

Noxious Weed, *Dittrichia graveolens* (Stinkwort) reduces species richness of other plants; but *Salvia* spp. may provide a mechanism for suppression.

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Introduction

Study species: *Dittrichia graveolens*

Invasive species, in particular members of the Asteraceae such as *Dittrichia graveolens* (stinkwort), have rapidly been expanding their range in California over the past decade. This species can form monoculture stands in disturbed areas. It has been associated with seasonally mesic soils with moderate to high drainage, both volcanic and serpentine in origin - quickly outcompeting native forbs and grasses. Each invaded site is a mesic soil, with moderate to high drainage, and each site is near a road or travel path. In several locations, the soil is relatively barren save for individuals of this species. Some sites, such as that in the Lake Murray Reservoir area (San Diego County), are often frequented by people.

Stinkwort Invasions and Health Hazards

Native to northern Africa and parts of the Mediterranean, *D. graveolens* is considered a noxious invasive weed in Australia and other Mediterranean regions. Stinkwort was first reported in 1984 in Santa Clara County, and by 2012 it had spread to 36 of California's 58 counties (Brownsey et al. 2013). True to its name, stinkwort exudes a cocktail of pungent terpene aromatics. Related economic impacts include loss of forage (livestock generally avoid this species), livestock mortality due to ingestion of barbed seeds (enteritis), dermatitis, and a foul smell that can interfere with open space use.

Chaparral and Stinkwort

Dittrichia graveolens, living its life in a rosette phase after germination, is quick to form a deep taproot that soaks up large water volumes, allowing it to adapt to nearly any soil. In the case of southern California's coastal chaparral biome, there appears to be an exception. However, *D. graveolens* appears unable to establish in native chaparral, an effect that was observed in the field. Observations at the Poway and Murray Lake sites in San Diego while measuring transects noted a conspicuous absence of any stinkwort amidst or near any large stand of sage plant (*Salvia* spp.) in coastal chaparral habitats, despite clear seed access to the chaparral areas. Further experimental work will evaluate whether sage can stymie stinkwort growth.

Objectives

The overall goal of this preliminary study was to characterize plant species richness and aboveground biomass in areas where stinkwort has invaded. Our specific objectives were to address the following questions:

1. Does *Dittrichia graveolens* decrease the species richness of cohabiting plants? If somewhat nonlinear, this suggests that other factors besides spatial preemption control the interaction beyond some threshold level of stinkwort percent cover.
2. Does *Dittrichia graveolens* reduce the amount of local biomass (living and dead) of adjacent plants? If relatively nonlinear, this suggests that other factors besides spatial preemption control the interaction beyond some threshold level of stinkwort percent cover.
3. Do any local ecotones demonstrate a resistance to the advance of stinkwort?

Materials and Methods

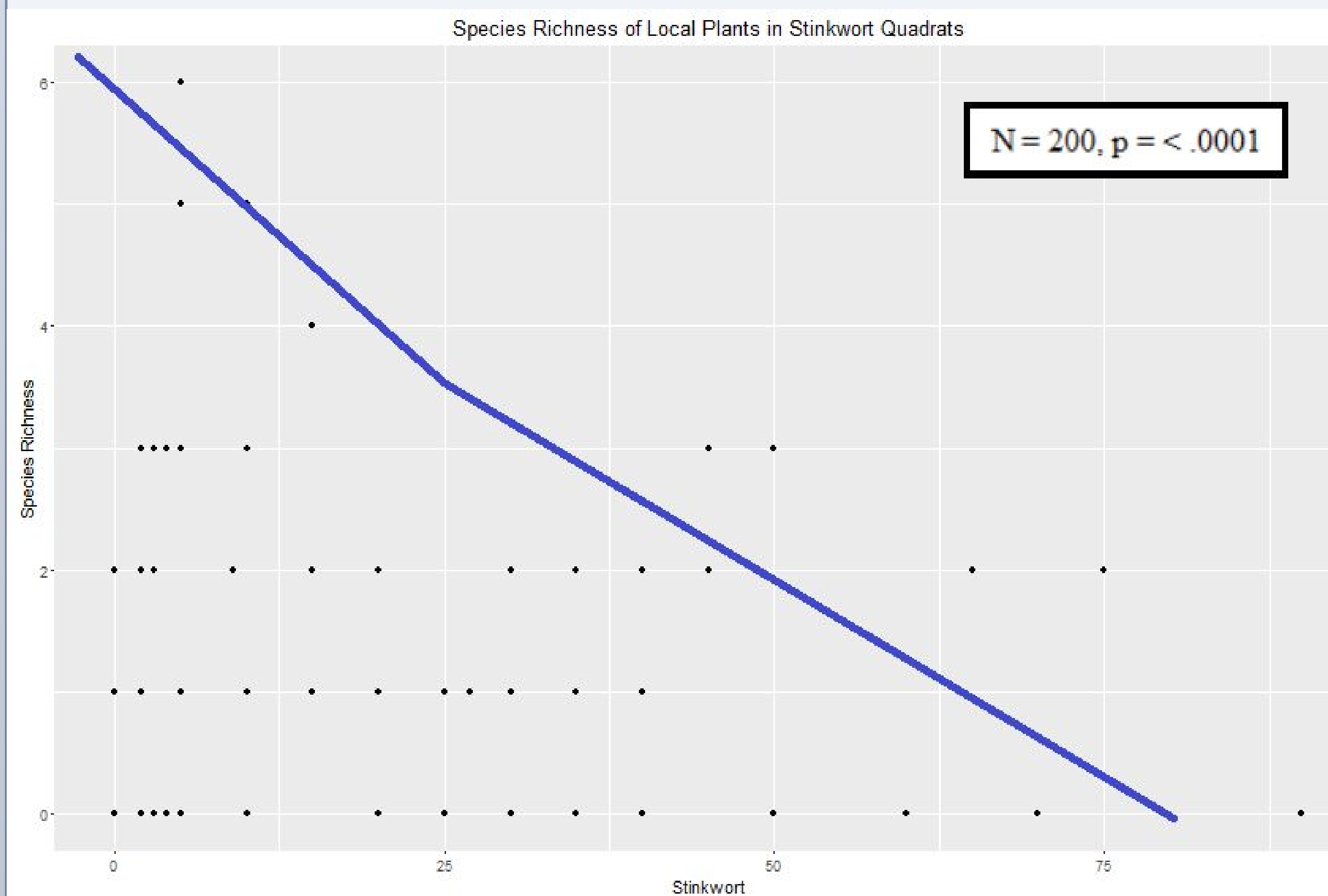
Potential sampling sites for *Dittrichia graveolens* populations in northern California (Butte and Glenn counties) and southern California (San Diego County) were identified from historical records (Consortium of California Herbaria; ucjeps.berkeley.edu/consortium). Criteria for sampling included a range of stinkwort densities present at each site.

Within a total of 8 transect sites (1 in Glenn County and 7 in San Diego County), ten 10-m long transects were established for quantitative sampling. Two (3 in Glenn County) transects were sampled within each site. For each transect, species identity and relative percent cover was recorded within 0.5 m² plots at 2 m intervals on alternating sides of a transect tape. In addition, at half of the transect sites, above-ground biomass was harvested, dried, and weighed to compare relative biomass production.

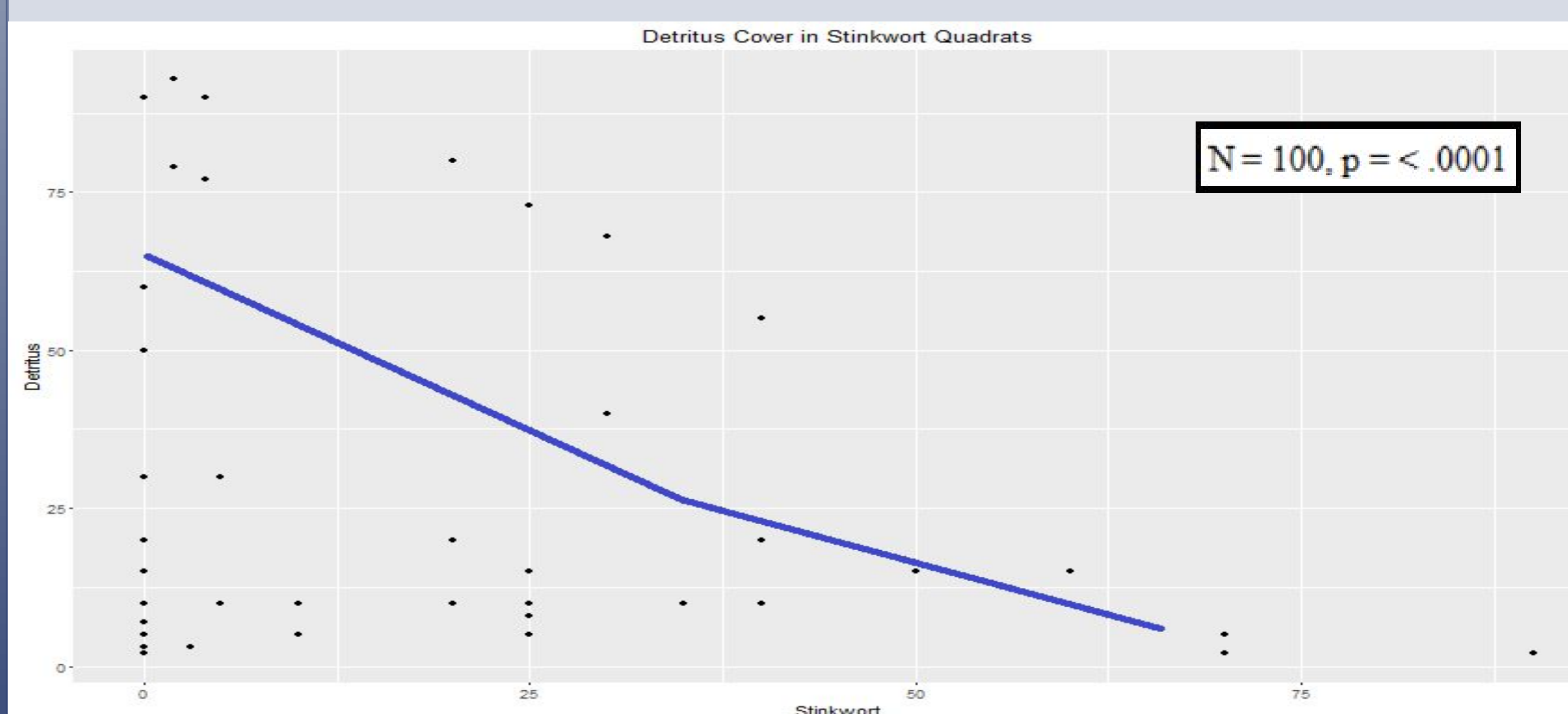
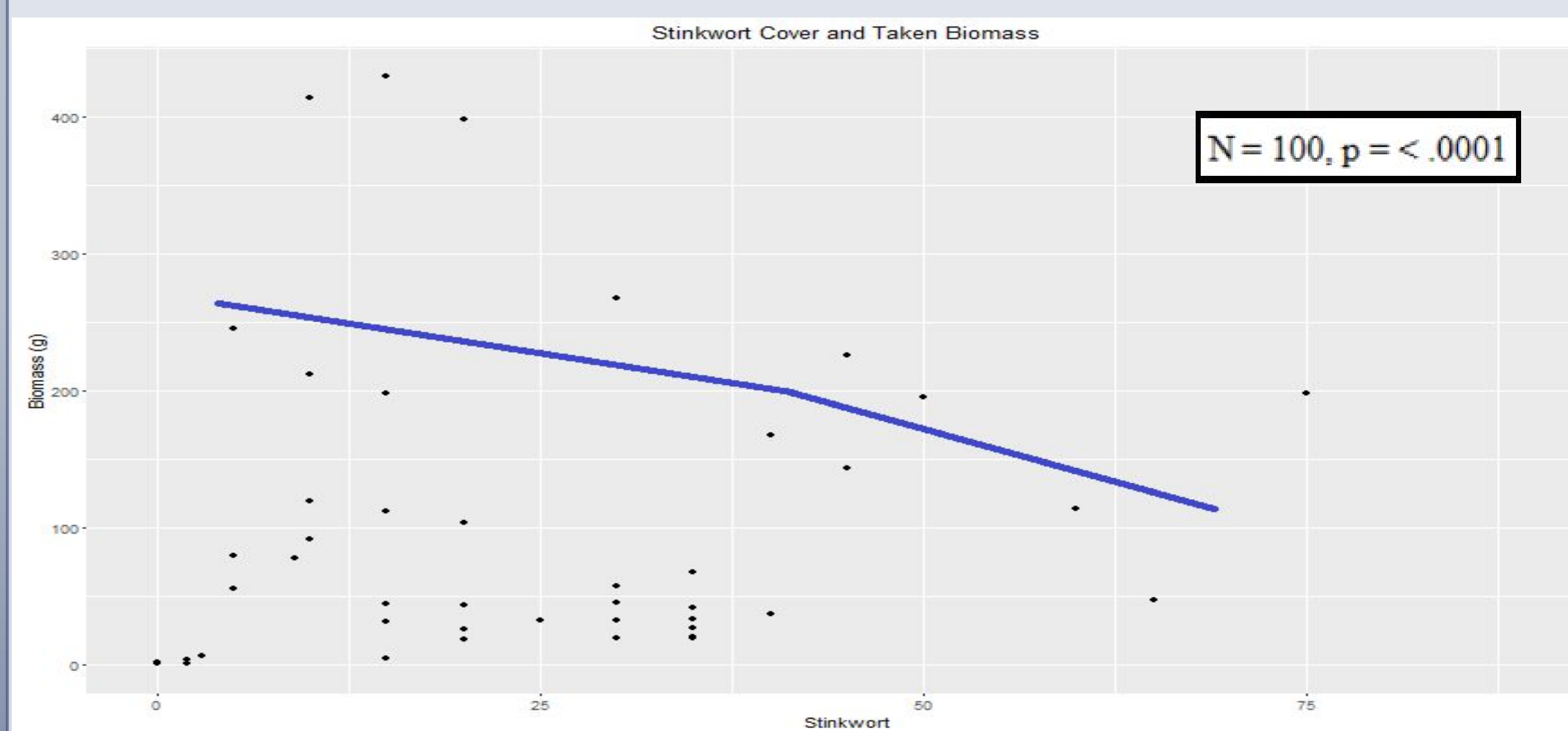
Cover relationships were graphed in Cartesian plane geometry. Linear regression was used to establish a statistical relationship between both the number of non-stinkwort species and increasing stinkwort presence, as well as biomass and stinkwort presence. A spline illustration (single knot, non-polynomial, in blue) was used to demonstrate a general pattern in each graph.

Results

Figure 1. The presence of *Dittrichia graveolens* in all ten transects conducted is weighed against the diversity of other plants sharing its niche.



Figures 2 & 3. In the five transects with biomass retrieved, stinkwort cover and biomass interact. In the remaining five, detrital cover and stinkwort cover are compared. All statistical results are the result of multiple linear regression analyses using stinkwort cover as the core intercept.



Conclusions

1. **What was the effect of *Dittrichia graveolens* on local plant biomass?**
As the amount of stinkwort cover increased, biomass taken tended to decrease, especially as the area of a given quadrat became more and more exclusively stinkwort cover. As a linear regression intercept, stinkwort was significantly different from biomass per quadrat (Figure 2). In the other half of the quadrats in which biomass was not taken, stinkwort and detrital cover were examined. As stinkwort cover increased, detrital cover quickly decreased. Similarly, detritus's and stinkwort's cover percentage significantly differed (Figure 3). Further analysis will establish nonlinear relationships.
2. **Did *Dittrichia graveolens* affect the species diversity in quadrats sampled?**
Yes. As increasing amounts of stinkwort fill a given quadrat, the amount of non-stinkwort species tends to starkly decrease, starting roughly at 25% stinkwort cover or greater (Figure 1). Further work will quantify nonlinear aspects of these data.
3. **Were there any examples of ecological boundaries that resisted stinkwort?**
In particular, southern California coastal chaparral appeared to have no stinkwort infiltration whatsoever, despite closeness and ample wind access to hillside chaparral sites. Sage is a very common denizen of this biome, and just as previous work established that powerful allelopathic effects take place here (Figure 4), it is very possible that those selfsame forces may work on *Dittrichia graveolens*. This project is ongoing, and a full-scale experiment, modeled after relevant methods, will examine the herbicidal effects of sage (*Salvia* spp.).

Figure 4. An example of a classic coastal sage scrub chaparral biome. Note the highly conspicuous volumetric spaces around each stand, caused by potent allelopathy.



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