Minimum Viable Area of CA Serpentine

By: Kayla Aburida

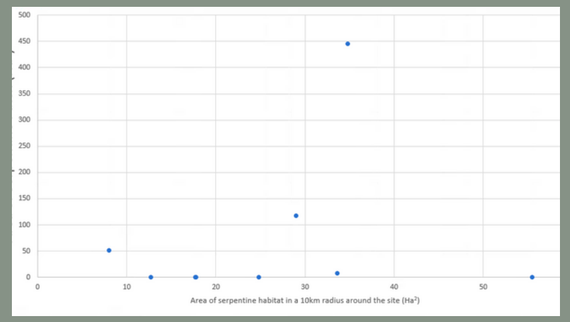

Figure 1. Calystegia collina serpentine patch Area and Isolation

Photo thanks to David A. Hofmann

Introduction

This study was conducted to determine if there is a relationship between patch area and isolation where our focal species have been found. In order to help managers sort which sites in a landscape should be the highest priority for conservation. We used the area of serpentine in a 10 Ha radius around a site as a measurement of isolation. This is because it shows us if there are patches around it or not- fewer isolates, more isolated. The Insular Distribution Function (IDF) was a hypothesis used in this lab to understand the relationship our species had with Area and Isolation and to investigate if there is a pattern. IDF is merely a hypothesis, in this study we didn't have a distance to 'mainland' islands, so we used proxy data- how much serpentine habitat is in the area around a particular site. We denoted more serpentine in the area as the patch being less isolated, and less serpentine in the area as being more isolated. Our null hypothesis states that we should have increasing island areas as we increase isolation. The idea behind this is so species can more easily disperse because if a patch is more isolated a larger area size is an advantage due to increased resources and the species can thrive. On top of dispersal, this study is important to discover which serpentine patches to manage to conserve the endemic species.

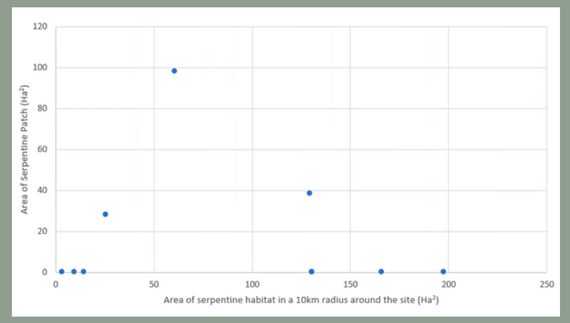

Figure 3. Minuartia nuttallii serpentine patch Area and Isolation

Photo thanks to Béatrice Escande

Methods

To determine if there is a relationship between the range of values for patch area and isolation where our focal species have been found on serpentine patches across California. I compared data on the Area of serpentine habitat in a 10 Ha radius around the site (Ha2), the Area of serpentine at this site (Ha2). After downloading the data, students eliminated rows of species that they weren't focusing on. This study only looks at Castilleja affini, Minuartia douglasii, Minuartia nuttallii, and Calystegia collina. The scatterplots created for each species show distribution of area and isolation which was analyzed in comparison to the patterns of the IDF hypothesis. Finally, I drew conclusions how this data can help us understand and aid distribution and conservation efforts.

Results

Our results did not support our null hypothesis which states that we should have increasing island areas as we increase isolation. We found that high isolation corresponds with large and small areas, while low isolation tends to only correspond with small areas. As seen in figures one through four our data tend to be centered in the bottom left corner, which means most of the species in their plots have small patch areas and high isolations. With increasing area dispersal rate increase. Likewise, as the distance from the mainland increases dispersal rate decreases- this is associated with isolation, when isolation increases dispersal rates decrease. We see from the data collected that it doesn't follow the IDF hypothesis. There are many reasons for this to occur, like resources and competition, biotic and abiotic factors of species, and how management influences area size and isolation. I believe that the management of large versus small patches is the most influential aspect of what could be happening to the serpentine patches in California. Harrison analyzes endemic species in serpentine environments in California and found that, a region containing a larger total area of habitat is likely to support higher regional richness (Harrison et al., 2006). I speculate that the large patches are being managed and likely protected, with less invasive species. Whereas the smaller patches are random

Photo thanks to Belinda Lo

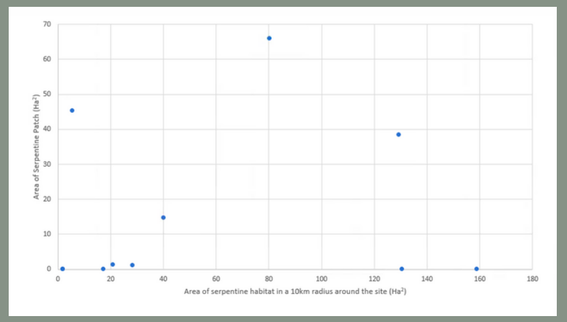

Figure 2. Castilleja affinis serpentine patch Area and Isolation

and likely not protected, susceptible to invasion (Harrison et al., 2001). This is important because even though there is a variation of isolation within serpentine patches of large size, they are more suitable for dispersal, instead of the random smaller patches. Conservation and dispersal go hand in hand because conservation of the serpentine endemic species is aided by dispersal. According to the Island Biogeographic Theory, we could expect to find the most diversity of species in the larges serpentine patches (MacArthur and Wilson, 1967), therefore look to conserve them. Conservation managers should focus small serpentine patches to mitigate invasive species.

Conclusion

This study suggests that small serpentine patches should be managed for optimal conservation of endemic species from invasive species and a higher probability of dispersion. The data are drawn from species in serpentine patch areas in California depicted plots areas and isolation did not support the null hypothesis. The 6000 Km2 of serpentine patches across California vary in their area and isolation, although no significant linear relationship was found. Therefore managers with concerns about conservation and dispersal must do a case-by-case analysis of serpentine patches, with emphasis on small plots.

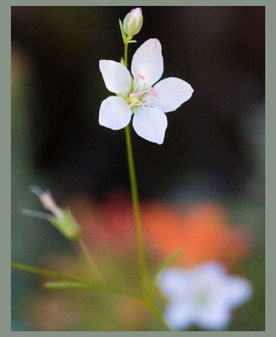

Photo thanks to Ken-ichi Ueda

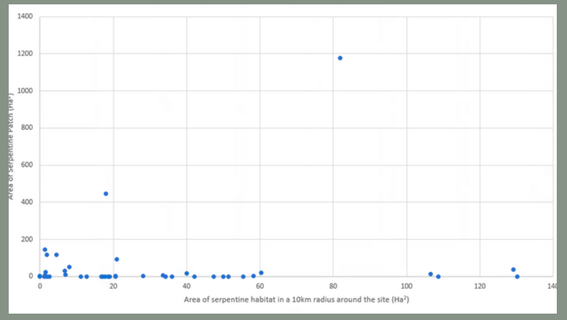

Figure 4. Minuartia douglasii serpentine patch Area and Isolation

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Harrison, S., Safford, H. D., Grace, J. B., Viers, J. H., & Davies, K. F. (2006). Regional and local species richness in an insular environment: Serpentine plants in California. Ecological Monographs, 76(1), 41–56. https://doi.org/10.1890/05-0910