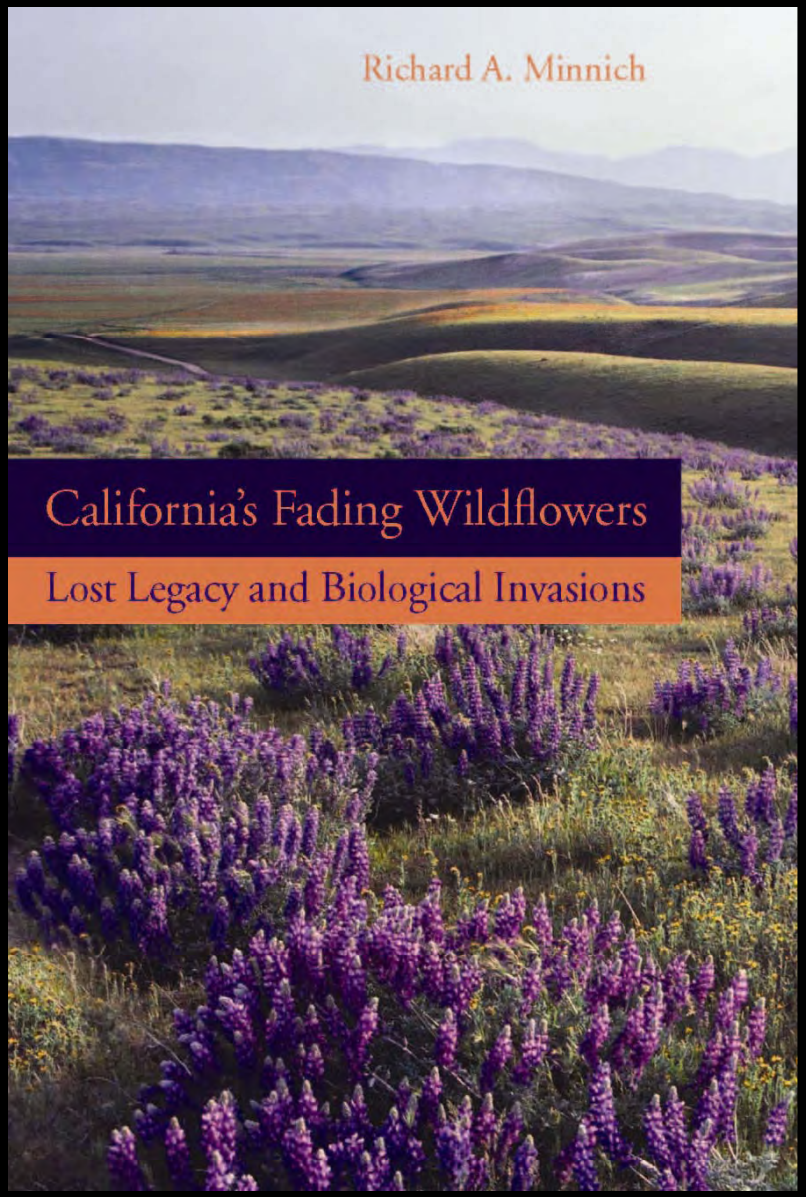
“No poet has yet sung the full beauty of our poppy, no painter has successfully portrayed the satiny sheen of it lustrous petals, no scientist has satisfactorily diagnosed the vagaries of its variations and adaptability. In its abundance, this colorful plant should not be slighted: cherish it and be ever thankful that so rare a plant is common.” John Thomas Howell



Cryptantha

Calandrinia

Penstemon

Emmenanthe

California poppy
(*Eschscholzia*)

Amsinckia

Lupinus

Nemophylla

Phacelia

Layia

Salvia (Chia)

California’s modern golden hillsides

Ground cover of European / Mediterranean bromes, oats, barleys, mustards

What was the indigenous herbaceous cover?

The furious pace of exotic annual invasions hampered scientific scrutiny because indigenous herb cover was already altered before the first botanists arrived in California, ca. 1850.

Without constraint of empirical evidence at European contact, this led to a plethora of hypotheses.

- Indigenous cover was perennial bunch grassland
- Bunch grasslands converted to wildflowers and exotic grassland due to overgrazing
- Exotic annual grasslands are invasive species that outcompete native herbs

Consensus models on California grasslands have historically resorted to deductive historical scenarios based on spatial evidence (space-for-time substitution), beginning with “climax” and “relict” theory of Clements (1916, 1934).

Modern computer similations that forecast future vegetation based on niche theory and global warming scenarios are a throwback to Clementsian thinking.

SHIFTING BASELINE SYNDROME

The choice of baseline affects the outcome of your story (Jackson et al. 2001)

- Defenders of the bunch grassland model claim that only observations of trained botanists (> 1860) have scientific merit (Clements 1934)
- But the first botanists saw biological invasions in progress.

Distribution of the California prairies

HISTORICAL ECOLOGY

Ecology is a historical science, a seamless extension of the geosciences and quaternary paleoecology (Jeremy Jackson et al. 2001 *Science)*.

To enlarge spatial and temporal scales, it is vital to sacrifice precision and analytical elegance in ecology in order to buy time and analyze long-term ecological questions.

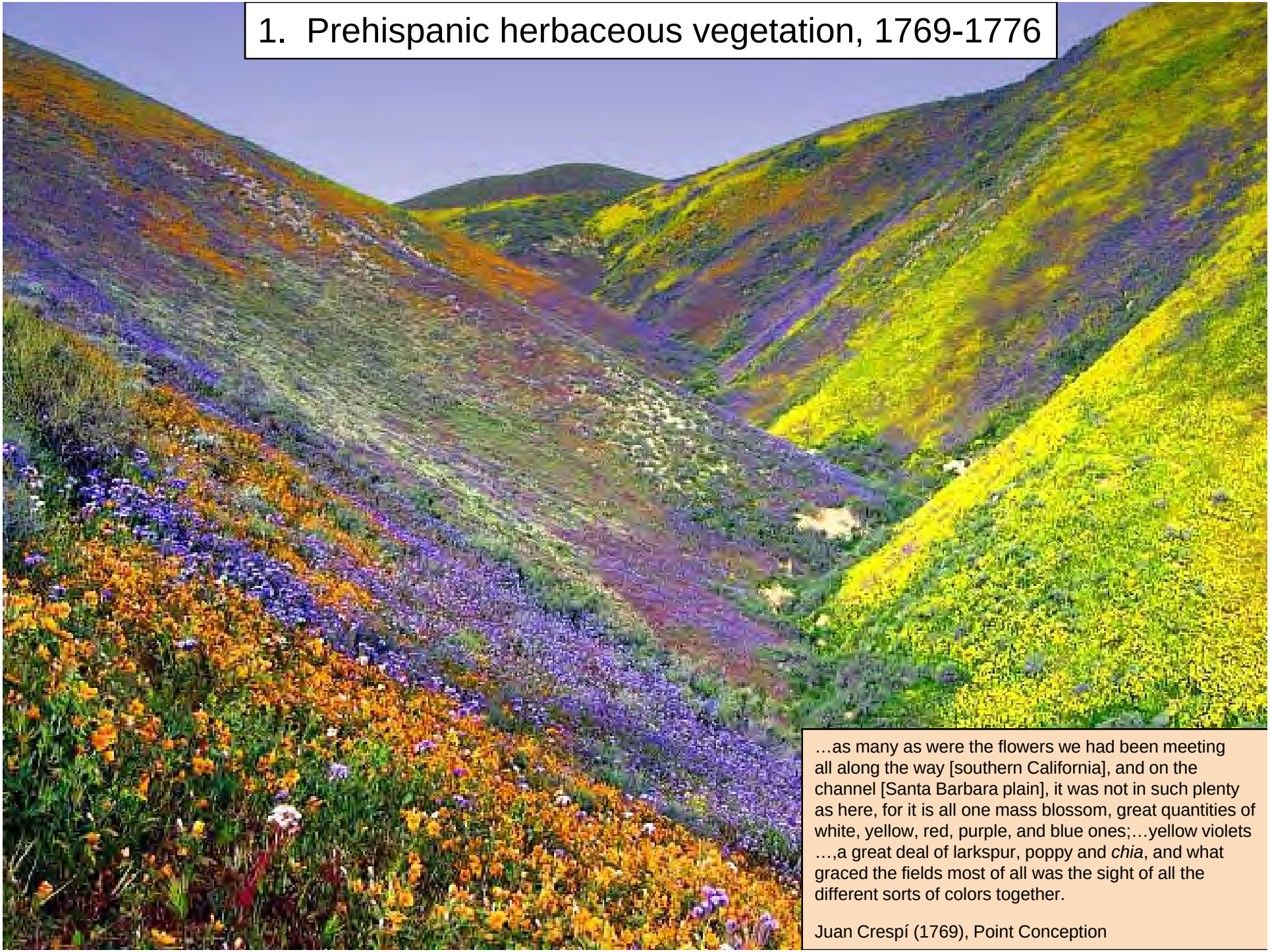
Here we begin with the Spanish record (1769-1776)
Then follow with

- Gold Rush period (1840-1880)
- Flower reports from 20th century newspapers (1880 to present)
- Paleobotany of packrat middens and mammalian paleontology

THE GLOBAL HYPOTHESIS OF MY BOOK:

INDIGENOUS WILDFLOWER FIELDS WERE DISPLACED BY INVASIVE ANNUALS

1. Prehispanic herbaceous vegetation, 1769-1776

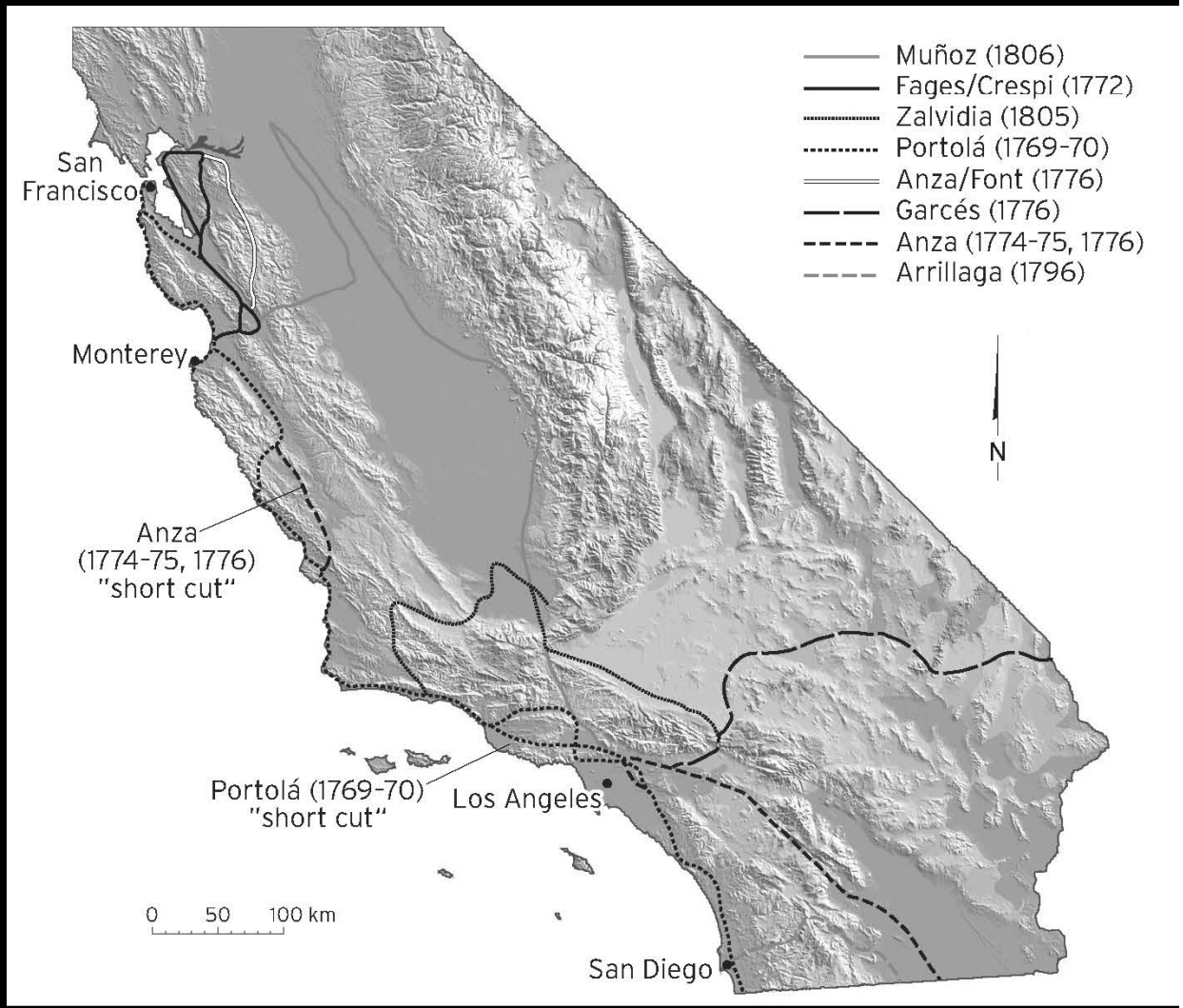


…as many as were the flowers we had been meeting all along the way [southern California], and on the channel [Santa Barbara plain], it was not in such plenty as here, for it is all one mass blossom, great quantities of white, yellow, red, purple, and blue ones;…yellow violets …,a great deal of larkspur, poppy and *chia*, and what graced the fields most of all was the sight of all the different sorts of colors together.

Juan Crespí (1769), Point Conception

The Spanish Record

- Systematic survey of the state (mandated by the Viceroy of Mexico)
- Daily assessment of vegetation and other resources necessary for the establishment of a mission system (pasture, wood, timber).
- The Spaniards were the only people to write about California's aboriginal landscape before the expansion of invasive species.
- Spanish journals must be evaluated in their historical context.



Pasture was described every day from San Diego to San Francisco

Spanish observations and vocabulary on the vegetation were made by priests, but they were the educated scholars of the period.

Baja California deserts: Identification to genus, sometimes to species.

Mediterranean vegetation: Identifications of trees species are accurate because they are congeners with Europe (riparian/conifer forest, oak woodland)

Descriptions of unfamiliar mediterranean shrublands are muddled. Chaparral was avoided, an impedance to travel.

Coastal sage scrub: “Kitchen plants” (salvia, lavender, rosemary).

APPENDIX 2

Spanish plant names for California vegetation

ABETO fir (*Abies concolor*) in southern California
ABROJOS cactus
ÁLAMO, ALAMEDA, ALAMILLO poplar, mostly Fremont cottonwood (*Populus fremontii*)
ÁLAMO NEGRO black cottonwood (*Populus trichocarpa*)
ALISO traditional meaning in Mexico is alder (*Alnus*); in California it refers to sycamore (*Platanus racemosa*); Brown (2001) and Bolton (1927, 1930a,b, 1933) erroneously translate aliso to “alder”; Roberts (1989) and Minnich and Franco-Vizcaíno (1998) translate aliso to California sycamore (*P. racemosa*)
AMARANTH *Amaranthus* spp.
ARBOL tree
ÁRBOLES CORCHO cork tree, very likely *Quercus agrifolia* (term used by Pedro Fages in Priestly 1937)
ARBOLILLO shrub
ARBUSTO shrub, bush
AVELLANAS hazelnuts, California buckeye (*Aesculus californica*)
AVENO wild oat
BOSQUE, VOSQUE thicket, woodland, wood
BOSQUE CHAPARRO a shrubby growth
BOSQUE ESPINOSO literally, “spiny brush” or “wood” in chaparral, likely dominated by *Ceanothus*
BREÑALES “brambles,” in reference to dense chaparral of the Santa Monica Mountains
CACHANILLA
CACOMITES a species of *Iris*
CALABASAS wild gourd (*Cucurbita foetidissima*)
CARDOS SANTOS prickly poppy, holythistle
CARRIZO a large cane grass, reed grass, probably tule (*Scirpus* spp.)

Arrowweed, Mexicali Valley

“Rosetta stone” for pasture in the Spanish journals

TABLE 2.1 USE OF *PASTO* AND *ZACATE* IN THE JOURNALS OF CRESPÍ, FONT, AND COSTANSÓ

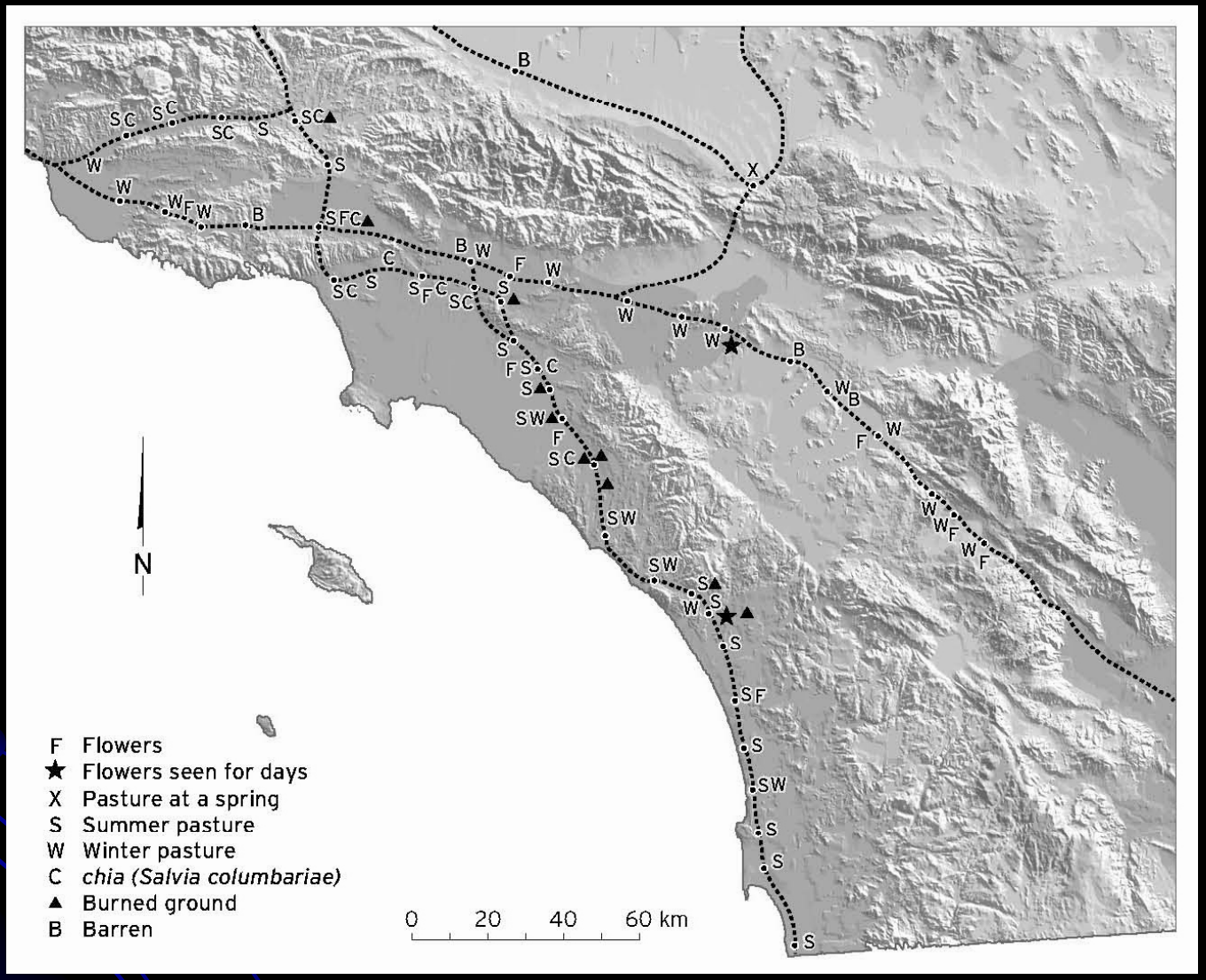
	Dry Herbage (summer)				Green Herbage (winter)		
	Salt grass	*Pasto*	*Zacate*	Both	*Pasto*	*Zacate*	Both
Crespí	2	26	24	26	9	5	4
Costansó	—	23	1	0	—	—	—
Font[a]	—	—	—	—	8	1	—

SOURCE: Brown 2001; Teggart 1911; Web de Anza Archives.
[a]. Font's explorations were entirely in the winter growing season.

esteril— barren, sterile, not useful for livestock
trigo— wheat
Centeno— rye

Words for bunch grass
Grama— bunch grass
Sabaneta— a species of bufo grass

Historians of Spanish texts translated pasto and zacate as “GRASSLAND.”
(Bolton, many books; A.K. Brown 2001)



Southern California

OBSERVATIONS IN THE GROWING SEASON

Crespí. Near Carlsbad. “It is a pleasure to see how the fields are abloom everywhere,

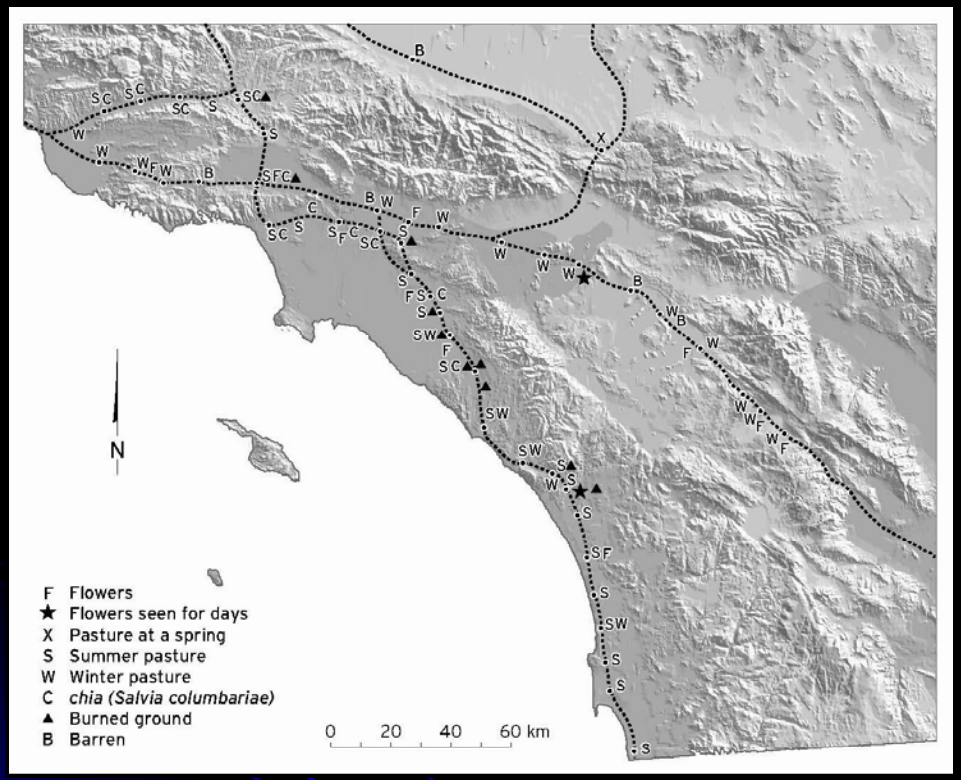
Crespí. San Luis Rey. “The entire way has been, like the preceding ones, very flowery.”

Anza. San Jacinto Valley. “All its plains are full of flowers, …”

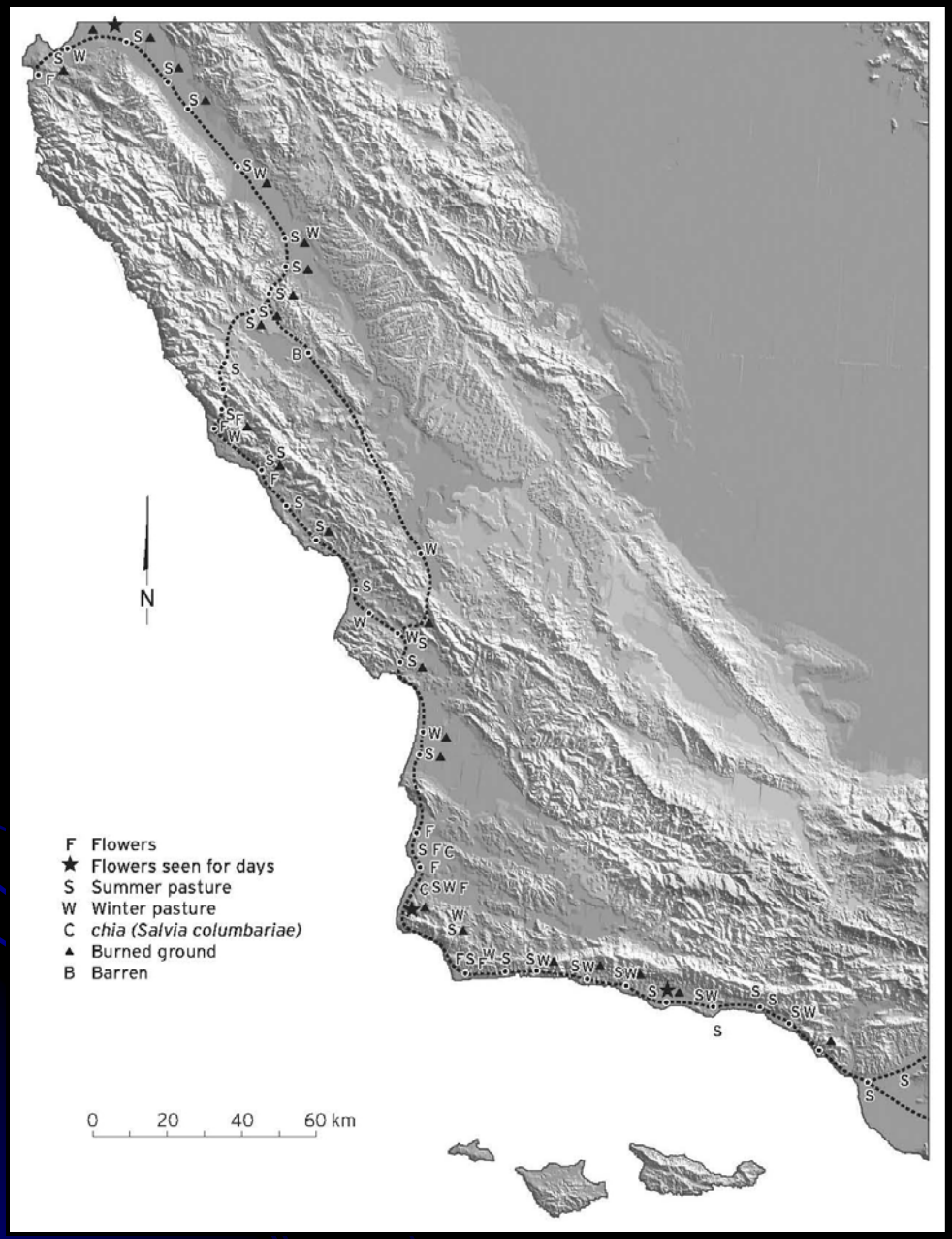
Lasthenia gracilis (gold fields)

Font, Orange County plains. “Among the infinite variety of flowers, such as tulips [California poppy] and others of very diverse colors and very pretty…”

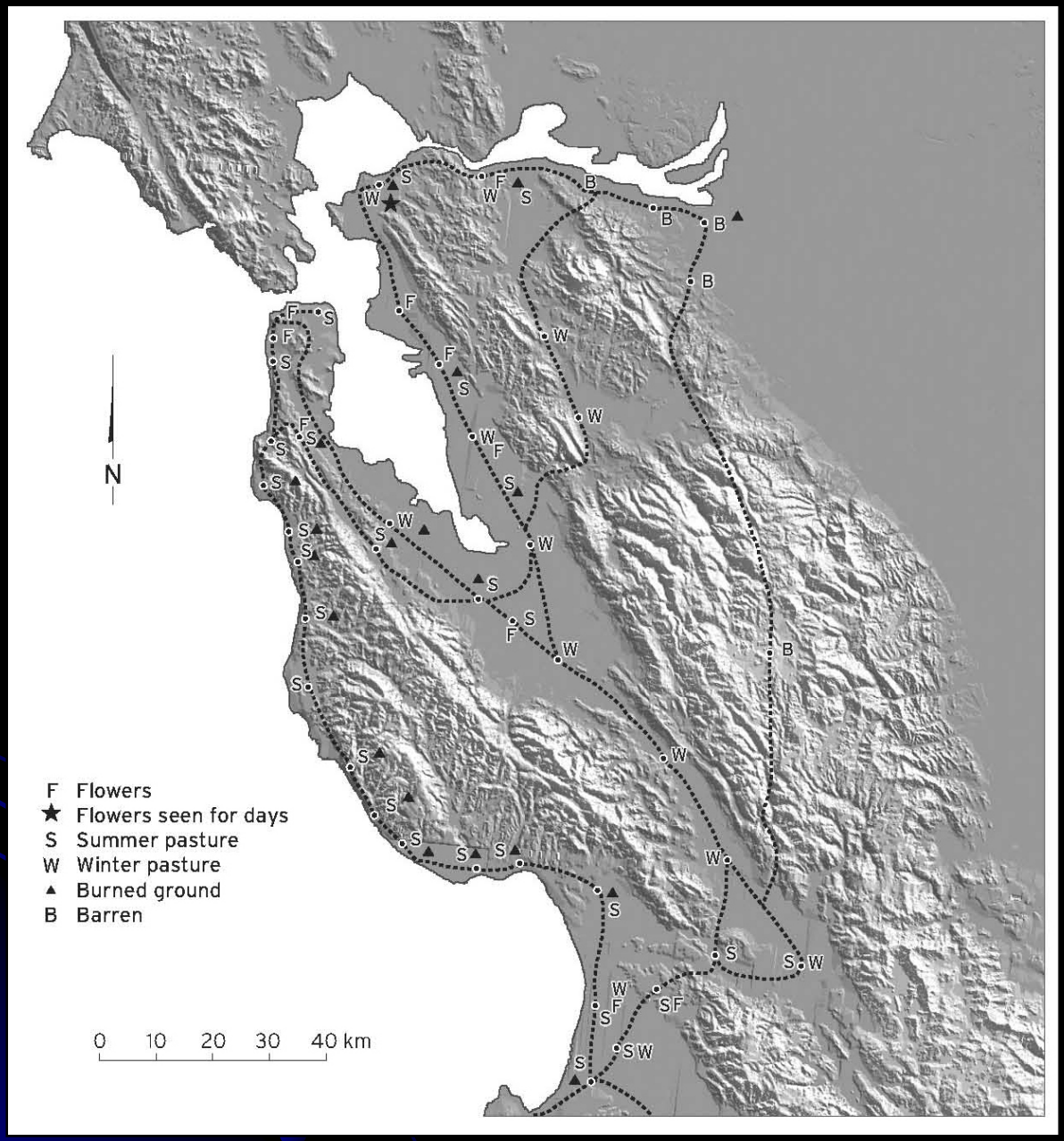
Crespí, Placentia. The entire countryside,…., is full of chia that is very good for refreshment, so much of it that I thought it impossible for the heathen folk, …..to gather even half of it. It was in bloom at present, purple-colored bloom.



Salvia columbariae (chia)



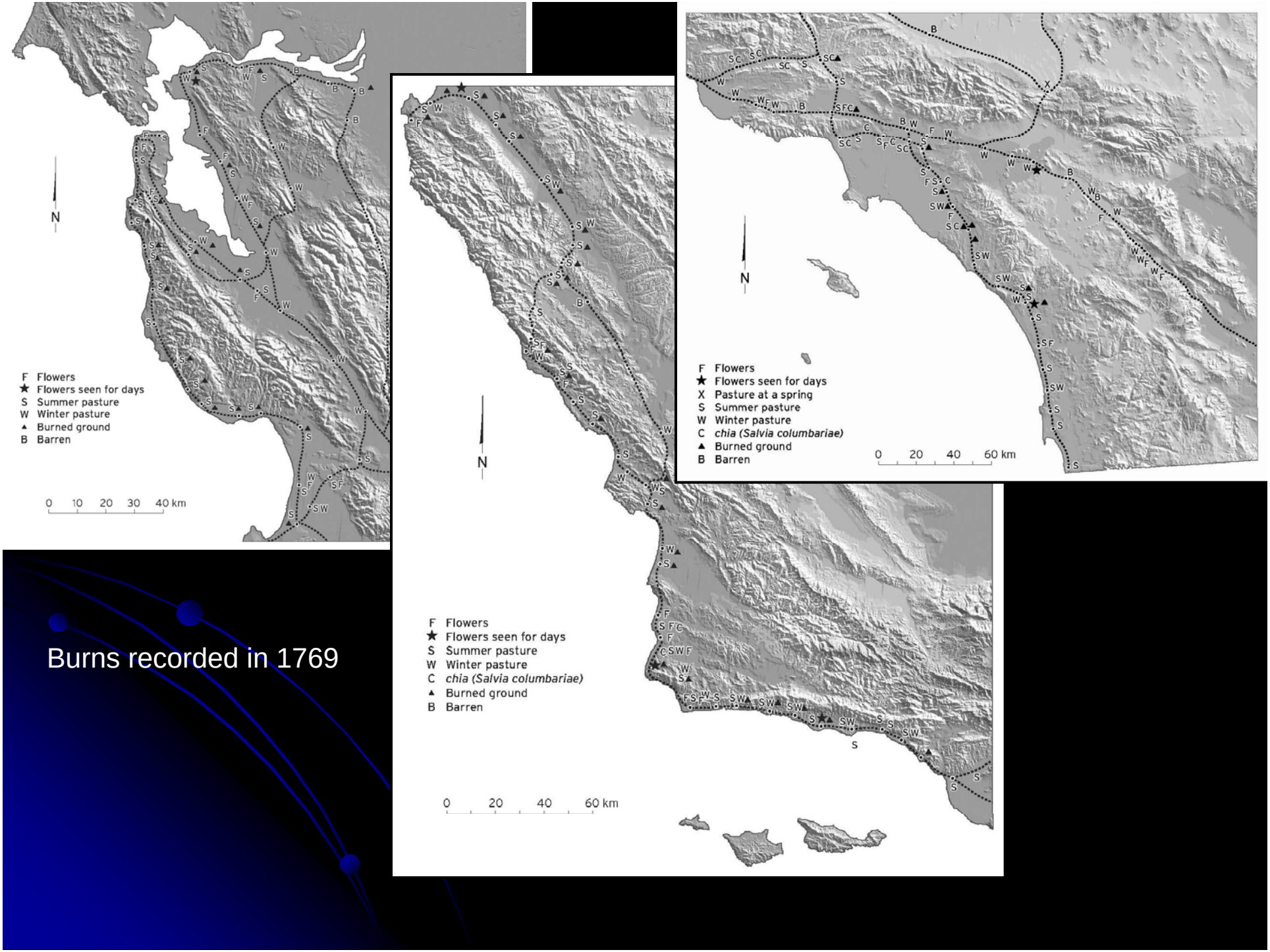
Central California



San Francisco Bay and Monterey

FONT Salinas Valley. “The road like all the rest is through pretty country,…flower-strewn,…fertile, beautiful, and splendid.”

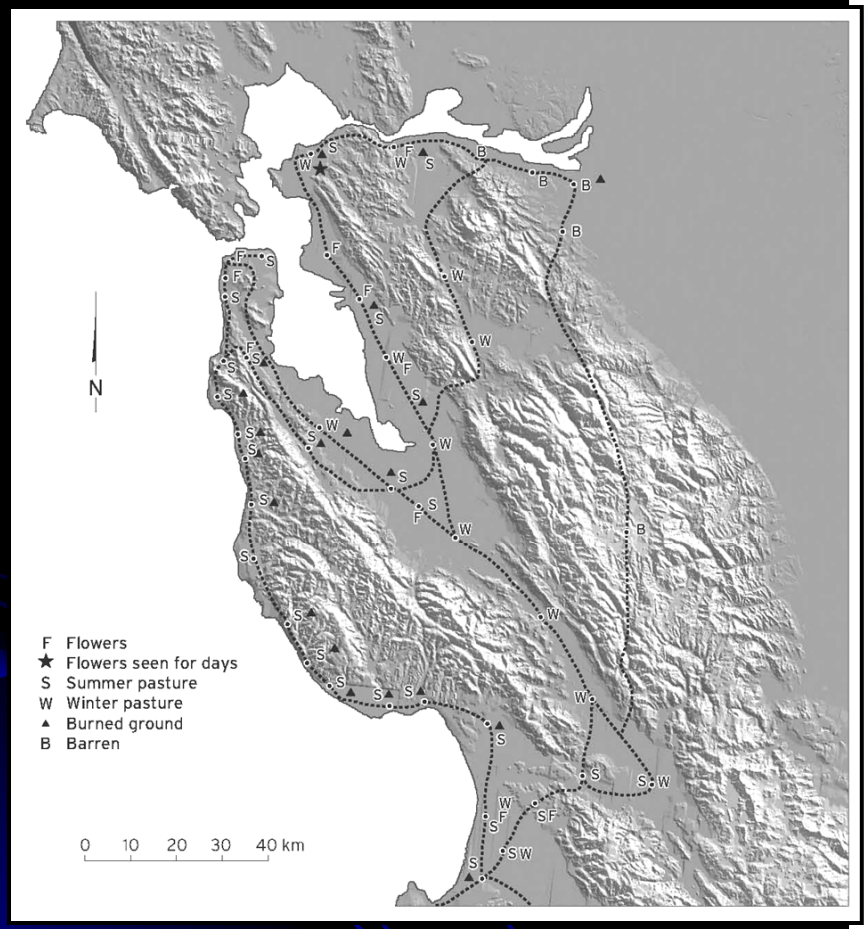
FONT April 1, 1776. Carquinez Strait, “the fields are…thickly covered with various wildflowers as those [areas] farther back.”

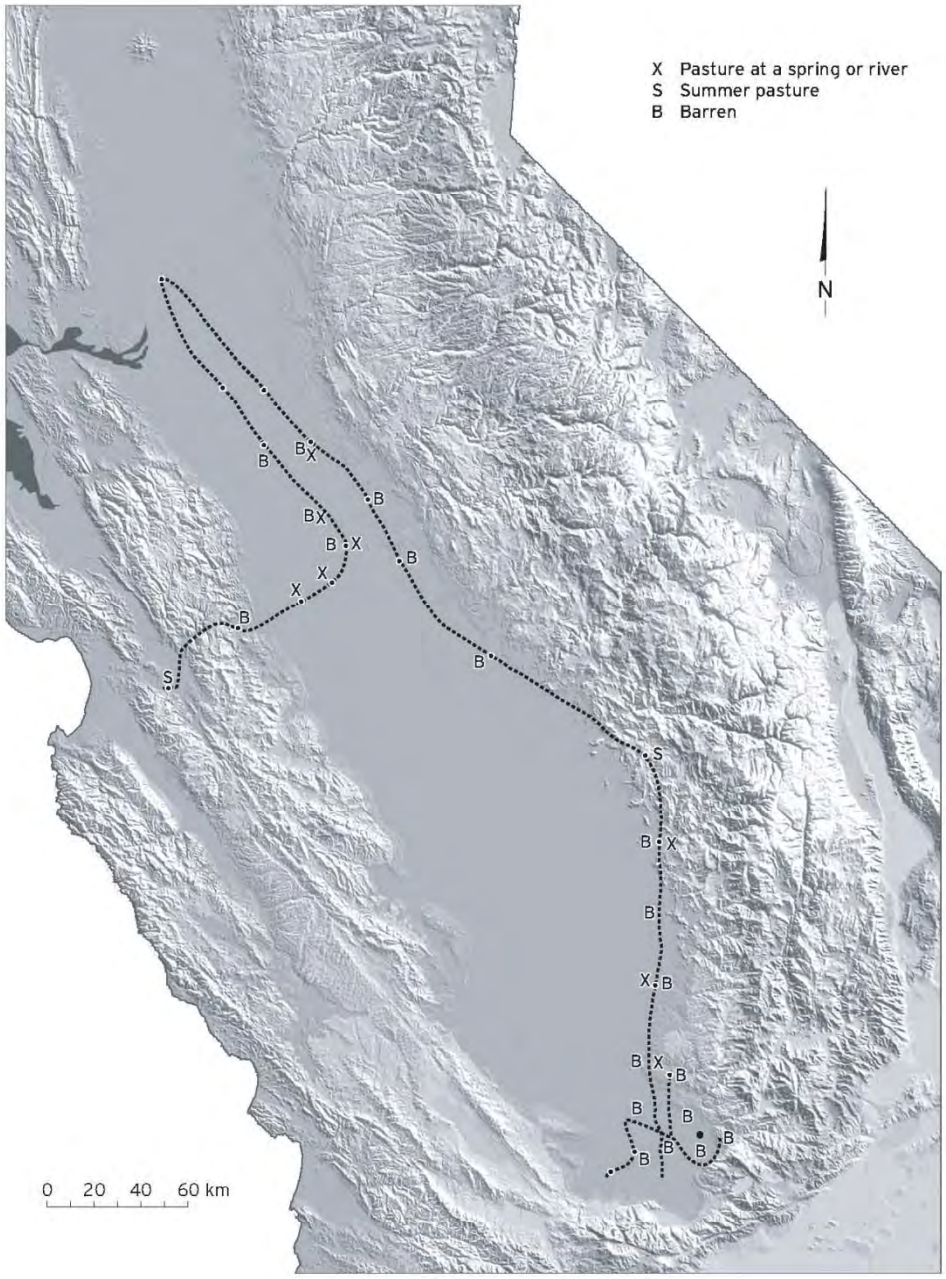


Burns recorded in 1769

Santa Barbara Channel. Rivera y Moncadas, 1776. …in the country side [there has been] extreme need of pasture for the animals,…all occasioned by the great fires of the gentiles, who,….. burn the fields as soon as they gather up the seeds,…..

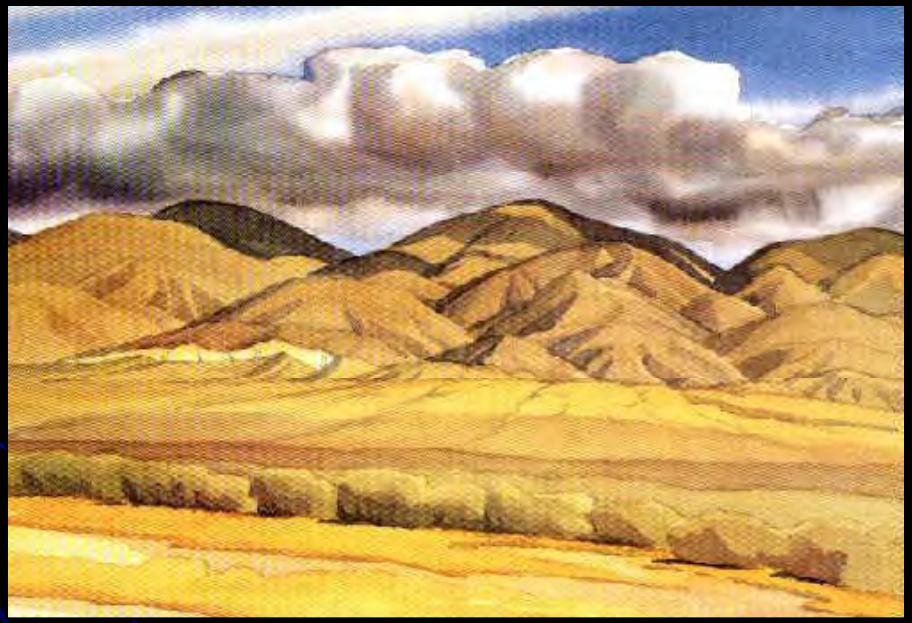
Central Valley barrens





CENTRAL VALLEY
Font, Antioch. a very sterile and dry plain

Muñoz (1806) E of Fresno. ….All the country... is worse than bad….there is little pasturage..,



Wildflowers in Chumash burials (Timbrook et al. 1982, Timbrook and Chapman 2007)

Amsinckia, Aster, Atragalus, Calandrinia, Camissonia, Chaenactis Cryptantha
Eschscholzia, Hemizonia, Heterotheca, Layia, Lepidium, Lotus, Lupinus,
Malva, Phacelia, Salvia, Senecio.

Gilia angelensis

Redmaids, *Calandrinia ciliata*

2. California pasture and biological invasions in the mid-18th century (1840-1880)

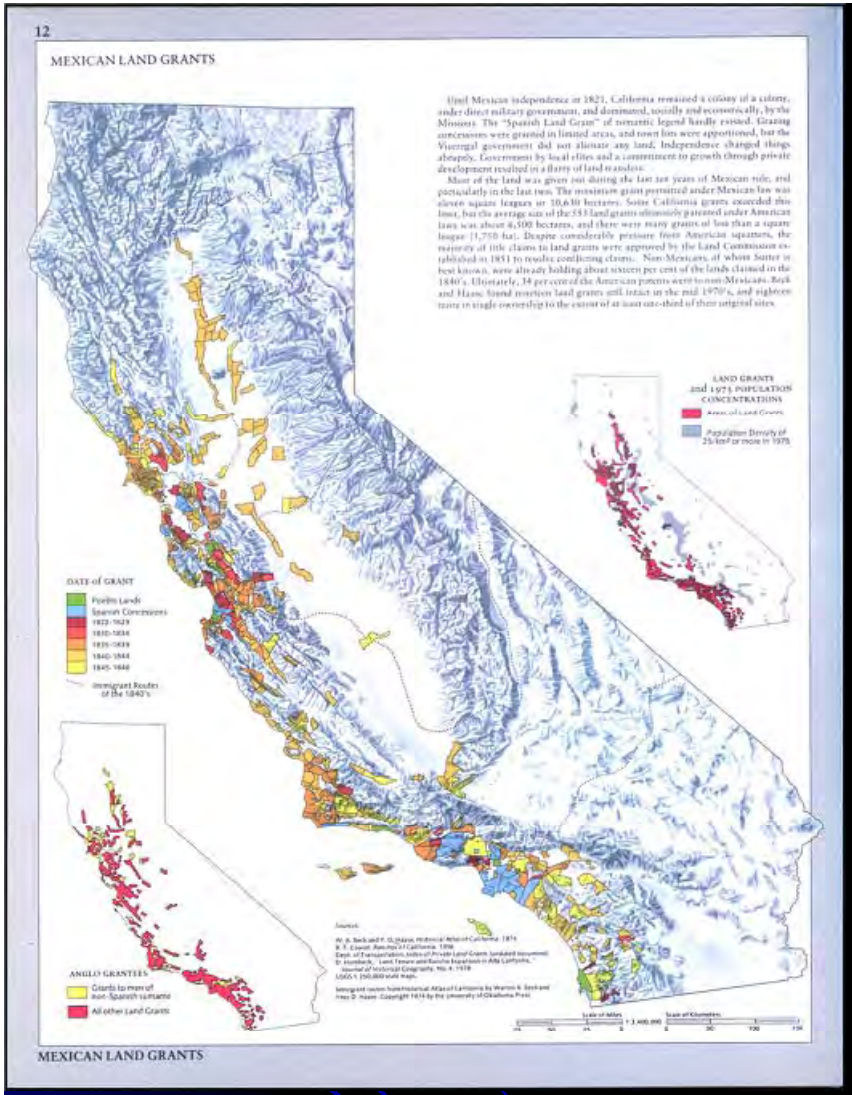
The Great Central Plain of California, during the months of March, April, and May, was one smooth, continuous bed of honey-bloom, so marvelously rich that, in walking from one end of it to the other, a distance of 400 miles, your foot would press a hundred flowers at every step.

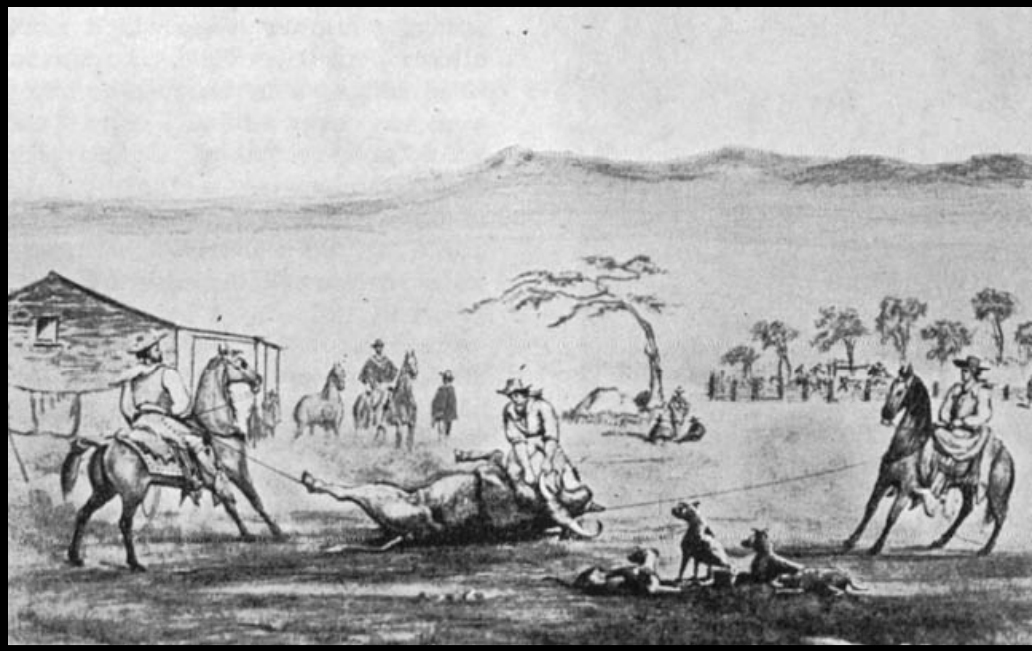
John Muir in 1868

We encountered more than one forest of mustard, … This plant has become…a terrible scourge for part of California. It invades the finest pasture lands, and threatens to spread over the entire country.

August Bernard Duhaut-Cilly in 1828

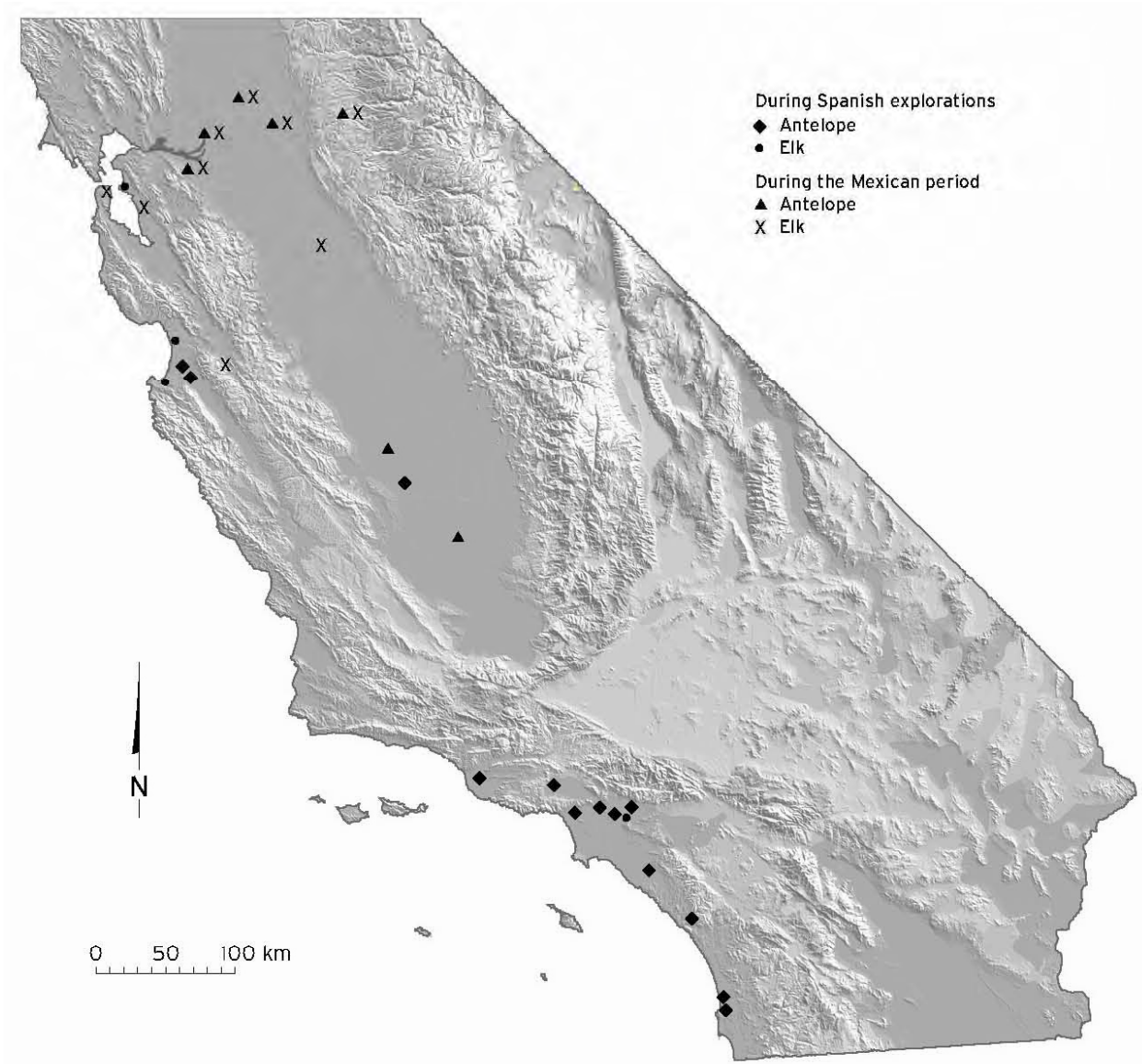
Black mustard
Brassica nigra





Cronise 1868, "In no country are cattle raised at so trifling cost. They get no shelter and no feed except the wild pasture of the mountain ranges."

Leonard 1959: 96. San Juan “The wild cattle are…much wilder than deer, elk, etc. “These cattle incline much to rough and hilly parts of the country, owing, it is supposed, to the Spaniards and Indians hunting them when found in the plains.”



Antelope

Elk

Deer

Half million cattle and other livestock

TABLE 3.1 ESTIMATES OF MISSION LIVESTOCK IN EARLY HISTORIES

A

Mission/Land Grant	Cattle	Horses	Sheep
San Juan Bautista	7,070	401	7,017
San Carlos	2,050	470	4,400
Soledad	6,599	1,070	6,358
San Antonio	5,000	1,060	10,000
San Miguel	3,762	950	8,999
San Luis Obispo	2,000	800	1,200
Presidio Santa Barbara	7,900	300	—
La Purísima	10,500	1,000	7,000
Santa Inés	7,300	320	2,200
Santa Barbara	2,600	511	3,300
San Buenaventura	4,000	300	3,100
San Fernando	6,000	300	3,000
Pueblo Los Angeles	38,624	5,280	—
Presidio San Diego	608	625	—
San Gabriel	20,500	1,700	13,554
San Juan Capistrano	10,900	290	4,800
San Luis Rey	26,000	2,100	25,500
San Diego	6,220	1,196	17,624

B

Mission/Rancho	Cattle	Horses	Sheep
San Luis Obispo	60,000	thousands	thousands
Sonoma	30,000	1,000	—
Santa Clara	65,000	4,000	30,000
San Juan Bautista	60,000	2,000	20,000
San Antonio	10,000	500	10,000
San Miguel	35,000	1,000	20,000
Soledad	25,000	1,000	10,000
La Purisima Conception	20,000	1,000	15,000
Santa Ynez	20,000	1,500	10,000
San Fernando	50,000	1,500	20,000
San Gabriel	80,000	3,000	30,000
San Luis Rey	60,000	1,000	20,000
San Juan Capistrano	20,000	1,000	10,000
San Diego	15,000	1,000	20,000
Santa Barbara	20,000	1,000	20,000
San Buena Ventura	25,000	1,500	10,000

SOURCE: Davis (1929: 389–95); based on his merchant and trading business.

C

Mission	Cattle	Horses	Sheep
San Francisco	76,000	2950	79,000
Santa Clara	74,280	6,100	82,540
San José	62,000	2,340	62,000
San Juan Bautista (1820)	43,870	6,230	69,500
San Carlos	87,600	1,800	7,500
Soledad	36,000	+	70,000
San Antonio (1822)	52,800	4,800	48,000
San Miguel (1821)	91,000	4,100	47,000
San Luis Obispo	87,000	5,500	72,000

SOURCE: Cronise (1868). Cronise states that "all the other missions [not on his list] were equally rich in livestock."
+ = greater than all the other missions

D

	1834			1842		
Mission	Horned Cattle	Horses	Sheep, Goats, Pigs	Horned cattle	Horses	Sheep, Goats, Pigs
San Diego	12,000	1,800	17,000	20	100	20
San Luis Rey	80,000	10,000	100,000	2,800	400	4,000
San Juan Capistrano	70,000	1,900	10,000	500	150	200
San Gabriel	105,000	20,000	40,000	700	500	3,500
San Fernando	14,000	5,000	7,000	1,500	400	2,000
San Buenaventura	4,000	1,000	6,000	200	40	400
Santa Barbara	5,000	1,200	5,000	1,800	180	400
San Ines	14,000	1,200	12,000	10,000	500	4,000
Purísima	15,000	2,000	4,000	800	300	3,500
San Luis Obispo	9,000	4,000	7,000	300	200	800
San Miguel	4,000	2,500	10,000	40	50	500
San Antonio	12,000	2,000	14,000	800	500	2,000
Soledad	6,000	1,200	7,000	—	—	—
Carmelo	3,000	700	7,000	—	—	—
San Juan Bautista	9,000	1,200	9,000	—	—	—
Santa Cruz	8,000	800	10,000	—	—	—
Santa Clara	13,000	1,200	5,000	1,500	250	3,000
San José	2,400	1,100	19,000	8,000	200	7,000
San Francisco	5,000	1,600	4,000	60	50	200
San Rafael	3,000	500	4,500	—	—	—
Solano	3,000	700	400	—	—	—

SOURCE: Bancroft (1888: 339); includes data before and after the mission slaughter of the early 1930s.

TABLE 3.2 RECORD OF SHIPS IN CALIFORNIA PORTS, AND DROUGHTS

Year	Arrivals	Drought	Year	Arrivals	Drought
1774	2		1812	0	
1775	0		1813	1	
1776	3		1814	2	
1777	0		1815	1	
1778	1		1816	8	
1779	3		1817	3	
1780	0		1818	2	
1781	0		1819	4	
1782	0		1820	0	
1783	2		1821	3	X
1784	1		1822	3	
1785	0		1823	7	
1786	4		1824	7	
1787	5		1825	33	
1788	2		1826	25	
1789	1		1827	33	
1790	0		1828	33	X
1791	5		1829	28	X
1792	0		1830	21	X
1793	0		1831	21	
1794	17		1832	24	
1795	7		1833	29	
1796	4		1834	31	
1797	5		1835	30	
1798	5		1836	16	
1799	3		1837	27	
1800	3		1838	21	
1801	1		1839	16	
1802	0		1840	19	
1803	6		1841	30	X
1804	4		1842	28	
1805	0		1843	4	X
1806	4		1844	10	X
1807	2		1845	16	
1808	0		1846	9	
1809	0	X	1847	22	
1810	0	X	1848	15	
1811	0				

SOURCE: Davis (1929: 397).

Drought in 1857, 1862-64

Drought and livestock crashes

Wild horses

The onset of biological invasions in California recorded in mission bricks

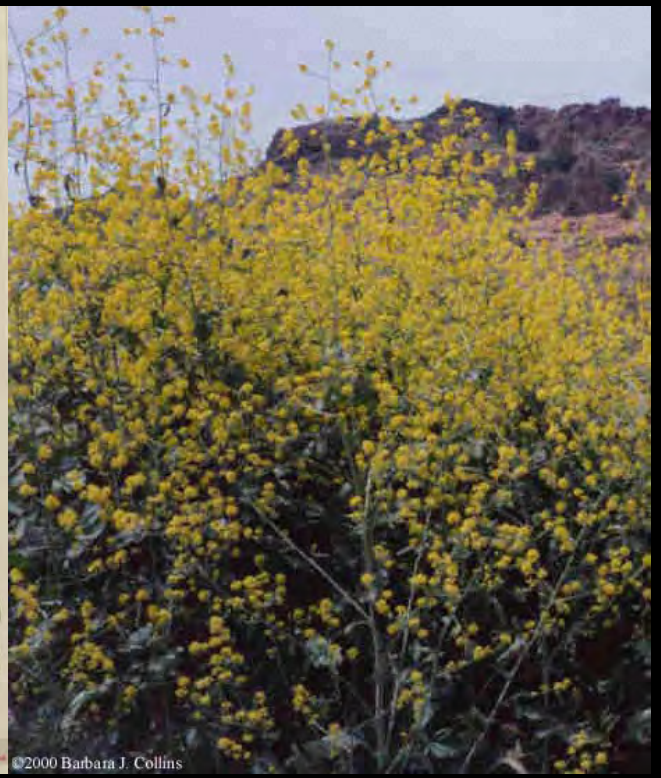
Misión San Fernando Velicatá

TABLE 3.3 SELECTED ANNUALS AND HERBACEOUS PERENNIALS FOUND IN CALIFORNIA MISSION ADOBE BRICKS

Missiona	SFV	SAN	SDM	SVC	SDD	SFR	SJS	SJB	SFS	RES	RVJ	RNV
Date of founding	1769	1771	1775	1780	1791	1797	1797	1797	1824	1834	1834–45	1837
Date of adobe brick	1769	1787	1775	1780	1793–97	1797	1811	1805–13	1824	1834	1834–45	1837
EXOTIC ANNUAL SPECIES												
Erodium cicutarium	X	X	X	X	X	X	X	X		X	X	X
Malva parviflora	X		X		X	X	X					
Brassica nigra			X		X							
Avena fatua								?				
Poa annua								X				
Hordeum murinum							X					
Medicago hispida	X											
Melilotus indica	X					X						
Trifolium involucratum												
NATIVE SPECIES												
Elymus triticoides			X	X	X							X
Eleocharis spp.							X					
Scirpus spp.	X		X	X					X			X
Carex spp.	X					X						
Stipa spp.												
Other bunch grasses												

Font, Jan 4 1775. San Gabriel Mission: “there are many turnips [*nabos*], which from a little seed which was scattered, took possession of the land.

Longinos-Martínez 1792 (Simpson, 34) Mustard, a very common field plant.



Avena fatua (wild oat). Apparently not introduced by the Spanish missionaries, as generally assumed; it was not recorded in mission bricks until 1810. It was still expanding rapidly at San Francisco in the 1830s. Widespread along coast and floodplains in the interior by the Gold Rush.

Erodium cicutarium (filarie). Expanded throughout California including the deserts before 1840.

Clovers. *Trifolium* and *Medicago*. Mission bricks document the clovers. Frémont's observations indicate they were widespread across California by the 1840s.

Filarie and clovers coexisted with wildflowers

***Hordeum murinum* (wall barley).** Recorded in mission bricks as early as 1810. It was most common in degraded, overgrazed pasture.

LANDSCAPE DESCRIPTIONS, Southern California

Revere 1847. “In the plain itself, the richest and most brilliant wildflowers flourish which far transcends all art; All colors, all shades of colors, all hues, all tints, …..

Nemophila menziesii

Amsinckia intermedia

J.F. James. *American Naturalist*, 1879. “In… Los Angeles…the plains…hills, and valleys are one mass of gorgeous, brilliant flowers…the Californian poppy,…in places where the ground was plowed…they seemed like tongues of fire running over the ground.”

Coastal central California

Wilkes (1845) Carquinez Straits that “the hills are thickly covered with wild oats;

Frémont 1846 San Francisco. “after the spring rains…the area is covered in grass….four or five varieties of wild clover [and] wild mustard ten or twelve feet high.”

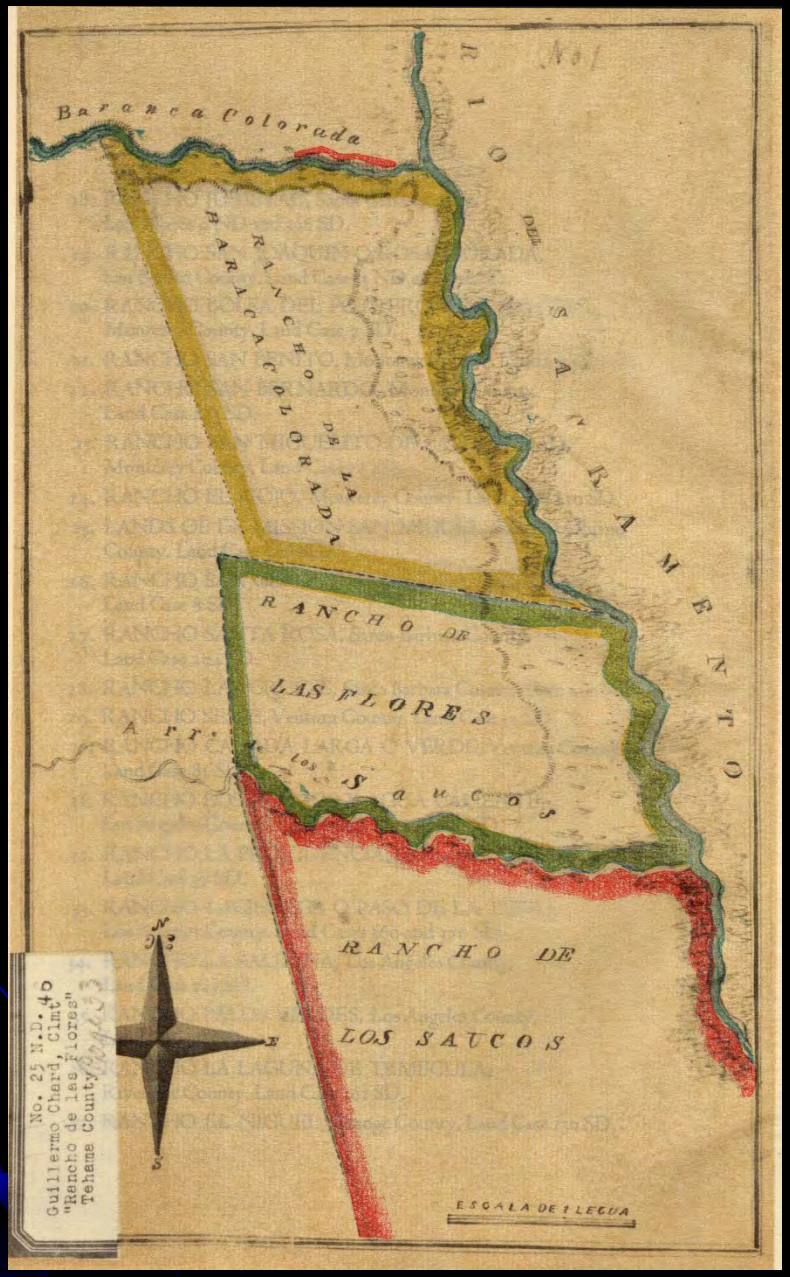
Central Valley

Frémont 1845. San Joaquin Valley near Kern R. “Instead of grass, the whole face of the country is closely covered with *erodium cicutarium*, here only two or three inches high.

Frémont 1848. “The Sacramento bottoms were covered with oats.” 1844

Frémont 1848: 27. Butte County. "The range consisted of excellent grasses, wild oats in fields, red and other varieties of clover…."

Diseño: Rancho de las Flores



Wildflower carpets in the Central Valley

Frémont. Sacramento Valley,1844 “The higher prairies…..presented unbroken fields of yellow and orange colored flowers…..”

William Perkins (1849-1852) ….the whole country is one immense flower bed. The hills look like gigantic bouquets, and the llanos like a huge Persian carpet.

Hittell 1874. “Along the railroads on either hand runs continuously the rich radiant bloom. Your sight becomes pained, your very brain is bewildered, by watching the galloping rainbow.”

TABLE 3.4 MUIR'S WILDFLOWER SAMPLE AT HILLS FERRY

Natural Order [family]	No. of Flowers		No. of Species
Gramineae	29,830	Panicles 1,000	3
Compositae	132,125	Heads 3,305	2
Leguminosae	2,620		2
Umbelliferae	620		1
Polemoniaceae	401		2
Scrophulariaceae	169		1
————?	85		1
Rubiaceae	40		1
Geraniaceae [*Erodium*?]	22		1
Musci	1,000,000 Funaria and Dicranum		

SOURCE: Muir (1974).
NOTE: Number of natural orders, 9 to 10; of species, 16; total number of open flowers, 165,912; mosses, 1,000,000.

Pacheco Pass

C. King. 1861. A great inland prairie sea, extending for 500 miles, …now a broad arabesque of colors.

Muir. 1868. All the ground was covered….. with radiant corollas… Hundreds of these happy sun-plants brushed against my feet at every step, …as if I were wading in liquid gold.

Boudet. 1880. …general rainbow effects I have never seen equaled.

Brewer and Watson. *Eschscholzia californica*. "….large areas are made painfully brilliant by its intense glow in the bright sunshine."

BUNCH GRASS -- Not recorded in mission bricks.

Frémont 1844. Foothills east of Sacramento. Hills generally covered with a species of geranium (*erodium cicutarium*)…with this was frequently interspersed good and green bunch grass…

Bryant 1848. Coast range west of Sacramento: he saw with the wild oats, "tufts or bunches of a species of grass, which remains green through the whole season."

Nessella (*Stipa*) *pulchra*

Central Valley Barrens

Wilkes 1849. "The western side [of the San Joaquin Valley]….is entirely barren and useless.

Muir 1906 … the shrunken mass of leaves and stalks of the dead vegetation crinkle and turn to dust beneath the foot, as if it had been baked in an oven.

VTM SURVEY (ca. 1930)

Summer barrens in the interior

Diseño Rancho del la Laguna de Temecula

Valle poco pastoso, lomeria esteril

Brewer. …barren hills of Temescal

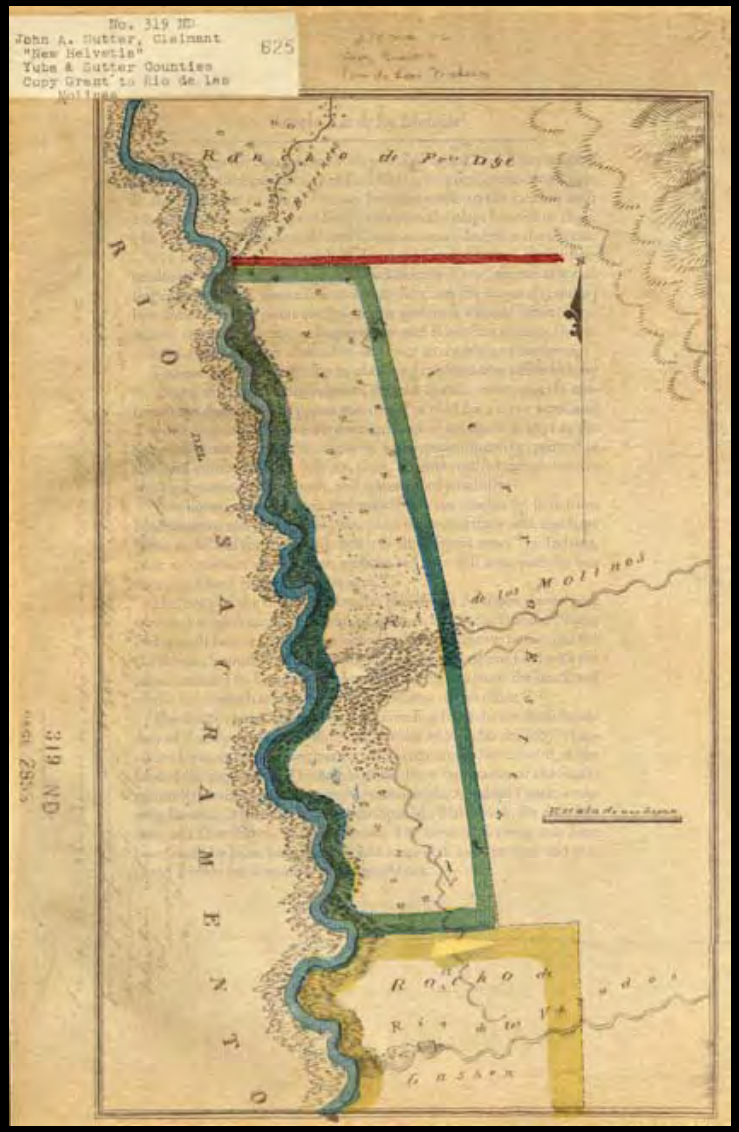
Rancho Omochomne

Terenos altos con poco pastos

Rancho Tolenas diseño,
Solano County

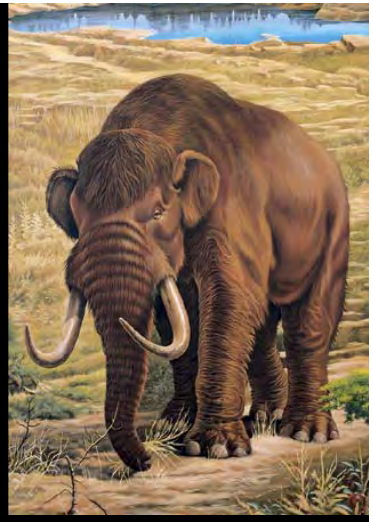
Courtesy, Bancroft Library
University of California Berkeley

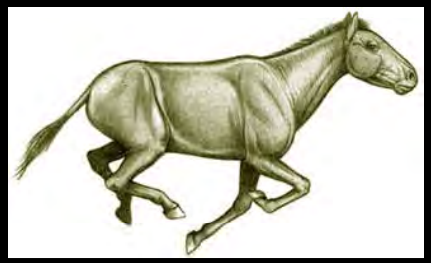
Rancho New Helveta (Sutter)

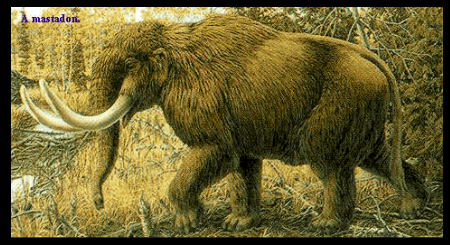


Tierra esteril









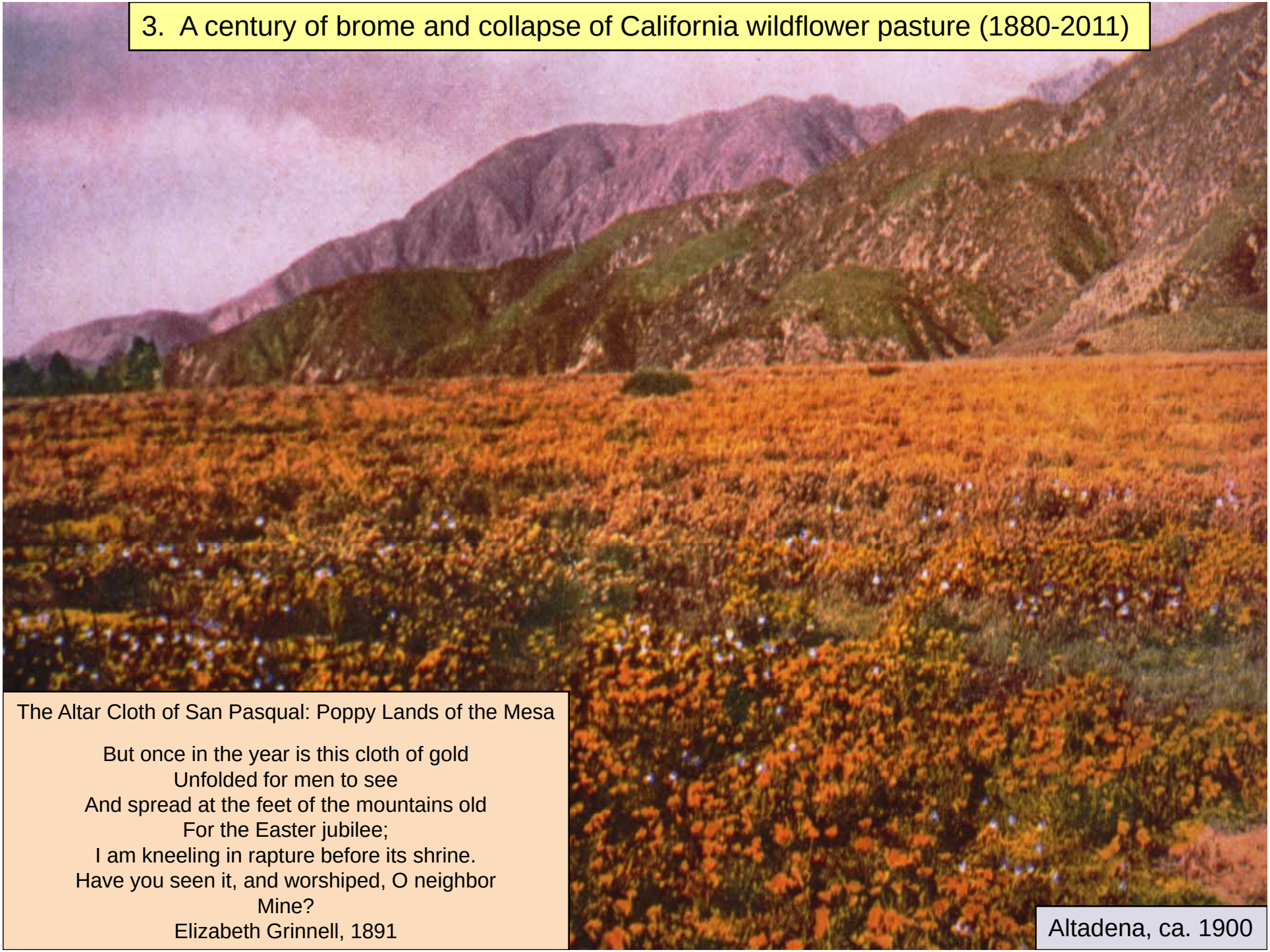



Pleistocene and modern megafauna

TABLE 3.7 FOSSIL WILDFLOWERS AND BUNCH GRASSES IN PACKRAT MIDDENS IN THE MOJAVE AND SONORAN DESERTS

Source	Mead and Phillips 1981	Spaulding 1983	Cole 1986	King 1976	King and Van Devender 1977	Cole and Webb 1985
Location	Grand Canyon	Marble Mtns., Owl Canyon, of Rocks	Picacho Peak Point	Lucerne Valley River Valley	Lower Colorado	Greenwater Valley
Period	Pleistocene	Late Pleistocene	Late Pleistocene	Late Pleistocene-Holocene	Late Pleistocene-Holocene	Late Holocene
Amsinckia	X	X	X	X	X	X
Argemone	X	X				
Aristida			X			
Astragalus		X	X	X		
Castilleja				X	X	X
Chorizanthe		X	X			
Circium	X	X		X		
Cryptantha		X	X		X	
Dithyrea						X
Draba			X			
Eriogonum		X		X		
Eschscholzia				X	X	
Euphorbia			X			
Gilia		X			X	X
Hilaria			X			
Lepidium	X	X	X		X	X
Lupinus			X	X		
Malvastrum				X		
Mentzelia		X				X
Mirabilis		X				
Oryzopsis			X			
Penstemon		X			X	
Perityle			X			
Pectocarya		X				
Phacelia	X		X	X	X	
Plagiobothrys			X		X	
Plantago		X			X	
Solanum					X	
Stephanomeria						X
Stipa (*Nassella*)		X	X			X
Vulpia (*Festuca*)			X			
Other grasses					X	

3. A century of brome and collapse of California wildflower pasture (1880-2011)



The Altar Cloth of San Pasqual: Poppy Lands of the Mesa

But once in the year is this cloth of gold
Unfolded for men to see
And spread at the feet of the mountains old
For the Easter jubilee;
I am kneeling in rapture before its shrine.
Have you seen it, and worshiped, O neighbor
Mine?
Elizabeth Grinnell, 1891

Altadena, ca. 1900

Parish (1920). In the San Bernardino Valley, these bromes were first noticed in the spring of 1888. They continued to spread with increasing rapidly, and in a very few years large patches…. could be found in all parts of the valley and the surrounding hills. They are now among the most wide-spread, abundant and well established grasses of the region. As a result, some delicate indigenous herbs, formerly abundant, are now rare. Both species are sparingly eaten when young by stock, but are practically worthless as forage, and soon drying up they become a serious fire menace.

Bromus rubens

Bromus diandrus

Bromus rubens

Davidson 1907. “It was rare and local in Los Angeles County in 1892, but now [1907] may be found in many parts of the county, even as far as the Mojave Desert.

Bromus diandrus

Davidson. 1893. Already frequent in the waste grounds throughout the city and rapidly spreading.

Jepson 1901. Now one of our most abundant grasses.

Avena barbata, 1890s

Brassica geniculata, 1905
(*Hirschfeldia incana*)

Brassica tournefortii, 1970

Schismus barbatus, 1940s

"Second wave invaders"

Table 5.3: Flower reports near Riverside[1]

Year	PON[3]	Comments
1884-85	89	-
1885-86	94	April 27…[there were] myriads of beautiful flowers.....that bedeck our...fields.
1886-87	59	-
1887-88	117	April 14. …through the plains...[the] flower(s) perfuming the air everywhere meets the eye. On the abrupt rocky hills, are beds of yellow and blue flowers.....
1888-89	156	March 9. The wildflowers have not been so abundant this winter as last. The rains were not continuous enough.
1889-90	185	February 23. Immense field of poppies..[.at] the mesa lying at the base of Mt. Cucamonga.
1890-91	129	February 28. Vegetation of all kinds is springing up and hills are taking on a delightful greenish tint....In a few days, the golden poppy will tint the hill-sides with a warm, rich yellow, and beautiful flowers of a hundred different varieties [species] and hues will deck the are plains [with] many colors. March 28. The Box Springs hills are covered with masses of golden poppies.
1891-92	65	-
1892-93	124	March 23. Wildflowers are becoming very abundant, especially the beautiful golden poppy. April 1. The drive down the valley, following the canal [east Riverside], is one of great beauty at this season of the year. The hills are covered with a carpet of emerald green bedecked with beautiful wildflowers. The air is sweet with the fragrance.....and the exhalations of blossoms so numerous as to seem like solid beds of yellow, and blue, and white..." April 17. …people gather gorgeous wildflowers upon the broad expanse of the plains and the sloping mesas, or to wander among the charming nooks and corners of the many beautiful canyon retreats (LA Times).
1893-94	71	May 3. Dry weather has affected the wildflowers (Los Angeles *Times*)
1894-95	164	March 31. The hillsides were never so gorgeously beautiful with wildflowers [Murrieta].[2]
1895-96	75	-
1896-97	128	March 25. West Riverside seems to have quite an attraction for wild-growing flowers, especially poppies.....[2]
1897-98	55	-
1898-99	48	-
1899-00	69	-
1900-01	122	February 26. ...dainty wildflowers on the hills.
1901-02	70	-
1902-03	129	March 6, 1903. The golden poppies are again in bloom; also cream cups, baby blue eyes, and several other small varieties. April 3. [Corona] The mesa is covered with wildflowers.
1903-04	57	-
1904-05	168	March 6. Those going to Coldwater Canyon report...they found such a profusion of wild flowers as they had never seen before. March 18. In has been many days [years] since there has been such an abundance of wildflowers, as are now to be found in this neck of the woods. This morning, crowds of school children and tourists were out on Rubidoux Hill, where they were gathering the beauties by the handful and the armload. March 20. Spare the poppies. But if the crowds of people and children who have been engaged in pulling up these beautiful flowers do not show more discretion, the poppies will not be there next year…Therefore, all persons who want Riverside to have these poppies in great profusion are urged not to pick the flowers now making Rubidoux Hill so attractive.

1. Source, *Riverside Press and Horticulturalist*, unless otherwise indicated.
2. Source, *Riverside Enterprise.*
3. PON, percent of normal precipitation. Mean 25.4 cm.

The Alter Cloth of San Pasqual circa 1900, Charles Frances Saunders

Altadena poppy field visited by rail from Los Angeles

ca. 1895

Table 5.4. Observations of poppy and wildflower fields at Los Angeles and Pasadena, reported in the Los Angeles *Times*.

Year	Precip.[3] PON	Flower abundance	Precipitation pattern	Dates of flower observations in Los Angeles Times (July to June)
1886-87	94	**	Feb, Apr	April 27, May 24.
1887-88	93	***	Winter/spring	January 2, February 23, March 11, 29.
1888-89	129	-	Mid-winter drought	-
1889-90	233	***	Fall/winter floods	Dec 6, Jan 28, 29, 30, 31, Feb 11, March 16, 22, April 12.
1890-91	89	**	Heavy/ February	Feb 7, March 9, 26.
1891-92	79	**	Spring	March 12, 27, April 7.
1892-93	176	***	Evenly distributed	February 11, March 10, May 21.
1893-94	45	*	December	February 2, March 18, May 3.
1894-95	108	***	Winter/late spring	March 10, March 28, 31, April 9, 25, 28, 26. July 22.
1895-96	57	**	Jan/March	January 1, March 1, March 17.
1896-97	113	***	Evenly distributed	February 2, 6, April 10.
1897-98	45	*	Winter/spring drought	February 23.
1898-99	37	*	Jan/March	March 20.
1899-00	53	*	Fall/winter drought	January 10. Fall rains. Reports flowers are scarce
1900-01	109	***	Evenly distributed	February 27, March 1, 3, 8.
1901-02	71	*	Spring	March 1.
1902-03	129	**	Evenly distributed	February 14, March 14,
1903-04	58	-	Late spring	-
1904-05	131	**	Winter/spring	May 15.
1905-06	124	***	Winter/spring	February 18, 25, March 15, 26.
1906-07	129	**	Winter/spring	January 31, March 21, 29.
1907-08	78	**	Winter	February 24, 26, April 1.
1908-09	128	***	Evenly distributed	January 28, February 7, 23. March 11, 21 April 21.
1909-10	84	*	December	February 13, March 8, 28, April 2.
1910-11	108	***	Winter/spring	February 5, April 11.
1911-12	77	**	Mid-winter drought,	March 11, April 1, 19, 28.
1912-13	89	***	Jan/Feb	March 13, 30, April 11, 13, 18. June 7.
1913-14	158	**	Fall/winter, flooding	March 9.
1914-15	114	**	Winter	March 8, April 3, 4, 19.
1915-16	133	**	Winter, flooding	February 6, March 30.
1916-17	93	*	Fall/winter	May 13.
1917-18	93	*	Late spring	May 1.

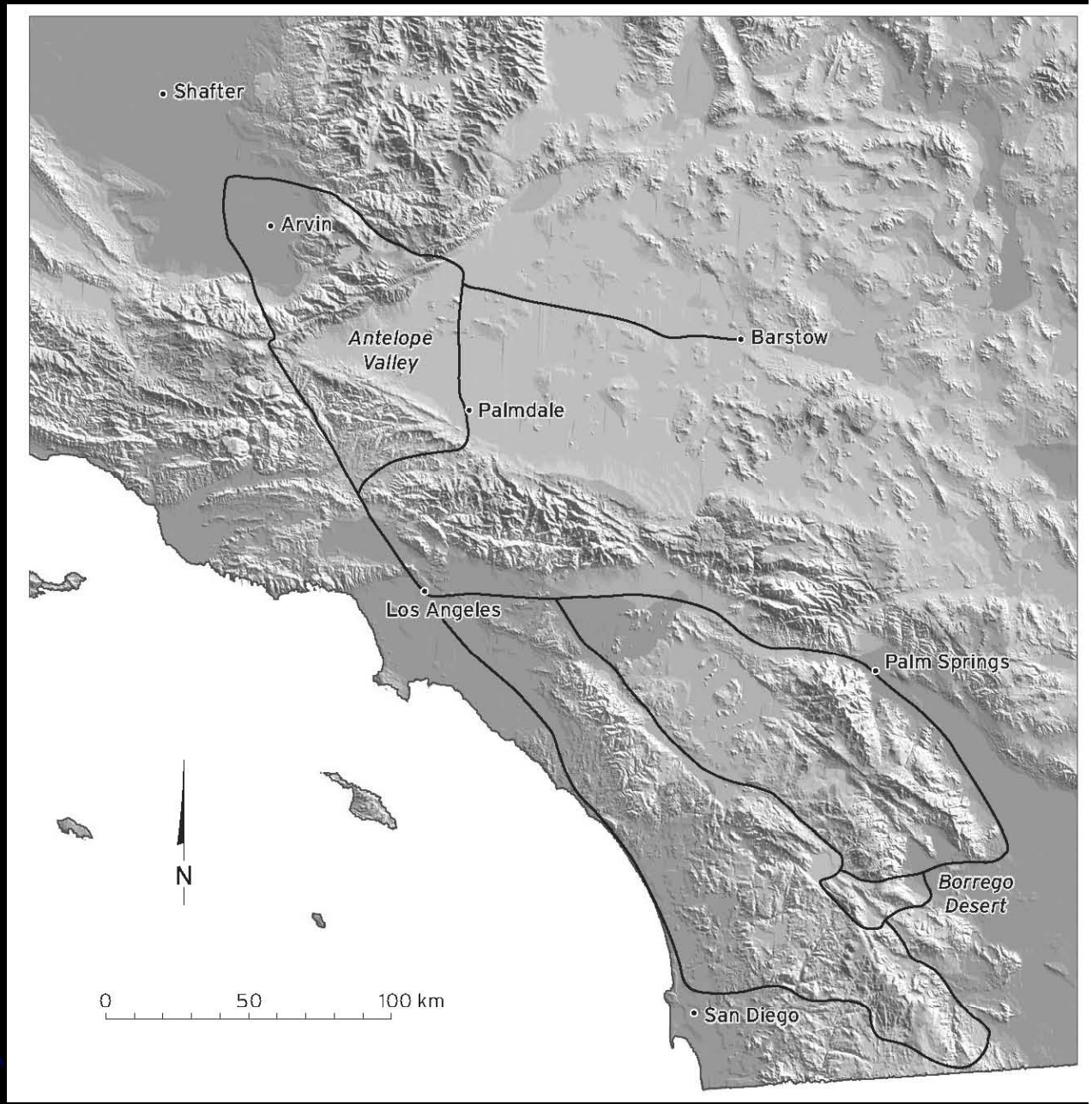
1. Flower abundance: - no report, * local, **normal, ***unusually abundant.
2. Los Angeles CBD
3. PON, percent of normal precipitation, July-June. Mean, 38.0 cm.

Wildflower “circle tours.”

The Los Angeles *Times*

Automobile Club of Southern California

The Desert Magazine (Randall Henderson)



Los Angeles *Times*
Articles by Lynn Rogers,
Lee Shippey and others.

The Desert Magazine
(Randall Henderson)

Wildflower Tour Recalls History

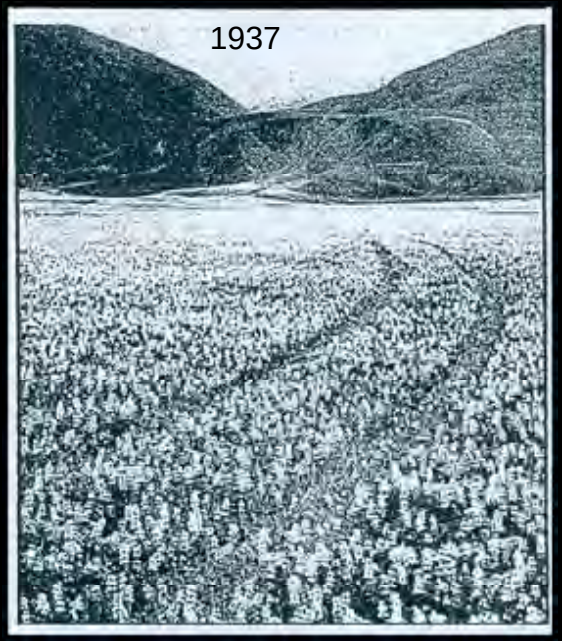
VISITORS PARK new Buick Century Caballero at end of road leading into one of the colorful poppy fields in the Edison region located southeast of Bakersfield.

BY LYNN ROGERS, Automobile and Outdoor Editor

Since Padre Francisco Garces crossed the Kern River, near the present site of the Odoese Ranch at the mouth of Kern River Canyon, on May 1, 1776, millions of motorists have driven through the canyon during the spring months to view the wild-flower displays along its slopes.

It could well be that Garces, the first white man to travel through the area, was also the first to behold the brilliant showings of these flowers in the canyon and over the countryside to the south, east and west.

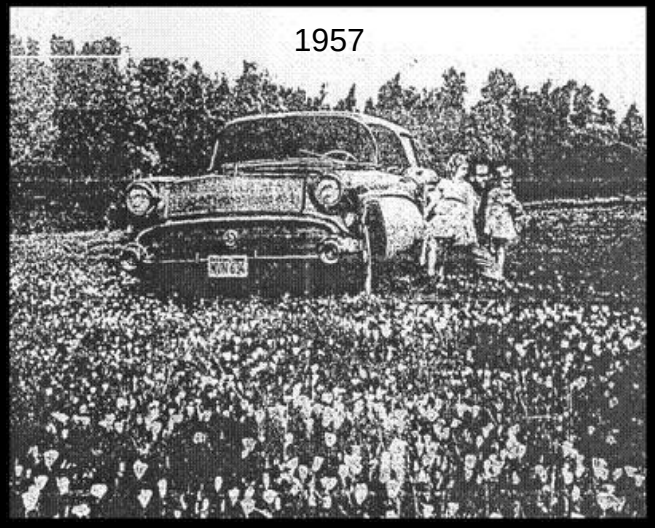
Lynn Rogers
Since Padre Francisco Garces cross the Kern River, near the present site of the Odoese Ranch at the mouth of Kern River Canyon, on May 1, 1776, millions of motorists have driven through the canyon during the spring months to view the wildflower displays along its slopes.



Southern San Joaquin Valley, Arvin


1941


1952


1957

San Gorgonio Pass in the 1910s, Charles Frances Saunders

Western Mojave Desert, 1936

Los Angeles Public Library

National Geographic, 1929

Autochromes by Charles Martin

IN SPRINGTIME THE DESERT BURSTS INTO BLOOM

Coreopsis with its gorgeous blossoms, many of them three inches across, literally carpets Antelope Valley, Los Angeles County, in April and May. These flower patches gleam for miles.

Poppies in Pomona, 1937

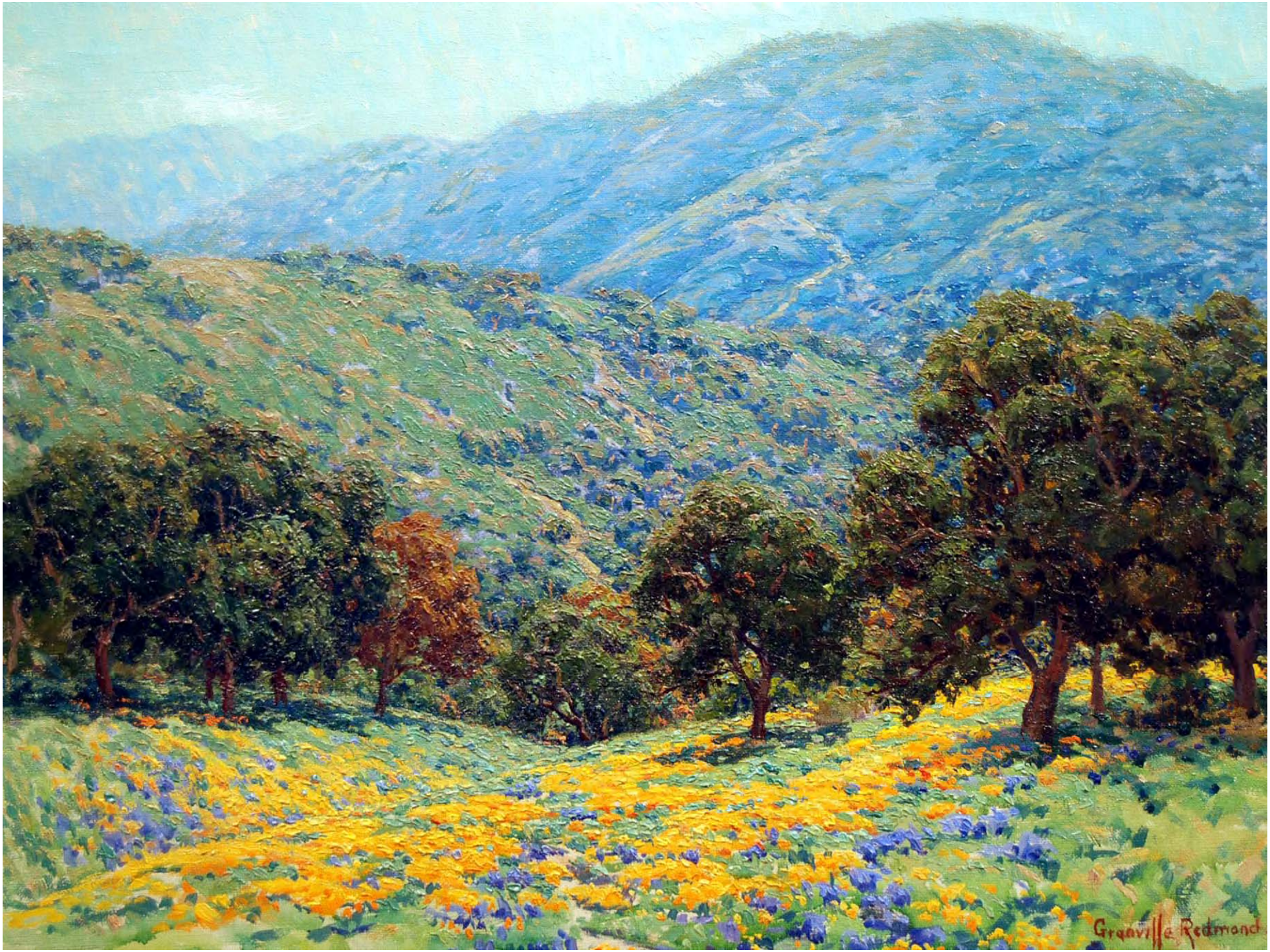
Los Angeles Public Library

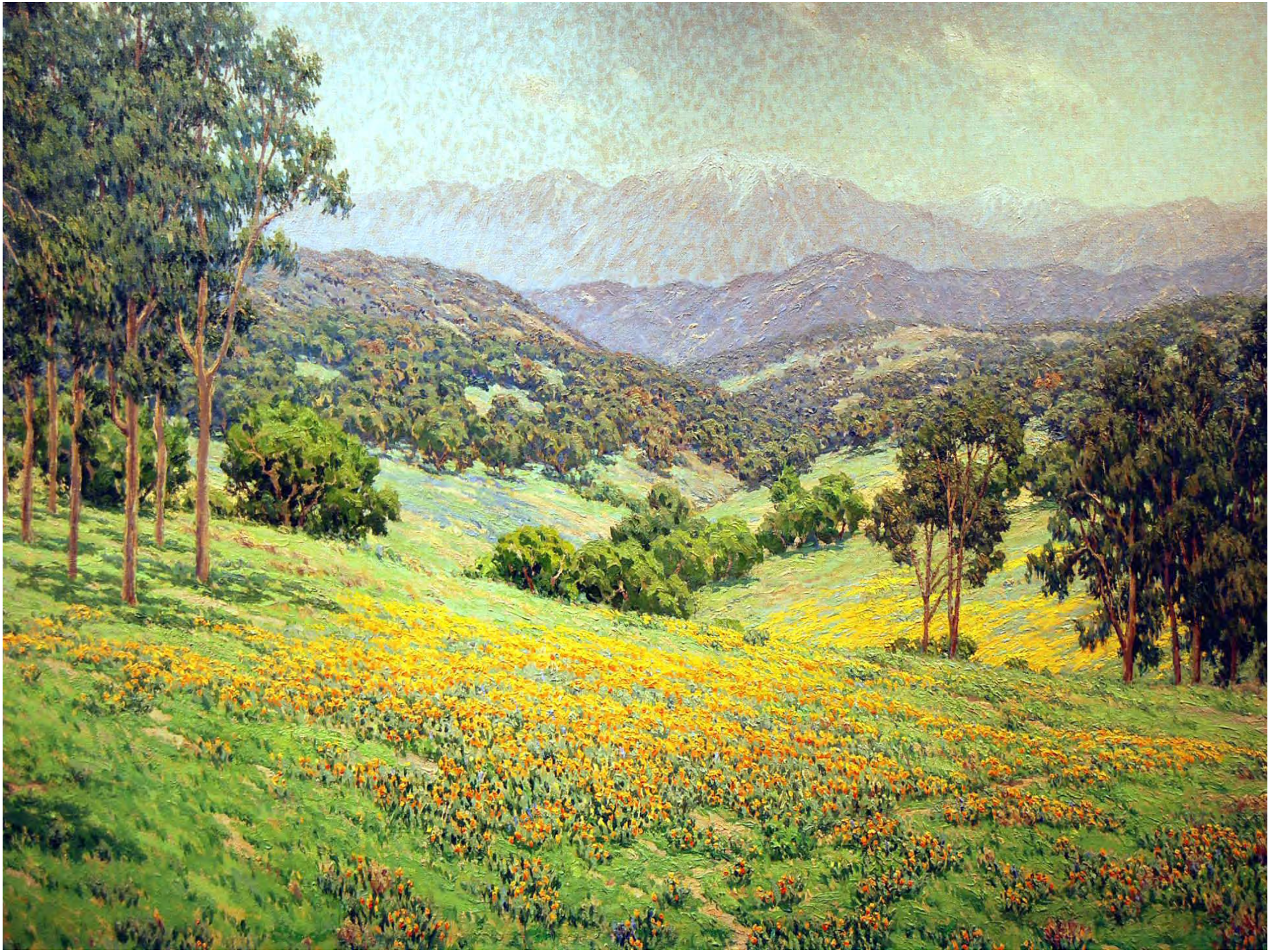
Bakersfield Lupines
1939

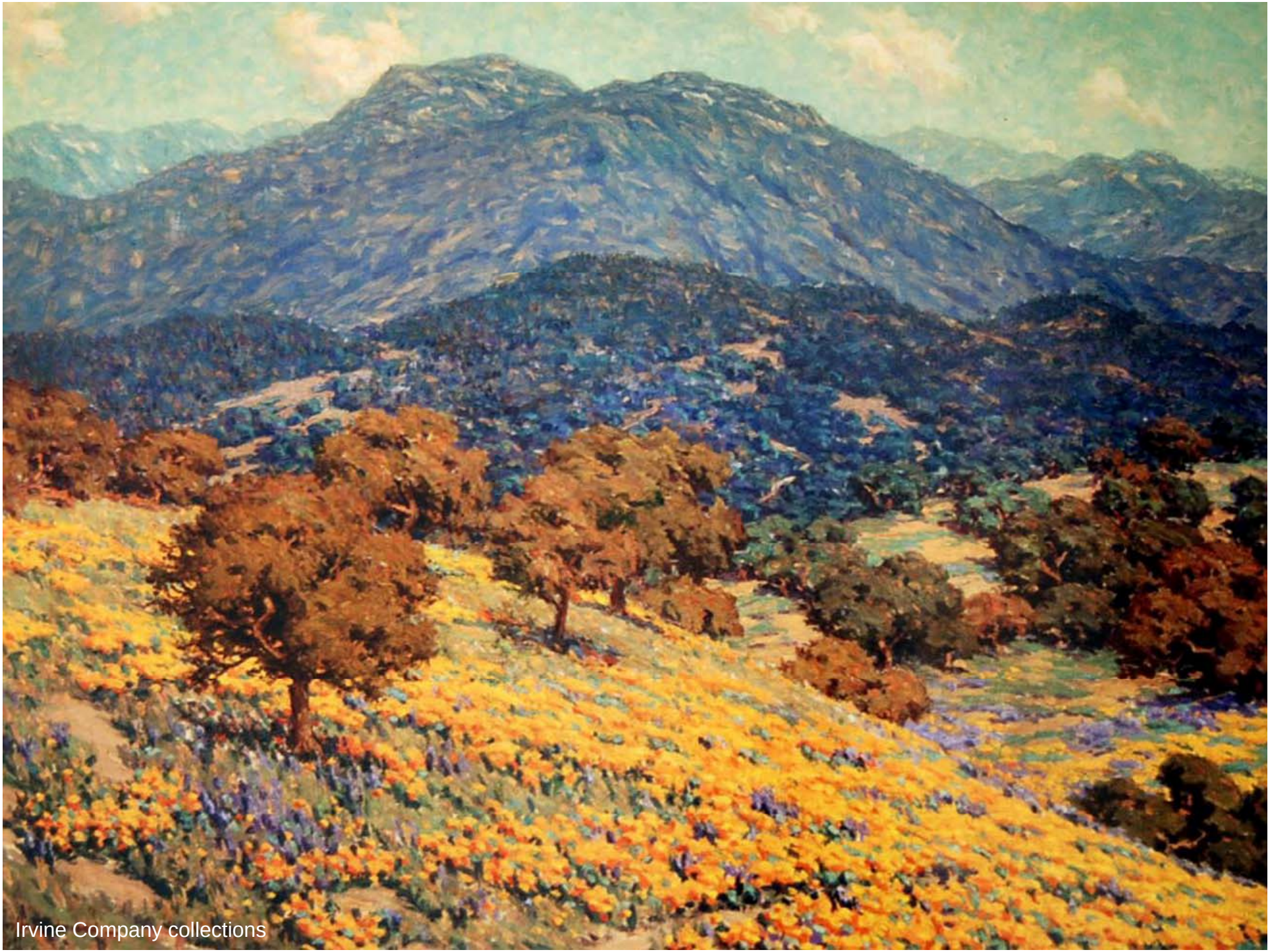
- The blue lupine field at the Grapevine was “broken up by small patches of golden poppies, evening snow, sun cups, owls clover and other smaller varieties.”

J. Raymond Minnich

Arvin and Shafter flower festivals


Granville Redmond




Irvine Company collections

Reports of wildflowers in southern California since 1920

Table 5.6. Reports of flowers in southern California since 1918[1]

Year/ Region	LA PON	LA FLR	Riv PON	Riv FLR	BAK PON	Kern FLR	Plm PON	Ant Val. FLR	Moj. Des. FLR	PS PON	Coa Val. FLR	DV PON	Death Val. FLR	Cen Calif. Interior
1918-19	57	-	99	-	80	-	80	**	-	61	-	nd	-	nd
1919-20	84	*	119	**	85	-	102	-	-	148?	-	nd	-	nd
1920-21	91	**	102	-	112	-	89	-	-	59	-	nd	-	nd
1921-22	131	**	203	***	142	***	133	***	***	224	***	nd	-	nd
1922-23	64	-	94	-	95	-	89	-	-	6	-	nd	-	nd
1923-24	44	*	84	*	59	-	44	-	-	24	-	nd	-	nd
1924-25	53	-	79	-	74	***	54	-	-	28	-	nd	-	nd
1925-26	117	-	140	-	81	**	89	**	-	177	**	nd	-	nd
1926-27	119	*	142	**	100	***	121	***	***	132	***	nd	-	***
1927-28	68	*	116	-	95	**	60	**	*	83	*	nd	**	-
1928-29	85	*	80	-	72	**	76	**	**	109	**	nd	**	**
1929-30	77	**	130	**	77	-	78	-	-	152	*	nd	-	-
1930-31	84	-	118	-	93	**	74	**	-	118	*	nd	-	-
1931-32	113	**	150	***	151	***	130	***	**	242	***	nd	***	**
1932-33	79	**	91	**	113	*	80	*	*	84	**	nd	-	**
1933-34	97	**	47	**	36	*	71	**	**	47	*	nd	-	**
1934-35	145	**	120	***	135	***	134	***	***	160	**	128	***	***
1935-36	81	-	111	*	77	-	80	-	-	113	*	13	-	-
1936-37	143	*	218	**	152	***	163	***	***	225	**	171	-	**
1937-38	157	*	121	*	81	***	146	**	**	70	**	61	-	*
1938-39	87	*	108	**	110	**	137	***	***	130	**	207	**	*
1939-40	128	*	108	**	116	**	97	**	***	176	***	167	***	**
1940-41	219	**	230	***	186	***	232	***	***	221	***	156	**	***
1941-42	74	-	98	-	81	-	55	-	*	181	-	89	*	**
1942-43	122	-	152	-	169	*	163	-	-	223	-	75	-	-
1943-44	128	-	158	-	83	**	118	**	**	210	-	118	-	-
1944-45	77	-	96	-	135	*	57	**	*	75	-	57	-	-
1945-46	78	-	88	-	81	-	68	*	*	130	*	68	-	-
1946-47	84	-	91	-	82	**	159	**	*	55	*	159	-	-
1947-48	48	-	62	-	71	-	42	*	*	73	*	42	-	-
1948-49	53	-	77	*	65	***	105	**	**	111	***	105	-	-
1949-50	71	*	70	-	78	***	9	*	-	26	-	9	-	-
1950-51	55	*	56	-	88	*	58	-	-	30	-	58	-	*
1951-52	175	-	175	***	139	***	118	**	***	160	***	118	-	***
1952-53	63	-	96	-	99	**	49	*	**	137	*	49	-	-
1953-54	81	*	97	-	71	*	65	*	*	122	*	65	-	*
1954-55	80	-	83	-	74	**	90	*	*	83	*	90	**	*
1955-56	107	-	74	-	63	**	19	-	-	51	-	19	-	**
1956-57	64	-	98	-	75	**	86	**	*	75	**	86	-	**
1957-58	141	-	159	**	161	***	85	***	***	135	**	85	**	***
1958-59	37	-	43	-	39	*	65	-	-	45	-	65	-	-
1959-60	59	-	76	-	67	*	124	-	-	74	-	124	*	-
1960-61	32	-	29	-	65	*	33	-	-	29	-	33	-	**
1961-62	125	-	95	**	103	**	130	**	**	48	*	77	-	-
1962-63	58	-	55	*	73	**	36	-	-	50	-	59	-	*
1963-64	53	-	98	-	74	**	93	*	-	117	-	69	-	-
1964-65	91	-	80	**	92	**	44	*	**	64	*	108	-	*
1965-66	137	*	126	**	83	*	124	*	**	187	**	93	-	*
1966-67	147	*	120	**	114	**	89	**	**	107	**	36	-	-
1967-68	111	-	86	-	99	-	86	-	-	89	-	128	-	-
1968-69	183	-	193	-	141	**	145	-	-	143	*	122	-	-
1969-70	52	-	62	-	54	-	33	-	-	76	-	98	-	-
1970-71	82	-	63	-	107	-	73	*	*	42	-	55	-	-
1971-72	48	-	49	-	48	-	59	-	-	25	-	61	-	-
1972-73	142	*	120	**	128	***	103	**	**	80	**	167	***	***
1973-74	99	-	77	-	80	-	68	**	-	75	-	87	-	-
1974-75	96	-	71	-	108	-	71	*	-	44	-	120	-	-
1975-76	48	-	77	-	70	-	37	-	-	86	-	158	-	-
1976-77	82	-	82	-	67	-	136	-	**	129	**	125	-	-
1977-78	223	-	218	**	204	***	190	**	**	213	***	233	-	-
1978-79	132	-	152	-	107	-	143	-	-	139	*	99	-	-
1979-80	180	-	165	-	105	-	174	-	-	304	*	142	-	-
1980-81	60	-	59	-	77	-	60	-	-	47	-	45	-	-
1981-82	72	-	128	-	102	-	120	-	-	72	-	115	-	-
1982-83	209	-	184	-	156	-	190	-	-	164	*	155	-	-
1983-84	70	-	98	-	84	-	51	-	-	156	-	86	-	-
1984-85	86	-	75	-	65	-	88	*	-	56	-	90	-	-
1985-86	120	-	104	-	107	-	68	*	-	112	-	50	-	-
1986-87	51	-	56	-	90	-	42	*	*	85	-	90	-	-
1987-88	83	-	98	-	95	-	111	**	**	108	**	265	**	-
1988-89	54	-	66	-	60	-	50	-	-	32	-	31	-	-
1989-90	49	-	56	-	54	-	33	*	-	27	-	26	-	-
1990-91	77	*	104	-	96	-	86	**	-	92	-	81	-	*
1991-92	141	-	111	-	96	*	158	**	-	143	***	119	-	*
1992-93	183	-	208	-	150	**	224	*	-	243	**	162	*	-
1993-94	54	-	93	-	93	-	45	*	-	48	-	11	-	-
1994-95	164	-	189	-	149	-	116	**	-	167	**	157	-	-
1995-96	83	-	73	-	105	-	49	-	-	25	-	33	-	-
1996-97	83	-	113	-	103	-	46	*	-	26	-	44	*	-
1997-98	207	-	253	*	232	-	203	**	**	176	***	279	***	-
1998-99	61	-	64	-	110	-	33	-	-	15	-	57	-	-
1999-2000	77	-	64	-	82	-	34	-	-	32	-	52	-	-
2000-01	120	*	85	**	89	**	77	-	-	84	*	124	-	*
2001-02	29	-	34	-	56	-	28	-	-	6	-	21	-	-
2002-03	110	-	128	**	95	**	113	*	-	70	**	97	-	*
2003-04	62	-	70	-	73	-	64	-	-	73	**	101	**	-
2004-05	249	-	229	*	147	*	251	**	***	241	***	321	***	**

Blooms throughout southern California in normal and wet years, more frequent in the coast than in the interior.

Wildflowers disappear from the coastal plain

Wildflowers displaced by brome grassland in the interior valleys and central valley

Wildflowers decline with red brome invasion of the deserts

First brome crash, flower outbreaks in the Sonoran Desert

The great drought of 1999-2002, flower outbreaks in interior southern California, Carrizo Plain, Bakersfield

Second brome crash, flower outbreaks in Sonoran and Mojave Deserts

California today: Red brome and ripgut brome grassland

Box Springs Mountains, Riverside

Study the following time-series and propose relationships between exotic annual grasses and native wildflowers.

1. Biomass and rainfall
2. Species composition and rainfall
3. Under what circumstances were natives most abundant?
4. Could you have determined these relationships with a “one-time only” visit.

Two Trees Canyon-1 (burn in March 1988)

1989

Precipitation 6.44”

1.6 tons ha^{-1}

Phacelia distans
Brassica geniculata
Cryptantha intermedia
Erodium cicutarium

The square rock is in the upper right of most photographs

1990

Precipitation 5.53”

2.5 tons ha^{-1}

Phacelia distans
Cryptantha intermedia
Erodium cicutarium

1991

Precipitation 10.38”

2.5 tons ha^{-1}

Phacelia distans
Cryptantha intermedia

1992

Precipitation 11.05”

1.8 tons ha^{-1}

Phacelia distans

1993

Precipitation 20.70”

3.3 tons ha^{-1}

Phacelia distans
Bromus rubens

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}

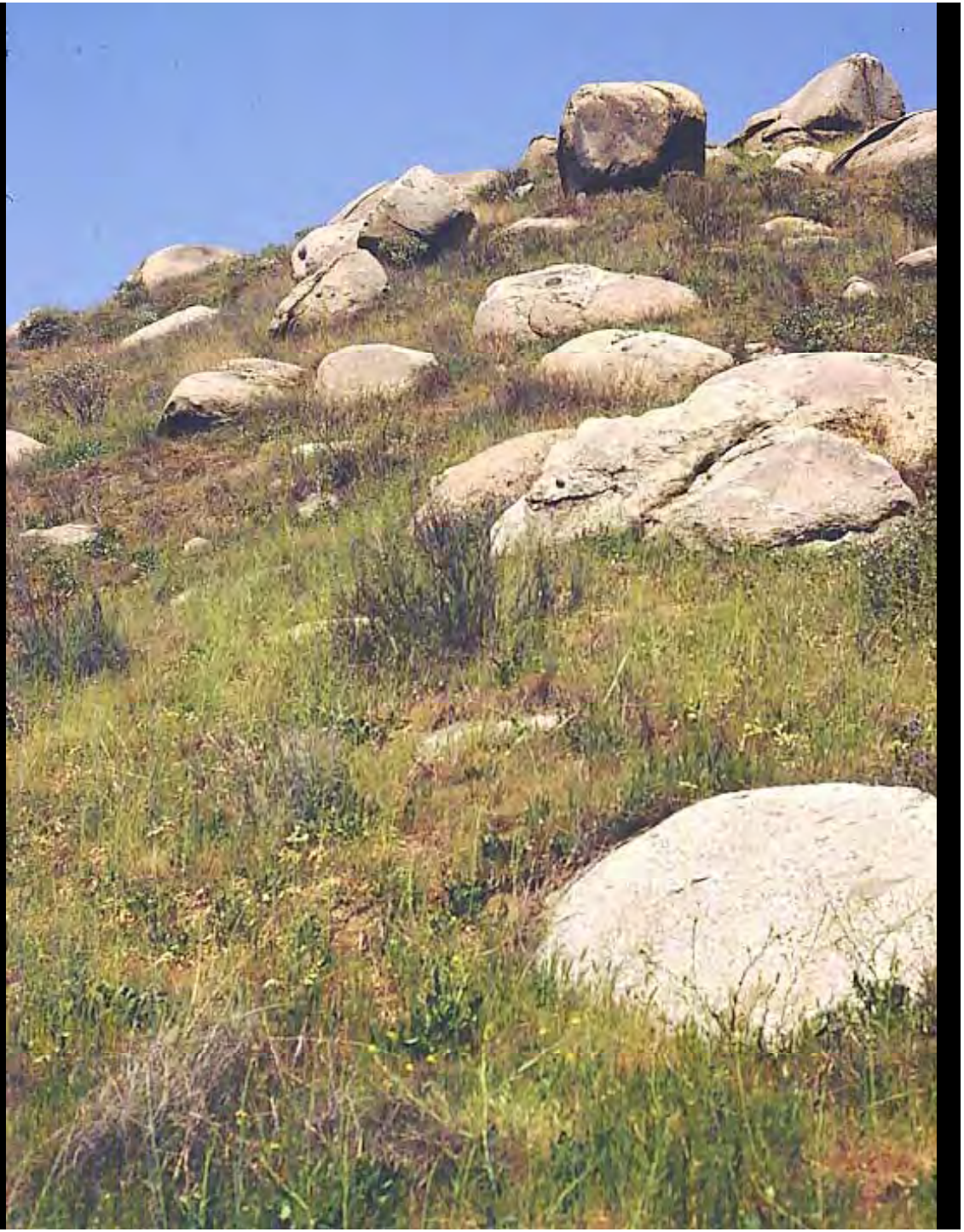
Avena barbata
Bromus rubens

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}

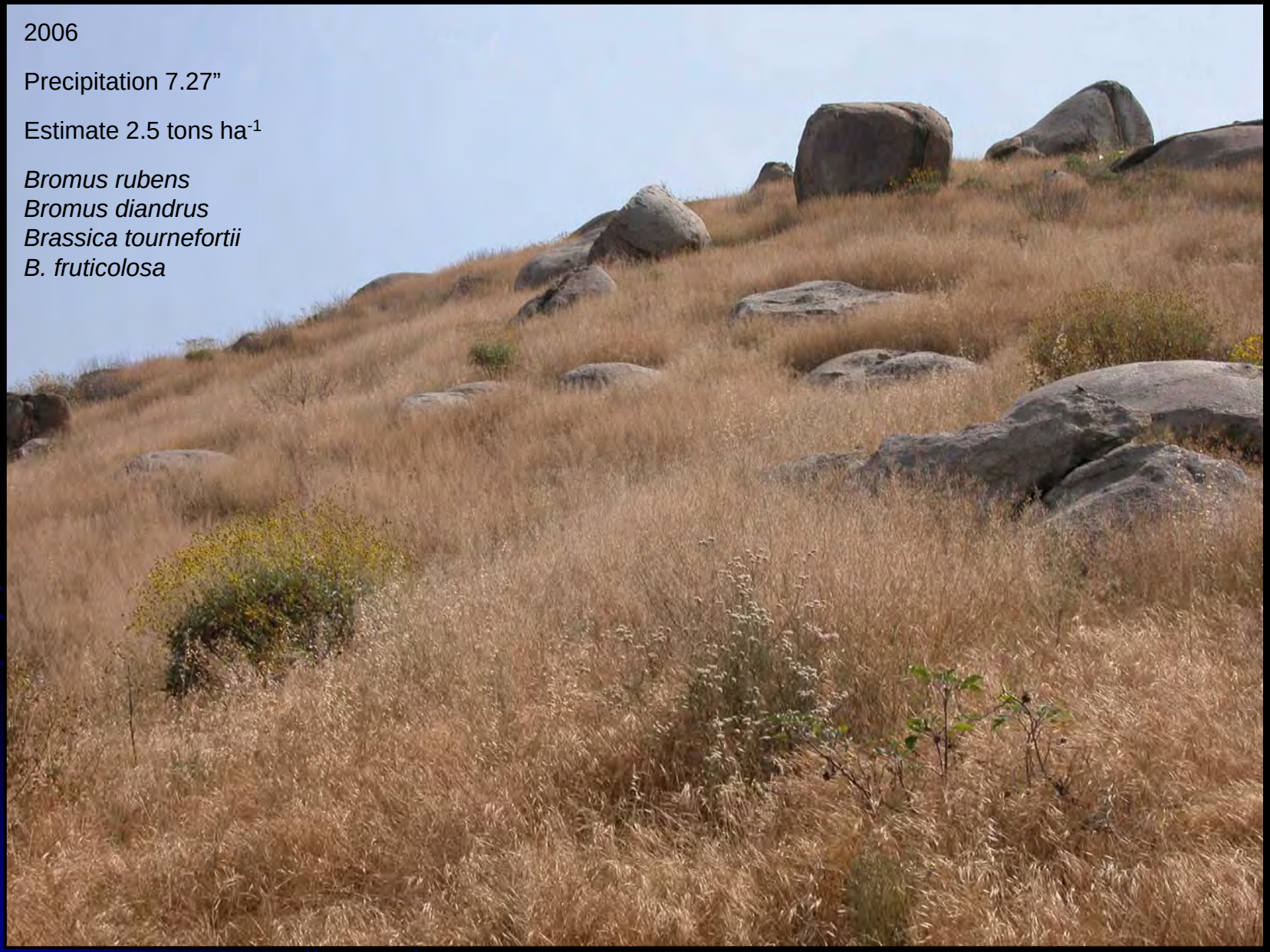
No germination

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. fruticolosa


2007
Precipitation 1.80”
0 tons ha-1
No germination

2008

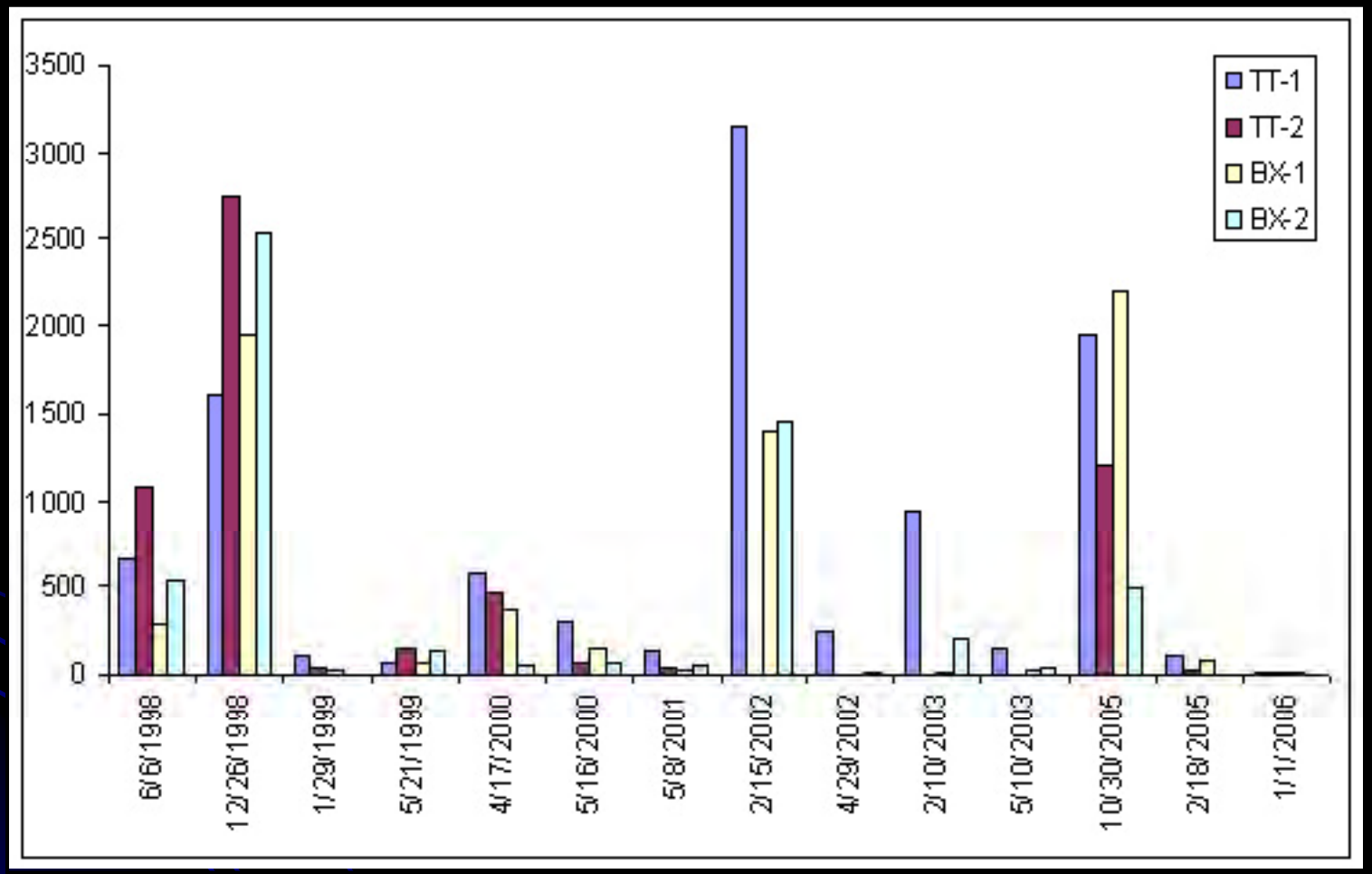
Precipitation, 9.12”

Estimate, 2.0 tons ha^{-1}

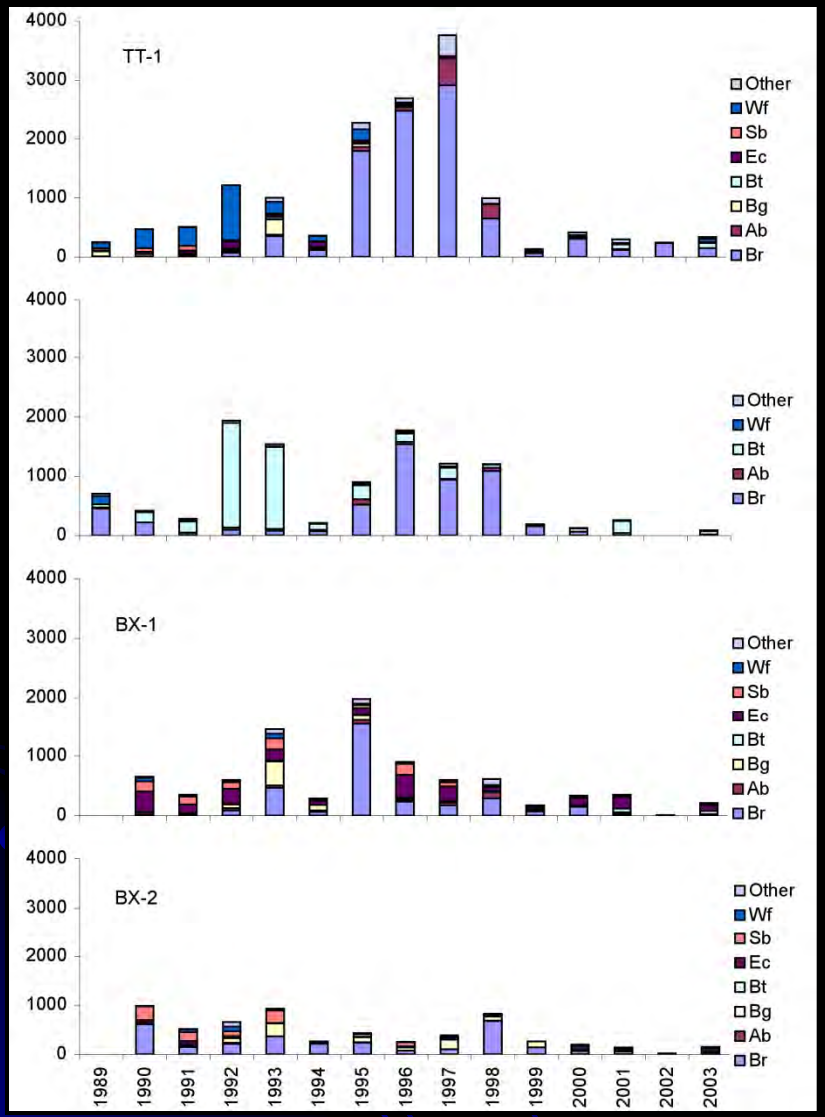
Brassica tournefortii
Phacelia distans
B. geniculata


Brome “crash,” 2006-07

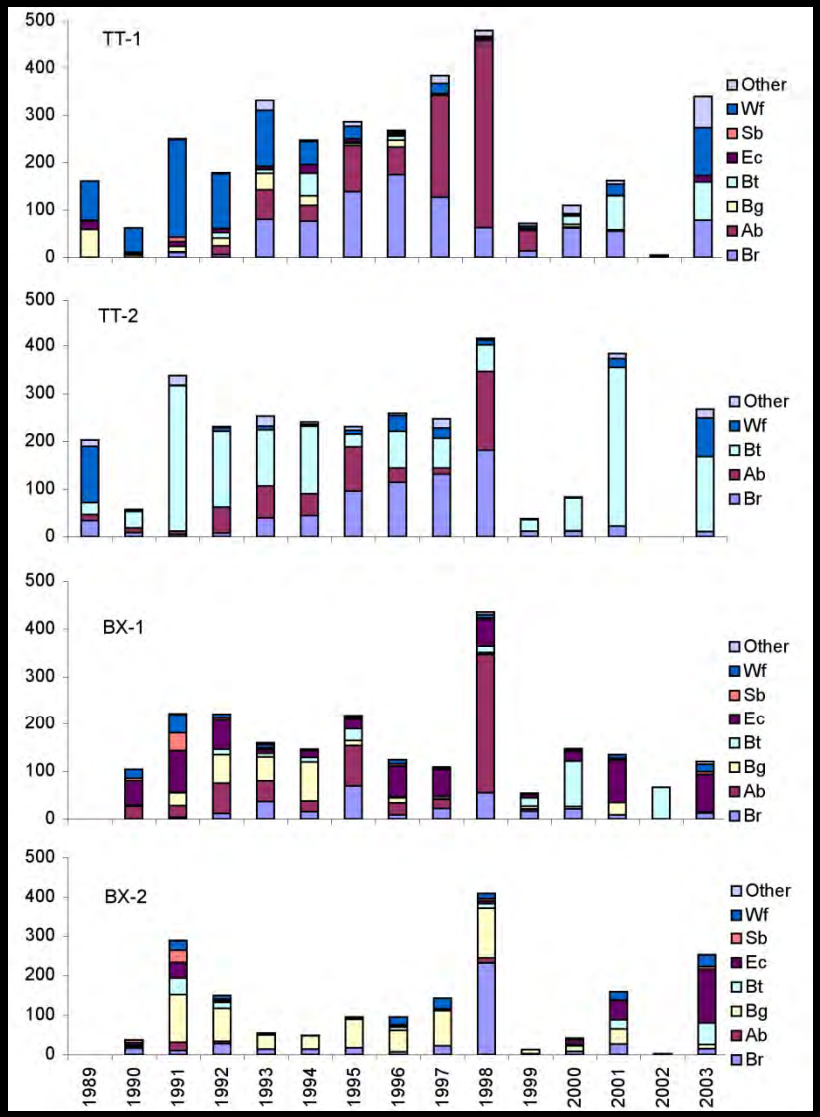
Density of *Bromus rubens* (stems m^{-2})



Wildflower and exotic annual frequency and biomass at Two Trees Canyon



Frequency



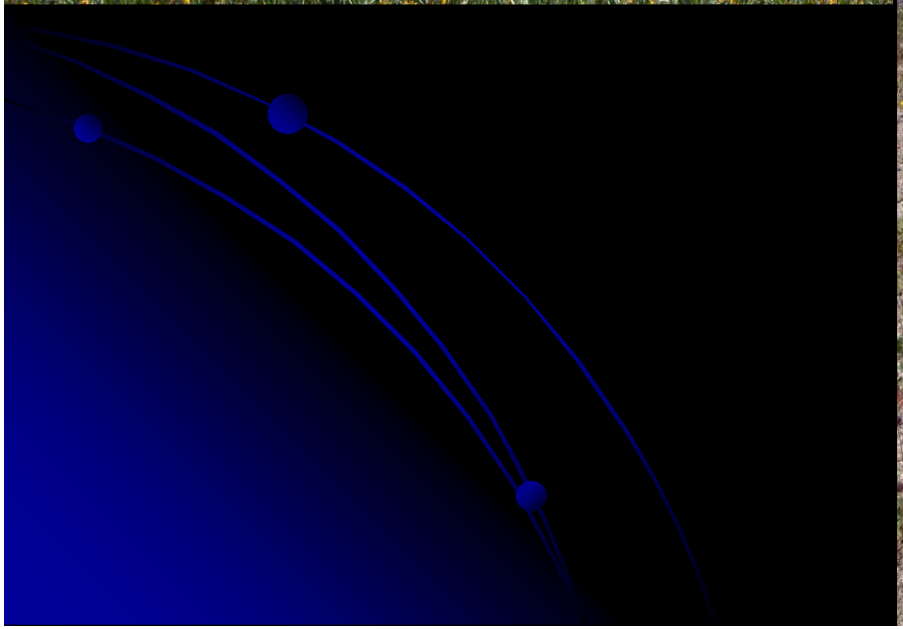
Biomass

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

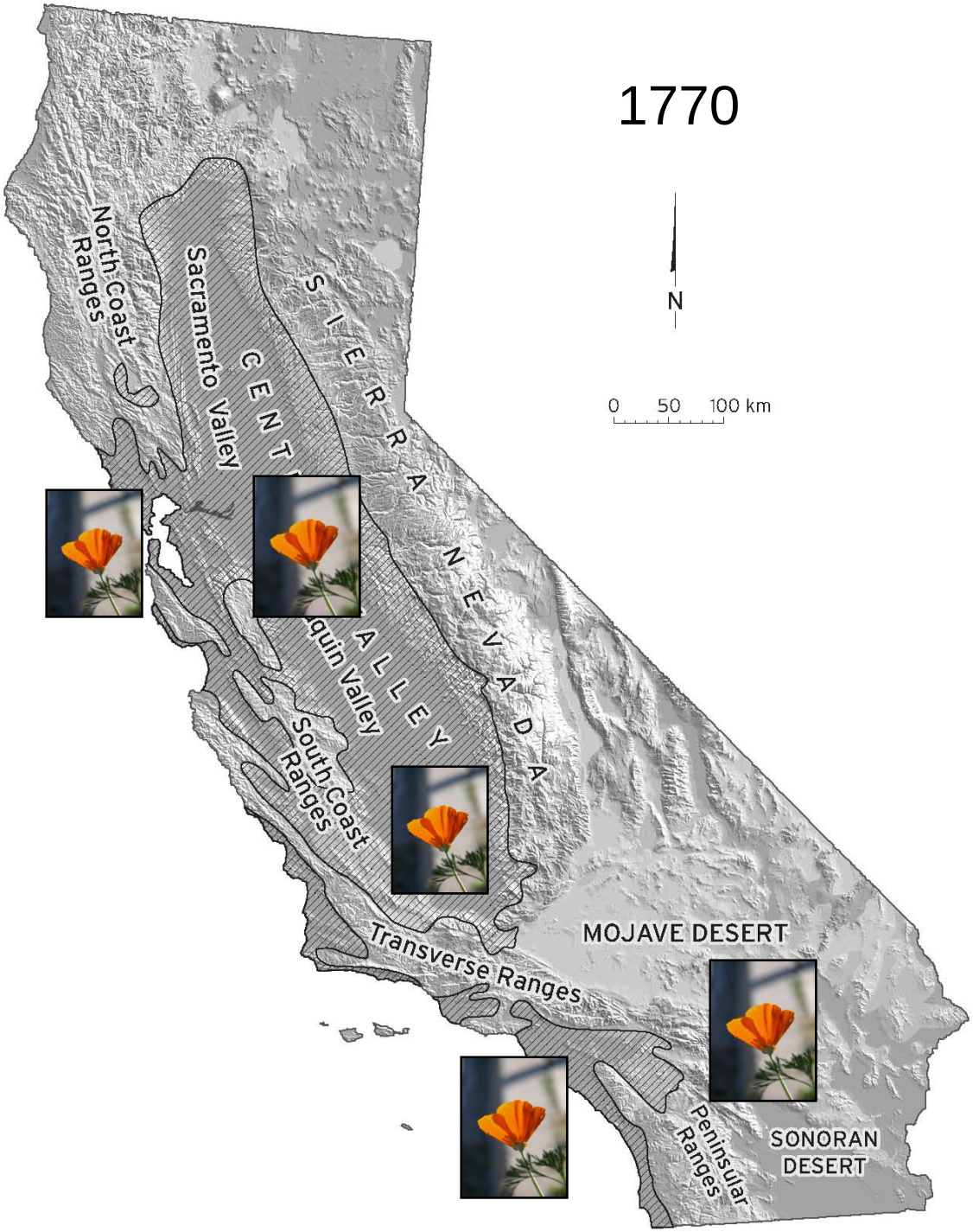
- Franciscan invasives reached their ecological range by the Gold Rush
- Wildflowers persisted in the interior.
- Second wave invasives (bromes) displaced forbs in the interior after 1965
- Wet years favor bromes and oats; dry years favor filarie, mustards and wildflowers.

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”



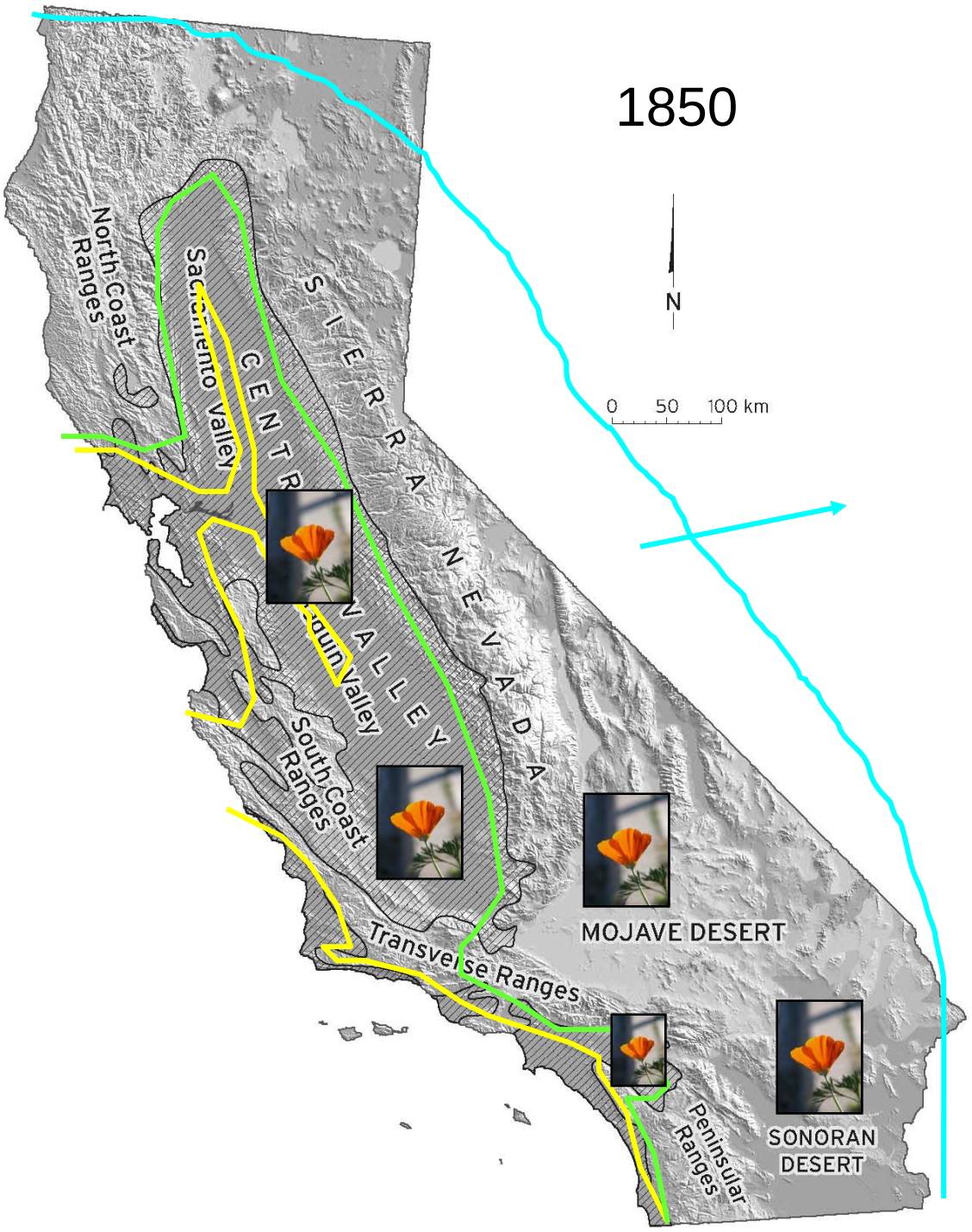
- Franciscan invasions of coast and interior floodplains
- Wildflowers in interior and deserts
- Coastal Franciscan pasture of wild oat and black mustard
- Interior barrens with Erodium and clovers

Wild oats, black mustard

Clovers

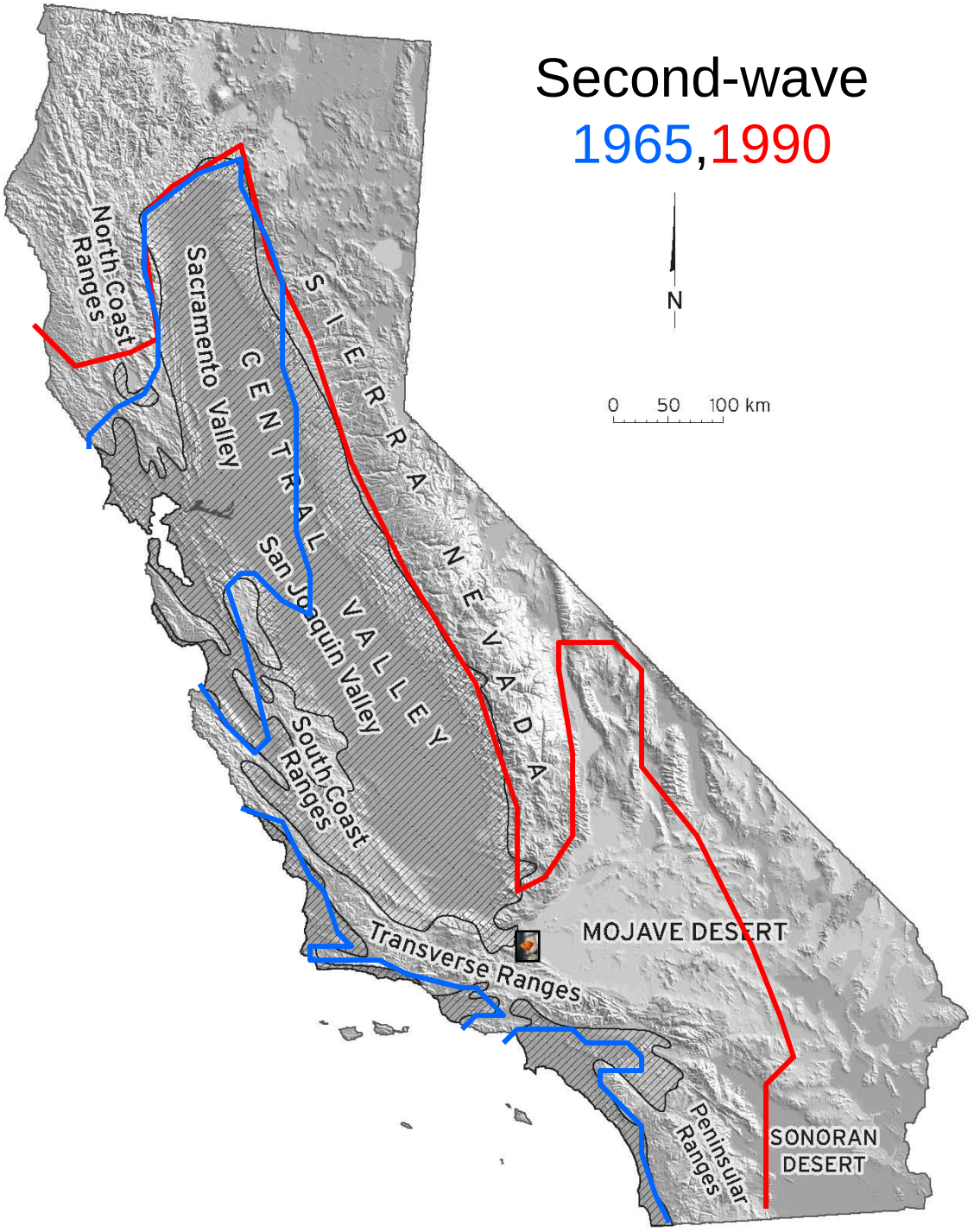
Erodium

Brome

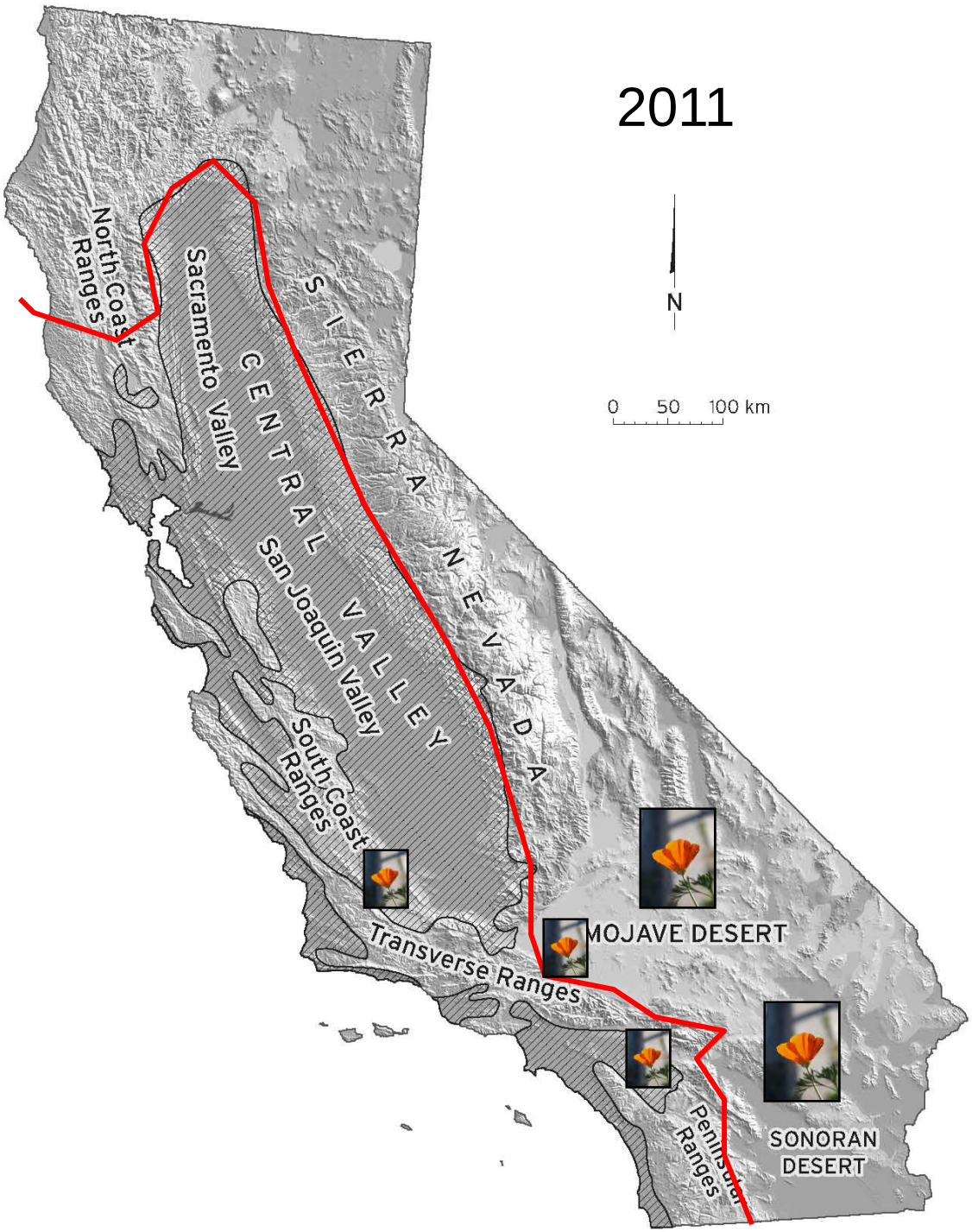


"Second-wave" brome, slender wild oat, summer mustard invasion

- 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.