The California Geographer

Volume 45, 2005

A Publication of the
California Geographical Society

Edited by
Dorothy Freidel

Copyediting and layout by Cooper Publishing,
Corvallis, Oregon

Printed by OSU Printing, Corvallis, Oregon

The California Geographer

The California Geographer is a refereed journal of the California Geographical Society, and has been published annually since 1960. All statements and opinions that appear in the journal are the full responsibility of the authors and do not necessarily reflect the views of the California Geographical Society.

Volume XVII (1977) indexes volumes through IXVII, and volume XXIX (1989) indexes volumes through IXXIX. Volume numbering changed from Roman to Arabic numbering with volume 42 (2002). Volume 44 (2004) indexes volumes IXXX through 43.

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CALIFORNIA GEOGRAPHICAL SOCIETY 2005–2006

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The History of Oak Woodlands in California, Part I: The Paleoecologic Record

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Abstract

Oak woodlands are a fixture of California geography, yet as recently as 10,000 years ago, oaks were only a minor element in the landscape. In this paper, I review the long-term history of California oaks, beginning with the Tertiary fossil record from the Early Miocene (~20 million years ago), when oaks were present across the west, intermixed with deciduous trees typical of Eastern North America. As climate became drier, many species went locally extinct and oaks retreated west of the Sierra Nevada. During the ice ages (~ the last 2 million years), oaks nearly disappeared as cool and wet climate favored expansion of coniferous forests and oak woodlands persisted in refugia. After the last glacial maximum, oaks expanded rapidly to become the dominant trees in the Coast Ranges, Sierra Nevada foothills, and Peninsular Ranges. Within the last 10,000 years, climate change has continued to alter oak woodland distribution patterns. During this period, human impacts on oak woodlands have also caused significant changes. The human impacts on oaks, associated with Native Californians, and the Spanish, Mexican, and American populations that displaced them, will be reviewed in Part II.

Key Words: *Oak woodlands, Quercus, California, paleoecology, vegetation history*

Oak woodlands scattered across grass-covered hills represent the characteristic landscape of California. Yet this familiar scene is of relatively recent origin, and the oak woodlands that symbolize California today represent only the most recent pattern in a long history of change, influenced by both changing climates and changing land use practices. Fossil evidence shows that all of California's oaks were present in western North America by about ten million years ago (Millar 1996), but their modern geographic ranges have been established within only the last 10,000 years. As the summer-dry Mediterranean climate developed and strengthened over time, the range and distribution of California oaks has changed. During the last 100,000 years, oaks were a minor element of the landscape, most likely persisting as isolated refugia.

With the end of the last ice age, about 10,000 years ago, oaks rapidly expanded, creating the woodlands we recognize today. Even during this time period, climate change has influenced the range and distribution patterns of oak woodlands, such that in some locations, woodlands have been in place for only the last few thousand years. Evidence of the first appearance of humans in California also dates to about 10,000 years ago, so that the expansion of oak woodlands after the last glacial maximum coincides with a period of environmental modification through human use. Native Californians lived throughout the oak woodlands, and evidence suggests that their practice of frequently burning the landscape influenced the development of the open oak savannas commonly described in the earliest European accounts. Within just the last two centuries, intensive resource use has completely altered the distribution and abundance of oak woodlands throughout most of their range in California

In this paper, I review the paleoecologic and historical literature to reconstruct the history of change in California's oak woodlands. The paper has two parts. Part I focuses on the long-term geologic record reconstructed from fossil evidence. I begin with a brief overview of the ecology and geographic ranges of the nine tree oaks in California. Review of the geologic record starts in the Early Miocene (~ 20 million years ago) with the first oak fossils conformable to modern species, and continues through the Holocene. Since the formation and development of California's Mediterranean climate is crucial to reconstructing the history of oak woodlands, the paleoecology discussion includes relevant aspects of climate change.

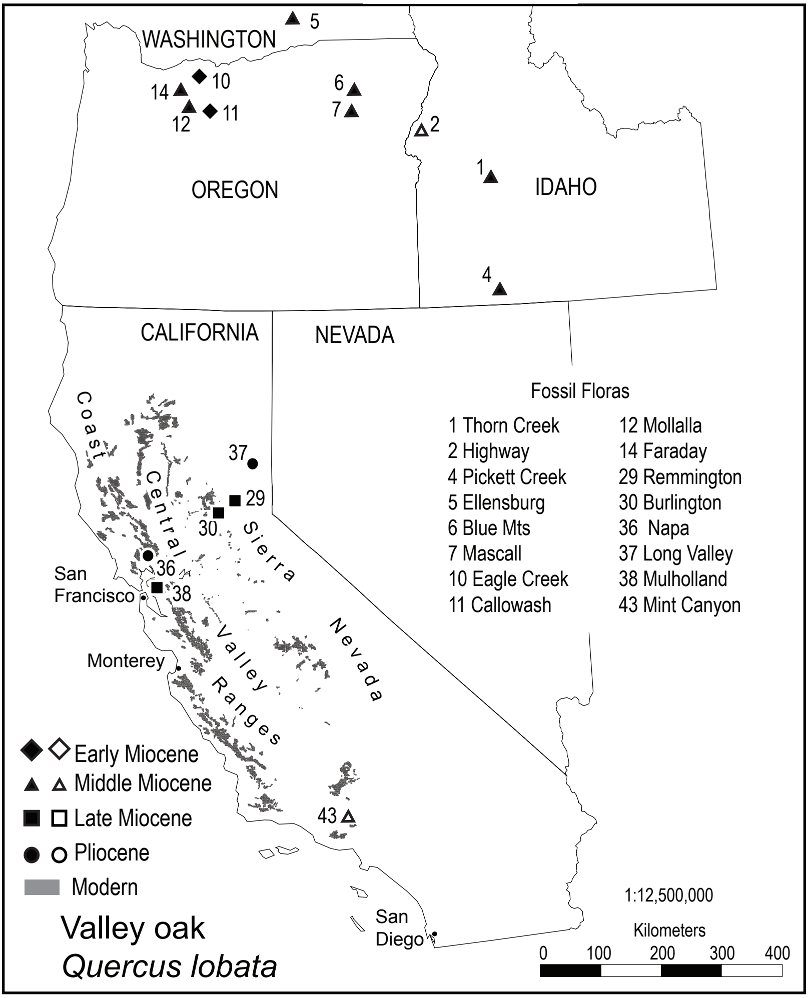
Part II encompasses the history of human interactions with oak woodlands, beginning with Native Californians and continuing through the Spanish, Mexican, and American periods. The section on the influence of native Californians on oak woodlands relies primarily on ethnographies and descriptions of early explorers, supported by fossil pollen evidence and studies of land use changes. To a certain extent, we can understand what the landscape must have been like during the aboriginal period by documenting the changes that happened after the removal of the native population from the landscape. European impacts are documented in diaries and written records from the early periods of settlement. Unfortunately, most of these accounts are descriptive and non-quantitative, and provide only a sketch of how oak woodlands were transformed over time. But the broad picture of large-scale landscape conversion can be easily read on the landscape as well as in the literature. People have always lived with oaks in California, and as land use has intensified, it has directly impacted the abundance and distribution of oak woodlands. In many ways, the history of California's oak woodlands is the history of California.

California's Oaks

California has nine species of oak that grow as trees: valley oak (*Quercus lobata*), blue oak (*Q. douglasii*), coast live oak (*Q. agrifolia*), interior live oak (*Q. wislizeni*), Engelmann oak (*Q. engelmannii*), canyon live oak (*Q. chrysolepis*), black oak (*Q. kelloggii*), Oregon white oak (*Q. garryana*), and island oak (*Q. tomentella*) (Pavlik et al. 1991). Five species—valley oak, blue oak, coast live oak, interior live oak, and Engelmann oak—form oak savanna in California.

Valley oak (deciduous) is the tallest of all California oaks and typically grows in riparian habitats or on rich, deep, valley soils below 600 m. It is endemic to California and is widespread in the Central Valley (including the Sacramento Valley in the north and the San Joaquin Valley in the south), as well as smaller valleys throughout the Coast and Transverse Ranges (Figure 1a) (Griffin and Critchfield 1976). Blue oak (deciduous), also endemic, commonly grows adjacent to valley oak and forms savanna woodlands in the low foothills surrounding the Central Valley, as well as extending into the foothills of the Coast Ranges (Figure 1b). This species tolerates the driest climate of all California tree oaks and can grow in areas where temperatures exceed 38°C for weeks at a time and annual precipitation is less than 250 mm, although it can also grow in areas with up to 1,000 mm annual precipitation (Pavlik et al. 1991). Nearly half of oak woodlands in California are dominated by blue oak.

Interior live oak (evergreen) a California endemic, commonly grows in association with blue oak and valley oak at lower elevations in the Sierra Nevada foothills and northern Coast Ranges (Figure 1c). In the south Coast Ranges and Transverse Ranges of southern California, the species is shrubby and grows at elevations above coast live oak (Griffin and Critchfield 1976). It is interesting to note that in the dry interior valleys of California, blue oak, a deciduous species, occupies the driest habitats with the most severe summer drought, while the evergreen interior live oak is absent from these sites. Evergreen sclerophyllous taxa are often considered to be classically



Figures 1a–g. Distribution maps of the fossil localities and modern ranges of (a) valley oak (Quercus lobata), (b) blue oak (Q. douglasii), (c) interior live oak (Q wislizeni), (d), coast live oak (Q. agrifolia), (e) Engelmann oak (Q. engelmannii), (f) black oak (Q. kelloggii), and (g) canyon live oak (Q. chrysolepis). Filled symbols represent sites where there is greatest confidence in the fossil identification, and open symbols are sites with the least confidence, following Table 1.

adapted to the Mediterranean climate type; however, in California, deciduous oaks occupy this niche as well (Blumler 1991).

Coast live oak (evergreen) is the species that the early Spanish explorers were most familiar with, because it occupies the valleys and hills of the

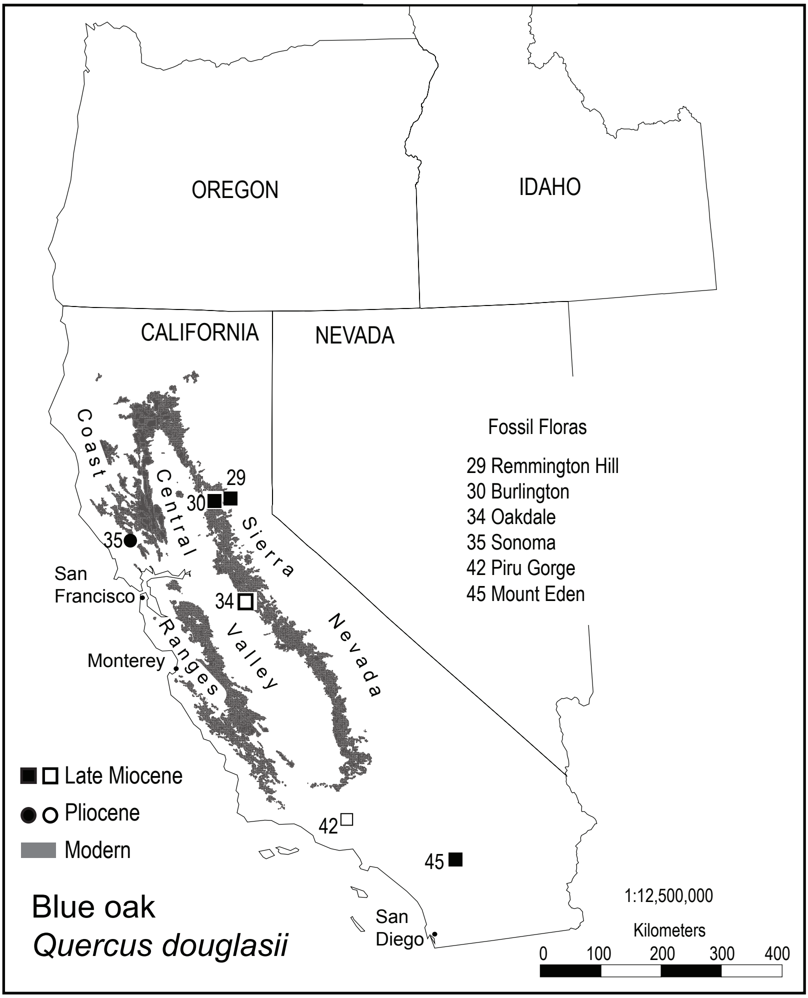


Figure 1b

Coast Range (Figure 1d) where the Franciscans established their chain of missions (Griffin and Critchfield 1976). The species occupies the cooler coastal habitat and becomes restricted to streams at the southern extent of its range in Baja California (Minnich and Franco-Vizcaíno 1998). Another southern oak, Engelmann oak (semi-deciduous) is restricted to southern California and Baja California (Figure 1e), and populations are concentrated at elevations between 700 m and 1,250 m, where frosts are rare and precipitation typically exceeds 450 mm annually (Scott 1991). This species is most closely related to oaks in Arizona and the Sierra Madre Occidental of northern Mexico, and is considered the northern outpost of sub-

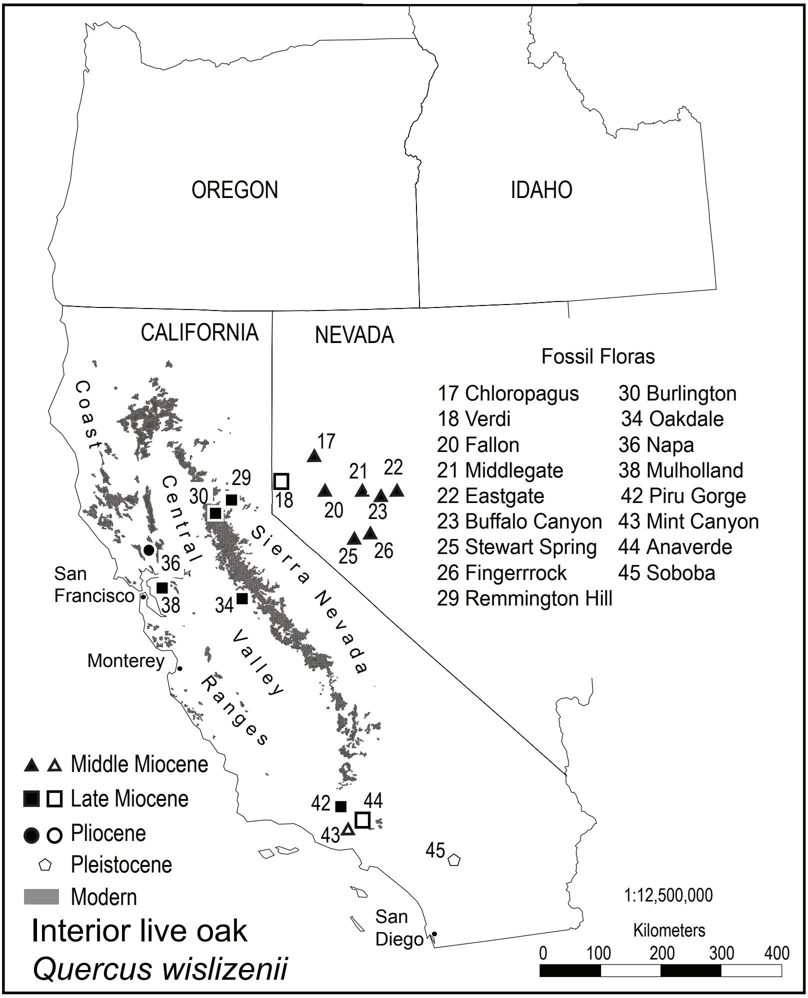


Figure 1c

tropical oaks in the western United States (Pavlik et al. 1991; Minnich and Franco-Vizcaíno 1998).

Black oak commonly grows in mixed conifer forests of the Sierra Nevada, southern Cascades, and northern Coast Ranges at elevations between 600 m and 1,980 m (Figure 1f). The species prefers precipitation greater than 625 mm annually, and snow and frost are common within its range. Frequent fires favor the growth of black oak in place of conifers (Pavlik et. al 1991). The most widely distributed oak is canyon live oak, growing from near sea level to 2,700 m from Oregon to Baja California in nearly every major mountain

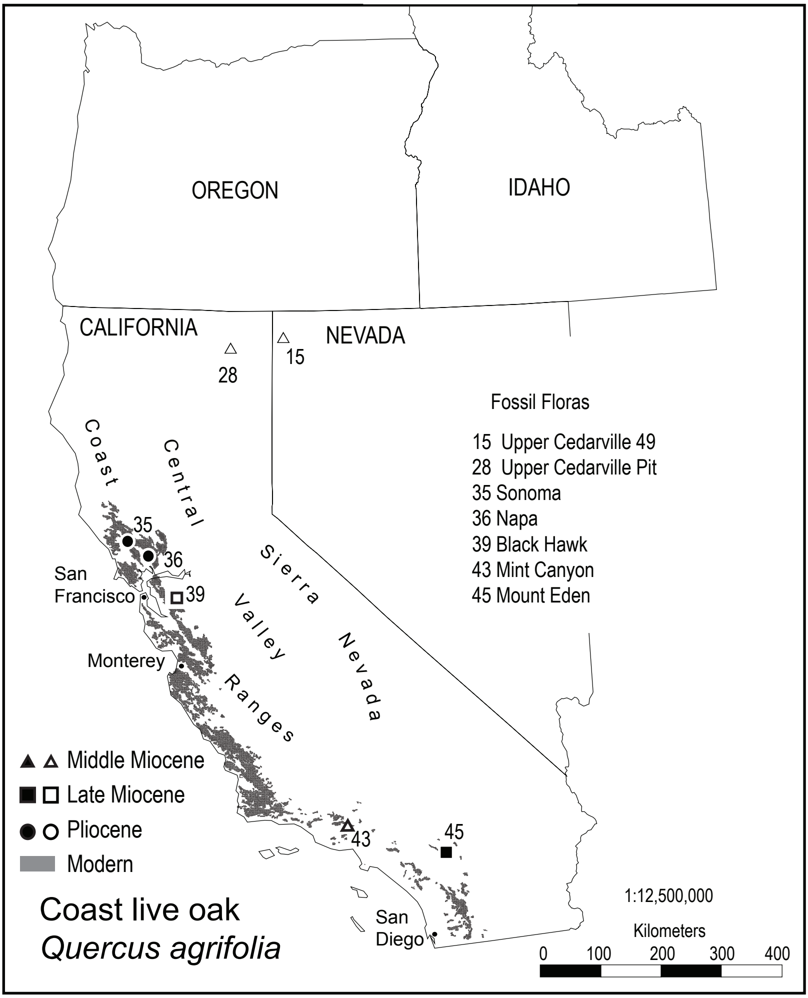


Figure 1d

range in the state (Figure 1g) (Griffin and Critchfield 1976; Pavlik et al. 1991). This species is common in moist canyons and on steep slopes but does not occur in areas with frequent fires and is not common in the savanna habitat.

Two oaks—Oregon white oak and island oak—live primarily outside the typical range of Mediterranean oak woodlands. Oregon white oak ranges from the northern Coast Range and Klamath Mountains of northwest California north into Canada, and is associated with Douglas-fir (*Pseudotsuga menziesii*) and mixed evergreen forests. Island oak was distributed throughout southern California in the

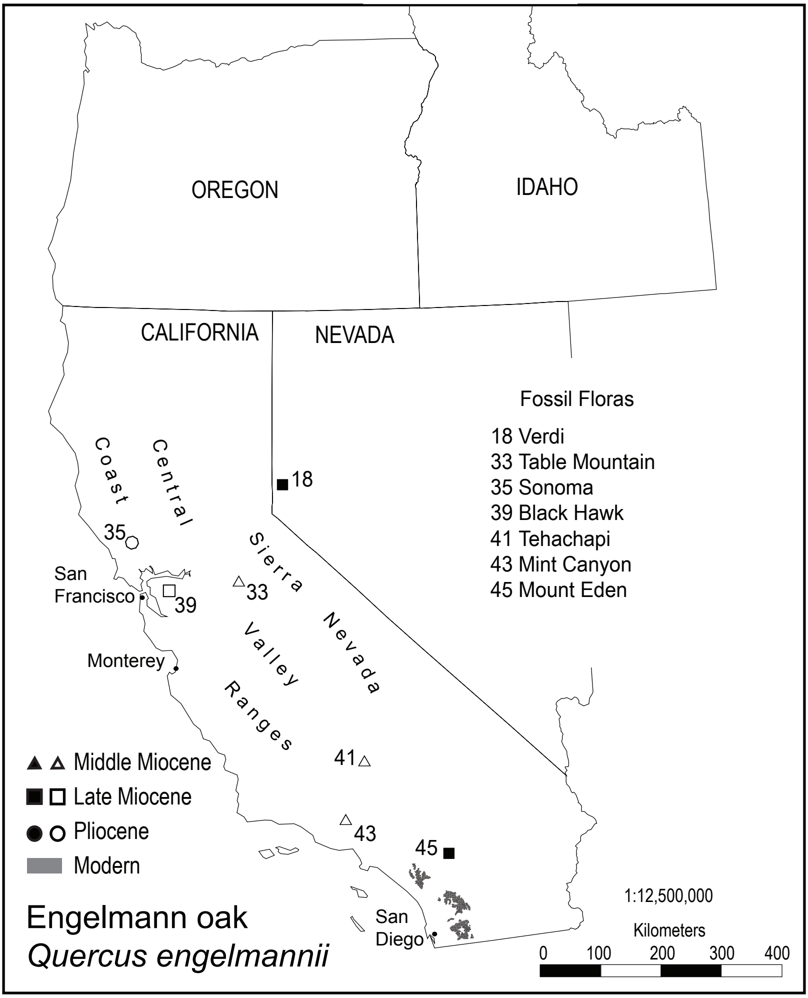
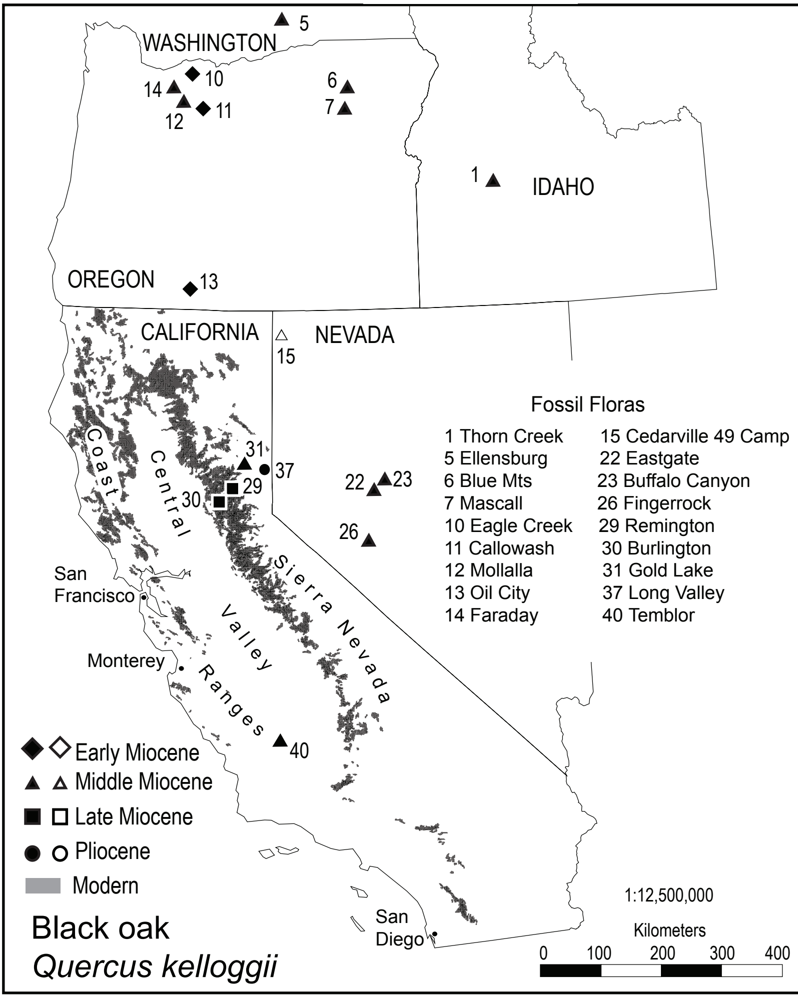


Figure 1e

Pliocene (ca 3 million years ago—Ma) (Axelrod 1973) but today is confined to the Channel Islands off the southern California coast and Guadalupe Island off of Baja California (Griffin and Critchfield 1976). While these two species are important in California and may have interesting histories that are worth examining, this review does not discuss them.



WASHINGTON
IDAHO
OREGON
CALIFORNIA
NEVADA
5
10
14
12
11
6
7
1
13
15
31
37
29
30
22
23
26
40
Coast
Central
Valley
Ranges
Sierra Nevada
San Francisco
Monterey
San Diego
Fossil Floras
1 Thorn Creek
5 Ellensburg
6 Blue Mts
7 Mascall
10 Eagle Creek
11 Callowash
12 Mollalla
13 Oil City
14 Faraday
15 Cedarville 49 Camp
22 Eastgate
23 Buffalo Canyon
26 Fingerrock
29 Remington
30 Burlington
31 Gold Lake
37 Long Valley
40 Temblor
Early Miocene
Middle Miocene
Late Miocene
Pliocene
Modern
Black oak
Quercus kelloggii
1:12,500,000
Kilometers
0 100 200 300 400

Figure 1f

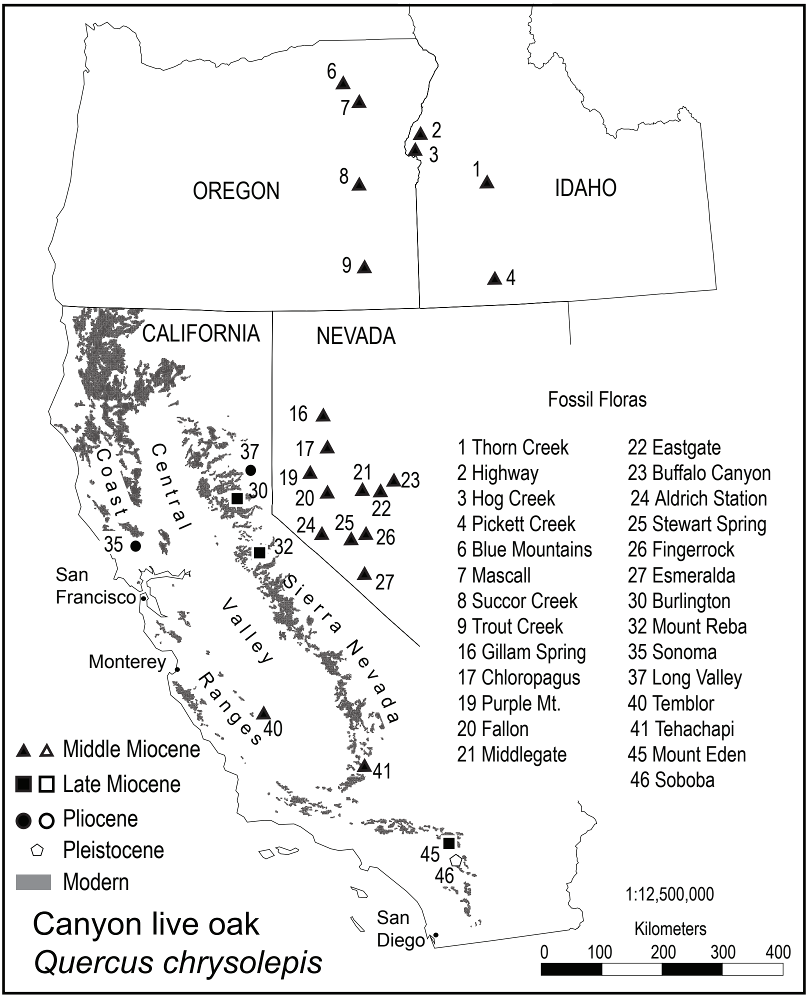

OREGON
IDAHO
CALIFORNIA
NEVADA
Coast
Central
Valley
Ranges
Sierra Nevada
San Francisco
Monterey
San Diego
Fossil Floras
1 Thorn Creek
2 Highway
3 Hog Creek
4 Pickett Creek
6 Blue Mountains
7 Mascall
8 Succor Creek
9 Trout Creek
16 Gillam Spring
17 Chloropagus
19 Purple Mt.
20 Fallon
21 Middlegate
22 Eastgate
23 Buffalo Canyon
24 Aldrich Station
25 Stewart Spring
26 Fingerrock
27 Esmeralda
30 Burlington
32 Mount Reba
35 Sonoma
37 Long Valley
40 Temblor
41 Tehachapi
45 Mount Eden
46 Soboba
Middle Miocene
Late Miocene
Pliocene
Pleistocene
Modern
Canyon live oak
Quercus chrysolepis
1:12,500,000
Kilometers
0 100 200 300 400

Figure 1g

Paleoecology of California Oaks—The Paleoflora Record

Interpreting the Fossil Record

This review is not a taxonomic revision of oaks but a historical biogeography based on the existing fossil record. Oak taxonomy is complicated, and unraveling the potential evolution of lineages is a study in itself (Nixon 2002). I use the fossil record to map changes in distribution patterns of the ancestors of our modern oaks to document the history of California oaks and provide some insight into the climatic and geographic changes that may have been associated with the development of oak woodlands.

Since identification of the fossil flora is critical to interpreting historical distribution patterns, in addition to referring to photographs of type-specimens published in the literature, I examined the original fossil material of each oak type-specimen discussed in the literature, with the assistance of Howard Schorn and Diane Erwin of the California Museum of Paleontology. Most of the original fossils of the floras reviewed in this paper are held in the museum collection. In a few cases, the material was held elsewhere or unavailable, but we were able to check more than ninety percent of the original fossils, to make our own determination as to the relative confidence of the identity. I have not revised any original species identifications and present the species as published by the authors. However, where the literature is ambivalent, or preservation is poor, I have indicated those identifications that appear to be less certain and may require more careful analysis before being used to confidently reconstruct oak biogeography (Table 1).

Oak leaf morphology is notoriously variable, particularly among the live oaks, which have similarly shaped leaves. Differentiation between live oaks relies largely upon vein patterns (venation), which requires fossils with well-preserved secondary and tertiary veins. Even using the fossil material, we were unable to confidently identify some live oak specimens. Leaves of the deciduous oaks are more morphologically distinct and the fossil record seems clearer for these types. However, even in these cases, there is variation that may represent hybridization or lineages that went extinct. Within the three sections of oaks (Table 1), all species are known to hybridize (Nixon 2002), and hybrid swarms can produce a nearly continuous range of leaf morphologies between species (Benson et al. 1967).

Table 1. List of floras mentioned in the text in chronological order with the best known age in millions of years. Chronology follows Woodburne and Swisher (1995), and Schorn (unpublished data). # refers to site identification numbers in Figure 1. Taxa are arranged by section following Nixon (2002). Species are as follows: agri = *Q. agrifolia*, kell = *Q. kellogii*, wisl = *Q. wislizenii*, chry = *Q. chrysolepis*, engl = *Q. Engelmanii*, loba = *Q. lobata*, doug = *Q. douglasii*. X = fossil present that conforms to the modern species. x = fossil present that has been identified to the modern species but the identification was determined ambiguous after examination of the type fossil. [1]Unpublished floras examined at the University of California Museum of Paleontology paleobotany collection.

#	Name	State	Best Age	Lobatae			Protobalanus	Quercus		
				agri	**kell**	**wisl**	**chry**	**engl**	**loba**	**doug**
Pleistocene										
46	Soboba	CA	~1-2			x	x			
Pliocene ~5-2 Ma										
35	Sonoma	CA	~3-4	X			X	x		X
36	Napa	CA	~3-4	X		X			X	
37	Long Valley[1]	CA	~4		X		X		X	
Late Miocene (~11-5 Ma)										
42	Piru Gorge	CA	~5-6			X				x
44	Anaverde	CA	~5-6			x				
45	Mt Eden	CA	~5-6	X			X	X		X
18	Verdi	NV	~6			x		X		
38	Mulholland	CA	~6-7			X			X	
32	Mt. Reba	CA	~7				X			
34	Oakdale	CA	~7-8			X				x
30	Burlington Rg[1]	CA	~8-9		X	X	X		X	X
29	Remington	CA	~8-9		X	X			X	X
39	Black Hawk	CA	~9	x				x		
Mid Miocene (~16-11 Ma)										
33	Table Mt.	CA	~10-11					x		
2	Highway	ID	~10-11				X		x	
5	Ellensburg	WA	~10-11		X				X	
14	Faraday[1]	OR	~11		X				X	
4	Pickett Creek[1]	ID	~11				X		X	
3	Hog Creek	ID	~11-12				X			
43	Mint Canyon[1]	CA	~12	x		x		x	x	
24	Aldrich	NV	~13				X			
1	Thorn Creek	ID	~12-14		X		X		X	
20	Fallon	NV	~13-14			X	X			
9	Trout Creek	OR	~13-14				X			
12	Mollalla	OR	~13-14		X				X	
25	Stewart Spr	NV	~14			X	X			
6	Blue Mtns	OR	~14-15		X		X		X	
27	Esmeralda	NV	~14-15				X			
17	Chloropagus	NV	~14-15			X	X			
19	Purple Mt.	NV	~14-15				X			
16	Gillam Spring	NV	~15.5				X			
28	Cville Pit Rvr	CA	~15.5	x						
15	Cville 49 Cmp	NV	~15.5	x	x					
31	Gold Lake[1]	CA	~15-16		X					
8	Succor Creek	OR	~15-16				X			
7	Mascall	OR	~15-16		X		X		X	
21	Middlegate	NV	~15-16			X	X			
22	Eastgate	NV	~15-16		X	X	X			
23	Buffalo Cnyn	NV	~15-16		X	X	X			
26	Fingerrock	NV	~16		X	X	X			
40	Temblor	CA	~16		X		X			
41	Tehachapi	CA	~16				X	x		
Early Miocene (~20 – 16 Ma)										
13	Oil City	OR	~16-18		X					
11	Callawash	OR	~16-18		X				X	
10	Eagle Creek	OR	~18-20		X				X	

The fossil literature includes many species names that are overlapping or equivalent. To simplify this discussion, I refer to the most commonly used fossil name and its modern equivalent, and then simply use the common name thereafter. This does not imply that the species filled the exact ecological niche throughout its evolution. In fact, one of the important stories of California oaks is that they appear to have been able to adapt to an increasingly drier climate. Since the fossil record contains only leaves and occasionally acorns, we know nothing about the actual growth habits of the trees, which we assume were similar but have certainly changed over time.

Finally, an accurate chronology is key to interpreting the fossil record. Many of the studies cited in this review were done before the development of radiometric dating techniques. I used the chronology developed by Schorn (unpublished data), utilizing Ar/Ar, K/Ar, mammalian faunas, stratigraphic position, and floral evidence (Woodburne and Swisher 1995). Thus, the chronology will follow not the ages suggested in the original literature but the revised ages for each flora.

Early Miocene (20–16 Ma)

California oak history begins in the Pacific Northwest in the Early Miocene, with the first fossils that can be compared with ancestors of modern oaks (Wolfe 1980). The ancestor for black oak (*Q. pseudolyrata–Q. kellogii*) and valley oak (*Q. prelobata–Q. lobata*) are found in Oregon (Figure 1) between 20 and 16 Ma (million years ago) in the Eagle Creek and Callawash floras (Chaney 1920; Peck et al. 1964). The Oil City flora in southern Oregon contains black oak. These oaks grew with an exotic mix of species within genera now commonly found in either East Asia ginko (*Ginko*) and zelkova (*Zelkova*), or the Eastern United States hickory (Carya), tulip tree (*Liriodendron*), sweet gum (*Liquidambar*), elm (*Ulmus*), and magnolia (*Magnolia*).

The earliest oaks were commonly associated with broadleaf deciduous trees that are now confined to mesic environments in the Eastern United States or to riparian habitats in the west, including maple (*Acer*), hornbeam (*Carpinus*), persimmon (*Diospyros*), beech (*Fagus*), witch hazel (*Hamamelis*), holly (*Ilex*), walnut (*Juglans*), tupelo (*Nyssa*), hornbeam (*Ostrya*), avocado (*Persea*), cherry (*Prunus*), and sassafrass (*Sassafras*) (Axelrod 1983). As summer rainfall disappeared through the late Cenozoic, most deciduous broadleaf species went locally extinct. California's oaks did not evolve under the summer dry Mediterranean climate where they thrive today, but rather are survivors of a rich and diverse flora dominated by year-round precipitation (Axelrod 1973). Today's native species must have been pre-adapted to summer drought and were able to persist in the region as the climate became more Mediterranean (Blumler 1991).

Fossil oaks are always found as part of rich assemblages of sclerophyllous and deciduous woodlands, whereas today we typically find large expanses of woodlands comprised of pure stands of one species of oak. Wolfe (1980) suggests that such monoclimax communities represent a recent development. This is difficult to confirm, however, because preservation favors wet locations that are more likely to contain a mix of riparian and upland species. Even today, species diversity is greatest along riparian corridors, suggesting that even though single species stands are widespread throughout the state, depositional environments suitable for preserving macrofossils are uncommon within these stands.

Middle Miocene (16–10 Ma)

By the beginning of the Middle Miocene (~16 Ma), two additional oaks comparable to modern species are found in the fossil record: canyon live oak (*Q. hannibali–Q. chrysolepis*) and interior live oak (*Q. wislizenoides–Q. wislizeni*). The vast majority of oak woodlands were outside the present area of California, in Nevada, Idaho, Oregon, and Washington (Axelrod and Schorn 1994; Axelrod 1956, 1964, 1973, 1995).

Only two species were confidently present in California during the Middle Miocene: black oak, found in the Temblor flora of the southern Coast Range and the Gold Lake flora north of Lake Tahoe; and canyon live oak, found in the Temblor flora (Renny 1972) and Tehachapi flora (Axelrod 1939) of southern California (Table 1, Figure 1). In the Tehachapi, oaks grew alongside laurels (*Persea*), suggesting a wetter climate than now. These two species had the widest distribution pattern of all the oaks, also being found in Nevada, Oregon, Idaho, and in the case of black oak, southern Washington (Smiley 1963). Today these two species continue to have the widest geographic range of California oaks.

At the Blue Mountain and Mascall sites in Oregon, black oak, valley oak, and canyon live oak grew together in a mixed evergreen forest (Oliver 1936; Chaney and Axelrod 1959). This flora also included deciduous forest types such as tree of heaven (*Ailanthus*), maples (*Acer*), hawthorn (*Crataegus*), beech (*Fagus*), Eastern-type oaks (*Quer-*

cus prinus, imbricaria), walnut (*Juglans*), sweet gum (*Liquidambar*), and sassafras (*Sassafras*). Conifers included fir (*Abies*), spruce (*Picea*), Douglas-fir (*Pseudotsuga*), redwood (*Sequoia*), hemlock (*Tsuga*), and western red cedar (*Thuja*) (Axelrod 1973). The association of both Eastern deciduous species, as well as redwoods, with oaks indicates mild temperatures with wet summers. At the Succor and Trout Creek localities (Graham 1965) in southeastern Oregon, canyon live oak grew in association with *Zelkova*, now restricted to Eastern Asia, and *Oreopanax,* a genus that is not frost hardy and occurs primarily in tropical America. The Mollalla and Faraday localities included black oak and valley oak (Chaney 1944, 1959). Idaho floras included genera now restricted to coastal sites, such as *Sequoia* at Hog Creek and Highway (Dorf 1936; Smith 1939) and an ironwood type (*Lyonothamnus*) in the Pickett Creek flora (Buechler et al. 1998).

Lobed oaks similar to valley oak have been found only in Oregon, Washington, and Idaho during the Middle Miocene. Leaf morphology of these fossils resembles both valley oak and Oregon white oak. These two species may have had similar progenitors in the Pacific Northwest that diverged sometime after the Middle Miocene, with valley oak becoming restricted to California.

Interior live oak fossils are restricted to Nevada during the Middle Miocene (Figure 1c), where they co-occur with canyon live oak and black oak. Sites with interior live oak included Middlegate, Eastgate, Chloropagus (Axelrod 1956); Buffalo Canyon (Axelrod 1985); and Fingerrock (Wolfe 1964). These sites had a mix of deciduous species indicative of a summer wet climate, including ancestors of madrone (*Arbutu*s), walnut (*Juglans*), *Eugenia* (extinct), birche (*Betula*), maple (*Ace*r), buckeye (*Aesculus*), persimmon (*Diospyros*) hickory (*Carya*), elm, (*Ulmus*), and zelkova (*Zelkova*) (Axelrod 1973).

The distribution pattern of interior live oak in central Nevada and valley oak in the Pacific Northwest recalls the concept of separate Arcto-Tertiary and Madro-Tertiary floras described by Axelrod (1983). The genus *Quercus* first appears in the fossil record in the late Cretaceous. Oaks today are widespread in Asia, Europe, and North America, where the center of diversity is in montane forests of Mexico (Nixon 2002). Axelrod (1983) suggests that live oaks such as interior live oak are most closely allied to peninsular oaks of Mexico and would be considered part of the Madro-Tertiary flora characterized by shrubby taxa and semiarid climate with summer rain. He suggested that many of the California oaks had their origins in Mexico-Central America and the southwestern United States, spreading northward as aridity increased. Morphological data comparing modern interior live oak and coast live oak (red oaks in the section *Lobatae*) with Mexican red oaks find no obvious connections between Californian and Mexican species (Nixon 2002). California black oak, which looks more like oaks of Eastern North America, also has no particularly close morphological characteristics with Eastern species. In general, lobed-leaf species, or species thought to be derived from lobed-leaf ancestors (valley oak, black oak, blue oak, coast live oak), are characteristic of temperate or cold climates, and canyon live oak (Section *Protobalanus*), a true evergreen, probably originated in a more tropical region (Nixon 2002).

Late Miocene (11–5 Ma)

By the late Miocene, California oaks became restricted within the present political boundaries, with the only exception being just across the state line in Verdi, Nevada (Figures 1a–1g). Reliable fossil evidence for each species can be found within or near some portion of the species' present boundaries, indicating that the mild and humid climate of the Early Miocene had begun to give way to a more seasonal Mediterranean climate.

The Remington flora (Condit 1944) and adjacent Burlington flora in the west central Sierra Nevada held five species of oak, including canyon live oak, black oak, interior live oak, valley oak, and the first appearance of blue oak (*Q. douglasoides–Q. douglasii*) (Table 1). Chaparral species from several genera are present, including manzanita (*Arctostaphylos*) and buckbrush (*Ceanothus*). These floras contain the first evidence of a diverse oak woodland within California associated with chaparral shrubs. Summer rainfall types present include maple (*Acer*), buckeye (*Aesculus*), sweetgum (*Liquidambar*), avocado (*Persea*), and elm (*Ulmus*), indicating that although oaks and chaparral are present, the landscape was still not comparable to modern oak woodlands. The Mediterranean climate typical of California today appears to have strengthened during the late Pliocene but did not fully develop until the Pleistocene (Axelrod 1980).

The first fossils that can be confidently attributed to coast live oak (*Q. lakevillensis–Q. agrifolia*) appear in the Mount Eden flora (Dorf 1930; Axelrod 1937, 1950a) about 5–6 Ma, on the northwest slopes of the San Jacinto Mountains in southern California. Coast live oak is found only at its southern limit, although this particular species is uncommon in the fossil record, indicating that it is either rare or difficult to differentiate. This locality also has blue oak, which places this species well south of its modern range limits.

Perhaps the most intriguing locality for the Late Miocene is the presence of Engelmann oak (*Q. orindensis–Q. engelmannii*) in the Verdi flora (Axelrod 1958) in western Nevada. This locality is in the rainshadow of the Sierra Nevada at ~1,700 m elevation, with average winter temperatures of -7°C and ~20–25 mm annual precipitation. Engelmann is frost intolerant and is restricted today to southern California. Presence of this species in Verdi suggests that the high desert climate of today did not yet exist. This is the only reliable oak species identified from this locality, and unfortunately there are no other late Miocene-age floras in Nevada to confirm whether other not oaks may have been more widespread across this region at this time. Today, small, isolated populations of canyon live oak are found in the Tahoe Basin and in the Carson Range of Nevada, but in general the vegetation on the eastern slope of this range is distinctly arid, dominated by sagebrush (*Artemisia tridentata*) below 1,650 m elevation.

Pliocene (5–2 Ma)

Evidence from the Pliocene is limited. The major sites are located near Santa Rosa, well within the modern distribution of the species today. The Central Valley was a large inland sea in the early Pliocene (Johnson et al. 1993) that would have modified temperature and precipitation patterns but prevented colonization of the Central Valley and created a barrier to dispersal. Fossil sites are missing from most of the potential ranges.

Mixed oak woodland appears to be well developed at the Sonoma and Napa localities (Axelrod 1944a, 1950b), with blue oak being associated with interior live oak, coast live oak, canyon live oak, and valley oak. Most of the fossils suggest a modern forest typical of the Coast Range with redwood (Sequoia), Douglas-fir (*Pseudotsuga*), alder (*Alnus*), tan oak (*Lithocarpus*), sycamore (*Platanus*), and shrubs such as mountain mahogany (*Cercocarpus*), buckbrush (*Ceanothus*), and manzanita (*Arctostaphylos*). Several fossils stand out as exotic, though, suggesting persistence of a wetter climate than today, including elm (*Ulmus*) and avocado (*Persea*).

One apparent outlier is the presence of valley oak at Long Valley, located on the eastern crest of the Sierra Nevada north of Reno and east of Quincy. Populations of black oak cross the Sierra Nevada here today, nearly to the Nevada border where low passes provide dispersal routes, such as along the South Fork of the Feather River (Griffin and Critchfield 1976). This pattern appears to have possibly persisted here for at least 4 million years.

Pollen Evidence for Oak Woodlands

Macrofossil evidence from floras provides detailed lists of species presence or absence but cannot inform us about the abundance of individuals in the landscape. Alternatively, pollen microfossils provide a measure of abundance, although for oaks this is limited to the generic level. The relationship between species abundance on the landscape and abundance in the fossil pollen record is calibrated through surface samples that compare modern vegetation with the associated pollen rain. Studies from northwest California and southern Oregon (Heusser 1983), and along transects from the Central Valley, over the Sierra Nevada into the Great Basin (Adam 1967; Anderson and Davis 1988) found a positive correlation between oak abundance on the landscape and oak pollen in surface samples. When oak pollen is absent, oaks are typically not present in the region. Trace amounts of pollen up to about 5 percent indicate that oaks are either present locally in small numbers, or present in the region, however not as an important part of the plant community. Pollen sums of 30–40 percent represent oak-dominated landscapes, and sums between 5 and 30 percent suggest that oaks are locally abundant, roughly in proportion to their pollen sum (Anderson and Davis 1988).

Evidence for oak woodlands in the early Pliocene comes from pollen in sediment cores collected in the Pacific Ocean off the coast of California between Monterey and San Francisco (Heusser 2000a). Oak pollen typically cannot be identified below the genus level; however, as records move toward the present, species can sometimes be inferred from the modern ecology. Between 6 and 5 Ma, Heusser (2000a) found that *Quercus* pollen averaged 20–30 percent of the total pollen sum. Pollen of summer rainfall taxa now extinct in California was also identified, including sweetgum, hickory, linden, and wingnut (*Pterocarya*). This assemblage suggests a warm, moist climate along the coast, with a rich mixed woodland dominated by oaks. After 5 Ma, these summer rainfall taxa disappear from the pollen record, suggesting an increase in summer aridity. However, percent oak pollen also declines, typically averaging 10–15 percent, but sometimes dropping below 5 percent. Based on macrofossil evidence from western North America, Axelrod (1973) suggests that oak woodland-savanna expanded in California in the early to mid-Pliocene, but declined in the late Pliocene as the climate cooled and precipitation increased. Recent evidence from marine ^{18}O records supports the interpretation of a progressively cooler climate from 3.1 to 2.6 Ma, probably associated with growth of ice in Antarctica and the northern Hemisphere (Bradley 1999, p. 213). About 2.7 Ma, there was a dramatic increase in ice-rafted debris in the North Atlantic as the global climate continued to cool, leading to the ice ages of the Pleistocene. This climate shift brought a dramatic change to California oak woodlands.

The Pleistocene (2 Ma–10,000 yr BP)

The Pleistocene has been marked by a period of glacial and interglacial oscillations (Figure 2) that appear in the marine ^{18}O record in the late Pliocene and become more pronounced toward the present (Raymo 1992). Although there is much debate concerning the exact periodicity of glacial cycles, estimated ages and terminations of the last six glacial cycles suggest a duration of approximately 100,000 years, with warm, largely "ice-free" interglacials lasting about 10,000 years, and cool, "ice-dominated" glacials lasting about 90,000 years (Bradley 1999). Oscillations within these cycles, termed *interstadials* (warmer periods) and *stadials* (cooler periods), provide evidence that glacials are not simply long cold periods. They are, however, largely dominated by cool climates, with maximum cooling occurring just prior to interglacials. The record of climatic oscillations has been subdivided into stages based on the marine oxygen isotope record, with odd numbers (1, 3, 5, etc.) representing warmer phases, and even numbers (2, 4, 6, etc.) representing cooler phases (Bradley 1999).

Northern hemisphere continental ice sheets were much larger over the last 1 million years as compared to the early Pleistocene, and the contrast between cold periods (glacials) and warm periods (interglacials) has become more pronounced in the last 600,000 years (Figure 2) (Raymo 1992). Axelrod (1973) has argued that the modern pattern of Mediterranean climate—nearly or completely rainless summers—originated during the Pleistocene in association with interglacial periods. The pollen record supports this conclusion and provides evidence that during the Pleistocene, oak woodlands have been a major part of the California landscape only during the short, warm, dry interglacial periods (Adam 1988; Heusser 1995; Davis 1999). Considered another way, during as

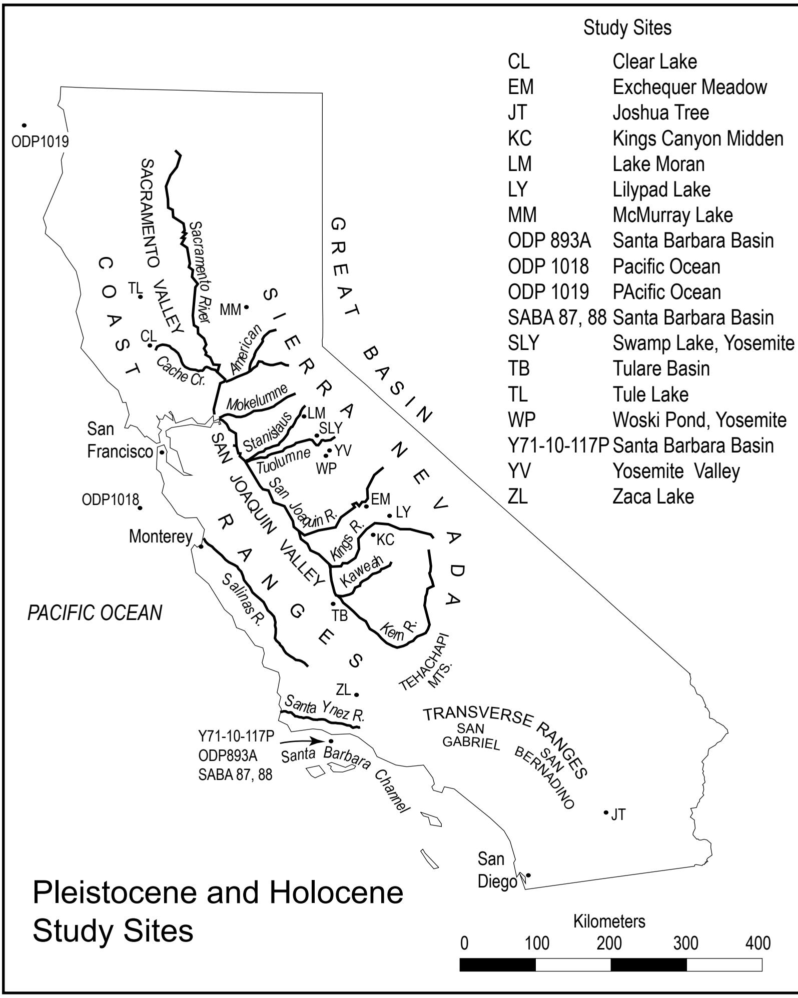


Figure 2. Benthic ^{18}O curve from marine sediments illustrating the onset of glacial cycles in the Pleistocene (adapted from Raymo, 1992).

much as 80 percent the last two million years, oaks were rare in California. The last glacial maximum occurred about 18,000 ^{14}C yr BP (radiocarbon years before present) and the current interglacial, termed the Holocene, began about 10,000 ^{14}C yr BP Widespread oak woodlands so characteristic of California today originated only within the last 10,000 years.

The majority of fossil evidence from the Pleistocene comes from pollen studies of sediment cores recovered from either unglaciated lakes or the Pacific Ocean (Figure 3). Macrofossil evidence of can-

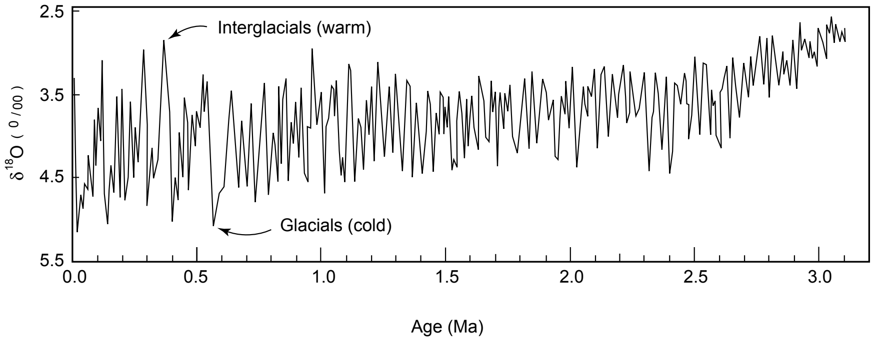


Figure 3. Location map of Pleistocene and Holocene study sites and place names referred to in the text.

yon live oak and interior live oak comes from the Soboba flora in southern California (Axelrod 1966). Axelrod argues that this flora is early Pleistocene in age, based largely on the fossil composition. The flora is dominated by native California species except for the fossils of two extralocal types, magnolia (*Magnolia grandiflora*), now confined to the southeastern United States, and canyon maple (*Acer brachypterum*) with a modern distribution confined to the southwestern United States. Throughout the Miocene and Pliocene, species requiring summer rainfall were gradually extirpated from California, such that by the beginning of the Pleistocene, California's flora was essentially modern in composition. The presence of only two exotic taxa suggests a fairly recent deposit; however, the continued existence of two species that survive today in regions dominated by summer rainfall suggests that even at the beginning of the Pleistocene, California's Mediterranean climate was not as severe as today (Axelrod 1966, 1973).

Heusser et al. (2000) published a pollen record from a core taken off the northern California coast that goes back 350,000 years spanning the last four interglacials, including the Holocene. The pollen record for the last 140,000 years is presented here (Figure 4). Oak pollen ranges from 10 to 25 percent of the pollen sum for both the Holocene and the last interglacial (ca 125 Ka) (thousand years ago) while earlier interglacials averaged only 5–8 percent oak pollen. During glacial maximums, oak pollen is less than 5 percent. Within the last glacial cycle, percent oak pollen generally increases during interstadial (warmer periods) and decreases during stadials (cooler periods) (Figure 4). Although glacial cycles include a great deal of climate variability, the duration of cooler/wetter phases is longer than warm/dry phases. Interglacials persist for 10,000–15,000

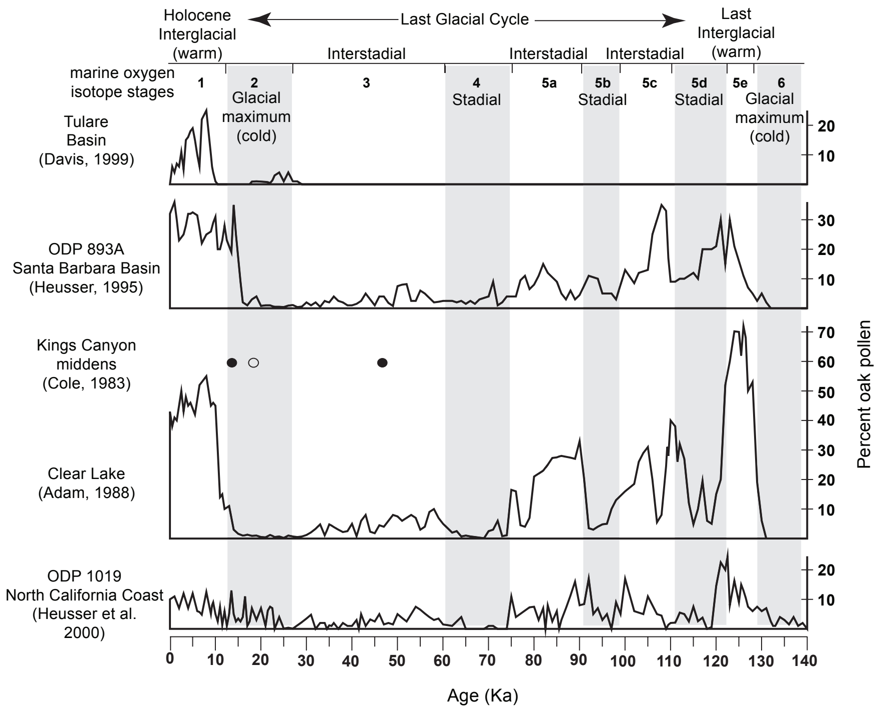


Figure 4. Pleistocene age pollen diagrams for sites in California recording oak. Filled circles represent packrat midden samples with oak pollen and open circles represent samples with no oak pollen. Note that each of the time series is based on independent age models. The marine oxygen isotope stages (1–6) are after Bradley (1999). Gray bands identify cold periods (stadials and glacial maxima) when percent oak pollen was generally very low.

years while glacials last 90,000–100,000 years. Pleistocene-age pollen records show that oak woodlands are regionally important during interglacials, but they nearly disappear from the landscape for very long periods of time during periods of glacial advance.

Adam's (1988) findings at Clear Lake (404 m elev) in the northern Coast Ranges reinforce this interpretation. Oak woodland surrounds the lake today, composed predominantly of blue oak with gray pine (*Pinus sabiniana*) at lower elevations and interior live oak and black oak at higher elevations. Also present in smaller populations are canyon live oak, valley oak, and Oregon white oak. Oak pollen represents 40 percent of the total sum in modern surface pollen samples and averages 45 percent during the last 10,000 years since the last glacial maximum (Figure 4). Percentages of oak pollen during the last interglacial centered about 125 Ka were even higher, ranging between 50 and 70 percent. In contrast, during periods of glacial maxima, (e.g., 70–10 Ka) oak pollen was reduced to 0–5 percent. Under these colder conditions, pines, sagebrush, and juniper dominated the landscape. Shifts from oak dominance to oak absence were abrupt (Adam and West 1983), suggesting that when the climate became wet and cold, oak woodlands were quickly replaced by pine forest, but when climate became warm and dry, oaks rapidly reestablished.

If oak woodlands were largely absent from their present range during glacial epochs, it is natural to ask where they were. One possibility would be that with cooler temperatures, oaks migrated downslope. Clear Lake drains into the Sacramento Valley via Cache Creek, providing a corridor for plant migrations to lower elevations. However, pollen evidence from Tulare Lake in the southern San Joaquin Valley does not show high percentages of oaks during glacial periods.

Tulare Lake was a large freshwater lake created by an outwash fan from the Sierra Nevada that blocked river drainage within the valley. Today the lake has been drained for agriculture, but it was originally a large body of water with extensive settlements of native Californians along the shore (Aikens 1978). Evidence of occupation has been dated to as early as 11 ^{14}C yr BP Early accounts of the region note that although the western side of the lake was devoid of trees, the eastern side had open oak savanna on the flat valley floor where the water table was high (Preston 1981). On the nearby Kaweah River delta, oaks were so thick that settlers had trouble traversing the forest by wagon. Griffin (1988) relates that the eminent California botanist Jepson (1910) noted that "…four hundred square miles of Valley Oaks…" grew on alluvial soils of the Kaweah River. And yet during the last glacial maximum (~18 ^{14}C yr BP), San Joaquin Valley vegetation was more similar to the Great Basin than to Mediterranean oak woodland (Davis 1999).

During the last glacial maximum, the Tulare Lake pollen record is dominated by pine (20–40 percent), juniper (20–40 percent), sagebrush (10–20 percent), and greasewood (5–10 percent) (Davis 1999), indicating a Pinyon-Juniper woodland with an understory of sagebrush similar to Nevada. The presence of greasewood suggests extensive salt flats surrounding a lowered lake. Oak pollen is less than 4 percent of the pollen sum, indicating that the Central Valley was not a refugium for oaks during the ice ages.

During glacial maxima, pluvial lakes and extensive wetlands covered much of the Central Valley, reducing available habitat for oaks. Temperature inversions associated with cold-air drainage off Sierra Nevada glaciers may have also affected oaks. During glacial periods, oaks were probably locally rare in California, persisting in small populations on favorable sites. It seems likely that they remained within their modern latitudinal and longitudinal range throughout each glacial cycle, but many populations were locally extirpated. With the return of favorable conditions, local populations increased rapidly, forming the woodlands we see today (Davis 1999).

Macrofossil evidence from a series of seven *Neotoma* (packrat) middens found in Kings Canyon in the Sierra Nevada foothills (920–1,270 m elev.) provide some clues as to the location of oak woodlands around the Central Valley during late glacial time (Cole 1983). These small rodents collect all types of vegetation to construct nests within the shelter of rock caves. The rats use the outer nest area as a latrine and the urine hardens over time, preserving the plant remains indefinitely if they are protected from moisture. Since *Neotoma* collect intensively, but only within 100 m of their nest, fossil middens provide an accurate account of local vegetation (Bettancourt et al. 1990). Today, the foothills of Kings Canyon lie within the oak-chaparral zone and include canyon live oak, but a midden sample dated to 17,500 ^{14}C yr BP, immediately following the full glacial, contained no oak macrofossils and no oak pollen. Instead, Cole found red fir (*Abies magnifica*), western juniper (*Juniperus occidentalis*), incense cedar (*Calocedrus decurrens*), sugar pine (*Pinus lambertiana*), and ponderosa pine (*P. ponderosa*). During periods of warmer climate, including the interstadial at marine oxygen isotope stage 3 and following the glacial maximum, oak is present (Figure 4). Pollen analysis of the midden found 20 percent oak pollen for the earliest midden (less than 45,000 yr BP), and 20 percent oak pollen during the late glacial (14,000 ^{14}C yr BP) (Cole 1983).

Absence of oak pollen during the glacial maximum suggests that, under the coldest conditions, oaks were locally rare or absent. The Tulare Lake evidence indicates that the refugium was not on the valley floor (Davis 1999). It seems likely that oaks contracted into isolated populations, most likely within a narrow elevation band in the Sierra Nevada foothills. The presence of oak pollen at ~45,000 and 14,000 yr BP suggests that oaks must have been common in the canyon except during the coldest climates, and as the climate warmed after the full glacial, oaks rapidly expanded back upslope.

An alternative explanation is that as the climate warmed, montane conifers thinned, allowing an increase in the local pollen rain of low-elevation taxa (Edlund 1996). Both explanations, however, suggest a change in forest cover from montane conifers to chaparral-oak woodland.

Coastal oak woodlands appear to have followed the same pattern as that found at Clear Lake. Pollen analysis of marine sediments taken offshore of California record high percentages of oak pollen only during interglacials, with very low values during glacial maxima (Figure 4) (Heusser 1995; Poore et al. 2000). In coastal northern California, oaks are generally a minor component of woodlands; however, pollen evidence from two marine cores (Ocean Drilling Project (ODP) sites 1020 and 1080) provides a record similar to those from inland sites (Poore et al. 2000). During the interglacial marine oxygen isotope stage 5E (ca. 127–120 Ka), oak pollen reached its maximum values (15 and 25 percent respectively). During glacials, oak pollen typically averages less than 5 percent.

In the Santa Barbara Channel off the coast of southern California, pollen evidence (Figure 4) records 30 percent oak pollen at 124 Ka, with high values throughout the interglacial period (128–116 Ka), declining to 10 percent by 115 Ka (Heusser 1995). Values for oak pollen fluctuate during interstadials (brief warm episodes within longer glacial cycles), with increases between 106 and 108 Ka to 30 percent, and again to ca 10–15 percent at 94 Ka, 84 Ka, and 52 Ka (Heusser 1995; Heusser 2000b). The general trend following the end of the last interglacial is of a decline in percent oak, with values between 0 and 5 percent from 70–14Ka. Between 70–14 Ka, TCT pollen (Taxodiaceae, Cupressaceae, Taxaceae), probably representing juniper, dominated the coastal region around Santa Barbara (Heusser 1995). Oak abruptly increased to 20 percent of the pollen sum at 14,000 ^{14}C yr BP and averaged 20–40 percent throughout the Holocene.

Higher resolution analysis of the late Pleistocene and Holocene record from the Santa Barbara Basin shows that oak pollen reached about 15 percent by 12,135 ^{14}C yr BP and increased to 25 percent by 7,750 ^{14}C yr BP (Heusser 1978). Oak pollen increased to 30 percent after 7,750 ^{14}C yr BP, averaging about 30 percent throughout the rest of the Holocene. Along the Santa Barbara coast, oak woodlands are dominated by coast live oak. Low percentages of oak pollen during the glacial maximum indicate that these oak woodlands did not retreat to the coastal shelf during glacial climates. It also seems unlikely that Mediterranean climate and California oak woodlands migrated south en masse into southern California or Mexico. Given how rapidly oak pollen increased with the end of the ice age (from less than 5 percent to more than 50 percent at Clear Lake, from less than 1 percent to more than 20 percent at Tulare Basin, and from less than 5 percent to more than 30 percent in Santa Barbara), it seems more probable that oaks maintained their general distribution pattern, but were largely extirpated, with small populations persisting as isolated refugia where suitable habitat existed, such as rocky south facing slopes.

The pattern of nearly continuous expanses of oak woodlands in the Coast Ranges and around the Central Valley is a very recent phenomenon. During ice ages, low-elevation California would have been characterized by coniferous forest. The characteristic Mediterranean climate of California with its oak-covered rolling hills has existed only for brief periods during interglacial cycles like the one we enjoy today.

The Holocene (~10,000 yr BP to Historic)

The earliest evidence of human occupation in California based on lithic artifacts found at Borax Lake, north of San Francisco, and Tulare Lake, in the San Joaquin Valley, suggest an arrival date of 11,500–11,000 ^{14}C yr BP (Aikens 1978). However, evidence for direct Native Californian influence on oak woodlands is largely restricted to the last thousand years. Part II of this paper will review the impacts Native Californians have had on oak woodlands. This review will focus largely on climate-related explanations of Holocene oak woodland history, with the caveat that human impacts may have contributed to these changes.

Holocene California oak woodland history in the Coast Ranges and Central Valley is different from that reconstructed from sites in the Sierra Nevada. In the Sierra Nevada, pollen data indicate that oak populations increased soon after deglaciation and reached a maximum between 8,000–6,000 cal yr BP (calibrated radiocarbon years before present), declining after that date. In contrast, most coastal and low-elevation sites show a steady increase in importance following the end of the ice age, reaching maximum levels about 8,000–7,000 cal yr BP, but then remaining high throughout the Holocene (Byrne et al. 1991). While low-elevation oak woodlands (dominated by blue oak, valley oak, coast live oak and interior live oak) became well established in the mid-Holocene, higher-elevation oak populations (primarily black oak and canyon live oak) decreased to become a minor component of the lower montane forests.

The North Coast Range Record

Unfortunately, the Holocene record of California oak woodlands is sparse, due to the lack of suitable fossil sites (lakes, meadows, fens) at low elevations (Mensing 1993). Two published pollen studies document changes in oak woodlands in the northern Coast Ranges. At Tule Lake (Figure 5), percent oak pollen began to increase at 7,000 cal yr BP, from ~5 percent up to 10 percent, and continued to increase, reaching 30 percent about 5,000 cal yr BP (West 1982). In the last 1,000 years, oak pollen decreased to about 15 percent at this site. Pine, which was abundant at 8,000 yr BP (more than 80 percent), decreased to 50 percent by 7,000 cal yr BP and remained at that level for the rest of the record. The increase in percent oak (primarily blue oak) at Clear Lake occurred earlier (Adam et al. 1981). Oak pollen represented 20 percent of the pollen sum at about 12,000 cal yr BP and increased to 40 percent by 9,500 cal yr BP. Maximum values (~50 percent) occurred between 6,000 and 3,500 cal yr BP, with a gradual decrease in abundance to 40 percent at the present.

The Central Valley Record

The only Holocene pollen record from the San Joaquin Valley is the Tulare Lake record (Davis 1999). The pollen assemblage between 10,100–8,500 cal yr BP is similar to that of the Pleistocene, suggesting that the climate did not support a shift to oak woodland. Beginning at 8,500 cal yr BP, oak woodland replaced pinyon-juniper woodland and sagebrush. Oak pollen increased from less than 5 percent to 25 percent (Figure 5), and the other types decreased. Throughout the Holocene at this site, the abundance of oak was associated with a high water table. Other than along riparian corridors, oaks are generally not present on the floor of the Central Valley (Griffin and Critchfield 1976). The extension of oak savanna onto the flat valley floor of the Central Valley is unique to the Tulare Lake Basin and most likely persists because of high ground-water levels under the alluvial fans of the Sierra Nevada (Preston 1981). Average annual precipitation for the period 1878–1978 recorded in the nearby town of Visalia is 255 mm, well below the average required for valley oak, supporting the assertion that oak woodlands in the region are largely supported by high groundwater levels.

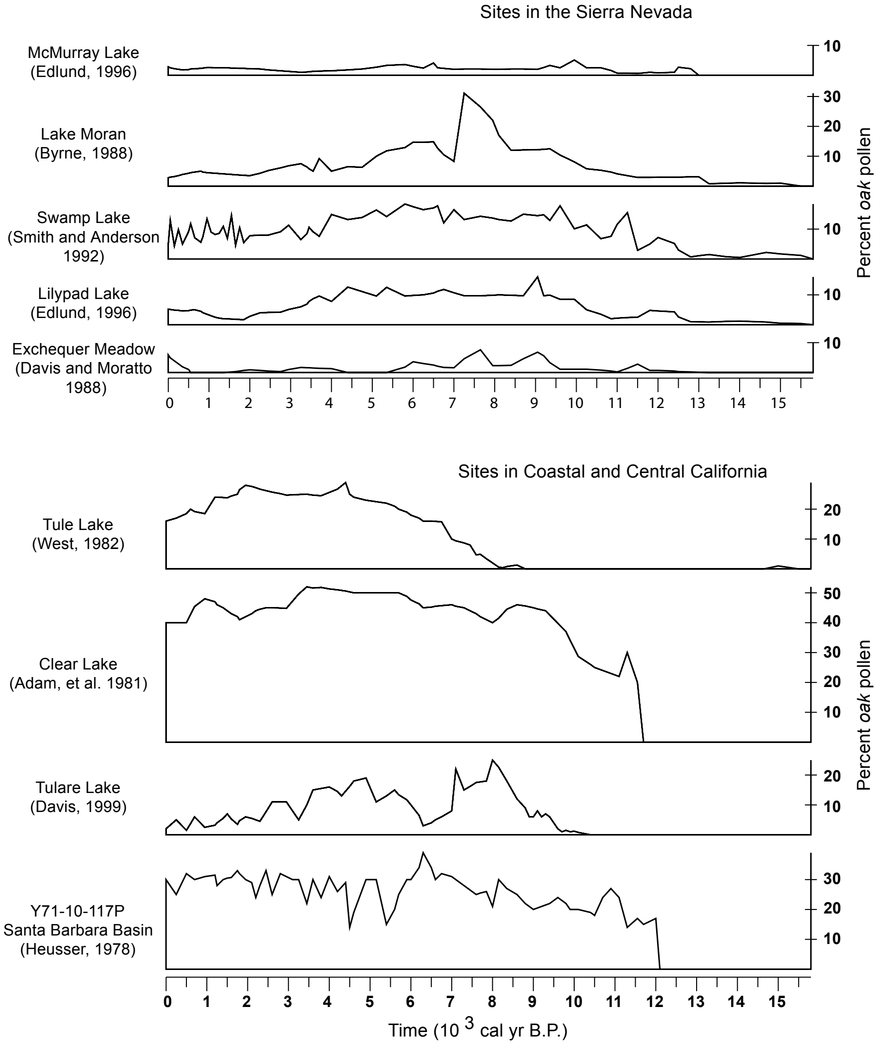


Figure 5. Holocene age pollen diagrams for sites in California recording oak. Records vary in length. Note that each of the time series is based on independent age models. Pollen data from Smith and Anderson (1992) and Davis and Moratto (1988) obtained from the North American Pollen Database. All other data were digitized from published pollen diagrams.

Oaks remained abundant at this site until 7,000 cal yr BP when lake levels dropped, lowering the water table, and oaks abruptly declined. Increased concentrations of charcoal in the sediments indicate an increase of fire after 7,000 cal yr BP (Davis 1999). These fires are likely associated with the drier climate; however, this area was occupied from an early date and may be associated with human activity. Lake levels remained low between 7,000–4,000 cal yr BP; however, by 5,500 cal yr BP, oak pollen increased to ~15 percent and remained high until ca 3,500 cal yr BP, when lake levels were once again high. In the last 3,000 years, the climate of the San Joaquin Valley has remained dry, and oaks have declined in importance as saltbush species have increased (Davis 1999). The evidence suggests that recent climate changes have influenced oak woodland distribution patterns, such that oaks were probably more widespread in the San Joaquin Valley 3,000 years ago.

A peculiar hybrid, *Q. munzii*, a cross between valley oak and desert scrub oak (*Q turbinella* ssp. *Californica*) identified in Joshua Tree National Park, 200 km east of the modern range of valley oak, suggests that this species may have extended its range at some point in the last 150–175 years. Human transport is also possible, although the local Indians were not known for utilizing acorns (Tucker 1968). The migration most likely would have occurred after the warm, dry, mid-Holocene, during a time when cooler climates allowed dispersal along a corridor following the San Gabriel and San Bernardino mountains. However, no evidence supports the existence of former valley oak woodland connecting this disjunct hybrid with extant populations, and the origin of this unusual tree remains a conundrum.

The South Coast Range record

Along the coast of southern California, oaks were largely absent from the Santa Barbara region at 15,000 ^{14}C yr BP (0–3 percent pollen) (Heusser 1995) but increased rapidly after that date to about 25 percent of the total pollen sum. Following the initial rapid expansion, oak populations increased slowly, reaching 30 percent of the pollen sum by about 8,000 cal yr BP (Heusser 1978). Pine pollen was also high between 15,000–8,000 cal yr BP (20–30 percent), suggesting that a mixed pine oak woodland grew along the coast. However, after 8,000 cal yr BP, pine decreased and oaks increased, marking a shift from a mixed forest to a coast live oak woodland. Coast live oak has persisted throughout the Holocene as the dominant oak woodland species in coastal California.

Pollen evidence from Zaca Lake (730 m), 50 km northwest of Santa Barbara, located at the transition zone between oak woodland (dominated by coast live oak) and pine forest (dominated by ponderosa pine, coulter pine (*P. coulteri*), and gray pine (*P. sabiniana*), confirms that oak woodland has dominated the low-elevation coastal mountains in the region since at least 2,500 cal yr BP (Mensing 1998).

The Sierra Nevada Record

The majority of higher elevation Holocene paleoecologic studies come from lakes on the western slopes of the central and southern Sierra Nevada between 1,500 and 2,000 m elevation (Figure 5). These sites have been characterized as lower montane forest (Rundel et al. 1988), including black oak, white fir, ponderosa pine, jeffrey pine, and incense cedar. Black oak rarely forms oak woodlands and most commonly occurs today as a minor component of coniferous forests below 2,000 m elevation, but it has played a major role as a food plant for native Californians and is important to review for that reason.

Studies conducted near the modern-day upper-elevation limit of black oak provide a consistent story of vegetation change (Edlund 1996; Smith and Anderson 1992; Davis and Moratto 1988; Mackey and Sullivan 1986). Late Pleistocene records from these sites are dominated by juniper and/or incense cedar, sagebrush, and pine pollen, with oak pollen consistently less than 5 percent, suggesting an open landscape with a cooler, drier climate than today. Beginning about 10,000 cal yr BP, oak pollen began to increase, reaching maximum values of 20–30 percent between 7,000–6,000 cal yr BP After 6,000 cal yr BP, oak declined and was generally replaced by fir, with oak pollen percentages averaging only 3–10 percent (Edlund 1996; Smith and Anderson 1992).

These authors interpret these data to represent a dry early Holocene, with oaks migrating upslope and becoming more abundant within the montane forest. The forest also became more open, probably having the appearance of a pine-oak parkland with abundant black oak scattered among ponderosa pine. Charcoal accumulations indicate that fires were increasingly important during this period, with more frequent and possibly larger fires (Edlund 1996). Both warmer climate and increased fire activity would maintain forest openings that favor black oak. In the presence of frequent burning, black oak increase in importance relative to pines (Reynolds 1959).

The increase in fires was probably a result of the change in climate, with hotter, drier summers providing conditions suitable for burning. Although humans reached California by ~11,000 years ago and are known to have actively burned the landscape to manipulate vegetation (Lewis 1973; Blackburn and Anderson 1993), it is unlikely that they were responsible for the vegetation changes seen between 10,000 and 6,000 cal yr BP. Native populations probably were still quite low, and there is no clear evidence that they were relying on acorns as a major food crop at this early date. In addition, after 6,000 cal yr BP, conifers—including firs, pines, and incense cedar—again increased, suggesting a return to a cooler, wetter climate (Edlund 1996; Smith and Anderson 1992). Oaks remained a minor component in the montane forests of the Sierra Nevada until the late Holocene, when evidence suggests that burning by native Californians once again favored an increase in oak woodlands at the expense of conifers (Anderson and Carpenter 1991).

Conclusion

The oak species that now dominate California's landscape evolved under a radically different climate than the Mediterranean climate of today. Oaks grew alongside a mix of deciduous broadleaf trees now restricted in distribution to eastern North America and Asia characterized by summer rainfall. As global climate cooled and became increasingly arid, eastern deciduous varieties became locally extinct. Oaks became restricted to California about 5 million years ago as the rainshadow of the Sierra Nevada and Cascade Range intensified. Over the last 2 million years, oak woodlands in California have come and gone regularly with glacial cycles. During periods of glacial maxima, cool, wet climate has favored coniferous forest and oaks have nearly disappeared, isolated as small populations hanging on as refugia in pockets with suitable microclimates. During brief interglacials, oak populations have exploded, forming near monoclimax stands that dominate the Coast Ranges and Sierra Nevada foothills. Within the last 10,000 years, oak woodland populations have changed in response to climatic shifts. However, these changes are modest in comparison with the changes following the last glacial maximum. Human impacts on oak woodlands probably have been significant only within the last few thousand years, after Native Californians began utilizing acorns as a major food source. Part II of this article will review the history of California oak woodlands as they were influenced first by Native Californians, and then by the Spanish, Mexican, and American populations.

Acknowledgments

I am thankful to Howard Schorn, who played a critical role in providing me with an up-to-date chronology of the fossil flora data and for helping guide me through examination of the fossil material. Howard helped correct many errors and omissions from the original manuscript, and any errors that remain are mine alone. I am also grateful to Diane Erwin, of the University of California Museum of Paleontology, for allowing me access to the collection, and to Barbara Holzman and an anonymous reader for their reviews. Inspiration to write this review came from conversations with Richard Joffre. Pollen data were obtained from the North American Pollen database.

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Land-Use Change and Preservation in Fresno's Armenian Town, 1916–2005

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Abstract

Fresno, California, has seen many changes over the past 100 years. Urban sprawl and suburbanization have resulted in a city of polarities. While the northern areas flourish with new residential and commercial development, the downtown languishes. One of the city's greatest strengths lies in its diversity. Within a ten-square-block downtown area, one can find at least five distinct ethnic neighborhoods. Armenians have been present in Fresno since the early 1900s, flourishing during the several decades that followed but subsequently leaving the area. This paper discusses land-use change and preservation in the Armenian Town district of Fresno, by analyzing Sanborn maps in 1916 and 1950, current photographs, and personal observations. Unveiled is an increasingly changing area, from predominately residential, to commercial, to blight, to possible urban revival.

Fresno, California, has seen many changes over the past 100 years. The downtown alone has changed from a thriving Victorian business and residential district to a cutting-edge shopping Mecca, and recently to an area of blight and decline. Urban sprawl and suburbanization have resulted in a city of polarities. While the northern areas flourish with new residential and commercial development, the downtown languishes. City planners, however, are optimistic about the future of Fresno's downtown. One of the city's greatest strengths lies in its diversity. Within a ten-square-block area, one can find at least five distinct ethnic neighborhoods. Among the many ethnic groups that have chosen Fresno as home over the past century, the Armenians remain prominent in the area. This paper details land-use change in the Armenian Town district of Fresno by discussing Sanborn maps from 1916 and 1950, current photographs, and personal observations. The future of Armenian Town is then discussed as the forefront of the city's redevelopment goals.

Early Geographical History

Present-day Armenia comprises only a small part of historical Armenia. The frontiers of the original Armenia at times reached from the Black Sea to portions of the Mediterranean Sea. The origins of the Armenian people are disputed. According to many studies and oral histories, the ancestor of the nation was a man named Hayk, who is reputed to be a direct descendant of Noah. It is said that Noah established the nation of Hayastan, the Armenian word for "the country of Hyes" (Armenians), on the Ararat plateau (Hayastan 2005). This land is said to be part of the "cradle of civilization." According to the Old Testament, Noah's Ark landed on the top of Mt. Ararat following the Great Flood and is said to be one of the oldest artifacts in Armenia. A piece of wood believed to be from Noah's ark is safeguarded in the Etchmiadzin Museum, in present-day Armenia.

The Armenians first appear in historical texts approximately eighth-century B.C. The greatest glory for independent Armenia was during the reign of Tigranes the Great, from the Arsacid Dynasty period of 95 to 55 B.C. The kingdom covered land from the Caspian Sea to the Mediterranean and from the Black Sea to the location of present-day Syria (Bournaoutian 2003). This region is the largest territory Armenia ever occupied.

Rule over Armenian land followed with a dynasty of Parthian origin between 53 B.C. and 430 C.E. The two most conspicuous events of this period are the conversion to Christianity of King Tiridates III by St. Gregory the Illuminator (301 C.E.) and the invention of the Armenian alphabet by Mesrop Mashtots in the late fourth to early fifth century (Hayastan 2005). In 885 C.E., Prince Ashot Bagratuni was crowned King of Armenia by the Caliph and the Emperor of Byzantium (Bournaoutian 2005). One of his successors, Ashot III, founded the city of Ani and made it the capital of his kingdom. The "Golden Age of Armenia" lasted from 952 until 1064 C.E., when Ani was completely destroyed by the Turanians. The spectacular ruins of the city are in Turkish territory today, a short distance from the Armenia border.

Faced with constant massacres, Bagratid Prince Ruben led the Armenians to Cilicia, when in 1080 they founded a new state, Lesser Armenia, whose fate was linked to the Crusades. In 1342, the Armenia dynasty became extinct through lack of heir and the fall of Cilica to the Moseems.

Greater Armenia, devastated by invasions, was conquered by the Turanians after Ani fell in 1064. Later, the Mongols invaded in the 13th century, the Turks in the 15th century, and the Persians thereafter. Russia conquered the eastern provinces of Armenia in the early part of the twentieth century, when this ancient land became part of the Soviet Union.

The Migration of Armenian People

The nineteenth century saw the birth of Armenian nationalism, but the promises of autonomy and a constitution with influences from the Western and Russian powers put the Ottoman rulers under pressure. Conflicts over tax extortion and double taxing of agrarian communities led to massacres in Armenian villages. Many Armenians fled to nearby mountains for refuge, but as the killings continued, many more left the country. The United States was the destination of choice during this first mass migration (see Table 1). Many of these first American Armenians settled in New York and Massachusetts, seeking industrial opportunities, and these states today still contain large Armenian ethnic enclaves (Deranian 1998; Armenian Historical Society 1937).

Table 1: Distribution of Armenians in the United States by States, 1900–1930.

State	1900	1910	1920	1930
California	649	4,441	10,112	12,379
Connecticut	226	1,263	1,728	1,458
Illinois	286	1,556	2,210	na
Massachusetts	2,896	8,307	13,204	14,035
New Jersey	636	1,942	3,519	na
New York	1,915	4,006	7,054	na
Pennsylvania	551	1,402	3,548	na
Rhode Island	284	2,902	2,950	3,591

Source: Mahakian, C. 1932, *History of Armenians in California*.

The events of World War I led to a second wave of Armenian migration. From the spring through fall of 1915, massacres and deportations were carried out in a deliberate and systematic way in all sectors of the Ottoman Empire. Many scholars estimate that in 1915 alone, one million Armenians died (Balakian 2003). It is estimated that 80,000 Armenians immigrated to the United States during this time, many once again settling in the Northeast to work in factories. Many, however, later became dissatisfied with Atlantic coast opportunities and like many Americans, headed west to California.

The Beginnings of Armenian Town: 1916

Approximately half of all Armenians living in the United States today reside in California (Vartanian 2002). The majority of Armenians who fled from the Armenian genocide between the years 1915 and 1923 migrated to the vicinity of Fresno and Los Angeles by 1930 (Bulbulian 2001; Patterson 1999) (see Table 2). Much of the data available regarding historical land-use in the Fresno area comes from Sanborn maps, which provide a wealth of information for geographers. Sanborn maps were drawn for fire insurance purposes in early London, thus they are also referred to as Sanborn Fire Insurance maps. Collections include a uniform series of large-scale maps dating from as early as 1867 to the present. Since they were used to inform insurance companies of fire risk, each map shows the size, shape, and construction of houses, commercial buildings, and factories. Some are so detailed that they also include widths and names of streets, property boundaries, building use, and house and block numbers. Sanborn maps thus give geographers an excellent sense of land-use in American cities. The Sanborn maps reproduced in this manuscript were taken from the collections of California Historical Archives of the Fresno County Public Library System.

Table 2: Distribution of Armenians in California Counties, 1930.

County	Number of Armenians
Alameda	542
Fresno	4,389
Imperial	38
Kings	122
Los Angeles	4,768
Sacramento	270
San Francisco	928
San Joaquin	51
San Mateo	56
Santa Clara	42
Solano	84
Stanislaus	104
Tulare	704
All others	281

Source: Mahakian, C. 1932, History of Armenians in California.

During the first few decades of the twentieth century, most of the Fresno-area Armenians found residence west of the Southern Pacific Railroad tracks, near the 300 blocks of G and F Streets (Figure 1). Early Armenian settlers who arrived in Fresno prior to the genocide moved northward across the railroad tracks around 1914 after the reconstruction and relocation of Holy Trinity Armenian Apostolic Church to the corner of Ventura Avenue and M Street. This area eventually became known as "Armenian Town." Although "Armenian Town" consisted of a greater area, the central portion of this ethnically thriving community was within the borders of Ventura

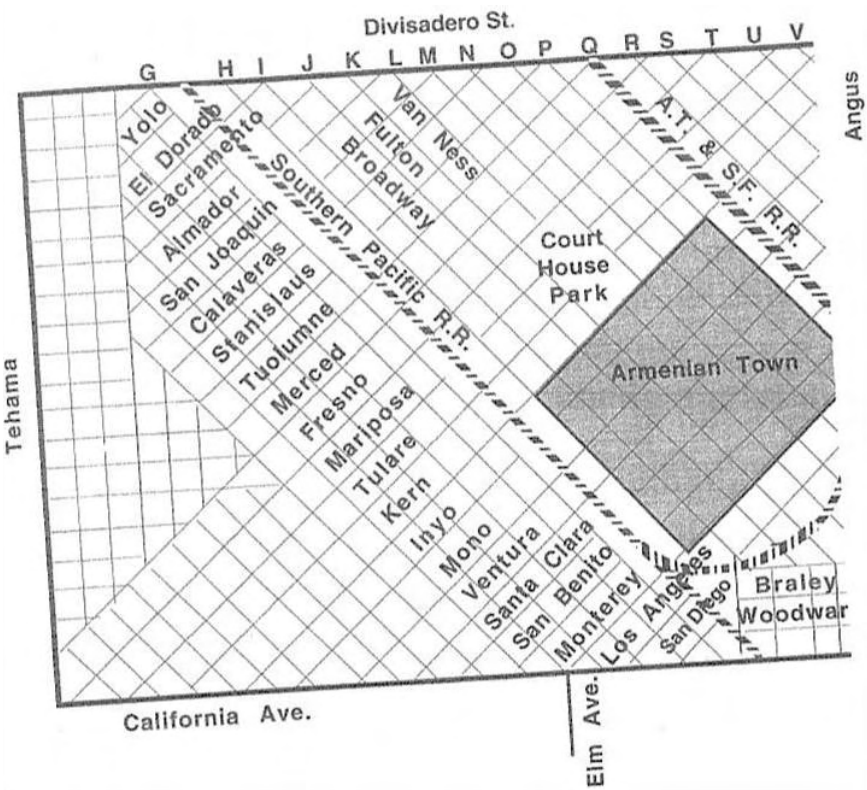

Figure 1. Bulbulian's map of downtown Fresno including "Armenian Town."

Avenue to San Benito and Van Ness (previously K Street) to N Street (Figure 1).

In 1916, the major feature of Armenian Town was the Holy Trinity Armenian Apostolic Church. This church was the first built in the traditional Armenian style in the United States as well the first designed by an Armenian architect (National Register of Historic Places 1997). The church was formally established on the corner of F and Monterey Streets in 1900. Due to an unfortunate fire in 1913, the church and adjoining hall burned to the ground. Touted as proud descendents of the first Christian nation, the Armenian community joined together to rebuild a more beautiful and larger church. On January 9, 1914, the first stone of the church was laid, and the church was completed on December 13 of the same year, at its present location on the corner of M Street and Ventura Avenue (Figure 2; Bulbulian 2001). This church today remains one of the focal points of the community.

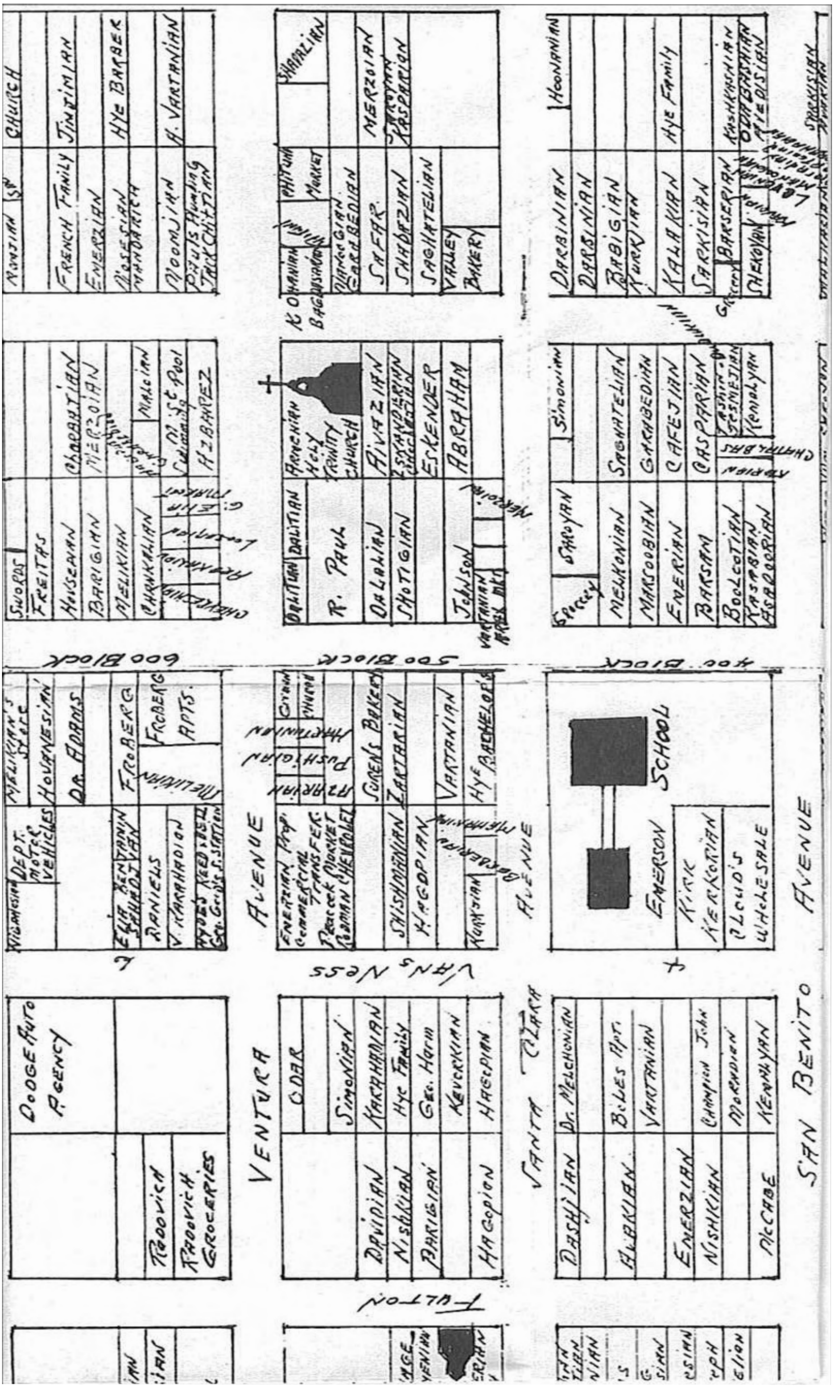

Figure 2. Armenian Town as remembered by Elish Shekoyan 1915–1939.

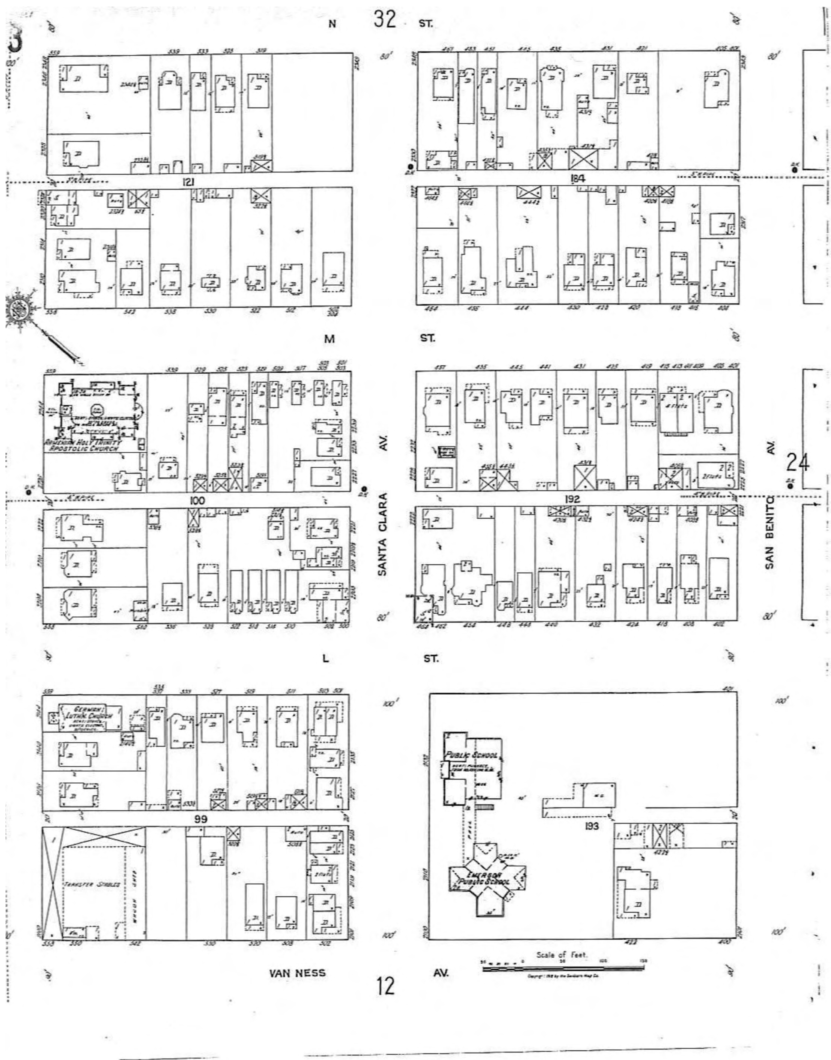

Figure 3. 1916 Sanborn map.

Another prominent landmark in the area was the Emerson Public School (Figure 3). This school catered to the surrounding Armenian community. Encompassing the entire northern portion of the block between Van Ness Avenue and L Street and San Benito and Santa Clara, the Emerson Public School was the location that many remember as the hub of neighborhood activity. The German Lutheran Church located at the corner of Ventura Avenue and L Street served a second group of immigrants around and within the boundaries of Armenian Town.

Armenian Town at this time was primarily occupied by residential homes with little commercial development. Arax Market was one of the few commercial buildings, located at the corner of L and Santa Clara Streets (Figure 4). Arax Market was considered a "general store." It was a family-owned business that remains today in its original location but is no longer in use.

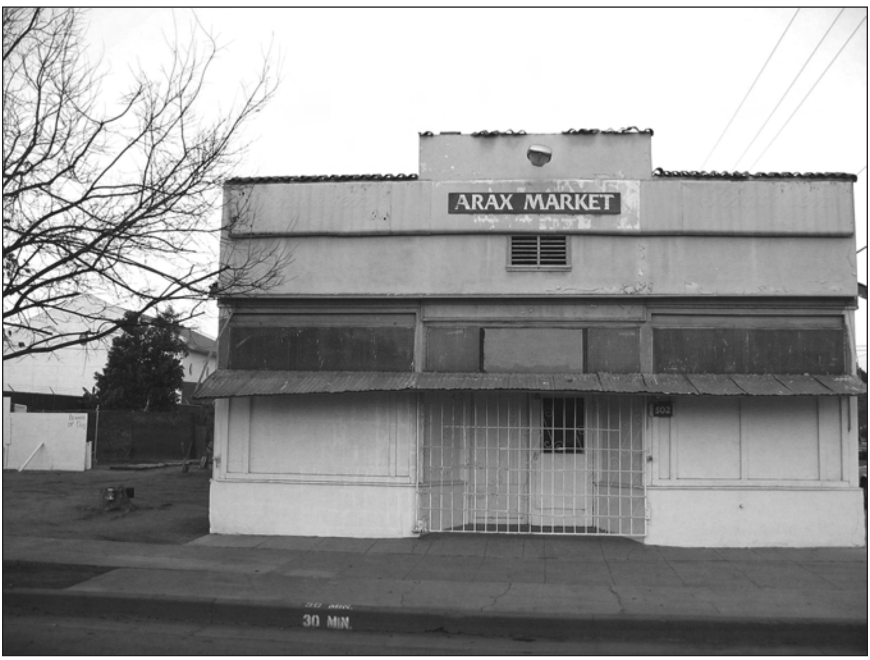

Figure 4. Arax Market (market established prior to 1915).

The original sidewalks were quite wide, for a residential area, at approximately six feet in width, signifying heavy pedestrian traffic. The street width ranged from 80 to 100 feet. The 2100 block of Santa Clara had the widest streets and was perhaps the "main" street of the neighborhood at that time.

The Later Decades: Armenian Town from the 1950s to the Present

Significant changes were made to the area in the 1950s (Figure 5). The German Lutheran Church was no longer in existence, replaced by The Fresno Café at 2146 Ventura Avenue, Saghatelian Bond and Trust at 2144 Ventura Avenue, and Marcus Bail Bonds at 2142 Ventura Avenue. Many ethnic groups had moved in and out of this area, and since it had become predominately Armenian by this time, the German population was no longer large enough to support a church of that size.

Another significant change in urban landscape was the removal of a portion of the Emerson Public School, located on the eastern corner of the block. The Ventura Avenue facade, between M Street and N Street, had changed in appearance as well. The previous location of dwellings was now home to many different businesses. These stores consisted of a barbershop, a grocery store, and a restaurant. The downtown area was becoming increasingly commercial and less residential.

The major landmark on the 1950 map was the establishment of the Valley Bakery on the corner of M Street and Santa Clara, in 1922. This bakery, established by the Saghatelian family, was first built to cater to the needs of the immediate community (Seacrest 1993). Valley Bakery became known for an Armenian and Middle Eastern bubbly, thin, cracker bread called Lavash. This was a staple in all the Armenian families' diets. The bakery today is noted for its historical presence and lifelong dedication, which has expanded to include a wider community over the years (Figure 6).

In the next half-decade, Armenian Town and its surrounding area experienced its most dramatic changes. The dwellings that had lined the streets on the 1916 and 1950 Sanborn maps no longer existed, and many Armenians, now financially and socially successful, had moved to other areas of the city (National Register of Historic Places 1997). The only homes that remained were those at the corner of N Street and Santa Clara, which are now Fresno landmarks.

At 461 N Street, the Hoonanian home remains in its original location since the time of its construction in 1900. This was one of the only homes in this area to have historic Queen Anne architectural detailing. The owner thus requested that the home be registered as an historic landmark. The request was approved due to its unique

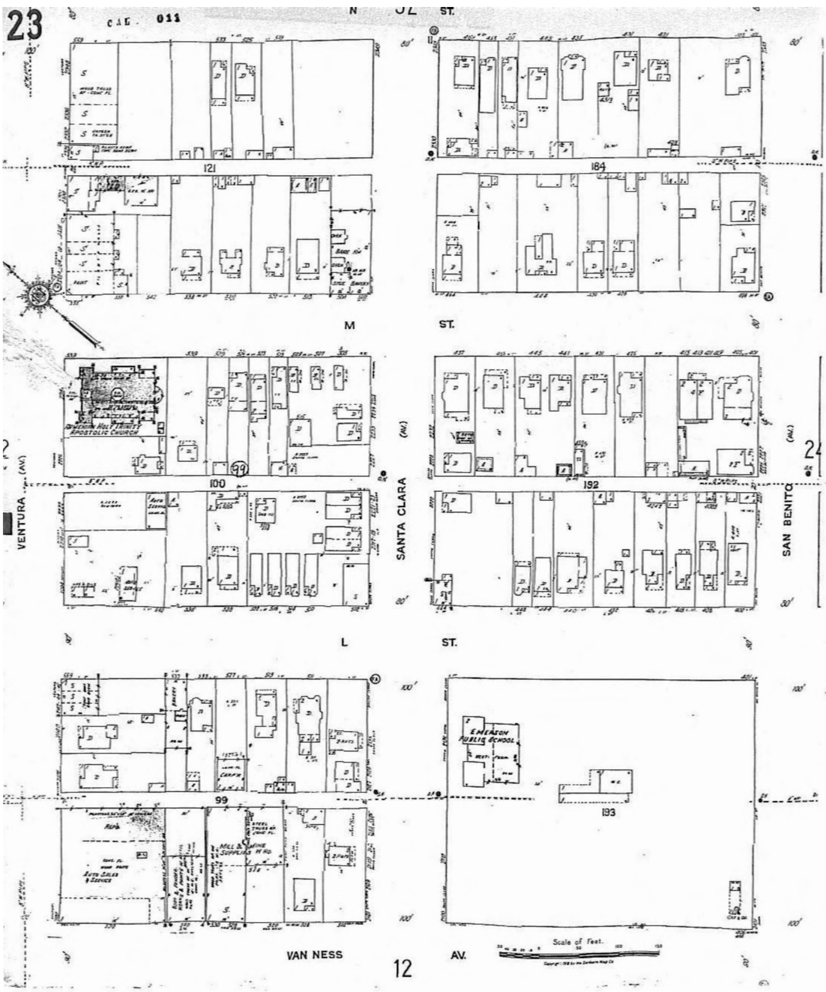

Figure 5. 1950 Sanborn map.

Figure 6. Valley Bakery (established 1992).

design, superior condition for its age, and the significance for Armenian culture in the area.

Neighboring the Hoonanian residence is the Schmidt-Terzian home, also a local historic site. This home shows evidence of the early German influence in the area, with an outdoor or "summer" kitchen. Built and first occupied by Germans (Schmidt) and then later by Armenians (Terzian), it was purchased by the city of Fresno in 2002 and now stands as a remnant of both cultures. The other dwellings that remain are duplexes on the 2200 block of Santa Clara. These homes have been in existence since the 1950 Sanborn map (Figure 7).

Figure 7. Hoononian House, 461 N Street (Fresno Historic Site).

Several auto body shops and automotive dealers exist in the area. Haron's Jaguar at the corner of L Street and Ventura Avenue became a part of the neighborhood in 1952. In addition, there is an automotive sales lot on the corner of Van Ness and Ventura Avenue, which has changed ownership many times. Yet another auto body shop is located in the middle of L Street just north of Santa Clara (Figure 8). Agglomeration of businesses such as these is not uncommon in an urban setting.

The Holy Trinity Armenian Apostolic Church has expanded its property boundaries over the past fifty years. In 1958 and 1959, the church expansion included a social hall. This provided a place for people to gather following the church services. An additional larger hall was connected and was often used for receptions and annual banquets. Continuing to add to the property, the church built a gymnasium and Sunday school in 2002 and 2003. This is now where you can find the church basketball team practicing throughout the week (Figure 9).

The Armenian Community Center and Asbaraz Club (formerly known as the Armenian Patriotic Club) now stands on the corner of N Street and Ventura Avenue (Figure 10). These establishments took over storefronts in the early 1980s, when they moved from the corner of M Street and Ventura Avenue, where the Radisson Hotel is currently located. Here, the community center provides an atmosphere for local Armenians to gather. Patrons are mostly older Armenian men who commonly can be found talking over homemade Shish Kebab and pilaf. The men who gather here come for entertainment as well. They play cards and the traditional game of backgammon, while socializing and reminiscing.

The only city building in the area is the Fire Headquarters, established in 1956, on the corner of M Street and Santa Clara. This was originally a local fire station, but changed in recent years due to its prime downtown location. The building encompasses all the property from Santa Clara south to the freeway. Hye Quality Bakery, also on Santa Clara, has been in its present location since 1978. The locally owned Armenian bakery serves the local delicatessen and supermarkets with traditional Armenian-style breads and pastries.

The oldest building that remains is the previously mentioned Arax market. Although the Arax market is no longer in business, you can occasionally find the owner, Harry Kaloustian, sitting inside playing backgammon with friends.

There have been significant changes to the streets and sidewalks since the removal of most of the dwellings. Today an average side-

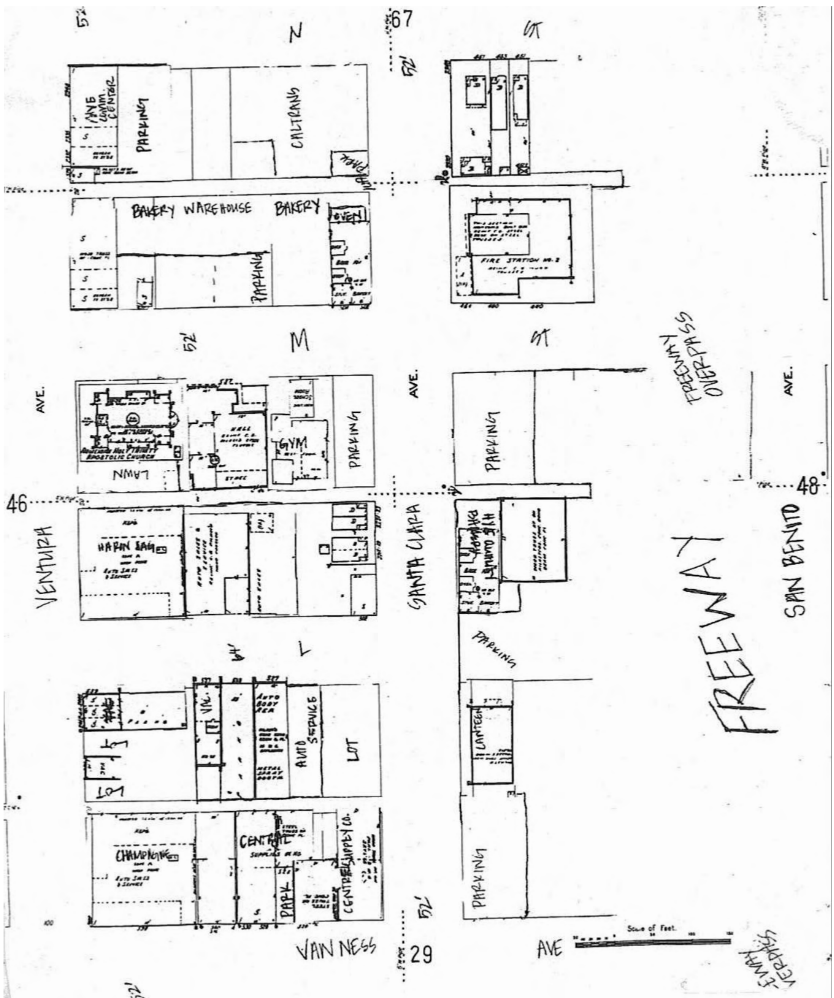

Figure 8. 2004 map (author creation).

Figure 9. Holy Trinity Armenian Apostolic Church (established 1900, re-established at M Street and Ventura 1914).

Figure 10. Asbarez Club and Armenian Community Center (moved 1980–82).

walk along a commercial street is fourteen feet in width (including planting strip). At the major intersections, the sidewalk-to-building distance is twenty-one feet. The street widths have also been altered. Today the widest street is L Street, between Santa Clara and Ventura, at sixty-four feet, eleven more than the others in the six-block radius. The most significant change to the area was the construction of Freeway 41 in the late 1970s and early 1980s, which has eliminated much of the southern portion of this study area. This area now cuts through Armenia Town, closely parallel to San Benito. Today, there are few remnants of this street, as one passes over it when going under the freeway overpass. Freeway 41 is the path to the north and thus contributes to the downtown's decline as many people simply pass by downtown on their way to newer development. Fresno, like many other American cities, has fallen into the urban-growth dichotomy where "instead of gracious boulevards, avenues and shopping streets, America's urban areas are crossed by arterials and collectors that move traffic, but have no power to move men's souls" (Institute of Transportation Studies 2001:2). The neighborhood has clearly changed from predominantly residential to predominantly commercial.

Although there are many Armenian landmarks in the area, the presence of the Armenian people has significantly declined. Armenia Town, in theory, still exists and has become part of Fresno's re-beautification project for the downtown area. The proposed city project, "Vision 2010," includes adding a designated Armenian district between M and O Streets, just north of Freeway 41. It is planned to include an Armenian Cultural Center, retail shops and restaurants, office buildings, a pedestrian plaza, and the Fifth District Court of Appeals. This proposal has been upheld and there is discussion of ground breaking in the near future. The remaining area of study has no proposed changes by the city. Businesses such as Haron's Jaguar, the Valley Bakery, and Hye Quality Bakery are doing quite well and currently have no desire to relocate their businesses (Figure 11). However, there is discussion of Haron's Jaguar moving north to relocate near the newly developed luxury-car dealerships, such as Mercedes and BMW.

Preserving Armenian Town

There are currently four Armenian Town sites designated as historical sites by the City of Fresno: the Valley Lavosh Baking Company (1921), the Schmidt Home (1908), the Hoonanian Home (1900), and

Figure 11. Haron's Jaguar (established 1952).

the Holy Trinity Armenian Apostolic Church (1914). The primary intent of the Historic Preservation Ordinance is to continue to preserve and improve the historic resources of Fresno for educational, cultural, and economic benefit, and to protect these resources and districts that have a distinctive character or special historic, architectural, aesthetic, and cultural value for the city, state, and nation (Historic Preservation Ordinance 13-400).

With continued development in the area, it has become increasingly difficult to preserve Armenian Town. Although a district has been designated as part of "Vision 2010," it is not without controversy. The Armenian Cultural Foundation Building is at the heart of the issue. This building, which is proposed to sit on the corner of M and Ventura streets (Figures 5 and 8), is wanted by both the city and the residents of Armenian Town. This area once was the center of news and politics for Armenian Town, so its prime location and historical significance have raised interest among four primary groups: The Armenian Museum Group, The Armenian Technology Group, The Armenian Cultural Foundation, and The Historical Society of Fresno. Their interests are as follows:

1. **The Armenian Museum Group (part of Friends of Fresno):** This group desires ownership rights of the area and would like to build a museum at the same location. It is argued by opposing groups that their intent has little to do with the Armenian Cultural Foundation (ACF) and Armenian culture.

2. **The Armenian Technology Group (ATG):** This group desires ownership to the same location in order to build a 10,000 sq. ft. art center. They originally wanted to build adjacent to the ACF building, but there was not enough land available. It is reported that they were offered one story of the AFC building, but the offer has not been accepted to date.

3. **The Armenian Cultural Foundation:** This group is reputed to hold legal ownership of this area. They desire full rights to the AFC building, as they state were promised by the Vision 2010 project developers. They want to construct a 30,000 sq. ft. building that will house offices for such organizations as the Armenian National Committee, the Armenian Relief Society, and the Armenian Youth Federation. Space for business rentals and a social hall are also envisioned.

4. **The Historical Society of Fresno:** The Historical Society is currently preserving five homes within Armenian Town and would like to move them to the AFC building location. This debate is currently in litigation with the ACF (Mugrdechian 2005).

Much of the controversy arises from the fact that Armenian Town is an ethnic community. Ethnic neighborhoods are voluntary communities where people of like origin reside by choice, showing a desire to maintain group cohesiveness. Ethnic groups tend to act as keepers of distinctive cultural traditions. The neighborhood is often the focal point of various kinds of social interactions; it provides a group identity, friendships, marriage partners, a recreational outlet, business successes, and a political powerbase (Hardwick 1979; Rau 1992). Survival from one generation to the next is guaranteed, since most land is inherited and/or the sale of land is typically confined within the ethnic group. Small group sizes, however, can make populations more susceptible to acculturation and assimilation. Urban ethnic neighborhoods also tend to be transitory. Central-city ethnic neighborhoods experience a "life cycle," where one group is replaced by a later-arriving one. Suspicion, friction, and distrust therefore often arise in the face of change (Conzen 1993; Jordan-Bychkov 2002).

Because of the complexity of factors involved, it is estimated that groundbreaking in the area will not begin for several years.

Conclusion

Early in the history of Armenian town, the residents lived within close proximity to each other and it was a community in which everyone knew each other. The boundary of the neighborhood extended far past the current boundaries of today. As residents grew older and walking became difficult, many would sit on their front porches and listen to the church bells. Some would wait to see who went to church, in hopes of someone bringing them "mahs" or blessed bread. Streets at this time were primarily for pedestrians, and automobiles were not very common. Children were often seen playing together in the streets or on the Emerson School grounds.

The establishment of the community was grounded in hard labor. The demographics consisted primarily of established entrepreneurs and new immigrants. Farmers of the outlying areas would make weekly trips to town to purchase groceries that they did not grow on their lands. Once residents were established and became financially stable, many began to move to more northern neighborhoods of Fresno. Today, Armenians are dispersed throughout Fresno, some still prospering with local farms. Many have continued with the trade their family brought over when they immigrated, such as jewelers, restaurant owners, and craftsmen.

At present, the area appears abandoned most of the day. The neighborhood's population is much smaller, consisting primarily of older residents of Hispanic and African-American descent. Most pedestrian traffic is limited to Sundays or days of special events. As 11:00 a.m. on Sunday draws near, the parking lots and surrounding streets fill with cars, only to become abandoned once again by early afternoon. The Armenian bakeries maintain a healthy business and are not only patronized by downtown workers on lunch break, but also by valley residents—Armenians and others who wish to do their weekly shopping. Today, the only Armenian residents who gather together are the patrons of the family-owned restaurant in the Asbaraz Club. There one can find older gentlemen eating, smoking cigars, and playing cards and backgammon together. The residential dwellings have been removed, leaving either vacant lots or retail establishments. The commercial businesses cater primarily to the local residents and rely on exports for the bulk of their income.

Many consider Armenian Town part of Fresno's history, but to some it is also a part of their family history. Upon closer inspection, one can discover that people not only lived in this area, they were the heart of this area. The stories of the area hold fond memories for past, present, and future generations. The cultural landscape tells the story and the next chapter is ready to unfold. The direction that chapter will take depends upon the outcomes of variables outlined above. Historical, cultural, and urban geographies all play a significant role in the rebuilding and preservation of one of Fresno's oldest neighborhoods.

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Geographic Education

The State of Geography and Its Cognate Disciplines in the California State Universities

from Fall 1992 through Fall 2004

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Introduction

The purpose of this article is to assess the condition of geography enrollments in the California State University (CSU) system from fall 1992 through fall 2004 in comparison with cognate disciplines. The timeframe chosen reflects the availability of data on the CSU Chancellor's Office Web site, "Statistical Reports: CSU Student Enrollment in Degree Programs," available at http://www.calstate.edu/as/stat_reports/degree.shtml. After providing background about the state of geography and its cognate disciplines nationally, this paper reviews the situation of CSU undergraduate enrollments in geography in the study period and then compares geography with the cognate disciplines of geology, environmental studies and science, anthropology, and area studies/international studies/global studies. Consideration of graduate enrollments in these disciplines follows. After presentation of the data is a summary of informal e-mail discussions among the CSU geography chairs during March 2005 and among all interested geographers attending a special session at the California Geographical Society meeting in Yosemite during late April. A closer case study of CSU Long Beach will be examined in more detail, using data on ethnicity by major by year provided by the campus Office of Institutional Research. A few suggestions for increasing geography enrollments are presented as a result of these data and discussions.

National Background

Data on enrollment trends are available for the three traditional disciplines of geography, geology, and anthropology. I was unable to find comparable data on the newer interdisciplinary fields of environmental studies/science/systems or for area/international/global studies.

The enrollment health of geography has varied markedly over the past few decades in the United States. Bachelor degrees experienced explosive growth from 1960, when fewer than 1,000 were granted, to a peak of more than 4,000 in the early 1970s (Hardwick 2001) as the Baby Boom hit the academy. The downturn in the national economy following on the oil shocks, however, began to strangle budgets for institutions of higher learning, as geography and many other departments entered a decade or more of few to no tenure-track hires. Bachelor degrees in geography, for example, began a long slide until the late 1980s, declining about 25 percent to around 3,000 degrees annually, as the Baby Boom passed through school and as departments hunkered down for hard times with an aging faculty mix. Enrollments in geography began to pick up in 1988, reaching a peak comparable to the early 1970s (around 4,000 degrees) in the early to mid 1990s. Speculatively, perhaps society began to appreciate the power of GIS and other forms of geographical analysis and seek graduates trained in them. This time also saw the resumption of hiring in geography departments as the faculty hired in the 1960s to educate the Baby Boom began to retire, producing an influx of energetic younger faculty. Even so, however, enrollments nationally began to sag again after about the mid 1990s, reaching around 3,500 degrees annually at the turn of the millennium. Master's degrees followed a very similar trajectory, rising from about 200 in 1960–61 to about 800 by 1972–73 and dropping more than 30 percent, to roughly 550, in 1988–89. As with bachelor's degrees, master's degrees increased to about 800 in 1994–95 and, again, dropped to some 650 in 1999–2000 (Hardwick 2001). Doctoral degrees show a similar bimodal distribution in time, but the second peak of little more than 150 around the mid 1990s is only about two-thirds of its early 1970s peak of about 225 (Hardwick 2001).

Nationally, the various geological sciences followed the same general 1960s rise in degrees granted that geography did, with a trough hitting by the late 1980s, followed by a peak in the early 1990s and then a decline until 2000. Trends in geology parallel those in geography, though with a lag: Geography might be the canary in the mine for geology! Geology's original national peak occurred about a decade later than geography's, in 1982, when over 7,000 bachelor's degrees were granted. With the decline in potential careers in the petroleum industry, geology degrees granted plummeted sharply in the 1980s, reaching a nadir of little more than 2,500 in 1991, a drop of 64 percent in nine years. Like geography, geology began to pick up again, rising 80 percent to a smaller second peak of over

4,600 in 1996. Again, like geography, geology slid in the late 1990s, falling to just over 2,000 in 2000, a drop of almost 60 percent in four years. Master's degrees in geology peaked at just over 2,000 in 1986 and have been declining unevenly since, hitting around 800 (a 60 percent drop) in 2000. Doctoral degrees have held remarkably steady from 1973 to 2001, somewhere around 500 a year (American Geological Institute 2004).

Anthropology, too, has paralleled geography and geology nationally. From 1966, when it granted about 1,500 bachelor's degrees, anthropology rose to a peak of just over 6,000 by 1974. It declined 55 percent to under 2,700 by 1985 and began to rise again in the late 1980s. Unlike the other two disciplines, however, anthropology enrollments have continued to rise nationally from that time to this, breaking the 7,000 mark for the first time in 2000 (a climb of over 150 percent in fifteen years). Master's degrees more than tripled from 1966, when just under 300 were awarded, to 1975, when just over 1,000 were. They followed undergraduate degrees to a low point in 1989, when only 725 were granted. Much like geography but lagging, master's degree awards grew until 1997, when they broke past 1,100, and then dropped to 950 by 2000. At the doctoral level, anthropology grew from just over 100 in 1966 to a 1976 peak of 450, slumping unevenly to just under 350 by 1990. Doctorates increased from that point to just under 500 by 1999 (Doyle 2004).

Geography, geology, and anthropology have, then, followed somewhat similar paths in fortune through time, with two peak periods of enrollments. The first occurred in the early 1970s to early 1980s, followed by a trough in the late 1980s as the Baby Boom worked its way out of school, with growth resuming in the early 1990s with the Baby Boom Echo. Geography and geology had their second peaks in the early to mid 1990s and then declined, while anthropology has enjoyed sustained growth, not having peaked as late as 2000. With this national context as backdrop, the data and methods I used to reconstruct the history of fall enrollments in the California State Universities from fall 1992 through fall 2004 are discussed next.

Data and Methods

All data on enrollments within the CSU come from the CSU Chancellor's Office Web site: http://www.calstate.edu/as/stat_reports/. They are directly comparable to the data available from Web-published institutional research office (IRO) data from each of the CSU campuses, rarely differing from these by more than one or two students. I chose to use the Chancellor's Office data, rather than the IRO data, for the sake of consistency and comparability, since not all IROs make their enrollment by department data available on the Web and, of those that do, there are great discrepancies in the duration of records published online.

There may be more inconsistencies with graduate student enrollments. Each campus may have its own way of accounting for those graduate students who are still actively working on their theses but who have exhausted their thesis units. On my own campus, Long Beach, for example, such students are asked to maintain continuous enrollment through extension in a non-credited and non-graded "course" called Graduate School 700, which is not differentiated by major. These extension students are not reported by department in the Chancellor's Office dataset, which thereby undercounts our graduate enrollment by twenty actively supervised graduate students. Chico, Fullerton, and Los Angeles also require continuous enrollment be maintained through similar non-credit, non-graded units and, again, their graduate enrollment may be undercounted thereby. Other campuses, such as Northridge, do not require continuous enrollment: Leaves of absence of up to two semesters are automatically granted without application. How students on leave are counted in the Chancellor's dataset on such a campus is not clear. Similarly, San Francisco, Hayward, and San Diego do not require the non-credit unit. San Jose's Web page is silent on the issue. Readers should be aware that Chancellor's Office data on graduate enrollments may not be comparable among campuses.

The last part of this paper concentrates on my own campus, CSU Long Beach, where the three traditional disciplines enjoy an unusually positive relationship and collaborate to run the Environmental Science and Policy Program and various research partnerships. One of these collaborations was specifically designed to increase the diversity of students drawn to the four majors, the Geoscience Diversity Enhancement Project (NSF #GEO-0119891). I drew on ethnic diversity data by program and fall semester from F/97 to F/04 provided by the CSULB Institutional Research Office to evaluate the success of GDEP in diversifying the major and to test the association between diversification trends and growth trends in the cooperating programs.

With the caveats noted above, the data were processed in a spreadsheet and then summarized in line graphs. These are, for the most part, interpreted qualitatively and comparatively, though the CSULB diversity data underwent basic correlation and regression analysis of the association between diversity and growth trends in a major.

Undergraduate Enrollments

Undergraduate geography majors in the CSU System have been declining from their fall 1992 peak of 1,184, sagging to a low point of 829 in F/02 and stirring from there only to 854 last fall (Figure 1). Geography has dropped 28 percent from the 1992 peak enrollment. The timing of the peak and the slump reflects national trends (Hardwick 2001), but the decline was steeper in the CSU.

Perhaps misery loves company, but geology is in even worse straits than geography: The peak geology enrollment of 921 occurred in 1994, plummeting to its low point of only 525 in fall 2004, representing a drop of fully 43 percent (Figure 2). Meanwhile, environmental studies, environmental science, and environmental systems (ENVSSS) programs climbed from their low point of 976 in F/92 to their high point of 1,274 in F/00. Their major enrollments have dipped somewhat since then, showing 1,254 as of F/04 (Figure 3).

By adding together all earth- and environmentally oriented undergraduate majors, peak enrollments among all three majors hit 3,084 in F/93 and then slid down 14 percent to 2,636 by F/04, which is the trough in the data set so far. Within that generally slipping picture, environmental studies and science programs are growing, geography is slipping at a rate roughly parallel with that of the whole, and geology is dropping like a rock as environmental studies and science take off (Figure 4).

Geography can be compared with the other earth and environmental fields, but it can also be compared with anthropology, a discipline with which it shares the natural science/social science split, as well as decades of interdisciplinary cross-fertilization between cultural geography and cultural anthropology and between archaeology and physical geography/geospatial techniques. Adding these two diverse fields' enrollments together, the collective enrollments are pretty steady somewhere between 2,100 and 2,300. Within that collective, however, geography is declining and anthropology is, perforce, increasing (Figure 5).

Another group of programs overlapping geography's human side is area studies, international studies, and the relatively new global

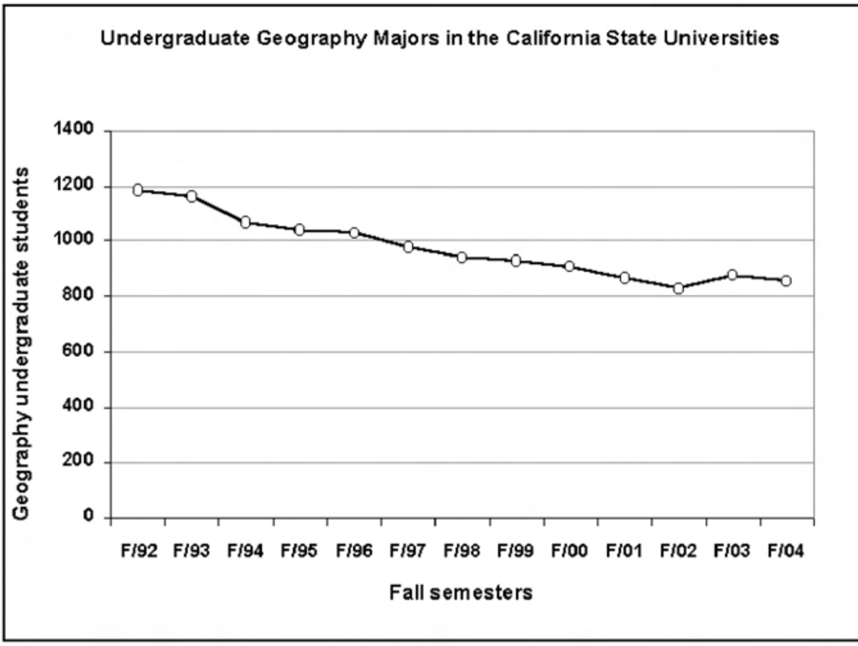

Figure 1. Undergraduate geography majors in the California State Universities (CSU).

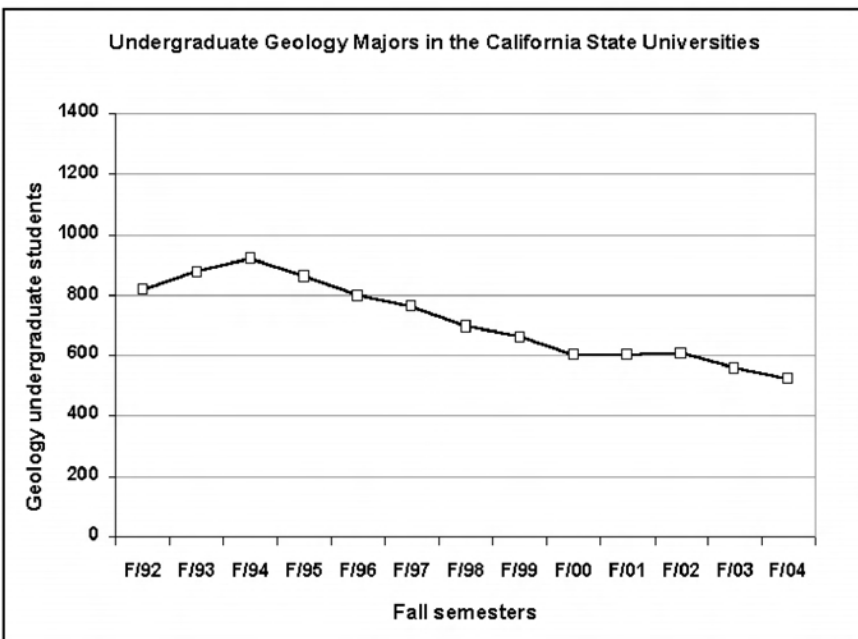

Figure 2. Undergraduate geology majors in the CSU.

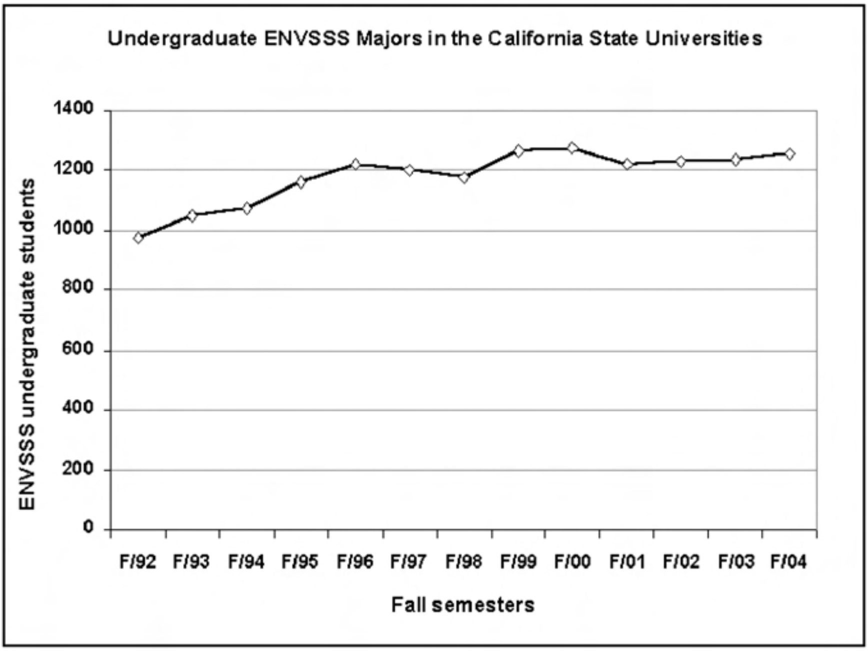

Figure 3. Undergraduate ENVSSS (Environmental Studies, Environmental Science, and Environmental Systems) majors in the CSU.

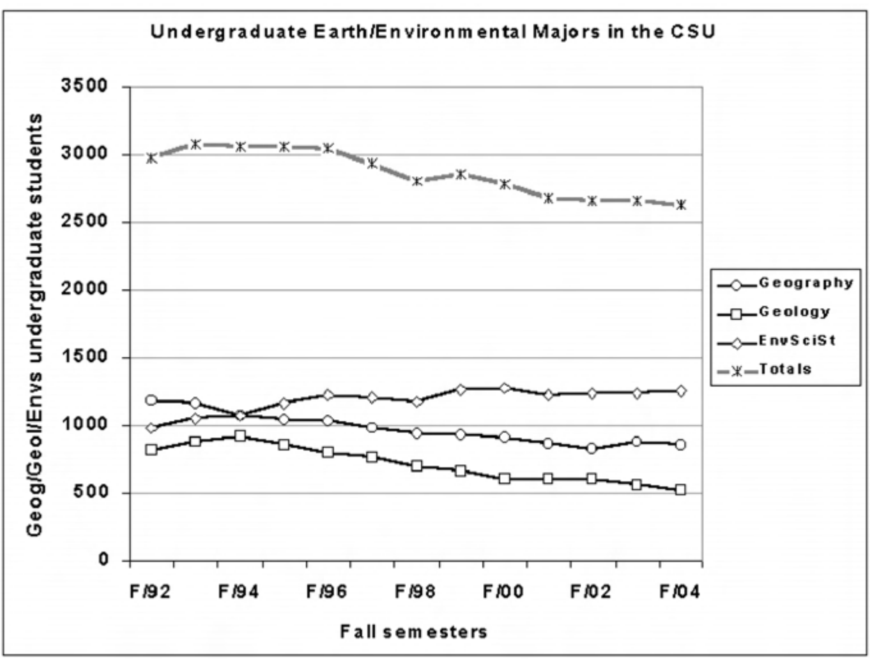

Figure 4. Undergraduate earth/environmental majors in the CSU.

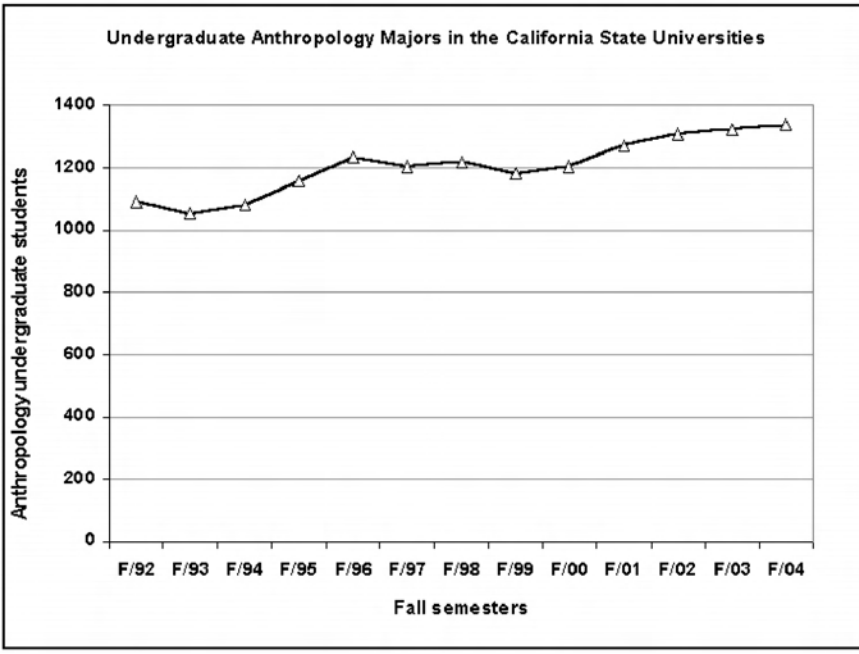

Figure 5. Undergraduate anthropology majors in the CSU.

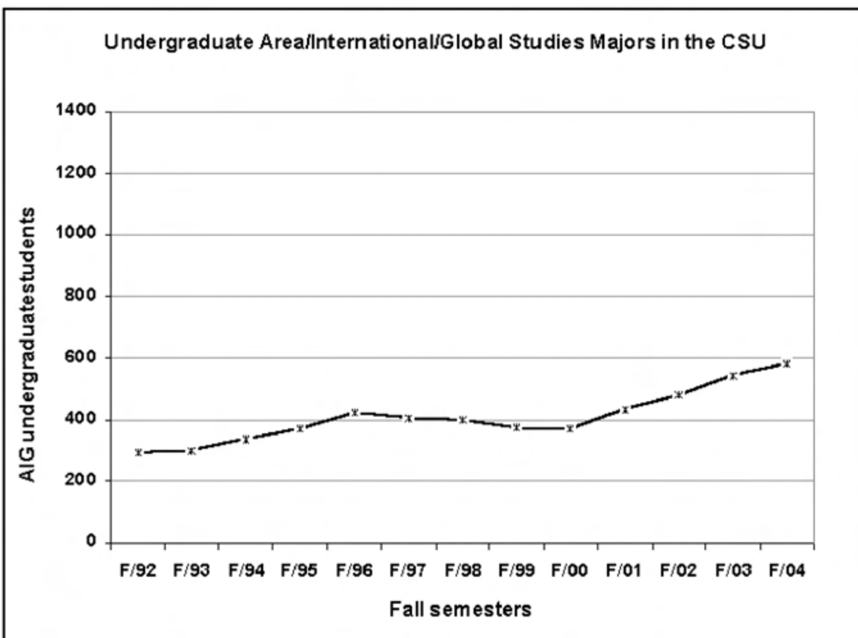

Figure 6. Undergraduate area/international/global studies majors in the CSU.

studies (AIGS). These programs have almost exactly doubled from their low point of 295 in fall 1992 to their high point of 580 in F/04, experiencing a particularly fast-growing phase after F/00. Plotting these fields' enrollments together with geography's and anthropology's shows an overall pattern of slight growth from 2,571 in F/92 to 2,772 by F/04. Anthropology and area/international/global (AIG) studies show nearly identical patterns of growth, while geography counters them with its decline over this time frame (Figure 6).

The overall picture, then, is a little disheartening, with geography declining in comparison with environmental studies/science/systems and with anthropology and AIG. Only geology "feels our pain." Disaggregating enrollments by campus, however, provides a little room for optimism. A few departments have experienced a little to a lot of growth in the past five years: The Long Beach department has grown 70 percent from F/00 to F/04 (and has actually more than doubled from S/01 to S/05, according to campus IRO data), while the Humboldt department has increased 12 percent, the Los Angeles department has grown by 9 percent, and Sacramento has inched up by 1 percent. All other departments are declining, most from 15 to 35 percent in the past 5 years (Figure 7).

Graduate Enrollments

Nine geography departments offer graduate degrees. All of these offer master's of arts degrees, except San Diego, which also offers a joint Ph.D. degree with its University of California partner, Santa Barbara. Fresno began the time period with an M.A. program but ended it by the late 1990s. No new graduate programs have been instituted in the study period.

Graduate enrollments in geography show a somewhat different and more optimistic pattern than undergraduate enrollments (Figure 8). They peaked in Fall 1994, a little later than undergraduate majors, reaching 311 among the ten then-existing graduate programs, which represented 23 percent of all geography enrollments. They then dropped to a nadir of 237 in F/01, or 22 percent of all enrollments. Unlike undergraduate enrollments, however, graduate enrollments have rebounded quite strongly, reaching 296 by F/04 and accounting for 26 percent of all geography enrollments. Geography enrollments remain essentially unchanged from the beginning of the study period (294) to the end of the study period (296).

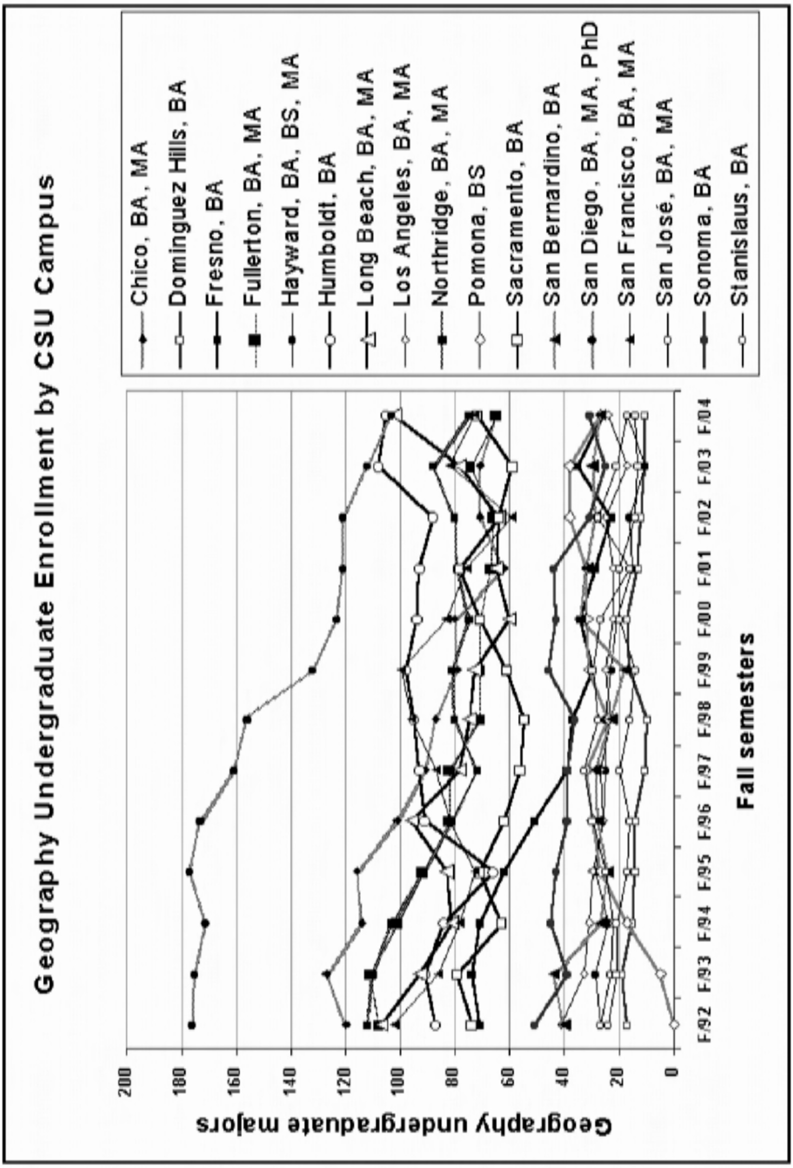

Figure 7. Geography undergraduate enrollment by CSU campus. A color version of this line graph is available at http://www.csulb.edu/geography/jpegs/CSUgeogmajorscampus.jpg.

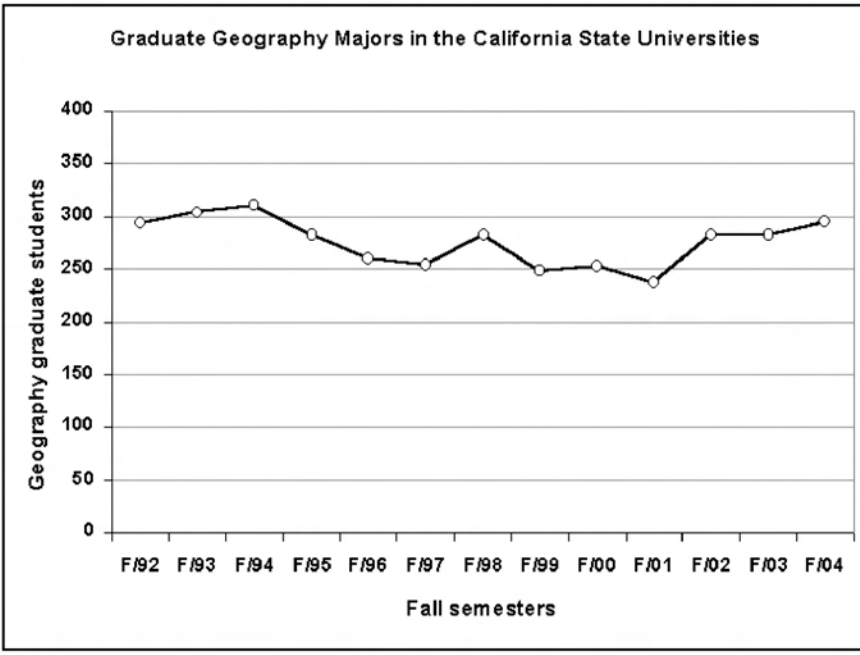

Figure 8. Graduate geography majors in the CSU.

Examining graduate enrollments by campus (recognizing that the data may not be fully comparable), the erratic pattern of "small sample effects" comes through. Nearly all programs show wildly swinging levels of graduate enrollment from one year to the next (Figure 9). San Diego is the largest graduate program and, although erratic, its overall pattern is neither growing nor shrinking. San Jose, a smaller program, is holding a level pattern, too. At the other extreme, Fresno dropped its graduate enrollment by the late 1990s. Some programs are showing strong growth: San Francisco, Northridge, and Los Angeles, while Long Beach is growing more modestly. Other programs show declining enrollments overall: Chico, Hayward, and Fullerton. While there are data comparison problems from one campus to the next in counting graduate students, there should be consistency through time in the data for any one campus, so, presumably, the trends for each campus described here should be valid. Overall, the attractiveness of graduate study in geography seems to be rebounding, unlike undergraduate enrollments.

Geology shows a similar but more pronounced pattern of contrariness between undergraduate and graduate enrollments. Geology graduate enrollments started the study period at only 133 in F/92

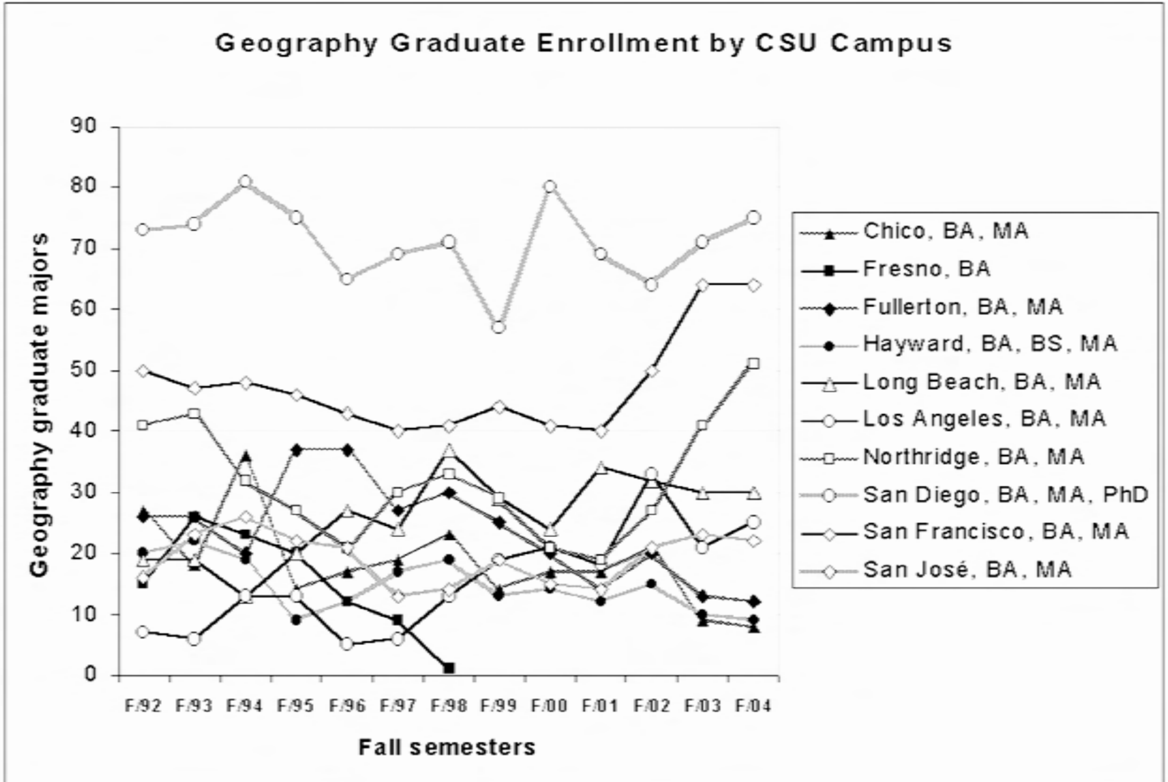

Figure 9. Graduate geography enrollment by CSU campus. A color version of this line graph is available at http://www.csulb.edu/geography/jpegs/CSUgeoggradstcampus.jpg.

and F/93 but have climbed steadily to 192 by F/04 (Figure 10), an expansion of fully 44 percent, virtually the obverse of the 43 percent decline in undergraduate enrollments. Graduate enrollments made up only 14 percent of total geology enrollments in F/02, but, by F/04, they comprised fully 27 percent of total enrollments.

Environmental studies/systems/science (ENVSSS) graduate enrollments also run contrary to undergraduate patterns (Figure 11). In this case, however, while undergraduate enrollments have increased 29 percent from F/92 through F/04, graduate enrollments have declined 24 percent, from 212 (or 18 percent of total ENVSSS enrollment) to 162 (which represent only 11 percent of the total). The worst semester was F/01, when they dropped to 147. ENVSSS seems to be a powerful draw for earth- and environmentally conscious undergraduates, but not for those wanting to do advanced work in these topics. It might be worth exploring whether the graduate programs in geography and geology have benefited from ENVSSS majors wanting to go on and deciding to pursue their interests in a traditional discipline. If so, why? Perhaps there are greater choices in geography, with ten graduate departments to choose from in the CSU, and in geology, with twelve (including three programs that

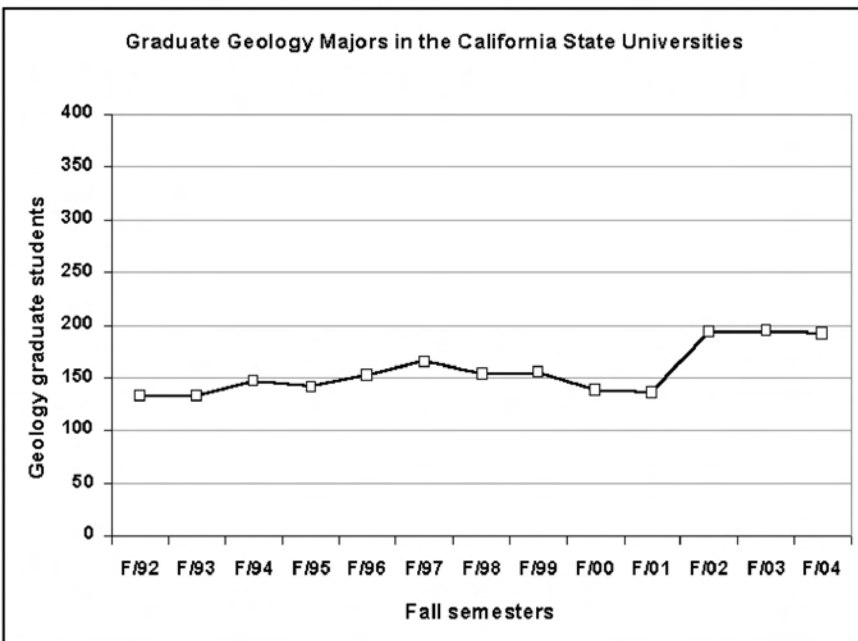

Figure 10. Graduate geology majors in the CSU.

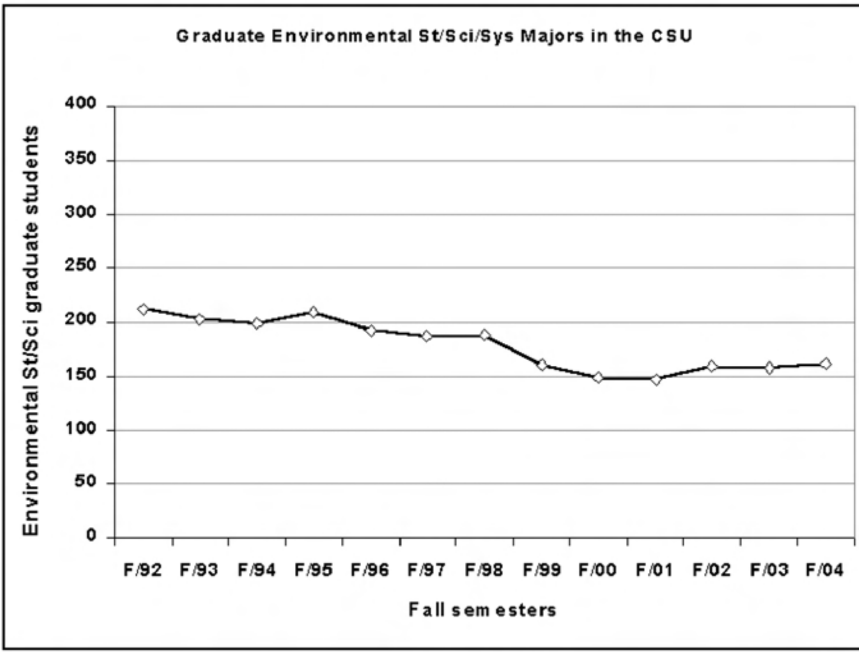

Figure 11. Graduate environmental St/Sci/Sys majors in the CSU.

debuted in the study period). In ENVSSS, there are only four graduate programs, including a new one in Chico.

Anthropology graduate enrollments sank from 287 in F/92 to their trough of 240 in F/94, or 18 percent of total enrollments (Figure 12). After that, they rose fairly steadily (except for a small dip in F/01) to 389 in F/04, at which point graduate enrollment constituted 23 percent of total anthropology enrollments. Graduate enrollments, then, reinforce the growth trends in anthropology over the study period, amounting to a growth of 36 percent from the beginning of the study period (287) to the end (389). Undergraduate enrollments increased 23 percent in that time frame. There are presently nine graduate programs available in the CSU, including one that was launched during the study period (Bakersfield).

Area/international/global studies (AIG) follows a very different pattern from any of the other disciplines (Figure 13). It rose from 122 graduate enrollments in Fall 1992 to 142 in F/97 and then plummeted to 115, its lowest point, in F/01. From that low point, it has rebounded strongly to 168. Over the study period, then, AIG has increased 38 percent, and graduate enrollment has dropped from 29 percent of the total AIG enrollment to 23 percent during that

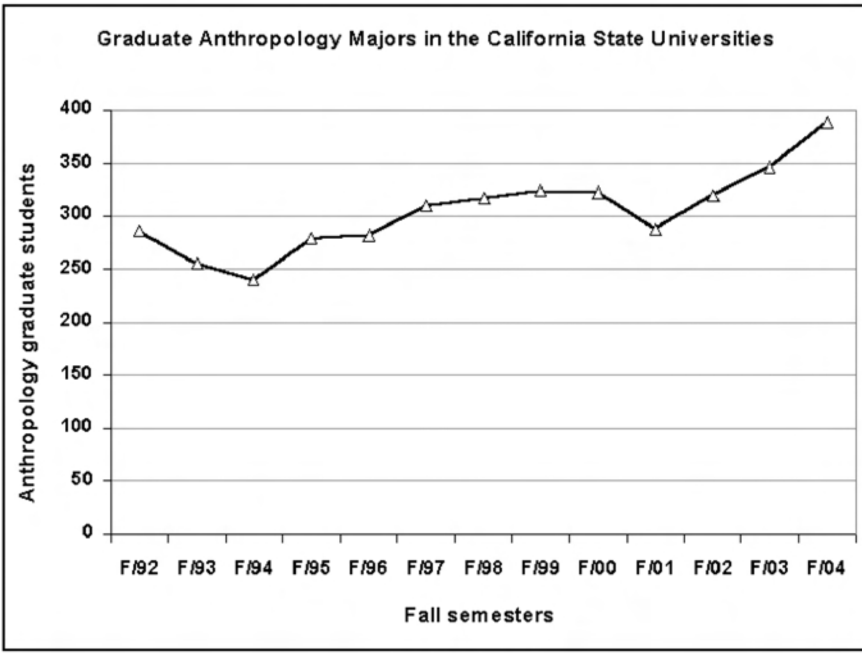

Figure 12. Graduate anthropology majors in the CSU.

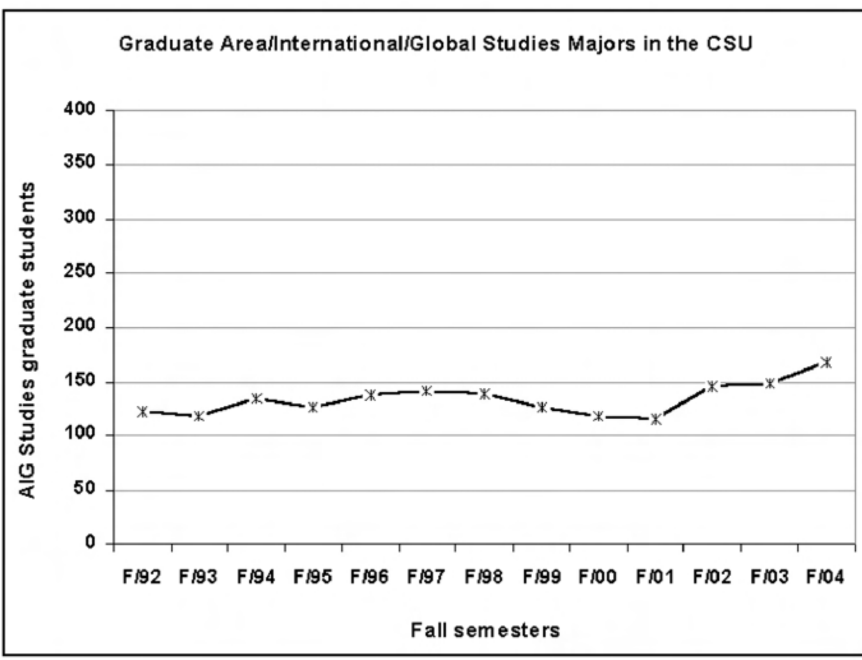

Figure 13. Graduate area/international/global studies majors in the CSU.

time frame, reflecting the virtual doubling in undergraduate majors in these programs. Like ENVSSS, AIG may be hindered in graduate-level growth by the paucity of graduate programs: There are only four in the CSU, and this may deflect potential graduate students into other fields, possibly including geography.

Discussions among CSU Geography Chairs and the CGS 2005 Attendees

These data were shared with the chairs of all CSU geography departments in March 2005 through e-mail and then with all interested California geographers at the Yosemite meeting of the California Geographical Society in April. Additionally, I asked the other departments that have experienced any growth since fall 2000 (Long Beach, Humboldt, Los Angeles, and Sacramento in the undergraduate division; Los Angeles, Northridge, San Francisco, and Long Beach in the graduate division) to identify a few factors that they think may account for the turnaround. Of these, I received responses from Humboldt, Sacramento, and San Francisco. There were a lot of common elements. Everyone noted that their departments had several new faculty and, more importantly, that these faculty were very dynamic and active researchers who found ways to involve undergraduates in their research.

Several people cited the critical role of excellent lower-division teaching, mentioning that they had at least one star instructor, who enjoyed a bit of a cult following through word-of-mouth. This reputation brought general education students into the department's courses, which offered the opportunity to recruit majors.

Everyone commented that they enjoyed pretty good relations with their deans and the rest of their campus administrations. This helped the departments maintain their faculty lines following retirements and thus their enrollments and opportunity to recruit majors.

The chairs noted that they were a bit entrepreneurial, too. They see the role of the chair as noticing and publicizing the accomplishments of their faculty and their students, particularly through internal and alumni newsletters, conversations with their deans, participating in major fairs, and the occasional external press-release for a department event.

The chairs all commented that their faculty got along with little to no factionalization among them. They could pull together as a unit and avoid becoming a problem for the administration (and potential target during fiscal downturns).

Two of the departments (Humboldt and Sacramento) are bachelor's granting departments, and they felt that perhaps the lack of a graduate program forced them to focus more on the undergraduates, who then responded to the attention and mentoring to become geography majors. Two of the others, San Francisco and Long Beach, have graduate programs and thought that the presence of graduate students helped them maintain their programs. At Long Beach, the presence of graduate students in upper-division major courses (of which they may take twelve semester units) maintained enrollments above the dean's minimum enrollment expectations, saving classes, so that the undergraduates could get through in a timely manner. San Francisco and Long Beach also feel that the graduate programs are intellectually stimulating to them and that this might have made their undergraduate programs more vital. In other words, the presence of a graduate program has unclear effects on the health of the undergraduate program.

I queried all department chairs again in June to find out what is happening in those programs that are having problems in maintaining their enrollments, but there was no response, what with the summer begun or about to begin. It is possible that most or all of them are doing things no differently than the growing programs, to no avail, which would be useful information to have. This is a sobering possibility, given the degree to which the CSU enrollment trends as a whole roughly mirror national trends, a parallel seen with geography, geology, and anthropology. What, exactly, is the boundary between structure and agency, the limit to individual departmental initiative?

Case Study: Geography at "The Beach"

Given the many parallels among our cognate disciplines, both nationally and within the CSU, it seems that we might try making common cause with them to grow the number of students who are interested in the earth and its stewards. Cooperation may be challenging, however, given the rivalries built into the department and college structure of universities, especially in a time of competition for scarce resources. If we can find ways to collaborate with our colleagues in related programs, rather than compete with them, maybe joint activities could generate enough excitement on our campuses to attract enough new students to share around.

On our campus, the departments of Geography, Geology, and Anthropology collaborate on a number of research and grant projects, which has substantially eroded the old rivalries among the programs to the point that I worry about the fate of geology! We have held common workshops on jobs in our fields for Earth Sciences Week. We have begun to coordinate our general education (GE) offerings to channel our students into one another's GE classes. We also work together with three other departments (Biology, Economics, and Chemistry) to manage the new Environmental Science and Policy (ES&P) major, which on our campus is an interdisciplinary program rather than a department. ES&P debuted in F/03 and already has twenty-eight majors. With Geology, Anthropology, Biology, and Physics and Astronomy, we have begun participating in the Institute for Integrated Research in Materials, Environments, and Society (IIRMES), which manages high-end research equipment and coordinates extramurally funded projects drawing on these facilities.

The most intense interaction among Geography, Geology, and Anthropology involves the NSF-funded Geoscience Diversity Enhancement Project, which ran from summer 2001 through summer 2004. GDEP was an eight-week research immersion program designed to increase the interest of underrepresented students in the geosciences. Each summer, roughly ten students from local community colleges and high schools worked on research projects with CSULB faculty and with the faculty at their home institutions who had nominated them.

I'd like to spend a little time looking at the state of the three GDEP partner departments on my own campus, because I think there may be portents there for every department in California. Both Geography and Geology at Long Beach experienced a drop in majors since 1992. The Geology decline was slower and less variable, while Geography skidded fairly steeply from 1992 to 2000. At that point, Geography began to grow, while Geology began what looks like a decline (Figure 14).

With respect to Geography and Anthropology, the totals for majors in both fields increased erratically from 1992 to the present. Geography, however, was declining fairly steeply from 1992 to 2000, at which point it began to take off and nearly catch up with the more slowly growing Anthropology (Figure 15). I had thought that Geography's growth might have had something to do with GDEP,

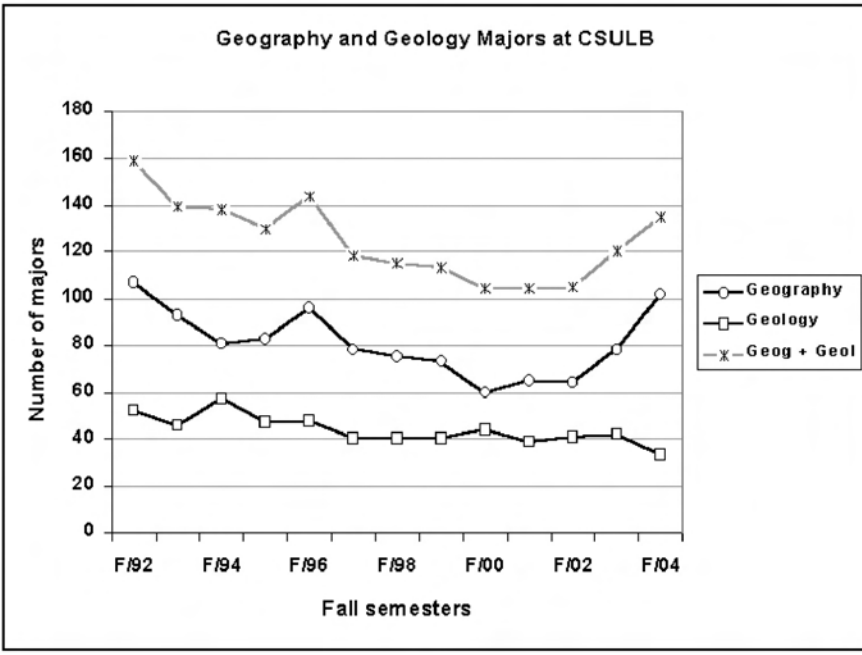

Figure 14. Geography and geology majors at CSULB.

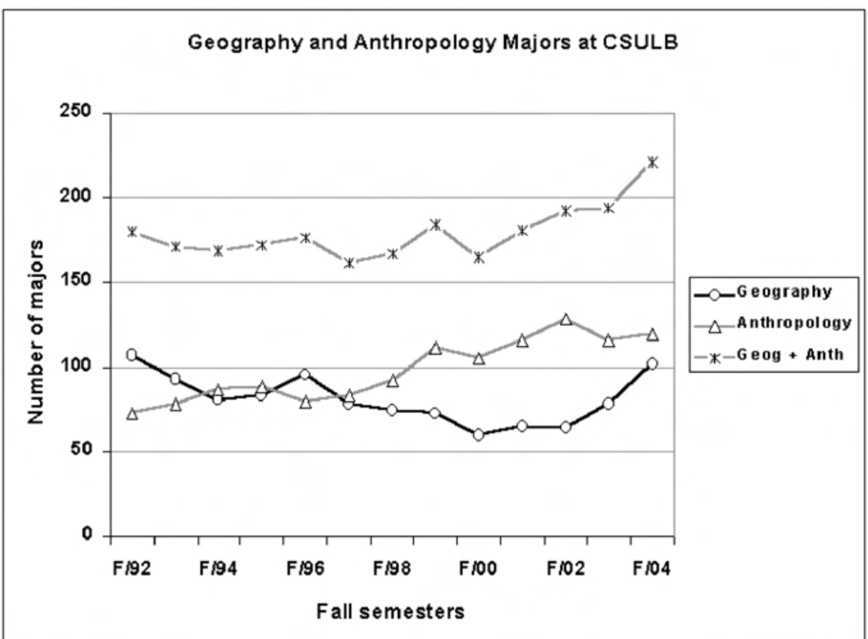

Figure 15. Geography and anthropology majors at CSULB.

but that idea foundered by examination of Geology's fate at CSULB during and after GDEP.

I then looked into the diversity of the three majors, which, after all, was the whole point of GDEP. I examined the relationship between the percentage of majors who were non-Hispanic white and the number of majors in each of the three departments. I had data from the campus Institutional Research Office from F/97 to F/04 (2005). In all three cases—Geography (Figure 16), Geology (Figure 17), and Anthropology (Figure 18)—there is an inverse relationship between the percentage of majors who are non-Hispanic white and the number of majors. I then combined data from all three departments and the two years of data from our new Environmental Science and Policy major. To make the data suitable for comparison, I represented each program's enrollments in terms of the percentage of their maximum enrollment over the eight years of data. Whichever semester saw the program's peak enrollment was set to 100. I then combined the data on percentage of majors who are non-Hispanic white and this index of enrollment size relative to peak enrollments (Figure 19). With twenty-six data points in the combined data set, the inverse relationship between the dominance of white students and the relative numbers of majors emerges as a significant factor driving the number of majors (Figure 20), with a correlation co-efficient of 0.50 and a regression co-efficient of 0.25, a relationship significant at the 0.01 level (that is, random selection could have created an association as strong as this in fewer than 1 percent of samples that could have been drawn).

Conclusions

One take-away message is that geography and its cognate fields need to work on diversifying their majors and appealing to new kinds of students. Geography and geology, especially, tend to be disproportionately white, even on minority-dominated campuses, such as Long Beach. Potential majors may have picked up an interest in the earth on middle-class family vacations to Yosemite or Grand Canyon, an interest further piqued in college general education classes. The demographics of California are changing dramatically, however, and the earth and environmental sciences are likely to continue declining as long as they are driven by a declining demographic: The non-Hispanic white portion of the state population is now only 47 percent (U.S. Census 2005).

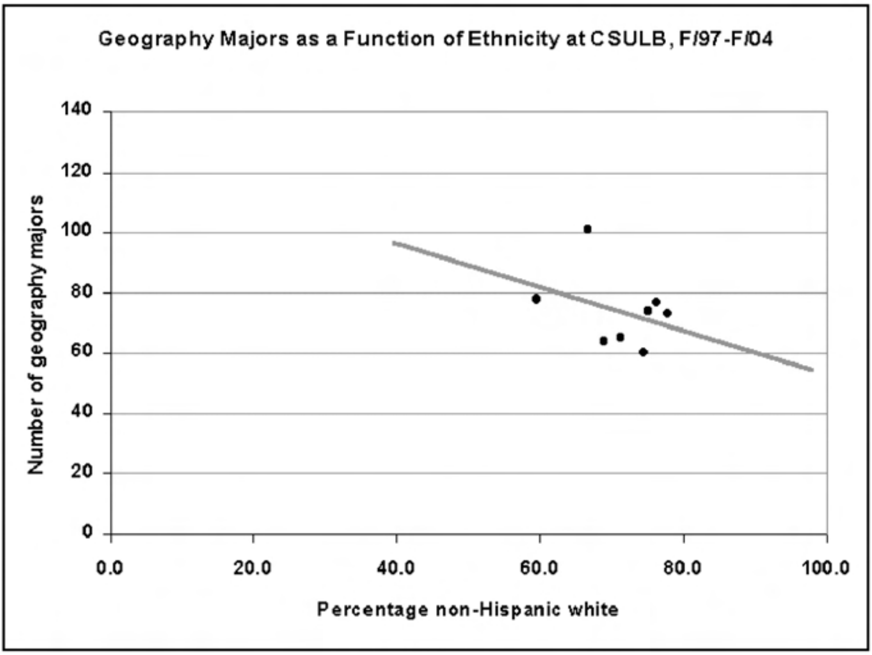

Figure 16. Geography majors as a function of ethnicity at CSULB, F/97–F/04.

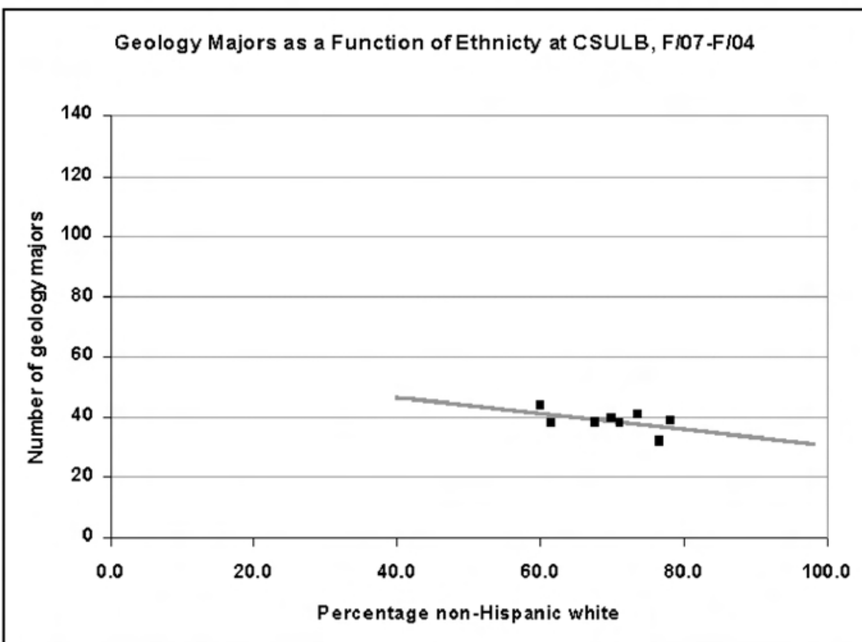

Figure 17. Geology majors as a function of ethnicity at CSULB, F/97–F/04.

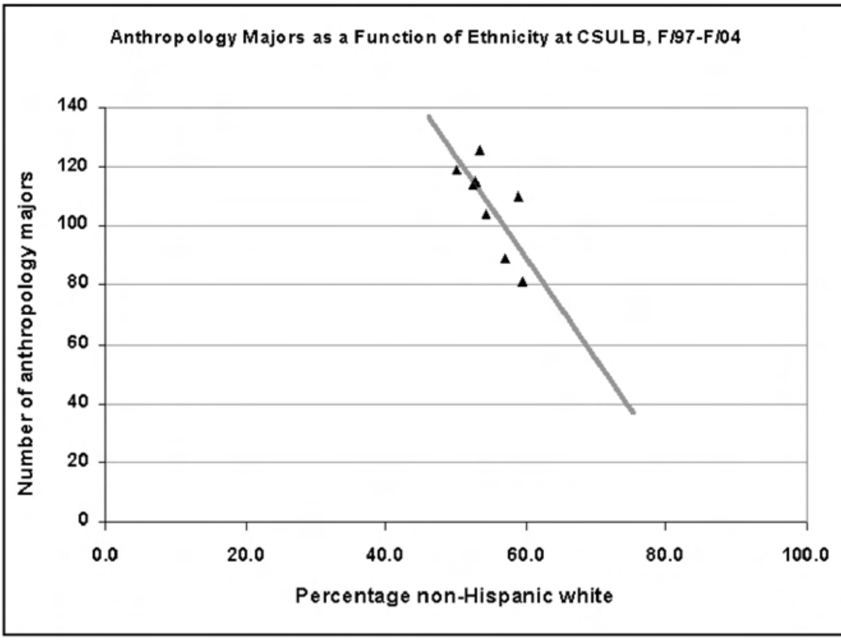

Figure 18. Anthropology majors as a function of ethnicity at CSULB, F/97–F/04.

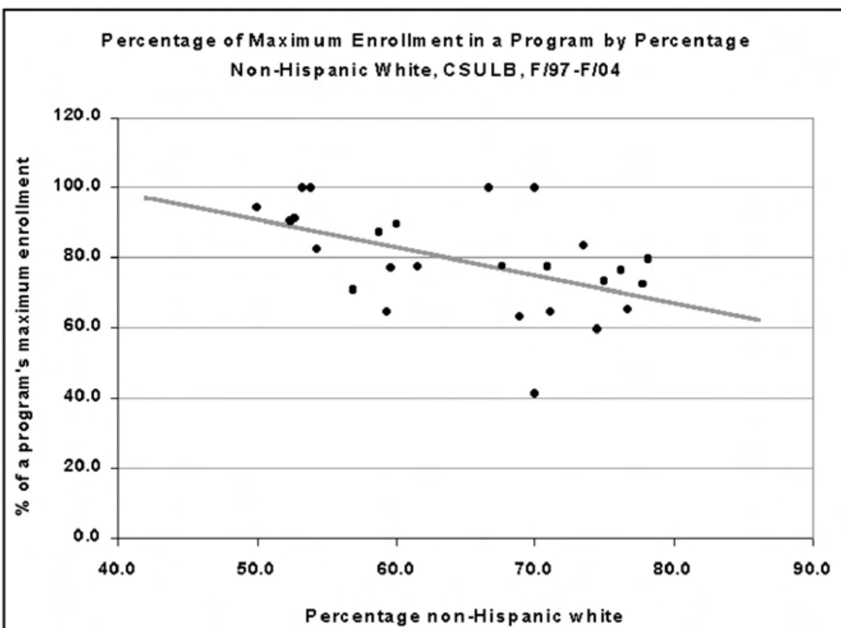

Figure 19. Percentage of maximum enrollment in a program by percentage non-Hispanic white, CSULB, F/97–F/04.

Percentage of a CSULB Program's Maximum Enrollment (F/97-F/04) as a Function of Percentage Non-Hispanic White

Regression Statistics

R	0.50
R^2	0.25

ANOVA	*F stat*	*signif F*		
Regression	7.85	0.01		
MODEL	*Co-eff*	*SE*	*t*	*prob*
Y Intercept	130.41	18.45	7.07	0.00
Slope	-0.79	0.28	-2.80	0.01

Figure 20. Percentage of a CSULB program's maximum enrollment (F/97–F/04) as a function of percentage non-Hispanic white.

Our campus tried to remedy this demographic mismatch by partnering with local community colleges and high schools and collaborating to create summer research internships for underrepresented students in these feeder schools, thereby creating a seamless pathway for them from high school, through community college, and into CSULB. This partnership was the Geoscience Diversity Enhancement Project, which Suzanne Wechsler described at the Yosemite meeting of the CGS (2005) and which was characterized in a recent article (Wechsler, *et al.* 2005). GDEP has built a community of trust, respect, friendships, and ongoing research among the three departments and their partners and created an exciting and often life-transforming experience for the approximately thirty student research assistants. It was hoped that intense summer interaction with the underrepresented student research assistants would affect the way CSULB faculty present geoscience information to students already in their regular classes, making the fields more appealing to underrepresented students.

For Geography, it may really have borne fruit: Our majors went from 76 percent non-Hispanic white in F/97 to 74 percent in F/00 (just before GDEP began) to 67 percent in F/04 at the conclusion of GDEP. For Anthropology, those numbers went from 59 percent in F/97 to 54 percent in F/00 to 50 percent in F/04. Geology, however, for some reason showed an opposite trend, going from 78 percent in F/97 to 60 percent in F/00 and then back up to 77 percent in F/04. None of us know quite what to make of this, but I think we may be seeing statistical small-sample effects here. At CSULB, Geology has only one-third of the majors that Geography does and only one-fourth the majors in Anthropology, so the recruitment or graduation of a small number of students produces marked change in the percentages reported.

So, cautiously interpreting the GDEP outcomes, it would seem a good investment of energy for geography departments to work on diversifying their major base, concentrating on their lower-division GE courses and, if feasible, the local community colleges, where a disproportionate number of underrepresented and poorer students start their college careers. Getting kids in the field and working in our labs and actually participating meaningfully in some kind of research project can give minority students the "Yosemite" experience that may not have been part of their childhood experiences. Informing them (and their parents) of the jobs available to geography majors is also critical, and GDEP made "Jobs in Geoscience" a key part of the program. Many of the new demographics in college are the first generation through college in their families, and they often report parental pressure to major in something that will get them a good job after graduation, and parents and students may see geography as a frivolous and unemployable major. We are working hard to confront that misperception, and a GDEP-type program gives faculty several weeks to break through that conditioning. Many of the GDEP research assistants did go on to major in one of the participating majors, and we've had a couple who continued to major in engineering or business but minored in geography. The GDEP Web page, http://www.csulb.edu/geography/gdep/, includes links to assessment materials presented in various conferences.

With or without a formal research partnership, it is rewarding for CSU faculty to reach out to community college faculty and deepen ties with the institutions that are so important in the recruitment of geography majors. Supporting their programs with guest speakers and inviting them to participate in CSU campus events with their students are good ways to build a local geography community and create a ready path for students from the community colleges to the CSU. CSU retirees or FERPs (Faculty Early Retirement Program participants) might be invited to take on some of this liaison role on behalf of their departments. This kind of deepened interaction, alone, can increase the diversity of the geography majors in the CSU, given the importance of the community college system as a gateway to college for underrepresented groups in California.

A few other ideas on developing a plan for a department to grow can be found in the Association of American Geographers 1998 brochure, *Everyone Likes a Winner*. The CSULB Department of Geography has been following this template unconsciously for a few years now, and it seems from discussions among several chairs that other growing departments in the CSU are implementing many of its recommendations. The brochure both validates these efforts and deserves exploration as a possible template for the departments experiencing problems in sustaining or expanding their enrollments.

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Acknowledgments

The author would like to acknowledge the National Science Foundation, which funded the Geoscience Diversity Enhancement Project under grant #GEO-0119891, and the other members of the GDEP team at CSULB, five local community colleges, five local high schools, and, especially, all the GDEP student research assistants, who made all the work and many surprises deeply rewarding for all the faculty involved. For a list of participants, please visit http://www.csulb.edu/geography/gdep/.

Tales from a Tourism Geography Class

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Abstract

This paper summarizes the experiences of a tourism geography seminar taught at California State University, Northridge, in the fall 2004 semester. Students in this course were divided into two groups, choosing their locations and engaging in field research where they were responsible for all of the steps in undertaking such a project. They began with the selection of a research site, then raised funds, chose a topic and research questions, prepared the survey instrument, undertook the research, analyzed the results, and finally presented at a professional conference. This paper provides an overview of the pedagogy and logistics of the course and assignment, along with a summary of each project's findings.

The Pedagogy and Logistical Issues of Taking Students in the Field

There are many valid reasons why university faculty are reluctant to take students into the field for course-related assignments. The logistics can be painstaking, costs prohibitive, the risk-management division of the university may throw up a series of red flags, and students may be reluctant or unable to partake in such an experience, due to family/work commitments and/or financial limitations. Also, class sizes may be too large to be manageable in the field. Despite these numerous and very real barriers to coordinating such an assignment, there are some invaluable learning experiences that can emanate from taking students into the field. Kent, et al. (1997) and many others have argued on behalf of the benefits of fieldwork as a means to integrate the theoretical and practical aspects of geography.

According to Dunn (2003), there are three important pedagogic benefits of fieldwork: 1) improved delivery and retention of content (see also Kent, et al. 1997); 2) a deeper form of learning where students can more fully understand the interconnected complexities of a locale; and 3) building of transferable or generic skills such as organizational skills of research planning, and group work and presentation (pp. 3–4).

To illustrate these benefits, I reflect on my experiences of taking a cross-listed (graduate and undergraduate students) seminar on tourism geography into the field, where students engaged in participatory fieldwork in which they gather and use the data themselves. This paper includes the logistics of designing and implementing a research component into the course as well as a summary of the research, with an elaboration on the educational benefits.

In fall 2004, while preparing to teach this seminar, knowing that it would be a relatively small class (ten to fifteen students), I wanted to design a course that would be of benefit to both graduate and undergraduate students. My main objective was to teach them research skills often not taught in other classes. The solution was to incorporate a group field project that would teach students the numerous stages involved in doing research, from formulating the idea to presenting in front of an audience. The limited time frame of one semester, along with the multiple demands of the students, made a group project the only practical way to achieve this goal.

On the first day of class, the idea of an in-the-field group project was presented to the class of twelve students. Of course, there was the usual student concern over doing a "dreaded group project." I tried to alleviate this concern by allowing students to choose the study location, emphasizing the bounty of fun that would ensue and the interesting places nearby where they could potentially do their research. It is important to note that all of the students in the class were either from southern California or had lived here for some time, so I knew they were familiar with regional tourism locales. Of course, this scenario is not always the case, and many students may lack such extensive regional knowledge. As for the research site parameters, I suggested that the site must be within a four-hour driving radius of our campus, which presents many options including Baja, Mexico, Santa Barbara, Yosemite, Las Vegas, Palm Springs, etc. I asked students to suggest a place within these limits, and quickly we had fifteen or so suggestions listed on the board. Next, each student was required to secretly choose his or her top three, and we would then tally the results and select our two research sites. The Danish village of Solvang, in Santa Barbara County, and Rosarito Beach, Mexico, were the selections. Fortunately, students self-selected into two manageable groups: five preferred Solvang and seven Rosarito. This process was effective in that it gave students a sense of ownership over the research and that it was "their idea." Also, no students would be forced to do research in a place they did not choose. My sense was that some had trepidations about undertaking such an assignment south of the border, while others embraced the opportunity and challenge. So ultimately, all students were enthusiastic and comfortable with their study sites.

The class met once a week, and during every meeting, time was devoted for each group to provide progress reports to the class and discuss their objectives and tasks to be completed for the next meeting. This gave the projects a certain momentum and ensured that sufficient progress was made each week so that they would be able to complete the assignment in a timely manner. I gave each group time to meet by themselves during the class to answer any questions that emerged. This also forced a level of accountability among all the students, since they could not rightfully skip the meeting. The first tasks to be handled were getting money to support the trip and deciding the research topic for each place. Acquiring money to support research is a procedure that most students have very little familiarity with, but on our campus, the Associated Students organization often has funds to support such activities. I provided them with this lead, and two people from each group were assigned the task of getting the proper forms, writing up the (brief) proposal (including the budget), and attending the requisite meetings to get the funds. Fortunately, both groups were awarded the funds (to my knowledge, most student project requests are successful). In cases where funds are not available, instructors would have to be more creative, perhaps camping near the research site or selecting places closer to the campus so that no overnight stays would be necessary (see Harner 2003).

Deciding on a research theme was at least partially determined by the sites themselves. Tourism in Solvang focuses on the town's Danish heritage, thus that group decided to find out whether or not heritage was indeed the draw, and if it was, what aspects of heritage were most easily and readily consumed. There is a rich literature on heritage tourism, which made this a very "doable" assignment by following existing literature and methodologies. Rosarito Beach, Mexico, is a relatively small Mexican beach community, but is easily subsumed under the sun, sea, and sand tourism literature. Within this context, this group chose to focus on the varying perceptions of tourism's impact on this community by surveying locals, tourists, and business owners.

While some students were assigned to work on the grant proposals, others were gathering literature and devising specific research questions. Some of the course material was relevant to both projects and was used as part of the literature, but each group supplemented these with additional sources more closely linked to their respective research projects. The experience of the several graduate students in the class was helpful in the process of accessing the "right" journals and synthesizing the literature. Each group was required to have a "chief editor" who admittedly took on a large responsibility, but in most classes there are competent, motivated students willing to take on that task. In this situation, I nominated a graduate student to be the chief editor in one group, while a competent undergraduate volunteered for that role in the other. Over several class sessions, we discussed potential research angles and group members contributed to the construction of a survey instrument. The survey questions were discussed in class, with all students and myself offering comments and critiques to "fine tune" them before heading into the field.

By the time we went into the field (the eighth or ninth week of the semester), each group had a significant portion of its literature review completed and surveys ready to be implemented. The groups planned to be in the field on different weekends so that I could accompany them, offer suggestions, and reflect on the experience while it was happening. I set a target of 200 surveys for each group. The Rosarito group easily reached this goal, while Solvang fell a bit short. This was likely due to a combination of several factors. The Rosarito group had two more students than the Solvang group, and several of the group's students were very assertive in approaching people. Indeed, one student in the Rosarito group completed seventy-five surveys by himself. Also, people in Rosarito seemed to be more receptive to participating in the research than did those in Solvang. The Solvang group received many more "No" responses than did the Rosarito group. The end result however, was that both groups completed a sufficient number of surveys to arrive at some interesting conclusions.

Once the data were collected and we returned to campus, students in each group coded the data and entered it into a spreadsheet. One issue that arose was that many students do not have the skills or comfort level to statistically analyze the data. However, it was easy enough to give a quick tutorial on cross-tabulations that allowed them to move beyond raw numbers and simple percentages and look for relationships among the data. Other students were responsible for putting together detailed maps of the study area to include in the final paper and presentation.

When the papers were completed, the students began to work on the presentation. I scheduled it for the end of the semester, held it in a larger classroom, and invited other faculty and students. This was effective in "upping the ante" for the presentation, since the students were now presenting to a wider audience. I felt that this put an added layer of pressure and responsibility on the students to perform. It also illustrated to them that the work they had done was of interest beyond the confines of our class and was something substantial. After the presentation experience, they were comfortable and eager to present at a professional conference (CGS 2005 in Yosemite).

Research Summaries

What follows is a brief overview of the two research projects, beginning with a short discussion of each locale and followed by a summary of the research methodology and results. A discussion of the learning objectives/benefits of each project is threaded through these summaries.

Heritage Tourism in Solvang, California

Solvang is a quaint Danish village located in Santa Barbara County, about two hours from our campus. The town was founded by Danish educators in 1911 and by mid-century had evolved into a regional tourist mecca. Many shops, restaurants, hotels, and art galleries, most with a Danish theme, sprang up to accommodate the visitors. More recently, numerous wine shops and tasting rooms have opened in the town. These have become even more popular with the success of the film "Sideways," parts of which were filmed in Solvang. A large majority of the visitors are day-tourists from southern and central California who come to stroll the charming streets and to shop and eat, "consuming" the local heritage. These day-tourists were the target group for our team of researchers. The town is also compact, making it easy for the team of researchers to separate into smaller groups, canvass the area, and reconvene, if necessary, in a short amount of time.

Heritage, or the prevalence and utilization of a locality's heritage, stands as an ever-more-common approach to promoting tourism both in the United States and abroad. Exploring the different dimensions of heritage tourism has become increasingly relevant in an age when certain ways of life begin to disappear, prompting an inquisitive public to view various modes of living retrospectively (Shaw and Williams 2004). According to Waitt (2000), "the commodification of the past has provided a mechanism whereby city authorities can refashion sites and direct the tourist gaze towards a limited range of interpretations." Solvang approaches tourism with a purposeful placement of heritage as the centerpiece of engagement and activity, making it the cornerstone of its success. The literature on this type of tourism provided the students with the necessary background literature to help formulate research questions and set their study in a broader conceptual framework.

Methodology and Approach

Because Solvang's existence as a tourist destination is owed to the Danish heritage, this research team set out to determine to what extent heritage played a role in the tourist experience. To address this topic, the group decided to focus on the "user's approach," that is, from the perspective of the tourist rather than that of the host, or from a neutral perspective. Thus, the three main questions posed by the group were:

1) Who is visiting Solvang?
2) How are they consuming/experiencing certain elements of heritage?
3) What role does heritage play in their experience as a tourist?

By narrowing the research design to interviewing tourists and these three questions, the students had a manageable project that they could complete in a weekend's worth of interviews. Over the weekend, 106 surveys (56 women/50 men) were completed. These were then coded and entered into a spreadsheet and cross-tabulated to identify key relationships among tourists and their behaviors.

Key Findings

- The majority of tourists are older adults. Of those surveyed, 61% were 46 years of age or older and 87% were above 31.

- Not surprisingly, the majority of visitors (64 percent) come from southern or central California.
- Most (60 percent) claim that the Danish heritage played little or no role in their decision to visit Solvang. Most important to them was that it was a nice place to walk around and spend the day. Indeed, nearly 30 percent of respondents were unaware that the culture on display is Danish. (Many said Dutch or Scandinavian—which of course is not entirely wrong.)
- When asked *how* they consumed/experienced the Danish culture in Solvang, the architecture and food were the most common responses, followed by souvenirs, history, and clothing. Many visitors commented on how they noticed and admired some of the unique architectural styles of the town.
- Respondents aged forty-six to fifty-five were the most frequent and abundant consumers of things Danish, which is not surprising given that they were also the largest population surveyed.

In this project, students developed some practical skills that they would not have obtained if they were simply writing a term paper. These included: conducting surveys (which for several required them to overcome some initial fears about approaching strangers), working with and as a team, and developing a functional proficiency in the statistical software package, SPSS. Perhaps most importantly, they learned to keep in mind the group's original questions when collecting data, and they experienced first hand the bridge between theory and practice/reality. I felt that these goals were successfully accomplished; the students achieved what they set out to do.

Sun, Sea, and Sand Tourism in Rosarito Beach, Mexico

In Mexico, tourism has become a significant sector of the economy. Mexico now ranks eighth globally in international arrivals and tenth in worldwide tourism earnings (EFE World News Service, 10/01/04). Indeed, after agriculture, tourism provides the country with its second-largest source of employment (Clancy 2001). By situating the group's research project within this broader context, an extra layer of importance was added to what they were doing.

Rosarito Beach is a region popular with southern Californians due to its close proximity to the U.S.-Mexico border. The resort area is essentially an extension of nearby Tijuana, a much larger city situated right on the border. While Tijuana is a popular destination with southern Californians as well, many tourists are increasingly opting to bypass Tijuana and go straight into Rosarito, seeking an environment safer and cleaner than its much-maligned neighbor. Rosarito's tourists are invited to fish, ride horses on the beach, eat lobster at Puerto Nuevo, visit the 20th Century Fox production studio where the 1997 movie *Titanic* was filmed, and frequent the bars and nightclubs, where the minimum drinking age is 18. This latter aspect renders Rosarito a popular weekend destination for southern California's college students.

There is a substantive academic literature illustrating that the interaction between hosts and tourists and their perceptions of each other forms an interesting dynamic, underpinning successful tourist operations. This dynamic is paramount in terms of resort tourism vis-à-vis other types of tourism. With heritage tourism, for example, the tourist's interaction with residents is intertwined with appreciation of the historical attraction at its center. With resort tourism, on the other hand, the tourist's overall satisfaction with his or her experience hinges significantly on dealings with the residents encountered in the service sector. Studying host/tourist perceptions, especially in such a setting, can offer insight on how to better accommodate both residents and tourists, ensuring positive future growth. This study chose to pay attention to such perceptions instead of adding to the already vast library of tourism/economic data.

Methodology

Seven students administered surveys over one October weekend, primarily along Rosarito Beach's main strip, Boulevard Benito Juárez, and along the nearby beach. Because the course was held during the fall semester, the tourism season was not at its peak, which runs from March through September. However, there were still plenty of people in town to talk with, and by the end of the weekend, the group had tallied 235 surveys. The breakdown of individuals surveyed is illustrated in Table 1. Of particular note is the disproportionate number of males in the study. For businesses and residents, we believe the gender lopsidedness reflects the preponderance of men among Rosarito Beach business owners, managers, and tourism industry workers. For tourists, it is representative of what we posit as the segment of the population that is most attracted to this coastal town: male college students who are of legal drinking age in Rosarito Beach but not in the U.S. Despite the presence of other attractions as noted earlier, it seems that the majority of visitors are lured by the local party scene.

Table 1. Description of Individuals Surveyed

	Number of Surveys	Number of Surveys (%)	Male Participants (%)	Female Participants (%)
Residents	69	29.3%	69.1%	30.1%
Tourists	85	36.1%	65.8%	34.2%
Business persons	81	34.4%	77.7%	22.3%
Total	***235***	***100%***	***100%***	***100%***

Each survey was written in both English and Spanish, which allowed students who did not speak Spanish to query those participants not fluent in English. Fortunately, several of the students in this group had at least a working knowledge of Spanish. Students did the surveys mostly in pairs with at least one Spanish speaker, so that they could communicate with all willing participants. Having students work in pairs is also preferable for safety reasons.

The aim of the survey was to measure respondents' perceptions of tourist activity in Rosarito Beach and its effects on the environment, the economy, infrastructure, and level of safety. For purposes of the survey, business owners and managers were deemed businesspeople, while other employees of business establishments were considered residents. These designations were discussed prior to departing for Rosarito. We met as a group after the first hour of survey to ensure that we were all in agreement regarding all elements of the survey, including designation of respondents as residents and businesspersons.

Key Findings

- Most tourists in Rosarito are educated (70 percent attended college); the largest age cohort was between the ages of eighteen and twenty-five (41 percent); most were staying in Rosarito Beach for a two- to three-day weekend (60 percent); most planned to spend between US $100 and $500 during their stay, excluding lodging; and 41.1 percent were experiencing Rosarito for the first time while 37.6 percent frequented Rosarito Beach more than once a year.
- 92.9 percent of tourists said they would come back and would recommend Rosarito Beach to others.
- 68.2 percent of the tourists came from southern California, while only one respondent was from another part of Mexico.

- All three groups (tourists, residents, and businesspersons) felt that tourism has had a positive effect on the economy. Businesspersons were less certain about this, however, as 32 percent felt that tourism has had a neutral effect.
- With regard to the impact that tourism had on safety, tourists said that they felt “very safe” there and that tourism played a role in safety. Nearly 50 percent of residents, however, felt that tourism had a negative influence on safety in Rosarito. In all categories, females felt less safe than males. Indeed, 68 percent of female residents felt that tourism had a negative impact on the safety in the town.
- When asked what they would like to see changed about Rosarito, police reform was the number one response by residents, while tourists prioritized environmental improvements.
- Most respondents in all three categories felt that tourism either had a positive or at least neutral effect on the infrastructure in Rosarito. Businesspersons, not surprisingly, would like to see stricter enforcement of business licenses, as many of the illegal vendors cut into their market share.

Similar to the Solvang group, several students commented on how they overcame some inhibitions about approaching strangers to ask them questions. They also improved on their group skills, and in fact a strong sense of camaraderie emerged among the group. The field experience also exposed them to some of the pitfalls that may arise during a project, such as language barriers. Another interesting aspect of this group’s work was that they often found themselves interviewing other college students who were there for a weekend vacation. The students from other universities were intrigued by and perhaps envious of the Northridge students, “who got to go to Rosarito for a class project.” I also think this made them feel good about what they were doing.

In both groups, students had to confront group members who were less than enthusiastic about the project or were not delivering on their respective assignments. This also is part of the learning experience and could be of benefit to those who will become teachers at any level. Lastly, we cannot emphasize enough the value of bridging in-class discussions with in-the-field activities that allow students to experience first hand the connectivity between theory and practice. The engagement of students in fieldwork is an important step in demystifying our discipline.

Conclusion

While fieldwork remains an integral requirement to a geographic education outside the U.S., it is still mostly peripheral to the education mission of many U.S. geography undergraduate programs. As a learning experience, this assignment was designed to teach students about the multiple aspects of putting together a research project. This is a skill that seems to be sorely needed and should be integral to undergraduate curriculums. Of course, the research itself is bound by certain limitations, but that does not lessen the educational mission. Students who engage in such activities are better prepared to mount their own research as a result. Feedback about this project from the students was overwhelmingly positive, including such comments as “I wish I had more classes like this” and “I feel much better prepared now to do my senior thesis.” My hope is that the increasingly rigid institutional barriers will not discourage like-minded colleagues from engaging in these valuable assignments.

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Geographic Chronicles

Tom Down Under: McKnight's Relationship with the Fifth Continent

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Tom Lee McKnight, who passed away February 16, 2004, was a man who loved life, loved geography, and loved Australia. McKnight became known to tens of thousands of American students through his textbooks on physical geography and North American geography, which passed through many editions (McKnight and Hess 2004, McKnight 2004). His American contributions to geography and geographic education are not part of this survey, which focuses on McKnight's "regional specialty," Australia. Between 1961 and 2003, McKnight made seventeen trips to the Land Down Under, most of them not short visits but rather lengthy stays. His research on and in Australia led to the authorship of six Australian books, a dozen Australian papers, chapters about Australia in four books, and a host of ephemeral writings on Australia.

McKnight was born a Texan, in Dallas, October 8, 1928. His early years were spent in the idyllic setting of a large house in the pleasant inner suburban neighborhood of Munger Park, where he enthusiastically attended the local James W. Fannin Elementary School and the Munger Place Methodist Church. At the age of nine, having been double-promoted three times, McKnight was already attending the J. L. Long Junior High when he was "bit by the travel bug." His mother crowded young Tom, together with his sister Nancy and his aunt, cousin, and maternal grandmother, into a capacious Plymouth sedan and drove them from Dallas to Callander, Ontario, to see the famous Dionne quintuplets (McKnight 2002). Along the way they visited St. Louis, Chicago, Toronto, Niagara Falls, West Point, New York City, Washington, D.C., and Richmond, taking two months to complete the journey. Plans were laid for the following summer of 1939, when the same group traveled 5,000 miles through "The West," visiting Colorado Springs, Rocky Mountain National Park, Yellowstone Park, Salt Lake City, Bryce Canyon, Zion National Park, both rims of the Grand Canyon, the Petrified Forest, and Albuquerque. This was the start of McKnight's love affair with the two great national parks, Rocky Mountain and Yellowstone, and of his lifelong passion for animals, preferably wild or feral.

The following year, he went with his mother and a cousin to Rocky Mountain National Park to spend the month of June in a rustic cabin, one of the Cascade Cottages that occupied an inholding in Rocky Mountain National Park (RMNP). They returned to this same cabin annually, despite wartime rationing of gasoline, and McKnight spent each teenage summer backpacking and camping, while climbing as many peaks of RMNP as he could. He found summer employment in the park variously at a coffee shop, as a laborer for the Bureau of Reclamation's Big Thompson Project, and as a temporary fire-spotter.

As a student at Southern Methodist University (SMU), the lure of an outdoor life led McKnight to choose a geology degree. In the summer of 1948, the SMU senior class in geology, comprised of eight students, drove from Dallas to Alaska, visiting Fairbanks and carrying out fieldwork in Banff. But McKnight had also discovered at SMU that "there was a field of study called geography" and met his lifelong professional mentor, Edwin J. Foscue, who arranged for the new geology graduate to become a geographer and to receive a teaching assistantship at the University of Colorado in Boulder. McKnight's master's thesis was completed in the near-record time of four quarters, and his thoughts turned to a teaching career. He taught at his *alma mater* for the spring semester of 1951 and attended his first Association of American Geographers (AAG) meeting, held in Chicago. Here McKnight met Glen Trewartha, who soon after accepted the applicant into the University of Wisconsin Ph.D. program.

Two years were spent in Madison, then two years as an instructor in geology/geography at SMU, while completing his Ph.D. dissertation. In 1955, the fresh Dr. McKnight was offered faculty positions at three universities but chose to remain in Texas, at Austin. The following year, however, UCLA offered McKnight a significantly higher salary. In order to take up this position, McKnight took "a geographer's shortcut," traveling from Austin to Los Angeles via Edmonton (McKnight 2002). In September 1956, he began a professional career at UCLA that lasted more than four decades. Beginning as assistant professor in geography, McKnight moved through all the positions in the Geography Department, including department chair from 1978 to 1983.

The travel bug never stopped biting, and in the summer of 1957, his first summer at UCLA, McKnight drove from Los Angeles to Florida and then flew around the Caribbean, an adventure described as "fly now, pay later." Two years later, a highlight of his drive from Los Angeles to Yellowstone was the sighting of twenty-three bears on a single day. In late 1959, his destination was Ann Arbor; the return drive covered 10,000 miles and took sixty-three days (McKnight 2002).

Always a sports enthusiast—who had, after all, attended SMU on a basketball scholarship and had become a passionate SMU Mustangs fan—McKnight also regularly and frequently played both volleyball and the lesser-known game of handball. This passion for handball, which was a tradition at contemporary AAG meetings, had been awakened by playing at the Dallas Athletic Club, where each male McKnight inherits a life membership (McKnight 2002).

McKnight's first visit to Australia was a year of sabbatical leave in 1961–62, for which he received a Fulbright research grant and taught for one semester at the University of Adelaide. This became McKnight's favorite Australian city, since here he made many friends. In Adelaide in 1961, McKnight soon made the acquaintance of Jack Foley, an architect and builder and president of the South Australian Handball Association. This was a friendship that persisted over three generations—Jack Foley, together with his wife Berenice; later, Jack's son Shane and wife Margaret Foley; and finally, Shane's son John Foley and wife Amanda.

Three papers also derive from McKnight's first Australian visit. Although the first dealt with American leisure, and so is indeed not about Australia, it did appear in the *Australian Journal of Planning*, and so is mentioned here (McKnight 1961b). Close geographical observation of the South Australian economy soon led to the first of a series of papers on economic geography topics such as industrial location, development, decentralization, and manufacturing, published in various Australian journals (McKnight 1962a). Back in America after this first visit, McKnight also published a survey of academic geography in Australia in the *Professional Geographer* (McKnight 1962). It is interesting to note that at that time there were ten geography departments in Australia offering classes and one research department; the total geography staff was 60.5 persons, of whom 25 held a doctorate. At the Townsville University College (a branch of the University of Queensland), the sole geographer was a fellow American and McKnight friend, F. H. "Slim" Bauer, and the present author was a student in his class. When news of Bauer's death was revealed at the Flagstaff meeting of the Association of Pacific Geographers in 1998, it seemed appropriate to dedicate that year's issue of *The California* Geographer, then almost ready for press, to the memory of "Slim," and to ask McKnight, who was a reviewer for the journal, to write a short piece as opener. He agreed with alacrity, and supplied an attractive picture of Bauer to supplement the article (McKnight 1998).

In 1966, McKnight returned to Adelaide and again taught one session at the university there. He also attended his first Institute of Australian Geographers (IAG) meeting, held that year in Sydney. His continued research into industrial and economic geography led to four more papers on aspects of South Australian manufacturing and industrial location. The papers were published in Australian journals (McKnight 1965, 1966, 1967, 1968). A new stage in this omnivorous geographer's life was developing. Always the wildlife enthusiast, McKnight had in the late 1950s researched and published several articles, both scholarly and popular, about feral burros and wild horses in the western United States (McKnight 1957, 1958, 1959a, 1959b, 1959c, 1960, 1961a), culminating in a monograph on America's feral livestock (McKnight 1964). Now, in South Australia

A bush picnic, somewhere in the Outback McKnight loved so well.

he had also become interested in the packs of exotic wild camels that roamed the outback, leftovers from a time when they provided a valuable means of transportation of goods across the arid interior. The camel drivers were then referred to as "Afghans," though many were not in fact from the country of Afghanistan. When a train line was completed in 1929, taking passengers and goods from Port Augusta to Alice Springs along the same route as the camel teams, it was christened "The Ghan," in memory of the contribution made by these men and their hardy, once-valued animals. In early 2004, a long-awaited extension north was opened, so passengers can now enjoy a luxury air-conditioned transcontinental ride on "The Ghan" from Adelaide to Darwin. McKnight's research on the wild camels led to the publication of his first Australian book, *The Camel in Australia*, published by Melbourne University Press (McKnight 1969). An amusing anecdote is associated with the distribution of this now classic and hard-to-obtain title. During a trip along hundreds of miles of rough dirt roads in the outback of northern South Australia in 1992, Tom and his wife Joan Clemons rolled one afternoon into the town of Marree (current population 250). After the long, hot, dusty drive, the pub was of course the immediate destination. McKnight ordered two beers, and the publican of course noticed the accent: "You're a Yank." Tom admitted to this fact. "I know a Yank, the publican continued. He pulled a book from a tiny shelf behind the bar, where his modest library of four books was kept. It was *The Camel in Australia*. Modestly, Tom admitted that he was that "Yank," but the outback of Australia is a place renowned for its tall tales, so before the publican would believe this, McKnight was required to show his driver's license and passport (Clemons pers. comm., Salter 2004).

The camel research led to the wider issue of feral animals in Australia, a problem that continues to plague this once-isolated country, where delicate ecosystems have been devastated by the introduction of exotic creatures (Rolls 1969). McKnight's paper on barrier fences as a means of control, focusing on the fascinating series of dingo fences, appeared in the *Geographical Review* (McKnight 1969). Two years later, McKnight wrote about Australia's wild buffalo in the *Annals of the Association of American Geographers* (McKnight 1971). A broader approach to rural Australia suffused the paper McKnight wrote on biotic influences on Australian pastoral land use for the Association of Pacific Coast Geographers (APCG) (McKnight 1970). Back in Los Angeles, McKnight followed this line of research with his next monograph on feral livestock in Australia (McKnight 1976)

McKnight always loved to see "critters," and none are more lovable than these cute Australian wallabies.

and in a chapter comparing feral hoofed livestock in Australia and the United States (McKnight 1975).

On his third visit to Australia, in 1970, McKnight taught a semester at the University of New England in Armidale, New South Wales. At this time, Prentice-Hall was producing various series of small but scholarly Foundations of Geography books, whose titles and simple covers are familiar to all who studied geography in the 1960s and 1970s. The Foundations of Cultural Geography Series included such geography classics as Amos Rapoport's *House Form and Culture* (1969) and John Fraser Hart's *The Look of the Land* (1975). Wilbur Zelinsky's *Population Geography* (1966) was also part of the Foundations of Economic Geography series. McKnight was invited to produce a book for the World Regional Geography Series, *Australia's Corner of the World; a Geographical Summation* (McKnight 1970).

The tri-fold brochure printed as advertising material for this book has two amusing features, one intentional by the publishers. The first leaf of the brochure reads "Announcing the first geography of Australia…." This claim could well have offended several living geographers, and certainly seems to ignore several more geographers already dead. James Bonwick, for example, who wrote *Geography* *of Australia and New Zealand* in the mid-nineteenth century, was just one of a handful of early authors of Australian geographies, and of course in the early twentieth century Griffith Taylor wrote four Australian geographies, while even Cumberland's well-received *geography of Australia, New Zealand and Pacific Islands* was by then fifteen years old (Bonwick 1855; Taylor 1911, 1914, 1923, 1931; Cumberland 1954). The reader opens the second page of the brochure, however, to reveal the key words "by an American." The second amusing feature of the brochure seems to derive from layout problems. Modern Australia has three icons—the misnamed Sydney Opera House, the kangaroo, and the koala. Now McKnight's book appeared in pre-Opera House days, and so the first photograph shows sailing boats at Sydney Heads; but the "cuddly" koala was obligatory for an audience of American readers. Unfortunately the koala had to fit the layout, so his picture was turned sideways, giving a whole new slant to "down under." We can also marvel today that the little McKnight book sold for a mere $2.50. Yet another oddity associated with the publication of *Australia's Corner* is that the publishers decided to use the name Thomas L. McKnight for the author, despite the fact that Tom was his real and legal given name, as recorded on his birth certificate. Many library catalogues have followed this "naming" and now assume incorrectly that Tom L. McKnight is the abbreviated form.

Although it was to be eight years between McKnight's third and fourth visits to Australia, it remained on his research horizon, leading to the monograph on Australian stock routes, *The Long Paddock*, published in the University of New England Monograph Series (McKnight 1977). The year 1978 saw McKnight in Australia again, this time teaching three months at the Royal Military College (Duntroon) in Canberra and attending the Institute of Australian Geographers (IAG) meeting, held that year in Townsville.

Possibly the shortest of McKnight's Australian sojourns was in 1980, when he visited Adelaide for the Australian and New Zealand Association for the Advancement of Science (ANZAAS) meeting in that city. McKnight wrote a survey of Australia's changing rural geography for a volume of international examples of rural transformation (McKnight 1980), and was deeply involved in writing his physical geography text. By now he was also deeply involved in geography education. As chair of the Geography Department at UCLA, McKnight introduced the Community College/UCLA Geographic Alliance, an outreach program to community college instructors in

Map of places in Australia visited by Tom McKnight and Joan Clemons (cartographer J. Clemons).

California. From the Southern California Geographic Alliance grew over time the familiar State Geographic Alliances, now funded by the National Geographic Society.

McKnight had also conceived a plan for a UCLA Education Abroad Program in Australia. This led to a "scouting" trip to Australia in early 1984, followed by his seventh and longest sojourn in Australia, an eighteen-month visit with the program, based in Melbourne, from where he supervised the academic programs of almost fifty UCLA students studying at six Australian universities. This visit culminated in a tour of all Australian states but Tasmania, concluding with island hopping on the return journey, via New Zealand, Papua New Guinea, Solomon Islands, Nauru, Guam, and Honolulu.

The year of 1984 also saw the publication of McKnight's now-classic undergraduate text on physical geography, now in its eighth edition (McKnight 1984). Written primarily for American students, with much of the cartography done by McKnight's son Clint, the book was larded with photographs of Australian examples, with the emphasis on the quaint and the remote; the geographic grid was illustrated with a picture of a sign reading "Tropic of Capricorn," not from the coastal city of Rockhampton but from outside Alice Springs; in fluvial landforms, the dry bed of an ephemeral stream was pictured, of course, from some desolate inland location of Australia.

At a 1987 conference at UCLA on the essence of place, sponsored by the National Geographic Society and organized by Gail Hobbs, McKnight gave an opening paper on Australia (McKnight 1987), but another eight years separated his Australian visits. On all visits mentioned so far, McKnight had been accompanied by his wife Marylee, who passed away in 1986. A few years later, McKnight became affianced to fellow-geographer Joan Clemons, and wanted to show her the country he knew and loved so much. Together they visited Australia nine times in eleven years. First, in 1992 a grand tour of over 10,000 kilometers was undertaken, heading south from Sydney through New South Wales, Victoria, South Australia, up through "the Centre" to Darwin, across to the Gulf of Carpentaria and down the coast of Queensland, and back to Sydney. Much McKnight research on irrigation technology, written in the late 1970s and into the '80s, has not been discussed in this paper, as it deals with American geography, but in 1992 McKnight wrote on high-technology irrigation in Australia for a book in a series on socioeconomic dimensions of agriculture (McKnight 1992).

In mid-1993, McKnight took partial retirement from UCLA. He and Clemons returned to Australia for a wedding in Adelaide and a honeymoon tour through Western Australia. Early 1995 saw the couple as guest lecturers on a Royal Viking cruise from Fiji to New Zealand, then north around the Queensland coast from Sydney to Darwin; they flew back to Los Angeles via Kakadu, Adelaide, and Sydney. Prentice Hall Publishers were so happy with the success of McKnight's physical geography text that they allowed him to publish a text for a much smaller group, mostly his students in his UCLA upper-division class on the geography of Oceania (McKnight 1995). In 1996, an extensive tour of Tasmania was followed with another outback adventure on a loop taking in Adelaide, Broken Hill, Tibooburra, Thargominda, Windorah, Longreach, Winton, Cloncurry, Mt. Isa, Boulia, Alice Springs, Coober Pedy, Roxby Downs, Port Augusta, and back to Adelaide. Published in that year was a small volume on Australia for the general reader, as part of a series of country-study books in the American Geographical Society's Around the World Program. Three cheerful koalas huddle on a branch on the cover of this small book (McKnight 1996).

In 1998, McKnight retired from UCLA, becoming an emeritus professor. Failing health did not prevent McKnight and Clemons' now-annual visits to Australia, but the couple had a tendency to stay in one place for longer periods: in early 1998 one month was spent on Kangaroo Island, and one on the Eyre Peninsula; in 1999 a pleasant month was spent on Queensland's Sunshine Coast, and another on the Yorke Peninsula (McKnight and Clemons n.d.). The new millennium saw three months on Kangaroo Island and a drive across the Nullarbor Plain from Adelaide to Esperance. McKnight was a special guest at the IAG meeting, held in 2001 in Dunedin, where he became the third—and the first non-Australian—recipient of the IAG Australia-International Medal for "outstanding contributions to the understanding of the geography of Australia by geographers permanently residing outside Australia." The first two medal recipients were Janice Monk in 1999 and Reg Golledge in 2000. In 2002, a month at Noosa was followed by a tour of outback New South Wales; in early 2003, McKnight and Clemons spent time on the Fleurieu Peninsula and at Lightning Ridge before making their second safari to Southern Africa. Throughout the 1980s until his passing, McKnight was occupied with revisions, additions, and improvements to the later edition of his two major textbooks; for *Physical Geography* he was joined from the sixth edition on by collaborator Darryl Hess. The fourth edition of *Regional Geography of the United States and Canada* came off the press just prior to his unexpected and untimely death in February 2004 (McKnight 2004).

Tom Lee McKnight loved life, loved geography, loved travel, loved “critters,” and loved Australia (Anon 2004). In forty years of overseas travel, he visited every continent except Antarctica, but none as frequently as Australia. At a celebration of his seventy-fifth birthday in Santa Monica in October 2003, McKnight presented his seventy-five all-time favorite slides; ten of these were from Australia, depicting landscapes and critters, but initially the Australian selection would have comprised fifty percent of the show, except for his wife Joan’s pointing out this imbalance. McKnight was loved by thousands who met him in person, as students or as colleagues at the local, regional, and national geography meetings he never failed to attend; he was admired by tens of thousands who knew him through his influential books. It was McKnight’s wish to have his ashes rest in four places he loved best: at his home of forty-five years in Los Angeles “lower Tilden Avenue”; among the wolves at Yellowstone National Park; at his second home in Estes Park, on the edge of his beloved Rocky Mountain National Park; and finally in Adelaide. His wife, Joan Clemons, traveled to Australia to scatter this last portion of Tom’s ashes just before her own death in November, 2004. (See memorial article in this issue).

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Acknowledgments
Dr. Joan Clemons generously contributed to this survey.

Joan Clemons, a Legacy of Loving Service to Geography

by Jenny Zorn
California State University, San Bernardino

Joan Clemons, tireless supporter of geography and geographers, passed away November 28, 2004, at Cedars Sinai Hospital in Los Angeles. Over the years, Joan was an advocate for many under-appreciated groups, especially K–12 teacher empowerment, women in geography, and community college instructors.

Joan retired in 2001 from her position at UCLA as Academic Director of Community College Programs. Previously she had served as chair of the Earth Sciences Department at Los Angeles Valley College, where she was a faculty member for twenty-five years. She earned a Ph.D. in Environmental Sciences from the University of Minnesota, an MA and BA in geography at UCLA, and a BS in geology at UCLA.

Joan's ties to UCLA ran deep. She was consistently involved in the UCLA Geography Department, serving as president of the Friends of Geography Alumni Association at UCLA from 2000 to 2002.

Joan was recognized numerous times for her contributions to the discipline and its various organizations. She received the Association of American Geographers (AAG) 2005 Honors Award for Geographical Education. The award was presented posthumously; however, Joan was informed before her death that she was the recipient. The AAG also recognized her in 2002 with the Jan Monk Service Award, from the Geographic Perspectives on Women Specialty Group. The California Geographical Society awarded her the Friend of Geography Award in 2001.

She received numerous teaching awards, including the Outstanding Educator Award from Los Angeles Community Colleges in 1993, the Award of Merit for Distinguished Teaching in Geography from the California Geographical Society in 1991, the Outstanding Faculty Award at Los Angeles Valley College in 1991, the Science Educator Award from the National Science Foundation in 1984, and the Outstanding Instructor Award for Instructional Television from the Los Angeles Community College District in 1976.

As the first Community College Faculty member to be elected president of the Association of Pacific Coast Geographers in 1996, she fought for recognition of the contributions that community college instructors make to our discipline. She researched the linkages between community colleges and four-year institutions and published research in this area.

As a founding member of the Women's Network in the Association of Pacific Coast Geographers, she mentored many women through this group. Her deep impact there has been far reaching. Her experiences as a faculty member and administrator have proven invaluable sources of advice and counsel for many women and men. She valued the written word and the need to document our histories. It was in that spirit that she penned the History of the Women's Network. Joan was one of the founding members of the Los Angeles contingent who began the National Geographic Society's Geographic Alliance Network. She served as coordinator of the Alliance from 1988 to 1990 and 1997 to 2000, always struggling to make it a valuable asset for K–12 educators. A leader in geography in California, she worked on the state standards for K–12, serving as director of the UCLA History/Geography Project from 1993 to 2001. She also served for several years on the California Geographical Society Board of Directors.

Joan traveled extensively throughout the world, exploring its places and enjoying its people and creatures. She was particularly connected to the African Studies Center at UCLA, directing the Peace Corps Projects and serving as the center's associate director in the earlier years of her career. Shortly before her death, Joan made her last trip to Australia to spread the last of the ashes of her husband, Tom McKnight, in one of their favorite locations.

Joan gave in so many ways to various geography organizations, not just with her time, energy, and knowledge, but also financially.

It was Joan's wish to leave a legacy reflected in the poem "Afterglow," written by Robert Lamb.

> I'd like the memory of me to be a happy one.
> I'd like to leave an after glow of smiles when life is done.
> I'd like to leave an echo whispering softly down the ways,

Of happy times and bright and sunny days.
I'd like the tears of those who grieve,
To dry before the sun,
Of happy memories that I leave when life is done.

Indeed, we are glowing with happy memories of Joan.

The Yosemite Conference

The 59th Annual Conference of the California Geographical Society was held at the Ahwahnee Hotel in Yosemite National Park, April 22–24, 2005

Surrounded by 3,000-foot granite cliffs and nestled amongst a luxuriant forest of pine and oak trees, 342 geography enthusiasts gathered in Yosemite Valley for the first CGS conference ever held in a national park. By all accounts, the event was a huge success, and it was a record-breaking event in CGS history. New records were set for Friday night BBQ attendance (273), field trip participation (280) conference revenue, and profit. In addition, folks traveled from six different states, representing fifty-nine colleges, universities, and other organizations. We were especially pleased to host Association of American Geographers' Executive Director, Doug Richardson, who flew out from Washington, D.C., for the event.

Yosemite was the perfect venue for the eleven field trips scheduled on Friday and Sunday. Topics included physical geography (with emphasis on biogeography, geology, and geomorphic evolution), fire ecology and management, black bear management, giant se-

Yosemite Valley's waterfalls (including Bridalveil Falls, pictured here) were at their best for the 2005 conference. (Photo by Kris Jones.)

CGSers on the Hetch Hetchy field trip pose atop O'Shaughnessy Dam. (Photo by Mike Wangler.)

quoia ecology, the controversy over water policy and wildlands conservation at Hetch Hetchy Valley, and Native American lifeways and settlement patterns. Field trips were led by geographers (John Aubert, Jeffrey Schaeffer, Michael Wangler, and Nancy Wilkinson) as well as experts from Restore Hetch Hetchy, Yosemite Institute, and Yosemite National Park.

After a great day exploring the park's awe-inspiring geography, CGSers gathered for an outdoor kick-off BBQ (hosted by Steve Cunha and Humboldt State staff/students) at the Yosemite Valley School on Friday. Nearby, raging Yosemite Falls was in full view and occasionally reminded us of its presence with fine showers of mist, but no one seemed to care. (Interestingly, its high flow would contribute, three weeks later, to valley-floor flooding.) Just as the darkening sky threatened light rain, the crowd ducked into the school's multipurpose room to be entertained by keynote speaker and Professor Emeritus Bob O'Brien, of San Diego State University, who shared his slides and knowledge amassed during sixty years of park visitation and research.

On Saturday, sixty-eight papers, posters, maps, and workshops were presented at one of the national park system's flagship hotels, the Ahwahnee. In the afternoon, the crowd was entertained outdoors, amidst scattered sun rays and spectacular views of Yosemite Falls and

Half Dome, by special Presidential Plenary guest speaker John Muir (impersonated by professional actor Lee Stetson). That evening, 210 people attended the Awards Banquet, also held at the Ahwahnee. The event began with introductions of AAG Executive Director Doug Richardson and APCG President Jim Allen, who each addressed the audience. Next, moving remembrances were given for late friends Joan Clemons, whose advocacy for geographic education and support of CGS are unparalleled, and H. J. Bruman, who is credited with calling the first meeting of geographers that ultimately led to the creation of the CGS. A highlight of the evening was the presentation to students of almost $2,500 in the form of scholarships (for academic excellence) and award money (for excellent paper, poster, and map presentations). Additionally, two faculty members received honor and recognition. The Outstanding Service Award was presented to Jenny Zorn, outgoing Past President, and Robin Datel received the Outstanding Educator Award. To conclude the evening, outgoing President Debra Sharkey awarded Certificates of Appreciation to thirty-one individuals who helped organize the Yosemite conference, made final remarks, and crowned (yes, literally) incoming President John Aubert.

Presidential Plenary speaker "John Muir" (impersonated by professional actor Lee Stetson) gave a special outdoor performance in the meadow adjacent to the Ahwahnee Hotel. (Photo by Steve Graves.)

AAG Executive Director Doug Richardson addresses the crowd at the Saturday Awards Banquet held at the Ahwahnee Hotel. (Photo by Mike Wangler.)

Organization of the annual CGS conference is always a group effort. CGS extends sincere appreciation to Cosumnes River College for providing the paid faculty and staff time to organize this conference. In addition, huge thanks go to the CGS board—as well as a few exceptionally dedicated spouses—for critical on-site assistance throughout the weekend. Thanks also to CGS Past President Steve Cunha for inspiration, trouble-shooting advice, and organization of the Friday BBQ. As conference organizer, I greatly appreciated and benefited from the guidance and support received from past CGS conference organizers Jenny Zorn and John Aubert (whose "smart" Excel registration spreadsheet saved my sanity). Finally, thanks to the staff of Delaware North Corporation, Yosemite National Park, and the Yosemite Institute for their countless hours of help. Thanks to the hard work and dedication of those mentioned above, I received more than thirty jubilant e-mails after the conference, from people who commented about the weekend's events and the great time they had. I, too, had a blast. Thank you!

See you next April in Redding,
Debra Sharkey
2005 Conference Coordinator
CGS Past President

California Geographical Society Award Winners 2005

SPECIAL AWARDS
OUTSTANDING EDUCATOR AWARD:
Robin Datel, CSU Sacramento
OUTSTANDING SERVICE AWARD:
Jenny Zorn, CSU San Bernardino

DAVID LANTIS SCHOLARSHIP AWARDS
GRADUATE AWARD ($500):
Doreen Crespin, CSU Long Beach
UNDERGRADUATE AWARD ($400):
Ronnie Caluza, CSU Sacramento

GEOSYSTEMS AWARD ($250)
Cassie Hansen and Kevin McManigal, Humboldt State University
Correlation of Temperature and Snow Water Equivalency in the Sierra Nevada

TOM MCKNIGHT PROFESSIONAL PAPER AWARDS
Undergraduate Papers
FIRST PLACE ($125):
Kevin McManigal, Humboldt State University
The Economic Geography of Switzerland's Special Relationship with the European Union
SECOND PLACE ($100):
Kaitlin Yarnell, Humboldt State University
A Force of Change: The Mexican Community of the Eel River Valley
THIRD PLACE ($75):
Stacey Ellis, Humboldt State University
A Cup of Joe and a Joint: Arcata's Coffee Culture
Graduate Papers
FIRST PLACE ($125):
Crystal A. Kolden, University of Nevada, Reno
Drought and Escaped Prescribed Fires in California
SECOND PLACE ($100):
Michael McDaniel, CSU Long Beach
Persistence of Culture: Remnants of the Mexican Land Tenure System in Los Angeles and Orange County

Third Place ($75):

Linda Quiquivix, Ben Elisondo & John Hess, CSU Northridge
Host and Guest Perceptions: A Case Study of Resort/Border Tourism in Rosarito Beach, Mexico

JOE BEATON PROFESSIONAL POSTER AWARDS

First Place ($100):

Cassie Hansen and Kevin McManigal, Humboldt State University
Are Rising Temperatures Threatening California's Snowpack?

Second Place ($75):

Ronnie Caluza, CSU Sacramento
Exploring the Presence of Filipinos in South Sacramento

Third Place ($50):

Delaney Gerlich, University of Southern California
The Effects of Marine Protected Areas on the Commercial Fish Density in Turks & Caicos Islands, British West Indies

MAPPING AWARDS

Professional Paper Cartographic Awards

First Place ($100):

Ronnie Caluza, CSU Sacramento
Integrated Area Planning: American River Parkway Plan Update

Second Place (three-way tie—$75):

Dustine Granville, CSU Chico
Tour de Taco

Erec DeVost, CSU Chico
The Life of Ansel Adams, A Photographic Journey

Peter Hansen, CSU Chico
Escape from Death Valley: The Journey to the West via Death Valley by William Lewis Manly and Other Forty-Niners

Third Place ($50):

Christopher Burton, CSU Sacramento
Oak Park: Non-taxable Property Analysis

PROFESSIONAL COMPUTER DISPLAYED CARTOGRAPHIC AWARDS

First Place ($100):

Ross Nolan, Humboldt State University
Geography of Rock-n-Roll: Diffusion Across the American Landscape

INSTRUCTIONS TO CONTRIBUTORS

The California Geographical Society welcomes submissions in the following categories:

Geographic Scholarship—refereed articles that reflect the diverse interests of our membership and the range and depth of geography (all subfields, regions, and approaches). Maximum length: twenty pages, double-spaced.

Geographic Education—short articles on topics that stimulate geographic education at all levels, including innovative teaching techniques, classroom and field activities, educational initiatives, and special workshops.

Geographic Chronicles—includes chronicles of annual CGS meeting and presentation abstracts, reflective essays about the Society and its members, and items of general geographical interest including commentary on issues within the discipline, notices of grant or travel/study opportunities, and research notes.

Book Reviews—reviews of recently published books or atlases of particular interest to our members.

SUBMISSION GUIDELINES

Manuscripts: Manuscripts must conform to the guidelines published in recent issues of the *Annals of the Association of American Geographers*. (The *Annals* follows "Documentation Two" of the *Chicago Manual of Style*.) Pay special attention to formatting of references and citations, and use endnotes sparingly and only to explicate the text. Provide an abstract of 150 words or fewer. Place tables/charts within the body of the manuscript, but provide graphics separately as described below.

Graphics: All graphics—maps, photographs, drawings, graphs—must be clearly readable in black and white and cited within the text. For proper formatting of graphics and captions, follow *Annals* examples. For final submission, graphics must be in one of two digital formats: EPS (Encapsulated Postscript) for most illustrations, or TIFF (Tagged-Image File Format) for raster images. Resolution should be 300 dpi or better. Provide each graphic as a separate document, and in addition provide a list of captions.

Tables: Follow examples in the *Annals* for proper formatting. Place tables in appropriate location in the manuscript, not at the end.

Disclaimer: In your cover letter, provide a statement that your manuscript has not been published elsewhere, is not under review elsewhere, and will not be submitted to another publication while under consideration by *The California Geographer*. Articles that have been previously published or are being considered for publication elsewhere cannot be considered.

Peer Review: Manuscripts are subject to anonymous peer review, a process that takes approximately four to six weeks.

Submission: Please send by mail (or e-mail attachment) three double-spaced hard copies of the manuscript and figures to: Dolly Freidel, CG Editor, Department of Geography and Global Studies, Sonoma State University, Rohnert Park, CA 94928 (e-mail: freidel@sonoma.edu). E-mail attachments of manuscript and figures are preferred. Do not identify yourself as author anywhere in the manuscript except on a cover page. E-mail inquiries to Dolly Freidel at freidel@sonoma.edu.