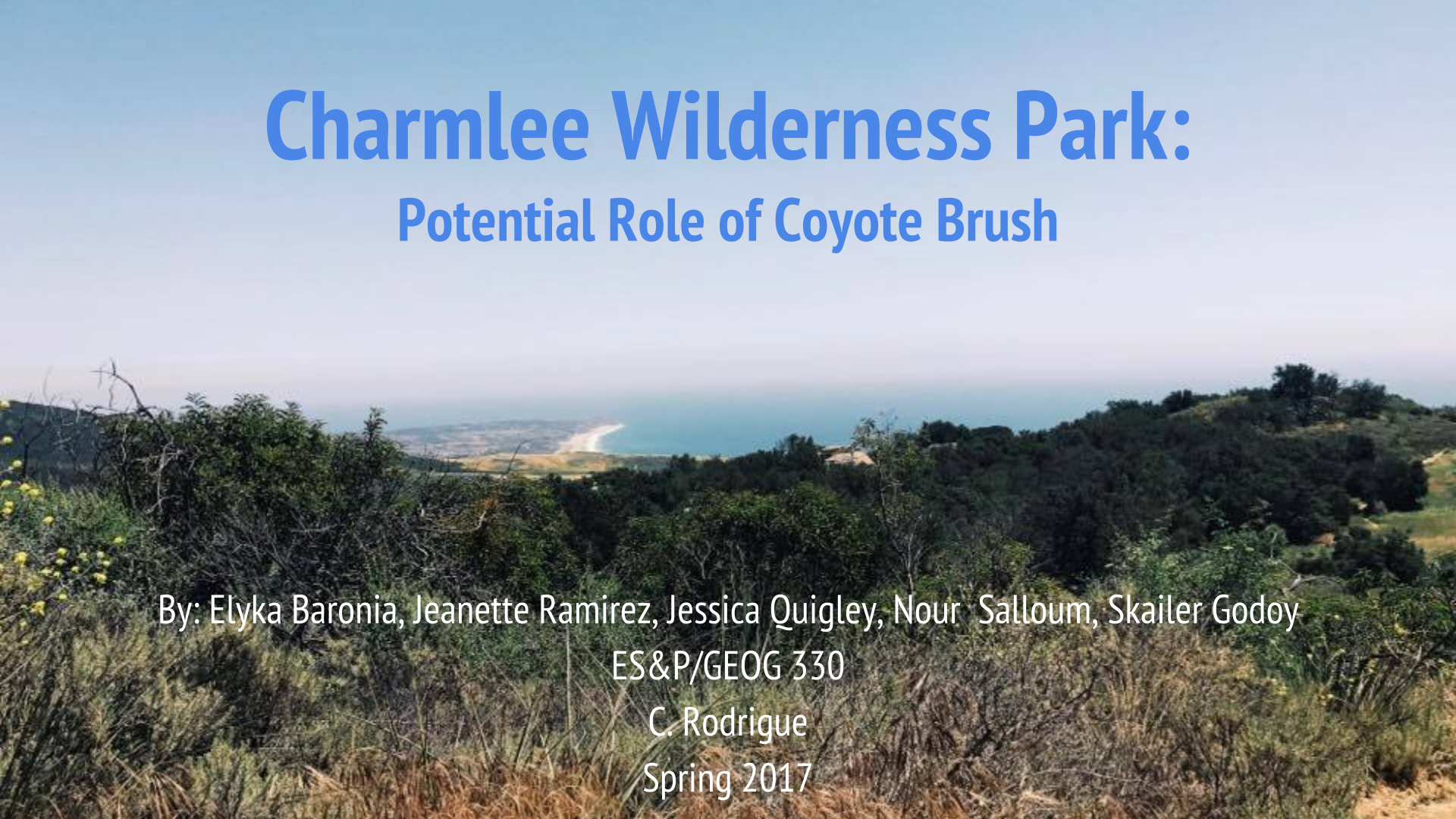
Charmlee Wilderness Park:

Potential Role of Coyote Brush



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ES&P/GEOG 330

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Background: Charmlee Wilderness Park

- 530 acre park on the coastal bluffs in Malibu
- Many different species including many patches of coyote brush of different ages
- Observance of type conversion of CSS to mostly non-native grassland due to disturbance

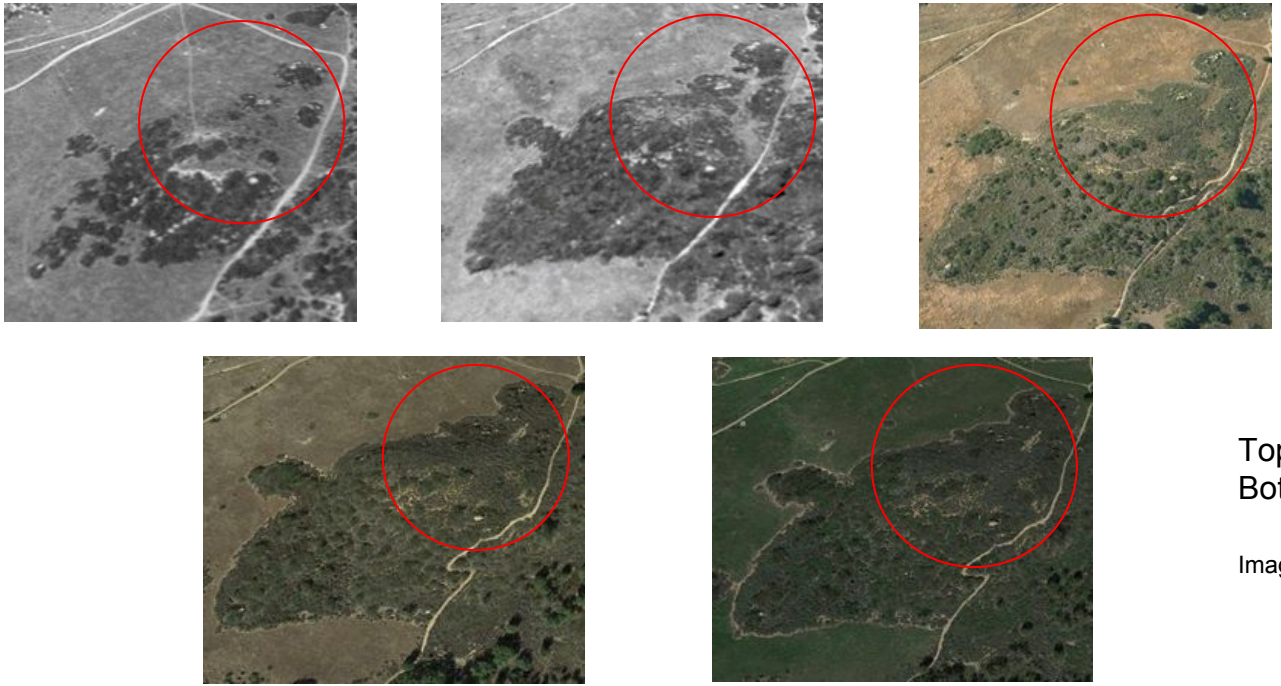
Coyote brush "…facilitates the establishment of other CSS species."
U.S. Department of Agriculture

Background: *Baccharis pilularis*

- Second pioneer species ⟶ grows after disturbance event
  - Often found in recently cleared/burned/flooded areas
- Perennial shrub; part of the Sunflower Family
- Small drought-resistant, fire-retardant leaves and a large root system

Introduction

Does *Baccharis pilularis* facilitate the development of CSS species over time?



Top: 1990, 2002, 2007
Bottom: 2013, 2016

Images from Google Earth

Introduction continued...

- Will patches of different ages show different proportions of native vs. non-native species?

  Yellow circles: 1989

  Green circles: 1994

  Pink circles: 2002

Image from Google Earth, Edits by Dr. Rodrigue

Hypotheses

- Null hypothesis: There is no significant difference in the proportions of native vs. non-native species between the three areas having different ages.
- Alternate hypothesis: There is a significant difference in the proportions of native vs. non-native species between the three areas having different ages.

Data Collection Methods

- Quadrats (1 m) and sample collection
- GPS
- Chi square test

Data Processing and Analysis Methods

		1989	2002	2002	2002	1989	1989	1994	1994
		Q1	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**
Bare ground		15	25	50	2	16	1	35	10
Coyote brush	***Baccharis pilularis***	35	40		40		50	20	
Red brome	***Bromus madritensis***	10			15	25	49	45	30
Small head clover	***Trifolium hirtum***			2					
Black mustard	***Brassica nigra***					2			
Sticky monkey-flower	***Diplacus aurantiacus***				25	15			20
Island morning glory	***Calystegia macrostegia***		5		15	10			10

- Listed identified species in a table
- Total proportions of native and non-native species calculated for each age group
- Total % bare ground and unidentified species also calculated

Data Processing and Analysis Methods

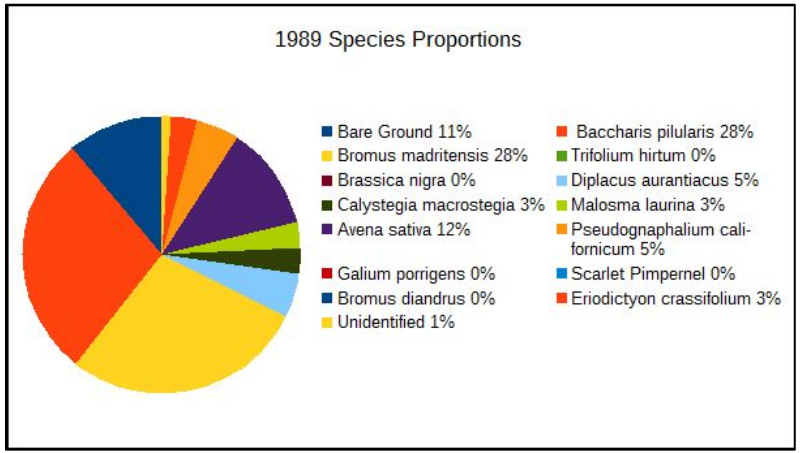
Laurel sumac	***Malosma laurina***	10		40					
Wild oats	***Avena sativa***	20				15			
Ladies' tobacco	***Pseudognaphalium californicum***		5			15			
Graceful bedstraw	***Galium porrigens***		10		3				15
Anagallis arvensis	***Scarlet pimpernel***		15						
Ripgut brome	***Bromus diandrus***								
Bicolored yerba santa	***Eriodictyon crassifolium***	10		8					
Unidentified						2			15
SUM		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

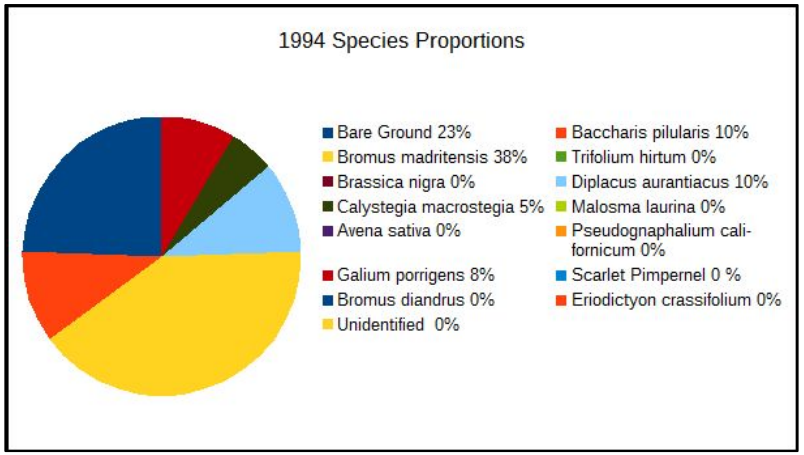
Data Processing and Analysis Methods

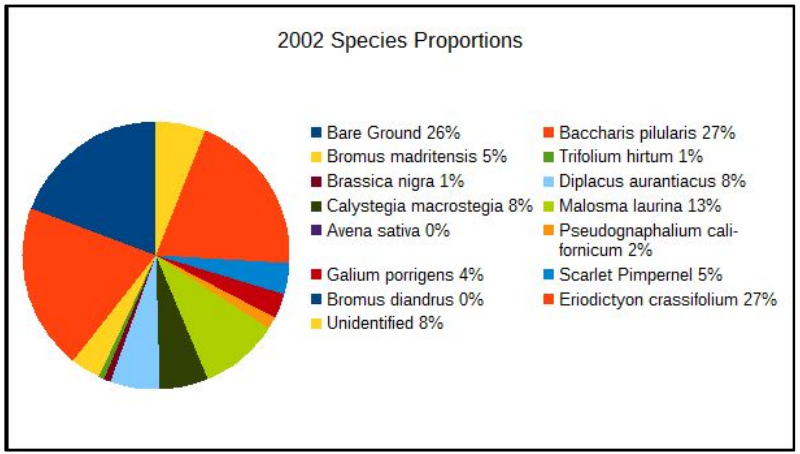
	1989	1994	2002
Total % native	145	70	191
% native / # of patches	48.33	35.0	63.67
total % non-native	121	94	32
% non-native / # of patches	40.33	47.0	10.67
total % bare ground	32	45	77
% bare ground / # of patches	10.67	22.5	25.67
total % unidentified	2	15	0
% unidentified / # of patches	0.67	7.5	0

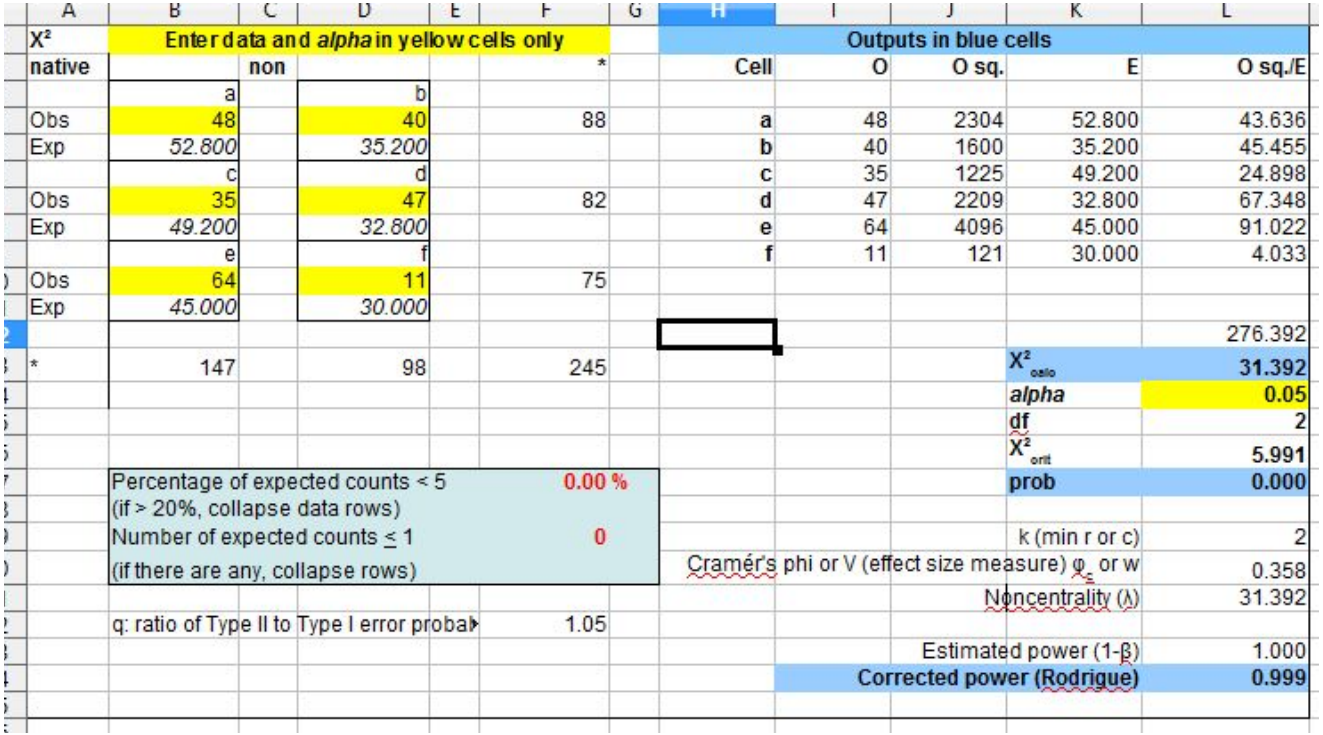
- Chi square analysis to see if a significant difference existed between:
  - % Native vs. Non-native species
  - Age of patch (1989, 1994, 2002)

Results


1989 Species Proportions
Bare Ground 11%
Baccharis pilularis 28%
Bromus madritensis 28%
Trifolium hirtum 0%
Brassica nigra 0%
Diplacus aurantiacus 5%
Calystegia macrostegia 3%
Malosma laurina 3%
Avena sativa 12%
Pseudognaphalium cali-fornicum 5%
Galium porrigens 0%
Scarlet Pimpernel 0%
Bromus diandrus 0%
Eriodictyon crassifolium 3%
Unidentified 1%


1994 Species Proportions
Bare Ground 23%
Baccharis pilularis 10%
Bromus madritensis 38%
Trifolium hirtum 0%
Brassica nigra 0%
Diplacus aurantiacus 10%
Calystegia macrostegia 5%
Malosma laurina 0%
Avena sativa 0%
Pseudognaphalium cali-fornicum 0%
Galium porrigens 8%
Scarlet Pimpernel 0 %
Bromus diandrus 0%
Eriodictyon crassifolium 0%
Unidentified 0%


2002 Species Proportions
Bare Ground 26%
Baccharis pilularis 27%
Bromus madritensis 5%
Trifolium hirtum 1%
Brassica nigra 1%
Diplacus aurantiacus 8%
Calystegia macrostegia 8%
Malosma laurina 13%
Avena sativa 0%
Pseudognaphalium cali-fornicum 2%
Galium porrigens 4%
Scarlet Pimpernel 5%
Bromus diandrus 0%
Eriodictyon crassifolium 27%
Unidentified 8%



	A	B	C	D	E	F	G	H	I	J	K	L
	X^2	Enter data and *alpha* in yellow cells only						Outputs in blue cells				
	native		non			*		Cell	O	O sq.	E	O sq./E
		a		b								
	Obs	48		40		88		a	48	2304	52.800	43.636
	Exp	*52.800*		*35.200*				b	40	1600	35.200	45.455
		c		d				c	35	1225	49.200	24.898
	Obs	35		47		82		d	47	2209	32.800	67.348
	Exp	*49.200*		*32.800*				e	64	4096	45.000	91.022
		e		f				f	11	121	30.000	4.033
	Obs	64		11		75						
	Exp	*45.000*		*30.000*								
												276.392
	*	147		98		245					X^2_{calc}	31.392
											alpha	0.05
											df	2
											X^2_{crit}	5.991
		Percentage of expected counts < 5				0.00 %					prob	0.000
		(if > 20%, collapse data rows)										
		Number of expected counts ≤ 1				0					k (min r or c)	2
		(if there are any, collapse rows)						Cramér's phi or V (effect size measure) φ_c or w				0.358
											Noncentrality (λ)	31.392
		q: ratio of Type II to Type I error probab				1.05						
											Estimated power (1-β)	1.000
											Corrected power (Rodrigue)	0.999

Results:

Significant difference between proportion of native vs. non-native species.

Effect size small (larger sample needed).

- P-value: 0.00
- X^2 crit < X^2 calc
- Power: 0.999
- Effect size: 0.358

Discussion

Type I error

- Largely underpowered datasets

- P-value: 0.00
- X^2 crit < X^2 calc
- Power: 0.999
- Effect size: 0.360

- Overall pattern of study was significant
- Reject null hypothesis
- Non-native species dominated affected study area
  - % non-native decreases with age
  - Bare ground increases with age

Conclusions

- Multiple events of disturbance (i.e. droughts, fires, etc.) → type conversion of CSS to grassland
- Proportion of non-native species decreased with age of patch. Proportion of native species fluctuated.
- Proportion of bare ground increased with age of patch. Reflective of drought?
- Effect size small, some species unidentified → Larger, more accurate sample may lead to stronger results

Challenges

- The presence of long thorny plants made it challenging to reach the precise location
- Estimating the species proportions is not perfectly accurate
- Difficulty in identifying species especially when dead/dormant

References

- Bell, David T., and Muller, Cornelius H. 1973. Dominance of California annual grasslands by Brassica nigra. American Midland Naturalist 90, 2: 277- 299.
- Stinson, Kristina A.; Campbell, Stuart A.; Powell, Jeff R.; Wolfe, Benjamin E.; Callaway, Ragan R.; Thelen, Giles C.; Hallett, Steven G.; Prati, Daniel; and Klironomos, John N. 2006. Invasive Plant suppresses the growth of native tree seedlings by disrupting belowground mutualisms. PLOS Biology 4, 5: e140. doi: 10.1371/journal.pbio.0040140.
- Laris, P., Brennan, S., Engleberg, K., Dean, J., Rodrigue, C., Langdon, S., et al. (2015). Recovering from the Second Wave?: Post-grazing CSS and Grass Dynamics in La Jolla Valley. *CSULB Department of Geography.*