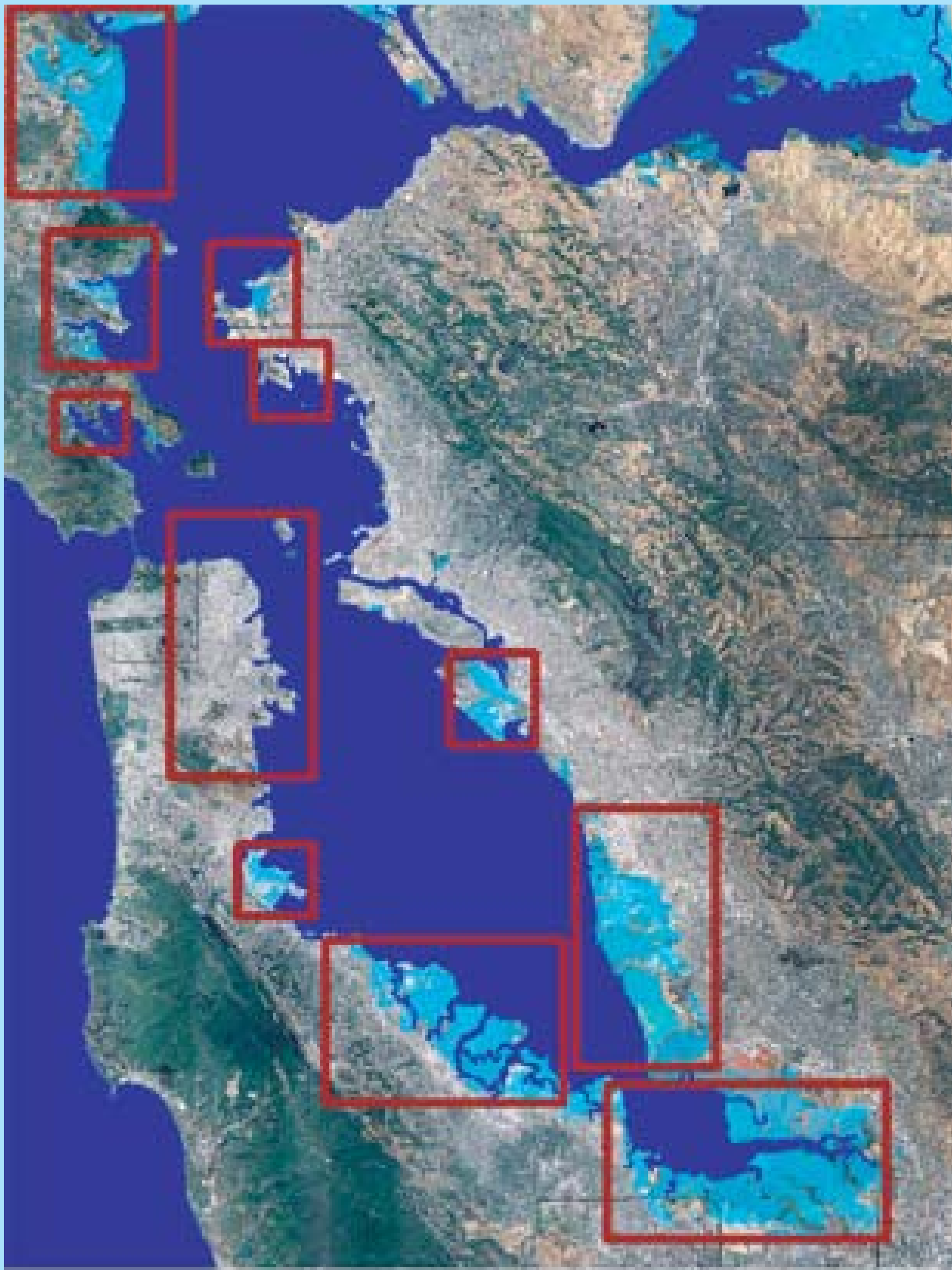


## Threats due to sea level rise, drought, and loss of snow pack

### Impacts of Sea Level Rise



Map is based on USGS 2m OSM and National Agriculture Imagery Program delta. Map is illustrative and depicts a potential inundation scenario in 2100. Limitation in the geospatial data available may affect accuracy. Map should not be used for planning purposes.

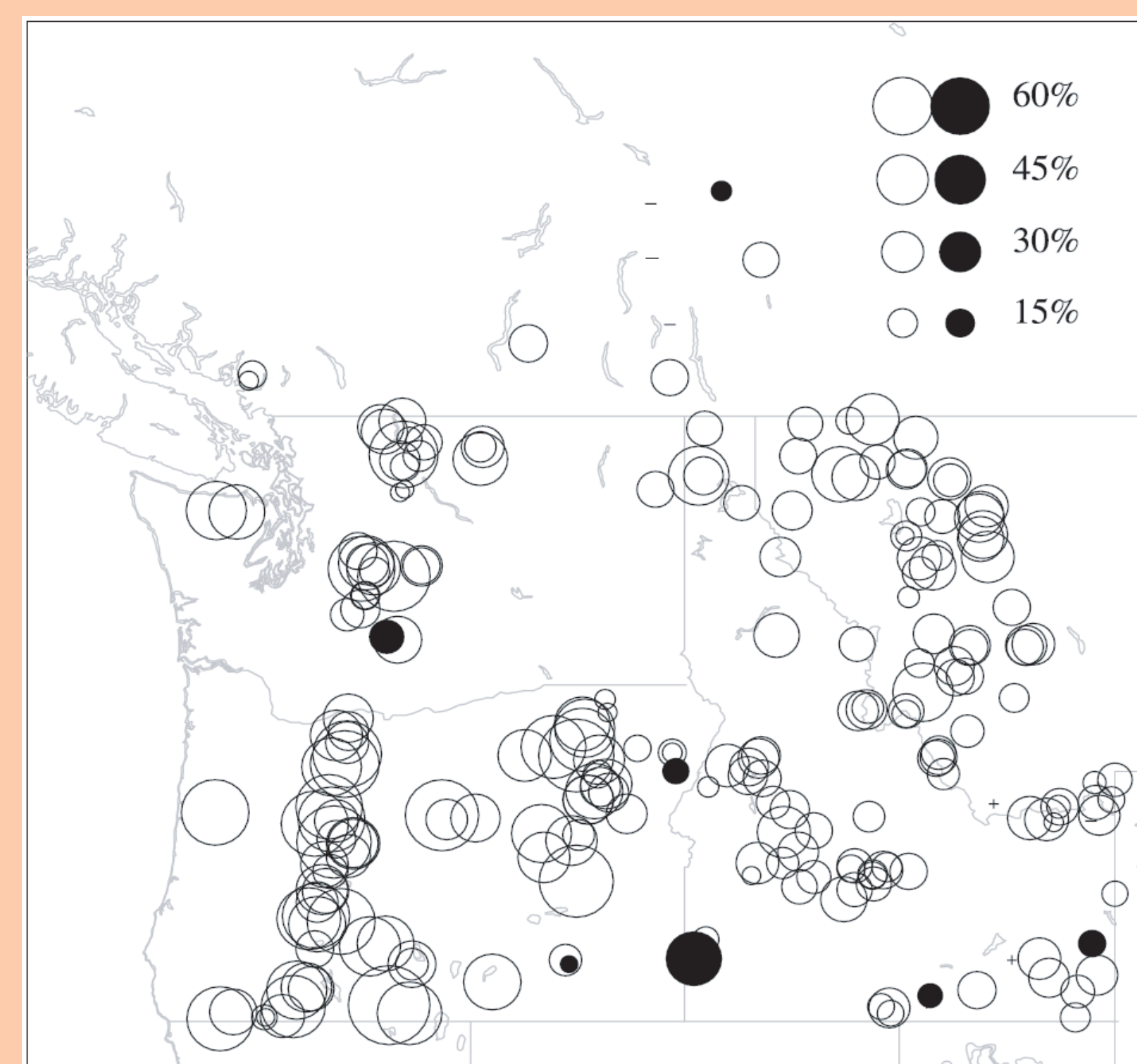
- \* With over 1,340 miles of coastline and 1,600 square miles of estuary, California is particularly vulnerable to changes in sea level
- \* In the next century, sea level is expected to rise 20-80 cm (8-30 in)
- \* Most at-risk are low-lying coastal areas, estuaries, and deltas
- \* Numerous levees exist within the San Francisco Bay estuary and delta system and are more likely to fail if inundated

### Main Points

- \* Increases in temperature over most of California will continue over the next century
- \* Snow pack and glaciers are melting faster than they are forming
- \* Droughts will continue to increase in frequency and duration
- \* Crop yield and quality decreases with increases in temperature and decreases in water supply
- \* Sea level rise of 1 m (3.3 ft) could inundate 77-193 mi<sup>2</sup> (200-500 km<sup>2</sup>) around the San Francisco Bay

### Impacts to Water Quality and Quantity

- \* Melt water derived from snow and ice decreased between 1950-2000, despite increases in precipitation
- \* In the 20th century, summer and fall mean temperatures in the San Joaquin Valley increased by >0.25°C (>0.45°F) per decade
- \* Land-use changes cause changes in albedo (percent of light reflected)
  - Albedo changes associated with irrigation increased temperatures by >0.4°C (>0.72°F) in San Joaquin Valley since 1913
- \* Higher temperatures increase water need and decrease yield/quality of crops
- \* Droughts increase potential for forest fires
- \* Sea level rise could result in sea water intrusion into freshwater supplies



(Above) Hetch-Hetchy reservoir supplies much of San Francisco's drinking water and is located in the high-Sierra. More periods of drought will put greater pressure on this freshwater supply. (Left) Changes in meltwater in Pacific Northwest (1950-2000). Open circles are decreases in melt water; closed circles are increases in melt water.

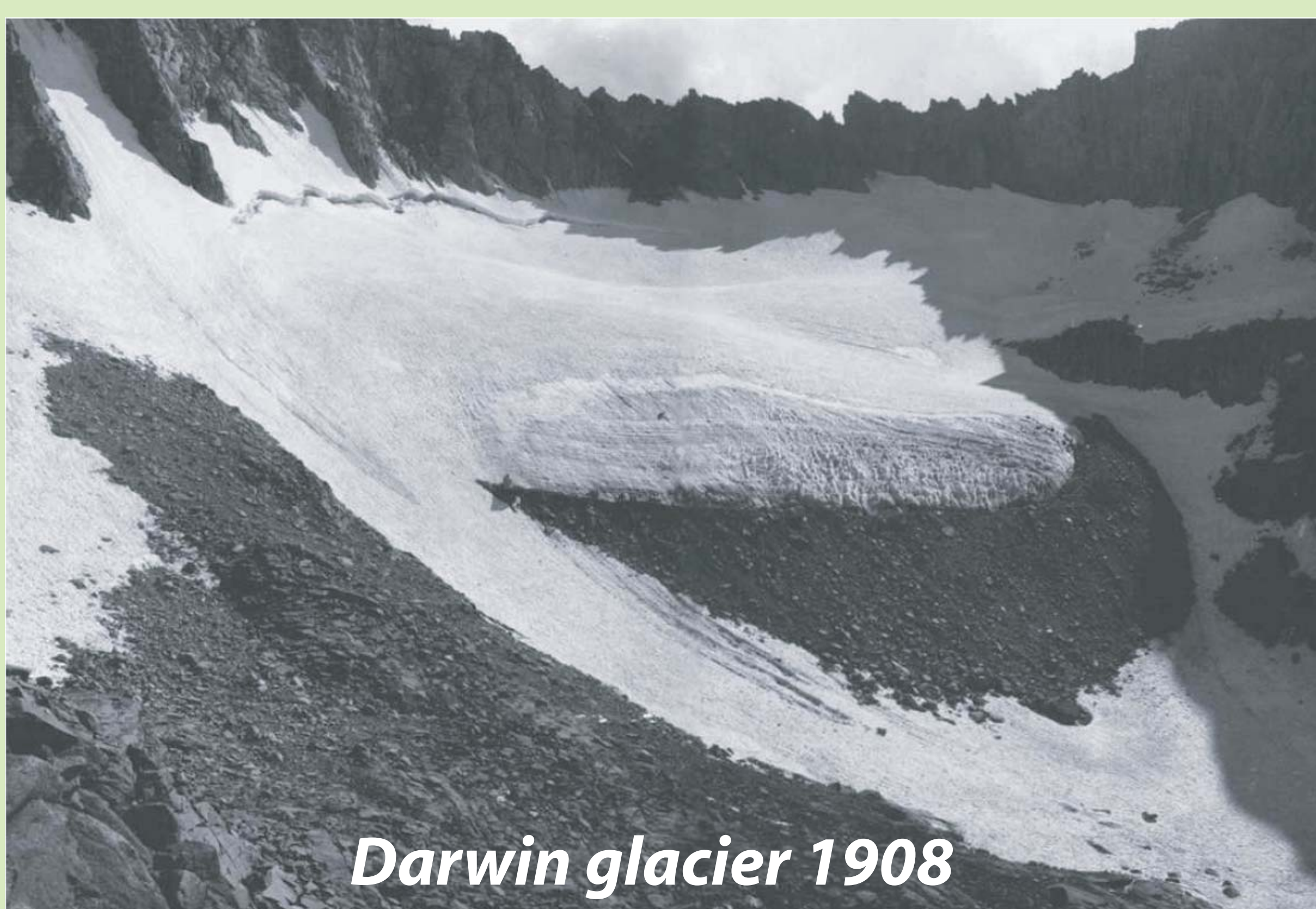
### Decreasing Wine Grape Quality

Wine Country	1961-1990	2070-2099			
	Current Conditions	LOWER EMISSIONS		HIGHER EMISSIONS	
Wine Country	Optimal (mid)	Impaired	Marginal	Impaired	Impaired
Cool Coastal	Optimal (low)	Optimal (mid-high)	Optimal (mid-high)	Optimal (high)	Impaired
Northern Central Valley	Marginal	Impaired	Impaired	Impaired	Impaired

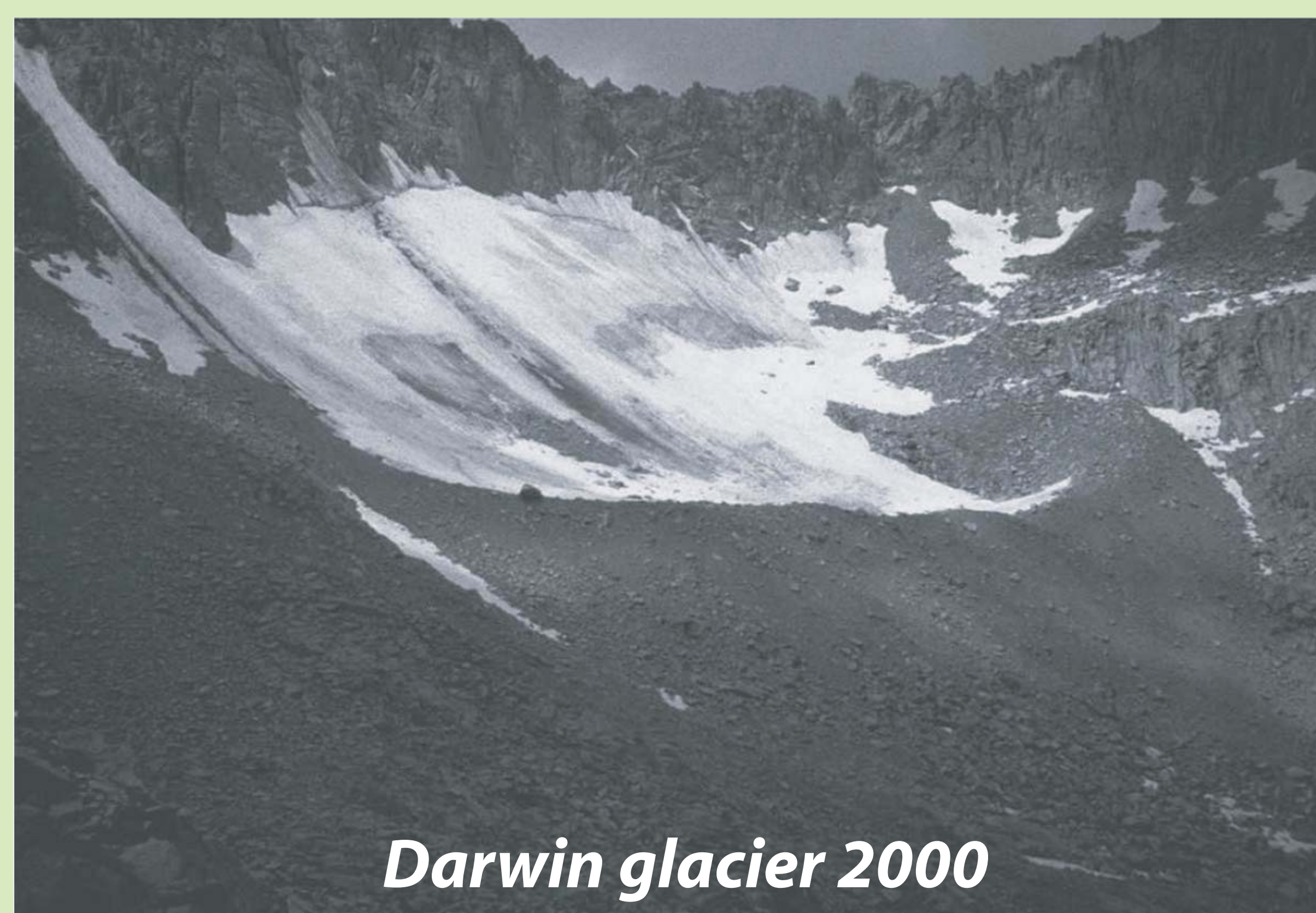
Source: M. Hanneman, UC Berkeley

- \* Wine is a \$33 billion industry in California
- \* Reasons why grape quality may decrease
  - Decreased water resources due to drought
  - Increased temperature

### Disappearing Glaciers



Darwin glacier 1908



Darwin glacier 2000

- \* Why are glaciers important?
  - Provide clean drinking water
  - Reflect heat away from Earth
- \* Glaciers in Yosemite have decreased in area by 30-70% since ~1900
- \* ~500 glaciers in California
- \* ~90% of California glaciers are in retreat
- \* Darwin glacier is a prime example of ice loss in the high-Sierra
  - 50-100 ft (15-30 m) of vertical thinning
  - Horizontal extent is also reduced