Assessing Woody Plant Encroachment in Marin County, California, 1952-2018

2022 Cal-IPC Symposium Lightening Talk

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Study Area

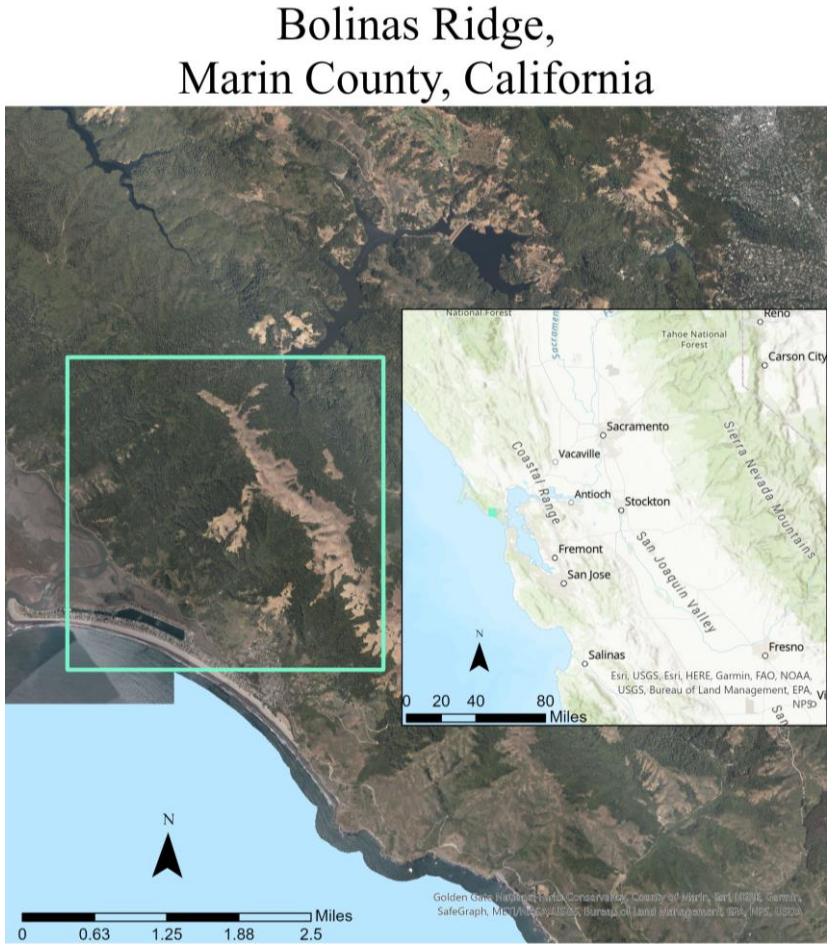


Figure 1. Location of study area.

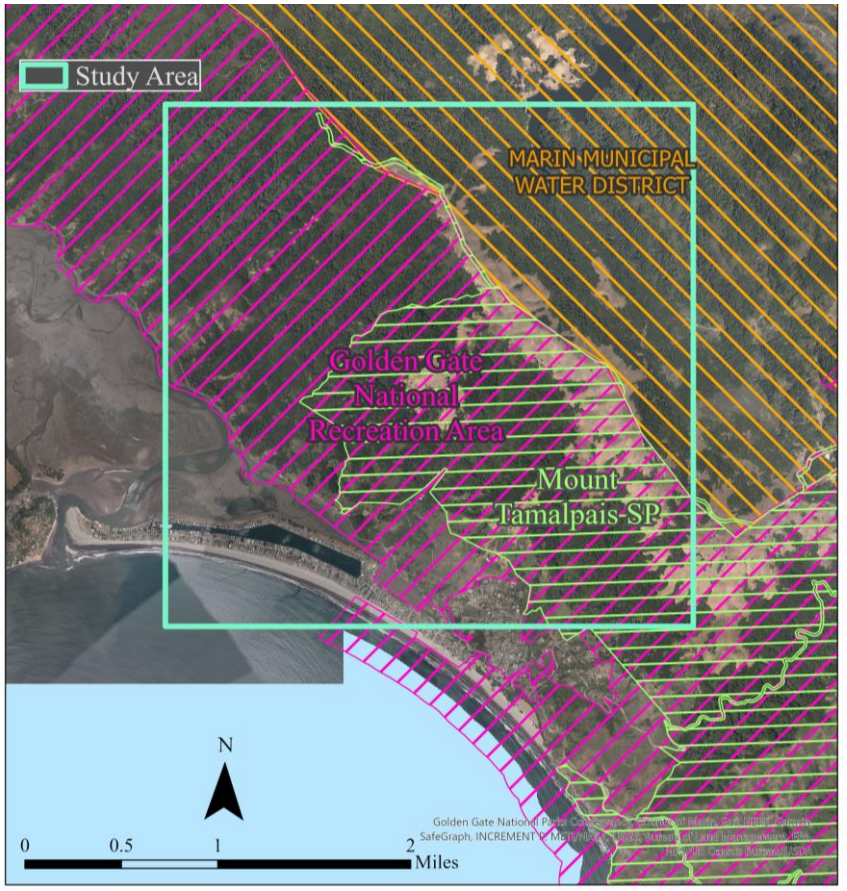


Figure 2. Land ownership within study area.

Background

- Woody plant encroachment
  - Historical ecology: indigenous land management used frequent wildfires vs. current fire suppression[1,2]
  - Type conversion
    - Changes in ecosystem function and structure
    - Decreased biodiversity

1. Mensing, S. 2006. "The History of Oak Woodlands in California, Part II: The Native American and Historic Period." *The California Geographer*, 46: 1-31.
2. Anderson, K. 2013. *Tending the Wild: Native American Knowledge and the Management of California's Natural Resources.* CA: University of California Press.

Table 1. Data description, sources, and quality information

Dataset	Spatial reference	Description
1952 historical image	• None	• Spatial resolution: 25cm • Spectral resolution: B&W panchromatic • Format: TIF (1 out of 390 mosaicked images)
2018 orthophotos	• CA State Plane 3, NAD83 (2011) • Units: Feet	• Spatial resolution: 15.24cm • Spectral resolution: bands 1, 2, 3, NIR • Format: 4-band MrSID (8-bit county mosaic)
2021 Marin County fine scale vegetation map	• CA State Plane 3, NAD83 (2011) • Units: Feet	• Semi-automated map including field work, machine learning, & manual interpretation • 106-classes of vegetation • Format: Vector layer

Image to image rectification

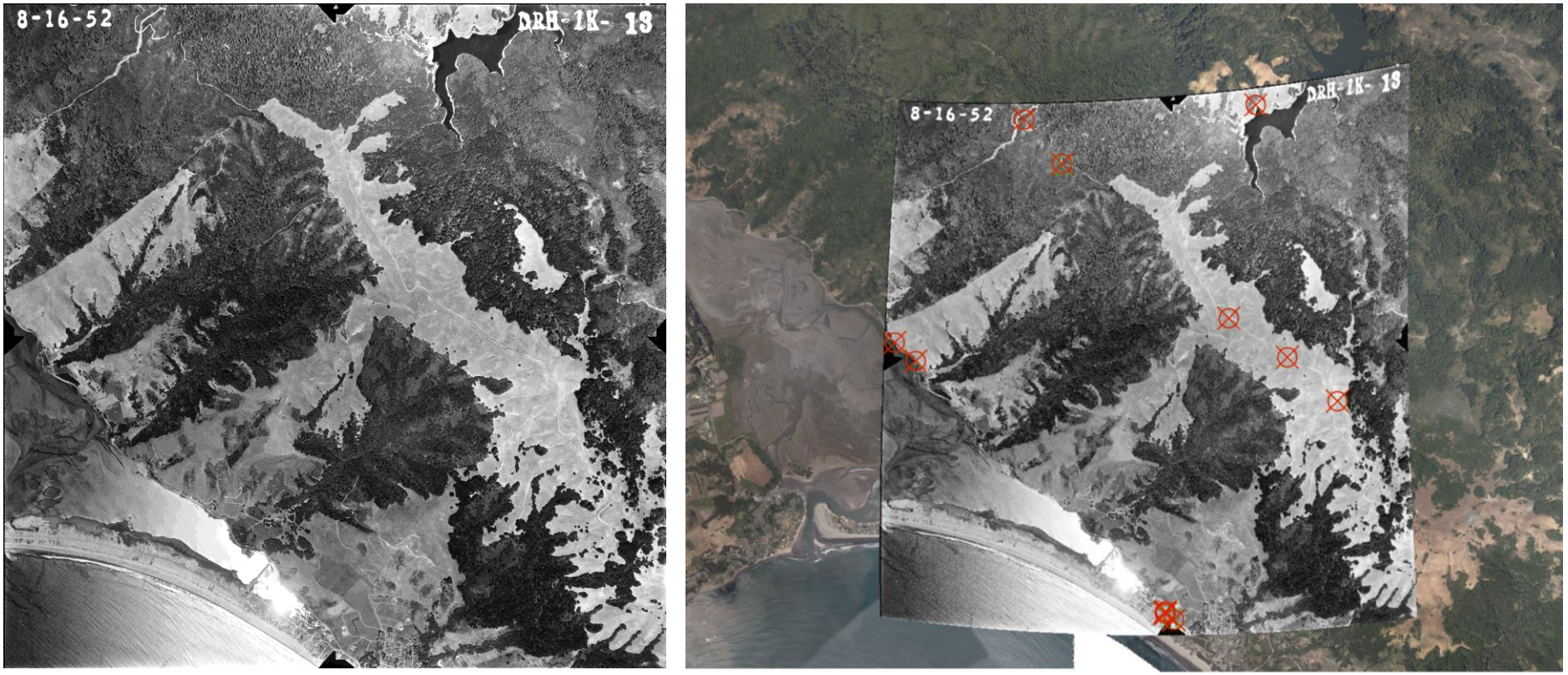


Figure 3. Left: Original historical image. Right: image rectified to the 2018 orthoimagery (background image) using 2nd order polynomial transformation with 13 GCPs (red).

Results

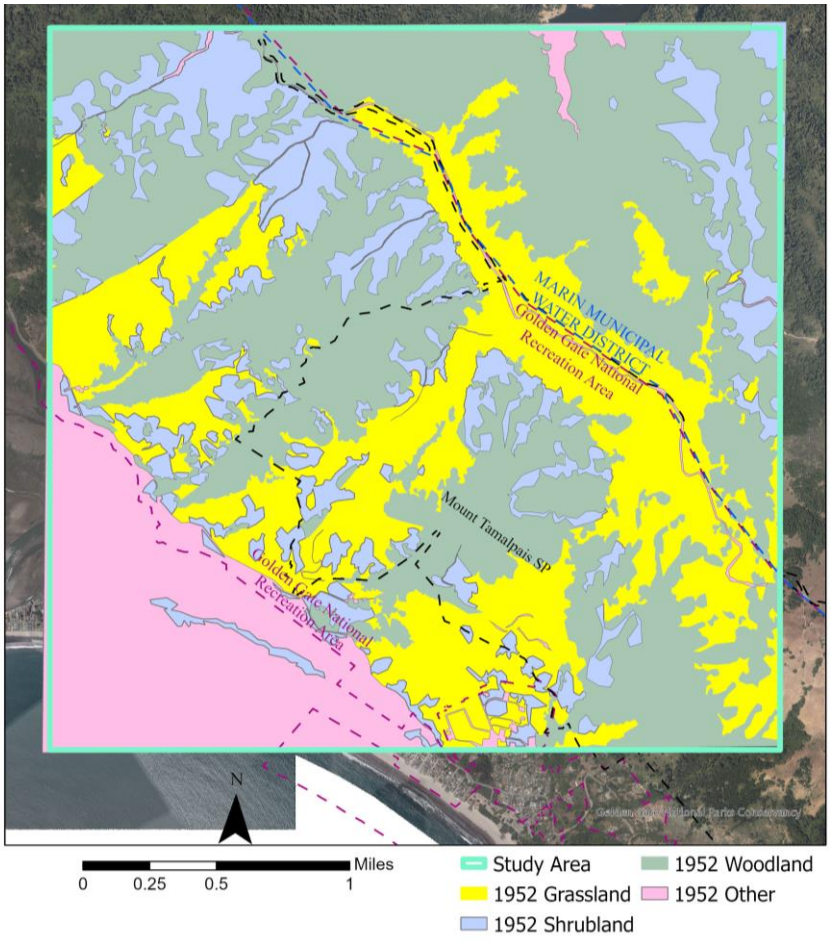


Figure 5. Life form classification of the 1952 aerial.

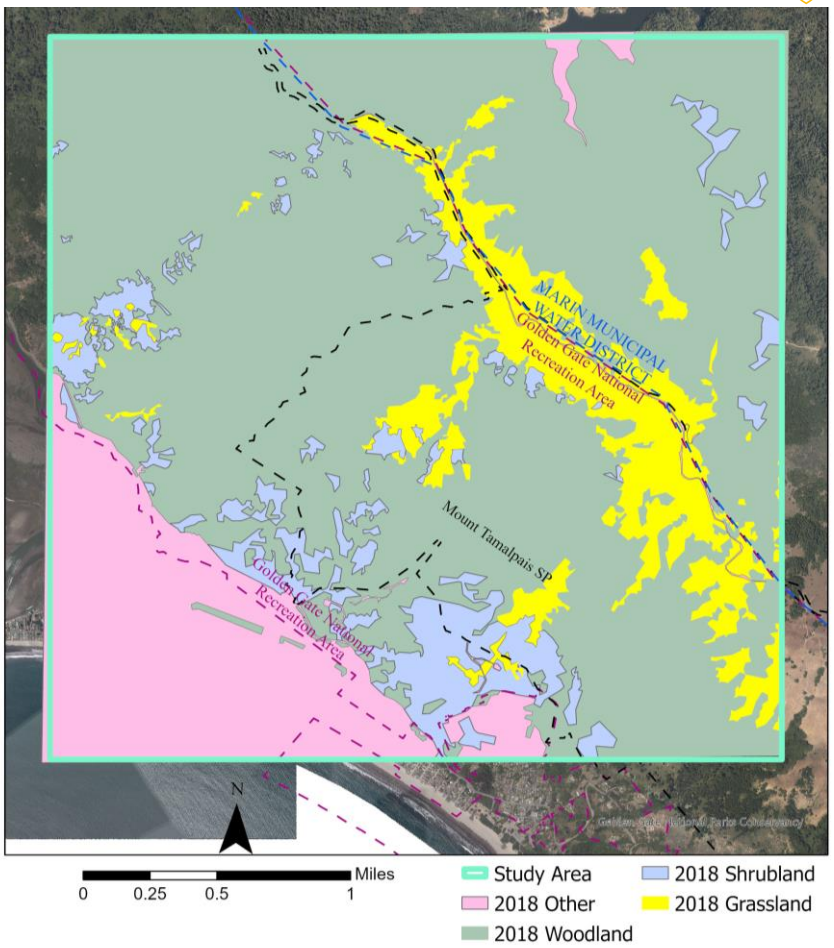


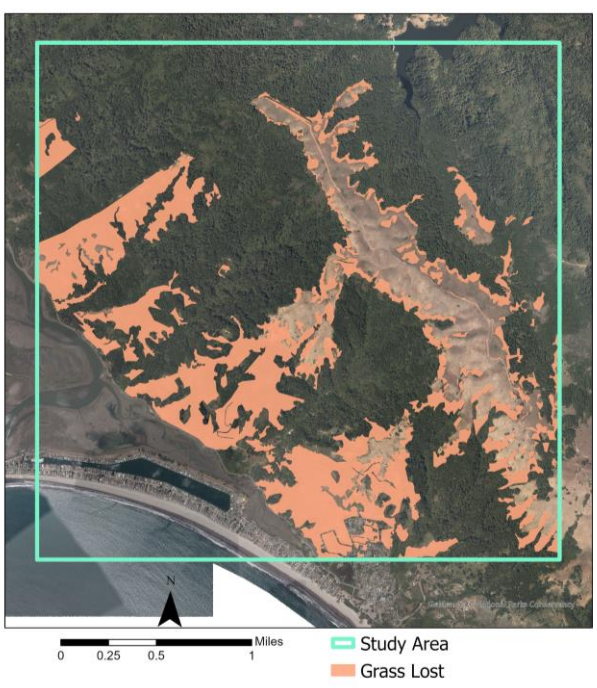
Figure 6. Life form classification of the 2018 orthophoto.

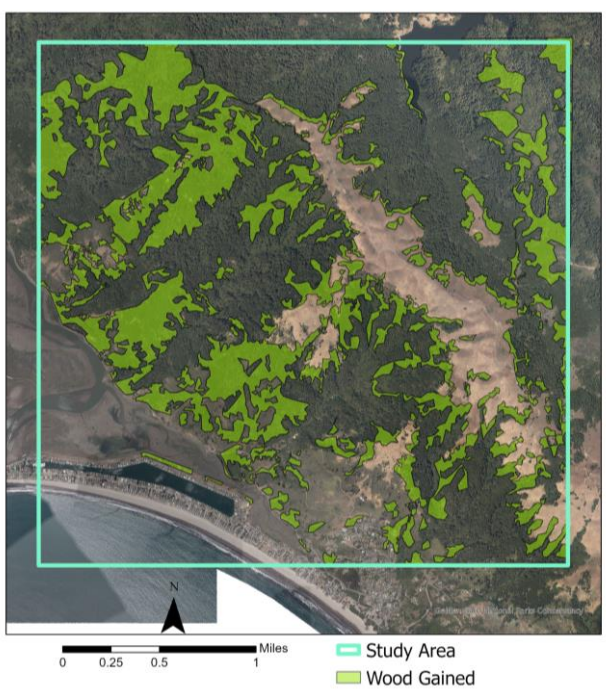
Change Analysis

Table 2. **Net change and % change of grassland, shrubland, and woodland cover between 1952 and 2018. The area of shrubland gained and lost is further broken down.**

	Area (acres)			
Year	Grass	Shrub	Forest	Other
1952	1,205	726	795	737
2018	455	359	3,237	758
Net difference	-750	-367	+2,441	+20.68
Net change (%)	-62	-51	+307	+3

	Area (acres)	
	Shrub gained	Shrub lost
	279	646
Change (%)	+38	-89





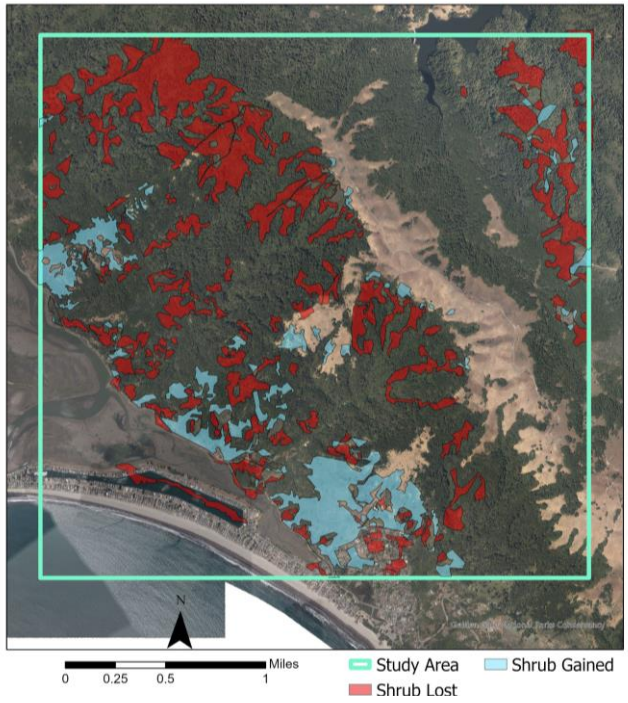


Figure 7. Changes in life form since 1952; grassland lost (orange), forest gained (green), shrubland gained (blue), and shrubland lost (red).

Results

Table 3. Total areas of woody plant encroachment in the study area between 1952 and 2018.

Woody plant encroachment (1925-2018)	Area (acres)	% of total area
Grassland replaced by shrubland	240	17
Grassland replaced by woodland	536	39
Shrubland replaced by woodland	614	44
Total	1,390	100

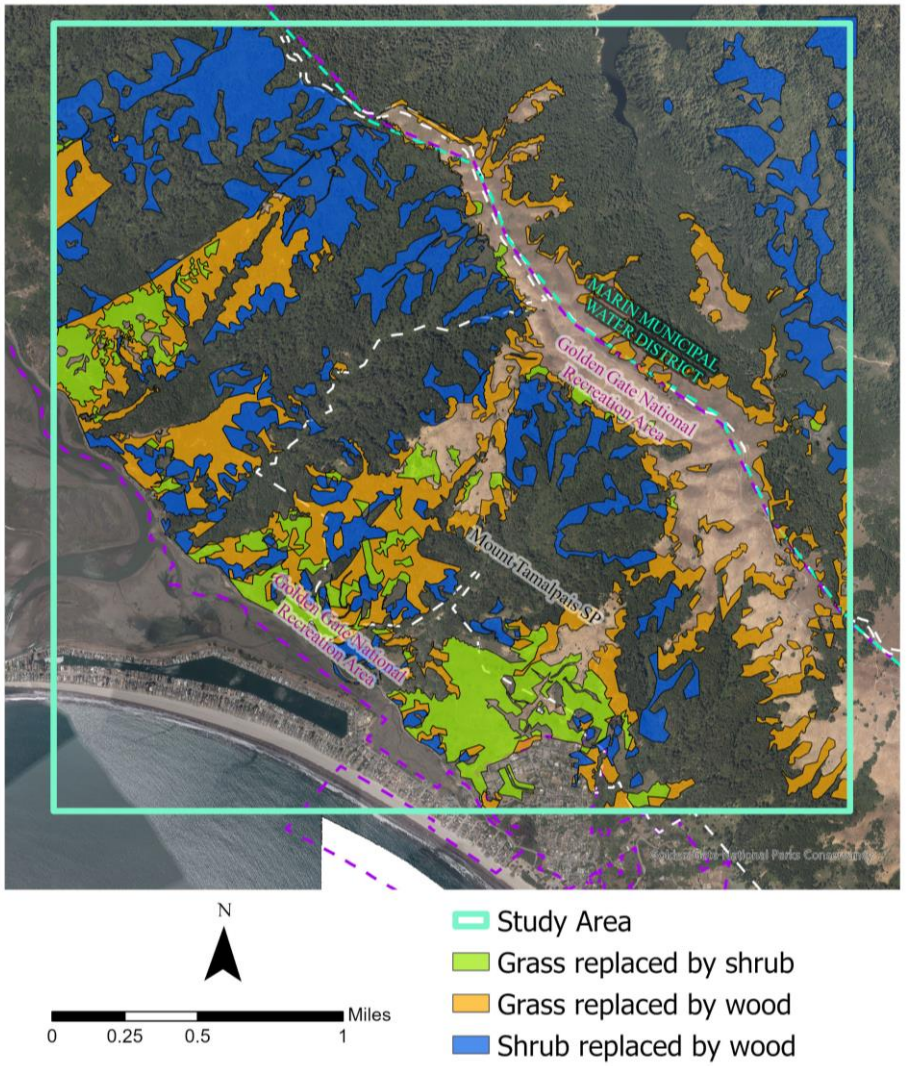


Figure 8. Encroachment of woody plants onto grassland and shrubland.

Results

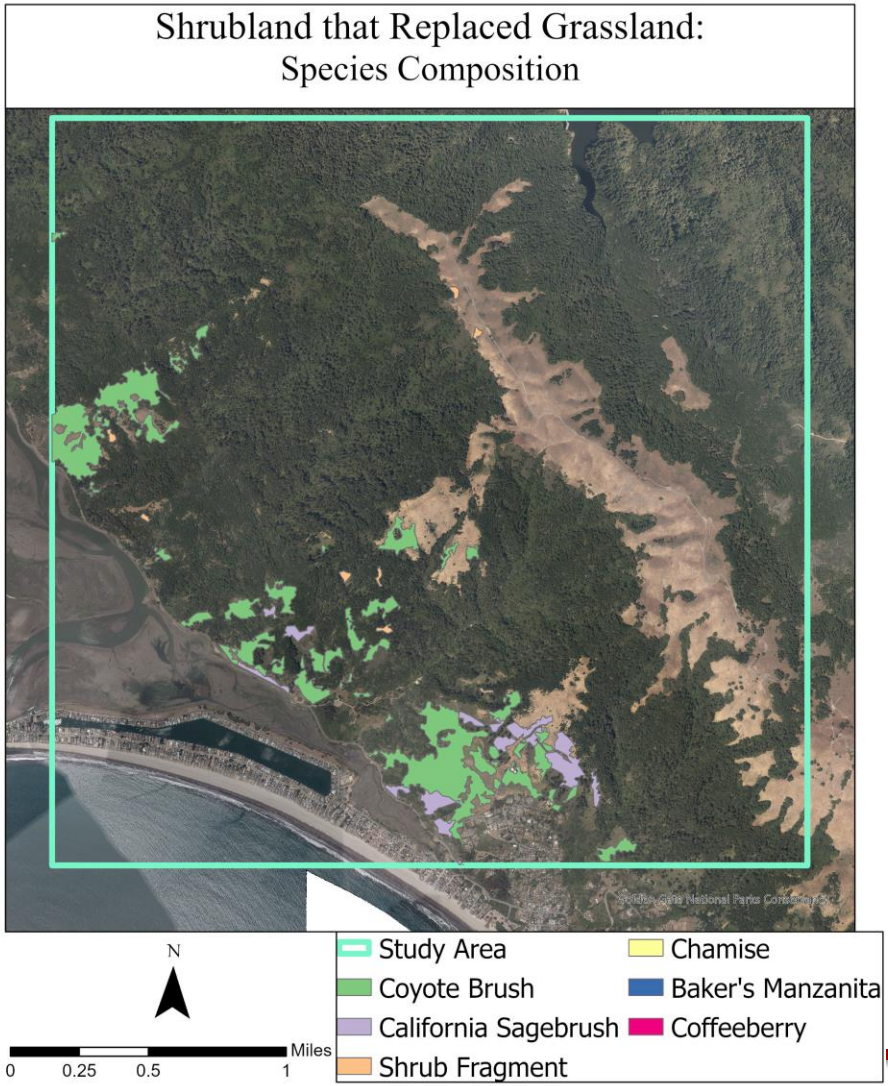


Figure 9. Shrubland that replaced grassland: species composition

Results

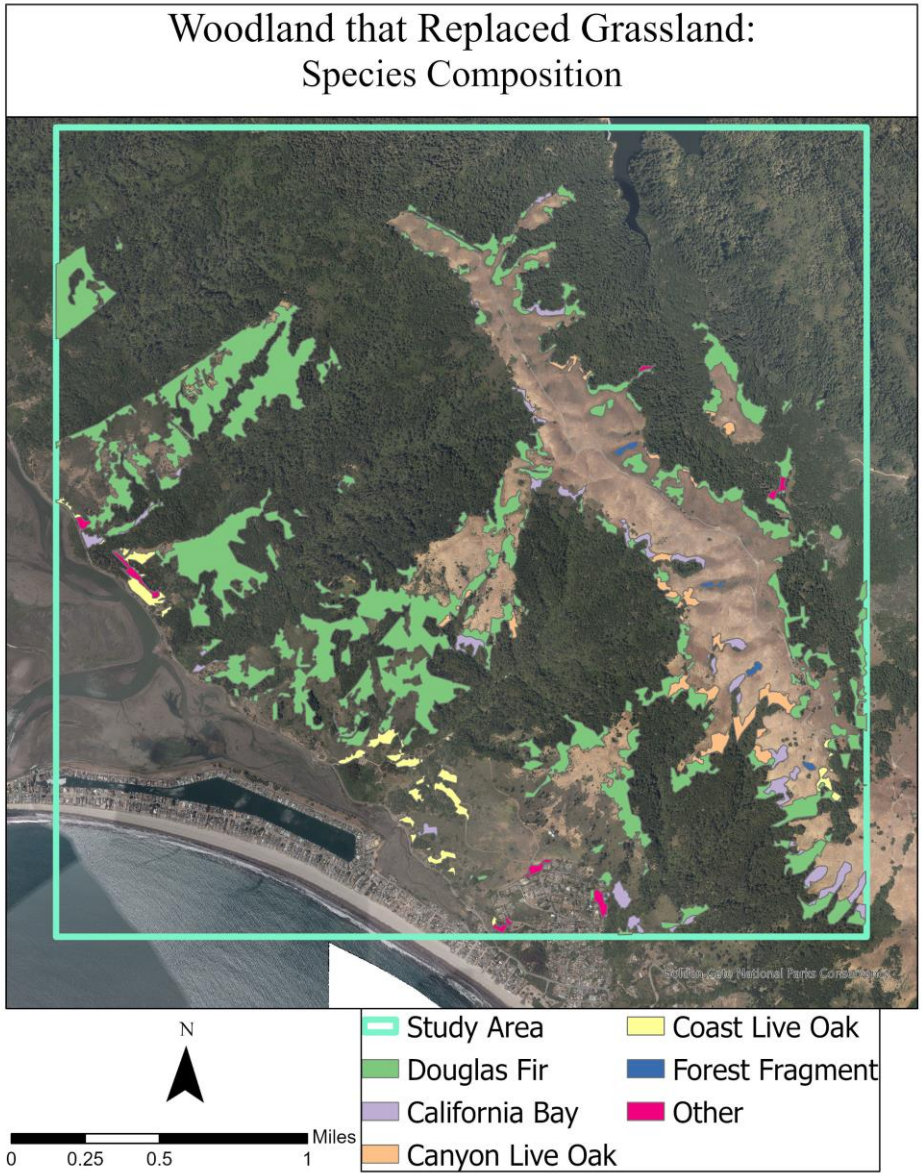


Figure 10. Woodland that replaced grassland: species composition

Results

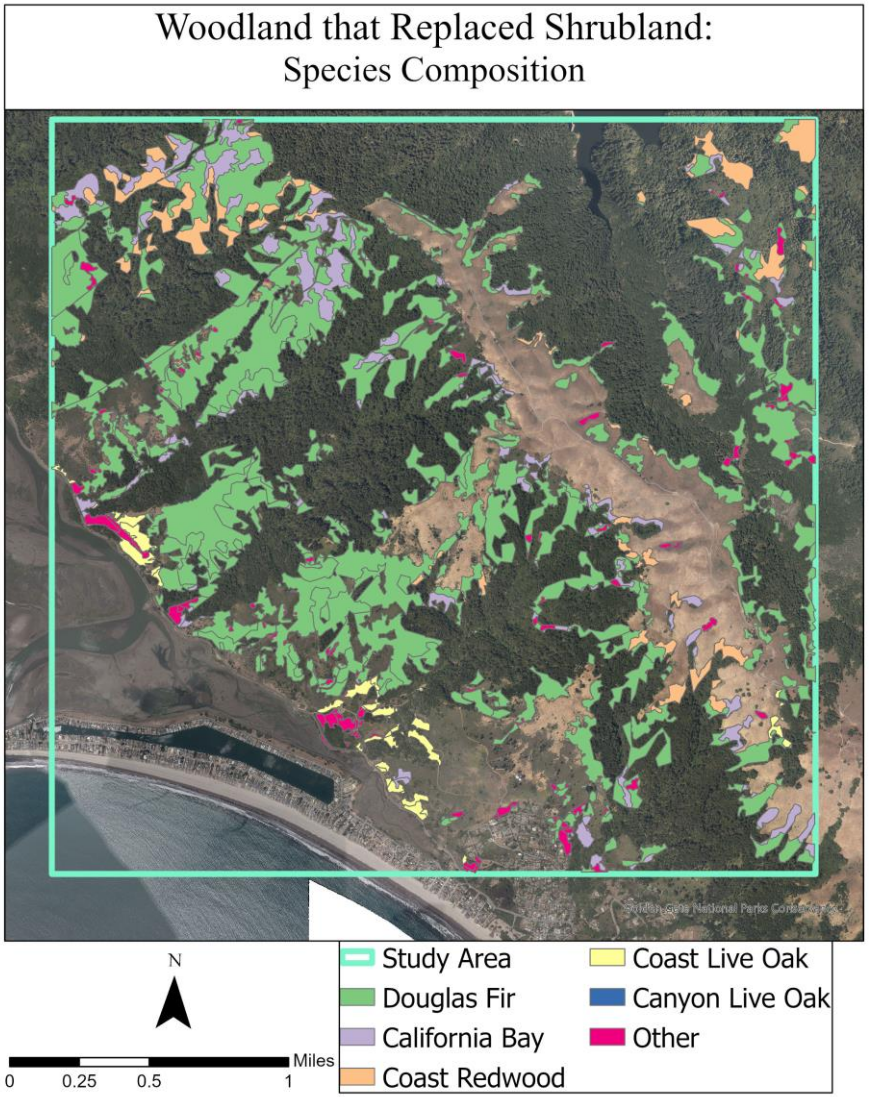


Figure 11. Woodland that replaced Shrubland: species composition

Discussion

- Primarily native species Douglas fir and coyote brush
- Invasive species found to contribute include Monterey pine and blue gum eucalyptus

Figure 12. Bolinas Ridge at sunset from: Fahey, Michael. “Bolinas Ridge Sunset.” 31 Mar. 2014, https://pixels.com/featured/bolinas-ridge-sunset-michael-fahey.html. Accessed 24 Oct. 2022.