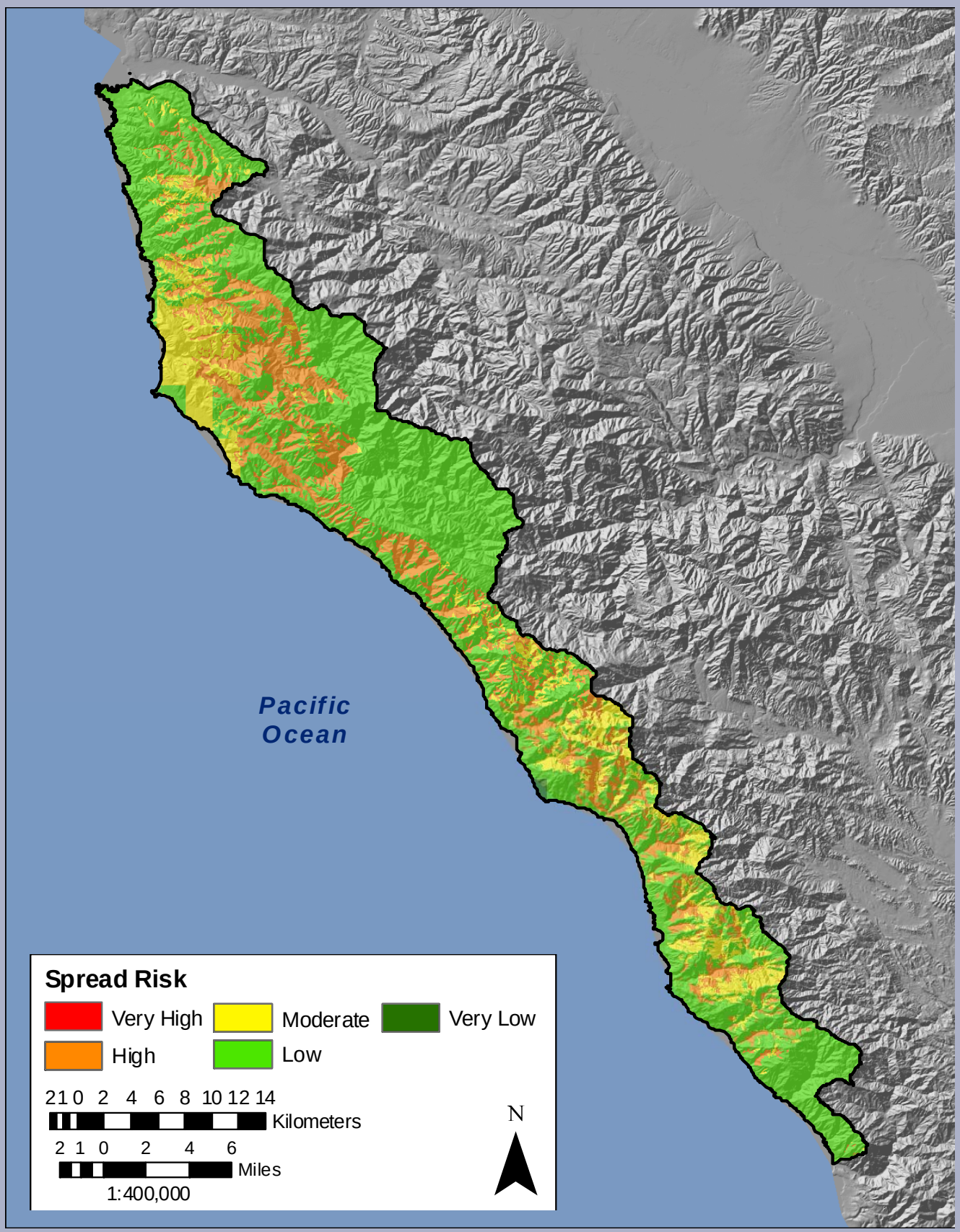
# Big Sur Ecoregion Ownership

| Owner | Acres | Percent |
|---|---|---|
| US Forest Service | 111478 | 56 |
| Private | 78623 | 40 |
| State | 6212 | 3 |
| Local Government | 97 | <1 |
| Military | 86 | <1 |
| Bureau of Land Management | 3 | <1 |
| Total | 196500 | 100 |

# Big Sur Ecoregion Ownership in mortality areas

| Owner | Acres | Percent |
|---|---|---|
| Private | 14741 | 62 |
| State | 1422 | 6 |
| US Forest Service | 7493 | 32 |
| | 23656 | 100 |

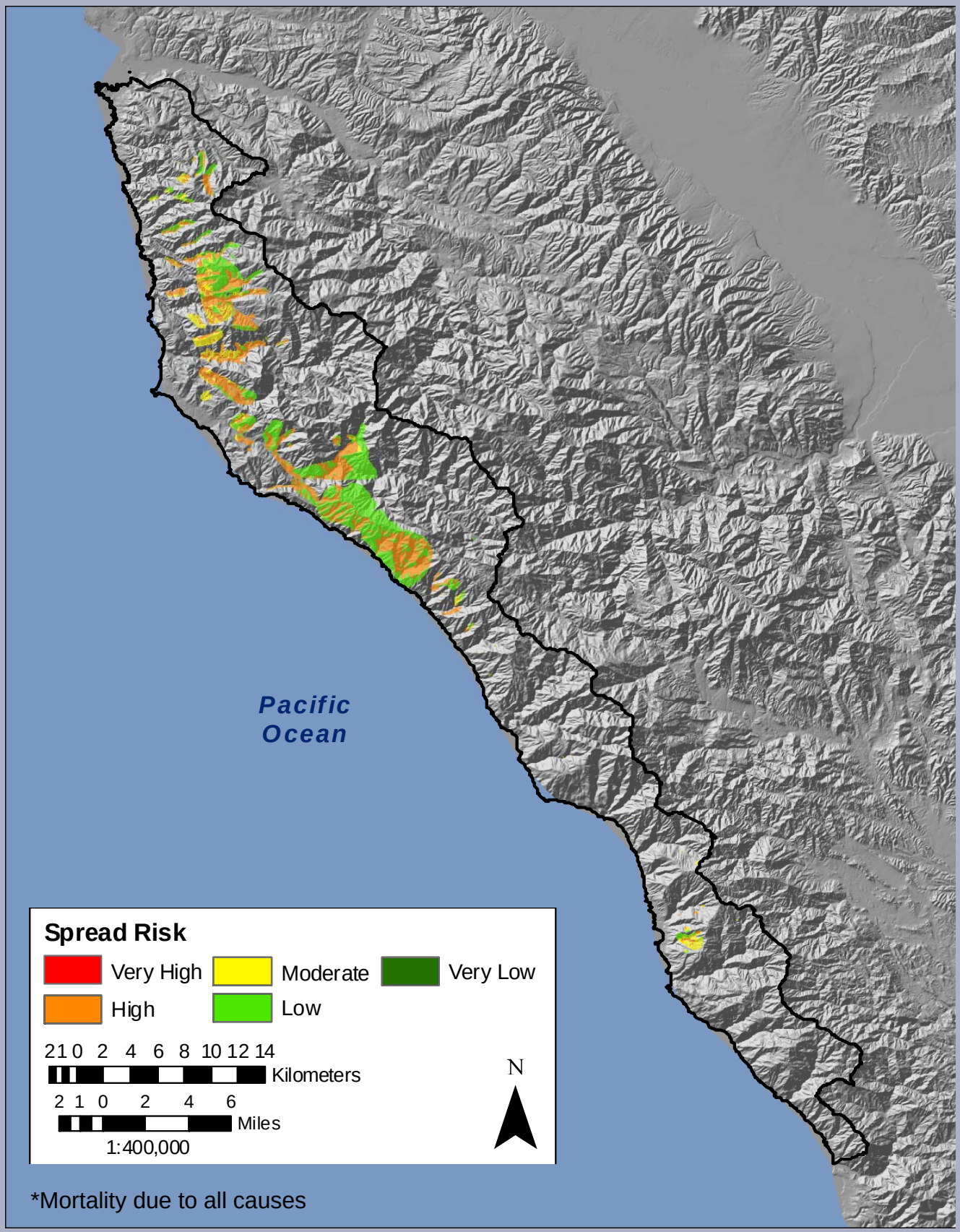
# Big Sur Ecoregion Sudden Oak Death Spread Risk



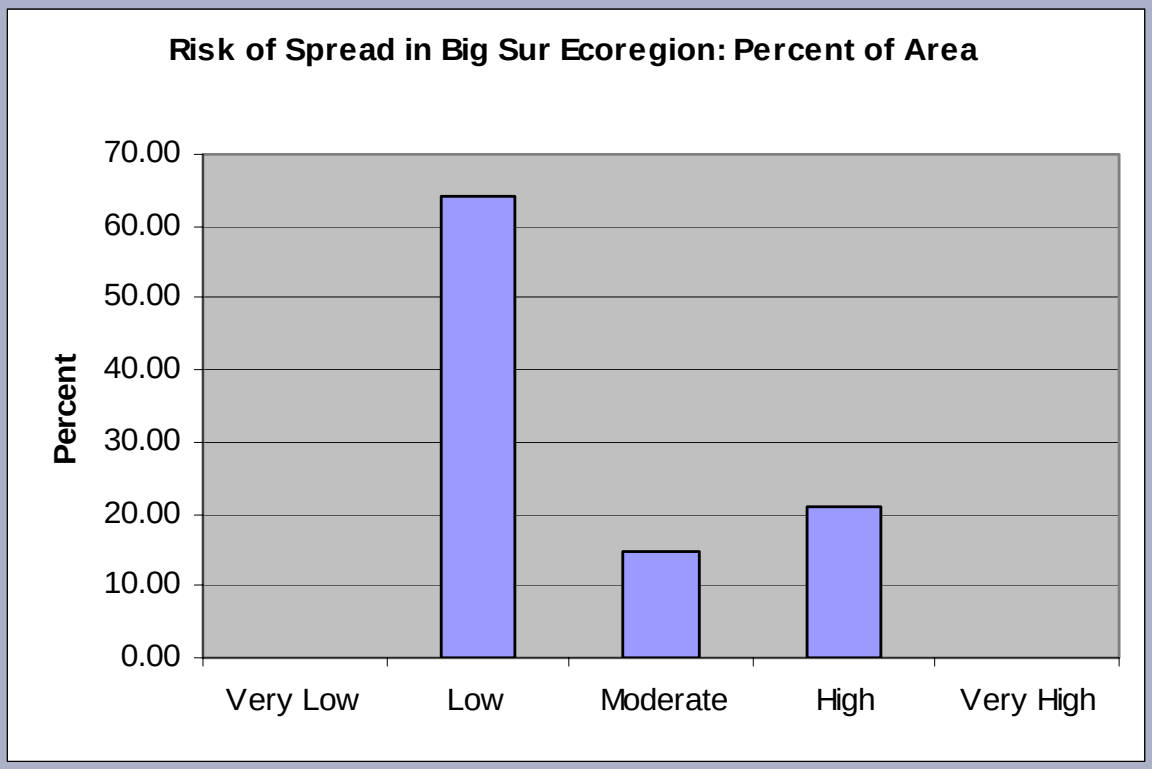

State and Private Forestry—Forest Health Protection

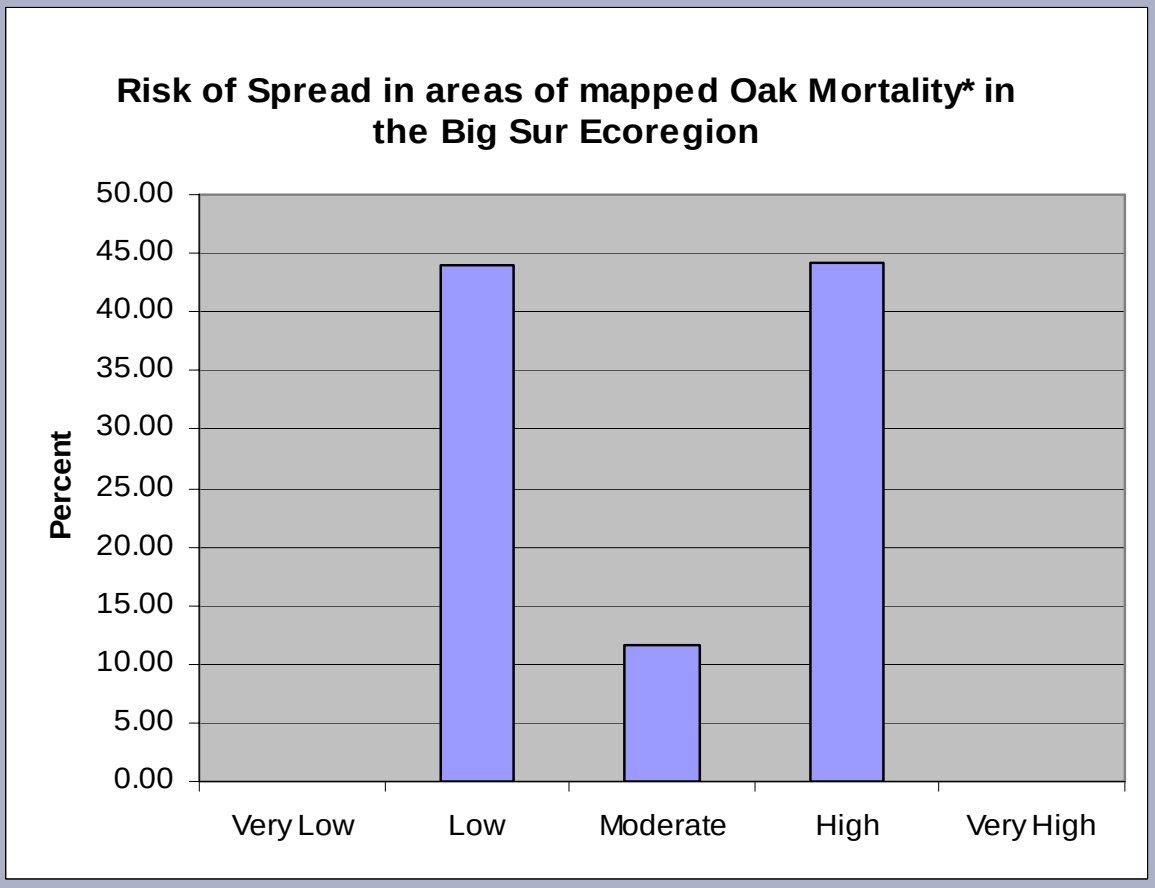
August 2006

# SOD Risk of Spread in Oak Mortality* Areas 2001-2005



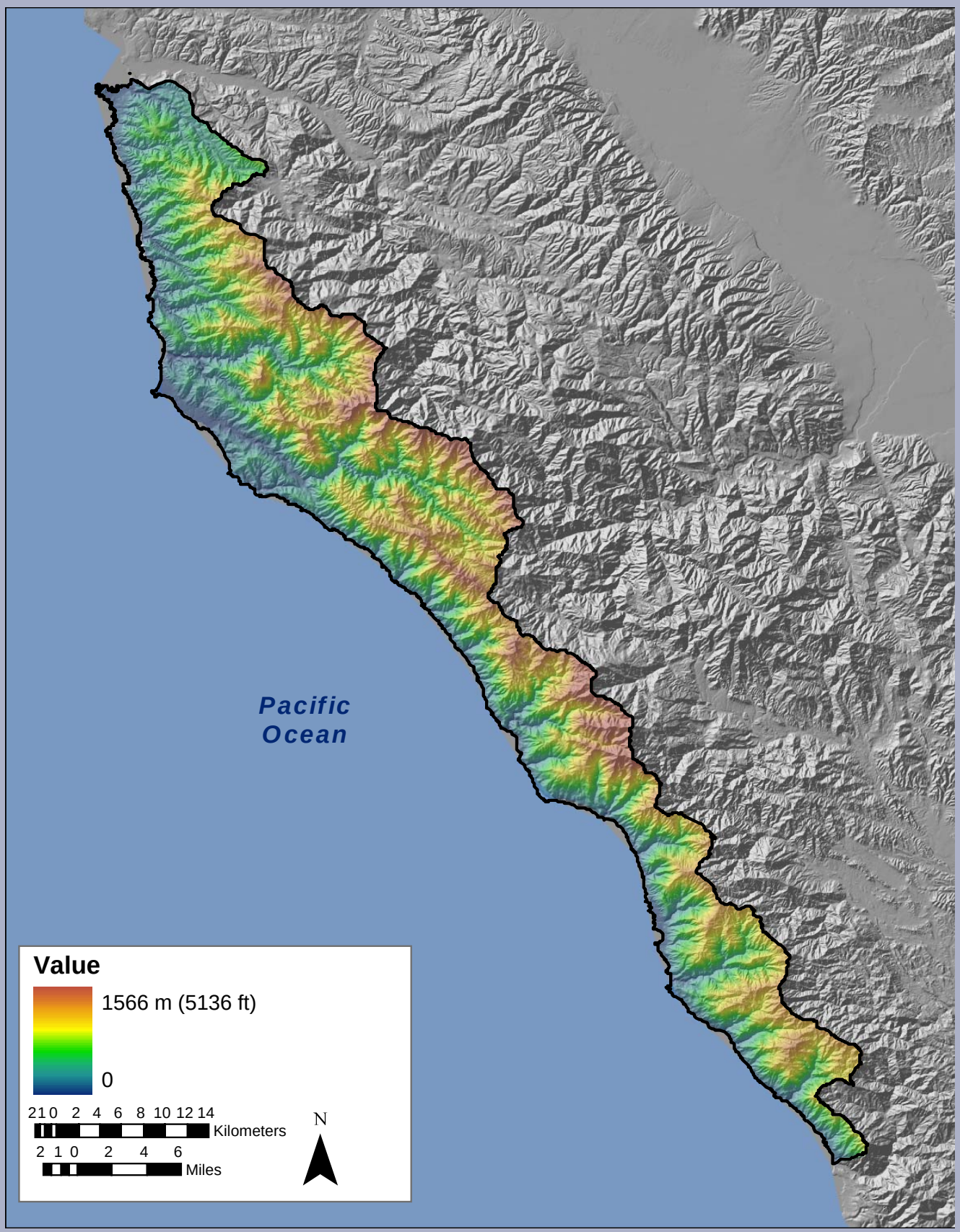

*Mortality due to all causes



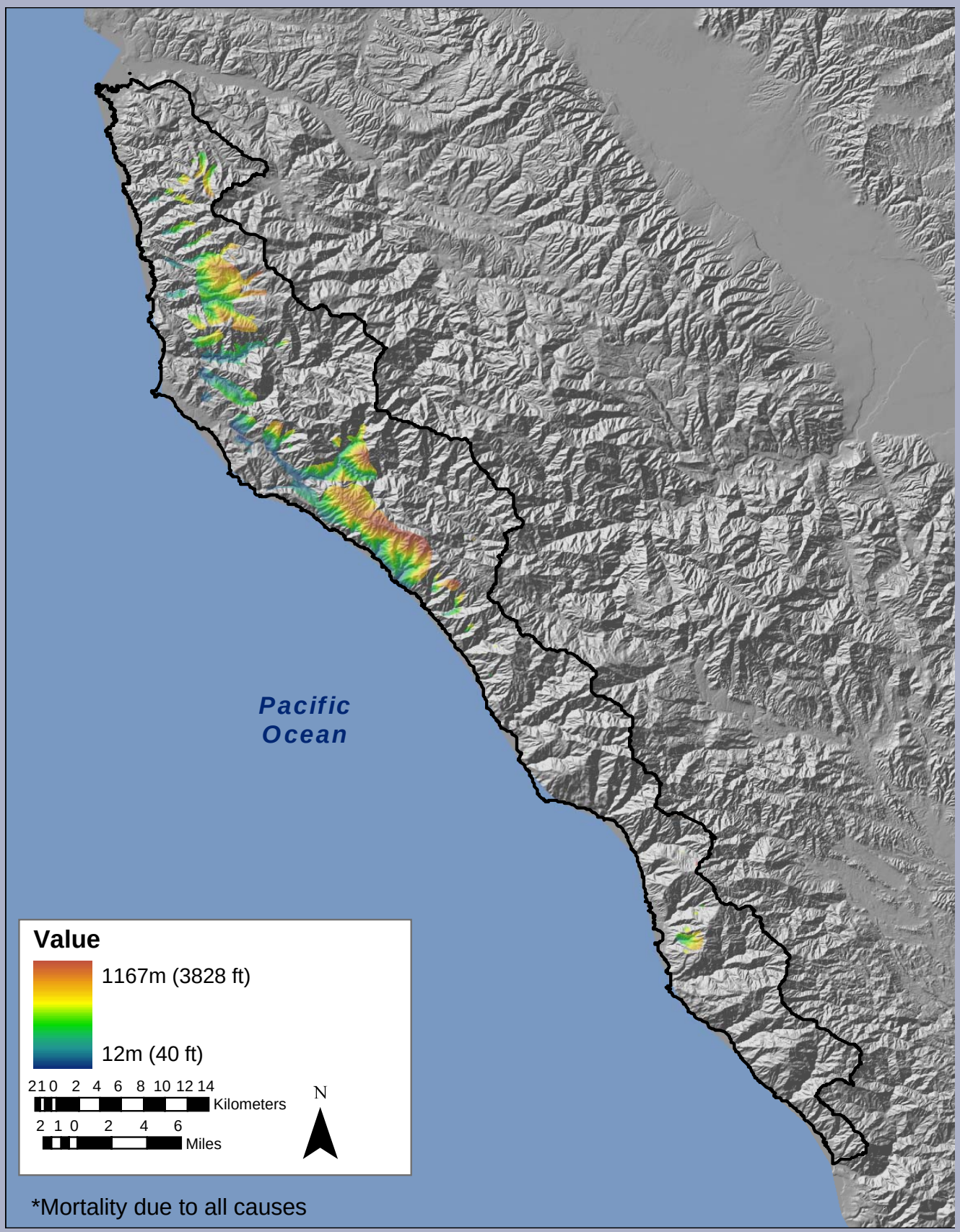




*Mortality due to all causes

# Big Sur Ecoregion Elevation

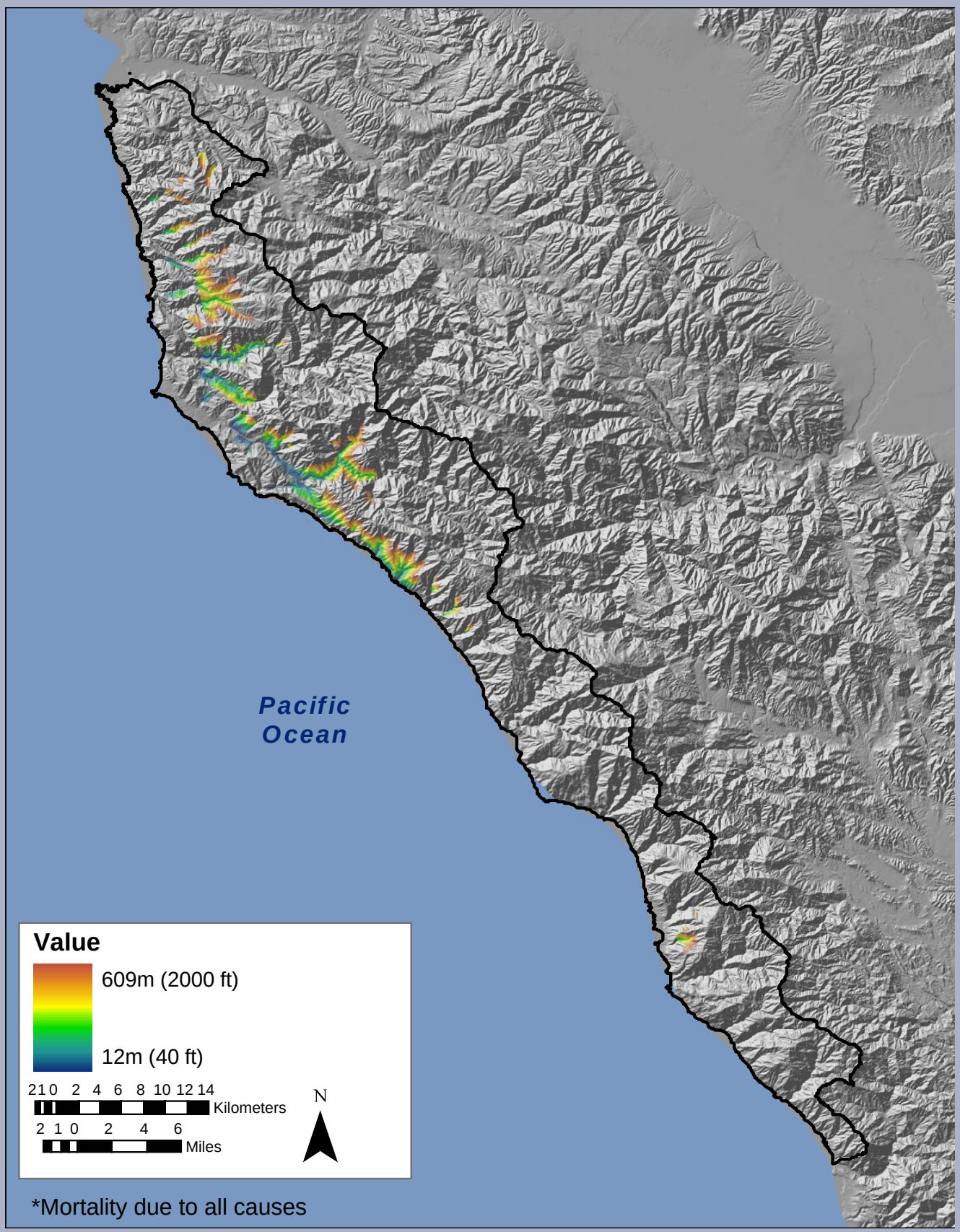


# Big Sur Ecoregion – Elevation in Mapped Oak Mortality* Areas




*Mortality due to all causes

# Big Sur Ecoregion – Elevation in Mapped Oak Mortality* Areas <2000ft




*Mortality due to all causes