SAN DIEGO COUNTY **NATIVE PLANTS** IN THE 1830s

The Collections of Thomas Coulter, Thomas Nuttall, and H.M.S. *Sulphur* with George Barclay and Richard Hinds

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Preface

Our knowledge of the natural environment of the San Diego region in the first half of the 19th century is understandably vague. References in historical sources are limited and anecdotal. As prosperity peaked around 1830, probably no more than 200 inhabitants in the region could read and write. At most one or two were trained in natural sciences or medicine. The best insights we have into the landscape come from narratives of travelers and the periodic reports of the missions' lands. They provide some idea of the extent of agriculture and the general vegetation covering surrounding land.

The stories of the visits of United Kingdom naturalists who came in the 1830s illuminate the subject. They were educated men who came to the territory intentionally to examine the flora. They took notes and collected specimens as botanists do today. Reviewing their contributions now, we can imagine what they saw as they discovered plants we know.

Their stories also remind us that the naturalists of the time were a tough breed. Several died from hazards in the field - Douglas, Gambel, and John Jeffrey, for example. Fortunately, Thomas Coulter, Thomas Nuttall and the naturalists on board the *Sulphur* all made it home to share their collections and recount their adventures.

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Introduction

For historians of California, the 1830s are the decade of secularization. Anti-Spanish sentiment, competition for wealth, and general anarchy conspired to ruin the Catholic missions. Sixty years of religious work unraveled in that one unruly decade.

For California naturalists, the 1830s are the decade when famous United Kingdom collectors, including David Douglas, explored the territory and discovered hundreds of native plants. The west coast of North America became a rich new source of species.

Three expeditions of UK naturalists passed through the San Diego region during those years. Thomas Coulter (b.1793-d.1843) journeyed overland across the mountains and desert in 1832. Thomas Nuttall (b.1786-d.1859) explored the coast and pueblo lands during spring 1836. George Barclay (dates unknown) and Richard Hinds (b.1812–d.1847) on board H.M.S. *Sulphur* surveyed in San Diego for five days in October 1839.

Images from these explorers' 180-year old botanical collections can be viewed today courtesy of leading herbaria in the UK and USA.

Population of San Diego Region in 1830

Native American Indians comprised the large majority of inhabitants at the time the naturalists visited. Indians had settled over centuries in nearly all the important valleys where fresh water could be found, by the coast and also in the mountains [1]. When the Spanish first arrived in 1769, the Indian population amounted to around 10,000 across the region, defined here to include all of San Diego County's present area plus Riverside County west of Mount San Jacinto and the northern limit of Baja California between Tijuana and Tecate. By 1830, Indians were still the overwhelming majority, though their numbers had declined, probably to around 8,000 [2].

Of the 8,000 or so Indians in the region in 1830, approximately 4,300 were Catholic converts, or neophytes, who had been baptised with the two local missions, San Diego de Alcalá and San Luis Rey de Francia [3]. The others remained pagans, or gentiles. Most Luiseño Indians had converted to Catholicism and joined the San Luis Rey mission under Father Antonio Peyri, its founder and inspirational leader. By contrast, fewer than half of the more diverse and dispersed Diegueño or Kumeyaay Indians belonged to the San Diego mission [4].

Neophytes from coastal areas generally lived at the mission compounds or in nearby settlements or rancherías, and by 1830 few if any pagan settlements remained along El Camino Real between present-day Tijuana and San Clemente. The priests allowed neophytes from inland areas to stay in their traditional territories and work on surrounding lands; many worshipped and received care at the Pala *asistencia* of the San Luis Rey mission or the Santa Ysabel *asistencia* of the San Diego mission [5]. While the religious devotion of individual neophytes varied, many learned Spanish and adopted Catholic customs while working for the mission's enterprises in exchange for food and support. Understandably, Hispanics in the town and on private ranches preferred to employ Indians who were Catholic and spoke Spanish. By 1830 the settlements of pagan Indians tended to be remote from the town and missions, located peripherally to the east, southeast and south.

A minority of approximately five hundred or so Hispanic immigrants and their descendents resided in the San Diego region in 1830 [6]. Their number included two or three Franciscan brothers at each mission – men born in Spain who came up to California from the San Fernando seminary in Mexico City; the mission-managers or *majordomos*; a dozen or so skilled tradesmen such as carpenters, masons, etc.; between eighty and one-hundred-and-twenty guards and retired guards; a few independent settlers and merchants; many wives and children; and a handful of Sandwich Islanders and itinerant whites mainly associated with maritime commerce. More than half these people resided in and around the town of San Diego; the remainder lived mainly at the missions and the *asistencias*, while two or three dozen lived scattered in adobe houses at various ranches and roadside *sitios*, including outposts of the missions, the Rancho Nacional in Chula Vista, and the cluster of private ranches in the Jamul-Otay-Tijuana area [7].

Domains of the Missions and Town of San Diego in 1830

In 1830 the two Catholic missions dominated the life and economy of the San Diego region as they had for several decades. The Franciscans who led each mission took vows of poverty and considered the missions' secular property as in trust for the neophytes who peopled the church [8]. As the missions' domains included the territories from which the neophytes came, the priests oversaw vast areas of land.

In an 1822 administrative report, the San Diego mission claimed twenty leagues or 52 miles from north to south and seventeen leagues or 44 miles from west to east, a maximum area of 1.4 million acres [9]. An 1827 report detailed productive areas under the San Diego mission's control and is reproduced in the notes below [10]. The lands included large parts of Mission Valley east of Highway 163; the College area, La Mesa, Mission Gorge, El Cajon, Rancho San Diego, Lemon Grove and Spring Valley; Lakeside and the Barona Valley; Ramona and Pamo Valley; Santa Ysabel to Lake Henshaw; the San Dieguito River valley from San Pasqual to the east end of Del Mar; and Rancho Bernardo and Poway.

In its administrative report of 1822, the San Luis Rey mission claimed its domain extended eleven leagues or 28 miles from north to south and fifteen leagues or 39 miles from east to west - a maximum area of 650,000 acres; the report also affirmed "the livestock needs it all [the land]" [11]. Its report of 1827 detailed the productive parts of the San Luis Rey mission's domain and is also reproduced in the notes below [12]. The lands included the San Luis Rey River valley from Oceanside to Bonsall and on to Pala and Pauma Valley; much of Carlsbad, Vista and San Marcos; the Lake Henshaw plain including Warner Springs and east toward Ranchita; the Santa Rosa plateau, Temecula, and most of western Riverside County to the Temescal Valley in the north; and the area of Camp Pendleton by the coast.

In 1830 the town of San Diego consisted of the presidio complex and thirty to forty buildings at the foot of presidio hill [13]. Residents used as commons a large area within San Diego's pueblo lands, including the western end of Mission Valley to False Bay, Ocean Beach and Point Loma; frontage on San Diego Bay; and the valleys to the north along and adjacent to El Camino Real. The presidio guard maintained livestock for its own use at the north end of La Jolla in the Soledad Valley (Peñasquitos Marsh) and on the Rancho Nacional in South Bay. In December 1834 the territorial governor granted the petitioning residents of San Diego legal status for a pueblo, with self-government and election of a town council

or *ayuntamiento* and mayor or *alcalde*; however in 1838 the *ayuntamiento* was disbanded due to depopulation. The presidio was abandoned after 1834 [14].

Ranching and Other Practices Affecting Natural Vegetation

The physical landscape in 1830 reflected widespread anthropogenic disturbance. For centuries Indians had practiced prescriptive burning to clear land and maintain clearings, and their custom left a mosaic of vegetation-types including unnaturally large areas of type-converted grassland or prairie [15]. Slash-and-burn clearing had been practiced for primitive agriculture worldwide since the neolithic era, but Indians of the San Diego region did not burn vegetation in preparation to till land [16]. They set fires to gain space and visibility, to encourage the succession of edible grasses and forbs, to eliminate accumulations of waste-materials, to attract or round up game, and for myriad other reasons [17]. Repeated burning over years reduced or eliminated shrubs, including *Ceanothus* and *Adenostoma fasciculatum* (Chamise) which sprout from burls [18]. Without such regular human intervention, most cleared land would otherwise revert to shrubs [19].

Practices introduced by the Spanish, such as ranching, farming, the daily collection of wood or kindling, and the introduction of exotic plants, further altered and in some places denuded the landscape [20].

Table 1 lists agricultural statistics recorded by the two missions for 1830 [21]. Indian-made clearings were a boon for imported Spanish livestock, including cattle, sheep, horses, goats, dairy-cows, pigs, oxen, burros and mules. By 1830 farming and ranching were practiced extensively across the San Diego region and had supplanted the Indians' customary hunting and gathering [22]. The two missions' collective holdings of 33,140 cattle, 41,256 sheep and 3,260 horses are astonishing considering the small number of Hispanic settlers and the few animals with which they started. Moreover, mission statistics understate totals for the San Diego region; they omit animals around the town and on the presidio's substantial grazing lands, as well as herds maintained by individuals and Indians independent of the missions, and the significant numbers of wild cattle and horses [23]. Narratives of foreigners who visited Southern California in the 1820s and early 1830s cite productive mission-farms and enormous numbers of livestock covering the plains and hills [24].

Grazing and browsing by cattle, horses and other livestock – particularly the hardy churros (sheep) and goats - cleared pasture and often left land bare. Many visitors to the region described portions of the landscape as barren or lacking herbage; 19th-century drawings and photographs support that impression [25]. Tens of thousands of acres in the Warner's Ranch area, used primarily by sheep belonging to the San Luis Rey mission, continue to be grazed by cattle today and remain stripped

of shrubs. Vaqueros moved flocks and herds among pastures, and the missions branded cattle, but ranch animals generally relied on free-grazing, and livestock roamed great distances for food [26]. Animals were left untended until sought for harvesting [27]. As their numbers increased and overgrazing occurred, especially in drought years, many became essentially wild, browsing shrubs and finding refuge in riparian areas and woodlands. The region's scarce rainfall compared to more northern parts of California limited the land's carrying capacity. Spanish cattle in the San Diego region required on average at least 2 acres per animal-unit-month; horses required more, and sheep about one-fifth as much [28]. The area of range needed by ranch animals in the region amounted to many hundreds of thousands of acres.

Table 1: 1830 Farm Production and Livestock Count

	San Diego Mission	San Luis Rey Mission	Total
Crop Harvest in Fanegas (1 Fanega=55.7 liters)			
Wheat	2,826	4,065	6,891
Barley	856	3,015	3,871
Corn	516	3,014	3,530
Beans	86	234	320
Livestock and Farm Animals Counted			
Sheep	16,120	25,136	41,256
Cattle	7,630	25,510	33,140
Horses	1,050	2,210	3,260
Goats	320	1,235	1,555
Mules	142	258	400
Pigs		287	287

Farming occurred near mission compounds, around Indian rancherías and in valleys where irrigation was feasible. Though the area of land tilled for crops was small compared to that used by livestock, by 1830 the missions and their rancherías cultivated an array of grains, beans, vegetables and fruits introduced from Mediterranean Europe, Mexico, and South America. The olive orchards of the missions supported the export of olive-oil to all of Alta California; both missions had productive vineyards and produced significant volumes of wine [29].

Collection of wood for domestic fire-pits and kilns also contributed to the barren appearance of land. As they did fresh water, people required firewood or kindling daily wherever they lived, particularly for heat and cooking [30]. Richard Henry Dana wrote at length of the challenge of collecting wood around Point Loma in 1835; he remarked, "the getting of wood was a great trouble, for all that in the vicinity of the houses had been cut down, and we were obliged to go off a mile or two" [31].

Invasive Plants and Animal-Pests

Introduction of non-native plants permanently altered the region's vegetation. Sacks of agricultural seed the Spanish imported contained impurities including common weeds; some plants considered weeds today may have been welcomed by the Spanish as Old-World native forage [32]. Analysis of adobe bricks from the late 1700s and early 1800s has revealed familiar weeds such as *Erodium cicutarium* (Filaree), *Malva parviflora* (Mallow), *Hordeum murinum* (Hare Barley), *Medicago polymorpha* (Bur-clover) and *Melilotus* (Sweetclover) [33]. Thomas Coulter wrote of seeing *Medicago* in California in 1832; Thomas Nuttall collected *Erodium* along the Oregon Trail in 1834 and *Festuca myuros* (Rat-tail Fescue) in San Diego in 1836.

Other plants the Spanish introduced for food or medicinal value spread beyond cultivated plots. Wild Mustard (*Brassica*, *Hirschfeldia* and *Sisymbrium* species) was first planted for the food value of its leaves and seeds and quickly grew out of control. By 1830 it invaded large areas of up and down California, drawing the attention of numerous travelers, as well as territorial officials such as mission-inspector William Hartnell, who wrote in 1839 of wheat-fields "badly overgrown with Mustard" [34]. Wild Oat (*Avena barbata, A. fatua*) also spread rapidly; Americans James Pattie in 1828, William H. Emory in 1846, Cave Couts in 1849, and J.R. Bartlett in 1852 all noted extensive areas covered by that alien grass [35].

Prior to 1830 missionaries also introduced exotic shrubs and trees, in addition to the Olive and other fruits. Father Peyri is said to have planted the first Peruvian Pepper Tree (*Schinus molle*) in California on the grounds of the San Luis Rey mission; a large specimen is labeled as the original tree at the rebuilt mission in Oceanside today. Various species of pad-cactus were introduced from Mexico for their edible nopals and tunas, and today *Opuntia ficus-indica* (Mission Prickly-pear) is common around the region. The Spanish introduced *Phoenix canariensis* (Canary Island Date Palm), *Ricinus communis* (Castor Bean), *Nicotiana glauca* (Tree Tobacco - from South America), and *Mesembryanthemum* and/or *Carpobrotus* (Ice-plant), all of which are familiar in waste places today [36]. They also likely introduced *Tamarix* (Salt-cedar). In the diary of his journey on horseback from San Gabriel to San Diego in December 1826, Jedediah Smith mentions traveling "through hills covered with Bastard Cedar" on the road across present-day Camp Pendleton, where *Tamarix* is documented as a common weed [37].

Dogs and pigs roamed freely around settlements, as they do in under-developed parts of Latin America today, serving several purposes, including consumption of food-related scraps and waste and in the case of dogs to counter intrusions by wildlife [38]. Native animals including gophers, squirrels, rats and crows were common pests in cultivated areas, as they are today. Fleas menaced humans around settlements [39].

Figure 1 (top): San Diego Bay viewed from Point Loma. Thomas Nuttall in 1836 and Barclay and Hinds in 1839 stayed on ships in the bay.
Figure 2 (bottom): Coastal chaparral on the ridge of Point Loma. Nuttall discovered and described many of the shrubs that populate the habitat.

Figure 3 (top): Scrub habitat in Anza-Borrego Desert State Park. Thomas Coulter was the first naturalist to collect plants in the region's desert. Figure 4 (bottom): Chuparosa in desert-transition habitat. Richard Hinds of the *Sulphur* first collected the plant on the Baja California coast.

Table 2 lists selected events related to secularization of the San Diego region's missions. Secularization refers to the transfer of control over the missions' domains and assets - including land, livestock, farms, orchards, food production, the hide and tallow trade, non-religious buildings, light industries, etc. - out of the hands of the Catholic Church and Franciscan fathers and into the hands of the government and private citizens.

Secularization was conceived in Spanish colonial law to distribute mission property among neophytes once they became responsible citizens. In 1830 there was little dispute about the theory of the original law. The conflict between conservatives, including the older priests and their supporters, and secularists, including Mexicans suspicious of Spanish institutions and *californios* who felt entitled to share the missions' wealth, centered on timing and corruption. The priests argued neophytes were not yet prepared to take responsibility for their rightful property and would squander the wealth or have it taken by *californios* [40]. Those favoring secularization blamed priests for the Indians' ignorance and for implying that the mission system should continue indefinitely [41].

With historical perspective, the absence of schools for Indians has been cited as a failure of the mission system. However, partisans of secularization also failed to finance or advance Indian schools.

In 1833 Governors Echeandía and Figueroa appointed administrators to oversee the missions' enterprises, removing authority from the Franciscan fathers. Unlike the *padres*, the *administradores* were drawn from *californio* families and made no vow to serve God's children. They attempted, with little success, to maintain continuity in agricultural and industrial production while allowing the Indians greater liberty. They did not propose to grant the missions' assets to the Indians. The neophytes - roused by Echeandía to assert their rights - lost more than they gained under the *administradores*. They lost the *padres* who had capably led them. Father Peyri left the territory in 1832 and Father Martín died in 1838.

Disaffection, inconsistent labor, disorder including protests, raids and crime, and declining productivity across the region thus accompanied secularization [42]. By the end of the decade most neophytes had severed their connections to the missions and sought employment elsewhere or settled in subsistence rancherías, often joining pagan bands. Only a fraction of the Indians maintained successful farms or ranches, at Temecula and a few other places. Among *californios*, insecurity and anarchy led to depopulation; many inhabitants moved to Los Angeles or elsewhere.

By 1846 territorial governors had granted the prime agricultural lands of the San Diego region to *californios*. The sprawling mission enterprises were replaced by a patchwork of private ranches in the hands of a few dozen families. Indians sought employment at the ranches but they no longer could claim rights to the land or its production.

Table 2: Timeline Related to Secularization of San Diego Region Missions and Grants of Ranchos

Year	Event
1818	Serrano occupies Temescal valley 22,140 acres with Fr. Peyri's permission
1823	Ruiz granted first rancho, Peñasquitos 8,486 acres; Fr. Martín objects
1824	Mexican Republic established with new constitution
1825 Oct.	Liberal Echeandía arrives to be governor, resides in San Diego
1826	Fathers Martín (SD) and Peyri (SLR) consent to oath to new constitution
1826	Echeandía issues decree of emancipation for qualifying neophytes
1828-29	Mex. government passes laws and decrees to expel Spanish loyalists
1829 Sep.	Spain attempts to re-conquer Mexico and is defeated at Tampico
1829	Arguello granted Tia Juana rancho 26,027 acres
1829	Estudillo granted Janal rancho 4,437 acres
1830 Dec.	Conservative Victoria arrives to replace Echeandía as governor
1831 Jan.	Echeandía issues decree of secularization just before meeting Victoria
1831	Victoria attempts military rule to counter Liberal opponents
1831 Sep.	**Thomas Coulter arrives in Monterey, meets David Douglas who is living there**
1831 Dec.	Victoria wounded by rebels, yields authority back to Echeandía
1831	Pío Pico granted Jamul rancho 8,926 acres despite Fr. Martín's objection
1832 Jan.	Fr. Peyri after 33 yrs at SLR leaves California despondent with Victoria
1832 Jan.	**Douglas and Coulter join compañía extranjera supporting Zamorano**
1832	Echeandía and Barroso incite and arm Indians to help defeat Zamorano
1832 May	**Coulter stays at Pala on way to/from Colorado River with mule-traders**
1832 end	**Coulter travels overland via SLR mission to San Diego, leaves by ship**
1832 Nov.	Echeandía issues secularization rules for four So. California missions
1833 Jan.	Echeandía names Ramirez commissioner for SD mission, Portilla for SLR
1833 Jan.	Figueroa arrives to be governor, resides at Monterey
1833 Feb.	Leading residents petition Figueroa for creation of San Diego pueblo
1833	Zacatecan priests replace Spanish Fernandinos at some missions
1833 Jul.	Figueroa endorses Indian pueblos for selected neophyte families
1833 Aug.	Mex. law requires missions reduced to parishes, land returned to Indians
1833	10-15 presidio guards kept at SLR mission against Indian unrest
1833 end	San Dieguito and Las Flores pueblos established for selected neophytes
1833	Arguello granted Melijo or La Punta rancho 4,386 acres
1833	Bandini granted Tecate rancho 21,683 acres; abandoned after Indian raids
1833-34	SLR and SG missions slaughter livestock in unusually large numbers
1834	**Thomas Nuttall crosses North America on Oregon Trail with Wyeth**
1834 Apr.	Mex. government decrees all missions be secularized within 4 months
1834 Aug.	Figueroa, territory government issue far-reaching secularization decree
1834 Oct.	Hijar arrives with scheme to transfer missions' assets to new colonists
1834 Nov.	Figueroa issues supplemental decree advancing secularization
1834 end	Rocha commissioner assumes SD mission affairs from Fr. Martín
1834 end	Portilla as commissioner assumes SLR mission affairs from Fr. Fortuni
1834	Arenas granted San Felipe rancho 9,972 acres; abandoned due to Indians
1834 Dec.	San Diego pueblo formed with Osuña named alcalde
1835	San Diego presidio abandoned; town left with few soldiers
1835	Indians threaten San Luis Rey lands and Santa Ysabel
1835 Apr.	Ortega appointed *administrador* of San Diego mission
1835 Aug.	Fr. Fortuni assigns SLR assets to Portilla and new *administrador* Pío Pico
1835 Sep.	Governor Figueroa dies at Monterey
1835 Nov.	Mex. government decree delays Aug.1833 law, but decree ignored in California
1835 Nov.	San Pasqual pueblo established for selected Dieguẽno neophytes
1836	Portilla granted Valle de San Jose rancho 17,634 acres
1836 Apr.	**Thomas Nuttall spends 3 weeks in San Diego before sailing on *Alert***
1836 Jun.	Pico faces ongoing protests of SLR Indians, forced to release Pablo Apis
1836 Dec.	Alvarado governor after revolution against Gutierrez and *cholos*
1837	Indian raids many; murders at Jamul rancho and abduction of 2 girls
1838 Apr.	Carrillo and Alvarado meet at Las Flores near SLR with respective armies
1838 Oct.	Fr. Martín dies after 26 years with San Diego mission
1838 Nov.	Alvarado confirmed governor by Mexican president
1838	San Diego pueblo status revoked due to depopulation
1839	Indian raids numerous on ranches and mission lands in SD region
1839 May	Hartnell begins inpecting missions in San Diego on order of Alvarado
1839 Oct.	**HMS *Sulphur* and *Starling* anchored in San Diego Bay for 5 days**
1840 Feb.	Fr. Ibarra accuses Pío Pico of coveting SLR mission's best lands
1840 Mar.	Alvarado decrees replacement of *administradores* by limited *majordomos*
1840	Hartnell removes *administradores* Ortega, Pico; appoints Osuña, Estudillo
1840 Sep.	Hartnell resigns as *visitador* of missions due to difficulties with *californios*
1840	Alvarado granted San Marcos rancho 8,975 acres
-	Lorenzana granted Jamacha rancho 8,881 acres
-	Pico granted San Jose del Valle rancho 26,689 acres; soon abandoned
1841	Pico granted Santa Margarita y Las Flores rancho 133,441 acres
1841 Dec.	Bishop García Diego arrives in SD to open diocese but moves to Santa Barbara
1842	Estudillo granted San Jacinto Viejo rancho 35,503 acres
-	Marrón granted Agua Hedionda rancho 13,311 acres
-	Snook granted San Bernardo rancho 17,763 acres
-	Ybarra granted Los Encenitos rancho 4,431 acres
-	Alvarado granted Rincón del Diablo rancho 12,654 acres
1842 Sep.	Micheltorena arrives in San Diego as new governor, assembles troops
1843 Mar.	Micheltorena restores to priests remnants of SD and SLR missions
1843	Ortega and Stokes granted Pamo or Santa María rancho 17,709 acres
1844	Ortega and Stokes granted Santa Ysabel rancho 17,709 acres
1844	Arenas and Moraga granted Pauba rancho 26,598 acres
-	Serrano granted Pauma rancho 13,310 acres
-	Valdez granted Temecula rancho 26,609 acres
-	Warner granted San Jose del Valle rancho 26,689 acres (ex-Pico)
1845 Mar.	Pío Pico governor after expulsion of Micheltorena and *cholos*
1845 Oct.	Governor Pío Pico orders sale of remainder of several missions
1845	Estudillo granted Santa Monica or El Cajón rancho 48,800 acres
-	Forster granted Rancho Nacional 26,632 acres
-	Juana (Indian) granted Cuca rancho 2,174 acres
-	Manuel (Indian) granted Guajome rancho 2,219 acres
-	Olvera granted Cuyamaca rancho 35,501 acres
-	Orozco granted Guejito rancho 13,299 acres
-	Osuña granted San Dieguito rancho 8,825 acres
-	Subría granted Buena Vista rancho 2,288 acres
-	Pablo Apis (Indian) granted portion of Temecula rancho 2,200 acres
1846	Alvarado granted Monserate rancho 13,323 acres
-	Arguello granted ex-San Diego mission lands 58,875 acres
-	Carrillo granted Isla de San Diego (Coronado Is.) 4,185 acres
-	Castillo granted Valle de San Felipe rancho 9,972 acres
-	Estudillo granted Otay rancho 6,658 acres
-	Estudillo granted San Jacinto Sobrante rancho 48,847 acres
-	Moreno granted Santa Rosa rancho 47,815 acres
-	Lopez granted San Vicente or Barona rancho 13,316 acres
-	Pedrorena granted San Jacinto Nuevo y Potrero rancho 48,861 acres
1846 May	United States declares war against Mexico
1848 Feb.	Mexico cedes California to United States.

Thomas Coulter's Visits in 1832

Thomas Coulter (b.1793-d.1843) first came to the San Diego region in April 1832, accompanying a group of Americans who purchased mules and horses from the California missions and were driving them east to be sold in Louisiana [43]. He was 38 years old. He had arrived in Monterey six months earlier after working for five years in Mexico.

Coulter grew up Presbyterian in northeast Ireland and in 1820 became a medical doctor or surgeon [44]. In 1822 he studied botany at the Jardin des Plantes in Paris and in Geneva under Augustin-Pyramus de Candolle (b.1778–d.1841), his mentor. In 1824 he took a position as surgeon for a British mining company and moved to central Mexico. While working there he occasionally collected natural specimens, sending several new cacti to de Candolle in 1828 for publication [45]. In 1830 he moved up to Hermosillo in Sonora and after an unsuccessful mining venture prepared to travel overland to California for scientific observations and collecting. He decided not to cross the Sonora and Colorado Deserts and instead traveled down to Guaymas, where in September 1831 he boarded an American brig for Monterey.

In Monterey Coulter joined a significant expatriate community. In October 1831 he accompanied a group riding overland to and from Santa Barbara. He then met David Douglas and explored the Central California coastal region with him during the winter months. Douglas – a thorough and determined collector who became the source for hundreds of new California taxa - had been in the territory amassing specimens for a year before Coulter met him; many of the two explorers' plant-collections overlapped, causing Coulter some regret. In January 1832 both men enlisted in the *compañía extranjera* at Monterey opposing Echeandía's forces [46]. In March 1832 Coulter joined the American mule-traders and traveled south to San Gabriel, interested to see a part of the territory where Douglas had not gone.

Coulter is the first naturalist known to collect plants in the Southern California desert. The route he followed is shown on the map drawn for his *Notes on Upper California*, communicated by letter to the Royal Geographical Society in London in March 1835 (Figure 5) [47]. The group Coulter accompanied included Jonathan T. Warner and is described in Warner's *Reminiscences of Early California, 1831-1846* [48]. Coulter's companions were tough and experienced, led by two renowned trappers or mountain-men – David E. Jackson and Ewing Young. Warner (b.1807-d.1895) was one of nine employees Jackson brought from Santa Fe to California in October 1831 with sacks of silver coin to purchase mules. At San Gabriel, Young and many of his men joined Jackson to manage the herd of around 700 animals on the return trip east. The party moved southeast over San Luis Rey mission lands in Riverside County, reaching Pala around April 30, 1832. From Pala they headed east up what Coulter described as the "narrow valley" of the San Luis Rey River, then crossed the Lake Henshaw plain and proceeded down the San Felipe valley to Vallecitos. Enduring hot days without water or much forage, the group finally passed the Algodones Dunes and arrived south of the confluence of the Gila and Colorado Rivers around May 8, 1832. Coulter camped ten days near present-day Yuma while the Americans worked strenuously to ford the river at its seasonal height. From there he wrote a letter to de Candolle's son, dated May 16, 1832, saying "...here is nothing, nothing. This is truly the kingdom of desolation" [49]. He then turned back west, accompanying Young, Warner, Kit Carson's older brother Moses Carson, Isaac Williams and a few other men, reaching Pala around May 27. He returned to San Gabriel in the second week of June 1832.

Coulter's route between Yuma and Lake Henshaw became a portion of the Southern Emigrant Trail - the main road between New Mexico and California after 1846 [50]. Coulter was one of the first English-speaking travelers known to take the trail, preceded only by Jackson's initial party including Warner, and probably by Ewing Young's group, which had followed Jackson west out of New Mexico late in 1831. Warner settled his ranch along the trail-route near Lake Henshaw in 1844 and died in Los Angeles in 1895.

Late in 1832, recovering from a broken leg, Coulter journeyed south from Monterey again, following El Camino Real via San Juan Capistrano and San Luis Rey to San Diego, where he sought passage by ship to central Mexico [51]. Douglas had left Monterey by ship in August 1832 for further exploration in the Pacific Northwest; after his injury Coulter withdrew from a project to accompany Ewing Young overland to the Oregon Territory, instead deciding to return to Mexico. He almost certainly stayed at the San Luis Rey mission en route to San Diego. With whom he traveled and where he slept in the town of San Diego, and the name and dates of his ship, are not presently known; he may have obtained lodging from a shipping agent.

Coulter possessed several advantages for travel in California at that early date. He had worked in rural Mexico for several years, understood Spanish, and carried a passport issued by the central government. He was an excellent marksman and fly-fisherman, according to Douglas. Most importantly, he was a medical doctor and scientist, lending him authority with the local residents, trappers, and missionaries whom he encountered. The priests befriended him, and he thought well of them, particularly Father Sanchez of the wealthy San Gabriel mission, whom Captain Barroso of Echeandía's presidio-guard imprisoned the year Coulter visited, and who died, dispirited by his Liberal opponents, in January 1833 [52]. Coulter showed an interest in anthropology, taking time to study Indian languages in addition to time spent on his natural history collections and geographical observations [53].

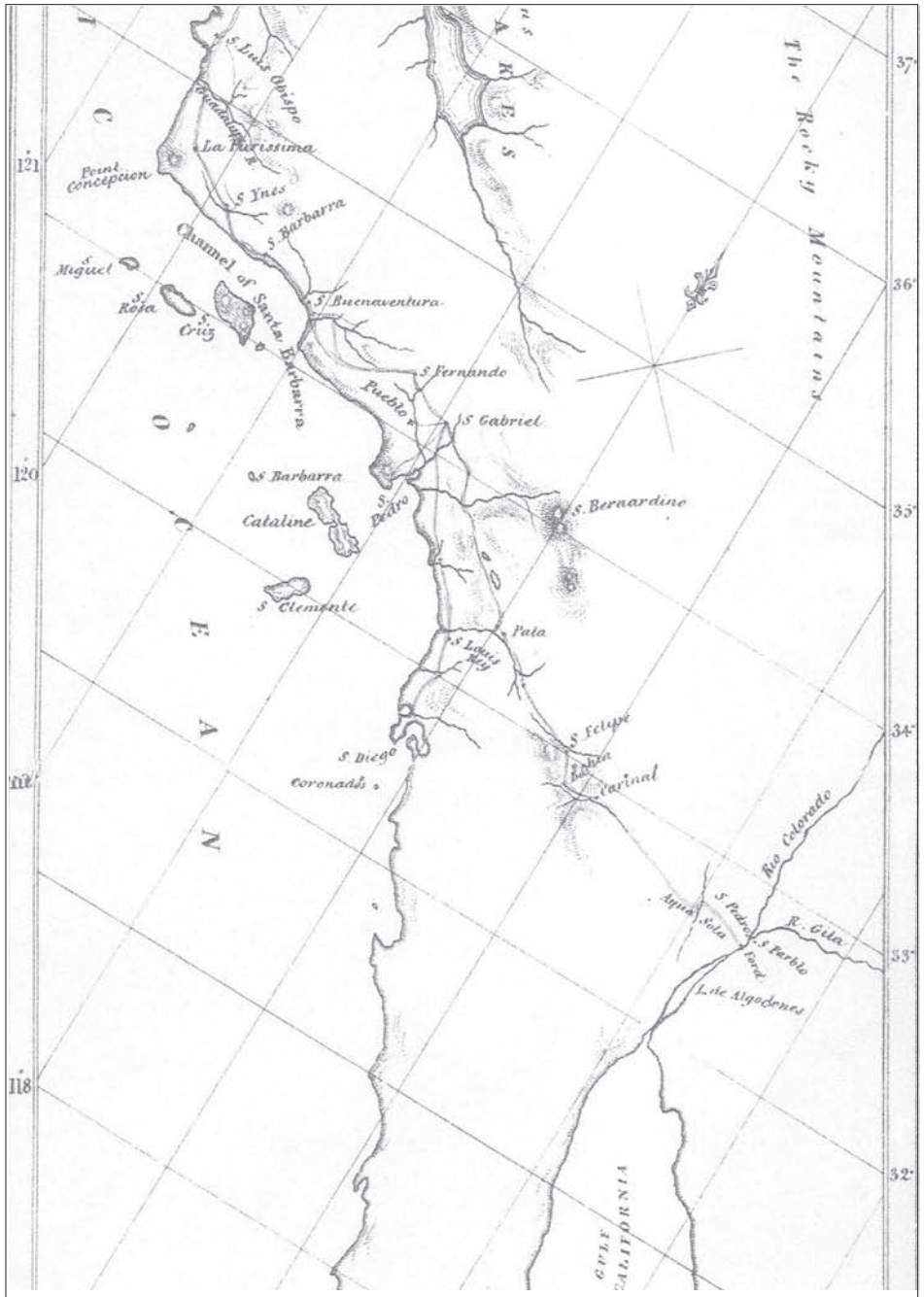

Figure 5: Map drawn in 1835 depicting Thomas Coulter's route in spring 1832 from the San Gabriel mission to Pala and across the desert to present-day Yuma. The route became part of the Southern Emigrant Trail.

Coulter's fame among California botanists derives primarily from two plants he discovered – *Pinus coulteri* (Coulter Pine) and *Romneya coulteri* (Matilija Poppy) - both of which grow in the San Diego region. The Coulter or Big-cone Pine is notorious for its heavy, prickly cones, while the Matilija Poppy is celebrated for its impressive white flowers – the largest of any native California plant (cover photo).

In 1833 Coulter shipped his specimens from Mexico to his sister in London. He arrived in the UK in November 1834 and soon met with Aylmer Lambert - whose name Douglas gave to *Pinus lambertiana*, the Sugar Pine. Lambert had published a monograph on pines; Coulter shared some seed-cones he had collected. Using Coulter's specimens, in June 1835 Lambert's associate David Don published descriptions of five new conifers from California: *Pinus coulteri* (Coulter Pine), *P. radiata* (Monterey Pine), *P. muricata* (Bishop Pine), *P. tuberculata* or *P. attenuata* (Knob-cone Pine), and *P. bracteata* or *Abies bracteata* (Bristlecone Fir) [54]. Of the five only the Coulter Pine is native in San Diego County, and Coulter may have seen it near Lake Henshaw in May 1832. He reported collecting the type specimen near the San Antonio de Padua mission east of Big Sur [55].

Coulter donated his thousands of plant-specimens from Mexico and California to found the herbarium at Trinity College Dublin; in return he received an appointment as the first curator there. But he made scant progress organizing the herbarium or publishing new species in the nine years before he died, in November 1843. William H. Harvey, appointed to succeed Coulter at the new herbarium, deserves credit for numbering Coulter's California plants, sending duplicates to other taxonomists, and describing some new species.

In 1845 Harvey published a description of the Matilija Poppy in Hooker's *Journal of Botany* [56]. Coulter – who also collected *Eschscholzia californica* (California Poppy), *Dendromecon rigida* (Bush Poppy) and *Platystemon californicus* (Cream Cups) - apparently did not leave a record where he found *Romneya*. In his May 1832 letter from Yuma he mentions finding "a few fine Papaveraceae", suggesting he may already have collected it by then, possibly in western Riverside County where it is a fire-follower today. *Romneya* blooms in spring and early summer; Coulter only spent one spring in the territory. The *Romneya* sheet in the Kew herbarium shows bristles on the inflorescence and a relatively small flower on Coulter's specimen, suggesting the plant may be *Romneya trichocalyx*, which is concentrated today in southern San Diego County (Figure 6) [57].

Coulter almost certainly collected some of his known plants in the San Diego County desert. The *Jepson Manual* lists Harvey as the authority for the following taxa which are found today in Anza-Borrego Desert State Park, though not exclusively: *Acamptopappus sphaerocephalus* (Desert Goldenhead); *Baileya pauciradiata* (Colorado Desert Marigold), *Baileya*

pleniradiata (Desert Marigold); *Chaenactis artemisiifolia* (White Pincushion); *Pectis papposa* (Chinch Weed); *Phacelia minor* (Desert Canterbury Bells); *Dithyrea californica* (Spectacle Pod); and *Lyrocarpa coulteri* (Lyrepod) [58]. In 1844 Harvey forwarded duplicates of dozens of Coulter's specimens to George Bentham, John Lindley and William Hooker in the UK, and to John Torrey and Asa Gray in the United States. These and other taxonomists authored additional new species most likely on the basis of Coulter's collection, including the desert species *Geraea canescens* (Desert Sunflower) by Gray; *Dalea mollis* (Silk Dalea) by Bentham; *Prosopis pubescens* (Screwbean Mesquite) by Bentham; *Hilaria rigida* (Galleta Grass) by Bentham; *Loeseliastrum schottii* (Desert Calico) by Torrey; *Rhus ovata* (Sugar Bush) by Gray's assistant Sereno Watson; and *Parkinsonia florida* (Blue Palo Verde) - from Sonora - by Bentham.

Uncertainties with Coulter's Collection

Coulter's California collection presents some uncertainties or difficulties. The herbarium at Trinity College Dublin, where his primary collections continue to be stored, thus far has not catalogued the specimens [59]. The California plants were numbered into the 800's - probably by Harvey – but identifications have not been completed. A few of the numbered plants are known to be repeats, including multiple different specimens of the variable taxon *Corethrogyne filaginifolia* (California Aster). Of the herbaria possessing duplicates of the known taxa, such as Kew, Harvard, and the New York Botanical Garden, no one herbarium outside Ireland is known to have more than a fraction of Coulter's total.

A second difficulty is the absence of a single taxonomic authority for the collection. Douglas sent his plants to Hooker; Thomas Nuttall described his own; the *Sulphur* had Bentham. Coulter failed to pursue the work himself or enlist a leading taxonomist to examine and identify his specimens. A related difficulty is the delay of more than a decade before the plants were unpacked. Without doubt, Coulter was the first naturalist to collect a great many new California species – perhaps hundreds – but because of the delay, later naturalists such as Nuttall found the same plants and identified them before Coulter's saw daylight. Many of his specimens became obsolete.

Finally, the lack of precise location information for Coulter's specimens frustrates California botanists today. Almost all herbarium-sheets showing his specimens give California - nothing more - as the location. He may have recorded precise locations and other descriptive details in field-notebooks; unfortunately, his personal papers from Mexico were lost or stolen en route to the United Kingdom in 1834 [60]. It may be that Coulter lost interest in his specimens after he lost the notes for them, or the combination of that setback and his knowledge of David Douglas' collection discouraged him from further work.

Figure 6. *Romneya coulteri* (Matilija Poppy) sheet, courtesy of Kew Herbarium, showing duplicate of Coulter's collection provided by William Harvey. Notation suggests Coulter's plant may be *R. trichocalyx*.

Figure 7. *Navarretia atractyloides* (Holly-leaf Navarretia) sheet, courtesy of Kew Herbarium, showing specimens of David Douglas, Thomas Coulter and Thomas Nuttall. Nuttall notes his plant is from San Diego.

List of Plants Collected by Coulter, Nuttall, and the *Sulphur*

Table 3 lists a selection of about 160 San Diego County native plants collected by Coulter, Nuttall, and Barclay and Hinds of the *Sulphur*. The latter three naturalists documented many of their plants as from San Diego, presumably collected within a few miles of La Playa. Locations for most of Coulter's plants cannot presently be verified; the table lists some which he is reasonably likely to have found in the region. Where records are absent, locations are estimated based on Coulter's known movements, the plants' present distributions, and the plants' blooming periods. It should be considered that Coulter may have explored the San Bernardino region while staying at the San Gabriel mission in April and June. Some of the *Sulphur* plants grow in the San Diego desert but were collected on the Baja California coast; Coulter is not known to have been in Baja California. He did segregate his California collection from his other plants.

All of the UK naturalists made extensive discoveries in Central and Northern California. Taxa known to be discovered there are omitted from Table 3; a few exceptions are made for plants of special interest in San Diego, such as *Xylococcus bicolor* (Mission Manzanita), which Nuttall later recorded finding near Monterey - probably by mistake - and in cases where different collectors' discoveries overlapped.

All of the naturalists separately collected a large number of coastal plants. if Douglas' specimens are also considered, the number of repeat collections from the 1830s is indeed substantial. Sheets from the Kew herbarium often show Douglas' and Coulter's specimens side-by-side; many also show Nuttall's (Figure 7). Coulter discovered several plants in Central California that Douglas missed – such as *Pinus coulteri* – but generally Nuttall became the author of those taxa after he collected them in 1836. *Peritoma arborea* (Bladderpod) is one familiar repeat-collection from San Diego (Figure 10). Coulter collected it in 1832 but left it unpacked; Nuttall discovered it in 1836 and authored the description within several months; Barclay and Hinds collected it in San Diego again in 1839.

Sources for Table 3 include the catalogues of the Kew, Harvard, Philadelphia Academy of Sciences, and New York Botanical Garden herbaria [61]. These herbaria - Kew in particular - provide public access to images of many herbarium-sheets. Also of use are papers Frederick Coville (b.1867-d.1937) published in the late 1890s on Coulter's and Nuttall's California collections [62]. *The Botany of H.M.S. Sulphur*, discussed below, and a 1964 study by Peter Raven on new California plants discovered by the naturalists of the *Sulphur* illuminate that subject [63]. The original *Flora of North America* compiled by Torrey and Gray and published in installments between 1838 and 1843, contains information on type-specimens and the collectors who found them, along with some location notes; due to the difficulties enumerated above, Coulter's collections are almost entirely unrecognized in that original document.

Thomas Nuttall's Visit in 1836

Thomas Nuttall (b.1786-d.1859) (Figure 8) came to San Diego around April 15, 1836 on the American brig *Pilgrim*, operated by the Boston firm Bryant & Sturgis, arriving after stops in Monterey, Santa Barbara, and San Pedro [64]. He was 50 years old. In March 1834 he had resigned his position as lecturer in natural history and curator of the Harvard Botanic Garden to join Nathaniel Wyeth's second expedition west over the Oregon Trail [65]. After crossing the Rocky Mountains he spent seventeen months, from September 1834 to March 1836, around the Columbia River and in Hawaii, and the last two months of his trip in California. San Diego was his final stop before sailing on the *Alert* back to Boston while his former student, R.H. Dana, worked on the *Alert*'s deck [66].

Nuttall grew up Anglican in northern England and worked as a printer's apprentice in Liverpool between ages 15 and 22. In 1808 he sailed for North America to pursue an interest in natural sciences, going first to Philadelphia, where he contacted Benjamin Barton (b.1776-d.1815) to obtain a copy of Barton's *Elements of Botany* [67]. Barton became Nuttall's mentor, instructing him and contracting him to make collecting trips in the eastern, southern and midwestern United States. In 1818 Nuttall gained acclaim with publication of *The Genera of North American Plants and a Catalogue of the Species to the Year 1817*, characterizing 834 genera of plants [68]. Nuttall collected in the Arkansas territory from 1818 to 1820 and lectured in botany at the Philadelphia Academy of Natural Sciences between 1820 and 1822, then moved to Harvard in 1823 where he stayed for most of the next eleven years. He corresponded with John Torrey (b.1796-d.1873) in the years when Torrey aspired to assemble the *Flora of North America*; later Torrey and Gray used Nuttall's descriptions for hundreds of plants in that compendium [69]. Nuttall also collected bird-specimens and published *A Manual of the Ornithology of the United States and Canada* in 1832 [70].

Nuttall's record of making arduous overland collecting trips distinguishes him from most leading taxonomists of his time. He was not an armchair naturalist. By 1834 he knew Wyeth from outings at Fresh Pond near Cambridge. Wyeth gave Nuttall his collected plants from the first expedition to Oregon, approximately fifty of which Nuttall published as new species, including some that grow in San Diego County such as *Wyethia ovata* (Mule-ears) and *Iris missouriensis* (Western Blue Flag) [71]. At the time Wyeth discussed the Oregon Trail with Nuttall, Hooker was publishing Douglas' discoveries, drawing attention to the far-west flora. Given the surging interest in western botany, Nuttall's decision to leave Harvard and accompany Wyeth is perhaps not surprising. John Kirk Townsend, a young ornithologist whom Nuttall enlisted to join the expedition, wrote at the outset of the journey as the party left Missouri: "On the 28th of April (1834), at 10 o'clock in the morning, our caravan, consisting of seventy men, and two hundred and fifty horses, began its march; Captain Wyeth and Milton Sublette took the lead, Mr. N. [Nuttall] and myself rode beside them; then the men in double file, each leading, with a line, two horses heavily laden, and Captain Thing (Captain W.'s assistant) brought up the rear. The band of [Methodist] missionaries, with their horned cattle, rode along the flanks..." [72].

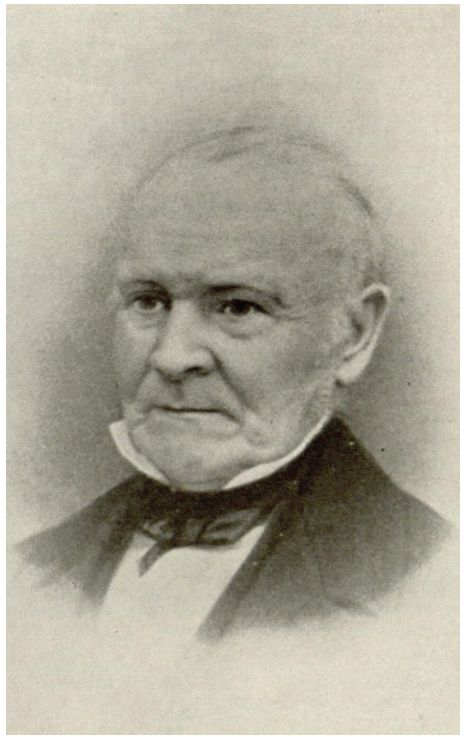

Figure 8: Thomas Nuttall, one of the leading botanists of the 19th c., collected and described hundreds of new plants from his trip west in 1834-36.

The group reached Fort Vancouver toward the end of September. In December 1834 Nuttall and Townsend took a ship to Hawaii; Douglas had died there weeks earlier. They sailed back to Oregon in April 1835; then in September Nuttall returned to Hawaii, where he stayed until February 1836. In that month he sailed to Monterey on the brig *Isabella*, where he arrived in March and transferred to the *Pilgrim* for the voyage to San Diego.

In San Diego Nuttall stayed on board the Bryant & Sturgis ships rather than take lodging in the town [73]. The company's agent, Alfred Robinson, was in San Diego at the time, and all three of its brigs - the *Pilgrim*, the *Alert* and the *California* – anchored at La Playa at the end of April 1836 as sailors packed the *Alert* with hides [74]. By April 25 Nuttall had moved his possessions, including his natural-history collections, from the *Pilgrim* to the *Alert*, where he was the only paid passenger and enjoyed a private cabin. When not organizing for the voyage home, Nuttall spent his three weeks collecting specimens, mainly on Point Loma, around the river, bays and estuaries, on the beaches, and in the vicinity of Old Town. Dana wrote of his surprise to see Nuttall "strolling about San Diego beach, in a sailor's pea-jacket, with a wide straw hat, and bare-footed, with his trousers rolled up to his knees, picking up stones and shells," and noted the report of the *Pilgrim*'s second mate that Nuttall "spent all his time in the bush, and along the beach, picking up flowers and shells and such truck, and had a dozen boxes and barrels full of them" [75].

Nuttall collected hundreds of plants on his stops along the California coast including dozens in San Diego; Table 3 includes a small selection. Beginning in summer 1836 he settled in Philadelphia to examine and describe the specimens, using rooms at the Academy of Natural Sciences, to which he sold his North American collections. The *Jepson Manual* sheds light on the scope and novelty of his California plants, listing Nuttall as authority for 326 taxa found in the state [76]. The large majority he alone collected; a smaller number were given to him for identification by persons such as Wyeth and William Gambel, a Nuttall protege who collected plants in California in the early 1840s and is known for birds he discovered like the California Thrasher [77].

Nuttall discovered and first described many of the best-known native plants that grow along the coast of San Diego, including prominent shrubs like *Rhus integrifolia* (Lemonadeberry), *Malosma laurina* (Laurel Sumac), *Encelia californica* (Bush Sunflower), *Xylococcus bicolor* (Mission Manzanita), *Quercus dumosa* (Coast Scrub Oak), *Ceanothus verrucosus* (Wart-stem Ceanothus), *Adenostoma fasciculatum* var. *obtusifolium* (Coastal Chamise), and *Cneoridium dumosum* (Bush-rue). These are among the main species populating Point Loma today.

As he collected in the middle of spring he also discovered a number of celebrated herbaceous plants including *Leptosyne maritima* (Sea Dahlia), *Rafinesquia californica* (California Chicory), *Phacelia grandiflora* (Grand Phacelia), *Dudleya pulverulenta* (Chalk Dudleya), *Antirrhinum nuttalianum* (Nuttall Snapdragon), and *Linanthus dianthiflorus* (Ground Pink) (Figure 9). He also found interesting new plants in the salt-marshes and on the margins of beaches, including *Camissoniopsis cheiranthifolia* (Beach Sun Cup), *Nemacaulis denudata* (Coast Cotton-heads), and *Chloropyron maritimum* (Salt-marsh Bird's Beak).

The original *Flora of North America* provides Nuttall's location notes along with botanical descriptions for many of the plants he found [78]. For *Rhus integrifolia* Nuttall wrote: "[It grows] on the margins of cliffs, etc. near the sea, around St. Diego and Sta. Barbara; common – An unsightly tree, about the thickness of a man's arm, branching widely and forming almost impervious thickets." He found *Encelia californica* "on dry hills near Sta. Barbara or St. Diego," while *Leptosyne maritima* grew "on shelving rocks near the sea, St. Diego." *Ceanothus verrucosus* populated "low hills near the coast, St. Diego, California;" he also remarked that taxonomically it was "very near *C. cuneatus*, and perhaps only another variety of that species; from which it differs, however, in its broader leaves and tuberculate stems, as well as in the minute tubercles of the fruit."

In San Diego Nuttall first discovered both *Ferocactus viridescens* (Coast Barrel Cactus) and *Cylindropuntia californica* (Cane Cholla). About the latter cactus he wrote: "[It grows on] arid hills and denuded tracts near St. Diego, California - common. ...Erect and shrubby, with numerous clusters of long and short spines; the branches somewhat cylindric, repandly grooved, reticulated; flowers small, yellow; fruit dry and spiny."

He called *Linanthus dianthiflorus* "a very elegant but minute plant, scarcely more than an inch or an inch and a half high." Similarly, he found *Pentachaeta aurea* (Golden Pentachaeta) at "St. Diego, California, in dry plains near the sea," and called it "a very elegant, though often minute plant, from 2-3 inches to a foot high." He located *Clematis pauciflora* (Small-leaf Clematis) "near the sea-coast of St. Diego," and took note that *Acmispon glaber* (Deer Weed), which occurred in San Diego and other places on his trip, is "used in California for making brooms."

Among the many San Diego native plants Nuttall collected around Santa Barbara, he reported finding *Pickeringia montana* (Chaparral Pea), *Dendromecon rigida* (Bush Poppy), *Cercocarpus betuloides* (Mountain Mahogany) and *Prunus ilicifolia* (Holly-leaf Cherry) upslope from the town.

Nuttall returned to the United Kingdom in 1842 and lived there until his death in September 1859, age 73. In 1844, after Nuttall had left the United States, Asa Gray (b.1810-d.1888) wrote of him:

> No botanist has visited so large a portion of the United States, or made such an amount of observations in the field and forest. Probably few naturalists have ever excelled him in aptitude for such observations, in quickness of eye, tact, in discrimination and tenacity of memory [79].

During the 1830s and early 1840s, as the *Flora of North America* was assembled and published, Gray is said to have disparaged the older Nuttall, disagreeing with some of his classifications and raising other matters to dispute [80]. In that context it is ironic Gray is the source for the above assessment which captures Nuttall's achievement.

Figure 9. Sea Dahlia and Ground Pink, two of the many popular wildflowers collected by Nuttall in San Diego. Coulter also found Ground Pink.

Figure 10. *Peritoma arborea* (Bladderpod) sheet, courtesy of Kew Herbarium, showing specimens of both Coulter and Nuttall. Nuttall authored the description. The *Sulphur* also collected *Peritoma* in San Diego.

Visit of HMS *Sulphur* and HMS *Starling* in October 1839

Her Majesty's Ship *Sulphur*, a sturdy, 105-foot, 12-gun modified sloop of the Royal Navy, and its smaller tender HMS *Starling*, a 61-foot, 4-gun schooner, together arrived in San Diego Bay on October 17, 1839 commanded by Edward Belcher (b.1799-d.1877), for a five-day stay in the middle of a lengthy, six-year survey around the Pacific Ocean and Southeast Asia (Figure 11) [81]. The combined crew of approximately one hundred included at least four persons interested in natural sciences – Belcher himself, 40 years old, a member of the Royal Geographical Society who earlier had collected specimens with HMS *Blossom* under Beechey; Richard Hinds (b.1812–d.1847), the young surgeon on the *Sulphur*; George Barclay (dates unknown), sent to collect plants and seeds for the Royal Botanic Gardens at Kew; and Andrew Sinclair (b.1796-d.1861), another surgeon interested in botany. The expedition had already made two trips to the Pacific Northwest and explored the San Francisco Bay area; San Diego was the last stop on its survey of Upper California.

Belcher published his *Narrative of a Voyage Round the World Performed in Her Majesty's Ship Sulphur* in 1843, and in 1844 Hinds oversaw publication of *The Botany of the Voyage of H.M.S. Sulphur* [82]. George Bentham authored the plant descriptions for the *Botany* and maintained Hinds' plant-collection until donating his herbarium to Kew in 1854 and collaborating closely with Hooker.

Belcher's *Narrative* discusses San Diego on pages 326-328. The ships arrived in port on October 17 and departed on October 22, 1839. Belcher praised the natural advantages of San Diego Bay but also observed, "The chief drawback [of the port] is the want of fresh water". He went on:

> Since the missions have been taken from the *padres*, and placed under the *administradores*, they have fallen entirely into decay and ruin; and it is not improbable that the whole country will ere long either fall back into the hands of the Indians, or find other rulers. During [our] visit they were very apprehensive of an [Indian] attack...[83]

Belcher visited the San Diego mission but did not say who among his party accompanied him up Mission Valley or what they collected; presumably Hinds, the most highly ranked of the naturalists on board, accompanied Belcher. The surveyors and collectors climbed Point Loma; it may have been there or on hills surrounding Mission Valley they suffered contact with chollas and other cacti, including the "Turk's head" variety, which Belcher cites as a nuisance to the survey-parties.

Hinds' *Botany* contains a single paragraph describing San Diego, which reads in part:

> San Diego, 32 deg. 29′ N. lat. The vegetation generally is highly aromatic... It continues to consist of a low shrubby character, amongst which multitudes of quail, rabbits, and hares love to nestle. Com-

positae [Asteraceae] greatly prevail, and are numerous even as species. Cactaceae are now common, and three species have been noticed; there are a few lactescent plants [i.e. Euphorbiaceae], and many of the shrubs have tough leathery leaves – intelligible indices of the prevailing climate. *Ricinus communis* is seen for the first time, and a few trees of *Phoenix dactylifera*... None of the stunted evergreen oak have been seen below Santa Barbara...[84]

More generally, in the introduction to the *Botany*, Hinds comments on the difficulty of surveying California's flora in autumn due to dormant vegetation. He also notes Upper California had already been "tolerably examined" before the expedition collected there [85]. Most of the original *Flora of North America* – including Nuttall's contribution - was available to Bentham before the *Botany* was published in 1844.

Leaving San Diego, Belcher's expedition explored the west coast of Baja California and made numerous discoveries on the peninsula. Hinds cites the Bay of Magdalena northwest of La Paz for having vegetation that is "truly varied, beautiful, and engaging" [86]. Many plants they collected there proved new to science.

The *Sulphur*'s Collection from the San Diego Region

The *Botany of the Sulphur* lists several new species authored by Bentham including, from specimens taken in San Diego, the shrubs *Eriodictyon crassifolium* (Yerba Santa), *Atriplex canescens* (Four-Wing Saltbush), and *Euphorbia misera* (Cliff Spurge), and the berbaceous plants "*Hemizonia ramosissima*" and *Stephanomeria virgata* (Twiggy Wreath-plant). Bentham's *H. ramosissima* was later included with *Deinandra fasciculata* (Tarweed), one of the most common plants locally in the Asteraceae. The *Botany* describes *Stephanomeria*, which can grow to six feet high and bears straight, wire-like branches, as "a very pretty species when recent, with numerous small pinkish flowers" [87].

Figure 11. HMS *Sulphur* & HMS *Starling*, which visited San Diego in 1839. *The 1837 Charting Expedition of Hanalei Bay*, painted by Raymond Massey.

Figure 12. *Bebbia juncea* (Rush Sweetbush) sheet, courtesy of Kew Herbarium, showing Coulter's specimen #297, possibly from the San Diego desert, and Hinds' from Baja California, which Bentham used as type.

Figure 13. *Physalis crassifolia* (Desert Ground-cherry) sheet, courtesy of Kew Herbarium, showing Hinds' 1839 collection from Baja California, and an 1860 collection from the Mojave Desert signed by Asa Gray.

Other specimens the collectors took in San Diego - likely on Point Loma - but which repeated plants described by Nuttall or others, include *Malosma laurina* (Laurel Sumac), *Peritoma arborea* (Bladderpod), *Eriogonum fasciculatum* (California Buckwheat), *Ceanothus verrucosus* (Wartstem Ceanothus), and *Adenostoma fasciculatum* (Chamise).

Bentham based many of the new species common in the San Diego region on the *Sulphur*'s collections from Baja California. They include *Justicia californica* (Chuparosa, Figure 4), *Ambrosia chenopodiifolia* (San Diego Bur-sage), *Bebbia juncea* (Rush Sweetbush), *Porophyllum gracile* (Odora), *Acalypha californica* (California Copperleaf), *Ditaxis lanceolata* (Desert Silverbush), *Krameria erecta* (Rhatany), *Lycium brevipes* (Desert-thorn), and *Physalis crassifolia* (Desert Ground-cherry) (Figures 12-13). Most of these plants grow in arid habitat on both sides of the San Diego mountains. That they were first found in Baja California is a reminder of the continuity of vegetation from San Diego south through the peninsula.

Table 3 includes the above plants and others collected on the *Sulphur*'s voyage. While in Northern California the party discovered *Phacelia distans* (Common Phacelia), a familiar wildflower in the San Diego region. In Lower California they found *Chamaesyce polycarpa* (Sand Mat or Rattlesnake Spurge), also common; at San Pedro they discovered *Croton setigerus* (Dove Weed), a late-summer spurge of dry lots and roadsides.

Hinds took the initiative to edit the *Botany*, but it is likely Barclay's specimens exceeded Hinds' in number, as the surgeon Hinds had broader responsibilities on the expedition. The two men apparently were not close collaborators [88]. It is unclear whether Barclay may have sailed on the *Starling* rather than the *Sulphur*, or whether the two collectors ever hiked together in the field. Belcher and Hinds excluded Barclay from the party that first explored the Sacramento River valley. The two naturalists sent their plant-collections to different places – Hinds to Bentham and Barclay to Aiton at Kew – but in the end, Bentham reviewed Barclay's plants as well as Hinds', ensuring the *Botany* was more or less complete.

The Coming of Americans

The *Sulphur* and *Starling* sailed out of San Diego Bay at the end of a tumultuous decade in California history, shaped by secularization of the territory's once-prosperous Catholic missions. The next decade would be shaped by Americans. By the end of 1848, the United States annexed California, New Mexico, Texas and the Oregon Territory. The United States and Mexican boundary survey, begun soon after the Mexican war ended, brought various engineers and surveyors to the San Diego region, including Charles Christopher Parry (b.1823-d.1890), an important young collector. Parry discovered *Pinus torreyana* (Torrey Pine) while hiking around La Jolla in 1850. By that year Americans and their livestock were streaming over the Southern Emigrant Trail.

Table 3. Selected San Diego County Native Plants Collected Between 1832 and 1839 by Thomas Coulter, Thomas Nuttall, and H.M.S. *Sulphur* (1/4)

Family	Taxon (current)	Common Name	Collector(s)	Authority, early	Location collected	Herbarium-image
Acanthaceae	*Justicia californica*	Chuparosa	*Sulphur*-Hinds	Bentham	Baja California coast	Kew
Adoxacea	*Sambucus nigra* ssp. *caerulea*	Blue Elderberry	Nuttall	Nuttall	Santa Barbara	Kew
Anacardiaceae	*Malosma laurina*	Laurel Sumac	Nuttall	Nuttall	San Diego	PhilAS
"	"	"	*Sulphur*	"	San Diego	
Anacardiaceae	*Rhus integrifolia*	Lemonadeberry	Nuttall	Nuttall	San Diego	Kew
"	"	"	*Sulphur*	"	Baja California coast	
Anacardiaceae	*Rhus ovata*	Sugar Bush	Coulter #550	S.Watson	So. California desert trans.	
Anacardiaceae	*Toxicodendron diversilobum*	Poison-oak	Coulter #126	Torrey/Gray	California	
Apiaceae	*Apiastrum angustifolium*	Mock Parsley	Nuttall	Nuttall	San Diego	
Apiaceae	*Sanicula bipinnata*	Purple Sanicle	Coulter #208	Hooker	California	Kew
Apiaceae	*Tauschia arguta*	Southern Tauschia	Coulter #216		California	Kew
"	"	"	Nuttall	Nuttall	San Diego	"
Asteraceae	*Acamptopappus sphaerocephalus*	Desert Goldenhead	Coulter #281	Harvey	So. California desert/trans.	
Asteraceae	*Amblyopappus pusillus*	Pineapple-weed	Nuttall	Nuttall	San Diego	
Asteraceae	*Ambrosia pumila*	San Diego Ambrosia	Nuttall	Nuttall	San Diego	
Asteraceae	*Ambrosia chenopodiifolia*	San Diego Bur-sage	*Sulphur*-Barclay	Bentham	Baja California coast	Kew
Asteraceae	*Baileya pauciradiata*	Small-ray Desert Marigold	Coulter	Harvey	So. California desert	NYBG
Asteraceae	*Baileya pleniradiata*	Desert Marigold	Coulter	Harvey	So. California desert	
Asteraceae	*Bebbia juncea*	Rush Sweetbush	Coulter		So. California desert/trans.	Kew
"	"	"	*Sulphur*-Hinds	Bentham	Baja California coast	"
Asteraceae	*Chaenactis artemisiifolia*	White Pincushion	Coulter	Harvey	Southern California	
Asteraceae	*Chaenactis glabriuscula* var. *g.*	Yellow Pincushion	Nuttall	Nuttall	San Diego	
Asteraceae	*Cirsium occidentale* v. *californicum*	Cobweb Thistle	Coulter #367	Gray	Southern California	Kew
Asteraceae	*Corethrogyne filaginifolia*	California Aster	Coulter #267+		Southern California	
"	"	"	Nuttall	Nuttall	San Diego	PhilAS
Asteraceae	*Deinandra fasciculata*	Tarweed	Coulter	de Candolle	Southern California	
"	"	"	Nuttall	"	San Pedro	PhilAS
"	"	"	*Sulphur*-Barclay	"	San Diego	Mo.BG
Asteraceae	*Encelia californica*	Bush Sunflower	Nuttall	Nuttall	San Diego, Santa Barbara	
Asteraceae	*Geraea canescens*	Desert Sunflower	Coulter #304	Gray	So. California desert	
Asteraceae	*Heterotheca grandiflora*	Telegraph Weed	Nuttall	Nuttall	Santa Barbara	
"	"	"	*Sulphur*	"	San Diego	
Asteraceae	*Laennecia coulteri*	Coulter Fleabane	Coulter #285,286	Gray	California	
Asteraceae	*Lasthenia coronaria*	Royal Goldfields	Nuttall	Nuttall	San Diego	PhilAS
Asteraceae	*Lasthenia glabrata* ssp. *coulteri*	Marsh Goldfields	Coulter #338	Gray	California coast	
Asteraceae	*Leptosyne californica*	Tickseed	Nuttall	Nuttall	San Diego	
Asteraceae	*Leptosyne maritima*	Sea Dahlia	Nuttall	Nuttall	San Diego	
Asteraceae	*Malacothrix californica*	Desert Dandelion	Coulter #342	de Candolle	So. California desert/trans.	Kew
Asteraceae	*Osmadenia tenella*	Three-spot	Coulter		Southern California	
"	"	"	Nuttall	Nuttall	San Diego	
Asteraceae	*Pectis papposa*	Chinch Weed	Coulter #331	Harvey	So. California desert	
Asteraceae	*Pentachaeta aurea*	Golden Pentachaeta	Nuttall	Nuttall	San Diego	PhilAS
Asteraceae	*Porophyllum gracile*	Odora	*Sulphur*-Hinds	Bentham	Baja California coast	Kew
Asteraceae	*Rafinesquia californica*	California Chicory	Nuttall	Nuttall	San Diego	PhilAS
Asteraceae	*Stephanomeria virgata*	Twiggy Wreath-plant	*Sulphur*-Hinds	Bentham	San Pedro or San Diego	Kew
Asteraceae	*Uropappus lindleyi*	Silver Puffs	Coulter		California	
"	"	"	Nuttall	Nuttall	San Diego	

Table 3. Selected San Diego County Native Plants Collected Between 1832 and 1839 by Thomas Coulter, Thomas Nuttall, and H.M.S. *Sulphur* (2/4)

Family	Taxon (current)	Common Name	Collector(s)	Authority, early	Location collected	Herbarium-image
Boraginaceae	*Eriodictyon crassifolium*	Yerba Santa	*Sulphur*	Bentham	San Diego	
Boraginaceae	*Heliotropium curassavicum*	Salt Heliotrope	Nuttall	Linnaeus	San Diego	PhilAS
"	"	"	*Sulphur*	"	California coast	
Boraginaceae	*Phacelia distans*	Common Phacelia	*Sulphur*	Bentham	Northern California coast	
Boraginaceae	*Phacelia grandiflora*	Grand Phacelia	Nuttall	Bentham	San Diego	
Boraginaceae	*Phacelia minor*	Desert Canterbury Bells	Coulter	Harvey	So. California desert	
Boraginaceae	*Pholisma arenarium*	Sand Plant	Nuttall	Hooker	San Diego	Kew
Brassicaceae	*Caulanthus heterophyllus* var. *h.*	Slender-pod Jewel-flower	Nuttall	Nuttall	San Diego	Kew
Brassicaceae	*Dithyrea californica*	Spectacle-pod	Coulter #37	Harvey	So. California desert	Kew
Brassicaceae	*Lyrocarpa coulteri*	Lyre-pod	Coulter	Harvey	San Diego desert	
Brassicaceae	*Thysanocarpus laciniatus*	Fringe-pod	Coulter #32		California	
"	"	"	Nuttall	Nuttall	Santa Barbara	
Cactaceae	*Cylindropuntia californica* v. *parkeri*	Cane cholla	Nuttall	Torrey/Gray	San Diego	
Cactaceae	*Ferocactus viridescens*	Coast Barrell Cactus	Nuttall	Torrey/Gray	San Diego	
Campanulaceae	*Nemacladus ramosissimus*	Thread-plant	Nuttall	Nuttall	San Diego	
Caprifoliaceae	*Symphoricarpos mollis*	Snowberry	Coulter #202		California	Kew
"	"	"	Nuttall	Nuttall	Santa Barbara	"
Caryophyllaceae	*Cardionema ramosissima*	Tread Lightly	Nuttall	Weinmann	San Diego	
Caryophyllaceae	*Loeflingia squarrosa*	Pygmy-leaf	Nuttall	Nuttall	San Diego	
Caryophyllaceae	*Polycarpon depressum*	All-seed	Nuttall	Nuttall	San Diego	
Chenopodiaceae	*Atriplex coulteri*	Coulter Saltbush	Coulter	de Candolle	California coast	
Chenopodiaceae	*Atriplex canescens*	Four-wing Saltbush	*Sulphur*	Bentham	San Diego	
Chenopodiaceae	*Atriplex pacifica*	South Coast Saltbush	*Sulphur*	Nelson	San Diego	
Cistaceae	*Helianthemum scoparium*	Peak Rush-rose	Coulter		California	
"	"	"	Nuttall	Nuttall	Monterey	
Cleomaceae	*Peritoma arborea*	Bladderpod	Coulter #65		San Diego coast or desert	Kew
"	"	"	Nuttall	Nuttall	San Diego	"
"	"	"	*Sulphur*	"	San Diego	
Convolvulaceae	*Cuscuta californica*	Dodder	Nuttall	Hooker/Arnott	Santa Barbara	Kew
Crassulaceae	*Dudleya edulis*	Lady-fingers	Nuttall	Nuttall	San Diego	
Crassulaceae	*Dudleya lanceolata*	Lance-leaf Dudleya	Nuttall	Nuttall	San Diego	
Crassulaceae	*Dudleya pulverulenta*	Chalk Dudleya	Nuttall	Nuttall	San Diego	Kew
Ephedraceae	*Ephedra californica*	California Ephedra	Nuttall	S.Watson	San Diego	
Ericaceae	*Arctostaphylos pungens*	Mexican Manzanita	Coulter #240,243	Kunth	California	Kew
"	*A.p. and/or A. pumila*	" and/or Dune Manzanita	Nuttall	Nutt. - *A.pumila*	California	"
Ericaceae	*Xylococcus bicolor*	Mission Manzanita	Nuttall	Nuttall	California coast	
Euphorbiaceae	*Acalypha californica*	California Copperleaf	*Sulphur*-Barclay	Bentham	Baja California coast	Kew
Euphorbiaceae	*Chamaesyce polycarpa*	Sand Mat	*Sulphur*	Bentham	Baja California coast	
Euphorbiaceae	*Croton setigerus*	Dove Weed	*Sulphur*	Bentham	San Pedro	
Euphorbiaceae	*Ditaxis lanceolata*	Desert Silverbush	*Sulphur*-Barclay	Bentham	Baja California coast	Kew
Euphorbiaceae	*Euphorbia misera*	Cliff Spurge	*Sulphur*-Hinds	Bentham	San Diego	Kew
Fabaceae	*Astragalus lentiginosus*	Borrego Milvetch	Coulter	M.E.Jones	So. California desert	
Fabaceae	*Astragalus trichopodus*	Coast Loco-weed	Nuttall	Nuttall	Santa Barbara	
Fabaceae	*Dalea mollis*	Silk Dalea	Coulter #430	Bentham	So. California desert	
Fabaceae	*Acmispon glaber*	Deer Weed	Nuttall	Nuttall	San Diego	PhilAS
Fabaceae	*Acmispon prostratus*	Nuttall or Prostrate Lotus	Nuttall	E.Greene	San Diego	
Fabaceae	*Lathyrus vestitus*	Wild Pea	Nuttall	Nuttall	San Diego	

Table 3. Selected San Diego County Native Plants Collected Between 1832 and 1839 by Thomas Coulter, Thomas Nuttall, and H.M.S. *Sulphur* (3/4)

Family	Taxon (current)	Common Name	Collector(s)	Authority, early	Location collected	Herbarium-image
Fabaceae	*Lupinus bicolor*	Miniature Lupine	Coulter #398	Lindley	California	Kew
Fabaceae	*Lupinus concinnus*	Bajada Lupine	Coulter #372	Agardh	California	Kew
Fabaceae	*Lupinus excubitus*	Bush Lupine	Coulter #394,396	M.E.Jones	California	
Fabaceae	*Lupinus hirsutissimus*	Stinging Lupine	Coulter #373	Bentham	Southern California	Kew
Fabaceae	*Lupinus sparsiflorus*	Coulter Lupine	Coulter	Bentham	So. California desert	
Fabaceae	*Lupinus truncatus*	Collar Lupine	Coulter #369,378	Hooker/Arnott	Southern California	Kew
"	"	"	Nuttall	"	San Diego	
Fabaceae	*Parkinsonia florida*	Blue Palo Verde	Coulter	Bentham	Sonora desert	Kew
Fabaceae	*Pickeringia montana*	Chaparral Pea	Nuttall	Nuttall	Santa Barbara	
Fabaceae	*Prosopis pubescens*	Screw-bean Mesquite	Coulter	Bentham	San Diego desert	
Fabaceae	*Trifolium albopurpureum*	Indian or Rancheria Clover	Coulter #417	Torrey/Gray	California	
Fagaceae	*Quercus dumosa*	Nuttall Scrub Oak	Coulter #661		Southern California	Kew
"	"	"	Nuttall	Nuttall	Southern California	"
Gentianaceae	*Zeltnera venusta*	Canchalagua	Coulter #561	Gray	California	Kew
Gentianaceae	*Frasera parryi*	Deer's Ears	Coulter #538	Torrey	Southern California	Kew
Krameriaceae	*Krameria erecta*	Rhatany	*Sulphur*	Bentham	Baja California coast	Kew
Lauraceae	*Umbellularia californica*	California Bay	Coulter #709	Hooker/Arnott	California	Kew
"	"	"	Nuttall	"	Santa Barbara	"
Liliaceae	*Fritillaria biflora*	Chocolate Lily	Coulter #737,738	Lindley	California	
Malvaceae	*Malacothamnus fasciculatus*	Bushmallow	Coulter #671	Torrey/Gray	California	Kew
"	"	"	Nuttall	"	Santa Barbara	"
Montiaceae	*Calandrinia ciliata*	Red Maids	Nuttall	Hooker	Santa Barbara	Kew
Montiaceae	*Calandrinia maritima*	Coast Red Maids	Nuttall	Nuttall	San Diego	
Nyctaginaceae	*Abronia maritima*	Red Sand Verbena	Nuttall	S.Watson	San Diego	
Nyctaginaceae	*Abronia umbellata*	Beach Sand Verbena	Coulter #578	Lambert	California	
"	"	"	*Sulphur*	"	Northern California	
Nyctaginaceae	*Mirabilis laevis*	Wishbone Bush	Coulter #600	Bentham	California	Kew
"	"	"	Nuttall	"	Santa Barbara	"
Onagraceae	*Camissoniopsis bistorta*	California Sun Cup	Coulter #158		Southern California	Kew
"	"	"	Nuttall	Nuttall	San Diego	"
Onagraceae	*Camissoniopsis cheiranthifolia*	Beach Sun Cup	Coulter #168		California	Kew
"	"	"	Nuttall	Nuttall	San Diego	PhilAS
Onagraceae	*Clarkia epilobioides*	Canyon Clarkia	Coulter #157		California	Kew
"	"	"	Nuttall	Nuttall	San Diego	
Onagraceae	*Epilobium canum*	California Fuchsia	Coulter #181	E.Greene	California	
"	"	"	*Sulphur*	"	San Pedro	
Onagraceae	*Eulobus californicus*	California Primrose	Nuttall	Torrey/Gray	San Diego	Kew
Orobanchaceae	*Chloropyron maritimum*	Salt-marsh Bird's Beak	Nuttall	Bentham	San Diego	PhilAS
Papaveraceae	*Eschscholzia californica*	California Poppy	Coulter #25	von Chamisso	California	Kew
"	"	"	*Sulphur*-Barclay	"	California coast	"
Papaveraceae	*Dendromecon rigida*	Bush Poppy	Coulter	Bentham	Southern California	
"	"	"	Nuttall	"	Santa Barbara	
Papaveraceae	*Platystemon californicus*	Cream Cups	Coulter	Bentham	California	
Papaveraceae	*Romneya coulteri* (= *R. trichocalyx*)	Matilija Poppy	Coulter #20	Harvey	Southern California	Kew
Phrymaceae	*Mimulus aurantiacus*	Bush Monkeyflower	Coulter #641	Curtis	California	
"	*M.a.* var. *puniceus*	"	Nuttall	Nuttall	San Diego	
Pinaceae	*Pinus coulteri*	Coulter Pine	Coulter	D.Don	Central California	

Table 3. Selected San Diego County Native Plants Collected Between 1832 and 1839 by Thomas Coulter, Thomas Nuttall, and H.M.S. *Sulphur* (4/4)

Family	Taxon (current)	Common Name	Collector(s)	Authority, early	Location collected	Herbarium-image
Plantaginaceae	*Antirrhinum coulterianum*	White Snapdragon	Coulter #607	Bentham	Southern California	
Plantaginaceae	*Antirrhinum nuttallianum*	Nuttall Snapdragon	Coulter #599		Southern California	
"	"	"	Nuttall	Nuttall	San Diego	
Poaceae	*Festuca microstachys*	Small Fescue	Coulter #762		California	
"	"	"	Nuttall	Nuttall	California	
Poaceae	*Hilaria rigida*	Galleta Grass	Coulter #752	Bentham	So. California desert	
Poaceae	*Melica imperfecta*	Coast Melic	Coulter #780	Trinius	California	
Polemoniaceae	*Linanthus dianthiflorus*	Ground Pink	Coulter #464	Bentham	Southern California	Kew
"	"	"	Nuttall	"	San Diego	
Polemoniaceae	*Loeseliastrum schottii*	Desert Calico	Coulter #449	Torrey	So. California desert	
Polemoniaceae	*Navarretia atractyloides*	Holly-leaf Navarretia	Coulter #450	Bentham	California	Kew
"	"	"	Nuttall	"	San Diego	"
Polygonaceae	*Chorizanthe fimbriata*	Fringed Spineflower	Nuttall	Nuttall	San Diego	PhilAS
Polygonaceae	*Chorizanthe procumbens*	Prostrate Spineflower	Nuttall	Nuttall	San Diego	
Polygonaceae	*Chorizanthe staticoides*	Turkish Rugging	Nuttall	Bentham	San Diego	PhilAS
Polygonaceae	*Eriogonum fasciculatum*	California Buckwheat	Nuttall	Bentham	Santa Barbara	PhilAS
"	"	"	*Sulphur*	"	San Pedro or San Diego	
Polygonaceae	*Nemacaulis denudata*	Coast Cotton-heads	Nuttall	Nuttall	San Diego	PhilAS
Polygonaceae	*Pterostegia drymarioides*	Granny's Hairnet	Coulter #89	Fischer/Meyer	California	Kew
"	"	"	Nuttall	"	Santa Barbara	"
Pteridaceae	*Pentagramma triangularis* ssp. *viscosa*	Silverback Fern	Nuttall	Nuttall	San Diego	
Ranunculaceae	*Clematis pauciflora*	Small-leaf Clematis	Nuttall	Nuttall	San Diego	Kew
Rhamnaceae	*Ceanothus cuneatus*	Buck Brush	Coulter #110		California	Kew
"	"	"	Nuttall	Nuttall	Oregon	PhilAS
Rhamnaceae	*Ceanothus leucodermis*	Chaparral Whitethorn	Coulter #123	E.Greene	California	Kew
"	"	"	Nuttall	"	Santa Barbara	"
Rhamnaceae	*Ceanothus oliganthus*	Hairy-leaf Ceanothus	Coulter #122		California	
"	"	"	Nuttall	Nuttall	Santa Barbara	
Rhamnaceae	*Ceanothus verrucosus*	Wart-stem Ceanothus	Nuttall	Nuttall	San Diego	PhilAS
"	"	"	*Sulphur*	"	San Diego	
Rhamnaceae	*Rhamnus crocea*	Spiny Redberry	Coulter #116		California	Kew
"	"	"	Nuttall	Nuttall	Monterey	"
Rosaceae	*Adenostoma fasciculatum*	Chamise	*Sulphur*	Hooker/Arnott	San Diego	
"	*A.f.* and *A.f.* var. *obtusifolium*	Chamise, Coastal Chamise	Nuttall	S.Watson - *A.f.o.*	San Diego	PhilAS
Rosaceae	*Cercocarpus betuloides*	Mountain Mahogany	Nuttall	Nuttall	Santa Barbara	
Rosaceae	*Heteromeles arbutifolia*	Toyon	Nuttall	Lindley	Santa Barbara	Kew
Rosaceae	*Horkelia cuneata*	Coast Horkelia	Coulter #133	Lindley	California	Kew
"	"	"	Nuttall	"	California	PhilAS
Rubiaceae	*Galium angustifolium*	Narrow-leaf Bedstraw	Coulter #197		California	
"	"	"	Nuttall	Nuttall	Santa Barbara	
Rubiaceae	*Galium nuttallii*	San Diego Bedstraw	Nuttall	Nuttall	San Diego	
Rutaceae	*Cneoridium dumosum*	Bush-rue	Nuttall	Nuttall	San Diego	Kew
Salicaceae	*Salix lasiolepis*	Arroyo Willow	Coulter #657	Bentham	California	
Saururaceae	*Anemopsis californica*	Yerba Mansa	Nuttall	Nuttall	San Diego	Kew
Saxifragaceae	*Lithophragma heterophyllum*	Woodland Star	Coulter #186	Hooker/Arnott	California	Kew
Solanaceae	*Lycium brevipes*	Desert-thorn	*Sulphur*	Bentham	Baja California coast	Kew
Solanaceae	*Physalis crassifolia*	Desert Ground-cherry	*Sulphur*	Bentham	Baja California coast	Kew

Notes to Main Text

[1] Crespi, Juan: *Original Journals of the First Expedition into California, 1769-1770*; Brown, Alan K. ed. and translator; SDSU Press, San Diego, 2001. The daily account as the first Spanish land-expedition made its way, walking over hills and through valleys by the coast, indicates frequent Indian settlements and characterizes vegetation.

Keeley, Jon E.: *Native American Impacts on Fire Regimes of the California Coastal Ranges*, in Journal of Biogeography Vol.29 No.3, 2002: "It appears that most-all valleys and adjacent drainages with at least seasonal water flow were inhabited partly or all the year round. Settlements of 10-250 individuals comprised politically autonomous lineages with families in widely scattered houses on cleared sites. Each family had fields in its home valley, usually in the form of wedges extending from the valley bottom up to the crest on each side of the drainage." Also: "The archaeological record in San Diego County has over 11,000 Indian sites documented, and the widespread dispersion of human activity is illustrated by the fact that these sites occurred within all thirty-two USGS 7.5 min quadrangles studied by Christenson (1990) and on all fifty-nine soil types present within the Kumeyaay (Diegueño) territory."

Engelhardt, Zephyrin: *San Diego Mission*, James H. Barry Co., San Francisco, 1920, Appendix H, pages 349-50, provides a list of rancherías associated with the San Diego de Alcalá mission, naming 67 Indian settlements, some of which were later assigned to the San Luis Rey mission.

Engelhardt, Zephyrin: *San Luis Rey Mission*, James H. Barry Co., San Francisco, 1921, Appendix D, page 255, names 110 Indian settlements associated with the San Luis Rey de Francia mission.

[2] Cook, Sherburne F.: *The Population of California Indians 1769-1970*, UC Press, 1976, following Kroeber, Alfred L.: *Handbook of the Indians of California*, 1925, is the traditional authority on Native American historical demography in Southern California. Pgs. 38-42: The author estimates a pre-contact population in the area of the five most southerly missions (San Fernando, San Gabriel, San Juan Capistrano, San Luis Rey, and San Diego) in the range of 20,000, basing his calculation on the lists of Indian rancherías cited by each mission and assuming a minimum number of inhabitants per settlement. The author also estimates a gradual decline of the Indian population through the early 1840s, followed by a dramatic and tragic reduction after California joined the United States.

Carrico, Richard: *Strangers in a Stolen Land*, Sunbelt Publications, San Diego, 2008, pg. 12, puts the pre-contact Indian population for San Diego County alone at 20,000 but does not elaborate the methodology.

Applying 40% of Cook's 20,000 figure for the five Southern California missions to the two San Diego region missions and adding another 2,000 from settlements possibly unknown to the missionaries yields the estimate here of 10,000 for the region in 1769.

Engelhardt, *San Diego Mission*, pg.229: "Comandante Santiago Arguello, on December 31, 1830, reported that in the district subject to his jurisdiction, there were to be found 7,851 inhabitants, of whom 7,294 were Indians." In addition to the San Diego region, Arguello's estimate included domains of the San Juan Capistrano and San Gabriel missions as parts of the presidio district; however, it would have omitted the thousands of pagan Indians not registered by civil or religious authorities, and it probably omitted many young people. Therefore Arguello's numbers would not be inconsistent with the estimate here of 8,000 Indians (neophytes and gentiles) in the San Diego region in 1830.

[3] Engelhardt, *San Diego Mission*, pg. 300, and *San Luis Rey Mission*, pg. 220, give numbers of neophytes.

[4] Luiseño people inhabited a relatively small geographic area in northern San Diego County and western Riverside County, were more amenable to religious conversion than persons of some neighboring tribes, and were relatively industrious in agricultural activities and related light industries, all to the benefit of the prosperous San Luis Rey mission. As a tribe they may have gained security by joining the Spanish mission, thereby neutralizing traditional threats from Cahuilla and Kumeyaay peoples. The territories of Diegueño or Kumeyaay people were much larger, extending from the coast across the Laguna Mountains and Colorado Desert and including the northern part of Baja California. The website for the Campo Band of Kumeyaay Indians (*campo-nsn.gov*) quotes Pedro Fages from 1779: "Indeed this tribe [the Kumeyaay], which among those discovered is the most numerous, is also the most restless, stubborn, haughty, warlike, and hostile toward us, absolutely opposed to all rational subjection and full of the spirit of independence." The large territory caused natural separations among groups of Diegueño, as between northern and southern, desert and cismontane groups, and there were dozens of independent bands in the region, with conflicts occurring even among related groups.

[5] Engelhardt, *San Diego Mission*, pgs. 167-170: Construction at Santa Ysabel began in 1818; "in 1822, it was reported that the *asistencia* of Santa Isabel comprised a chapel, a granary, several houses, a cemetery, and an Indian population of 450 neophytes."

Engelhardt: *San Luis Rey Mission*, pgs. 35-36: In 1818 the chapel of San Antonio at Pala was lengthened and two large granaries were built. Also, quoting a report for that year by Fr. Jayme Escude: "A large number of gentiles applied for Baptism... In the past year more than 300 adults had been baptized, besides a large number of children. San Antonio de Pala is surely in as good order and perfection as this Mission itself could be."

[6] Ref. note 2 above, the 1830 Arguello report put the number of non-Indians in the entire district at 557, including San Gabriel and San Juan Capistrano.

Bancroft, Hubert Howe: *History of California*, Volume 2 (1801-1824),

San Francisco, 1886, pg.544: "The total population [of *gente*] *de razon* in the district, which I have given as 450 in 1820, I put down at 520 in 1830." Of that number perhaps 20 to 40 resided at the San Juan Capistrano and San Gabriel missions and on their lands. Bancroft's note 6 refers to a report of 273 men, 246 women, and 250 children in the town of San Diego in 1827; however those figures included Indians living and working among the *gente de razon* – probably between 150 and 200 of the total.

Killea, Lucy: "A Political History of a Mexican Pueblo: San Diego from 1825 to 1845", in the *Journal of San Diego History* Vol.12 No.3, July 1966, and Vol.12 No.4, October 1966, repeats Bancroft.

[7] Bancroft, *History of California*, Vol. 2, pgs. 546-47, including footnote 10, describes some non-Indian settlements around San Diego.

Pico, Pío: *Don Pío Pico's Historical Narrative*, ed. by Cole, Martin and Welcome, Henry, translated by Botello, Arthur; Arthur Clark Company, Glendale, 1973; contains allusions to various locations where Pico met other *californios*, slept, gambled, sold liquor, contracted to slaughter cattle, did other business, etc. between 1815 and 1840.

[8] Brothers of the Franciscan order vow to live in chastity, to choose a life of poverty, and to offer the sacrifice of obedience.

[9] Engelhardt, *San Diego Mission*, pg. 204.

[10] *ibid*, pgs. 221-223: "Going down the cañada toward the port of San Diego, the territory of this Mission reaches the cañada of Osuña. On the land intervening, wheat and barley are planted; there is no irrigation. The distance is one and a half league. Adjoining it are the lands of the settlers of said port, and the pastures for the horses and mules of the government. Going toward the cattle ranch of the government (Rancho Nacional), the territory of the Mission extends as far as the ranchería of San Jorge; its extent is two leagues and a half. On the land intervening, the sheep are pastured during the winter season. On the borders are the gentiles of said ranchería of San Jorge. On the way to Santa Monica or El Cajón are the territories called San Jácome de la Marcha and San Juan Capistrano de Mátamo. In these districts pasture the horses and mules and the sheep of this Mission. They extend almost two leagues and a half. Adjoining them are the pagans of said rancherías. In the territory of El Cajón or Santa Monica, wheat, barley, corn, and beans are raised, the greater part depending on rains, and the rest on irrigation with the water obtained from the dam. This water comes from a grove called El Chocolate, which lies below the sierra of Cuyamat. This whole tract lies five leagues from the Mission. Contiguous to it are the rancherías of said gentiles. From Santa Monica or El Cajón to the asistencía of Santa Isabel is a distance of nine leagues. In this territory wheat, barley, corn, and beans are planted, the greater part depending on the rains and the rest on irrigation. From the Valle de San Jose to the laguna called El Agua Caliente is a stretch of two leagues, on which the cattle of the Mission are pastured and also the sheep. From the laguna farther on and the environs, approach the territories belonging to Mission San Luis Rey. From said territories to the Rancho de San Bernardo is seven leagues. On this stretch is a territory called Pamo, where there is a grove with a good deal of water, but not enough for raising grain. It is sufficient only for pasturing the sheep, horses and mules. From the Rancho de San Bernardo moving toward the territory of Mission San Luis Rey is a distance of two leagues. Here the cattle of this Mission of San Diego find pasture. Proceeding toward San Dieguito, the territory of this Mission reaches as far as La Joya, a distance of three leagues. On this stretch of land pasture the cattle of this Mission. From the Rancho de San Bernardo, coming toward this Mission, lies the ranchería with the permanent running water, which is called Paguay, reaching to where we pasture the cattle of this Mission. From the ranchería of Paguay to the Mission of San Diego is a large and mountainous jungle, of no use for anything."

[11] Engelhardt, *San Luis Rey Mission*, pg. 41.

[12] *ibid*, pgs. 51-53: "To the east at a distance of three leagues the Mission has a locality named San Juan for the cattle, and in the same direction, at a distance of sixteen leagues, there is another district reserved for the sheep, which is famed for its warm springs. There pasture also the flocks of Mission San Diego. At a distance of seven leagues, toward the northeast, at the entry of the sierra madre, the Mission has a station called San Antonio de Pala, with a church, dwellings, and granaries and with a few fields where wheat, corn, beans, garbanzos, and other leguminous plants are grown. There are also a vineyard and an orchard of various fruits and of olives, for which there is sufficient irrigation, the water being from the stream which runs to the vicinity of this Mission. To the north, at a distance of one league and a half, the Mission has a place with a house and garden, and near the beginnings of the sierra a vineyard. This site, lying in a cañada, is called Santa Margarita. The land is cultivated and wheat, corn, beans and barley are raised. The fields are irrigated by means of the water from the sierra, which, though not plentiful, assures some crops. In the same direction, to the north, at a distance of three leagues, the Mission has the Rancho of San Pedro, known as Las Flores. The place has a house, granaries, and a chapel, which buildings form a square or large patio. Holy Mass is offered up in the chapel. In the patio, by means of water taken out of a pool near the sea, corn is raised. In the plain, wheat and barley are raised in season. About one league from the rancho are the pastures for the cattle. The locality is called Las Pulgas. In the direction of the northeast, in the sierra, at a distance of twelve leagues, the Mission has the rancho of San Jacinto with a house of adobes for the *mayordomos*. Here pasture the cattle. Between the said ranchos, sites, and stations, there are no mountains whatever, but the valleys and mesas are covered with thickets and underbrush, which are good only for firewood. In the clearings and foothills, the cattle and sheep have their pastures. Two leagues east of the station of San Antonio de Pala and nine

leagues from the Mission, in the sierra, there is a forest of pines and firs and larches where the timber was cut for the buildings of the Mission and other stations... The reason for having livestock so scattered is the lack of water and pastures... Necessity compels searching for both in the cañadas which the *sierra madre* offers."

[13] Robinson, Alfred: *Life in California: During a Residence of Several Years in that Territory*, H.G. Collins, London, 1851, pg. 27: "On the lawn beneath the hill on which the Presidio is built stood about 30 houses of rude appearance, mostly occupied by retired veterans..."

Duhaut-Cilly, A.: *Voyage Autour du Monde, Principalement à la Californie et aux Îles Sandwich*. Translated by Carter, Charles Franklin, in California Historical Society Quarterly Vol.8 #2-4, 1929, pg. 219: "[In April 1827] Below the presidio, on a sandy plain, are scattered thirty to forty houses of poor appearance, and some badly cultivated gardens. A stream, dry in summer, flows at the foot of the hill, and rushes to the sea, to the west of Point Loma [into False Bay]."

[14] The first map of pueblo lands of San Diego, drawn by Henry Fitch in 1845, shows an area along the coast three or four miles wide extending from near the Sweetwater River in the south to the north side of the Soledad Valley (Peñasquitos Marsh) in Del Mar.

Bancroft, Hubert Howe: *History of California*, Volume 3 (1825-1840), San Francisco, 1886, pg.609-610: "In 1837 the [San Diego presidio] troops were sent north in the sectional disputes, and never returned as a body. From that date the presidio was abandoned... Of the presidio buildings nothing is known except that they were abandoned in 1835 or a little earlier, and in ruins long before 1840."

Bancroft, *ibid*, pg. 611: "Bandini, without giving figures, states that the depopulation was very rapid after 1836. As an estimate, I put the population in 1840 at 150, the smallest figure for more than half a century." The number 150 in 1840 is compared to 520 in 1830 – see note 6 above.

Bancroft, *ibid*, pg. 612: "[In the late-1830s] The inhabitants of the town still pastured their cattle and raised crops, as they had done before, on lands regarded as common. The cultivated fields were chiefly in Soledad Valley, where the cultivators built *enramados* for temporary residence."

Bancroft, *ibid*, pg. 616: The *ayuntamiento* was with effect for three years only, 1835-37, after which a *juez de paz* appointed by the governor assumed responsibility for local affairs, and San Diego came under the administration of Los Angeles.

[15] Keeley, *Native American Impacts on Fire Regimes of the California Coastal Ranges*: "It is hypothesized that a substantial fraction of the landscape was type converted from shrubland to grassland and much of the landscape that underwent such type conversion has either been maintained by Euro-American land management practices or resisted recolonization of native shrublands."

Keeley, *ibid*: "The clearest documentation of this [regular burning of brushlands by Indians] is the 1792 report by Spanish explorer Jose Longinos Martínez who wrote 'In all of New California from Fronteras northward the gentiles have the custom of burning the brush...'"

Lightfoot, Kent, and Parrish, Otis: *California Indians and Their Environment*, UC Press, 2009, refers to use of fire by Indians as "California Indian pyrodiversity practices," and suggests the indigenous people "employed a regional rotation system of prescribed burns" (pg. 125).

Pyne, Stephen: *Fire in America, A Cultural History of Wildland and Rural Fire*, University of Washington Press, 1997: "So extensive were the cumulative effects of these modifications [burns] that it can be said that the general consequence of the Indian occupation of the New World was to replace forested land with grassland or savannah, or, where the forest persisted, to open it up and free it from underbrush."

Clar, C. Raymond: *California Government and Forestry from Spanish Days until the Creation of the Department of Natural Resources in 1927*, Sacramento, 1959, pg. 8: Quoting a letter of 1793 from Governor Arrillaga to Fr. Lasuen regarding the prohibition of intentional burning in inhabited and productive areas: "Because of various complaints that have reached me about the serious damage that results from the fires that are set each year in the pastures by Christian and Gentile Indians, and having been informed not only by various officials but also by different mission fathers that the aforesaid damage is true, I have taken measures to publish the enclosed proclamation..."

Williams, Gerald W.: *Introduction to Aboriginal Fire Use in North America*, in Fire Management Today, USDA Forest Service, Vol.60 No.3, Summer 2000: "Wherever Europeans went, they generally stopped the Indians from burning, usually by eliminating them from the land. Ironically, more forest exists today in some parts of North America than when the Europeans first arrived."

[16] Carrico, *Strangers in a Stolen Land*, pgs. 12-13: While Indians of the San Diego region did not practice farming, the author believes they "were not simple or typical hunter-and-gatherers... By moving from one environmental zone to another on regular seasonal rounds, they maximized their ability to collect large and varied quantities of food stuffs." Also: "There is strong evidence that the Kumeyaay planted or transplanted vegetation that was of particular importance or value to them," such as cacti, which may have been spread for defensive walls around settlements or for other reasons.

[17] Keeley, *Native American Impacts on Fire Regimes of the California Coastal Ranges*, lists explanations for Indian burning.

Lewis, Henry T.: *Patterns of Indian Burning in California: Ecology and Ethnohistory*, Ballena Press Anthropological Papers No.1, 1973, pg.26: "Fire, by removing [leaf] litter, changing the chemical components within soil, and stimulating germination, initiates secondary succession [of herbs]..." Herbaceous plants reappear after successive fires as long as new

seed is produced in the interval between burns.

[18] Keeley, Jon E.: *Fire as a Threat to Biodiversity in Fire-Type Shrublands*, USDA Forest Service Gen. Tech. Rep. PSW-GTR-195, 2005: "Unnaturally high wildfire frequency has long been a leading cause of degradation of chaparral and coastal sage scrub ecosystems, second only to land development. While these shrublands are fire-adapted, below a certain threshold of fire frequency resilience is inversely related to the fire return interval; this threshold is 3-5 years in coastal sage scrub and 10-20 years in chaparral, with the higher values more typical of interior sites."

Isolated fire events have little long-term effect on the density of chaparral; repeated events close in time progressively reduce the density of shrubs.

[19] Archer, Steven R., et al.: *Brush Management as a Rangeland Conservation Strategy: A Critical Evaluation*, in Conservation Benefits of Rangeland Practices, Allen Press, Lawrence, Kansas, 2011, cites disruption of historic grazing and fire regimes as a root cause of woody plants colonizing herbaceous plant communities across the Western United States.

Keeley, *Native American Impacts on Fire Regimes of the California Coastal Ranges*: "With the demise of the native population in the early part of the nineteenth century, fire incidence decreased and sites likely have been reinvaded by shrubs. On the mesas of coastal San Diego County, Cox [Cox, G.W.: "Mima mounds as an indicator of the pre-settlement grassland-chaparral boundary in San Diego County, California", American Midland Naturalist, 116, 64-77, 1986] examined size structure of chaparral along an ecotone with grasslands and concluded that during the twentieth century chaparral has been colonizing grassland after a long hiatus of fires dating back possibly to Native American times...".

Holstein, Glen: *Geology, Climate, and California Prairie Distribution*, in Fremontia, California Native Plant Society, Vol.39, Nos.2 & 3, 2011, associates natural grasslands in California with clay soils. Thus type-converted grasslands on well-drained soils over time naturally revert to woody plants.

DeSimone, S.A. and Zedler, P.H.: "Do shrub colonizers of Southern California grassland fit generalities for other woody colonizers?", pgs. 1101-1111 in Ecological Applications Vol.11 No.4.

[20] Preston, William: "Serpent in the Garden", pgs. 260-298 in *Contested Eden, California Before the Gold Rush*, UC Press, 1998, an essay on environmental change during the Spanish and Mexican periods, cites some human practices that altered the landscape.

[21] Engelhardt, *San Diego Mission*, pgs. 294-299; *San Luis Rey Mission*, pgs. 218-222.

[22] Indian neophytes became skilled horsemen, serving as vaqueros for the missions' livestock. With the deterioration of the missions in the 1830s, Indians were regularly suspected in thefts of horses and cattle.

[23] Smith, Jedediah: *Jedediah Smith's Journals, 1826-27*, published in:

Brooks, George R., *The Southwest Expedition of Jedediah S. Smith*, Arthur S. Clark Co., 1977: (30 November 1826) "Wild horses and wild cattle [ ] range the country in great numbers..."

Duhaut-Cilly, *Voyage Autour du Monde*, pg. 311: (In 1827) "... wild cattle abound[ ] in the woods..."

[24] Smith, Jedediah, *Journals*: (November 1826) "...the herds of cattle and the bands of wild horses reminded me of the plains of the buffalo east of the mountains..."

Duhaut-Cilly, *Voyage Autour du Monde*, pg. 226: (1827) "The verdant valley in which this mission [San Luis Rey] is placed... enlivened by great herds which could as yet be seen only as white and red spots, stretched to the north as far as the eye could reach..."

Dana, Richard Henry: *Two Years Before the Mast*, Modern Library, New York 1936, pg. 181: "...waters filled with fish, and the plains covered with thousands of herds of cattle..."

[25] Menzies, Archibald: *Menzies' California Journal*, in California Historical Society Quarterly Vol.2 No.4, January 1924: (November 1794, of the view east from San Diego Bay) "The whole presented a naked dreary arid prospect in which there was not a tree to be seen in any direction within our view."

Vancouver, George: *Journals*, quoted in Engelhardt, *San Diego Mission*, pg. 175: (With Menzies in 1794) "The situation of the [Presidio] is dreary and lonesome, in the midst of a barren, uncultivated country, producing so little herbage, that excepting the spring months, their cattle are sent to the distance of twenty or thirty miles for pasturage..."

Smith, Jedediah, *Journals*: "The wild horses become so abundant at times as to eat the grass quite clean."

Dana, *Two Years Before the Mast*, pg. 98: (At San Pedro) "as far as the eye could reach, [the land was] entirely bare of trees and even shrubs..."

Emory, W.H.: *Notes of a Military Reconnoissance*, Washington, 1848, pg.113: (December 12, 1846, descending with Kearny's army from the north, passing False Bay): "At this place we were in view of the fort overlooking the town of San Diego and the barren waste which surrounds it."

Nineteenth-century drawings and photographs of areas close to habitations or formerly inhabited places, such as of Mission Valley, the missions, *asistencias* such as Las Flores near Oceanside, and the various ranchos, often depict large areas of land completely devoid of shrubs and in some cases appearing devoid of herbaceous cover.

[26] Vancouver, *Journals* – Note 25 above, regarding pastures.

Engelhardt, *San Diego Mission* and *San Luis Rey Mission* – Notes 10 and 12 above - pastures to which missions' flocks and herds were driven.

Extensive outlying pastures were not fenced. Jedediah Smith describes the *californios*' method of running down wild cattle and horses. R.H. Dana refers to horses running free and having to be caught to be ridden. Certain crops and animals close to habitations were enclosed.

[27] Pico, *Historical Narrative*, pg. 136, discusses slaughter for San Gabriel mission in 1833: "... I brought 10 cowboys and 30 Indians with over 300 horses... [at one ranch alone we] killed 2,500 head of cattle."

[28] Burcham, H.T.: *Cattle and Range Forage in California*, in Agricultural History, Vol.35, No.3, July 1961, estimates the grazing capacity of different habitat-types for Spanish livestock, being a function primarily of the density of shrub- and tree-cover and the annual rainfall. On typical California prairie only 1.6 acres per animal-unit month were required for Spanish cattle but given relatively low rainfall and prolonged dry season in the San Diego region compared to the average in western California, the grazing requirement on local prairie or grassland can be assumed to be significantly more than 1.6 acres/AUM. The requirement in chaparral would be much higher - 12.0 acres/AUM or more. The author continues: "California ranges required lighter stocking and more attention to season of grazing... Disturbances of the plant cover, by grazing or other activities, favored vigorous responses of native animals of inferior quality... Rangelands with these characteristics may deteriorate rapidly..."

Nuzum, Robert C.: *Using Livestock Grazing as a Resource Management Tool in California*, Contra Costa Water District, Concord, California, 2005: "From this [U.C. Davis] assessment, California's grazing lands were found to occupy about 31.5 million acres of the 99.8 million total acres... It is estimated that only 30% to 50% of the forested grazing lands were actually grazed by livestock in any one year."

[29] Carter, Nancy Carol: "San Diego Olives: Origins of a California Industry", in *Journal of San Diego History* Vol.54 No.4, Summer 2008.

Duhaut-Cilly, quoted in Engelhardt, *San Luis Rey Mission*, pg. 57: (1827) "These orchards [of the San Luis Rey mission] grow most exquisite olives and produce the best grapevine in all California. I took a sample of this wine with me and I have it still. I kept it seven years. It has the taste of the Paxaret and the color of the Porto purgato."

[30] Wood collected from local plants was the primary fuel for heat in the San Diego region in the 1830s. Candles were produced from tallow.

[31] Dana, *Two Years Before the Mast*, pgs. 160-61.

Menzies, *Menzies' California Journal*: (November 1793) "Fire wood was here [in San Diego] equally scanty and difficult to procure, what we laid in was got from some scrubby brushwood on the side of the ridge to the westward of where we lay and as it was hard it answered tolerably well with coals."

[32] Original seed for mission crops came by ship from Mexico. Subsequently missions relied on internal trade, as the San Diego mission acquired seed from San Gabriel where crops were more successful (Bancroft, *History of California*, Vol.1, pg. 205). Purity of seed no doubt was unreliable; even today 100% purity is impractical. As weeds proliferated, impurities in seed-collections undoubtedly increased.

[33] Hendry, George W. and Kelly, M.P.: *The Plant Content of Adobe Brick*, pgs. 361-373 in California Historical Society Quarterly Vol.4, 1925.

[34] Duhaut-Cilly, *Voyage Autour du Monde*, pg. 219: "The road leading to [the San Diego mission] follows the edge of the stream for nearly the whole distance; and when it leaves it, it crosses a long field of mustard whose flowers, of a beautiful yellow, then in full bloom [April], dazzled the eye, and appeared like the most splendid gold."

Dana, *Two Years Before the Mast*, pg. 98: (At San Pedro) "...except for the stalks of the mustard plant, there was no vegetation."

Hartnell, William E.P.: *The Diary and Copybook of William E.P. Hartnell*; translated by Gurcke, Starr Pait; edited by Farris, Glenn; Arthur H. Clark Company, 2004, pg. 32.

Bancroft, *History of California*, Vol.2, pg. 417: "... to say nothing of the mustard, which sometimes choked the crop and furnished a hiding-place for livestock."

[35] Pattie, James O.: *The Personal Narrative of James O. Pattie of Kentucky* (for the period June 20, 1824-August 30, 1830), John H. Wood, Cincinnati, 1831, pg. 170: (in northern Baja California in spring of 1828) "...the wild oats and clover grow spontaneously, in great luxuriance."

Emory, *Notes of a Military Reconnoissance*, pg. 112: (On December 11, 1846, marching after San Pasqual to San Diego) "Our march was in close order, over a road leading through a rolling country of light black soil, destitute of trees, and without water, covered with oats indigenous to the soil [i.e. wild or naturalized], now fallen to decay."

Couts, Cave J.: "Pages from *The Diary of Cave John Couts* – San Diego in the Spring and Summer of 1849", San Diego History Center: "San Luis Rey, April 10, 1849... The Valley is separated from the valley of Santa Margarita by a chain or ridge of mountains, now covered with wild oats..."

Bartlett, John Russell: *Personal Narrative of Explorations and Incidents* (1850-53) refers to wild oats in the vicinity of Los Angeles.

[36] Page 24 above, quote of Hinds refers to *Phoenix* and *Ricinus*. Hinds' *Phoenix dactylifera* (Date Palm) is presumed to be *Phoenix canariensis*, a close relative but with inferior fruit, common in San Diego today.

Menzies, *Menzies' California Journal*: (1793) "I also saw the *Mesembryanthemum edulis* and five or six species of the genus Cactus [in S.D.]..."

[37] San Diego Natural History Museum herbarium records show numerous collections of *Tamarix ramosissima* from Camp Pendleton.

Smith, Jedediah, *Journals*, 1826-27. *Tamarix* is a common plant in Spain, first documented in the USA in the 1850s, that may have been introduced earlier in California for windbreaks etc.; it is quite conceivable it was planted on the large ranch of Santa Margarita y Las Flores. Another plant that could be "bastard cedar" i.e. with scale-like leaves is not obvious; Incense Cedar, Cypress or Juniper are not likely in the Camp Pendleton area, nor are pines.

[38] References to dogs and pigs or hogs occasionally appear in the historical literature. R.H. Dana adopted a dog at La Playa; Dana (pg. 164)

also mentions flocks of crows around hide-houses scavenging for beef-scraps. Others write of crows around missions and mission-farms.

[39] Bancroft, *History of California*, Vol.2, pg. 417: "the *chapulin*, the *chahuistli*, ground squirrels, gophers, and rats – these animals having rapidly multiplied since the Indians no longer need to hunt them for food – were the agricultural pests still complained of..." [in period 1811-20].

Pattie, *Personal Narrative*, complains miserably of fleas at San Diego presidio where he was held prisoner by Echeandía.

Robinson, *Life in California*, pg.92: (At the San Juan Bautista mission in 1831) "...I feared I was to become a martyr to never-ending tortures. They were fleas indeed! and it appeared to me as if they came in armies to glut their appetite with human blood! It was terrifying!"

[40] Hutchinson, Alan C.: *Frontier Settlement in Mexican California*, Yale Univ. Press, 1969, pg. 130, quotes Father Francisco González de Ibarra of the San Fernando mission fortuitously around 1827: "[The Indians] are being told [by Gov. Echeandía] that they are free, but in fact they are simply being deceived... Some are leaving their missions, some are going off into the woods, some are going off to work for the so-called *gente de razon*. As a result of this the crops cannot be sewn at the regular time and even those that are sewn are lost, for there is no one to harvest them. And the Indians who have gone off, because of their little knowledge, will slowly but surely lose their lands and become slaves."

Coulter, Thomas: *Notes on Upper California*, pgs. 59-70 in Journal of the Royal Geographical Soceity of London Vol.5, 1835: (In 1832) "the mission of San Luis Rey is the only remarkable exception [to Indians' decline]. In it the Indians are stated to be on the increase... but... [depopulation is] the inevitable fate of their race in the neighborhood of white men – a fate from which I fear the Luiseños are not likely to escape. The political reforms now in active operation in California, and of which the first and most important measure is the destruction of the missions, will enable the white inhabitants to acquire possession of the great bulk of the mission lands..."

[41] Bancroft, *History of California*, Vol.3, pg. 22, quotes the Mexican junta's 1825 dictamen to Echeandía's instructions: "... The junta has not been able to persuade itself that this [mission] system is the only one fitted to arouse among the gentiles a desire for civil and social life, or to teach its first rudiments, much less to carry it to perfection. It believes rather that it is positively contrary to the political aims in accordance with which it should have been arranged, and still more to the true spiritual aim which should be kept in view." Bancroft also notes, pg.104: "The governor [Echeandía] doubtless used his influence to imbue the neophytes with ideas of independence and civil liberty, not conducive to contentment with mission life."

[42] Accounts of the ruin of the missions, and the chaos and Indian troubles that occurred, are numerous and often embittered.

See pg. 23 above, quote from Belcher's *Narrative* re fear in town.

Dana, *Two Years Before the Mast*, pg. 176, provides an American perspective from 1836: "The priests have now no power, except in their religious character, and the great possessions of the missions are given over to be preyed upon by the harpies and the civil power, who are sent there in the capacity of *administradores*, to settle up the concerns; and who usually end, in a few years, by making themselves fortunes, and leaving their stewardship worse than they found them. The dynasty of the priests was much more acceptable to the people of the country, and, indeed, to everyone concerned with the country, by trade or otherwise, than that of the *administradores*. The priests were connected permanently to one mission, and felt the necessity of keeping up its credit. Accordingly the debts of the missions were regularly paid, and the people were, in the main, well treated, and attached to those who had spent their whole lives among them... The change had been made but a few years before our arrival..., yet, in that short time, the trade was much diminished, credit impaired, and the venerable missions were going rapidly to decay."

[43] Nelson, E. Charles, and Probert, Alan: *A Man Who Can Speak of Plants, Dr. Thomas Coulter (1793-1843) of Dundalk in Ireland, Mexico and Alta California*, Dublin, 1994, is the principal authority on Coulter's life, travels and botanical contributions. Pgs. 95-116 address Coulter's time in California. Pg. 105: Coulter in April 1832 "joined a party driving cattle south towards Mexico", arriving at the Pala *asistencia* by April 30 and crossing the Anza-Borrego Desert in early May. Coulter's paper for the Royal Geographical Society provides dates and locations for this trip. Although Nelson and Probert's book does not elaborate, it is rather certain Coulter accompanied the party of the trappers David E. Jackson and Ewing Young who had purchased mules and horses from the California missions and were driving them east to Louisiana. The Jackson party's dates and itinerary, recollections of participants, and Coulter's intention to accompany Ewing Young on Young's Northern California expedition support that conclusion, as detailed here.

Bancroft, *History of California*, Vol.3, pg. 387 discusses Jackson's party but does not mention Coulter in association with it.

Bancroft, *ibid*, pgs 406-7 discusses Coulter and his route without drawing a connection to Jackson or Young.

Warner, Juan Jose: *Reminiscences of Early California, 1831 to 1846*, pgs. 176-193 in Southern California Quarterly Vol. VII, 1906-1908, recollects the journey from Warner's viewpoint as one of Jackson's hired men; Bancroft obtained his information from Warner. Warner omits names of most participants in the operation, including Coulter.

Coulter, *Notes on Upper California*, refers to the difficulty for "horses and mules" to complete the desert journey. He also sets dates his party spent fording the Colorado River at May 8–17, 1832, i.e. approximately ten days, and estimates his return to San Gabriel on June 15, 1832.

Warner, *ibid*: "With great difficulty and after some twelve days of incessant toil in the burning sun and other casualties the mules and horses were swam to the east shore [of the Colorado River] and Jackson with about thirty men went on his way with the herd. Mr. Young, with five men, of whom I was one, retraced their steps over the desert and reached [the pueblo of] Los Angeles in the last days of June [1832]."

Thus Coulter's and Warner's dates and recollections are nearly identical despite the passage of time.

Nelson, *ibid*, pg. 150, cites an encounter Asa Gray had in Los Angeles almost certainly with Warner, who lived in that city until 1895: "Gray's interest in Coulter was reawakened in 1885, during a visit to Los Angeles, when, according to a letter to Alphonse de Candolle, Gray "fell in with one of the 'old settlers' " who knew [Coulter], and who accompanied him on that expedition into the Arizona desert on the Lower Colorado."

Nelson, *ibid*, pg. 111, footnote 49, quoting a letter of Nov. 27, 1834 from Coulter to Alphonse de Candolle: "From the Red River [Colorado River] I returned Northwards and was proceeding to the Columbia River to return home by Canada when I had the misfortune to break my leg and was obliged to remain behind the party." The party was certainly that of Young, Moses Carson, et al., with whom Coulter had recently crossed the desert. We know from Warner, *ibid*, and Bancroft, *ibid*, Young left Monterey in September 1832 to trap the rivers of Northern California; Young did not get to Oregon on that initial trip but succeeded a year or so later.

[44] Nelson, *A Man Who Can Speak of Plants*, relates Coulter's biography in detail. Botany as an academic discipline fell under the medical schools of the time; a medical degree was considered a prerequisite for authority in biological sciences, at least in universities.

[45] Nelson, *A Man Who Can Speak of Plants*, pg. 90.

[46] Bancroft, *History of California*, Vol.3, pg. 221, lists forty-six members of the *compañía extranjera*, including Coulter, Douglas, and William Hartnell. The group never saw action.

[47] Coulter, *Notes on Upper California*; map by John Murray, Albemarle St., London, 1835. The map is also reproduced in Bancroft, *History of California*, Vol.3, pg 407.

[48] Warner, *Reminiscences*, and Bancroft - see note 43 above.

[49] Nelson, *A Man Who Can Speak of Plants*, pg. 107.

[50] Brigandi, Phil: *The Southern Emigrant Trail*, in Overland Journal, Fall 2010. Following Bancroft, the author refers to Coulter's trip in 1832 separately from Jackson's.

[51] Nelson, *A Man Who Can Speak of Plants*, pgs. 112-14. Coulter, *Notes on Upper California*, note 40 above, demonstrates an understanding of the Luiseño Indians, implying he stayed at the mission, although he may also have learned from the two stays at Pala. Nelson's information that Coulter sailed from San Diego appears to come from a letter dated April 27, 1833 that Coulter sent from Mexico City to William Hartnell in Monterey, a copy of which is among the Hartnell papers at the Bancroft Library, the text of which the present author has not seen.

[52] Bancroft, *History of California*, Vol.3, pg. 227 (note 14) refers to Echeandía's occupation of San Gabriel; pgs. 315-16 discuss Fr. Sanchez's opposition to Echeandía's secularization plan.

Nelson, *A Man Who Can Speak of Plants*, pg. 114, mentions Coulter's regret for not having seen Fr. Sanchez as the latter was dying toward the end of 1832. Undoubtedly Fr. Sanchez's supporters hoped the surgeon would come up from San Diego and cure the priest.

[53] Nelson, *A Man Who Can Speak of Plants*, pg. 112: "He then reached San Diego where, while he waited to get a passage to Mexico, he continued to record the aboriginal vocabularies."

[54] Nelson, *A Man Who Can Speak of Plants*, pg. 120, note 19: "D.Don, 'Descriptions of five new species of the genus *Pinus*, discovered by Dr. Coulter in California', Transactions of the Linneaen Society of London 17 (1836): 439-444..."

[55] Nelson, *ibid*: "Don reported that it [*P. coulteri*] had been 'Discovered by Dr. Coulter on the mountains of Santa Lucia, near the Mission San Antonio, in latitude 36, within sight of the sea and at an elevation from 3000 to 4000 feet above its level. It was growing intermingled with *Pinus lambertiana*. The tree rises to the height of 80 or 100 feet, with large permanent spreading branches, and the trunk 3 or 4 feet in diameter... The cones which are the largest of all, being more than a foot long, half a foot in diameter, and weighing about four pounds... At the suggestion of Mr. Lambert I have applied to the remarkable tree the name of its discoverer...' "

[56] Nelson, *A Man Who Can Speak of Plants*, pg. 144, note 14: "W.H. Harvey, Description of a new genus of Papaveraceae, detected by the late Dr. Coulter in California'. Hooker's Journal of Botany 4 (1845): 73-76."

[57] Baldwin, Bruce G. et al., editors: *The Jepson Manual, Vascular Plants of California*, 2d edition, UC Press, Berkeley, 2012, pg. 986: "*Romneya*, Matilija Poppy... 1. Sepals glabrous; peduncle glabrous; petals 60-100 mm; lf 5-20 cm = *R. coulteri*. 1' Sepals appressed-hairy; peduncle +/- bristly at top; petals 40-80 mm; lf 3-10 cm = *R. trichocalyx*. *R. coulteri* - Harvey... *R. trichocalyx* – Eastwood.... [note to *R. trichocalyx*:] included in *R. coulteri* by some."

[58] Baldwin et al., *The Jepson Manual*, 2d ed., 2012.

[59] Communication from Trinity College Dublin Herbarium dated December 12, 2012: "I am afraid that we do not have a list of the specimens collected by Coulter whilst in western North America... Looking at the material in the collection does not... give very much information as the specimens are minimally labelled, usually with no date."

[60] Nelson, *A Man Who Can Speak of Plants*, pg. 117-18.

[61] These and other prominent herbaria in Britain and the United States maintain catalogues accessible online.

[62] Coville, Frederick: *The Botanical Explorations of Thomas Coulter in Mexico and California*, pgs. 519-531 in The Botanical Gazette, December 1895.

Coville, Frederick: *The Botanical Explorations of Thomas Nuttall in California*, pgs. 109-121 in Proceedings of the Biological Society of Washington, December 30, 1899, Vol.XIII.

[63] Raven, Peter: *George Barclay and the "California" Portion of the 'Botany of the Sulphur'*, pgs. 469-477 in Aliso Vol.5 No.4, 15 May 1964.

[64] Beidleman, Richard G.: *California's Frontier Naturalists*, UC Press, 2006, pgs. 137-140.

[65] Graustein, Jeannette E.: *Thomas Nuttall, Naturalist: Explorations in America 1808-1841*, Harvard Univ. Press, 1967, pgs. 291-92 (regarding Harvard resignation).

Sampson, William R.: *Nathaniel Jarvis Wyeth*, pgs. 311-331 in Hafen, LeRoy R., ed.: *Mountain Men and Fur Traders of the Far West*, Univ. of Nebraska Press, 1982, details the Wyeth expeditions.

Sampson, *ibid*, pg.323: "The caravan with seventy men, including the Nez Perce boy Baptiste, Wiggin Abbott, and the naturalists Thomas Nuttall and John Kirk Townsend, finally departed from Independence on April 28 [1834] with Wyeth and Milton Sublette in the lead."

[66] Dana, *Two Years Before the Mast*, pgs. 301-303: "This passenger... was no one else than a gentleman whom I had known in my smoother days... Professor Nuttall, of Cambridge... I saw but little of him on the passage home. Sometimes, when I was at the wheel on a calm night... he would come aft and hold a short yarn with me, but this was against the rules of the ship..."

[67] Graustein, *Thomas Nuttall*, pg 18.

[68] Nuttall, Thomas: *The Genera of North American Plants, and a Catalogue of the Species, to the Year 1817*, Philadelphia, 1818.

Graustein, *Thomas Nuttall*, pg. 127: "Hooker's verdict was that the *Genera* marked 'an era in the history of American botany'."

[69] Torrey, John, and Gray, Asa: *A Flora of North America*, Wiley & Putnam, New York, Vol.1 in 4 parts 1838-40; Vol. 2 in 3 parts 1841-43.

Graustein, *Thomas Nuttall*, pgs. 326-27: (In June 1837, in New York) "[Nuttall] found that Torrey and Gray were definitely planning to work together on a flora of North America... Then and there an agreement was made that Nuttall would describe his hundreds of new species in their publication under his own name."

[70] Nuttall, Thomas: *A Manual of the Ornithology of the United States and Canada*, (Vol.1, Land Birds), Hilliard and Brown, Cambridge,1832.

[71] Graustein, *Thomas Nuttall*, pgs. 284: "Nuttall's analysis [of Wyeth's collection] yielded one hundred and twelve species of flowering plants, fifty-one of which he judged to be new. A new genus represented by a stout "dwarf sunflower" he named for Wyeth."

[72] Townsend, John Kirk: *Across the Rockies to the Columbia*, Philadelphia, 1839; excerpted and reprinted by Oregon Historic Trails Fund (oregonhistorictrailsfund.org).

[73] Beidleman, *California's Frontier Naturalists*, pg. 139: "...the ship [*Pilgrim*] passed Point Loma and entered San Diego harbor on April 15, 1836. But the naturalist [Nuttall] remained aboard during a three-week wait for a Bryant and Sturgis ship to take him back to Boston."

[74] Dana, *Two Years Before the Mast*, pg. 282: "The next day [April 25, 1836] the *California* began unloading her cargo... a gang of [her crew] were sent on board the *Alert* to help us steeve our hides... Our cargo was now nearly taken in, and my old friend, the *Pilgrim*, having completed her discharge, unmoored, to set sail next morning on another long trip to windward."

[75] Dana, *Two Years Before the Mast*, pg. 302.

[76] Baldwin et al., *The Jepson Manual*, 2d ed., 2012.

[77] Beidleman, Richard G: *William Gambel, Frontier Naturalist*, pgs. 10-14 in Pacific Discovery Vol.11, Nov.-Dec.1958.

[78] Torrey and Gray, *Flora of North America*, 1838-43.

[79] Pennel, Francis W.: *Travels and Scientific Collections of Thomas Nuttall*, pgs. 34-45 in Bartonia No.18, 1936. Gray quoted on pg. 44.

[80] Pennel, *ibid*, pg. 44, note 106: "Gray's approval was given to Nuttall's earlier rather than later work, which he likened to that of Rafinesque. This comparison seems to me unjust, and I think that it betrays the fact that in 1844 Gray had not grasped what a remarkable proportion of endemism characterizes every portion of western North America. There is also the fact that Nuttall was inclined to the formation of small concrete genera and Gray to retain large comprehensive ones."

Graustein, *Thomas Nuttall*, chapter 18, pgs. 318-61, relates some communications and disputes between Nuttall and Gray during the compilation of the *Flora of North America*.

[81] Bancroft, *History of California*, Vol.4, pgs. 142-46.

Belcher, Edward: *Narrative of a Voyage Round the World, Performed in her Majesty's Ship Sulphur, During the Years 1836-42*; Henry Colburne, London, 1843.

[82] Belcher, *ibid*.

Hinds, Richard Brinsley, ed.: *The Botany of the Voyage of H.M.S. Sulphur, under the command of Captain Sir Edward Belcher, during the years 1836-42*; *the botanical descriptions by George Bentham, Esq.*; Smith, Elder and Co., London, 1844.

[83] Belcher, *ibid*, pgs. 326-27.

[84] Hinds, *Botany of the Sulphur*, pg. 4.

[85] Hinds, *ibid*, pg. 3.

[86] Hinds, *ibid*, pg. 4.

[87] Hinds, *ibid*, pg. 32.

[88] Raven, *George Barclay and the "California" Portion of the 'Botany of the Sulphur'*.