

1993

Burn in November



1994

Precipitation 9.34"

2.5 tons ha⁻¹

Bromus rubens

Brassica tournefortii

B. geniculata

Avena barbata



1995

Precipitation 18.90"

2.9 tons ha⁻¹

Bromus rubens

Avena barbata

Two crows



1996

Prec. = 7.33"

2.7 tons ha⁻¹

Bromus rubens
Avena barbata



1997

Prec. = 11.38"

3.6 tons ha⁻¹

Avena barbata

Bromus rubens



1998

Precipitation 25.30"

4.8 tons ha⁻¹

Avena barbata

Bromus rubens



1999

Precipitation 5.77"

0.7 tons ha⁻¹

Carryover

Biomass 3.6 tons ha⁻¹

Avena barbata

Bromus rubens



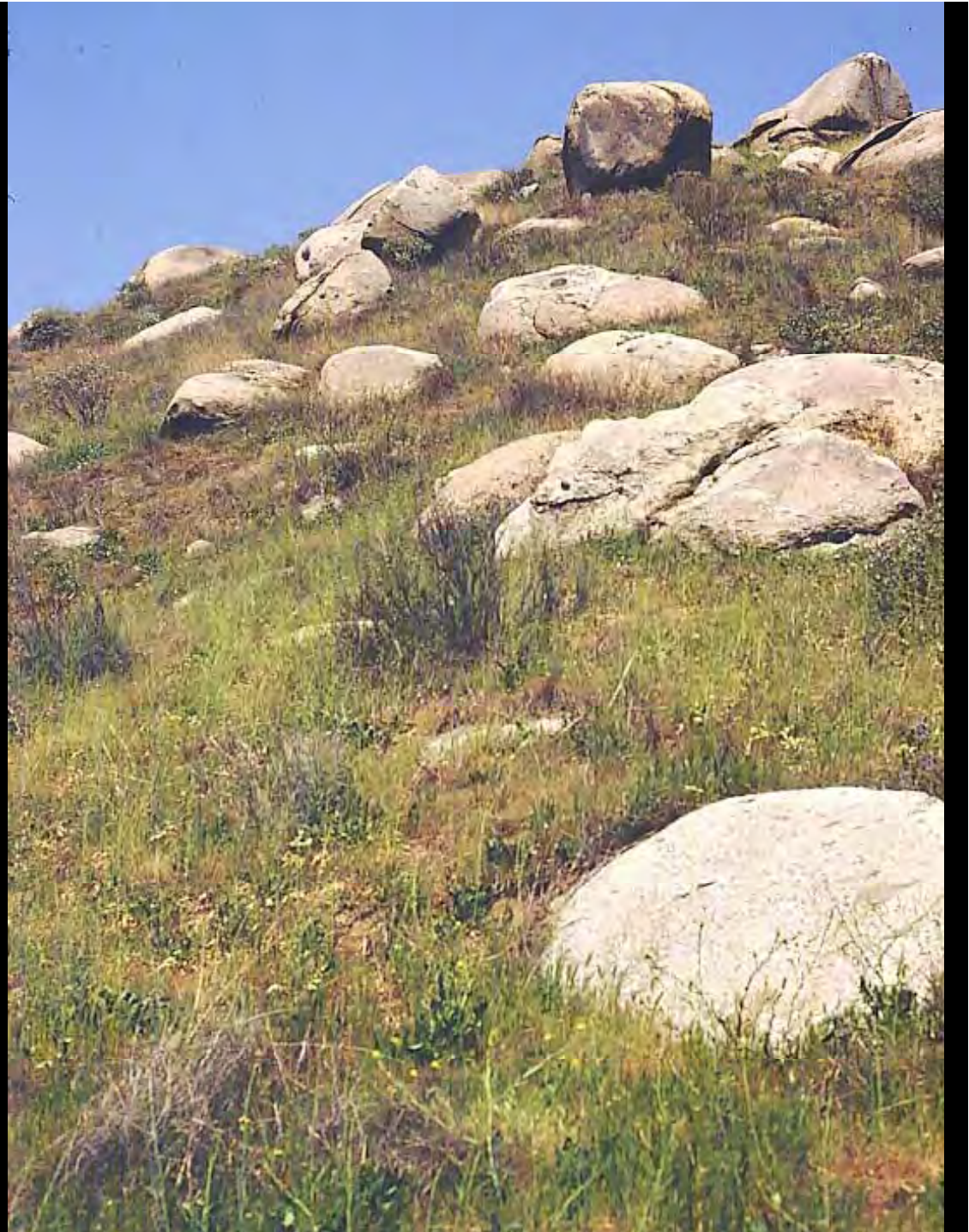
2000

Precipitation 6.29"

1.1 tons ha⁻¹

Bromus rubens

Brassica tournefortii



2001

Precipitation 8.47"

2.0 tons ha⁻¹

Brassica tournefortii

Bromus rubens



2002

Precipitation 3.46"

0 tons ha⁻¹

Carryover biomass
0.8 tons ha⁻¹

No germination



2003

Precipitation, 12.60"

3.3 tons ha⁻¹

Brassica tournefortii
Phacelia distans
Bromus rubens



2006

Precipitation 7.27"

Estimate 2.5 tons ha⁻¹

Bromus rubens

Bromus diandrus

Brassica tournefortii

B. fruticulosa



2007

Precipitation 1.80"

0 tons ha⁻¹

No germination



2008

Precipitation, 9.12"

Estimate, 2.0 tons ha⁻¹

Brassica tournefortii

Phacelia distans

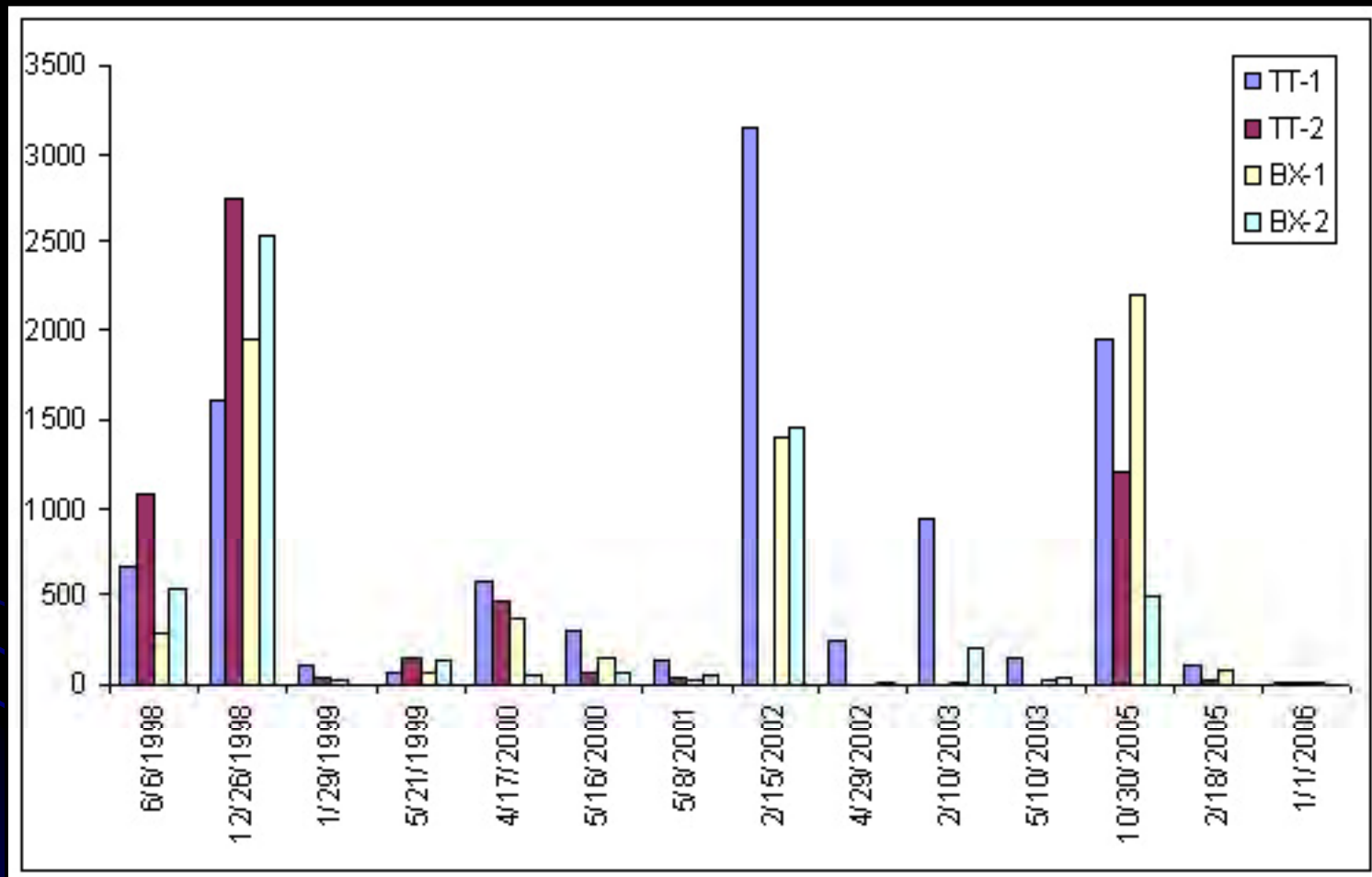
B. geniculata



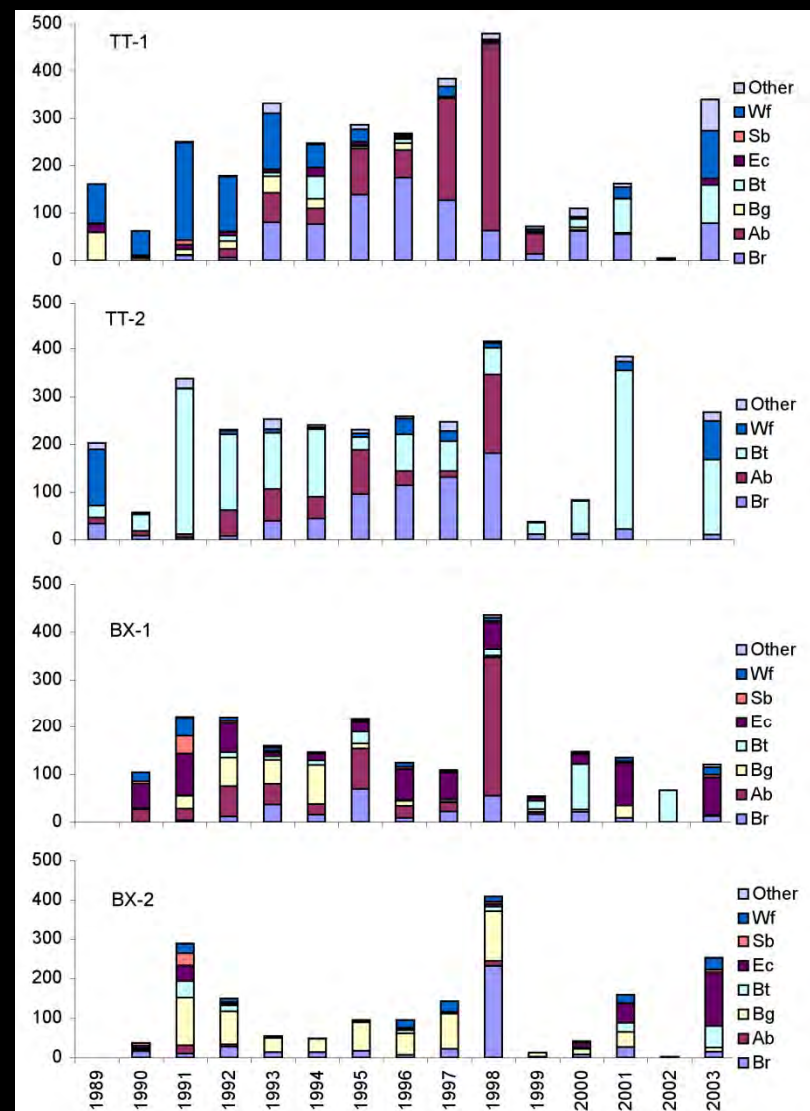
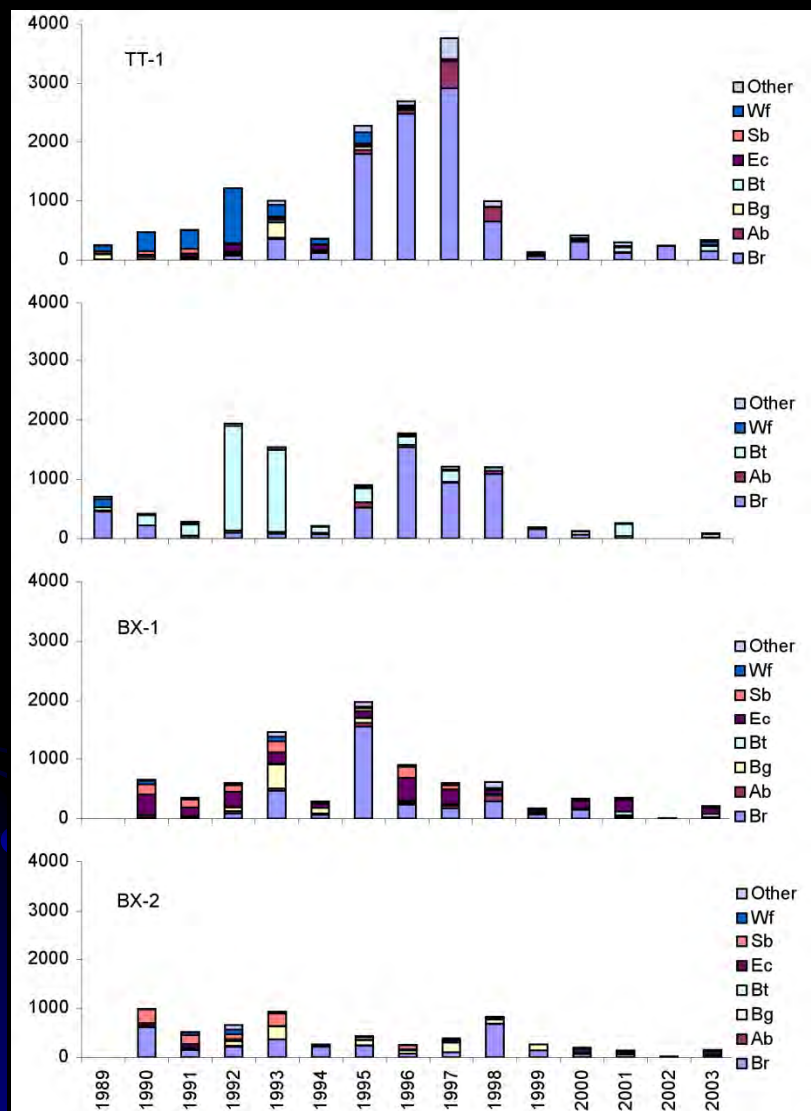
Brome "crash," 2006-07



Density of *Bromus rubens* (stems m⁻²)



Wildflower and exotic annual frequency and biomass at Two Trees Canyon





Layia platyglossa

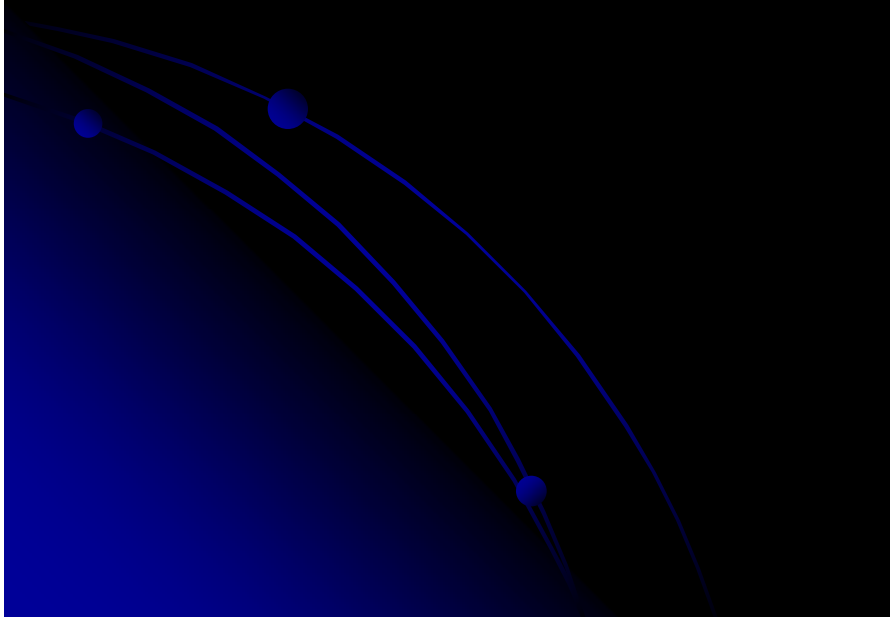


Lasthenia gracilis

Wildflower outbreaks at Riverside in 2001 and 2003, the first since 1978

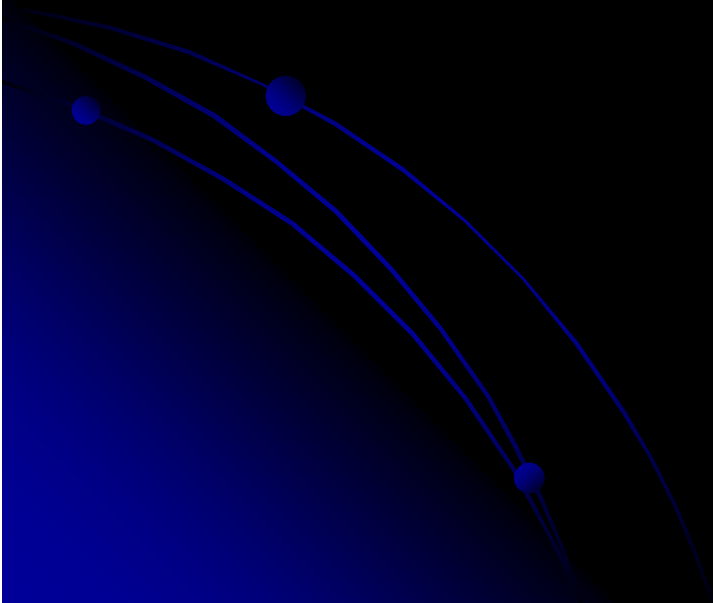


University of California
Riverside, 2008



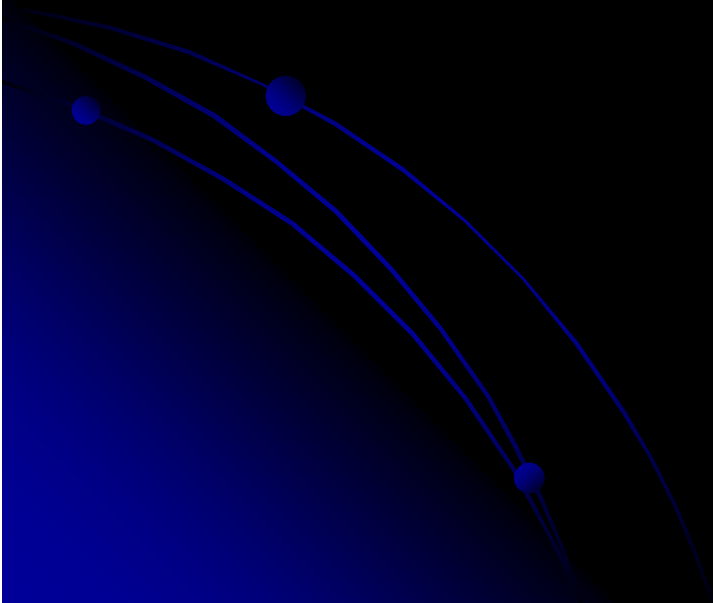
Conclusions on the Franciscan vegetation baseline

- Winter herbaceous vegetation of wildflower fields.
- Dry summer pasture along the coast; barren interior valleys.
- Widespread burning along the coast, but not in the interior for lack of fuel.
- Spanish texts do not record bunch grassland.



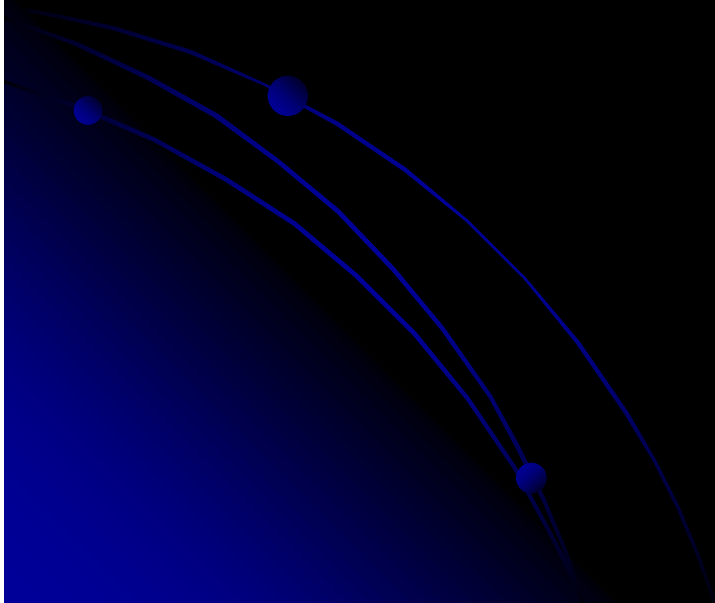
Summary of California pastures in the mid-19th century.

- Wildflowers dominated most of the California interior, mixed with *Erodium* and clovers.
- Coastal wildflower prairies were invaded or displaced by wild oats and black mustard
- Cattle numbers fluctuated with climate variability much like the wildlife, but did not reach carrying capacities until ca. 1810.
- Mediterranean annuals spread ahead of grazing, a confirmation of biological invasion theory.
- Bunch grasslands are rare now because they have always been rare.
- Native forbs (and exotic annual grasses) adapt to grazing with prolific seed production.
- Native wildflowers recorded in packrat middens date to the last glacial maximum.
- These species extend far back into the Quaternary, in association with a diverse megafauna that exert a “cattle-like” disturbance.
- Unconstrained space-for-time substitution methods lead to *ad hoc*, and *untestable* stories.



Summary of the 20th century

- Franciscan invasives reached their ecological range by the Gold Rush
- Wildflowers persisted in the interior.
- Second wave invasives (bromes) displaced forbs in the interior after 1965
- Wet years favor bromes and oats; dry years favor filarie, mustards and wildflowers.

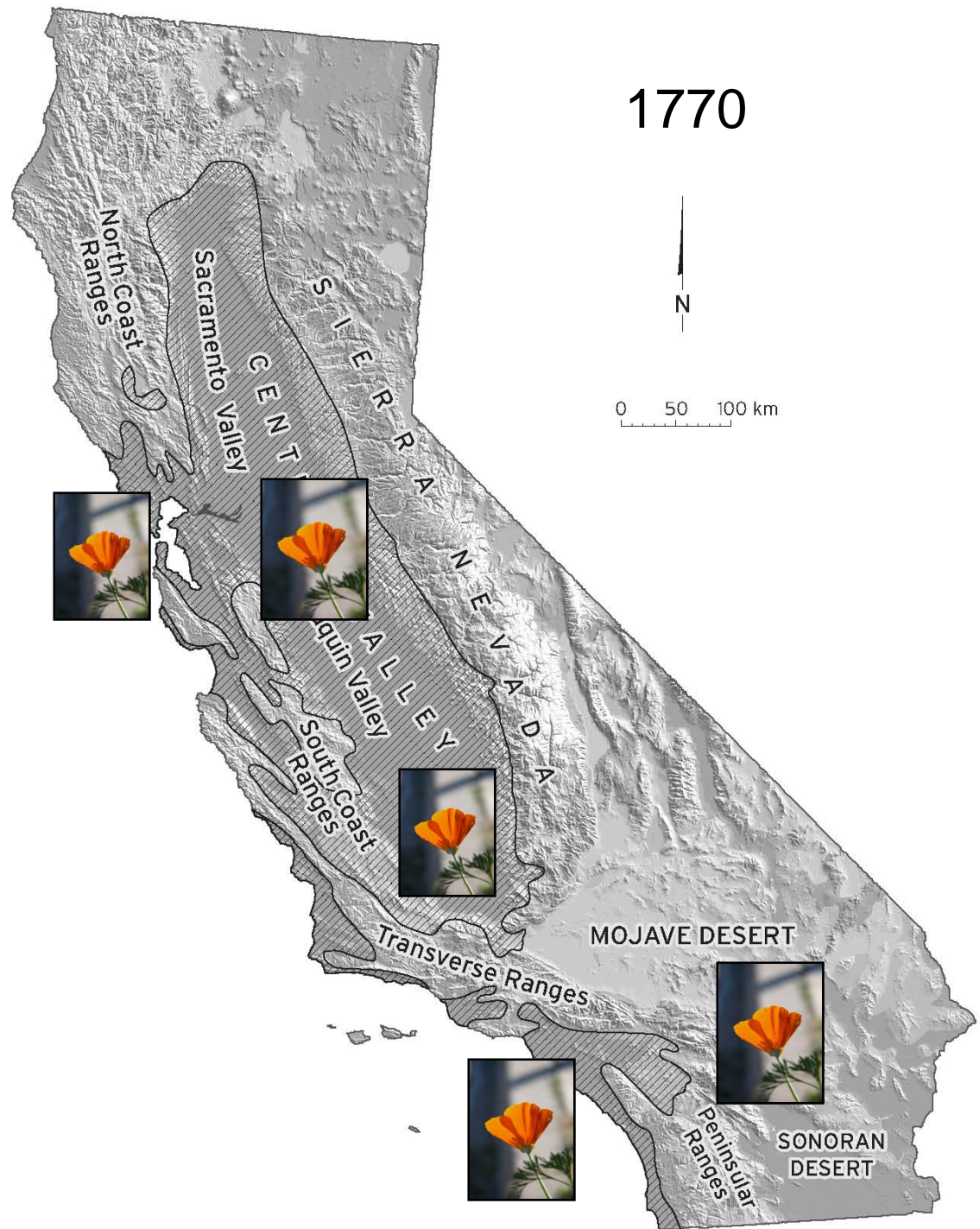




- Invasive species--fire feedback
- Refuted for coastal pastures
 - Merit for interior pastures

TWO CENTURIES OF INVASIONS

- Wildflowers throughout California plains, valleys, foothills, and deserts
- Dry season coastal pasture
- Dry season interior valley and desert “barrens”



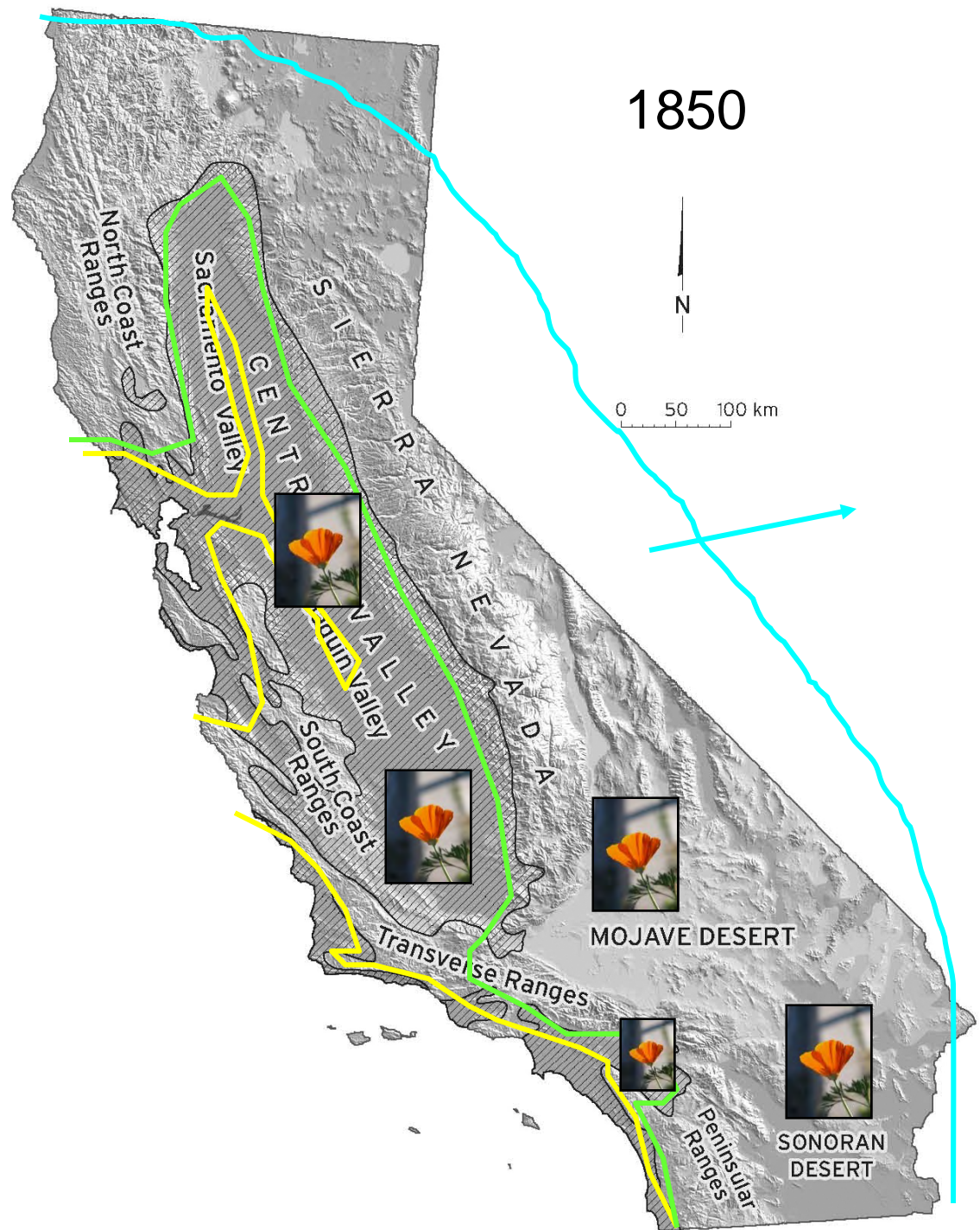
- Franciscan invasions of coast and interior floodplains
- Wildflowers in interior and deserts
- Coastal Franciscan pasture of wild oat and black mustard
- Interior barrens with Erodium and clovers

— Wild oats, black mustard

— Clovers

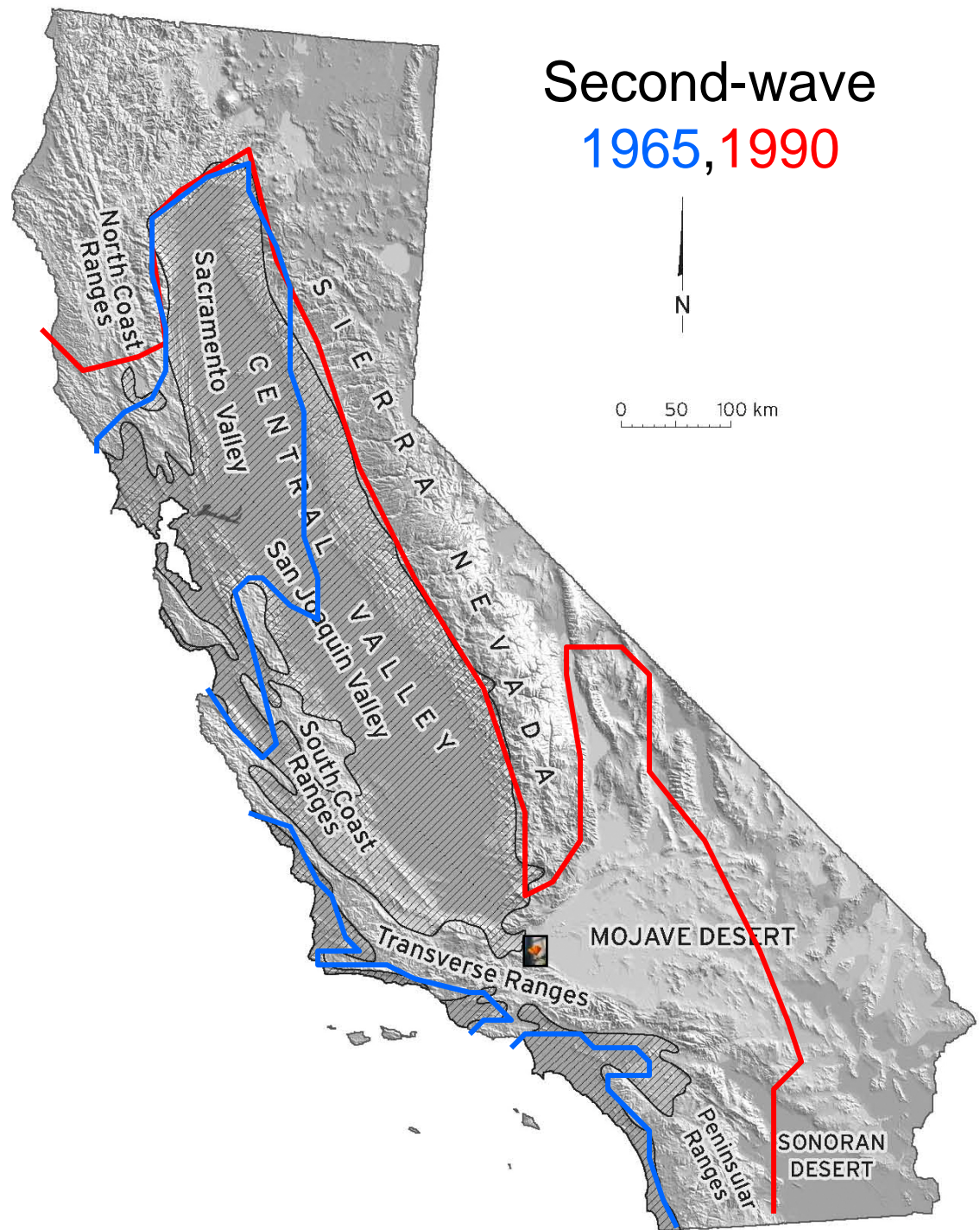
• Erodium

— Brome

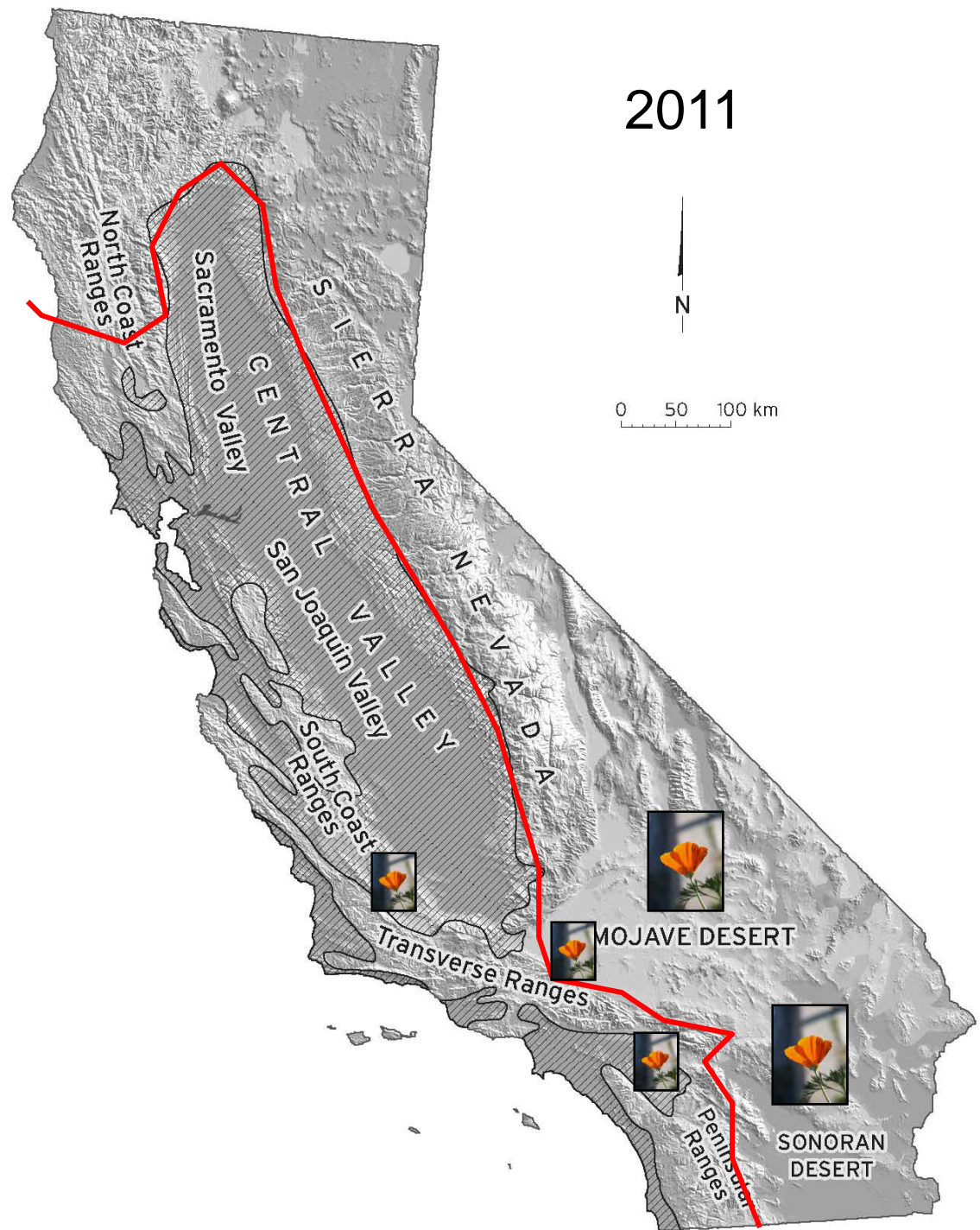


“Second-wave” brome,
slender wild oat, summer
mustard invasion

- Coastal pasture of ripgut brome, red brome and wild oats
- Interior pasture of ripgut brome, red brome, and bastard oats
- Desert scrub with Erodium, split grass, Sahara mustard, and red brome
- Coastal and interior pasture of cured grassland
- Desert edge grasslands
- Hyperarid desert barrens



- Coastal pasture of ripgut brome, red brome and wild oats
- Interior pasture of ripgut brome, red brome, and bastard oats
- Desert scrub with Erodium, split grass, and wildflowers
- Coastal and interior pasture of cured grassland with local flowers
- Deserts alternate between cured grassland and barrens





Death Valley, 2005

The Rose Parade



In New York, people are buried in the snow.
Here our flowers are blooming and our oranges
are about to bear. Let's hold a festival to tell
the world about our paradise.

Charles Fredrick Holder, 1890



Charles Fredrick Holder
Women's flower festivals



CONCLUSIONS

- Wildflowers no longer a reminder of our past, nor on the agenda of species protection.
- Legal structures for protection of species, not landscapes.
- Species protection is irrational, the salvation of one will come at the expense of its neighbors.
- Restoration of wildflower pastures will require management strategies involving the entire landscape.
- Biological control: Invasive exotic annuals are “goats on islands.” California habitat is not superior to indigenous European habitat.

Management

1. Spring burning.
2. Seasonal grazing of domesticated livestock.
3. Dedication of flower reserves.
4. Biological control: Introduction of pathogens to reduce the abundance of bromes and oats.



Ecology should be studied at broad scales and understood from a probabilistic perspective.

California ecology is focused too much on the individual flowers, not the float.

The “shifting baseline syndrome” predicts that this story will be everchanging.

