

# Origin and Evolution of Artichoke Thistle in California

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## Outline:

- The problem in California
- Questions addressed
- Chosen approach
- Findings to date
- Upcoming analyses
- What does it mean?
- *Flavescens* = *sylvestris*

For the moment...  
*Cynara cardunculus* varieties:



*scolymus*  
(Artichoke)

*altilis*  
(Cardoon)



*sylvestris* (Artichoke thistle)



# The Problem in California

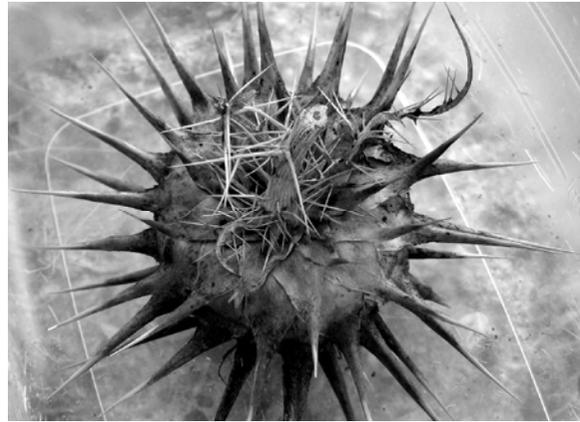


Photo credit: Joanne Heraty

# Varying Degrees of Aggressiveness



# Varied Morphologies



# Questions:



Coincident immigration  
and spread patterns?

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*Is there an aggressive genotype?*

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# Questions:

Origin: Where did it come from?

Are there aggressive hybrid or feral crop populations?

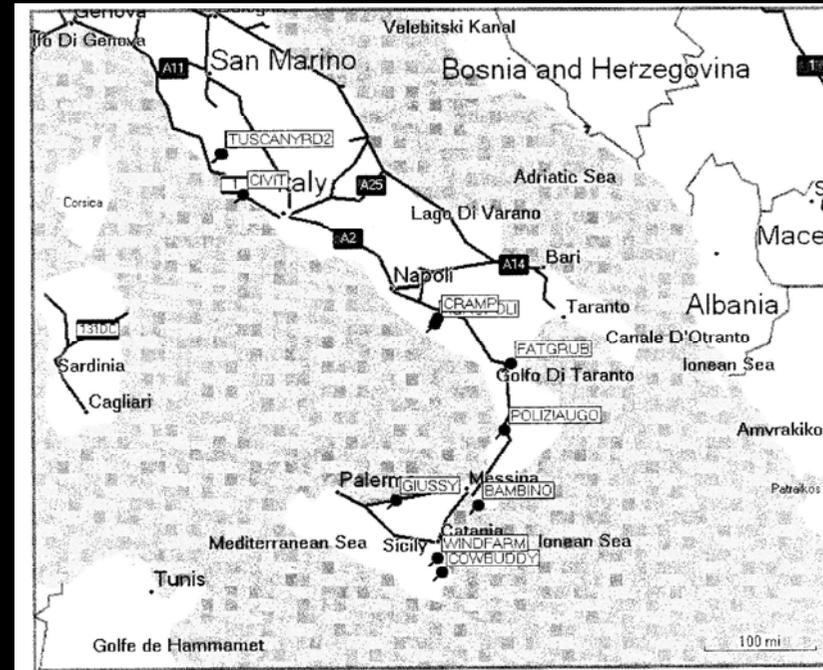
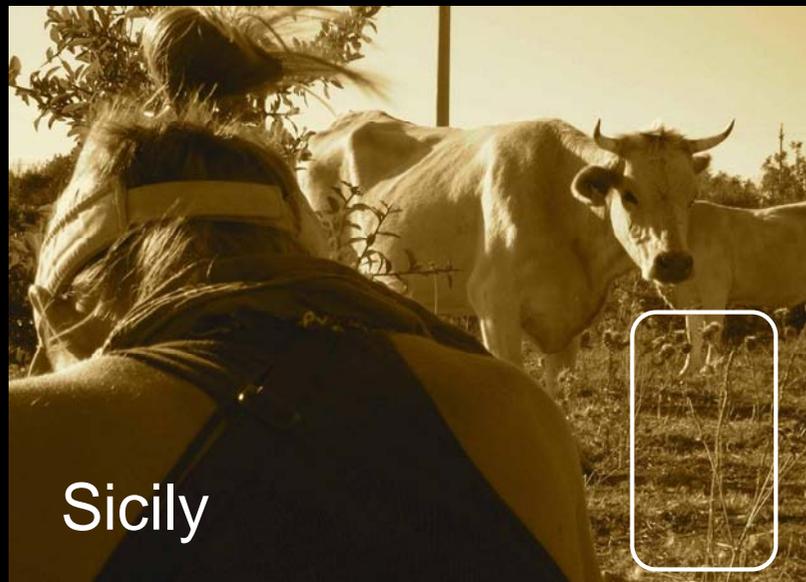
What can the genetic structure of California's populations tell us about how or why they spread?

*Is there an aggressive genotype?*





2006



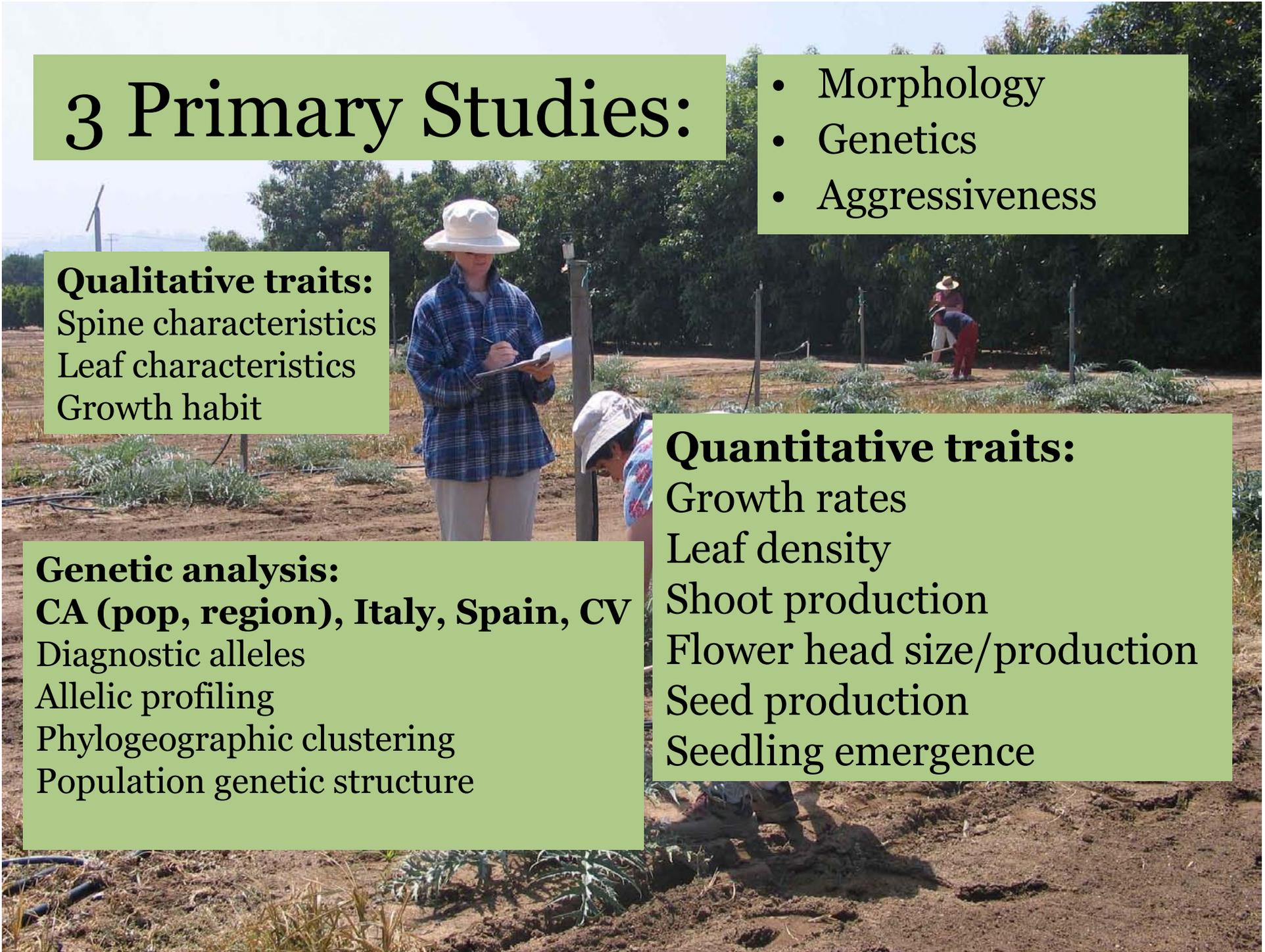
# 3 Primary Studies:

- Morphology
- Genetics
- Aggressiveness

**Qualitative traits:**  
Spine characteristics  
Leaf characteristics  
Growth habit

**Genetic analysis:**  
CA (pop, region), Italy, Spain, CV  
Diagnostic alleles  
Allelic profiling  
Phylogeographic clustering  
Population genetic structure

**Quantitative traits:**  
Growth rates  
Leaf density  
Shoot production  
Flower head size/production  
Seed production  
Seedling emergence



# Experiments:

- Common garden 1: California plants + cultivars, *inland location*
- Common garden 2: California + putative parent plants, *inland location*
- Common garden 3: California + putative parents, *coastal location*
- Microsatellite analysis:  
13 SSR markers, average of 13 alleles each, 476 individuals representing all groups.



UCR October 2006  
Common Garden #1

California collection

# UCR April 2007



# UCR Summer 2006



IMG\_4193.JPG



IMG\_4194.JPG



IMG\_4199.JPG



IMG\_4223.JPG



IMG\_4346.JPG



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# UCR Greenhouse 2007



# Within and Between Populations Seedling Variability



BNCA GH.JPG



LAKE GH.JPG



KRST GH.JPG



CALV GH.JPG



SACS GH.JPG



PUGO GH.JPG



COWB GH.JPG



LASB GH.JPG

# Seedling Regional Differences



# Regional Leaf Morphology Differences



# 2007: Measuring Reproductive Capabilities



In California  
Populations



All heads were  
measured and  
bagged for later  
seed retrieval

# 3 Primary Studies:

- Morphology
- Genetics
- Aggressiveness

**Qualitative traits:**  
Coming spring 2008

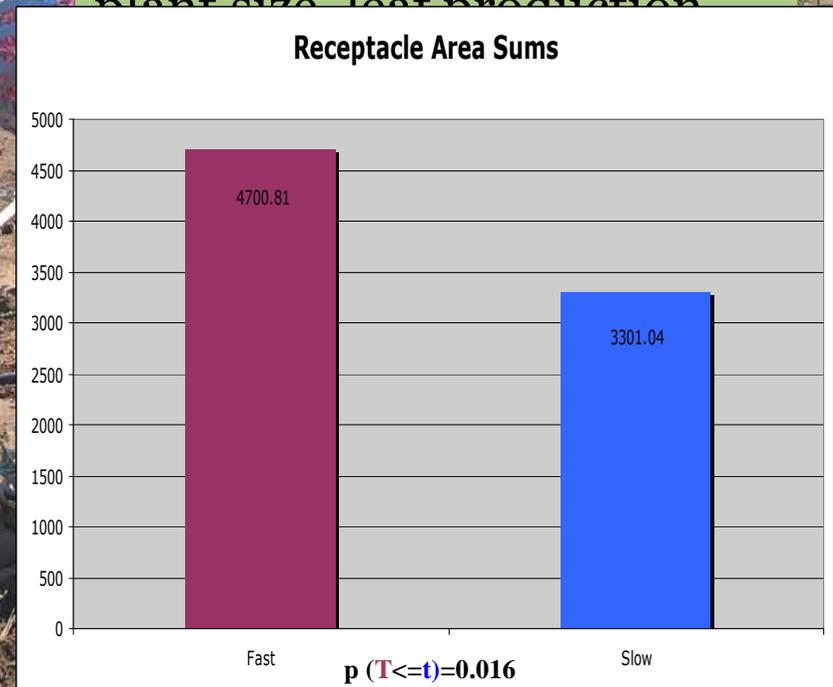
**Quantitative traits:**  
Significant differences between CA pops in emergence times, ultimate plant size, leaf production

## **Genetic analyses:**

Visual analysis of allelic patterns reveals within-population uniformity, between population diversity, particularly in California.

Between-group diversity in regional and taxonomic groups (CA, IT, SP, CV).

Italian alleles are not absent in CA

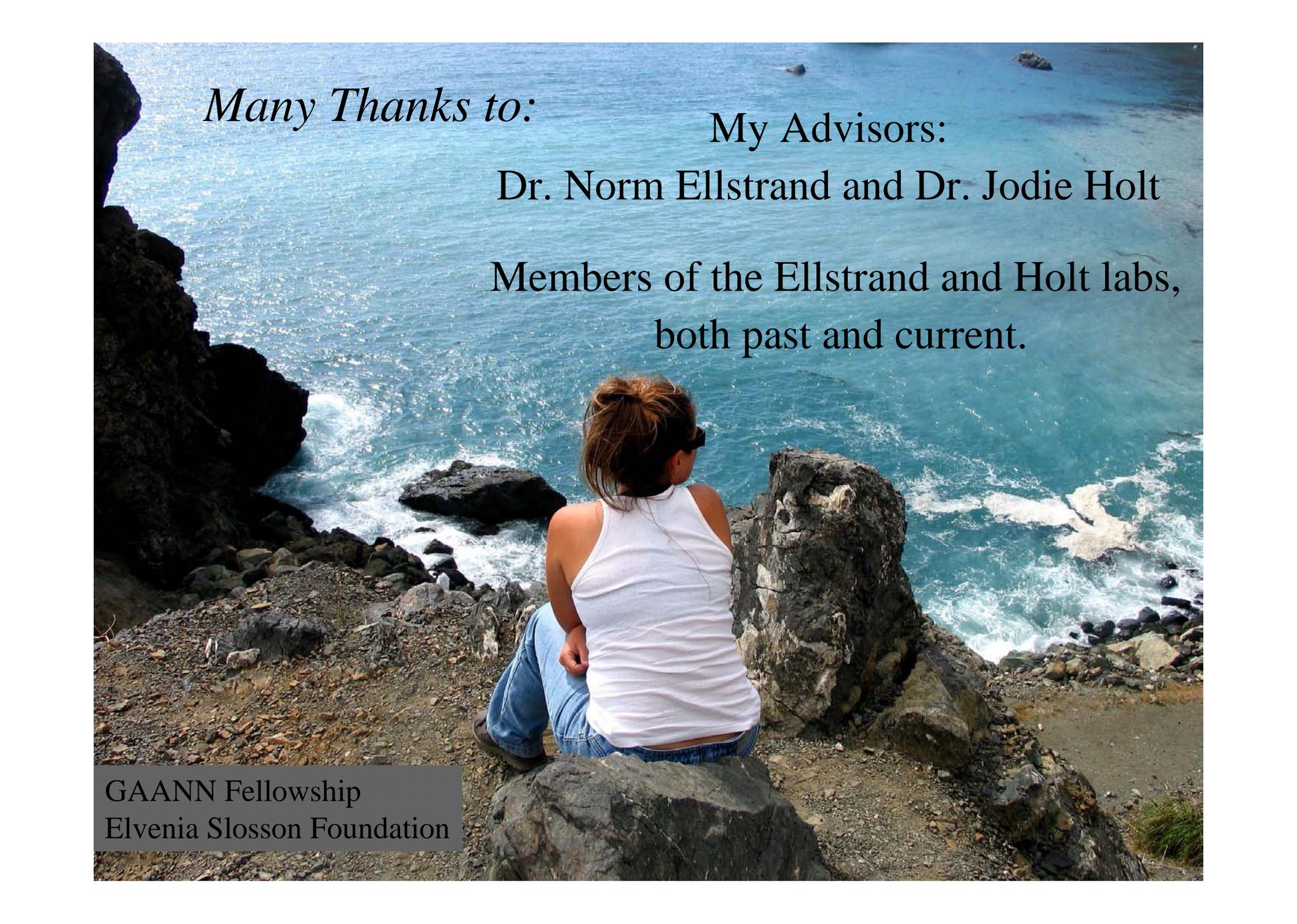


## Summary: What does it mean?

- California: uniformity within and variability between populations; in the *wild*, in the *greenhouse* in a *common garden* and in *SSR allelic distribution*.
- As a group, California populations have greater variability than Spain, Italy or the 2 cultivars.
- California populations are idiosyncratic. Many are feral hybridized or introgressed with cultivar genes.
- California's artichoke thistle likely has Spanish origins. The presence of both Spanish and Italian alleles suggest that Italian artichoke thistle may have been introduced then genetically absorbed by a more aggressive Spanish form.

# Summary...

- Multiple introductions of all sub-taxa provide an enormous amount of genetic diversity.
- Genotypes never before exposed to each other produce novel new combinations.
- Weedy genotype(s) emerge?

A woman with her hair in a ponytail, wearing a white tank top and blue jeans, is sitting on a large rock on a rocky cliff. She is looking out over a vast, blue ocean with white-capped waves crashing against the shore. The sky is clear and blue. The overall scene is a serene coastal landscape.

*Many Thanks to:*

My Advisors:

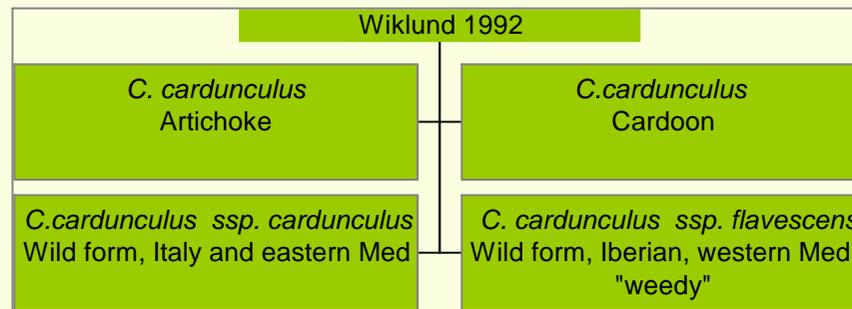
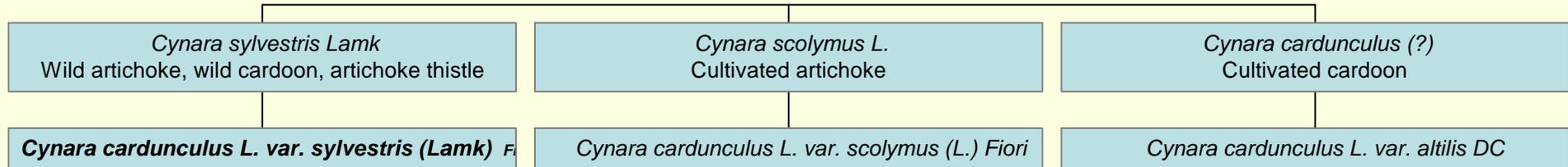
Dr. Norm Ellstrand and Dr. Jodie Holt

Members of the Ellstrand and Holt labs,  
both past and current.

GAANN Fellowship  
Elvenia Slosson Foundation

# Cynara sp. Taxonomy

Rottenberg and Zohary 1995, 1996\*



\* See also Harlan and DeWitt 1971

Synonyms (also listed by Wiklund):

- Cynara cardunculus* L. var. *ferocissima* = *Cynara horrida*
- Cynara cardunculus* L. var. *hortensis*
- Cynara cardunculus* L. var. *inermis*
- Cynara cardunculus* L. var. *sativa*
- Cynara cardunculus* L. var. *scolymus*
- Cynara scolymus* L. var. *mutica*
- Cynara scolymus* L. var. *pungens*