Determining Spatial Distribution of *Toxicodendron diversilobum*

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Abstract

The distribution of western poison oak *(Toxicodendron diversilobum)* comprises a wider range of environmental conditions than any other California shrub. The purpose of this study is to identify a spatial relationship between the location of poison oak individuals in relation to: vegetation cover type, disturbed areas, and surface water. In a foothill environment in northern California, poison oak individuals within belt transects were recorded in a GPS. A large portion of the analysis had a spatial component and was done in a Geographic Information System (GIS). A measure of density by vegetation cover type, and distances from each poison oak individual (N=308) to the nearest disturbance, and nearest surface water source was calculated in a GIS. The slope and aspect at each individual was also analyzed.

Poison oak of both growth forms is more commonly present in close proximity to a disturbed area and in low-sloping areas near surface water sources. Riparian and mixed oak vegetation types are correlated with vining poison oak.

Introduction

Western poison oak (*Toxicodendron diversilobum*) has one of the widest geographic ranges of any native Californian shrub. It is found under a greater variety of soil conditions, temperature, and rainfall ranges than any other Californian shrub. Poison oak is also unique in its ability to grow in extreme shade, and full-sun. A useful structural adaptation of poison oak is its ability to grow as a climbing vine with presence of a support, instead of as a shrub.

Proximity to disturbed areas and surface water can strongly influence the composition of vegetation found at any site. Disturbed areas can create edge effects that influence the hydrology, insolation, and nutrient cycling at a site. Edge effects offer a unique opportunity for plants to exploit these conditions if they can adapt to the differences. Different habitats offer different variables that can be exploited by species with particular adaptation traits. This study explored the spatial distribution of climbing and non-climbing poison oak individuals in relation to disturbances and sources of surface water. The influence of dominant vegetation type and slope were also examined.

Methods & Materials

To explore the relationship between the distribution of poison oak and three spatial variables, poison oak individuals were sampled in three distinct areas of Upper Bidwell Park, Chico, CA. The variables being explored were distance to a disturbance (road or trail), distance to a surface water source (ephemeral or perennial stream), and dominant vegetation type. Individuals were classified as climbing or non-climbing and recorded with a GPS waypoint.

Poison oak individuals were sampled using a 10 meter wide belt transect located within either a valley oak, blue oak, or mix oak dominated vegetation type as identified from a vegetation map of Upper Bidwell Park. Transects were identified using Google Earth, and chosen to capture a range of gradients (i.e. elevation, distance to water).

Waypoints were exported from the DeLorme PN-40 GPS and brought into ESRI's ArcMap. Trails, roads, and streams not traced in the field were drawn in Google Earth, and brought into ArcMap for spatial analysis. A Near analysis was done to determine the distance from each poison oak individual to the nearest disturbance, and nearest source of surface water. Slope and aspect for each individual was determined from a Digital Elevation Model of Butte County. The area of each vegetation type within each transect was calculated to get a density of poison oak by vegetation type.

Statistical analysis was done using IBM SPSS. For all statistical tests, an alpha value of 0.05 was used.

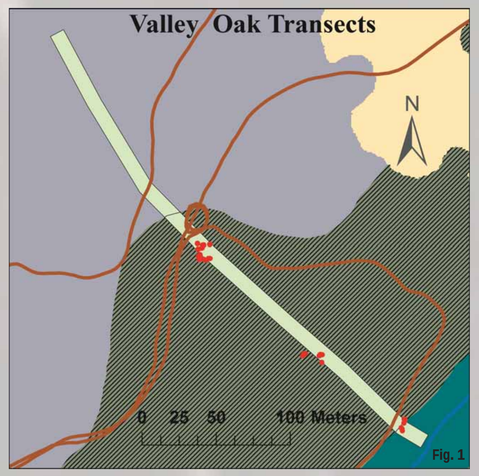
Results

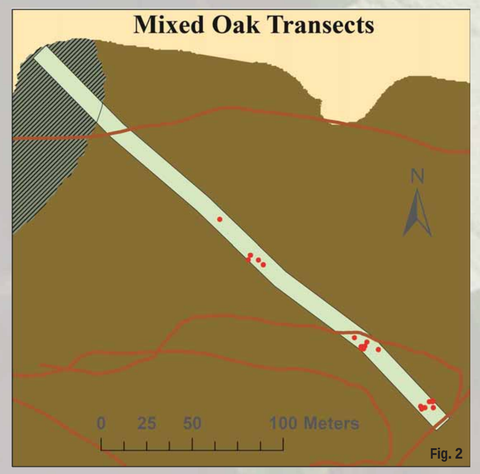
There is a strong association between climbing poison oak, riparian, and mixed oak vegetation types. From nonparametric tests, the distribution of values for the variables: distance to water, distance to disturbance, and slope are significantly associated with growth form of poison oak. Riparian vegetation type has a significantly higher density of poison oak individuals per square kilometer than any other type, while mix oak and valley oak types have nearly identical densities.

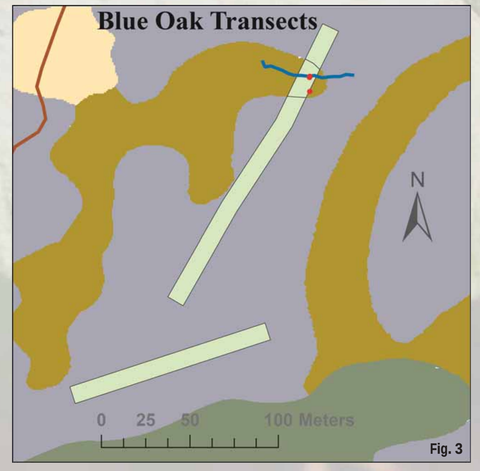
Conclusions

Riparian vegetation type has a very high density of poison oak possibly due to its close association with surface water, and increased activity of animals which play a role in seed dispersal. The similar densities of mix oak and valley oak vegetation types are expected because their habitat characteristics are very similar in stand density and understory vegetation composition.

It can be concluded that the morphological adaptation of vining poison oak is most common near large trees that create a high amount of canopy closure. Poison oak of both growth forms is more common in low-sloping areas in close proximity to disturbed areas and sources of surface water, even if the source is ephemeral.







Figures 1, 2, 3: Distribution of poison oak individuals in transects. Survey transects with disturbance and surface water features included on top of vegetation cover type basemap.

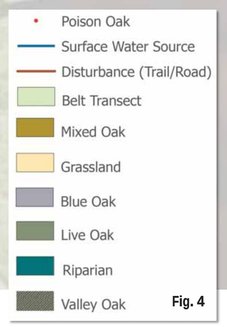


Figure 4: Legend for Figures 1,2, and 3.

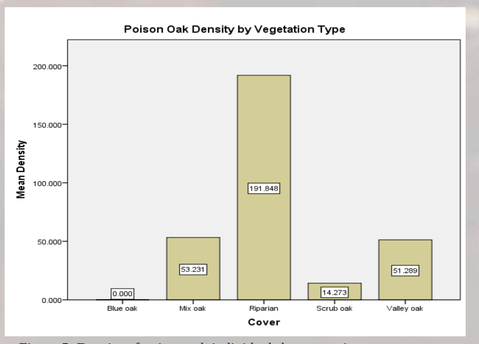


Figure 5: Density of poison oak individuals by vegetation cover type (individuals/sq km). (N=308).

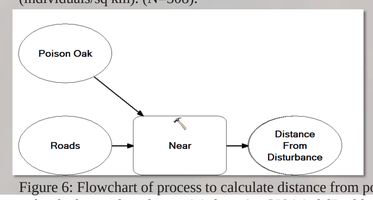


Figure 6: Flowchart of process to calculate distance from poison oak individuals to a disturbance. Made in ArcGIS ModelBuilder.

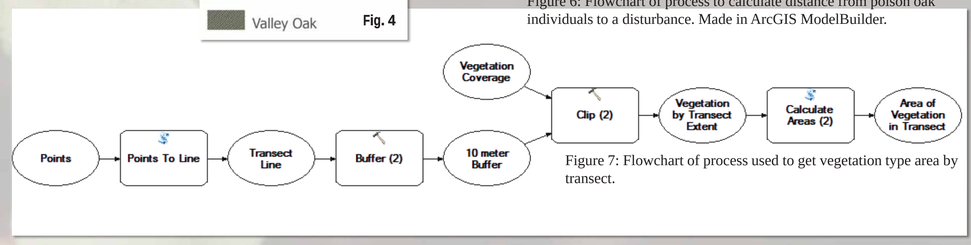


Figure 7: Flowchart of process used to get vegetation type area by transect.