

Effects Of Feral Pig Rooting On Vegetation Communities & Rare Endemic Plants On Santa Cruz Island, California



Structure Of Talk

- Vegetation Monitoring Design
 - Community
 - Rare Plants
- General Community-level Patterns
 - Richness, Diversity & Evenness
 - Structure & Species Composition
- Rooting Effects On Vegetation Dynamics
- Rooting Effects On Rare Endemic
- Generality Of Results



Physical Characteristics

- 246 km² in area
(96 mi²)
- Complex
Topography
(highest elevation
745 m)
- Complex Geology
& Soils



Santa Cruz Island Floristics



- 10-12 Plant Communities
 - 5-6 major ones
- 470 Native Species
- 157 Non-native Species
- 36 Channel Island Endemic Species
- 7 Santa Cruz Island Endemic Species

Goals

- Vegetation
 - Evaluate the degree to which feral pig rooting was influencing changes in structure & species composition in the 5 major vegetation communities
- Rare Plants
 - Determine which species were being impacted by feral pig rooting



Vegetation Communities

- 5 types
 - Grassland
 - Chaparral/Bishop Pine
 - Oak Woodland
 - Coastal Scrub
 - Fennel



Vegetation Monitoring Protocol

- Stratified (semi) random design
 - 100 plots (30 m x 2 m)
- Species-based
 - Cover (100 points)
 - Point Intercept
 - Herbaceous layer, shrub layer, tree layer
 - Density (60 m²)
 - Belt transect
 - Shrubs and trees
- Bare ground, litter, rooting
- Sampling 1991-1995, 1998



Rare Plants



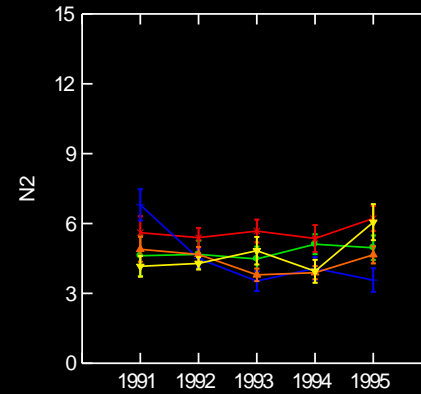
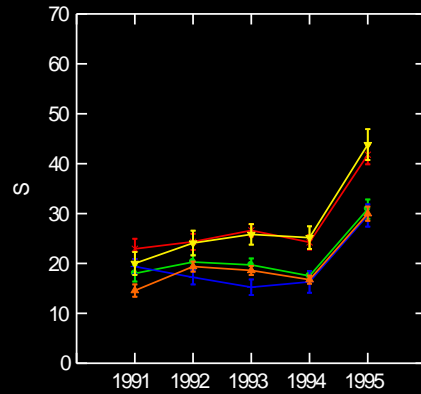
Rare Plant Monitoring Target Species

- *Berberis pinnata insularis*
 - Presence/Absence
 - 3 populations
- *Arabis hoffmannii*
 - Census, height, floral counts
 - 3 populations
- *Thysanocarpus conchuliferus*
 - Presence/Absence
 - 1-11 populations
- *Dudleya nesiotica*
 - Density, cover, & floral counts
 - Height
 - Vegetation community (cover & height)
- *Malacothamnus fasciculatus nesioticus*
 - Census, height, floral counts
 - 3 populations

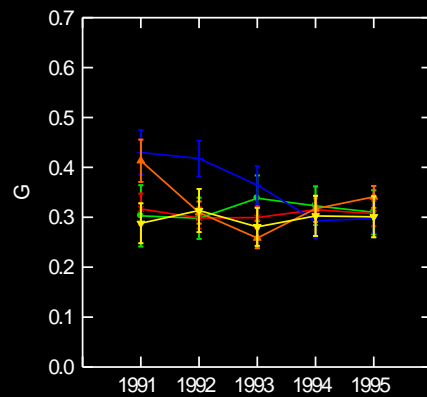
General Patterns For Vegetation Communities



Species Diversity

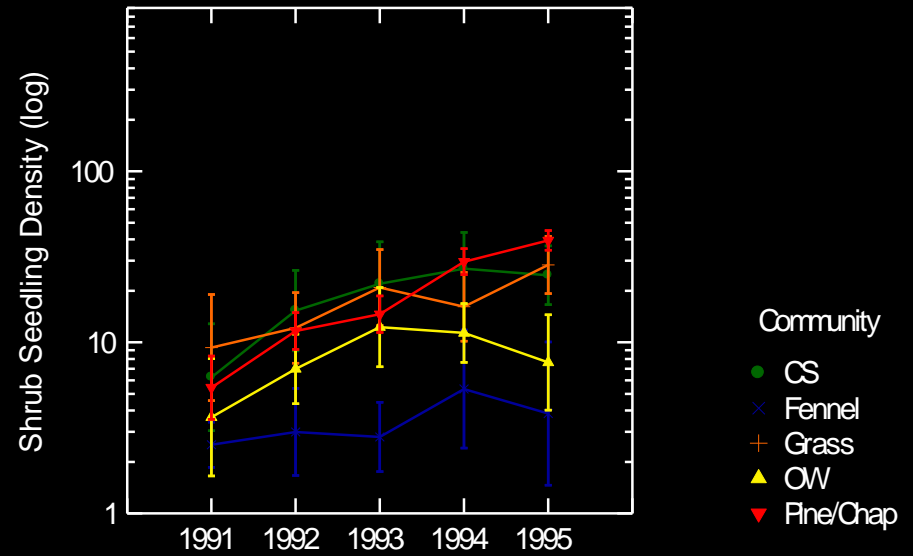
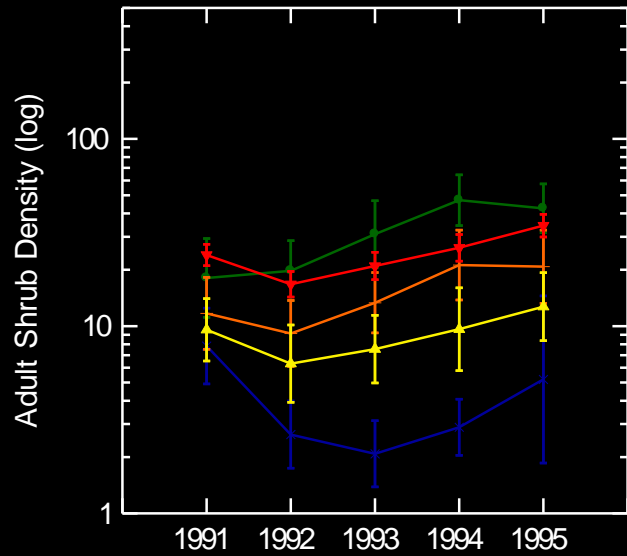


Community
● CS
× Chap/Flne
+ Fennel
▲ Grass
▼ OW



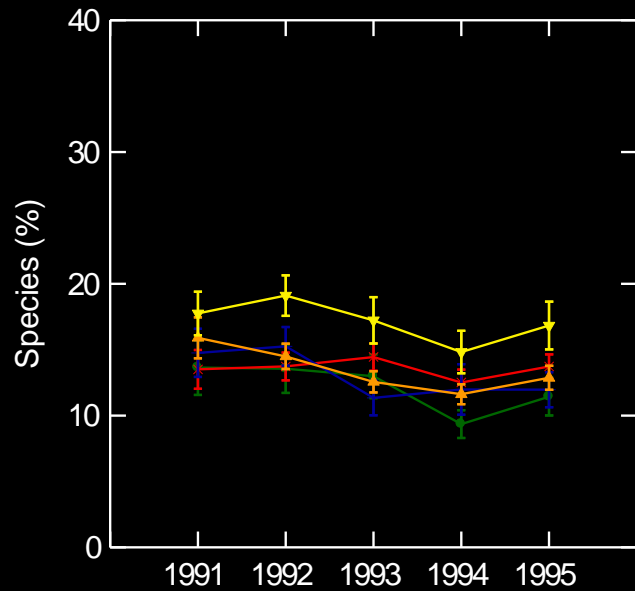
Community
● CS
× Chap/Flne
+ Fennel
▲ Grass
▼ OW

Shrub Expansion

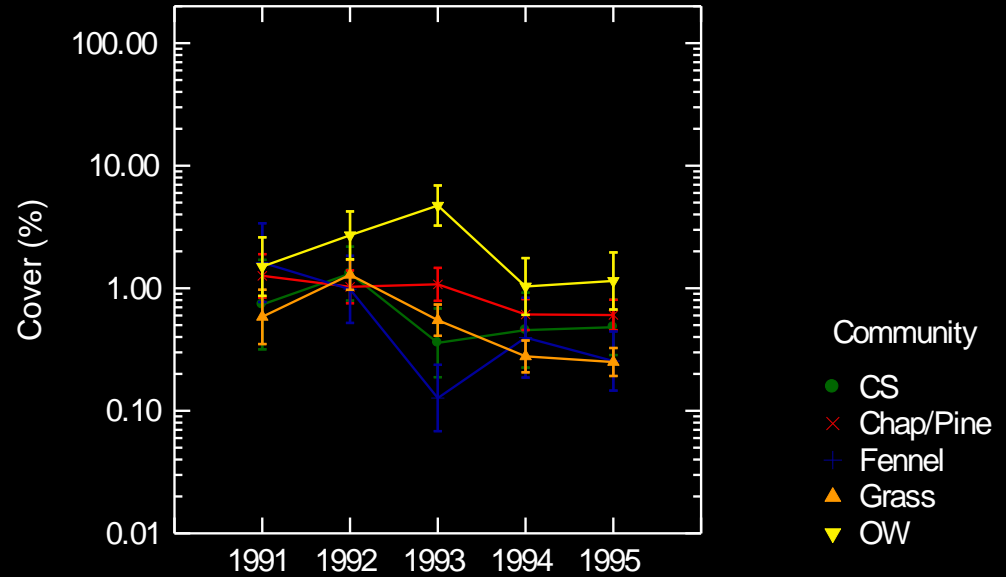


Native Grasses & Forbs

Native Herbaceous Species



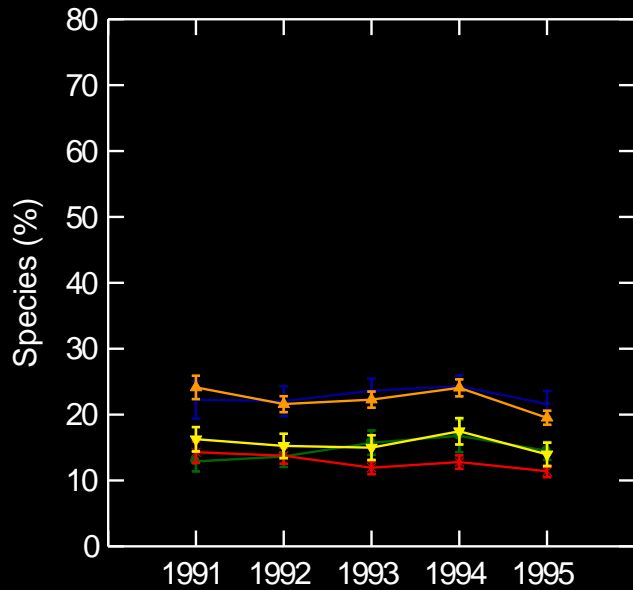
Native Herbaceous Species



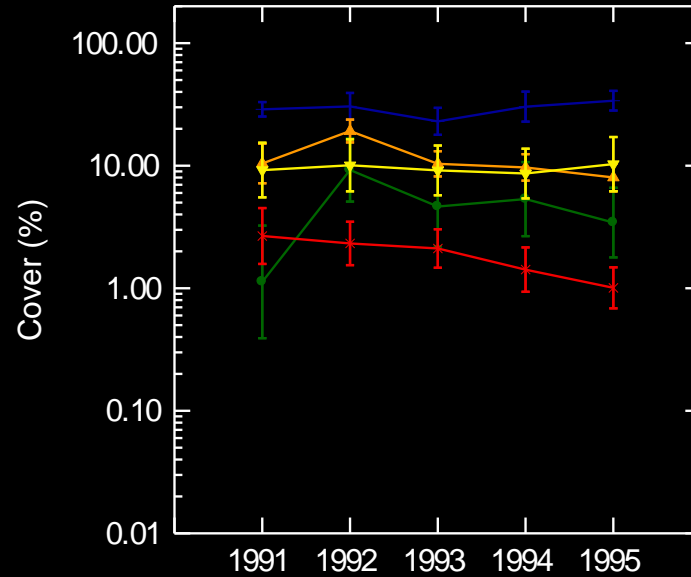
- Community
- CS
 - × Chap/Pine
 - + Fennel
 - ▲ Grass
 - ▼ OW

Alien Grasses & Forbs

Alien Herbaceous Species



Alien Herbaceous Species

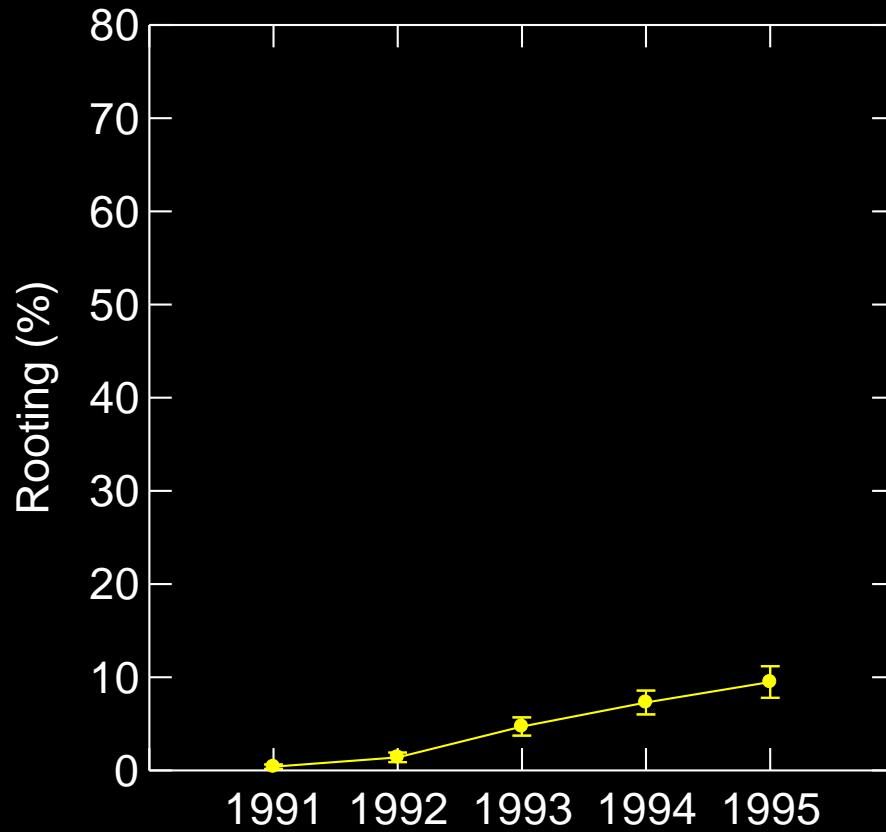


- Community
- CS
 - × Chap/Pine
 - + Fennel
 - ▲ Grass
 - ▼ OW

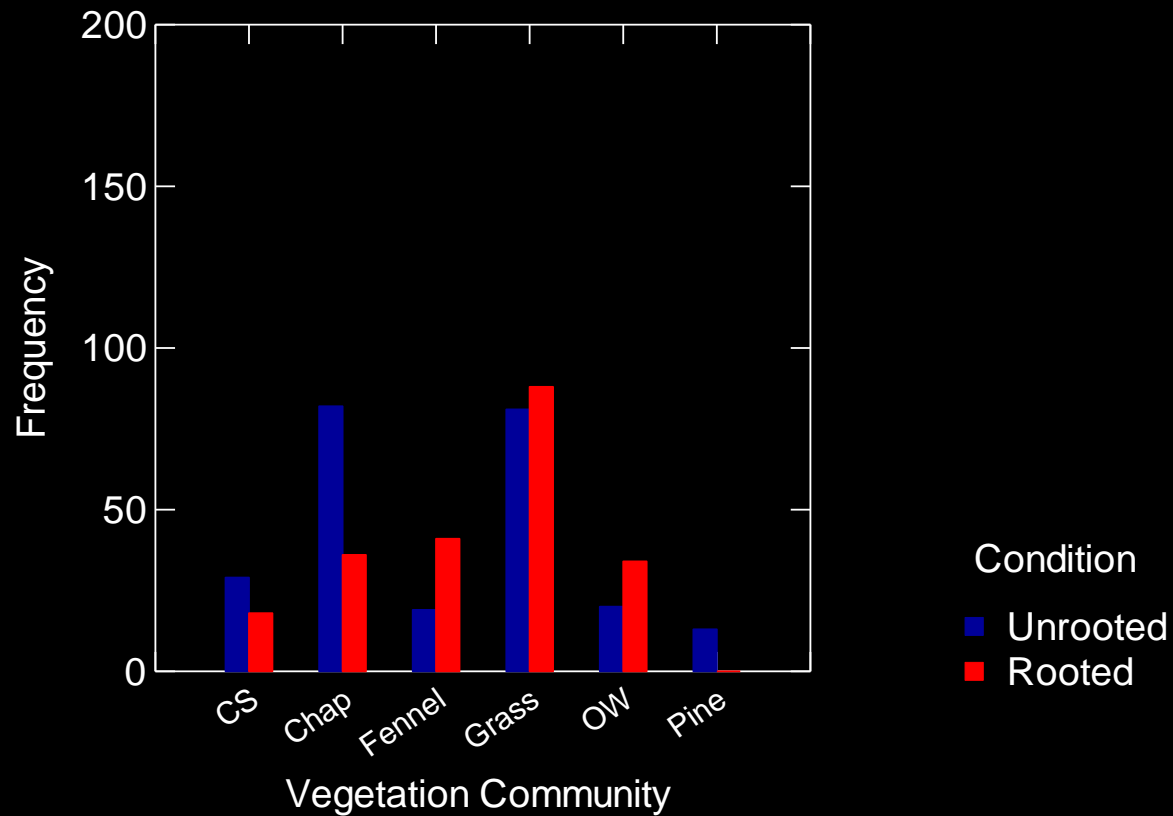
Rooting Effects On Vegetation Communities



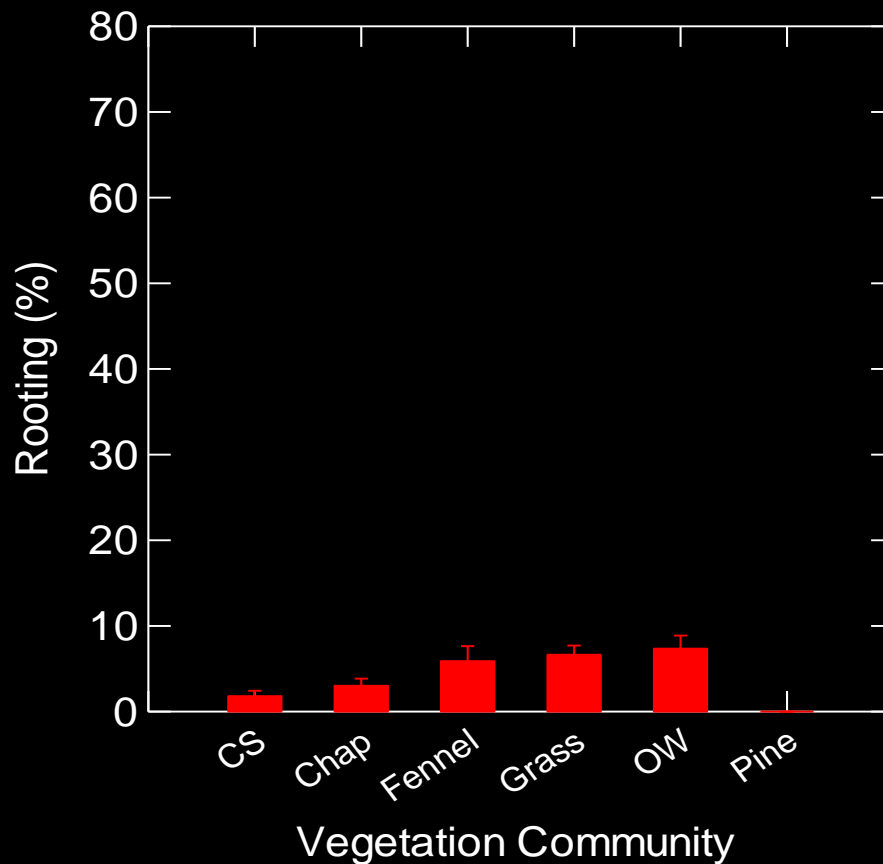
Magnitude Of Rooting



Rooting Frequency & Vegetation Communities



Rooting Intensity & Vegetation Communities



Analysis Approach

- Disturbance Regime
 - Intensity (% rooted)
 - Frequency (cumulative number times)
 - Interval (years since last rooted)
- Multiple Regression
 - Community Measures
 - Total Species Richness (S)
 - Species Diversity (N2)
 - Evenness (Molinari's G)
 - Guilds/Vegetation Structure
 - Shrub Species Richness, Cover, Density
 - Shrub Seedling Density
 - Non-native and Native Forb Cover and Species Richness
 - Annual & Perennial
 - Non-native and Native Grass Cover and Species Richness

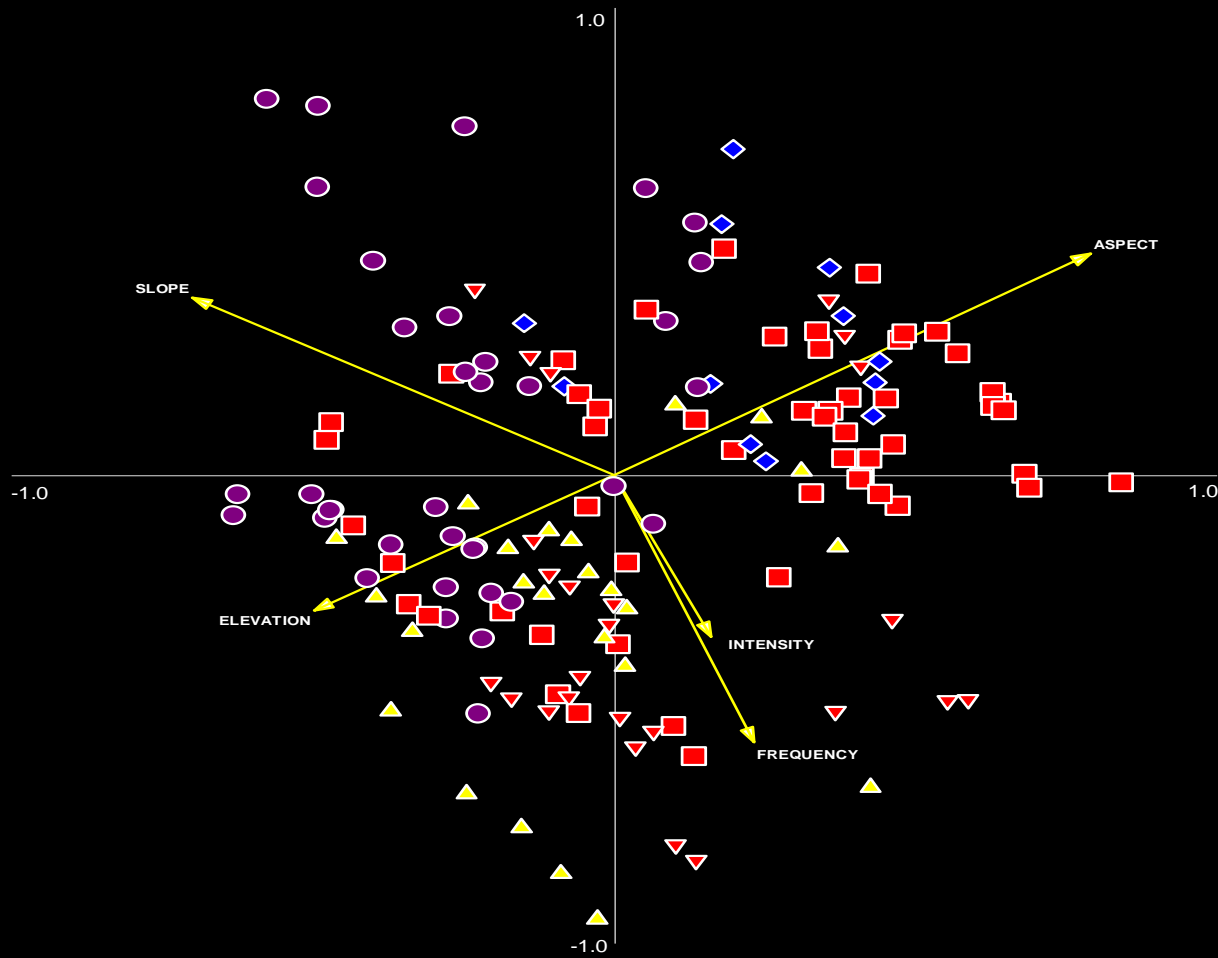
Rooting/Community Measures Correlations

Statistic	Intensity	Frequency	Return Interval
S		Positive	Positive
N2	Negative		
G	Negative		

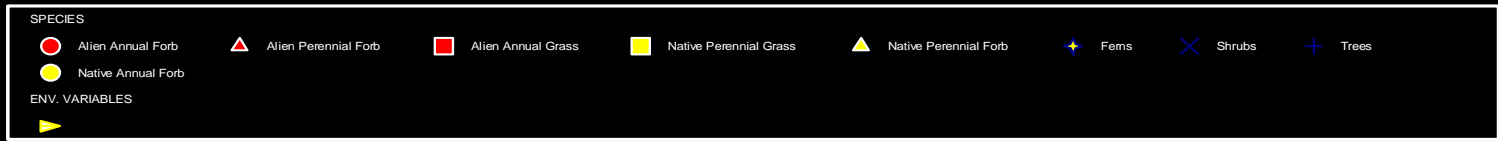
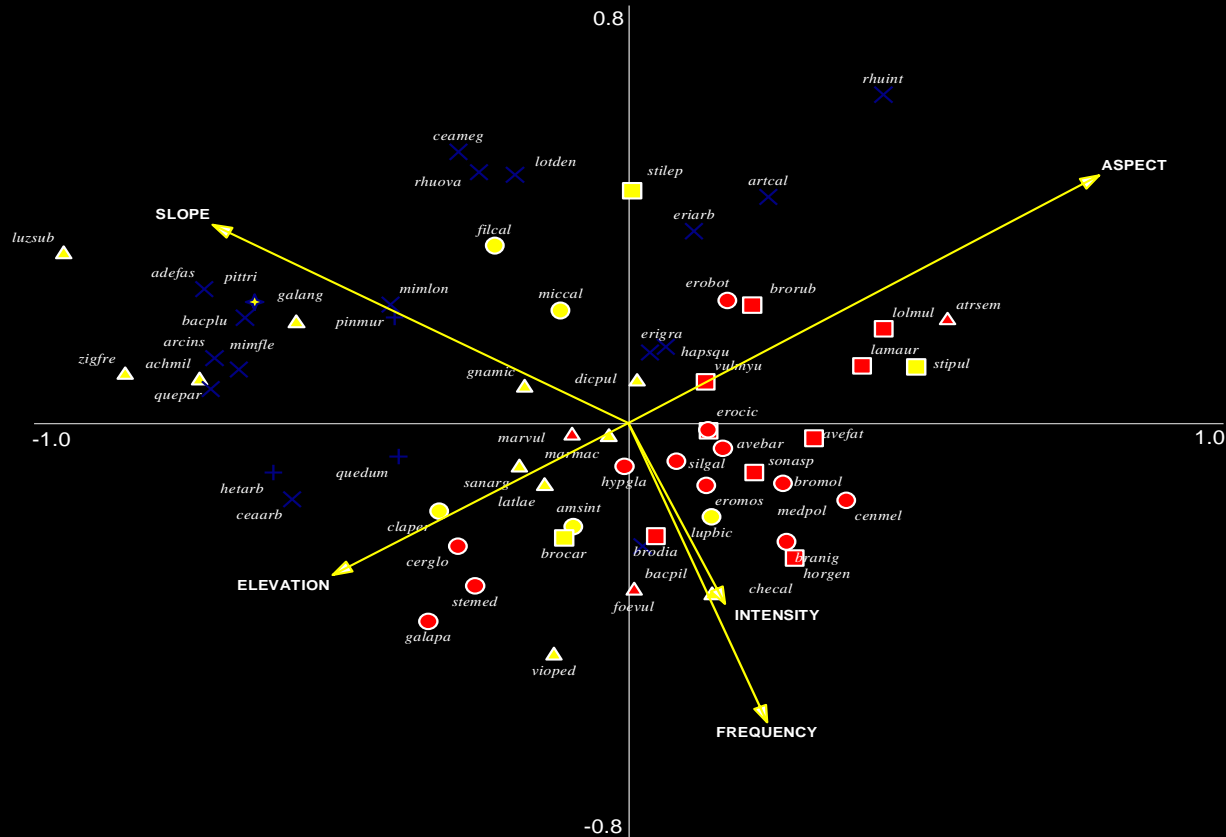
Rooting/Vegetation Structure Correlations

Guild	Intensity	Frequency	Return
Shrub Species	Negative		Positive
Shrub Cover	Negative	Negative	Positive
Shrub Seedlings	Negative	Negative	Positive
Native Annual Forb Species		Positive	
Alien Annual Forb Species		Positive	
Alien Annual Forb Cover	Positive		
Alien Grass Cover		Positive	

Ordination of Plots



Ordination of All Species



Summary & Interpretation For Vegetation

- As much as 10% of the island can be rooted in years with high pig density
- Most rooting occurs in grassland, fennel and oak woodland communities
- High intensity of rooting reduces overall species diversity, but species richness increases in plots with frequent, low intensity rooting
- Recruitment and cover of woody species are reduced with increasing intensity of rooting
- Increase in species richness is outcome of native and non-native annual forbs replacing woody species
- Rarer species potentially reduced by higher intensity and frequency of rooting
- Rooting mediates community structure, patch dynamics and probably succession patterns

Feral Pig Impacts On Rare Plants

- *Thysanocarpus conchuliferus*
 - 11 of 14 known populations found in 1991 with individuals present
 - 3 populations found in 1992 with individuals present (3 populations rooted)
 - 1 population found in 1993-1998 with individuals present (2 additional populations rooted)
 - N=56 in remaining population (1998)
 - 5 populations rooted by pigs; remaining ones heavy cover alien grass



Feral Pig Impacts On Rare Plants

- *Arabis hoffmannii*
 - Centinela Population
 - Pigs reduced stem density from 32 in 1992 to 19 in 1993. Population rebounded 78-110 stems 1994-98.
 - Platt's Harbor Population
 - Pigs destroyed population in 1995 (N=15 stems)
 - Albert's Road Population
 - Discovered 1995
 - No impacts
 - Stem density 11-81 from 1995-1998



Generality Of Results



- Likely To Be Representative Of Effects In Many Similar Ecosystems With Mediterranean-climate
- Mediation Of Shrub Invasion Into Grasslands Has Conservation Importance
 - Type conversion
- Rare Species Impacts!

