Rapid Assessment of Unpaved Roads and Trails

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  - In cooperation with California State Parks

Condition Assessment

- Observation and location data collected on:
  - Facilities
  - Erosion
  - Geomorphology
  - Hydrology
- Data managed in a GIS (geographic information system)

Erosion Assessment- Problem

Field conditions result from a history of events that are not precisely known during the assessment.

Speculations of the cause of particular conditions and appropriate mitigations can be subjective, controversial, and inconsistent.

Erosion Assessment - Solution

- We use a system of metrics and indicators to provide objective and transparent interpretations.
- We use the metrics to generate indices.

Metrics

- Observations and measurements of conditions adjacent to or within a road/trail that are recorded relative to linear distances along the road/trail.

Indicators

- Geological and hydrological conditions that generally relate to elevated erosion potential.
- These can be documented by fieldwork in combination with a GIS, aerial photos, and a variety of maps.

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Indices

- The indices provide relative scoring systems by which comparisons can be made.
- These indices are computed for each associated feature and at higher levels such as segments, networks, watersheds, or parks.
- Thus, indices provide data driven assessments of conditions at larger spatial scales.

Drainage Structures – Metrics and Indices

- 20 metrics represent various structural and functional impairments
  - maintenance issues,
  - installation issues,
  - mixed installation and environment issues, and
  - stressed fill.

Drainage Structure Metric- Example

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Drainage Structure Condition Index

- DSCI = (Condition factor) x (severity factor)
- DSCI values range from 1 to 16 provide a rating scale.
- The values are not pure mathematical quantities:
  - they are simply relative scores by which the data can be sorted and trends evaluated.

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Erosion – Metrics and Indices

- 24 metrics that represent various soil and hydrologic characteristics related to erodibility and runoff

Erosion Metric - Example

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Potential significance to water resources

- Factors that characterize the magnitude of potential significance for each event of erosion include:
  - 1) the severity of the erosion,
  - 2) the connectivity to water resources, and
  - 3) the width of the road/trail.

IPSWR

- IPSWR = (Connectivity factor) x (severity factor) x (road width factor).
- IPSWR values which will range from 1 to 60 provide a rating scale.
- IPSWR values are not pure mathematical quantities:
  - they are simply relative scores by which the data can be sorted and trends evaluated.

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Significance to Watersheds

- To consider the magnitude of significance at the scale of a watershed, add up the indices for that area.
- The total of the indices represents a general magnitude of the observed metrics affecting that geographic area.
- Watersheds with greater totals can be assumed to represent greater potential significance to water resources

Cluster Analysis

- Cluster analysis provides a basis (an actual map) for identifying any underlying associations with geology and landuse history that make one area more prone to erosion than another.

Cluster analysis - Example

- Mount Diablo State Park
- Clusters correlated well to a fault zone that hosts metallic ore deposits, primarily mercury ore.
- Clusters correlate especially well with areas that were mined and associated mining roads.

Cluster analysis - Example

- This suggests that on-going sediment discharges from these areas of legacy land use may include toxic metals.
- If spatially explicit geochemistry data become available, it could be used as another weighting factor for a more refined cluster analysis.

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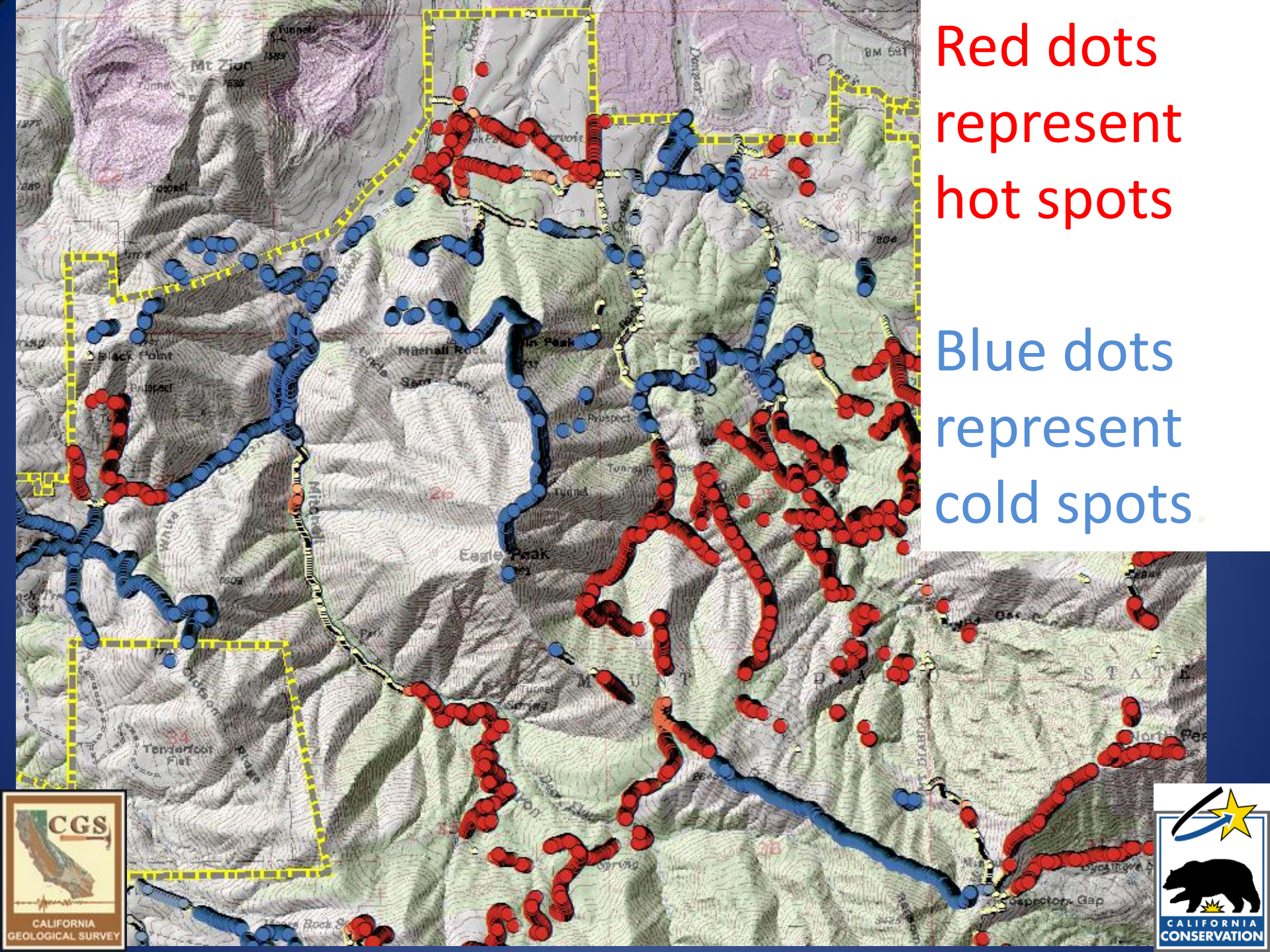
Red dots represent hot spots
Blue dots represent cold spots.
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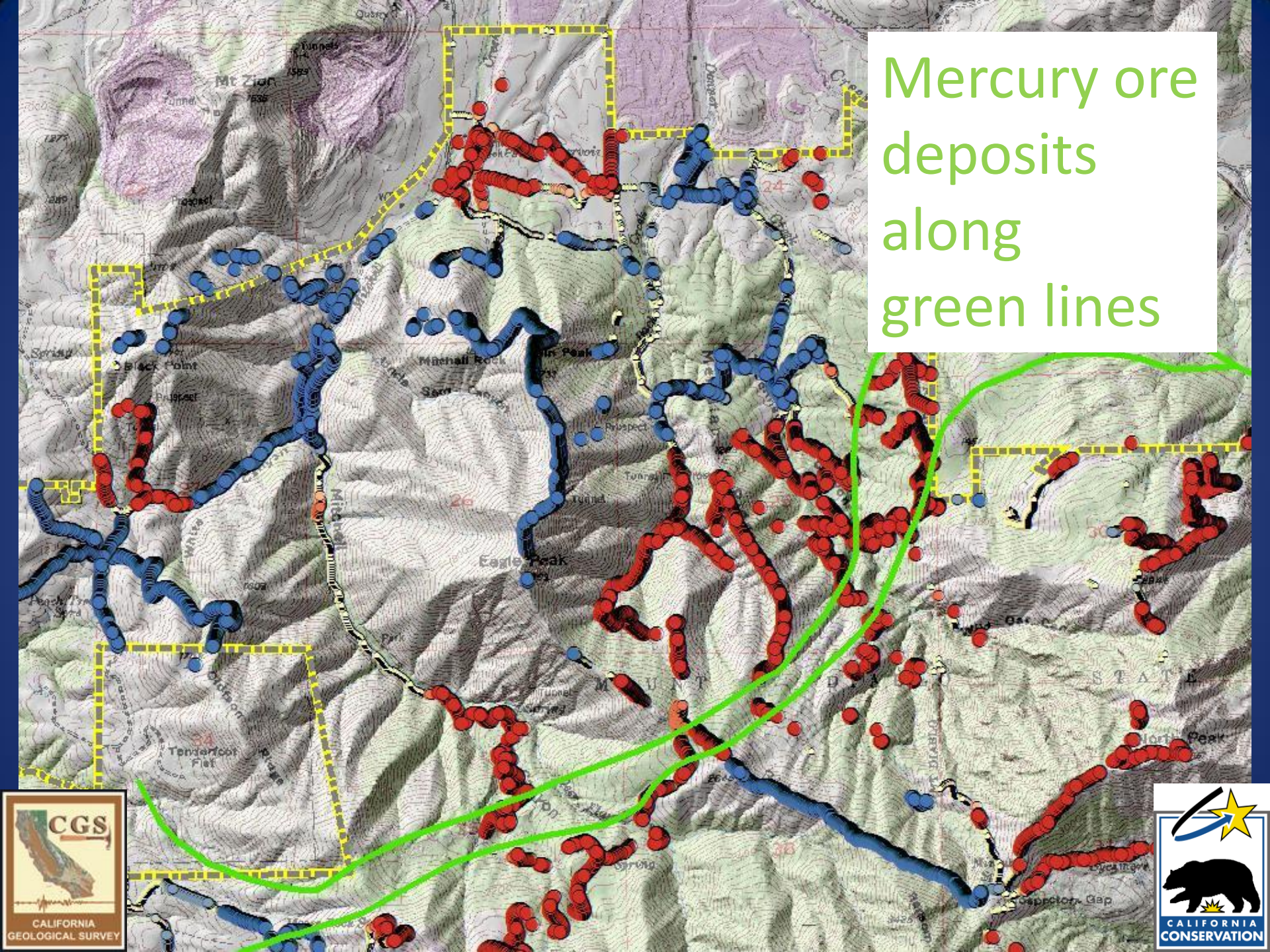
Mercury ore deposits along green lines
Mt Zion
Black Point
Eagle Peak
Tenderfoot Flat
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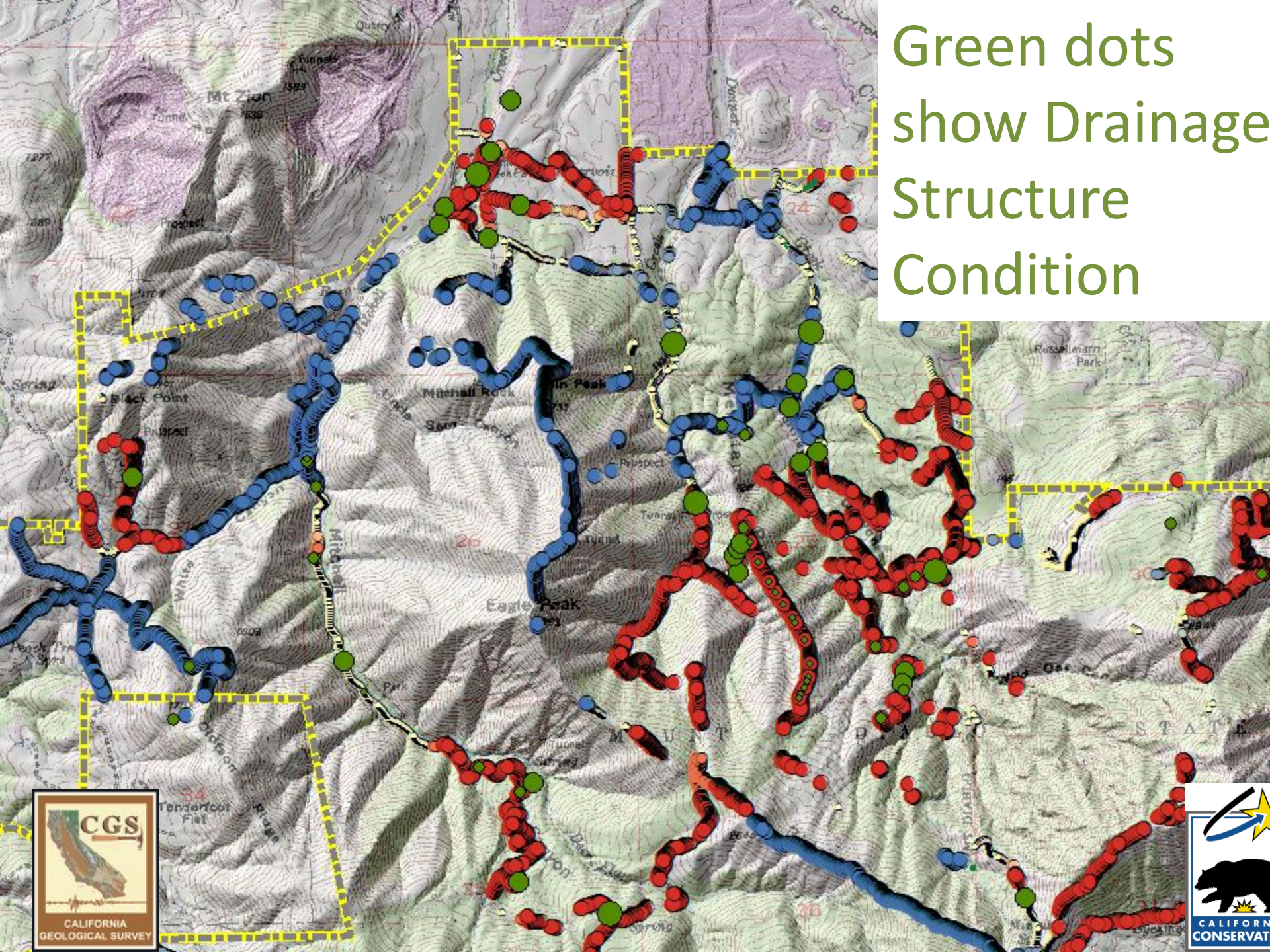
Green dots show Drainage Structure Condition
Mt Zion
Black Point
Mitchell Rock
Eagle Peak
Tenderfoot Flat
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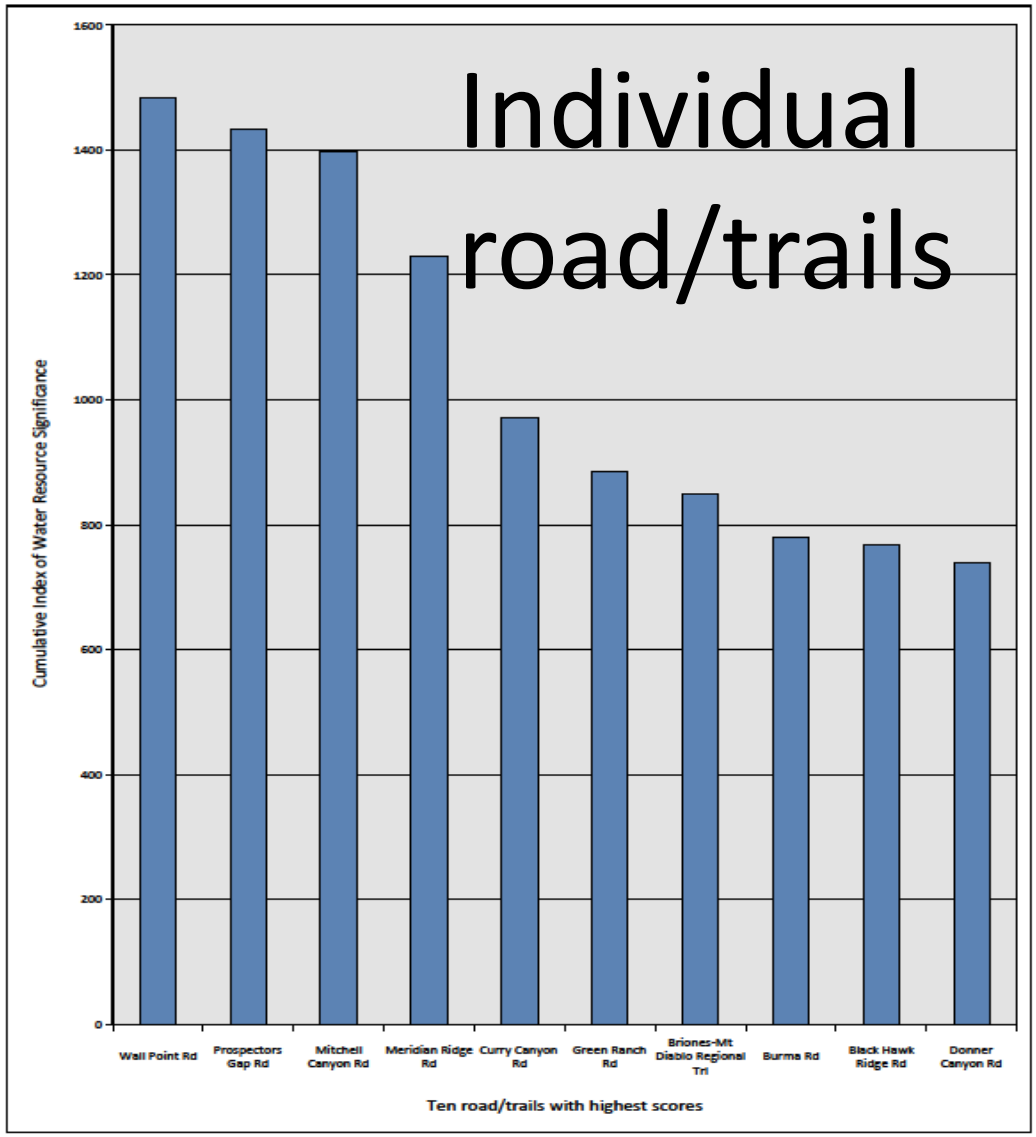

POTENTIAL SIGNIFICANCE TO WATER RESOURCES

To consider the magnitude of significance at the scale of individual road/trails, we simply add up the indices for the entire road/trail.

The top ten in terms of cumulative scores for potential significance to water resources are shown below.

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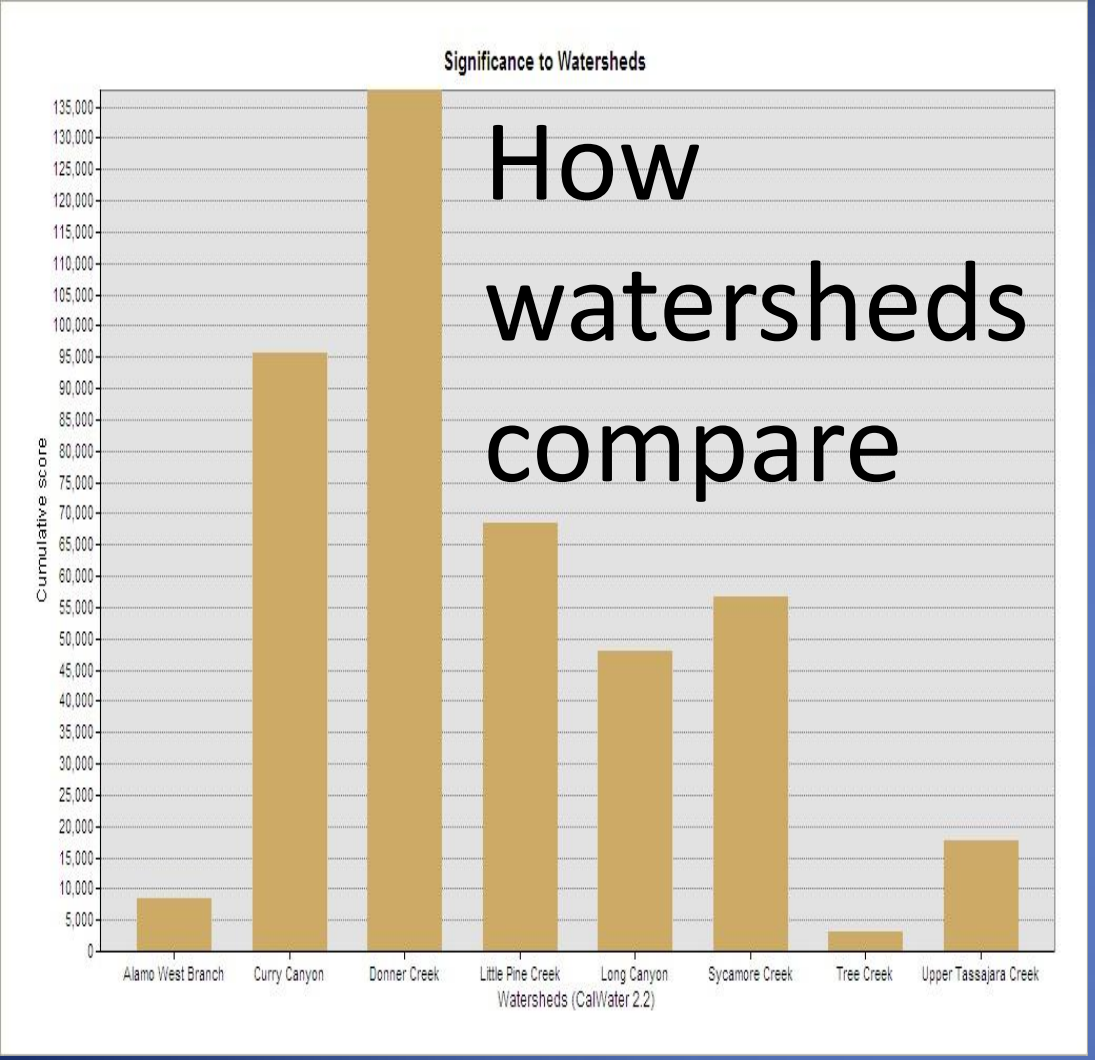

How watersheds compare

TALLY BY WATERSHED

By tallying up the sum of the indices of significance to water resources on a watershed basis, we can determine how watersheds compare.

The watersheds with the higher totals are potentially the most affected by erosion.

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Questions?