# Spatial approaches to refine agricultural chemical use areas for endangered species assessments: Study with California Tiger Salamander

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## Objectives

Conduct a geospatial analysis of a threatened and endangered species risk assessment with a tiered approach to characterize the **potential exposure of the California Tiger Salamander (CTS) to an herbicide use**. Overall approaches were:

- Obtain **best available geospatial data** for species habitat, pesticide use, crop, vegetation, hydrology and wetlands, and incorporate them in a step-wise manner to represent realistic spatial relationships.
- Identify the herbicide use within all California counties and narrow to **co-occurring counties and Public Land Survey System (PLSS) sections** based on U.S. Fish and Wildlife Service (FWS) CTS critical habitat definitions.
- Conduct **proximity analysis** to identify the closest distance of a potential pesticide use area to CTS critical habitat location.
- **Spatially refine the CTS critical habitat locations** using the species biological information to identify areas that spatially represent the species habitat range.

## Best Available Data at the State Level

### CTS Habitat and Biology

- Listed as threatened and endangered species[1]
- Biphasic life cycle (Figure 1):
  - aquatic phase - breeding, larvae and metamorphosis
  - terrestrial phase - juvenile and adult migration and feeding
- Species range in central CA:
  - grasslands and foothills
  - vernal pools and seasonal ponds (within grasslands & oak savanna) (Figure 2)
- Critical habitat[2] (CH) locations are distributed in 21 counties in CA (Figure 3)


Figure 1: EPA ES factsheet on CTS

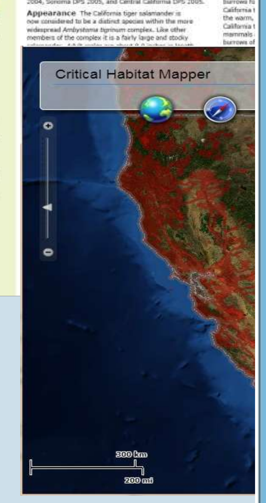


Figure 2: FWS Critical Habitat Mapper

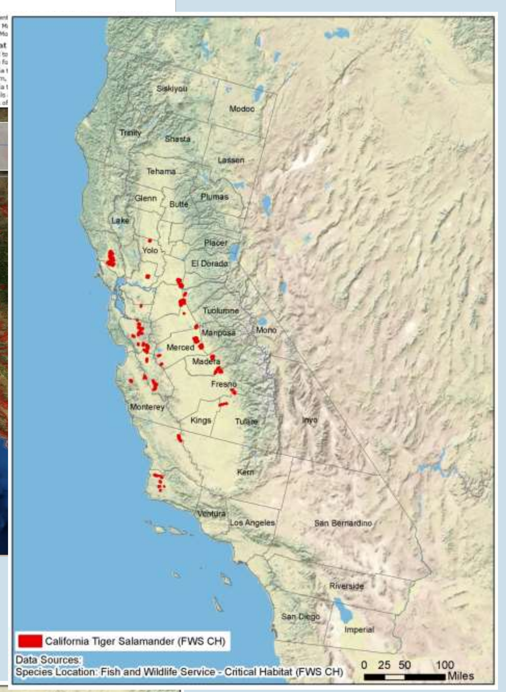


Figure 3: CTS critical habitat locations from FWS

### Historic Herbicide Use

- Historically, the herbicide was used[3] in 35 counties from 2001-2010
- All historic uses of the herbicide were considered, irrespective of current label restrictions (Figure 4)


Figure 4: Study herbicide use distribution at PLSS sections

### All Potential Use Sites

- Crop classes by EPA[4] were used and some classes were refined to separate out major crops (e.g.: orchards class was separated into citrus, grapes, ground fruit and ground nut classes)
- For all California, potential use sites were developed by creating a 4-year (2008-2011) composite of NASS-CDL[5] data to include all potential crop use areas
- For example, the 4-year composite contained 1,090,156 acres of grape production across the state (Figure 5)


Figure 5: 4-year composite NASS-CDL representing potential grape use areas

## Co-occurrence at County and PLSS Section Level

Study herbicide use and CTS critical habitat locations were examined for co-occurrence at county and PLSS section level

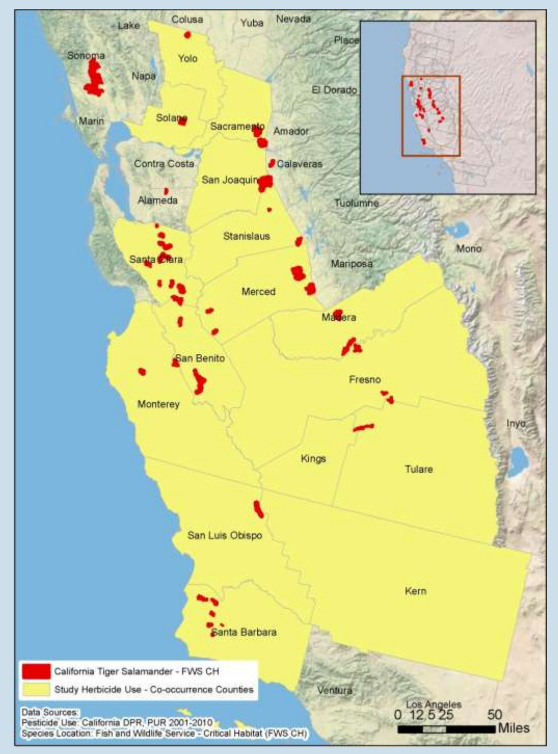


Figure 6: County level co-occurrence of CTS CH with herbicide use

### County Level Co-occurrence

At the county level, of the 35 counties with historic herbicide use, 16 show co-occurrence with CTS CH locations (Figure 6)

### Section Level Co-occurrence

- Further examining the 35 counties for herbicide use at PLSS section level, only 7 counties have reported use in the preceding 10 years
- Within these 7 counties, only 15 PLSS sections contained both CTS critical habitat and herbicide use (Figure 7)
  - This represents 0.38% of all historic use sections

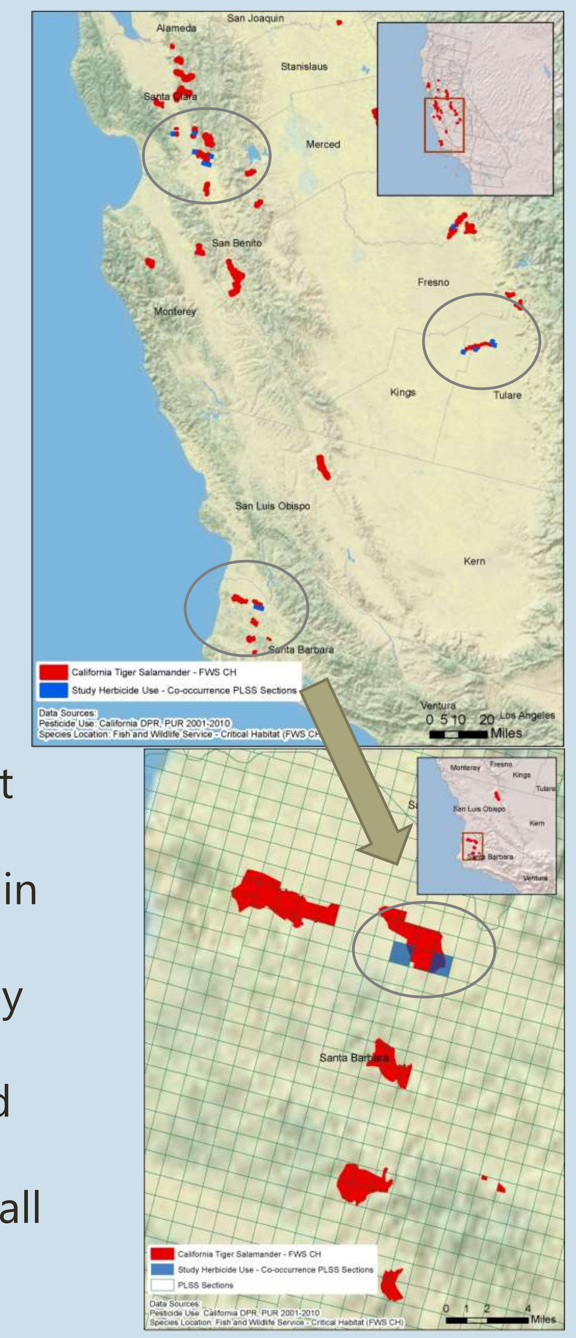

Figure 7: PLSS section level co-occurrence of CTS CH with herbicide use

## Proximity Analysis of All Potential Use Sites at the Local Level

- Geospatial analysis was conducted to determine the proximity of CTS critical habitat locations in relation to all potential herbicide use locations. An example of grapes is shown in Figure 8.
- A terrestrial spray drift model (e.g.: RegDISP) was used to determine a distance to identify CTS CH locations, for further refinement in consideration of potential effects (e.g.: 100 feet was selected for demonstration purpose)
- Proximity distance was calculated along the perimeter of CTS CH locations to the nearest potential use site
- Each CTS CH location and potential use site was characterized individually

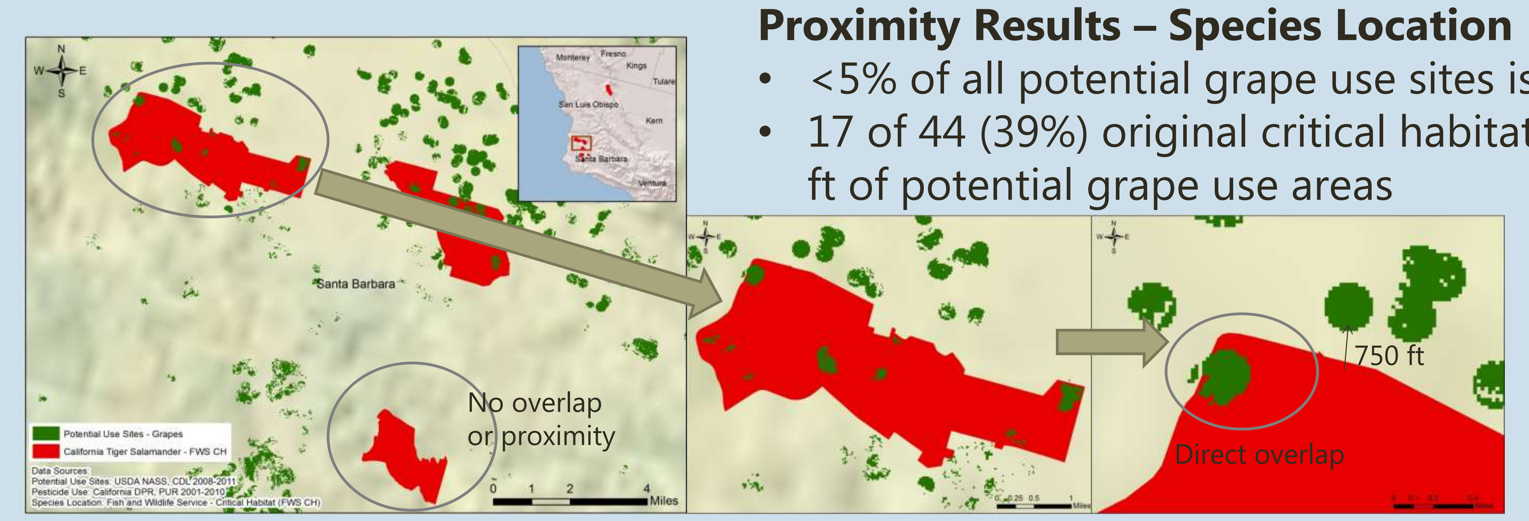


Figure 8: Grapes use sites showing overlap or proximity to CTS CH locations.

### Proximity Results – Species Location

- <5% of all potential grape use sites is within 100 ft of a CTS CH location (Figure 9)
- 17 of 44 (39%) original critical habitat locations were found completely outside 100 ft of potential grape use areas

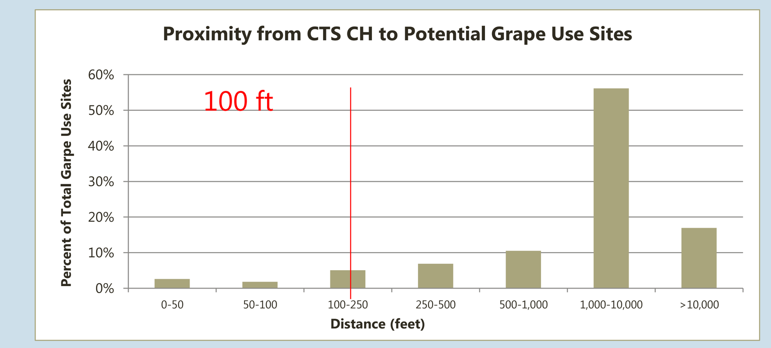


Figure 9: Extent of CTS CH proximity to grapes

## Example of Spatial Refinement using Biological Information

- Identify static waterbodies[6] & vernal pools/seasonal ponds[7] within CH boundary that represent CTS breeding pools
- Create spatial buffer based on the adult CTS movement distance range (1.3 mile[1]). Within the spatial buffer, identify land cover[8] (forest & grassland) that is suitable habitat for adult CTS movement that represents the "refined" habitat.
- The large original CH location polygons were separated into several smaller CTS "refined" habitat polygons.
- Spatial refinement reduced the total CTS critical habitat area by 19%, but varies for each habitat location (Figure 10)

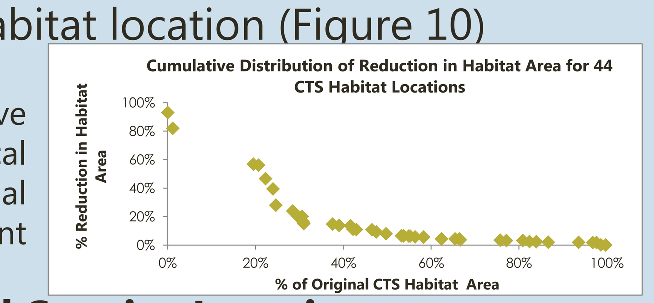


Figure 10: Cumulative reduction in CTS critical habitat area due to spatial refinement


Figure 11: Grape use sites in proximity to smaller "refined" CTS CH locations. Example shows single large CH polygon split into smaller refined polygons, reducing proximity of species locations and grape use areas.

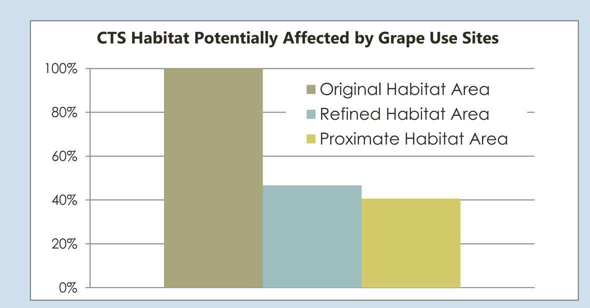


Figure 12: Reduction in CTS Habitat area potentially affected (100 ft) from grape use sites (example from Figure 10)

### Proximity Results – Refined Species Location

- In the CTS critical habitat example (Figure 11), area was reduced from a single polygon of 4,136 acres to 1,927 acres comprising 135 refined smaller polygons - 53% reduction
- Of the 135 refined polygons, 109 were found outside 100 ft of potential grape use areas, which represents 59% reduction from the original habitat area (Figure 12)
- 19 of the original 44 critical habitat locations (43%) were found outside 100 ft of potential grape use areas, and the subdivision into refined critical habitat locations reduced the area potentially affected (e.g., by 59% in the example shown)

## Summary

- The geospatial analyses were performed in a programmatic, documented and transparent way, allowing for full retrieval of all details.
- The proximity analysis results show that understanding spatial distribution of use sites and its proximity to species habitat was integral to asses potential exposure.
- Spatial refinements of critical habitat using ecological and biological information helped identify relevant areas of species habitat for evaluation of the exposure potential.
- The tiered approach offers a step-wise refinement to quantify the potential overlap of herbicide use with widely distributed species locations from state-wide to field scale.
- The study showed that geographical specific use information should be considered to refine potential use areas. In addition, the species-specific habitat characteristics and requirements (i.e., elevation, vegetation type, migration route and timing, and specific dietary preferences) could be considered for further refinement.

## References


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